Desert Tortoise Survey Report
Areas B1, B2, F & G
Gemini Solar Project
N-84631

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

Prepared by
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Exhibits

LIST OF ACRONYMS

ACEC	Area of Critical Environmental Concern
BLM	Bureau of Land Management
CHU	Critical Habitat Unit
DWMA	Desert Wildlife Management Area
EIS	Environmental Impact Statement
GIS	Geographical Information System
NEPA	National Environmental Policy Act
NNHP	Nevada Natural Heritage Program
POD	Plan of Development
ROW	Right Of Way
USFWS	United States Fish and Wildlife Service

INTRODUCTION

Solar Partners XI, LLC, a wholly owned subsidiary of Valley of Fire, LLC, proposes to construct the Gemini Solar Project in Clark County, Nevada, approximately 25 miles northeast of the Las Vegas metropolitan area (Exhibit 1). The project would consist of a solar photovoltaic (PV) power-generating facility on Bureau of Land Management (BLM)-administered land, located immediately south of the Moapa Indian Reservation and southeast of Interstate 15 (I-15).

Due to the potential biological impacts associated with the development of the site, Phoenix Biological Consulting conducted protocol level presence/ absence surveys for the Mojave Desert tortoise (*Gopherus agassizii*), a federally threatened species. The desert tortoise surveys were conducted in accordance with U.S. Fish and Wildlife Service (USFWS) 2017 guidelines, for the purpose of estimating desert tortoise densities within the proposed impact area.

Desert tortoise presence/ absence surveys were conducted by Phoenix Biological Consulting in the fall of 2017 on the initial site plan. Following the fall 2017 surveys, site plan alternatives were introduced through early EIS (Environmental Impact Statement) analysis. Subsequent tortoise surveys were initiated in the spring of 2018 to identify additional areas of potential development in an effort to avoid higher density desert tortoise areas within the proposed impact area. The preliminary alternative analysis added four new polygons, which were combined to create the total spring 2018 survey area; referred to as Areas B1, B2, F and G in this report. The desert tortoise presence/ absence surveys, on the additional polygons, were conducted in the spring of 2018; between April 3rd and April 12th, 2018 on Area F, and between May 7th, 2018 and May 27th, 2018 on Areas B1, B2 and G, respectively.

During the spring 2018 survey, biologists recorded a total of 43 live tortoises. Only adult tortoises ≥ 180mm MCL were included in the abundance estimate calculations, in accordance with the USFWS 2017 spreadsheet (USFWS (c)). Based on the density calculations, a total of 65 desert tortoises (≥ 180 mm MCL) are estimated to occur within the survey area of 3,722 acres. This report includes a project description, description of the survey area, survey methodology, climate, soils and results on the distribution and abundance of the desert tortoise found within Areas B1, B2, F and G of the proposed project area.

PROPERTY AND PROJECT DESCRIPTION

Project Location

The project site is located 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 (Exhibit 1). The project site is situated immediately south of the Moapa Indian Reservation, less than 0.5 miles southeast of Interstate 15 (I-15), and less than 4 miles east of the NV Energy Crystal Substation and a NV Energy high-voltage transmission line; in the Piute Point and Dry Lake quadrangles of the United States Geographical Surveys (USGS) 7.5-minute topographic map series (Exhibit 2). The legal description of the parcels identified in the Plan of Development (POD) is listed below (Table 1).

Table 1: Township/Range and Section Information

Township	Range	Sections	Description
17S	64E	10 & 11	S ½
		12, 13, 23, 24, 25, 26, 35 & 36	ALL
		14	N ½, E ½
		15	N ½
		22, 27 & 34	E ½
17S	65E	7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35 & 36	ALL
17S	66E	7, 18 & 19	ALL
18S	64E	1, 2, 11, 12, 13, 14, 23, 24, 25, 26, 35 & 36	ALL
		3, 10, 15, 22, 27 & 34	E ½
18S	65E	1, 2, 3, 4, 5, 6, 7, 8, 9, 16, 17, 18, 19, 20 & 30	ALL
		21	N ½, SW ¼

Project Description

Solar Partners XI, LLC, a wholly owned subsidiary of Valley of Fire, LLC, proposes to construct, own, operate, and decommission a solar photovoltaic (PV) power-generating facility, known as the Gemini Solar Project, on Bureau of Land Management (BLM)-administered land located in Clark County, Nevada. The proposed Gemini Solar project intends to generate approximately 690-megawatt (MW) alternating current (MWac) of renewable electrical energy by utilizing solar PV modules mounted on single-axis, horizontal tracker structures. Electricity generated by the project would be interconnected to the NV Energy transmission system via overhead generation (gen)-tie lines extending from the project switchyards to Nevada Energy's Crystal Substation. The gen-tie lines would consist of a 230 KV circuit for delivery of 440 MW to Nevada Energy Balancing Authority (Phase I) and a 500 KV circuit for delivery of 250 MW to the Los Angeles Department of Water and Power (LADWP) (Phase II). Additional elements to the proposed solar energy

facilities include 34.5 KV overhead and underground collector lines, a 2-acre operations and maintenance area, one to three substations, internal access roads, access roads along gen-tie lines, a perimeter road, perimeter fencing, other site infrastructure such as fire-protection water storage, a potential water line to the site, and drainage features such as berms, and improvements to the existing NV Energy facilities to support interconnection.

The disturbance acreage for the proposed site plan is approximately 7,115 acres of permanent disturbance, which includes the solar facility, primary access road, collection line road, collection line single pole site, and gen-tie lines; and 7 acres of temporary disturbance, including laydown areas and two pull sites for collection line construction. The solar facility is divided into multiple polygons that are connected via connection lines and gen-tie options (Exhibit 14). This report includes the survey efforts for the polygons that were not previously included in the survey efforts from the fall of 2017; referred to as Areas B1, B2, F, and G in this report (Phoenix, 2018). The total spring 2018 survey area of the aforementioned areas is 3,722 acres.

The proposed project is located on public land entirely within the ~44,000 acres of the BLM right-of-way application (SF299) with serial number N-84631. The ROW application contains a larger area than required for the solar field to allow for adjustments in the facility layout to minimize environmental impacts, based on the National Environmental Policy Act (NEPA) analysis. The project will generate greenhouse gas-free electricity during daylight hours when electricity demand is at its peak, averaging an energy production that equates to the annual daytime electricity needs of approximately 260,000 households.

DESERT TORTOISE NATURAL HISTORY

The desert tortoise is a large herbivorous reptile that occurs in the Mojave and Sonoran deserts, in southwestern Utah, southern Nevada, southeastern California and western Arizona, into northern Sinaloa Mexico. The designated Mojave population of the desert tortoise (*Gopherus agassizii*) is listed as federally and state threatened and occurs north and west of the Colorado River in the Mojave Desert of California, Arizona, Nevada, southwestern Utah, and in the Sonoran (Colorado) desert in California (USFWS 2011).

The desert tortoise occupies a variety of habitats including creosote bush scrub at lower elevations and blackbrush scrub and juniper woodland transition zones at higher elevations (Germano, 1994). Elevation range for the desert tortoise has been recorded from below sea level to 7,300 feet. Typical habitat for the desert tortoise in the Mojave Desert has been

characterized as creosote bush scrub below 5,500 feet (Luckenbach 1982). Throughout most of the Mojave Desert, the desert tortoise is most commonly found on gently sloping terrain with sandy-gravel soils of sparse low growing shrubs, which allow for the establishment of herbaceous plants. Soils must be friable enough for digging burrows but firm enough to avoid collapse (USFWS 2011).

Desert tortoises spend most of their lives in burrows, even during seasons of activity. In addition to digging their own burrows, desert tortoises will opportunistically use burrows, deep caves, rock and caliche crevices, and overhangs (Germano, 1994). Burrows provide constant temperature and higher humidity which protect the tortoise during periods of extreme temperatures and reduces water loss during very dry conditions. The preferred body temperature of the desert tortoise is 69 degrees to 101 degrees Fahrenheit (McGinnis and Voigt, 1971). Desert tortoises are most active during spring and early summer, during summer rains, in the early morning and late afternoon as temperatures increase, and in early fall as new sprouts germinate (Stebbins, 2003). During periods of inactivity, desert tortoises reduce their metabolism and water loss by remaining dormant underground.

Desert tortoises ingest most of their water from plants, and store it in their bladders; allowing them the ability to survive for more than a year without access to water of any kind. The diet of desert tortoises consists of winter annuals, perennial grasses, woody perennials, and cacti. Desert tortoises will eat non-native species such a red brome (*Bromus rubens*) and red-stem filaree (*Erodium cicutarium*), but they generally prefer native forbs when available (USFWS, 2011).

The desert tortoise is long lived with delayed sexual maturity. Maximum longevity for desert tortoises in the wild is between 50 and 70 years, with the average life expectancy around 25 to 35 years (Germano, 1994). Desert tortoises begin reproducing between 12 and 20 years, when they are roughly 180 to 200mm MCL (median carapace length) in size. The number of eggs (1-10 per clutch) and the number of clutches (0-3) that a female desert tortoise can produce in a season is dependent on a variety of factors including environment, habitat, availability of forage and drinking water, and physiological condition (Turner et al. 1986). Reproductive potential for the desert tortoise is low, due to high mortality rates before successful reproduction is reached.

Some reasons for the threatened status of the desert tortoise include disease, predation, and the destruction, modification, and fragmentation of its habitat and range. Human related activities such as development, agriculture, military activity, mining, waste disposal, road construction,

livestock grazing, and off-highway vehicles (OHVs), can cause loss of habitat and the proliferation of invasive plants, limiting the desert tortoises' natural food supply; ultimately threatening the long-term survival of the species (USFWS 2011).

Disease, specifically Upper Respiratory Tract Disease (URTD), caused by the bacterium *Mycoplasma agassizii*, is associated with major declines in desert tortoise populations in the 1980s. Other diseases affecting desert tortoises include cutaneous dyskeratosis (shell lesions), urolithiasis (bladder stones), and shell necrosis (Homer at el. 1998). Hatchling and juvenile desert tortoises are vulnerable to predation, due to their slow growth and soft flexible shell. The common raven (*Corvus corax*) is a common predator of small tortoises. Increased human activities lend to elevated raven populations, due to more available resources for ravens such as food from garbage, water from sewage ponds and municipal areas, and nesting areas such as utility towers and buildings; thus resulting in increased predation on desert tortoises (Boarman et al. 2006). Other known predators of desert tortoises include coyotes (*Canis latrans*), kit foxes (*Vulpes macrotis)*, mountain lions (*Felis concolor*), red-tailed hawks (*Buteo jamaicensis*) and golden eagles (*Aquila chrysaetos*).

REGIONAL AND LOCAL SETTING

The action area is regionally characterized as typical Nevada landscape, consisting of broad basins and north-south trending mountains, known as the Basin and Range Province, which encompasses the entire state of Nevada. Plant communities within this region consist of drought tolerant shrubs such as creosote (*Larrea tridentata*), white burrobush (*Ambrosia dumosa*), yuccas, cacti, and Mesquite and Acacia thornscrub washes.

The action area is locally situated along the lower bajada of a northeasterly sloping landform consisting of multiple braided intermittent washes that connect into the California Wash, and flow to the northeast, into the Muddy River. The rainfall averages 4-8 inches and a mean annual temperature between 60 to 70 degrees Fahrenheit. The vegetation community consists predominantly of Creosote-White Burrobush and Acacia thornscrub, within some of the larger washes. Along the western boundary of the action area (Area A), the vegetation community transitions to *Atriplex confertifolia* shadscale shrubland alliance interspersed with patches of Big galletta grass and Badlands further to the west. The topography is mostly level with gentle, rolling hills along the lease boundary to the west, south and east. The topography within the lease area slopes towards the California Wash. Outside of the action area, the surrounding hills include the Dry Lake Range to the west, the Muddy Mountains to the south and North Muddy

Mountains to the east. The topography to the north is relatively flat as the California Wash watershed levels and meanders to the northeast, combining with multiple intermittent washes prior to connecting with the Muddy River; which is located approximately thirteen miles to the northeast. Progressing to the south of the site and along the upper bajada, into the Muddy Mountains, the landscape is intermittently punctuated with limestone outcrops, larger rocks and an increase in cacti. The soils on site are derived from both eolian deposition, and limestone and dolomite parent material. Cryptobiotic crust is found throughout the project site in a patchy mosaic with concentrations near drainages banks. The soil consistency within the majority of the site consists of either sandy-gravelly loams or fine sand with gravelly substratum.

EXISTING CONDITIONS

Habitat and Land Use

The project site is located in the northeastern portion of the Mojave Desert and is surrounded by relatively undeveloped and undisturbed desert scrubland. The Moapa Indian Reservation is located immediately north of the project site, with the remaining surrounding area consisting of undeveloped open access desert that is owned by the federal government and managed by the U.S. Bureau of Land Management (BLM).

Disturbed areas within the project site consist of multiple two-track unimproved dirt roads that traverse through the project site; including a BLM-designated trail in Area F. Other disturbed areas in the vicinity of the project include the paved Valley of Fire Road south of Area F, powerline unpaved road to the west of Areas B2 and G, the Moapa Piute Travel Plaza on the northern edge of the project boundary, I-15 to the northwest of the project site, and K Road Solar approximately 1.5 miles north of the project site on the Moapa Indian Reservation. The Nevada Energy Crystal substation – into which the Gen-tie line would connect – is located approximately 2.5 miles west of the project site.

The dominant vegetation consists of Creosote-White Burrobush *Larrea tridentata-Ambrosia dumosa* Shrubland Alliance, interspersed with Catclaw Thornscrub *Acacia greggii* Shrubland Alliance (Desert wash scrub) within the braided ephemeral drainage channels that traverse the site (Sawyer, J.O. et al., 2009).

Topography and Soils

The topography of the site is relatively flat, with elevations ranging from approximately 2,025, along the northern extent, to 2,450 feet, near the southern survey boundary, (617 to 747 meters)

above mean sea level (Exhibit 2). According to the USDA Natural Resource Conservation Service (NRCS) online Web Soil Survey, Areas B1, B2, F and G of the Gemini project site consist of 7 soil types: (1) AOB - Arada fine sand, gravelly substratum (2) BD – Badland (3) BHC – Bard gravelly fine sandy loam (4) BMD – Bard very gravelly fine sandy loam (5) BOB – Bard-Rough broken land association (6) MMB – Mormon Mesa loamy fine sand, and (7) MOB – Mormon Mesa fine sandy loam. The description of the soil types along with the breakdown by site location are shown in Table 2 and Exhibit 3.

Table 2: Soil Types Present Within the Spring 2018 Survey Areas

Map Unit Symbol	Map Unit Name	Description	Location Area(s)
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	F
BD	Badland	On fan remnants	G
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	B1, B2
BMD	Bard very gravelly fine sandy loam	2-15% slopes, very 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	F
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	B2, G
MMB	Mormon Mesa loamy fine sand	0-4% slopes, loamy fine sand (0-2 inches), fine sandy loam (2-16 inches), cemented material (16-60 inches), well drained, fan remnants, and non-saline to very slightly saline	F
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	G

Climate

According to the National Climate Data Center (NCDC) 1981-2010 for Valley of Fire, NV, the average annual temperature range in the area is between 58.3°F and 81.0°F. Average temperatures range from 78.0° F to 102.9° F in summer months, 40.0° F to 59.0° F in winter, and 56.1° F to 81.6° F in spring and fall. Average annual precipitation is 6.5 inches, with the most precipitation occurring during the winter months (NOAA, 2017). Recorded weather data was accessed from the NOAA Cooperative (COOP) weather station in Valley of Fire State Park,

Nevada, which is located approximately 11 miles east of the project site. The Valley of Fire NOAA Cooperative station rainfall average from October, 2017 to March, 2018 was approximately 2.7 inches (69 mm) (WRCC, 2018).

Proximity to ACECs and DWMAs

Areas of Critical Environmental Concern (ACECs) are limited use areas designated and managed by the BLM to protect sensitive biological, historical, and cultural resources; natural process or systems; and/or natural hazards. ACECs in Clark County, NV protect unique cultural and archeological resources and areas of high-quality habitat for species of concern, including the desert tortoise. The ACECs that are located within the Northeast Recovery unit contain desert tortoise critical habitat include the Mormon Mesa, Gold Butte, and Coyote Springs Desert Wildlife Management Areas (DWMAs) (Exhibit 4).

Desert Wildlife Management Areas (DWMAs) have been established to protect high quality habitat for the threatened desert tortoise; ACEC overlap critical habitat for the desert tortoise. Critical habitat, designated under the Endangered Species Act, is protected from "destruction" or "adverse modification" of the habitat; essentially excluding critical habitat from development. The project site is located roughly 10 miles east of Coyote Springs DWMA, 25 miles south of Mormon Mesa DWMA, and 23 miles west of the Gold Butte DWMA. The project site is not within and does not border any of the DWMAs, so no impacts to DWMAs are anticipated.

METHODOLOGY

Presence/Absence Surveys

Prior to conducting field surveys, Phoenix initiated informal consultation with USFWS personnel (Carla Wise), via electronic mail on March 26, 2018 to discuss survey schedule, methodology and incidental observations. In addition, BLM biologists Mark Slaughter and Greg Brooks were contacted via electronic mail on March 28, 2018 to confirm survey methodology, timing and approach.

In accordance with the 2017 USFWS Desert Tortoise Survey Protocol, Phoenix Biological Consulting conducted desert tortoise presence/ absence surveys on the additional polygons, between April 3rd and April 12th, 2018 for Area F; and between May 7th, 2018 and May 27th, 2018 for Areas B1, B2, and G.

In an effort to achieve 100% visual coverage of areas containing suitable desert tortoise habitat, the survey consisted of ten-meter wide pedestrian transects walked within the entire area of the sites. Surveyors recorded the beginning and ending easting and northing coordinates to ensure all areas were covered and track logs for each team were also recorded on GPS units for redundancy. During the survey efforts, each survey team recorded start and end temperatures, wind and cloud cover. Surveys were conducted during daylight hours and were not conducted during temperatures exceeding 104^{o} F, in accordance with survey protocols.

Biologists recorded desert tortoises and desert tortoise sign, including tortoise burrows, pallets, carcasses, and scat; the presence of eggshell fragments, courtship rings, water depressions/ drinking sites, and tracks was also noted when accompanied with a tortoise burrow or pallet. No desert tortoises were handled and no desert tortoise sign was collected. Biologists documented data using Garmin Global Positioning System (GPS) in the Universal Transverse Mercator (UTM) World Geodetic System (WGS) 1984 Zone 11N datum with 3-5 meter accuracy. Field data was recorded on data sheets for each day in which the surveys were conducted. The conditions recorded for each desert tortoise burrow, carcass, and scat observation were classified according to the USFWS 2009 protocol classification system (Table 3). Incidental observations for American badger (*Taxidea taxus*), desert kit fox (*Vulpes macrotis)*, Bighorn sheep (*Ovis canadensis*), and burrowing owl (*Athene cunicularia*) sign were also recorded (Exhibits 11 & 12). Quality control and quality assurance were accomplished during the continuous GPS track logs, initial data recording, electronic data entry and proofed for accuracy during the spreadsheet assimilation and GIS mapping process.

Table 3: Information Index for Desert Tortoise Sign

Sign	Class	Definition
Burrows and Dens		
	1	currently active, with desert tortoise or recent desert tortoise sign
	2	good condition, definitely desert tortoise; no evidence of recent use
	3	deteriorated condition; definitely desert tortoise
	4	good condition; possibly desert tortoise
	5	deteriorated condition; possibly desert tortoise
Scats		
	1	wet (not from rain or dew) or freshly dried; obvious odor
	2	dried with glaze; some odor; dark brown
	3	dried; no glaze or odor; signs of bleaching (light brown), tightly packed material
	4	dried; light brown to pale yellow, loose material; scaly appearance
	5	bleached, or consisting only of plant fiber
Shell Remains		
	1	fresh or putrid
	2	normal color; scutes adhere to bone
	3	scutes peeling off bone
	4	shell bone is falling apart; growth rings on scutes are peeling
	5	disarticulated and scattered

Abundance Estimates

Abundance estimates are designed to estimate take in the action area and to develop plans to minimize impacts to tortoises in the project footprint. Desert tortoise abundance estimates were calculated using the USFWS 2017 excel spreadsheet for estimating desert tortoise density in the action area (Exhibit 13). This spreadsheet takes into account that not all desert tortoises within the action area and/or project footprint are seen by the surveyor. To estimate the number of desert tortoises within the action area, the equation divides the number of adult tortoises (≥ 180 mm MCL) observed during the survey by the product of the probability that a tortoise is above ground during the survey (Pa) and the probability that a surveyor will see the tortoise if it is above ground (Pd). Pa is relative to the previous winter's rainfall, recorded in this case between October 2017 and March 2018 by the Western Regional Climate Center. In accordance with the USFWS protocol, Pa for this project is equal to 0.85 because the previous year's rainfall in the region was greater than 1.5 inches, and Pd is equal to 0.63, which is the standard searcher efficiency for presence/ absence surveys. The rainfall total for the October 2017 to March 2018 period that was utilized in the calculations (Pa) was approximately 69 mm.

RESULTS

Abundance Estimates

During the survey, biologists recorded a total of 43 live tortoise. Only adult desert tortoises ≥180 mm MCL were included in the abundance estimate calculations, in accordance with the USFWS 2017 spreadsheet. Average transect length (1.1 km) is utilized in the calculations due to the fact that there were 1411 unequal transects within the site. Average transect length was calculated by determining the total kilometers walked (1552 km) divided by total number of transects (1411 transects). Total tortoises observed, that were ≥ 180 mm MCL in size, is 36. The results of the calculation spreadsheet are provided in Exhibit 13. Based on the density calculations, a total of 65 desert tortoises are estimated to occur within the project footprint.

In addition to live tortoises, biologists observed a total of 380 desert tortoise burrows, 113 pallets, 89 carcasses, and 39 scats (Table 6). The location of live desert tortoises, along with a comparison of scat distribution to live tortoise observations, are shown in Exhibits 5 & 6. Carcass distribution is provided in Exhibits 7 & 8. Desert tortoise burrows Class 1-3 and pallets, are shown in Exhibits 9 & 10.

Confidence Interval

The confidence interval (CI) was calculated using the USFWS 2017 spreadsheet. The lower 95% CI for the Gemini Solar spring 2018 survey is 40 and the upper 95% CI is 106 for the project footprint. The number of hatchlings (young of year) is relevant for disturbance occurring in August through December, and the number of tortoises < 180 mm MCL (not young of year) is relevant for disturbance at any time of year (Exhibit 13).

Density Analysis

Preliminary comparative density analysis from nearby areas of interest are listed in Table 4. The areas of interest include the three closest, surrounding critical habitat units and the two closest solar projects, all located within the Northeastern Mojave Recovery Unit. Playa Solar is located approximately 7 miles to the west of Gemini Solar and K Road Solar is situated 1.5 miles to the north. Desert tortoise density estimates for the Mormon Mesa, Coyote Springs, and Gold Butte CHUs, were determined based on data from the range wide monitoring line distance studies prepared by Linda Allison at USFWS. The density estimate for K Road Solar, is based on the actual number of tortoises relocated during the translocation effort (C. Wise, personal communication, November 14, 2017). The Playa Solar density estimates are based on the abundance estimate calculation from the presence/ absence survey report (ESA, 2014).

Table 4: Preliminary Comparative Density Analysis

Area Name		Area Surveyed	Estimate # of Desert Tortoises (≥ 180 mm)	Desert Tortoises Per mi² or km² (Density)
Gemini Solar	Fall 2017	7,108 acres	208	18.7 / mi²
		11.11 mi²		7.2 / km²
		28.77 km²		
	Spring 2018	3,722 acres	65	11.2 / mi²
		5.82 mi²		4.3 / km²
		15.06 km²		
K Road Solar[1]		2,141 acres	107	31.9 / mi²
		3.35 mi²		12.4 / km²
		8.66 km²		
Playa Solar[2]		2,150 acres	44	13.1 / mi²
		3.36 mi²		5.1 / km²
		8.70 km²		
Coyote Springs CHU[3]		1,025 km²	26	4.2 / km²
Gold Butte CHU[4]		1,977 km²	15	1.7 / km²
Mormon Mesa CHU[3]		968 km²	7	2.1 / km²
Average Density in NE[3] Recovery Unit		-	-	4.4 / km²

1-(USFWS, 2012), 2-(ESA, 2014), 3-(USFWS (e)), 4-(USFWS (f))

Based on preliminary analysis, the Gemini Solar spring 2018 survey areas (Area B1, B2, F, and G) have a lower density by more than half of K Road Solar and a slightly lower density than Playa Solar. The Gemini Solar spring 2018 survey areas also have a lower average density then the average density for the Northeastern Recovery unit.

Tortoise density within the project site for the spring 2018 surveys was highest in Area B2, followed by Area G (49 and 55 acres/tortoise, respectively), and Area B1 (71 acres/tortoise) (Table 5), with lowest density in Area F.

Table 5: Desert Tortoise Density per Area and Total Area

Survey Area	Acres & Percent of Total	Total # of DT observed	# of DT ≥ 180 mm MCL	Acres per Tortoise (≥ 180 mm MCL)
Area B1	141 (3.8%)	2	2	71
Area B2	979 (26.3%)	23	20	49
Area F	1,832 (49.2%)	1	0	-
Area G	770 (20.7%)	16	14	55
TOTAL	3,722	42	36	-

Incidental Observations of Predators and Other Wildlife

During the presence/ absence surveys, a total of 117 non-tortoise burrows were recorded, including one American Badger burrow, 3 burrowing owl burrows, and 113 desert kit fox burrows. Of the desert kit fox burrows, 15 of were recorded as active. One Big Horn sheep hoof was observed in Area F, and one partial Big Horn sheep horn was observed in Area G (Exhibits 11 & 12).

Discussion

The highest density of live tortoises observed during the spring 2018 surveys was located in Area B2 (49 acres/tortoise); followed by Area G (55 acres/tortoise) and Area B1 (71 acres/tortoise) (Table 5). Specifically, the middle and western portion of Area B2 contained the highest densities, with relatively even distribution throughout Area G. Only two desert tortoises were observed in Area B1, one in the northeastern portion and one on the southern edge of the site. The lowest overall density occurred in Area F, with only one desert tortoise sighting in the southeastern corner (Exhibit 5). Class 1-2 desert tortoise burrows and tortoise scat appear to be positively correlated and clustered in areas of higher density live tortoise observations, as depicted in Exhibits 6, 9 & 10.

Desert kit fox burrows were found in the highest concentrations throughout Area B1 and F; with the highest density of active desert kit fox burrows located in the western portion of Area F. Desert kit fox burrows were minimal with sporadic distribution in Area G and the southern half of Area B2. Burrowing owl and American Badger sign were only observed in the northern half of Area B2 (Exhibits 11 & 12). The summary of the spring 2018 survey results is listed in Table 6.

Table 6: Summary of Spring 2018 Survey Results

Species/Observation Type	Total Observed
Total Live Desert Tortoises	43
≥ 180 mm MCL	36
< 180 mm MCL	7
Desert Tortoise Scat	39
Desert Tortoise Carcasses	
Class 1	5
Class 2	5
Class 3	11
Class 4	12
Class 5	56
Desert Tortoise Burrows	
Class 1	44
Class 2	123
Class 3	213
Pallets	113
Desert Kit Fox Burrows	113
American Badger Burrows	1
Burrowing Owl Individuals & Burrows	3
Big Horn Sheep Sign	2

REFRENCES

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Project Exhibits

Exhibit 1: Regional View

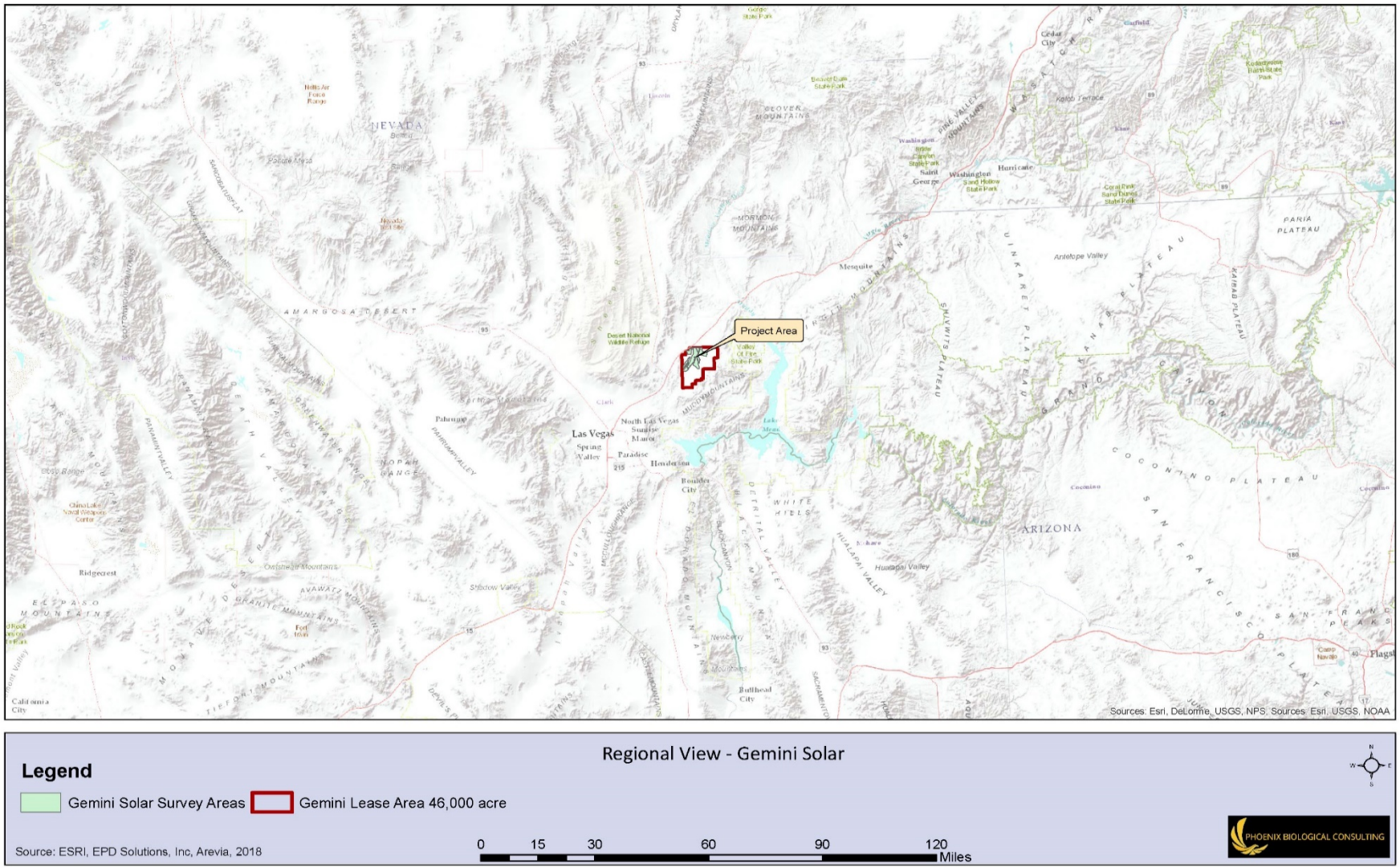


Exhibit 2: Topographic View

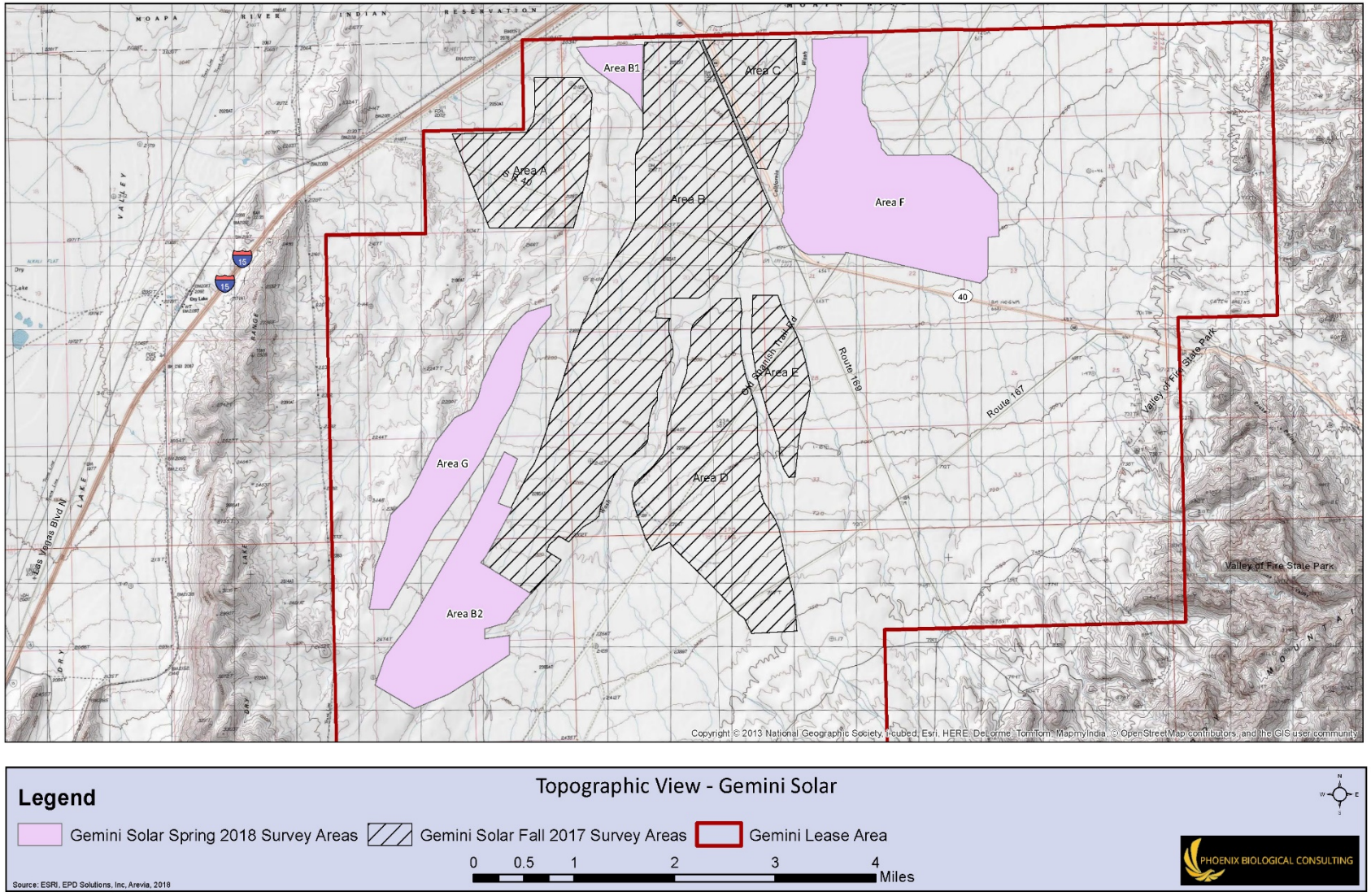
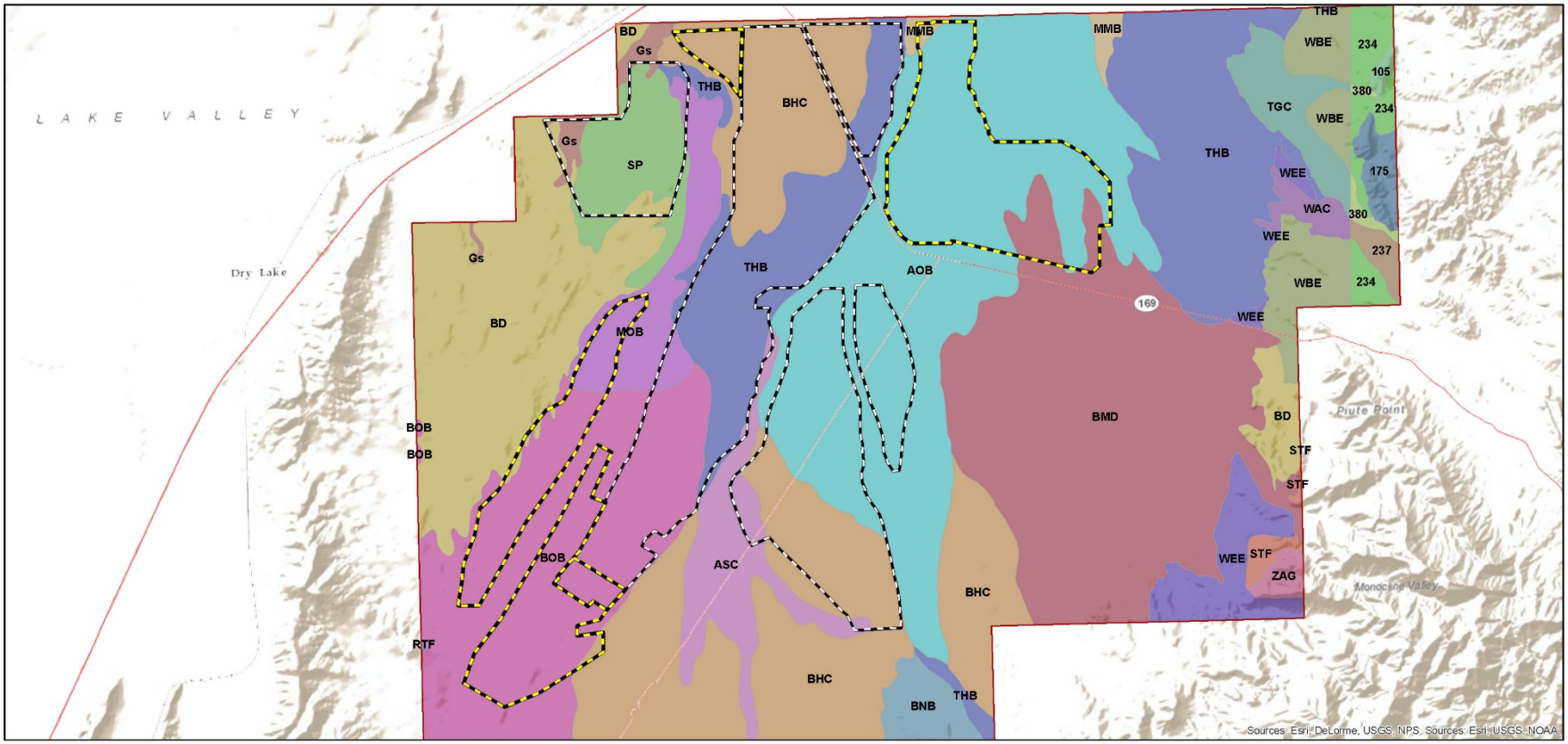


Exhibit 3: Soil Classification



Legend

- Gemini Solar Desert Tortoise Spring 2018 Survey Areas
- Gemini Solar Desert Tortoise Fall 2017 Survey Areas
- Gemini Lease Area 46,000 acre 012318

Gemini Solar - USDA Soil Data

USDA Soils Data

- 105 - Galehills extremely gravelly fine sandy loam, 15 to 50 percent slopes
- 175 - St. Thomas-Rock outcrop complex
- 234 - Wechech very gravelly fine sandy loam, 8 to 30 percent slopes
- 237 - Wechech association
- 380 - Tonopah-Arizo association
- AOB - Arada fine sand, gravelly substratum, 0 to 4 percent slopes
- ASC - Arada fine sand, hardpan variant, 2 to 8 percent slopes
- BD - Badland
- BHC - Bard gravelly fine sandy loam, 2 to 8 percent slopes
- BMD - Bard very gravelly fine sandy loam, 2 to 15 percent slopes
- BNB - Bard very stony loam, 2 to 4 percent slopes
- BOB - Bard-Rough broken land association, gently sloping
- Gs - Glendale loam, strongly saline
- MMB - Mormon Mesa loamy fine sand, 0 to 4 percent slopes
- MOB - Mormon Mesa fine sandy loam, 0 to 8 percent slopes
- RTF - Rock land-St. Thomas association, very steep
- SP - Spring silty clay loam
- SQE - St. Thomas association
- STF - St. Thomas-Rock outcrop complex
- TGC - Tonopah-Arizo association
- THB - Tonopah gravelly sandy loam, 0 to 4 percent slopes
- WAC - Wechech association
- WBE - Wechech very gravelly fine sandy loam, 8 to 30 percent slopes
- WEE - Weiser cobbly sandy loam, 15 to 30 percent slopes
- ZAG

0 0.75 1.5 3 4.5 6 Miles

Source: USDA, ESRI, EPD Solutions, Arevia, 2018

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Exhibit 4: Proximity to ACEC and Desert Tortoise Critical Habitat

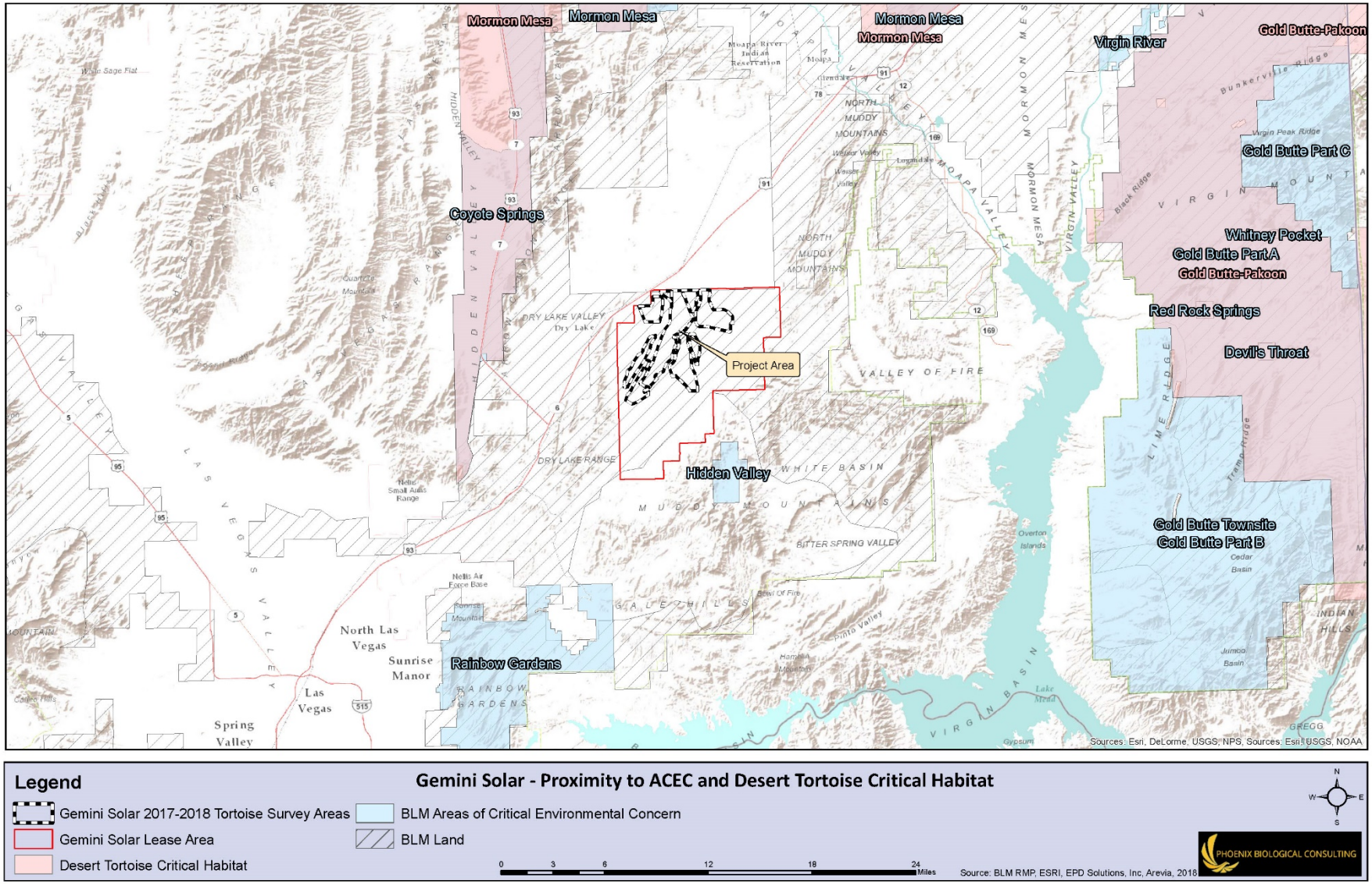

Exhibit 5: Live Desert Tortoise Observations

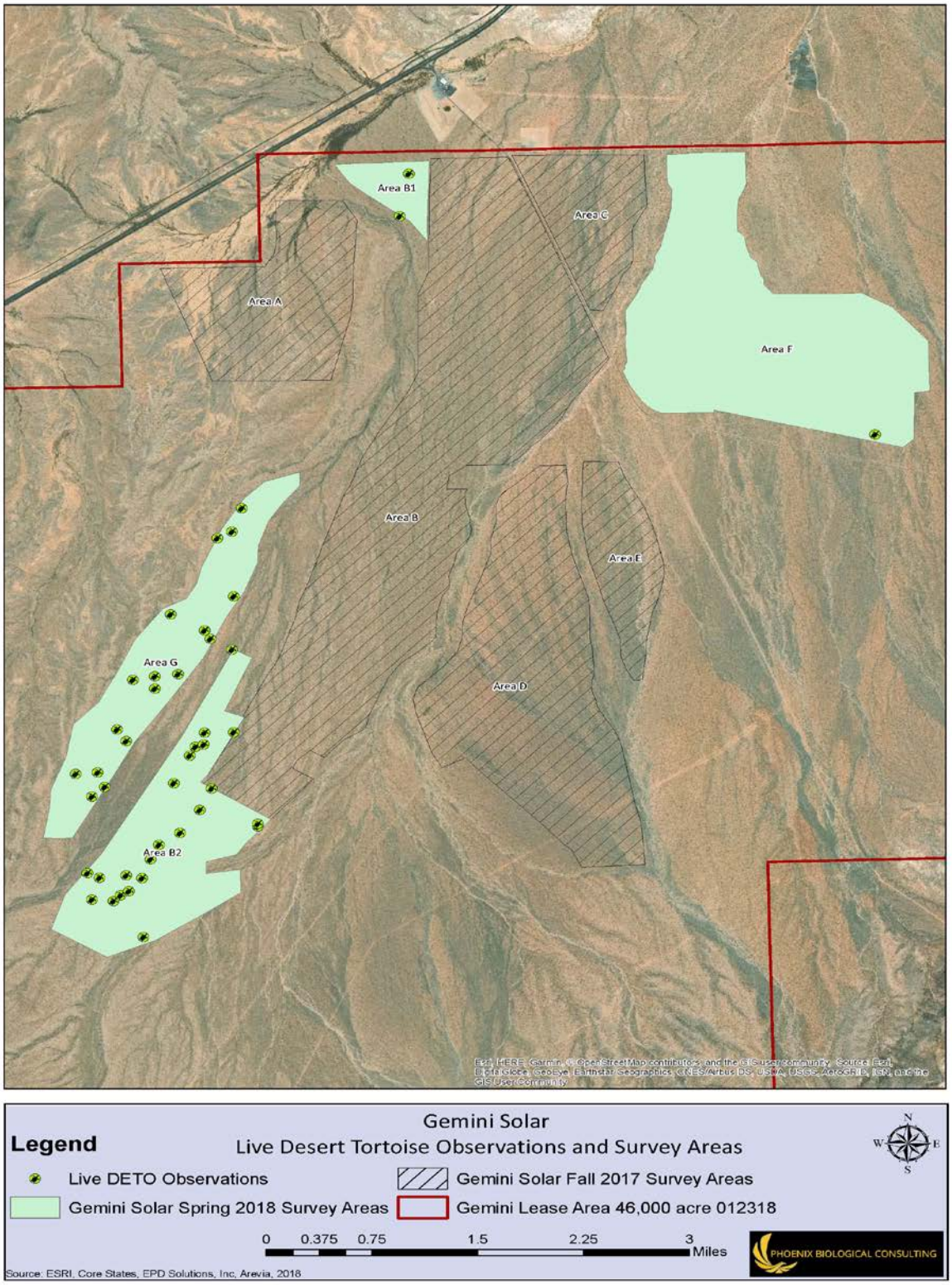

Exhibit 6: Desert Tortoise Scat with Live Tortoise Observations

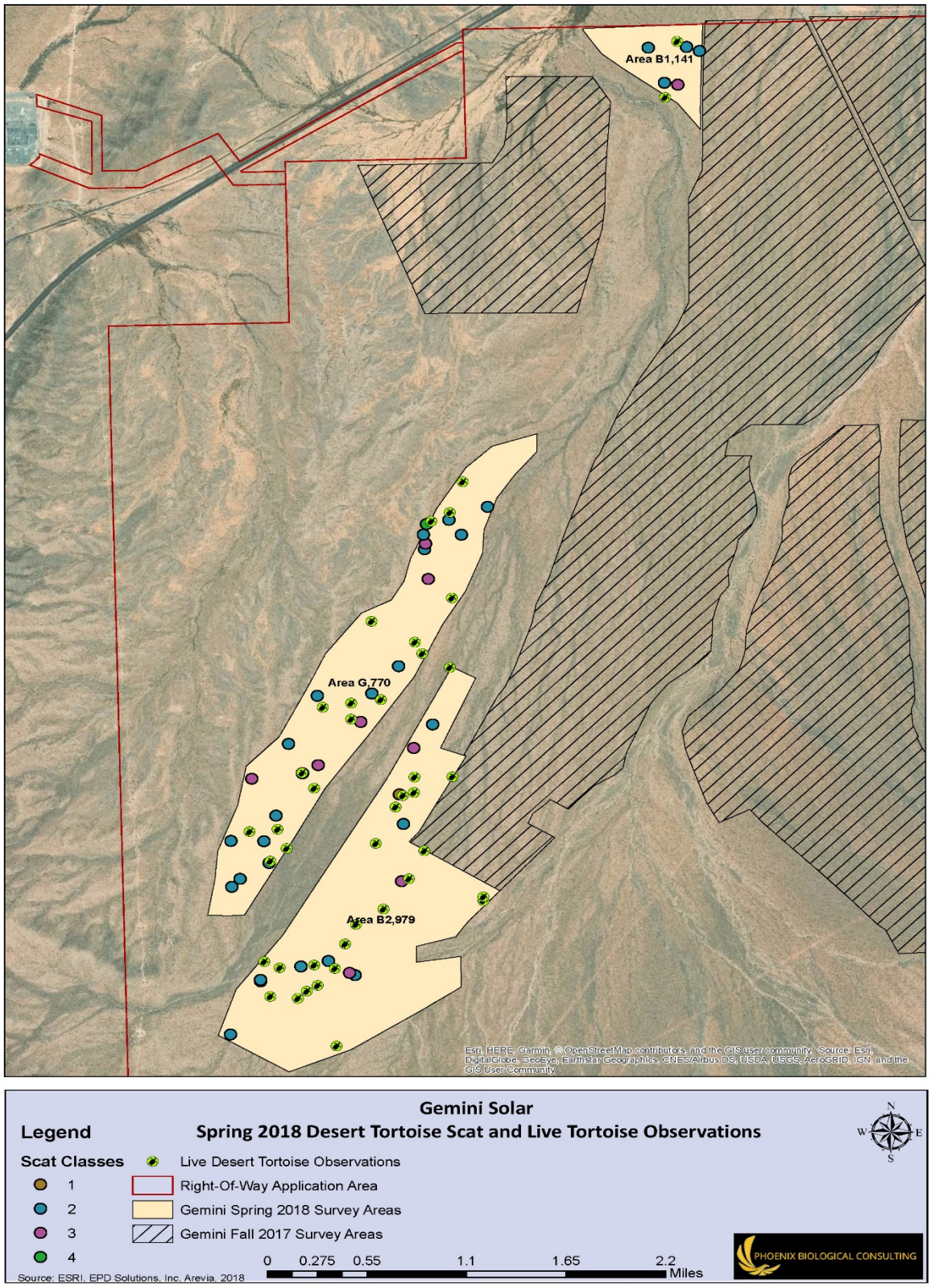

Exhibit 7: Desert Tortoise Carcasses – Areas B1 & F

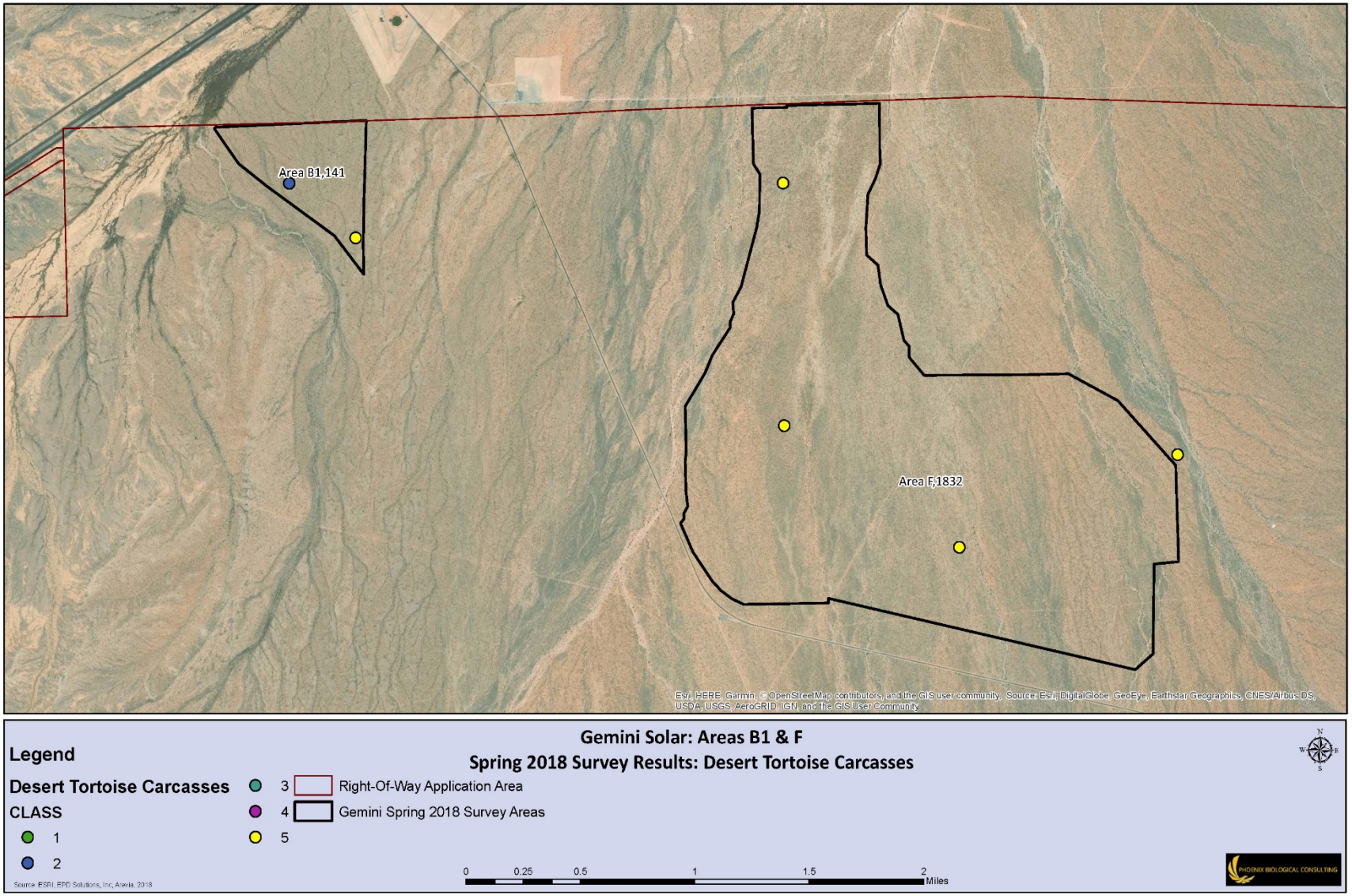

Exhibit 8: Desert Tortoise Carcasses – Areas B2 & G

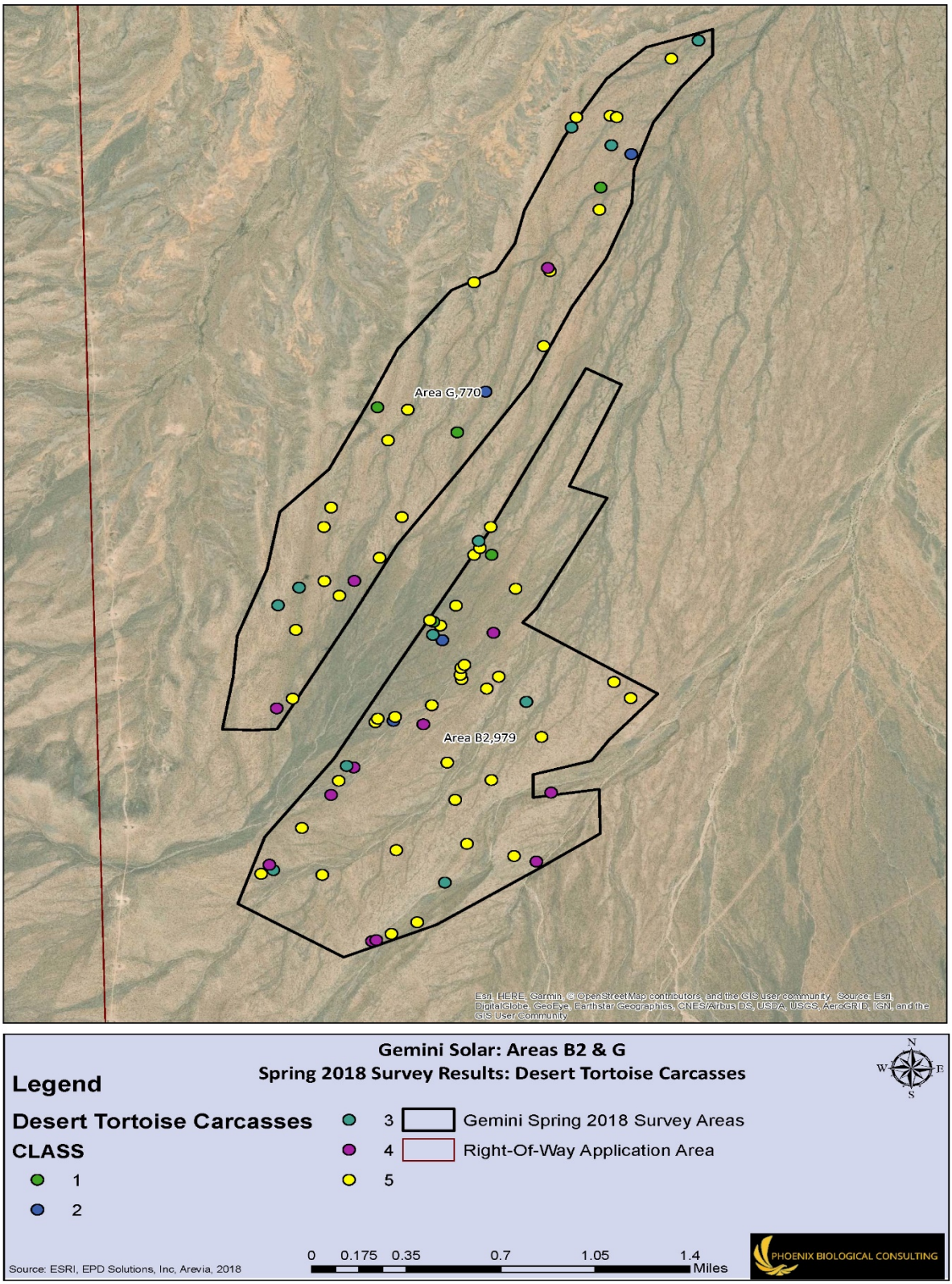

Exhibit 9: Desert Tortoise Burrows and Pallets – Areas B1 & F

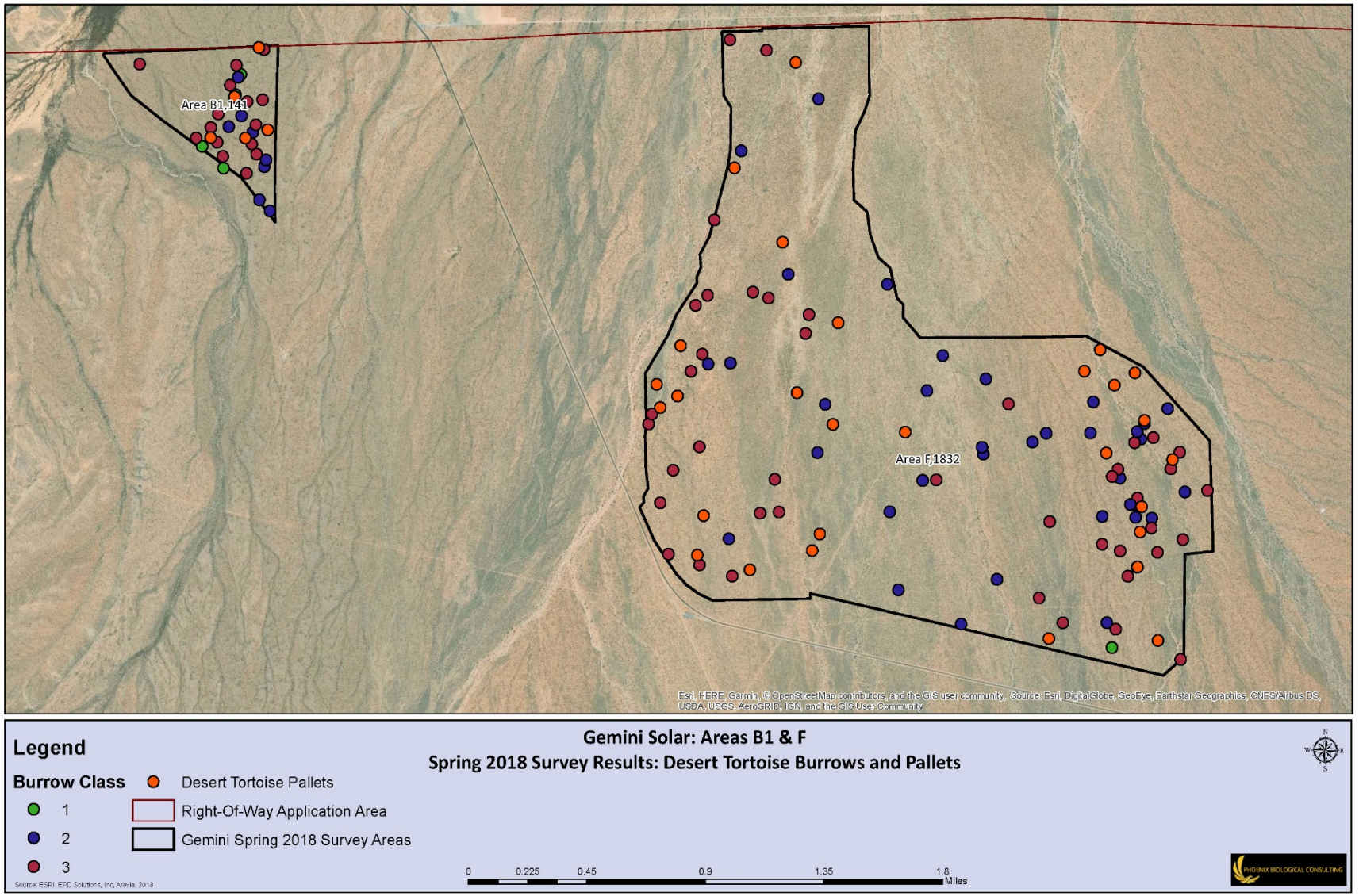

Exhibit 10: Desert Tortoise Burrows and Pallets – Areas B2 & G

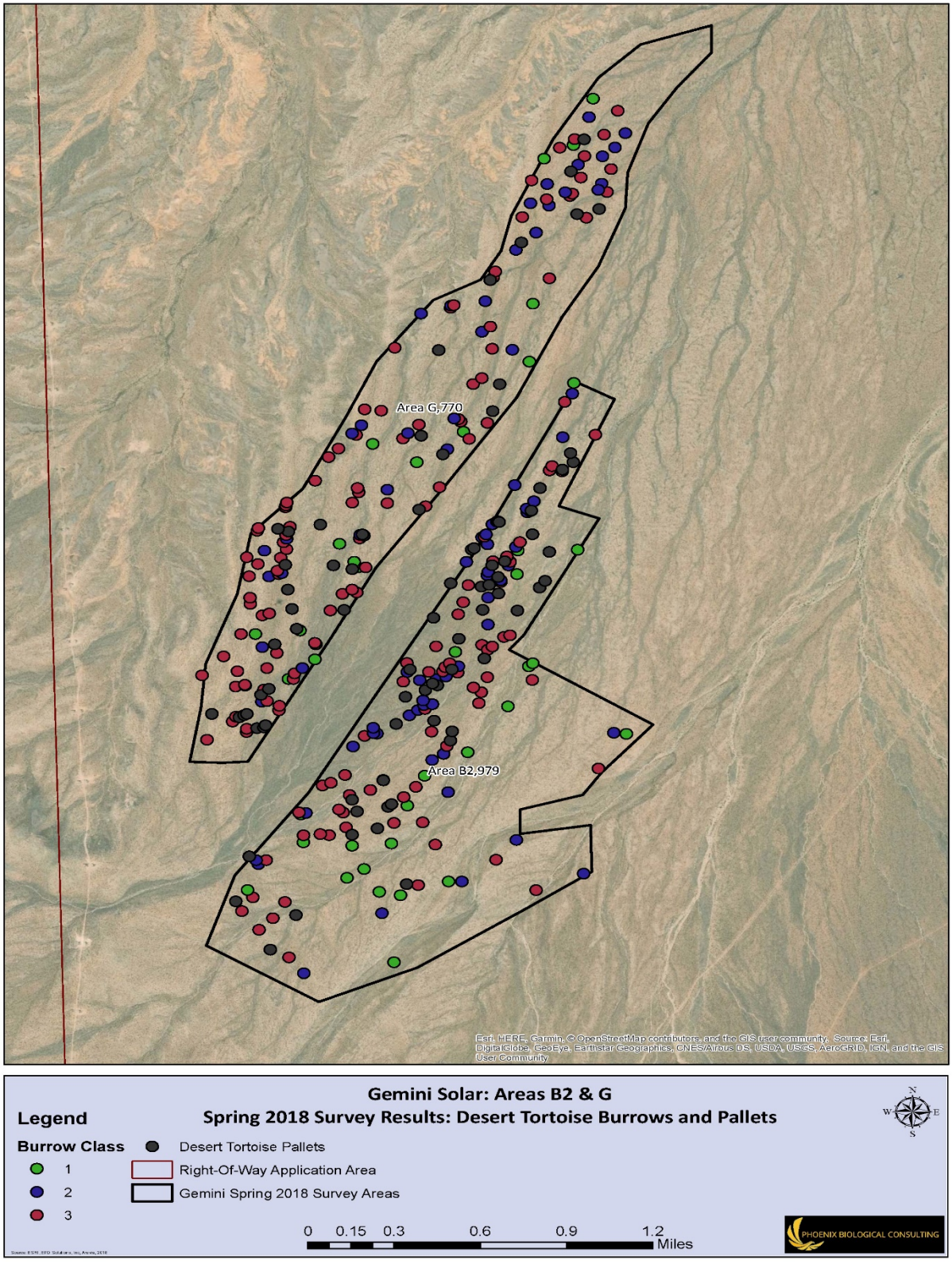

Exhibit 11: Desert Kit Fox Burrows, American Badger, Big Horn Sheep and Burrowing Owl Sign – Areas B1 & F

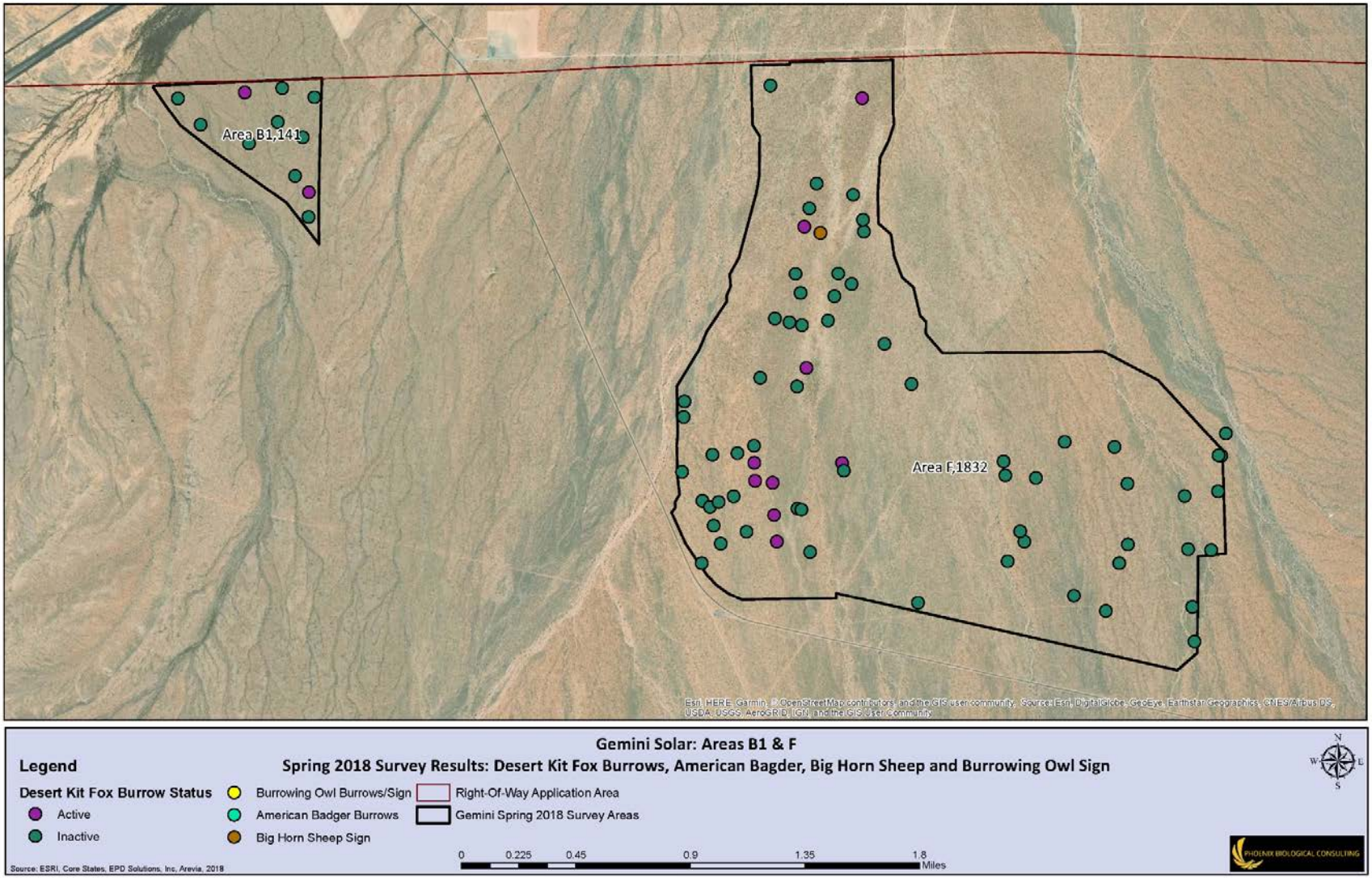

Exhibit 12: Desert Kit Fox Burrows, American Badger, Big Horn Sheep and Burrowing Owl Sign – Areas B2 & G

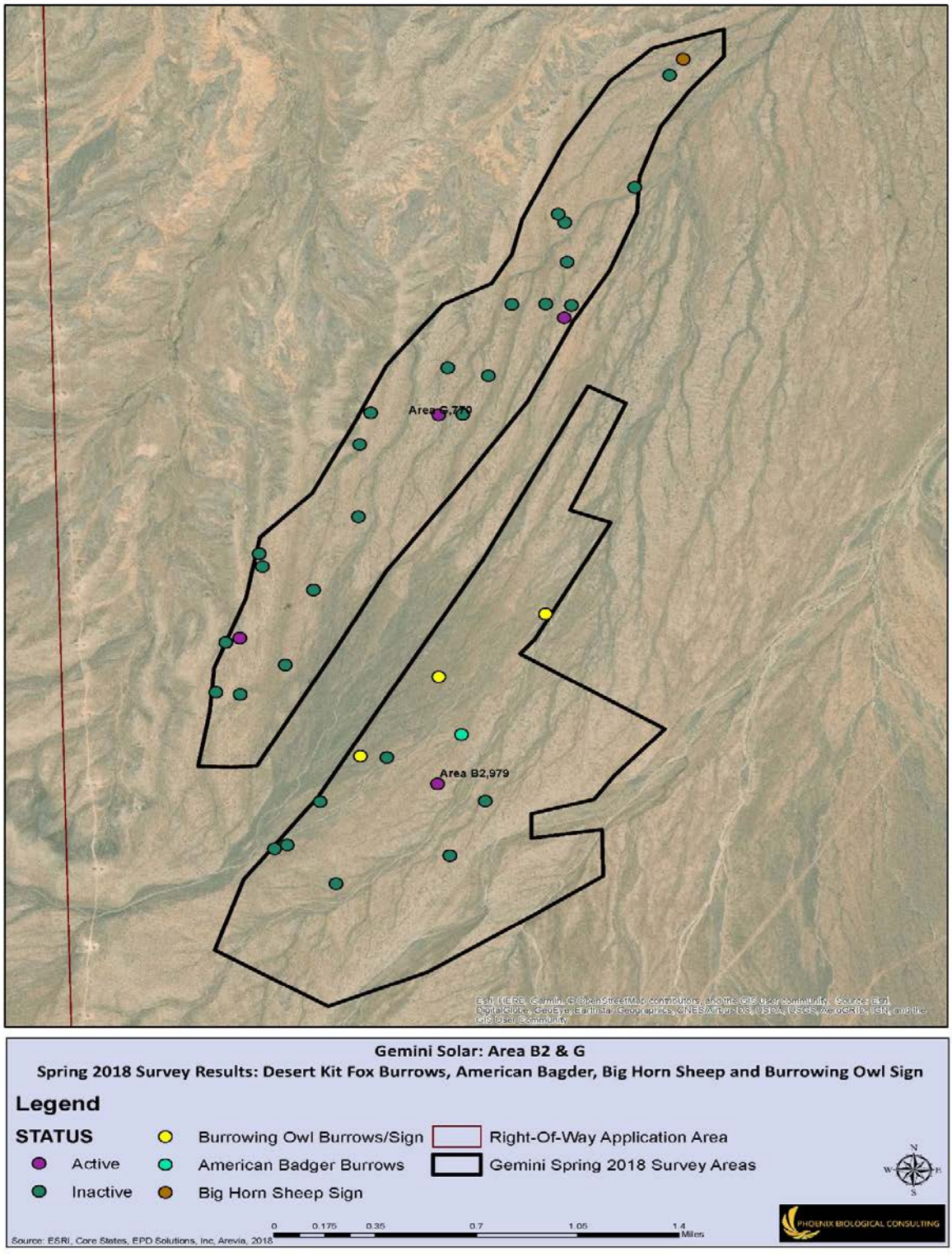

Exhibit 13: 2017 USFWS Density and Confidence Interval Spreadsheet

Table 2. USFWS Desert Tortoise Pre-Project Survey Guidance

What is the estimated number of tortoises in the action area and project footprint?

INSTRUCTIONS *Use this tab when all your transects were of equal length.*

Enter the appropriate values from the survey into the yellow cells below. The number of tortoises for the action area and project footprint will be calculated.

	Action area	Project footprint	
Number of tortoises ≥ 180 mm MCL =	65.2	65.2	
Lower 95%CI =	40.23	40.23	
Upper 95%CI =	105.82	105.82	
Number of hatchlings (young-of-year) =	84.8	84.8	Relevant for disturbance occurring in August - Dec
Number of tortoises < 180 mm MCL, not young-of-year =	339.3	339.3	Relevant for disturbance at any time of year
Project-impacted area (acres)	3722	3722	
D (tortoises/km^2) in surveyed area =	4.3		
Average density in Recovery Unit =	4.4		Based on USFWS (2015) for recovery unit in cell E2
Probability that a tortoise is visible given winter rainfall (Pa in Table 1) =	0.850		
var(Pa) (from Table 1) =	0.002		
Probability of detecting a tortoise, if visible (Pd) =	0.630		
var(Pd) =	0.010		
var(n) (assume all transect lengths equal)	45.113		
var(D)	1.178		
C for N	1.622		
Project/site name	Gemini Solar		
Desert tortoise Recovery Unit	Northeastern Mojave		
Survey start date	4/3/2018		
Survey end date	5/27/2018		
Pre-survey Oct-March rainfall (mm)	180		
Total length of transects walked (L, km) =	1552		
Transect length (km)	1		
Number of transects walked (k) =	1411		
Number of tortoises found during surveys (n) =	36		

Transects all the same length

Number of tortoises ≥ 180 mm MCL (n_i)	Number of transects on which (n_i) tortoises were seen
0	1380
1	26
2	5
3	0
4	0
5	0
6	0
7	0
8	0
9	0

Exhibit 14: Preliminary Site Design