SWCA®
ENVIRONMENTAL CONSULTANTS
Sound Science. Creative Solutions.®

Avian Surveys and Nest Monitoring on MSHCP Properties 2020 Final Project Report

Prepared for

Desert Conservation Program
Clark County Department of Air Quality

Prepared by

SWCA Environmental Consultants

September 2020

AVIAN SURVEYS AND NEST MONITORING ON MSHCP PROPERTIES
FINAL PROJECT REPORT

Prepared for

Desert Conservation Program
Clark County Department of Air Quality
4701 W. Russell Road, Suite 200
Las Vegas, Nevada 89118

Prepared by

SWCA Environmental Consultants
7210 Placid Street
Las Vegas, Nevada 89119
702-248-3880
www.swca.com

SWCA Project No. 52768

DCP Project Nos. 2019-SWCA-1910B & 2019-SWCA-1920D

September 2020

CONTENTS

EXECUTIVE SUMMARY ..... **IV**

1.0 INTRODUCTION **1**

1.1 Description of the Project 1

1.2 Background and Need 1

1.2.1 Riparian Reserve Units 4

1.2.2 Boulder City Conservation Easement 5

1.3 Management Actions, Goals, and Objectives 5

2.0 METHODS AND MATERIALS **6**

2.1 Federally Listed Bird Surveys 6

2.2 Southwestern Willow Flycatcher Monitoring 13

2.3 Federally Listed Bird Surveys and Monitoring Data Management 14

2.4 Point-Count Surveys 15

3.0 RESULTS AND EVIDENCE OF THE RESULTS **22**

3.1 Objectives Completed 22

3.2 Survey Effort 22

3.2.1 Federally Listed Bird Surveys 22

3.2.2 Point-Count Surveys 23

3.3 Findings 24

3.3.1 Federally Listed Bird Surveys and Monitoring 24

3.3.2 Point-Count Surveys 28

4.0 EVALUATION/DISCUSSION OF RESULTS **33**

4.1 Mesquite West 33

4.1.1 Parcel 1-A 33

4.2 Bunkerville 34

4.2.1 Parcels 2-A through 2-G 35

4.2.2 Parcels 2-I and 2-J 38

4.2.3 Parcels 2-K through 2-M 41

4.3 Riverside 42

4.4 Mormon Mesa 45

4.5 Muddy River 47

4.6 BCCE 49

5.0 CONCLUSION **50**

6.0 RECOMMENDATIONS **51**

7.0 LITERATURE CITED **52**

Appendices

Appendix A – CONFIDENTIAL Federally Listed Bird Location Maps

Figures

Figure 1. Riparian Reserve Unit locations. 2
Figure 2. BCCE location. 3
Figure 3. Yellow-billed cuckoo and southwestern willow flycatcher survey areas at the Mesquite West Riparian Reserve Subunit. 7
Figure 4. Yellow-billed cuckoo and southwestern willow flycatcher survey areas at the Bunkerville Riparian Reserve Subunit. 8
Figure 5. Yellow-billed cuckoo and southwestern willow flycatcher 9
Figure 6. Yellow-billed cuckoo and southwestern willow flycatcher survey areas at the Mormon Mesa Riparian Reserve Subunit. 10
Figure 7. Yellow-billed cuckoo and southwestern willow flycatcher survey areas at the Muddy River Riparian Reserve Unit. 11
Figure 8. Point-count locations within the Mesquite West Riparian Reserve Subunit. 16
Figure 9. Point-count locations within the Bunkerville Riparian Reserve Subunit. 17
Figure 10. Point-count locations within the Riverside Riparian Reserve Subunit. 18
Figure 11. Point-count locations within the Mormon Mesa Riparian Reserve Subunit. 19
Figure 12. Point-count locations within the Muddy River Riparian Reserve Unit. 20
Figure 13. Point-count locations within the BCCE. 21
Figure 14. Left: Nest 02A with banded nestlings at Mormon Mesa Parcel 5-A. Right: Parasitized southwestern willow flycatcher Nest 03B at Mesquite West Parcel 1-A. 26
Figure 15. Left: LeConte's thrasher nest with nestlings at the BCCE. Right: LeConte's thrasher nest in a buck-horn cholla (*Cylindropuntia acanthocarpa*). 32
Figure 16. Typical narrowleaf willow habitat at Mesquite West Parcel 1-A. 34
Figure 17. Examples of flood-disturbed habitat at Bunkerville Parcels 2-A through 2-E. 35
Figure 18. Evidence of the 2019 flooding at Bunkerville Parcels 2-A through 2-E. 36
Figure 19. BV-7, facing north, in 2017 (left) and in 2020 (right). 36
Figure 20. Anthropogenically disturbed habitat at Bunkerville Parcels 2-F and 2-G. 37
Figure 21. Examples of young seep willow and arrowweed at Bunkerville Parcels 2-F and 2-G. 37
Figure 22. Monotypic tamarisk at Bunkerville Parcel 2-F (left) and the narrowleaf willow patch at Bunkerville Parcel 2-G (right). 37
Figure 23. Typical open, scrubby habitat at Bunkerville Parcels 2-I and 2-J. 38
Figure 24. Evidence of the 2019 flooding at Bunkerville Parcel 2-I. 39
Figure 25. Open tamarisk (left) and screwbean mesquite (right) habitat at Bunkerville Parcels 2-I and 2-J. 39
Figure 26. Tamarisk stand treated with herbicide at Bunkerville Parcel 2-J, before (left) and after (right) treatment. 40
Figure 27. Open water (left) and wet meadow (right) habitats at Bunkerville Parcel 2-J. 40
Figure 28. Evidence of cattle browse on narrowleaf willow at Bunkerville Parcel 2-I (left) and the meadow habitat at Bunkerville Parcel 2-J where the cattle were regularly seen (right). 41
Figure 29. Tall, dense tamarisk along a backwater feature in Parcel 2-M provides potential flycatcher breeding habitat. 41
Figure 30. Goodding's and narrowleaf willow habitat in Bunkerville Parcel 2-M. 42

Figure 31. Typical open, scrubby habitat at Bunkerville Parcels 2-L and 2-M. 42
Figure 32. Scrubby, open habitat within the floodplain at Riverside Parcels 3-A and 3-B. 43
Figure 33. Narrowleaf willow along the irrigation ditch at Riverside Parcels 3-A and 3-B. 43
Figure 34. Mesquite patch at Riverside Parcels 3-A and 3-B before (left) and after (right) cutting in 2019. 44
Figure 35. Mesquite patch at RS-5, facing west, in 2018 - showing dense growth (left), and in 2020 – following thinning but exhibiting regrowth (right). 44
Figure 36. Dead and dying tamarisk at the Mormon Mesa Subunit. 45
Figure 37. Masticated tamarisk at the Mormon Mesa Subunit. 45
Figure 38. Sample habitat within restoration plots at the Mormon Mesa Subunit. 46
Figure 39. Narrowleaf willow habitat in the occupied restoration plot in Mormon Mesa Parcel 5-A. 47
Figure 40. Horticultural trees planted at Muddy River Parcels A–E. 47
Figure 41. Creosote bush habitat with scattered honey mesquite at Muddy River Parcel F. 48
Figure 42. Varied scrub habitat at Muddy River Parcels G-I. 48
Figure 43. Mojave Desert scrub habitat at point-count locations 12 (left) and 17 (right). 49
Figure 44. Dense cholla at point-count location 33 (left) and desert wash habitat at point-count location 37 (right). 49

Tables

Table 1. Dates for Southwestern Willow Flycatcher Surveys, 2020 22
Table 2. Dates for Yellow-Billed Cuckoo Surveys, 2020 23
Table 3. Area and Total Hours of Survey for Southwestern Willow Flycatcher and Yellow-Billed Cuckoo Surveys 23
Table 4. Survey Dates for Point-Count Surveys at the Riparian Reserve Units, 2020 23
Table 5. Survey Dates for Point-Count Surveys at the BCCE, 2020 24
Table 6. Details of Flycatchers and Willow Flycatchers Detected at Monitored Parcels during the 2020 Breeding Season 25
Table 7. Summary of Causes of Southwestern Willow Flycatcher Nest Failure at Monitored Parcels, 2020 27
Table 8. Fates of Southwestern Willow Flycatcher Nests Parasitized by Cowbirds at Monitored Parcels, 2020 27
Table 9. Number of Detections of MSHCP Species Recorded at the Riparian Reserve Units during Point-Count Surveys, 2020 28
Table 10. All Other Bird Species Present at the Riparian Reserve Subunits during Point-Count Surveys, 2020 29
Table 11. Number of Detections and Breeding Codes for MSHCP Evaluation Species Recorded at the BCCE during 2020 Point-Count Surveys 31
Table 12. Number of Detections and Breeding Codes for Non-MSHCP-listed Species Recorded at the BCCE during Point-Count Surveys, 2020 32

EXECUTIVE SUMMARY

In 2020, SWCA Environmental Consultants conducted avian surveys across all properties managed by the Clark County Desert Conservation Program (County); these properties include the Riparian Reserve Units and the Boulder City Conservation Easement (BCCE). Surveys were conducted to build on the baseline dataset of avian species presence and distribution at the County's properties. These baseline data can be compared with future data to quantify the success of management and restoration efforts at the County's properties. Surveys consisted of three rounds of breeding bird point-count surveys at the Riparian Reserve Units and at the BCCE, and species-specific surveys for southwestern willow flycatcher (*Empidonax traillii extimus*) and yellow-billed cuckoo (*Coccyzus americanus*) at the Riparian Reserve Units. In addition, an intensive southwestern willow flycatcher monitoring program was instituted at Mesquite West Parcel 1-A, and opportunistic monitoring was performed at Mormon Mesa Parcel 5-A during survey visits.

Surveys conducted in 2020 were completed between May 1 and August 6, 2020. The 2020 surveys detected six of the eight bird species covered by the Clark County Multiple Species Habitat Conservation Plan (MSHCP): American peregrine falcon (*Falco peregrinus anatum*), Arizona Bell's vireo (*Vireo bellii arizonae*), blue grosbeak (*Passerina caerulea*), phainopepla (*Phainopepla nitens*), southwestern willow flycatcher, and yellow-billed cuckoo. In addition, the two other covered bird species, summer tanager (*Piranga rubra*) and vermilion flycatcher (*Pyrocephalus obscurus*), were detected incidentally in 2020, while surveyors moved between survey locations. The surveys also yielded three evaluation species: loggerhead shrike (*Lanius ludovicianus*), crissal thrasher (*Toxostoma crissale*), and LeConte's thrasher (*Toxostoma lecontei*). In total, 65 avian species were recorded across all the County's properties in 2020, and MSHCP-covered and evaluation species and their habitats were observed at each of these properties. Still, opportunities for habitat restoration, creation, and enhancement exist at almost all of the properties.

Flycatcher monitoring was conducted between May 15 and August 6, 2020, to assess the effects of brown-headed cowbird (*Molothrus ater*) control on flycatcher nest success at Parcel 1-A. A total of 18 adult willow flycatchers (*Empidonax traillii*) were detected at Mesquite West Parcel 1-A, Bunkerville West Parcel 2-M, Riverside Parcel 3-A, and Mormon Mesa Parcel 5-A. The willow flycatchers detected at Parcels 2-M and 3-A were detected only during the first round of surveys and were believed to be spring migrants passing through the Riparian Reserve Units. The remaining 16 individuals at Parcels 1-A and 5-A comprised six pairs, one unpaired male, and three individuals for which residency and/or breeding status could not be determined. Nine confirmed nesting attempts were documented; one of these attempts was successful. Six adult and two nestling flycatchers were banded in 2020. Of the two nestlings banded at Mormon Mesa Parcel 5-A, one is known to have fledged. Opportunities for brown-headed cowbird control were limited in 2020, for multiple reasons, so no inferences on effectiveness could be made.

1.0 INTRODUCTION

The Clark County Desert Conservation Program (County) manages compliance with the Endangered Species Act (ESA) through the Clark County Multiple Species Habitat Conservation Plan (MSHCP) (Clark County 2000). This is accomplished, in part, through the management of a reserve system, which includes Riparian Reserve Units, as well as the Boulder City Conservation Easement (BCCE).
The MSHCP covers eight bird species, six of which are known to occur primarily in desert riparian habitats: Arizona Bell's vireo (*Vireo bellii arizonae*), blue grosbeak (*Passerina caerulea*), southwestern willow flycatcher (*Empidonax traillii extimus*), summer tanager (*Piranga rubra*), vermilion flycatcher (*Pyrocephalus rubinus*), and yellow-billed cuckoo (*Coccyzus americanus*). The other two MSHCP-covered bird species can occur away from desert riparian habitats: the phainopepla (*Phainopepla nitens*) is typically found in desert washes with mesquite (*Prosopis* spp.) or catclaw acacia (*Senegalia greggii*), and the American peregrine falcon (*Falco peregrinus*) can be found in almost any type of habitat (Clark County 2000). Two of the eight covered bird species are also protected under the ESA—the southwestern willow flycatcher, listed as endangered (U.S. Fish and Wildlife Service [USFWS] 1995), and the yellow-billed cuckoo, listed as threatened (USFWS 2014a). In addition to the eight covered species, several evaluation species can be found in a variety of desert habitats, including upland habitats, which compose the vast majority of the BCCE.

The extent and quality of desert habitat, particularly riparian habitat, across the desert Southwest have been steadily diminishing for decades, threatened by urban and agricultural development, invasion of non-native species such as tamarisk (*Tamarix* spp.), fire, and the reduction of water tables through unsustainable water use (Clark County 2015). Because quality avian habitats, particularly riparian habitat, are scarce within arid environments, management of these areas, and conservation of the MSHCP-covered avian species that inhabit them, are essential to these species' survival.

1.1 Description of the Project

In 2019, the County solicited proposals to conduct continued avian surveys on its Riparian Reserve Units (Figure 1) and on the BCCE (Figure 2). SWCA Environmental Consultants (SWCA) was selected to conduct presence/absence surveys for both southwestern willow flycatcher and yellow-billed cuckoo across the Riparian Reserve Units (Muddy River, Virgin River Subunit 1 [Mesquite West], Virgin River Subunit 2 [Bunkerville], Virgin River Subunit 3 [Riverside], and Virgin River Subunit 5 [Mormon Mesa]) (see Figure 1), as well as conduct avian point-counts at 48 locations at the Riparian Reserve Units and at the BCCE (see Figure 2). In 2020, SWCA continued these surveys at all of the properties surveyed in 2019 and at an additional property that the County purchased in early 2020 (Bunkerville Parcels 2-K, 2-L, and 2-M). These surveys will build on baseline presence/absence and relative abundance data for all bird species on these properties, including any MSHCP-covered and evaluation avian species. Data collected for these surveys can be used to inform and evaluate the success of future restoration efforts and land management decisions for these properties. Additionally, in 2020, SWCA was contracted by the County to perform southwestern willow flycatcher territory/nest monitoring at Mesquite West Parcel 1-A to assess the effects of brown-headed cowbird (*Molothrus ater*) control on flycatcher nest success at Parcel 1-A.

1.2 Background and Need

On November 19, 2000, the USFWS issued the Intra-Service Biological and Conference Opinion on Issuance of an Incidental Take Permit to Clark County, Nevada, for an MSHCP (Biological and Conference Opinion) (USFWS 2000). Then, on March 28, 2001, the USFWS issued an amended incidental take permit for the Clark County MSHCP (USFWS 2001).

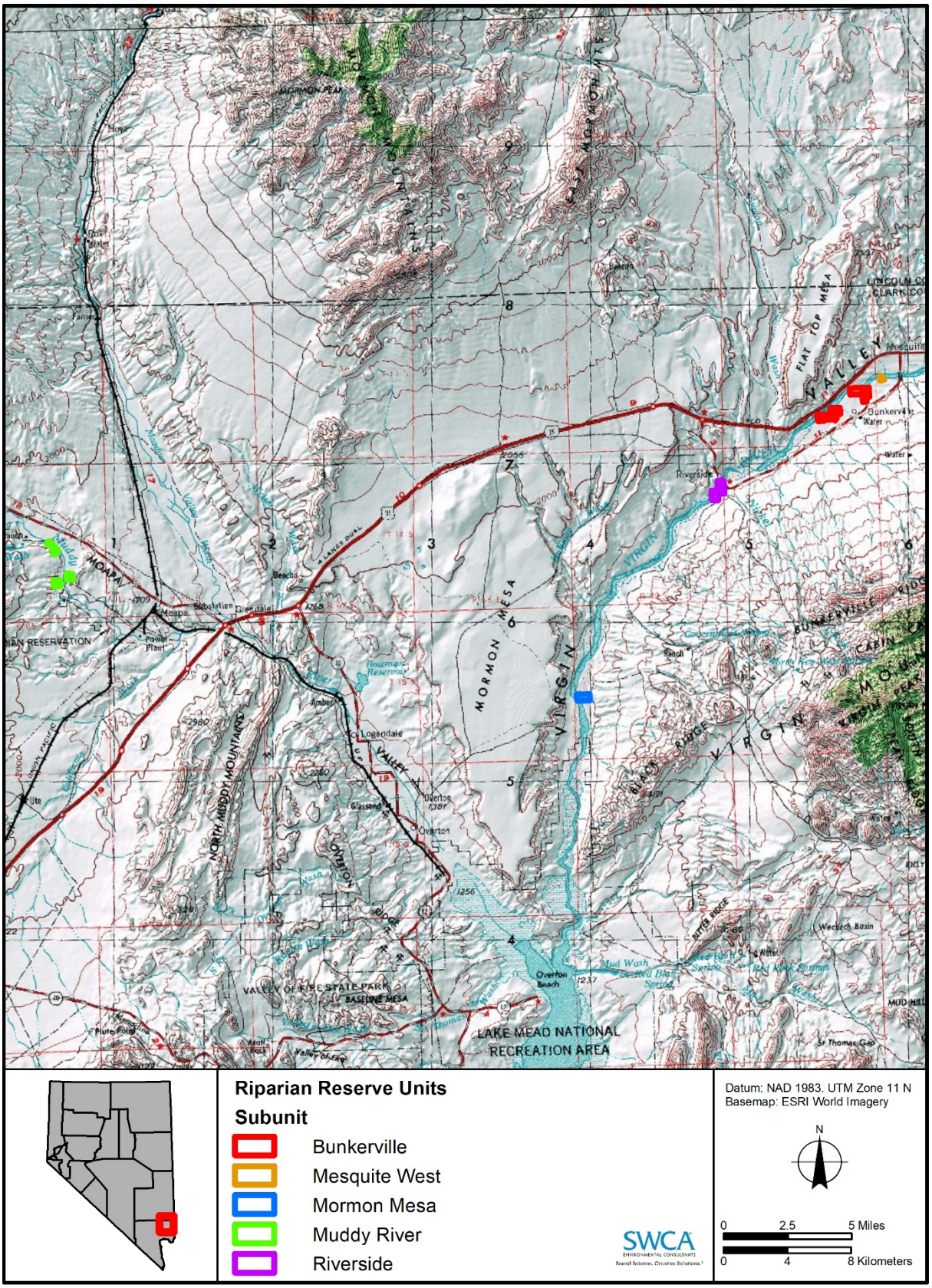

Figure 1. Riparian Reserve Unit locations.

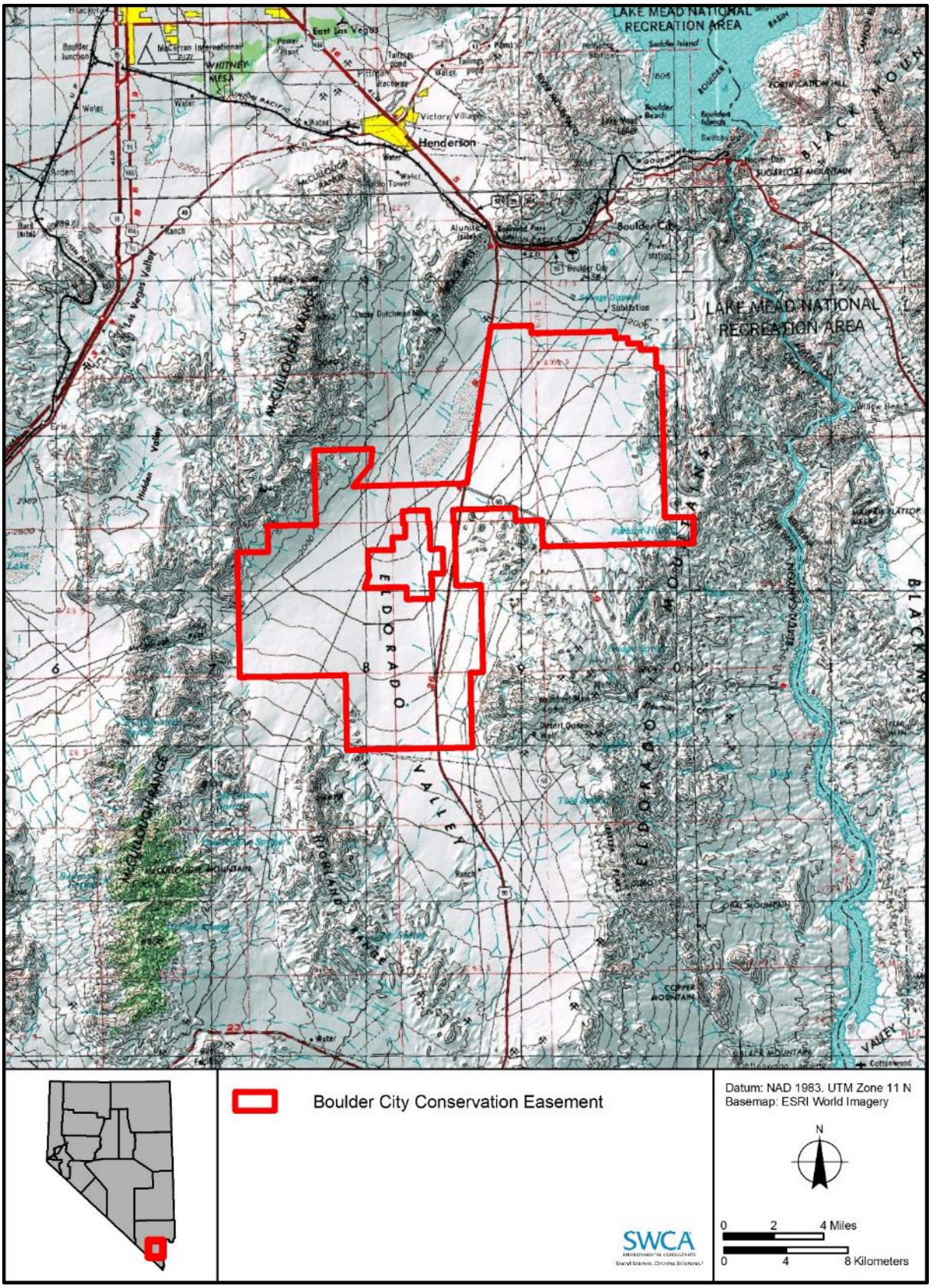

Figure 2. BCCE location.

1.2.1 Riparian Reserve Units

According to both the Biological and Conference Opinion and Condition K.1 of the associated incidental take permit, the County must acquire private property that contains desert riparian habitat along the Virgin River, Muddy River, and Meadow Valley Wash in Clark County. It was recognized that proper management of desert riparian habitats would be crucial in conserving the six covered bird species (including the two federally listed species) known to use this habitat. To date, the County has acquired approximately 267 ha (660 acres) of land along the Muddy and Virgin Rivers in northeastern Clark County, Nevada. Prior to 2017, the County acquired 115 ha (285 acres) along the Muddy and Virgin Rivers. SWCA conducted avian surveys at these parcels in 2017 to establish a baseline dataset of avian species presence and distribution under two separate projects: 1) Federally Listed Bird Surveys on Riparian Properties (SWCA 2017a) and 2) Point-count Surveys on Riparian Properties (SWCA 2017b). In late 2017, the County acquired an additional 128 ha (316 acres) along the Virgin River. Point-count surveys and species-specific surveys for federally listed species were conducted at these newly acquired properties under one project in 2018 (SWCA 2018a). Then in 2019, avian surveys at all the County's properties were combined into one project (SWCA 2019a). In early 2020, the County acquired three new parcels (2-K, 2-L, and 2-M) located within the Bunkerville Subunit, totaling an additional 24 ha (59 acres). Point-count surveys and species-specific surveys for federally listed species were conducted at all of the County's riparian properties, including Parcels 2-L and 2-M, in 2020 and are described herein.

SOUTHWESTERN WILLOW FLYCATCHER MONITORING

Of the eight nests for which parasitism status was known at Mesquite West Parcel 1-A in 2019, four (50%) were parasitized by cowbirds (SWCA2019b). Two of the parasitized nests produced one flycatcher fledgling each and the other two parasitized nests failed (0.5 fledglings/nest); the four unparasitized nests produced three fledglings total (0.75 fledglings/nest). Mean productivity for all Mesquite West nests combined was 0.63 fledglings/nest in 2019. Productivity at all southern Nevada sites ranged from 0 to 2.5 fledglings/nest, with an overall average of 1.43 (SWCA 2019b), over two times greater than at Mesquite West. Since 2013, the Mesquite study area (which encompasses several sites, including Mesquite West) has consistently yielded one of the lowest average productivity rates (0.45 fledglings/nest) of all the southwestern willow flycatcher study areas in southern Nevada.

Nest-monitoring data indicate consistently high rates of cowbird parasitism at Mesquite West, and it is believed that parasitism has significantly contributed to the nest failures and low productivity at that site (SWCA 2019b). As part of a previous project with the U.S. Bureau of Reclamation, SWCA trapped brown-headed cowbirds across the Mesquite study area between 2003 and 2007 (McLeod and Pellegrini 2013). Despite substantial trapping efforts, the percent of successful nests did not significantly improve during or following trapping (pre-trapping 48%, trapping 49%, post-trapping 36%).

Starting in 2010, SWCA began addling cowbird eggs for Bureau of Reclamation and Nevada Department of Wildlife (NDOW) projects. Data combining all study areas monitored for this project showed that after addling began, the proportion of cowbird eggs that hatched dropped from 74% (2003–2009) to 11% (2010–2012) (McLeod and Pellegrini 2013). While nest productivity showed no significant change from cowbird egg addling, nests with unhatched cowbird eggs produced more flycatcher fledglings, on average, than nests with cowbird nestlings; therefore, McLeod and Pellegrini (2013) recommended that addling continue to be used as a cowbird control method along the Lower Colorado River watershed.

More recent data from the Mesquite study area continue to show high nest parasitism rates from 2015 to 2019 (53%) (SWCA 2019b). A cowbird control program has been recommended when parasitism rates of a threatened or endangered host reach 20%–30% or 50% for any host species (Rothstein et al. 2003). While trapping or addling alone did not prove beneficial to flycatcher nest success or productivity at Mesquite West, several avian studies have shown an increase in nest success when different means of

cowbird control were combined, such as shooting adult cowbirds, addling cowbird eggs, and removing nestling cowbirds (Whitfield et al. 1999; Kostecke et al. 2005).

To combat historically and recently high levels of nest parasitism by brown-headed cowbirds on southwestern willow flycatchers (SWCA 2019b), SWCA proposed a combined-method cowbird control program at Mesquite West Parcel 1-A for 2020. Monitoring of flycatcher territories/nests would be an essential component in determining whether any level of cowbird control has an impact on the nesting success of the southwestern willow flycatchers at Mesquite West (U.S. Bureau of Reclamation 2004). While SWCA had proposed multiple methods for cowbird control at Mesquite West in 2020, funding for the cowbird trapping efforts could not be secured due to the COVID-19 pandemic. Despite the lack of funding for cowbird trapping, SWCA contracted with the County to conduct cowbird egg addling, cowbird nestling euthanasia, and monitoring of southwestern willow flycatcher territories and nests in 2020.

1.2.2 Boulder City Conservation Easement

Implementation of the MSHCP required the establishment of a conservation easement in the Eldorado Valley. This easement, known as the Boulder City Conservation Easement (BCCE), was established in July 1995 through an agreement between Clark County and Boulder City. In 2018, SWCA began conducting breeding bird point-count surveys for the County at 40 locations across the BCCE (SWCA 2018b). In 2019, SWCA continued breeding bird point-count surveys at a subset of these locations as part of a comprehensive bird survey effort across all the County's properties (SWCA 2019a). In early 2020, the County completed a land exchange for certain portions of the BCCE, resulting in a net increase of 325 ha (803 acres) within the BCCE. According to both the Biological and Conference Opinion (USFWS 2000) and Condition P of the associated incidental take permit (USFWS 2001), the County is required to take measures necessary to ensure maintenance of connectivity for Mojave desert tortoise (*Gopherus agassizii*) and other covered species within the BCCE. While the BCCE is primarily managed for protection of the desert tortoise, it was recognized that proper management of desert tortoise habitat could also be beneficial for protecting habitat for other species covered by the MSHCP, including avian species (Clark County 2019).

1.3 Management Actions, Goals, and Objectives

The County's Riparian Reserve Unit Management Plan (Clark County 2015) identifies goals and objectives that help guide management directives on the Riparian Reserve Units. The first goal listed in this plan is to "manage reserve units to provide habitat for the six MSHCP covered bird species" (Clark County 2015:35) that use desert riparian habitat. The objective identified to reach this goal is to "restore, create, and enhance habitat for riparian bird species" (Clark County 2015:35). In addition, the BCCE Management Plan (Clark County 2019) identifies goals and objectives that help guide management directives within the BCCE. The second goal listed in the BCCE Management Plan is to "protect and manage the BCCE for other MSHCP covered species" (Clark County 2019:78).

Management of species covered under the MSHCP and their habitats requires an in-depth understanding of baseline conditions within a given management unit. Collection of species' abundance and distribution data is a critical first step in monitoring of and conservation management efforts for the MSHCP-covered bird species found in Clark County. The short-term objectives for this project are 1) to establish a baseline record of all breeding bird species recorded on the County's reserve system properties and 2) to assess the effect of brown-headed cowbird control on nesting southwestern willow flycatchers. The long-term goal is to track changes in presence and relative abundance of all the MSHCP-covered bird species that use these properties in an effort to measure the success of management and restoration efforts conducted therein.

2.0 METHODS AND MATERIALS

2.1 Federally Listed Bird Surveys

In 2019, the County outlined 53.5 ha (132.2 acres) within the Riparian Reserve Units that were targeted for southwestern willow flycatcher and yellow-billed cuckoo surveys. Habitat suitability and the need for species-specific surveys were assessed during the site reconnaissance completed for point-count surveys. Any portions of the 53.5 ha (132.2 acres) identified in the County's solicitation that were devoid of woody vegetation ≥ 3 m (9.8 feet) in height (as a result of scouring, restoration activities, etc.) were not surveyed. These areas were described (e.g., species, height, and percent cover of the dominant vegetation), photographed, delineated in the field, and then delineated in ArcGIS. Of the 53.5 ha (132.2 acres) originally estimated for survey by the County, SWCA delineated 47.9 ha (118.4 acres) in 2019 as potential habitat to be surveyed for both species across all subunits; these areas were resurveyed in 2020 (Figures 3–7), although some minor changes were made to the survey area, as described below.

During 2019 yellow-billed cuckoo surveys, a cuckoo was detected in a screwbean mesquite (*Prosopis pubescens*)-dominated bosque outside the delineated survey area within Mormon Mesa Parcel 5-A; in an effort to better document cuckoo habitat use within this portion of the parcel, SWCA added this 5.1 ha (12.7 acres) of mesquite bosque to the Mormon Mesa yellow-billed cuckoo survey area in 2020 (see Figure 6).

Additionally, SWCA delineated 2.6 ha (6.4 acres) of potential cuckoo/flycatcher habitat to be surveyed within newly acquired Parcels 2-L and 2-M in May 2020 (see Figure 4). In total, the 2020 flycatcher survey area equaled 50.5 ha (124.8 acres), and the 2020 cuckoo survey area totaled 55.6 ha (137.4 acres). Within these polygons, surveys were completed in all areas that were dominated by trees or shrubs ≥ 3 m (9.8 feet) in height. These areas will be reassessed for habitat suitability during subsequent survey years.

The southwestern willow flycatcher is one of four subspecies of willow flycatcher (Unitt 1987). It breeds in dense, mesic riparian habitats at scattered, isolated sites in New Mexico, Arizona, southern California, southern Nevada, southern Utah, southwestern Colorado, and, at least historically, extreme northwestern Mexico and western Texas (Unitt 1987). Factors contributing to the decline of southwestern willow flycatchers on their breeding grounds include loss, degradation, and/or fragmentation of riparian habitat; invasion of riparian habitat by non-native plants; and brood parasitism by brown-headed cowbirds. One of the last long-distance neotropical migrants to arrive in North America in spring, southwestern willow flycatchers typically arrive in May or June and depart in August (Sogge et al. 2010).

They nest in a variety of habitats, but common characteristics of southwestern willow flycatcher breeding habitat include dense tree or shrub cover ≥ 3 m (9.8 feet) in height, vegetation with dense twig structure and high canopy closure, and proximity to surface water or saturated soil (McLeod and Pellegrini 2013; Sogge et al. 2010). Southwestern willow flycatchers nest in habitat patches ranging in size from 0.8 ha (2.0 acres) to several hundred hectares but are rarely found in narrow strips of habitat < 10 m (32.8 feet) wide (Sogge et al. 2010). During the nesting season, southwestern willow flycatchers occupy home ranges averaging less than 0.5 ha (1.2 acres) in size (Cardinal 2005). Willow flycatchers are generally monogamous, but polygyny has been documented (Ehrlich et al. 1988), particularly in the southwestern subspecies (SWCA 2019a; SWCA 2019b). Migrant willow flycatchers are found in both spring and fall in a variety of habitats that are unsuitable for breeding. These migration stopover habitats, though not necessarily used for breeding, are likely important for both reproduction and survival. Designated critical habitat for the southwestern willow flycatcher includes riparian habitats along the Virgin River from Berry Springs, Utah, downstream to the full pool level of Lake Mead (USFWS 2013a) and includes all three subunits of the Virgin River Riparian Reserve Unit.

Figure 3. Yellow-billed cuckoo and southwestern willow flycatcher survey areas at the Mesquite West Riparian Reserve Subunit.

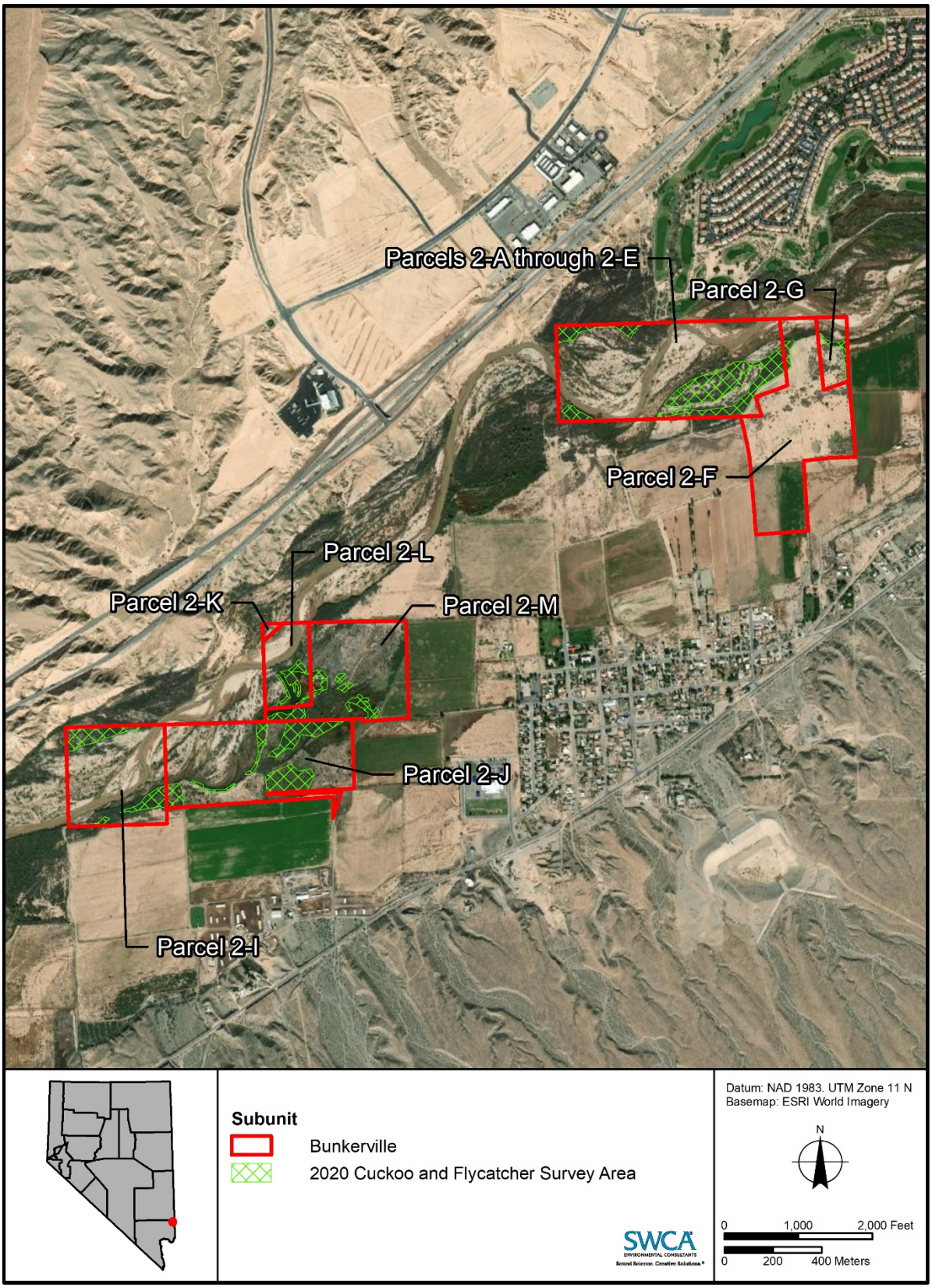

Figure 4. Yellow-billed cuckoo and southwestern willow flycatcher survey areas at the Bunkerville Riparian Reserve Subunit.

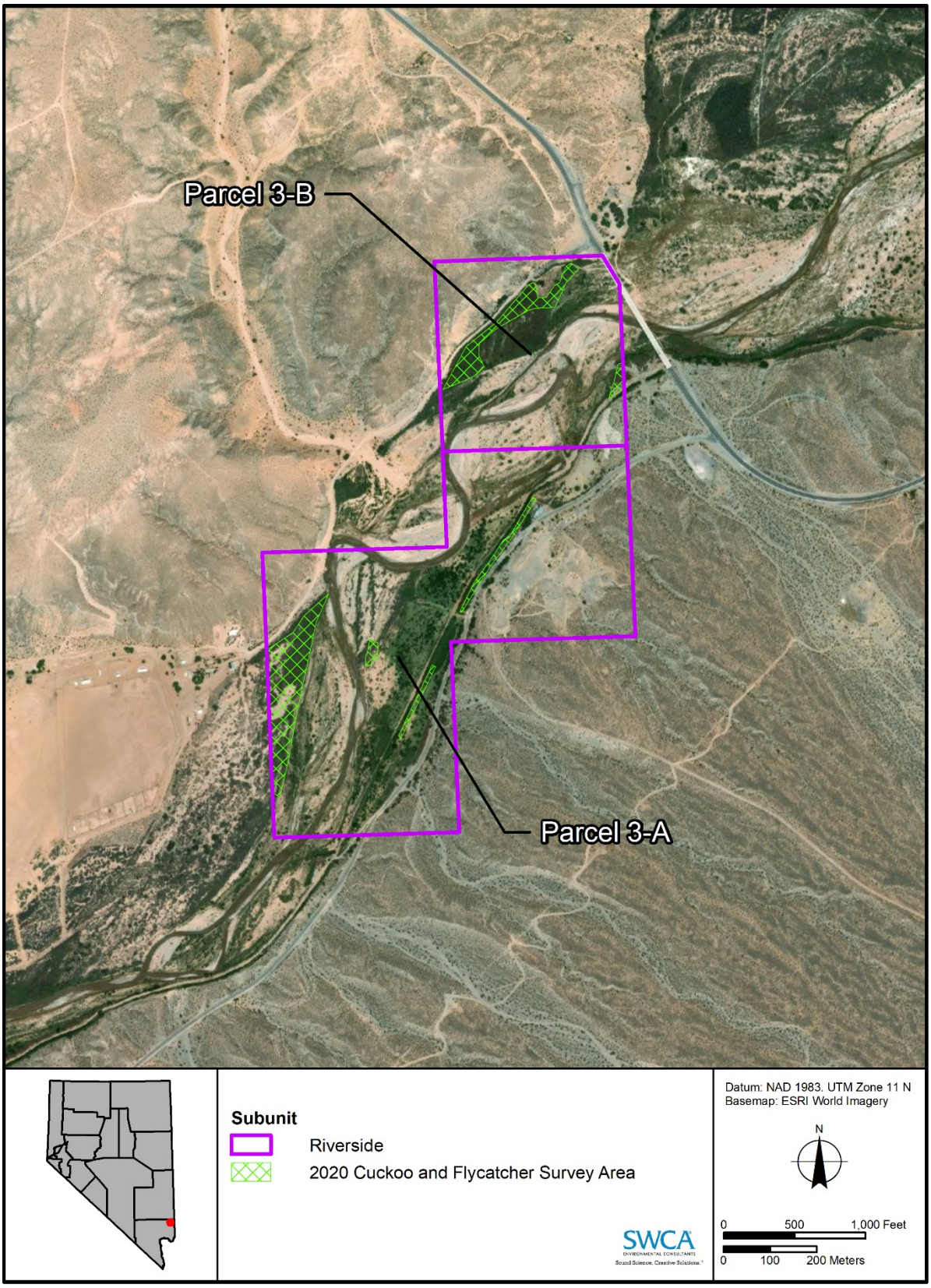

Figure 5. Yellow-billed cuckoo and southwestern willow flycatcher survey areas at the Riverside Riparian Reserve Subunit.

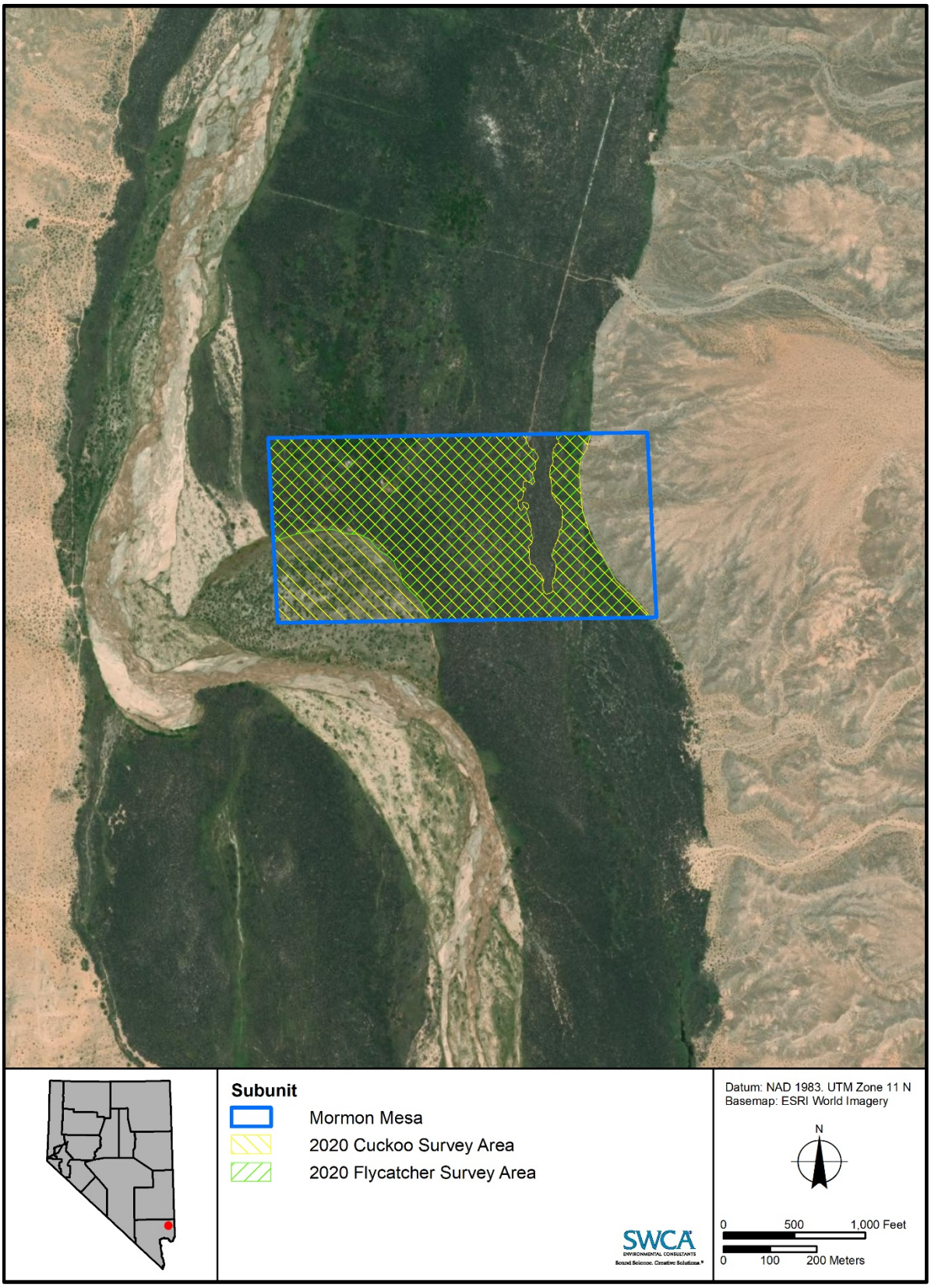

Figure 6. Yellow-billed cuckoo and southwestern willow flycatcher survey areas at the Mormon Mesa Riparian Reserve Subunit.

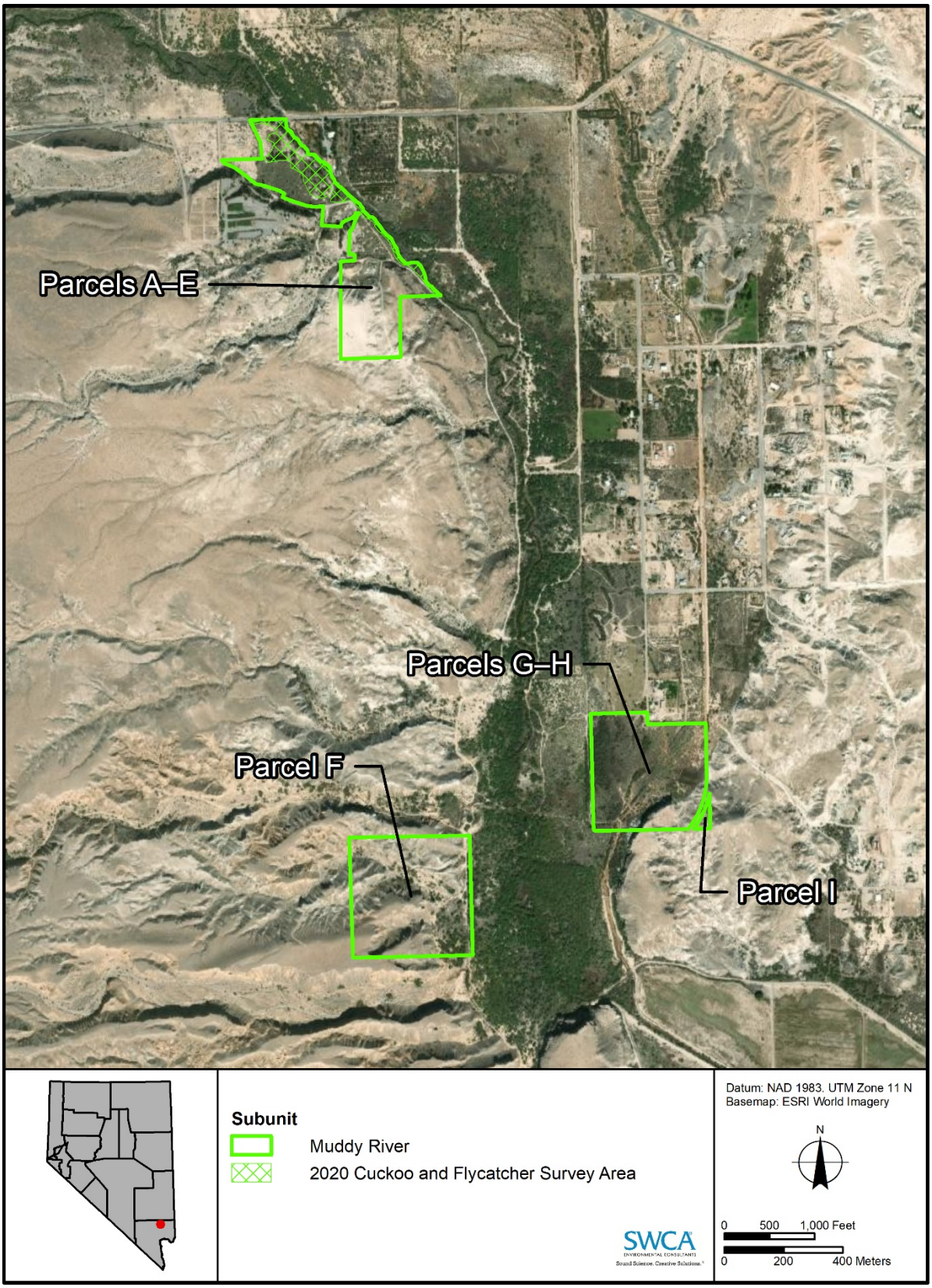

Figure 7. Yellow-billed cuckoo and southwestern willow flycatcher survey areas at the Muddy River Riparian Reserve Unit.

Multiple broadcast surveys for southwestern willow flycatcher conducted throughout the breeding season were used to assess the presence and residency of the southwestern subspecies. Southwestern willow flycatcher surveys followed the standard five-survey protocol described in Sogge et al. (2010), which calls for one survey between May 15 and 31, two surveys between June 1 and 24, and two additional surveys between June 25 and July 17. The surveys were separated by a minimum of 5 days. To elicit responses from nearby southwestern willow flycatchers, surveyors stopped approximately every 30 m (98 feet) and broadcast 10–15 seconds of the willow flycatcher's primary song (*fitz-bew*) and call (*breet*). Field personnel watched for flycatchers and listened for vocal responses for 1 minute before proceeding to the next survey station. If an unidentified *Empidonax* flycatcher was observed but did not respond with song to the initial broadcast, other conspecific vocalizations were broadcast, including *creets/breets*, *wee-oos*, *whitts*, *churr/kitters*, and a set of interaction calls given by a mated pair of flycatchers (per Lynn et al. 2003). These calls are frequently effective in eliciting a *fitz-bew* song, thereby enabling surveyors to positively identify willow flycatchers.

The yellow-billed cuckoo was historically widespread and locally common along rivers throughout the western United States (USFWS 2013b). However, populations have declined across the West in recent years, largely as a result of loss, degradation, and fragmentation of riparian habitat. Consequently, the western distinct population segment was listed as Threatened under the ESA in October 2014 (USFWS 2014a). Proposed critical habitat for the western yellow-billed cuckoo was revised in 2020, but no critical habitat units were designated within the state of Nevada (USFWS 2020).

Yellow-billed cuckoos are late neotropical migrants, arriving on their breeding grounds around mid-June and departing by mid-September. Yellow-billed cuckoo home ranges are generally at least 40 ha (100 acres) in size and often exceed 80 ha (200 acres), though home ranges as small as 1 ha (2.5 acres) have been documented (USFWS 2020). These patches are typically at least 100 m (328 feet) wide (USFWS 2020). Yellow-billed cuckoos have not been found nesting in isolated patches less than 1 ha (2.5 acres) in size or in linear habitats less than 10 to 20 m (33 to 66 feet) wide, but they may use these habitats during migration and early in the breeding season (Halterman et al. 2015). Breeding habitat typically includes multi-storied riparian woodlands dominated by willow or cottonwood (USFWS 2020). Breeding habitat is typically adjacent to watercourses with less than 3 percent slopes. Yellow-billed cuckoos are known to nest in dense early to mid-successional riparian habitats (USFWS 2014b). A study of nest placement in Arizona and California found that nests were placed between 1 and 22 m (0.3 to 72 feet) above ground, with an average height of 7 m (23 feet) (Hughes 2015). Yellow-billed cuckoos tend to be serially monogamous, but serial polyandry has been regularly documented in western populations.

Cuckoos vocalize infrequently, have a short breeding cycle, and typically occupy home ranges varying from 40 to 80 ha (100 to 200 acres) in size (USFWS 2020). These factors make it difficult to use survey results to determine the number of cuckoo territories at a site. However, repeated broadcast surveys allow an assessment of the presence or absence of cuckoos, and survey results can be used to estimate the number of possible and probable breeding territories (Halterman et al. 2015).

Yellow-billed cuckoo surveys followed the standard four-survey protocol described by Halterman et al. (2015). One survey was completed between June 15 and 30, two surveys were completed between July 1 and 31, and one survey was completed between August 1 and 15. Surveys were separated by 12–15 days. Surveyors stopped every 100 m (328 feet) and listened for 1 minute for spontaneously calling yellow-billed cuckoos, then broadcast a series of five cuckoo contact calls (*kuk/kowlp*), spaced 1 minute apart, to listen and watch for cuckoo responses between each set of broadcast calls; the total time spent at each survey point was approximately 6 minutes.

If willow flycatchers or yellow-billed cuckoos were detected, the observer recorded the location of the bird, the type of detection, and any other pertinent notes. The surveyor then proceeded at least 40 m (131 feet) beyond any detected flycatcher and 300 m (984 feet) beyond a cuckoo before resuming the survey to avoid double-counting individuals. All surveys commenced before sunrise when it was light enough for observers to walk safely. Surveys were concluded by 10:45 a.m. PDT for southwestern willow flycatcher and by 11:15 a.m. PDT or when the temperature reached 40°C for yellow-billed cuckoo. No surveys were conducted if winds exceeded 3 on the Beaufort scale (19.3–30.6 km [12–19 miles] per hour).

Starting points for southwestern willow flycatcher and yellow-billed cuckoo surveys varied between surveys. Standard southwestern willow flycatcher and yellow-billed cuckoo survey summary forms were also completed. All surveys were completed by personnel authorized under a USFWS 10(a)1(A) permit (#TE028605-7) and a NDOW permit (#495754). In addition to completing cuckoo and flycatcher surveys, SWCA recorded qualitative site descriptions for each parcel. Field personnel recorded the dominant vegetation species, visual estimates of vegetation height (to the nearest meter), canopy closure (to the nearest 5%), and qualitative assessments of surface hydrology.

2.2 Southwestern Willow Flycatcher Monitoring

Color banding and subsequent resighting can greatly improve the certainty with which individual flycatchers can be associated with a specific territory or nest. Furthermore, color banding nestling flycatchers would help with confirming the number of fledglings produced from each nest and allow for a more accurate determination of nest success and productivity. Color banding involves fitting each flycatcher with a metal USFWS band on one leg and a colored, metal, pin-striped band on the opposite leg, resulting in a unique color combination of bands. Resighting involves subsequently observing these color bands via binoculars to confirm a bird's identity. Resighting color-banded birds at different times of the season or in subsequent years would also help with understanding movements of flycatchers within and between study areas and sites.

Flycatcher territory/nest monitoring involves more frequent visits to flycatcher territories than broadcast surveys alone and results in locating flycatcher nests, determining nest fates, and calculating flycatcher productivity. Nest searching and monitoring commenced at Mesquite West once a territorial flycatcher was detected. The methods described herein followed those described by Rourke et al. (1999), Martin et al. (1997), Martin and Geupel (1993), and Ralph et al. (1993), which recommend territory monitoring every 2–4 days, depending on territory stage and activity.

Southwestern willow flycatcher territory and nest monitoring occurred once every 4 days to determine territory status, locate nests, and monitor known nests. When possible, nests were monitored using a mirror on a telescoping pole to determine nest contents, including the presence of any cowbird eggs or nestlings. When appropriate, biologists addled cowbird eggs and euthanized cowbird nestlings. No nest was mirror poled after nestlings reached 8 days of age to avoid forced fledging. Nesting attempts were determined to be successful if fledged young were observed in the vicinity of the nest or observed being fed by banded adults known to be associated with that nest. The number of nestlings produced from each nest were determined by the number of fledglings visually confirmed, resulting in a conservative number of nestlings produced per nest. Failed nests were inspected to determine the condition of the nest and record the presence of eggs, eggshells, or dead nestlings in or around the nest. These data were used to determine the stage and cause of nest failure.

Banding of up to 20 adult and nestling flycatchers at Mesquite West Parcel 1-A was anticipated. Personnel captured, uniquely color banded, and subsequently monitored adult and nestling flycatchers whenever possible. Adult flycatchers were captured with mist nets, which provide the most effective

technique for live capture of adult songbirds (Ralph et al. 1993). A targeted capture technique was used (per Sogge et al. 2001) whereby a variety of conspecific vocalizations were broadcast via an MP3 player and remote speakers to lure territorial flycatchers into the nets. Nestlings were banded at 7 to 10 days of age, when they were large enough to retain the leg bands, yet young enough that they would not prematurely fledge from the nest (Paxton et al. 1997; Whitfield 1990). Each flycatcher was banded with a single, numbered U.S. Federal aluminum band on one leg and a colored metal band on the other. The aluminum Federal bands are either standard silver or anodized in one of several colors.

Though not part of the monitoring contract, flycatcher monitoring and banding at Mormon Mesa Parcel 5-A were performed as time and survey budget allowed. Monitoring occurred opportunistically while biologists were at Parcel 5-A conducing flycatcher or cuckoo surveys.

2.3 Federally Listed Bird Surveys and Monitoring Data Management

For flycatcher and cuckoo surveys and flycatcher monitoring, data was collected using a Samsung or Panasonic tablet equipped with Collector for ArcGIS and paired with an external GPS receiver. The GPS receiver is capable of submeter accuracy and provided real-time data corrections; data post-processing was not required. Several feature services were published to ArcGIS Online for use in Collector. These included site boundaries, trails, a feature service to record real-time locations of the surveyor at regular intervals (i.e., surveyor "tracks"), a 40 × 40–m grid, and feature services for field data. High-resolution aerial imagery of all survey sites was also loaded directly onto the tablets for use in Collector.

Data collected included point locations of survey points, flycatcher and cuckoo detections (e.g., territorial male, territory center, pair, nest, nest flag, or family group), and line features to show the relationship between any two willow flycatcher detection locations (e.g., same bird, different bird, countersinging males, or possible pair). All data collected in the field were recorded into an offline copy of the feature services, which the observer downloaded onto his/her tablet.

Summary information for each resight and for each territory or nest visit (time in and out of the territory, breeding stage [e.g., single male, pair, nest stage, or no activity], nest contents [if applicable], and behavioral comments) was entered in a form in Survey123 for ArcGIS. Each form was a child feature linked to its respective territory center or nest flag point.

Any data recorded via Collector was synced to and managed in a feature service that resides on the ESRI server. Quality control features that facilitate identifying common errors were built into Collector. All data will reside on an ESRI server and will be backed-up to an SWCA server periodically and stored indefinitely. All data was reviewed and proofed at least twice: once immediately after the data were downloaded or imported into the database, and again by the project manager before data were delivered.

All spatial data collected in the field, as well as any spatial data provided by the County and edited by SWCA, have been exported to a geodatabase and have been included as part of the 2020 Final Data Deliverable. A full list of the spatial layers included and a description of the data that each file contains has been included in the metadata included in the geodatabase provided as part of the 2020 Final Data Deliverable. This file also includes general project information, such as the County project number, SWCA's project manager, the dates for the project, a brief project description, the title of the associated final report, the model of GPS receiver used for the project, and an average accuracy of data collected.

2.4 Point-Count Surveys

Surveys conducted for this study in 2020 followed methods used during the 2017–2019 point-count surveys (SWCA 2017b, 2018a, 2018b, 2019a), which applied established point-count protocols and drew from methods described by the Great Basin Bird Observatory (GBBO) for its Habitat-based Monitoring Program for Breeding Birds of Nevada (GBBO 2003) and the *Handbook of Field Methods for Monitoring Landbirds* (Ralph et al. 1993).

In 2019, SWCA randomly selected 25 of the 51 previously surveyed point-count locations across the Riparian Reserve Units to be surveyed in odd-numbered years (i.e., 2019, 2021, 2023); the remaining 26 points were selected to be surveyed in even-numbered years (i.e., 2020, 2022) (Figures 8–12).

In 2020, SWCA performed avian point-count surveys at these 26 points, as well as two additional points located in Parcels 2-L and 2-M, for a total of 28 point-count locations. Prior to the commencement of surveys, SWCA avian biologist Sarah Nichols conducted a site reconnaissance to re-familiarize herself with the project parcels and identify any impediments to access. During the reconnaissance, Ms. Nichols navigated to each survey point using a handheld GPS unit capable of 5-m accuracy. Each point was marked with flagging so that it could be easily located on subsequent visits. Access routes were flagged, as needed, to facilitate efficient travel between survey points. In 2019, above-average winter precipitation yielded abnormally high water levels along the Virgin River; as a result, two of the riparian point-count locations surveyed in 2019 were not accessible due to inundation by the active river channel, which necessitated that these point-count locations be repositioned. In 2020, however, water levels did not prevent access to the survey area, and all point-count locations selected for 2020 surveys were successfully accessed.

In 2019, SWCA randomly selected 20 of the 40 previously surveyed point-count locations at the BCCE to be surveyed in odd-numbered years (i.e., 2019, 2021, 2023); the remaining 20 locations were selected to be surveyed in even-numbered years (i.e., 2020, 2022) and were surveyed by SWCA in 2020 (Figure 13). As it was anticipated that conditions at the BCCE had not changed dramatically since 2019, no field reconnaissance was completed prior to field surveys at that property in 2020.

Surveyors were able to access all 20 of the previously surveyed point-count locations without impediment, thereby negating the need to move or alter any of the predetermined survey locations. Each surveyor followed standard unlimited-radius point-count procedures, with surveys starting at sunrise and concluding by 10:00 a.m. PDT (GBBO 2003; Ralph et al. 1993). Consecutive surveys at a given point were separated by a minimum of 7 days. The order in which point-counts were completed was alternated between each round of surveys so that a given point was not always surveyed at the same time of day.

For each survey, the surveyor approached each point quietly to avoid overly disturbing any birds present. Prior to the commencement of each point-count, the surveyor recorded weather data, including cloud cover, wind speed and direction, temperature, and precipitation, on a standardized form. No surveys were conducted when wind speeds exceeded 40 km (25 miles per hour) or during periods of heavy rain, as both conditions could have inhibited the comprehensive inventory of a survey area (GBBO 2003). The 10-minute observation period was broken into four intervals (0–3, 3–5, 5–8, and 8–10 minutes), and surveyors noted the time interval in which the first detection of a given bird was made.

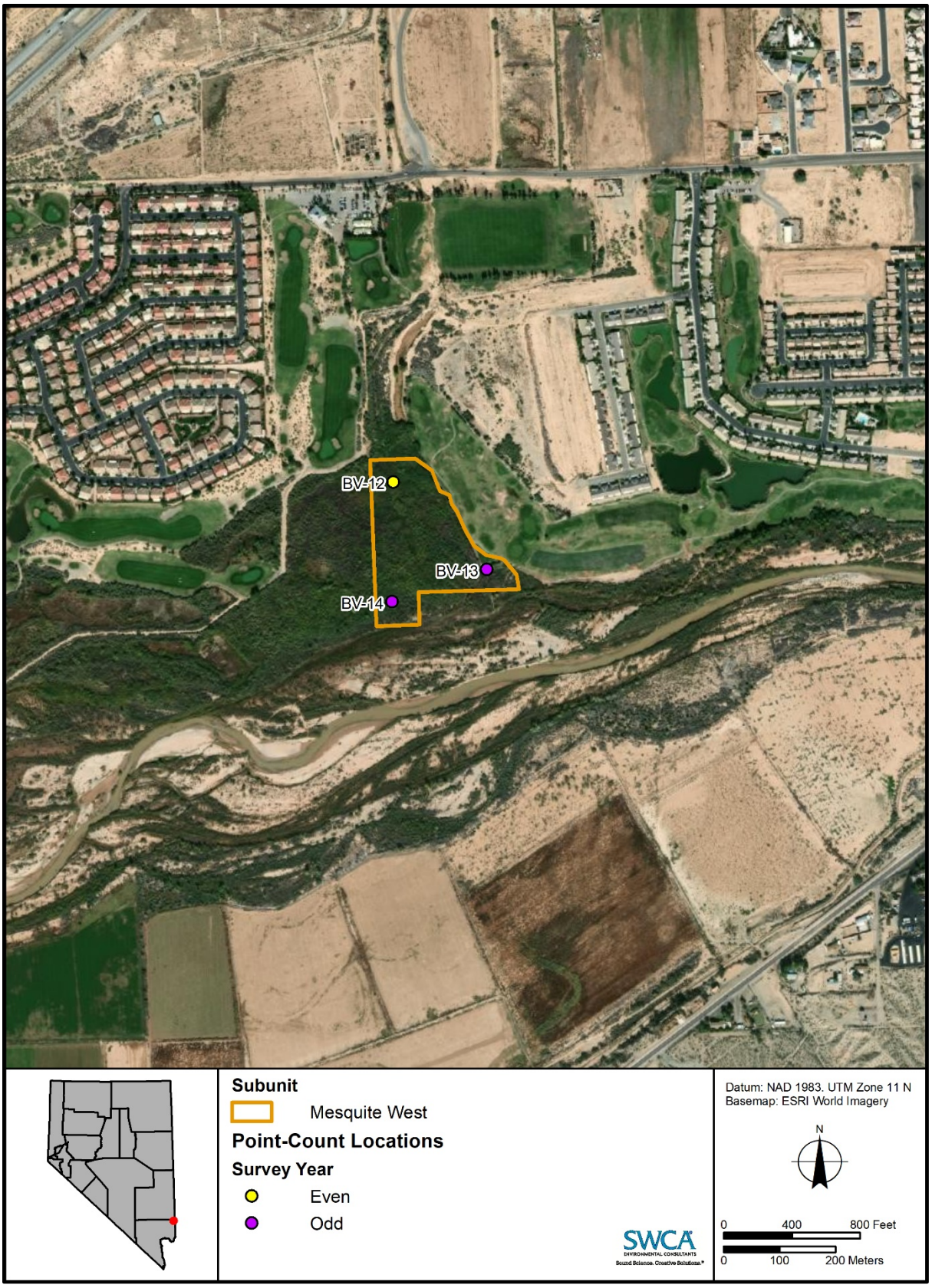

Figure 8. Point-count locations within the Mesquite West Riparian Reserve Subunit.

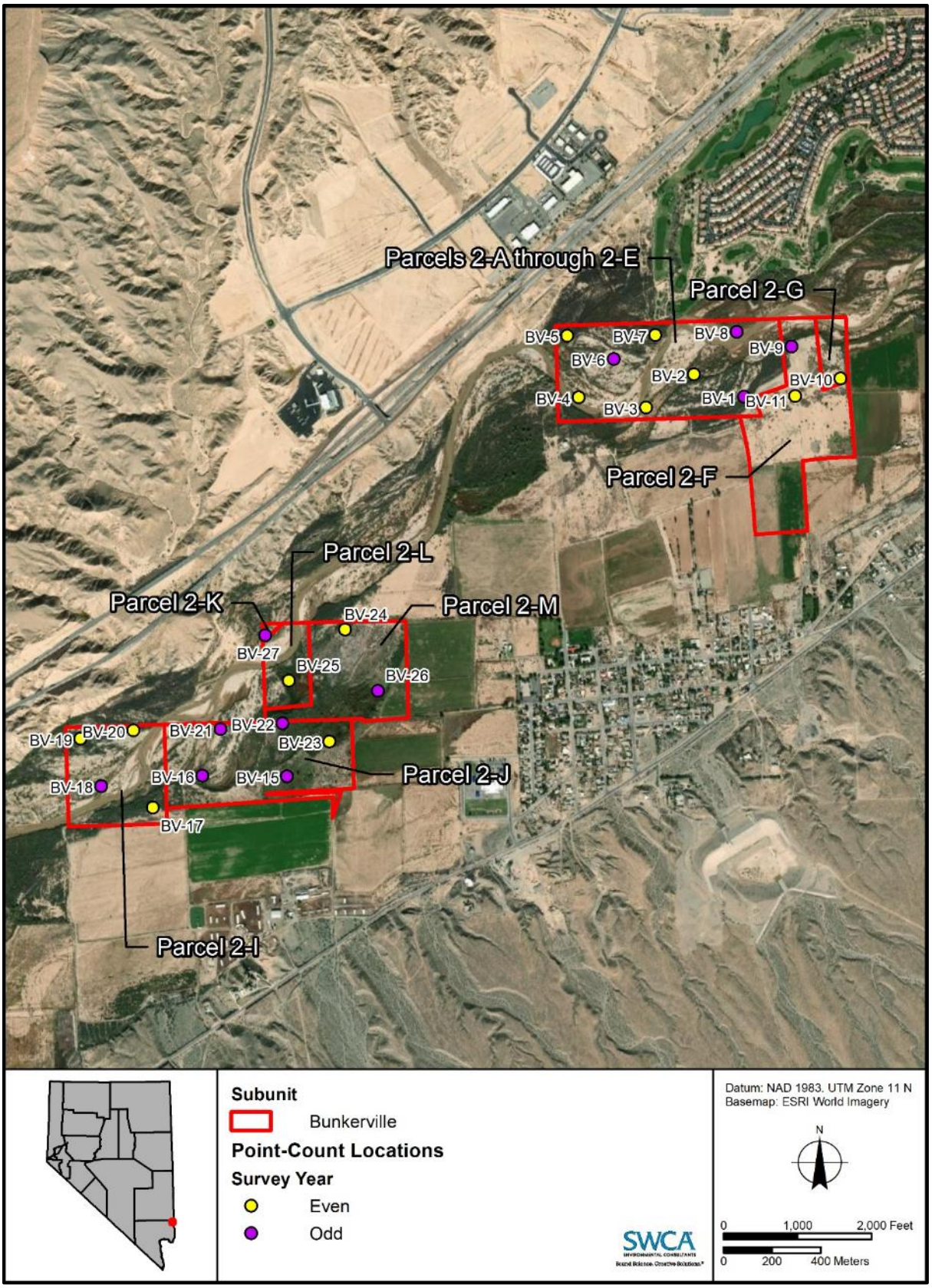

Figure 9. Point-count locations within the Bunkerville Riparian Reserve Subunit.

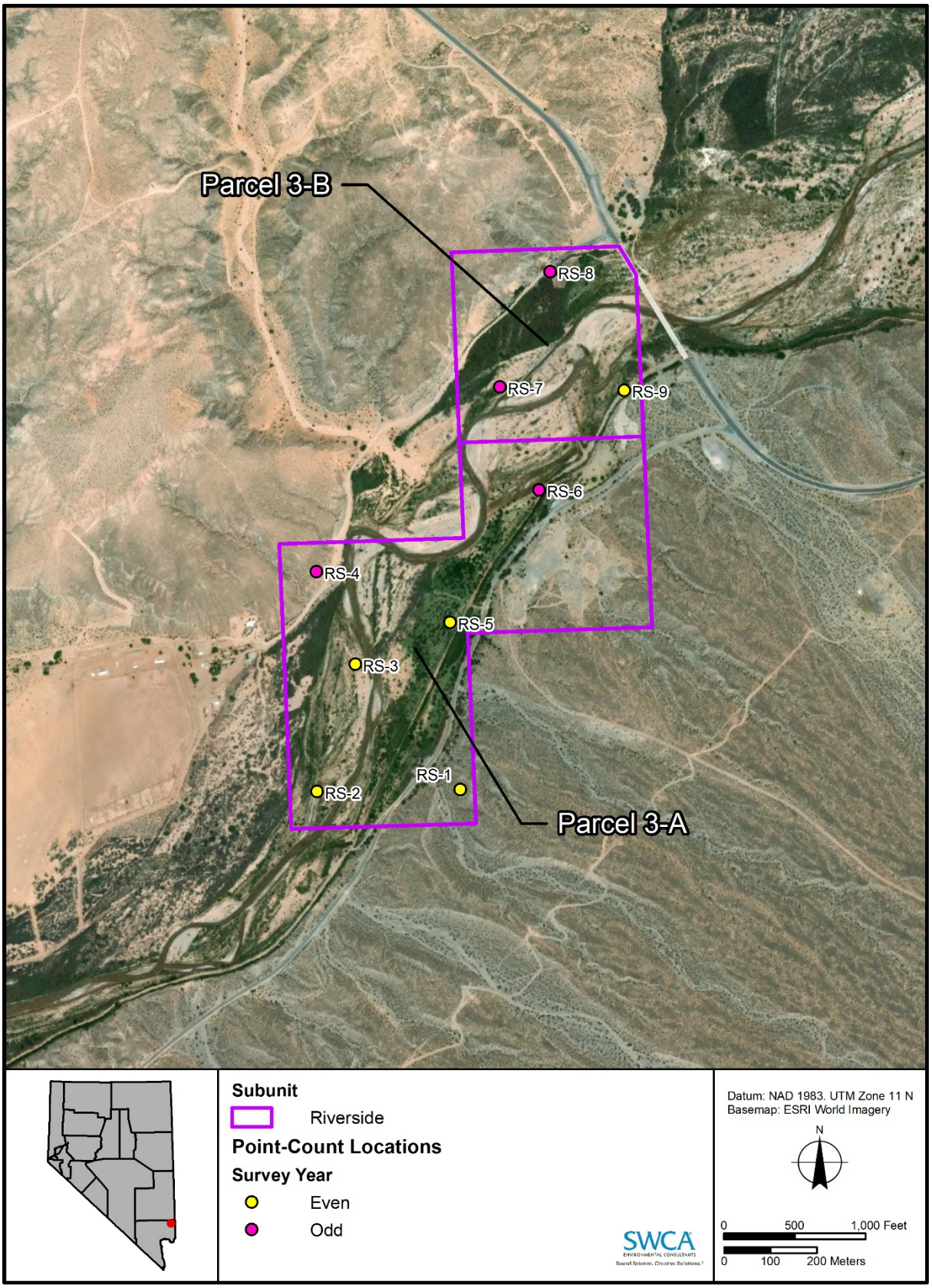

Figure 10. Point-count locations within the Riverside Riparian Reserve Subunit.

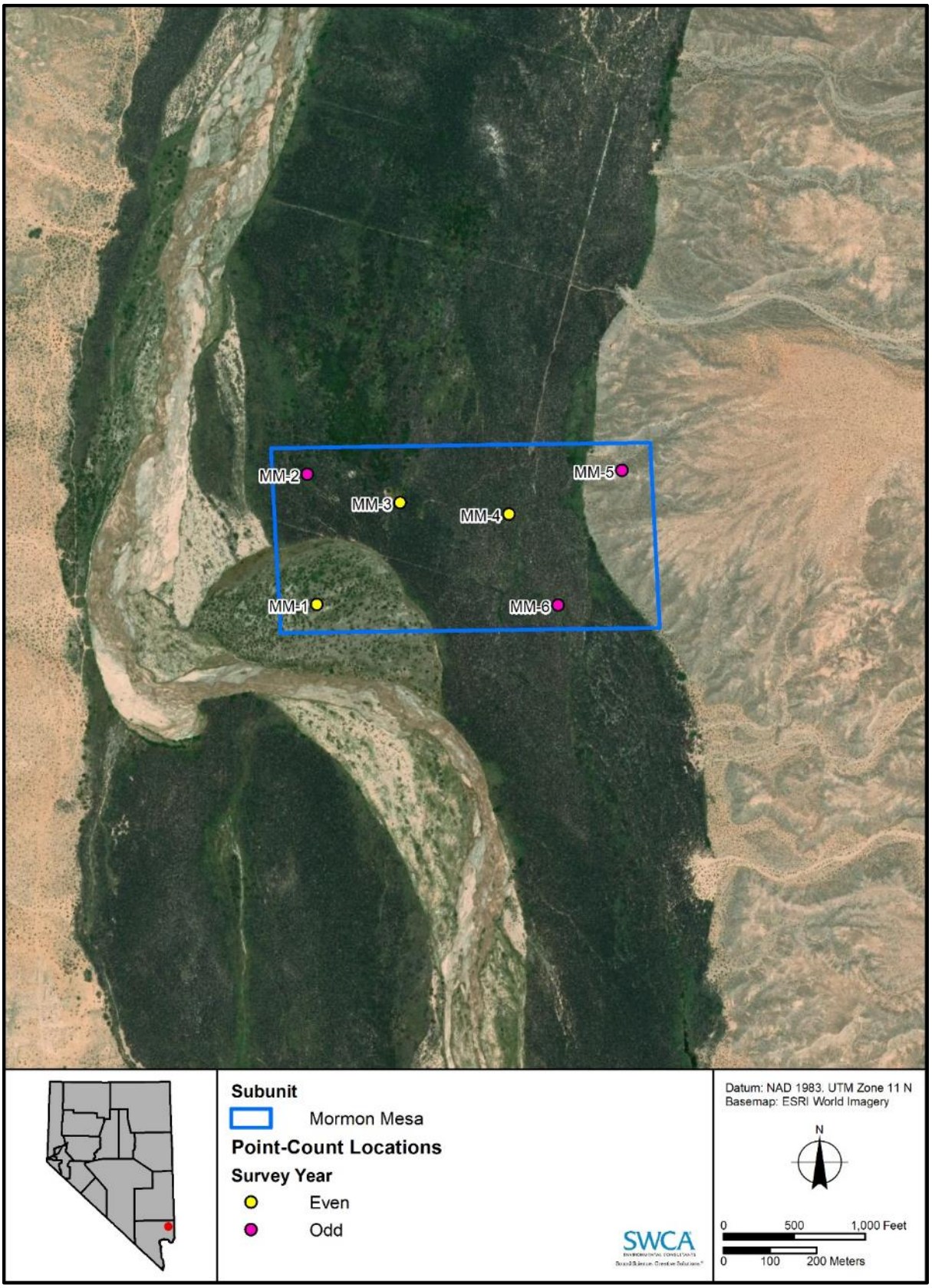

Figure 11. Point-count locations within the Mormon Mesa Riparian Reserve Subunit.

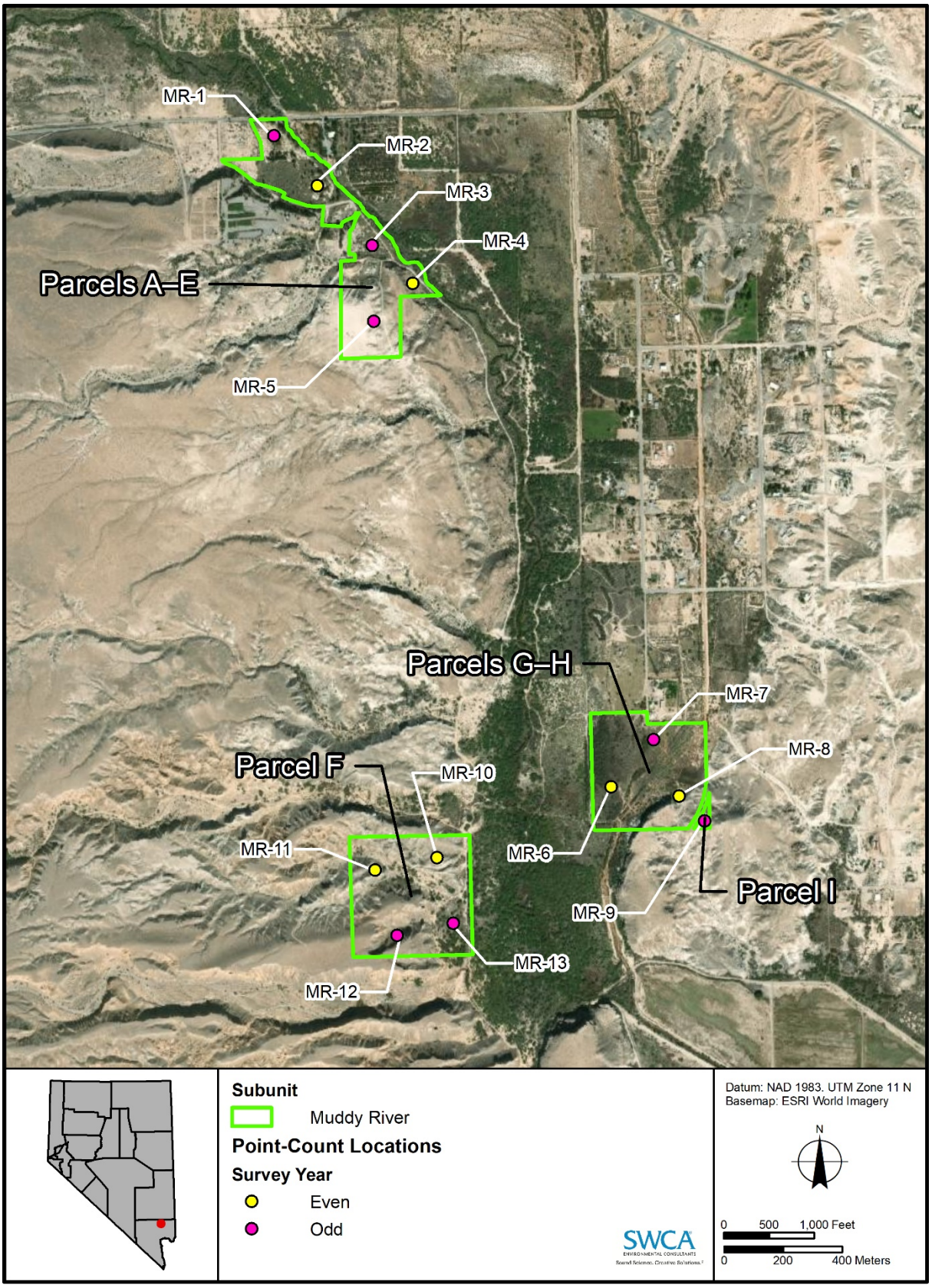

Figure 12. Point-count locations within the Muddy River Riparian Reserve Unit.

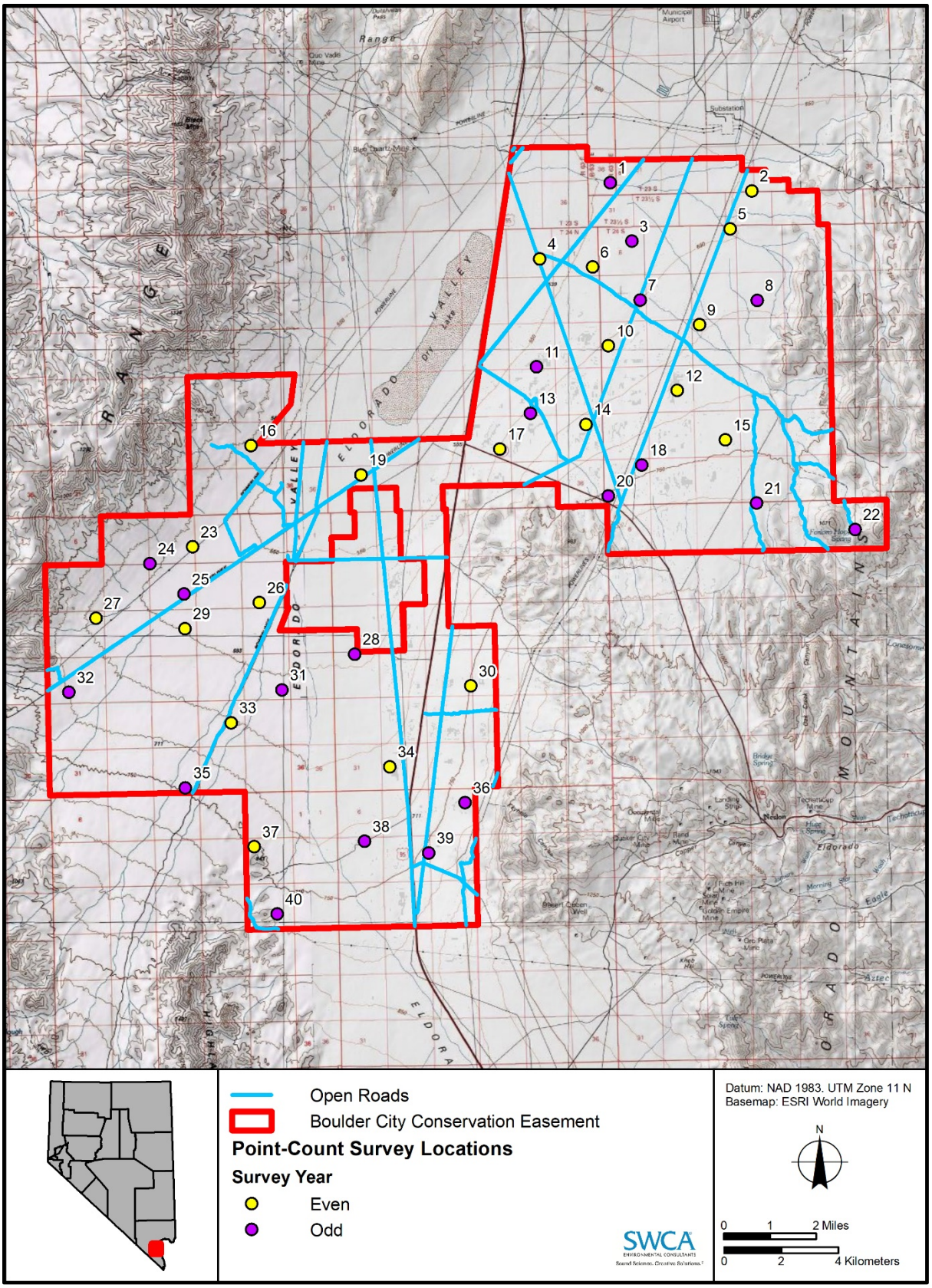

Figure 13. Point-count locations within the BCCE.

Surveyors recorded species code, interval of detection, sex, age, estimated distance from the observer, bearing to the bird, and behavior of the bird as it pertains to its breeding status. Any bird that flushed as the surveyor approached the point-count location but that was not detected during the survey was recorded as observed during the 0- to 3-minute interval and in the location from where it flushed. All detections were recorded on hardcopy datasheets, and bird locations were plotted on a standard point-count map (with their associated behavior codes) to help avoid double-counting individuals within a survey location. Any bird that gave an unknown vocalization was tracked following the survey to determine its identity (Ralph et al. 1993).

3.0 RESULTS AND EVIDENCE OF THE RESULTS

3.1 Objectives Completed

The objectives for this project were 1) to continue building on a baseline record of federally listed and non-listed bird species present at both the Riparian Reserve Units and at the BCCE and 2) to assess the effect of brown-headed cowbird control on nesting southwestern willow flycatchers. Completion of both of these objectives will allow for comparison with future datasets to measure the success of management and restoration efforts at the County's properties; the results of these objectives are presented here.

3.2 Survey Effort

3.2.1 Federally Listed Bird Surveys

The five rounds of southwestern willow flycatcher surveys were completed by Ms. Nichols and SWCA biologists Justin Streit and Mike Swink between May 15 and July 17, 2020 (Table 1). Each round of southwestern willow flycatcher surveys required up to six survey mornings; this was either conducted across six different days or across fewer days using a combination of surveyors working at different parcels. The four rounds of yellow-billed cuckoo surveys were completed by Ms. Nichols and Mr. Swink between June 23 and August 6, 2020 (Table 2). Each yellow-billed cuckoo survey round required four mornings. In 2020, SWCA surveyed a total of 50.5 ha (124.8 acres) for southwestern willow flycatcher, and 55.6 ha (137.4 acres) for yellow-billed cuckoo across all subunits. These surveys required 103.4 survey-hours for southwestern willow flycatcher and 71.3 survey-hours for yellow-billed cuckoo (Table 3). Descriptions and rationale for areas excluded from surveys in 2020 are included in Section 4.0.

Table 1. Dates for Southwestern Willow Flycatcher Surveys, 2020

Subunit	Mesquite West	Bunkerville			Riverside	Mormon Mesa	Muddy River
Parcel(s)	**1-A**	**2-A through 2-G**	**2-I and 2-J**	**2-K through 2-M**	**3-A and 3-B**	**5-A**	**A through H**
First Survey	May 15	May 20	May 18	May 18	May 19/23	May 16	May 15
Second Survey	June 13	June 10	June 2	June 3	June 9/13	June 1	June 9
Third Survey	June 20	June 17	June 18	June 18	June 16/20	June 15	June 20
Fourth Survey	July 2	July 4	June 30/ July 3	July 3	June 29	July 1	June 30
Fifth Survey	July 17	July 17	July 16	July 14	July 17	July 15	July 11

Table 2. Dates for Yellow-Billed Cuckoo Surveys, 2020

Subunit	Mesquite West		Bunkerville		Riverside	Mormon Mesa	Muddy River
Parcel(s)	**1-A**	**2-A through 2-G**	**2-I and 2-J**	**2-K through 2-M**	**3-A and 3-B**	**5-A**	**A through H**
First Survey	June 24	June 24	June 23	June 23	June 27	June 26	June 27
Second Survey	July 9	July 9	July 7	July 7	July 10	July 8	July 10
Third Survey	July 22	July 22	July 20	July 20	July 23	July 21	July 23
Fourth Survey	August 6	August 6	August 3	August 3	August 5	August 4	August 5

Table 3. Area and Total Hours of Survey for Southwestern Willow Flycatcher and Yellow-Billed Cuckoo Surveys

Subunit	Mesquite West		Bunkerville		Riverside	Mormon Mesa	Muddy River
Parcel(s)	**1-A**	**2-A through 2-G**	**2-I and 2-J**	**2-K through 2-M**	**3-A and 3-B**	**5-A**	**A through H**
Area Surveyed (acres)	9.9	20.5	17.9	6.3	9.6	52.0[1]; 64.7[2]	8.5
Total Survey Hours – Southwestern Willow Flycatcher	6.2	22.2	20.1	11.3	13.6	21.2	8.8
Total Survey Hours – Yellow-billed Cuckoo	4.7	12.5	13.8	6.9	11.0	16.6	5.8

[1] Total acres surveyed for southwestern willow flycatcher.

[2] Total acres surveyed for yellow-billed cuckoo.

3.2.2 Point-Count Surveys

The three rounds of point-count surveys were completed at the Riparian Reserve Units by Mr. Streit and Mr. Swink between May 8 and June 23, 2020 (Table 4). Each round of point-counts required four mornings to cover all the Riparian Reserve Units. Weather conditions were favorable during all three survey rounds, with no precipitation and wind speeds ranging from 0 to 19.8 km (0 to 12.3 miles) per hour.

Table 4. Survey Dates for Point-Count Surveys at the Riparian Reserve Units, 2020

Subunit	Mesquite West		Bunkerville		Riverside	Mormon Mesa	Muddy River
Parcel(s)	**1-A**	**2-A through 2-G**	**2-I and 2-J**	**2-K through 2-M**	**3-A and 3-B**	**5-A**	**A through H**
First Survey	May 9	May 9	May 12	May 12	May 15	May 8	May 8
Second Survey	June 4	June 4	June 9	June 9	June 5	June 5	June 8
Third Survey	June 16	June 16	June 17	June 17	June 17/19	June 19	June 23

Mr. Swink completed three rounds of point-count surveys within the BCCE between May 1 and June 15, 2020 (Table 5). Each round of point-counts at the BCCE required three survey mornings. Weather conditions were favorable during all three survey rounds, with light drizzle or no precipitation and wind speeds ranging from 0 to 17.2 km (0 to 10.7 miles) per hour.

Table 5. Survey Dates for Point-Count Surveys at the BCCE, 2020

Survey Round	Dates
First	May 1–2, May 4
Second	May 26–28
Third	June 12–13, June 15

3.3 Findings

3.3.1 Federally Listed Bird Surveys and Monitoring

SOUTHWESTERN WILLOW FLYCATCHER

The term "willow flycatcher" is used for individuals for which the subspecies could not be confirmed. Individuals detected for more than 7 days at a particular study area were considered to be residents at that study area. In addition, individuals detected between June 24 and July 17 were assumed to be of the southwestern subspecies. The term "flycatcher" is used to refer to residents detected for more than 7 days, as well as individuals assumed to be of the southwestern subspecies based on their detection dates.

A total of 18 adult flycatchers and willow flycatchers were detected during survey and monitoring activities at the Riparian Reserve Units in 2020. Of the 18 adults, one was detected at Bunkerville West Parcel 2-M, one was detected at Riverside Parcel 3-A, 12 were detected at Mesquite West Parcel 1-A, and four were detected at Mormon Mesa Parcel 5-A. Breeding (i.e., those for which at least one nest attempt was found) and resident flycatchers were detected at Parcels 1-A and 5-A.

One willow flycatcher detection was recorded during the first round of surveys at each Bunkerville West Parcel 2-M and Riverside Parcel 3-A. No subsequent survey detections in these parcels and behavior observed during the initial detections suggest these willow flycatchers were not resident individuals but were most likely spring migrants. Band status could not be confirmed for either individual.

Mesquite West

Field personnel spent 50.1 observer-hours territory monitoring at Mesquite West in 2020; activities included determining residency status, observing resident flycatchers, monitoring nests, and banding adults. Twelve adult flycatchers and willow flycatchers were documented at Mesquite West Parcel 1-A. The 12 adults comprised four pairs, one territorial male, and three individuals that could not be confirmed as resident at the study area. Of the four pairs, three were confirmed to have nested (Pairs 03, 05, and 07), while a possible nesting attempt could not be confirmed for the fourth pair (Pair 01; Table 6). A total of six nesting attempts were documented; all were unsuccessful (Appendix A; Figure A-1). Ms. Nichols color banded three new adults (see Table 6). Two additional adults were identified to individual via color band resighting. Four adults remained unbanded, and band status could not be determined for the remaining three adults. One male (MG[M]:VI) was polygynous with two females (GG[M]:EY and EY:KB[M]), and one female (GG[M]:EY) bred consecutively with two different males (OWO[M]:XX and MG[M]:VI) (see Table 6).

Mormon Mesa

Field personnel spent 7.3 observer-hours territory monitoring at Mormon Mesa in 2020; monitoring activities included determining residency status, observing resident flycatchers, monitoring nests, and banding adults and nestlings. Four flycatchers were recorded in the northwestern portion of the Mormon Mesa Subunit. These individuals composed two breeding pairs (see Table 6). One pair (Pair 01) had two unsuccessful nesting attempts, both located just north of the County's Parcel 5-A boundary (Appendix A; Figure A-2). The second pair (Pair 02) had one successful nesting attempt, which was located within one of the County's restoration plots. Ms. Nichols color banded three adults; the fourth individual remained unbanded. Two nestlings were banded at the 02A nest on July 1, 2020 (Figure 14). The nest was successful and produced one confirmed fledgling.

Table 6. Details of Flycatchers and Willow Flycatchers Detected at Monitored Parcels during the 2020 Breeding Season

Subunit[1]	Parcel	Date banded[2]	Federal band #[2]	Color combination[3]	Age[4]	Sex[5]	Territory or location[6]	Observation status[7]
MW	1-A	May 19, 2020	2660-23158	VI:BB(M)	AHY	M	01	N
		INA	INA	Undetermined	AHY	U	01	-
		June 29, 2013	2590-53177	OWO(M):XX[8]	A9Y	M	03	RS
		June 24, 2017	2590-53216	GG(M):EY	5Y	F	03	RS
		N/A	N/A	UB:UB	AHY	M	F04	Detected May 23–27
		May 27, 2020	2660-23165	MG(M):VI[9]	AHY	M	05, 03	N
		May 27, 2020	2590-53234	EY:KB(M)	AHY	F	05	N
		N/A	N/A	UB:UB	AHY	M	F06	Detected June 13
		N/A	N/A	UB:UB	AHY	M	07	RS
		INA	INA	Undetermined	AHY	F	07	-
		N/A	N/A	UB:UB	AHY	M	T08	Detected June 13–20
		INA	INA	Undetermined	AHY	U	F09	Detected July 10
MM	5-A	July 15, 2020	2590-53281	DW(M):EY	SY	M	01	N
		N/A	N/A	UB:UB	AHY	F	01	RS
		June 15, 2020	2590-53274	EY:KV(M)	AHY	M	02	N
		June 15, 2020	2660-23167	VI:BY(M)	AHY	F	02	N
		July 1, 2020	2660-23229	DD(M):VI	L	U	02	N; not confirmed to have fledged
		July 1, 2020	2590-53279	BR(M):EY	L	U	02	N

[1] MW = Mesquite West, and MM = Mormon Mesa.

[2] INA = information not available, and N/A = not applicable.

[3] Color-band codes: B = light blue, D = dark blue, EY = electric yellow Federal band, G = green, K = black, M = mulberry, (M) = metal pinstriped band, O = orange, R = red, UB = unbanded, V = violet, VI = violet Federal band, W = white, XX = standard silver Federal band, and Y = yellow. Color combinations are read as the bird's left leg and right leg, top to bottom; two or three letters designate every band; color-band designations for left and right legs are separated with a colon.

[4] Age in 2020: L = nestling, SY = 2 years, AHY = 2 years or older, 5Y = 5 years, and A9Y = 9 years or older.

[5] Sex codes: F = female, M = male, and U = unknown.

[6] Territory or location code: Numbers indicate unique individual, pair, or nest locations, a number without an alpha prefix indicates a flycatcher pair, F = individual detected for less than 7 days, and T = territorial individual detected for at least 7 days.

[7] Observation status codes: N = new capture, and RS = resight.

[8] This male was paired with GG(M):EY for one nesting attempt; not detected after nest failure.

[9] This male was paired with GG(M):EY after OWO(M):XX was no longer detected.

Of the 16 adults detected at parcels monitored in 2020, 13 were residents. Of the 13 residents, eight (62%) were known to be banded. Six of these eight adults were banded in 2020, while two were returning adults that had been banded in previous years. Three resident adults were known to be unbanded, and the band status for two individuals could not be confirmed. Of the two adults that had been banded in previous years, both returned to the study area where they had been most recently detected. Male OWO(M):XX was originally banded at Electric Avenue Pond in 2013, another study site within the Mesquite study area, and female GG(M):EY was originally banded at the Muddy River study area at the Overton Wildlife Management Area in 2017.

Figure 14. Left: Nest 02A with banded nestlings at Mormon Mesa Parcel 5-A. Right: Parasitized southwestern willow flycatcher Nest 03B at Mesquite West Parcel 1-A.

Nine nesting attempts were documented at Mesquite West Parcel 1-A and Mormon Mesa Parcel 5-A; six of these nests were known to contain flycatcher eggs and were used in calculating nest success and productivity. One (17%) nest was successful and fledged young, and five (83%) failed. Nest success was 0% at Parcel 1-A and 100% at Parcel 5-A; the only nest known to contain flycatcher eggs at Parcel 5-A successfully fledged young. The frequency of survey and subsequent monitoring activities at Mormon Mesa Parcel 5-A were insufficient to allow an accurate assessment of nest contents or cause of failure for all nests; thus, the two unsuccessful nests could not be included in the nest success calculation.

Nesting attempts were located for five female flycatchers, four of which were known to have produced at least one egg. Of the five females, two had one nesting attempt, two had two nesting attempts, and one had three nesting attempts. A suspected nesting attempt for an additional female detected at Parcel 1-A could not be confirmed.

Depredation and desertion were the main causes of nest failure at Parcel 1-A, each accounting for 33% of failed nests at that parcel (Table 7). One nest (17%) was abandoned before flycatcher eggs were laid, and parasitism caused failure at one nest (17%). Infrequent visits to Mormon Mesa Parcel 5-A resulted in unknown causes of failure for both failed nests at that parcel.

Table 7. Summary of Causes of Southwestern Willow Flycatcher Nest Failure at Monitored Parcels, 2020

Subunit[1]	Total # of nests	All failed nests	Abandoned	Depredated	Deserted	Parasitized	Unknown
MW	6	6	1 (17%)	2 (33%)	2 (33%)	1 (17%)	0
MM	3	2	0	0	0	0	2 (100%)
Total	**9**	**8**	**1 (13%)**	**2 (25%)**	**2 (25%)**	**1 (13%)**	**2 (25%)**

* All nesting attempts (those with and without flycatcher eggs) are included. Percentage of failed nests is shown in parentheses for each cause of failure. Abandoned = no flycatcher eggs were laid; deserted = deserted with eggs or young remaining in the nest; depredated = nest empty or destroyed 2 days or more before anticipated fledge date; and parasitized = cowbird young outlived any flycatcher young or appearance of cowbird egg(s) coincided with disappearance of all flycatcher eggs.

[1] MW = Mesquite West, and MM = Mormon Mesa.

Two of six nests (33%) with flycatcher eggs and known parasitism status were brood parasitized by cowbirds (Mesquite West Nest 03B and 05B) (Table 8). One cowbird egg was addled via vigorous shaking at Nest 03B in Mesquite West Parcel 1-A; this nest later failed when all three flycatcher eggs were replaced by cowbird eggs, so the cause of failure was nest parasitism (see Table 8; see Figure 14). A single cowbird egg was found in Nest 05B, but this nest was too high to safely access, so addling of this egg was determined to be too dangerous to attempt. One additional nest (Mormon Mesa Nest 01A) contained a single cowbird egg after the nest was determined to have failed; it is unknown whether this nest ever contained flycatcher eggs, and the cause of the nest failure remains unknown.

Table 8. Fates of Southwestern Willow Flycatcher Nests Parasitized by Cowbirds at Monitored Parcels, 2020

Subunit[1]	Nest ID code	Outcome[2]
MW	03B	First CE shaken during incubation; 1CE, 2WE in nest. All 3 eggs in nest were CE on next visit; parasitism caused failure.
	05B	1WE, 1CE observed with female in area. No eggs in nest on next visit; nest depredated.
MM	01A	Contents during incubation unknown. Contents on next visit 1CE. Nest had already failed at this time; cause of nest failure unknown.

[1] MW = Mesquite West, and MM = Mormon Mesa.

[2] WE = flycatcher egg(s), CE = cowbird egg(s), WN = flycatcher nestling(s), and CN = cowbird nestling.

YELLOW-BILLED CUCKOO

Yellow-billed cuckoo surveys across the Riparian Reserve Units in 2020 yielded five different yellow-billed cuckoo detections, and an additional two detections were recorded incidentally during southwestern willow flycatcher surveys and monitoring activities; these detections represent an estimated four different individual adult cuckoos.

At Mesquite West Parcel 1-A, a yellow-billed cuckoo was heard giving repeated "*coo*" calls in response to broadcast surveys on June 24 and incidentally giving contact calls during southwestern willow flycatcher monitoring activities on July 2 and July 6. During surveys on July 9, a yellow-billed cuckoo was heard giving knock/alarm calls in response to playback. No additional cuckoo detections were made during subsequent surveys or incidentally at Parcel 1-A (Appendix A; Figure A-3).

At Mormon Mesa, a yellow-billed cuckoo was detected giving a contact call in response to playback on June 26 (Appendix A; Figure A-4). This bird was not detected during any subsequent round of cuckoo survey and, therefore, does not meet the criteria for a possible breeder (Halterman et al. 2015).

During the first round of surveys at the Muddy River Subunit on June 27, one yellow-billed cuckoo responded to broadcast surveys by giving knock/alarm calls before flying off to the northwest (Appendix A; Figure A-5). Following this detection, biologists observed a second bird flying and foraging in the southeastern region of the Muddy River survey area; this bird gave a contact call 17 minutes after the initial observation (see Appendix A; Figure A-5). As no cuckoos were detected during the second, third, or fourth rounds of surveys, these detections at the Muddy River Subunit during the first survey round do not constitute sufficient evidence of a possible breeding territory (per Halterman et al. [2015]).

No yellow-billed cuckoos were detected at the Riverside Subunit or at any of the Bunkerville Subunit Parcels in 2020.

3.3.2 Point-Count Surveys

RIPARIAN RESERVE UNITS

MSHCP Species

Of the eight MSHCP-covered bird species, five were recorded during the 2020 point-count surveys: American peregrine falcon, Arizona Bell's vireo, blue grosbeak, phainopepla, and southwestern willow flycatcher. In addition, one other MSHCP-covered species, the yellow-billed cuckoo, was recorded while other surveys were conducted at the Riparian Reserve Units. Neither the summer tanager nor the vermilion flycatcher was recorded within the Riparian Reserve Units during point-count surveys in 2020; however, both were recorded incidentally in 2020. A female-type summer tanager was detected at Mormon Mesa following a point-count survey, and vermilion flycatchers were detected during federally listed bird surveys at Muddy River and at Bunkerville Parcel 2-J.

In addition to the eight covered bird species, the MSHCP also identifies seven evaluation bird species for which future viability is a concern and that may be considered for inclusion in subsequent phases or amendments to the MSHCP. Of the seven evaluation bird species, the crissal thrasher was recorded at all the Riparian Reserve Subunits, except Mesquite West, and the loggerhead shrike was recorded twice within the Bunkerville Subunit. Loggerhead shrikes were also incidentally detected multiple times at the Mormon Mesa Subunit.

Seven MSHCP-covered and evaluation species were recorded during point-count surveys at the Riparian Reserve Units in 2020 (Table 9). For each species, the number of recorded individuals is listed for each set of connected parcels. In an effort to standardize the data and account for species that may be detected at greater distances than others (e.g., crissal thrasher, yellow-breasted chat [*Icteria virens*]), numbers recorded in Table 9 only refer to birds detected within 100 m (328.1 feet) of a point-count location.

Table 9. Number of Detections of MSHCP Species Recorded at the Riparian Reserve Units during Point-Count Surveys, 2020

Subunit	Mesquite West	Bunkerville		Riverside	Mormon Mesa	Muddy River
Parcel(s)	**1-A**	**2-A through 2-G**	**2-I through 2-M**	**3-A and 3-B**	**5-A**	**A–H**
Willow flycatcher					1 (PO)[1]	
American peregrine falcon	-	X	-	-	-	-
Loggerhead shrike	-	-	2	-	-	-
Blue grosbeak	-	4 (PO)	1 (PO)	4 (PO)	-	-

Subunit	Mesquite West	Bunkerville		Riverside	Mormon Mesa	Muddy River
Parcel(s)	**1-A**	**2-A through 2-G**	**2-I through 2-M**	**3-A and 3-B**	**5-A**	**A–H**
Phainopepla	-	-	-	1	-	1
Crissal thrasher	-	4	6	1	2	4 (PO)
Arizona Bell's vireo	2 (PO)	2 (PO)	7 (PO)	15 (PO)	7 (PO)	6 (PO)

* X = species recorded at that unit but never within 100 m (328.1 feet) of a point-count location; CO = Breeding confirmed—recently fledged birds observed; PO = breeding possible—individual(s) singing in appropriate habitat at that unit during the breeding season.

[1] Breeding was confirmed for this species during federally listed bird surveys but could only reach the level of PO during point-count surveys.

While southwestern willow flycatchers and yellow-billed cuckoos were recorded at multiple parcels during species-specific surveys and were confirmed breeding at Mesquite West Parcel 1-A and Mormon Mesa Parcel 5-A, these species were generally not detected during point-count surveys, with the exception of one willow flycatcher detection at Mormon Mesa. Breeding could not be confirmed for any of the other MSHCP species in 2020. However, blue grosbeak, crissal thrasher, and Arizona Bell's vireo were all suspected of breeding at the Riparian Reserve Units, because individuals were heard singing in appropriate habitat during the breeding season (refer to breeding codes in Table 9). Note that a species without a breeding code does not indicate that the species was not breeding in a particular subunit or set of parcels, but only that no evidence of such was recorded.

Non-MSHCP-listed Species

During the three rounds of point-count surveys in 2020, the biologists recorded 54 non-MSHCP avian species across all the subunits (Table 10). Of these 54 species, two were recorded at each of the five subunits, mourning dove (*Zenaida macroura*) and yellow-breasted chat. While some of these species (e.g., black-throated gray warbler [*Setophaga nigrescens*] and MacGillivray's warbler [*Geothlypis tolmiei*]) were likely just migrating through the area on their way to breeding grounds farther north or at higher elevations, most of the species recorded during point-count surveys are known to breed in the Mojave Desert. While breeding could not be confirmed for the majority of the species recorded at the Riparian Reserve Units, it is assumed that many may have bred or attempted to breed in the Riparian Reserve Units in 2020.

Table 10. All Other Bird Species Present at the Riparian Reserve Subunits during Point-Count Surveys, 2020

Common Name	Scientific Name	Clark County Riparian Reserve Subunits – Presence and Breeding Codes*				
		Mesquite West	Bunkerville	Riverside	Mormon Mesa	Muddy River
Cooper's Hawk	*Accipiter cooperii*	-	-	1	-	-
Red-winged blackbird	*Agelaius phoeniceus*	1 (PO)	36 (PO)	4	5 (PO)	-
Mallard	*Anas platyrhynchos*	-	1	-	-	-
Great blue heron	*Ardea herodias*	-	1	X	X	-
Verdin	*Auriparus flaviceps*	-	8 (PO)	6	3	2
Red-tailed hawk	*Buteo jamaicensis*	-	-	-	-	X
Swainson's hawk	*Buteo swainsoni*	-	X	-	-	-
Gambel's quail	*Callipepla gambelii*	2 (PO)	30 (PO)	10	-	18 (PO)
Anna's hummingbird	*Calypte anna*	1	-	-	-	-

Common Name	Scientific Name	Clark County Riparian Reserve Subunits – Presence and Breeding Codes*				
		Mesquite West	**Bunkerville**	**Riverside**	**Mormon Mesa**	**Muddy River**
Wilson's warbler	*Cardellina pusilla*	-	-	1	-	-
Turkey vulture	*Cathartes aura*	-	X	1	5	1
Killdeer	*Charadrius vociferus*	-	9 (PO)	3	-	-
Lesser nighthawk	*Chordeiles acutipennis*	-	-	1	-	-
Northern flicker	*Colaptes auratus*	1				
Western wood-pewee	*Contopus sordidulus*	-	1	-	-	-
Common raven	*Corvus corax*	-	X (CO)	X	1	1 (CO)
Ladder-backed woodpecker	*Dryobates scalaris*	1	1 (PO)	X	-	-
Horned lark	*Eremophila alpestris*	-	-	5	-	-
Greater roadrunner	*Geococcyx californianus*	-	2	1	-	2 (PO)
MacGillivray's warbler	*Geothlypis tolmiei*	-	-	1	-	-
Common yellowthroat	*Geothlypis trichas*	1 (PO)	10 (PO)	-	4 (PO)	1 (PO)
House finch	*Haemorhous mexicanus*	-	11 (PO)	20 (PO)	-	9
Yellow-breasted chat	*Icteria virens*	6 (PO)	2 (PO)	9 (PO)	6 (PO)	4 (PO)
Hooded oriole	*Icterus cucullatus*	-	-	-	-	1
Song sparrow	*Melospiza melodia*	5 (PO)	2 (PO)	1	12 (PO)	-
Northern mockingbird	*Mimus polyglottos*	-	X	1	1	-
Brown-headed cowbird	*Molothrus ater*	3 (PO)	31 (PO)	10	5	-
Ash-throated flycatcher	*Myiarchus cinerascens*	-	1	5 (PO)	-	-
Lucy's warbler	*Oreothlypis luciae*	-	24 (PO)	11 (PO)	2 (PO)	7 (CO)
House sparrow	*Passer domesticus*	-	1	-	-	36 (PO)
Indigo bunting	*Passerina cyanea*	-	-	1 (PO)	-	-
Cliff swallow	*Petrochelidon pyrrhonota*	-	1	22	-	X
Double-crested cormorant	*Phalacrocorax auratus*	-	X	-	-	-
Abert's towhee	*Pipilo aberti*	-	41 (PO)	14 (PO)	1	19 (PO)
White-faced ibis	*Plegadis chihi*	-	X	-	-	-
Black-tailed gnatcatcher	*Polioptila melanura*	-	5 (CO)	1	1	7
Great-tailed grackle	*Quiscalus mexicanus*	-	11	1	1	-
Rock wren	*Salpinctes obsoletus*	-	X	-	-	4 (PO)
Black phoebe	*Sayornis nigricans*	-	-	-	-	1
Say's phoebe	*Sayornis saya*	-	2	3	-	-
Black-throated gray warbler	*Setophaga nigrescens*	-	1	-	-	-
Yellow warbler	*Setophaga petechia*	9 (PO)	4	1	1 (PO)	-
Lesser goldfinch	*Spinus psaltria*	1	5	-	-	1
Northern rough-winged swallow	*Stelgidopteryx serripennis*	-	30	10	10	1
Eurasian collared-dove	*Streptopelia decaocto*	-	-	1	-	7 (PO)
Western meadowlark	*Sturnella neglecta*	-	9 (PO)	-	-	-

Common Name	Scientific Name	Clark County Riparian Reserve Subunits – Presence and Breeding Codes*				
		Mesquite West	Bunkerville	Riverside	Mormon Mesa	Muddy River
Violet-green swallow	*Tachycineta thalassina*	-	-	-	2	-
Bewick's wren	*Thryomanes bewickii*	-	2 (PO)	-	2 (PO)	9 (PO)
Western kingbird	*Tyrannus verticalis*	-	1	-	-	1
Yellow-headed blackbird	*Xanthocephalus xanthocephalus*	-	-	1	4	-
White-winged dove	*Zenaida asiatica*	-	-	-	-	2 (PO)
Mourning dove	*Zenaida macroura*	2 (PO)	33 (PO)	7 (PO)	11 (PO)	23 (PO)
White-crowned sparrow	*Zonotrichia leucophrys*	-	1 (PO)	-	-	-

***** X = species recorded at that unit but never within 100 m (328.1 feet) of a point-count location; CO = Breeding confirmed—adult(s) observed carrying food; PO = breeding possible—individual(s) singing or performing a territorial display in appropriate habitat at that unit during the breeding season.

Confirmation of breeding was recorded for Lucy's warbler (*Leiothlypis luciae*), common raven (*Corvus corax*), and black-tailed gnatcatcher (*Polioptila melanura*), all of which were observed carrying food, which indicates the presence of nestlings or fledglings. Additionally, 23 other species were recorded singing or performing territorial displays, indicating that breeding for those species was possible within the Riparian Reserve Units (though some species may also exhibit either of these behaviors during migration).

Species richness varied between the five Riparian Reserve Subunits. The Bunkerville Subunit showed the highest avian species richness, with 35 species recorded, while the Mesquite West Subunit yielded the lowest species richness, with 13 species recorded. The three most commonly detected species across all the Riparian Reserve Units were mourning dove, Abert's towhee (*Pipilo aberti*), and Gambel's quail (*Callipepla gambelii*).

BCCE

MSHCP-listed Species

None of the eight MSHCP-covered bird species were recorded during 2020 point-count surveys in the BCCE. However, biologists recorded two evaluation bird species: loggerhead shrike was recorded at three point-count locations, and LeConte's thrasher (*Toxostoma lecontei*) was recorded at eleven point-count locations (Table 11). These data are presented as total detections and detections within 100 m (328 feet) of the observer in order to compare species with different detection probabilities and reduce bias towards species that are more conspicuous at greater distances (e.g., LeConte's thrasher) (GBBO 2003; Ralph et al. 1995). While breeding could not be confirmed for either species during point-count surveys, Mr. Streit was able to incidentally detect multiple LeConte's thrasher nests on March 15, 2020, thereby confirming breeding (Figure 15).

Table 11. Number of Detections and Breeding Codes for MSHCP Evaluation Species Recorded at the BCCE during 2020 Point-Count Surveys

Common Name	Scientific Name	Total Detections	Detections within 100 m	Breeding Codes*
Loggerhead shrike	*Lanius ludovicianus*	4	3	PO
LeConte's thrasher	*Toxostoma lecontei*	13	3	PO

* PO = breeding possible—individual(s) singing or performing a territorial display in appropriate habitat at that unit during the breeding season.

Figure 15. Left: LeConte's thrasher nest with nestlings at the BCCE. Right: LeConte's thrasher nest in a buck-horn cholla (*Cylindropuntia acanthocarpa*).

Non-MSHCP-listed Species

SWCA biologists recorded 15 avian species not listed under the MSHCP across the BCCE point-count locations over all three rounds of 2020 point-count surveys (Table 12). As in Table 11, data presented in Table 12 include all detections, as well as birds detected within 100 m (328 feet) of a point-count location, to standardize the data and account for bias towards birds that can be detected at greater distances than others (e.g., common raven and turkey vulture [*Cathartes aura*]). Of these 15 species recorded during point-count surveys, 13 were recorded within 100 m (328 feet) of a point-count location. The three most commonly detected species at the BCCE, independent of distance from surveyor, were black-throated sparrow (*Amphispiza bilineata*), horned lark (*Eremophila alpestris*), and common raven (see Table 12). The three most common species recorded within 100 m (328.1 feet) of a point-count location were black-throated sparrow, horned lark, and mourning dove (*Zenaida macroura*).

Table 12. Number of Detections and Breeding Codes for Non-MSHCP-listed Species Recorded at the BCCE during Point-Count Surveys, 2020

Common Name	Scientific Name	Total Detections	Detections within 100 m	Breeding Codes*
Black-throated sparrow	*Amphispiza bilineata*	130	89	PO
Red-tailed hawk	*Buteo jamaicensis*	4	1	-
Cactus wren	*Campylorhynchus brunneicapillus*	4	2	PO
Lesser nighthawk	*Chordeiles acutipennis*	2	0	PO
Western wood-pewee	*Contopus sordidulus*	1	1	-
Common raven	*Corvus corax*	21	1	CO
Horned lark	*Eremophila alpestris*	37	30	PO
House finch	*Haemorhous mexicanus*	2	2	-
Northern mockingbird	*Mimus polyglottos*	3	0	-
Brown-headed cowbird	*Molothrus ater*	1	1	-
Ash-throated flycatcher	*Myiarchus cinerascens*	1	1	-
Black-tailed gnatcatcher	*Polioptila melanura*	7	4	PO

Common Name	Scientific Name	Total Detections	Detections within 100 m	Breeding Codes*
Rock Wren	*Salpinctes obsoletus*	4	3	PO
Brewer's sparrow	*Spizella breweri*	9	6	PO
Mourning dove	*Zenaida macroura*	9	8	-

* CO = Breeding confirmed – adult(s) observed carrying food or at an active nest; PO = breeding possible – individual(s) singing or performing a territorial display in appropriate habitat during the breeding season.

While some of the species detected at the BCCE in 2020 were likely migrating through the area on their way to breeding grounds farther north or at higher elevations (e.g., Western wood-pewee [*Contopus sordidulus*]), most of these species are known to breed in the Mojave Desert and may have bred or attempted to breed within the BCCE boundary in 2020. For example, black-throated sparrows, the most abundant species at the BCCE in 2020, were never confirmed to be breeding within the BCCE during the 2020 point-count surveys; however, this species is one of the most common breeders in the Mojave Desert, and it undoubtedly breeds within the BCCE boundary.

Confirmation of breeding was recorded for one species not covered under the MSHCP: common raven (at a nest). Additionally, seven other species were recorded singing or performing territorial displays, which indicates that breeding for those species was possible (though some species may do either during migration). Species lacking a breeding code in Table 12 may have bred within the BCCE; however, no evidence of breeding was recorded.

4.0 EVALUATION/DISCUSSION OF RESULTS

This project builds on a baseline avian dataset for the County's MSHCP properties. Point-count surveys across the Riparian Reserve Units resulted in a total of 61 avian species detected, including seven MSHCP-covered and evaluation species. Point-counts across the BCCE yielded 17 total avian species, including two MSHCP-evaluation species. Goals identified in both the Riparian Reserve Unit Management Plan (Clark County 2015) and the BCCE Management Plan (Clark County 2019) include managing these properties to protect MSHCP-covered species. Baseline vegetation community and structure data for the MSHCP properties are necessary to inform habitat management interventions to successfully manage avian species at these properties. This section includes a closer analysis of avian species presence and distribution for each set of connected parcels within the Riparian Reserve Units and at the BCCE, as well as a qualitative assessment of existing vegetation conditions therein.

4.1 Mesquite West

4.1.1 Parcel 1-A

More than 90% of the vegetation at Bunkerville Parcel 1-A consists of narrowleaf willow, the majority of which is 4–6 m (13.1–19.7 feet) in height (Figure 16); the remainder of the vegetation consists of 4- to 6-m- (13.1- to 19.7-feet-) tall tamarisk and some patches of narrowleaf willow approximately 3–4 m (9.8–13.1 feet) in height. Parcel 1-A generally exhibits canopy closure > 90%. Intermittently throughout the breeding season, irrigation return water runs north to south throughout all but the southeast corner of Parcel 1-A. On days when there are no return flows, the site still contains saturated soils. This parcel contains the best habitat for southwestern willow flycatchers within the County's Riparian Reserve Units. All 4.0 ha (9.9 acres) originally delineated for surveys by the County were considered habitat suitable for federally listed bird surveys in 2019 and 2020 (see Figure 3).

Figure 16. Typical narrowleaf willow habitat at Mesquite West Parcel 1-A.

Habitat quality in Parcel 1-A is evidenced by the presence of five known southwestern willow flycatcher territories and six known nesting attempts (see Section 3.3.1, and Figure 14 and Appendix A). Bunkerville Parcel 1-A occupies the majority of the eastern portion of a larger study site known as Mesquite West, which has been monitored annually by SWCA (under contract with the Bureau of Reclamation) and NDOW biologists since 2003 (McLeod and Pellegrini 2013, 2014; NDOW, unpublished data). From 2003 to 2012, Mesquite West had anywhere from 6 to 30 resident adult southwestern willow flycatchers in a given year (McLeod and Pellegrini 2013). Hydrologic conditions within Parcel 1-A appear to be highly variable from year to year, and soil moisture levels were noted to be decreasing in July 2020. All documented flycatcher nesting attempts failed in 2020, and the increasingly arid conditions observed toward the end of the nesting season may have been a contributing factor in flycatcher nests being abandoned or deserted (see Table 7).

There were four cuckoo detections within Parcel 1-A in 2020. The western and central portions of Parcel 1-A contain taller narrowleaf willows that approach 8 m (26 feet) in height, and it was at the eastern edge of one of these patches that yellow-billed cuckoos nested in 2019. Breeding could not be confirmed for this yellow-billed cuckoo at Parcel 1-A in 2020.

In addition to the southwestern willow flycatcher and yellow-billed cuckoo, one other MSHCP-covered avian species, Arizona Bell's vireo, was recorded on two of three point-count surveys conducted at Mesquite West Parcel 1-A in 2020. This habitat is ideal for Arizona Bell's vireo, as this species is known to nest in thickets of dense willow (Clark County 2000; Floyd et al. 2007), and it is presumed that Arizona Bell's vireos likely breed within this parcel.

Though not an MSHCP-covered species, the yellow warbler (*Setophaga petechia*), a Mojave riparian indicator species (GBBO 2010), was also recorded within Mesquite West Parcel 1-A in 2020, further indicating that Parcel 1-A has some of the best quality habitat of any of the parcels within the Riparian Reserve Units.

4.2 Bunkerville

The habitat at the Bunkerville Subunit is extremely varied, ranging from highly disturbed areas to mostly intact, native habitat. In vegetated areas, dominant species range from young, sparsely distributed arrowweed (*Pluchea sericea*) in open, sandy soil, to mature monotypic tamarisk, to dense stands of narrowleaf willow (*Salix exigua*). The following section describes the avian habitat use within each

unique set of connected parcels in the Bunkerville subunit: 1) Parcels 2-A through 2-G, 2) Parcels 2-I and 2-J, and 3) Parcels 2-K through 2-M.

4.2.1 Parcels 2-A through 2-G

Bunkerville Parcels 2-A through 2-G contain mostly shrubby habitat with frequent openings that have been scoured by flooding or cleared by anthropogenic activities. Parcels 2-A through 2-E are situated mostly within the active floodplain of the Virgin River, which experiences frequent high-flow events. These parcels therefore consist largely of sandy bare ground dotted with sapling arrowweed and tamarisk (Figure 17). In 2019, higher than normal winter precipitation yielded significant spring run-off that scoured portions of these parcels, creating more open, unvegetated habitat (Figure 18) and affected the habitat at point-count location BV-7 (Figure 19). Of the 9.8 ha (24.3 acres) originally delineated for surveys by the County, 1.3 ha (3.2 acres) were scoured by the 2019 flooding, and 0.3 ha (0.7 acre) was burned in a wildfire late in 2017 (SWCA 2017a). These 1.6 ha (3.9 acres) of previously tamarisk-dominated woodland were excluded from surveys in 2019 and 2020. Parcels 2-A through 2-G do not currently contain vegetation that resembles typical southwestern willow flycatcher or yellow-billed cuckoo breeding habitat, and the lack of detections for both species is not surprising. The site completely lacks the multistoried canopy that is generally used by cuckoos, and although the minimum canopy height for breeding flycatchers is considered to be 3 m, occupied flycatcher sites along the Virgin River in 2003–2011 had median canopy heights of 5–6 m (16.4–19.7 feet) (McLeod and Pellegrini 2013). There is generally very little continuous canopy at this height within Parcels 2-A through 2-G. Median canopy closure of occupied flycatcher sites along the Virgin River from 2003 to 2011 was > 90% (McLeod and Pellegrini 2013). Portions of the site exhibit canopy closure that reached 80%, but the majority of the site is much more open.

Figure 17. Examples of flood-disturbed habitat at Bunkerville Parcels 2-A through 2-E.

Figure 18. Evidence of the 2019 flooding at Bunkerville Parcels 2-A through 2-E.

Figure 19. BV-7, facing north, in 2017 (left) and in 2020 (right).

Bunkerville Parcels 2-F and 2-G are dominated by anthropogenically disturbed lands and include large areas that have been completely bladed and cleared of native vegetation (Figure 20). Any regrowth in this area is generally patchy tamarisk and arrowweed, 2- to 4-m- (6.6- to 13.1-foot-) high, with little continuous canopy. Much of the southern portion of Bunkerville Parcel 2-F is currently being used for growing alfalfa (*Medicago sativa*) and grazing cattle (see Figure 4). The areas of Parcels 2-F and 2-G that have not been disturbed by anthropogenic activities are dominated by 1- to 3-m- (3.3- to 9.8-foot-) tall seep willow (*Baccharis salicifolia*), tamarisk, and intermittent arrowweed (Figure 21). There is a small patch of monotypic tamarisk in Parcel 2-F and a small patch of narrowleaf willow in Parcel 2-G (Figure 22). The tamarisk occurs largely on a dry terrace, raised above the river, and consists of 3- to 4-m- (9.8- to 13.1-foot-) tall trees with < 50% canopy closure. The patch of willow consists largely of narrowleaf willow, with intermittent tamarisk and seep willow, all of which ranges mostly between 3 and 4 m (9.8 and 13.1 feet) in height. This area of willow has intermittent surface water and relatively dense canopy cover (~75%) but is less than 0.4 ha (1 acre) in size, which is likely too small to support most of the MSHCP-covered bird species, including southwestern willow flycatcher (Sogge et al. 2010). A few mature Goodding's willow (*Salix gooddingii*) and screwbean mesquite also occur within the Virgin River floodplain throughout Parcels 2-A through 2-G.

Figure 20. Anthropogenically disturbed habitat at Bunkerville Parcels 2-F and 2-G.

Figure 21. Examples of young seep willow and arrowweed at Bunkerville Parcels 2-F and 2-G.

Figure 22. Monotypic tamarisk at Bunkerville Parcel 2-F (left) and the narrowleaf willow patch at Bunkerville Parcel 2-G (right).

Three MSHCP-covered avian species were recorded at Bunkerville Parcels 2-A through 2-G: Arizona Bell's vireo, blue grosbeak, and crissal thrasher. Arizona Bell's vireo is typically found in desert riparian habitat (Clark County 2000), and this species was recorded from four of the seven points surveyed within this set of parcels in 2020. Blue grosbeaks were detected from three of the seven point-count locations surveyed within this set of parcels in 2020. While both species are considered to be desert riparian obligates, it appears that they both can tolerate more open, scrubby habitat than some of the other MSHCP riparian species. In addition to the covered species, crissal thrasher was also recorded from three of the seven point-locations within these parcels. This species prefers dense, scrubby vegetation often near water, but is not a riparian obligate species.

4.2.2 Parcels 2-I and 2-J

Much of Bunkerville Parcels 2-I and 2-J appear to be subject to regular flooding, and some of the most abundant plants within these two parcels are sapling arrowweed and tamarisk < 3 m (9.8 feet) tall (Figure 23). Much of the area is relatively unvegetated when compared to other riparian habitat in the desert Southwest, and this is likely due, at least in part, to relatively recent flood events, including flooding in the spring of 2019. Of the 8.1 ha (20.1 acres) delineated for surveys by the County prior to 2019 surveys, 0.9 ha (2.2 acres) were scoured by spring flooding, leaving unvegetated bare ground (Figure 24). These areas were excluded from southwestern willow flycatcher and yellow-billed cuckoo surveys in 2019 and 2020.

Figure 23. Typical open, scrubby habitat at Bunkerville Parcels 2-I and 2-J.

Figure 24. Evidence of the 2019 flooding at Bunkerville Parcel 2-I.

Bunkerville Parcels 2-I and 2-J host very few large native riparian tree species, such as the Goodding's and narrowleaf willow, which are preferred by southwestern willow flycatcher and yellow-billed cuckoo. Most of the mature riparian vegetation within these parcels consists of tamarisk and screwbean mesquite 2–5 m (6.6–16.4 feet) tall (Figure 25), and these stands have virtually no continuous canopy cover or nearby surface water. Additionally, much of the tamarisk is dead or dying, due to defoliation by the tamarisk leaf beetle (*Diorhabda* spp.) or herbicidal treatment by the National Park Service (personal communication, C. Deuser, National Park Service, with Justin Streit, Project Manager, SWCA, August 28, 2019) (Figure 26). While tamarisk can provide habitat for desert riparian bird species, much of the tamarisk at Bunkerville Parcels 2-I and 2-J does not, due largely to its poor health at these two parcels.

Figure 25. Open tamarisk (left) and screwbean mesquite (right) habitat at Bunkerville Parcels 2-I and 2-J.

Figure 26. Tamarisk stand treated with herbicide at Bunkerville Parcel 2-J, before (left) and after (right) treatment.

No southwestern willow flycatchers or yellow-billed cuckoos were detected during surveys in 2020. Bunkerville Parcels 2-I and 2-J do not currently contain any potential habitat for southwestern willow flycatcher or yellow-billed cuckoo, and the site completely lacks the multistoried canopy that is generally used by cuckoos.

Despite a lack of many native trees, Parcels 2-I and 2-J do have flowing channels, a pond, and a wet meadow (Figure 27), all of which could support native riparian vegetation in the future. The wet meadow is located in the eastern half of Parcel 2-J and is composed largely of sedges (*Carex spp.*) and other wetland grasses, with relic Goodding's willow and scattered tamarisk. The wet meadow is unique to Parcel 2-J within the County's reserve system and could be an area to target for riparian restoration. Cattle, which were seen on multiple visits to this parcel and which have been documented browsing on the narrowleaf willows at these parcels (Figure 28), should be excluded prior to any restoration efforts.

Figure 27. Open water (left) and wet meadow (right) habitats at Bunkerville Parcel 2-J.

Figure 28. Evidence of cattle browse on narrowleaf willow at Bunkerville Parcel 2-I (left) and the meadow habitat at Bunkerville Parcel 2-J where the cattle were regularly seen (right).

In total, one MSHCP-covered bird species (Arizona Bell's vireo) and two MSHCP evaluation bird species (crissal thrasher and loggerhead shrike) were recorded within Bunkerville Parcels 2-I and 2-J in 2020. These avian species are known to thrive in open, scrubby habitats bordering desert riparian habitat.

4.2.3 Parcels 2-K through 2-M

Bunkerville Parcels 2-K, 2-L, and 2-M compose a total of 59 acres and are located immediately north of Bunkerville West Parcel 2-J (see Figure 4). In total, SWCA mapped 6.3 acres as potential cuckoo/flycatcher breeding habitat in Parcels 2-L and 2-M, which is characterized by isolated and/or narrow patches of riparian vegetation containing tamarisk, narrowleaf willow, and Goodding's willow adjacent to wet meadows, marshes, and open water features (Figures 29 and 30). There were no areas mapped as cuckoo/flycatcher habitat within Parcel 2-K.

Figure 29. Tall, dense tamarisk along a backwater feature in Parcel 2-M provides potential flycatcher breeding habitat.

Figure 30. Goodding's and narrowleaf willow habitat in Bunkerville Parcel 2-M.

Outside of the areas mapped as cuckoo/flycatcher potential habitat, vegetation within these parcels consists primarily of riparian scrub dominated by arrowweed, and soils in these areas were dry in 2020 (Figure 31). Bunkerville Parcels 2-L and 2-M do not currently provide habitat for southwestern willow flycatcher or yellow-billed cuckoo; however, future restoration actions, including changes in vegetation and water management, could improve the habitat potential for these species within these areas.

Three MSHCP-covered bird species were recorded in Parcels 2-L and 2-M. Southwestern willow flycatcher was detected during targeted playback surveys, and biologists recorded four detections of Arizona Bell's vireo and one detection of blue grosbeak during point-count surveys. Additionally, two MSHCP evaluation species, crissal thrasher and loggerhead shrike, were also documented in Parcels 2-L and 2-M during point-count surveys.

Figure 31. Typical open, scrubby habitat at Bunkerville Parcels 2-L and 2-M.

4.3 Riverside

Much like Bunkerville Parcels 2-I and 2-J, Riverside Parcels 3-A and 3-B are composed mostly of the open, scrubby habitat typically found in riparian areas that experience frequent flooding (Figure 32). Like Parcels 2-I and 2-J, the Riverside Subunit was subjected to substantial seasonal run-off associated

with above-average winter precipitation in the Virgin River watershed in 2019. The 2019 flooding removed portions of a large, contiguous patch of tamarisk at the northern end of the Riverside Subunit. Subsequently, of the 5.3 ha (13.1 acres) that the County identified for federally listed bird surveys, 3.9 ha (9.6 acres) were deemed suitable for surveys by SWCA in 2019 and 2020. These survey areas consisted of two general vegetation types: 1) relatively contiguous tamarisk 3–4 m (9.8–13.1 feet) in height, with canopy closure < 50%, and 2) a generally < 5-m- (16.4-foot-) wide strip of 3- to 4-m- (9.8- to 13.1-feet-) tall narrowleaf willow along an irrigation ditch (Figure 33).

Figure 32. Scrubby, open habitat within the floodplain at Riverside Parcels 3-A and 3-B.

Figure 33. Narrowleaf willow along the irrigation ditch at Riverside Parcels 3-A and 3-B.

As of 2018, there were also large areas of dense 2-m- (6.6-foot-) tall arrowweed and fairly dense 2- to 4-m- (6.6- to 13.1-foot-) tall screwbean and honey mesquite (*Prosopis glandulosa*) (Figure 34). However, between the 2018 and 2019 surveys, the majority of this largest patch of mesquite was cut down by an unknown party (see Figure 34). Regrowth of these mesquite trees in Parcels 3-A and 3-B was documented in 2020, as shown in Figure 35.

Figure 34. Mesquite patch at Riverside Parcels 3-A and 3-B before (left) and after (right) cutting in 2019.

Four MSHCP avian species were recorded at the Riverside Subunit: Arizona Bell's vireo, blue grosbeak, crissal thrasher, and phainopepla. With the exception of Arizona Bell's vireo, the MSHCP identifies all of these species as capable of occupying habitat other than desert riparian, and blue grosbeak can occupy open riparian habitat (Clark County 2000). Crissal thrasher and phainopepla prefer shrub- or mesquite-dominated habitats and are not desert riparian obligates, so their presence at the Riverside Subunit is not surprising.

Figure 35. Mesquite patch at RS-5, facing west, in 2018 - showing dense growth (left), and in 2020 – following thinning but exhibiting regrowth (right).

The Arizona Bell's vireo is a desert riparian obligate, but it can occupy dense mesquite habitat (SWCA 2017b) and is not restricted to nesting in willow, as suggested in the MSHCP (Clark County 2000). While dense willow is present along the irrigation ditch that runs along the eastern side of Parcels 3-A and 3-B, Arizona Bell's vireos were regularly heard singing and seen foraging in screwbean mesquite and tamarisk. In fact, the Arizona Bell's vireo was the third-most detected species (behind cliff swallow [*Petrochelidon pyrrhonota*] and mourning dove) at the Riverside Subunit, which contains very few native riparian trees, further exhibiting that this species can occupy habitat other than desert riparian habitat.

The Riverside Subunit does not currently contain vegetation that resembles typical southwestern willow flycatcher or yellow-billed cuckoo breeding habitat; the narrowleaf willow along the irrigation ditch is generally not wide enough to provide suitable breeding habitat, and the patches of tamarisk are dry and open and do not have the saturated soils typical of southwestern willow flycatcher breeding habitat. Surface water at the Riverside Subunit is restricted to the active river channel and the irrigation ditch running down the east side of the Subunit. Furthermore, the Riverside Subunit completely lacks the mature vegetation and multistoried canopy that are generally required by yellow-billed cuckoo.

4.4 Mormon Mesa

The Mormon Mesa Subunit is dominated largely by a monotypic stand of tamarisk. However, much of this vegetation is dead or dying as the result of defoliation by the tamarisk leaf beetle (Figure 36), and 1.7 ha (4.3 acres) of dead tamarisk was cleared via mastication by the County in late 2018 (Figure 37 and see Figure 36). This area of masticated tamarisk was subsequently not surveyed for southwestern willow flycatcher or yellow-billed cuckoo in 2020 (see Figure 6).

Figure 36. Dead and dying tamarisk at the Mormon Mesa Subunit.

Figure 37. Masticated tamarisk at the Mormon Mesa Subunit.

An approximately 5-ha (13-acre) patch of screwbean mesquite and arrowweed shrubland is present in the southwestern corner of this Subunit, and some large native Goodding's willow are present in the northwestern corner. Eight restoration plots are also scattered throughout the northwestern corner of the Mormon Mesa Subunit; in 2014, the County cleared non-native tamarisk and planted native vegetation within these plots. Examples of these plots are shown in Figure 38.

Four MSHCP-covered bird species were recorded at the Mormon Mesa Riparian Reserve Unit. Both yellow-billed cuckoo and southwestern willow flycatcher were detected during targeted playback surveys for those species, and a single willow flycatcher was also detected at MM-3 (see Figure 11) during point-count surveys. In addition, biologists recorded seven detections of Arizona Bell's vireo and two detections of crissal thrasher.

Figure 38. Sample habitat within restoration plots at the Mormon Mesa Subunit.

While tamarisk can provide habitat for desert riparian species, the dead or dying tamarisk at the Mormon Mesa Subunit has less benefit to wildlife than does native vegetation. This is corroborated by the fact that Mormon Mesa yielded the lowest species richness of any of the subunits during both the 2017 and 2019 point-count surveys (surveys were not conducted at Mormon Mesa in 2018) and the second lowest species richness in 2020. These dying monotypic tamarisk stands provide less concealment from predators and are relatively hot and dry compared to living vegetation, thereby causing a reduction in canopy cover and decreased thermal protection for eggs and nestlings (McLeod 2019). McLeod and Pellegrini (2013) showed that occupied breeding habitat for southwestern willow flycatcher exhibited > 90% median canopy closure along the Virgin River between 2003 and 2011. However, despite much of the unit appearing to be in poor health, there are still patches of mature native vegetation that should be protected.

This year marked the first year that a pair of southwestern willow flycatchers successfully nested in one of the County's focused restoration plots (see Appendix A; Figure A-2). The habitat in this specific plot is composed largely of 7- to 8-m- (23- to 26-feet-) tall narrowleaf willow (Figure 39), and surface water is regularly observed in this location. This nest contained two nestlings, both of which were color banded and at least one of which successfully fledged. This habitat is ideally suited for southwestern willow flycatcher.

Figure 39. Narrowleaf willow habitat in the occupied restoration plot in Mormon Mesa Parcel 5-A.

4.5 Muddy River

Vegetation at the Muddy River Riparian Reserve Unit is highly diverse. Parcels A–E are dominated by horticultural plantings (e.g., pine [*Pinus* spp.] and California fan palm [*Washingtonia filifera*]) (Figure 40), creosote bush (*Larrea tridentata*) scrubland, or big saltbush (*Atriplex lentiformis*). Parcel F is dominated almost completely by creosote bush scrub, with smaller patches of honey mesquite, particularly in the central and southeast portions of the parcel (Figure 41). Parcels G–I are composed largely of very dense thickets of big saltbush and Mojave seablite (*Suaeda moquinii*), mixed with scattered honey mesquite and tamarisk (Figure 42). While the Muddy River runs near the Muddy

Figure 40. Horticultural trees planted at Muddy River Parcels A–E.

Figure 41. Creosote bush habitat with scattered honey mesquite at Muddy River Parcel F.

Figure 42. Varied scrub habitat at Muddy River Parcels G-I.

River Riparian Reserve Unit, it does not run through any of the southern parcels and only forms the eastern boundary of Parcels A–E. This portion of the Muddy River is also deeply incised, and true desert riparian vegetation, consisting of widely scattered tamarisk and velvet ash (*Fraxinus velutina*), is generally limited to within a couple of meters of the riverbank.

In total, three MSHCP-covered bird species (Arizona Bell's vireo, phainopepla, and yellow-billed cuckoo) and one MSHCP evaluation bird species (crissal thrasher) were recorded on the Muddy River Riparian Reserve Unit. Two detections of yellow-billed cuckoo were recorded at opposite ends of Parcels A–E during the first round of playback surveys. Bell's vireo and crissal thrasher were recorded within the boundaries of the Muddy River Riparian Reserve Unit multiple times and from multiple locations. Arizona Bell's vireo was recorded from three of the seven point-count locations at Muddy River. This species is a desert riparian obligate, but it will also occupy dense mesquite habitat (SWCA 2017b) and is not restricted to nesting in willow, as suggested in the MSHCP (Clark County 2000). Most of the desert riparian obligates (e.g., southwestern willow flycatcher and yellow warbler) were absent from the Muddy River Riparian Reserve Unit in 2020, which is not surprising given the lack of desert riparian habitat at this property. The crissal thrasher was recorded from four of the seven point-count locations at the Muddy River Riparian Reserve Unit. Crissal thrasher, a low priority evaluation species, is found mainly in dense

cover within mesquite and riparian woodlands (Floyd et al. 2007). The phainopepla was recorded from two of the seven Muddy River point-count locations. This species depends heavily on mistletoe (*Phoradendron* spp.) berries that grow on mesquite. More than any other Riparian Reserve Unit, Muddy River has a relatively abundant population of honey mesquite with dense patches of understory vegetation; therefore, it is suspected that both crissal thrasher and phainopepla are breeding in their preferred habitats within the Muddy River Riparian Reserve Unit.

4.6 BCCE

Mojave Desert scrub, which is co-dominated by creosote bush and burrobush (*Ambrosia dumosa*), is the dominant vegetation community across the Mojave Desert, and this community covers over 97% of the BCCE (Clark County 2019). The majority of point-count survey locations are situated within this habitat type (Figure 43). The remainder of the BCCE is composed of salt desert scrub (1.5%), mesquite/acacia habitat (less than 1%), and previously disturbed habitat (Clark County 2019). A few survey points were located to sample areas of dense cholla (*Cylindropuntia* spp.) or desert wash habitat (Figure 44).

Figure 43. Mojave Desert scrub habitat at point-count locations 12 (left) and 17 (right).

Figure 44. Dense cholla at point-count location 33 (left) and desert wash habitat at point-count location 37 (right).

The BCCE Management Plan identified that no MSHCP-covered avian species are known to occur within the BCCE (Clark County 2019). During the 2019 point-count surveys, biologists did not observe any habitat that could be considered suitable breeding habitat for the MSHCP-covered avian species, particularly desert riparian habitat. No MSHCP-covered species were observed within the BCCE in 2020. Two evaluation species, LeConte's thrasher and loggerhead shrike, are known to occur within the BCCE (Clark County 2019) and were recorded multiple times at multiple locations within the BCCE during 2020 point-count surveys (see Table 8).

5.0 CONCLUSION

Six MSHCP-covered and three MSHCP evaluation bird species were recorded at the County's reserve system properties in 2020. Some notable conclusions about MSHCP avian species and their habitats at the County's properties are listed below.

- Yellow-billed cuckoos were detected from three of the five Riparian Reserve Subunits in 2020, but breeding could not be confirmed at any of the County's properties in 2020.
- Surveys for southwestern willow flycatcher yielded four pairs (three of which were confirmed nesting) in Mesquite West Parcel 1-A and two nesting pairs in Mormon Mesa Parcel 5-A over the course of the breeding season.
- Surveyors recorded six nesting attempts by southwestern willow flycatcher in Mesquite West Parcel 1-A, all of which failed, and three nesting attempts in Mormon Mesa Parcel 5-A, one of which was successful.
- Opportunities for brown-headed cowbird control were extremely limited in 2020, consisting of one egg addled in a single nest; this nest still succumbed to brown-headed cowbird nest parasitism. No inferences can be made from this limited attempt to control cowbird parasitism at the County's properties. Conducting additional nest monitoring in future years across multiple sites could allow for a more effective implementation and evaluation of cowbird control actions.
- Arizona Bell's vireos were fairly abundant, particularly at the Riverside Subunit, where it was the third most commonly detected species on point-count surveys. This species is likely breeding throughout the Riparian Reserve Units, particularly anywhere where willows or mesquite are present.
- Mature native desert riparian habitat within the County's Riparian Reserve Units is limited to small patches throughout the parcels and one large patch of narrowleaf willow that constitutes almost all of Mesquite West Parcel 1-A. Due to a number of factors, native riparian habitats have largely died off or been replaced by non-native species such as tamarisk. While tamarisk can provide valuable habitat for some species, such as the southwestern willow flycatcher, habitat quality diminishes after infestation and defoliation by the tamarisk leaf beetle.
- Breeding habitat for the MSHCP-covered bird species is currently limited to non-existent within the BCCE. Habitat for phainopepla could be created or enhanced with the establishment of more mesquite/acacia habitat, as long as that habitat also includes mistletoe, a required food source for phainopepla. Phainopepla was not recorded at the BCCE during the 2020 point-counts.
- Biologists recorded a total of 13 LeConte's thrasher detections at 11 point-count locations within the BCCE in 2020. Although breeding of LeConte's thrasher could not be confirmed within the BCCE during point-count surveys, several active nests were incidentally recorded in 2020; this is the second consecutive year that breeding was confirmed for this evaluation species, and breeding presumably occurs at the BCCE annually.

Aggressive efforts are likely required in order to restore, create, and enhance additional habitat for most of the MSHCP avian species at the County's Riparian Reserve Units. Continued monitoring of avian populations before, during, and after the restoration process is needed to document restoration success within the County's properties. Recommendations to achieve these objectives are detailed in the following section.

6.0 RECOMMENDATIONS

Based on observations from the 2020 avian surveys and factors discussed in this report, there are several recommendations that would support the County's long-term goals for the Riparian Reserve Units and the BCCE in Clark County:

- As directed by the *Clark County Desert Conservation Program Riparian Reserve Units Management Plan* (Clark County 2015), the County should continue to purchase parcels along the Virgin and Muddy Rivers, particularly available parcels adjacent to the existing Riparian Reserve Units (if possible), and attempt to purchase parcels along the Meadow Valley Wash.
- Tamarisk that has been killed or suffered substantial dieback as the result of defoliation by tamarisk leaf beetles provides little benefit to avian species that require at least some degree of canopy closure for nesting. The County should begin or continue the removal of tamarisk from all its Riparian Reserve Units, particularly these dead or dying stands, assuming that any tamarisk removal be immediately followed by planting of native vegetation, such as willow and Fremont cottonwood (*Populus fremontii*).
- The County could plant honey and screwbean mesquite in areas of enhanced runoff that do not have the hydrological potential to support wetland facultative species like willow or cottonwood. Portions of the Riparian Reserve Units are susceptible to scouring floods, as evidenced by conditions recorded in 2019. Any restoration plan should take this into account by limiting plantings in flood-prone areas or taking steps to protect planted areas from floods. The potential to create mature habitats at these sites may be limited by the flood risk.
- Cattle exclusion fencing should be erected in any area where native trees are newly planted. At parcels where fencing already exists, such as portions of Mormon Mesa and Bunkerville Parcel 2-J, the County should remove cattle from within the fenced area and make sure that all fences and gates are in working order. Cattle have been observed at all the Riparian Reserve Subunits, except for Muddy River, and they should be inhibited from foraging on native plantings wherever practicable.
- Areas of native vegetation that currently provide nesting habitat for MSHCP-covered and evaluation bird species should not be disturbed during restoration and should be allowed an appropriate buffer, in particular the existing willow stands in the Mesquite West, Bunkerville, and Mormon Mesa Subunits, and the patches of honey and screwbean mesquite scattered throughout the County's properties.
- Because the Virgin River Riparian Reserve Unit lies within designated critical habitat for the southwestern willow flycatcher, restoration plans should be designed in coordination with the USFWS.
- Avian point-counts and species-specific surveys should be continued for subsequent years to help build on baseline data and to track changes in avian populations throughout the land management, restoration, and post-implementation processes. These surveys should use the protocols established for this project to ensure datasets are standardized and comparable.

7.0 LITERATURE CITED

Cardinal, S.N. 2005. Conservation of Southwestern Willow Flycatchers: Home Range and Habitat Use by an Endangered Passerine. M.S. thesis, Northern Arizona University, Flagstaff.

Clark County. 2000. *Final Clark County Multiple Species Habitat Conservation Plan and Environmental Impact Statement for Issuance of a Permit to Allow Incidental Take of 79 Species in Clark County, Nevada*. Prepared by RECON, San Diego, California. Las Vegas, Nevada: Clark County Department of Comprehensive Planning, and Reno, Nevada: U.S. Fish and Wildlife Service.

———. 2015. *Clark County Desert Conservation Program Riparian Reserve Units Management Plan*. February 2015.

———. 2019. *Clark County Desert Conservation Program Boulder City Conservation Easement Management Plan*. Version 3.4, February 2019. Available at: http://www.clarkcountynv.gov/airquality/dcp/Documents/mitigation/bcce/BCCE%20Management%20Plan%20%20Version%203.4%20Final.pdf. Accessed September 2019.

Ehrlich, P.R., D.S. Dobkin, & D. Wheye. 1988. *The Birder's Handbook*. New York: Simon & Schuster Inc.

Floyd, T., C.S. Elphick, G. Chisholm, K. Mack, R.G. Elston, E.M. Ammon, and J.D. Boone. 2007. *Atlas of the Breeding Birds of Nevada*. Las Vegas: University of Nevada Press.

Great Basin Bird Observatory (GBBO). 2003. *Nevada Bird Count. A Habitat-Based Monitoring Program for the Breeding Birds of Nevada. Instruction Package and Protocol for Point-count Surveys*. April 2003. Available at: https://www.gbbo.org/s/Instructions2003.doc. Accessed September 2019.

———. 2010. *Nevada Comprehensive Bird Conservation Plan*, ver. 1.0. Great Basin Bird Observatory, Reno, NV. Available at: http://www.gbbodata.org/pdf/bcp/NV_Bird_Conservation_Plan_ver1.0_Dec2010.pdf. Accessed September 2019.

Halterman, M.D., M.J. Johnson, J.A. Holmes, and S.A. Laymon. 2015. *A Natural History Summary and Survey Protocol for the Western Distinct Population Segment of the Yellow-billed Cuckoo*. U.S. Fish and Wildlife Techniques and Methods. Available at: https://www.fws.gov/southwest/es/Documents/R2ES/YBCU_SurveyProtocol_FINAL_DRAFT_22Apr2015.pdf. Accessed September 2019.

Hughes, J.M. 2015. Yellow-billed Cuckoo (*Coccyzus americanus*). In *The Birds of North America*, edited by P.G. Rodewald. Ithaca, NY: Cornell Lab of Ornithology.

Kostecke, R.M., S.G. Summers, G.H. Eckrich, and D.A. Cimprich. 2005. Effects of brown-headed cowbird (*Molothrus ater*) removal on black-capped vireo (*Vireo atricapilla*) nest success and population growth at Fort Hood, Texas. *Ornithological Monographs* 57:28–37.

Lynn, J.C., T.J. Koronkiewicz, M.J. Whitfield, and M.K. Sogge. 2003. Willow flycatcher winter habitat in El Salvador, Costa Rica, and Panama: characteristics and threats. In *Ecology and Conservation of the Willow Flycatcher*, edited by M.K. Sogge, B.E. Kus, S.J. Sferra, and M.J. Whitfield, pp. 41–51. Studies in Avian Biology No. 26. Cooper Ornithological Society.

Martin, T.E., C.R. Paine, C.J. Conway, W.M. Hochachka, P. Allen, and W. Jenkins. 1997. *Breeding Biology Research and Monitoring Database (BBIRD) Field Protocol*. Missoula: Montana Cooperative Wildlife Research Unit, University of Montana.

Martin, T.E., and G.R. Geupel. 1993. Nest-monitoring plots: Methods for locating nests and monitoring success. *The Journal of Field Ornithology* 64:507–519.

McLeod, M.A. 2019. Responses of southwestern willow flycatchers to tamarisk defoliation. Paper presented at 15th Biennial Conference of Science and Management on the Colorado Plateau and Southwest Region, Flagstaff, Arizona.

McLeod, M.A., and A.R. Pellegrini. 2013. *Southwestern Willow Flycatcher Surveys, Demography, and Ecology along the Lower Colorado River and Tributaries, 2008–2012*. Submitted to Bureau of Reclamation, Boulder City, Nevada. Flagstaff, Arizona: SWCA Environmental Consultants, Inc.

———. 2014. *Southwestern Willow Flycatcher Surveys, Demography, and Ecology along the Lower Colorado River and Tributaries, 2013*. Submitted to Bureau of Reclamation, Boulder City, Nevada. Flagstaff, Arizona: SWCA Environmental Consultants, Inc.

Paxton, E., S. Langridge, and M.K. Sogge. 1997. Banding and Population Genetics of Southwestern Willow Flycatchers in Arizona – 1997 Summary Report. U.S. Geological Survey Colorado Plateau Research Station Northern Arizona University report. 63 p.

Ralph, C.J., G.R. Geupel, P. Pyle, T.E. Martin, and D.F. DeSante. 1993. *Handbook of Field Methods for Monitoring Landbirds*. Gen Tech. Rep. PSW-GTR-144. Albany, California: U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station.

Ralph, C.J., J.R. Sauer, and S. Droege. 1995. *Monitoring Bird Populations by Point Counts*. General Technical Report PSW-GTR-149. Albany, California: U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station.

Rothstein, S.I., B.E. Kus, M.J. Whitfield, and S.J. Sferra. 2003. Recommendations for cowbird management in recovery efforts for the southwestern willow flycatcher. *Studies in Avian Biology* 26:157–167.

Rourke, J.W., T.D. McCarthey, R.F. Davidson, and A.M. Santaniello. 1999. *Southwestern Willow Flycatcher Nest Monitoring Protocol*. Nongame and Endangered Wildlife Program Technical Report No. 144. Phoenix: Arizona Game and Fish Department.

Sogge, M.K., J.C. Owen, E.H. Paxton, S.M. Langridge, and T.J. Koronkiewicz. 2001. A targeted mist net capture technique for the willow flycatcher. *Western Birds* 32:167–172.

Sogge, M.K., D. Ahlers, and S.J. Sferra. 2010. *A Natural History Summary and Survey Protocol for the Southwestern Willow Flycatcher*. U.S. Geological Survey Techniques and Methods 2A-10. Available at: https://pubs.usgs.gov/tm/tm2a10/pdf/tm2a10.pdf. Accessed September 2019.

SWCA Environmental Consultants (SWCA). 2017a. *Federally Listed Bird Surveys on Three Riparian Reserve Units in Clark County, Nevada – Final Project Report.* September. Prepared for Desert Conservation Program, Clark County Department of Air Quality. Las Vegas, Nevada: SWCA Environmental Consultants, Inc.

———. 2017b. *Point-Count Surveys on Riparian Properties - Final Project Report*. September. Prepared for Desert Conservation Program, Clark County Department of Air Quality. Las Vegas, Nevada: SWCA Environmental Consultants, Inc.

———. 2018a. *Avian Surveys on Riparian Properties - Final Project Report*. September. Prepared for Desert Conservation Program, Clark County Department of Air Quality. Las Vegas, Nevada: SWCA Environmental Consultants, Inc.

———. 2018b. *Desert Upland Baseline Bird Surveys - Final Project Report*. September. Prepared for Desert Conservation Program, Clark County Department of Air Quality. Las Vegas, Nevada: SWCA Environmental Consultants, Inc.

———. 2019a. *Avian Surveys on MSHCP Properties - Final Project Report*. September. Prepared for Desert Conservation Program, Clark County Department of Air Quality. Las Vegas, Nevada: SWCA Environmental Consultants, Inc.

———. 2019b. *Southwestern Willow Flycatcher Surveys and Monitoring in Southern Nevada – 2019*. Prepared for Animal and Plant Health Inspection Service, Riverdale, Maryland. Las Vegas, Nevada: SWCA Environmental Consultants.

Unitt, P. 1987. *Empidonax traillii extimus*: an endangered subspecies. *Western Birds* 18:137–162.

U.S. Bureau of Reclamation. 2004. *Brown-headed Cowbird Management Techniques Manual*. Denver, Colorado: U.S. Department of the Interior Bureau of Reclamation, Technical Service Center, Ecological Planning and Assessment.

U.S. Fish and Wildlife Service (USFWS). 1995. Final rule determining endangered status for the southwestern willow flycatcher. *Federal Register* 60:10694–10715.

———. 2000. *Intra-Service Biological and Conference Opinion on Issuance of an Incidental Take Permit to Clark County, Nevada for a Multiple Species Habitat Conservation Plan*. Available at: http://www.clarkcountynv.gov/airquality/dcp/Documents/Library/Guiding%20Docs/current/MSHCP_BioOpin.pdf. Accessed September 2019.

———. 2001. Clark County Desert Conservation Plan Permit TE-034927-0.

———. 2013a. Designation of critical habitat for southwestern willow flycatcher. *Federal Register* 78:344–534.

———. 2013b. Proposed threatened status for the western distinct population segment of the yellow-billed cuckoo (*Coccyzus americanus*). *Federal Register* 78:61622–61666.

———. 2014a. Determination of threatened status for the western distinct population segment of the yellow-billed cuckoo (*Coccyzus americanus*). *Federal Register* 79:59992–60038.

———. 2014b. Species Fact Sheet. Western Yellow-billed Cuckoo. Available at: https://www.fws.gov/southwest/es/arizona/Documents/SpeciesDocs/YellowBilledCuckoo/WYBC-factsheet-southwestlearning.pdf. Accessed September 2019.

———. 2020. *Endangered and Threatened Wildlife and Plants; Revised designation of critical habitat for the western distinct population segment of the yellow-billed cuckoo; Proposed Rule.* Federal Register 85:11458–11594. Prepared for the Department of the Interior. Sacramento, California: USFWS.

Whitfield, M.J. 1990. Willow flycatcher reproductive response to brown-headed cowbird parasitism. M.S. thesis. California State University, Chico. 25 p.

Whitfield, M.J., K.M. Enos, and S.P. Rowe. 1999. Is brown-headed cowbird trapping effective for managing populations of the endangered southwestern willow flycatcher? *Studies in Avian Biology* 18:260–266.

APPENDIX A – CONFIDENTAL

Federally Listed Bird Location Maps

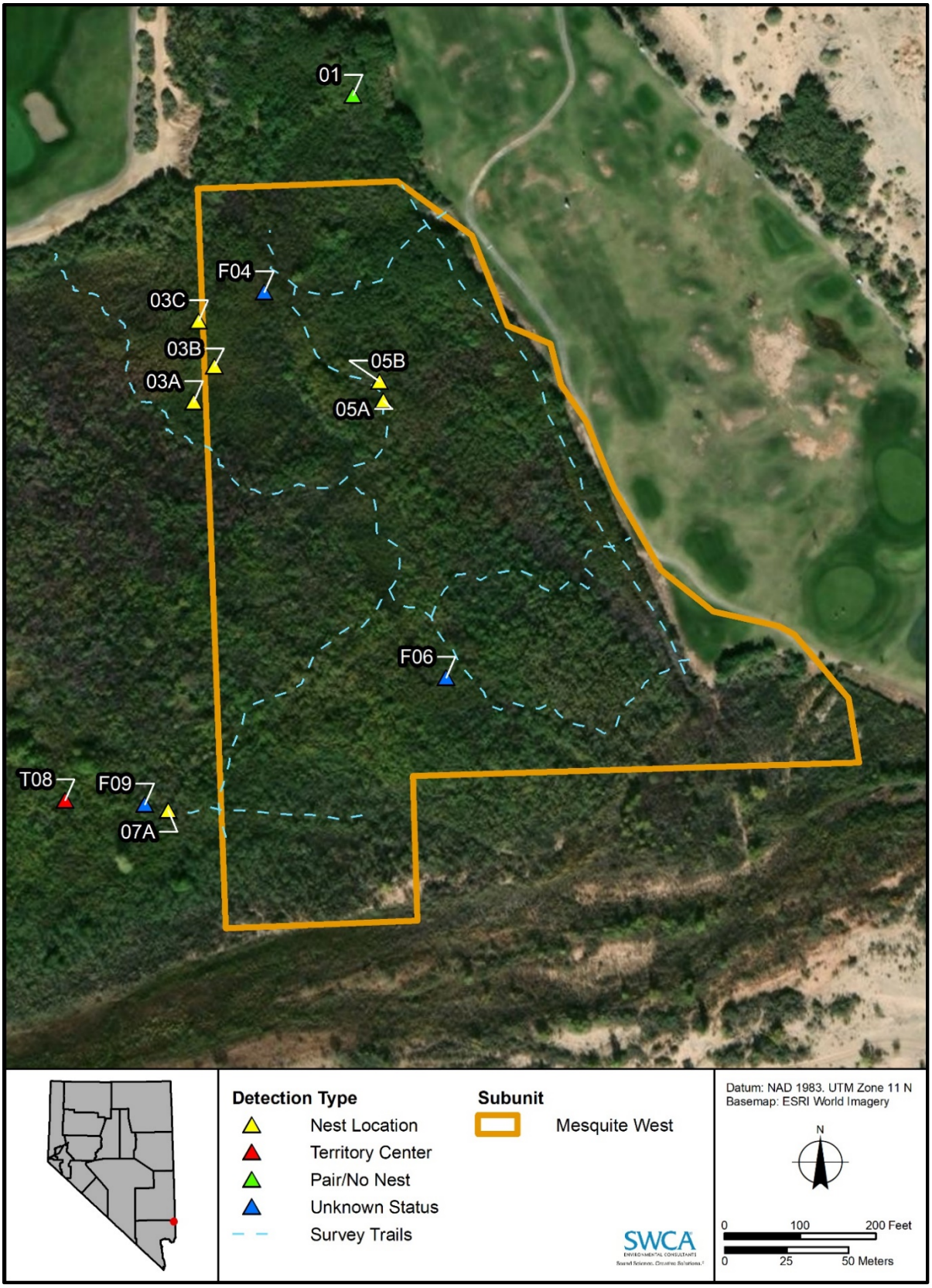

Figure A-1. Territory and nest locations at Mesquite West Parcel 1-A, 2020.

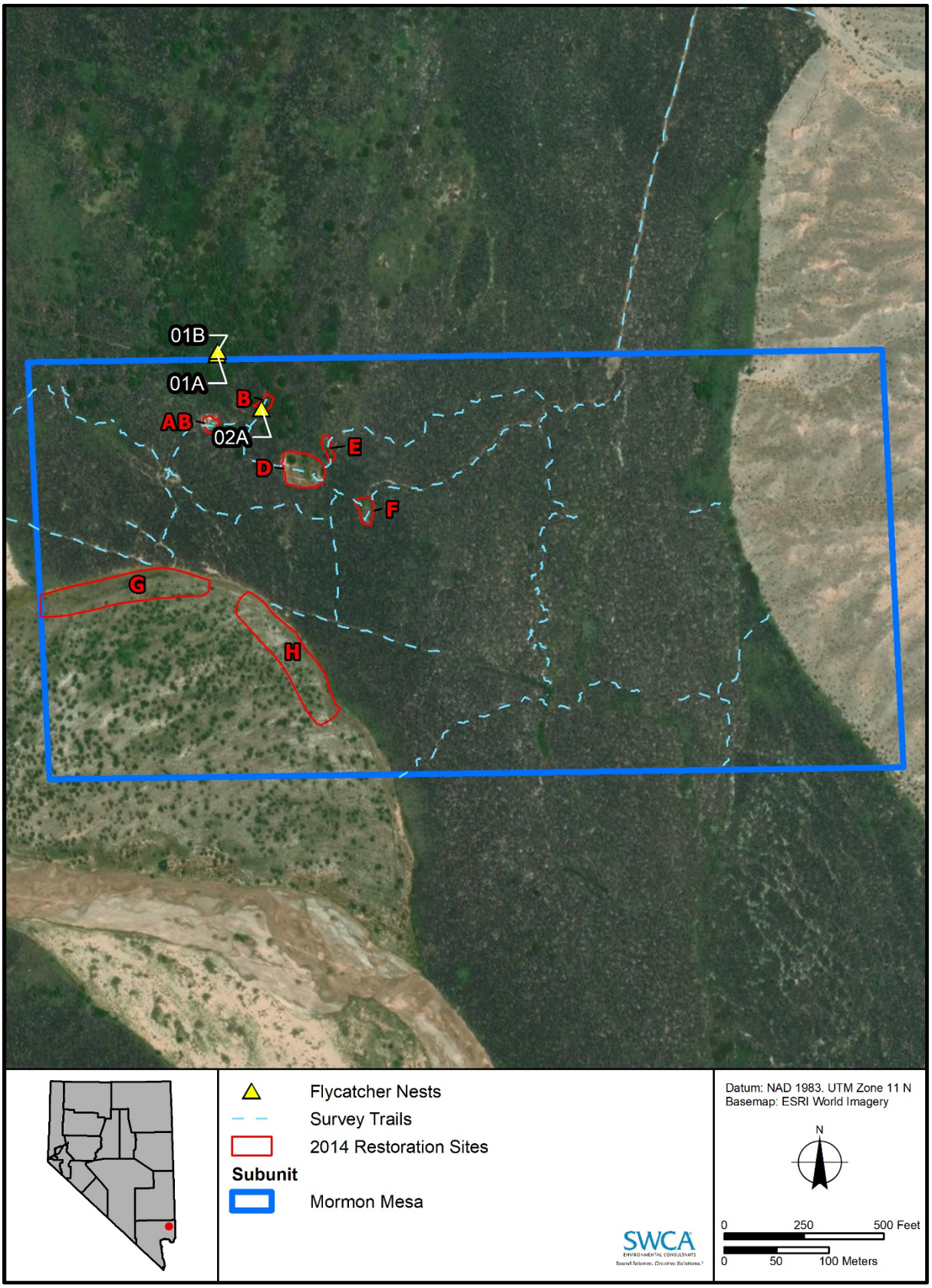

Figure A-2. Territory and nest locations at Mormon Mesa Parcel 5-A, 2020.

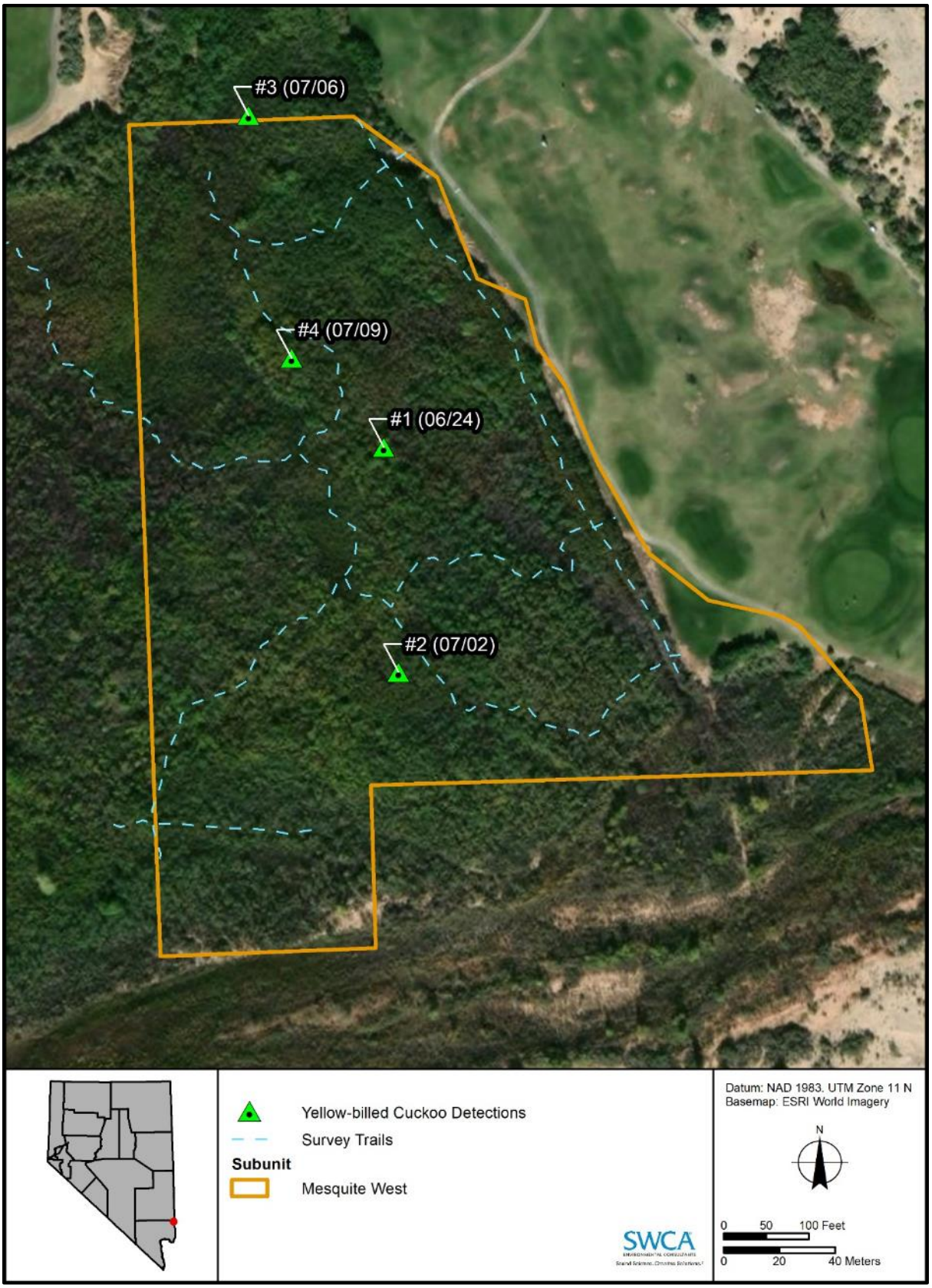

Figure A-3. Yellow-billed cuckoo detections at Mesquite West Parcel 1-A, 2020.

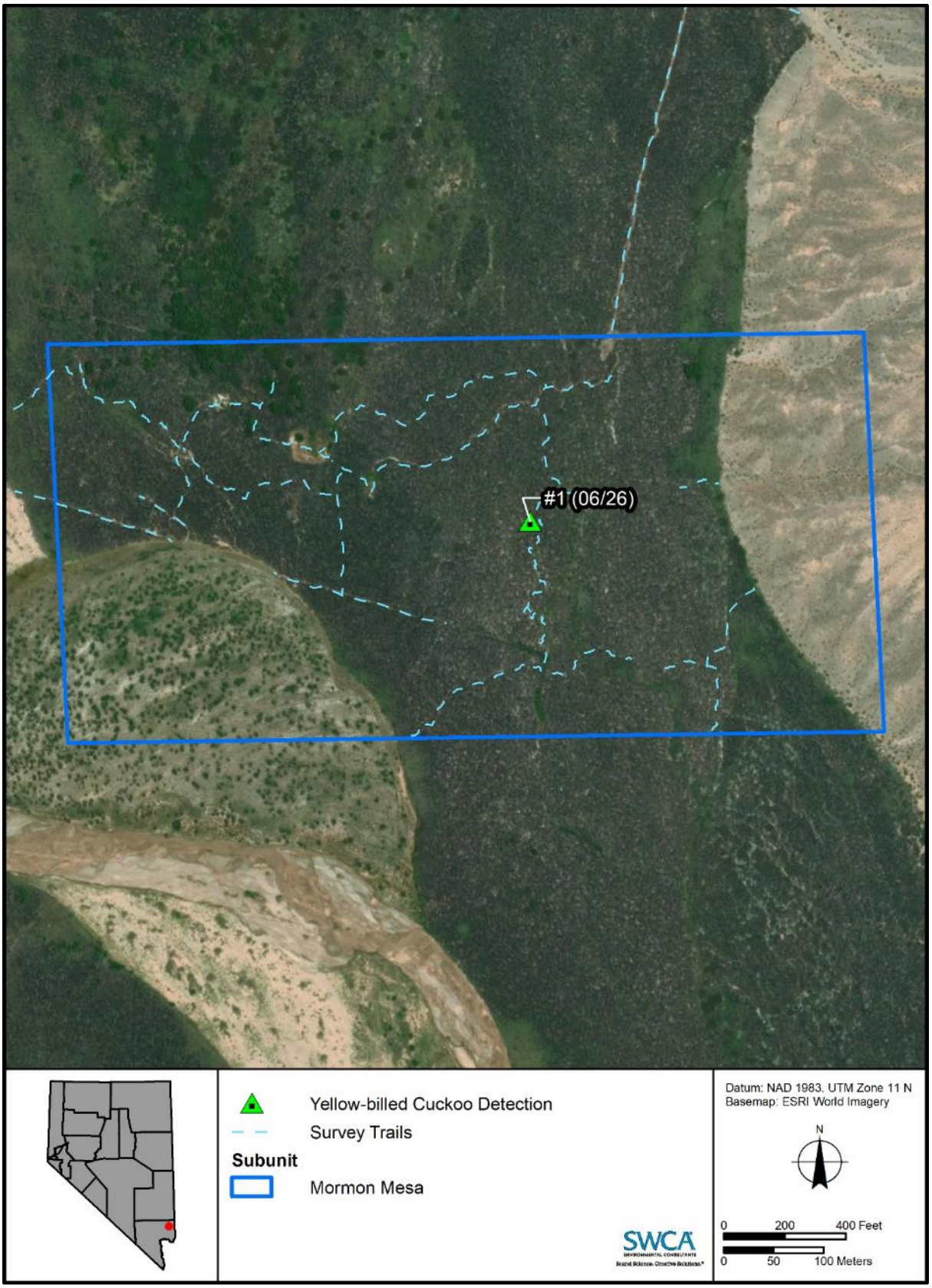

Figure A-4. Yellow-billed cuckoo detections at Mormon Mesa, 2020.

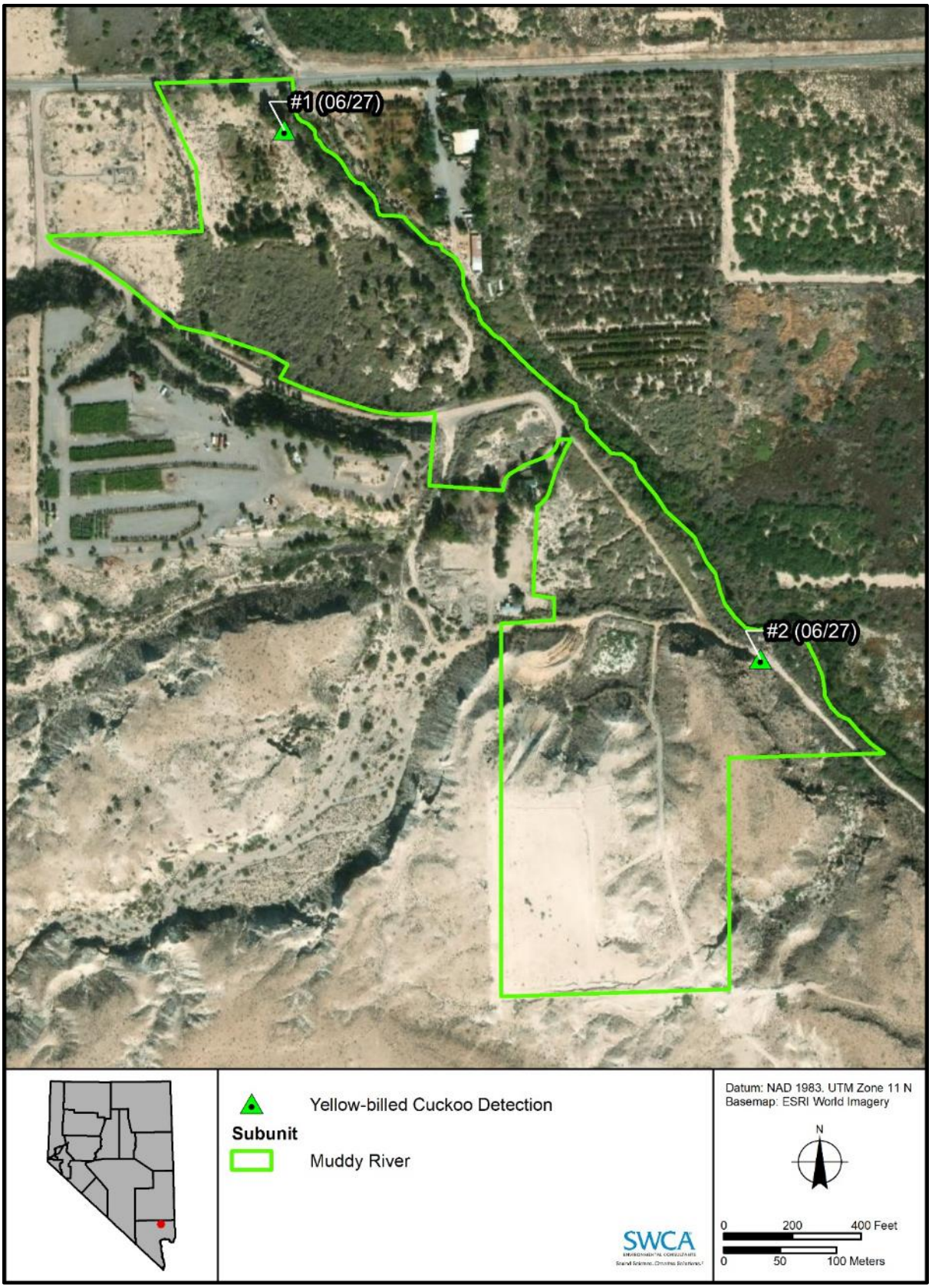

Figure A-5. Yellow-billed cuckoo detections at Muddy River, 2020.