Botanical Resources Report

Gemini Solar Project
N-84631

Clark County, Nevada

Prepared for:
Arevia Power & Solar Partners XI, LLC
(a wholly owned subsidiary of Valley of Fire, LLC)

Prepared by:
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Introduction

This report describes the protocol-level botanical resources survey conducted in spring of 2018 for the proposed Gemini Solar Project (Project). The botanical resources survey followed the Bureau of Land Management (BLM) Southern Nevada District Office's *Survey Protocols Required for National Environmental Policy Act (NEPA)/Endangered Species Act (ESA) Compliance for BLM Special Status Plant Species* and *Integrated Vegetation Protocols for Pre-Project Surveys*.

PROJECT DESCRIPTION

The Project is located on public land administered by the Bureau of Land Management (BLM) in the northeastern portion of the Mojave Desert; approximately 25 miles northeast of the Las Vegas metropolitan area, in an unincorporated area of Clark County, Nevada (Figure 1). The Project site is situated immediately south of the Moapa Indian Reservation and less than a half mile southeast of Interstate 15 (I-15) within the *Piute Point* and *Dry Lake* United States Geographical Survey (USGS) 7.5-minute topographic quadrangles. The Project is located in T17S, R64E, sections 10-15, 22-27, and 34-36; T17S, R65E, sections 7-24 and 26-35; T17S, R66E, sections 7, 18, and 19; T18S, R64E, sections 1-3, 10-15, 22-27, and 34-36; T18S, R65E, sections 2-9, 16-21, and 30 (Mount Diablo Base and Meridian).

This Project includes the construction, operation, maintenance, and decommissioning of a 690-megawatt (MW) alternating current (MWac) photovoltaic (PV) solar project and ancillary facilities. Project components include onsite facilities, offsite facilities, and temporary facilities needed during Project construction. The major onsite facilities are comprised of solar array blocks, substations, and operations and maintenance (O&M) facilities. Electricity generated by the Project would be interconnected to the NV Energy transmission system via overhead generation tie (gen-tie) lines extending from the Project switchyards to NV Energy's Crystal Substation, located less than four miles west of the Project. The gen-tie lines would consist of a 230-kilovolt (kV) circuit for delivery of 440 MW to NV Energy Balancing Authority and a 500 kV circuit for delivery of 250 MW to the Los Angeles Department of Water and Power (LADWP). Additional elements to the proposed solar energy facilities include a 34.5-KV overhead and underground collector line, a two-acre O&M area, switchyards, internal access roads, access roads along gen-tie lines, a perimeter road, perimeter fencing, three substations, and improvements to the existing NV Energy facilities to support interconnection. A commercially available water source will be utilized via temporary water pipelines or via trucking water onto the site.

The proposed Project will directly or indirectly disturb approximately 7,123 acres. Permanently disturbed areas will include the solar facility (7,109 acres), access roads (3.59 acres), a single pole site (0.9 acre), and the gen-tie lines (2.21 acres).

Botanical surveys in spring 2018 were conducted by Phoenix Biological Consulting (PBC) over approximately 10,463 acres. The Project Area is divided into nine separate polygons, referred to as areas A, B, C, D, E, F, G, B1, and B2 in this report (Figure 2). The nine areas (A-G, B1 and B2), a buffer area of 656 feet (200 meters) surrounding the Project Area, and all proposed gen-tie lines were surveyed during the botanical resources survey and are collectively referred to as the Study Area in this report (Figure 2).

Figure 1. Gemini Solar Project Location

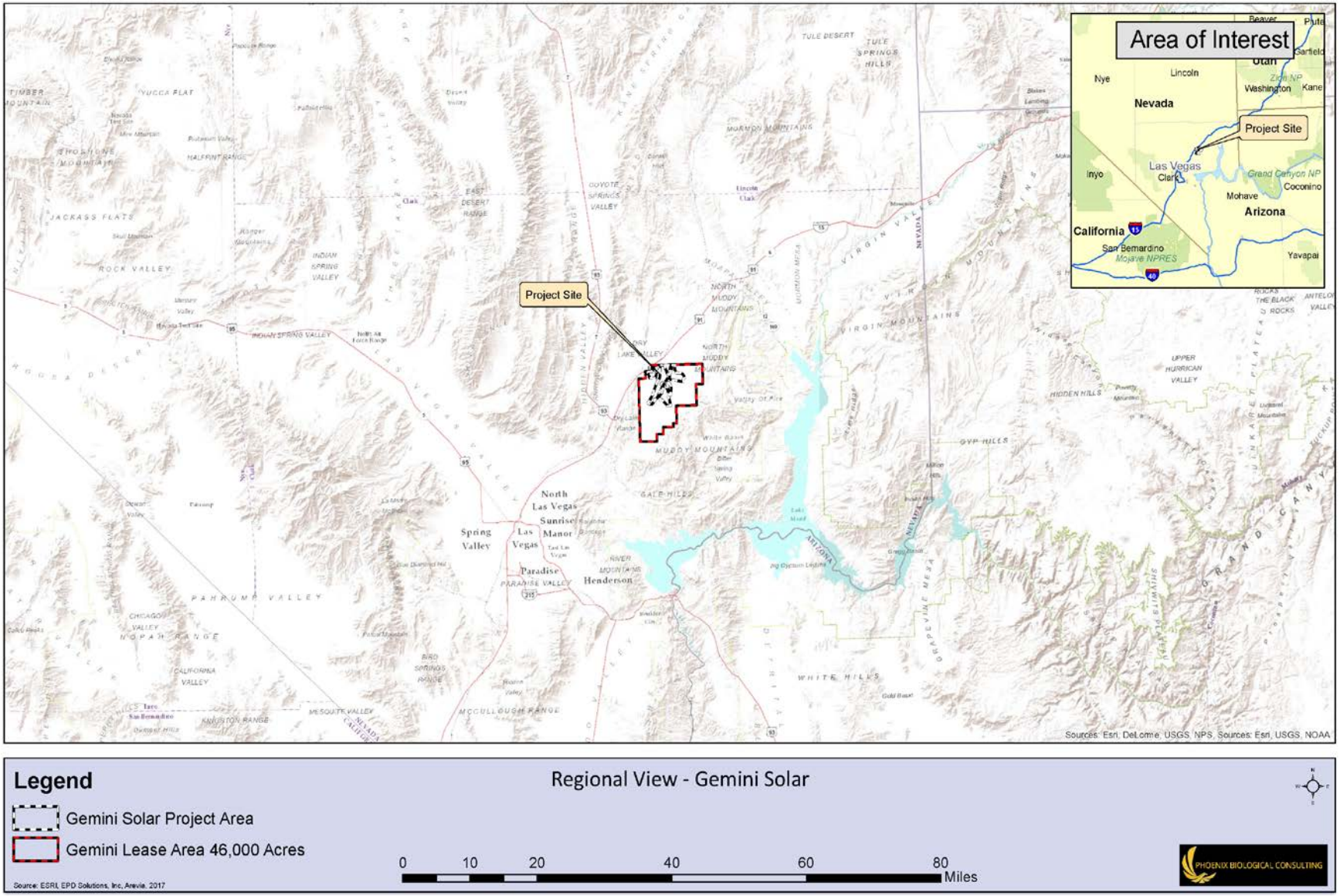
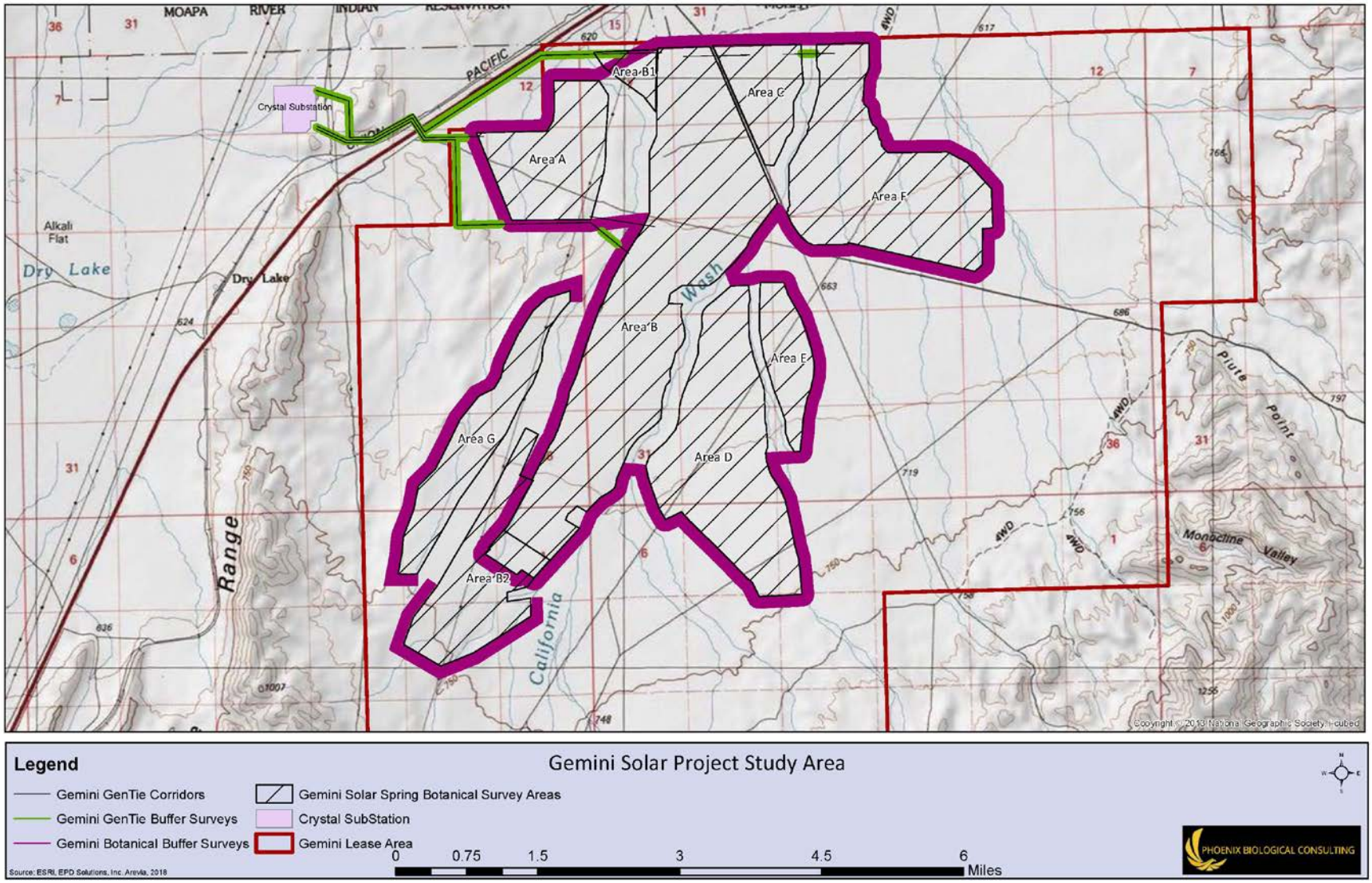


Figure 2. Gemini Solar Project Study Area



ENVIRONMENTAL SETTING

The Project is located east of the Dry Lake Valley in the northeastern portion of the Mojave Desert (figures 1 and 2). The topography within the Study Area is a gently sloping bajada (with about two to six percent slopes), except for badlands just outside the western Project footprint. Elevations in the Study Area range from approximately 2,000 to 2,500 feet with the highest elevations in the southeast corner and the lowest in the northeast corner. The area where the Project is situated is typical of this region and is characterized by broad basins and numerous, paralleling mountain ranges aligned in a north-south configuration, referred to as the Basin and Range Province, that encompasses much of the interior western United States. The Project is situated along the lower part of a gently sloping bajada that extends up into the Muddy Mountains, located approximately five miles to the south and east. The Dry Lake Range is approximately four miles west of the Project site. Multiple braided, intermittent washes flow northward through the Project Area and connect into the California Wash. The topography to the north is relatively flat as the California Wash watershed meanders to the northeast, combining with multiple intermittent washes prior to connecting with the Muddy River, approximately 13 miles away, near the towns of Moapa and Glendale; from there, the Muddy River flows east and then southeast through the Moapa Valley and into Lake Mead.

The climate is typical of the northeastern Mojave Desert, characterized by arid conditions and dramatic daily and seasonal temperature fluctuations (Table 1). Most rainfall occurs from December through March and snow is very uncommon; summer rainfall occurs regularly, typically in July and August (WRCC 2018). No precipitation or temperature data is available for the Study Area. Temperature and precipitation data for the Study Area were estimated from records from a National Weather Service (NWS) Cooperative Observer Program (COOP) station and the California Nevada River Forecast Center (CNRFC) in Valley of Fire State Park, approximately 14 miles east of the Study Area (WRCC 2018 and NOAA 2018). The NWS COOP station recorded climate data from December 1972 through June 2016 (WRCC 2018) and the CNRFC recorded precipitation data from October 2001 through June 2018 (NOAA 2018). The Valley of Fire State Park is comparable in elevation to the Study Area.

The Valley of Fire State Park COOP station recorded the average annual high and low temperatures as 80.7 degrees Fahrenheit (°F) and 57.9°F, respectively, with average highs between 100 and 106°F during the summer months (June, July, and August) and average lows between 38 and 43°F during the winter months (December, January, and February) (Table 1; WRCC 2018). Average annual precipitation recorded between 1976 and 2016 at the Valley of Fire State Park COOP station was 6.51 inches (Table 1; WRCC 2018). Average annual precipitation recorded between 2001 and 2018 at the Valley of Fire State Park CNRFC was 5.95 inches (Table 1; NOAA 2018).

Table 1. Average monthly precipitation and temperature from Valley of Fire State Park.

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual Average
Average High (°F)	57.3	62.1	69.6	78.5	89.2	100.3	105.6	103.4	96.0	82.3	67.0	57.0	**80.7°F**
Average Low (°F)	38.8	42.7	47.6	54.5	64.1	73.9	80.5	78.4	71.0	59.0	46.6	38.3	**57.9°F**
Precipitation (in.)[1]	0.86	1.06	0.85	0.25	0.15	0.07	0.52	0.63	0.41	0.56	0.46	0.69	**6.51 inches**
Precipitation (in.)[2]	0.71	0.93	0.42	0.27	0.12	0.03	0.43	0.53	0.25	0.64	0.45	1.06	**5.95 inches[3]**

[1] From the Valley of Fire RAWS COOP Station (1976-2016) (WRCC 2018)

[2] From the Valley of Fire CNRFC (2001-2018) (NOAA 2018)

[3] Precipitation data was missing for March and April 2017; the annual average does not reflect the total precipitation for 2017.

The soils on site are derived from both aeolian deposits and alluvial deposition of limestone and dolomite parent material. The majority of the site consists of either sandy-gravelly loams or fine sand with gravelly substratum.

Natural vegetation types are found throughout the region except in developed areas. The vegetation types found in the Study Area are characteristic of lower to mid-elevations throughout the region and include shrublands associated with arid valley floors and alluvial slopes, which are commonly characterized by species such creosote (*Larrea tridentata*), white burrobush (*Ambrosia dumosa*), and saltbush (*Atriplex* spp.).

Methods

This section describes the methods for the botanical resources surveys conducted in spring 2018 within the Study Area. The spring 2018 survey was conducted on April 2-7, April 9-14, April 16-28, April 30, and May 1-12, 2018. Methods used for the spring 2018 botanical survey of the Study Area complied with BLM Southern Nevada District Office's *Survey Protocols Required for National Environmental Policy Act (NEPA)/Endangered Species Act (ESA) Compliance for BLM Special Status Plant Species* and *Integrated Vegetation Protocols for Pre-Project Surveys*.

Plant growth response at the Study Area from March through May was poor and delayed, indicating that rainfall was below average and/or poorly timed for optimal growth conditions. The average annual precipitation recorded at the two Valley of Fire State Park stations are 6.51 and 5.95 inches, respectively (Table 1; WRCC 2018; NOAA 2018). Average high and low temperatures recorded at the Valley of Fire State Park NWS station are 80.7 and 57.9, respectively (Table 1; WRCC 2018). Total precipitation could not be recorded at the Valley of Fire State Park CNRFC for the 2017 water year because rainfall data was missing for the months of March and April; however, the 2017 water year total without those two months was 8.33 inches, which is either 128 or 140 percent of average, based on the two precipitation averages shown in Table 1 above (WRCC 2018; NOAA 2018). Precipitation recorded from May 2017 through May 2018 was 4.22 inches, approximately 71 or 65 percent of average (Table 1; WRCC 2018; NOAA 2018). Over two (2.35) inches of precipitation was recorded between October 2017 and July 2018; summer rains typically account for approximately 20 to 30 percent of the annual rainfall in the region, thus the rainfall for the 2018 water year (October 1, 2017 - September 30, 2018) is on track to be approximately 50 percent below average (Table 2; WRCC 2018; NOAA 2018).

Table 2. Precipitation from Valley of Fire State Park CNRFC, September 2017-June 2018.

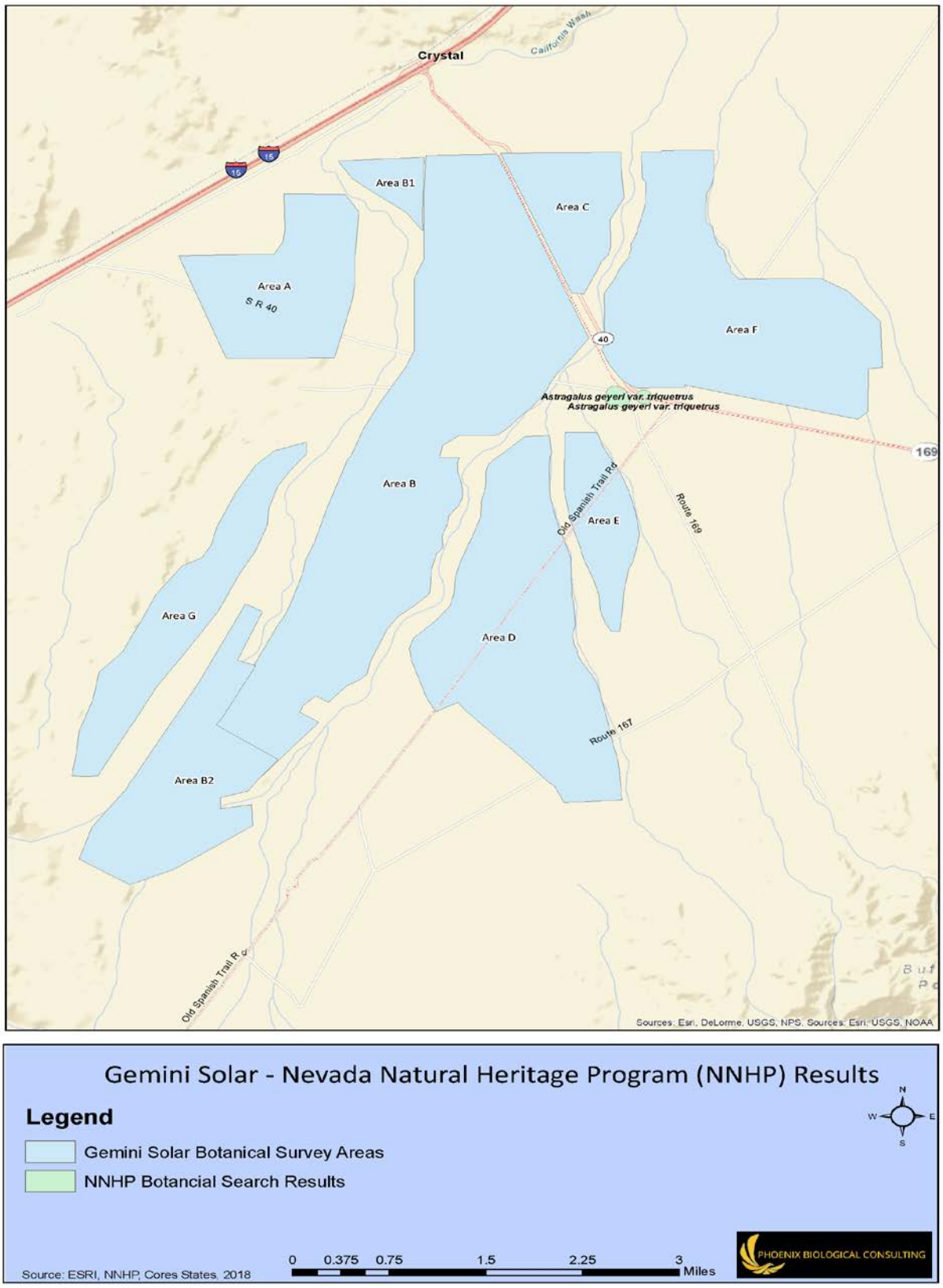
	2017			2018						Precipitation Total for October 2017 to July 2018
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	
Precipitation (in.)	0.00	0.00	0.01	1.67	0.00	0.59	0.00	0.08	0.00	**2.35 inches**

PRE-PROJECT REVIEW

Development of the Special-status Species Potentials List

Pre-field review was conducted to determine the special-status plant taxa with potential to occur within the Study Area. James Andre, director of the Sweeney Granite Mountains Desert Research Center from the University of California Riverside biology department, developed the list of potential special-status species for the Study Area as a consultant to Phoenix Biological Consulting (PBC). Lara Kobelt, District Botanist with the BLM's Southern Nevada District Office, was also consulted during development of the potential's list (L. Kobelt pers. comm., April 2017). In addition, plant databases were utilized, including a search request from the Nevada Natural Heritage Program (NNHP) (NNHP 2017), NNHP's online species information site (NNHP 2018a), and the U.S. Fish and Wildlife Service's (USFWS) Information for Planning and Consultation (IPaC) site (USFWS 2018). The list of special-status species determined to have at least some likelihood to occur in the Study Area is included in Appendix A. Figure 3 shows the results of the NNHP search in the vicinity of the Study Area.

Figure 3. Nevada Natural Heritage Program Results in the Gemini Study Area.



RECONNAISSANCE VISITS

PBC Project Manager Ryan Young made several reconnaissance visits to the Study Area. Reconnaissance visits were made by Lara Kobelt (BLM District Botanist), Ryan Young (PBC), and James Andre (PBC Botanical Consultant) on January 12, 2018 to discuss the project site, survey methods, areas to be surveyed, and assess habitat for species such as threecorner milkvetch (*Astragalus geyeri* var. *triquetrus*), yellow twotone beardtongue (*Penstemon bicolor* spp. *bicolor*) and rosy twotone beardtongue (*Penstemon bicolor s*pp. *roseus*). Additional reconnaissance visits were made by Mr. Young and Russell Kokx (PBC Biologist) during the fall of 2017 and late winter of 2018 in order to prepare a preliminary plant species list, prepare a preliminary list of vegetation community types, to map vegetation communities, to assess the site for suitable habitat for special-status plants, and to assess the conditions of the 2017-2018 growing season for the spring botanical survey.

IDENTIFICATION OF NATIVE PLANT COMMUNITIES AND SOILS

Native plant communities within the Study Area were identified and mapped during reconnaissance surveys in fall 2017 and late winter 2018 by PBC Project Manager Ryan Young and Biologist Russell Kokx and were further refined in the field during the botanical survey, as needed. Vegetation types within the Study Area were classified to the alliance level using the NNHP's *International Vegetation Classification Alliances and Associations Occurring in Nevada with Proposed Additions* (Peterson 2008).

A custom soil resource report for the Study Area was created using the Natural Resources Conservation Service's Web Soil Survey (NRCS 2018).

REFERENCE SITE VISITS

Reference site visits are conducted to determine the phenology of special-status plants which may potentially occur in the Study Area, to obtain a visual image of the plants, and to observe the habitat and vegetation where they occur. Reference site visits focused on species that had the highest potential to occur based on the habitat of the Study Area. These include species that are listed as federally threatened or endangered; and/or, those that are unlikely to be found or identifiable without suitable climate conditions (e.g., sufficient precipitation) and phenology, such as annuals or perennials that can only be identified in flower or fruit. Reference site taxa were identified using the following sources: *The Jepson Manual: Vascular Plants of California,* second edition (Baldwin et al. 2012), *Intermountain Flora* (Cronquist et al. 2013), and *A Flora of Nevada* (Kartesz 1988). Reference sites were located using the Southwest Environmental Information Network (SEINet) portal (SEINet 2018) and from personal knowledge.

Pre-survey reference site visits were made on March 20 and 21, 2018 by PBC biologist Russell Kokx and botanist Onkar Singh. These visits focused on checking the phenology of special-status taxa that would be expected to be identifiable in early spring, such *Astragalus* and *Pediomelum*. Pre-survey reference site visits focused on early spring blooming annual species, though some perennial species were also observed. Reference sites were not visited for some of the perennial taxa because these species would be identifiable, even in vegetative phenology, if they were to occur in the Study Area. The Valley of Fire State Park CNRFC rainfall totals for the month of March at the time of the pre-survey reference site visits was 0.59 inch; the year-to-date total was 2.27 inches. Later visits to reference populations of special-status *Eriogonum* and *Penstemon* taxa were made by PBC botanists Russell Kokx on April 23 and Glenn Rink on April 8, 15, 22, and 29 and on May 5 and 6. Reference site visits are summarized below by taxon.

Las Vegas bear poppy (*Arctomecon californica*): On March 20, 2018, R. Kokx and O. Singh visited a population of Las Vegas bear poppy known previously to O. Singh. This population is north-northeast of the corner of Horse Drive and Aliante Parkway in north Las Vegas within the Tule Springs Fossil Beds National Monument, at 2,303 feet in elevation. One hundred and four plants were observed at this location during the site visit, 80 percent were vegetative and 20 percent were in bud. All were readily identifiable as *Arctomecon*, and of the 20 percent in bud they were separated from white bearpoppy (*A. merriamii*) by having sepals that are glabrous (versus hairy in white bearpoppy). The site is in a disturbed but undeveloped area within Tule Springs Fossil Beds National Monument with relatively flat topography and shallow draws (slopes 0-20 percent), the substrate is gypsiferous, with very white soils and scattered gravels. Associated species are catclaw acacia (*Senegalia greggii*), Torrey's jointfir (*Ephedra torreyana*), white burrobush, Heermann's buckwheat (*Eriogonum heermannii*), winter fat (*Krascheninnikovia lanata*), Mojave woody aster (*Xylorhiza tortifolia*), desert peppergrass (*Lepidium fremontii*), Shockley's goldenhead (*Acamptopappus shockleyi*), shadscale (*Atriplex confertifolia*), and prince's plume (*Stanleya pinnata*).

Threecorner milkvetch (*Astragalus geyeri* var. *triquetrus*): On March 21, 2018, R. Kokx and O. Singh visited a known population of threecorner milkvetch (SEINet/New York Botanical Gardens collection Occurrence ID [GUID]: 94444f33-c84a-42cf-8fc8-90ab1b15a6f1) located at an unnamed cove 0.6 mile south of Ebony Cove on the west side of Overton Arm in the Lake Mead National Recreation Area (LMNRA) at 1,230-1,385 feet in elevation (SEINet 2018). Kokx and Singh found 40-50 plants with emerging compound leaflets readily identifiable as *Astragalus*. The combination of the location, appressed hairs, and associates indicated a high likelihood that the plants found were threecorner milkvetch. The population was found on prominent stabilized dunes and/or sandy inclusions on hillsides, an east-facing slope, and on adjacent lower, flat areas**.** Vegetation was sparsely scattered creosote-white burrobush scrub with devil's lantern (*Oenothera deltoides*), Saharan mustard (*Brassica tournefortii*), and Mediterranean grass (*Schismus barbatus*). Another special-status plant, sticky buckwheat (*Eriogonum viscidulum*), was listed as an associate species in the collection record, but no *Eriogonum* species were observed in the area during the site visit.

Nye milkvetch (*Astragalus nyensis*): On March 20, 2018, R. Kokx and O. Singh visited a known population of Nye milkvetch (SEINet Occurrence ID [GUID]: 903ae363-cbe9-48f8-ba6e-0ec5ebcbd7c1) 3.4 road miles south-southeast of Highway 15 on the Valley of Fire Road, at 2,140 feet in elevation (SEINet 2018). No plants were observed at the location given on SEINet. Three plants were found in similar habitat to the west of this location with characteristics of Nye milkvetch including "shaggy" hairs on the leaflets; however, without flowers and fruits, a positive identification could not be made. This site was pin-flagged and mapped for a revisit. The site has sandy hummock-to-small-dune-like topography with sparse vegetation within creosote-white burrobush scrub with beavertail (*Opuntia basilaris*), devil's spineflower (*Chorizanthe rigida*), Torrey's jointfir, Saharan mustard, and *Schismus* sp.

Littlefield/Lancaster milkvetch (*Astragalus preussii* var. *laxiflorus*): G. Rink observed this variety of *A. preussii* on the Valley of Fire Road on April 15. This population consisted of a few plants in flower and fruiting condition. The plants were growing out of roadside gravel along a weedy area of the roadside within a creosote-white burrobush community. Ladder buckwheat (*Eriogonum exaltatum*) was noted as an associate.

Silverleaf sunray (*Enceliopsis argophylla*): During their March 20-21 reference site visits, R. Kokx and O. Singh incidentally observed this species in vegetative and blooming condition all around Lake Mead.

Additionally, G. Rink visited a population of silverleaf sunray on the Bitter Springs Road toward Lake Mead on April 22.

Amargosa buckwheat (*Eriogonum contiguum*): On April 23, R. Kokx visited two known populations of Amargosa buckwheat (SEINet Occurrence ID [GUID]: d7b07352-8c13-4188-bb98-23993d05f0f5 and c62b20d3-05d1-4272-9e14-128e18d0e1a0) (SEINet 2018). One was in Death Valley National Park along Furnace Creek Road, 0.3 mile north of its intersection with Twenty Mule Team Canyon, at approximately 500 meters in elevation. The second was in Nye County, NV, 0.5 mile east of Crystal Reservoir (SEINet 2018). No plants were observed at the locations given on SEINet, though the location appeared to be accurate and matched the descriptions given. Several individuals of a perennial *Eriogonum*, desert trumpet (*Eriogonum inflatum*), were observed at both sites. The habitat at the Death Valley site is a gravel flat that was derived from a wash outlet in sparsely scattered creosote-white burrobush scrub; the gravel flats supported several species such as desert holly (*Atriplex hymenelytra*), honey sweet (*Tidestromia oblongifolia*), desert trumpet, desert sunflower (*Geraea canescens*), and narrow-leaved forget-me-not (*Cryptantha angustifolia*). The other site near Crystal Reservoir was in a flat alkaline depression area, with fine white and somewhat flocculent soils and sparsely scattered gravel in mesquite scrub; the flat supported several species including prince's plume, shadscale, and desert trumpet.

Sticky buckwheat (*Eriogonum viscidulum*): On April 29, G. Rink visited a reference site in Sand Hollow Wash, Mohave County, Arizona and observed a few plants in flower. The site was in creosote-white burrobush scrub with a substrate of sand over gypsiferous soils.

Beaver Dam breadroot (*Pediomelum castoreum*): On March 20, 2018, R. Kokx and O. Singh visited a known population of Beaver Dam breadroot (SEINet Occurrence ID [GUID]: 5e254a2d-03f0-4070-909e-196113b5da9b) located in the Dry Lake Valley, 27 miles northeast of Las Vegas at 2,034 feet in elevation (SEINet 2018). No plants were found at the location mapped for this reference population; however, a search of similar habitat to the west revealed a population of 30 plants with emerging palmately compound leaflets readily identifiable as *Pediomelum*. The population was found in fine cracked soils with sparsely scattered gravel on relatively flat topography in creosote-white burrobush scrub with Indian rice grass (*Stipa hymenoides*), pink funnel lily (*Androstephium breviflorum*), devil's spineflower, wild buckwheat (*Eriogonum trichopes*), Torrey's jointfir, yellow-eyed lupine (*Lupinus flavoculatus*), African mustard (*Strigosella africana*), big galleta (*Hilaria rigida*), Mediterranean grass, and apricot mallow (*Sphaeralcea ambigua*). Beaver Dam breadroot was also observed in blooming condition in gypseous sand in Sand Hollow Wash on the Arizona-Nevada border by G. Rink on April 29.

Rosy twotone beardtongue (*Penstemon bicolor* ssp. *roseus*): On May 5, G. Rink, observed rosy twotone beardtongue off U.S. Highway 93 at the turnoff for the Apex Powerplant. A couple of large plants (with greater than 40 stems) were observed in the most disturbed portion of the road, growing out of cracks in the pavement and in places that had been severely disturbed for construction of the drainage ditch. On May 6, G. Rink also observed rosy twotone beardtongue on a dirt road west of U.S. Highway 93 in a large, dry desert wash; this population numbered in the thousands, but most were not in bloom.

VEGETATION SAMPLING SURVEY METHODOLOGY

Vegetation communities within the Study Area were mapped and classified to the alliance level using Peterson (2008), as described above under Pre-project Review. Representative photos were taken of vegetation communities throughout the Study Area.

Sampling was also conducted within each vegetation community to estimate the cover, density, and species richness for each vegetation community. No vegetation typing or sampling was conducted in the buffer zone or in the gen-ties. Vegetation sampling was conducted in 16 plots, each measuring 100 meters by 100 meters or one hectare. Six plots were randomly placed in the *Larrea tridentata-Ambrosia dumosa* (Creosote-White Burrobush) Shrubland Alliance, four in the *Atriplex confertifolia* (Shadscale) Shrubland Alliance, two in the *Pleuraphis rigida* [=*Hilaria rigida*] (Big Galleta) Herbaceous Alliance, and four in the *Acacia greggii* [=*Senegalia greggii*] (Catclaw Acacia) Shrubland Alliance. Vegetation cover, density, and species richness was assessed for each plot using the Line Point Intercept method following the BLM's Assessment, Inventory, and Monitoring (AIM) program (USDA-ARS 2018). Data collected was entered in Microsoft Access using the Database for Inventory, Monitoring, and Assessment (DIMA). DIMA is a customizable software program for data collection, management, and interpretation (USDA-ARS 2018).

SPECIAL-STATUS PLANT INVENTORY METHODOLOGY

A complete floristic survey of the Study Area was conducted. Within the Project Area, transects were spaced 49 feet (15 meters) apart west of California Wash (in areas A, B, B1, B2, C, and G), and 33 feet (10 meters) apart east of California Wash (in areas D, E, and F), because this area was considered more likely to be suitable habitat for threecorner milkvetch. The 656-foot (200-meter) buffer was surveyed around the entire Project area in transects spaced 49 feet (15 meters) apart. The gen-tie routes were surveyed in six transects spaced 49 feet (15 meters) apart in order to cover the 200-foot corridor. Additionally, two or three transects (spaced 49 feet [15 meters] apart) were also surveyed along the west side of California Wash, adjacent to area B, and along the east side of the Valley of Fire Road, adjacent to area C. The buffer area and the spacing of the transects was determined in coordination with the BLM District Botanist (L. Kobelt pers. comm., February 2018).

Methods used for the spring 2018 special-status plant survey of the Study Area complied with BLM Southern Nevada District Office's *Survey Protocols Required for National Environmental Policy Act (NEPA)/Endangered Species Act (ESA) Compliance for BLM Special Status Plant Species*. Late-season surveys are not proposed because all special-status species with potential to occur in the Study Area are detectable in spring. The following key aspects of the survey protocols were implemented during the survey of the Study Area:

- PBC botanists conducted a 100 percent visual inspection of the Study Area using transects;
- The floristic inventory included documenting all plant taxa within the Study Area, by vegetation community and by area (A-G, B1, and B2; buffers; and gen-ties);
- All rare taxa encountered were mapped using a global positioning system (GPS) unit (Trimble GeoExplorer 6000); and,
- Data for all rare taxa were recorded in a data dictionary loaded into the GPS units that was developed to record all requisite fields of the NNHP's Nevada Native Species Site Survey Report (NNHP 2018b).

The botanical survey teams were divided into four groups of three to four individuals; each team surveyed designated areas (e.g., Team 1 surveyed area A; Team 2 surveyed areas C and E; Team 3 surveyed Area B; Team 4 surveyed area F, etc). Each group was given one Trimble GeoExplorer 6000 Series GPS unit and one Garmin GPSmap 78 unit; the Trimble units were used for recording all rare plant data, and the Garmin units were used for keeping track of transect lines and recording tracks via a track

log to ensure that no areas were missed. Two GPS units also provided redundancy to minimize equipment and operator errors. All data was recorded on the Trimble units, which were collected each day by a designated person and all data was downloaded and all units were charged. Each group also had a set of aerial-photo based maps with labels to help with orientation. A working master plant list was maintained and updated by all groups daily using Google Sheets.

Special-status plant locations were mapped as points using the Trimble GeoExplorer 6000 Series units. Data was recorded for each point using a project-specific data dictionary that included the data requested on the NNHP's Nevada Native Species Site Survey Report form. Recorded data included the observer's name, scientific name, phenology (percent dormant, vegetative, budding, flowering, fruiting, and/or seeding), age structure (percent senescent, mature, seedling), interactions (disease, predation, competition, parasitism, symbiosis, pollination, hybridization, none, or other), current site use (camping, grazing, mining, OHV trails, transmission line, undisturbed, or other), substrate type (clay, sandy clay, sandy clay loam, loamy sand, clay loam, loam, silty clay, silty clay loam, silt loam, silt, rocky, gypsum), vegetation alliance (*Larrea tridentata - Ambrosia dumosa* Shrubland Alliance, *Pleuraphis rigida* [*Hilaria rigida*] Herbaceous Alliance, *Acacia greggii* [*Senegalia greggii*] Shrubland Alliance, or *Atriplex confertifolia* Shrubland Alliance), associated species, population estimate, size estimate, and notes. Representative photos were taken of special-status plant taxa and their habitats.

All project botanists had experience surveying for rare plants in the Mojave Desert, met the requirements of the BLM Southern Nevada District Office, and were pre-approved by the BLM (see Contractor Qualifications section below for more information).

A general training was held on April 2nd for all the botanists to familiarize themselves with the Study Area, maps, GPS units, and data collection methods. This training also reviewed identification of several *Astragalus* specimens. Each crew was given a laminated field notebook with details regarding the rare plants with potential to occur in the Study Area, including color photos. *Astragalus* in vegetative stage that were determined to possibly be threecorner milkvetch and Nye milkvetch were mapped using the Trimble GPS unit and a follow-up survey was conducted on May 8-10 by R. Kokx to confirm identification of the plants. The follow-up survey was primarily conducted in area A, but also in areas B, C, D, and E. This follow-up survey also doubled as a semi-random survey effort to check for any new observations that may have been missed. Another in-field training was held on April 14 to discuss how to distinguish between several *Astragalus* (including threecorner milkvetch and Nye milkvetch) in their vegetative stage using leaf hair characters.

References used for plant identification during the survey included Baldwin et al. 2002, Barneby 1964, Cronquist et al. 2013, Flora of North America electronic flora (FNA 2018), and Kartesz 1988.

Bryophyte Survey Protocols

Bryophytes were collected where encountered on the site. Before the survey began, botanists were given a short training by PBC botanist Jason Brooks on how and where to collect bryophytes. Bryophyte packets were used for all collections with relevant information recorded on the outside of the packets. Identification of bryophytes was performed by PBC botanist Jason Brooks and California Academy of Sciences herbarium botanist David Toren. Representative bryophytes from the Study Area were donated to California Academy of Sciences (CAS) herbarium after the survey was completed. References used for bryophyte identification included FNA 2018, Greven 2003, Norris and Shevock 2004, Sharp et al. 1994, and Spence 2018.

Inventory Timing

The special-status plant inventory of the Study Area was conducted from April 2, 2018 to May 12, 2018 (Table 3). The timing of the special-status plant inventory was determined based on seasonal rainfall events, regional temperatures, reconnaissance and reference site visits, and input from James Andre (PBC consultant and regional expert) and Lara Kobelt, District Botanist with the BLM's Southern Nevada District Office (J. Andre pers. comm., March 2018; L. Kobelt pers. comm., April 2018). Despite the slightly below average rainfall in the region, the inventory survey was scheduled to proceed with the expectation that there would be at least some germination of annuals and short-lived perennials, that certain species may not flower (e.g., *Penstemon bicolor*, which is only identifiable in blooming condition), and that others (e.g., *Eriogonum*) could respond to spring rainfall.

Table 3. Special-status plant inventory survey dates and rare plant species identified.

Survey Date	Rare Plant Species Found	Survey Date (cont'd)	Rare Plant Species Found
April 02, 2018	*Astragalus nyensis*	April 23, 2018	*A. nyensis, A. geyeri* var. *triquetrus*
April 03, 2018	*A. nyensis*	April 24, 2018	*A. nyensis, A. geyeri* var. *triquetrus*
April 04, 2018	*A. nyensis*	April 25, 2018	*A. nyensis, A. geyeri* var. *triquetrus*
April 05, 2018	*A. nyensis, A. geyeri* var. *triquetrus*	April 26, 2018	*A. geyeri* var. *triquetrus*
April 06, 2018	*A. nyensis, A. geyeri* var. *triquetrus*	April 27, 2018	*A. nyensis, A. geyeri* var. *triquetrus, Penstemon* spp.
April 07, 2018	*A. nyensis*	April 28, 2018	*A. nyensis, A. geyeri* var. *triquetrus*
April 09, 2018	*A. nyensis*	April 30, 2018	*A. nyensis, A. geyeri* var. *triquetrus*
April 10, 2018	*A. nyensis, Penstemon* spp.	May 01, 2018	*A. nyensis*
April 11, 2018	*A. nyensis, A. geyeri* var. *triquetrus*	May 02, 2018	*A. nyensis, A. geyeri* var. *triquetrus, P. bicolor* ssp. *roseus*
April 12, 2018	*A. nyensis, A. geyeri* var. *triquetrus*	May 03, 2018	*A. nyensis*
April 13, 2018	*A. nyensis, A. geyeri* var. *triquetrus*	May 04, 2018	*A. nyensis*
April 14, 2018	*A. nyensis, A. geyeri* var. *triquetrus*	May 05, 2018	*A. nyensis*
April 16, 2018	*A. nyensis, A. geyeri* var. *triquetrus*	May 06, 2018	
April 17, 2018	*A. nyensis, A. geyeri* var. *triquetrus*	May 07, 2018	
April 18, 2018	*A. nyensis, A. geyeri* var. *triquetrus*	May 08, 2018	*A. nyensis*
April 19, 2018	*A. nyensis, A. geyeri* var. *triquetrus*	May 09, 2018	*A. nyensis, A. geyeri* var. *triquetrus*
April 20, 2018	*A. nyensis, A. geyeri* var. *triquetrus*	May 10, 2018	
April 21, 2018	*A. nyensis, A. geyeri* var. *triquetrus*	May 11, 2018	*A. nyensis*
April 22, 2018	*A. nyensis, A. geyeri* var. *triquetrus*	May 12, 2018	*A. nyensis*

CACTI/YUCCA, INVASIVE WEEDS, AND BIOCRUST/DESERT PAVEMENT SAMPLING SURVEY METHODOLOGY

Cacti and yucca, invasive weeds, and biological soil crust (biocrust)/desert pavement substrates were all sampled by surveying belt transects. The initial goal was to sample approximately eight percent of the primary Study Area (the gen-ties and buffer zone were not included in this sampling) subdivided proportionally by vegetation community. However, the total kilometers sampled within the Creosote-White Burrobush Shrubland Alliance was reduced in order to include the new sampling areas that were added during the spring botanical survey season (areas B1, B2, and G) without greatly increasing the level of sampling effort. This adaptation was made in consultation with the BLM (L. Kobelt pers. comm., June 2018) and resulted in sampling of 6.4 percent of primary Study Area (including approximately 6.3 percent of the Creosote-White Burrobush Shrubland Alliance and eight percent of all other vegetation communities).

The belt transect locations within the Shadscale and Creosote-White burrobush shrubland alliances were randomly selected. Due to the linear alignment of the Big Galleta Herbaceous Alliance and the Catclaw Acacia Shrubland Alliance, transects within these vegetation communities were not randomly selected, but instead were assigned within the communities. Transects were 33 feet (15 meters) wide and lengths were variable. Table 4 below shows how the approximate linear distance of transects needed to capture a representative sample from each community was determined from the size and proportion of each vegetation community in the Study Area. Appendix B includes an example of the data sheet used during sampling. Pre-established transect lines were uploaded to hand-held GPS units to be used by each surveyor as the center line of the survey transect. Surveyors worked individually and walked along the center line of each transect.

Table 4. Size and proportion of vegetation communities in the Study Area areas A-G, B1 and B 2 and the approximate linear distance of transects needed to capture a representative sample from each community.

Vegetation Community	Approximate Acreage within the Study Area[1]	Percentage of the Study Area	Approximate Acreage to Sampled	Linear Distance of Belt Transects to be Sampled
Shadscale Shrubland Alliance	385	5.4%	31 acres	8.3 kilometers of 15 meter wide transects
Big Galleta Herbaceous Alliance	68	0.9%	5 acres	1.6 kilometers of 15 meter wide transects
Creosote-White Burrobush Shrubland Alliance	9,936	95%	630 acres	170 kilometers of 15 meter wide transects[2]
Catclaw Acacia Shrubland Alliance	73	1%	6 acres	1.6 kilometers of 15 meter wide transects
Total	**10,463**	**99.90%**	**672 acres**	**182 kilometers**

[1] No belt transects were assigned within the gen-tie routes or the buffer zone, so acreages for those areas are not included.

[2] The total kilometers within the Creosote-White Burrobush Shrubland Alliance was a compromise reached with BLM (Lara Kobelt, Botanist) in order to sample new areas that were added during the spring botanical survey season (areas B1, B2, and G).

Cacti and Yucca Sampling

The surveyors counted each individual species of cacti and yucca and tallied them as they went on a data sheet; tallies for each were made in the appropriate row and height class (0-3 feet; 3-6 feet; >6 feet) as either numeric values or tally marks. At the end of each transect, surveyors totaled up the numbers of individuals of each species and record the totals on the data sheet at the end of the row.

Invasive Weed Sampling

For the weed sampling, weed points were not mapped, but instead the number of weeds were estimated and tallied per species on the data sheet. The surveyor estimated the number of weeds and tallied them on the data sheet as either numeric values or tally marks as they went along. At the end of each transect, surveyors totaled the number of weeds and recorded the totals on the data sheet at the end of the row for each weed species.

Additional Invasive Weed Mapping

Invasive weed species targeted during the inventory included all species listed on the Nevada Department of Agriculture (NDA) Nevada Noxious Weed List (NDA 2018a). A preliminary list of weeds likely to occur in the Study Area was developed from the BLM's weed inventory data (BLM 2014), which mapped weed occurrences in the Study Area and vicinity (Figure 4, Table 5). In addition to weed sampling conducted during the belt transects surveys, described above, updates to the BLM's weed inventory data (BLM 2014) were also made to document areas where weeds have spread. In order to update the BLM data, all of the dirt and paved roads in and around the Study Area were inspected in order to document new areas of weed invasion and to update the existing BLM data (Figure 4). Any other significant or potential vector populations of invasive weeds noted during the botanical survey were also mapped.

Table 5. Weed inventory species mapped by the BLM in the vicinity of the Study Area (BLM 2014).

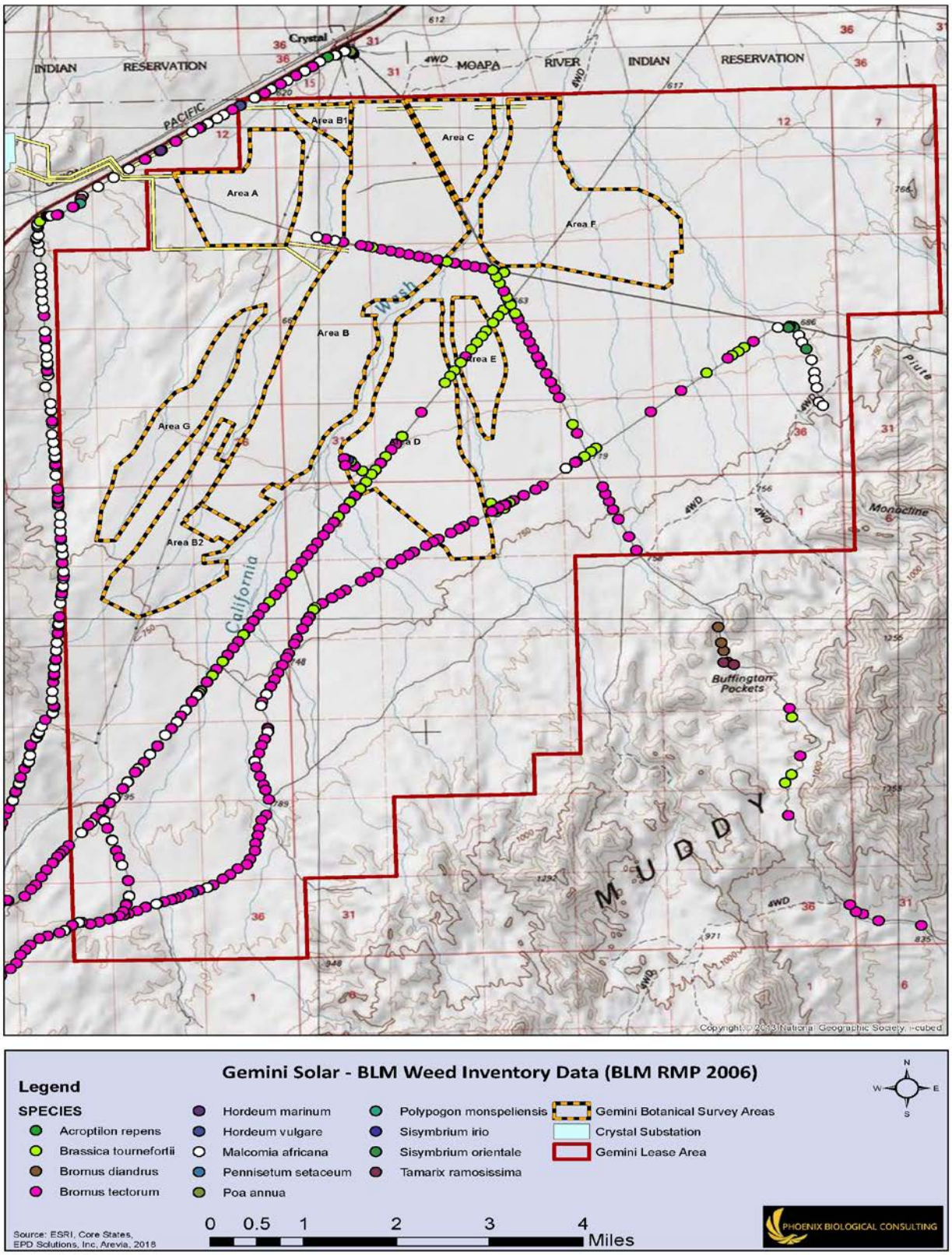
Common Name	Scientific Name	Nevada Noxious Weed List Category (NDA 2018a)
Russian knapweed	*Acroptilon repens*	B
African mustard*	*Brassica tournefortii*	B
ripgut brome	*Bromus diandrus*	--
cheatgrass	*Bromus tectorum*	--
foxtail barley	*Hordeum marinum*	--
common barley	*Hordeum vulgare*	--
African mustard	*Malcolmia (=Strigosella) africana*	--
crimson fountain grass	*Pennisetum setaceum*	A
annual blue grass	*Poa annua*	--
annual beard grass	*Polypogon monspeliensis*	--
London rocket	*Sisymbrium irio*	--
Indian hedge mustard	*Sisymbrium orientale*	--
salt cedar	*Tamarix ramosissima*	C

*The BLM used this common name for both *Brassica tournefortii* and *Strigosella africana*; to avoid confusion, this report uses the common name Saharan mustard for *Brassica tournefortii* and the common name African mustard for *Strigosella africana*.

Biocrust and Desert Pavement Sampling

Estimates of the areas of biocrust and desert pavement encountered were recorded on data sheets. The surveyors would stop every ten meters to record biocrust and desert pavement areas. At the end of each belt transect, the areas were added up and an estimate of the total area (in square meters) of biocrust and desert pavement within each transect was determined.

Figure 4. BLM Weed Inventory Data (BLM 2014)



Results

NATIVE PLANT COMMUNITIES

Four natural vegetation communities occur in the Study Area: *Larrea tridentata* - *Ambrosia dumosa* (Creosote-White Burrobush) Shrubland Alliance, *Atriplex confertifolia* (Shadscale) Shrubland Alliance, *Pleuraphis rigida* [*Hilaria rigida*] (Big Galleta) Herbaceous Alliance, and *Acacia greggii* [*Senegalia greggii*] (Catclaw Acacia) Shrubland Alliance (Peterson 2008; Sawyer et al. 2009). In addition, badlands were mapped along the gen-ties lines. Vegetation communities and badlands in the Study Area are described below and are quantified in Table 6 and mapped in Figure 5. Vegetation communities in the buffer were not classified or mapped. A complete list of all plants observed during the botanical survey is included in Appendix C; each taxon was identified to the lowest taxonomic level possible. Representative photos of vegetation communities in the Study Area are included in Appendix D.

Table 6. Area and proportion of each vegetation community in the Study Area.

Vegetation Community and Badlands	Approximate Acreage by Area										Total Approx. Acreage in the Study Area[1]	Proportion of the Study Area
	A	B	C	D	E	F	G	B1	B2	Gen-ties		
Creosote-White Burrobush Shrubland Alliance	413	3,284	473	1,751	404	1,822	770	142	867	209	**10,135**	**93%**
Shadscale Shrubland Alliance	386	--	--	--	--	--	--	--	--	154	**540**	**5%**
Big Galleta Herbaceous Alliance	68	--	--	--	--	--	--	--	--	17	**85**	**<1%**
Catclaw Acacia Shrubland Alliance	--	59	--	14	--	10	--	--	--	18	**101**	**1%**
Badlands	--	--	--	--	--	--	--	--	--	49	**49**	**<1%**
Total	**867**	**3,343**	**473**	**1,765**	**404**	**1,832**	**770**	**142**	**867**	**447**	**10,910**	**100%**

[1] Vegetation communities in the buffer were not included in the vegetation classification, so acreages for that area is not included.

Larrea tridentata - *Ambrosia dumosa* (Creosote-White Burrobush) Shrubland Alliance

This xerophytic shrubland community is the dominant vegetation alliance of the Mojave Desert. The Creosote-White Burrobush Shrubland Alliance occurs most often on gentle- to moderately sloped alluvial fans, bajadas, and hills in well-drained, sandy soils that are oftentimes calcareous with a caliche hardpan and/or desert pavement surface (Peterson 2008). The shrub layer is open and co-dominated by creosote and white burrobush; according to the alliance description in Peterson (2008) "cover of either species does not exceed the other by more than twice, and no other species greatly exceeds the cover of both combined." Other shrubs and sub-shrubs are common and may co-dominate, these may include

saltbush (*Atriplex* spp.), ephedra (*Ephedra* spp.), cheesebush (*Ambrosia salsola*), rhatany (*Krameria* spp.), thornbush (*Lycium* spp.), indigobush (*Psorothamnus* spp.), bladder-sage (*Scutellaria mexicana*), desert senna (*Senna armata*), and many others (Peterson 2008).

Creosote-White Burrobush Shrubland Alliance is the most common vegetation community in the Study Area and comprises approximately 10,135 acres or 93 percent of the Study Area (Figure 5). This community occupies a variety of soil types in the Study Area including sandy, well-drained soils, caliche, biocrust, desert pavement, and limestone bedrock. Though relative abundance of both creosote and white burrobush varies throughout the site, both species are ubiquitous and can be found everywhere the community exists. Throughout the site, several additional shrubs commonly co-occur including white ratany (*Krameria bicolor*), rayless goldenhead (*Acamptopappus sphaerocephalus*), spiny desert olive (*Menodora spinescens*), and Anderson thornbush (*Lycium andersonii*). Beavertail (*Opuntia basilaris*) and silver cholla (*Cylindropuntia echinocarpa*) are also common in this alliance. The herbaceous layer consists of perennial and annual forbs and grasses, commonly including white easter bonnets (*Eriophyllum lanosum*), pebble pincushion (*Chaenactis carphoclinia*), Nevada cryptantha (*Cryptantha nevadensis* var. *nevadensis*), chuckwalla pectocarya (*Pectocarya heterocarpa*), brittle spineflower (*Chorizanthe brevicornu*), devil's spineflower (*Chorizanthe rigida*), wild buckwheat (*Eriogonum trichopes*), Moapa bladderpod (*Physaria tenella*), woolly plantain (*Plantago ovata*), red brome (*Bromus madritensis* ssp. *rubens*), cheatgrass (*Bromus tectorum*), and Mediterranean grass (*Schismus* sp.).

In small washlets within the Creosote-White Burrobush Shrubland Alliance, the following sub-shrubs and perennial herbs are common: broom snakeweed (*Gutierrezia sarothrae*), paper flower (*Psilostrophe cooperi*), odora (*Porophyllum gracile*), desert marigold (*Baileya multiradiata*), wire lettuce (*Stephanomeria pauciflora*), and linda tarde (*Oenothera suffrutescens*).

Atriplex confertifolia (Shadscale) Shrubland Alliance

The Shadscale Shrubland Alliance is another common alliance of the Mojave Desert and is typically found in valley bottoms or alluvial slopes on medium- to fine-textured alkaline soils, but can also occur on coarser, calcareous substrates. The shrub layer is open to somewhat dense and dominated or co-dominated by shadscale. Other common shrubs may include other saltbush species, Nevada ephedra (*Ephedra nevadensis*), rabbitbush species (*Ericameria* spp.), winter fat (*Krascheninnikovia lanata*), and thornbush species (*Lycium* spp.). The herbaceous layer is usually sparse and dominated by grasses (Peterson 2008).

This vegetation alliance is found in the northwestern portion of the Study Area in Area A and along the gen-ties (Figure 5). Shadscale Shrubland comprises approximately 540 acres, or five percent, of the Study Area. This community occurs on alkaline soils that are typically fine textured or on coarse calcareous soils where the alliance occurs near badlands. Shadscale, desert holly, white burrobush, and alkali seepweed (*Suaeda nigra*) generally co-dominate the alliance. In addition, little leaved rhatany (*Krameria erecta*), Anderson thornbush, creosote, Nevada ephedra, Torrey's jointfir (*Ephedra torreyana*), and big galleta, are all present throughout this area; four-wing saltbush (*Atriplex canescens*) also occurs in this alliance. Forbs have low cover within this alliance. In playa-type areas, only ladder buckwheat (*Eriogonum exaltatum*), halogeton (*Halogeton glomeratus*), and African mustard are common. Other forbs and grasses found in this alliance include Mojave pincushion (*Chaenactis macrantha*), devil's spineflower, red stem stork's bill (*Erodium cicutarium*), chuckwalla pectocarya, red brome, Mediterranean grass, and others.

Pleuraphis rigida [=*Hilaria rigida*] (Big Galleta) Herbaceous Alliance

The Big Galleta Herbaceous Alliance is found in the Mojave Desert on flat ridgelines, lower slopes, and stabilized sand dunes. According to Peterson (2008), big galleta "is the sole or dominant graminoid in the herbaceous layer." Other grasses that may also be present include black grama (*Bouteloua eriopoda*), fluff grass (*Dasyochloa pulchella*), red brome, galleta (*Hilaria jamesii*), sand rice grass (*Stipa hymenoides*), and more. Shrubs, if present, are usually present in low densities (Peterson 2008).

In the Study Area, the Big Galleta Herbaceous Alliance is found along the small washlets, rivulets, and depressions in the northwest portion of the Study Area in Area A and along the gen-ties (Figure 5). There are approximately 85 acres of the Big Galleta Herbaceous alliance in the Study Area, less than one percent of the Study Area's vegetation. The alliance in the Study Area is characterized by small shallow swales with fine cracked soils and dense grass. The alliance is dominated by big galleta. Shrubs are common, often dense, and include white burrobush, broom snakeweed, Cooper's box thorn (*Lycium cooperi*), Anderson thornbush, creosote, little leaved rhatany, and shadscale. Forbs are also common in the rivulets and include lobed ground cherry (*Physalis lobata*), linda tarde, African mustard, *Erodium* species, winding mariposa (*Calochortus flexuosus*), rattlesnake sandmat (*Euphorbia albomarginatus*), red brome, Arizona brome (*Bromus arizonicus*), cheatgrass, and Mediterranean grass.

Acacia greggii [=*Senegalia greggii*] (Catclaw Acacia) Shrubland Alliance

The description of this alliance in Peterson (2008) is specific to the Sonoran Desert; however, the equivalent alliance in the Manual of California Vegetation, Second Edition (Sawyer at al. 2009), also the *Acacia greggii* Shrubland Alliance, fits the community found in the Study Area and so is used here.

According to Sawyer et al. (2009), catclaw acacia is dominant or co-dominant in the shrub canopy with cheesebush, woolly bur-sage (*Ambrosia eriocentra*), sweetbush (*Bebbia juncea*), buckhorn cholla (*Cylindropuntia acanthocarpa*), Virgin River encelia (*Encelia virginensis*), California ephedra (*Ephedra californica*), Nevada ephedra, green rabbitbrush (*Ericameria teretifolia*), eastern Mojave buckwheat (*Eriogonum fasciculatum*), desert lavender (*Condea emoryi*), creosote, desert almond (*Prunus fasciculata*), sugar bush (*Rhus ovata*), bladder-sage, desert sage (*Salvia dorrii*), desert senna, Parish viguiera (*Bahiopsis parishii*), and Mojave yucca (*Yucca schidigera*). An emergent tree canopy may be present at low cover and could include desert willow (*Chilopsis linearis*), California or Utah juniper (*Juniperus californicus* or *J. osteosperma*), ironwood (*Olneya tesota*), blue palo verde (*Parkinsonia florida*), or smoke tree (*Psorothamnus spinosus*). The shrub layer is under three meters tall with an open to intermittent canopy. The herbaceous layer is composed of annuals. This alliance typically occurs in arroyos, channels, and washes in coarse, well-drained soils.

In the Study Area, this community is found along the larger washes in areas B, D, and F and along the gen-ties (Figure 5). There are approximately 101 acres of the Catclaw Acacia Shrubland in the Study Area, comprising approximately one percent of the Study Area. The alliance is found in coarse, sandy soils. The shrub canopy is co-dominated by white burrobush, catclaw acacia, and creosote. Other common shrubs and sub-shrubs include Nevada ephedra, Torrey's jointfir, little leaved rhatany, desert almond, white rhatany, and Fremont's indigobush; other characteristic species found in this alliance include woolly bur-sage, cheesebush, sweetbush, Virgin River encelia, bladder-sage, and eastern Mojave buckwheat. Desert willows are occasional in the tree layer. The herbaceous layer includes native and non-native grasses and forbs such as red brome, cheatgrass, Mediterranean grass, sand rice grass, cryptantha species (*Cryptantha* spp.), pectocarya species (*Pectocarya* spp.), red stem stork's bill, woolly plantain, and other annuals.

Badlands

Badlands are located in the northwest corner of the Study Area along the gen-ties (Figure 5). Approximately 49 acres (less than one percent) of the Study Area is badlands. This area is primarily a series of small flat-topped hills with deeply incised drainages between them. Soils are a mixture of clay and caliche that appear red in some areas and are bleached white in others. Vegetation is extremely sparse throughout most of this area and in some areas it is completely barren of plant life. Shrubs occur in very low densities and include white burrobush, desert holly, and alkali seepweed.

Soil Typing

Soils identified in the Study Area are summarized in Table 7 and shown in Figure 6 (NRCS 2018). No unique soils types, such as gypsum, were identified during the survey. Areas of caliche were observed, especially around the badlands along the gen-ties and in Area A. Cracked or puffy alkaline silty clay soils were also unique to Area A in the Shadscale Shrubland Alliance. Aeolian sand deposits were also noted, particularly in Area F.

Table 7. Soil units identified in the Study Area (NRCS 2018).

Map Unit Symbol	Map Unit Name	Description	Location Area(s)	Percentage within Areas
AOB	Arada fine sand, gravelly substratum	0-4% slopes, fine sand (0-24 inches), stratified extremely gravelly loamy coarse sand to extremely gravelly fine sandy loam (24-60 inches), somewhat excessively drained, fan remnants, and non-saline to very slightly saline	D, E	17.8
ASC	Arada fine sand, hardpan variant	2-8% slopes, fine sand (0-30 inches), cemented material (30-34 inches), somewhat excessively drained, fan remnants, and non-saline to very slightly saline	B, D	2.7
BD	Badland	On fan remnants	A	1.4
BHC	Bard gravelly fine sandy loam	2-8% slopes, gravelly fine sandy loam (0-3 inches), fine sandy loam (3-19 inches), cemented material (19-36 inches), well drained, fan remnants, and non-saline to very slightly saline	A, B, C, D	29.7
BOB	Bard-Rough broken land association	2-4% slopes, very gravelly fine sandy loam (0-5 inches), fine sandy loam (5-19 inches), cemented material (19-36 inches), well drained, fan remnants, and non-saline to very slightly saline	B	14.2
Gs	Glendale loam	0-2% slopes, loam (0-9 inches), stratified very fine sandy loam to silty clay loam (9-60 inches), well drained, flood plains, and strongly saline	A	1.1
MOB	Mormon Mesa fine sandy loam	0-8% slopes, fine sandy loam (0-16 inches), cemented material (16-60 inches), well drained, fan remnants, and non-saline to very slightly saline	A, B	1.6
SP	Spring silty clay loam	0-2% slopes, silty clay loam (0-5 inches), clay loam (5-11 inches), gypsiferous material (11-43 inches), moderately well drained, fan remnants, and strongly saline	A	9.2
THB	Tonopah gravelly sandy loam	0-4% slopes, gravelly sandy loam (0-6 inches), extremely gravelly sand (6-60 inches), excessively drained, and non-saline to slightly saline	A, B, C	22.3

Figure 5. Vegetation Communities in the Study Area

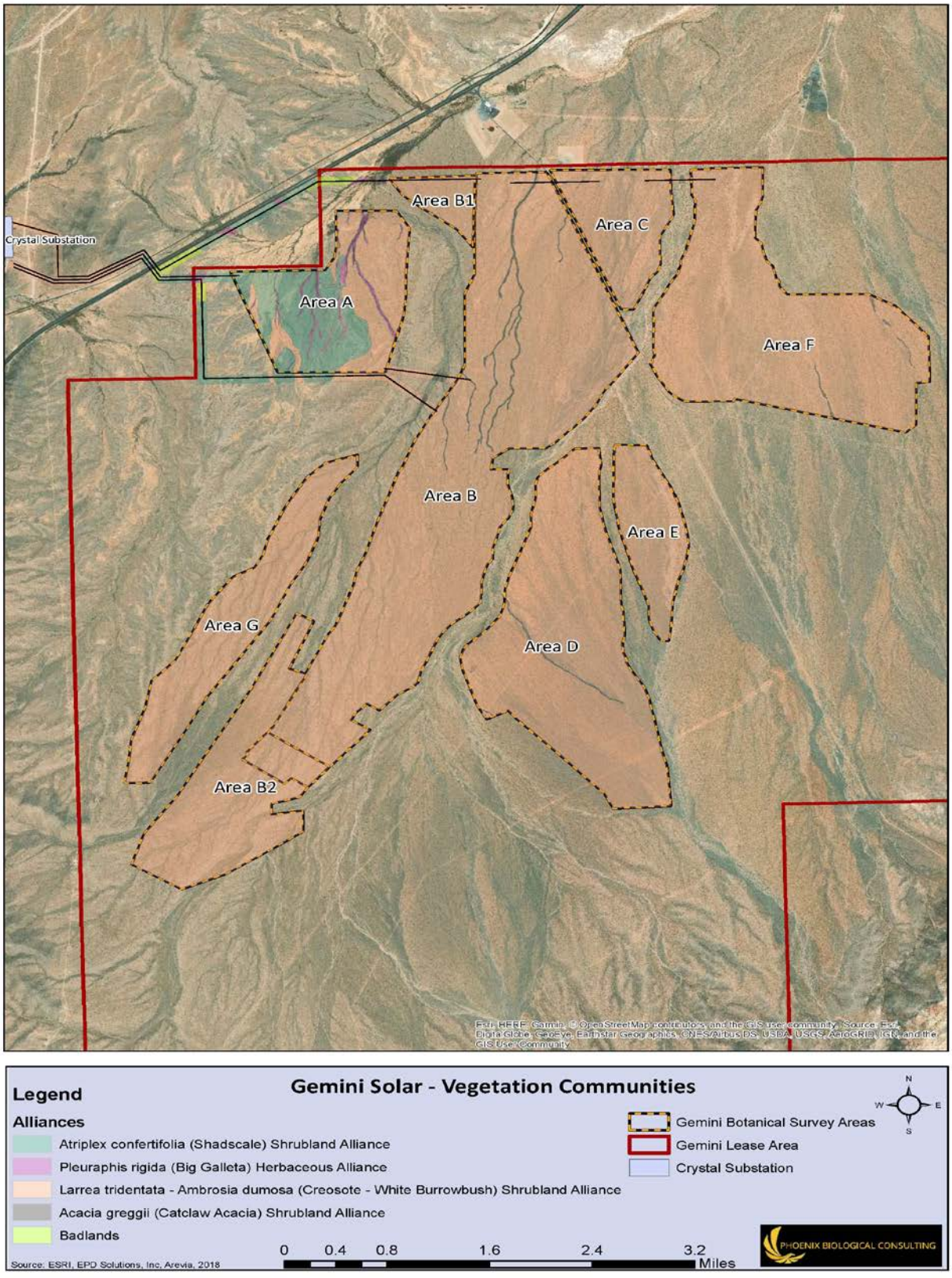
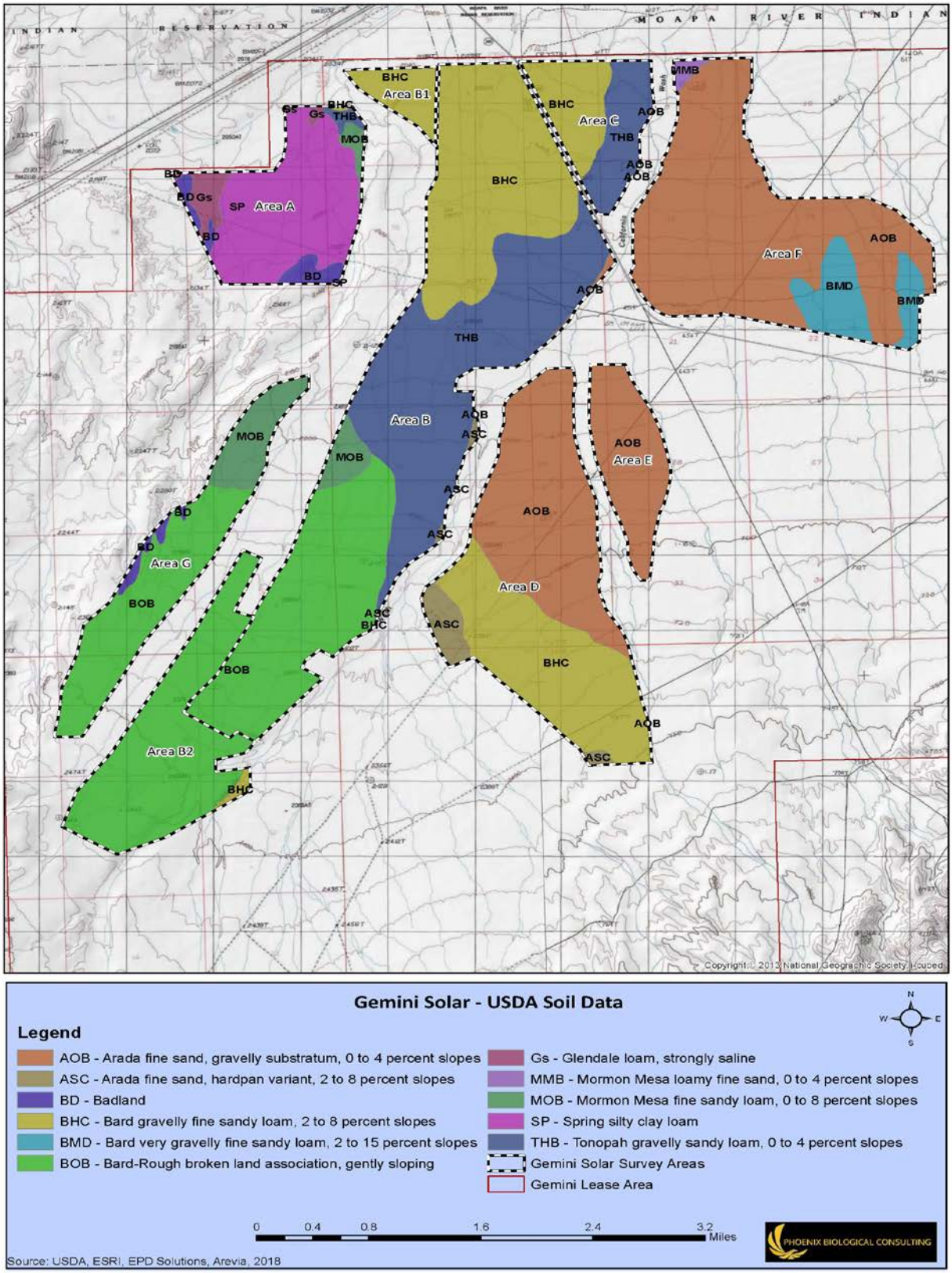


Figure 6. Soils in the Study Area



VEGETATION SAMPLING

Line Point Intercept transect sampling was conducted within each of the 16 plots to estimate the cover, density, and species richness for each vegetation community. The 16 plots are mapped on Figure 9, located below in the *Cacti and Yucca, Invasive Weeds, and Biocrust and Desert Pavement Sampling* section. Six plots were sampled in the Creosote-White Burrobush Shrubland Alliance, four in the Shadscale Shrubland Alliance, two in the Big Galleta Herbaceous Alliance, and four in the Catclaw Acacia Shrubland Alliance. Plant cover, density, and species richness was assessed in each plot using Line Point Intercept transects following the BLM's Assessment, Inventory, and Monitoring (AIM) program (USDA-ARS 2018).

Table 8 below summarizes the percent cover, density, average species richness, total number of species recorded during AIM sampling, and total number of taxa recorded during AIM sampling and the botanical inventory (Appendix C). Respective discussions for each alliance type are included below. Of the four alliances in the Study Area, the Big Galleta Herbaceous Alliance had the highest percent cover (90.3 percent), followed by the Catclaw Acacia Shrubland Alliance (46.2 percent), and the Creosote-White Burrobush Shrubland Alliance (35.9 percent); the Shadscale Shrubland Alliance had the lowest percent cover at 16.6 percent. The big galleta alliance also had the highest density of plants per hectare (6,716), followed by the creosote-white burrobush alliance with 6,385 plants per hectare and the catclaw acacia alliance with 5,914 plants per hectare; the shadscale alliance also had the lowest density at 2,840 plants per hectare. Average species richness values were highest in the big galleta and catclaw acacia alliances with 31 and 29.5 species per hectare, respectively; average richness was lowest in the creosote-white burrobush alliance at 19.5 species per hectare and only slightly higher in the shadscale alliance with 21.5 species per hectare. The big galleta alliance also had the highest number of species recorded (n=47), followed closely by the creosote-white burrobush and catclaw acacia alliance (both with 43 species); 35 species were recorded in the shadscale alliance.

Table 8. Percent cover, density, average species richness, and total number of species for each vegetation alliance recorded during AIM sampling.

Alliance	Number of Plots Sampled[1]	Estimated Percent Cover[2]	Density (plants/ hectare)	Average Species Richness (number of species/ hectare)	Total Number of Species from all Plots Combined	Total Number of Taxa Recorded[3]
Creosote-White Burrobush Shrubland	6	35.9%	6,385	19.5 [2.1] [4]	42	171
Shadscale Shrubland	4	16.6%	2,840	21.5 [5.1]	35	53
Big Galleta Herbaceous	2	90.3%	6,716	31 [N/A]	47	56
Catclaw Acacia Shrubland	4	46.2%	5,914	29.5 [3.1]	43	61

[1]Each plot measured 100 meters by 100 meters or 1 hectare in size

[2] Estimated average annual foliar cover %

[3] All taxa recorded in each alliance during both the botanical inventory survey and the AIM sampling

[4] Standard deviation of sample

Creosote-White Burrobush Shrubland Alliance

Percent Cover

The average annual foliar cover for the plots in the Creosote-White Burrobush Shrubland Alliance was 35.9 percent cover by 16 species (Table 9). The species with the highest estimated cover was common Mediterranean grass (*Schismus barbatus*) at 16.1 percent foliar cover, followed by white burrobush (nine percent), creosote (six percent), woolly plantain (1.9 percent), and wild buckwheat (0.9 percent); 11 additional species and the 'unknown dead shrub' category comprised the other two percent cover in the plots.

Table 9. Percent cover estimates by species in the Creosote-White Burrobush Shrubland Alliance.

Scientific Name	Common Name	Average Annual Foliar Cover (%)[1]	Average Annual Basal Cover (%)
Acamptopappus sphaerocephalus	rayless goldenhead	0.2	0.0
Ambrosia dumosa	white burrobush	9.0	0.1
Bromus madritensis ssp. *rubens*	red brome	0.2	0.0
Bromus tectorum	cheatgrass	0.1	0.0
Chorizanthe brevicornu	brittle spineflower	0.1	0.0
Cylindropuntia echinocarpa	silver cholla	0.1	0.0
Eriogonum trichopes	wild buckwheat	0.9	0.0
Krameria bicolor	white rhatany	0.4	0.0
Larrea tridentata	creosote	6.0	0.1
Lycium andersonii	Anderson thornbush	0.1	0.0
Menodora spinescens	spiny menodora	0.1	0.0
Opuntia basilaris	beavertail	0.2	0.2
Pectocarya heterocarpa	chuckwalla pectocarya	0.2	0.0
Physaria tenella	Moapa bladderpod	0.2	0.0
Plantago ovata	woolly plantain	1.9	0.1
Schismus barbatus	common Mediterranean grass	16.1	0.0
UNKNOWN DEAD SHRUB		0.1	0.0
Total Percent Cover		**35.9**	**0.5**

[1] For percent cover, both foliar and basal cover were estimated; foliar cover represents the area occupied by the plant canopy when viewed from above, while basal cover represents how much area the stem of the plant occupies. Basal cover is always much lower than foliar cover; foliar cover is what is typically used when discussing percent cover.

Density

The plant density for the plots in the Creosote-White Burrobush Shrubland Alliance is approximately 6,385 plants per hectare (Table 10). Thirteen species were recorded in the alliance during the density sampling. The species with the highest densities in this alliance were white burrobush and creosote, with densities of approximately 4,980 and 619 plants/hectare, respectively. Other species with moderate to high densities include spiny menodora (237 plants/hectare), white rhatany (161 plants/hectare), rayless goldenhead (143 plants/hectare), and beavertail (102 plants/hectare).

Table 10. Plant density by species in the Creosote-White Burrobush Shrubland Alliance.

Scientific Name	Common Name	Density (plants/hectare)
Acamptopappus sphaerocephalus	rayless goldenhead	143
Ambrosia dumosa	white burrobush	4,980
Cylindropuntia echinocarpa	silver cholla	33
Ephedra nevadensis	Nevada ephedra	26
Ephedra torreyana	Torrey's jointfir	4
Krameria bicolor	white rhatany	161
Krameria erecta	little leaved rhatany	59
Krascheninnikovia lanata	winter fat	17
Larrea tridentata	creosote	619
Lycium andersonii	Anderson thornbush	4
Menodora spinescens	spiny menodora	237
Opuntia basilaris	beavertail	102
Psorothamnus fremontii	Fremont's indigobush	2
Total		**6,385**

Species Richness

The average species richness for the plots in the Creosote-White Burrobush Shrubland Alliance is 19.5 species per hectare. The total number of species recorded in the plots during sampling was 42. These species are: rayless goldenhead, desert wing-fruit (*Acleisanthes nevadensis*), white burrobush, Menzie's fiddleneck (*Amsinckia menziesii*), desert marigold, red brome, cheatgrass, Saharan mustard, pebble pincushion, Mojave pincushion, brittle spineflower, devil's spineflower, silver cholla, yellow tansy mustard (*Descurainia pinnata*), Nevada ephedra, Torrey's jointfir, desert trumpet (*Eriogonum inflatum*), wild buckwheat, white easter bonnets (*Eriophyllum lanosum*), red stem stork's bill, broom snakeweed, big galleta, white rhatany, little leaved rhatany, winter fat, creosote, shaggyfruit pepperweed (*Lepidium lasiocarpum*), Moapa bladderpod, Anderson thornbush, spiny menodora, linda tarde, beavertail, chuckwalla pectocarya, common phacelia (*Phacelia crenulata*), woolly plantain, Fremont's indigobush, common Mediterranean grass, catclaw acacia, apricot mallow, wire lettuce, sand rice grass, and African mustard.

Shadscale Shrubland Alliance

Percent Cover

The average annual foliar cover for the plots in the Shadscale Shrubland Alliance was 16.6 percent cover by 16 species (Table 11). The species with the highest estimated cover was white burrobush with 4.2 percent foliar cover, followed by African mustard (2.5 percent), common Mediterranean grass (2.2 percent), alkali seepweed and red brome (both 1.3 percent), and big galleta and Anderson thornbush (both one percent); nine additional species and the 'unknown dead shrub' category comprised the other 3.1 percent cover in the plots.

Table 11. Percent cover estimates by species in the Shadscale Shrubland Alliance.

Scientific Name	Common Name	Average Annual Foliar Cover (%)[1]	Average Annual Basal Cover (%)
Ambrosia dumosa	white burrobush	4.2	0.0
Atriplex confertifolia	shadscale	0.5	0.0
Atriplex hymenelytra	desert holly	0.8	0.2
Bromus madritensis ssp. *rubens*	red brome	1.3	0.0
Chaenactis macrantha	Mojave pincushion	0.2	0.0
Chorizanthe rigida	devil's spineflower	0.2	0.0
Erodium cicutarium	red stem stork's bill	0.2	0.0
Halogeton glomeratus	halogeton	0.2	0.0
Hilaria rigida	big galleta	1.0	0.0
Krameria erecta	little leaved rhatany	0.3	0.0
Lycium andersonii	Anderson thornbush	1.0	0.0
Pectocarya heterocarpa	chuckwalla pectocarya	0.2	0.0
Schismus barbatus	common Mediterranean grass	2.2	0.0
Sphaeralcea ambigua	apricot mallow	0.2	0.0
Strigosella africana	African mustard	2.5	0.0
Suaeda nigra	alkali seepweed	1.3	0.0
UNKNOWN DEAD SHRUB		0.3	0.0
Total Percent Cover		**16.6**	**0.2**

[1] For percent cover, both foliar and basal cover were estimated; foliar cover represents the area occupied by the plant canopy when viewed from above, while basal cover represents how much area the stem of the plant occupies. Basal cover is always much lower than foliar cover; foliar cover is what is typically used when discussing percent cover.

Density

The plant density for the plots in the Shadscale Shrubland Alliance is approximately 2,840 plants per hectare (Table 12). Ten species were recorded in the alliance during the density sampling. The species with the highest densities in this alliance were white burrobush and desert holly, with densities of approximately 1,939 and 420 plants/hectare, respectively. Other species with moderate to high densities include shadscale (203 plants/hectare), little leaved rhatany (108 plants/hectare), and Anderson thornbush (97 plants/hectare).

Table 12. Plant density by species in the Shadscale Shrubland Alliance.

Scientific Name	Common Name	Density (plants/hectare)
Ambrosia dumosa	white burrobush	1,939
Atriplex confertifolia	shadscale	203
Atriplex hymenelytra	desert holly	420
Cylindropuntia ramosissima	pencil cholla	19
Ephedra nevadensis	Nevada ephedra	3
Ephedra torreyana	Torrey's jointfir	8
Krameria erecta	little leaved ratany	108
Larrea tridentata	creosote	36
Lycium andersonii	Anderson thornbush	97
Lycium cooperi	Cooper's box thorn	6
Total		**2,840**

Species Richness

The average species richness for the plots in the Shadscale Shrubland Alliance is 21.5 species per hectare. The total number of species recorded in the plots during sampling was 35. These species are: white burrobush, shadscale, desert holly, red brome, cheatgrass, Saharan mustard, winding mariposa, *Chaenactis* sp., Mojave pincushion, devil's spineflower, silver cholla, pencil cholla, cottontop cactus, Nevada ephedra, Torrey's jointfir, desert trumpet, red stem stork's bill, rattlesnake sandmat, halogeton, big galleta, little leaved rhatany, creosote, Moapa bladderpod, Anderson thornbush, Cooper's box thorn, linda tarde, beavertail, chuckwalla pectocarya, woolly plantain, bladder-sage, common Mediterranean grass, apricot mallow, wire lettuce, alkali seepweed, and African mustard.

Big Galleta Herbaceous Alliance

Percent Cover

The average annual foliar cover for the plots in the Big Galleta Herbaceous Alliance was 90.3 percent cover by 15 species (Table 13). The species with the highest estimated cover was big galleta at 37 percent foliar cover, followed by red brome (23.7 percent), white burrobush (6.7 percent), broom snakeweed (4.7 percent), red stem stork's bill (four percent), Arizona brome (*Bromus arizonicus*), and Cooper's box thorn (both 3.3 percent); eight additional species and the 'unknown dead shrub' category comprised the other 7.6 percent cover in the plots.

Table 13. Percent cover estimates by species in the Big Galleta Herbaceous Alliance.

Scientific Name	Common Name	Average Annual Foliar Cover (%)[1]	Average Annual Basal Cover (%)
Ambrosia dumosa	white burrobush	6.7	0.3
Atriplex confertifolia	shadscale	0.7	0.0
Bromus arizonicus	Arizona brome	3.3	0.0
Bromus madritensis ssp. *rubens*	red brome	23.7	0.0
Bromus tectorum	cheatgrass	1.7	0.0
Erodium cicutarium	red stem stork's bill	4.0	0.0
Euphorbia albomarginata	rattlesnake sandmat	0.3	0.0
Gutierrezia sarothrae	broom snakeweed	4.7	0.0
Hilaria rigida	big galleta	37.0	0.3
Krameria erecta	little leaved rhatany	1.0	0.0
Larrea tridentata	creosote	1.3	0.0
Lycium andersonii	Anderson thornbush	0.3	0.0
Lycium cooperi	Cooper's box thorn	3.3	0.0
Schismus barbatus	common Mediterranean grass	0.7	0.0
Strigosella africana	African mustard	1.3	0.3
UNKNOWN DEAD SHRUB		0.3	0.0
Total Percent Cover		**90.3**	**0.9**

[1] For percent cover, both foliar and basal cover were estimated; foliar cover represents the area occupied by the plant canopy when viewed from above, while basal cover represents how much area the stem of the plant occupies. Basal cover is always much lower than foliar cover; foliar cover is what is typically used when discussing percent cover.

Density

The plant density for the plots in the Big Galleta Herbaceous Alliance is approximately 6,716 plants per hectare (Table 14). Eleven species were recorded in the alliance during the density sampling. The species with the highest densities in this alliance were white burrobush and broom snakeweed, with densities of approximately 3,283 and 2,208 plants/hectare, respectively. Other species with moderate densities include little leaved rhatany (485 plants/hectare), Cooper's box thorn (206 plants/hectare), shadscale (167plants/hectare), Torrey's jointfir (129 plants/hectare), Anderson thornbush (115 plants/hectare), and creosote (101 plants/hectare).

Table 14. Plant density by species in the Big Galleta Herbaceous Alliance.

Scientific Name	Common Name	Density (plants/hectare)
Ambrosia dumosa	white burrobush	3,283
Atriplex confertifolia	shadscale	167
Cylindropuntia ramosissima	pencil cholla	11
Ephedra torreyana	Torrey's jointfir	129
Gutierrezia sarothrae	broom snakeweed	2,208
Krameria erecta	little leaved rhatany	485
Larrea tridentata	creosote	101
Lycium andersonii	Anderson thornbush	115
Lycium cooperi	Cooper's box thorn	206
Prosopis glandulosa	honey mesquite	1
Senegalia greggii	catclaw acacia	11
Total		**6,716**

Species Richness

The average species richness for the plots in the Big Galleta Herbaceous Alliance is 31 species per hectare. The total number of species recorded in the plots during sampling was 47. These species are: white burrobush, Menzie's fiddleneck, three awn (*Aristida purpurea*), shadscale, desert marigold, Arizona brome, red brome, cheatgrass, pebble pincushion, devil's spineflower, narrow-leaved forget-me-not (*Cryptantha angustifolia*), Nevada cryptantha (*Cryptantha nevadensis*), pencil cholla, fluff grass (*Dasyochloa pulchella*), Parish larkspur (*Delphinium parishii*), cottontop cactus, Virgin River encelia, Nevada ephedra, Torrey's jointfir, green ephedra (*Ephedra viridis*), spreading daisy (*Erigeron divergens*), desert trumpet, red stem stork's bill, white easter bonnets, rattlesnake sandmat, broom snakeweed, big galleta, little leaved rhatany, bristly langloisia (*Langloisia setosissima*), creosote, shaggyfruit pepperweed, Moapa bladderpod, Anderson thornbush, Cooper's box thorn, velvetweed (*Oenothera curtiflora*), linda tarde, woolly plantain, desert almond, honey mesquite (*Prosopis glandulosa*), Fremont's indigobush, lobed ground cherry, bladder-sage, common Mediterranean grass, catclaw acacia, apricot mallow, African mustard, and five-needled thymophylla (*Thymophylla pentachaeta*).

Catclaw Acacia Shrubland Alliance

Percent Cover

The average annual foliar cover for the plots in the Catclaw Acacia Shrubland Alliance was 46.2 percent cover by 19 species (Table 15). The species with the highest estimated cover was red brome at 10.7 percent foliar cover, followed by white burrobush (eight percent), catclaw acacia (6.5 percent), creosote (5.3 percent), and common Mediterranean grass (4.2 percent); 14 additional species and the 'unknown dead shrub' category comprised the other 11.5 percent cover in the plots.

Table 15. Percent cover estimates by species in the Catclaw Acacia Shrubland Alliance.

Scientific Name	Common Name	Average Annual Foliar Cover (%)[1]	Average Annual Basal Cover (%)
Ambrosia dumosa	white burrobush	8.0	0.2
Bromus madritensis ssp. *rubens*	red brome	10.7	0.0
Bromus tectorum	cheatgrass	0.8	0.0
Chorizanthe rigida	devil's spineflower	0.2	0.0
Ephedra nevadensis	Nevada ephedra	1.5	0.0
Ephedra torreyana	Torrey's jointfir	1.2	0.0
Erodium cicutarium	red stem stork's bill	0.3	0.0
Gutierrezia sarothrae	broom snakeweed	0.2	0.0
Krameria bicolor	white rhatany	1.7	0.0
Krameria erecta	little leaved rhatany	0.5	0.0
Larrea tridentata	creosote	5.3	0.0
Lycium andersonii	Anderson thornbush	0.8	0.0
Pectocarya heterocarpa	chuckwalla combseed	0.2	0.0
Plantago ovata	desert Indianwheat	1.8	0.0
Prunus fasciculata	desert almond	1.0	0.0
Psorothamnus fremontii	Fremont's indigobush	0.5	0.0
Schismus barbatus	common Mediterranean grass	4.2	0.0
Senegalia greggii	catclaw acacia	6.5	0.0
Sphaeralcea ambigua	apricot mallow	0.3	0.0
UNKNOWN DEAD SHRUB		0.5	0.0
Total Percent Cover		**46.2**	**0.2**

[1] For percent cover, both foliar and basal cover were estimated; foliar cover represents the area occupied by the plant canopy when viewed from above, while basal cover represents how much area the stem of the plant occupies. Basal cover is always much lower than foliar cover; foliar cover is what is typically used when discussing percent cover.

Density

The plant density for the plots in the Catclaw Acacia Shrubland Alliance is approximately 5,914 plants per hectare (Table 16). Fourteen species were recorded in the alliance during the density sampling. The species with the highest densities in this alliance were white burrobush and Nevada ephedra, with densities of approximately 3,828 and 556 plants/hectare, respectively. Other species with moderate to high densities include creosote (392 plants/hectare), little leaved rhatany (381 plants/hectare), broom snakeweed (303 plants/hectare), catclaw acacia (139 plants/acre), Anderson thornbush (86 plants/hectare), Torrey's jointfir (70 plants/hectare), bladder-sage (58 plants/hectare), and Fremont's indigobush (56 plants/hectare).

Table 16. Plant density by species in the Catclaw Acacia Shrubland Alliance.

Scientific Name	Common Name	Density (plants/hectare)
Ambrosia dumosa	white burrobush	3,828
Cylindropuntia ramosissima	pencil cholla	6
Encelia virginensis	Virgin River encelia	17
Ephedra nevadensis	Nevada ephedra	556
Ephedra torreyana	Torrey's jointfir	70
Gutierrezia sarothrae	broom snakeweed	303
Krameria bicolor	white rhatany	14
Krameria erecta	little leaved rhatany	381
Larrea tridentata	creosote	392
Lycium andersonii	Anderson thornbush	86
Prunus fasciculata	desert almond	11
Psorothamnus fremontii	Fremont's indigobush	56
Scutellaria mexicana	bladder-sage	58
Senegalia greggii	catclaw acacia	139
Total		**5,914**

Species Richness

The average species richness for the plots in the Catclaw Acacia Shrubland Alliance is 29.5 species per hectare. The total number of species recorded in the plots during sampling was 43. These species are: white burrobush, three awn, desert marigold, red brome, cheatgrass, pebble pincushion, Mojave pincushion, devil's spineflower, narrow-leaved forget-me-not, silver cholla, pencil cholla, fluff grass, yellow tansy mustard, wedgeleaf draba (*Draba cuneifolia*), cottontop cactus, Virgin River encelia, Nevada ephedra, Torrey's jointfir, green ephedra, desert trumpet, red stem stork's bill, white easter bonnets, rattlesnake sandmat, *Gilia* sp., broom snakeweed, white rhatany, little leaved rhatany, creosote, shaggyfruit pepperweed, Moapa bladderpod, Anderson thornbush, linda tarde, chuckwalla pectocarya, woolly plantain, desert almond, Fremont's indigobush, bladder-sage, common Mediterranean grass, catclaw acacia, apricot mallow, wire lettuce, African mustard, and five-needled thymophylla.

SPECIAL-STATUS PLANT INVENTORY

The spring 2018 special-status plant survey was floristic in nature and a complete list of all plant taxa identified during the survey is included in Appendix C. Representative photos of special-status plant taxa and their habitats are included in Appendix D. Three taxa of special-status plants, threecorner milkvetch, Nye milkvetch, and rosy twotone beardtongue, were identified within the Study Area during the spring 2018 special-status plant inventory. Threecorner milkvetch is listed by the State of Nevada as Critically Endangered/Fully Protected, by the BLM as Sensitive, by the NNHP as At-Risk, and by the Nevada Native Plant Society (NNPS) as Threatened. Nye milkvetch is listed by NNHP as At-Risk and is included on the NNPS's Watch List. Rosy twotone beardtongue is listed by the BLM as Sensitive, as At-Risk by NNHP, and is included on the NNPS's Watch List.

At the start of the survey period, annual species of *Astragalus* were in vegetative condition and could not be positively identified as either threecorner milkvetch or Nye milkvetch; however, a gestalt was established based on leaflet and foliage hair characteristics and all suspected threecorner milkvetch and Nye milkvetch populations were mapped as probable localities. Additionally, survey teams were initially deployed into areas west of California Wash which had lower potential for threecorner milkvetch in order to provide additional time for threecorner milkvetch to develop in the survey areas east of the California Wash (areas D, E, F and buffer surveys) where it had greater likelihood of occurring, based on soil types and known occurrences. After approximately mid-April, most populations of annual *Astragalus* on the site were flowering and/or fruiting, lending to positive identification of these taxa and confirming the gestalt established on the vegetative populations encountered in the earliest part of the survey effort. On May 8-10, 155 of the 338 (43 percent) localities mapped as suspected threecorner milkvetch or Nye milkvetch were revisited and all populations that were relocated (92 percent) were confirmed to be the taxon suspected.

Two occurrences of rosy twotone beardtongue were found in early May; two other *Penstemon* occurrences in the Study Area remained unconfirmed because the plants did not flower in 2018, but all are suspected to be rosy twotone beardtongue.

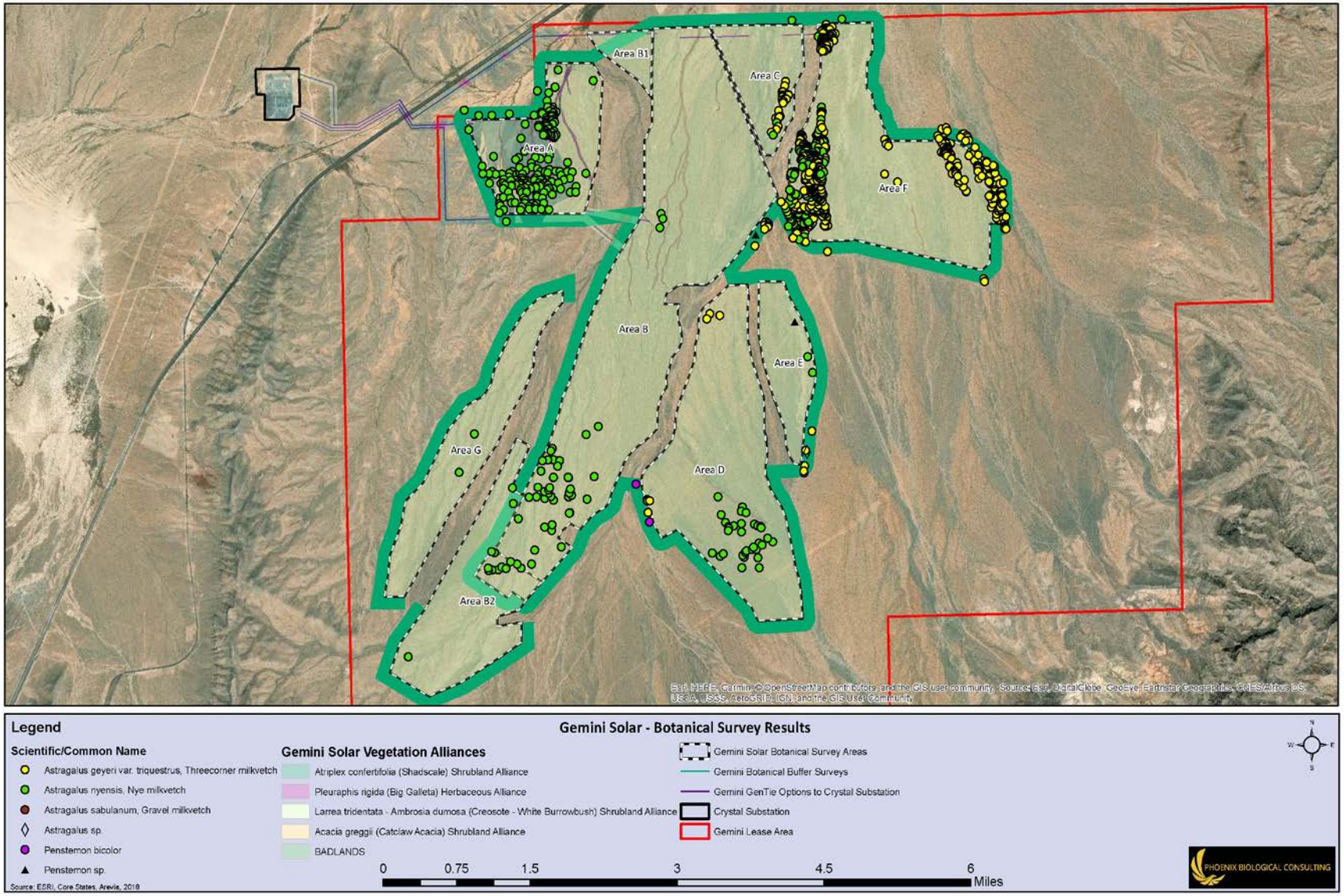
Close attention was paid to annual *Eriogonum* species encountered during the survey and some were revisited later if a species determination could not be made at the time they were encountered. Several annual *Eriogonum* were identified in the Study Area during the botanical survey, indicating that low rainfall totals or other environmental conditions did not preclude germination of these taxa in spring 2018. No gypseous or gypsiferous soils were found to occur in the Study Area during the survey.

All populations of special-status plant taxa identified during the special-status plant inventory survey are mapped in Figure 7. Table 17 summarizes the special-status plant occurrences and population numbers recorded in the Study Area during the special-status plant inventory survey. Each special-status plant taxon found during the special-status plant inventory survey is discussed in detail below.

Table 17. Occurrences and population numbers of special-status plants identified in the Study Area.

Species	Number of Occurrences											Number of Individuals											Total Number of Individuals in Study Area (Occurrences)
	Area									Gen-ties	Buffer	Area									Gen-ties	Buffer	
	A	B	C	D	E	F	G	B1	B2			A	B	C	D	E	F	G	B1	B2			
Threecorner milkvetch *Astragalus geyeri* var. *triquetrus*	--	--	22	6	4	504	--	--	--	--	80	--	--	139	11	4	1102	--	--	--	--	173	**1,429 (616)**
Nye milkvetch *Astragalus nyensis*	179	53	5	33	3	341	2	--	1	--	36	948	263	14	51	3	677	2	--	15	--	144	**2,117 (653)**
Rosy twotone beardtongue *Penstemon bicolor* spp. *roseus*	--	--	--	--	--	--	--	--	--	--	2	--	--	--	--	--	--	--	--	--	--	2	**2 (2)**
Suspected rosy twotone beardtongue	--	--	--	--	1	--	--	--	--	--	1	--	--	--	--	1	--	--	--	--	--	2	**3 (2)**
Total rosy twotone beardtongue (confirmed + suspected)	--	--	--	--	1	--	--	--	--	--	3	--	--	--	--	1	--	--	--	--	--	4	**5 (4)**

Figure 7. Special-status Plant Populations Identified in the Study Area



Threecorner milkvetch (*Astragalus geyeri* var. *triquetrus*)

Threecorner milkvetch is a rare fast-maturing annual in the Pea Family (*Fabaceae*). Plants are slender and erect, often diminutive, typically five to 25 centimeters tall, with ash gray stems and greenish to green leaflets. Foliage is covered with small stiff, straight, sharp, appressed hairs. Leaflets are few ([5]7-9) per leaf, and are broad, flat, and hairy on both sides with notched or blunt tips; the terminal leaflet, if present, is often longest. Flowering stalks are much shorter than the leaves and each has approximately two to eight flowers; petals are whitish, sometimes with faint pink to lilac blushing. Fruit pods are triangular in cross section, with parallel grooves on the dorsal side, and a narrow septum forming two partial seed chambers (Cronquist et al. 2013; Barneby 1964). In Nevada, threecorner milkvetch flowers from late winter to early spring and is thought to germinate only in wetter years (NNHP 2001).

Threecorner milkvetch occurs in dynamic sandy soils such as dunes and open, deep sandy soils typically stabilized by vegetation and/or a gravel veneer with creosote (NNHP 2001; Barneby 1964). Specifically, threecorner milkvetch is found on loose, fine-textured aeolian and fluvial sands re-deposited from the Muddy Creek Formation sedimentary deposit found in the region (National Park Service [NPS] 2010). It is known only from Clark and Lincoln counties in southern Nevada and in the far northwest corner of Mohave County, Arizona at elevations from 1,100-2,400 feet (335-732 meters). Its current range is from Sand Hollow Wash in Lincoln County, NV (northernmost population) to Coon Creek in Mohave County, AZ (easternmost population) to Sandy Cove on the north shore of Boulder Basin in the LMNRA (southernmost population) to the Dry Lake Valley in Clark County, NV (westernmost population) (NPS 2010).

In the Dry Lake Valley, threecorner milkvetch is known from the California Wash, Mud Lake, and Logandale populations (NPS 2010); the status of these populations was either unknown or known to contain few or no individuals when the NPS evaluated them for monitoring in 2007 (NPS 2010). Threecorner milkvetch found in the Study Area would be included in the California Wash populations (NPS 2010). In 2001, a total population of 4,094 individuals at 39 sites were known of in Nevada (NNHP 2001); however, after record rainfall in 2008, an estimated 8,000 plants were documented on Sandy Cove in the LMNRA (this is the largest known population) (NPS 2010). The SEINet Portal Network maps five occurrences of threecorner milkvetch in the Dry Lake Valley (including one collection from Barneby 1983 that is erroneously mapped in the Spring Mountains) (SEINnet 2018).

During the special-status plant inventory survey, 1,429 individuals within 616 occurrences of threecorner milkvetch were identified in the Study Area. Threecorner milkvetch was found in areas C, D, E, F, and in the buffer zone (Figure 7). The highest number of occurrences and highest population numbers were found in Area F with 504 occurrences and a population of 1,102 (Figure 8, Table 17). All threecorner milkvetch in the Study Area were found in Creosote-White Burrobush Shrubland Alliance in sand or sandy loam soils. Dominant shrubs were creosote and white burrobush. Notes on the substrates where plants occurred, when taken, described them as occurring in sandy washlets, fine sand in washlets, fine sand, fine sands with scattered gravels, deep fine sand, deep fine sand with scattered gravels, sandy fine soil, and sandy fine soil with scattered gravels.

Prior to mid-April, all of the threecorner milkvetch found during the inventory was in vegetative phenology and was mapped as suspected threecorner milkvetch based on leaflets with stiff, straight, sharp appressed hairs versus the dense, loose, and wavy hairy foliage of gravel milkvetch (*Astragalus sabulonum*), the other similar annual *Astragalus* in the Study Area. Gravel milkvetch is generally a more robust plant and is densely wavy-hairy, giving a more silvery appearance; its flowers are larger than

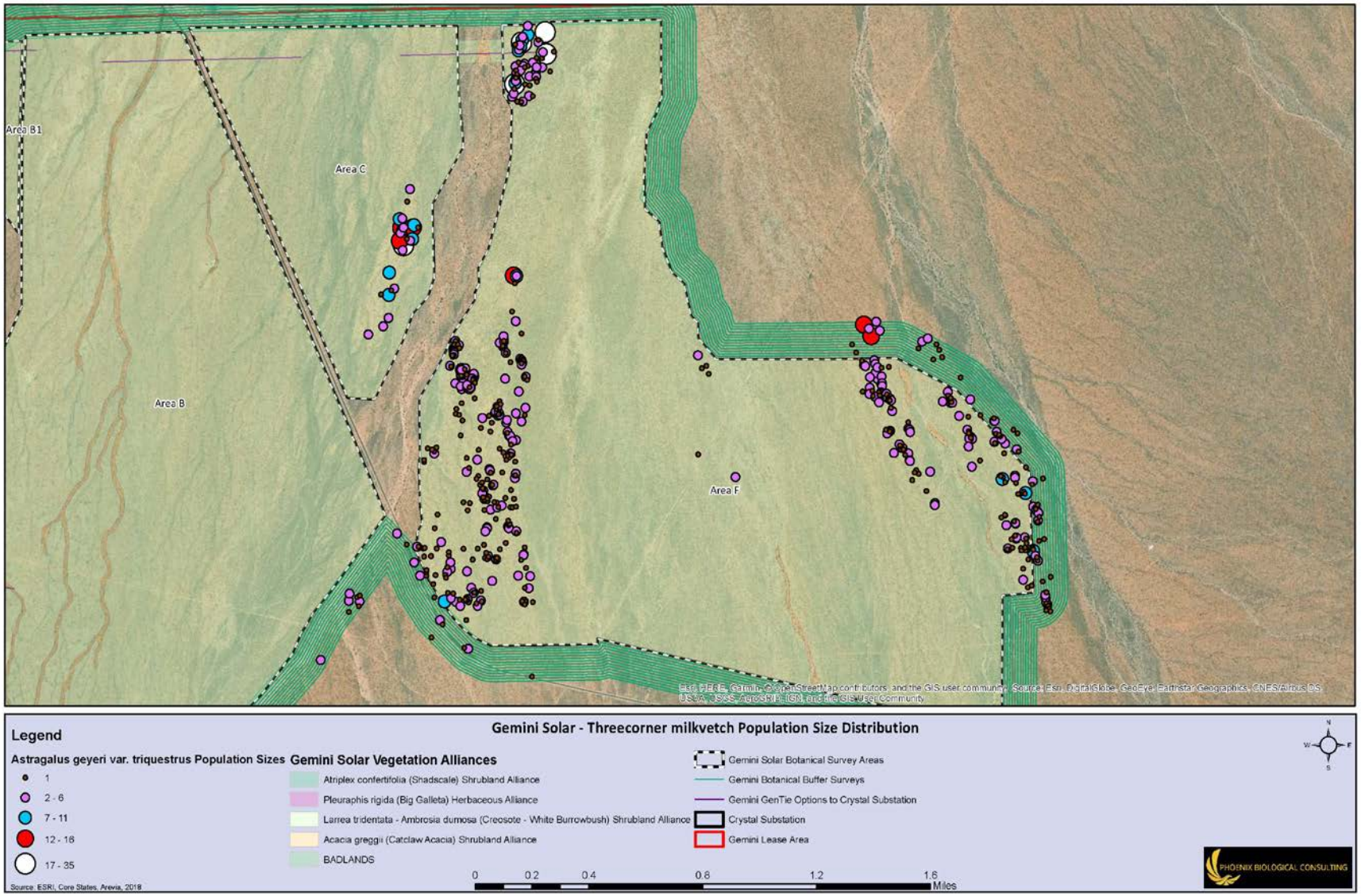
threecorner milkvetch and often pink to lilac with a recurved banner. Gravel milkvetch pods are incurved and leathery and lack the triangular and strongly keeled shape of threecorner milkvetch pods. After mid-April, most occurrences of threecorner milkvetch had at least some flowering and fruiting individuals within the population that made positive identification possible.

Approximately 21 percent of the threecorner milkvetch occurrences recorded during the inventory survey were comprised of plants in predominantly vegetative phenology; the majority of these occurrences were located prior to April 14. Approximately 42 percent of threecorner milkvetch occurrences were comprised of plants predominantly in bud or in flower, with most of these found between April 14 and April 21. Finally, approximately 36 percent of threecorner milkvetch occurrences were comprised of individuals predominantly in fruit or going to seed, these occurrences were mostly found after April 21.

Interactions with threecorner milkvetch observed in the Study Area include insect predation noted at two locations and totaling three individuals. No threats to any of the threecorner milkvetch occurrences were noted, all were considered to be in undisturbed conditions.

This taxon is threatened by invasive weeds, urban development and sprawl, off-highway vehicle (OHV) use, recreational use, increased fire frequency and intensity, energy development, surface water development, utility corridor maintenance and construction, some agricultural practices, and the inundation and fluctuating shoreline of Lake Mead (NPS 2010). Because of its habitat preferences, this taxon occurs in areas that may be invaded by sand-loving weed species such as Saharan mustard, Mediterranean grass, salt cedar (*Tamarix ramosissima*), and Russian thistle (*Salsola* spp.) (NPS 2010).

Figure 8. Threecorner Milkvetch Population Distribution in the Study Area



Nye milkvetch (*Astragalus nyensis*)

Nye milkvetch is a rare ephemeral annual in the Pea Family (*Fabaceae*). Plants are slender and small, typically four to 20 centimeters tall, and covered with long, loosely ascending, straight or incurved hairs. Herbage is greenish-ash gray and leaves are one to four centimeters long with seven to 13 crowded leaflets. Leaflets are wider than long and loosely folded with notched, blunt tips and are covered equally on both sides with short, soft hairs or are hairless in the middle of the upper side. Flowering stalks are much shorter than the leaves with approximately one to four flowers. Flowers are whitish with the upper petal (banner) faintly lilac tinted. Fruit pods are linear, oblong, and incurved (Cronquist et al. 2013; Barneby 1964; Kartesz 1988). Nye milkvetch flowers in spring, typically April - May (NNHP 2001).

Nye milkvetch grows in the foothills of desert mountains, on calcareous outwash fans, and gravelly flats, sometimes in sandy soil, in Mojave Desert scrub vegetation communities (NNHP 2001). It is known only from Clark, Lincoln, and Nye counties in southern Nevada and far southeastern Inyo County, California at elevations from 1,100-5,600 feet (335-1,707 meters). In Nevada, Nye milkvetch is known from 24 extant occurrences with an estimated total of 1,126+ individuals and two extirpated occurrences (NNHP 2001). The SEINet Portal Network maps two occurrences of Nye milkvetch in the Dry Lake Valley region (SEINnet 2018). One is from near the intersection of Highway 93 and Interstate 15 near Dry Lake and the other is from along the Valley of Fire Road just outside of the Study Area.

During the special-status plant inventory survey, 2,117 individuals within 653 occurrences of Nye milkvetch were identified in the Study Area. Nye milkvetch was found in areas A, B, C, D, E, F, G, B2, and in the buffer zone. The highest number of occurrences and highest population numbers were found in areas A and F with 948 individuals in 179 occurrences in Area A and 677 individuals in 341 occurrences Area F (Figure 7, Table 17). Of the 653 occurrences of Nye milkvetch recorded in the Study Area, 610 (93 percent) were located in Creosote-White Burrobush Shrubland Alliance, 32 (five percent) were located in the Big Galleta Herbaceous Alliance, and 11 (two percent) were located in the Shadscale Shrubland Alliance. Dominant associates for Nye milkvetch occurrences in each vegetation alliance are as follows: in the Creosote-White Burrobush Shrubland Alliance, creosote, white burrobush, and shadscale; in the Big Galleta Herbaceous Alliance, big galleta and white burrobush; and, in the Shadscale Shrubland Alliance, shadscale, white burrobush, desert holly, alkali seepweed (*Suaeda nigra*), and red stem stork's bill (*Erodium cicutarium*).

Of the 653 occurrences of Nye milkvetch in the Study Area, 569 (87 percent) were located in sandy loam, 38 (six percent) were located in sand, 21 (three percent) were located in loamy sand, 17 (three percent) were located in silt clay loam, four (one percent) were located in rocky substrates, and two each (less than one percent) were located in silt loam and clay loam, respectively. Notes on the substrates where plants occurred, when taken, described them as occurring in sandy washes and washlets, gravels, fine sand, fine sand, fine sands with scattered gravels, deep fine sand, deep fine sand with scattered gravels, sandy fine soil with scattered gravels, fine soil, fine soil with scattered gravels, sandy loam with lots of limestone/caliche chips and biocrust.

Prior to mid-April, all of the Nye milkvetch found during the inventory was in vegetative phenology and was mapped as suspected Nye milkvetch based on blunt and/or notched leaflets versus the acute leaflets of Nuttall's locoweed (*Astragalus nuttallianus* var. *imperfectus*) and being minutely and often densely hairy versus being loosely strigulose hairy like sharp-keeled milkvetch (*A. acutirostris*), the other annual *Astragalus* species that is closely aligned with Nye milkvetch. All three of these species, Nye milkvetch, Nuttall's milkvetch, and sharp-keeled milkvetch, have small pale flowers and linear, dorsally

grooved pods and are distinguished from each other by leaflet shape, keel petals, and by pod curvature and dehiscence. Nye milkvetch differs from sharp-keeled milkvetch by having keel petals that are wider than long, by being minutely and often densely hairy, and by its incurved pod (versus a downwardly reflexed pod in sharp-keeled milkvetch). Nye milkvetch differs from Nuttall's locoweed by having incurved, deciduous pods and blunt to cleft leaflets versus the nearly straight and persistent pod and acute leaflets of Nuttall's locoweed. After mid-April, most occurrences of Nye milkvetch had at least some flowering and fruiting individuals within the population that made positive identification possible.

Approximately 56 percent of the Nye milkvetch occurrences recorded during the survey were comprised of plants in predominantly vegetative phenology; the majority of these occurrences were located earlier in the survey period (prior to April 19). Approximately 18 percent of Nye milkvetch occurrences were comprised of plants predominantly in bud or in flower, with most of these found after April 18. Approximately 27 percent of Nye milkvetch occurrences were comprised of individuals predominantly in fruit or going to seed, these occurrences were mostly found after April 20.

No interactions, such as disease, predation, or competition, were noted for Nye milkvetch with the exception of three occurrences noted to be 'weedy.' These included one population in the Shadscale Shrubland Alliance where the immediate area was dominated by red stem stork's bill and two occurrences where lots of foxtail chess (*Bromus madritensis* ssp. *rubens*) was noted (in Shadscale and Creosote-White Burrobush shrubland alliances). Off-highway vehicle trails were also noted at one Nye milkvetch occurrence, all other occurrences were considered to be undisturbed.

Threats to Nye milkvetch are likely similar to those to threecorner milkvetch including invasive weeds, urban development and sprawl, off-highway vehicle (OHV) use, recreational use, increased fire frequency and intensity, energy development, surface water development, utility corridor maintenance and construction, and some agricultural practices.

Rosy twotone beardtongue (*Penstemon bicolor* ssp. *roseus*)

Rosy twotone beardtongue is a short-lived perennial herb in the Plantain Family (*Plantaginaceae*). Plants grow up to 0.5 meters tall and are glaucous (covered in white to bluish film) with many erect flowering stalks. Flowers are tubular shaped and pink to magenta in color. Leaves are thick and irregularly toothed, the upper leaves have no stalk and encircle the stem (Baldwin et al. 2002; Smith 2005). Rosy twotone beardtongue flowers in late-winter to early spring, typically mid-March to May (NNHP 2001). Rosy twotone beardtongue can only be distinguished from a more common species, Palmer's penstemon (*Penstemon palmeri*) when it is in bloom. *P. bicolor* is distinguished by its smaller flowers (corollas in *P. bicolor* are 18-24 mm versus 25-32 mm in *P. palmeri*) and by its staminode (sterile stamen) being included within the corolla versus exerted in *P. palmeri*. Rosy twotone beardtongue can also only be distinguished when in flower from the other subspecies of *P. bicolor*, yellow twotone beardtongue (*P. bicolor* ssp. *bicolor*), which has cream to pale yellow colored flowers.

Rosy twotone beardtongue grows in rocky calcareous, granitic, or volcanic soils in areas that receive enhanced runoff, such as washes, along roadsides, in rocky areas such as scree at the base of rock outcrops, rocky slopes, and rock crevices in creosote-burrobush, blackbrush (*Coleogyne ramosissima*), and mixed-shrub desert vegetation communities (NNHP 2001). It is known from Clark, and Nye counties in southern Nevada and also from Arizona and California at elevations from 1,800-4,839 feet (549-1,475 meters). In Nevada, rosy twotone beardtongue is known from approximately 50 occurrences with an estimated total of 6,049+ individuals (NNHP 2001). The SEINet Portal Network maps nine occurrences of

rosy twotone beardtongue in the Dry Lake Valley (SEINnet 2018). Eight are near Highway 93 and one is from near the Valley of Fire Road at the base of the Muddy Mountains.

During the special-status plant inventory survey, two occurrences of rosy twotone beardtongue were identified in the buffer zone on May 2, each with a population of one. In addition, two other suspected occurrences of rosy twotone beardtongue were found, one in Area E and the other in the buffer (Figure 7, Table 17). Both of these suspected occurrences are expected to be rosy twotone beardtongue based on proximity to other rosy twotone beardtongue populations, but neither population is expected to flower this year and they are therefore not identifiable to genus or species. No Palmer's penstemon was found in the Study Area during the floristic survey. The two confirmed occurrences of rosy twotone beardtongue were located in sand in the Creosote-White Burrobush Shrubland Alliance dominated by white burrobush. The unconfirmed *Penstemon* occurrence in Area E was located in sandy loam in Creosote-White Burrobush Shrubland Alliance dominated by cheesebush; the other unconfirmed *Penstemon* occurrence, in the buffer, was in sandy loam in Catclaw Acacia Shrubland Alliance and the dominant shrub species there was white burrobush.

No interactions, such as disease, predation, competition, threats, or disturbances were noted for any of the *Penstemon* found in the Study Area.

Threats to rosy twotone beardtongue include urban development and sprawl, hybridization with Palmer's penstemon (accelerated by introduction Palmer's penstemon from roads and utility corridors and in seed mixes used in planting in reclamation areas), road and utility corridor construction and maintenance, and energy development.

Bryophyte Survey

Bryophytes collected in the Study Area during the special-status plant survey were identified and/or confirmed by PBC botanist Jason Brooks and California Academy of Sciences herbarium botanist David Toren. No special-status bryophytes were found. Bryophytes identified from the Study Area are listed in Appendix C.

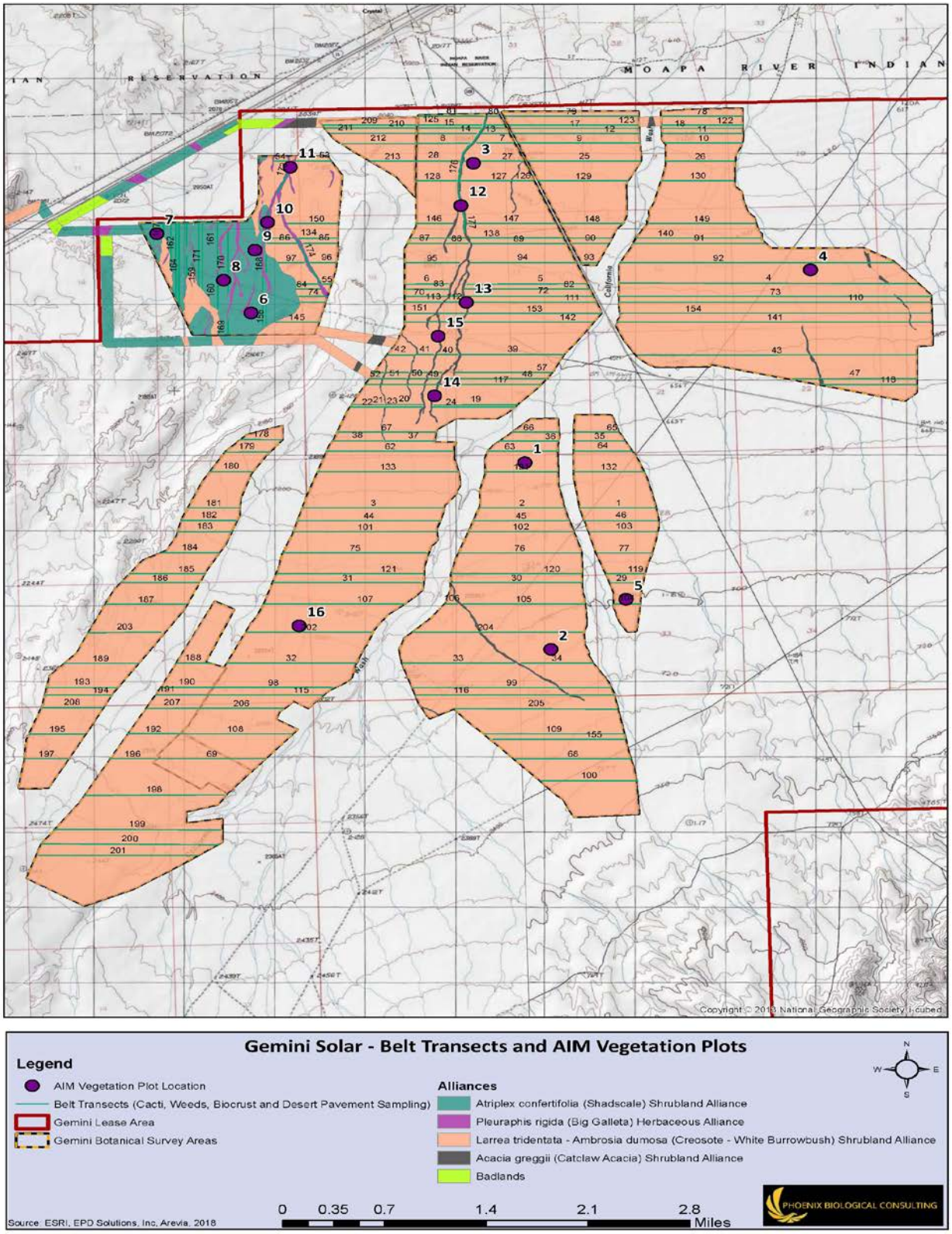
CACTI AND YUCCA, INVASIVE WEEDS, AND BIOCRUST AND DESERT PAVEMENT SAMPLING

A total of 213 belt transects were sampled for cacti and yucca, invasive weeds, and biocrust and desert pavement throughout the Study Area, excluding gen-ties and the buffer zone (Table 18, Figure 9). Table 18 shows the number and lengths of transects distributed throughout the four vegetation communities and the nine areas (A-G, B1, and B2). A total of 6.5 percent of the approximately 10,463-acre Study Area was sampled including 6.4 percent of the Creosote-White Burrobush Shrubland, 8.1 percent of the Shadscale Shrubland, 8.2 percent of the Big Galleta Herbaceous alliance, and 8.1 percent of the Catclaw Acacia Shrubland. Results of the belt transect sampling are discussed below under each resource (cacti/yucca, invasive weeds, and biocrust/desert pavement).

Table 18. Number, length, and area of belt transects sampled in each vegetation community and site within the Study Area.

Area	Alliance												Total per Area		
	Creosote-White Burrobush Shrubland			Shadscale Shrubland			Catclaw Acacia Shrubland			Big Galleta Herbaceous					
	# of Transects	Total Length (km)	Total Area (acres)	# of Transects	Total Length (km)	Total Area (acres)	# of Transects	Total Length (km)	Total Area (acres)	# of Transects	Total Length (km)	Total Area (acres)	# of Transects	Length (km)	Area (acres)
A	15	4.7	17.5	16	8.4	31.0	--	--	--	4	1.5	5.6	**35**	**14.6**	**54.0**
B	81	60.9	225.6	--	--	--	2	1.6	5.9	--	--	--	**83**	**62.5**	**231.5**
C	11	11.0	40.8	--	--	--	--	--	--	--	--	--	**11**	**11.0**	**40.8**
D	22	27.1	100.4	--	--	--	--	--	--	--	--	--	**22**	**27.1**	**100.6**
E	11	6.5	24.2	--	--	--	--	--	--	--	--	--	**11**	**6.5**	**24.2**
F	19	35.6	132.1	--	--	--	--	--	--	--	--	--	**19**	**35.6**	**132.1**
G	17	11.3	41.9	--	--	--	--	--	--	--	--	--	**17**	**11.3**	**41.9**
B1	5	4.2	15.7	--	--	--	--	--	--	--	--	--	**5**	**4.2**	**15.7**
B2	10	10.3	38.1	--	--	--	--	--	--	--	--	--	**10**	**10.3**	**38.1**
Total per Alliance	**191**	**171.7**	**636.3**	**16**	**8.4**	**31.0**	**2**	**1.6**	**5.9**	**4**	**1.5**	**5.6**	**213**	**183.1**	**678.8**

Figure 9. Cacti and Yucca, Invasive Weeds, and Biocrust and Desert Pavement Sampling Transects in the Study Area



Cacti and Yucca

Eight species of cacti occur in the Study Area: silver cholla (*Cylindropuntia echinocarpa*), pencil cholla (*Cylindropuntia ramosissima*), cottontop cactus (*Echinocactus polycephalus* var. *polycephalus*), strawberry hedgehog (*Echinocereus engelmannii*), desert barrel cactus (*Ferocactus cylindraceus*), common fishhook cactus (*Mammillaria tetrancistra*), beavertail (*Opuntia basilaris* var. *basilaris*), and Johnson's fishhook cactus (*Sclerocactus johnsonii*). One species of yucca, Mojave yucca (*Yucca schidigera*) occurs in the Study Area (Appendix C). One species of cactus, common fishhook cactus, was detected during the floristic survey but not during the belt transect sampling. The results of the belt transect sampling for cacti and yucca are summarized in Tables 19 and 20. Belt transect sampling results for silver cholla, pencil cholla, cottontop cactus, strawberry hedgehog, and beavertail are depicted in figures 10, 11, 12, 13, and 14, respectively. No figures are included depicting the results for desert barrel cactus or Mojave yucca because they were only detected in a few transects.

Within the Study Area, transects in areas D, E, and F had much higher densities of cactus than those in the other areas (figures 10-14, Table 19). Beavertail was the most abundant, followed by silver cholla. Pencil cholla, cottontop cactus, and strawberry hedgehog. Desert barrel cactus and Mojave yucca were encountered only once and twice, respectively, during sampling. Although not sampled during the belt transect surveys, a population of desert barrel cactus was observed on a low limestone hill during the botanical survey along the gen-ties just east of Crystal Substation. The greatest density and richness of cacti and yucca were found in the Creosote-White Burrobush Shrubland Alliance where all seven cacti species and the yucca were recorded (Table 20). Six of the cacti species (all but desert barrel cactus) were recorded during sampling in the Shadscale Shrubland Alliance. Four of the seven cacti species, silver cholla, pencil cholla, strawberry hedgehog, and beavertail, were recorded in the Catclaw Acacia Shrubland Alliance during the belt transect sampling; in addition, a fifth species, cottontop cactus, was detected during the AIM vegetation plot sampling. Finally, three cacti species, silver cholla, cottontop cactus, and beavertail, were found during sampling in the Big Galleta Herbaceous Alliance.

As expected, nearly all cactus sampled (98 percent) were between zero and three feet tall. Species such as cottontop cactus, strawberry hedgehog, and beavertail rarely reach heights greater than two feet. Most taller species of cacti were found in Area F, where 280 silver cholla were between three and six feet tall and one was over six feet; five silver cholla in Area E were between three and six feet tall and the two Mojave yucca sampled (both in Area E) were between three and six feet tall. Other than the above mentioned, only one other silver cholla sampled in Area B was between three and six feet tall.

Table 21 shows the estimated total numbers of cacti and yucca in each vegetation alliance in the Study Area, as extrapolated from the results of the belt transect sampling.

Table 19. Cacti and yucca identified during belt transect sampling in the Study Area per area (A-G, B1 and B2).

Area	Species							Total Cacti/Yucca Individuals	Acreage Sampled	Density (plants/ acre)
	silver cholla	pencil cholla	cottontop cactus	strawberry hedgehog	desert barrel cactus	beavertail	Mojave yucca			
A	6	16	6	2	0	32	0	62	54.0	1.2
B	57	48	21	6	0	371	0	503	231.5	2.2
C	67	3	5	2	0	135	0	212	40.8	5.2
D	680	0	39	44	1	3,770	0	4,534	100.6	45.1
E	312	2	1	0	0	1,245	2	1,562	24.2	65.6
F	2,703	18	7	9	0	3,356	0	6,093	132.1	46.1
G	21	15	12	7	0	92	0	147	41.9	3.5
B1	1	0	0	1	0	5	0	7	15.7	0.5
B2	10	26	14	4	0	61	0	115	38.1	3.0
Total	**3,857**	**128**	**105**	**75**	**1**	**9,067**	**2**	**13,235**	**678.8**	**19.5**

Table 20. Cacti and yucca identified during belt transect sampling in the Study Area per vegetation alliance.

Alliance	Species							Total Cacti/Yucca Individuals	Acreage Sampled	Density (plants/ acre)
	silver cholla	pencil cholla	cottontop cactus	strawberry hedgehog	desert barrel cactus	beaver-tail	Mojave yucca			
Creosote-White Burrobush Shrubland	3,851	120	101	72	1	9,043	2	13,190	636.3	20.7
Shadscale Shrubland	4	7	3	2	0	19	0	35	31.0	1.1
Catclaw Acacia Shrubland	1	1	0	1	0	3	0	6	5.9	1.0
Big Galleta Herbaceous	1	0	1	0	0	2	0	4	5.6	0.7
Total	**3,857**	**128**	**105**	**75**	**1**	**9,076**	**2**	**13,235**	**678.8**	**19.5**

Table 21. Extrapolated total numbers of cacti and yucca species in the Study Area per vegetation alliance based on the results of the belt transect sampling.

Alliance	Total Area of each Alliance in the Study Area (acres)	Extrapolated Total Number of Cacti/Yucca in the Study Area[1]						
		silver cholla	pencil cholla	cottontop cactus	strawberry hedgehog	desert barrel cactus	beavertail	Mojave yucca
Creosote-White Burrobush Shrubland	10,135	61,339	1,911	1,609	1,147	16	144,037	32
Shadscale Shrubland	540	70	123	52	35	0	331	0
Catclaw Acacia Shrubland	85	14	14	0	14	0	43	0
Big Galleta Herbaceous	101	18	0	18	0	0	36	0
Total	**10,861[2]**	**61,441**	**2,048**	**1,679**	**1,196**	**16**	**144,447**	**32**

[1] Extrapolated total number of cacti/yucca = (acreage of each alliance in the Study Area/acreage of each alliance sampled)*number of each species found during sampling.

[2] Does not include the 49 acres of badlands in the Study Area because no sampling was conducted there.

Figure 10. Belt Transect Cacti Sampling - *Cylindropuntia echinocarpa*

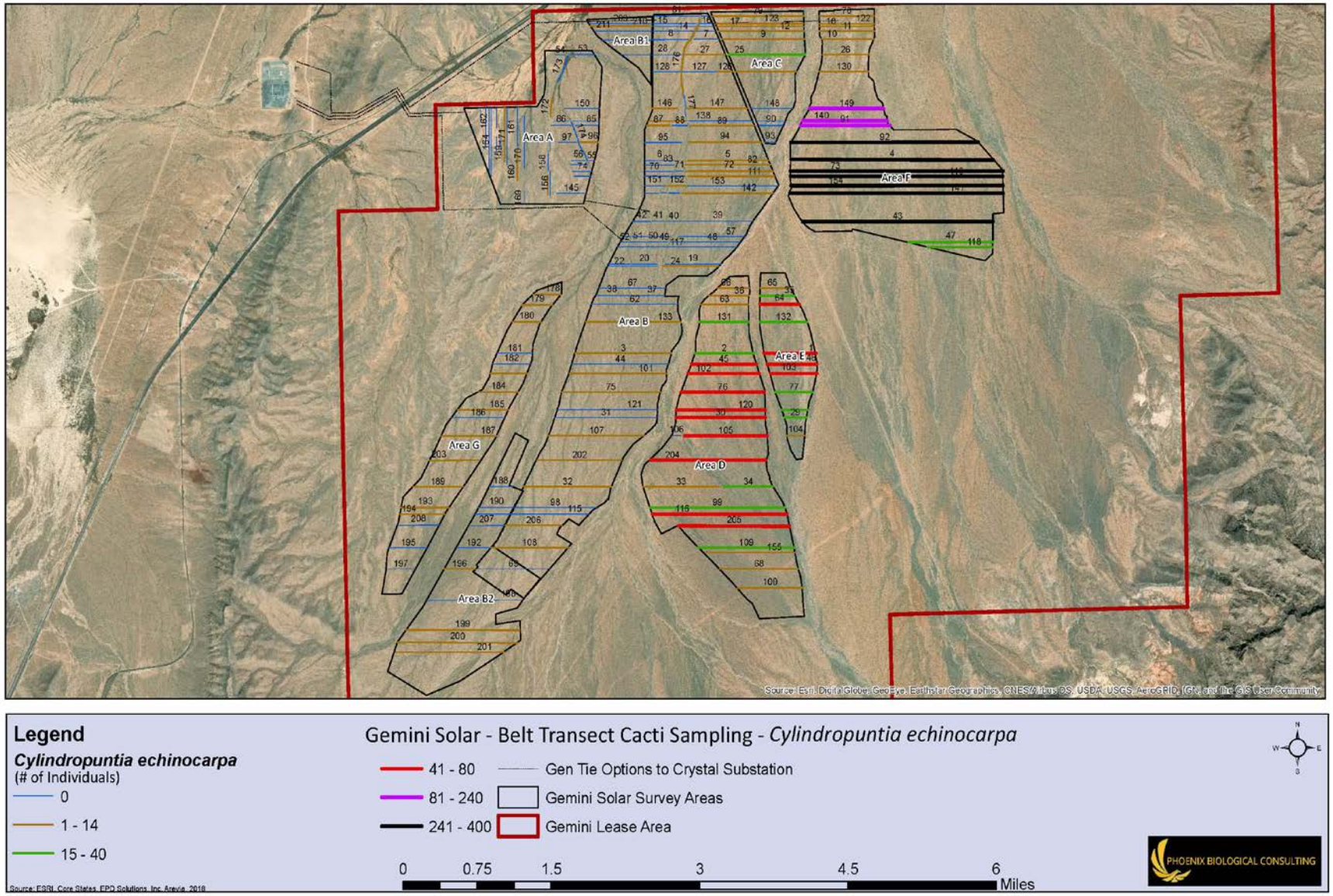


Figure 11. Belt Transect Cacti Sampling - *Cylindropuntia ramosissima*

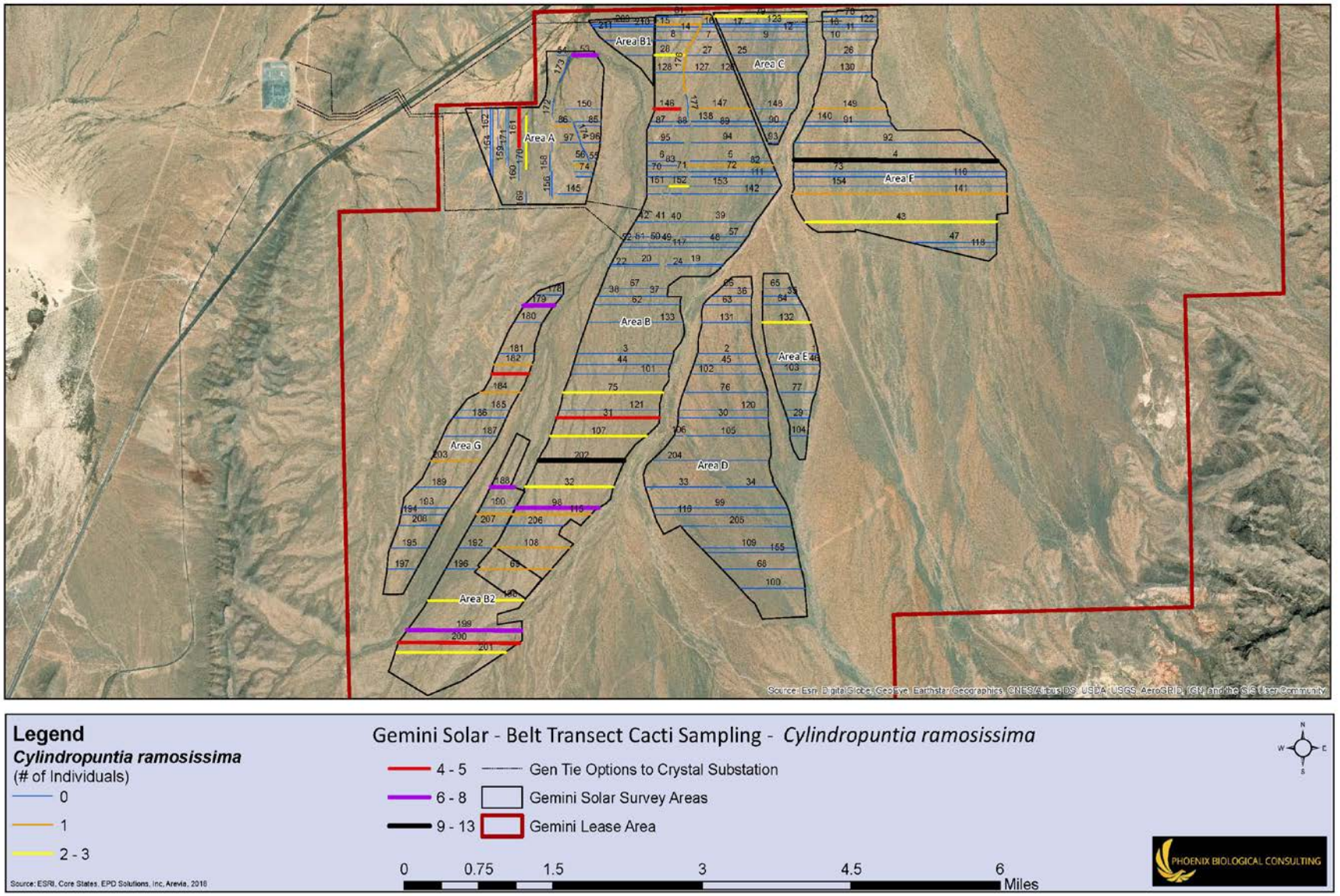


Figure 12. Belt Transect Cacti Sampling - *Echinocactus polycephalus*

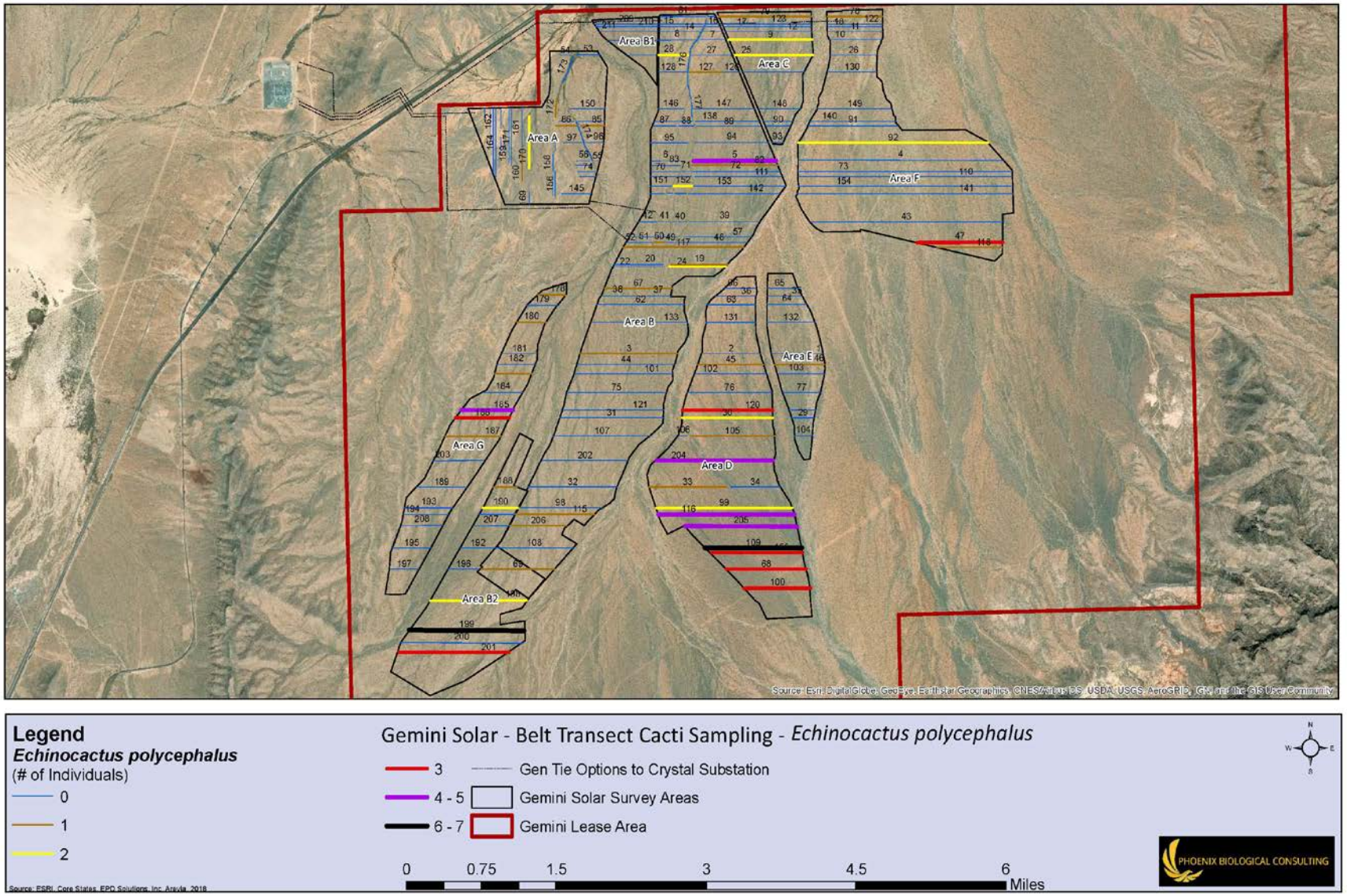


Figure 13. Belt Transect Cacti Sampling - *Echinocereus engelmannii*

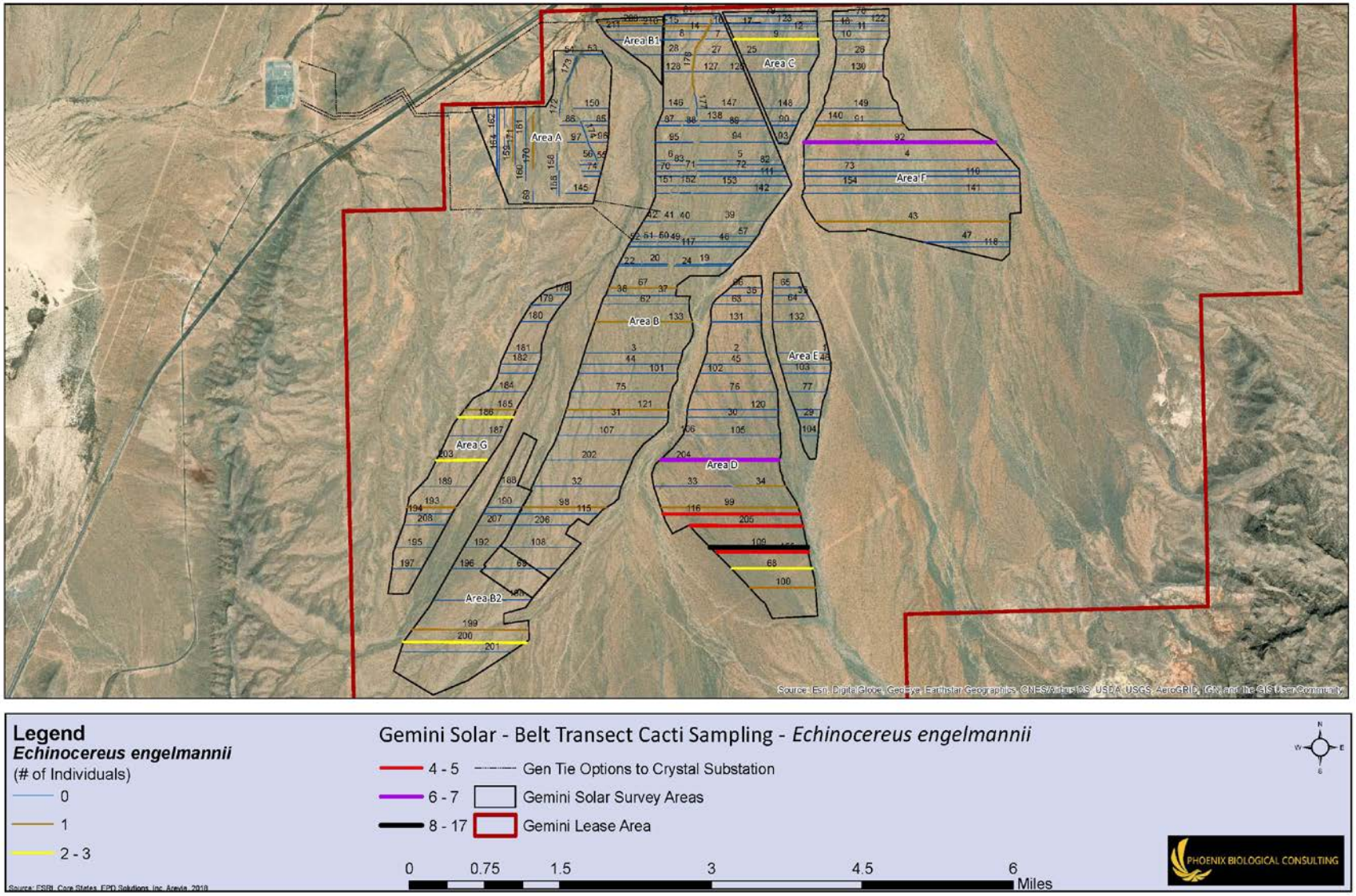
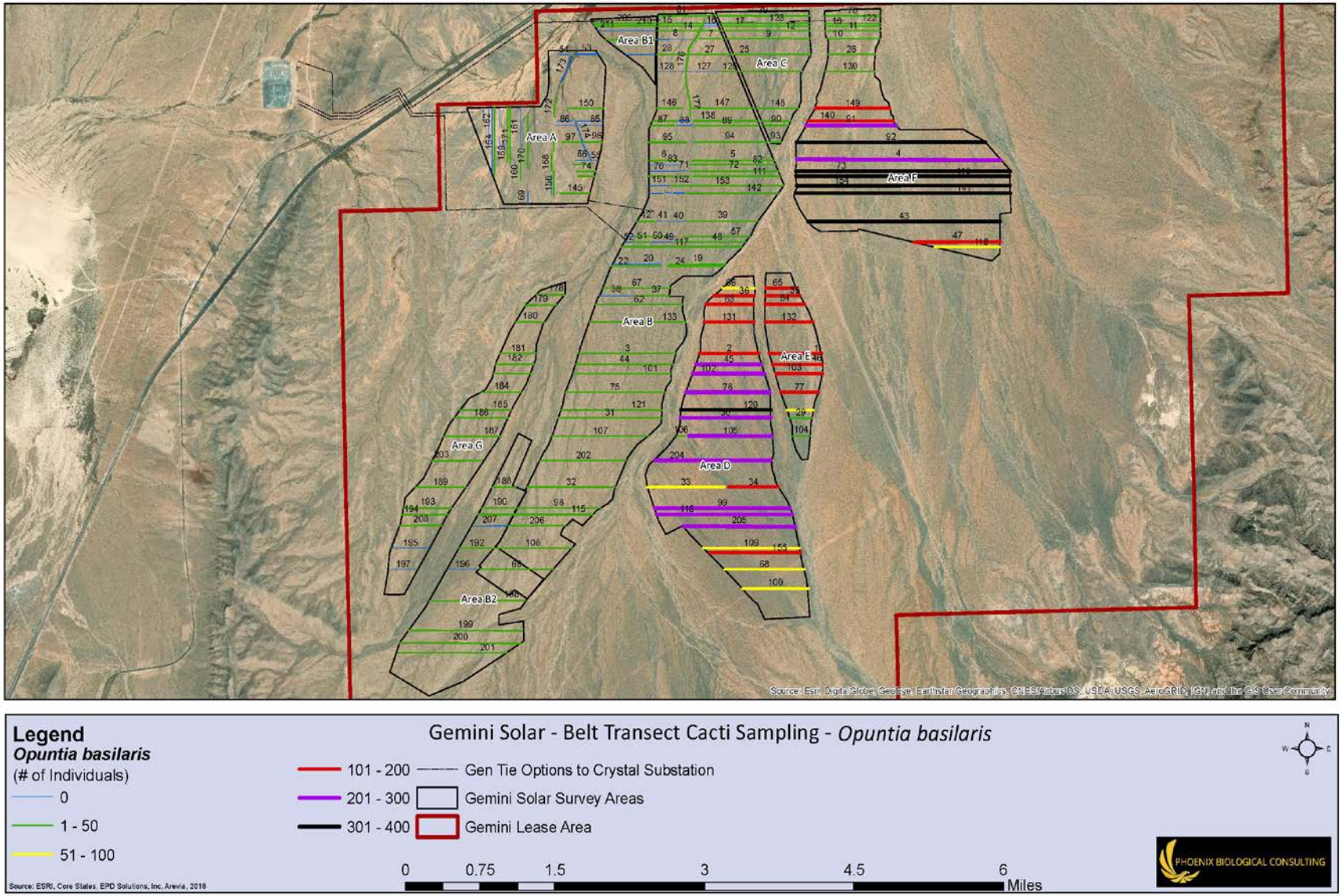


Figure 14. Belt Transect Cacti Sampling - *Opuntia basilaris*



Biocrust and Desert Pavement

Biocrust, or biological soil crust, is a surface crust comprised of living organisms including bacteria, algae, fungi, lichen, and moss. Biocrusts play an important role in soil surface stabilization, nutrient cycling, and the soil-water relationship. Desert pavement is a feature of the ground surface in deserts composed of a closely fitted, single layer of rock fragments over fine sand and/or silt; this layer traps dust particles over time which settle beneath the rock layer and form a vesicular horizon below the pavement. Desert pavement and the vesicular horizon beneath control important soil processes, affect water infiltration rates and redistribute water, increase salinization, and accumulate nitrate.

Table 22 summarizes the estimated amount of biocrust and desert pavement observed during the belt transect sampling. Figures 15 and 16 depict the results of the biocrust and desert pavement sampling. The percent cover of biocrust in the sampling area was 5.8 percent. Area F had the highest percent cover of biocrust (8.7 percent), followed by Area B (7.8 percent) and Area D (6.0 percent); areas C and E had 3.9 and 3.3 percent biocrust cover, respectively. Areas A, B1, and G had the lowest percent cover of biocrust at 0.3, 0.5, and 1.0 percent, respectively. The percent cover of desert pavement in the sampling area was similar to biocrust, at 5.3 percent. Area D had the highest percent cover of desert pavement (9.8 percent), followed by Area B (8.7 percent), Area B1 (6.0 percent), and Area C (4.7 percent); areas A and G had similar percent cover of desert pavement (2.6 percent). No desert pavement was recorded in Area E during sampling and only 0.2 percent cover of desert pavement was recorded in Area F during sampling.

Table 22. Estimated area and percent cover of biocrust and desert pavement identified during belt transect sampling in the Study Area.

Area	Estimated Area (square meters)		Area Sampled (square meters)	Percent Cover[1]	
	Biocrust	Desert Pavement		Biocrust	Desert Pavement
A	700	5,763	218,700	0.3	2.6
B	72,642	81,888	936,885	7.8	8.7
C	6,508	7,800	165,015	3.9	4.7
D	24,537	39,779	406,140	6.0	9.8
E	3,243	0	98,100	3.3	0.0
F	46,228	860	534,645	8.7	0.2
G	1,608	4,406	169,725	1.0	2.6
B1	336	3,835	63,615	0.5	6.0
B2	2,803	1,493	154,200	1.8	1.0
Total	**158,605**	**145,824**	**2,747,025**	**5.8**	**5.3**

[1] Percent cover = the percent of the area sampled covered in biocrust or desert pavement.

Figure 15. Belt Transect Results - Areas with Biocrust

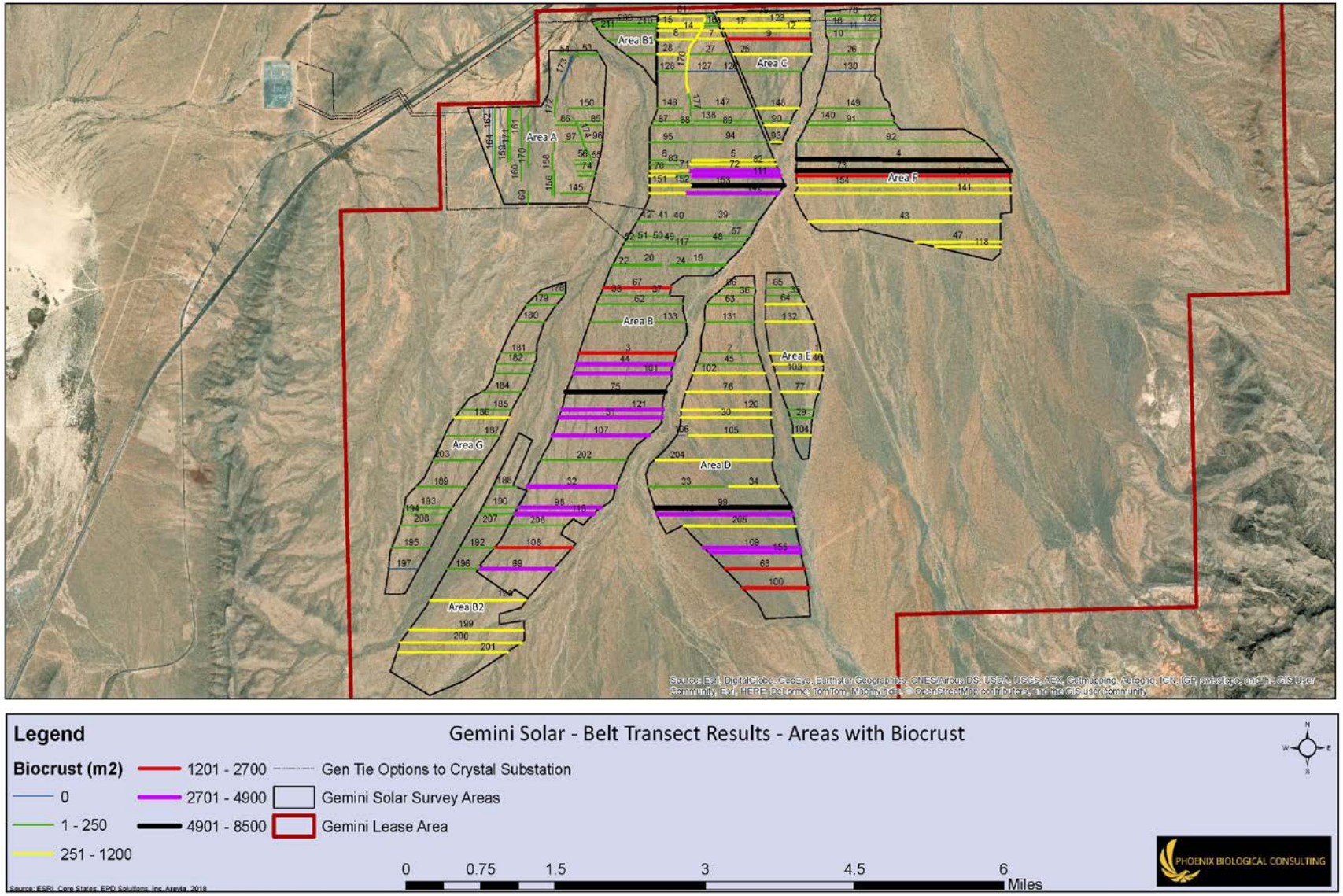
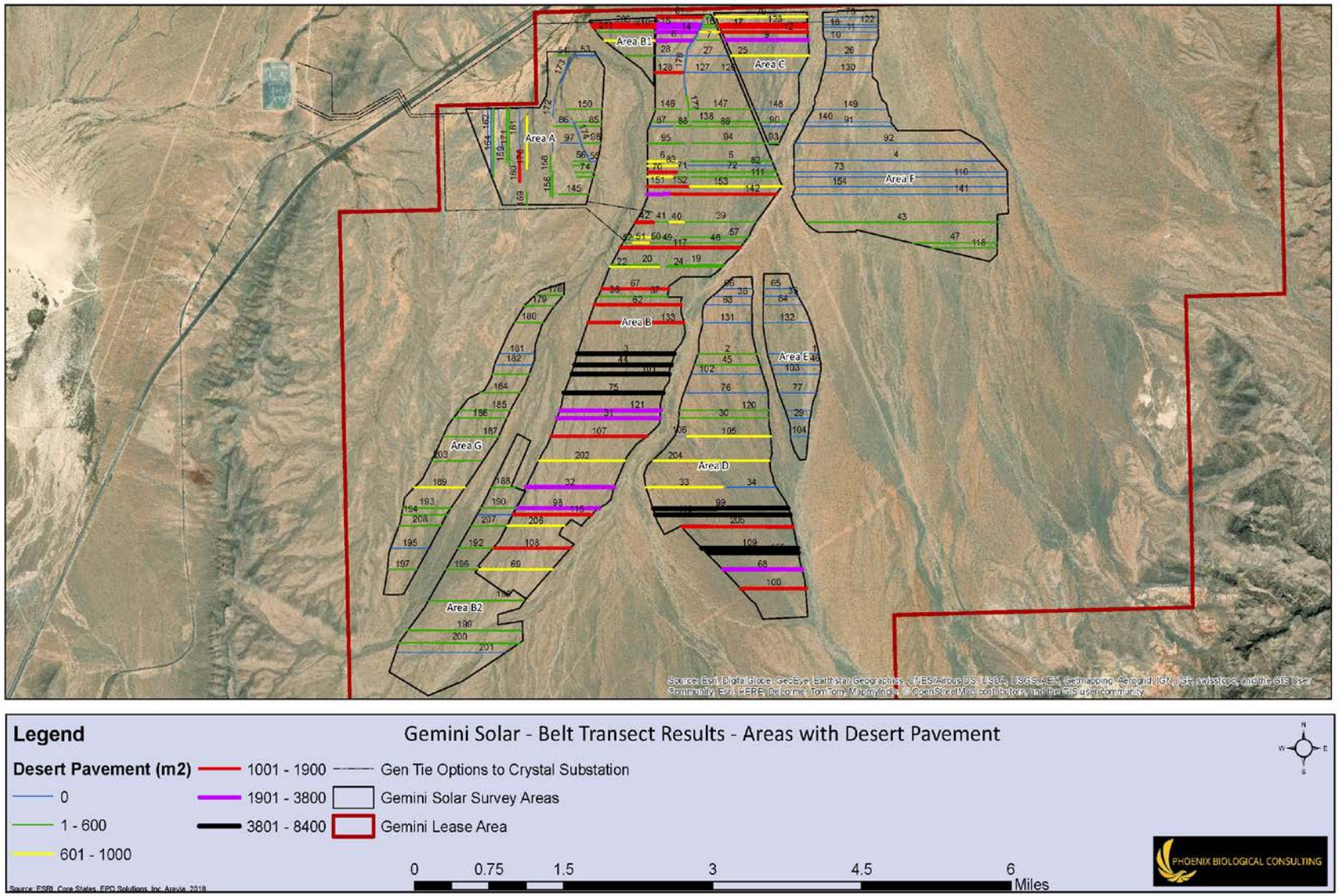


Figure 16. Belt Transect Results - Areas with Desert Pavement



Invasive Weeds

Belt Transect Sampling

Three species of weeds were recorded in large numbers during the belt transect sampling in the Study Area: Saharan mustard, halogeton (*Halogeton glomeratus*), and African mustard. Of these, Saharan mustard is listed by the NDA on the *Nevada Noxious Weed List* as a Category B Weed, which are noxious weeds that are "generally established in scattered populations in some counties of the State" (NDA 2018a). Weed sampling results for Saharan mustard, halogeton, and African mustard are depicted in figures 17, 18, and 19, respectively. The estimated populations and densities of these weed species are listed below in Table 23. In addition, one individual Russian thistle (*Salsola tragus*) was found during the sampling effort. Four additional weed taxa, red brome (*Bromus madritensis* ssp. *rubens*), cheatgrass (*Bromus tectorum*), Mediterranean grass (*Schismus* sp.), and red stem stork's bill (*Erodium cicutarium*) occur throughout the Study Area but were excluded from the sampling because they are so widespread. Species descriptions, including discussion of the weed populations in the Study Area, for these and other weeds of concern in the Study Area are included below.

Table 23. Invasive weeds identified during belt transect sampling in the Study Area.

Area	Estimated No. of Individuals			Total Weeds	Acreage Sampled	Estimated Density (plants/acre)			Estimated Density (total weeds/ acre)
	BRTO	HAGL	STAF			BRTO	HAGL	STAF	
A	0	7,357	49,738	57,095	54.0	0	136.2	921.1	**1,057.3**
B	6,342	2	36,949	43,293	231.5	27.4	0.008	159.6	**187.0**
C	270	0	560	830	40.8	6.62	0	13.7	**20.3**
D	10,287	0	5	1,0292	100.6	102.3	0	0.05	**102.3**
E	33,147	0	0	33,147	24.2	1,369.7	0	0	**1,369.7**
F	4,489	0	0	4,489	132.1	34.0	0	0	**34.0**
G	0	0	5,375	5,375	41.9	0	0	128.3	**128.3**
B1	0	0	0	0	15.7	0	0	0	**0**
B2	67	0	31,402	31,469	38.1	1.8	0	824.2	**826.0**
Total	**54,602**	**7,359**	**124,029**	**185,990**	**678.8**	**80.4**	**10.8**	**182.7**	**274.0**

[1] Weed species abbreviations are as follows: BRTO=*Brassica tournefortii* (Saharan mustard); HAGL=*Halogeton glomeratus* (halogeton); STAF: *Strigosella africana* (African mustard); and, SATR=*Salsola tragus* (Russian thistle).

Figure 17. Weed Sampling Results - *Brassica tournefortii*

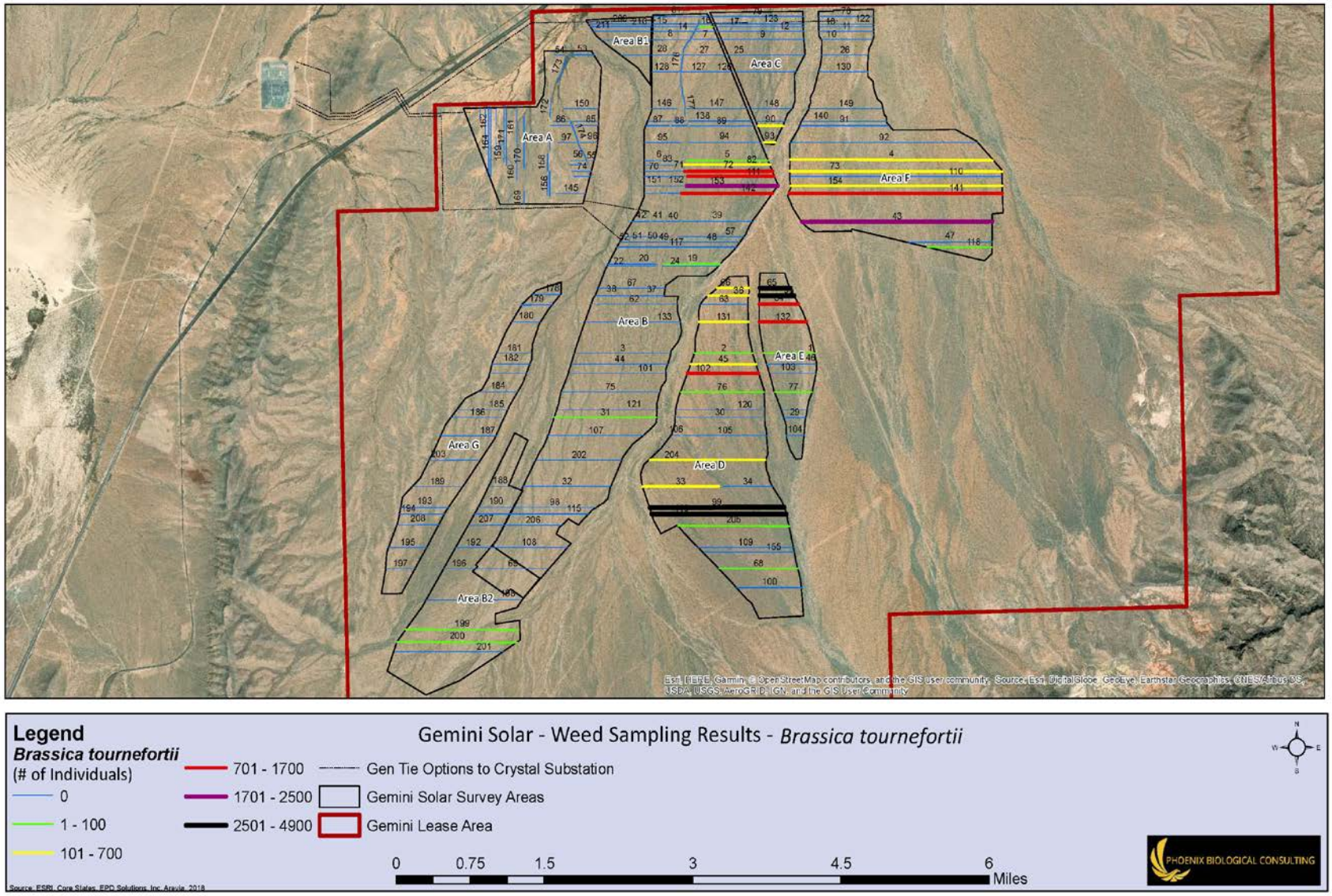


Figure 18. Weed Sampling Results - *Halogeton glomeratus*

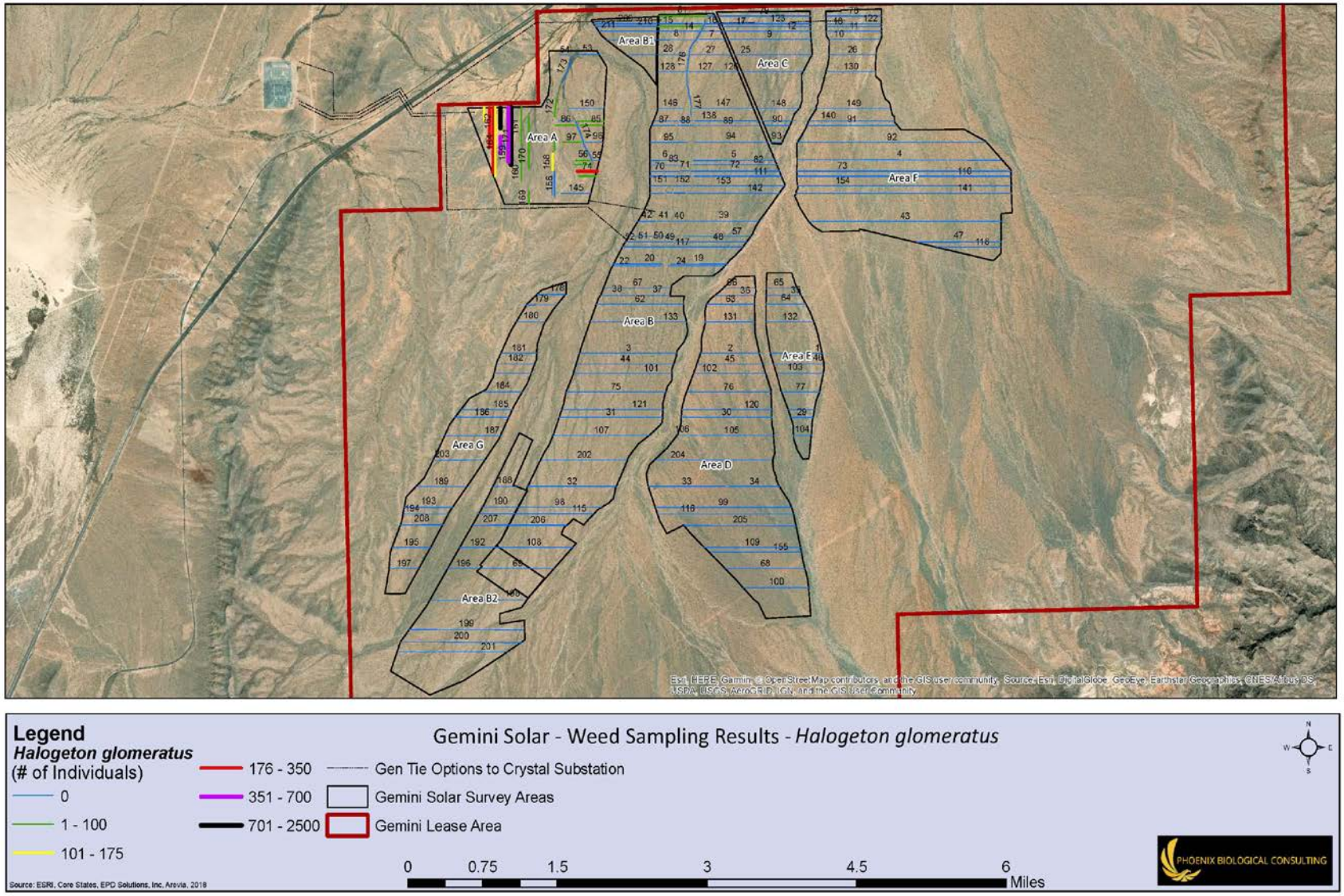
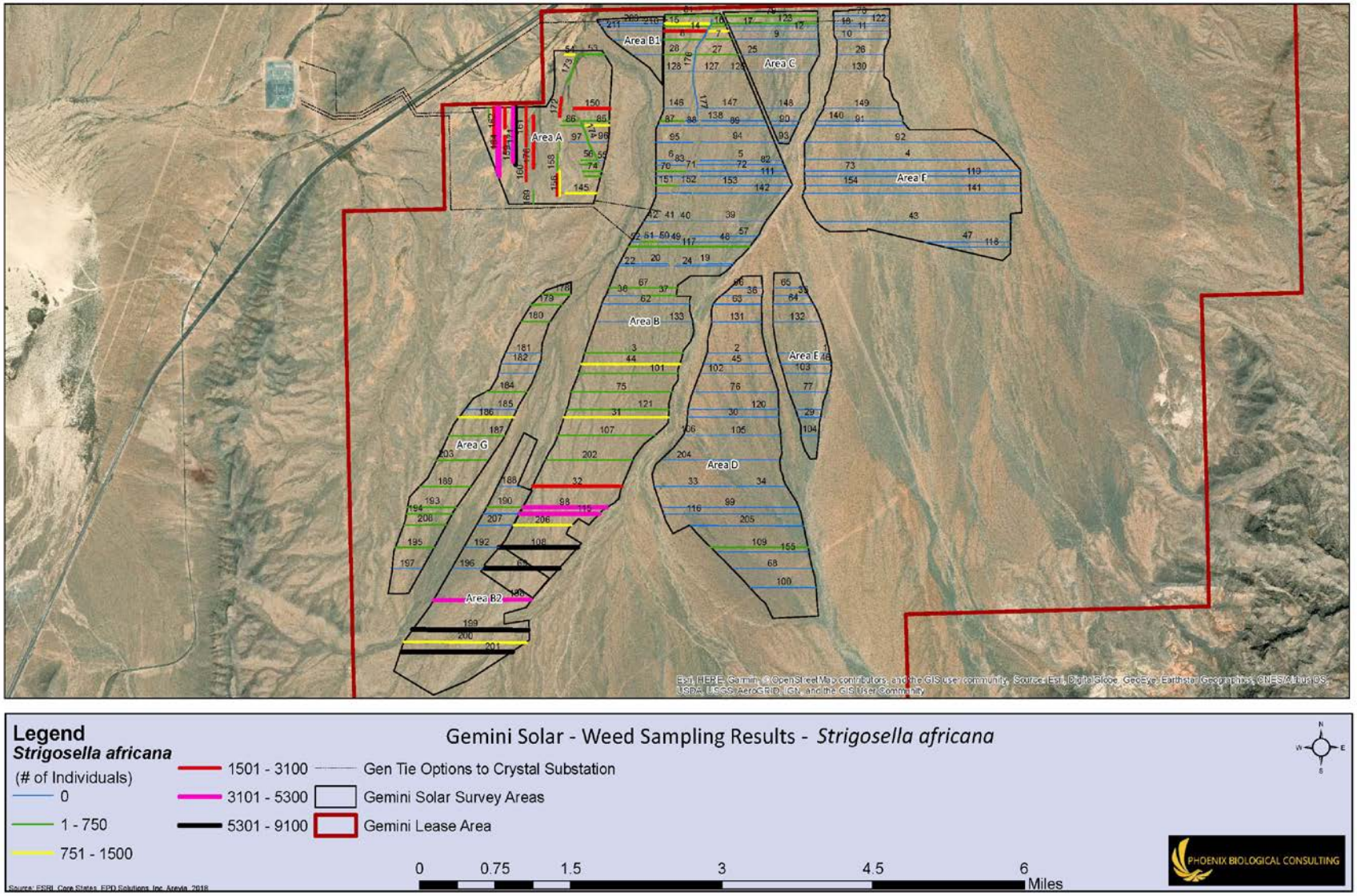


Figure 19. Weed Sampling Results - *Strigosella Africana*



Weeds Encountered During the Botanical Survey

Although not found during the belt transect sampling, several other invasive weed species were recorded in the Study Area during the botanical surveys including: Russian knapweed (*Acroptilon repens*), oat grass (*Avena* sp.), Chilean chess (*Bromus berteroanus*), ripgut brome (*Bromus diandrus*), Malta starthistle (*Centaurea melitensis*), Bermuda grass (*Cynodon dactylon*), foxtail barley (*Hordeum murinum* ssp. *glaucum*), Timothy grass (*Phleum pratense*), prickly sow thistle (*Sonchus asper*), and salt cedar (*Tamarix ramosissima*). Of these, Malta starthistle is a Category A Weed, defined as noxious weeds that are "generally not found or that are limited in distribution throughout the State;" Russian knapweed is a Category B Weed (defined above); and, salt cedar is a Category C Weeds, defined as noxious weeds that are "generally established and generally widespread in many counties of the State" (NDA 2018a). In addition, red brome, cheatgrass, Mediterranean grass, and red stem stork's bill are widespread and occur throughout the Study Area. Species accounts for Russian knapweed, Malta starthistle, salt cedar, red brome, cheatgrass, Mediterranean grass, and red stem stork's bill are included below. Because the remaining species (oat grass, Chilean chess, ripgut brome, Bermuda grass, foxtail barley, Timothy grass, and prickly sow thistle) are not listed by the NDA and were only found in the buffer zone and/or along the gen-ties, they are not discussed further in this report.

Invasive Weed Vector Mapping

Updates to the BLM's weed inventory data (Table 5; BLM 2014) were made to document areas where weeds have spread along the prominent weed vectors in and around the Study Area. In order to update the BLM data, all of the dirt and paved roads in and around the Study Area were inspected in order to document new areas of weed invasion and to update the existing BLM data. New or expanded populations of several invasive weed species were found during the road surveys including Saharan mustard, red brome, cheatgrass, Malta starthistle, halogeton, London rocket (*Sisymbrium irio*), African mustard, and salt cedar (Table 24). Figures 20, 21, and 22 show the BLM weed inventory data (BLM 2014) and the newly mapped weed populations along the vectors (i.e., roads) in and around the Study Area. Species accounts for all weeds found during the vector mapping are included below.

Table 24. New weed populations mapped during the vector survey.

Population I.D. No.[1]	Species	Population Area (acres)	Population Estimate	Notes
1	Saharan mustard	15	3,000	Patchy distribution
2	Saharan mustard	33	10,000	Patchy distribution
3	Saharan mustard	12	20,000	Patchy distribution
4	Saharan mustard	2	1,000	Patchy distribution. Red brome and cheatgrass interspersed.
5	Saharan mustard	25	10,000	Patchy distribution Red brome and Saharan mustard sparsely interspersed.
6	Saharan mustard	8	500	Patchy distribution
7	Saharan mustard	3	2,000	Patchy distribution
8	Saharan mustard	5	5,000	Patchy distribution
9	Saharan mustard	7	5,000	Patchy distribution. Red brome and cheatgrass interspersed.
10	London rocket	1	50-100	Patchy distribution
11	African mustard	5	200	Patchy distribution
12	Saharan mustard	5	200	Patchy distribution
13	red brome	33	20,000	Patchy distribution
14	cheatgrass	33	20,000	Patchy distribution
15	Saharan mustard	1	500	Patchy distribution
16	London rocket	1	1,000	Patchy distribution
17	cheatgrass	15	100,000	Patchy distribution. Red brome, London rocket interspersed.
18	cheatgrass	1	5,000	Patchy distribution. Red brome interspersed.
19	Malta starthistle	17	5,000	Patchy distribution
20	Halogeton	100	500,000	African mustard is more common along the north 1/2 of polygon. Halogeton is more common in the southern portion.

[1] The population ID number corresponds with the mapped population on figures 20-22.

Invasive Weed Species Descriptions

Russian knapweed (*Acroptilon repens*): Russian knapweed is a perennial herb in the Sunflower Family (*Asteraceae*) native to central Asia. It is commonly found in rangeland, disturbed areas including roadsides, and along waterways. The NDA lists it as a Category B noxious weed and it is known to occur in all counties in Nevada (NDA 2018b). Russian knapweed was found in Area A in Creosote-White Burrobush Shrubland Alliance, as well as in the buffer zone and along the gen-ties.

Saharan mustard (*Brassica tournefortii*): Saharan mustard is an annual plant in the Mustard Family (*Brassicaceae*) native to the Mediterranean an southwestern Asia. It is locally abundant where found and usually occurs along washes, roadsides, and open areas. In Nevada, it is a Category B noxious weed and is generally established in the southern portion of the state, mostly in Clark County (NDA 2018b). Saharan mustard was the second most abundant weed recorded, with a total estimate of 54,602 individuals and a density of approximately 80 plants/acre. Saharan mustard is most common in the eastern portion of the Study Area; it was not recorded during sampling in areas A, G, and B1, but was recorded in areas B, C, D, E, F, G, and B2 (Figure 17). The highest density of Saharan mustard was found in Area E, with approximately 1,370 plants/acre. During the botanical survey, Saharan mustard was

recorded in all the areas except for Area G, in the buffer zone, and along the gen-ties. Saharan mustard was only recorded in the Creosote-White Burrobush Shrubland Alliance during sampling, but was found in all four vegetation communities during the botanical survey. Saharan mustard was also mapped along the vectors.

Red brome (*Bromus madritensis* ssp. *rubens*): Red brome is a annual in the Grass Family (Poaceae) native to Europe. It invades disturbed areas including roadsides, agricultural fields, rangelands in a variety of habitats including desert shrublands, pinyon-juniper communities, pine woodlands, and coastal scrub. Red brome invasion contributes to increases in fire frequency and converts natural habitat to annual grassland. Red brome is widespread throughout the Study Area and was found in all areas, in the buffer zone, and along gen-ties in all four vegetation alliances. Red brome was also mapped along the vectors.

Cheatgrass (*Bromus tectorum*): Cheatgrass is a annual in the Grass Family (*Poaceae*) native to Eurasia. It invades rangelands, grasslands, and shrublands. Like red brome, cheatgrass invasion contributes to increases in fire frequency and converts natural habitat to annual grassland or overcrowds native grasslands and rangelands. Cheatgrass is widespread throughout the Study Area and was found in all areas, in the buffer zone, and along gen-ties in all four vegetation alliances. Cheatgass was also mapped along the vectors.

Malta starthistle (*Centaurea melitensis*): Malta starthistle is an annual herb in the Sunflower Family (*Asteraceae*) native to southern Europe. Malta starthistle invades open areas such as grasslands, pastures, croplands, disturbed areas including roadsides, but also woodlands. In Nevada, Malta starthistle is a Category A noxious weed and is known to occur in Clark, Lincoln, and Nye counties. Malta starthistle was found in the buffer zone and along the gen-ties and was also documented during the vector survey.

Red stem stork's bill (*Erodium cicutarium*): Red stem stork's bill is an annual/biannual herb in the Geranium Family (*Geraniaceae*) native to Eurasia. It is commonly found along roadsides, in grasslands, fields, and shrublands. It can be very aggressive and can out-compete native grasses and forbs resulting in carpets of red stem stork's bill covering large areas, though this is not typical in desert environments. Red stem stork's bill was found in all areas, the buffer zone, and along the gen-ties and in all vegetation alliances within the Study Area, but was most abundant in Area A.

Halogeton (*Halogeton glomeratus*): Halogeton is an annual herb in the Goosefoot Family (*Chenopodiaceae*) that is highly toxic. It was introduced to Nevada in the 1930s and has since spread throughout the state (NRCS 2008). Halogeton is highly tolerant of salty soils and typically inhabits disturbed or overgrazed areas, such as cheatgrass grasslands, saltbush scrub, and other alkaline areas (NRCS 2008)). Halogeton was only found in two areas, areas A and B, during the sampling, with a total estimate of 7,357 individuals and a density of approximately 136 plants/acre in Area A and only two plants in Area B; the majority of halogeton in Area A was in the northwest corner of the area (Figure 18). During the botanical survey, halogeton was found in areas A, B, and G, in the buffer zone, and along the gen-ties. Halogeton was recorded in the Shadscale Shrubland, Creosote-White Burrobush Shrubland, and Big Galleta Herbaceous alliances during the belt transect sampling and during the botanical survey, but was not found in the Catclaw Acacia Shrubland alliance. Halogeton was also mapped along the vectors.

Russian thistle (*Salsola tragus*): Russian thistle is a large annual herb in the Goosefoot Family (*Chenopodiaceae*) native to Eurasia. It is common in disturbed places and is better known as tumbleweed for its habit of being blown about in its roughly circular skeletal form. Only a single individual of Russian thistle was detected during the sampling effort, in Area B. During the botanical survey, Russian thistle was found in areas A, F, and G, and in the buffer zone. The Russian thistle found during the sampling was in the Creosote-White Burrobush Shrubland Alliance, but it was also found in the Shadscale Shrubland Alliance during the botanical survey.

Mediterranean grass (*Schismus* spp.): Two closely related species of Mediterranean grass, *Schismus arabicus* and *S. barbatus*, are found throughout the deserts of the southwestern United States. They are difficult to distinguish and one or both occurs in the Study Area. Both are annual grasses in the Grass Family (*Poaceae*), *S. arabicus* is native to Eurasia and *S. barbatus* is native to southern Europe and Africa. Both species are found in deserts and disturbed areas and contribute to the conversion of desert shrubland to annual grassland by increasing fire frequency. Mediterranean grass was found in all areas, the buffer zone, and along the gen-ties and in all vegetation alliances within the Study Area.

African mustard (*Strigosella africana*): African mustard is an annual herb in the Mustard Family (*Brassicaceae*) native to the Africa. It occurs in disturbed areas, desert, flats, shrublands, juniper woodlands, and fields throughout the intermountain west and is most established in Utah and Nevada. African mustard was the most abundant weed in the sampling area, with a total estimate of 124,029 individuals and a density of approximately 183 plants/acre. This species was most common in the western half of the Study Area, with the highest densities in areas A and B2; it was not found at all in areas E, F, and B1 and only in very low numbers in Area D (Figure 19). During the botanical survey, African mustard was found in all areas, in the buffer zone, and along the gen-ties. African mustard was recorded in the Shadscale Shrubland, Creosote-White Burrobush Shrubland, and Big Galleta Herbaceous alliances during the belt transect sampling and during the botanical survey, but was not found in the Catclaw Acacia Shrubland alliance. African mustard was also mapped along the vectors.

Salt cedar (*Tamarix ramosissima*): Salt cedar is a shrub or tree in the Tamarisk Family (*Tamaricaceae*) native to Asia. In Nevada, salt cedar is a Category C noxious weed and is known to occur in all counties. Salt cedar is usually found along watercourses, lakes, and ponds, it is highly invasive in riparian communities and is associated with changing geomorphology, groundwater availability, soil chemistry, fire frequency, and plant community composition. Salt cedar was found in Area A along a small washlet and in Area B around a stock pond, as well as in the buffer zone and along the gen-ties.

Figure 20. Weed Inventory Data and Vectors (Northern Area)

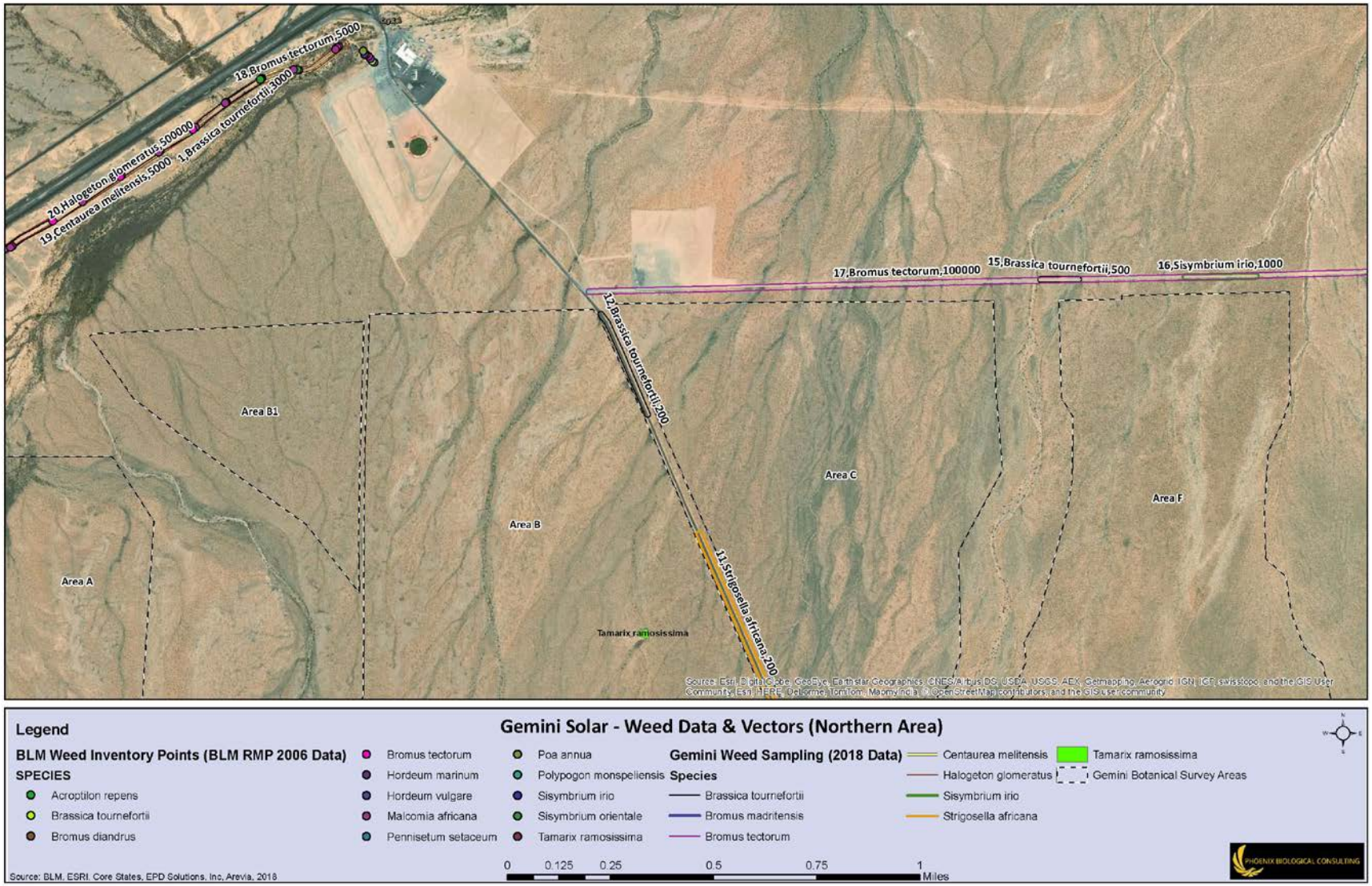


Figure 21. Weed Inventory Data and Vectors (Southern Area)

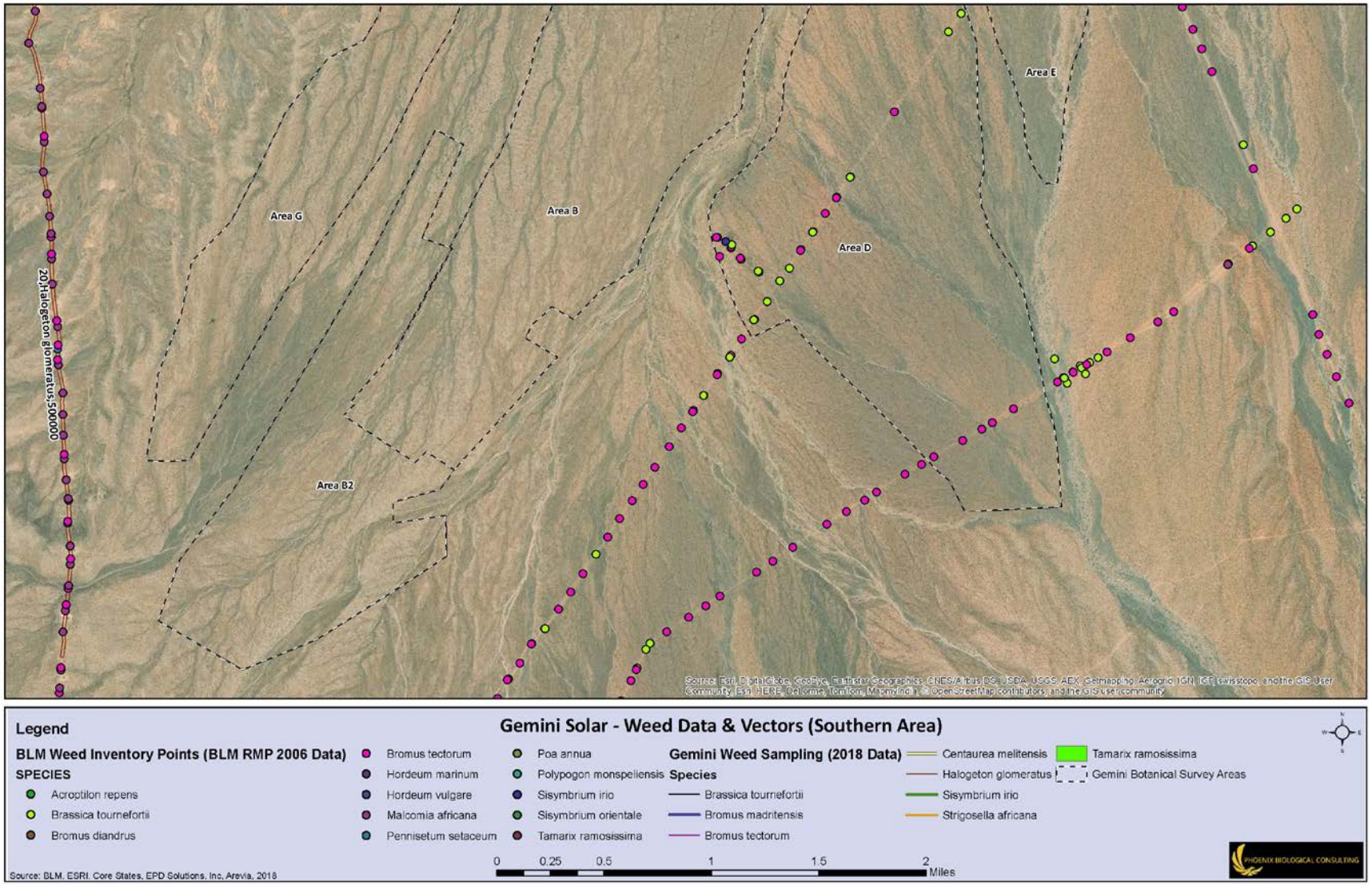
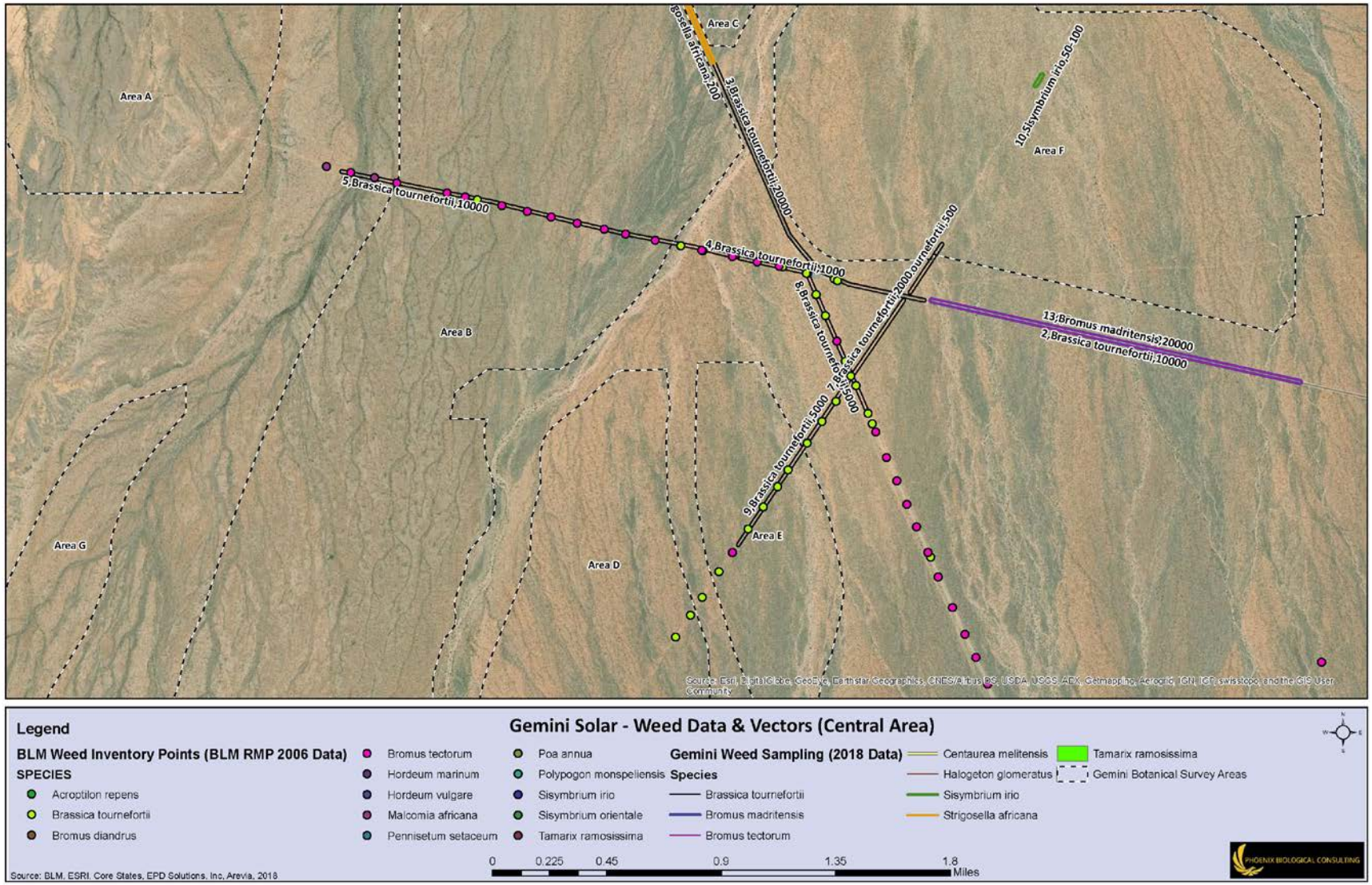


Figure 22. Weed Inventory Data and Vectors (Central Area)



Discussion

SPECIAL-STATUS PLANT SPECIES

Three taxa of special-status plants, threecorner milkvetch, Nye milkvetch, and rosy twotone beardtongue were positively identified within the Study Area during the spring 2018 special-status plant inventory. Threecorner milkvetch is listed by the State of Nevada as Critically Endangered/Fully Protected, by the BLM as Sensitive, by the NNHP as At-Risk, and by the Nevada Native Plant Society (NNPS) as Threatened. Nye milkvetch is listed by the NNHP as At-Risk and is on the NNPS's Watch List. Rosy twotone beardtongue is listed by the BLM as Sensitive, by the NNHP as At-Risk, and is on the NNPS's Watch List.

Threecorner milkvetch (*Astragalus geyeri* var. *triquetrus*)

Threecorner milkvetch is known only from Clark and Lincoln counties in southern Nevada and in the far northwest corner of Mohave County, Arizona. In the Dry Lake Valley region, threecorner milkvetch is known from the California Wash, Mud Lake, and Logandale populations (NPS 2010). Threecorner milkvetch found in the Study Area would be included in the California Wash populations (NPS 2010). The population of threecorner milkvetch documented in the Study Area during the botanical survey is in an area where this taxon is known to occur, but where additional information about the population was lacking.

In 2001, a total population of 4,094 individuals at 39 sites were known in Nevada (NNHP 2001); however, after record rainfall in 2008, an estimated 8,000 plants were documented on Sandy Cove in the LMNRA (this is the largest known population) (NPS 2010). Large fluctuations in population sizes from year to year are to be expected in annual species such as threecorner milkvetch and are usually attributed to rainfall. Although threecorner milkvetch was known from populations in the vicinity of the Study Area, the status of these populations was either unknown or known to contain few or no individuals when the NPS evaluated them for monitoring in 2007 (NPS 2010). The population of threecorner milkvetch documented in the Study Area during the botanical survey was comprised of 1,429 individuals within 616 occurrences. The highest number of occurrences and highest population numbers were found in Area F with 504 occurrences and a population of 1,102 (figures 7 and 8, Table 17). The populations of threecorner milkvetch found in the Study Area represent an expanded presence in the California Wash area than was known of previously.

This taxon is threatened by invasive weeds, urban development and sprawl, OHV use, recreational use, increased fire frequency and intensity, energy development, surface water development, utility corridor maintenance and construction, some agricultural practices, and the inundation and fluctuating shoreline of Lake Mead (NPS 2010). Because of its habitat preferences, this taxon occurs in areas that may be invaded by sand-loving weed species such as Saharan mustard, Mediterranean grass, salt cedar (*Tamarix ramosissima*), and Russian thistle (*Salsola* spp.) (NPS 2010). No threats to the threecorner milkvetch occurrences were noted and all were considered to be in undisturbed conditions; however, invasion of sand habitats from both Saharan mustard and Mediterranean grass was observed in the Study Area.

Nye milkvetch (*Astragalus nyensis*)

Nye milkvetch is known only from Clark, Lincoln, and Nye counties in southern Nevada and far southeastern Inyo County, CA. The SEINet Portal Network maps two occurrences of Nye milkvetch in the Dry Lake Valley; one near the intersection of Highway 93 and Interstate 15 near Dry Lake and the other

along the Valley of Fire Road just outside of the Study Area (SEINet 2018). The population of Nye milkvetch found in the Study Area during the botanical survey was not documented previously, but is in an area where this taxon is known to occur.

In 2001, Nye milkvetch was known from 24 extant occurrences in Nevada, with an estimated total of 1,126+ individuals and two extirpated occurrences (NNHP 2001). A search of the SEINet portal did not result in any new records of Nye milkvetch in the Dry Lake region since 2001. Several new populations of Nye milkvetch from the Pahrump Valley on the California-Nevada border were found in 2011 (SEINet 2018). The population of Nye milkvetch documented in the Study Area during the botanical survey is comprised of 2,117 individuals within 653 occurrences (Figure 7, Table 17). The highest number of occurrences and highest population numbers were found in areas A and F. The populations of Nye milkvetch found in the Study Area represent an expanded presence in the area than was known of previously. As stated above, annual plant population sizes fluctuate between years; still, the population found in the Study Area greatly increases the known population of Nye milkvetch in the state of Nevada from the NNHP report of 1,126+ individuals in 2001.

Threats to Nye milkvetch are likely similar to those to threecorner milkvetch including invasive weeds, urban development and sprawl, OHV use, recreational use, increased fire frequency and intensity, energy development, surface water development, utility corridor maintenance and construction, and some agricultural practices. No threats were observed to most of the Nye milkvetch populations and most were considered to be in undisturbed conditions; however, several populations were observed to be threatened by invasive weeds and one population was observed as threatened by OHV trails.

Rosy twotone beardtongue (*Penstemon bicolor* ssp. *roseus*)

Rosy twotone beardtongue is known from Clark, and Nye counties in southern Nevada and also from Arizona and California. In Nevada, rosy twotone beardtongue is known from approximately 50 occurrences with an estimated total of 6,049+ individuals (NNHP 2001). The SEINet Portal Network maps nine occurrences of rosy twotone beardtongue in the Dry Lake Valley region (SEINnet 2018). Eight are near Highway 93 and one is from near the Valley of Fire Road at the base of the Muddy Mountains. The rosy twotone beardtongue documented in the Study Area during the botanical survey was not documented previously, but is in an area where this taxon is known to occur.

Two occurrences of rosy twotone beardtongue were identified in the buffer zone during the botanical survey, each with a population of one individual. In addition, two other suspected occurrences of rosy twotone beardtongue were found, one in Area E and the other in the buffer (Figure 7, Table 17). Both of these suspected occurrences are expected to be rosy twotone beardtongue based on proximity to other rosy twotone beardtongue populations, but neither population is expected to flower this year and they are therefore not identifiable to species. The two confirmed occurrences of rosy twotone beardtongue were located in sand in the Creosote-White Burrobush Shrubland Alliance. The unconfirmed *Penstemon* occurrence in Area E was located in sandy loam in Creosote-White Burrobush Shrubland Alliance and the unconfirmed *Penstemon* occurrence in the buffer was in sandy loam in the Catclaw Acacia Alliance. No threats were noted to the *Penstemon* found in the Study Area. No Palmer's penstemon was found in the Study Area during the floristic survey.

Threats to rosy twotone beardtongue include urban development and sprawl, hybridization with Palmer's penstemon (accelerated by introduction Palmer's penstemon from roads and utility corridors

and in seed mixes used in planting in reclamation areas), road and utility corridor construction and maintenance, and energy development.

NATIVE PLANT COMMUNITIES

The native vegetation communities that comprise the Study Area are common desert shrubland and wash communities of the Mojave Desert and are typical natural communities of the region.

CACTI/YUCCA AND BIOCRUST/DESERT PAVEMENT

The cacti and yucca populations in the Study Area are also a typical representation of cacti and yucca found in the native plant communities and at the elevation of the Study Area.

Impact Analysis

SPECIAL-STATUS PLANT SPECIES

Potential permanent impacts to special-status plants from the proposed Project include mortality, morbidity, and disturbance to individual plants or plant populations, including the seed bank. Impacts may occur during vegetation removal, grading, and construction activities; via introduction of invasive weeds from new road and transmission line networks and increased use of the area; impacts to vegetation communities from vegetation management activities such as mowing and spraying herbicides; alterations to the topography, substrates, drainage system, and shade regime from construction activities and the resulting infrastructure of the Project.

Possible conservation measures that may be undertaken to reduce impacts to rare plant populations may include minimizing changes to drainage on rare plant populations; topsoil salvage, seed collection, implementing protection measures for rare plant populations to avoid impacts during construction; and, implementing a weed management program to reduce the spread of invasive weeds in the Study Area. The proposed action avoids direct impacts to the largest concentration of threecorner milkvetch because it does not include Area F (Figure 23). Threecorner milkvetch is considered to be the rarest of the special-status plants found in the Study Area, being both State of Nevada Critically Endangered/Fully Protected and BLM Sensitive.

NATIVE PLANT COMMUNITIES

Conservation measures to reduce impacts to vegetation communities may include allowing the plant communities in the solar fields to revegetate following construction, this will lessen permanent impacts to the native plant communities. A weed management program will also be implemented to control and reduce the spread of invasive weeds in the native plant communities of the Study Area. Additional restoration techniques that may be used to restore the temporary impact areas could include seed collection, perennial shrub salvage, soil/substrate salvage (including salvage of biocrust, desert pavement, vertical mulch and rocks, and surface and subsurface soils), plant propagation, shrub outplanting, soil surface stabilization, decompacting terrain, replacing soils, and replanting/reseeding.

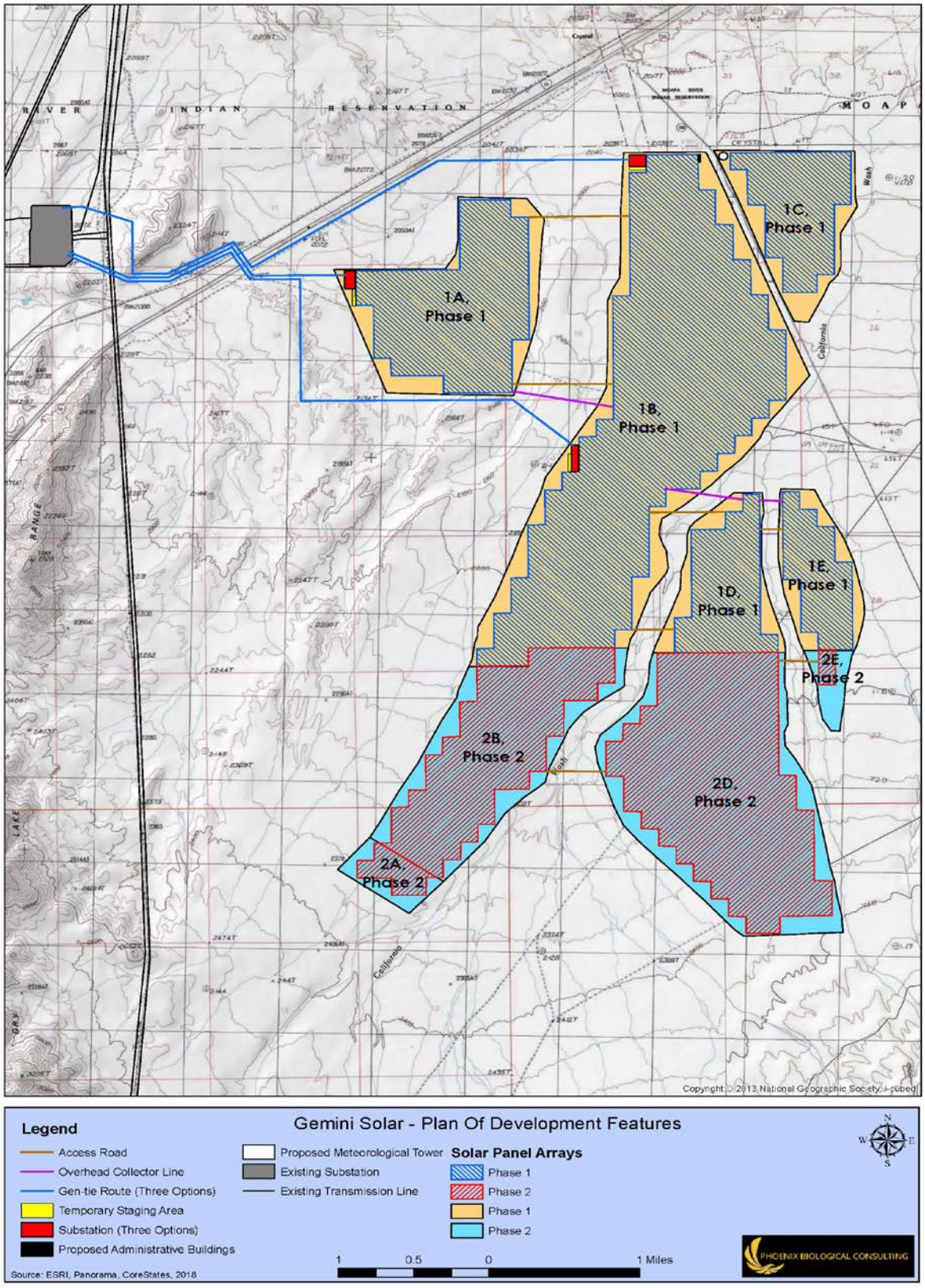
CACTI/YUCCA AND BIOCRUST/DESERT PAVEMENT

Potential permanent and temporary impacts to cacti and yucca from the proposed Project include mortality, morbidity, and disturbance to individuals or populations during vegetation removal, grading, and construction activities, during salvage and relocation activities, and/or via alterations to the topography, substrates, drainage system, and shade regime from construction activities and the resulting infrastructure of the Project. Potential permanent and temporary impacts to biocrust and desert pavement from the proposed Project include removal and disturbance during grading and construction activities; during salvage, storage, and relocation activities; and/or via alterations to the topography, substrates, and drainage system from construction activities and the resulting infrastructure of the Project.

Conservation measures to reduce impacts and protect cacti and yucca may include avoiding individuals where possible and salvaging and relocating healthy individuals (with a high percentage of live branches and stable root systems) outside of the impact area. Conservation measures to reduce impacts and

protect biocrust and desert pavement may include avoiding these substrates where possible and salvaging, stockpiling, and replacing them following construction activities.

Figure 23. Plan of Development Features



Surveyor Qualifications

The following PBC biologists conducted the botanical inventory and the vegetation, cacti/yucca, invasive weed, and biocrust/desert pavement sampling activities. Resumes for all biologists were submitted to the BLM botanist and were approved prior to the start of field work; approval emails from the BLM botanist are included in Appendix E.

Andrea Hazelton: M.S. (2011) and B.S. (2006) in Plant Biology from Arizona State University, Tempe, AZ; 13 years of professional experience conducting botanical and ecological field work in the southwestern United States. A. Hazelton conducted the special-status plant inventory for the Project.

Cecile Shohet: M.S. in Botany from Arizona State University, Tempe, AZ and B.A. in Biology from Queens College, State University of New York; 18 years of professional botanical experience in the western United States. Ms. Shohet conducted the special-status plant inventory and managed the list of plant taxa identified in the Study Area during the inventory for the Project.

Chloe Scott: B.A. in Environmental Studies from the University of California, Santa Cruz (2002); 15 years of professional experience conducting wildlife and botanical fieldwork in the western United States. Ms. Scott assisted with data review and preparation of the Botanical Resources Report for the Project.

Dave Kesonie: M.S. in Botany from the University of Wyoming, Laramie, WY (2008) and B.S. in Forestry from Northern Arizona University, Flagstaff, AZ (2001); 10 years of professional experience conducting botanical and vegetation field work in the Intermountain West and Colorado Plateau. D. Kesonie conducted the special-status plant inventory and the cacti/yucca, invasive weed, and biocrust/desert pavement sampling.

Francis Coburn: M.S. in Plant Biology and Conservation from Arizona State University, Tempe, AZ and B.S. in Biology from Northern Arizona University, Flagstaff, AZ; over 12 years of professional experience as a field botanist, plant taxonomist, and ecologist in the western United States. F. Coburn conducted the special-status plant inventory for the Project.

Glenn Rink: M.S. in Botany (2003) and B.S. in Geology (1985) from Northern Arizona University, Flagstaff, AZ; 22 years of professional botanical experience in the western United States. G. Rink conducted the special-status plant inventory and the rare plant reference site visits for the Project.

Jason Brooks: B.S. in Botany from Northern Arizona University, Flagstaff, AZ (1997); 17 years of professional experience conducting botanical surveys in the western United States. J. Brooks conducted the special-status plant inventory and led the bryophyte sampling and identification effort for the Project.

Jeanette Halderman: M.A. in Biology (emphasis Botany/Plant Physiology) (1991) and B.A. in Biology (emphasis Botany) (1988) from California State University, Fullerton; 25 years of botanical and habitat restoration experience in the western United States. J. Halderman conducted the special-status plant inventory for the Project.

Jolie Egert Elan: M.S. in Natural Resources from Humboldt State University, Arcata, CA (2002) and B.S. in Environmental Studies from Evergreen State College, Olympia, WA (1991); over 25 years of professional botanical experience in the western United States. J. Elan conducted the special-status plant inventory.

Karin Edwards: B.S. in Forestry/Recreation Resource Management (Geology minor) from the University of Montana, Missoula, MT; 14 years of professional experience conducting botanical fieldwork in the western United States. K. Edwards conducted the special-status plant inventory for the Project.

Mark Bagley: M.A. (1977) and B.A. (1974) in Botany from the University of California, Santa Barbara; 37 years of experience conducting rare plant surveys in the west, specializing in the Mojave Desert and the eastern Sierra Nevada Mountains. M. Bagley conducted the special-status plant inventory and the cacti/yucca, invasive weed, and biocrust/desert pavement sampling.

Michael Honer: M.S. in Botany from Rancho Santa Ana Botanic Garden, Claremont Graduate University, Claremont, CA (2003); 15 years of experience conducting rare plant and other biological field work in the western United States. M. Honer conducted the special-status plant inventory for the Project.

Onkar Singh: B.S. in Biology from California State University, Fresno (2007); 11 years of professional botanical experience focused on rare plants of the Mojave Desert in California and Nevada. O. Singh conducted the special-status plant inventory and the rare plant reference site visits for the Project.

Russell Kokx: B.A. in Environmental Biology from California State University, Fresno; 26 years of professional experience conducting rare plant surveys, mapping vegetation, and organizing floristic surveys throughout California, Nevada, and portions of Arizona. R. Kokx conducted the special-status plant inventory and re-visit surveys, as well as the rare plant reference site visits for the Project.

Ryan Young: B.A. in Geography from San Francisco State University, San Francisco, CA (1995); more than 25 years working in the arid southwest as Senior Biologist and Vice President of Phoenix Biological Consulting. His range of services include ArcGIS, project administration, technical report writing, agency consultation, focused biological surveys and permitting. R. Young's role consists primarily of project management, technical report writing, agency interface, logistics, and GIS services for the Project.

Sarah Schmid: B.S. In Botany from the University of Florida, Gainesville, FL; 13 years of professional experience performing biological surveys in the Mojave and Great Basin deserts, the Sierra Nevada, and the Intermountain West. S. Schmid conducted the special-status plant inventory and the AIM vegetation plot sampling for the Project.

Scott Massed: B.S. in Biology (focus on Botany) from Keene State College, Keene, NH (2010); eight years of professional experience conducting botanical and vegetation studies in the western United States. S. Massed conducted the special-status plant inventory and the AIM vegetation plot sampling.

Scott Smith: Over six years of professional experience conducting rare plant surveys in the Rocky Mountain region, South Dakota, and California including in the Mojave Desert. S. Smith conducted the special-status plant inventory for the Project.

Teague Embrey: B.A. in Biology from Whitman College, Walla Walla, WA (2006); 12 years of professional experience conducting vegetation and botanical surveys in the western United States. T. Embrey conducted the special-status plant inventory for the Project.

Youssef Atallah: Ph.D. in Plant Ecology from the University of Hohenheim, Germany (2007), M.S. in Environmental Science from California State University, Fullerton (2002), and B.S. in Landscape Management from the University of Hohenheim, Germany (1997). Y. Atallah has more than 20 years of professional experience conducting rare plant and vegetation community surveys and studies in southern California and the Mojave Desert. Y. Atallah conducted the special-status plant inventory, the cacti/yucca, invasive weed, and biocrust/desert pavement sampling, and the weed vector mapping for the Project.

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Personal Communications

April 13, 2017. Personal communication between Ryan Young of PBC and BLM District Botanist Lara Kobelt via email regarding suitable habitat for sensitive plants in the Study Area.

February 20, 2018. Personal communication between Ryan Young of PBC and BLM District Botanist Lara Kobelt via phone and email regarding botanical survey methodology.

March 22, 2018. Electronic mail communication between Ryan Young and James Andre Director at Granite Mountain Desert Research Center regarding timing of surveys.

April 3, 2018. Personal communication between Ryan Young of PBC and BLM District Botanist Lara Kobelt via telephone regarding timing of surveys and request for reference site visit information.

June 11, 2018. Personal communication between Ryan Young of PBC and BLM District Botanist Lara Kobelt via telephone regarding additional belt transects.

APPENDICES

Appendix A: List of Special-status Plants with Potential to Occur in the Study Area

List of Special-status Plants with Potential to Occur in the Gemini Study Area

Species	Endemic	NNHP & G/S ranks	State of Nevada	Nevada Native Plant Society	BLM	USFWS	Potential to Occur (High/ Medium/Low)
Arctomecon californica Las Vegas bearpoppy	No	At-Risk G3/S3	Critically Endangered, Fully Protected	Threatened	Sensitive	Species of Concern	Low
Arctomecon merriamii white bearpoppy	No	At-Risk G3/S3	N/A	Watch	Sensitive	N/A	Low-Medium
Astragalus amphioxys* var. *musimonum Sheep Range milkvetch	No	At-Risk G5T2/S2	N/A	Watch	N/A	Species of Concern	Low
Astragalus geyeri* var. *triquetrus threecorner milkvetch	No	At-Risk G4?T2T3/S2S3	Critically Endangered, Fully Protected	Threatened	Sensitive	N/A	Medium-High (known from local area)
Astragalus lentiginosus* var. *stramineus straw milkvetch	No	At-Risk G5T2T3/S1S2	N/A	Watch	Sensitive	N/A	Low-Medium
Astragalus nyensis Nye milkvetch	No	At-Risk G3/S3	N/A	Watch	N/A	N/A	Medium-High
Astragalus preussii* var. *laxiflorus Littlefield milkvetch	No	At-Risk G4T2/S1S2	N/A	Watch	N/A	N/A	Low-Medium
Cirsium virginense Virgin River thistle	No	At-Risk G2/S1	N/A	Watch	N/A	N/A	Low
Crossidium seriatim rough fringemoss	No	N/A	N/A	Watch	N/A	N/A	Low
Cryptantha insolita Las Vegas catseye	Yes	At-Risk GHQ/SH	Critically Endangered	Possibly Extirpated/ Extinct	N/A	N/A	Low
Didymodon nevadensis Gold Butte moss	No	N/A	N/A	Watch	Sensitive	N/A	Medium-High

Species	Endemic	NNHP & G/S ranks	State of Nevada	Nevada Native Plant Society	BLM	USFWS	Potential to Occur (High/ Medium/Low)
Enceliopsis argophylla silverleaf sunray	No	At-Risk G2/S1?	N/A	Watch	Sensitive	N/A	Low
Eriogonum bifurcatum Pahrump Valley buckwheat	No	At-Risk G3/S2	N/A	Threatened	Sensitive	N/A	Low
Eriogonum contiguum Amargosa buckwheat	No	Watch G2/S1	N/A	Marginal	N/A	N/A	Low-Medium
Eriogonum viscidulum sticky buckwheat	No	At-Risk G2/S2	Critically Endangered	Threatened	Sensitive	N/A	Low
Grimmia americana American dry rock moss	No	N/A	N/A	Threatened	N/A	N/A	Low
Helianthus deserticola dune sunflower	No	At-Risk G2G3Q/S3	N/A	N/A	N/A	N/A	Low-Medium
Mentzelia polita polished blazing star	No	At-Risk G2/S1S2	N/A	Watch	Sensitive	N/A	Low
Pediomelum castoreum Beaver Dam breadroot	No	At-Risk G3/S3	N/A	Watch	Sensitive	N/A	Medium
Penstemon bicolor* spp. *bicolor yellow twotone beardtongue	No	At-Risk G3T2Q/S2	N/A	Watch	Sensitive	N/A	Low
Penstemon bicolor* spp. *roseus Rosy twotone beardtongue	No	At-Risk G3T3Q/S3	N/A	Watch	Sensitive	N/A	Low-Medium
Phacelia anelsonii Aven Nelson phacelia	No	Watch G2G3/S1S2	N/A	Marginal	N/A	N/A	Low

Species	Endemic	NNHP & G/S ranks	State of Nevada	Nevada Native Plant Society	BLM	USFWS	Potential to Occur (High/ Medium/Low)
Phacelia filiae Clarke phacelia	Yes	At-Risk G2/S2	N/A	Watch	Sensitive	N/A	Low
Phacelia parishii Parish phacelia	No	At-Risk G2G3/S2S3	N/A	Watch	Sensitive	N/A	Low

Appendix B: Weeds/Soil Crust/Desert Pavement/Cacti/Yucca Data Sheet

WEEDS/SOIL CRUST/DESERT PAVEMENT/CACTI/YUCCA DATA SHEET

SURVEYOR:	TRANSECT #:	DATE:

CACTI					
CODE	Name	Numbers of individuals counted Height Class (Tally)			Total Ex: 1/0/1 or 0
		0-3 feet	3-6 feet	> 6 feet	
CylEch	*Cylindropuntia echinocarpa*				
CylRam	*Cylindropuntia ramosissima*				
EchPol	*Echinocactus polycephalus*				
EchEng	*Echinocereus engelmannii*				
OpuBas	*Opuntia basilaris*				
YucSch	*Yucca schidigera*				

WEEDS/DESERT PAVEMENT/SOIL CRUST		
Category	Tally	Total m^2 Estimate or #
Weeds		
Brassica tournefortii		
Halogeton glomeratus		
Strigosella africana		
Other_____		
Other_____		
Desert Pavement		
Soil Crust		

Appendix C: List of Plant Taxa Observed in the Gemini Study Area during the Botanical Inventory

List of Plant Taxa Observed in the Gemini Study Area during the Botanical Inventory

Scientific Name	Common Name	ALLIANCE[1]				NOTES[2]
		LATR	ATCO	SEGR	HIRI	
NONVASCULAR PLANTS						
Bryaceae						
Bryum caespiticium	dry calcareous bryum					
Gemmabryum sp.						
Grimmiaceae						
Coscinodon calyptratus	coscinodon moss					
Grimmia anodon	grimmia dry rock moss					
Grimmia orbicularis	orb dry rock moss					
Pottiaceae						
Tortula inermis	tortula moss					
Syntrichia caninervis	syntrichia moss					
Pterygoneurum lamellatum	lamella pterygoneurum					
VASCULAR PLANTS						
GYMNOSPERMS						
Ephedraceae						
Ephedra viridis	green ephedra			x	x	F, buffer
Ephedra fasciculata	Arizona ephedra	x				E
Ephedra nevadensis	Nevada ephedra	x	x	x	x	A-D, F, G, buffer, gen-ties
Ephedra torreyana	Torrey's jointfir	x	x	x	x	A-C, E-G, buffer, gen-ties
DICOTS						
Amaranthaceae						
Tidestromia oblongifolia	honey sweet	x				D, buffer
Apocynaceae						
Asclepias erosa	desert milkweed	x				E, F
Asclepias subulata	Ajamete	x				E
Funastrum utahense	Utah vine milkweed	x				A, D, C, F, buffer
Asteraceae						
Acamptopappus sphaerocephalus	rayless goldenhead	x		x	x	A-G, buffer, gen-ties
Acroptilon repens	Russian knapweed	x			x	A, buffer, gen-ties; non-native; Category B invasive weed
Adenophyllum cooperi	Cooper dyssodia	x				A-C, G, buffer, gen-ties
Ambrosia dumosa	white burrobush	x	x	x	x	A-D, F, G, buffer, gen-ties
Ambrosia eriocentra	woolly bur-sage	x		x		B, E, buffer, gen-ties
Ambrosia salsola	cheesebush	x		x		B, E, F, buffer
Amphipappus fremontii	chaff-bush	x				B, G, gen-ties
Atrichoseris platyphylla	gravel ghost	x	x			A, G, buffer, gen-ties

Scientific Name	Common Name	ALLIANCE[1]				NOTES[2]
		LATR	ATCO	SEGR	HIRI	
Baccharis sarothroides	desertbroom bacharis			x		E, G gen-ties
Baileya multiradiata	desert marigold	x	x	x	x	A-G, buffer, gen-ties
Bebbia juncea	sweetbush			x		G
Brickellia arguta	pungent brickellbush					gen-ties
Calycoseris wrightii	white tackstem	x				A, B, D, buffer, gen-ties
Centaurea melitensis	Malta starthistle					buffer, gen-ties; non-native; Category A invasive weed
Chaenactis carphoclinia	pebble pincushion	x	x	x	x	A-G, buffer, gen-ties
Chaenactis macrantha	Mojave pincushion	x	x	x		A, B, D, G, buffer, gen-ties
Chaenactis stevioides	Esteve pincushion	x				A, B, F, G, buffer, gen-ties
Encelia farinosa	brittlebush					gen-ties
Encelia virginensis	Virgin River encelia	x		x	x	B-G, buffer, gen-ties
Ericameria paniculata	Mojave rabbit brush	x		x		B, G, buffer
Erigeron divergens	spreading daisy	x			x	A, B, buffer, gen-ties
Eriophyllum ambiguum	annual woolly sunflower	x				B
Eriophyllum lanosum	white easter bonnets	x	x	x	x	A-G, buffer, gen-ties
Eriophyllum wallacei	woolly daisy	x				E, buffer
Gaillardia arizonica	Arizona blanketflower					buffer, gen-ties
Glyptopleura marginata	carved seed	x				A, buffer
Gutierrezia sarothrae	broom snakeweed	x		x	x	B-G, buffer, gen-ties
Machaeranthera pinnatifida	lacy aster					gen-ties
Malacothrix glabrata	desert dandelion	x				B, D-F
Pectis papposa	cinchweed					observed in the Study Area in fall 2017
Porophyllum gracile	odora			x		B, D, buffer
Prenanthella exigua	thorny skeleton plant	x				B, F, G, buffer, gen-ties
Psilostrophe cooperi	paper flower	x		x		B, D, F, G, buffer, gen-ties
Rafinesquia neomexicana	desert chicory	x			x	A-F, buffer
Senecio flaccidus var. monoensis	Mono groundsel					buffer
Sonchus asper	prickly sow thistle					buffer; non-native
Sonchus sp.		x			x	A
Stephanomeria pauciflora	wire-lettuce	x	x	x		A-G, buffer
Stephanomeria sp.		x				B, gen-ties
Stylocline psilocarphoides	Peck's stylocline	x				B, E-G
Stylocline micropoides	desert nest straw	x		x		C, D, buffer
Thymophylla pentachaeta var. *belenidium*	five-needled thymophylla	x		x	x	B, gen-ties
Trichoptilium incisum	yellow-heads	x				B

Scientific Name	Common Name	ALLIANCE[1]				NOTES[2]
		LATR	ATCO	SEGR	HIRI	
Uropappus lindleyi	silver puffs	x				A
Xylorhiza tortifolia	Mojave woody aster	x				B, buffer
Bignoniaceae						
Chilopsis linearis	desert willow			x		E, F, buffer
Boraginaceae						
Amsinckia menziesii	Menzies' fiddleneck	x		x	x	G
Amsinckia tessellata var. tessellata	Carrizo fiddleneck	x	x	x	x	A, B, D-G, buffer, gen-ties
Cryptantha angustifolia	narrow-leaved forget-me-not	x		x	x	A-G, buffer, gen-ties
Cryptantha barbigera	bearded cryptantha	x		x		E, buffer, gen-ties
Cryptantha circumscissa	cushion cryptantha	x		x		D-F, buffer
Cryptantha micrantha	redroot cryptantha	x		x		B-F, buffer
Cryptantha nevadensis var. *nevadensis*	Nevada cryptantha	x		x	x	A-G, buffer, gen-ties
Cryptantha pterocarya	winged-nut forget-me-not	x		x		A-G, buffer, gen-ties
Cryptantha recurvata	curved-nut cryptantha	x		x		B-F, buffer
Eucrypta micrantha	desert eucrypta	x		x	x	A, B, D, G
Nama demissa var. *demissa*	purplemat	x		x		B-F, buffer
Pectocarya heterocarpa	chuckwalla pectocarya	x	x	x		A-G, buffer, gen-ties
Pectocarya penicillata	winged comb seed	x				B
Pectocarya platycarpa	broad netted comb bur	x		x		A-F, buffer
Pectocarya setosa	moth combseed					E
Phacelia crenulata	common phacelia	x		x		A-D, F, G, buffer, gen-ties
Phacelia fremontii	Fremont's phacelia	x		x		A-C, E
Phacelia lemmonii	Lemmon's phacelia					buffer
Phacelia pulchella ssp. *gooddingii*	Gooding's phacelia	x	x			A, B
Phacelia rotundifolia	round-leaved phacelia	x				G
Lappula redowskii var. *redowskii*	western stickseed					buffer
Tiquilia canescens var. *canescens*	woody crinklemat					buffer, gen-ties
Brassicaceae						
Brassica tournefortii	Saharan mustard	x	x	x	x	A-F, buffer, gen-ties; non-native; Category B invasive weed
Caulanthus lasiophyllus	California mustard	x		x	x	A, B, D-G, buffer
Descurainia pinnata	yellow tansy mustard	x		x	x	A-F, buffer, gen-ties
Draba cuneifolia	wedgeleaf draba	x		x		B, G
Draba reptans	Carolina draba	x				A, B
Lepidium fremontii	desert peppergrass	x	x	x	x	A, B, D-G, buffer, gen-ties

Scientific Name	Common Name	ALLIANCE[1]				NOTES[2]
		LATR	ATCO	SEGR	HIRI	
Lepidium lasiocarpum	shaggyfruit pepperweed	x		x	x	A-D, F, G, buffer, gen-ties
Physaria tenella	Moapa bladderpod	x	x	x	x	B-D, F, G, buffer, gen-ties
Streptanthella longirostris	long-beaked twist flower	x				B, C, E-G, buffer
Strigosella africana	African mustard	x	x		x	A-G, buffer, gen-ties; non-native
Cactaceae						
Cylindropuntia echinocarpa	silver cholla	x	x	x	x	A-G, buffer, gen-ties
Cylindropuntia ramosissima	pencil cholla	x	x	x	x	A-G, buffer, gen-ties
Ferocactus cylindraceus	desert barrel cactus	x				B, buffer, gen-ties
Echinocactus polycephalus var. *polycephalus*	cottontop cactus	x	x	x	x	A-G, buffer, gen-ties
Echinocereus engelmannii	strawberry hedgehog	x		x		A-G, buffer, gen-ties
Mammillaria tetrancistra	common fishhook cactus					gen-ties
Opuntia basilaris var. *basilaris*	beavertail	x	x	x		A-G, buffer, gen-ties
Sclerocactus johnsonii	Johnson's fishhook cactus	x				B
Campanulaceae						
Nemacladus orientalis	eastern glandular nemacladus	x		x		D
Celastraceae						
Mortonia utahensis	Utah mortonia	x		x		D, E
Chenopodiaceae						
Atriplex canescens	fourwing saltbush	x	x			A, E, F, buffer, gen-ties
Atriplex confertifolia	shadscale	x	x		x	A, G, buffer, gen-ties
Atriplex elegans var. fasciculata	Mecca orach					
Atriplex hymenelytra	desert holly	x	x			A, G, buffer
Grayia spinosa	spiny hop sage	x				B, D, E, G, buffer
Halogeton glomeratus	halogeton	x	x		x	A, B, G, buffer, gen-ties; non-native
Krascheninnikovia lanata	winter fat	x				A-G, buffer, gen-ties
Salsola tragus	Russian thistle	x	x			A, F, G, buffer; non-native
Suaeda nigra	alkali seepweed		x			A, G, buffer, gen-ties
Cuscutaceae						
Cuscuta sp.						buffer
Euphorbiaceae						
Euphorbia albomarginata	rattlesnake sandmat	x	x	x	x	A-C, F, G, buffer, gen-ties
Euphorbia micromeris	desert spurge	x		x		B, D, buffer
Euphorbia setiloba	Yuma sandmat	x		x		D, gen-ties
Fabaceae						
Astragalus flavus	yellow milkvetch					gen-ties

Scientific Name	Common Name	ALLIANCE[1]				NOTES[2]
		LATR	ATCO	SEGR	HIRI	
Astragalus geyeri var. *triquetrus*	threecorner milkvetch	x				C-F, buffer; special-status
Astragalus nuttallianus	Nuttall locoweed	x		x	x	A, B, F, G, buffer, gen-ties
Astragalus nyensis	Nye milkvetch	x	x	x	x	A-D, F, G, B2, buffer; special-status
Astragalus sabulonum	gravel milkvetch					
Astragalus tidestromii	Tidestrom's milkvetch	x		x		B, D, G, buffer
Dalea mollis	hairy prairie clover			x		D
Hoffmannseggia glauca	hog potato	x				A
Lupinus brevicaulis	sand lupine	x				D
Lupinus odoratus	Mojave lupine	x				C, F
Lupinus sp.		x				C
Peteria thompsoniae	Thompson peteria	x				B, C, buffer
Prosopis glandulosa var. torreyana	honey mesquite				x	A, gen-ties
Psorothamnus fremontii	Fremont's indigobush	x		x	x	B-F, buffer
Psorothamnus polydenius	Nevada indigobush	x				E
Psorothamnus sp.		x				B, C
Senegalia greggii	catclaw acacia	x		x	x	A-F, buffer
Geraniaceae						
Erodium cicutarium	red stem stork's bill	x	x	x	x	A-D, F, G, buffer, gen-ties; non-native
Erodium texanum	desert heron's bill	x	x		x	A-D, F, G, buffer, gen-ties
Krameriaceae						
Krameria bicolor	white rhatany	x		x		B, D-F, buffer
Krameria erecta	little leaved rhatany	x	x	x	x	A-G, buffer, gen-ties
Lamiaceae						
Scutellaria mexicana	bladder-sage	x	x	x	x	B-D, F, G, buffer, gen-ties
Loasaceae						
Mentzelia albicaulis	white stemmed blazing star	x				F, buffer
Mentzelia affinis	yellow blazing star	x				D, gen-ties
Mentzelia dispersa	scattered blazing star	x		x		B, D, E, G
Mentzelia obscura	Pacific blazing star					buffer
Mentzelia sp.		x				B, C, F; annual
Mentzelia tricuspis	three pointed blazing star	x	x			A, B, D, G, buffer, gen-ties
Mentzelia tridentata	dentate blazing star	x				G, buffer
Malvaceae						
Sphaeralcea ambigua	apricot mallow	x	x	x	x	A-G, buffer
Nyctaginaceae						

Scientific Name	Common Name	ALLIANCE[1]				NOTES[2]
		LATR	ATCO	SEGR	HIRI	
Acleisanthes nevadensis	desert wing-fruit	x	x	x	x	A-G, buffer, gen-ties
Allionia incarnata	wind mills	x				D, G, buffer
Mirabilis bigelovii var. *retrorsa*	wishbone bush	x				B, G, buffer, gen-ties
Oleaceae						
Menodora spinescens var. *spinescens*	spiny menodora	x		x		B-F, buffer, gen-ties
Onagraceae						
Camissonia walkeri	Walkers suncup					buffer
Chylismia brevipes	yellow cups	x	x	x		E, F, G, buffer, gen-ties
Eremothera boothii	Booth's sun cup	x		x	x	A-F, buffer, gen-ties
Oenothera curtiflora	velvetweed				x	buffer; non-native
Oenothera deltoides	devil's lantern	x				C, D, F, buffer
Oenothera primiveris	yellow desert evening primrose	x			x	A, F
Oenothera suffrutescens	linda tarde	x	x	x	x	A-G, buffer
Orobanchaceae						
Orobanchaceae cooperi	broomrape	x		x		B, D, E, gen-ties
Papaveraceae						
Eschscholzia glyptosperma	desert gold poppy	x	x			A-D, F, G, gen-ties
Plantaginaceae						
Plantago ovata	woolly plantain	x	x	x	x	A-G, buffer, gen-ties
Plantago patagonica	Patagonia plantain	x				G
Penstemon bicolor ssp. r*oseus*	rosy twotone beardtongue					buffer; special-status
Penstemon eatonii	fire cracker penstemon					buffer
Polemoniaceae						
Eriastrum eremicum ssp. *eremicum*	desert wooly star	x		x		D, F, buffer
Eriastrum wilcoxii	Wilcox's wooly star	x				D, F, buffer
Gilia aliquanta	puffcalyx gilia				x	A
Gilia aliquanta ssp. *breviloba*	puffcalyx gilia	x				B
Gilia ochroleuca var. *exilis*	volcanic gilia	x			x	A, E, F
Gilia sinuata	cinder gilia					buffer
Gilia transmontana	trans montane gilia			x		D
Ipomopsis polycladon	branching gilia	x		x		A, D, F, buffer
Langloisia setosissima ssp. *setosissima*	bristly langloisia	x		x	x	A-G, buffer, gen-ties
Linanthus demissus	desert linanthus	x		x		B-F, buffer
Linanthus jonesii	Jones linanthus	x		x		A-F
Loeseliastrum schottii	Schott gilia	x				E, F, buffer

Scientific Name	Common Name	ALLIANCE[1]				NOTES[2]
		LATR	ATCO	SEGR	HIRI	
Polygonaceae						
Chorizanthe brevicornu	brittle spineflower	x		x		A-G, buffer, gen-ties
Chorizanthe rigida	devil's spineflower	x	x	x	x	A-G, buffer, gen-ties
Eriogonum brachypodum	Parry's wild buckwheat	x				B
Eriogonum exaltatum	ladder buckwheat	x	x			A, G, buffer, gen-ties
Eriogonum deflexum	flat topped buckwheat	x				G, buffer
Eriogonum fasciculatum var. *polifolium*	eastern Mojave buckwheat	x		x		B, D, G, buffer, gen-ties
Eriogonum inflatum	desert trumpet	x	x	x	x	A-G, buffer, gen-ties
Eriogonum thomasii	Thomas' buckwheat	x	x			A, C, gen-ties
Eriogonum trichopes	wild buckwheat	x	x	x		A-G, buffer, gen-ties
Oxytheca perfoliata	round-leaf puncturebract					buffer
Rumex hymenosepalus	wild rhubarb	x				A, B, E, F, buffer
Ranunculaceae						
Delphinium parishii	Parish Larkspur	x			x	A-F, buffer, gen-ties
Resedaceae						
Oligomeris linifolia	lineleaf whitepuff	x		x		A, B, D, G, buffer, gen-ties
Rosaceae						
Coleogyne ramosissima	black brush					buffer
Prunus fasciculata	desert almond	x		x	x	A-G, buffer, gen-ties
Rubiaceae						
Galium stellatum var. *eremicum*	starry bedstraw					buffer
Solanaceae						
Lycium andersonii	Anderson thornbush	x	x	x	x	A-G, buffer, gen-ties
Lycium cooperi	Cooper's box thorn	x	x	x	x	A-G, buffer, gen-ties
Nicotiana obtusifolia	desert Tobacco	x		x		B, E, G, buffer, gen-ties
Physalis lobata	lobed ground cherry	x	x		x	A, buffer, gen-ties
Tamaricaceae						
Tamarix ramosissima	salt cedar	x			x	A, B; non-native; Category C noxious weed
Viscaceae						
Phoradendron californicum	Californian mesquite mistletoe	x		x		B, D-F, buffer
Zygophyllaceae						
Larrea tridentata	creosote bush	x	x	x	x	A-G, buffer, gen-ties
MONOCOTS						
Agavaceae						
Yucca schidigera	Mojave yucca	x				E
Alliaceae						

Scientific Name	Common Name	ALLIANCE[1]				NOTES[2]
		LATR	ATCO	SEGR	HIRI	
Allium nevadense	Nevada onion	x				E
Liliaceae						
Calochortus flexuosus	winding mariposa	x	x	x	x	A-D, F, G, buffer, gen-ties
Poaceae						
Aristida adscensionis	six-weeks three-awn	x				B
Aristida purpurea var. *nealleyi*	blue three awn	x		x	x	G
Aristida purpurea var. *parishii*	Parish three awn	x		x		B-D, F, buffer, gen-ties
Avena sp.	Avena					gen-ties; non-native
Bromus arizonicus	Arizona brome				x	buffer
Bromus berteroanus	Chilean chess					buffer; non-native
Bromus diandrus	ripgut brome					gen-ties; non-native
Bromus madritensis ssp. *rubens*	red brome	x	x	x	x	A-G, buffer, gen-ties; non-native
Bromus tectorum	cheatgrass	x	x	x	x	A-G, buffer, gen-ties; non-native
Cynodon dactylon	Bermuda grass					gen-ties; non-native
Dasyochloa pulchella	fluff grass	x		x	x	A-G, buffer, gen-ties
Festuca octoflora	sixweeks grass	x				B, buffer, gen-ties
Hilaria rigida	big galleta	x	x	x	x	A-G, buffer, gen-ties
Hordeum murinum ssp. *glaucum*	foxtail barley					buffer; non-native
Phleum pratense	Timothy grass					buffer, gen-ties; non-native
Schismus sp.	Mediterranean grass	x	x	x	x	A-G, buffer, gen-ties; non-native
Sporobolus cryptandrus	sand dropseed					buffer
Sporobolus flexuosus	mesa dropseed					buffer
Tridens muticus	slim tridens					gen-ties
Stipa hymenoides	sand rice grass	x		x		B-G, buffer
Themidaceae						
Androstephium breviflorum	pink funnel lily	x				A-C, E, F, buffer
Dichelostemma capitatum	blue dicks	x			x	A

[1] Alliance Codes**:** LATR: Creosote-White Burrobush Shrubland Alliance; ATCO: Shadscale Shrubland Alliance; SEGR: Catclaw Acacia Shrubland Alliance; HIRI: Big Galleta Herbaceous Alliance

[2] Notes: locations in the Study Area; special-status; non-native; NDA invasive weed; phenology; other

Appendix D: Vegetation Community and Special-status Plant Photographs

Photo 1. Area A, view to west.

Photo 2. Area A, view north.

Photo 3. Area A, view east.

Photo 4. Area A, view south.

Photo 5. Area B, view west.

Photo 6. Area B, view north.

Photo 7.Area B, view east.

Photo 8. Area B, view south

Photo 9. Area C, view west

Photo 10. Area C, view north.

Photo 11.Area C, view east.

Photo 12. Area C, view south.

Photo 13. Area D, view west.

Photo 14. Area D, view north.

Photo 15. Area D, view east.

Photo 16. Area D, view south.

Photo 17. Area E, view west.

Photo 18. Area E, view north.

Photo 19. Area E, view east.

Photo 20. Area E, view south.

Photo 21. Area F, view west.

Photo 22. Area F, view north.

Photo 23. Area F, view east.

Photo 24. Area F, view south.

Photo 25. Area G, view west.

Photo 26. Area G, view north.

Photo 27. Area G, view east.

Photo 28. Area G, view south.

Photo 29. Threecorner milkvetch in Area F.

Photo 30. Threecorner milkvetch habitat, Area F.

Photo 31. Threecorner milkvetch in Area F.

Photo 32. Threecorner milkvetch habitat, Area F.

Photo 33. Threecorner milkvetch fruit close up.

Photo 34. Threecorner milkvetch habitat, Area F.

Photo 35. Nye milkvetch in Area D.

Photo 36. Nye milkvetch habitat, Area D.

Photo 37. Nye milkvetch in Area D.

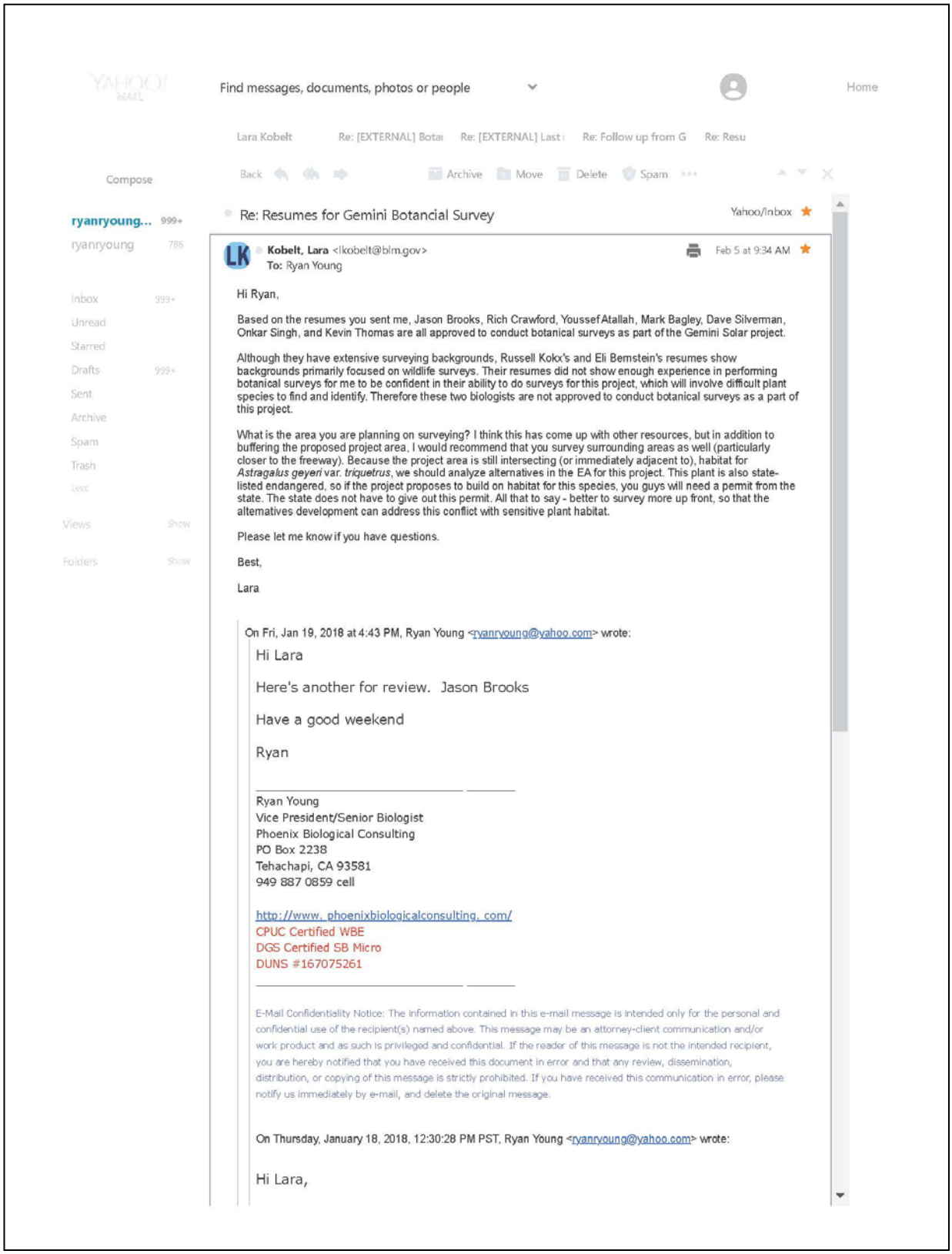
Photo 38. Nye milkvetch habitat, Area D.

Photo 39. Nye milkvetch in flower and fruit.

Photo 40. Rosy twotone beardtongue close up.

Photo 41. Rosy twotone beardtongue in buffer zone.

Appendix E: BLM Approvals of Project Personnel



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Re: Resumes for Gemini Botancial Survey

Yahoo/Inbox

Kobelt, Lara <lkobelt@blm.gov>
To: Ryan Young

Feb 5 at 9:34 AM

Hi Ryan,

Based on the resumes you sent me, Jason Brooks, Rich Crawford, Youssef Atallah, Mark Bagley, Dave Silverman, Onkar Singh, and Kevin Thomas are all approved to conduct botanical surveys as part of the Gemini Solar project.

Although they have extensive surveying backgrounds, Russell Kokx's and Eli Bernstein's resumes show backgrounds primarily focused on wildlife surveys. Their resumes did not show enough experience in performing botanical surveys for me to be confident in their ability to do surveys for this project, which will involve difficult plant species to find and identify. Therefore these two biologists are not approved to conduct botanical surveys as a part of this project.

What is the area you are planning on surveying? I think this has come up with other resources, but in addition to buffering the proposed project area, I would recommend that you survey surrounding areas as well (particularly closer to the freeway). Because the project area is still intersecting (or immediately adjacent to), habitat for *Astragalus geyeri* var. *triquetrus*, we should analyze alternatives in the EA for this project. This plant is also state-listed endangered, so if the project proposes to build on habitat for this species, you guys will need a permit from the state. The state does not have to give out this permit. All that to say - better to survey more up front, so that the alternatives development can address this conflict with sensitive plant habitat.

Please let me know if you have questions.

Best,

Lara

On Fri, Jan 19, 2018 at 4:43 PM, Ryan Young <ryanryoung@yahoo.com> wrote:

Hi Lara

Here's another for review. Jason Brooks

Have a good weekend

Ryan

Ryan Young
Vice President/Senior Biologist
Phoenix Biological Consulting
PO Box 2238
Tehachapi, CA 93581
949 887 0859 cell

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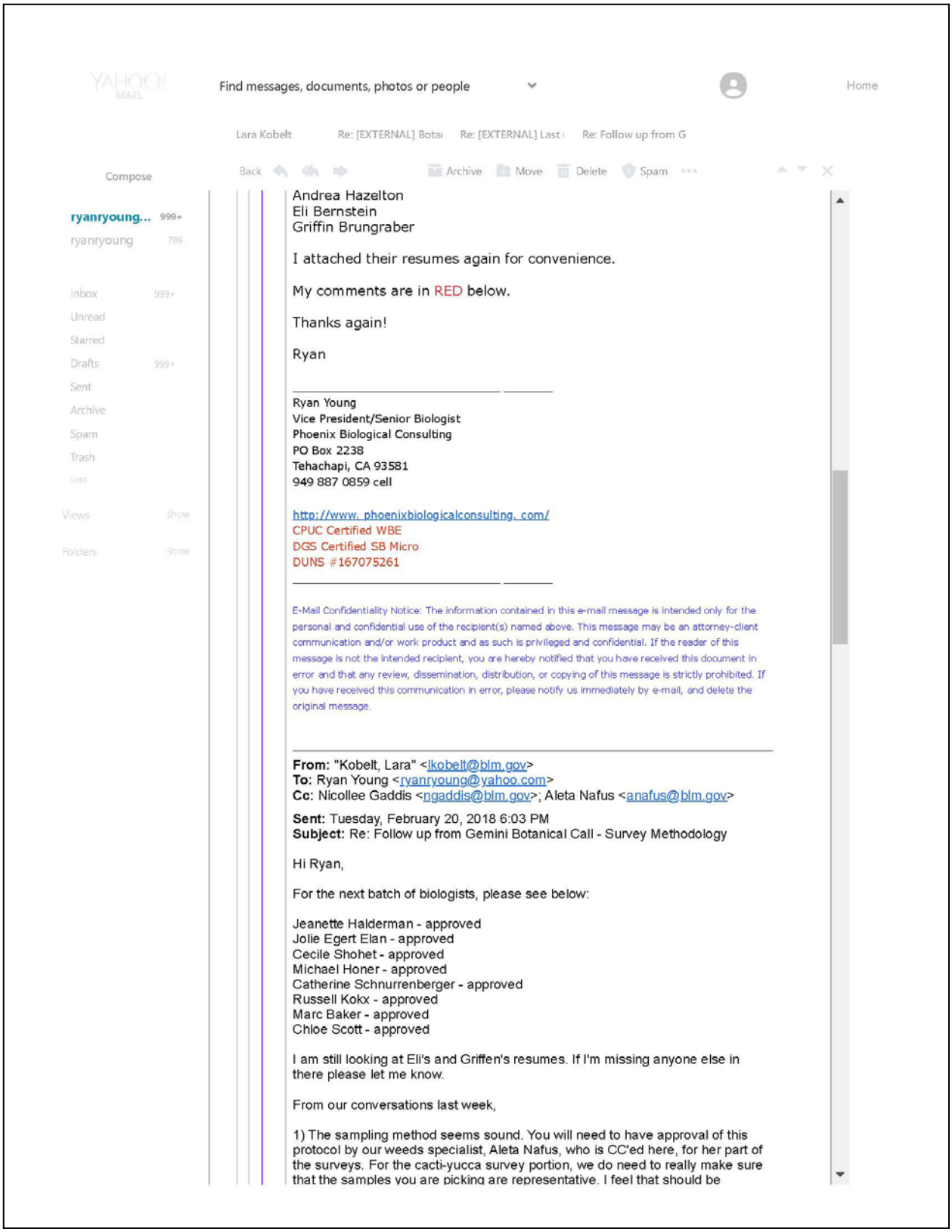
On Thursday, January 18, 2018, 12:30:28 PM PST, Ryan Young <ryanryoung@yahoo.com> wrote:

Hi Lara,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Andrea Hazelton
Eli Bernstein
Griffin Brungraber
I attached their resumes again for convenience.
My comments are in RED below.
Thanks again!
Ryan
Ryan Young
Vice President/Senior Biologist
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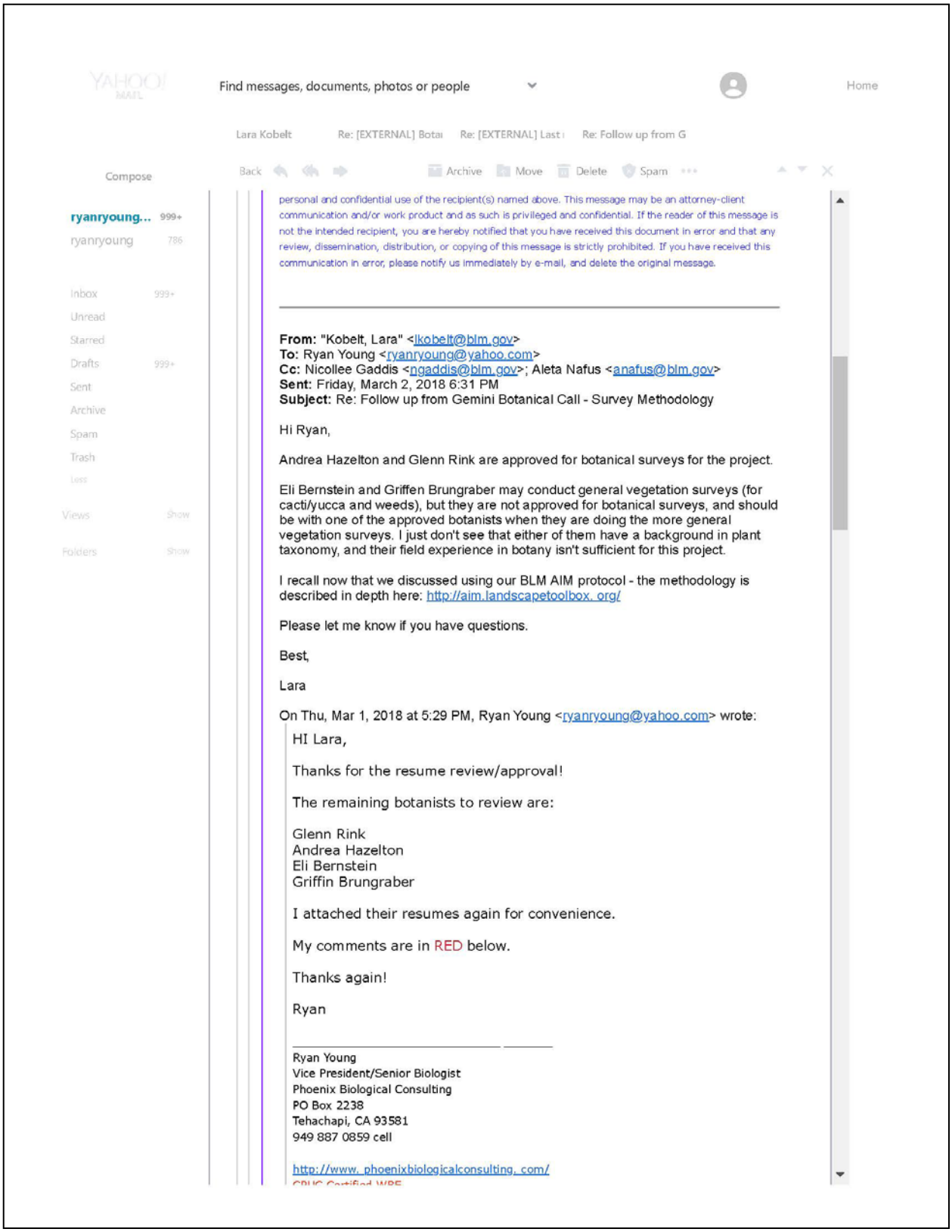
From: "Kobelt, Lara" <lkobelt@blm.gov>
To: Ryan Young <ryanryoung@yahoo.com>
Cc: Nicollee Gaddis <ngaddis@blm.gov>; Aleta Nafus <anafus@blm.gov>
Sent: Tuesday, February 20, 2018 6:03 PM
Subject: Re: Follow up from Gemini Botanical Call - Survey Methodology
Hi Ryan,
For the next batch of biologists, please see below:
Jeanette Halderman - approved
Jolie Egert Elan - approved
Cecile Shohet - approved
Michael Honer - approved
Catherine Schnurrenberger - approved
Russell Kokx - approved
Marc Baker - approved
Chloe Scott - approved
I am still looking at Eli's and Griffen's resumes. If I'm missing anyone else in there please let me know.
From our conversations last week,
1) The sampling method seems sound. You will need to have approval of this protocol by our weeds specialist, Aleta Nafus, who is CC'ed here, for her part of the surveys. For the cacti-yucca survey portion, we do need to really make sure that the samples you are picking are representative. I feel that should be



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From: "Kobelt, Lara" <lkobelt@blm.gov>
To: Ryan Young <ryanryoung@yahoo.com>
Cc: Nicollee Gaddis <ngaddis@blm.gov>; Aleta Nafus <anafus@blm.gov>
Sent: Friday, March 2, 2018 6:31 PM
Subject: Re: Follow up from Gemini Botanical Call - Survey Methodology

Hi Ryan,

Andrea Hazelton and Glenn Rink are approved for botanical surveys for the project.

Eli Bernstein and Griffen Brungraber may conduct general vegetation surveys (for cacti/yucca and weeds), but they are not approved for botanical surveys, and should be with one of the approved botanists when they are doing the more general vegetation surveys. I just don't see that either of them have a background in plant taxonomy, and their field experience in botany isn't sufficient for this project.

I recall now that we discussed using our BLM AIM protocol - the methodology is described in depth here: http://aim.landscapetoolbox. org/

Please let me know if you have questions.

Best,

Lara

On Thu, Mar 1, 2018 at 5:29 PM, Ryan Young <ryanryoung@yahoo.com> wrote:

> HI Lara,
>
> Thanks for the resume review/approval!
>
> The remaining botanists to review are:
>
> Glenn Rink
> Andrea Hazelton
> Eli Bernstein
> Griffin Brungraber
>
> I attached their resumes again for convenience.
>
> My comments are in RED below.
>
> Thanks again!
>
> Ryan
>
> ---
> Ryan Young
> Vice President/Senior Biologist
> Phoenix Biological Consulting
> PO Box 2238
> Tehachapi, CA 93581
> 949 887 0859 cell
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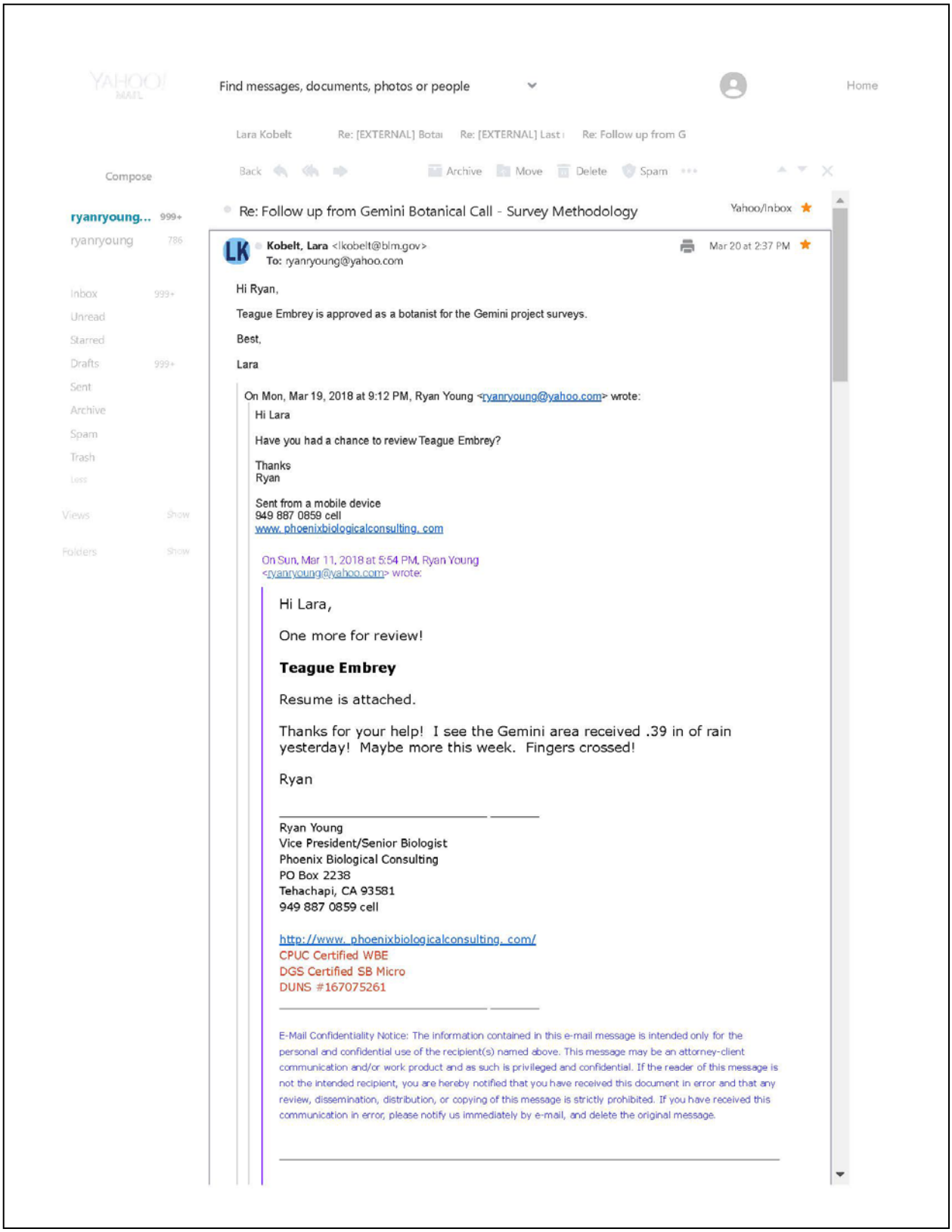
> http://www. phoenixbiologicalconsulting. com/



Re: Follow up from Gemini Botanical Call - Survey Methodology

Kobelt, Lara <lkobelt@blm.gov>
To: ryanryoung@yahoo.com

Mar 20 at 2:37 PM

Hi Ryan,

Teague Embrey is approved as a botanist for the Gemini project surveys.

Best,

Lara

On Mon, Mar 19, 2018 at 9:12 PM, Ryan Young <ryanryoung@yahoo.com> wrote:

Hi Lara

Have you had a chance to review Teague Embrey?

Thanks
Ryan

Sent from a mobile device
949 887 0859 cell
www. phoenixbiologicalconsulting. com

On Sun, Mar 11, 2018 at 5:54 PM, Ryan Young <ryanryoung@yahoo.com> wrote:

Hi Lara,

One more for review!

Teague Embrey

Resume is attached.

Thanks for your help! I see the Gemini area received .39 in of rain yesterday! Maybe more this week. Fingers crossed!

Ryan

Ryan Young
Vice President/Senior Biologist
Phoenix Biological Consulting
PO Box 2238
Tehachapi, CA 93581
949 887 0859 cell

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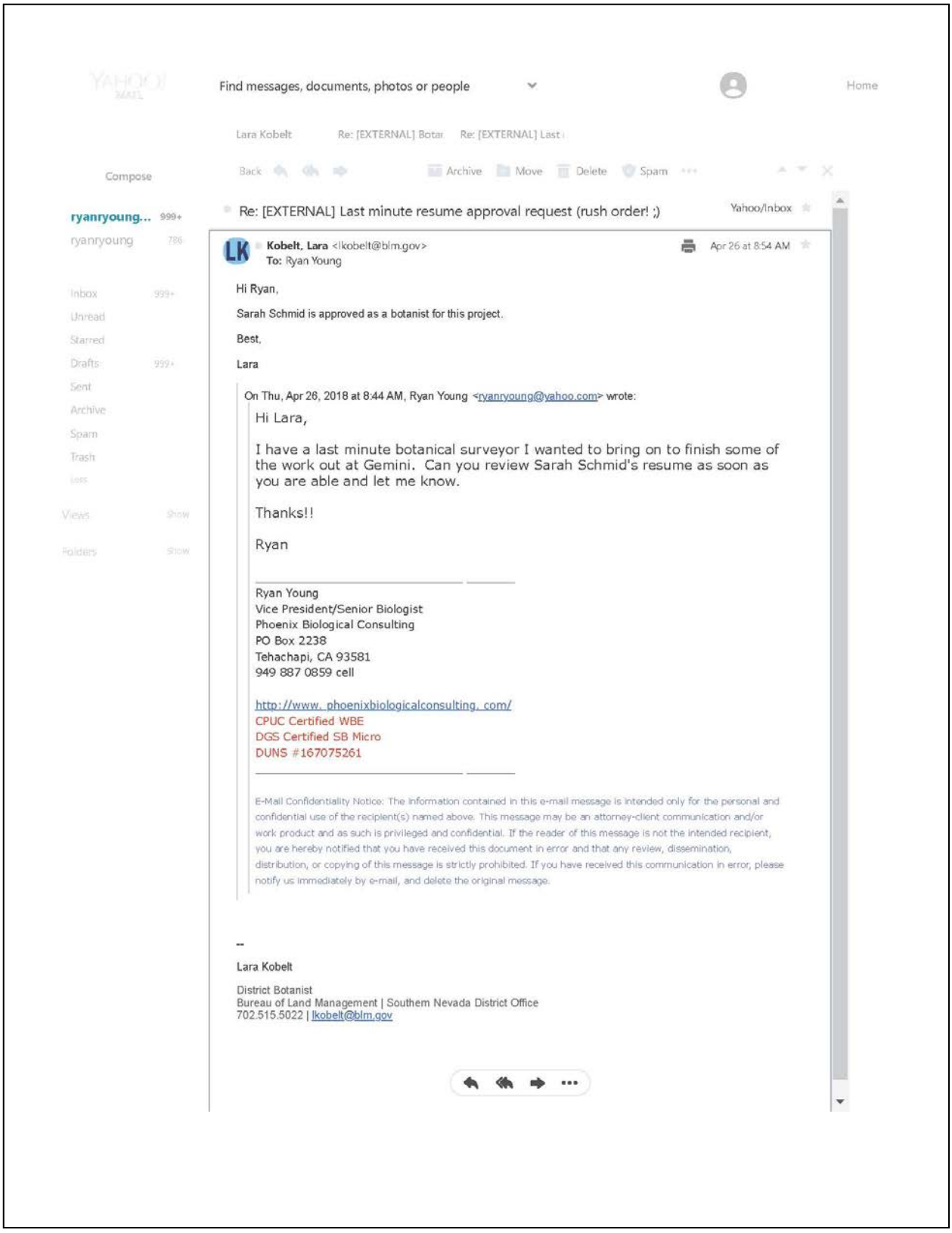

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Re: [EXTERNAL] Last minute resume approval request (rush order! ;)

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Kobelt, Lara <lkobelt@blm.gov>
To: Ryan Young

Apr 26 at 8:54 AM

Hi Ryan,

Sarah Schmid is approved as a botanist for this project.

Best,

Lara

On Thu, Apr 26, 2018 at 8:44 AM, Ryan Young <ryanryoung@yahoo.com> wrote:

Hi Lara,

I have a last minute botanical surveyor I wanted to bring on to finish some of the work out at Gemini. Can you review Sarah Schmid's resume as soon as you are able and let me know.

Thanks!!

Ryan

Ryan Young
Vice President/Senior Biologist
Phoenix Biological Consulting
PO Box 2238
Tehachapi, CA 93581
949 887 0859 cell

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Lara Kobelt

District Botanist
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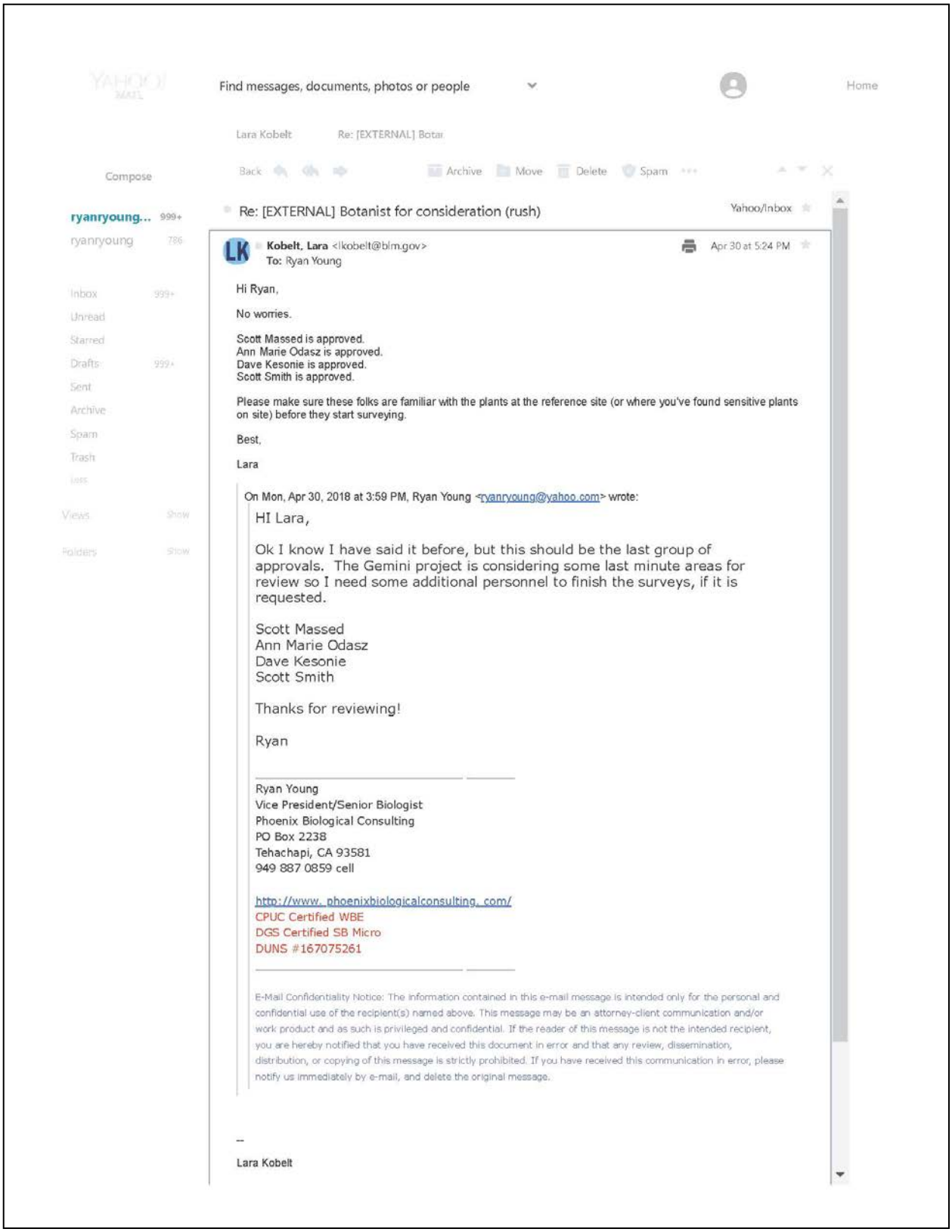
702.515.5022 | lkobelt@blm.gov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Re: [EXTERNAL] Botanist for consideration (rush)
Yahoo/Inbox
Kobelt, Lara <lkobelt@blm.gov>
To: Ryan Young
Apr 30 at 5:24 PM
Hi Ryan,
No worries.
Scott Massed is approved.
Ann Marie Odasz is approved.
Dave Kesonie is approved.
Scott Smith is approved.
Please make sure these folks are familiar with the plants at the reference site (or where you've found sensitive plants on site) before they start surveying.
Best,
Lara
On Mon, Apr 30, 2018 at 3:59 PM, Ryan Young <ryanryoung@yahoo.com> wrote:
HI Lara,
Ok I know I have said it before, but this should be the last group of approvals. The Gemini project is considering some last minute areas for review so I need some additional personnel to finish the surveys, if it is requested.
Scott Massed
Ann Marie Odasz
Dave Kesonie
Scott Smith
Thanks for reviewing!
Ryan
Ryan Young
Vice President/Senior Biologist
Phoenix Biological Consulting
PO Box 2238
Tehachapi, CA 93581
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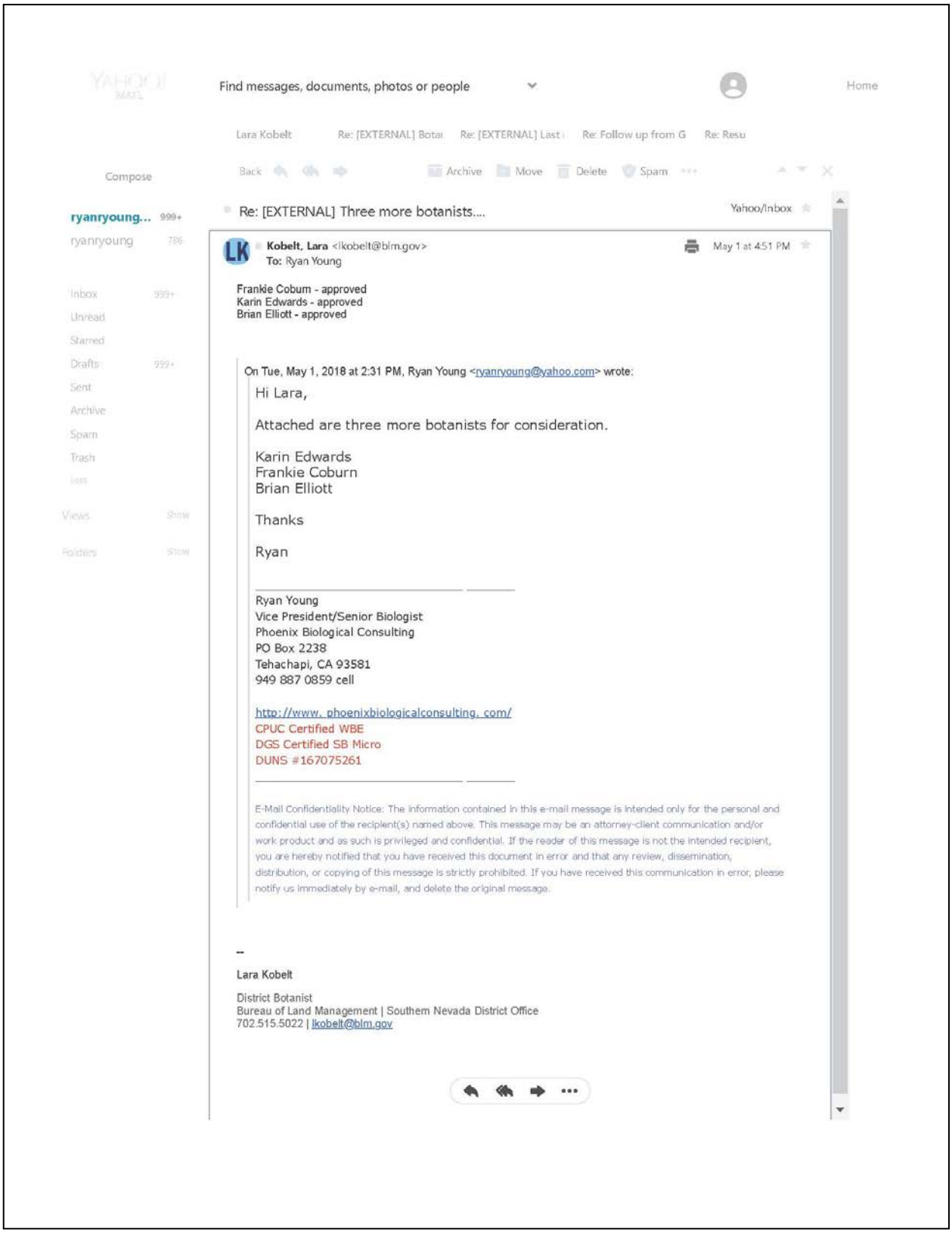
--
Lara Kobelt



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Re: [EXTERNAL] Three more botanists....

Yahoo/Inbox

Kobelt, Lara <lkobelt@blm.gov>
To: Ryan Young

May 1 at 4:51 PM

Frankie Coburn - approved
Karin Edwards - approved
Brian Elliott - approved

On Tue, May 1, 2018 at 2:31 PM, Ryan Young <ryanryoung@yahoo.com> wrote:

Hi Lara,

Attached are three more botanists for consideration.

Karin Edwards
Frankie Coburn
Brian Elliott

Thanks

Ryan

Ryan Young
Vice President/Senior Biologist
Phoenix Biological Consulting
PO Box 2238
Tehachapi, CA 93581
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Lara Kobelt

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