Attachment 13

Bat Conservation Strategy

Mohave County Wind Farm

Bat Conservation Strategy

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1 INTRODUCTION

1.1 Background Information

BP Wind Energy North America Inc. (BP Wind Energy), a wholly owned indirect subsidiary of BP p.l.c., a publicly traded company, or an affiliate thereof, is proposing to develop, own, and operate the Mohave County Wind Farm (Project) in Mohave County, northwestern Arizona, on federal lands managed by the Bureau of Land Management (BLM) and the Bureau of Reclamation (Reclamation). BP Wind Energy has applied to interconnect the proposed Project with either the Western Area Power Administration's (Western) Liberty-Mead transmission line or the Mead-Phoenix transmission line (of which Western is one of several co-owners) for up to 500 megawatts (MW). The proposed Project would interconnect through a new switchyard to be constructed within the Project. An Environmental Impact Statement (EIS) is being developed for the Project to meet the requirements of the National Environmental Policy Act of 1969 (NEPA). The NEPA process was initiated in 2006. BLM is the lead agency for the Project and released the Draft EIS for a public comment period on April 27, 2012 that closed on June 10, 2012. The Final EIS is scheduled to be released to the public in December 2012.

BP Wind Energy created this Bat Conservation Strategy (BCS) to fulfill a requirement set forth by BLM as the lead agency under NEPA. The BCS includes information consistent with the U.S. Fish and Wildlife Service (USFWS) Land-based Wind Energy Guidelines (USFWS 2012), which notes preparation of a BCS is optional for the applicant unless federally listed bat species will be affected or if it is required by another regulatory agency. The BCS summarizes the environmental conditions at the Project in the context of the results from bat studies that have been conducted in order to develop an assessment of potential impacts to bats, provides avoidance and minimization measures, summarizes a post-construction fatality monitoring protocol, and describes an adaptive management strategy.

1.2 Project Description

The Project Area includes approximately 38,099 acres (15,418 hectares) of public land managed by the BLM Kingman Field Office (KFO), and approximately 8,966 acres (3,628 hectares) of land managed by Reclamation for a total of 47,066 acres (19,047 hectares; Figure 1). Project features as described in the Draft EIS (BLM 2012) include wind turbines; foundations and pad-mounted transformers; electrical, communication, and distribution systems; interior access roads; substations; a switchyard; and ancillary facilities including an operations and maintenance (O&M) building, temporary laydown/staging areas, mobile batch plants, and temporary and permanent met towers. The exact location of the wind turbines, roads, and transmission and distribution lines would be determined during final design following completion of wind resource data analyses and other environmental studies, including identification of construction constraints and sensitive cultural or natural resources to be avoided (Figure 1).

The Project would generate and deliver electrical power to the regional electrical transmission grid by interconnecting with an existing transmission line passing through the Project Area. The potential interconnection points include the Liberty-Mead 345-kV or Mead-Phoenix 500-kV transmission lines, both of which cross the southern portion of the Project Area and are operated by Western. BP Wind Energy has filed applications to interconnect the Project with one of these two transmission lines. BP Wind Energy has applied to generate up to a maximum nameplate capacity of 500 MW at the Project and has filed interconnection requests with Western that commit the firm to certain generating capacities (dependent on the specific transmission line) if the Project is approved. Any alterations to the Project that lower the generation capacity below these respective levels would cause the Project to fail to meet its stated purpose and need (BLM 2012).

Up to 283 turbines are proposed to be installed within the corridors in the Project Area; each would have the capacity to generate between 1.5 to 3.0 MW. Depending on the turbine model used, the turbine hubs would be between 80 meters (m) (262 feet) and 105 m (345 feet) above the ground, and the turbine blades would extend between 39 m (126 feet) and 59 m (194 feet) above the hub. At the top of their arc, the blades would be between 119 m (390 feet) and 164 m (539 feet) above the ground. The energy generating capacity of the Project would depend on the turbine model selected, the transmission line used, and the turbine corridors approved by BLM and Reclamation. The Project would have a nameplate generating capacity of 425 MW in the event the Project interconnects to the Liberty-Mead line, and 500 MW in the event the Project interconnects to the Mead-Phoenix line. The desired generation level could be achieved by different numbers of turbines, depending on the turbine model(s) selected by BP Wind Energy, and the land area approved by BLM and/or Reclamation in accordance with the decisions made by these agencies in their respective RODs.

BP Wind Energy has used a “turbine corridor” approach instead of focusing on specific turbine locations in order to account for the degree of flexibility required for a project of this scale and complexity and given the long federal permitting timeline anticipated at the time of the initial development application submitted to BLM in August of 2006. By providing Project-specific data within broad turbine corridors, BP Wind Energy preserves flexibility to micro-site all elements of the Project in order to avoid and minimize impacts identified through NEPA and other analyses. In addition, BP Wind Energy preserves critical business flexibility to select turbine models and layout based on the options commercially available at the time a Notice to Proceed is issued. As a result of the turbine corridor approach, the Draft EIS describes and analyzes impacts based on three turbine-parameter specification ranges (see above).

The Project boundary analyzed for baseline conditions has shifted to accommodate comments received and the results of scoping. BP Wind Energy previously proposed a Project footprint east and southeast (Map 2-11 of the Draft EIS, BLM 2012) of what is currently proposed (Alternative A in the Draft EIS, BLM 2012; Figure 1). The previously proposed footprint was comprised of a checkerboard mix of private and public lands administered by BLM and Reclamation. The footprint was shifted for four primary reasons including: 1) constructability; 2) land access; 3) environmental constraints; and 4) agency and public feedback, including from EIS scoping. The previous footprint was composed of a higher proportion of lands with rugged topography, including ridges, mountain peaks, and mines. These characteristics imposed engineering and environmental impact constraints, as well as increased costs. In addition, comments received during the scoping and public comment period in the initial stages of the EIS suggested that a footprint shift would result in a project with fewer impacts to the human and natural environment, including bats. In response, BP Wind Energy proposed the current footprint to provide a better sited project with fewer constraints that could affect sensitive resources in the area. At the time of the layout shift, BLM decided that prior bat studies completed were sufficient (K. Grove, BLM, 2012 pers. comm.). In the BCS, this earlier footprint will be referred to as the prior layout. The proposed layout defines the current Project Area and represents a shift of turbine corridors to the west.

The currently proposed Project, Alternative A, consists of a maximum of 283 turbines and a Project Area of approximately 47,066 acres (19,047 hectares). Two additional development alternatives are considered in the Draft EIS (BLM 2012). Alternative B was developed to address concerns raised by the Lake Mead National Recreation Area which is a unit of the National Park Service (NPS), as well as by private landowners regarding visual and noise impacts from turbines located in proximity to NPS and surrounding lands. Turbine corridors in Alternative B are eliminated or shortened on lands managed by the BLM and Reclamation, and increase the distance from turbines to private lands. Alternative C was developed to address similar concerns, but differs from Alternative B in that more turbines are moved from near private lands to lands managed by the BLM. Both Alternatives B and C reduce the maximum number of turbines to 208 by removing turbines from the northwestern (Alternative B) edge or southern edge (Alternative C) of the Project Area but differ in the location of the turbine strings. Alternative B would have a Project Area of 34,720 acres (14,051 hectares), whereas Alternative C would have a Project Area of 35,302 acres (13,882 hectares). Either development alternative would result in potential avoidance and minimization of impacts to bats due to the reduction in turbine numbers. Alternative C may have further reduced impact to bats because more turbines would be removed from the eastern edge of the Project which is the area of the Project closest to mines with known bat presence. BLM has not yet indicated which alternative will be chosen as the preferred alternative. To be conservative, impacts of the Project are discussed based on Alternative A unless explicitly stated otherwise.

Due to concerns about golden eagles, BP Wind Energy is voluntarily implementing two types of avoidance and minimization measures relative to potential eagle impacts, both associated with the Squaw Peak golden eagle breeding area in the northwest corner of the Project Area. First, BP Wind Energy is voluntarily implementing a no-build buffer within 1.25 miles (2.0 km) of the known active and alternate golden eagle nests of the Squaw Peak breeding area as documented by pre-construction surveys (Figure 1). Second, BP Wind Energy is removing potential turbines from two township-range sections approximately 2 miles (3 km) south of the Squaw Peak breeding area (Sections 20 and 21 in T29N, R20W). The removal of turbines around the Squaw Peak breeding area is expected to provide benefits to bats by reducing the risk of collision in an area with locally high bat activity compared to the remainder of the Project Area (see Section 2.1, Figure 3).

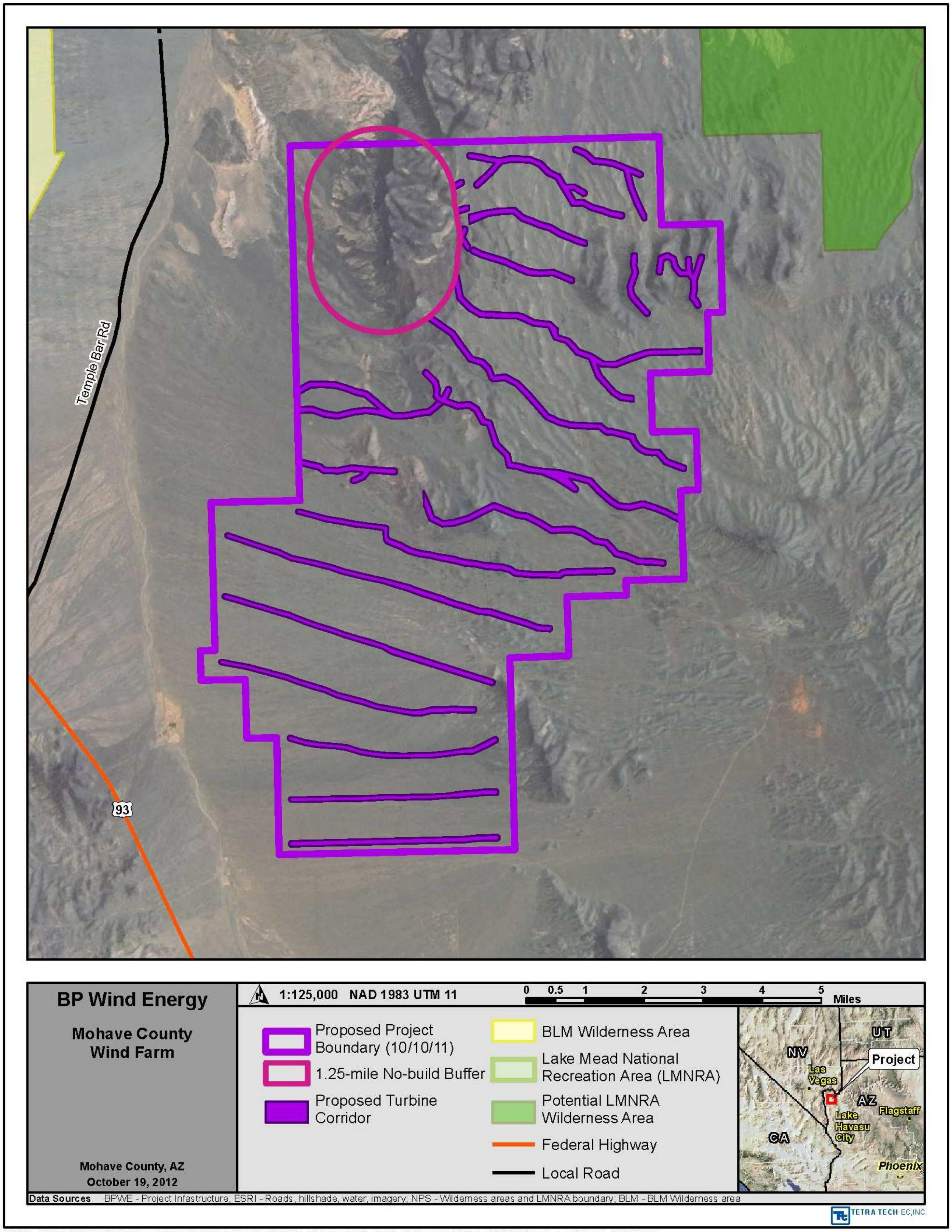

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Figure 1. Proposed Project Layout, EIS Alternative A With Turbines Removed Due to the Addition of a 1.25-mile No-Build Buffer Around the Squaw Peak Breeding Area and a Curtailment Zone.

1.3 Environmental Setting

The Project Area is located in the White Hills situated between the Detrital Valley Basin and Black Mountains to the west and the Hualapai Valley Basin and Grand Wash Cliffs to the east (USGS 1999, WRCC 2012). The Colorado River and Lake Mead are to the north and the Cerbat Mountains are south of the Project Area. The Project Area is located in the Mojave Desert ecoregion, a transitional zone between the warmer Sonoran Desert to the south and the higher and cooler Great Basin Desert to the north (Lowe 1985, USEPA 2007). The dominant vegetation type within the Project is Sonora-Mojave Creosotebush-White Bursage Desert Scrub which is described as 2-50 percent cover of small-leaved, broad-leaved, and drought-adapted shrubs (NatureServe 2011). This vegetation type is dominated by creosotebush (*Larrea tridentata*) and white bursage (*Ambrosia dumosa*). Within the Project Area and its surroundings, this vegetation type exhibits a great deal of variation in its secondary species, which change with elevation, soil texture, and available precipitation. Other vegetation in the Project Area includes white burrobush (*Hymenoclea salsola*), brittlebush (*Encelia farinosa*), Mojave yucca (*Yucca schidigera*), and Joshua trees (*Yucca brevifolia;* Thompson et al. 2011a). Numerous species of cactus also occur.

Mohave County experiences milder summers and colder winter temperatures than the low desert regions of Arizona. Average annual temperatures near the Project Area are in the low 60s degrees Fahrenheit (°F; 15-20 degrees Celsius (°C)). Summer temperatures generally range from the mid-70s to the mid-90s °F (24 to 35 °C). In winter, early morning temperatures normally drop to the low 30s and reach the mid-50s °F (-1 to 10 °C) by the afternoon (WRCC 2012). Precipitation is limited in the Project Area and its surroundings, and ranges from about 8 to 10 inches (20 to 25 centimeters [cm]) per year (WRCC 2012). The terrain is variable throughout the Project Area and ranges from 1,920 feet (585 m) to 3,836 feet (1,169 m) (USGS 1999). The greatest topographic relief is in the northwestern portion of the Project Area on land managed by Reclamation. The primary land uses within the Project Area are utility and road right-of-ways (ROW), Off Road Vehicle (ORV) use, other recreational activities, and livestock grazing.

1.4 Regulatory Framework

There are 21 species of bat with records of occurrence in Mohave County as detailed in the Arizona Game and Fish Department's (AZGFD) Natural Heritage Data Management System (HDMS; AZGFD 2012a). All bats are protected under state laws and regulations. For areas of federal land management within the state of Arizona, the NEPA permitting process is required, and Memoranda of Understanding have been developed to clarify management responsibilities. Thus, the regulatory framework for bats for the Project includes NEPA and two Memorandums of Understanding between the BLM and AZGFD and Arizona State Statute 17.

1.4.1 National Environmental Policy Act

NEPA is an act of Congress whose purpose is to ensure that the environmental impacts of any federal action are fully considered and that appropriate steps are taken to mitigate potential environmental impacts. An EIS is being prepared in compliance with NEPA in order to analyze and disclose the probable effects of the Project. The BLM is the lead agency responsible for preparing the EIS. Other agencies (Federal, state, and local) cooperating with BLM in the preparation of the EIS include Reclamation, Western, NPS, AZGFD, and Mohave County. The

Hualapai Tribe, a governmental entity, is also cooperating with BLM in the preparation of the EIS.

1.4.2 Memoranda of Understanding between BLM and AZGFD

In November 2007, the BLM and AZGFD entered into a memorandum of understanding (Agreement Number AZ-930-0703) to work cooperatively to manage resources on public lands within Arizona. This memorandum recognized AZGFD as the agency responsible for managing fish and wildlife populations on BLM public lands within Arizona, and BLM as the agency responsible for managing land cover and habitat on these lands. BLM agreed in the memorandum to manage uses and users of BLM public lands so that habitat on these lands will support and enhance fish and wildlife populations consistent with AZGFD's trust responsibilities, goals, and objectives. Both parties to the memorandum agreed to cooperate and participate in the development of all plans or programs that affect fish and wildlife management on BLM public lands in Arizona.

In December 2010, the BLM and AZGFD entered into an additional memorandum of understanding (Agreement Number AZ-2010-5) with respect to their roles on the Project. Specifically, the BLM is designated as the lead agency with responsibility for the completion of the Environmental Impact Statement and the Record of Decision. AZGFD is identified as a cooperating agency whose role is to provide technical assistance with respect to wildlife, hunting, recreation, and environmental issues where AZGFD has special expertise or jurisdiction by law.

AZGFD's conservation priorities for bats in the Mohave Desert ecoregion are preservation of hibernacula (abandoned mine entrances and shafts) and maintenance of existing riparian corridors and natural hydrological patterns (AZGFD 2006). Of the 20 bat species with records of occurrence in Mohave County (Thompson et al. 2011a), five are listed by BLM as Sensitive species (BLM 2010). No active or abandoned mines were found during a desktop review of available data and subsequent field surveys within the Project Area, nor are there any riparian corridors or perennial water sources within the Project Area (Thompson et al. 2011a).

1.4.3 Arizona State Statutes

Under the Arizona Revised Statutes (ARS) Title 17 §17-102 wildlife is the property of the state and under ARS §17-309 it is unlawful to take wildlife except as permitted by AZGFD. Take, as applicable in the context of wind development, is defined as pursuing or killing wildlife where wildlife includes all wild mammals (ARS §17-101). However, there is no take mechanism or permit available.

2 MONITORING AND SURVEYING TO DATE

Western EcoSystems Technology, Inc. (WEST) conducted a series of bat studies at the Mohave County Wind Study Area 2007 – 2011. The term Study Area encompasses all acoustic detector, mine, and mist-net locations within both the prior layout and the proposed layout of the Project (Alternative A). The term Project Area refers solely to the proposed layout of the Project based on Alternative A. Bat acoustic monitoring was conducted in both the prior layout and the proposed layout, abandoned mine surveys and exit counts were performed in the prior layout, and mist-netting was conducted in the prior layout (Table 1). Summaries of the methods used and salient results of each survey are provided in Sections 2.1-2.3. The 2012 field survey report, which is a new analysis of previously collected data, is attached as Appendix A (O'Farrell 2012). The previous reports were made available in the Draft EIS, and are therefore only cited in-text.

Table 1. Bat Monitoring Surveys, Duration, and Level of Effort for the Mohave County Wind Farm 2007 – 2011

YEAR	SURVEY	START	FINISH	LEVEL OF EFFORT
2007	Bat Acoustic Monitoring	May-07	December-07	1,084 detector-nights
	Abandoned Mine Surveys	August-07	October-07	27 mines (50 shafts) surveyed. Included visual inspections at 22 mines, motion-sensitive cameras at 8 mines, and exit counts at 20 mines (individual mines were sampled with multiple techniques as appropriate.)
	Bat Mist-netting	August-07	October-07	1,929 net-length hours
2008	Bat Acoustic Monitoring	January-08	October-08	41 detector-nights
	Abandoned Mine Surveys	June-08	July-08	31 mines (37 shafts) surveyed
	Exit Count Acoustic Array Surveys	June-08	July-08	2 mines surveyed (at least one night of exit counts were conducted per mine)
2009	Bat Acoustic Monitoring	March-09	June-09	989 detector-nights
2010	Bat Acoustic Monitoring	September-10	November-10	114 detector-nights
2011	Bat Acoustic Monitoring	February-11	July-11	518 detector-nights

2.1 Bat Acoustic Monitoring

WEST conducted bat acoustic monitoring surveys in the Study Area from 2007-2011. The objective of the bat acoustic surveys was to estimate the seasonal and spatial patterns of bat activity within the Study Area. Anabat™ II bat detectors (Titley Scientific™, Australia) were used, which provide information on bat call features, duration, and time between recorded calls.

Twenty-one different detector stations were operated within the Study Area between 2007 and 2011 (Figure 2). Of these 21 locations, 13 were located inside of the proposed Project Area and 8 were located outside of the proposed Project Area to the east. Eighty-one percent of the acoustic monitoring stations (n = 17) were "ground" detectors (i.e., the microphone was raised approximately 3 feet [1 m] above the ground), the remaining detectors (n = 4) were "high" detectors (i.e., the microphone was raised to a height of approximately 148 feet [45 m]).

Bat call sequences recorded during the acoustic monitoring effort from 2007-2011 were reviewed and analyzed by Dr. Michael O'Farrell of O'Farrell Consulting, LLC (O'Farrell) to provide an additional line of evidence and assist in responding to comments on the Draft EIS. Call sequences were classified to species based on call pulse frequency characteristics, call shape, and a comparison with a comprehensive call library developed by O'Farrell and colleagues (O'Farrell et al. 1999, O'Farrell 2012; Appendix A). O'Farrell calculated an Index of Activity for each monitoring station and species. The Index of Activity represents the magnitude of each species' contribution to use and was derived for each bat acoustic monitoring station by summing the 1-minute time increments for which a species was detected as present, divided by the number of detector-nights of sampling to standardize the value. Thus, Index of Activity was the sum of one-minute increments in which a species was present divided by the unit effort and multiplied by 100 to generate the percentage (Index of Activity = no. minutes / detector-nights * 100). The Index of Activity calculation allows for samples with different levels of effort (i.e., different total number of detector-nights) to be accurately compared, thereby reducing the potential bias associated with differences in study effort (Miller 2001). Using this method, any detection of a species within a one-minute increment, no matter how brief, is given equal weight to reduce the bias inherent in call counts due to individual bats repeatedly passing the detector. In addition this method allows for activity rates to be calculated independent of species richness at a given detector location, facilitating accurate comparisons of species' activity rates among detector stations.

A total of 15 species of bats were recorded in the Study Area (Table 2). Two of these species, Allen's big-eared bat and greater western mastiff bat, are BLM Sensitive species (BLM 2010). Species designated as BLM Sensitive are native species found on BLM land for which there is evidence that populations or associated habitats are at risk across all or a significant portion of their range (BLM 2010). All bat species are protected in Arizona as non-game species and AZGFD has identified the status of each species in the Arizona State Wildlife Action Plan (e.g., Species of Greatest Conservation Need (SGCN) Tiers 1A, 1B, and 1C; AZGFD 2006, 2010). Tier 1A indicates that the species is considered vulnerable in at least one of 9 categories (e.g., distribution within Arizona, degree of population fragmentation, population trend) or is a federally endangered, threatened or candidate species; is covered under a signed conservation agreement; or is petitioned for listing. Tier 1B species are considered vulnerable but match none of the additional criteria for Tier 1A. Tier 1C species have an unknown vulnerability status. However, these classifications do not confer additional protection. Of the bat species recorded in the Study Area, none are considered Tier 1A, two are considered Tier 1B (Brazilian free-tailed bat and greater western mastiff bat), and five are considered Tier 1C (Table 2). Tier 1C species are not discussed further given their unknown vulnerability status.

Species richness varied across detector locations, and no single sampling location recorded the full suite of bat species recorded in the Study Area (O'Farrell 2012; Appendix A). Species richness was greater outside of the Project Area, but Allen's big-eared bat (BLM Sensitive) was detected only within the Project Area. Detector locations within the Project Area recorded an average of 6.8 species (range 2 – 12 species) and detector locations outside of the Project Area recorded an average of 7.5 species (range 3 – 12 species). Activity rates, as measured by Index of Activity, also varied among the sampling locations (Figure 3). Overall activity was slightly higher within the Project Area (O'Farrell 2012; Appendix A). Average overall Index of Activity 2007-2011 for ground level detectors within the Project Area was 1,120, as compared to 964 outside of the Project Area. Average Index of Activity at high detectors was 694 in the Project Area and 871 at the single high detector located outside the Project Area (O'Farrell 2012; Appendix A). It is also important to note that the majority of activity (80.6 percent of Index of Activity) recorded in the Project Area was attributable to Brazilian free-tailed bat; Allen's big-eared bat and greater western mastiff bat (both BLM Sensitive) accounted for 0.005 and 0.06, percent, respectively, of the recorded activity as measured by Index of Activity. Although there were no detectors placed in the southwest portion of the Project Area, O'Farrell concluded that the existing data was representative of general spatial occurrence patterns within the Project

Area. Furthermore, O'Farrell stated that there were no bat attractant features present within the current Project boundary.

The most active species among all detector locations was Brazilian free-tailed bat (SGCN Tier 1B; 80.6 percent of the overall Index of Activity; Figure 4), followed by California myotis (7.8 percent of the overall Index of Activity) and canyon bat (4.7 percent of the overall Index of Activity). Yuma myotis accounted for 2.7 percent of Index of Activity (O'Farrell 2012; Appendix A). Big brown bat was active at a single location, but did not contribute significantly at any other sampling stations during the entire study (2.4 percent of the overall Index of Activity). All other species recorded accounted for less than 1 percent of Index of Activity at detector locations within the Project Area and Study Area. Brazilian free-tailed bat accounted for 99 percent of the Index of Activity at the high detectors (O'Farrell 2012; Appendix A).

Individual species activity at sampling locations were classified as "primary" (species contributed more than 25 percent of the activity at the detector) or "secondary" (species contributed less than 25 percent, but more than 6 percent, of the activity at the detector), all other species accounted for less than 6 percent of activity. Multiple species could be considered primary or secondary at a given detector location. Neither Allen's free-tailed bat nor greater western mastiff bat (both BLM Sensitive) were primary or secondary species at any sampling location. Brazilian free-tailed bat was a primary species at each of the 13 detector locations within the Project Area and was both a primary and secondary species at several locations outside the Project Area (Figure 5). California myotis was a secondary species at three of the Project Area detector locations, and both a primary and secondary species at several locations outside the Project Area (Figure 5). Canyon bat was a secondary species at four Project Area locations, and both a primary and secondary species at several locations outside the Project Area (Figure 5). Yuma myotis was a primary species at a single detector location within the Project Area, and was a primary and a secondary species at two detector locations outside the Project Area (Figure 5). Big brown bat was a primary species at one detector location outside the Project Area (Figure 5).

Two BLM Sensitive species was recorded within the Study Area, Allen's big-eared bat and greater western mastiff bat. Allen's big-eared bat was only detected at a single location (WH-1g) during a single month in 2007. Allen's big-eared bat occurred in the Project Area, but accounted for only 0.005 percent of the total Index of Activity recorded (Figure 4), and was only detected by a ground level detector (O'Farrell 2012; Appendix A). The greater western mastiff bat (BLM Sensitive and SGCN Tier 1B) was detected infrequently year-round, accounted for only 0.06 percent of the total Index of Activity (Figure 4), and was only detected once at a high detector at the eastern edge of the Project Area. A s mentioned above, the Brazilian free-tailed bat (SCGN Tier 1B) was a primary species at each of the detector locations within the Project Area and accounted for more than 80 percent of the total Index of Activity. Brazilian free-tailed bat also dominated detections at the high detectors, accounting for 99 percent of detections.

Seasonal peaks in bat activity varied among years and sampling dates. Bat activity peaked in summer and early fall in 2007 (sampling occurred from May to December 2007). Late summer and early fall peaks likely corresponded to the period when volant (capable of flight) young entered the foraging population, or when a particular species concentrated activity prior to autumn dispersal. In contrast, peak activity was documented in spring in 2009 (sampling occurred only from March through June) and 2010/2011 (sampling occurred from September to

November and February through July; O'Farrell 2012; Appendix A). Spring peaks in activity may correspond to a migratory influx of individuals that don't remain within the Study Area. The precipitous decline in Index of Activity in June is dissimilar to patterns in data for bats elsewhere in the southwestern U.S., which show peak activity in summer (Jones 1965, Jones 1966, O'Farrell et al. 1967, O'Farrell and Bradley 1970, O'Farrell et al. 2003, O'Farrell 2006a-d, O'Farrell 2007, O'Farrell 2009, O'Farrell 2010).

Table 2. Species Diversity at the Mohave County Wind Project Study Area 2007 – 2011

COMMON NAME	FAMILY/SPECIES	CONFIRMATION			SEASONAL OCCURRENCE*				CONSERVATION STATUS[+]
		Acoustic	Capture	At Mine	Winter (Nov - Mar)**	Spring (Apr. - May)**	Summer (June - Aug)**	Fall (Sept. - Oct.)**	
Vespertilionidae									
California Myotis	*Myotis californicus*	X	X	Likely[++]	X	X	X	X	-
Western Small-footed Myotis	*Myotis ciliolabrum*	X					X	X	-
Fringed Myotis	*Myotis thysanodes*	X				X	X		-
Yuma Myotis	*Myotis yumanensis*	X	X	Likely[++]	X	X	X	X	-
Silver-haired Bat[***]	*Lasionycteris noctivagans*	X			X				1C
Western Red Bat	*Lasiurus blossevillii*	X			X	X	X		1C
Hoary Bat	*Lasiurus cinereus*	X	X		X	X	X		1C
Canyon Bat	*Parastrellus hesperus*	X	X	X		X	X	X	-
Big Brown Bat	*Eptesicus fuscus*	X	X				X	X	-
Pacific Western Big-eared Bat	*Corynorhinus t. townsendii*	X	X		X	X	X	X	-
Allen's Big-eared Bat	*Idionycteris phyllotis*	X	X	X				X	BLM SS
Pallid Bat	*Antrozous pallidus*	X	X		X	X	X		1C
Molossidae									
Brazilian Free-tailed Bat	*Tadarida brasiliensis*	X	X		X	X	X	X	1B
Big Free-tailed Bat	*Nyctinomops macrotis*	X			X	X		X	1C
Greater Western Mastiff Bat	*Eumops perotis californicus*	X			X	X	X	X	BLM SS, 1B

***Call sequences present in the acoustic data set during the given time period.**
**** Seasons based on Hoffmeister 1970**
*****Not present in current Project Area**
[+] BLM SS - BLM Sensitive species; 1A, 1B, and 1C are Tiers of Species of Greatest Conservation Need (revised 2010) from the Arizona State Wildlife Action Plan:
1A Considered vulnerable in at least one of the 9 categories, or is federal endangered, threatened or candidate species; is covered under a signed conservation agreement; or is petitioned for listing
1B Considered vulnerable but matches none of the additional criteria above
1C Unknown vulnerability status species
[++]Species confirmed via acoustics and not visual observation during mine surveys.

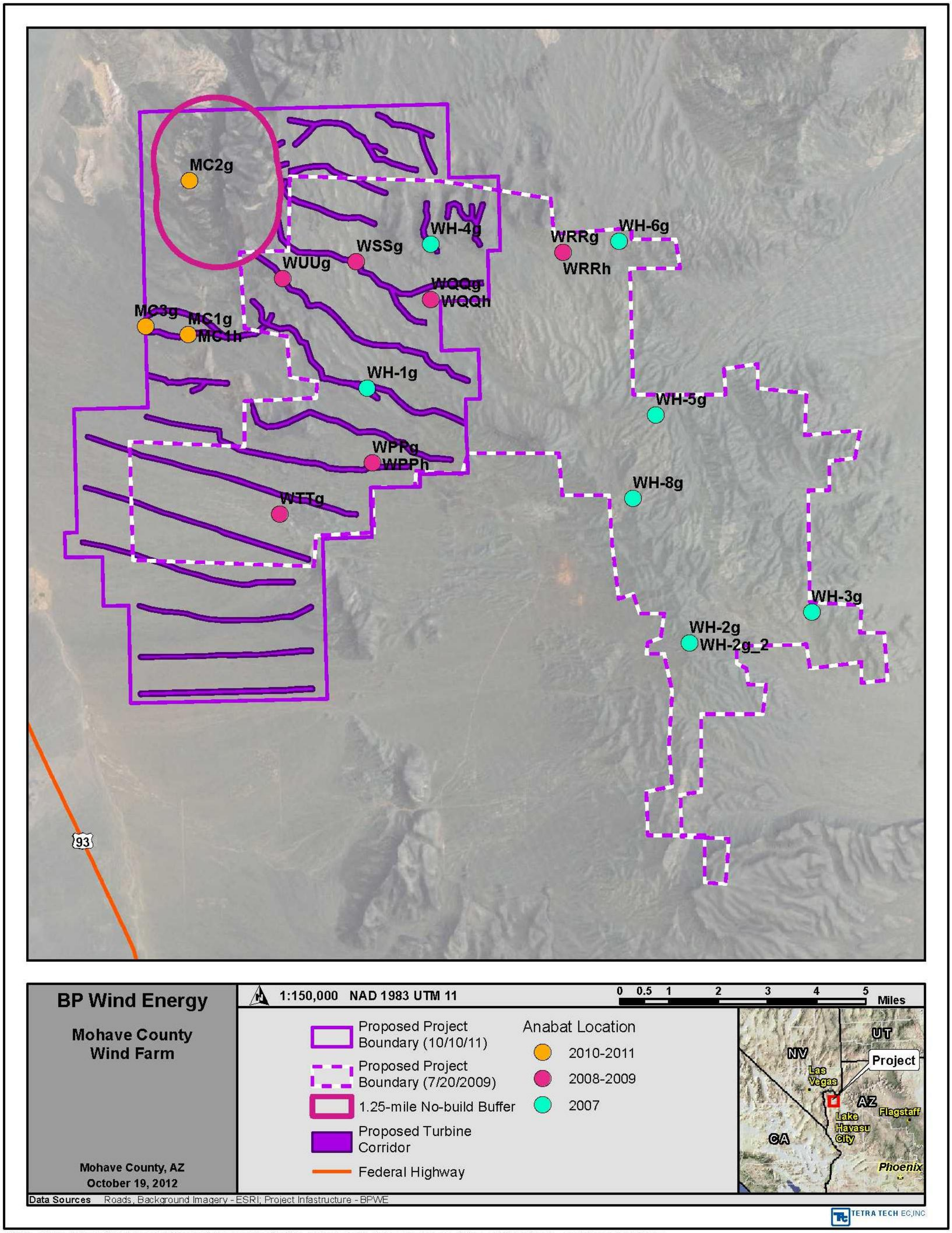

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Figure 2. Bat Acoustic Monitoring Stations Mohave County Wind Farm 2007 – 2011

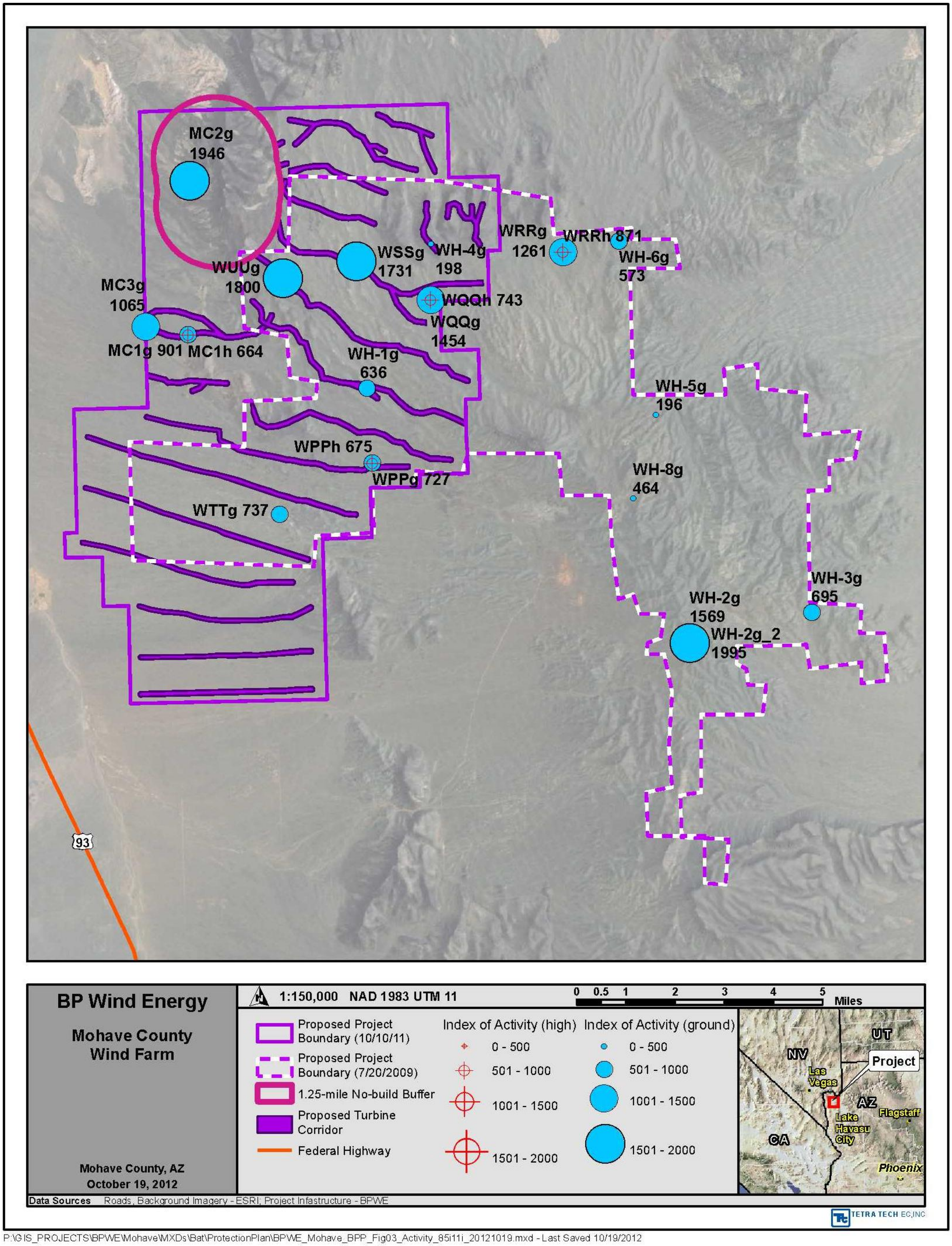
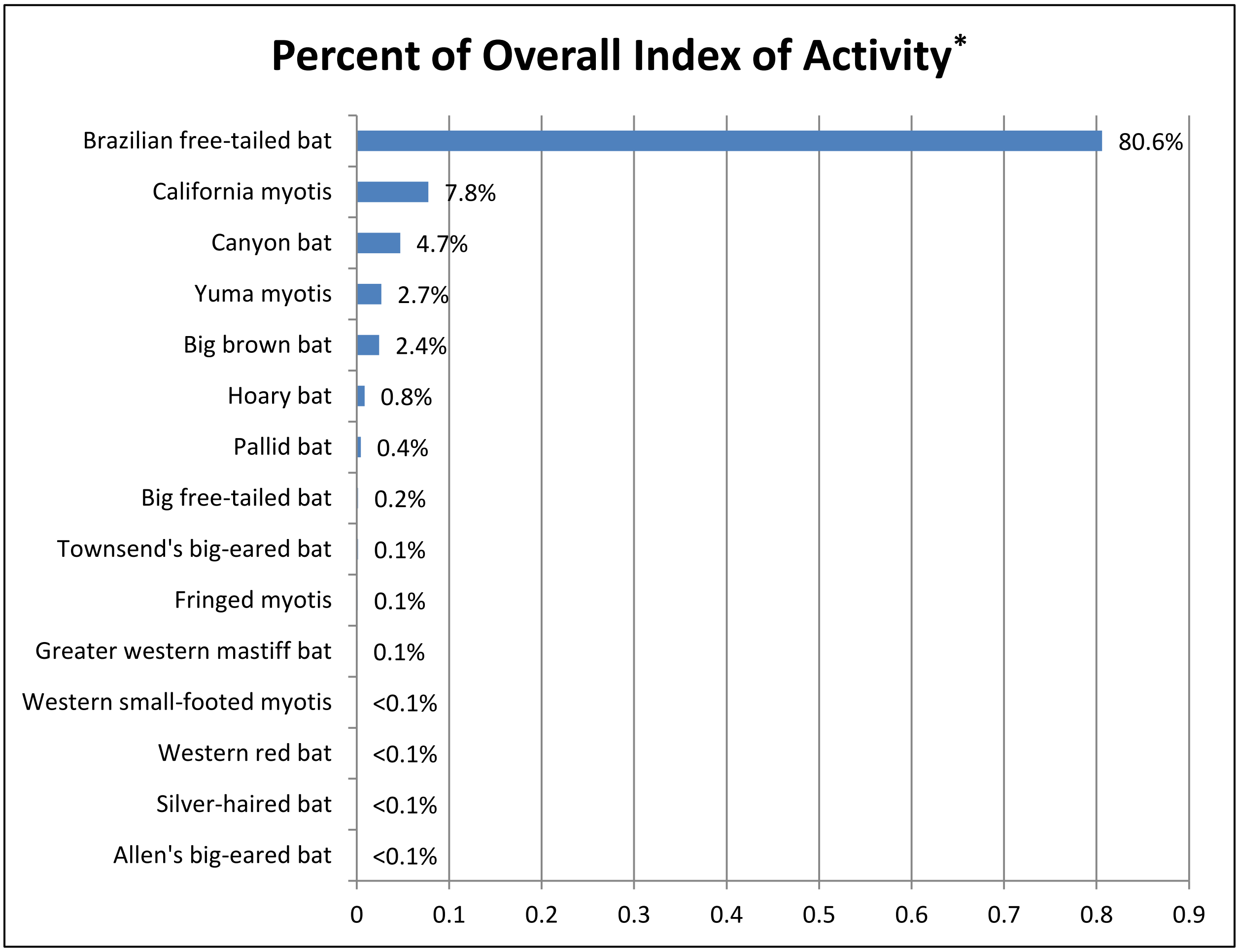


Figure 3. Index of Activity at the Mohave County Wind Farm 2007 – 2011



*Values are rounded to one decimal place.

Figure 4. Species Composition of Bat Acoustic Activity at the Mohave County Wind Farm 2007 – 2011

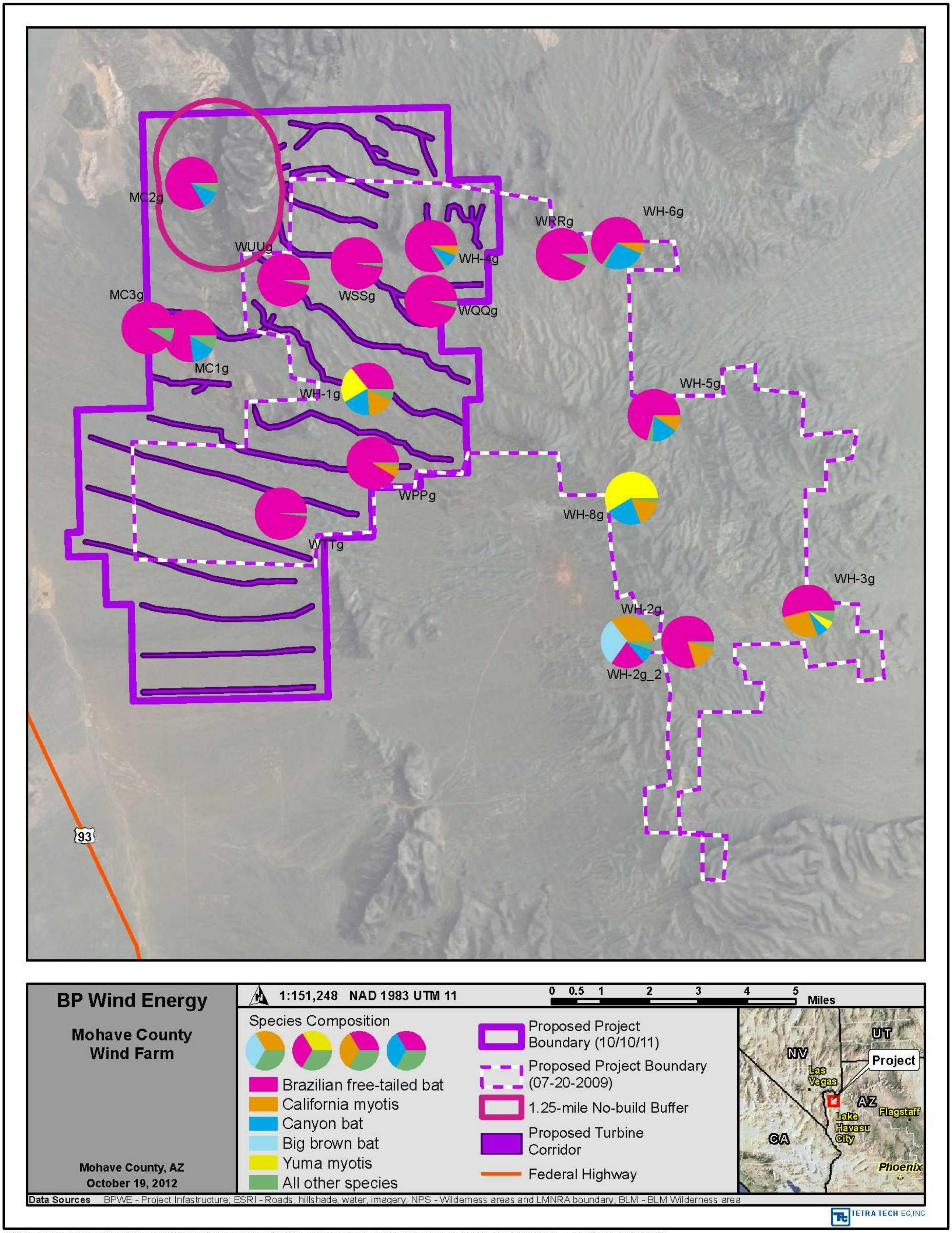


Figure 5. Species Composition of Bat Acoustic Activity by Detector Location at the Mohave County Wind Farm 2007 – 2011

2.2 Abandoned Mine Surveys

The goal of the abandoned mine surveys was to determine which mines were used by hibernating and breeding bats (i.e., maternity sites), and to document the general levels of bat use at suitable mines. In order to evaluate the mines in the Study Area, WEST conducted a desktop review of BLM and Arizona State Land Department databases in 2007 and identified 43 mine complexes (60 shafts) in the vicinity of the Project Area. Criteria used to evaluate the abandoned mines for potential bat habitat during the desktop review and preliminary field investigations included the recommendations outlined by the U.S. Department of Agriculture Natural Resources Conservation Service and Bat Conservation International (USDA-NRCS and BCI 2002).

Mines in the Study Area thought to be suitable for bat occupation were surveyed August – October 2007, and again in June and July of 2008. During field surveys an additional four mine complexes (10 shafts) were located. Most of the mine shafts identified during the desktop review and field surveys were in the southeast of the Study Area (Figure 6). Twenty of the 47 total mine complexes identified by WEST (20 shafts) were not surveyed: six were located on non-leased private land, five were actively being mined, five were closed or filled in, and four could not be found during field validation efforts. Although abandoned mines occur in portions of the Study Area, none are known to occur in the Project Area (Figure 6).

In 2007, WEST surveyed 27 mines (50 shafts) and assessed bat presence by either visual inspection (i.e., physically searching the interior for bats or guano; n = 22), use of motion-sensitive cameras (n = 8), or exit counts (n = 20). Twelve mines (14 shafts) were found to contain bats, and WEST conducted an additional one or two exit counts at each of these locations (Solick et al. 2009). WEST counted between 126 and 165 bats per count during 42 emergence counts, for an average of 3.0 to 3.9 bats per count. Binary Acoustic Technologies (BAT AR-125) systems were also used to confirm the occurrence of bat species during mine surveys.

In 2008, WEST surveyed a total of 31 mines (37 shafts) within the Study Area (Figure 6; Solick et al. 2009). Biologists re-visited the 12 mines (14 shafts) that contained bats in 2007, and found that 4 mines (5 shafts) contained bats again in 2008. WEST also identified and surveyed seven new mines (eight shafts) in 2008 and found bats in one mine (two shafts). WEST counted between 118 and 144 bats during 40 exit counts, for an average of 3.0 to 3.6 bats per count. WEST surveyed an additional four mines (seven shafts) in 2008 that lay outside of the prior layout (the Gold Hill and wet mine complexes; Solick et al. 2009). Bats occupied all four mines (but only six shafts), with an average count of 3.8 to 4.5 per shaft.

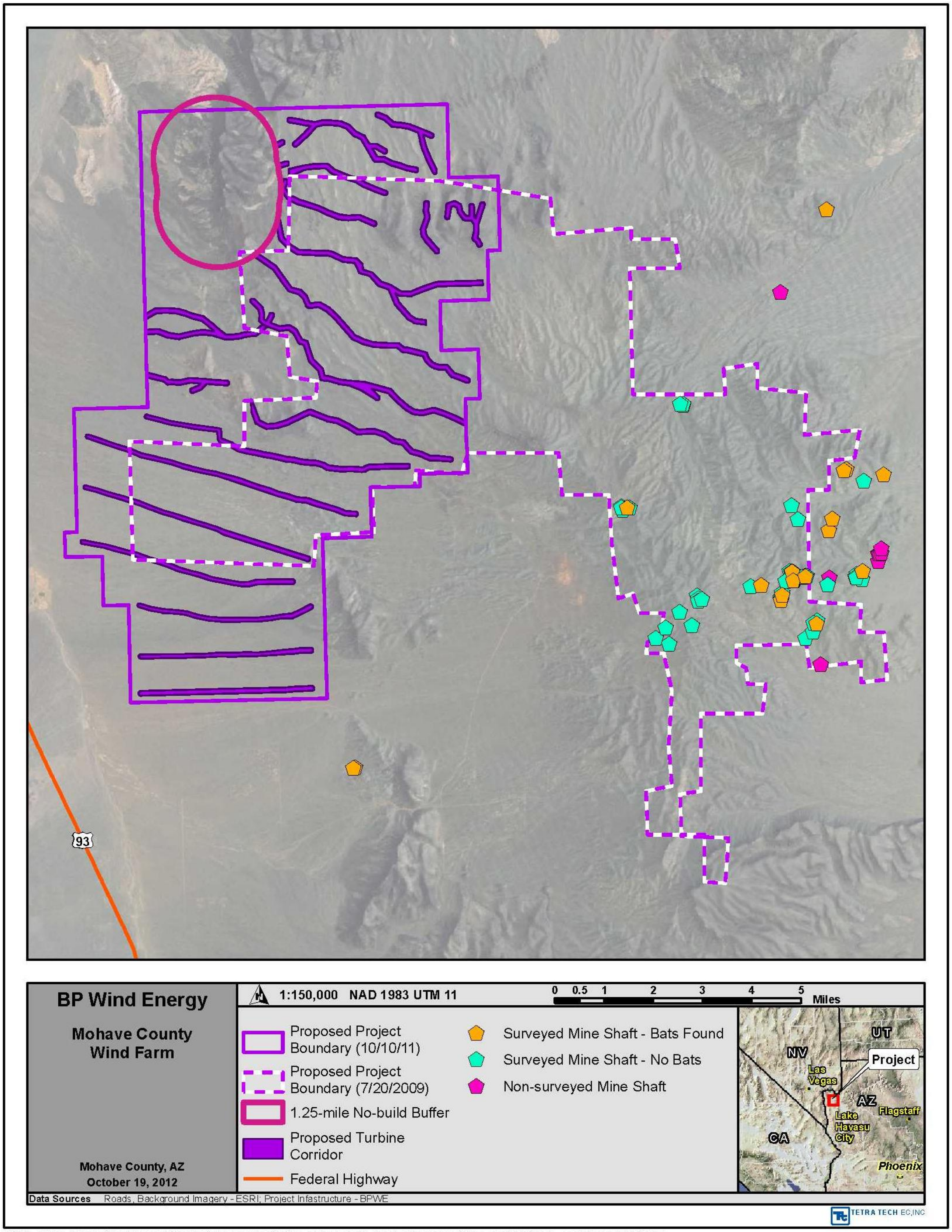


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Figure 6. Abandoned Mines Identified and Surveyed for Bats at the Mohave County Wind Farm 2007 - 2008

2.3 Bat Mist-net Surveys

The purpose of the mist-netting effort was to gather supplemental information on species presence that would support species identification in the acoustic monitoring study (Section 2.1). Bat captures allow for a greater degree of certainty in species identification than acoustic methods; however, bat captures indicate presence, but the lack of captures does not confirm absence. Mist-net captures also do not reflect activity levels as do acoustic surveys. Some bat species may be more or less susceptible to capture than other species; therefore, mist-net surveys should not be considered a representative inventory of species occurrence.

Three mist-net efforts were undertaken from summer through fall 2007 near or across water including cattle tanks (3), stock ponds (3), and one well and one spring (Table 1; Solick et al. 2009). Mist-net studies were carried out within the prior layout of the Project which was east and outside of the current Project Area (Figure 7). Both single and stacked nets were deployed. Four to seven nets (mean = 5.5) were set at sunset and checked regularly for up to six hours (mean = 4.7 hours). All bats captured were identified, aged, sexed, and weighed (Thompson et al. 2011a).

During the mist-net study, 14 bats were captured in August, 35 in September and 12 in October. Nine species, including a single BLM Sensitive species (Allen’s big-eared bat) and one SGCN Tier 1B species (Brazilian free-tailed bat), were captured during the surveys (Table 2). California bat (n = 17), canyon bat (n = 13), and Pacific western big-eared bat (n = 10) were the most common. Of the 61 bats captured, 37 were female, 22 were male and two were not identified to sex (Thompson et al. 2011a). Twenty-two of the female bats were not reproductive and 15 were post-lactating at the time of capture. Twelve males had descended testes, indicating they were reproductively active. A large stock pond in the southeastern portion of the Study Area yielded the most bat captures (27) during two trapping sessions, once in September and again in October (Solick et al. 2009,Thompson et al. 2011a).

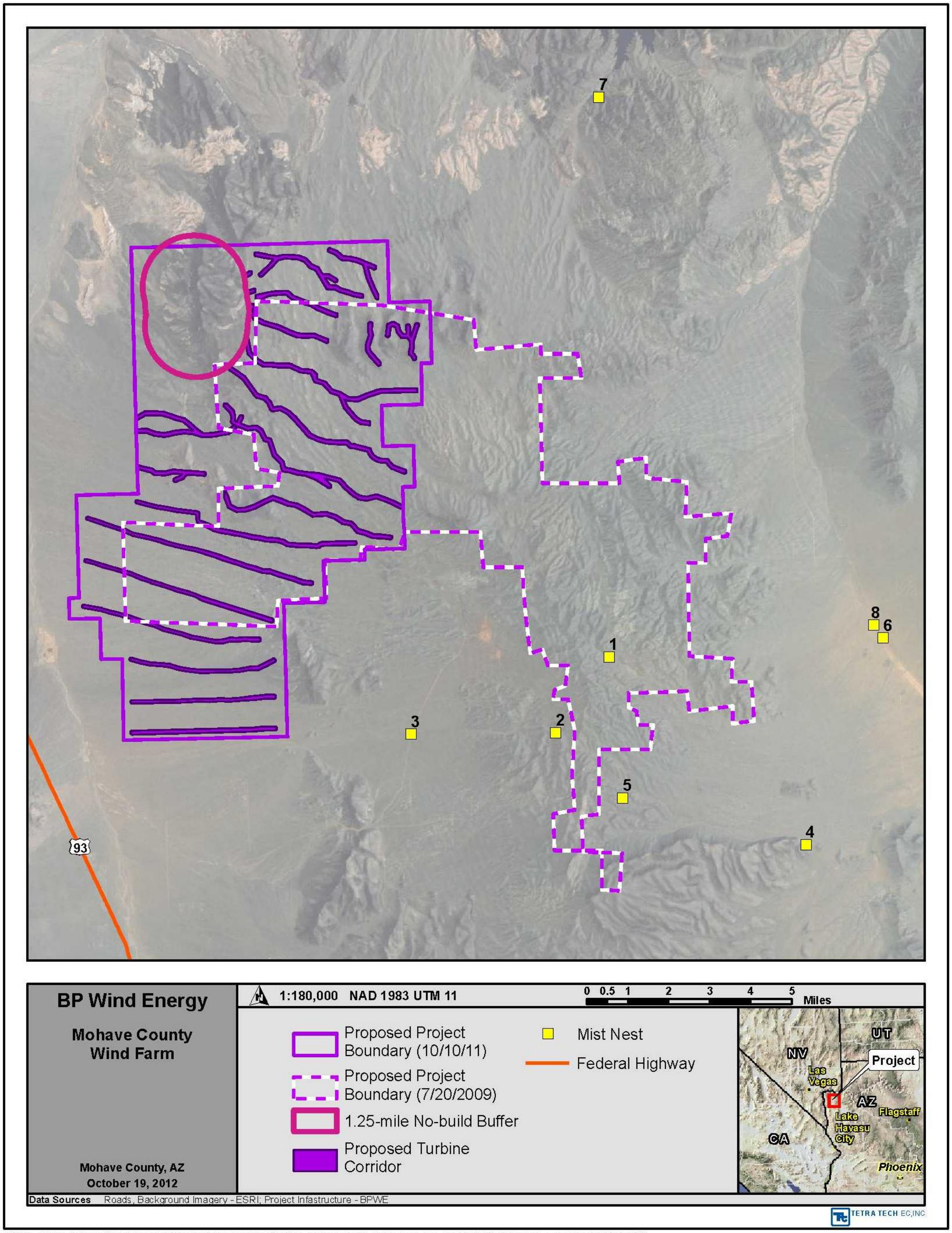

Figure 7. Bat Mist-net Study Locations

3 RISK ASSESSMENT

The following sections describe risk to bats at the Project Area (Alternative A), with additional details provided with respect to the two BLM Sensitive bat species detected (Allen's big-eared bat and greater western mastiff bat) and the two AZGFD Tier 1A or 1B species detected (Brazilian free-tailed bat and greater western mastiff bat, both SGCN Tier 1B). These categories of bats were chosen because the Project is on BLM land, the majority of bat activity within the Project Area is due to Brazilian free-tailed bats and because SGCN Tier 1A and Tier 1B species are classified as Vulnerable and therefore are of highest management concern.

3.1 Collision and Barotrauma

Bat mortality can occur at wind farms due to collisions with turbine blades and possibly from barotrauma (Kunz et al. 2007a,b, Arnett et al. 2009b); barotrauma is tissue damage to the lungs as a result of rapid air-pressure reduction near moving turbine blades (Baerwald et al. 2008, Rollins et al. 2012). Specific details about the causal factors that influence bat collisions with structures or mortality at a particular wind energy facility remain unknown (Crawford and Baker 1981, Barclay et al. 2007, Kunz et al. 2007a, Horn et al. 2008, Cryan and Barclay 2009). Although some authors suggest a link between activity and mortality (Arnett et al. 2008), other studies suggest that mortality is more influenced by environmental factors, such as wind speed, temperature, wind direction, and bat behavior (Cryan 2008, Baerwald and Barclay 2011, Strickland et al. 2011 and citations therein). Alternatively, some researchers hypothesize that bats may be attracted to wind turbines due to mating behavior, food availability, or other causes (Cryan 2008).

As the relationship between activity and mortality has yet to be clearly identified, we assume that regional fatality patterns are indicative of potential risk at the Project Area. Bat fatality rates at wind energy facilities in desert regions (defined as having < 20 inches [50 cm] annual precipitation; University of California Museum of Paleontology 2012) in the western U.S. range from 0.24 to 13.40 bats per turbine per year (mean: 2.95 bats/turbine/year, 95 percent confidence interval: 1.49 – 4.40 bats/turbine/year; Table 3a). When measured per MW, bat fatality rate values range from 0.16 to 4.3 bats per MW per year (mean: 1.40 bats/MW/year, 95 percent confidence interval: 0.85 – 1.84 bats/MW/year; Table 3a). These values are similar to those from other western facilities outside of desert regions, but are considerably lower than the national average, largely due to higher bat mortality at facilities in the eastern U.S. (Table 3b). Of the 15 bat species documented in the Project Area, Brazilian free-tailed bat, hoary bat, western red bat, silver-haired bat, big free-tailed bat, and big brown bat have been found during fatality searches at wind projects (Thompson et al. 2011a, Tetra Tech 2012). Of these species, the migratory tree bats (hoary bat, silver-haired bat, western red bat) and free-tailed bats are considered to be at the greatest risk from wind energy projects (Tierney 2009).

There is little habitat available in the Project Area that would attract bats and put them at risk of collision. Attractive foraging areas, such as perennial water and riparian corridors, are not known to occur in the Project Area (O'Farrell 2012; Appendix A). Roost habitats for cave-roosting bats such as abandoned mines are not known to occur in the Project Area, although there are numerous mines east of the Project Area. Rock outcroppings may provide roosts and hibernacula for cave and crevice-roosting bats in the Project Area.

Table 3a. Estimates of Mean Bat Fatalities per Turbine and per Megawatt at Wind Facilities in Desert Regions of the Western U.S.

WIND FACILITY, STATE	REGION	ESTIMATED BAT FATALITIES /TURBINE/YEAR	ESTIMATED BAT FATALITIES /MW/YEAR	DOCUMENTED BAT SPECIES FATALITIES
Big Horn, WA (Kronner et al. 2008)	Western Desert	2.86	1.9	Silver-haired, hoary, big brown, unidentified Myotis
Biglow Canyon Phase I (2008), OR (Jeffrey et al. 2009)	Western Desert	3.29	1.99	Silver-haired, hoary
Biglow Canyon Phase I (2009), OR (Enk et al. 2010)	Western Desert	0.96	0.58	Silver-haired, hoary, unidentified
Biglow Canyon Phase II (2009/2010), OR (Enk et al. 2011)	Western Desert	6.24	3.78	Hoary, silver-haired, unidentified, unidentified myotis
Biglow Canyon Phase II (2010/2011), OR (Enk et al. 2012)	Western Desert	1.32	0.57	Hoary, silver-haired, unidentified
Biglow Canyon Phase III (2010/2011), OR (Enk et al. 2012)	Western Desert	0.51	0.22	Hoary, silver-haired
Dry Lake I, AZ (Thompson et al. 2011b)	Western Desert	9.01	4.3	Hoary, Brazilian free-tailed, unidentified bat, silver-haired, big free-tailed, pocketed free-tailed
Elkhorn Valley, OR (Jeffrey et al. 2009)	Western Desert	2.07	1.26	Hoary, silver-haired, little brown, big brown, unidentified
Foote Creek Rim, Phase I, WY (Young et al. 2003)	Western Desert	1.34	-	Hoary, little brown, silver-haired, big brown, unidentified
High Winds (2003-2005), CA (Kerlinger et al. 2006)	Western Desert	3.63	2.02	Hoary, Brazilian free-tailed, western red bat, and silver-haired bat
Hopkins Ridge, WA (Young et al. 2007)	Western Desert	1.13	-	Silver-haired, hoary, big brown, little brown, unidentified
Judith Gap, MT (TRC Environmental 2008)	Western Desert	13.4	-	Hoary, silver-haired, unidentified
Klondike I, OR (Johnson et al. 2003)	Western Desert	1.16	-	Hoary, silver-haired, unidentified myotis
Klondike II, OR (NWC and WEST 2007)	Western Desert	0.63	0.41	Silver-haired, big brown, hoary
Klondike III Phase 1 (2007-2008), OR (Gritski et al. 2009)	Western Desert	2.24	1.26	Silver-haired, hoary, big brown, unidentified
Klondike III Phase 1 (2007-2009), OR (Gritski et al. 2010)	Western Desert	2.07	1.17	Silver-haired, hoary, big brown, unidentified
Klondike IIIa Phase 2 (2008-2010), OR (Gritski et al. 2011)	Western Desert	0.24	0.16	Hoary
Nine Canyon, WA (Erickson et al. 2003)	Western Desert	3.21	-	Silver-haired, hoary
Tuolumne (Windy Point), WA (Enz and Bay 2010 as cited in Johnson and Erickson 2011)	Western Desert	-	0.94	-
Wild Horse, WA (Erickson et al. 2008)	Western Desert	0.7	0.39	Hoary, silver-haired, little brown
Average for Western Facilities in Desert Regions		**2.95**	**1.40**	

Table 3b. Estimates of Mean Bat Fatalities per Turbine and per Megawatt at Wind Facilities Nationally in the U.S.

WIND FACILITY, STATE	REGION	ESTIMATED BAT FATALITIES /TURBINE/YEAR	ESTIMATED BAT FATALITIES /MW/YEAR	DOCUMENTED BAT SPECIES FATALITIES
Ainsworth, NE (Derby et al. 2007)	Western	1.91	1.16	Hoary, unidentified, big brown and eastern red
Big Horn, WA (Kronner et al. 2008)	Western Desert	2.86	1.9	Silver-haired, hoary, big brown, unidentified myotis
Biglow Canyon Phase I (2008), OR (Jeffrey et al. 2009)	Western Desert	3.29	1.99	Silver-haired, hoary
Biglow Canyon Phase I (2009), OR (Enk et al. 2010)	Western Desert	0.96	0.58	Silver-haired, hoary, unidentified
Biglow Canyon Phase II (2009/2010), OR (Enk et al. 2011)	Western Desert	6.24	3.78	Hoary, silver-haired, unidentified, unidentified myotis
Biglow Canyon Phase II (2010/2011), OR (Enk et al. 2012)	Western Desert	1.32	0.57	Hoary, silver-haired, unidentified
Biglow Canyon Phase III (2010/2011), OR (Enk et al. 2012)	Western Desert	0.51	0.22	Hoary, silver-haired
Blue Sky Green Field, WI (Gruver et al. 2009)	Eastern	40.54	24.57	Little brown, silver-haired, big brown, hoary, eastern red and unidentified
Buffalo Gap II, TX (Tierney 2009)	Western	0.21	0.14	Hoary, Mexican free-tailed, unidentified
Buffalo Mountain Expanded, Inclusive Phases (2005), TN (Fiedler et al. 2007)	Eastern	63.9	39.7	Eastern red, eastern pipistrelle, hoary bat, silver-haired, big brown, Seminole, unidentified
Buffalo Mountain Phase I (2000-2003), TN (Nicholson et al 2005)	Eastern	20.82	31.54	Eastern red, eastern pipistrelle, hoary bat, silver-haired, big brown, Seminole
Buffalo Ridge Phase I (1996-1999), MN (Johnson et al. 2000)	Eastern	0.26	-	Hoary, eastern red, silver-haired, eastern pipistrelle, little brown, big brown
Buffalo Ridge Phase II (1998-1999), MN (Johnson et al. 2000)	Eastern	1.78	-	Hoary, eastern red, silver-haired, eastern pipistrelle, little brown, big brown
Buffalo Ridge Phase III (1999), MN (Johnson et al. 2000)	Eastern	2.04	-	Hoary, eastern red, silver-haired, eastern pipistrelle, little brown, big brown
Casselman, PA (Arnett et al. 2009)	Eastern	32.3	-	Hoary, silver-haired, eastern red, eastern pipistrelle, little brown, big brown
Cedar Ridge (2009), WI (BHE Environmental 2010)	Eastern	50.5	30.4	Hoary, silver-haired, big brown, eastern red, little brown

Table 3b. Estimates of Mean Bat Fatalities per Turbine and per Megawatt at Wind Facilities Nationally in the U.S. (continued)

WIND FACILITY, STATE	REGION	ESTIMATED BAT FATALITIES /TURBINE/YEAR	ESTIMATED BAT FATALITIES /MW/YEAR	DOCUMENTED BAT SPECIES FATALITIES
Cedar Ridge (2010), WI (BHE Environmental 2011)	Eastern	39.8	-	Eastern red, hoary, silver-haired, big brown, little brown, unknown
Crescent Ridge, IL (Poulton 2010)[1]	Eastern	2.67 (fall), 0.18 (August)	1.75 (fall), 0.12 (August)	Silver-haired, hoary, eastern red, unidentified
Dry Lake I, AZ (Thompson et al. 2011b)	Western Desert	9.01 (6.62, 12.36)	4.3	Hoary, Brazilian free-tailed, unidentified bat, silver-haired, big free-tailed, pocketed free-tailed
Elkhorn Valley, OR (Jeffrey et al. 2009)	Western Desert	2.07	1.26	Hoary, silver-haired, little brown, big brown, unidentified
Foote Creek Rim, Phase I, WY (Young et al. 2003)	Western Desert	1.34	-	Hoary, little brown, silver-haired, big brown, unidentified
Forward Energy, WI (Grodsky and Drake 2011)	Eastern	23.44	15.63	Hoary, silver-haired, eastern red, unidentified, little brown, big brown
High Winds (2003-2005), CA (Kerlinger et al. 2006)	Western Desert	3.63	2.02	Hoary, Brazilian free-tailed, western red bat, and silver-haired bat
Hopkins Ridge, WA (Young et al. 2007)	Western Desert	1.13	-	Silver-haired, hoary, big brown, little brown, unidentified
Judith Gap, MT (TRC Environmental 2008)	Western Desert	13.4	-	Hoary, silver-haired, unidentified
Kewaunee County, WI (Howe et al. 2002)	Eastern	4.26	6.45	Red, Hoary (no other listed)
Klondike I, OR (Johnson et al. 2003)	Western Desert	1.16	-	Hoary, silver-haired, unidentified myotis
Klondike II, OR (NWC and WEST 2007)	Western Desert	0.63	0.41	Silver-haired, big brown, hoary
Klondike III Phase 1 (2007-2008), OR (Gritski et al. 2009)	Western Desert	2.24	1.26	Silver-haired, hoary, big brown, unidentified
Klondike III Phase 1 (2007-2009), OR (Gritski et al. 2010)	Western Desert	2.07	1.17	Silver-haired, hoary, big brown, unidentified
Klondike IIIa Phase 2 (2008-2010), OR (Gritski et al. 2011)	Western Desert	0.24	0.16	Hoary
Maple Ridge (2008), NY (Jain et al. 2009)	Eastern	8.18	4.96	Hoary, silver-haired, eastern red, little brown, big brown
Mars Hills (2007), ME (Poulton 2010)	Eastern	0.43	0.29	Silver-haired, hoary, eastern red, little brown
Mars Hills (2008), ME (Poulton 2010)	Eastern	0.68	0.45	Silver-haired, hoary, eastern red, little brown

Table 3b. Estimates of Mean Bat Fatalities per Turbine and per Megawatt at Wind Facilities Nationally in the U.S. (continued)

WIND FACILITY, STATE	REGION	ESTIMATED BAT FATALITIES /TURBINE/YEAR	ESTIMATED BAT FATALITIES /MW/YEAR	DOCUMENTED BAT SPECIES FATALITIES
Meyersdale, PA (Arnett et al. 2005)[2]	Eastern	7.7 - 16.4 (6 weeks)	-	Hoary, eastern red, eastern pipistrelle, big brown, silver-haired, little brown, unidentified, northern long-eared, unidentified myotis
Moutaineer, WV (Kerns and Kerlinger 2004)	Eastern	47.35	-	Hoary, eastern pipistrelle, little brown, silver-haired, northern long-eared, big brown, unidentified
Nine Canyon, WA (Erickson et al. 2003)	Western Desert	3.21	-	Silver-haired, hoary
Oklahoma, OK (Piorkowski and O'Connell 2010)[3]	Western	-	0.79 - 1.06	Brazilian free-tailed, hoary bat, eastern red, eastern pipistrelle, cave myotis, silver-haired, big brown
Stateline (2001-2003), OR/WA (Erickson et al. 2004)	Western	1.12	-	Silver-haired, hoary, big brown, unidentified, little brown
Stateline (2006), OR/WA (Erickson et al. 2007)	Western	0.63	-	Hoary, silver-haired
Top of Iowa (2003-2004), IA (Jain 2005, Jain et al. 2011)	Western	4.45 (2003), 7.14 (2004)	4.94 (2003), 7.94 (2004)	Hoary, little brown, eastern red, big brown, silver-haired
Tuolumne (Windy Point), WA (Enz and Bay 2010 as cited in Johnson and Erickson 2011)	Western Desert	-	0.94	-
Vansycle, OR (Erickson et al. 2000)	Western	0.74	-	Hoary, silver-haired, little brown, unidentified bat
Wild Horse, WA (Erickson et al. 2008)	Western Desert	0.7	0.39	Hoary, silver-haired, little brown
Average for All Western Facilities		**2.78**	**1.85**	
Range for Western Facilities (NWCC 2010 values)		**0.2 – 13.4**	**0.1 – 7.9 (0.9 – 11.0)**	
U.S. National Average		**9.96**	**6.75**	
Range for National Facilities (NWCC 2010 values)		**0.2 – 63.9**	**0.1 – 39.7 (0.9 – 39.0)**	

1. Excluded from national average because values were calculated per season.
2. Excluded from national average because values presented are for a 6 week period.
3. Excluded from western and national average because a range of values presented.

3.1.1 Migratory Tree Bats

Long-distance migratory bat species, primarily tree or tree-cavity roosting bats, have experienced the highest fatality rates at wind energy facilities in North America, particularly during the late summer/early fall season (Table 3; Kunz et al. 2007a). Three species of migratory, tree-roosting bats – the hoary bat, silver-haired bat, and eastern red bat – comprise 77 percent of bat fatalities found during post-construction fatality studies (Strickland et al. 2011). These species undertake annual migrations and peaks in fatality rates appear to coincide with increasing bat activity levels associated with the southward migration (Cryan 2003, Arnett et al. 2008).

Migratory tree bats accounted for a low proportion of overall activity across all detectors in the Study Area, and accounted for less than 1.0 percent of activity in the Project Area. The hoary bat is an uncommon, but widespread migratory tree bat and was recorded at all stations and heights except for two ground-level stations in 2007. Hoary bat accounted for 0.8 percent of the overall Index of Activity among sampling locations 2007-2011. Silver-haired bat and western red bat were also recorded (combined 0.03 percent of overall Index of Activity), although less frequently than hoary bat, and only at ground level stations. The exposure of migratory tree-roosting bats to collision at the Project will likely be low given the low frequency of use with respect to other species at the Project and use measured at other similar areas (Figure 8), and the lack of suitable roosting habitat. However, even facilities with little roosting habitat have detected fatalities of these species (Jeffrey et al. 2009, Tierney 2009, Thompson et al. 2011b), particularly during the migration period. Nonetheless, Project-related fatalities of these species likely have little potential to impact population stability.

3.1.2 BLM Sensitive Species

Allen's big-eared bat and greater western mastiff bat were detected in the Project Area and are both BLM Sensitive species (BLM 2010). Allen's big-eared bat occurs in much of Arizona but is thought to reside primarily in high elevation coniferous forests, especially pine-oak habitat (Hoffmeister 1986, Hinman and Snow 2003), although it is known to use abandoned mines for day roosts and has been found in lower elevation Mojave Desert Scrub. In Arizona, Allen's big-eared bat is roughly estimated to have a statewide population range between 1,000-10,000 individuals based on State Heritage Status Ranking (S2S3, AZGFD 2012a), although population trends are very poorly known (AZGFD 2001). Allen's big-eared bat was detected once during early fall within the central-eastern portion of the Project Area. Additionally, three Allen's big-eared bats were captured during the mist-netting surveys in summer 2007 outside of the Project Area. Together, this may suggest a small number of breeding individuals in or near the Study Area. No fatalities of Allen's big-eared bat have been found during post-construction fatality surveys at other wind farms in the region (Arnett et al. 2008, Thompson et al. 2011b). However, Allen's big-eared bat is restricted to Arizona and New Mexico where few wind facilities have been constructed, and if fatalities of this species are rare events they may not have been detected. Nonetheless, because this species has not been recorded as a fatality at other wind farms in the region (Kerlinger 2006, Tierney 2009; Table 3; O'Farrell 2012; Appendix A), the species was active at very low levels (0.005 percent of overall Index of Activity) in the Study Area, and it was not recorded flying near the RSA during acoustic monitoring in the Study Area, there is likely a low potential for collision fatalities. The estimated low potential for fatalities would not be likely to cause population-level impacts.

Greater western mastiff bat is a BLM Sensitive species as well as a SGCN Tier 1B. It is the largest bat in the U.S. and is found throughout much of Arizona and the southwest (Hoffmeister 1986, Hinman and Snow 2003). This is a fast, high-flying species that primarily roosts in crevices in cliff faces and boulders and is considered a year-round resident (Best et al. 1996, Hinman and Snow 2003). This species can travel over long distances to forage and seems to prefer foraging over large bodies of water (Best et al. 1996). In Arizona, greater western mastiff bat is roughly estimated to have a statewide population range between 3,000-10,000 individuals based on State Heritage Status Ranking (S3, AZGFD 2012a), although population trends are poorly known (AZGFD 2002). Greater western mastiff bat was detected throughout the Project Area but was active at very low levels (0.06 percent of overall Index of Activity), and was only detected once at a high detector. No fatalities of greater western mastiff bat have been found during post-construction fatality surveys at other wind farms in the region (Arnett et al. 2008, Thompson et al. 2011b). Although it is a high-flying bat and may occur within the RSA, fatalities of the species have a low probability of occurrence based on its low activity level within the Project Area; therefore, population impacts are not anticipated

3.1.3 AZ SGCN Tier 1A and Tier 1B Species

No Tier 1A bat species were detected during any bat survey, but two Tier 1B species were detected, the Brazilian free-tailed bat and the greater western mastiff bat (see Section 3.1.2). The Brazilian free-tailed bat was the most active species recorded during the pre-construction bat acoustic monitoring surveys (80.6 percent of the overall index of activity; Figure 5), with Index of Activity peaking in early spring (March, April, and May, Figure 9). However, the level of use recorded at the Project is relatively low compared to similar areas in the region (Figure 8). The Brazilian free-tailed bat is a ubiquitous species throughout the southwest and is a fast and high flying bat (McCracken and Gassel 1997, Horn and Kunz 2008). The species occurs in a variety of habitat types across its range, but southwestern populations usually roost in caves and undertake long-distance seasonal migrations (Harvey et al. 2011).

Due to the distribution of Brazilian free-tailed bat across the Project Area, the documentation of the species at the high detectors within the RSA, and the fact that this species has been found in fatality monitoring at other wind projects (Kerlinger et al. 2006, Tierney 2009), fatalities of this species are likely to occur. Project-related fatalities have a low potential to impact the population because the population of Brazilian free-tailed bats in northern Arizona is estimated to have at least 10,000 individuals based on State Heritage Status Ranking (S3S4, AZGFD 2012a), and the population appears to be stable (AZGFD 2004). Additionally, a roost numbering in the hundreds of thousands of bats was recently discovered in Mohave County, Arizona; possibly one of the largest roosts of Brazilian free-tailed bats in Arizona (A. McIntire, AZGFD, personal communication, July 26, 2012). Furthermore, the regional population of Brazilian free-tailed bats in the southern U.S. and adjacent Mexico may be in the hundreds of millions (Keeley and Keeley 2004, Betke et al. 2008, Geluso 2008, Horn and Kunz 2008, Harvey et al. 2011).

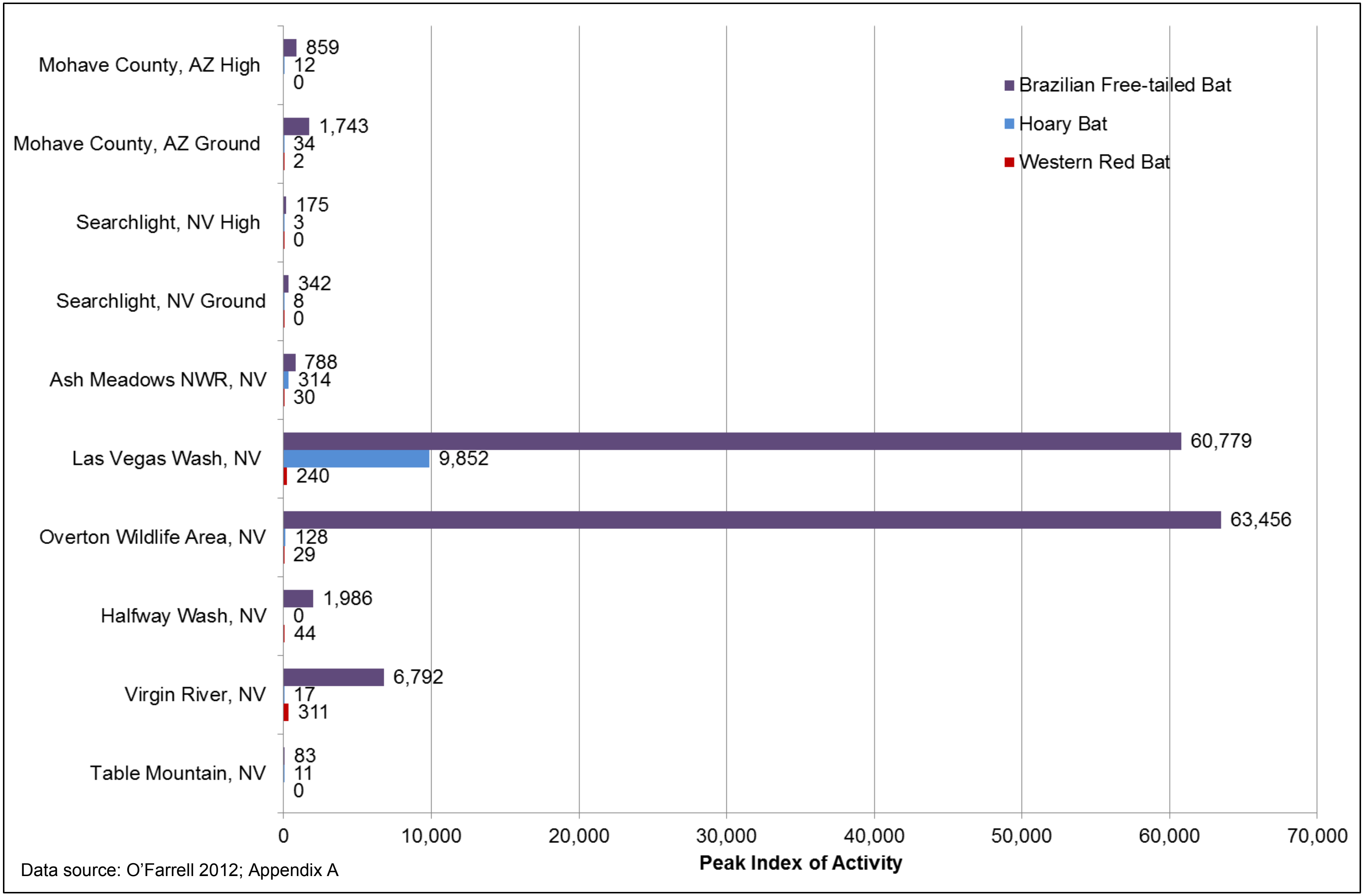

Figure 8. A Summary of Index of Activity for Brazilian Free-tailed Bat, Hoary Bat, and Western Red Bat from Acoustic Studies That Have Been Conducted at Low to Medium Elevations in Clark County, Nevada Compared with the Project.

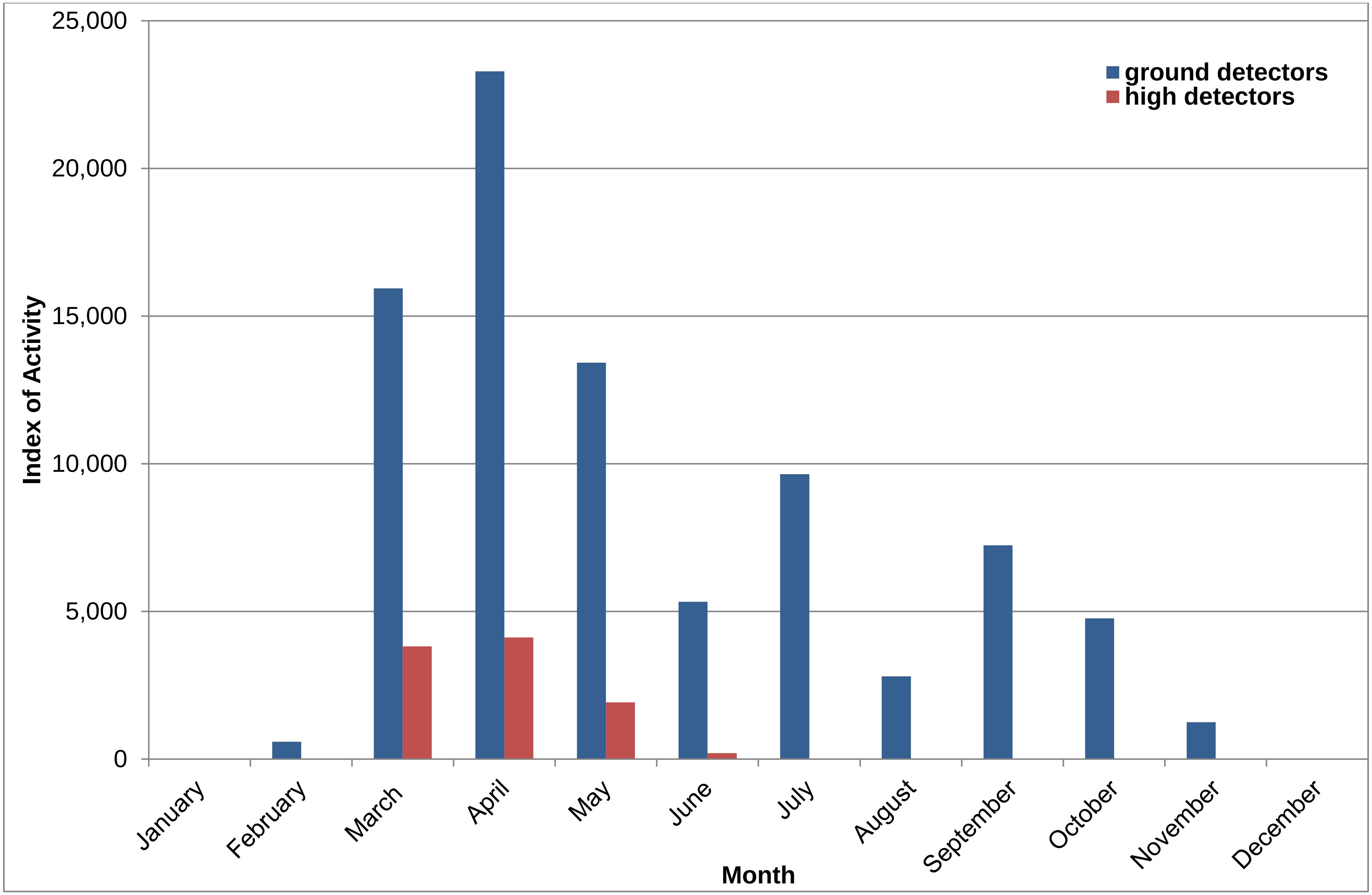

Figure 9. Bat Activity for All Species Combined by Month and Detector Height 2007-2011 at the Mohave County Wind Study Area

3.2 Habitat Loss, Fragmentation and Disturbance/Displacement

The impacts of habitat fragmentation from wind development on bats are not well-known (Arnett et al. 2007, Kuvlesky et al. 2007). Bat foraging habitat occurs within the Project Area in the form of desert scrub with ephemeral washes but there are no permanent water sources. Because bats in the arid southwest are adapted to open desert habitat, it is unlikely that alterations to desert scrub will impact bats in the area because resource distribution in this type of habitat is already sparse and uneven. Furthermore, the majority of the Project falls within the low value category in the Habimap unfragmented areas model (AZGFD 2012b), indicating a high degree of fragmentation. Therefore, changes in resource availability are unlikely to elicit substantial changes in foraging or migration strategy and the habitat types on the Project are widely distributed throughout the County (Lewis 1995, Fenton 1997). Given the sparse nature of the habitat, existing uses (multiple-use including off road vehicle activity), and historical land uses (mining) of the Project Area, the local bat community should not be adversely affected by any habitat loss or fragmentation caused by the Project.

Abandoned mines suitable for roosts, maternity colonies, and hibernacula exist in the vicinity of but not within, the Project Area. The majority of bat species (11 of 15 that occur in the Project Area), including the BLM Sensitive species Allen's big-eared bat and greater western mastiff bat, are known to use rock crevices, at least as seasonal day roosts (Harvey et al. 2011, Bat Conservation International [BCI] 2012). The Project Area was selected to avoid impacts to areas that may be used by rock-crevice roosting bat species. The northwestern portion of the Project area and scattered portions of the far northeastern portion of the Project Area support cliff habitat or rock outcroppings (BLM 2012, Map 3-6). The majority of the volcanic rockland in the northwestern portion of the Project Area is included in the 1.25-mile no-build buffer. In addition, the bedrock cliff outcrop habitat in the northeastern corner of the Project Area is very limited in extent and comprised of narrow north to south oriented areas. Collectively, construction impacts in these areas will be minimal. Blasting during installation of the turbines is expected to be short in duration and limited to the extent practicable for Project implementation. Therefore, any potential impacts to bats roosting in rock crevices or shelters in the Project Area during construction will be limited in scale and duration and are unlikely to cause fatalities. No impacts to abandoned mines will occur; therefore, there will be no impacts to those bats using abandoned mines, in the Project Area and vicinity, as hibernacula, day roosts, or maternity colonies.

Disturbance and displacement have not been identified as risks associated with bats and wind farms in reviews of bat-wind turbine impacts (Kunz et al. 2007b, NWCC 2010). Construction and operation activity may change the noise environment in the Project Area during daylight hours; however, current recreational uses include off-road vehicle traffic (including all-terrain vehicles), therefore increases in ambient day-time noise levels due to Project related vehicle traffic are likely to be minimal and short in duration. The proposed turbines are not in close proximity to potential roost sites (including abandoned mines and areas of high quality rocky habitat), where bats could be susceptible to disturbance.

Bats are known to habituate to anthropogenic structures (Keeley and Tuttle 1999). The Brazilian free-tailed bat roosts in large numbers in relatively few roosts, and may therefore be more vulnerable to human disturbance than bats with populations diffused among many roosts across the landscape. Documented disturbances to Brazilian free-tailed bats, however, have primarily been caused by human visitation and exploitation (e.g., for guano mining) of caves hosting large roosts (McCracken 1997). Given the history of extensive mining in the vicinity of the Project Area and the lack of mines within the Project Area, we expect that the local bat community will remain in the area at similar population levels after construction of the Project.

4 PROJECT PLANNING AND DESIGN MEASURES

This section identifies impact avoidance, minimization, and mitigation measures that have been or shall be incorporated into planning and design for the Project. Parallel measures considered during construction and operations are described in Sections 5 and 6, respectively.

This section identifies bat impact avoidance and minimization measures that BP Wind Energy has committed to:

- Due to concerns regarding potential impacts to nesting golden eagles, BP Wind Energy is voluntarily implementing a no-build buffer distance of 1.25 miles (2.0 km) around the known active and alternate nests of the Squaw Peak golden eagle breeding area within the Project boundary. This buffer will result in the removal of all turbines within 1.25 (2.0 km) miles of the nests, regardless of the final Alternative selected, and is expected to provide avoidance and minimization benefits to bats by reducing the risk of collision in an area of locally higher bat activity than other portions of the Project Area (see Section 2.1, Figure 3).
- Both Alternatives B and C reduce the maximum number of turbines to 208 by removing turbines from the northwestern (Alternative B) edge or southern edge (Alternative C) of the Project area but differ in the location of the turbine strings (BLM 2012). Either development alternative would result in potential avoidance and minimization of impacts to bats due to the reduction in turbine numbers.
- All permanent meteorological towers shall be equipped with pulleys to enable future installation of bat monitoring equipment if needed.

This section identifies Best Management Practices (BMPs) as identified in Appendix B of the Draft EIS (BLM 2012):

- The area disturbed by installation of meteorological towers (i.e., footprint) shall be kept to a minimum.
- Meteorological towers shall not be located in sensitive habitats or in areas where ecological resources known to be sensitive to human activities are present. Installation of towers shall be scheduled to avoid disruption of wildlife reproductive activities or other important behaviors.
- Meteorological towers installed for site monitoring and testing shall be inspected periodically for structural integrity.
- The Project shall be planned to utilize existing roads and utility corridors to the maximum extent feasible, and to minimize the number and length/size of new roads, lay-down

areas, and borrow areas. If new roads are necessary, they shall be designed and constructed to the appropriate standard.

- BP Wind Energy shall review existing information on species and habitats in the vicinity of the Project Area to identify potential concerns.
- BP Wind Energy shall conduct surveys for federal and/or state-protected species and other species of concern (including special status plant and animal species) within the Project Area and design the Project to avoid (if possible), minimize, or mitigate impacts to these resources.
- BP Wind Energy shall identify important, sensitive, or unique habitats in the vicinity of the Project and design the Project to avoid (if possible), minimize, or mitigate impacts to these habitats (e.g., locate the turbines, roads, and ancillary facilities in the least environmentally sensitive areas; i.e., away from riparian habitats, streams, wetlands, drainages, or critical wildlife habitats).
- The BLM shall prohibit the disturbance of any population of federally listed plant species.
- BP Wind Energy shall evaluate bat use of the Project Area and design the Project to minimize or mitigate the potential for bat strikes (e.g., development shall not occur in riparian habitats and wetlands). Scientifically rigorous bat use surveys shall be conducted.
- BP Wind Energy shall determine the presence of bat colonies and avoid placing turbines near known bat hibernation, breeding, and maternity/nursery colonies.
- A habitat restoration plan shall be developed to avoid (if possible), minimize, or mitigate negative impacts on vulnerable wildlife while maintaining or enhancing habitat values for other species. The plan shall identify revegetation, soil stabilization, and erosion reduction measures that shall be implemented to ensure that all temporary use areas are restored. The plan shall require that restoration occur as soon as possible after completion of activities to reduce the amount of habitat converted at any one time and to speed up the recovery to natural habitats.
- Procedures shall be developed by BP Wind Energy to mitigate potential impacts to special status species. Such measures could include avoidance, relocation of Project facilities or lay-down areas, and/or relocation of biota.
- If pesticides are used on the site, an integrated pest management plan shall be developed to ensure that applications would be conducted within the framework of BLM and Department of Interior (DOI) policies and entail only the use of Environmental Protection Agency (EPA)-registered pesticides. Pesticide use shall be limited to non-persistent, immobile pesticides and shall only be applied in accordance with label and application permit directions and stipulations for terrestrial and aquatic applications.
- “Good housekeeping” procedures shall be developed by BP Wind Energy to ensure that during operation the site shall be kept clean of debris, garbage, carrion, fugitive trash or waste, and graffiti; to prohibit scrap heaps and dumps; and to minimize storage yards.

- BP Wind Energy shall develop a fire management strategy to implement measures to minimize the potential for a human-caused fire.
- BP Wind Energy shall develop a plan for control of noxious weeds and invasive species, which could occur as a result of new surface disturbance activities at the site. The plan shall address monitoring, education of personnel on weed identification, the manner in which weeds spread, and methods for treating infestations.
- An environmental monitoring program shall be developed to ensure that environmental conditions are monitored during the construction, operation, and decommissioning phases. The monitoring program requirements, including adaptive management strategies, shall be established at the project level to ensure that potential adverse impacts of wind energy development are mitigated. The monitoring program shall identify the monitoring requirements for each environmental resource present at the site, establish metrics against which monitoring observations can be measured, identify potential mitigation measures, and establish protocols for incorporating monitoring observations and additional mitigation measures into standard operating procedures and BMPs.

This section identifies mitigation measures as identified in chapter 4 of the Draft EIS:

- Minimizing surface area disturbance, controlling erosion, applying dust suppression practices, and returning disturbed areas as close as possible to the original condition, including grade and vegetation.

5 CONSTRUCTION MEASURES

This section identifies wildlife impact avoidance and minimization measures that shall be incorporated during construction of the Project. Parallel measures considered during siting and operations are described in Sections 4 and 6, respectively.

This section identifies bat impact avoidance and minimization measures that BP Wind Energy has committed to:

- Due to concerns regarding potential impacts to nesting golden eagles, BP Wind Energy is voluntarily implementing a no-build buffer distance of 1.25 miles (2.0 km) around the known active and alternate nests of the Squaw Peak golden eagle breeding area within the Project boundary. This buffer will result in the removal of all turbines within 1.25 (2.0 km) miles of the nests, regardless of the final Alternative selected, and is expected to provide avoidance and minimization benefits to bats by reducing the risk of collision in an area of locally higher bat activity than other portions of the Project Area (see Section 2.1, Figure 3).

This section identifies Best Management Practices (BMPs) as identified in Appendix B of the Draft EIS (BLM 2012):

- The area disturbed by construction and operation of the Project (i.e., footprint) shall be kept to a minimum.

- The number and size/length of roads, temporary fences, lay-down areas, and borrow areas shall be minimized.
- Topsoil from all excavations and construction activities shall be salvaged and reapplied during reclamation.
- In accordance with the Integrated Reclamation Plan and Noxious Weed Management Plan plan, all areas of disturbed soil shall be reclaimed using weed-free native grasses, forbs, and shrubs. Reclamation activities shall be undertaken as early as possible on disturbed areas.
- Electrical collector lines shall be buried where feasible in a manner that minimizes additional surface disturbance (e.g., along roads or other paths of surface disturbance). Overhead lines may be used in cases where burial of lines would result in further habitat disturbance or where burial of lines is not feasible.
- Guy wires on permanent meteorological towers shall be avoided, however, may be necessary on temporary meteorological towers installed during site monitoring and testing.
- As a part of worker environmental training, all construction employees shall be instructed to avoid harassment and disturbance of wildlife, especially during reproductive (e.g., courtship and nesting) seasons. In addition, pets shall not be permitted on-site during construction.
- Project personnel and contractors shall be instructed and required to adhere to speed limits commensurate with road types, traffic volumes, vehicle types, and site-specific conditions, to ensure safe and efficient traffic flow and to reduce wildlife collisions and disturbance.
- BP Wind Energy shall develop a fire management strategy to implement measures to minimize the potential for a human-caused fire.
- Erosion, stormwater runoff, and transport of sediment and other contaminants shall be minimized through implementation of a stormwater pollution prevention plan, which shall be developed as a requirement of the construction stormwater permit required for the Project.
- If pesticides are used on the site, an integrated pest management plan shall be developed to ensure that applications would be conducted within the framework of BLM and DOI policies and entail only the use of EPA-registered pesticides. Pesticide use shall be limited to non-persistent, immobile pesticides and shall only be applied in accordance with label and application permit directions and stipulations for terrestrial and aquatic applications.
- BP Wind Energy shall develop a plan for control of noxious weeds and invasive species, which could occur as a result of new surface disturbance activities at the site. The plan shall address monitoring, education of personnel on weed identification, the manner in which weeds spread, and methods for treating infestations.

- A habitat restoration plan shall be developed to avoid (if possible), minimize, or mitigate negative impacts on vulnerable wildlife while maintaining or enhancing habitat values for other species. The plan shall identify revegetation, soil stabilization, and erosion reduction measures that shall be implemented to ensure that all temporary use areas are restored. The plan shall require that restoration occur as soon as possible after completion of activities to reduce the amount of habitat converted at any one time and to speed up the recovery to natural habitats.
- A monitoring program shall be developed to ensure that environmental conditions are monitored during the construction, operation, and decommissioning phases. The monitoring program requirements, including adaptive management strategies, shall be established at the project level to ensure that potential adverse impacts of wind energy development are mitigated. The monitoring program shall identify the monitoring requirements for each environmental resource present at the site, establish metrics against which monitoring observations can be measured, identify potential mitigation measures, and establish protocols for incorporating monitoring observations and additional mitigation measures into standard operating procedures and BMPs.

This section identifies mitigation measures as identified in chapter 4 of the Draft EIS:

- Develop and implement a spill prevention, control and countermeasures (SPCC) Plan that outlines procedures to prevent the release of hazardous substances into the environment, thereby avoiding water resource contamination. The SPCC Plan would include containment measures that would be implemented in areas where chemicals, fuel, and oil are stored. Spill response kits containing items such as absorbent pads would be located on equipment and in the on-site temporary storage facilities to respond to accidental spills.
- All noise-producing equipment and vehicles using internal combustion engines would be equipped with exhaust mufflers, air-inlet silencers where appropriate, and any other shrouds, shields, or other noise-reducing features in good operating condition that meet or exceed original factory specification. Mobile or fixed “package” equipment (e.g., arc-welders, air compressors) would be equipped with shrouds and noise control features that are readily available for that type of equipment.
- All mobile or fixed noise-producing equipment used on the Project, which is regulated for noise output by a local, state, or Federal agency, would comply with such regulation while in the course of Project activity.
- The Project will comply with all applicable federal, state and Mohave County requirements with respect to noise levels during construction and operation.

6 OPERATIONAL MEASURES

This section summarizes measures that shall be taken to avoid and minimize impacts to wildlife during long-term operation of the Project. Parallel measures considered during siting and construction are described in Sections 4 and 5, respectively.

This section identifies additional bat impact avoidance and minimization measures that BP Wind Energy has committed to:

- BP Wind Energy voluntarily committed to a multi-year monitoring framework that includes two years of standardized post-construction fatality monitoring; additional responsive monitoring as needed; standardized post-construction fatality monitoring in Years 5, 10, 15, 20, and 25; and incidental monitoring for the life of the Project. BP Wind Energy will provide agencies with an annual report each year for the life of the Project (Section 9). See Section 7 for monitoring details.

This section identifies Best Management Practices (BMPs) as identified in Appendix B of the Draft EIS (BLM 2012):

- Inoperative turbines shall be repaired, replaced, or removed in a timely manner. Requirements to do so shall be incorporated into the due diligence provisions of the rights-of-way authorization. BP Wind Energy shall be required to demonstrate due diligence in the repair, replacement, or removal of turbines; failure to do so could result in termination of the rights-of-way authorization.
- As part of the worker environmental training, employees, contractors, and site visitors shall be instructed to avoid harassment and disturbance of wildlife, especially during reproductive seasons. In addition, no pets shall be allowed on-site.
- A monitoring program shall be developed to ensure that environmental conditions are monitored during the construction, operation, and decommissioning phases. The monitoring program requirements, including adaptive management strategies, shall be established at the project level to ensure that potential adverse impacts of wind energy development are mitigated. The monitoring program shall identify the monitoring requirements for each environmental resource present at the site, establish metrics against which monitoring observations can be measured, identify potential mitigation measures, and establish protocols for incorporating monitoring observations and additional mitigation measures into standard operating procedures and BMPs.
- As part of the monitoring program, observations of potential wildlife problems, including annual wildlife fatality summaries, shall be reported to the BLM authorized officer and AZGFD area Wildlife Manager for Game Management Unit 15BW .
- BP Wind Energy shall develop a fire management strategy to implement measures to minimize the potential for a human-caused fire.
- “Good housekeeping” procedures shall be developed by BP Wind Energy to ensure that during operation the site shall be kept clean of debris, garbage, carrion, fugitive trash or waste, and graffiti; to prohibit scrap heaps and dumps; and to minimize storage yards.
- Project personnel and contractors shall be instructed and required to adhere to speed limits commensurate with road types, traffic volumes, vehicle types, and site-specific conditions, to ensure safe and efficient traffic flow and to reduce wildlife collisions and disturbance.

This section identifies mitigation measures as identified in chapter 4 of the Draft EIS:

- A site-specific worker environmental training shall be developed and implemented throughout the Project operating life. All employees and contractors working in the field shall be required to attend the environmental training session prior to working on-site. This training shall include information regarding the sensitive biological resources, restrictions, protection measures, individual responsibilities associated with the Project, and the consequences of non-compliance.
- Develop and implement a spill prevention, control and countermeasures (SPCC) Plan that outlines procedures to prevent the release of hazardous substances into the environment, thereby avoiding water resource contamination. The SPCC Plan would include containment measures that would be implemented in areas where chemicals, fuel, and oil are stored. Spill response kits containing items such as absorbent pads would be located on equipment and in the on-site temporary storage facilities to respond to accidental spills.
- The Project will comply with all applicable federal, state and Mohave County requirements with respect to noise levels during construction and operation.

7 POST-CONSTRUCTION FATALITY MONITORING

BP Wind Energy will voluntarily conduct three types of post-construction fatality monitoring throughout the life of the Project to evaluate the impacts to bats relative to expected fatality thresholds (Section 8). First, BP Wind Energy will conduct standardized post-construction fatality monitoring for the first two years of the project and at 5-year intervals thereafter starting with year 5. Second, if estimated fatality rates are greater than the anticipated thresholds, additional responsive monitoring will be conducted. Third, BP Wind Energy will also conduct incidental monitoring for the life of the Project as part of their Wildlife Incident Reporting System (WIRS).

7.1 Initial Monitoring Period

BP Wind Energy will conduct standardized post-construction fatality monitoring during the initial two years following the initiation of Project operations (Table 4). The objective of post-construction fatality monitoring is to estimate the number of bat fatalities that occur at the Project, which is based on the number of carcasses found during carcass searches conducted under operating turbines. Both the probability that a carcass persists onsite long enough to be detected by searchers (carcass persistence) and the ability of searchers to detect carcasses (searcher efficiency) can bias the number of carcasses located during standardized searches. Therefore, this post-construction monitoring plan includes (1) methods for conducting standardized carcass searches to monitor potential injuries or fatalities associated with Project operation; (2) carcass persistence trials to assess seasonal, site-specific carcass persistence; and (3) searcher efficiency trials to assess observer efficiency in finding carcasses. Annual Project fatality rates will then be calculated by correcting for the bias (i.e., underestimation) due to searcher efficiency and carcass persistence time. Full details of the standardized fatality monitoring protocol, including fatality documentation and fatality rate estimation, are provided below in Section 7.5.

7.2 Long-term Monitoring

Beginning in Year 5 and every five years thereafter, BP Wind Energy will conduct a single year of standardized post-construction fatality monitoring following the same approach used during the initial monitoring period (Table 4). Long-term monitoring surveys may have reduced level of effort for searcher efficiency and carcass persistence trials if the data suggest baseline parameters estimated during the initial monitoring period are representative over multiple years. Data collected during long-term monitoring will also be used to evaluate previously established thresholds (Section 8.1). Full details of the standardized fatality monitoring protocol, including fatality documentation and fatality rate estimation, are provided below in Section 7.5.

7.3 Responsive Monitoring

Additional post-construction fatality monitoring may occur if the designated thresholds have been exceeded during initial or long-term monitoring (See Section 8 for types of thresholds and adaptive management; Table 4). Monitoring in these years will focus on the specific season when thresholds are exceeded and the specific turbine(s) where thresholds are exceeded; therefore, effort may be reduced in temporal or spatial scales (i.e., target seasons instead of entire year or target spatial “hot spots”). As outlined in Section 8, BP Wind Energy will identify and attempt to address threshold exceedances quickly rather than waiting for the annual report.

Table 4. Post-construction Monitoring Frequency

MONITORING YEAR	TYPE OF STANDARDIZED FATALITY MONITORING PERFORMED	WIRS PERFORMED
Year 1	Initial	X
Year 2	Initial	X
Year 3	Responsive, if thresholds exceeded in previous year	X
Year 4	Responsive, if thresholds exceeded in previous year	X
Year 5	Long-term	X
Years 6-9	Responsive, if thresholds exceeded in previous year	X
Year 10	Long-term	X
Years 11-14	Responsive, if thresholds exceeded in previous year	X
Year 15	Long-term	X
Years 16-19	Responsive, if thresholds exceeded in previous year	X
Year 20	Long-term	X
Years 21-24	Responsive, if thresholds exceeded in previous year	X
Year 25	Long-term	X
Years 26-30	Responsive, if thresholds exceeded in previous year	X

7.4 Wildlife Incident Reporting System

In addition to the standardized fatality monitoring BP Wind Energy will also implement the WIRS (Appendix B), which will start immediately after commercial operation and continue for the life of the Project. WIRS is an approach BP Wind Energy uses at all operating facilities to provide a means of recording bat species found dead or injured in the Project Area by Project staff, thereby increasing the understanding of wind turbine and wildlife interactions. WIRS provides a set of standardized instructions for Mohave personnel to follow in response to wildlife incidents in the Project Area. Each incident will be documented on a data sheet and reported to the designated environmental affairs contact. The data will be logged in a tracking spreadsheet maintained by the environmental affairs team. Further detail of the protocol can be found in Appendix B. A quarterly review of the reported incidents will be undertaken by environmental affairs. This review frequency may be modified based on the results of the reporting. The WIRS will be the sole source of fatality monitoring in years without standardized fatality monitoring, but will only provide supplemental information in years with standardized fatality monitoring (Table 4). The WIRS is expected to be effective at detecting bat fatalities that occur at non-searched turbines given WIRS detection rates at other BP Wind Energy facilities. Additionally, most bat fatalities fall a short distance from the turbine (half the maximum blade-tip turbine height, Strickland et al. 2011), often landing on the turbine pad where they are more visible than in uncleared vegetation.

7.4.1 Training

Site personnel will be trained to follow WIRS procedure and fill out the WIRS reporting form (Appendix C). Additionally, posters identifying BLM Sensitive species and AZGFD SGCN Tier 1A and 1B species will be prepared and posted at the O&M Facility. Training shall be performed by qualified consultants or in-house environmental staff qualified to conduct the training. Training specifics will be described within the environmental monitoring program protocol.

7.4.2 Reporting

Any incident involving a federally threatened or endangered bat species will be reported to the USFWS, AZGFD, BLM, and Reclamation within 24 hours of identification. Any incident involving a BLM Sensitive or state threatened or endangered bat species will be reported to AZGFD, BLM, and Reclamation within 24 hours of identification.

Bat injuries or fatalities discovered by Project staff will be documented and recorded as part of the WIRS. This information will be used as a means of tracking impacts to all bats from the Project, but will not be used in fatality estimates. If injured bats are detected they will be left where found and not handled by operations staff to reduce the risk of rabies transmission.

7.5 Standardized Post-construction Fatality Monitoring

7.5.1 Technical Approach

During initial Project development, BP Wind Energy voluntarily committed to conduct 2 years of post-construction fatality monitoring to estimate the number and rate of bat fatalities at the Project. The next sections describe the process for this initial monitoring period. The same protocol will be used for long-term monitoring unless otherwise specified. This monitoring framework consists of standardized carcass searches conducted at a sample of the Project turbines. However, the number of fatalities found during searches represents a minimum number of fatalities at a project because not all fatalities that occur are found by observers. Therefore, both carcass persistence trials and searcher efficiency trials will be conducted concurrently with the fatality monitoring to account for the bias attributable to carcass removal by scavengers and searcher efficiency. Annual fatality rates (e.g., bats/turbine/year and bats/operational MW/year) will then be estimated using statistical methods that adjust the number of carcasses found for detection biases. Both per turbine and per MW estimates provide different ways of scaling fatality information to be comparable to other projects. Annual fatality rates will be calculated for all bat species combined. A separate fatality estimate will be calculated for BLM Sensitive bats as a group if sufficient numbers of this subgroup are detected (see Section 7.5.5).

The field and analytical methods proposed below are consistent with post-construction monitoring being conducted, or proposed, for other wind projects elsewhere in the U.S. (Johnson et al. 2003; Young et al. 2003; Jain et al. 2007; Arnett et al. 2005, 2009a, 2009b; Huso 2011, Strickland et al. 2011). Methods and timing outlined here may be modified over the course of the study year as Project-specific information is gained to maximize the effectiveness and efficiency of the monitoring program (e.g., search interval, number of turbines searched, plot size).

7.5.2 Standardized Carcass Searches

This section outlines the methods for the standardized carcasses searches that constitute the initial step in generating the fatality estimate (i.e., finding the carcasses under the turbines). The methods for standardized carcass searches include the sampling duration and intensity, search plot size and configuration, and fatality documentation. The resulting numbers of detected carcasses will then be adjusted to account for detection bias (see Sections 7.5.3-5).

7.5.2.1 Sampling Duration and Intensity

Standardized post-construction fatality monitoring will consist of standardized searches of 20 percent of the turbines and will be conducted for the first two years of operation and at 5-year intervals (Strickland et al. 2011). To avoid bias in the fatality estimate, turbines will be selected in a stratified random manner based on habitat type, topography, and location within the Project Area. To do this, habitat and topography will be determined for each turbine location and the sample turbines will be randomly selected from the habitat and topography categories in proportion to how often they occur in these categories. The same turbines will be searched in both years of the initial monitoring period to avoid confounding effects from individual turbines with variation among years but in subsequent survey years individual turbine selection may be adaptively managed.

Bats tend to have similar carcass persistence times to small birds, and a search interval of no greater than 7 days will be used for summer to minimize the detection bias associated with carcass persistence time (Strickland et al. 2011). A conservative search interval of 4-days will be used for spring and fall during the first year because pre-construction data collected for the Project showed high bat activity during these periods. Reducing the search interval will reduce the uncertainty associated with the estimate (i.e., result in a narrower confidence interval, M. Huso, 2012 pers. comm.). The search interval may be lengthened in the second year of monitoring to 7 days unless searcher efficiency and carcass persistence trials indicate the precision of the resulting estimate would be too low. A search interval of 14 days will be used for winter because scavenger activity is anticipated to be lower than in other seasons, as the winter sampling period is likely to have lower bat and scavenger use (e.g., Laundré and Keller 1984).

Seasonal sampling intervals will be as follows:

- Spring: March 1 to May 31 – 4-day search interval, approximately 23 searches
- Summer: June 1 to August 15 – 7-day search interval, approximately 11 searches

- Fall: August 16 to November 15 – 4-day search interval, approximately 23 searches
- Winter: November 16 to February 28 – 14-day search interval, approximately 8 searches

7.5.2.2 Search Plot Size and Configuration

To maintain consistency with avian post-construction fatality monitoring a square search plot centered on the turbine with sides equal to two times the maximum blade tip height will be used following the USFWS Land-based Wind Energy Guidelines (USFWS 2012) and based on the distance bird carcasses are found from wind turbines at other post-construction fatality studies (Strickland et al. 2011). Given that more than 80 percent of bat fatalities at wind facilities fall within half the maximum blade-tip turbine height (Strickland et al. 2011) this plot size should be sufficient to capture the vast majority of turbine-related bat fatalities. Linear transects will be established within search plots following the USFWS-recommended distance of approximately 20 feet (6 m) apart (USFWS 2012). This spacing should be adequate for the Project because of the limited ground cover within the Project area, but may be adjusted based on actual conditions to maximize visual coverage. Searchers will walk along each transect searching both sides out to 10 feet (3 m) for fatalities during all seasons.

7.5.2.3 Fatality Documentation

During the set-up for carcass surveys, a sweep survey will be conducted to remove any fatalities that occur before the study is initiated. These carcasses will be documented in the same manner as those found during the standardized carcasses searches; however, they will not be included in the statistical analysis because the statistical analysis requires a known search interval (i.e., an estimate of when fatalities occurred). Following the sweep survey, any bat carcasses found will be collected for use in carcass persistence and searcher efficiency trials. Permits will be obtained for bat collection, if required by the state.

Searchers will assume that carcasses found are a result of turbine collisions unless the cause of death can be clearly attributed to a non-turbine cause. Although an unknown number of fatalities may result from natural predation, disease, or anthropogenic events (e.g., disturbance at caves, shooting), the condition of the carcasses when found rarely facilitates determining the cause of death.

Carcasses found during standardized carcass searches will be labeled with a unique number, and species, sex, age, date, time found, location (Global Positioning System [GPS] coordinate, and distance/direction from the turbine), condition (e.g., intact, scavenged), observer, turbine number, and any comments that may indicate cause of death will be collected. All carcasses will be photographed in situ, and then collected for use in future carcass persistence and searcher efficiency trials.

Searchers may discover carcasses incidental to standardized carcass searches (e.g., outside of a search plot or of a scheduled survey date). For each incidentally discovered carcass, the searcher will identify, photograph, and record data for the carcass as would be done for carcasses found during standardized scheduled searches, but will code these carcasses as incidental discoveries. Incidental discoveries will not enter into the statistical calculation of fatality rate for reasons noted above for carcasses found during initial set-up.

7.5.3 Carcass Persistence Trials

Carcass persistence time estimates the amount of time a carcass remains on-site prior to its disappearance from the search area due to scavenging or other means (e.g., due to forces such as wind and rain or decomposition beyond recognition). The objective of the carcass persistence trials is to document the length of time carcasses remain in the search area. Seasonal differences in carcass persistence (i.e., due to changes in scavenger population density) will be taken into account when evaluating carcass persistence by conducting trials in multiple seasons.

Carcasses used in the trials will be bats collected as fatalities at the Project or a surrogate such as dark-colored mice or small non-protected bird species (e.g., house sparrows).

Assuming adequate carcass availability, one carcass persistence trial will be conducted at non-searched turbines during each of the spring, summer, fall, and winter seasons with at least 15 carcasses placed per trial. Additionally, carcass persistence trials during long-term monitoring may have reduced level of effort if the data suggest consistency among years.

Each carcass used for the carcass persistence trial will be placed randomly within the area beneath non-searched turbines. Random locations will be generated and loaded into a GPS as waypoints to allow the accurate placement of the carcasses by field personnel. Carcasses will be dropped from waist height and allowed to land in a random posture. Each trial carcass will be discreetly marked (e.g., small tag or wire wrapped around one leg) prior to dropping so that it can be identified as a study carcass if it is found by other searchers or wind facility personnel. Personnel will monitor the trial carcasses on days 1, 2, 3, 4, 7, 10, 14, 21, and 30. When checking the carcass, searchers will record the condition as intact (normal stages of decomposition), scavenged (fur pulled out, chewed on, or parts missing), fur spot (only fur left), or completely gone. Changes in carcass condition will be cataloged with pictures and detailed notes; photographs will be taken at placement and any time major changes have occurred. At the end of the 30-day period, any evidence of carcasses that remain will be removed and properly disposed of.

Estimates of the probability that a carcass persisted between search intervals and therefore was available to be found by searchers, will be used to adjust carcass counts for bias using methods presented in Huso 2011 or similar analysis method. To date, Huso (2011) presents the most bias-free equation for determining the average probability of persistence, which takes into account the length of the search interval and the carcass persistence time:

$$\hat{r} = \frac{\hat{\bar{t}}(I - e^{-I/\hat{\bar{t}}})}{I}$$

Where *t* is the estimated mean persistence time and *I* is the length of the interval. A bootstrapped estimate and 90 percent confidence interval will be calculated based on 5,000 iterations for carcass persistence time. Bootstrapping is a statistical resampling procedure where the data are re-sampled with replacement to obtain an estimate and confidence interval.

7.5.4 Searcher Efficiency Trials

The ability of searchers to detect carcasses is influenced by a number of factors including the skill of an individual searcher in finding the carcasses, the vegetation composition within the search area, and the characteristics of individual carcasses (e.g., color). The objective of searcher efficiency trials is to estimate the percentage of bat fatalities that searchers are able to find. Estimates of searcher efficiency are then used to adjust carcass counts for detection bias. Searcher efficiency trials will be conducted all seasons to account for seasonal differences in searcher efficiency. However, searcher efficiency trials during years of long-term monitoring may have reduced level of effort if the data suggest consistency among years. Carcasses used in the trials will be bats collected as fatalities at the Project or a surrogate such as dark-colored mice or small birds.

Searcher efficiency trials will begin when standardized carcass searches start. Personnel conducting the searches will not know when trials are conducted or the location of the efficiency-trial carcasses. Trials will be conducted multiple times throughout each spring, summer, and fall season during the first two years of monitoring, and will incorporate testing of each member of the field crew. A searcher efficiency trial will be conducted during winter of the first year, and the decision whether or not to continue with a searcher efficiency trial in the second year will be made adaptively based on the results of the analysis of fatality data during the first year. Assuming adequate carcass availability, at least 15 carcasses will be placed per season for searcher efficiency trials. At least 10 carcasses per season are needed to estimate searcher efficiency. The number of carcasses placed prior to the search (i.e., the number available for detection during each trial) will be verified immediately after the trial by the person responsible for distributing the trial carcasses. Any carcasses not found will be collected after the trial.

The probability of a carcass being observed is expressed as p, the proportion of trial carcasses that are detected by searchers in the searcher efficiency trials. The probability will be estimated by season to control for seasonal variation in detection. A bootstrapped estimate and 90 percent confidence interval will be calculated based on 5,000 iterations for searcher efficiency.

7.5.5 Fatality Rate Estimation

To calculate the Project-wide fatality rate (bats/turbine/year and bats/MW/year) and the total Project fatalities, BP Wind Energy will use the Huso estimator (Huso 2011) or other appropriate statistical methods. Fatality rate estimates will be calculated for all bat species as a group (All Bat). When sample size criteria are met ($n > 5$), the fatality rate can also be calculated for various subgroups, but if fewer than five fatalities are found it will not be possible to accurately calculate a fatality rate (Huso 2011), and in such a case the total number of fatalities found will be reported. Therefore, fatality estimates for the subgroup of BLM Sensitive species will be calculated separately under the following conditions:

- At least 5 fatalities within the subgroup are found during the year during standardized searches; and
- The 95 percent confidence interval of the fatality estimate for all bats at the Project lies within two standard deviations (SD, 1 SD = 3.32 bats/turbine/year) of the mean value for

all bats at desert region facilities in the western U.S. (mean = 2.95 bats/turbine/year; Table 3a), indicating that the Project estimate for all bat species is reasonably precise.

The estimation of fatality rates will incorporate observed fatalities documented during standardized carcass searches, and will take into account:

- Search interval;
- Observed number of carcasses found during standardized searches during the monitoring year for which non-Project-related causes of death have been eliminated;
- Carcass persistence, expressed as the probability that a carcass is expected to remain in the Study Area (persist) and be available for detection by the searchers during carcass persistence trials; and
- Searcher efficiency, expressed as the probability of trial carcasses found by searchers during searcher efficiency trials.

The Huso estimator (2011) uses the following equation to estimate fatalities: $f_{ijk} = \frac{c_{ijk}}{p_{jk^*}\, r_{jk^*}\, v_{jk}}$ where f_{ijk} is the estimated fatality at the i^{th} turbine during the j^{th} search in the k^{th} category and c_{ijk} is the observed number of carcasses at the i^{th} turbine during the j^{th} search in the k^{th} category. The variable r_{jk} is a function of the average carcass persistence time, which was described earlier, and the length of the search interval preceding a carcass being discovered. The variable r_{jk} is calculated using the lower value of *I*, the actual search interval when a carcass is found or $I,$ the effective search interval, and is estimated through searcher efficiency trials previously described*.* v_{jk} is the proportion of the effective search interval sampled where v = min (1, $I \quad I$). p_{jk} is the estimated probability that a carcass in the k^{th} category that is available to be found will be found during the j^{th} search. The variables $p_{jk,}$ $r_{jk,}$ and v_{jk} are assumed not to differ among turbines but can differ with carcass type, size class, and season. To obtain an estimate of the number of fatalities per turbine the following equation is used: $f = \frac{{}_{\mathrm{i=1}}^{u}\ {}_{\mathrm{j=1}}^{\mathrm{n_i}}\ {}_{\mathrm{k=1}}^{2}\ \mathrm{f_{ijk}}}{t}$ where n_i is the number of searches at turbine *i* (*i* = 1,…, *u*) and *t* is the effective number of turbines searched. A bootstrapped estimate and 90 percent confidence interval will be calculated based on 5,000 iterations for the fatality estimate. The 90 percent confidence interval represents the upper and lower bounds of the range of fatality rates that has a 90 percent probability of containing the true fatality rate. The 90 percent confidence interval is useful in a management context as a means of assessing the range of fatality rates that are probable given the number of carcasses that were detected. It should be noted that the upper 90 percent confidence limit corresponds to 95 percent probability that the true fatality rate is lower than the 90 percent confidence limit.

An annual post-construction fatality monitoring report will be prepared for each year the searches are conducted to summarize bat fatalities (if any) associated with operations of the Project. In years with initial, long-term, or responsive monitoring this report will include a detailed summary of the methods; results from carcass searches, carcass persistence trials, and searcher efficiency trials; an estimate of fatalities on a per turbine and per megawatt basis; and discussions of the results in the context of adaptive management thresholds. In years with only WIRS monitoring the report will be limited to details of the fatalities detected (e.g., numbers, species identification (when possible), condition, time and date, location). Annual reports will be provided to AZGFD, BLM, and Reclamation for review.

8 MITIGATION AND ADAPTIVE MANAGEMENT

This section provides an adaptive management framework in which thresholds will trigger additional avoidance and minimization measures, as well as operational mitigation (i.e., altering the function of wind turbines in relation to wind speed).

8.1 Thresholds

BP Wind Energy will implement mitigation for bats if either an annual or a turbine-specific threshold is crossed. Thresholds are a transparent means of demonstrating accountability and good-faith effort in protecting bat populations if unanticipated, high levels of fatalities occur. The BLM Sensitive Species Manual indicates that management actions on BLM land should not exacerbate or cause population-level declines (BLM 2008), so Project thresholds are set below levels that could potentially result in population-level impacts as a measure of assurance. BP Wind Energy is committed to avoiding and minimizing losses of bats at the Project and incorporates the threshold approach to respond to unforeseen fatality events, first and foremost by identifying and correcting problems on-site and, as a last resort, through operational mitigation. BP Wind Energy will notify BLM if and when designated thresholds are exceeded.

BP Wind Energy will employ thresholds for two types of exceedances: systematic and rare. A systematic threshold exceedance is defined as a rate of fatalities over the course of any given year that exceeds the annual threshold. A rare threshold exceedance is defined as an event at a single turbine in which Project-related fatalities occurring within a single search period are twice the magnitude of the annual threshold.

Thresholds will be based on the mean and variance of fatality rates found at wind energy facilities in desert regions in the western U.S. (Table 3a). These studies do not share identical methodologies (e.g., type of carcasses used for searcher efficiency and carcass persistence trials, fatality estimate methods), but they represent the current state of knowledge, and threshold values will be updated as new data become available. The systematic threshold for annual bat fatalities (All Bat) will be two SD (1 SD = 3.33 bats/turbine/year or 1.24 bats/MW/year) above the western desert region average of 2.95 bats/turbine/year (1.40 bats/MW/year). Therefore, this threshold value is 9.61 bats/turbine/year (3.88 bats/MW/year) and adaptive management will be triggered by an annual fatality estimate at the Project exceeding this threshold (see Section 8.3 below). We chose two SD as a threshold because 97.5 percent of annual fatality estimates in the desert region western U.S. would fall below that number (based on Table 3a); therefore, a value above this represents an extreme event. The rare threshold value will be defined as twice the systematic threshold, or 19.22 bat fatalities within a single search period at one turbine.

In addition to the All Bat systematic threshold, a separate systematic threshold will be established for a sensitive bat species subgroup. Sensitive bat species considered for the subgroup meet both of two criteria: 1) they are listed as BLM Sensitive bat species, and 2) they have estimated state population sizes of 10,000 or fewer bats. This subgroup includes Allen's and greater western mastiff bats (Section 3.1.2). For this sensitive bat species subgroup, the systematic threshold value will be detection of three fatalities combined from these two species during a single year of monitoring (standardized or incidental).

Incidental and WIRS detections will count towards the rare and sensitive bat species subgroup threshold because these thresholds use uncorrected counts of carcasses. However, because the All Bat systematic threshold relies upon the annual fatality estimate which requires systematically collected data, incidental and WIRS detections will not count toward the All Bat systematic threshold.

8.2 Timing of Trigger Evaluation

BP Wind Energy will proactively review post-construction fatality monitoring data to identify threshold exceedances quickly regardless of when in the reporting cycle they occur. For example, if a rare threshold is exceeded in a given season, BP Wind Energy will respond before the end of that season. This in turn will enable a swift response by BP Wind Energy in terms of assessment of the issue, determination of corrective measures, and communication with resource agencies.

8.3 Operational Mitigation

Based on the Project-specific baseline data and risk analysis, BP Wind Energy does not expect threshold exceedances to occur, but is providing operational mitigation as a means of assurance for the agencies that an adaptive management framework is in place in the event that unanticipated results are detected. If a rare or systematic threshold exceedance occurs in a given year, then operational mitigation will be triggered, in addition to responsive monitoring (Section 8.4; Figure 10). Operational monitoring will consist of feathering at night from dusk to dawn up to manufacturer cut-in speeds (i.e., the minimum speed at which the turbine generates useable power; ranges from 3 to 4 meters per second [m/s] for the turbine models under consideration) to reduce bat mortality. Feathering is a method where the blades of a turbine are pitched against the wind (i.e., in the opposite direction of the prevailing wind) and subsequently not actively rotating or generating energy. This feathering technique has been successful at reducing bat fatalities at BP Wind Energy's operational Fowler Ridge Wind Farm in Indiana (Good et al. 2012), and has been applied at other BP wind facilities. At the Fowler Ridge Wind Farm, feathering to a cut-in speed of 3.5 m/s reduced bat fatalities by an average of 36.3 percent (90 percent confidence interval: 12.4 to 53.8 percent).

8.3.1 Rare Threshold

If a rare threshold is exceeded at a specific turbine in a given season, operational mitigation will be implemented at the specific turbine which caused the exceedance during the season of the exceedance. This will involve feathering from dusk to dawn at the turbine where the exceedance occurred up to a cut-in speed ranging between 3-4 m/s (depending on manufacturer cut-in speed for the specific turbine model). The feathering will occur at that turbine for the remainder of the season in which the threshold was initially exceeded, after which normal operation will resume (Figure 10). Additionally, responsive fatality monitoring (if initial or long-term fatality monitoring is not already being performed) will occur at that turbine for the remainder of the season, as well as in the same season in the following year in order to test whether the problem is chronic or a one-time event. If results of fatality monitoring indicate that the exceedance of the rare threshold did not re-occur, the problem will be considered to be a one-time event. However, if fatality monitoring reveals that the threshold was exceeded for a second consecutive year (i.e., is chronic), feathering will be implemented at that turbine during that season for the life of the Project based on the success of this strategy at reducing bat fatalities documented at Fowler Ridge (Good et al. 2012).

8.3.2 Systematic Threshold

If a systematic threshold is exceeded, operational mitigation will be implemented Project-wide and will be targeted to the season which contributed the most to the annual fatality rate (Figure 10). Feathering will occur from dusk to dawn Project-wide up to a cut-in speed ranging between 3-4 m/s in the selected season the year following threshold exceedance. Additionally, responsive fatality monitoring (if initial or long-term fatality monitoring is not already being performed) will occur concurrently with feathering and in the same season in the following year in order to test whether the problem causing the initial threshold exceedance represents a one-time event or is chronic. In order to determine whether feathering in the season which contributed the most to the annual fatality estimate effectively reduces the annual number of fatalities to a level below the systematic threshold, a season-specific threshold will be calculated based on the contribution of that season's fatalities to the annual rate of fatalities in the previous year. For example, if the fatality rate in fall contributed 72 percent of the annual fatality rate, the season-specific threshold would be 72 percent of the systematic threshold, or 6.92 bats/turbine/year (2.79 bats/MW/year). If results of fatality monitoring in the same season of the subsequent year indicates that the season-specific systematic threshold was not exceeded, the problem will be considered a one-time event. However, if the season-specific systematic threshold is exceeded, indicating that the annual systematic threshold has been exceeded for a second consecutive year (i.e., is chronic), operational mitigation will be implemented Project-wide during this season for the remaining life of the Project. The effectiveness of this solution at addressing the systematic threshold exceedance is based on the success of this strategy at reducing bat fatalities documented at Fowler Ridge (Good et al. 2012).

8.4 Responsive Monitoring

If initial or long-term standardized post-construction fatality monitoring or WIRS reports indicates that designated thresholds have been exceeded (systematic or rare) in a given year, BP Wind Energy will conduct additional responsive fatality monitoring in the remainder of the season and in the subsequent year to identify the cause of threshold exceedance. Responsive monitoring will focus on the specific location and season in which the threshold exceedance occurred; therefore, effort may be reduced in temporal or spatial scales compared to initial fatality monitoring. As mentioned above, BP Wind Energy will notify BLM, Reclamation, and AZGFD and investigate threshold exceedances quickly rather than waiting for the annual report.

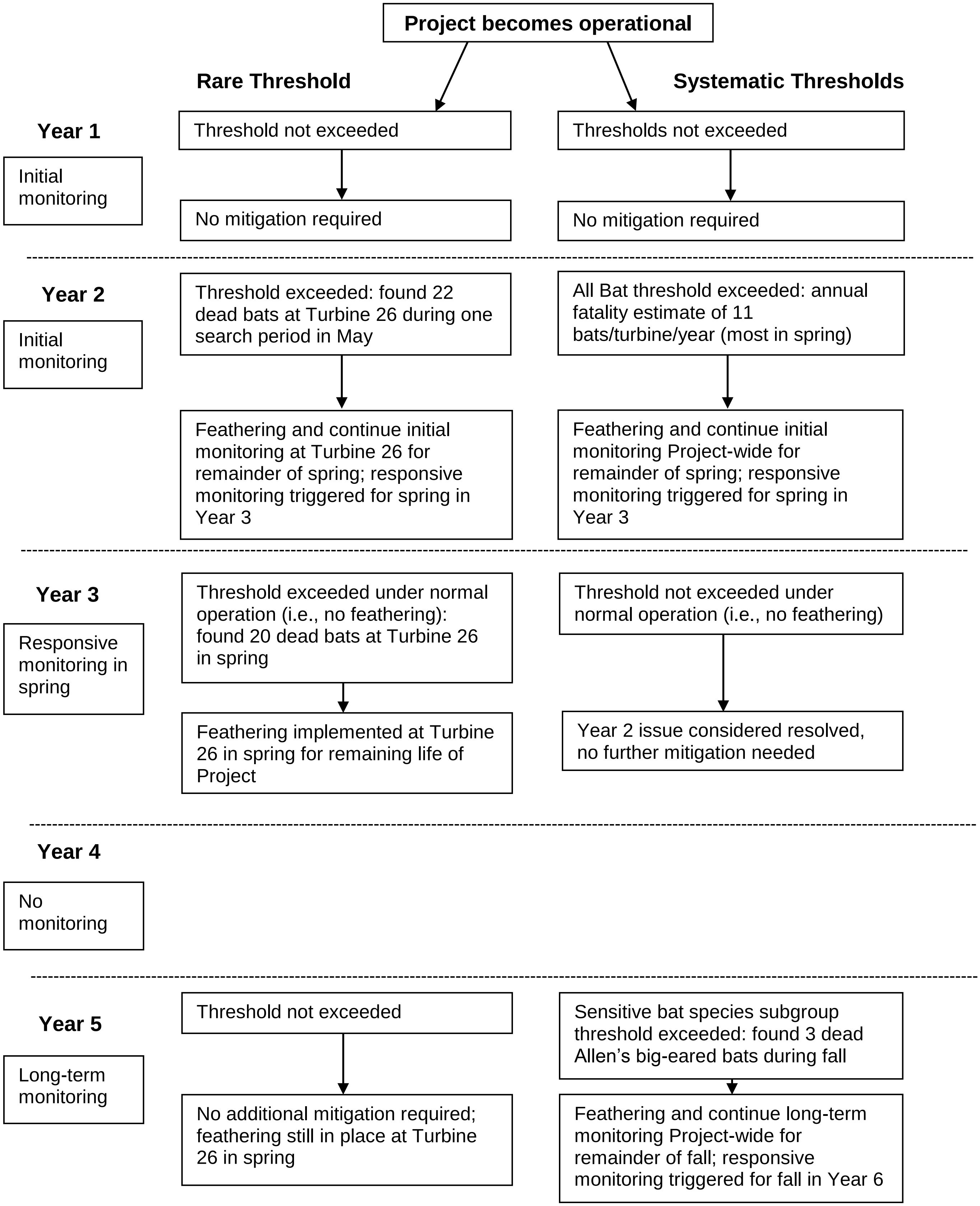

Figure 10. Flowchart of Example Mitigation Over First Five Years of Project Operation

9 REPORTING

An annual post-construction fatality monitoring report will be prepared for each year the searches are conducted to summarize bat fatalities (if any) associated with operations of the Project. In years with initial, long-term, or responsive monitoring this report will include a detailed summary of the methods; results from carcass searches, carcass persistence trials, and searcher efficiency trials; an estimate of fatalities on a per turbine and per megawatt basis; and discussions of the results in the context of adaptive management thresholds. In years with only WIRS monitoring the report will be limited to details of the fatalities detected. Annual reports will be provided to AZGFD, BLM, and Reclamation for review.

10 DECOMMISSIONING

The Project is anticipated to have a lifetime of up to 30 years after which it may no longer be cost-effective to continue operations. The Project will then be decommissioned, and the existing equipment removed. At that time, a Decommissioning Plan updated from the current plan in the Plan of Development will be provided and will address the procedures described in this section.

The goal of Project decommissioning is to remove the installed power generation equipment and return the site to a condition as close to a pre-construction state as feasible. The major activities required for the decommissioning are as follows:

- Remove wind turbines and met towers
- Remove electrical system
- Remove structural foundation per requirements in ROW grants
- Remove roads not desired for other purposes
- Re-grade and re-contour the disturbed area
- Re-vegetate

Once the Project and transmission line are de-energized, the substations, switchyard, steel structures, and control building will be disassembled and removed from the site along with all foundations and other concrete features. The fence and fence posts will be removed. The gravel placed at Project facilities will be removed and replaced with native rock, if surface rock is prevalent in the immediate area. BLM and Reclamation will be consulted to determine if the buried substation grounding grid should be removed or left in place. Assuming the transmission line no longer serves a purpose for the site or transmission provider, it will be disassembled and removed with the foundations. The transmission line tower structures will then be disassembled and removed. The areas around the transmission line poles, including access roads, will be returned to the pre-construction condition to the maximum extent feasible.

The following BMPs from Appendix B of the Draft EIS will also be followed:

- Prior to the termination of the rights-of-way authorization, a decommissioning plan shall be developed and approved by the BLM. The decommissioning plan shall include a site reclamation plan and monitoring program.

- All management plans, BMPs, and stipulations developed for the construction phase shall be applied to similar activities during the decommissioning phase.
- All turbines and ancillary structures shall be removed from the site.
- Topsoil from all decommissioning activities shall be salvaged and reapplied during final reclamation.
- All areas of disturbed soil shall be reclaimed using weed-free native shrubs, grasses, and forbs.
- The vegetation cover, composition, and diversity shall be restored to values commensurate with the ecological setting.

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Appendix A
Final Report 2007-2011 Secondary Assessment of the Baseline Acoustic Monitoring of Bat Populations within the BP Wind Energy Mohave County Wind Study Area, Mohave County, Arizona

Final Report 2007-2011

Secondary Assessment of the Baseline Acoustic Monitoring of Bat Populations within the BP Wind Energy Mohave County Study Area, Mohave County, Arizona

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1 Introduction

BP Wind Energy is developing the Mohave County Wind Project (Project) in Mohave County, Arizona. The Project is located approximately 40 miles northwest of Kingman, Arizona in the White Hills of Mohave County and will consist of up to 283 wind turbines aligned within corridors. As part of the environmental due diligence for the proposed Project, BP Wind Energy contracted Western EcoSystems Technology, Inc. (WEST) from 2007-2011 to collect information on bat activity patterns and species diversity using Anabat (Titley Scientific) bat acoustic detectors (Solick et al., 2009, Thompson et al., 2011a). Anabat detectors were deployed within the area where wind turbines are currently proposed, as well as in an area to the east where the Project was originally located (Figure 1). Over the course of the study, the footprint of the Project was modified, and some detector locations sampling in early years (2007-2009) are not within the current Project. To distinguish among locations, I refer to the collection of all detector locations as the "Study Area", and the subset of detector locations within the current footprint of the Project as the "Wind Project Site".

In the analysis undertaken by WEST, the data were reduced to simple high and low frequency groupings and no species-level identifications were made. WEST's analysis used bat passes per detector night as a metric of relative levels of bat activity across sampling locations. Tetra Tech EC, Inc. (Tetra Tech) and myself (Dr. Michael J. O'Farrell of O'Farrell Biological Consulting, LLC) were engaged by BP Wind Energy to re-analyze the existing data set. The goal of the reanalysis was to determine the species identification of the bat call sequences from the existing data. Because a number of sensitive species may occur in the Study Area, the species-level analysis of the bat acoustic data provides additional context for risk assessment.

In the reanalysis, minutes of bat activity were summed and used to calculate an index of activity (IA), which is a biologically meaningful metric to describe the spatial use of each species for each locality sampled. It is important to note that a minute of activity does not assume the presence of that species for the entire minute. It is a presence/absence value and ignores the number of occurrences recorded within that minute. Some species of bats utilize repetitive loops of flight when foraging; thus it is common for a single bat to generate > 5 separate files within a minute, which generates a disproportionate activity profile. The use of this presence/absence metric will result in a maximum score of 30 within a 30-minute block of time. This allows a more meaningful examination of the amount of time a species spends using a particular habitat patch and provides a direct comparison among species regardless of their foraging/flight behavior.

The analysis presented in this report reflects the body of data recorded by WEST and transmitted to me. I did not design or implement the original study.

2 Methods

WEST conducted sampling over a 5-year period from 2007 to 2011 (Tables 1a-c). Overall, the data set did not contain call sequences, or recordings, from all months of the year for each of the survey years. Based on the raw data, it appears that the amount of time the detectors were operational varied considerably by year and month, these gaps in the data set varied among sampling locations, months, and years . Of the 16 distinct sampling locations, all were sampled from ground level (ca. 1 m above ground surface) except for four paired units at MET towers (MC1h, WPPh, WQQh, and WRRh; ca. 45 meters (m) in height; Figure 1).

Identification of species used the methods of O'Farrell et al. (1999) based on frequency characteristics, call shape, and comparison with a comprehensive library of vocal signatures developed by O'Farrell and colleagues. Thus, species richness (number of species verified as present) was obtained for each location. A key feature of the Anabat system is that each file saved to the computer is named with a time-date code (e.g., B8012024.16#, where B = 2001, 8 = August, 01 = day of the month, 2024.16 = 8:24:16 PM), which allows for the determination of number of minutes of activity. An IA, or the magnitude of each species' contribution to spatial use, was obtained for each monitoring station using the sum of 1-minute time increments for which a species was detected as present divided by the number of nights of sampling (Miller, 2001). The IA was multiplied by a factor of 100 in order to scale the smallest index values up to whole numbers. The IA is rounded off to the nearest whole number for ease in interpreting the tables. Therefore, totals may not add up exactly but the magnitude of differences between species and/or stations is reflected accurately. Actual numbers of minutes of activity are presented in Appendix A. Reference calls for each species recorded during the present study are presented in Appendix B.

Table 1a. Sampling dates for all acoustic sampling locations within the BP Mohave County Study Area, 2007-2008.

	2007								2008		
Location	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**	**January**	**February**	**March**
WH-1g	23-29	7-20,27-30	1-31	1-6,9-31	1-7,11-30	1-12,17-21	28-30	1-13			
WH-2g	22-31	1-11,27-30	1-31	1-6,10-12,29	12-30	1-31	1-30	1-31	1-14	28-29	1-25
WH-3g	23-31	1-11,21,27-30	1-11,13-31	1-6,10-31	1-30	1-12,14,16-22	28-30	1-12			
WH-4g	23-31	1-19,27-30	1-14,27-31	1-6,9-31	1-30	1-12,17-31	1-30	1-13			
WH-5g	23-31	1-19,28-30	1-31	1-6,8-9,29-31	1-18,20-30	1-31	1-30	1-12			
WH-6g		12-20,28	13-31	1-6,9,29-31	1-30	1-12,17-31	1-28				
WH-8g		12-19,28-30	1-31	1-6,10-31	1-30	1-12,14-15,17-22	28-30	1-12			

Table 1b. Sampling dates for all acoustic sampling locations within the BP Mohave County Study Area, 2009.

	2009			
Location	**March**	**April**	**May**	**June**
WH-2g	10-31	1-30	1-31	1-15
WPPh	10-31	1-30	1-31	1-15
WPPg	3-31	1-30	1-31	1-15
WQQh	4,23-31	1-14,24-30	1,7-31	1-15
WQQg	4,10-31	1-30	1-31	1-15
WRRh	4-31	1-30	1-31	1-15
WRRg	4-31	1-30	1-31	1-15
WSSg	4-31	1-30	1-31	1-15
WTTg	3-31	1-3,9-30	1-31	1-15
WUUg	3-31	1-30	1-31	1-15

Table 1c. Sampling dates for all acoustic sampling locations within the BP Mohave County Wind Project Site, 2010-2011.

		2010				2011			
Location	**September**	**October**	**November**	**February**	**March**	**April**	**May**	**June**	**July**
MC1g	9-30	1-5,7-31	1-5	23-28	1-31	1-30	1-31	1-7,9-30	1-15
MC1h					5-31	1-30	1-31	1-30	1-9
MC2g	15-30	1-19,22-31	1-5	23-28	1-13,18,24-31	1-30	1-31	1-30	1-15
MC3g	8-14			23-28	1-31	1-30	1-21,29-31	1-24	

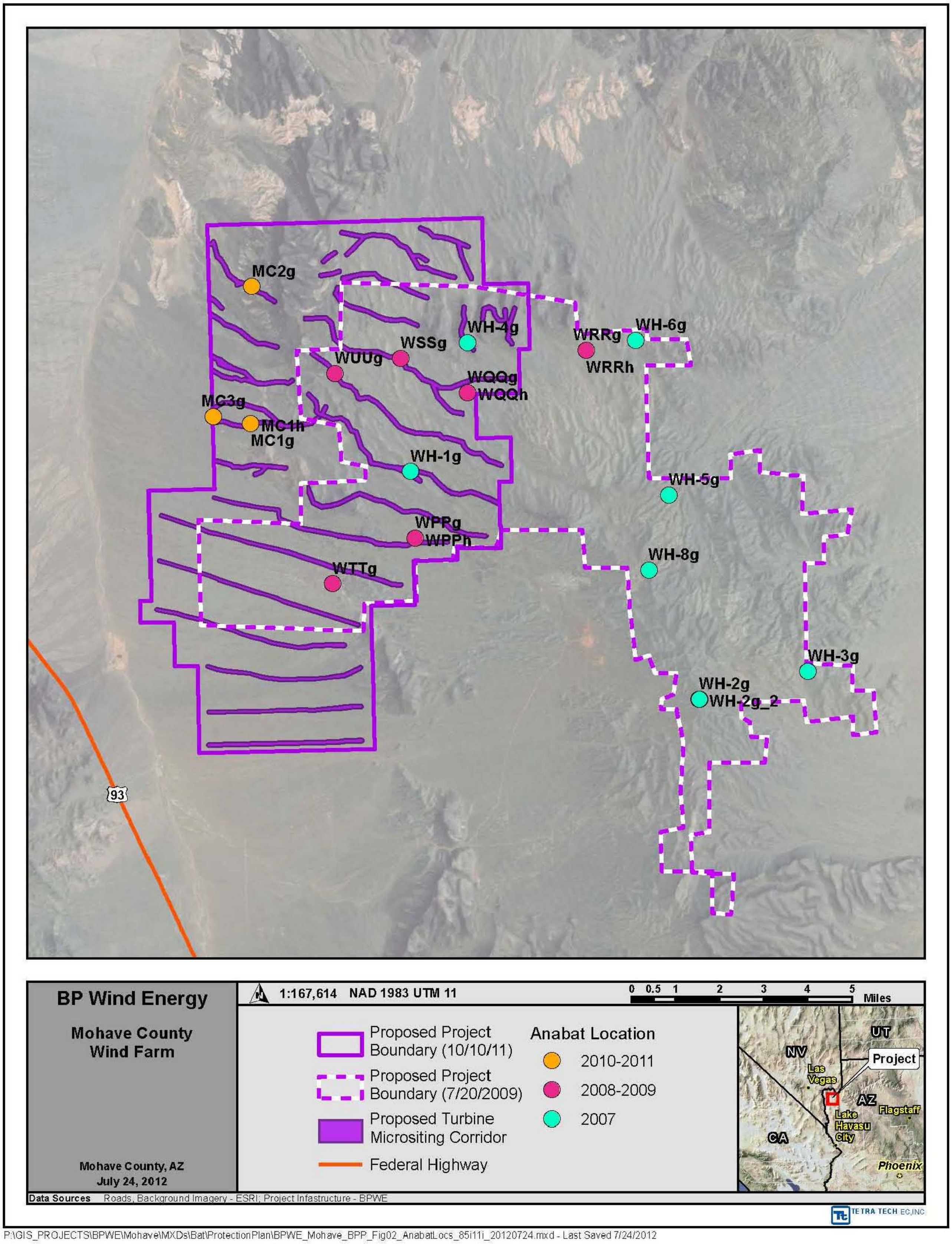

Figure 1. Detector locations at the Mohave County Study Area 2007 – 2011.

3 Results

A total of 15 species of bats were recorded (Table 2) in the Study Area. One species is a Bureau of Land Management (BLM) Sensitive Species (Allen's big-eared bat). Species designated as BLM Sensitive are native species found on BLM land for which there is evidence that populations or associated habitats are at risk across all or a significant portion of their range (BLM 2010). All bat species are protected in Arizona as non-game species and the Arizona Game and Fish Department (AZGFD) has assigned a status to each species in the Arizona State Wildlife Action Plan (e.g., Species of Greatest Conservation Need (SGCN) Tiers 1A, 1B, and 1C; AZGFD, 2006, 2010). Tier 1A indicates that the species is considered vulnerable in at least one of nine categories (e.g., distribution within Arizona, degree of population fragmentation, population trend) or is a federally endangered, threatened or candidate species; is covered under a signed conservation agreement; or is petitioned for listing. Tier 1B species are considered vulnerable but match none of the additional criteria for Tier 1A. Tier 1C species have an unknown vulnerability status. These state classifications do not confer additional protection. Of the bat species recorded in the Study Area none are considered Tier 1A, two are considered Tier 1B (greater western mastiff bat and Brazilian free-tailed bat), and five are considered Tier 1C (Table 2). Tier 1C species are not discussed further given their unknown vulnerability status.

In 2007-2008, monthly bat activity peaked in summer or early fall (Figures 2-4; Tables 3a, 4-10; Appendix A 1-7). The peak varied from June (WH-3, WH-5), July (WH-2, WH-4, WH-6), September (WH-1) to October (WH-8). Early peaks corresponded to the period when the summer resident community fully develops. Later peaks usually corresponded to volant young entering the foraging population or when a particular species concentrates activity prior to autumn dispersal. In 2009 (sampling only from March through June), peak activity occurred in March and April (Figures 2 and 5; Tables 3b, 11-17; Appendix A, 8-14). A similar spring pattern appeared in September 2010-July 2011 sampling (Figures 2 and 6; Tables 3c, 18-21; Appendix A 15-18). These spring peaks in activity may correspond to migratory influx of individuals, but the precipitous decline into June does not follow typical trends for bats throughout the southwestern US, which show activity peaking in summer (Jones, 1965, 1966; O'Farrell et al., 1967, 2003; O'Farrell and Bradley, 1970; O'Farrell, 2006a-d, 2007, 2009, 2010). However, early and mid-spring was not sampled in 2007 and mid- to late summer was not sampled in 2009-2011; I suspect that there may have been some equipment problems during these periods because of the variability in the number of recording folders in the raw Anabat data set with dates corresponding to these intervals (Figures 3 and 7; Solick et al., 2009).

Each bat species varied in its contribution of use among the monitoring locations (Figure 8; Tables 4-21; Appendix A 1-18). Species designated as primary species contributed >25% of all bat activity and secondary species contributed <25 but >6%. The remaining contribution to bat activity for each species was ≤ 6%. In 2007, *Tadarida brasiliensis*, a SGCN Tier 1B species, was the primary species at all locations (36-84% of bat activity), except for WH-2g and WH-8g where it accounted for 19-21% of bat activity. *Myotis californicus* was a secondary species at all locations (6-14% of bat activity), except WH-2g and WH-3g where it was a primary species (27-35% of bat activity). *Parastrellus hesperus* was a secondary species at all locations (6-18% of bat activity), except for WH-6g where it was a primary species (26% of bat activity). *Myotis yumanensis* was the primary species at WH-1g and WH-8g (30-50% of bat activity), and a secondary species at WH-3g (6% of bat activity). Most unusual was *Eptesicus* *fuscus*, which was a primary species at WH-2g (30% of bat activity), but did not contribute significantly at any other locality during the entire study.

For the remainder of the study (2009-2011), the primary species was *T. brasiliensis* (77-98% of bat activity) with *M. californicus* a secondary species at WH-2g and WPPg (7-16% of bat activity) and *P. hesperus* a secondary species at MC1g and MC2g (11-15% of bat activity; Tables 4-21; and Appendix A 1-18). At all four high stations (WPPh, WQQh, WRRh, MC1h), *T. brasiliensis* was the only primary species (99% of bat activity), with no secondary contributions (Table 22). A summary of primary and secondary species by location is given in Table 22.

3.1 Sensitive Species

Of the three sensitive species (BLM Sensitive or SGCN Tier 1A or 1B) detected in the Study Area, *T. brasiliensis* was the most commonly detected, and was found at all stations and heights during all years of sampling. The other two sensitive species detected (*Idionycteris phyllotis*, BLM Sensitive species; *Eumops perotis*, SGCN Tier 1B species) were minor in contribution to the total activity recorded at each location (Tables 23a-c). *I. phyllotis* was recorded at WH-1g in 2007 (Figure 9). *E. perotis* was recorded at WH-3g, and WH-8g in 2007, WH-2g, WPPg, WQQh, WQQg, WTTg, and WUUg in 2009, and MC1g and MC2g in 2010-2011.

Although not categorized as sensitive species, migratory tree bats and high-flying free-tailed bats are known to be susceptible to wind turbine collisions, and were found throughout the Study Area (Tables 23a-c). *Lasionycteris noctivagans*, a tree-roosting migratory species, was recorded at WH-2g in 2009. *Lasiurus blossevillii*, a tree-roosting migratory species, was recorded at WH-2g, WPPg, and WQQg in 2009. *Lasiurus cinereus*, a tree-roosting migratory species, was recorded at all stations and heights except for WH-2g and WH-5g in 2007. *T. brasiliensis*, a widespread high-flying free-tailed bat, was found at all stations and heights during all years of sampling.

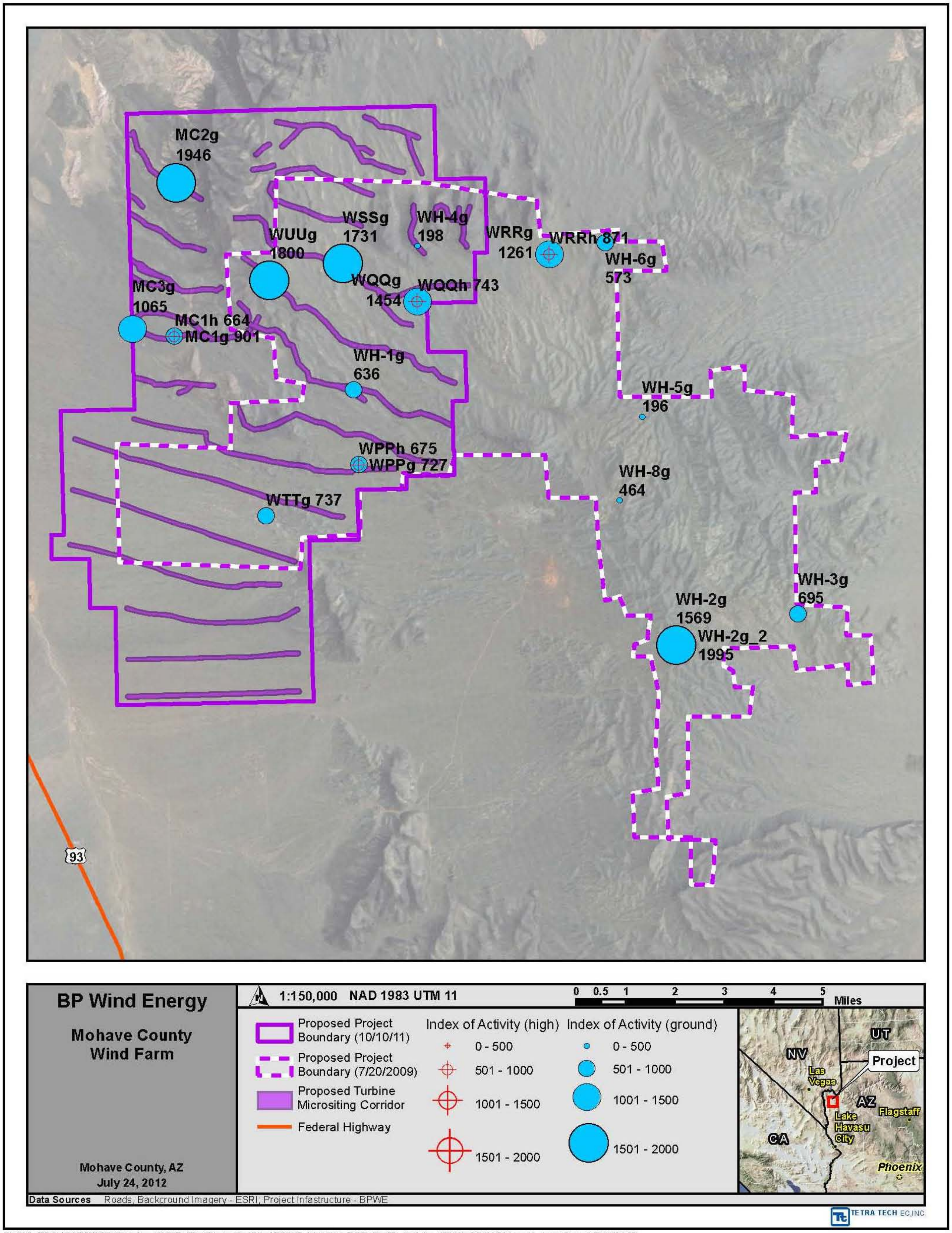

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Figure 2. Index of Activity at the Mohave County Study Area 2007 – 2011.

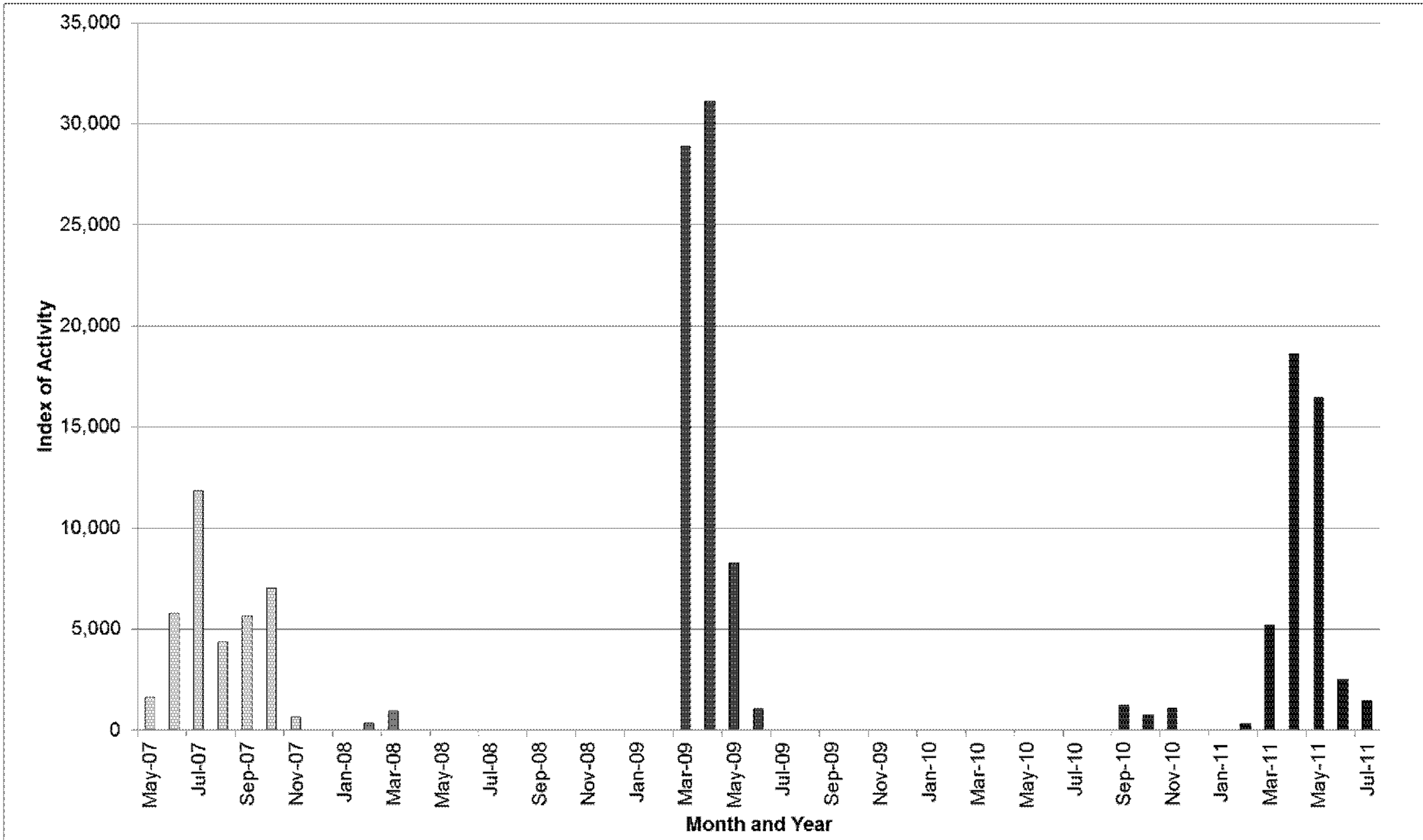

Figure 3. Index of activity for all detectors pooled, by month and year, May 2007 – July 2011, Mohave County Study Area.

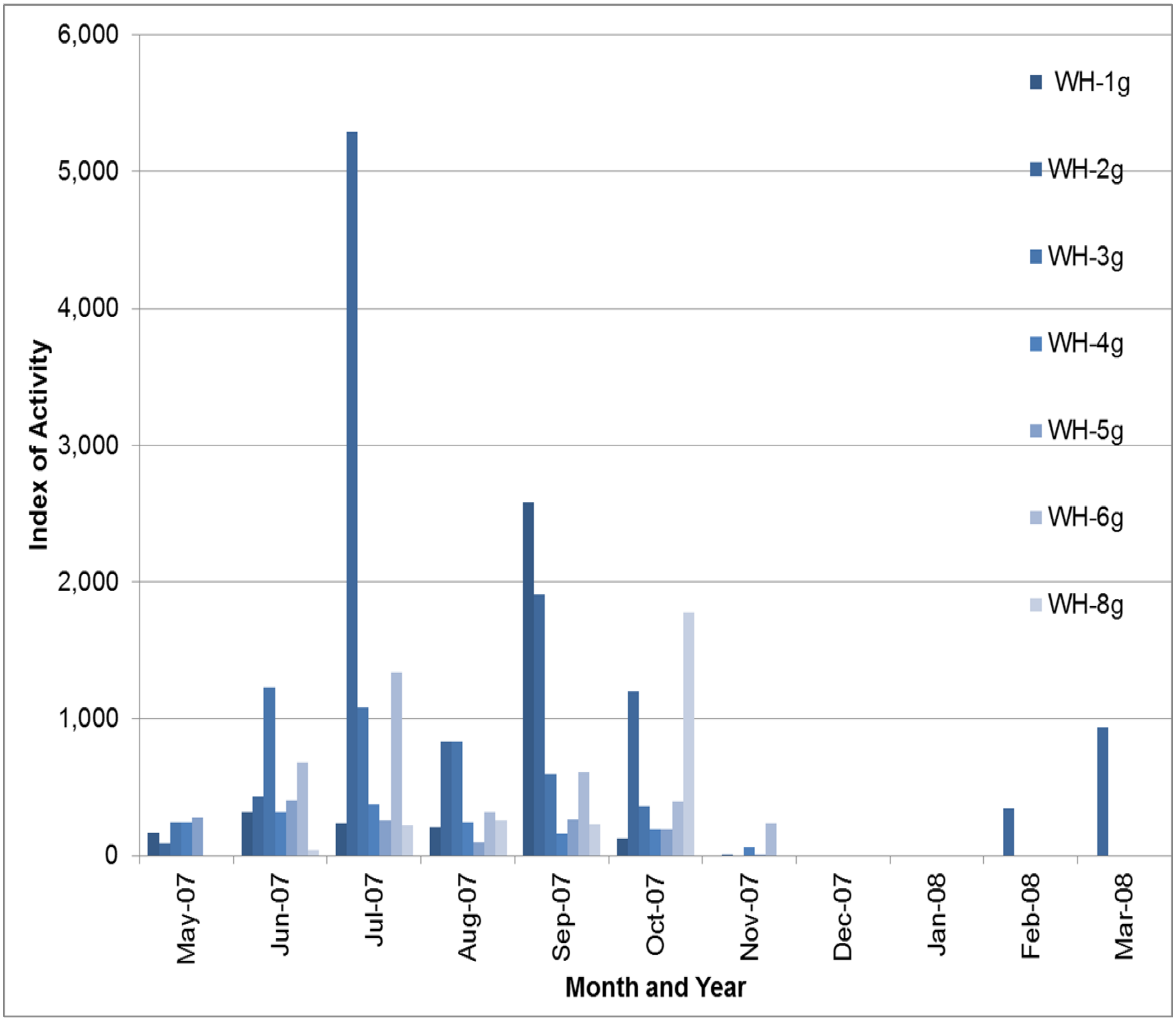

Figure 4. Index of activity by detector May 2007 – March 2008 Mohave County Study Area.

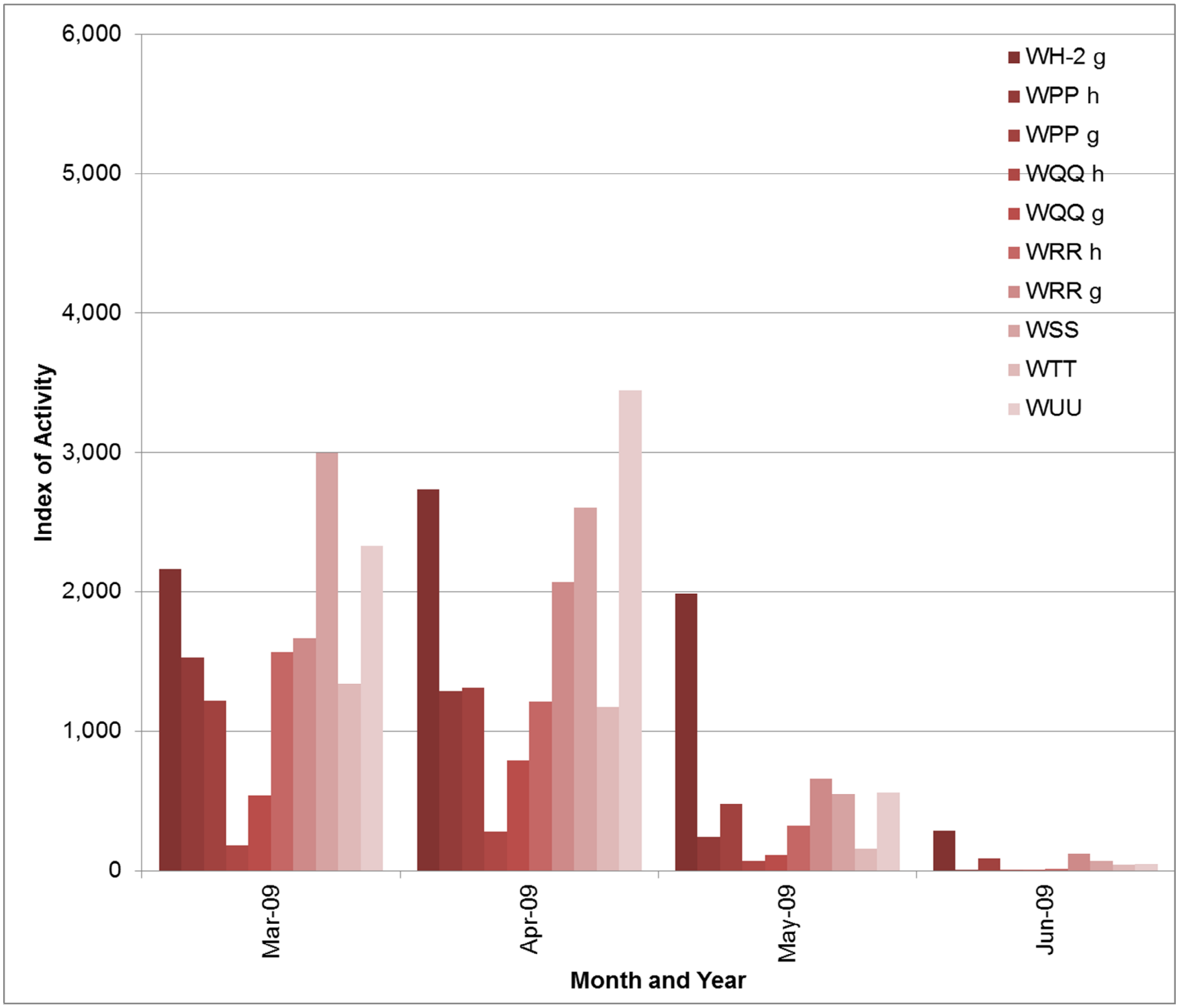

Figure 5. Index of activity by detector March 2009 – June 2009 Mohave County Study Area.

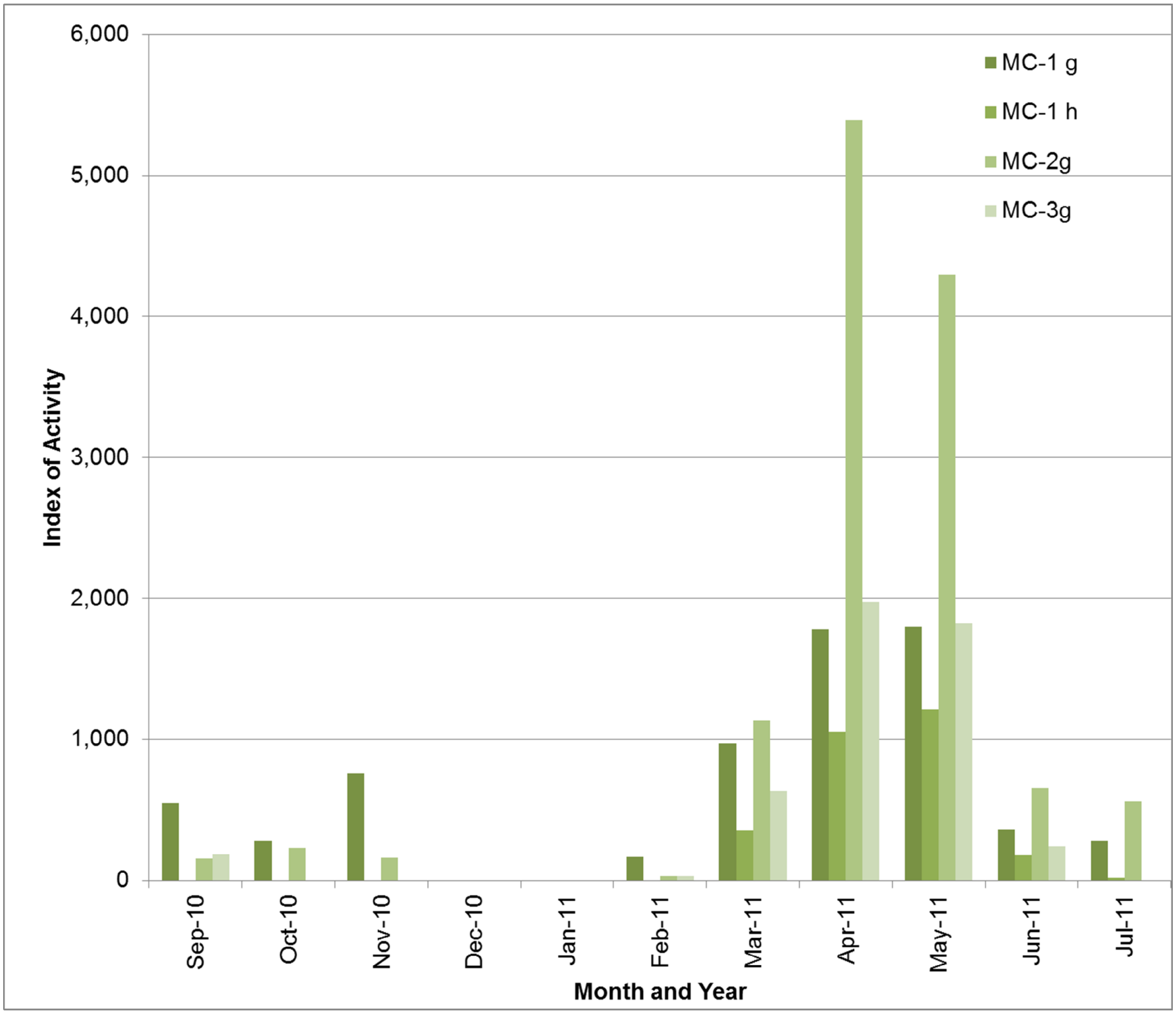

Figure 6. Index of activity by detector September 2010 - July 2011, Mohave County Wind Project Site.

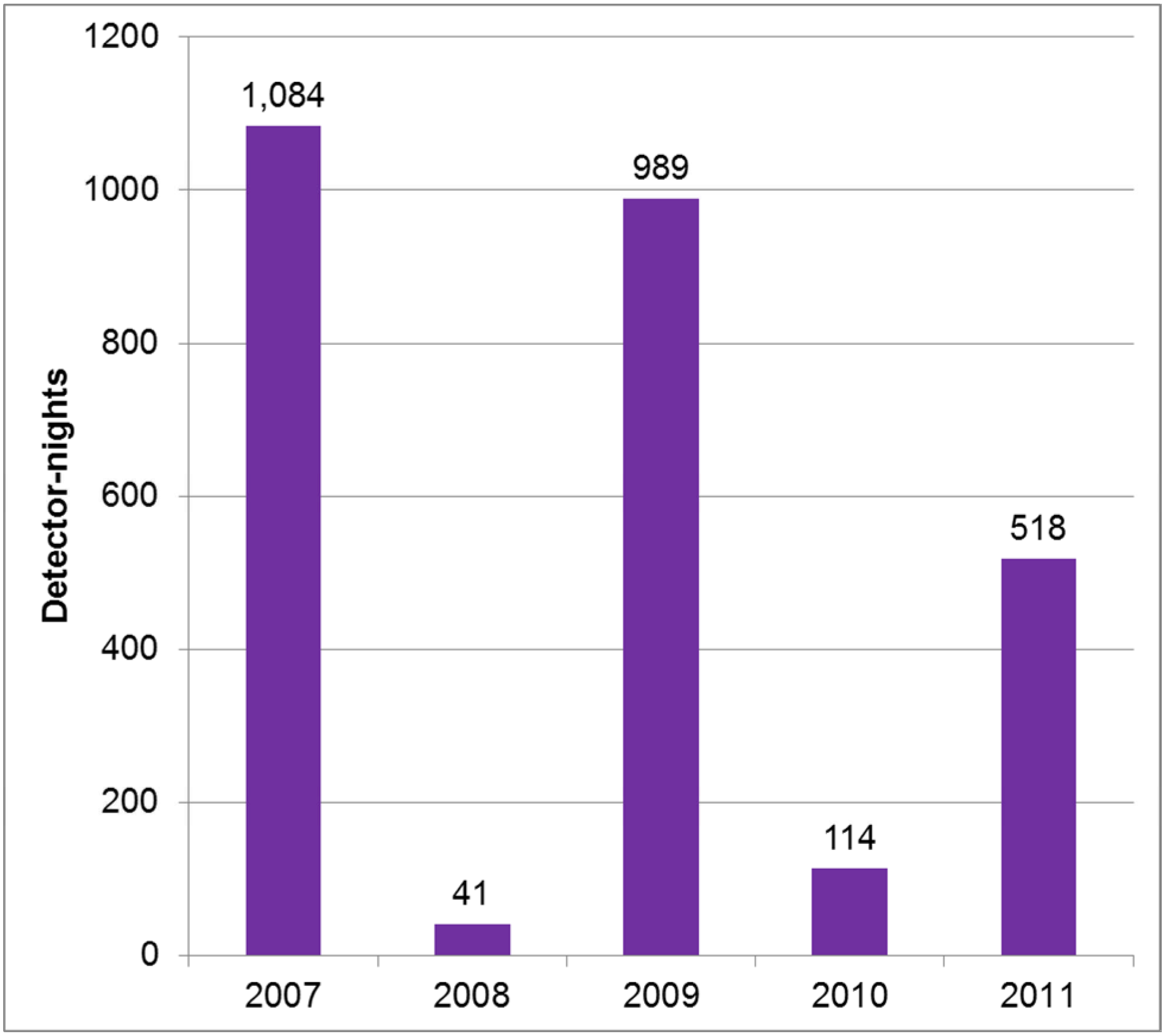

Figure 7. Level of effort (detector-nights) for all detectors pooled by year 2007-2011, Mohave County Study Area.

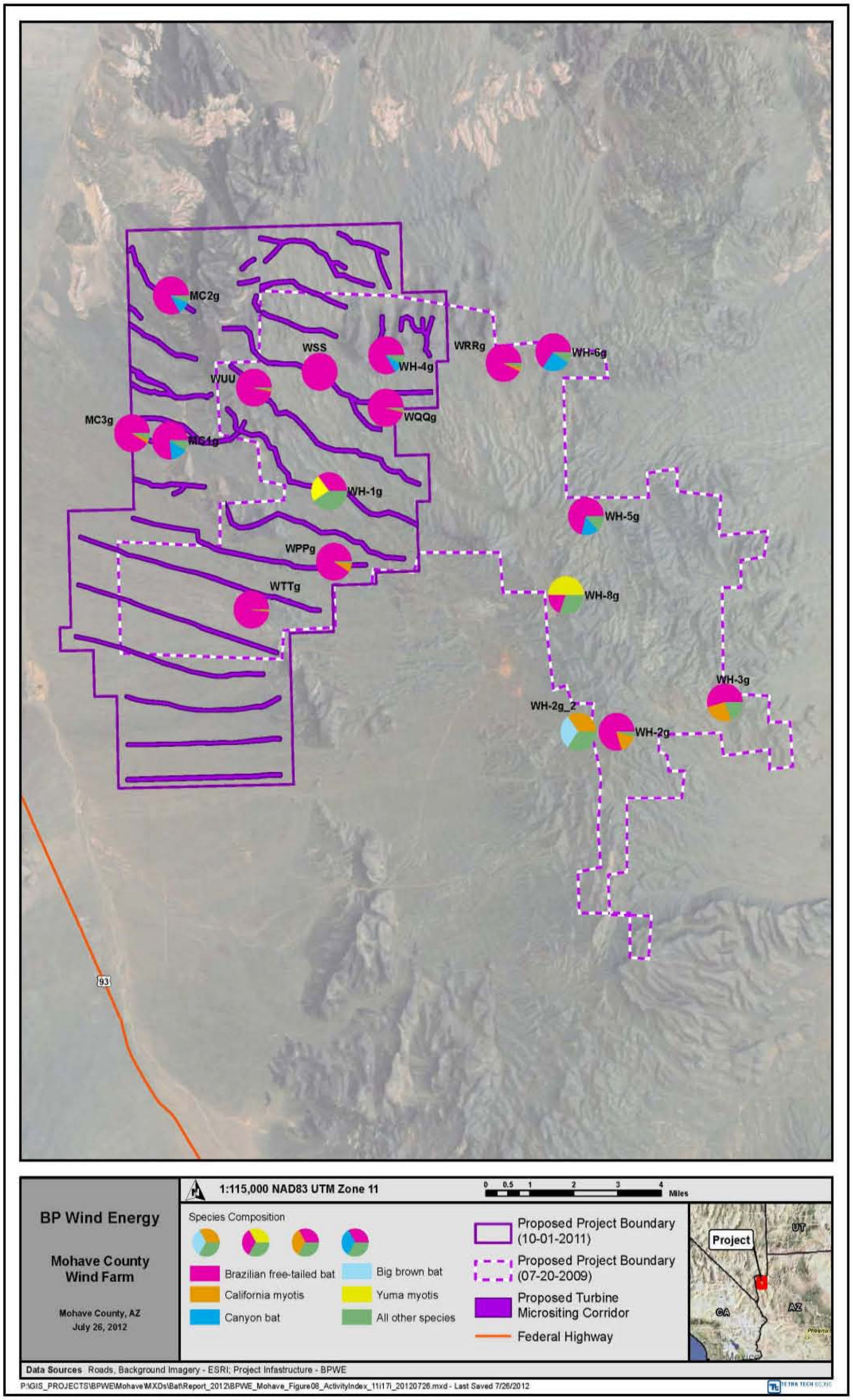

Figure 8: Index of activity for the most common species at the Mohave County Study Area 2007 – 2011

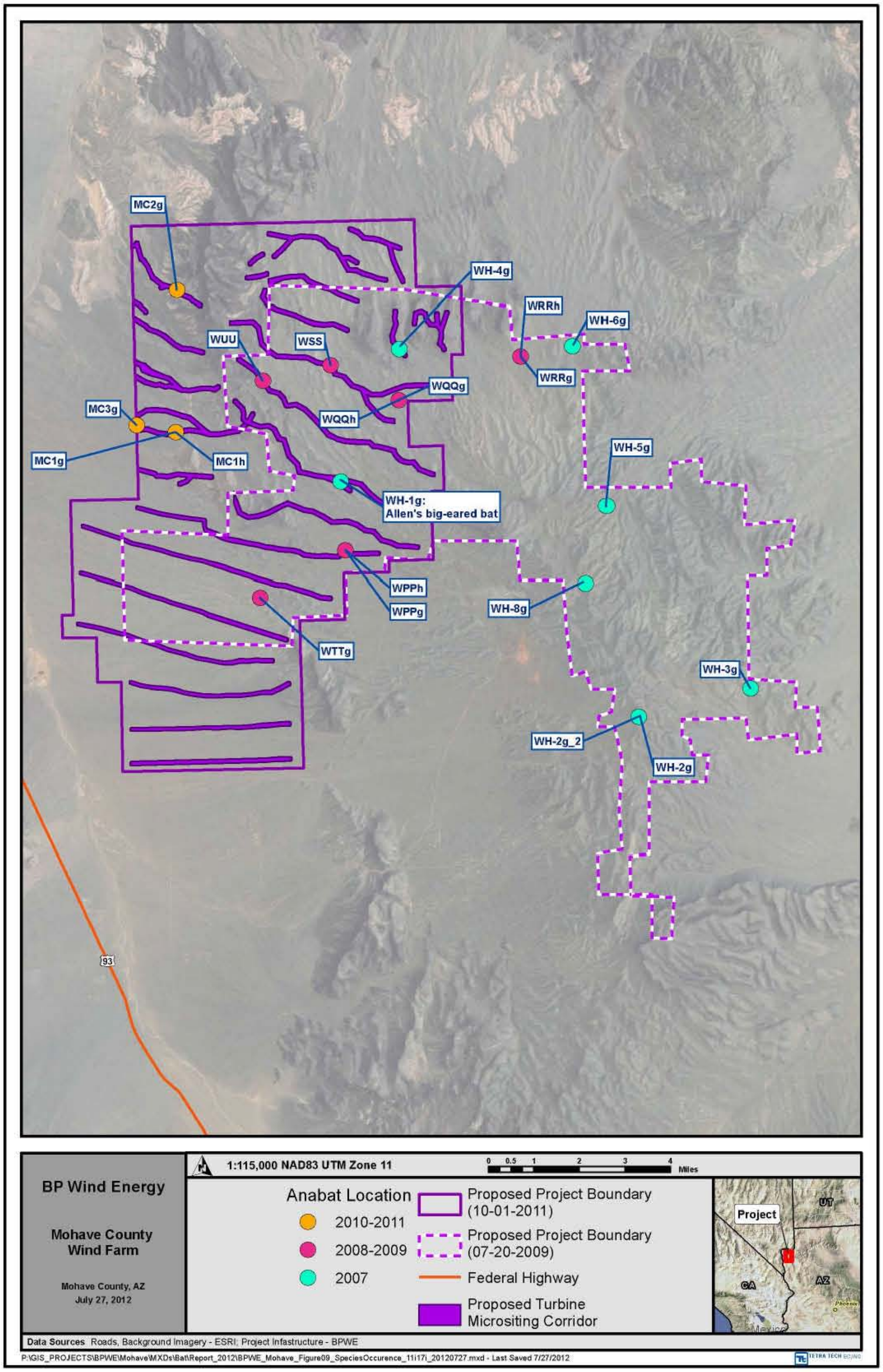

Figure 9: Occurrence of BLM Sensitive species detected at the Mohave County Study Area 2007 – 2011

Table 2. Checklist and status of bats found to occur within the BP Mohave County Study Area, 2007-2011. Nomenclature follows Hoofer et al. (2006), Wilson and Cole (2000), and Wilson and Reeder (1993).

Family/Species*	Common Name
Vespertilionidae	
Myotis californicus	California Myotis
Myotis ciliolabrum	Western Small-footed Myotis
Myotis thysanodes	Fringed Myotis
Myotis yumanensis	Yuma Myotis
Lasionycteris noctivagans	Silver-haired Bat[1C]
Lasiurus blossevillii	Western Red Bat[1C]
Lasiurus cinereus	Hoary Bat[1C]
Parastrellus hesperus	Canyon Bat
Eptesicus fuscus	Big Brown Bat
Corynorhinus townsendii townsendii	Pacific Western Big-eared Bat
Idionycteris phyllotis	Allen's Big-eared Bat‡
Antrozous pallidus	Pallid Bat[1C]
Molossidae	
Tadarida brasiliensis	Brazilian Free-tailed Bat[1B]
Nyctinomops macrotis	Big Free-tailed Bat[1C]
Eumops perotis californicus	Greater Western Mastiff Bat[1B]

* All bat species are protected in Arizona

‡ BLM Sensitive Species

1A/1B/1C Tiers of Species of Greatest Conservation Need (revised 2010) from the Arizona State Wildlife Action Plan

1A Scored 1 for Vulnerability in at least one of the 9 categories, or is federal endangered, threatened or candidate species; is covered under a signed conservation agreement; or is petitioned for listing

1B Scored 1 for Vulnerability but matches none of the additional criteria above

1C Unknown Vulnerability status species

Table 3a. Summary of the number of files, number of calls, number of minutes of bat activity, Species Richness (S*), and Index of Activity (IA) recorded at each of the acoustic sampling locations within the BP Mohave County Study Area, 2007-2008.

		2007-2008			
Location	**Files**	**Calls**	**Minutes**	**S***	**IA**
WH-1g	1,676	58,561	922	12	636
WH-2g	5,221	85,896	2,777	8	1,569
WH-3g	1,302	8,551	1,028	11	695
WH-4g	391	3,654	357	7	198
WH-5g	378	2,668	343	6	196
WH-6g	777	5,279	711	7	573
WH-8g	1,347	16,281	571	7	464
Total	**11,092**	**180,890**	**6,709**		

Table 3b. Summary of the number of files, number of calls, number of minutes of bat activity, Species Richness (S*), and Index of Activity (IA) recorded at each of the acoustic sampling locations within the BP Mohave County Study Area, 2009.

		2009			
Location	**Files**	**Calls**	**Minutes**	**S***	**IA**
WH-2g	2,369	22,599	1,955	12	1,995
WPPh	877	6,921	797	2	675
WPPg	983	6,297	909	8	727
WQQh	598	4,794	535	5	743
WQQg	1,672	18,440	1,439	9	1,454
WRRh	1,057	9,847	906	3	871
WRRg	1,503	12,577	1,311	6	1,261
WSSg	2,271	24,955	1,800	6	1,731
WTTg	805	6,649	737	4	737
WUUg	2,303	20,203	1,890	7	1,800
Total	**14,438**	**133,282**	**12,279**		

Table 3c. Summary of the number of files, number of calls, number of minutes of bat activity, Species Richness (S*), and Index of Activity (IA) recorded at each of the acoustic sampling locations within the BP Mohave County Wind Project Site, 2010-2011.

		2010-2011			
Location	**Files**	**Calls**	**Minutes**	**S***	**IA**
MC1g	2,232	23,226	1,793	9	901
MC1h	1,033	7,083	843	6	664
MC2g	5,385	80,444	3,581	8	1,946
MC3g	1,569	13,332	1,299	6	1,065
Total	**10,219**	**124,085**	**7,516**		

Table 4. Index of Activity (number of minutes of activity/nights of recording*100) for each month at site WH-1g, BP Mohave County Wind Project Site, 2007.

	2007								
	MAY	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**	**TOTAL**
Antrozous pallidus	0	11	0	0	70	6	0	0	**15**
Corynorhinus townsendii	0	6	0	0	30	0	0	0	**6**
Eptesicus fuscus	0	0	0	0	44	0	0	0	**8**
Idionycteris phyllotis	0	0	0	0	7	0	0	0	**1**
Lasiurus cinereus	0	0	0	3	22	0	0	0	**5**
Myotis californicus	0	22	3	52	493	12	0	0	**107**
Myotis ciliolabrum	0	0	0	0	19	0	0	0	**3**
Myotis thysanodes	0	0	0	0	26	0	0	0	**5**
Myotis yumanensis	0	22	10	52	704	0	0	0	**146**
Nyctinomops macrotis	0	0	0	0	4	0	0	0	**1**
Parastrellus hesperus	14	6	16	17	544	12	0	0	**111**
Tadarida brasiliensis	157	250	210	86	615	100	0	0	**227**
Total	**171**	**317**	**239**	**210**	**2,578**	**129**	**0**	**0**	**636**

Table 5. Index of Activity (number of minutes of activity/nights of recording*100) for each month at site WH-2g, BP Mohave County Study Area, 2007.

	2007								2008			
	MAY	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**	**JAN**	**FEB**	**MAR**	**TOTAL**
Antrozous pallidus	0	0	3	20	0	0	0	0	0	0	0	**2**
Corynorhinus townsendii	0	0	35	0	0	3	0	0	0	0	0	**7**
Eptesicus fuscus	0	87	2,574	120	26	13	0	0	0	0	0	**470**
Myotis californicus	0	60	742	590	1,805	1,016	0	0	0	300	76	**554**
Myotis yumanensis	0	60	329	10	0	13	0	0	0	0	0	**66**
Nyctinomops macrotis	0	0	0	0	0	0	0	0	0	0	4	**1**
Parastrellus hesperus	0	33	777	50	16	0	0	0	0	0	0	**144**
Tadarida brasiliensis	90	193	829	40	58	158	10	0	0	50	860	**327**
Total	**90**	**433**	**5,290**	**830**	**1,905**	**1,203**	**10**	**0**	**0**	**350**	**940**	**1,569**

Table 6. Index of Activity (number of minutes of activity/nights of recording*100) for each month at site WH-3g, BP Mohave County Study Area, 2007.

	2007								
	MAY	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**	**TOTAL**
Antrozous pallidus	0	0	7	61	7	0	0	0	**14**
Corynorhinus townsendii	0	0	3	4	7	0	0	0	**3**
Eptesicus fuscus	0	31	3	0	0	0	0	0	**4**
Eumops perotis	0	0	3	4	0	0	0	0	**1**
Lasiurus cinereus	22	0	0	7	0	5	0	0	**3**
Myotis californicus	111	181	143	196	333	185	0	0	**185**
Myotis ciliolabrum	0	0	3	4	0	0	0	0	**1**
Myotis thysanodes	0	0	40	29	23	5	0	0	**19**
Myotis yumanensis	0	25	47	79	50	10	0	0	**39**
Parastrellus hesperus	0	25	40	175	17	5	0	0	**48**
Tadarida brasiliensis	111	963	793	279	160	150	0	0	**377**
Total	**244**	**1,225**	**1,083**	**836**	**597**	**360**	**0**	**0**	**695**

Table 7. Index of Activity (number of minutes of activity/nights of recording*100) for each month at site WH-4g, BP Mohave County Wind Project Site, 2007.

	2007								
	MAY	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**	**TOTAL**
Eptesicus fuscus	0	22	0	0	0	0	0	0	**3**
Lasiurus cinereus	0	0	0	0	7	0	0	0	**1**
Myotis californicus	67	39	0	14	0	0	0	0	**11**
Myotis thysanodes	0	0	0	3	0	0	0	0	**1**
Myotis yumanensis	0	4	0	0	3	4	0	0	**2**
Parastrellus hesperus	0	9	21	41	13	15	7	0	**16**
Tadarida brasiliensis	178	243	353	186	140	174	57	0	**166**
Total	**244**	**317**	**374**	**245**	**163**	**193**	**63**	**0**	**198**

Table 8. Index of Activity (number of minutes of activity/nights of recording*100) for each month at site WH-5g, BP Mohave County Study Area, 2007.

	2007								
	MAY	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**	**TOTAL**
Antrozous pallidus	11	0	6	0	0	0	0	0	**2**
Myotis californicus	211	9	10	18	14	10	0	0	**19**
Myotis yumanensis	0	14	10	9	3	0	0	0	**5**
Nyctinomops macrotis	0	0	0	0	3	0	0	0	**1**
Parastrellus hesperus	0	18	39	64	110	0	0	0	**31**
Tadarida brasiliensis	56	364	190	9	131	184	10	0	**139**
Total	**278**	**405**	**255**	**100**	**262**	**194**	**10**	**0**	**196**

Table 9. Index of Activity (number of minutes of activity/nights of recording*100) for each month at site WH-6g, BP Mohave County Study Area, 2007.

	2007						
	JUN	**JUL**	**AUG**	**SEP**	**OCT**	**NOV**	**TOTAL**
Antrozous pallidus	0	5	0	13	4	0	**5**
Lasiurus cinereus	0	5	0	7	4	4	**4**
Myotis californicus	60	58	100	47	11	11	**38**
Myotis yumanensis	10	5	0	17	4	0	**6**
Nyctinomops macrotis	0	0	0	3	0	0	**1**
Parastrellus hesperus	60	584	100	150	30	7	**147**
Tadarida brasiliensis	550	684	120	373	341	218	**373**
Total	**680**	**1,342**	**320**	**610**	**393**	**239**	**573**

Table 10. Index of Activity (number of minutes of activity/nights of recording*100) for each month at site WH-8g, BP Mohave County Study Area, 2007.

	2007							
	JUN	**JUL**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**	**TOTAL**
Eptesicus fuscus	0	0	4	0	5	0	0	**2**
Eumops perotis	0	0	0	3	0	0	0	**1**
Lasiurus cinereus	0	0	0	0	40	0	0	**7**
Myotis californicus	36	58	100	53	75	0	0	**66**
Myotis yumanensis	0	0	14	7	1,405	0	0	**233**
Parastrellus hesperus	0	55	125	100	5	0	0	**67**
Tadarida brasiliensis	9	113	14	67	245	0	0	**89**
Total	**45**	**226**	**257**	**230**	**1,775**	**0**	**0**	**464**

Table 11. Index of Activity (number of minutes of activity/nights of recording*100) for each month at site WH-2g, BP Mohave County Study Area, 2009.

	2009				
	MAR	**APR**	**MAY**	**JUN**	**TOTAL**
Antrozous pallidus	27	0	10	0	**9**
Corynorhinus townsendii	32	0	10	7	**11**
Eptesicus fuscus	0	0	55	0	**17**
Eumops perotis	0	3	0	0	**1**
Lasionycteris noctivagans	9	0	0	0	**2**
Lasiurus blossevillii	0	0	0	13	**2**
Lasiurus cinereus	0	13	3	0	**5**
Myotis californicus	368	73	600	180	**322**
Myotis yumanensis	0	3	3	7	**3**
Nyctinomops macrotis	0	27	48	0	**23**
Parastrellus hesperus	0	0	6	0	**2**
Tadarida brasiliensis	1,727	2,617	1,248	80	**1,596**
Total	**2,164**	**2,737**	**1,984**	**287**	**1,995**

Table 12. Index of Activity (number of minutes of activity/nights of recording*100) for each month at site WPP, BP Mohave County Wind Project Site, 2009.

	2009				
	MAR	**APR**	**MAY**	**JUN**	**TOTAL**
	HIGH SET (45 m)				
Lasiurus cinereus	0	30	0	0	**8**
Tadarida brasiliensis	1,527	1,257	239	7	**668**
Total	**1,527**	**1,287**	**239**	**7**	**675**
	LOW SET (2 m)				
Antrozous pallidus	0	10	0	0	**2**
Eumops perotis	3	3	3	0	**2**
Lasiurus blossevillii	3	0	0	0	**1**
Lasiurus cinereus	0	3	0	0	**1**
Myotis californicus	28	10	145	60	**52**
Myotis yumanensis	3	7	6	0	**4**
Parastrellus hesperus	0	0	0	7	**1**
Tadarida brasiliensis	1,183	1,280	323	20	**664**
Total	**1,221**	**1,313**	**477**	**87**	**727**

Table 13. Index of Activity (number of minutes of activity/nights of recording*100) for each month at site WQQ, BP Mohave County Wind Project Site, 2009.

	2009				
	MAR	**APR**	**MAY**	**JUN**	**TOTAL**
	HIGH SET (45 m)				
Eumops perotis	1	0	0	0	**1**
Lasiurus cinereus	0	4	1	0	**5**
Myotis yumanensis	0	0	1	0	**1**
Nyctinomops macrotis	1	0	0	0	**1**
Tadarida brasiliensis	178	277	70	2	**527**
Total	**180**	**281**	**72**	**2**	**535**
	LOW SET (2 m)				
Antrozous pallidus	0	13	1	1	**15**
Eumops perotis	1	1	0	0	**2**
Lasiurus blossevillii	0	1	0	0	**1**
Lasiurus cinereus	0	8	1	0	**9**
Myotis californicus	2	5	10	0	**17**
Myotis thysanodes	0	1	0	0	**1**
Myotis yumanensis	2	0	4	0	**6**
Parastrellus hesperus	0	0	4	0	**4**
Tadarida brasiliensis	531	760	89	4	**1,384**
Total	**536**	**789**	**109**	**5**	**1,439**

Table 14. Index of Activity (number of minutes of activity/nights of recording*100) for each month at site WRR, BP Mohave County Study Area, 2009.

	2009				
	MAR	**APR**	**MAY**	**JUN**	**TOTAL**
	HIGH SET (45 m)				
Lasiurus cinereus	0	40	0	0	**12**
Parastrellus hesperus	0	0	3	0	**1**
Tadarida brasiliensis	1571	1173	319	13	**859**
Total	**1,571**	**1,213**	**323**	**13**	**871**
	LOW SET (2 m)				
Antrozous pallidus	21	7	0	0	**8**
Lasiurus cinereus	0	23	6	0	**9**
Myotis californicus	43	20	84	20	**45**
Myotis yumanensis	0	0	23	0	**7**
Parastrellus hesperus	4	7	58	0	**20**
Tadarida brasiliensis	1,596	2,017	490	100	**1,172**
Total	**1,664**	**2,073**	**661**	**120**	**1,261**

Table 15. Index of Activity (number of minutes of activity/nights of recording*100) for each month at site WSS, BP Mohave County Wind Project Site, 2009.

	2009				
	MAR	**APR**	**MAY**	**JUN**	**TOTAL**
Antrozous pallidus	4	0	0	0	**1**
Lasiurus cinereus	0	13	6	0	**6**
Myotis californicus	18	10	26	0	**15**
Myotis yumanensis	0	0	10	13	**5**
Parastrellus hesperus	0	3	13	0	**5**
Tadarida brasiliensis	2,975	2,577	494	53	**1,699**
Total	**2,996**	**2,603**	**548**	**67**	**1,731**

Table 16. Index of Activity (number of minutes of activity/nights of recording*100) for each month at site WTT, BP Mohave County Wind Project Site, 2009.

	2009				
	MAR	**APR**	**MAY**	**JUN**	**TOTAL**
Antrozous pallidus	3	4	0	0	**2**
Eumops perotis	3	4	0	0	**2**
Lasiurus cinereus	0	32	0	0	**8**
Tadarida brasiliensis	1,331	1,136	158	40	**725**
Total	**1,338**	**1,176**	**158**	**40**	**737**

Table 17. Activity Index (number of minutes of activity/nights of recording*100) for each month at site WUU, BP Mohave Wind Project Site, 2009.

	2009				
	MAR	**APR**	**MAY**	**JUN**	**TOTAL**
Antrozous pallidus	0	0	3	7	**2**
Eumops perotis	3	0	0	0	**1**
Lasiurus cinereus	0	47	3	0	**14**
Myotis californicus	41	27	13	0	**23**
Myotis yumanensis	10	3	0	0	**4**
Parastrellus hesperus	10	3	29	7	**13**
Tadarida brasiliensis	2,262	3,367	513	33	**1,743**
Total	**2,328**	**3,447**	**561**	**47**	**1,800**

Table 18. Index of Activity (number of minutes of activity/nights of recording*100) for each month at site MC1g, BP Mohave County Wind Project Site, 2010-2011.

	2010			2011						
	SEP	**OCT**	**NOV**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**TOTAL**
Antrozous pallidus	0	3	0	0	0	0	3	3	0	**2**
Eptesicus fuscus	0	3	0	0	0	0	0	0	0	**1**
Eumops perotis	0	3	0	0	0	3	0	0	0	**1**
Lasiurus cinereus	0	0	0	0	0	67	26	0	0	**14**
Myotis californicus	18	7	40	0	135	43	74	10	27	**47**
Myotis yumanensis	0	0	0	17	10	3	6	14	7	**6**
Nyctinomops macrotis	5	13	0	0	0	0	3	0	0	**3**
Parastrellus hesperus	455	160	480	0	255	0	6	7	87	**135**
Tadarida brasiliensis	*73*	93	240	150	571	1,663	1,677	328	160	**693**
Total	**550**	**283**	**760**	**167**	**971**	**1,780**	**1,797**	**362**	**280**	**901**

Table 19. Index of Activity (number of minutes of activity/nights of recording*100) for each month at site MC1h, BP Mohave County Wind Project Site, 2011.

	2011					
	MAR	**APR**	**MAY**	**JUN**	**JUL**	**TOTAL**
Antrozous pallidus	0	3	3	0	0	**2**
Corynorhinus townsendii	0	0	3	0	0	**1**
Lasiurus cinereus	0	13	29	0	0	**10**
Myotis yumanensis	0	3	0	0	0	**1**
Parastrellus hesperus	0	0	3	0	11	**2**
Tadarida brasiliensis	356	1,033	1,174	177	11	**649**
Grand Total	**356**	**1,053**	**1,213**	**177**	**22**	**664**

Table 20. Index of Activity (number of minutes of activity/nights of recording*100) for each month at site MC2g, BP Mohave County Wind Project Site, 2010-2011.

	2010			2011						
	SEP	**OCT**	**NOV**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**TOTAL**
Antrozous pallidus	0	0	0	0	14	23	10	7	13	**9**
Eumops perotis	0	3	0	0	0	0	0	0	0	**1**
Lasiurus cinereus	0	0	0	0	0	70	52	0	0	**20**
Myotis californicus	63	7	20	0	45	187	74	33	53	**65**
Myotis yumanensis	13	3	0	0	0	7	26	13	7	**10**
Nyctinomops macrotis	0	14	0	0	0	0	0	0	0	**2**
Parastrellus hesperus	38	31	0	0	291	387	355	243	107	**214**
Tadarida brasiliensis	*44*	172	140	33	782	4,717	3,781	360	380	**1,625**
Total	**156**	**231**	**160**	**33**	**1,132**	**5,390**	**4,297**	**657**	**560**	**1,946**

Table 21. Index of Activity (number of minutes of activity/nights of recording*100) for each month at site MC3g, BP Mohave County Wind Project Site, 2010-2011.

	2010	2011					
	SEP	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**TOTAL**
Antrozous pallidus	0	0	3	0	0	8	**2**
Lasiurus cinereus	0	0	0	83	67	0	**34**
Myotis californicus	14	0	29	37	92	13	**38**
Myotis yumanensis	0	0	10	7	0	4	**5**
Parastrellus hesperus	157	0	3	0	4	17	**14**
Tadarida brasiliensis	14	33	587	1,850	1,658	200	**972**
Total	**186**	**33**	**632**	**1,977**	**1,821**	**242**	**1,065**

Table 22. A summary of primary (P) or secondary (S) status based on the magnitude of activity demonstrated by each species for high (h) and low (g) stations at each of the sampling locations within the BP Mohave County Study Area, 2007-2011.

TADRA = *Tadarida brasiliensis*; MYOCAL = *Myotis californicus*; MYOYUM = *M. yumanensis*; PARHES = *Parastrellus hesperus*; EPTFUS = *Eptesicus fuscus*. Primary species contributed >25% of all bat activity, secondary species contributed <25% but >6% and the remaining contribution to bat activity for each species was ≤6%.

Location	TADBRA	MYOCAL	MYOYUM	PARHES	EPTFUS
WH-1g (2007)	P	S	P	S	-
WH-2g (2007-2008)	S	P	-	S	P
WH-3g (2007)	P	P	S	S	-
WH-4g (2007)	P	S	-	S	-
WH-5g (2007)	P	S	-	S	-
WH-6g (2007)	P	S	-	P	-
WH-8g (2007)	S	S	P	S	-
WH-2g (2009)	P	S	-	-	-
WPPh (2009)	P	-	-	-	-
WPPg (2009)	P	S	-	-	-
WQQh (2009)	P	-	-	-	-
WQQg (2009)	P	-	-	-	-
WRRh (2009)	P	-	-	-	-
WRRg (2009)	P	-	-	-	-
WSSg (2009)	P	-	-	-	-
WTTg (2009)	P	-	-	-	-
WUUg (2009)	P	-	-	-	-
MC1g (2010-2011)	P	-	-	S	-
MC1h (2011)	P	-	-	-	-
MC2g (2010-2011)	P	-	-	S	-
MC3g (2010-2011)	P	-	-	-	-

Table 23a. A summary of the distribution of sensitive species and those known or suspected of being at high risk of mortality associated with wind turbines, Mohave County Study Area, Mohave County, AZ, 2007.

Species	WH-1g	WH-2g	WH-3g	WH-4g	WH-5g	WH-6g	WH-8g
Eumops perotis[1B]	-	-	X	-	-	-	X
Idionycteris phyllotis[BLM]	X	-	-	-	-	-	-
Lasionycteris noctivagans	-	-	-	-	-	-	-
Lasiurus blossevillii	-	-	-	-	-	-	-
Lasiurus cinereus	X	-	X	X	-	X	X
Tadarida brasiliensis[1B]	X	X	X	X	X	X	X

[1B] SGCN Tier 1B
[BLM] BLM Sensitive

Table 23b. A summary of the distribution of sensitive species and those known or suspected of being at high risk of mortality associated with wind turbines, Mohave County Study Area, Mohave County, AZ, 2009.

Species	WH-2g	WPPh	WPPg	WQQh	WQQg	WRRh	WRRg	WSSg	WTTg	WUUg
Eumops perotis[1B]	X	-	X	X	X	-	-	-	X	X
Idionycteris phyllotis[BLM]	-	-	-	-	-	-	-	-	-	-
Lasionycteris noctivagans	X	-	-	-	-	-	-	-	-	-
Lasiurus blossevillii	X	-	X	-	X	-	-	-	-	-
Lasiurus cinereus	X	X	X	X	X	X	X	X	X	X
Tadarida brasiliensis[1B]	X	X	X	X	X	X	X	X	X	X

[1B] SGCN Tier 1B
[BLM] BLM Sensitive

Table 23c. A summary of the distribution of sensitive species and those known or suspected of being at high risk of mortality associated with wind turbines, Mohave County Wind Project Site, 2010-2011.

Species	MC1g	MC1h	MC2g	MC3g
Eumops perotis[1B]	X	-	X	-
Idionycteris phyllotis[BLM]	-	-	-	-
Lasionycteris noctivagans	-	-	-	-
Lasiurus blossevillii	-	-	-	-
Lasiurus cinereus	X	X	X	X
Tadarida brasiliensis[1B]	X	X	X	X

[1B] SGCN Tier 1B
[BLM] BLM Sensitive

4 Discussion

4.1 Impact of Wind Energy on Bats

Numerous studies have determined that wind energy projects can impact bats (Johnson, 2004; Kunz et al., 2007a). These impacts may be direct (e.g., physical impact resulting in injury or death) or indirect (e.g., disruption of foraging behavior, breeding activities, or migratory patterns). A template for assessing impacts to bats has been suggested recently (Kunz et al., 2007b). They discussed a range of methods, including visual, acoustic, radar, thermal imaging, and capture with a consensus that use of multiple methods will provide the greatest ability to assess baseline conditions and the potential for significant impacts. Unfortunately, there has been little success in establishing uniform protocols that would facilitate comparisons among projects throughout the US. This is particularly true for pre-construction studies. Regardless of methods used, Kunz et al. (2007b) recommended a minimum of one year, or at least a full active season (April through October), of monitoring should be completed. This is particularly true for the use of acoustic methods. Species composition and nightly activity is known to vary greatly on a temporal basis, and a true reflection of site use can best be determined by continuous sampling throughout the study period (O'Farrell et al., 2003; Hall et al., 2005; O'Farrell 2006a-d). Despite some gaps in data collection, the Mohave County Study Area data do provide information on general spatial occurrence patterns, species diversity, and temporal activity trends for those periods sampled in 2007 – 2011.

Wind turbines have been shown to be involved in bat mortality (for a review see Arnett et al., 2008). In general, tree-roosting migratory species are more susceptible; however, few studies have been conducted in the western US. Overall, past studies show that most fatalities occur in the late summer to early fall (see Arnett et al., 2008 for a review of fatality studies). However, most studies lack a full year of data. Four species detected within the present study have been found to contribute to most of the known bat fatalities associated with wind turbines. *Lasiurus cinereus* is the most susceptible species in North America and averages more than 44% of all documented fatalities at operational wind energy facilities. Additionally, *L. cinereus* was the most common bat fatality detected at the Dry Lake Phase I Wind Project in Navajo County in northern Arizona (Thompson et al. 2011b). Within a more restricted range than *L. cinereus* and at only four post-construction studies within that range, *T. brasiliensis* averaged 64.2% of total bat fatalities among those sites (Arnett et al., 2008, Miller 2008, Thompson et al. 2011b). Other species affected by wind turbine-related mortality include *L. borealis* (> 28% of total bat mortality), *L. noctivagans* (> 16%), *L. blossevillii* (4.3%), and *E. fuscus* (2.8%; Arnett et al., 2008).

Despite much speculation, the differential causes of turbine-related bat mortality are not certain. The primary cause appears to be that bats are either struck by rotors while flying within normal travel routes, or are actually attracted to the rotor-swept area (Horn et al., 2008). It appears that tree bats may be attracted to turbine monopoles as potential roost stations or areas of social congregation. There is so an indication that periods of higher insect abundance within the rotor-swept area may attract bats as a rich foraging ground. Other hypotheses have been suggested as well but none have been rigorously tested. However, it does not appear that mortality occurs simply due to random contact with turbines.

4.2 Mohave County Wind Project

The BP Mohave County Wind Project proposes a facility with a substantial footprint covering an area of low to middle elevation Mohave Desert Scrub. The bat species inventory generated during the present study appears to be relatively high (15 species out of 17 that could potentially occur on the site; Hinman and Snow, 2003) reflecting the range of topographic diversity found on and in proximity to the Project site; which includes a rich mosaic of foraging and roosting possibilities. The presence of five species (*Eptesicus fuscus, Lasionycteris noctivagans, Lasiurus blossevillii, L. cinereus*, and *Tadarida brasiliensis*) known to be adversely affected by wind energy projects suggests some risk to these species. Likewise, the presence of two other high-flying molossids (*Nyctinomops macrotis* and *Eumops perotis*) and the use of the high detector stations by other species suggest these species may be at risk of collision with turbine blades if presence at the rotor height equates to collision risk. It will be important to carefully evaluate actual fatality rates during operation. However, the relatively low quantity of bat use of the Study Area when compared with other sites in similar habitat in adjacent southern Nevada suggests minimal impact to the regional bat community (Table 24).

4.3 Species Profiles

The inventory generated by the present study provides new location data for all species detected (Hoffmeister, 1986; Hinman and Snow, 2003). However, all species detected in the Study Area have been previously found to occur within Mohave County (AZGFD, 2012).

Antrozous pallidus is found throughout the state but is considered a summer resident in the northern portion, and is a Tier 1C SGCN (Hermanson and O'Shea, 1983; Snow, Hoffmeister, 1986; Hinman and Snow, 2003, AZGFD, 2010). It uses a wide variety of roost types, including abandoned mines. In the present study, *A. pallidus* was recorded from March through October, indicating it was a breeding resident. It was recorded at all locations except for WH-4g and WH-6g in 2007.

Corynorhinus townsendii is found widely distributed through Arizona but is not considered common anywhere in the state (Kunz and Martin, 1982; Hoffmeister, 1986; Hinman and Snow, 2003). This species relies on abandoned mines for day roosts and has suffered drastic population declines throughout its range due to degradation of foraging habitat and loss of roost stations. In the present study, it was recorded at WH-1g, WH-2g, and WH-3g in 2007, WH-2g in 2009, and MC1h in 2010-2011. It occurred from March through October and probably moves to higher elevations off site to suitable structures for hibernation.

Eptesicus fuscus, although found throughout Arizona, is more associated with woodland and urban habitats, with its distribution more patchy and sparse in low desert habitats (Kurta and Baker, 1990; Hinman and Snow, 2003). It is better adapted to human habitation and will use a variety of buildings and abandoned mines. In the present study, it was found at all locations except WH-5g and WH-6g in 2007, but only found at WH-2g in 2009 and MC1g in 2010-2011. Uniquely, it was a primary species at WH-2g due to an intense burst of activity in July 2007. The fact that it would not be expected to be common in the type of habitat of the study area, and was only found in a burst of activity at the one location suggests the potential for a maternity colony, likely within an abandoned mine, in the vicinity of the detector. The presence of a maternity colony of *Eptesicus* (rarely more than 50 individuals) anywhere near the site is not significant. Additionally, changes in the Project footprint have moved the site away from the abandoned mines near WH-2g such that they are outside of the Project boundary. The vast majority of this bat's activity is below 30 m in height and out of the rotor-swept area, suggesting low risk of collision. It is not known where the species goes during the winter but it may stay in the region at higher elevations with suitable cold hibernals.

Eumops perotis is found through much of Arizona and is a Tier 1B SGCN (Hoffmeister, 1986; Hinman and Snow, 2003; AZGFD, 2010). This is a fast, high-flying species that primarily roosts in crevices in cliff faces and boulders, and is considered a year-round resident (Best et al., 1996; Hinman and Snow, 2003). It should be noted that some locations listed by Hinman and Snow (2003) were based on audible calls, but there was no recognition that four species of human-audible bats that occur in Arizona cannot be distinguished from each other simply with the unaided ear. Over the present study, this species was found from March through October and recorded at WH-3g, and WH-8g in 2007, WH-2g, WPPg, WQQh, WQQg, WTTg, and WUUg in 2009, and MC1g and MC2g in 2010-2011. This species can travel over long distances to forage and seems to prefer foraging over large bodies of water (Best et al., 1996). Lake Mead is approximately 20 air miles from the Study Area. The transient status within the Study Area may simply reflect seasonal changes in foraging movements as opposed to migratory movements. A second alternative could be that *E. perotis* is more common over the site than current data would indicate, but is confined to higher altitudes above the effective sampling range of the equipment. If the latter alternative is correct, activity could have occurred within the upper limits of the rotor-swept area but was not recorded.

Idionycteris phyllotis, a BLM Sensitive species, is found throughout much of Arizona but is considered to reside primarily in high elevation coniferous forests (Hoffmeister, 1986; Hinman and Snow, 2003). This species is known to use abandoned mines for day roosts and has been found in lower elevation Mojave desert scrub. In the present study, it was recorded only at WH-1g in September 2007.

Lasionycteris noctivagans is a Tier 1C SGCN species (AZGFD, 2010), and is found in eastern Arizona, mostly in the higher elevations of northwestern Arizona. It is a well-recognized migrator that exclusively uses trees for roosting during much of the year; although, it has been found in caves and abandoned mines during the winter (Kunz, 1982; Hoffmeister, 1986; Hinman and Snow, 2003). This species They are generally thought to migrate to warmer climates during the winter. However, recent long-term continuous acoustic monitoring in southern and east central Nevada demonstrates movement into select middle elevation stations for wintering (O'Farrell et al., 2003; Hall et al., 2005; O'Farrell 2006a-c). In the present study, it was only recorded at WH-2g in March 2009. Current data suggests that the species is only a casual transient within the Study Area.

Lasiurus blossevillii is a Tier 1C SGCN (AZGFD, 2010), is known from only 30 locations in Arizona, and is not considered to be common anywhere (Hoffmeister, 1986; Hinman and Snow, 2003). This is an obligate tree-roosting species and is generally associated with riparian habitat (Shump and Shump, 1982a; Hinman and Snow, 2003). With the advent of acoustic sampling, this species has been found at numerous new locations throughout Nevada, southern California, Idaho, and Utah; however, it never seems to be abundant anywhere (O'Farrell, 2002, 2006a-d, 2009, 2010; O'Farrell et al., 2003; Williams et al., 2006; unpublished personal observations). In the present study, it was recorded at WH-2g, WPPg, and WQQg in March, April, and June 2009. It appears this species is a casual transient within the Study Area.

Lasiurus cinereus is scattered throughout the state and is a Tier 1C SGCN (AZGFD, 2010). The species is a well-recognized migrator that exclusively uses trees for roosting and is generally associated with riparian habitats or high elevation forests (Shump and Shump, 1982b; Hoffmeister, 1986; Hinman and Snow, 2003).

A strong spring migratory occurrence is usually followed by a lesser occurrence in the fall. There is evidence that at least small numbers, possibly males, maintain summer residence in northern latitudes and/or at high elevations. It was recorded at all stations and heights except for WH-2g and WH-5g in 2007. The species was found in April and May and again from late July to October, consistent with a migratory pattern.

Myotis californicus is common throughout Arizona (Simpson, 1993; Hinman and Snow, 2003). It is considered to be a lower elevation species that roosts in crevices mainly in rock faces, mines, and buildings. It was recorded at all sites except WTTg in 2009 and MC1h in 2010-2011. It was a primary or secondary species at eight of the 20 sampling locations. The species is known to be a year-round resident in Arizona, which is apparent in the present study.

Myotis ciliolabrum is widespread throughout Arizona and primarily occurs at middle and high elevations (Holloway and Barclay, 2001; Hinman and Snow, 2003). It is known to commonly use abandoned mines for day roosting and hibernating. From April 2008-April 2009, it was found at all stations and heights, although the majority of activity at MET towers was at the low stations. In the present study it was recorded at WH-1g and WH-3g in July, August, and September 2007. It has been found in winter in central Mohave County (Hinman and Snow, 2003), suggesting that occurrence within the Study Area is from casual transients moving between breeding and wintering areas.

Myotis thysanodes is scattered widely over Arizona but is rarely common anywhere (O'Farrell and Studier, 1980; Hoffmeister, 1986; Hinman and Snow, 2003). This species is known to use abandoned mines and buildings as day roosts and is highly susceptible to human disturbance (O'Farrell and Studier, 1980). In the present study, it was recorded at WH-1g, WH-3g, and WH-4g in July through October 2007, and WQQg in April 2009. The split occurrence suggests dispersal movements from a breeding area off site to a wintering area, also off site.

Myotis yumanensis is found throughout most of Arizona (Hinman and Snow, 2003). Hinman and Snow (2003) state that the summer distribution is in juniper-pinyon habitat and wintering occurs along the lower Colorado River; however, I have found the species abundantly active along the Colorado River throughout the year (O'Farrell, unpublished observations). The species is known to use abandoned mines, rock crevices and buildings as day roosts. In the present study, it was recorded at all the ground level stations in all years except for WTTg, but among high units was found only at the WQQh high unit in 2009. It was a primary species at WH-1g and WH-8g and a secondary species at WH-3g in 2007. The species was recorded in all seasons confirming this species as a year-round resident.

Nyctinomops macrotis, a Tier 1B SGCN species, was known in Nevada from a single animal found in Henderson (Bradley et al., 1965; AZGFD, 2010). This is a fast, high-flying species that primarily roosts in crevices in cliff faces and boulders (Milner et al., 1990; Bradley et al., 2006). Recent acoustic surveys have documented autumn occurrence in the Upper Moapa Valley (Williams et al., 2006). Additionally, studies of Kyle and Lee canyons (O'Farrell, 2002; 2006a), Las Vegas Wash (O'Farrell, 2006b), Virgin and Muddy River drainages (O'Farrell, 2006c), and Searchlight (O'Farrell, 2010) reveal that *N. macrotis* disperses throughout southern Nevada in the fall. This species was recorded in September and October and again in March through May. It occurred at WH-1g, WH-2g, WH-5g, and WH-6g in 2007, WH-2g in 2009, and MC1g and MC2g in 2010-2011. Autumn and spring dispersal movements within the Study Area are apparent.

Parastrellus hesperus is common and widely distributed throughout Arizona (Hinman and Snow, 2003). This species primarily roosts in rock outcrops and cliff faces but disperses widely to forage. Throughout the present study, it was found at all stations and heights, except WTTg, with the majority of activity occurring at the low stations. The species is a year-round resident at low and middle elevations.

Tadarida brasiliensis are widespread and abundant throughout Arizona, and is a Tier 1B SGCNspecies (Hoffmeister, 1986; Wilkins, 1989; Hinman and Snow, 2003; AZGFD, 2010). The species can utilize a variety of man-made structures as well as a variety of natural features. Similar to large molossids, this species can fly at high altitudes and may travel long distances to foraging stations. Although historically considered an obligate migrator to southern winter areas, at least some portion of the resident population appears to remain year-round in southern Nevada and would be expected in adjacent northern Arizona. Recent long-term continuous acoustic monitoring in southern and east central Nevada has established considerable variation in temporal and spatial use by this species (O'Farrell et al., 2003; Hall et al., 2005; Williams et al., 2006; O'Farrell 2006a-d, 2009). Throughout the present study, it was the primary species at all acoustic stations and contributed 98-99% of activity at the high stations in all months sampled.

4.4 Comparison of Bat Use to Similar Sites

Prior to 1954, all records of bat occurrence were based on shooting, finding dead animals, or locating a roost site (Hoffmeister, 1986). In 1954, mist nets were introduced to North American bat research (Dalquest, 1954), resulting in the ability to conduct focused surveys. Arizona became one of the main regions subjected to intensive mist-net sampling, particularly in the southern portion (Hoffmeister, 1986). Because of their spatially finite nature, mist nets were used primarily at small desert waterholes and relatively constricted flyways. Thus, capture studies away from roosts were conducted at attractant features known to concentrate bat activity.

Although mist nets provide an enhanced ability to study localized bat faunas, there is considerable bias inherent in their use (Kunz and Kurta, 1988). Technological advances over the past decade have produced acoustic equipment capable of recording and displaying the time-frequency structure of echolocation calls, which then allows identification of the vocalizing species (O'Farrell, 1997; O'Farrell et al., 1999). Acoustic surveys have limitations, particularly for quiet species, such as *Corynorhinus townsendii* and *Macrotus californicus* (California leaf-nosed bat; O'Farrell and Gannon, 1999). However, significantly more species can be documented by acoustic means than standard capture methods (Kalko et al., 1996; Ochoa et al., 2000, and O'Farrell and Gannon, 1999). With the advent of acoustic studies and the ability to situate monitoring devices away from attractant features, a new understanding of bat use at the landscape level has become possible. Wind energy-related surveys have provided a strong impetus to gain this landscape-level data.

A comparison of total IA values was prepared for habitat similar to the Mohave County Study Area from multiple multi-year acoustic studies performed in adjacent Clark County, Nevada. This comparison is useful for evaluating the relative activity levels of species detected within the Study Area with the greatest potential for impacts by wind projects (see discussion above, Table 24).There are no apparent bat attractant features (e.g., riparian habitat, open water) in the Mohave County Study Area. There is, however, an abundance of potential roost sites including abandoned silver mines created in the early 1900's. Only three of the other sites presented in Table 24 are also devoid of conspicuous attractant features: Table Mountain (a mid-elevation site on a large mountain plateau with ridgelines); Halfway Wash (a low elevation site upslope from the Virgin River drainage), and Searchlight (a mid-elevation site separated from Lake Mohave by mountain ridges). The remaining sites (Table 24) were either in riparian corridors or were at streams or water impoundments; habitats considered to be attractants. All locations that had attractant features had IA values orders of magnitude larger than those obtained at Table Mountain or at Mohave County. The slightly higher values at Halfway Wash were probably influenced by the relatively close proximity of the Virgin River. Similarly, it would appear that the greater values in the present study, as compared to Table Mountain, may reflect the relatively close proximity of the Colorado River/Lake Mead, as well as potentially the presence of a large number of abandoned mines within the immediate region of the Study Area. So although the present Study Area does not contain bat attractants, such as riparian corridors, there are other features, such as the large number of abandoned mines and the Project’s proximity to the Colorado River/Lake Mead, which may be a cause of the increased bat activity recorded in the Study Area as compared to Table Mountain and Searchlight.

Patterns of bat activity at the Mohave County Study Area can be further supplemented with research at the Searchlight project (O’Farrell, 2010). The Searchlight study utilized paired high and low acoustic monitoring units, and found that the majority of species, excluding the migratory tree bats and high-flying molossids, were found to fly less than 30 m in height. Among those species that did occur within the higher spaces, they represented only a small fraction of the total activity. Thus, most species of bats recorded in the region of the Mohave County Study Area appear to be at minimal risk of adverse encounters with wind turbines. The overall magnitude of bat usage within the Study Area is significantly less than at any location studied that contained attractant features. It can be concluded that the potential effects of the proposed Project on the regional meta-community of bats in northern Arizona, including those species known to be susceptible to collision with turbine blades, would be negligible.

Table 24. A summary of Index of Activity (IA) for the entire period of study (Total), *Lasiurus blossevillii* (LASBLO), *L. cinereus* (LASCIN), and *Tadarida brasiliensis* (TADBRA) from acoustic studies that have been conducted at low to medium elevations in Clark County, Nevada compared with this study conducted in northern Mohave County, Arizona.

Location	Total IA	LASBLO	LASCIN	TADBRA
Table Mountain *	75-345	0	1-11	1-83
Virgin River **	46,583	311	17	6,792
Halfway Wash **	17,420	44	0	1,986
Overton Wildlife Area **	254,487	29	128	63,456
LV Wash Downstream 2004 †	101,614	123	1,069	26,872
2005 †	76,134	13	296	32,065
LV Wash Midstream 2004 †	66,127	23	13	5,620
2005 †	28,594	240	9,852	4,353
LV Wash Upstream 2004 †	168,428	58	900	60,779
2005 †	95,305	85	258	43,706
Ash Meadows NWR 2007 ††	11,416	19	314	549
2008 ††	10,404	30	37	788
Searchlight High 2008-2009 ‡	117-190	0	3	83-175
2009-2010 ‡	100-140	0-0.3	1-2	76-102
Searchlight Low 2008-2009 ‡	118-802	0	0.3-8	41-342
2009-2010 ‡	259-687	0-0.3	0.3-2	53-176
This study 7 Low 2007-2008	196-1,569	0	1-5	89-377
This study 3 High 2009	675-871	0	5-12	527-859
This study 7 Low 2009	727-1,995	1-2	1-14	664-1,743
This study 4 Low 2010-2011	664-1,946	0	10-34	649-1,625

* O'Farrell (2007); values are the range for 8 MET towers
** O'Farrell (2006c)
† O'Farrell (2006b)
†† O'Farrell (2009)
‡ O'Farrell (2010) values are the range for 3 high and 6 low units

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APPENDIX A

Raw data of sampling (number of minutes of activity) at the acoustic monitoring stations within the BP Wind Energy Mohave County Study Area, Mohave County, Arizona from 2007-2011.

Table A-1. Number of minutes of activity for each month at location WH-1g, BP Mohave County Study Area, 2007.

	2007								
	MAY	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**	**TOTAL**
Antrozous pallidus	0	2	0	0	19	1	0	0	**22**
Corynorhinus townsendii	0	1	0	0	8	0	0	0	**9**
Eptesicus fuscus	0	0	0	0	12	0	0	0	**12**
Idionycteris phyllotis	0	0	0	0	2	0	0	0	**2**
Lasiurus cinereus	0	0	0	1	6	0	0	0	**7**
Myotis californicus	0	4	1	15	133	2	0	0	**155**
Myotis ciliolabrum	0	0	0	0	5	0	0	0	**5**
Myotis thysanodes	0	0	0	0	7	0	0	0	**7**
Myotis yumanensis	0	4	3	15	190	0	0	0	**212**
Nyctinomops macrotis	0	0	0	0	1	0	0	0	**1**
Parastrellus hesperus	1	1	5	5	147	2	0	0	**161**
Tadarida brasiliensis	11	45	65	25	166	17	0	0	**329**
Total	**12**	**57**	**74**	**61**	**696**	**22**	**0**	**0**	**922**

Table A-2. Number of minutes of activity for each month at location WH-2g, BP Mohave County Study Area, 2007.

	2007								**2008**			
	MAY	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**	**JAN**	**FEB**	**MAR**	**TOTAL**
Antrozous pallidus	0	0	1	2	0	0	0	0	0	0	0	**3**
Corynorhinus townsendii	0	0	11	0	0	1	0	0	0	0	0	**12**
Eptesicus fuscus	0	13	798	12	5	4	0	0	0	0	0	**832**
Myotis californicus	0	9	230	59	343	315	0	0	0	6	19	**981**
Myotis yumanensis	0	9	102	1	0	4	0	0	0	0	0	**116**
Nyctinomops macrotis	0	0	0	0	0	0	0	0	0	0	1	**1**
Parastrellus hesperus	0	5	241	5	3	0	0	0	0	0	0	**254**
Tadarida brasiliensis	9	29	257	4	11	49	3	0	0	1	215	**578**
Total	**9**	**65**	**1640**	**83**	**362**	**373**	**3**	**0**	**0**	**7**	**235**	**2777**

Table A-3. Number of minutes of activity for each month at location WH-3g, BP Mohave County Study Area, 2007.

	2007								
	MAY	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**	**TOTAL**
Antrozous pallidus	0	0	2	17	2	0	0	0	**21**
Corynorhinus townsendii	0	0	1	1	2	0	0	0	**4**
Eptesicus fuscus	0	5	1	0	0	0	0	0	**6**
Eumops perotis	0	0	1	1	0	0	0	0	**2**
Lasiurus cinereus	2	0	0	2	0	1	0	0	**5**
Myotis californicus	10	29	43	55	100	37	0	0	**274**
Myotis ciliolabrum	0	0	1	1	0	0	0	0	**2**
Myotis thysanodes	0	0	12	8	7	1	0	0	**28**
Myotis yumanensis	0	4	14	22	15	2	0	0	**57**
Parastrellus hesperus	0	4	12	49	5	1	0	0	**71**
Tadarida brasiliensis	10	154	238	78	48	30	0	0	**558**
Total	**22**	**196**	**325**	**234**	**179**	**72**	**0**	**0**	**1028**

Table A-4. Number of minutes of activity for each month at location WH-4g, BP Mohave County Wind Project Site, 2007.

	2007								
	MAY	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**	**TOTAL**
Eptesicus fuscus	0	5	0	0	0	0	0	0	**5**
Lasiurus cinereus	0	0	0	0	2	0	0	0	**2**
Myotis californicus	6	9	0	4	0	0	0	0	**19**
Myotis thysanodes	0	0	0	1	0	0	0	0	**1**
Myotis yumanensis	0	1	0	0	1	1	0	0	**3**
Parastrellus hesperus	0	2	4	12	4	4	2	0	**28**
Tadarida brasiliensis	16	56	67	54	42	47	17	0	**299**
Total	**22**	**73**	**71**	**71**	**49**	**52**	**19**	**0**	**357**

Table A-5. Number of minutes of activity for each month at location WH-5g, BP Mohave County Study Area, 2007.

	2007								
	MAY	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**	**TOTAL**
Antrozous pallidus	1	0	2	0	0	0	0	0	**3**
Myotis californicus	19	2	3	2	4	3	0	0	**33**
Myotis yumanensis	0	3	3	1	1	0	0	0	**8**
Nyctinomops macrotis	0	0	0	0	1	0	0	0	**1**
Parastrellus hesperus	0	4	12	7	32	0	0	0	**55**
Tadarida brasiliensis	5	80	59	1	38	57	3	0	**243**
Total	**25**	**89**	**79**	**11**	**76**	**60**	**3**	**0**	**343**

Table A-6. Number of minutes of activity for each month at location WH-6g, BP Mohave County Study Area, 2007.

	2007						
	JUN	**JUL**	**AUG**	**SEP**	**OCT**	**NOV**	**TOTAL**
Antrozous pallidus	0	1	0	4	1	0	**6**
Lasiurus cinereus	0	1	0	2	1	1	**5**
Myotis californicus	6	11	10	14	3	3	**47**
Myotis yumanensis	1	1	0	5	1	0	**8**
Nyctinomops macrotis	0	0	0	1	0	0	**1**
Parastrellus hesperus	6	111	10	45	8	2	**182**
Tadarida brasiliensis	55	130	12	112	92	61	**462**
Total	**68**	**255**	**32**	**183**	**106**	**67**	**711**

Table A-7. Number of minutes of activity for each month at location WH-8g, BP Mohave County Study Area, 2007.

	2007							
	JUN	**JUL**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**	**TOTAL**
Eptesicus fuscus	0	0	1	0	1	0	0	**2**
Eumops perotis	0	0	0	1	0	0	0	**1**
Lasiurus cinereus	0	0	0	0	8	0	0	**8**
Myotis californicus	4	18	28	16	15	0	0	**81**
Myotis yumanensis	0	0	4	2	281	0	0	**287**
Parastrellus hesperus	0	17	35	30	1	0	0	**83**
Tadarida brasiliensis	1	35	4	20	49	0	0	**109**
Total	**5**	**70**	**72**	**69**	**355**	**0**	**0**	**571**

Table A-8. Number of minutes of activity for each month at location WH-2g, BP Mohave County Study Area, 2009.

	2009				
	MAR	**APR**	**MAY**	**JUN**	**TOTAL**
Antrozous pallidus	6	0	3	0	**9**
Corynorhinus townsendii	7	0	3	1	**11**
Eptesicus fuscus	0	0	17	0	**17**
Eumops perotis	0	1	0	0	**1**
Lasionycteris noctivagans	0	0	0	2	**2**
Lasiurus blossevillii	0	4	1	0	**5**
Lasiurus cinereus	2	0	0	0	**2**
Myotis californicus	81	22	186	27	**316**
Myotis yumanensis	0	1	1	1	**3**
Nyctinomops macrotis	0	8	15	0	**23**
Parastrellus hesperus	0	0	2	0	**2**
Tadarida brasiliensis	380	785	387	12	**1564**
Total	**476**	**821**	**615**	**43**	**1955**

Table A-9. Number of minutes of activity for each month at location WPP, BP Mohave County Wind Project Site, 2009.

	2009				
	MAR	**APR**	**MAY**	**JUN**	**TOTAL**
HIGH SET (45 m)					
Lasiurus cinereus	0	9	0	0	**9**
Tadarida brasiliensis	336	377	74	1	**788**
Total	**336**	**386**	**74**	**1**	**797**
LOW SET (2 m)					
Antrozous pallidus	0	3	0	0	**3**
Eumops perotis	1	1	1	0	**3**
Lasiurus blossevillii	1	0	0	0	**1**
Lasiurus cinereus	0	1	0	0	**1**
Myotis californicus	8	3	45	9	**65**
Myotis yumanensis	1	2	2	0	**5**
Parastrellus hesperus	0	0	0	1	**1**
Tadarida brasiliensis	343	384	100	3	**830**
Total	**354**	**394**	**148**	**13**	**909**

Table A-10. Number of minutes of activity for each month at location WQQ, BP Mohave County Wind Project Site, 2009.

	2009				
	MAR	**APR**	**MAY**	**JUN**	**TOTAL**
	HIGH SET (45 m)				
Eumops perotis	1	0	0	0	**1**
Lasiurus cinereus	0	4	1	0	**5**
Myotis yumanensis	0	0	1	0	**1**
Nyctinomops macrotis	1	0	0	0	**1**
Tadarida brasiliensis	178	277	70	2	**527**
Total	**180**	**281**	**72**	**2**	**535**
	LOW SET (2 m)				
Antrozous pallidus	0	13	1	1	**15**
Eumops perotis	1	1	0	0	**2**
Lasiurus blossevillii	0	1	0	0	**1**
Lasiurus cinereus	0	8	1	0	**9**
Myotis californicus	2	5	10	0	**17**
Myotis thysanodes	0	1	0	0	**1**
Myotis yumanensis	2	0	4	0	**6**
Parastrellus hesperus	0	0	4	0	**4**
Tadarida brasiliensis	531	760	89	4	**1384**
Total	**536**	**789**	**109**	**5**	**1439**

Table A-11. Number of minutes of activity for each month at location WRR, BP Mohave County Study Area, 2009.

	2009				
	MAR	**APR**	**MAY**	**JUN**	**TOTAL**
		HIGH SET (45 m)			
Lasiurus cinereus	0	12	0	0	**12**
Parastrellus hesperus	0	0	1	0	**1**
Tadarida brasiliensis	440	352	99	2	**893**
Total	**440**	**364**	**100**	**2**	**906**
		LOW SET (2 m)			
Antrozous pallidus	6	2	0	0	**8**
Lasiurus cinereus	0	7	2	0	**9**
Myotis californicus	12	6	26	3	**47**
Myotis yumanensis	0	0	7	0	**7**
Parastrellus hesperus	1	2	18	0	**21**
Tadarida brasiliensis	447	605	152	15	**1219**
Total	**466**	**622**	**205**	**18**	**1311**

Table A-12. Number of minutes of activity for each month at location WSS, BP Mohave County Wind Project Site, 2009.

	2009				
	MAR	**APR**	**MAY**	**JUN**	**TOTAL**
Antrozous pallidus	1	0	0	0	**1**
Lasiurus cinereus	0	4	2	0	**6**
Myotis californicus	5	3	8	0	**16**
Myotis yumanensis	0	0	3	2	**5**
Parastrellus hesperus	0	1	4	0	**5**
Tadarida brasiliensis	833	773	153	8	**1767**
Total	**839**	**781**	**170**	**10**	**1800**

Table A-13. Number of minutes of activity for each month at location WTT, BP Mohave County Wind Project Site, 2009.

	2009				
	MAR	**APR**	**MAY**	**JUN**	**TOTAL**
Antrozous pallidus	1	1	0	0	**2**
Eumops perotis	1	1	0	0	**2**
Lasiurus cinereus	0	8	0	0	**8**
Tadarida brasiliensis	386	284	49	6	**725**
Total	**388**	**294**	**49**	**6**	**737**

Table A-14. Number of minutes of activity for each month at location WUU, BP Mohave County Wind Project Site, 2009.

	2009				
	MAR	**APR**	**MAY**	**JUN**	**TOTAL**
Antrozous pallidus	0	0	1	1	**2**
Eumops perotis	1	0	0	0	**1**
Lasiurus cinereus	0	14	1	0	**15**
Myotis californicus	12	8	4	0	**24**
Myotis yumanensis	3	1	0	0	**4**
Parastrellus hesperus	3	1	9	1	**14**
Tadarida brasiliensis	656	1010	159	5	**1830**
Total	**675**	**1034**	**174**	**7**	**1890**

Table A-15. Number of minutes of activity for each month at location MC1g, BP Mohave County Wind Project Site, 2010-2011.

	2010			2011						
	SEP	**OCT**	**NOV**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**TOTAL**
Antrozous pallidus	0	1	0	0	0	0	1	1	0	**3**
Eptesicus fuscus	0	1	0	0	0	0	0	0	0	**1**
Eumops perotis	0	1	0	0	0	1	0	0	0	**2**
Lasiurus cinereus	0	0	0	0	0	20	8	0	0	**28**
Myotis californicus	4	2	2	0	42	13	23	3	4	**93**
Myotis yumanensis	0	0	0	1	3	1	2	4	1	**12**
Nyctinomops macrotis	1	4	0	0	0	0	1	0	0	**6**
Parastrellus hesperus	100	48	24	0	79	0	2	2	13	**268**
Tadarida brasiliensis	16	28	12	9	177	499	520	95	24	**1380**
Total	**121**	**85**	**38**	**10**	**301**	**534**	**557**	**105**	**42**	**1793**

Table A-16. Number of minutes of activity for each month at location MC1h, BP Mohave County Wind Project Site, 2011.

	2011					
	MAR	**APR**	**MAY**	**JUN**	**JUL**	**TOTAL**
Antrozous pallidus	0	1	1	0	0	**2**
Corynorhinus townsendii	0	0	1	0	0	**1**
Lasiurus cinereus	0	4	9	0	0	**13**
Myotis yumanensis	0	1	0	0	0	**1**
Parastrellus hesperus	0	0	1	0	1	**2**
Tadarida brasiliensis	96	310	364	53	1	**824**
Grand Total	**96**	**316**	**376**	**53**	**2**	**843**

Table A-17. Number of minutes of activity for each month at location MC2g, BP Mohave County Wind Project Site, 2010-2011.

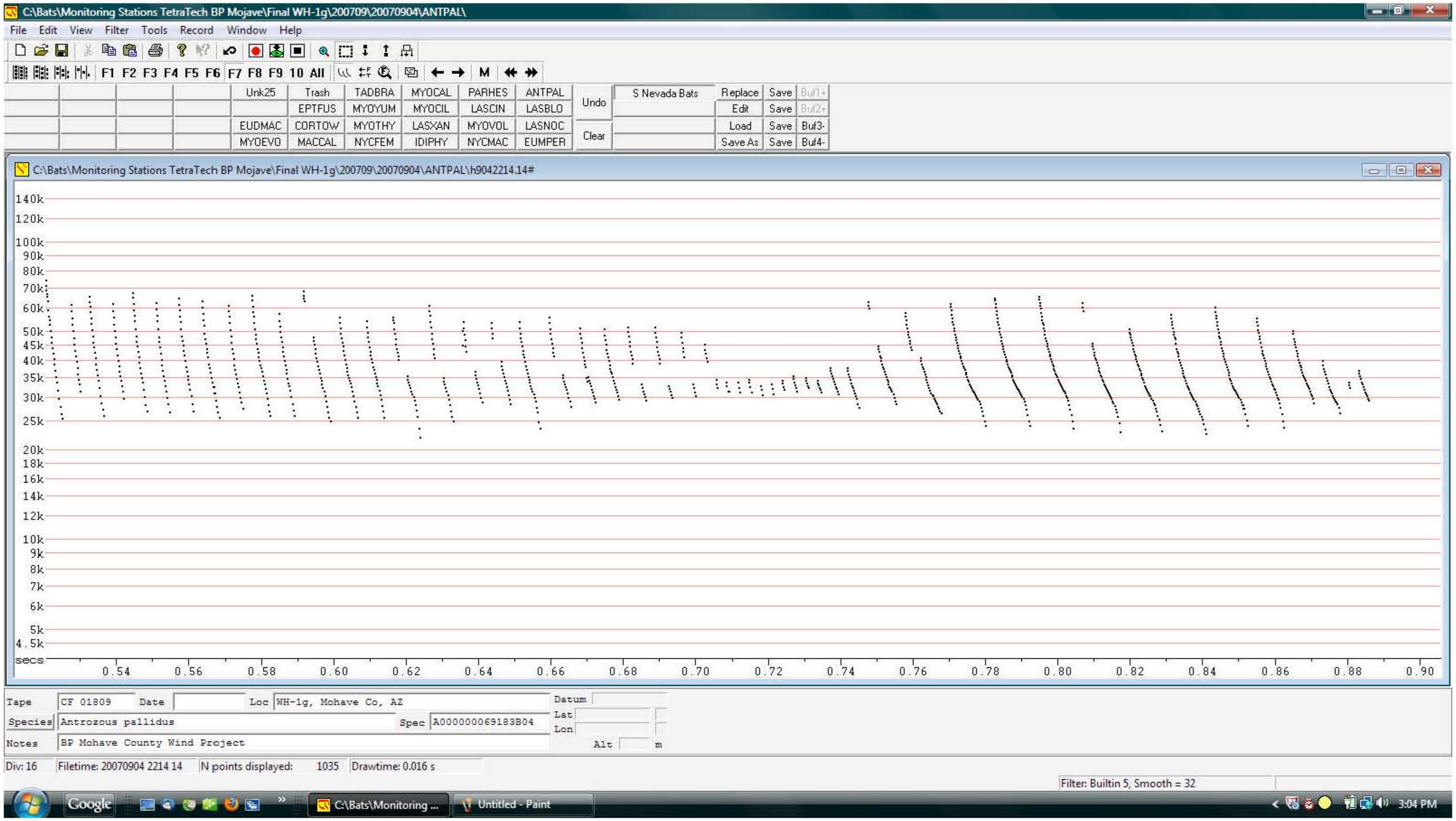
	2010			2011					
	SEP	**OCT**	**NOV**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**TOTAL**
Antrozous pallidus	0	0	0	0	3	7	3	2	2	**17**
Eumops perotis	0	1	0	0	0	0	0	0	0	**1**
Lasiurus cinereus	0	0	0	0	0	21	16	0	0	**37**
Myotis californicus	10	2	1	0	10	56	23	10	8	**120**
Myotis yumanensis	2	1	0	0	0	2	8	4	1	**18**
Nyctinomops macrotis	0	4	0	0	0	0	0	0	0	**4**
Parastrellus hesperus	6	9	0	0	64	116	110	73	16	**394**
Tadarida brasiliensis	7	50	7	2	172	1415	1172	108	57	**2990**
Total	**25**	**67**	**8**	**2**	**249**	**1617**	**1332**	**197**	**84**	**3581**

Table A-18. Number of minutes of activity for each month at location MC3g, BP Mohave County Wind Project Site, 2010-2011.

	2010	2011					
	SEP	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**TOTAL**
Antrozous pallidus	0	0	1	0	0	2	**3**
Lasiurus cinereus	0	0	0	25	16	0	**41**
Myotis californicus	1	0	9	11	22	3	**46**
Myotis yumanensis	0	0	3	2	0	1	**6**
Parastrellus hesperus	11	0	1	0	1	4	**17**
Tadarida brasiliensis	1	2	182	555	398	48	**1186**
Total	**13**	**2**	**196**	**593**	**437**	**58**	**1299**

APPENDIX B

Representative vocal signatures of each species of bat detected within the BP Wind Energy Mohave County Study Area, Mohave County, Arizona from 2007-2011.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EUDMAC CORTOW MYOTHY LASXAN MYOVOL LASNOC
MYOEVO MACCAL NYCFEM IDIPHY NYCMAC EUMPER
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S Nevada Bats
Replace Save Buf1+
Edit Save Buf2+
Load Save Buf3-
Save As Save Buf4-
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secs 0.54 0.56 0.58 0.60 0.62 0.64 0.66 0.68 0.70 0.72 0.74 0.76 0.78 0.80 0.82 0.84 0.86 0.88 0.90
Tape CF 01809
Date
Loc WH-1g, Mohave Co, AZ
Datum
Species Antrozous pallidus
Spec A000000069183B04
Lat
Lon
Notes BP Mohave County Wind Project
Alt m
Div: 16
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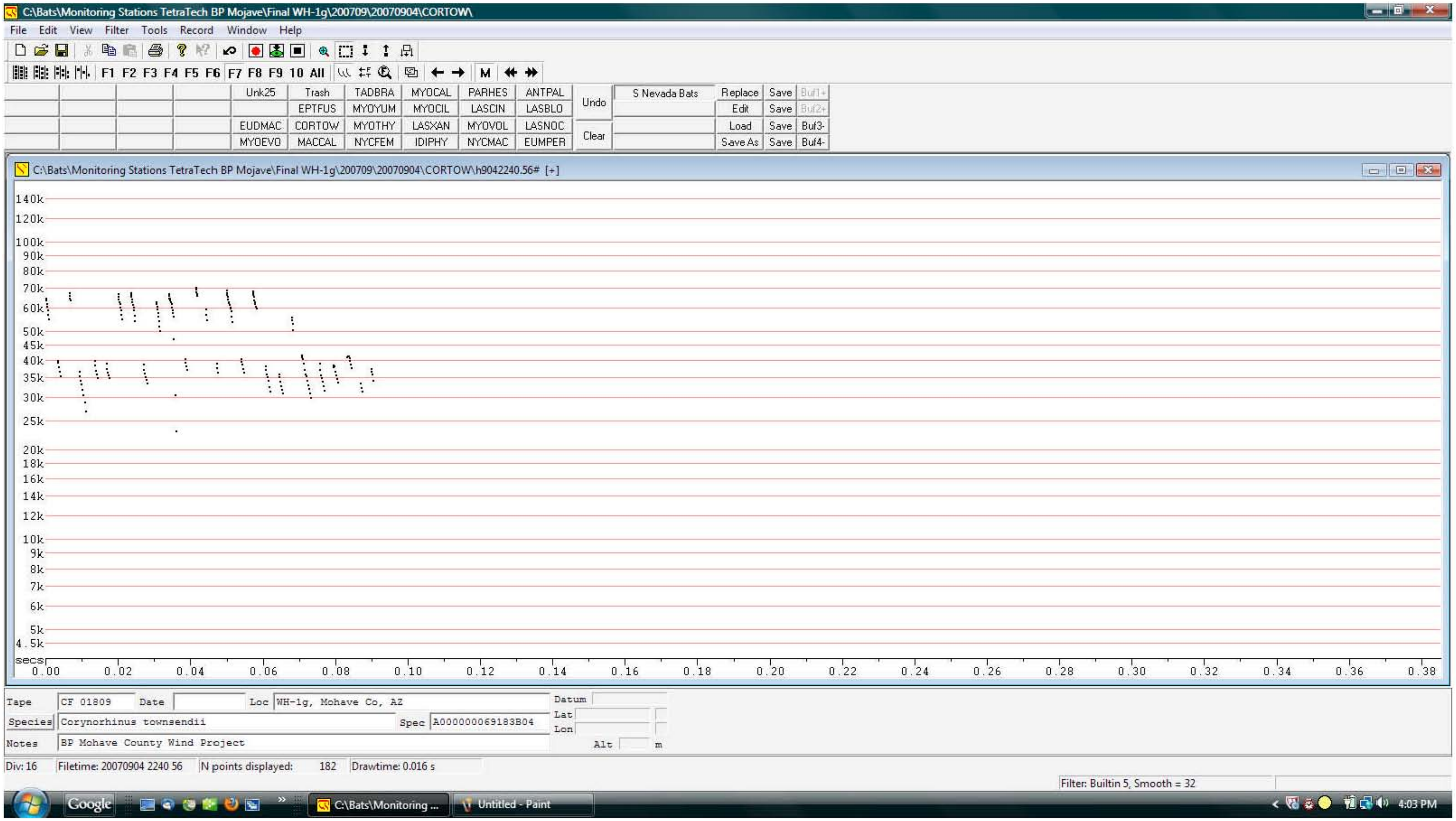
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Species Corynorhinus townsendii
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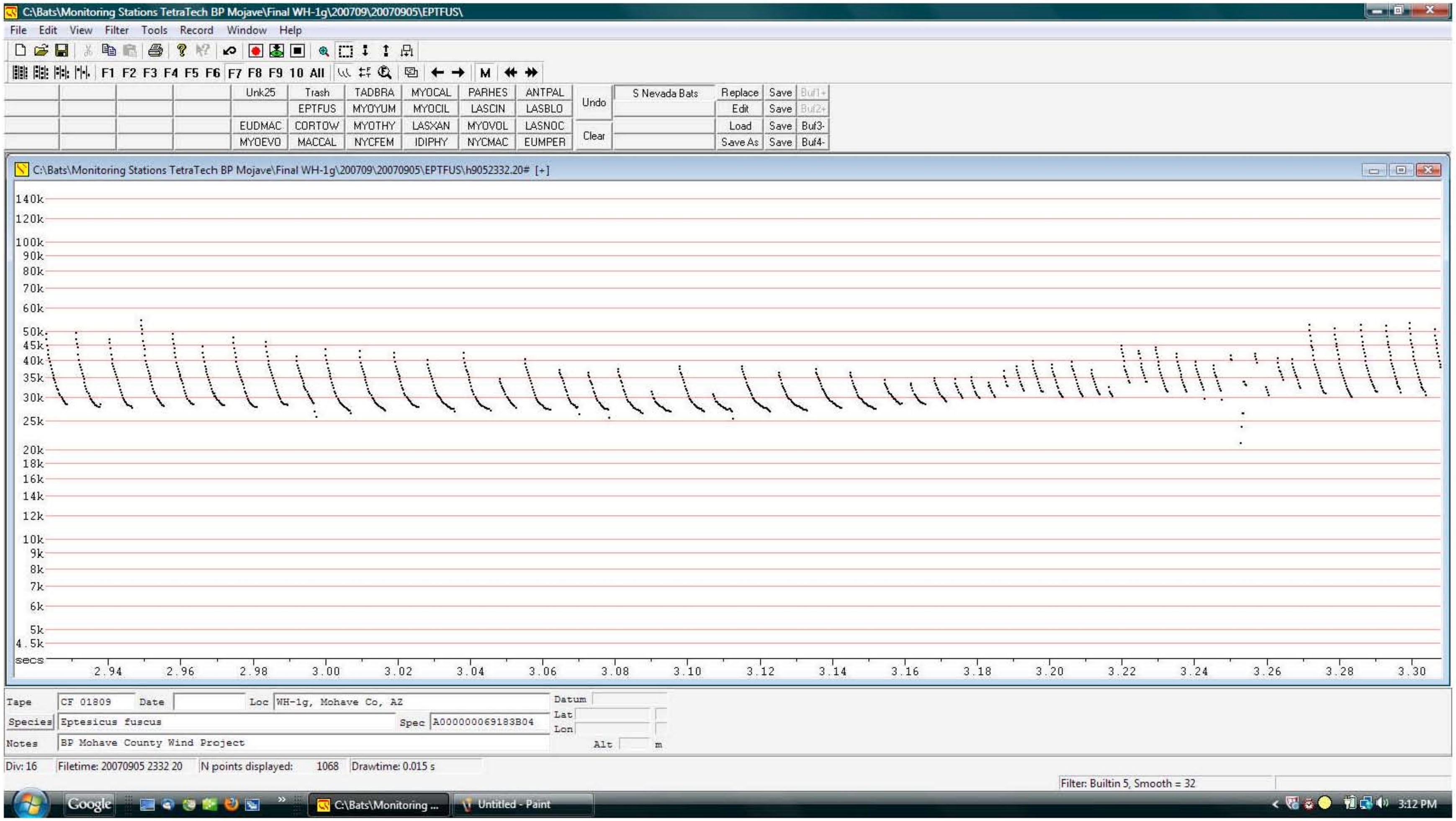
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EPTFUS MYOYUM MYOCIL LASCIN LASBLO
EUDMAC CORTOW MYOTHY LASXAN MYOVOL LASNOC
MYOEVO MACCAL NYCFEM IDIPHY NYCMAC EUMPER
Undo
Clear
S Nevada Bats
Replace Save
Edit Save
Load Save Buf3-
Save As Save Buf4-
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120k
100k
90k
80k
70k
60k
50k
45k
40k
35k
30k
25k
20k
18k
16k
14k
12k
10k
9k
8k
7k
6k
5k
4.5k
secs
2.94 2.96 2.98 3.00 3.02 3.04 3.06 3.08 3.10 3.12 3.14 3.16 3.18 3.20 3.22 3.24 3.26 3.28 3.30
Tape CF 01809
Date
Loc WH-1g, Mohave Co, AZ
Datum
Species Eptesicus fuscus
Spec A000000069183B04
Lat
Lon
Notes BP Mohave County Wind Project
Alt m
Div: 16
Filetime: 20070905 2332 20
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Google
C:\Bats\Monitoring ...
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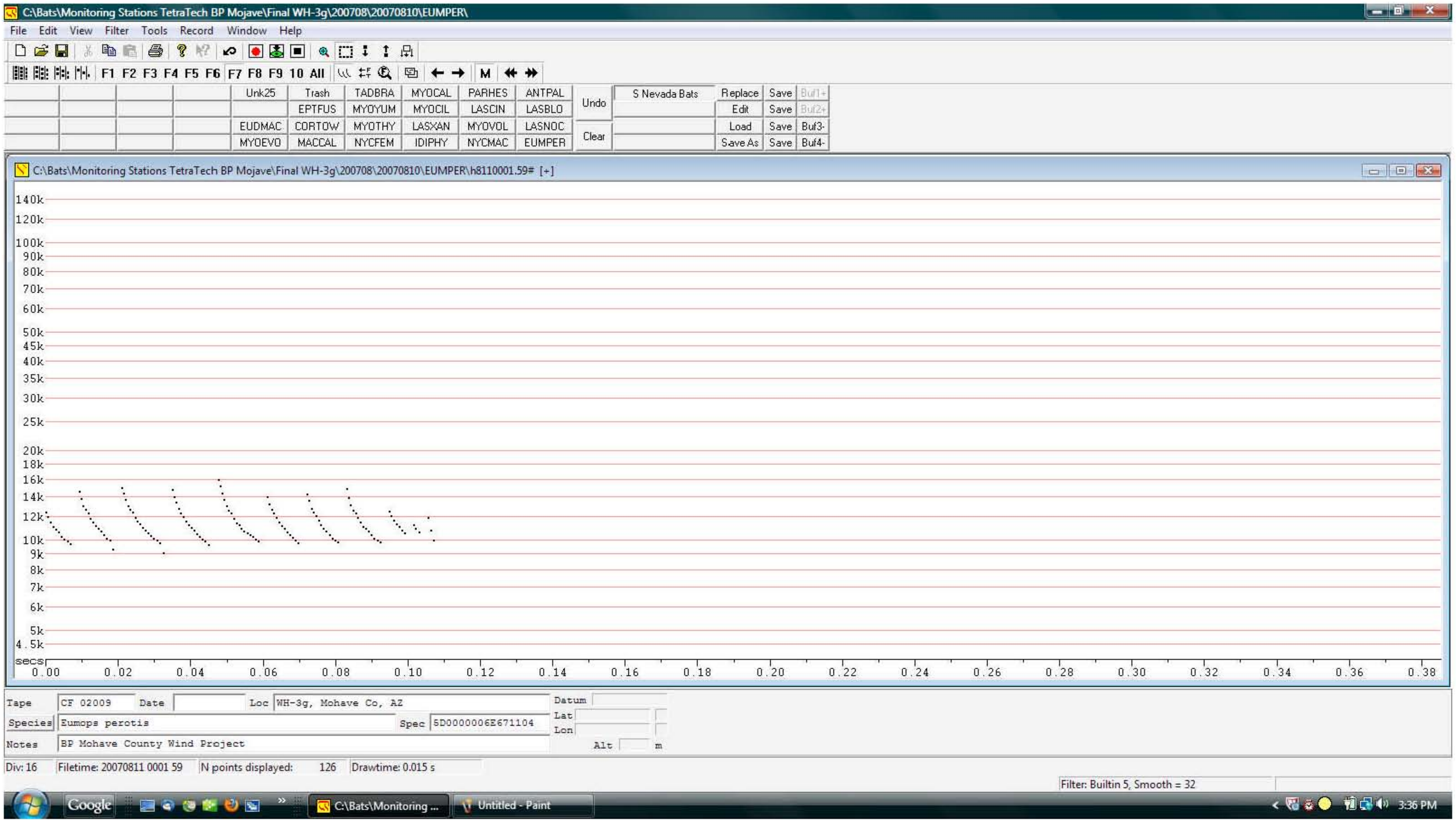
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Species Eumops perotis
Spec 5D0000006E671104
Notes BP Mohave County Wind Project
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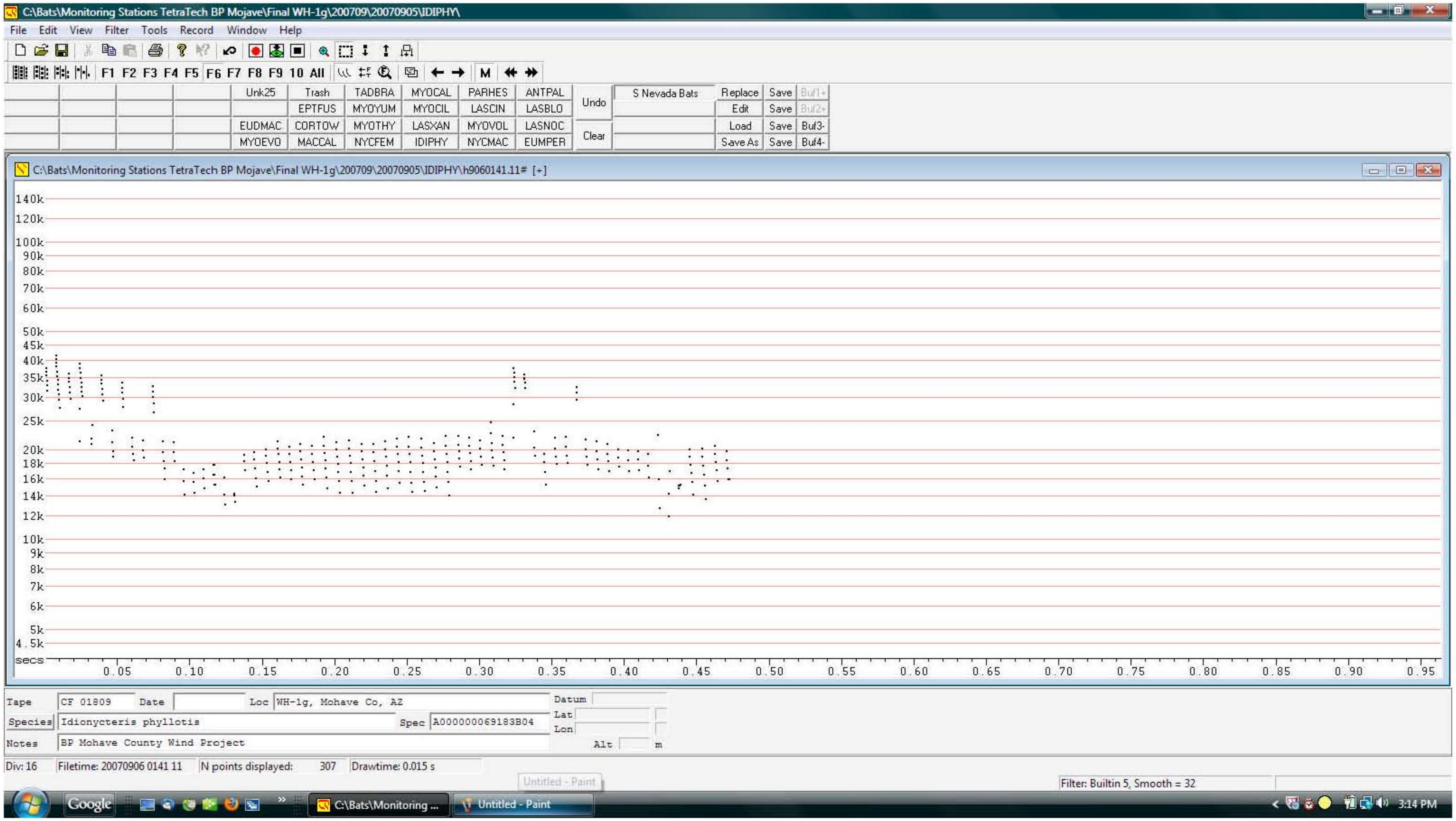
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EUDMAC CORTOW MYOTHY LASXAN MYOVOL LASNOC
MYOEVO MACCAL NYCFEM IDIPHY NYCMAC EUMPER
Undo
Clear
S Nevada Bats
Replace Edit Load Save As
C:\Bats\Monitoring Stations TetraTech BP Mojave\Final WH-1g\200709\20070905\IDIPHY\h9060141.11# [+]
Tape CF 01809
Loc WH-1g, Mohave Co, AZ
Species Idionycteris phyllotis
Spec A000000069183B04
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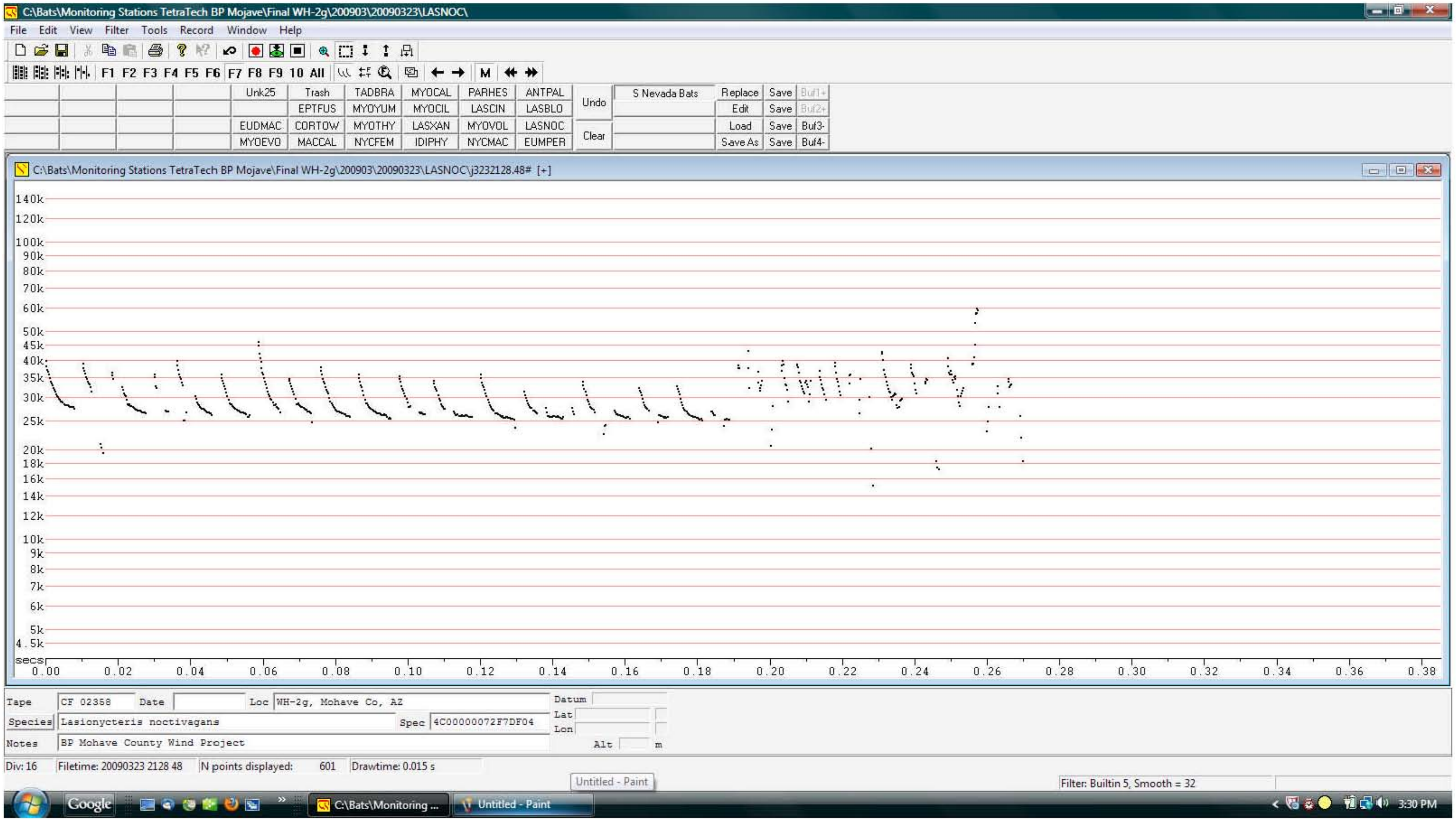
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Tape CF 02358
Loc WH-2g, Mohave Co, AZ
Species Lasionycteris noctivagans
Spec 4C00000072F7DF04
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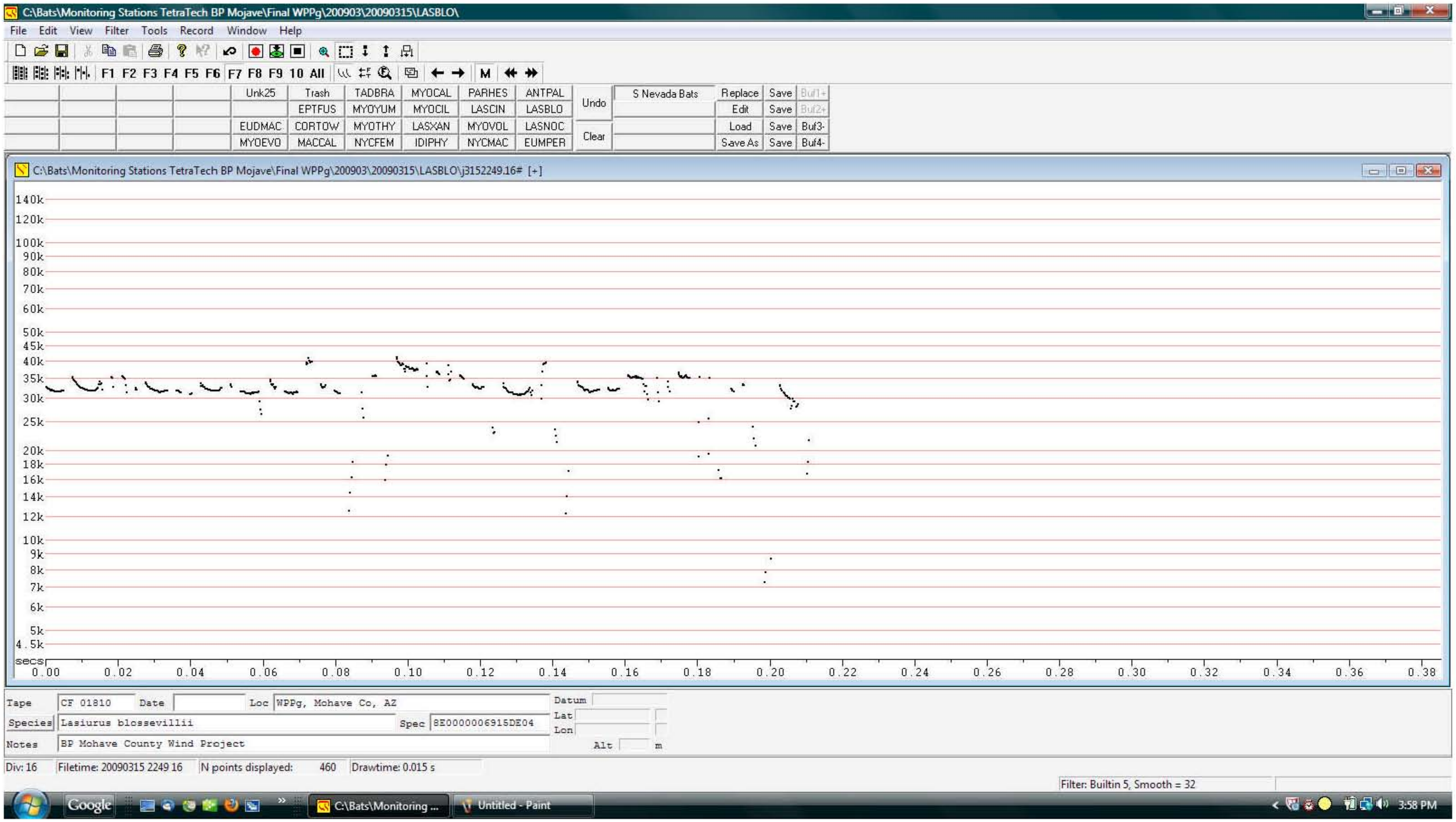
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Loc WPPg, Mohave Co, AZ
Species Lasiurus blossevillii
Spec 8E0000006915DE04
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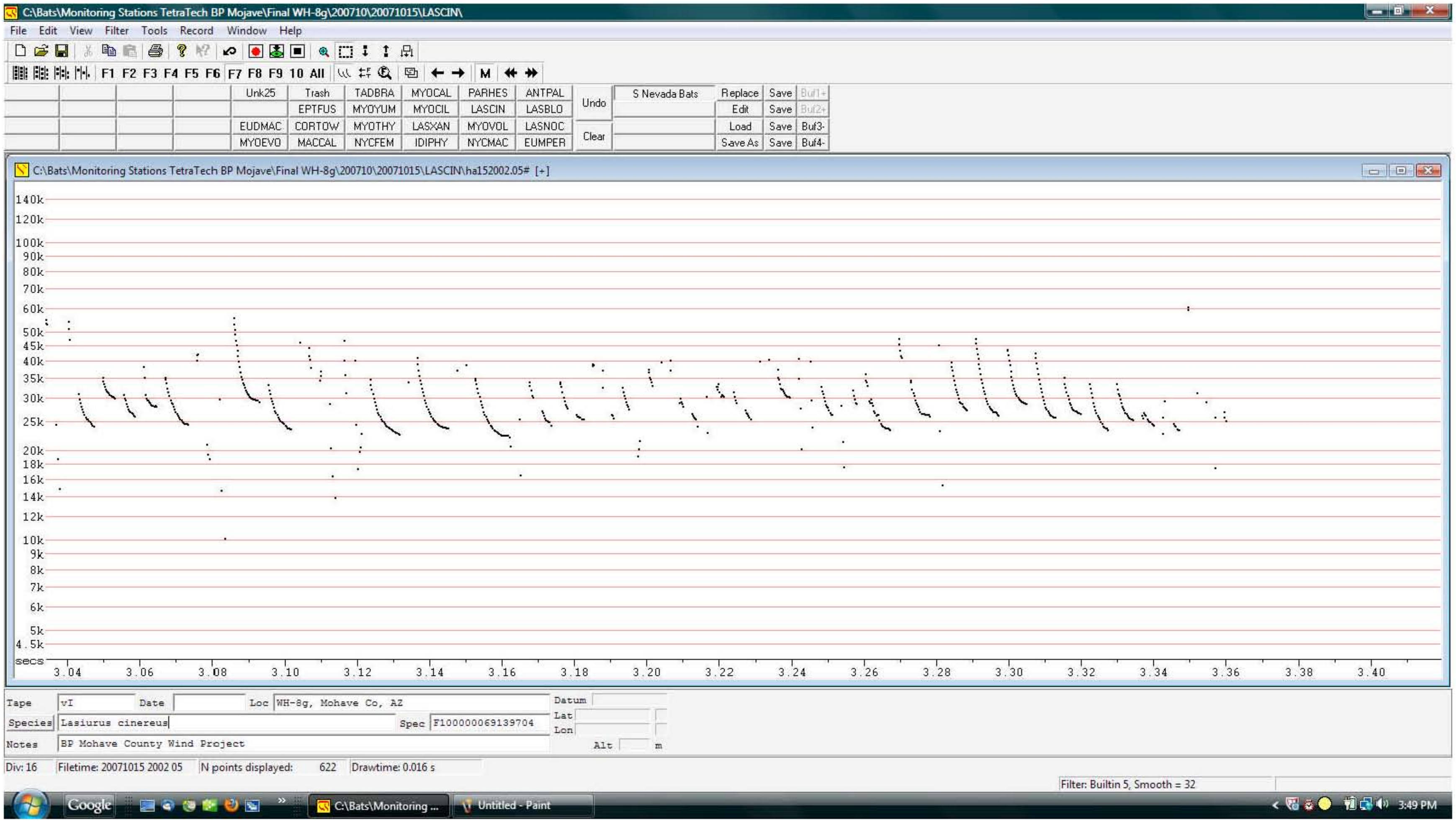

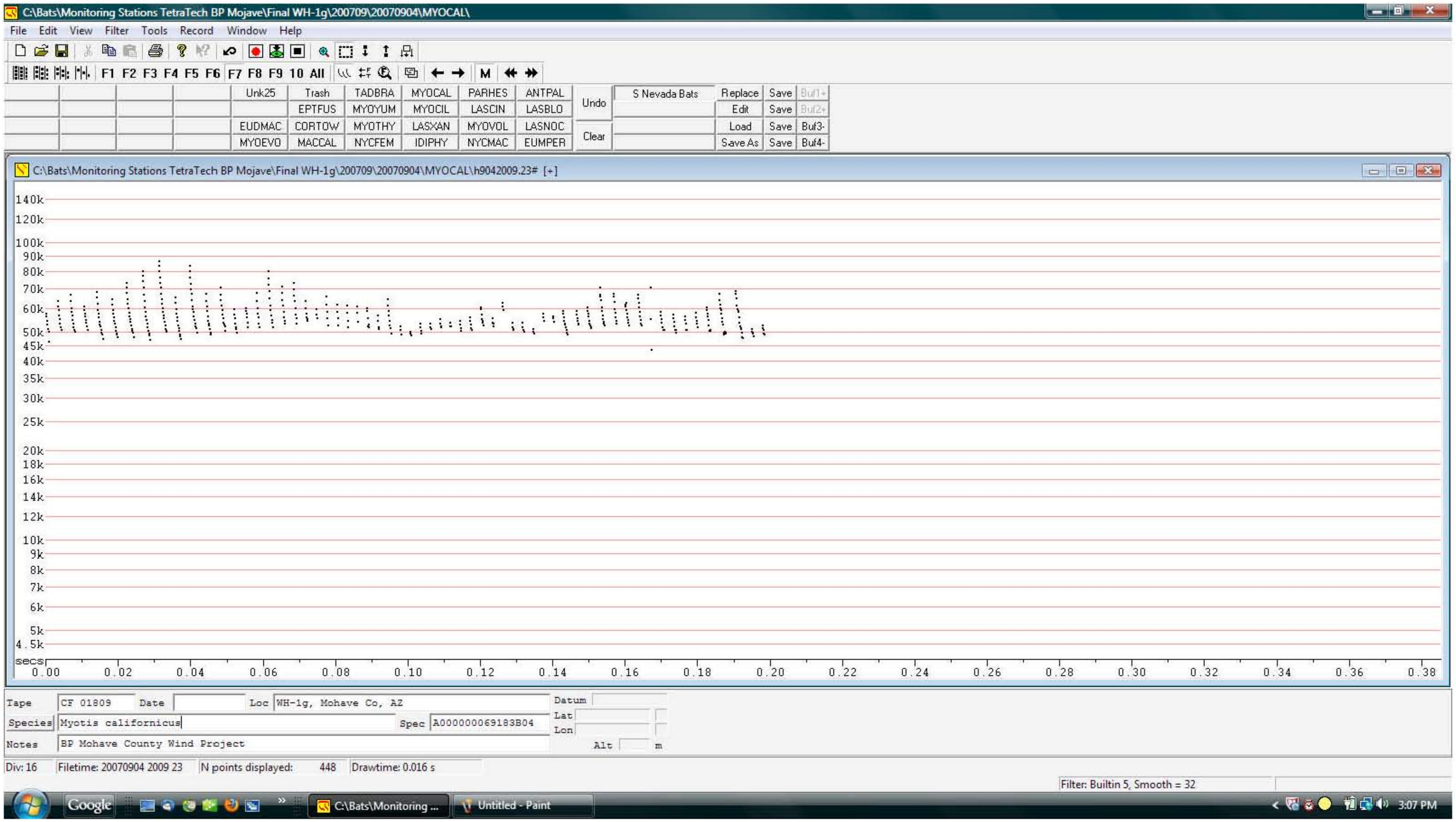
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Species Myotis californicus
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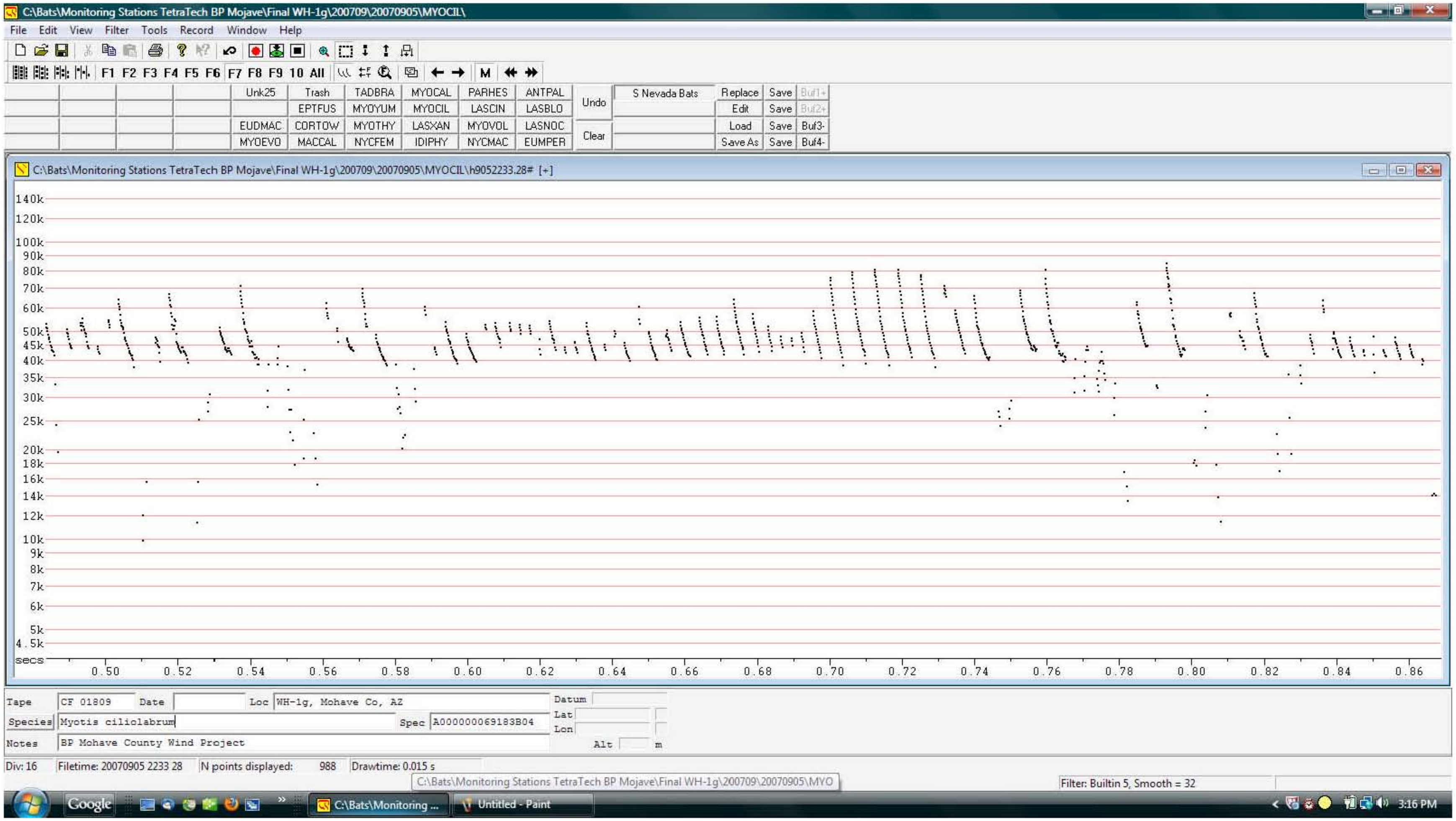
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Tape CF 01809
Loc WH-1g, Mohave Co, AZ
Species Myotis ciliolabrum
Spec A000000069183B04
Notes BP Mohave County Wind Project
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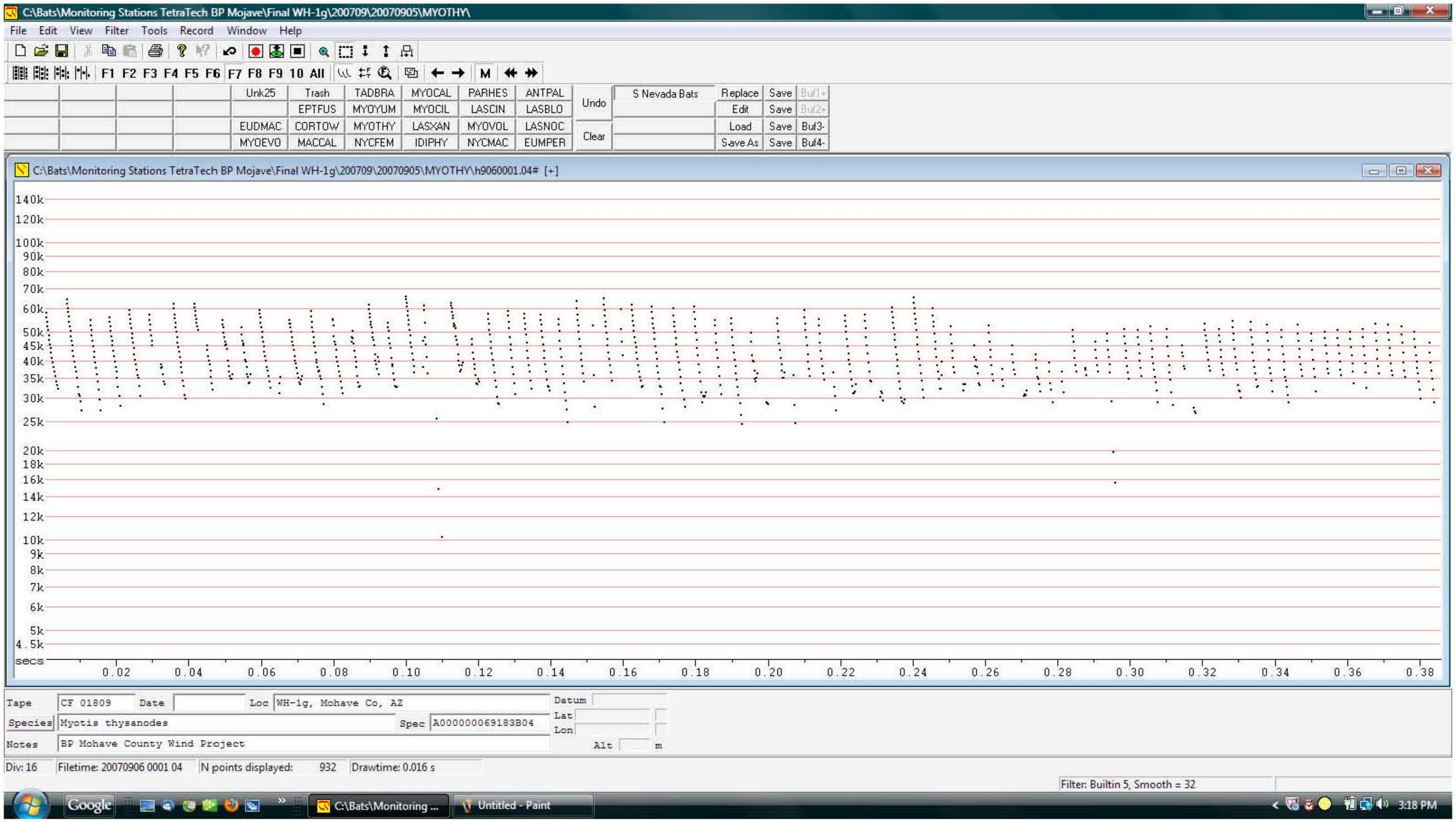
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EPTFUS MYOYUM MYOCIL LASCIN LASBLO
EUDMAC CORTOW MYOTHY LASXAN MYOVOL LASNOC
MYOEVO MACCAL NYCFEM IDIPHY NYCMAC EUMPER
Undo Clear S Nevada Bats Replace Edit Load Save As
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0.02 0.04 0.06 0.08 0.10 0.12 0.14 0.16 0.18 0.20 0.22 0.24 0.26 0.28 0.30 0.32 0.34 0.36 0.38
Tape CF 01809 Date Loc WH-1g, Mohave Co, AZ
Species Myotis thysanodes Spec A000000069183B04
Notes BP Mohave County Wind Project
Datum Lat Lon Alt m
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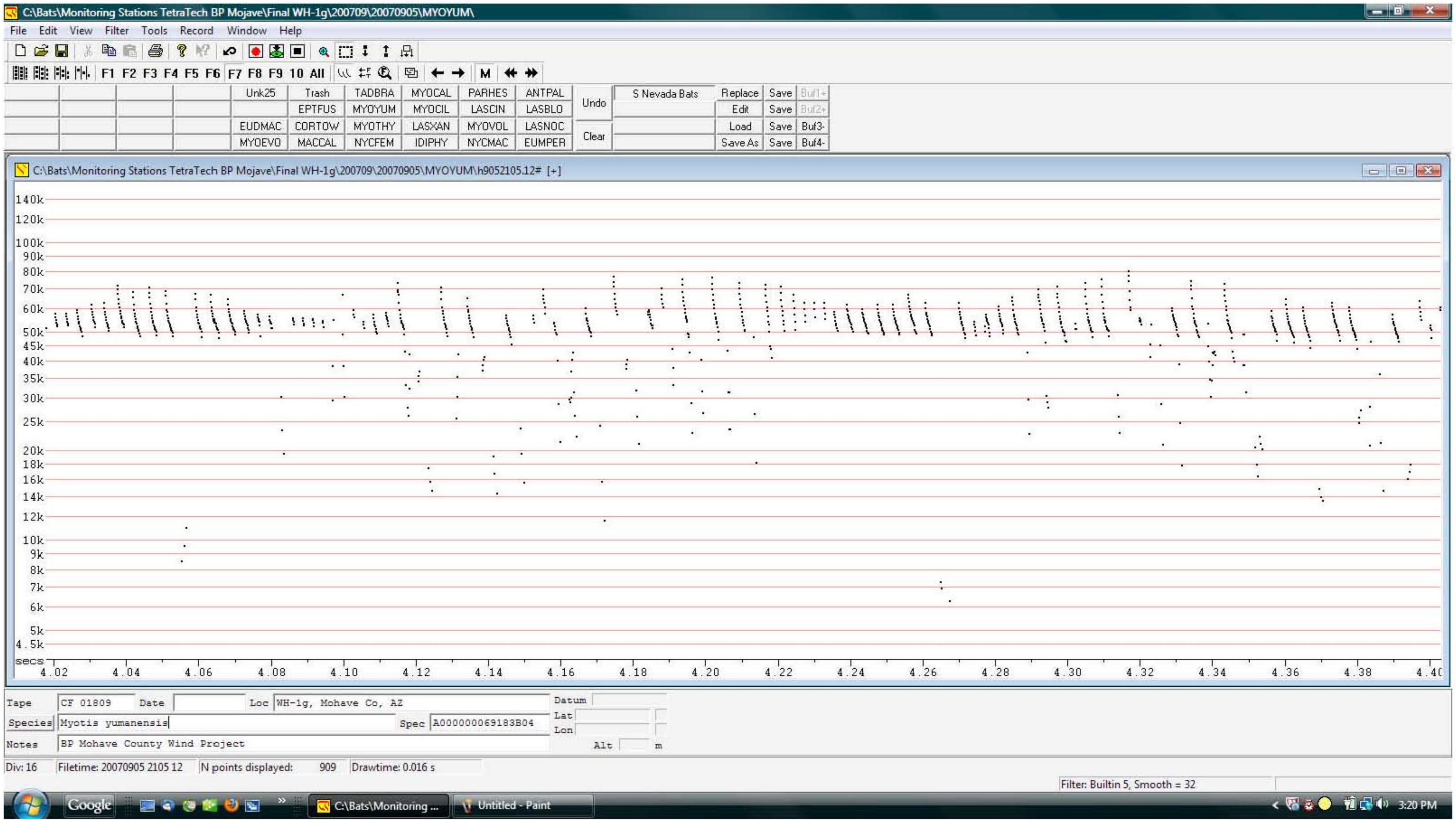
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Species Myotis yumanensis
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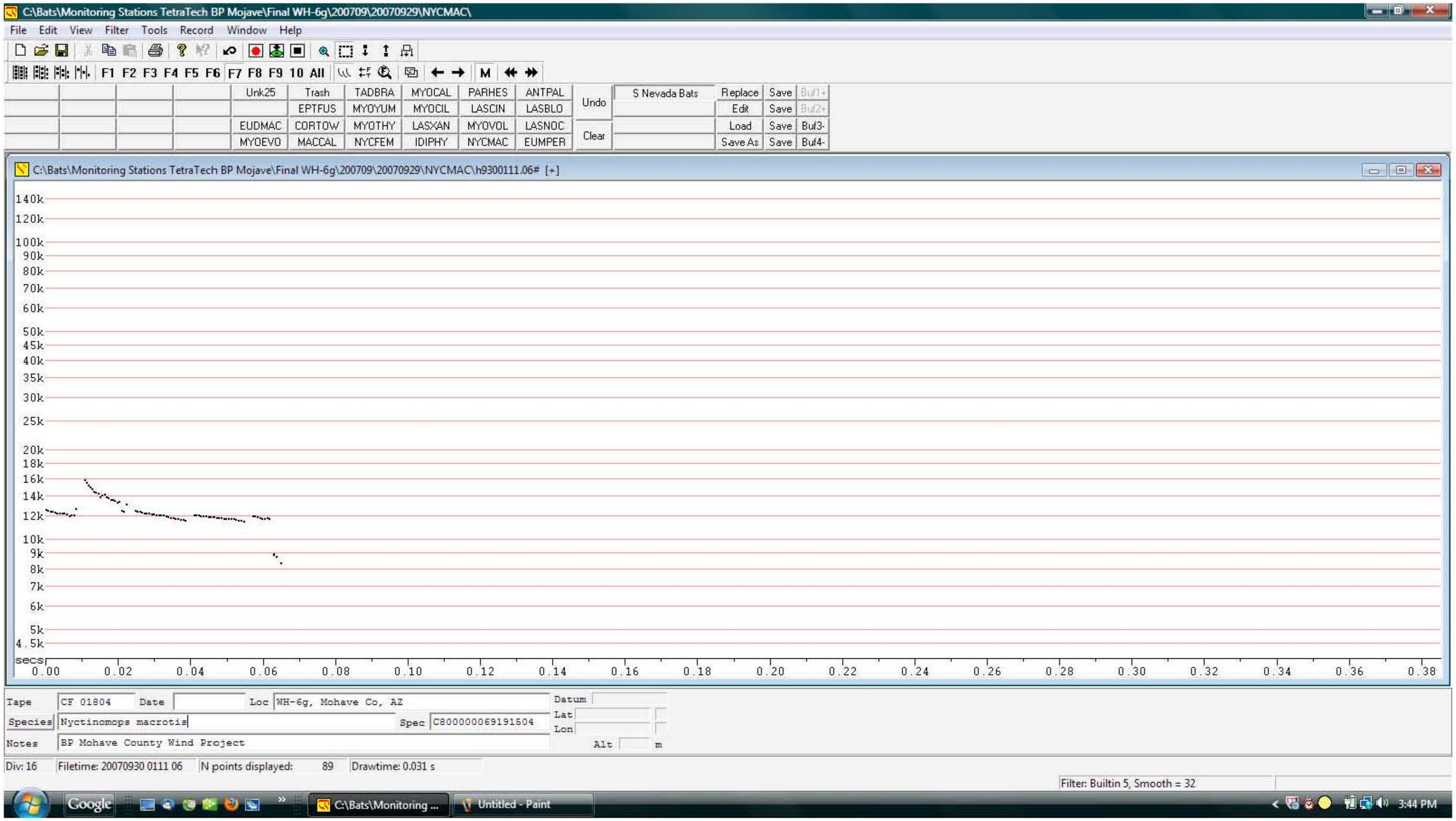
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F1 F2 F3 F4 F5 F6 F7 F8 F9 10 All
M
Unk25 Trash TADBRA MYOCAL PARHES ANTPAL
EPTFUS MYOYUM MYOCIL LASCIN LASBLO
EUDMAC CORTOW MYOTHY LASXAN MYOVOL LASNOC
MYOEVO MACCAL NYCFEM IDIPHY NYCMAC EUMPER
Undo
Clear
S Nevada Bats
Replace Save Buf1+
Edit Save Buf2+
Load Save Buf3-
Save As Save Buf4-
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120k
100k
90k
80k
70k
60k
50k
45k
40k
35k
30k
25k
20k
18k
16k
14k
12k
10k
9k
8k
7k
6k
5k
4.5k
secs
0.00 0.02 0.04 0.06 0.08 0.10 0.12 0.14 0.16 0.18 0.20 0.22 0.24 0.26 0.28 0.30 0.32 0.34 0.36 0.38
Tape CF 01804
Date
Loc WH-6g, Mohave Co, AZ
Datum
Species Nyctinomops macrotis
Spec C800000069191504
Lat
Lon
Notes BP Mohave County Wind Project
Alt m
Div: 16
Filetime: 20070930 0111 06
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Google
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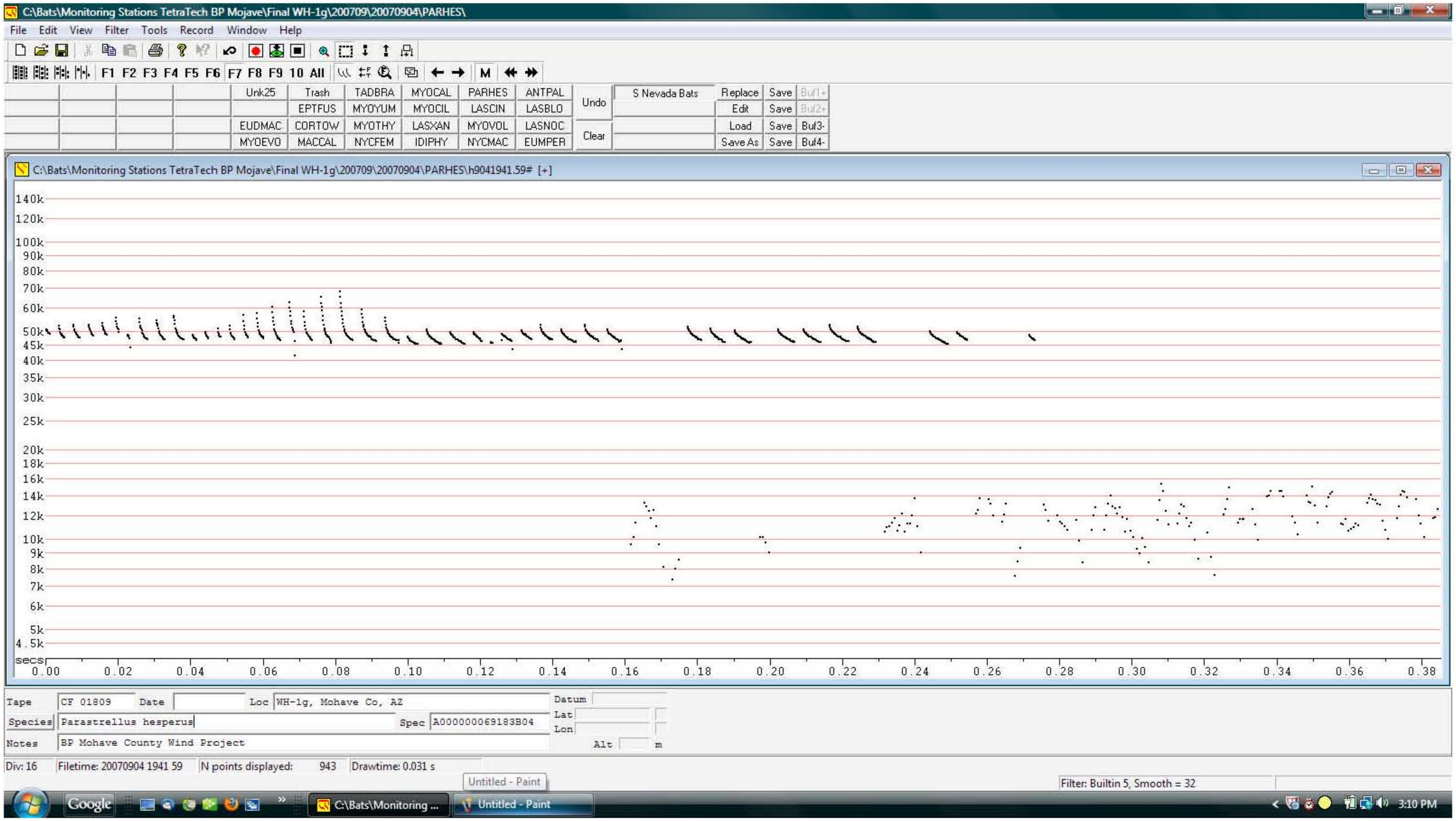
3:44 PM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Species Parastrellus hesperus
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Notes BP Mohave County Wind Project
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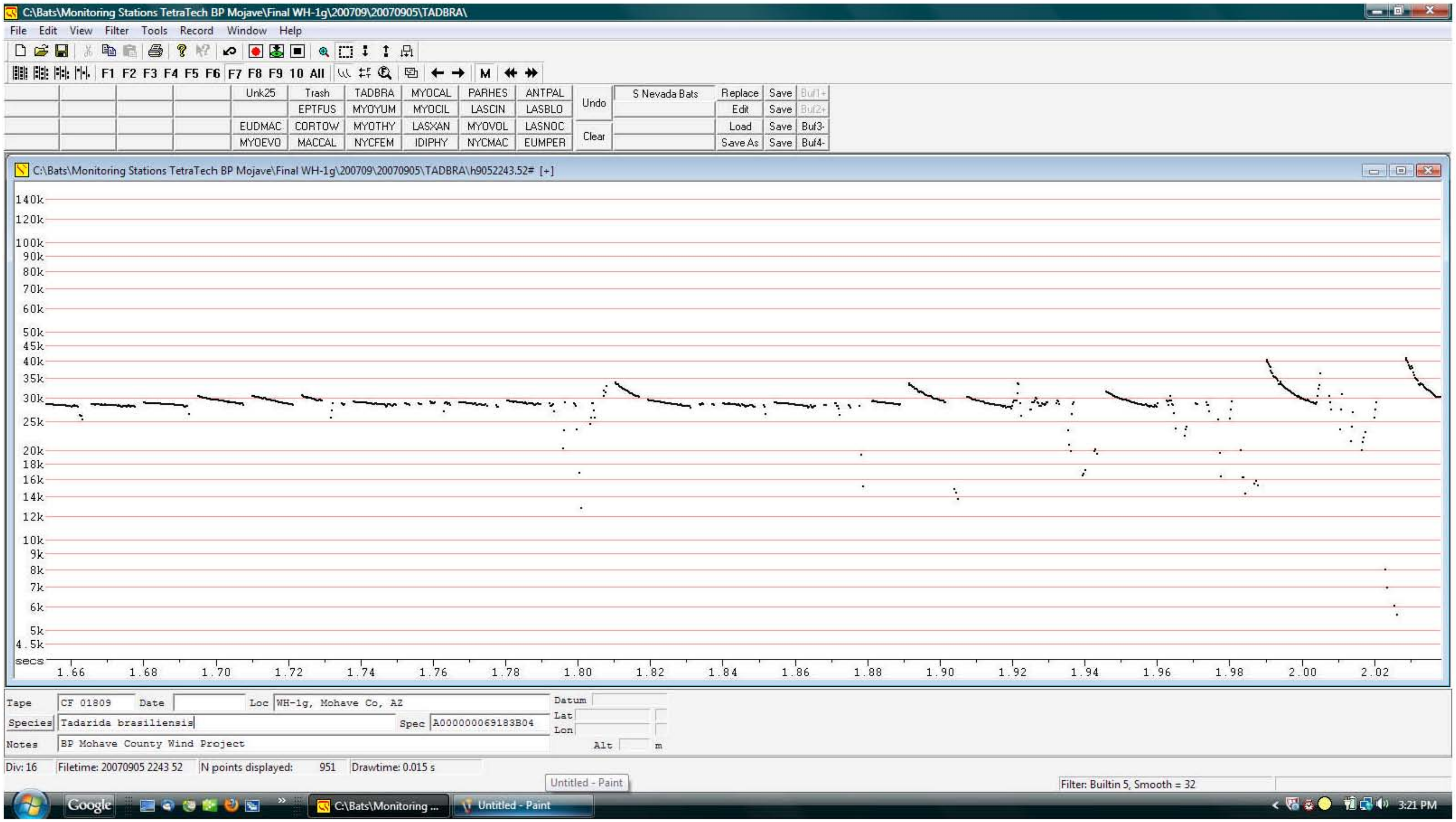
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Spec A000000069183B04
Notes BP Mohave County Wind Project
Div: 16
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Appendix B
Wildlife Incident Reporting System Protocol

BP Wind Energy	Document Number: HSSE 60.01.01

Wildlife Incident Reporting System (WIRS)

BP WIND ENERGY
POLICIES AND PROCEDURES

WILDLIFE INCIDENT REPORTING SYSTEM (WIRS)

Document Control Details

Wildlife Incident Reporting System (WIRS)

1.0 Purpose/Scope

1.1 The purpose of this policy is to define the procedures that employees and contractors should take when they observe an injured animal or animal carcass (an "incident") at a wind operating asset.

- For the purposes of this reporting system, "incident" is a general term that refers to any bird, bat, or other animal, or evidence thereof, that is found either dead or injured within the wind project facility.
- An intact, carcass, carcass parts, bones, scattered feathers (10 or more feathers constitute a feather spot), or an injured bird or bat are all considered reportable incidences.

1.2 These procedures are intended to be in place for the life of the project.

1.3 These procedures are independent of any formal monitoring studies and should occur simultaneously to any formal monitoring studies.

1.4 Implementation of the WIRS will be part of the AE Power Services staff training program.

1.5 New or existing projects may from time to time have additional special requirements. Projects with special considerations are listed in Attachment 3. The VP - Operations and Asset Management, Director of HSSE and the Environmental Manager, Construction and Operations are authorized to periodically update Attachment 3 and communicate those requirements to Director of O&M, Facility Managers, and Deputy Facility Managers, where appropriate..

2.0 Reference

3.0 Responsibilities

3.1 Facility Manager (Facility/Project) or Deputy Facility Manager (if no Facility Manager on site)

A. Facility (or Deputy Facility) Managers have overall accountability to ensure that the requirements of this procedure are being followed by all facility employees and contractors within their respective organizations.

3.2 Employees and Contractors

A. Employees must take action when they observe a wildlife incident.

B. Employees must report, using the procedure herein, all wildlife incidents.

C. Contractors must take action when they observe a wildlife incident, as directed by the Facility (or Deputy Facility) Manager.

3.3 Environmental Manager, Construction & Operations

A. Maintain completed WIRS reports and photos.

B. Answers questions as they arise, regarding the WIRS and wildlife interactions at the site.

C. Contacts agency(s) if an incident arises pertaining to threatened or endangered species.

4.0 Procedure

4.1 General

A. Prior to assuming a bird, bat, or other animal is injured, it should be observed to determine if it does not display normal behaviors.

- For example, raptors will occasionally walk on the ground, especially if they have captured a prey item. Raptors also "mantle" or hold their wings out and down covering a prey item. These types of behaviors may make the wings appear broken or the animal injured. Identification of specific behaviors typical to bird life cycles and distress behaviors will be part of the AE POWER SERVICES training program.

B. Always exercise caution before approaching or attempting to capture an injured bird. Typically, site personnel will not handle carcasses or injured animals on site, except with express approval from the HSSE Director.

C. Any incident involving a threatened or endangered species or a bald or golden eagle must be reported to BP Wind Environmental Manager, Construction & Operations immediately after identification.

4.2 Materials Needed to Complete a Report

- A copy of this WIRS procedure (unless already comfortable with the procedure)
- Wildlife Incident Report Form (see Attachment 1)
- Camera
- Pen/pencil

4.3 Incident Reporting Procedure

A. If the animal is injured:

- Move yourself to a distance far enough away that the animal is not further disturbed or uneasy due to your presence.
- Follow the procedure in Section 4.3B
- Call Environmental Manager, Construction & Operations, *immediately* to find out how the facility should handle getting the injured animal to a rehabilitation center. Leave a message if there is no answer.

B. If mortality occurs:

- Leave the animal in place.
- Photograph the incident, as it was found in the field. Take at least 2 pictures: a close-up shot of the animal as it lays in the field; and a broader view of the animal

with a local feature (turbine, road) in view. For the close-up picture, lay a measuring object (radio, coin, pencil) next to the carcass so that there is a scale comparison.

- Prepare the Wildlife Incident Report Form (Attachment 2, for an example)
- Submit the report to the Facility (or Deputy Facility) Manager and the Environmental Manager, Construction & Operations within 24 hours.

NOTE:
Do not touch or pick up the dead animal. A Collection Permit is required in order to do this.

5.0 Training

5.1 Training on the content and requirements of the WIRS procedure shall be conducted upon hiring and/or assignment to a job with exposure to wildlife incidents, and new contractor orientation.

6.0 Auditing

6.1 The requirements called for in this procedure are subject to periodic inspection by the BP Facility (or Deputy Facility) Manager and annually during the BPWE site-specific HSSE audit.

6.2 This procedure shall be reviewed at least every three years.

7.0 Acronyms and Definitions

Acronyms Table

Acronym	Definition
HSSE	Health, Safety, Security and Environmental
WIRS	Wildlife Incident Reporting System

Attachment 1
Wildlife Incident Reporting Form

Wildlife Incident Reporting Form

Site:

Date: ______________________ Time: ______________________

Observer: ______________________

(Please list all observers in the close vicinity of the discovered animal)

Animals Observed:

Type of Animal: Bird Common Name (if known): ______________________

Bat Color/Markings: ______________________

Other

Sex: Male Female Unknown

Age: Adult Juvenile Unknown

Condition: Injured Deceased

If injured what behavior is animal exhibiting? ______________________

____

If deceased what is the condition of the carcass? ______________________

Condition of remains		Age of remains	Was animal photographed?
Intact	Feather Spot	Fresh	Yes
Scavenged	Other	Aged	No
Dismembered		Unknown	Film roll/photo no. ______

Location of Animal:

Plot type: ______________________ Plot no. ______________________

Location if not on plot ______________________

UTM or long, lat coords (NAD27) ______________________

Distance and bearing from nearest tower/pole ______________________

Environmental conditions:

	Precipitation	Ambient Temperature	Wind Conditions	Other Weather Observations
Weather:	Clear	Cold	Calm	______
	Fog	Cool	Gusty wind	______
	Cloudy	Mild	Storm	______
	Rain	Warm	Violent storm	______
	Snow	Hot		______

Habitat:	Bare ground	Forest	Other (describe)	______
	Grassland	Tilled agriculture		______
	Gravel road	Mix of above (check all that apply)		______

Insect Pests: Mosquitos Fleas Ticks Flies None ______

Attachment 2
Wildlife Incident Reporting Form & Photos
(completed)

Wildlife Incident Reporting Form

Date: 6/22/11 Time: 1:35PM

Observer: Mark Hallowell

(Please list all observers in the close vicinity of the discovered animal)

Animals Observed:

Type of Animal: Bird / X Bat / Other

Common Name:

Color/Markings: Brown/Black

Is animal bagged or tagged? Yes / X No / Unknown

Does animal resemble a threatened or endangered species? Yes / No / X Unknown

Which species?

Sex: Male / Female / X Unknown

Age: Adult / Juvenile / X Unknown

Condition: Injured / Deceased X

If injured what behavior is animal exhibiting?

If deceased what is the condition of the carcass?

Condition of remains: Intact X / Feather Spot / Scavenged / Other / Dismembered

Age of remains: Fresh / Aged / Unknown

Was animal photographed? X Yes / No

Film roll/photo no.

Location of Animal:

Plot type: D4 Plot no. N/A

Location if not on plot Approximately 20 ft West of Turbine

UTM or long lat coords (NAD27) (hddd.mm.ss.s)

Distance and bearing from nearest tower/pole

Environmental conditions:

Weather:

Precipitation: X Clear / Fog / Cloudy / Rain / Snow

Ambient Temperature: Cold / Cool / X Mild / Warm / Hot

Wind Conditions: X Calm / Gusty wind / Storm / Violent storm

Other Weather Observations

Habitat: X Bare ground / Grassland / Gravel road / forest / Tilled agriculture / Mix of above (check all that apply) / Other (describe)

Insect Pests: Present: mosquitos / Ticks / Fleas / Biting flies / X None


1
16 ft
2
STANLEY®
3
4
5


6/23/2011

Attachment 3
Projects with Special Conditions

Project	Special Condition	Date of Condition
Fowler Ridge WF	All reports of bat incidents must be made within 4 hours of the observance.	July 15, 2011

DOCUMENT CONTROL DETAILS

Document Name				Wildlife Incident Reporting System		
Scope				BP Wind Energy		
Document #	HSSE 60.1.1			**Issue Date**	07-15-11	
Revision Date	07-14-11			**Next Review**	07-14-14	
Authority	Matt Sakurada	VP Operations & Asset Management	**Custodian**	Blayne Gunderman		Environmental Manager

REV #	REV DATE	Revision Detail	Authority	Custodian
0.0	07-14-11	Wildlife Incident Reporting System procedure	Matt Sakurada	Blayne Gunderman

Appendix C
Wildlife Incident Reporting Form

Wildlife Incident Reporting Form

Site:

Date: ______________________ Time: ______________________

Observer: ______________________

(Please list all observers in the close vicinity of the discovered animal)

Animals Observed:

Type of Animal: Bird Bat Other

Common Name (if known): ______________________

Color/Markings: ______________________

Sex: Male Female Unknown

Age: Adult Juvenile Unknown

Condition: Injured Deceased

If injured what behavior is animal exhibiting? ______________________

____

If deceased what is the condition of the carcass? ______________________

Condition of remains		Age of remains	Was animal photographed?
Intact	Feather Spot	Fresh	Yes
Scavenged	Other	Aged	No
Dismembered		Unknown	Film roll/photo no. ______

Location of Animal:

Plot type: ______________________ Plot no. ______________________

Location if not on plot ______________________

UTM or long, lat coords (NAD27) ______________________

Distance and bearing from nearest tower/pole ______________________

Environmental conditions:

	Precipitation	Ambient Temperature	Wind Conditions	Other Weather Observations
Weather:	Clear	Cold	Calm	______
	Fog	Cool	Gusty wind	______
	Cloudy	Mild	Storm	______
	Rain	Warm	Violent storm	______
	Snow	Hot		______
Habitat:	Bare ground	Forest	Other (describe)	______
	Grassland	Tilled agriculture		______
	Gravel road	Mix of above (check all that apply)		______

Insect Pests: Mosquitos Fleas Ticks Flies None ______________________