

# **Status and Management of the Least Bell's Vireo and Southwestern Willow Flycatcher in the Santa Ana River Watershed, 2018, and Summary Data by Site and Watershed-wide, 2000-2018**

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## ABSTRACT

The Santa Ana Watershed is the largest coastal river system in southern California. The Santa Ana Watershed Association (SAWA) is committed to the protection and improvement of natural areas within the watershed with major focus on the removal of invasive species, native habitat enhancement and the protection of endangered, threatened and other sensitive species. Since 2000, populations of endangered Least Bell's Vireo (*Vireo bellii pusillus*) and Southwestern Willow Flycatchers (*Empidonax traillii extimus*) have been studied and managed during the breeding season. Data were collected on status, distribution, breeding chronology, reproductive success, and nest site characteristics. Additionally, Brown-headed Cowbird (*Molothrus ater*) trapping in or near riparian habitat was conducted concurrently as well as during the winter at several dairies in the watershed. SAWA biologists documented 1,347 Least Bell's Vireo territories in the Santa Ana Watershed (excluding Prado Basin) in 2018, of which 646 were known to be paired. This represents a 12% increase in territories from 2017, and the highest number documented to date. Seven hundred twenty-eight fledglings were also documented. Prado Basin reported another 665 vireo in 2018, a 21% increase from the 549 documented in 2017. Nesting success was 52% overall and 148 well-monitored pairs had a 2.5 reproductive success rate. Sixty-eight percent of 333 vireo nests were placed in four species of willows (*Salix* spp.) and mulefat (*Baccharis salicifolia*).

In 2018, the watershed-wide cowbird parasitism rate of vireo nests was 3%, down from 5% in 2017. San Jacinto, SAR – Upstream (Riverside Ave. to Van Buren Blvd.) and Chino Hills were sites in which parasitism was documented in 2018. During the nesting season, 3,039 cowbirds were removed from 39 traps in the watershed. Additionally, 3,893 cowbirds were removed from the watershed during the fall and winter of 2017-2018. Over 117,000 cowbirds have been removed from the watershed by SAWA since cowbird management began.

Southwestern Willow Flycatchers were not detected by SAWA biologists in 2018; however, 18 migrant Willow Flycatchers were documented within the watershed. All wildlife species detected (164 avian, 19 mammalian, 19 herpetofauna and five fish) were incidentally reported by site.

## INTRODUCTION

As the largest coastal river system in southern California, the Santa Ana River Watershed is home to more than 6 million people and includes portions of San Bernardino, Riverside, Orange, and Los Angeles Counties. The Santa Ana Watershed Association (SAWA) is committed to the protection and enhancement of natural habitat within the Santa Ana River Watershed. Major focuses of SAWA are the removal of invasive species, native habitat enhancement and protection of endangered, threatened and other sensitive species. A large threat in the Santa Ana River Watershed is the extremely prolific invasive weed, *Arundo donax* (hereafter “arundo”). Arundo chokes riverine systems while out-competing native vegetation, resulting in a loss of habitat for native species and hampering flood control efforts. Due to its flammable nature, arundo increases the risk of fire, while also consuming twice the amount of water than native plants, thereby stressing a region that already has little available water. SAWA is dedicated to the restoration of the Santa Ana River Watershed to encourage natural riverine functions and enhance riparian habitat in an effort to aid the recovery of the endangered Least Bell’s Vireo (*Vireo bellii pusillus*) and Southwestern Willow Flycatcher (*Empidonax traillii extimus*).

The Least Bell’s Vireo (hereafter “vireo”) is a small, insectivorous bird that occupies riparian habitat in southern California and northern Baja Mexico. This sub-species is listed as endangered by both the State of California and the federal government due to the destruction of riparian habitat and brood parasitism by the Brown-headed Cowbird (*Molothrus ater*; hereafter “cowbird”). Vireo monitoring and cowbird control began in 1986 with only 19 known vireo pairs in the Prado Basin (Pike et al. 2005). The Prado Basin population has since increased to a high of 665 territorial males in 2018 (Bonnie Johnson, personal communication). The watershed-wide population (including Prado Basin and those reported by other agencies) totaled over 2,100 territorial males in 2018. The Southwestern Willow Flycatcher (hereafter “willow flycatcher”) occupies riparian habitat throughout the southwest. It too is listed as endangered by state and federal governments due to habitat loss and cowbird parasitism. Unfortunately, this species has not shown a similar recovery rate and is still in severe decline. These two endangered species and several other sensitive species have been monitored and managed in the Prado Basin annually since 1986 and throughout the rest of the watershed since 2000.

The work reported herein is an expansion upon the Prado Basin efforts into other portions of the watershed through the implementation of the Santa Ana Watershed Program by SAWA and the Orange County Water District (OCWD) in 2018 and prior years back to 2000, when expanded monitoring began. Data collected in Prado Basin are reported separately by OCWD. Monitoring was conducted during the avian nesting season to determine the number of vireo and willow flycatchers present, their breeding status, and nesting outcomes. Cowbird trapping in

or near riparian habitat is conducted concurrently as well as during the fall and winter at several dairies in the watershed. Past efforts have included nest monitoring in the major riparian corridors of the watershed. In 2018, nest monitoring occurred at several locations discussed here as monitored sites: San Jacinto, San Timoteo Canyon, Santa Ana River (SAR – Upstream) from Riverside Ave. downstream to I-15, Norco Bluffs, and the Santa Ana Canyon (SAC) below Prado Dam. Abundance and distribution data were documented at Temescal Canyon, Mockingbird Canyon and Chino Hills. Thirty-three additional peripheral drainages within the watershed were sampled ( $\geq 3$  visits) and incidental sightings were documented at eight sites visited on 1-2 occasions.

## METHODS

### *Study Location*

The Santa Ana Watershed is located in southern California and includes parts of San Bernardino, Riverside, Orange, and Los Angeles Counties and covers nearly 3,000 square miles (Figure 1). The watershed includes a diversity of terrain including mountains, foothills, valleys, and the coastal plain. The main river is the Santa Ana River (SAR), which contains more than 50 tributaries.

Study sites contained typical southern Californian riparian vegetation including tall canopies of Fremont cottonwood (*Populus fremontii*) and Goodding's black willow (*Salix gooddingii*), sub-stories of arroyo and red willow (*Salix lasiolepis* and *Salix laevigata*, respectively), and mulefat (*Baccharis salicifolia*). Vegetation classifications follow nomenclatures listed in A Manual of California Vegetation (Sawyer et al. 2009). Lush riparian habitat is abundant throughout the study sites; however, dispersed stands of invasive arundo are still abundant in many locations of the middle watershed. Other non-native plants found dispersed among the sites include perennial pepperweed (*Lepidium latifolium*), castor bean (*Ricinus communis*), poison hemlock (*Conium maculatum*), and tamarisk (*Tamarix ramosissima*). Other than natural storm flow, the river's water comes from discharged treated water, urban runoff, very limited natural springs, upwelling in the Prado Basin, and releases from the Seven Oaks and Prado Dams. The river is subjected to heavy human impacts from horseback riding, unauthorized trails, swimming, fishing, paintball gaming, homeless encampments, off-highway vehicle (OHV) use, trash dumping, and a variety of other illegal activities.

### *Monitored Sites*

Monitored sites, for the purposes of this study, are those sites where territories were well-monitored ( $> 8$  visits) and regular nest monitoring occurred. Vireo were monitored in the

Santa Ana River from Riverside Avenue in the city of Riverside downstream through the Santa Ana Canyon to Weir Canyon Road, excluding Prado Basin. These sites included Santa Ana River - Upstream (Riverside Ave. to Van Buren Blvd., Hidden Valley - north and south sides of the river, Goose Creek, Norco to I-15, Norco Bluffs (I-15 to River Rd.) and the Santa Ana Canyon (Upper Canyon, Green River Golf Course, and Featherly Regional Park). San Timoteo Canyon, a tributary of the Santa Ana River, as well as portions of the San Jacinto River and San Jacinto Wildlife Area were also monitored (Figure 2).

### ***San Jacinto***

San Jacinto includes three monitored sections: the San Jacinto River from Lake Park Drive to State Street, the San Jacinto River from the Golden Era Productions to Bridge Street including Potrero Creek to Massacre Canyon, and the San Jacinto Wildlife Area. These sites are located within the San Jacinto Valley in Riverside County. The San Jacinto Wildlife Area is managed by the California Department of Fish and Wildlife (CDFW) while the San Jacinto River is managed under multiple authorities. The San Jacinto River contains a number of invasive plant species, with the dominant invasive being tamarisk. To date, SAWA's non-native management efforts have been limited to the removal of tamarisk from Mystic Lake. The lands surrounding these sites include upland coastal sage scrub, agricultural land, golf courses, and residential development.

The riparian zone in the San Jacinto River can be classified as a *Populus fremontii* Forest Alliance, with narrowleaf willow (*Salix exigua*) and mulefat as co-dominants (Sawyer et al. 2009). This habitat is also interspersed with scattered Goodding's black willow. The dominant invasive plant in the riparian zone is tamarisk. The riparian zone in the San Jacinto Wildlife Area can be classified as a *Salix gooddingii* Woodland Alliance with Fremont cottonwood as a co-dominant (Sawyer et al. 2009). The area is also interspersed with red willow (*Salix laevigata*) and mulefat. There are few invasive plants in the riparian areas, but perennial pepperweed and Russian thistle (*Salsola tragus*) can be found on adjacent land.

### ***San Timoteo Canyon***

San Timoteo Canyon is located near the city of Redlands within the counties of San Bernardino and Riverside. San Timoteo Creek originally contained many invasive plant species, most notably arundo and tamarisk. A program initiated by SAWA removed 239 acres of invasive plants from 1997 to 2001, and continues a maintenance program to control regrowth. Restoration of the native plant community through natural recruitment has taken place throughout the canyon resulting in a healthy riparian understory, the effects of natural storm cycles notwithstanding. The canyon's immediate uplands contain citrus groves and remnants of over-grazed coastal sage scrub and chaparral. A railroad and a two-lane road border the canyon.



Development of portions of the uplands continues to occur. San Timoteo Creek was surveyed from Cooper's Creek to approximately 15 miles (24 km) downstream at the point the creek becomes channelized. In September 2017, the Palmer fire destroyed dozens of acres of riparian habitat in San Timoteo Creek and a number of vireo did not return in 2018 to the historical territories that were burned in the fire.

The riparian zone can be classified as a *Salix laevigata* Woodland Alliance (Sawyer et al. 2009), with arroyo willow as a co-dominant. However, the creek is also interspersed with Fremont cottonwood, Goodding's black willow, and mulefat. The dominant invasive plant in the riparian zone is tamarisk. Dominant invasives in the adjacent upland zone are Russian thistle, mustard (*Brassica* sp.) and perennial pepperweed.

### ***Santa Ana River (SAR) - Upstream***

The SAR - Upstream section extends along the Santa Ana River mainstem from Riverside Ave. in the City of Riverside downstream to Interstate 15 in Norco. The site is divided into four different sections to maintain the historic presentation of SAWA abundance and distribution data. These sections are: Riverside Ave. to Van Buren Blvd., Hidden Valley - North side of river, Hidden Valley - South side of river, and Goose Creek, Norco to I-15. A small portion of the Goose Creek section includes a mitigation area managed by the Inland Empire Resource Conservation District (IERCD). Prior to 2015, these sections of the river were not grouped together as "upstream"; all sites were reported separately. In 2015, the upstream section did not include Goose Creek, Norco to I-15; however, in 2016, a change in funding source now incorporates this area as part of SAR - Upstream.

There are a variety of habitat types throughout this section of the Santa Ana River. The riparian zone can be classified as a *Salix gooddingii* Woodland Alliance with Fremont cottonwood as a co-dominant (Sawyer et al. 2009). The dominant invasive plant in the riparian zone of SAR - Upstream is arundo. Other invasive plant species include tamarisk, castor bean, perennial pepperweed, tree of heaven (*Ailanthus altissima*), golden crownbeard (*Verbesina encelioides*), poison hemlock, white sweetclover (*Melilotus albus*), and various palm species.

Several land managers are engaged in different stages of restoration or mitigation along this portion of the river. The surrounding land use includes commercial and residential properties, recreational trails, parks and golf courses. Within the riparian habitat many large homeless encampments occur, which has caused damage (e.g. vegetation clearing, trash dumping) to portions of the native habitat. SAR – Upstream has seen an influx of many new large homeless encampments in the 2018 season.

### ***Norco Bluffs, I-15 to River Rd.***

The area referred to as “Norco Bluffs” is comprised of the 3-mile long riparian zone located along the river between Interstate 15 and River Road. The U.S Army Corps of Engineers (USACE) considers most of this area to be within the Prado Basin (566-foot elevation and below). In 2018, vireo were monitored in select areas within Norco Bluffs and excluded a 250-acre parcel monitored the previous two seasons; vireo within the parcel were surveyed by a USACE consultant as part of a 1-year maintenance contract. The on-going changes in the survey area preclude the possibility of comparing all data across all years; comparable population level data are as follows: 2015 and 2018, 2016 and 2017. Remaining USACE mitigation areas were not in SAWA’s scope of work for the 2018 breeding season and therefore not surveyed (Figure 4).

SAWA removed arundo in the winter of 2006 and 2007 from a 15-acre area located immediately south of Eastvale Community Park. After reviewing the mitigation files in 2017, it was determined only 4.6 acres of habitat needed to be mitigated. Small patches of re-established arundo were removed then treated with herbicide before nesting season. Additional monthly follow-up treatments were conducted during nesting season with the presence of a vireo biologist. Past construction activities were conducted on the north side of the river by the City of Norco (hereafter “the City”) on the east and west sides of Hamner Ave. In the spring of 2011, the City constructed a large, protective stone levee east of Hamner Ave. because of damaging floods during the previous winter. Construction of the levee resulted in the removal of riparian habitat and noise disturbance to vireo territories nearby. Additional habitat was removed by the City in the spring of 2012 to allow for the widening of Hamner Ave. In the spring of 2015, the City conducted construction activities at a site located in the riparian area approximately 50 yards beyond the end of Old Hamner Rd; no existing riparian vegetation was removed. Prior to the 2018 nesting season, riparian vegetation growing beneath and alongside Interstate 15 was removed in preparation for the 15 Express Lanes Project. No construction activities occurred during the 2016, 2017, or 2018 nesting season.

Norco Bluffs is almost exclusively comprised of riparian plant species without adjacent upland. Native species of willow, predominantly Goodding’s black willow, dominate much of the landscape, but large swaths are still heavily dominated by invasive arundo. The riparian habitat within the Norco Bluffs survey area can be classified as a *Salix gooddingii* Woodland Alliance with arundo as a co-dominant (Sawyer et al. 2009). Areas not dominated by mature Goodding’s black willow or arundo consist of early successional riparian woodland. These areas are where the river previously changed course and destroyed habitat, which has since regrown. Species in the more recently disturbed areas are composed of Goodding’s black willow, arroyo willow, Pacific willow (*Salix lasiandra*), and narrowleaf willow.

### ***Santa Ana Canyon (SAC)***

The Santa Ana Canyon (SAC) is located downstream of the Prado Dam to Weir Canyon Road, a distance of approximately nine miles (14 km). Due to the differences in the habitat throughout the canyon, it was divided into three sites: Upper Canyon, Green River Golf Club, and Featherly Regional Park. The Upper Canyon is located from Prado Dam downstream to the beginning of the Green River Golf Club. The Green River Golf Club covers approximately two miles (3.5 km) of the habitat, and the remaining 4.4 miles (7 km) is in the County of Orange's Featherly Regional Park. This location description and site history discuss the entire SAC.

This site has undergone a variety of impacts in the past decade. The USACE Reach 9 bank stabilization project began below Prado Dam in 2005, impacting habitat for multiple vireo territories to date. The Freeway Complex Fire of November 2008 destroyed habitat for an estimated 43 territories in SAC. However, this did not deter the vireo returning the following spring, with only moderate decreases in 2009 at Upper Canyon and Featherly Regional Park. Phase 2 of the USACE riverbank stabilization project (Reach 9) started in the winter of 2009 and 2010 near the western half of Green River Golf Club, removing over 16 acres of mature riparian habitat that survived the fire. This project phase directly affected six territories due to excavations that were needed to reconstruct the riverbed and banks in order to protect Highway 91 and adjacent homes. There were additional riparian impacts in the fall/winter of 2011 as the next phase of the riverbank stabilization project got underway further upstream, removing several more acres of mature riparian habitat. In 2014, Phase 3 of the stabilization project began and subsequently impacted the habitat of ten more vireo territories. In 2015, no USACE project work occurred during the nesting season in SAC. In 2016, Phase 5a of the USACE project began adjacent to La Palma Avenue in Yorba Linda, impacting nine vireo territories, though habitat was only partially removed from two territories. Additional disturbances in SAC in 2016 included repeated vegetation removal and grove expansion by the orange grove lessee in Featherly Park and the on-going brine-line project activities in the Upper Canyon and adjacent to the Green River Golf Club. In 2017, activities in Phase 5a continued and Phase 5b began upstream, removing habitat from an additional ten vireo territories. Phase 4 began on the south side of the river upstream from Canyon RV Park, completely removing habitat from one vireo territory and partially impacting other territories. In 2018, activities from Phases 5a, 5b, and 4 ran concurrently throughout the nesting season. The footprint of Phase 5b was expanded downstream to Brush Canyon, removing vegetation from another three and a half territories. In addition, the Burlington Northern Santa Fe (BNSF) railroad bridge construction project commenced this year in Green River Golf Course and removed vegetation from two territories and partially impacted

two additional territories. These impacts are offset by habitat restoration, which began as each phase was completed.

There is a variety of habitat types throughout SAC. Vireo typically inhabit the riparian zone along the river, but also use the adjacent upland habitats for nesting and foraging. The riparian zone is classified as a *Salix gooddingii* Woodland Alliance, with Fremont cottonwood as a co-dominant. The least disturbed adjacent upland is classified as a *Sambucus nigra* Shrubland Alliance (Sawyer et al. 2009). There are several areas adjacent to the riparian habitat that are in various stages of restoration and cannot be classified at this time. Additionally, there are some adjacent areas that are non-native dominant, such as the Green River Golf Club and Chino Hills State Park areas. The dominant invasive plant in the riparian zone is arundo. The dominant invasives in the adjacent upland zone are Russian thistle, mustard, and tocalote (*Centaurea melitensis*). Other invasive plant species in SAC include tamarisk, tree of heaven, castor bean, perennial pepperweed, gum tree (*Eucalyptus* sp.) and Peruvian pepper tree (*Schinus molle*).

### *Upper Canyon*

The Upper Canyon is located adjacent to Highway 91 within the County of Riverside, from downstream of Prado Dam to the northeast edge of Green River Golf Club. This site is the upstream portion of what is considered the Santa Ana Canyon. The Upper Canyon has undergone a barrage of habitat disturbances from native vegetation removal, subsequent restoration, additional vegetation removal and a devastating fire in the last decade. Heavy construction around and just below Prado Dam occurred from 2005 to 2008 and removed habitat for ten territories in 2005. Some of the habitat that was restored after construction is now upland habitat; however, other restored riparian habitat is maturing and being used by the vireo. In November 2008, the Freeway Complex Fire destroyed a wide swath of habitat that had held six territories that were not detected in 2009 or 2010. These areas were part of Phase 2A of the USACE riverbank stabilization project which is now complete in the Upper Canyon and restoration activities are ongoing.

### *Green River Golf Club*

The Green River Golf Club is located along the Santa Ana River in San Bernardino, Riverside, and Orange Counties, between the Upper Canyon site and Featherly Regional Park. This site is the middle portion of what is considered the Santa Ana Canyon.

Habitat at the Green River Golf Club has recovered well since the devastating Freeway Complex Fire that swept through SAC in November 2008. The USACE Reach 9 bank stabilization project removed almost 16 acres of habitat that was unburned and was occupied by six vireo.

The next phase of the project started during the fall/winter of 2011 with several more acres of riparian habitat removed that included mature willow and cottonwood trees that had been spared by the 2008 wildfire. This area supported an additional 13 vireo territories in 2011. The 2010 project phase was roughly 75% complete at the end of the 2012 season with some replanting underway, but the net result for the 2012 season was still a large loss of habitat and construction activities, which likely contributed to the decline in vireo activity that season. In 2014, no additional habitat was removed; however, construction continued adjacent to occupied habitat upstream of the railroad bridge in the beginning of the nesting season. On May 1 of that season, a vireo nest was found within 100 feet of construction activities that were moving toward the nest. The USACE and the U.S. Fish and Wildlife Service (USFWS) were both notified immediately, but work continued toward the nest. By the next week the nest had been abandoned with two eggs. Subsequently, other vireo nests were found near construction activities and work eventually stopped in this area for the rest of the 2014 season. No USACE related construction activities occurred at this site during the 2015 - 2017 nesting seasons. The Riverside County Santa Ana River Interceptor (SARI) Line project on the west side of the golf course impacted a small area in Lower Aliso Canyon in 2016. Although there was one vireo territory at this location in past years, none were documented in 2016 or 2017. In 2018, the new BNSF rail bridge construction project impacted four vireo territories. Riparian habitat for two territories was completely removed and habitat for two other territories was partially removed.

### *Featherly Regional Park*

Featherly Regional Park is located along the Santa Ana River, between the west end of the Green River Golf Club and the Yorba Linda Blvd./Weir Canyon Rd. bridge in the County of Orange. This site is the downstream portion of what is considered the Santa Ana Canyon.

The Santa Ana River Trail and Parkway runs adjacent to the park. Public access is restricted; however, there is no fencing to deter entry into the riparian habitat. Phase 3 of the USACE Santa Ana River Mainstem (SARM) Reach 9 reinforcement project began in 2014. Riparian habitat containing three vireo territories was removed on both sides of the river, upstream from the Canyon RV Park. This phase has since been completed and the habitat is being restored. In 2016, Phase 5a began on the north side of the river along La Palma Road, downstream of the Riverbend Car Wash. Vegetation removal partially impacted five vireo territories. In 2017, activities in Phase 5a continued and Phase 5b began upstream, removing habitat from an additional 10 vireo territories. Concurrently, Phase 4 began on the south side of the river upstream of Canyon RV Park and completed Phase 3, completely removing habitat from one vireo territory and partially impacting other vireo territories. In 2018, activities from Phases 5a, 5b, and

4 ran concurrently throughout the nesting season. The footprint of Phase 5b was expanded downstream to Brush Canyon, removing vegetation from another three and a half territories.

### ***Sampled Sites***

Sampled sites, for the purposes of this study, are those in which either assessment surveys were conducted (three surveys), or a site that was surveyed more than three times irregularly across the breeding season. The objectives were to document vireo occupancy, quantify a minimum number of territories, and to identify areas in need of restoration. For all surveys, a qualified biologist searched for territorial males, documenting each and incidentally recorded observations of females and fledglings. In 2018, the first assessment surveys were conducted between 4/20-4/27, the second surveys between 5/17-5/25, and the third between 6/21-7/5.

### ***Mockingbird Canyon***

Mockingbird Canyon is located in the city of Riverside in Riverside County, and its arroyo serves as a drainage tributary to the Santa Ana River. The riparian zone can be classified as a *Salix gooddingii* Woodland Alliance, with Fremont cottonwood as a co-dominant (Sawyer et al. 2009). However, the arroyo is also interspersed with red willow and arroyo willow. The dominant invasive plant in the riparian zone is perennial pepperweed with mustard being the dominant invasive in the adjacent upland zone.

Although the reservoir and basin are protected from development at this time, residential development continues throughout Mockingbird Canyon. Damage to the habitat and potential harm to nesting vireo occurs from residents extending their property into the arroyo. Most of the adjacent upland habitat will soon be lost and the arroyo is becoming more fragmented by culverts and bridges. The riparian habitat throughout the entire site is continually threatened by OHV's, paintball activity, trash dumping, and other illegal activities. SAWA manages an 11-acre easement in Mockingbird Canyon at Roosevelt St. and Markham St. and will continue to work with local stakeholders to enhance the canyon's natural resources.

### ***Temescal Canyon***

Temescal Canyon is approximately 26 miles (42 km) long and located along Interstate 15 between Lake Elsinore and Highway 91, where it crosses into Prado Basin. Survey areas include Railroad Canyon, Lake Elsinore, and most of Temescal Wash. The wash extends from Lake Elsinore downstream to two miles upstream of the intersection of Magnolia Avenue where it becomes channelized and flows into Prado Basin.

SAWA has monitored vireo in Temescal Canyon since 2001 when it began its arundo removal program. Temescal Wash is currently being managed for arundo regrowth and native vegetation has begun to reestablish. Five biologists covered the canyon over three visits in 2014, 2015, and 2016 with the goal of documenting an accurate territory count and as much data on reproductive status as time allowed. A seasonal contract biologist was hired to cover the entirety of the canyon and collect the same data in 2017 and 2018, albeit over several more visits. The additional visits resulted in a more complete dataset than was possible in prior years. However, as in 2017, SAWA was again unable to collect a complete dataset from the riparian habitat within the Dos Lagos golf course due to denial of access to the area. This area has contained approximately 15% of vireo territories in Temescal in previous years.

The habitat within Temescal Canyon is characterized by patchy, but dense riparian vegetation. Privately owned sand and gravel mines operate downstream adjacent to the creek. A commercial fishing lake is located near the middle section of the wash. Areas of complete channelization without riparian habitat occur downstream of Lake Elsinore and the most downstream section of the wash. Many sections of the wash are channelized by riprap and berms, but still allow some meandering for quality riparian habitat. The riparian zone in Railroad Canyon and the wash downstream of Lake Elsinore is classified as a *Salix gooddingii* Woodland Alliance (Sawyer et al. 2009). The riparian habitat surrounding Lake Elsinore is dominated by tamarisk. Semi-natural shrubland stands also occur with patches of sparse Goodding's black willow. Although SAWA has been effectively treating arundo since 2000, tamarisk has now become a dominant exotic throughout the wash, especially in areas surrounding Lake Elsinore.

### ***Chino Hills***

The fragments of riparian habitat in Chino Hills along Highway 71 have been surveyed annually since 2003. A total of nine riparian habitat patches were monitored in Chino Hills, including Slaughter Canyon Creek at Butterfield Park, a flood basin at Brookwood Lane, and a patch of habitat at Slate Drive. Formerly considered assessment sites, habitat at Soquel Canyon and the Community Park at English Channel were also monitored in 2018. One section adjacent to Butterfield Ranch Road that historically held three territories was lost to development. Most of these locations occur on private property for which access is restricted. The riparian patches in Chino Hills are classified as a *Salix gooddingii* Woodland Alliance (Sawyer et al. 2009).

### ***Incidental Sites***

Incidental sites, for the purposes of this study, are those sites that were visited on one or two occasions and no nest monitoring occurred. Sites were visited in an attempt to obtain



number of territories, pairs, and fledglings. See Appendix A for a complete listing of names and Global Positioning System (GPS) coordinates for all sites.

### ***Vireo Monitoring***

SAWA's vireo management includes habitat restoration, protection and cowbird control. The primary purpose of surveys at monitored sites was to locate all vireo and willow flycatchers to determine accurate territory numbers, breeding status and to enhance breeding output through management. Not all territories were monitored sufficiently to determine pairing success. Potential habitats were carefully traversed along the edges and open trails. The vegetation communities in areas of detection, including dominant native and exotic vegetation species, were documented. All vireo encountered were noted as to location, behavior, and reproductive status on each visit or survey. GPS coordinates were taken in the approximate center of the territory, if known. Each point denotes a territory, not just a sighting. Nest locations were not marked. Territory size range was estimated for monitored sites by drawing polygons around well-monitored territories using Google Earth. Attributes were associated with each vireo territory location and are as follows: unique ID, notes, survey location, surveyor name, agency, category (monitored/sampled/incidental), breeding status, GPS location, fledged (yes/no/unknown), number fledged, and parasitism (yes/no/unknown). A complete attribute table with detailed metadata was included in the shapefiles submitted to the USACE, CDFW and USFWS. Banded vireo are reported annually to the original bander, Barbara Kus of the U. S. Geological Survey (USGS) and the appropriate agencies. No playbacks of vireo vocalizations were used during surveys. Field biologists worked under the direction of the Principal Field Investigator and all surveys and nest visitations were performed under, and in compliance with, all terms and conditions of Federal Endangered Species Permit #TE-839480-5.2 and a Memorandum of Understanding with the CDFW.

Surveys were conducted five days per week throughout the nesting season (March through July). Occasional visits to determine continued vireo presence occurred through August. Biologists watch for nesting behavior from a distance and do not approach nests during the nest-building stage. Subsequent nest visits were conducted from a greater distance with binoculars if possible. Otherwise, a telescopic mirror was used to observe nest contents. Extreme care was used to avoid leaving a trail to or scent near the nest. Nest searching or visitation was avoided if excessive scolding by an adult occurred or if predators were observed nearby (e.g. jays, crows, etc.). Nest monitoring was avoided if there was a chance of inducing premature fledging of nestlings, if approaching the nest would result in habitat destruction or trailing, and during extreme climatic factors that could cause disturbance to nesting birds. Nest visitation dates and times were variable depending on a pair's reproductive stage. Nests were visited once every



seven to eight days during incubation to check for cowbird eggs. If found, cowbird eggs and nestlings were removed from nests (“manipulated”). If a parasitized nest had fewer than three remaining vireo eggs, a non-viable vireo egg was used to replace the cowbird egg.

Survey techniques and data analyses follow Pike et al. (1999). The following monitoring definitions, with some modifications, were taken from Pike et al. (2005):

Adult: an after hatch year bird; Male: a singing individual; Female: a non-singing individual accompanied by a male.

Breeding pair: only pairs for which nests were located, who were observed nest building, or were observed with at least one fledgling.

Well-monitored pair: visited frequently enough to observe and document all successful nesting attempts and accurately quantify number of young fledged from pair. Unsuccessful nests may or may not be found. Pairs that are known not to have fledged young may also be considered well-monitored.

Nesting attempt: any attempt by a well-monitored pair to build a nest. Includes carrying nesting material though never finding nest.

Complete nest: a nest built by a pair; capable of receiving young.

Well-tracked nest: a complete nest observed with a full clutch; nestlings observed at  $\geq 8$  days old.

Successful nest: a nest that fledged at least one known young.

Successful pair: a pair that produced at least one successful nest.

Failed nest: a nest that had eggs or nestlings but produced no known fledged young.

Presumed failure (nest): a complete nest that did not receive an egg; no powder from pin feathers seen in nest; adults seen without fledglings.

Presumed successful (nest): a well-tracked nest with powder from pin feathers seen in the nest.

Depredation: the loss of all eggs or nestlings in a nest.

Cowbird parasitism: classified as such only if a cowbird egg(s) or pieces, or nestling were found in, or below, the affected nest.

Reproductive failure: classified as such when loss due to reasons other than depredation or parasitism (e.g. abandonment, etc.).

Unknown failure: classified as such when loss due to unknown reasons.

Manipulated nest: cowbird egg or nestling removed from nest.

Known fledged young: a fledgling seen out of the nest; nestlings from well-tracked nests, presumed fledged.

Juvenile: a fledgling that has been out of the nest over 14 days.

Productivity aka breeding success (population): the number of known fledglings (minimum) divided by the number of known breeding (nesting) pairs.

Migrant willow flycatchers were documented in conjunction with visual and auditory searches for vireo. If a willow flycatcher was incidentally observed, the biologist checked the location weekly to determine if the individual(s) remained throughout the season. Willow

flycatchers are deemed migrants if they fail to remain on-site through June. In addition to vireo data, special attention was paid to other sensitive species found on-site, which were reported to the appropriate agencies. A complete list of wildlife species detected on-site is provided with sensitive species noted. GPS points were taken for all listed species and cowbirds detected in vireo habitat.

### ***Brown-headed Cowbird Trapping***

In 2018, thirty-three cowbird traps were deployed in or near riparian habitat in drainages throughout the watershed in addition to six deployed at dairy farms, for a total of 39 traps (Figure 3). The USACE and the USFWS funded 26 habitat traps and six dairy traps. The SAWA/IERCD Reach 3B project funded five traps in San Timoteo Canyon and the remaining two traps were contracted. Most of the traps were opened by March 26 and closed by July 27.

Traps are designed after modified Australian crow traps. The trap is constructed of wood and covered in wire mesh, then fitted with shade cloth on the top to provide shade for the birds. Ideal trap locations are in accessible open areas near riparian habitat, or near feeding areas such as stables and dairies. Most traps are placed in areas inaccessible to the general public to protect the trap from vandalism. Traps were kept free from weeds and vegetation, and labeled with signs identifying the purpose of the trap as well as SAWA contact information. Consequences for tampering with the trap, according to the Migratory Bird Treaty Act, were also specified on these signs.

Trapping procedures followed the “Santa Ana Watershed Association and Orange County Water District Cowbird Trapping Protocol” (Tenant et al. 2008). Each trap contained a food bowl, one-gallon water dispenser, a large paint tray for use as a bath, and perches. Cowbirds were fed with a basic millet seed mixture. Field assistants were hired and trained by SAWA biologists to perform daily maintenance, safely handle birds, and properly identify and release non-target species. Non-target native species were released at the beginning of the check to minimize stress. Due to new permit conditions, dated August 8, 2014, SAWA is now required to dispatch European Starlings (*Sturnus vulgaris*) and House Sparrows (*Passer domesticus*) caught in the traps. Since starlings require a different type of food and do not survive well in the traps, this permit condition required additional resources in supplies, time, and effort where these birds congregated and may hamper trapping of cowbirds. Due to these extenuating circumstances, some of these non-native species were released to avoid unnecessary distress to the birds.

Datasheets record non-target species, number of cowbirds in the trap (males, females, and juveniles), and number of cowbirds removed. Hatch-year birds were considered “juveniles” even as their adult coloring started to show. Traps were inspected daily for structural integrity.

Assistants were in constant contact with their supervising biologist for quick resolution of any problems.

Traps were baited with male and female cowbirds that were captured over the fall and winter. The typical ratios used were two males to three females for the smaller-sized habitat traps, and three males to four or more females for larger habitat traps. Large traps placed on dairies were typically baited with five males and nine females. The flight feathers on each cowbird were trimmed so they were more likely to return to the trap if they escaped. A lock was placed on the trap to prevent unauthorized access. Removed cowbirds, starlings, and House Sparrows were transferred to a licensed falconer for dispatch or temporarily housed in a holding trap until the falconer could collect the birds. Holding traps contained extra food and water containers and were closed to entry by additional birds. If applicable, banded cowbirds were reported to the U.S. Bird Banding Laboratory, but only banded males were released. At the end of July, birds were removed from all of the traps and food and water was removed. Trap entry was closed and the door locked open to prevent unintended captures. SAWA's field technicians removed most traps from the field after they had been closed.

## RESULTS

### *Vireo Abundance*

In 2018, SAWA documented a total of 1,347 vireo territories, including 646 known pairs and 728 known fledglings at all monitored, sampled, and incidental sites. This represents a 12% increase in territories from 2017 (n=1,208), the highest number documented to date. OCWD reported 665 territories in Prado Basin in 2018 (Bonnie Johnson, personal communication), and other agencies reported an additional 93 territories for a total of 2,105 vireo territories watershed-wide (Table 1). The number of territories, pairs, and fledglings documented at each monitored site can be found in Table 2.

In 2018, monitoring efforts at most sites were similar to 2017; notable exceptions were San Jacinto, Mockingbird Canyon, Hidden Valley – North and Norco Bluffs. The number of documented territories in San Jacinto increased 64% from 2017 (n=45) to 74 territories in 2018; however, much of this increase can be attributed to the expanded survey area that added 24 territories to the site total. Mockingbird Canyon had an increase of 48% from 2017 (n=29), with 43 territories detected in 2018. This increase may be attributed to an increased monitoring effort. Sixty-two territories were detected in Hidden Valley – North, an increase of 72% from 2017 (n=36). This increase may also be attributed to an increased monitoring effort. The number of

documented vireo territories in Norco Bluffs in 2018 (n=36) decreased by 48% from 2017 (n=69); however, 250 acres of this site were not surveyed in 2018 (see Results and Discussion by Site).

### ***Chronology of Breeding Activity***

Surveys at monitored sites began between March 13 and April 2. Surveys ended between July 19 and August 22. The first vireo was detected on March 21 in San Jacinto. The estimated earliest date for the arrival of 50% of vireo males was on April 5 at San Jacinto and estimated earliest date for 50% of males to be paired was April 18 also in San Jacinto. The first nests were found on April 5 at San Timoteo Canyon and San Jacinto. The first nest to successfully fledge was on May 12 at SAR - Riverside Ave. to Van Buren Blvd. The last nests to fledge were in Hidden Valley – North, Hidden Valley – South, and Norco Bluffs on July 17. The last vireo detected was on August 29 at Green River Golf Club (Table 3); however no further surveys were conducted in the watershed after this date.

### ***Nesting Site Preferences***

Nesting site preferences followed parameters previously documented in Pike et al. (1999). Nests were found mostly in riparian vegetation, near water, along dirt trails or roads, and on edges of riparian habitat. Mulefat (28%) and arroyo willow (19%) were the primary plant species used for nest placement by vireo in 2018 (n = 333). Three other abundantly used species of willow were Goodding's black willow (7%), narrowleaf willow (8%), and red willow (7%). Fremont cottonwood, desert wild grape (*Vitis girdiana*), and laurel sumac (*Malosma laurina*) held another 6%, 6%, and 3% respectively. Twelve nests (4%) were placed in non-native vegetation. A complete list of plant species utilized by nesting vireo in 2018 can be found in Table 4.

Other vegetation used by vireo in the watershed in 2018 include tamarisk, California sagebrush (*Artemisia californica*), Peruvian pepper tree, blue elderberry (*Sambucus nigra* ssp. *caerulea*), and coyote brush (*Baccharis pilularis*) (Appendix B-2). This suggests that Least Bell's Vireo will use a variety of vegetation for nesting in otherwise suitable riparian or adjacent habitat. The use of non-traditional riparian vegetation for nesting by vireo supports the need for careful monitoring of all plants during the nesting season.

### ***Reproductive Success***

Reproductive success, as measured by productivity of well-monitored pairs, was 2.5 watershed-wide in 2018. This rate represents a substantial decrease from 3.6 in 2017. Nest success was 52% (140/267 well-tracked nests), a decrease from 60% (167/279) in 2017

(Appendix B-3). Average clutch size was 3.4 based on 253 complete clutches (Table 5). See Appendix C-3 for individual site data over time.

### ***Predation Rates***

Nests are assumed depredated if all eggs or unfledged young were destroyed or removed. Depredation rates varied at each site, and can be found in individual site results. In 2018, the overall depredation rate across all sites was 42% (113/267 well-tracked nests). At sites with more than five well-tracked nests, depredation rates varied between 20% and 69% (Table 5). Historically, nest loss due to depredation is 34% watershed-wide (Appendix B-3). Over all years, nest losses are typically due to unknown predators. In 2018, a vireo pair was observed scolding a Greater Roadrunner (*Geococcyx californianus*) in the San Jacinto River, in the vicinity of a nest documented with missing eggs or nestlings. On the same site a red racer (*Coluber flagellum*), a potential vireo predator, was observed catching and consuming a fledgling Mourning Dove (*Zenaida macroura*) in the vicinity of a vireo nest. Multiple vireo pairs were observed scolding or chasing California Scrub-jays (*Aphelocoma californica*) at several sites. In San Timoteo, a vireo pair was observed scolding a scrub-jay in the vicinity of a nest containing nestlings. That nest was later documented as depredated. Featherly Park also documented Argentine ants (*Linepithema humile*) at a nest eating five-day-old chicks, and another nest with hatch-day eggs. One nest at Upper Canyon and another in San Timoteo documented nestlings being eaten by Argentine ants, though it is not clear if the ants were the cause of death or just scavengers. One depredated nest in SAC - Upper Canyon documented a nestling pulled through a hole in the side, though the predator in this instance is unknown. Other suspected nest predators include the American Crow (*Corvus brachyrhynchos*), Common Raven (*Corvus corax*), long-tailed weasel (*Mustela frenata*), raccoon (*Procyon lotor*), and various snake species. These species occur at most sites throughout the watershed.

Feral pigs (*Sus scrofa*) are another potential predator. This species occurs in high numbers in San Timoteo Canyon and the upstream portion of the Santa Ana River. Isolated sightings have been made in other areas throughout the watershed. Feral pigs are extremely disruptive to habitat by creating wallows, possibly trampling or knocking over nests, and eating a wide range of vegetation and animals.

### ***Brown-headed Cowbird Parasitism***

In 2018, 3% (9/267) of well-tracked nests were parasitized by cowbirds, down from 5% in 2017 (n = 279; Appendix B-1). San Jacinto, SAR – Upstream (Riverside Ave. to Van Buren Blvd.) and Chino Hills were sites in which parasitism was documented in 2018. In San Timoteo, a nest containing only two cowbird eggs was found abandoned. This nest was not considered

parasitized since no vireo eggs were seen in the nest. The watershed - wide parasitism rate has ranged from 2% to 5% in the last five years, and overall loss of well-monitored nests due to parasitism has ranged from 0% to 3% during that time. The criteria for judging nest failure due to parasitism is the loss or abandonment of vireo eggs in the presence of a cowbird egg or nestling. The low parasitism rates over the last five years are likely attributed to SAWA's extensive cowbird trapping program. Since SAWA began nest monitoring, 222 nests have been manipulated (cowbird egg or nestling removed), 100 of which successfully fledged 216 vireo (Appendix B-3).

### ***Repaired Vireo Nests***

Four nests were repaired in 2018 (Table 5). Of these, two were ultimately successful, fledging six young. Since SAWA has managed vireo in the watershed, 41 nests have been repaired and 80 young have fledged from those nests (Appendix B-3).

## ***Results and Discussion by Site***

### ***Monitored Sites***

#### ***San Jacinto***

In 2018, 74 vireo territories were documented in San Jacinto, 13 of which were in the San Jacinto Wildlife Area (SJWA), 24 in the river from Bridge St. to Potrero Creek, and the remaining 37 territories in the river from State St. to Lake Park Dr. This large increase (64%) in detected vireo territories when compared to 2017 (n=45) can be partly attributed to the expansion of the survey area in the 2018 breeding season. In previous years, this area has been monitored inconsistently due to funding and staff availability. Despite differential monitoring over the years, the population at these sites has increased over fifteen-fold from three territories in 2004 when SAWA began monitoring this location (Appendix D). This increase can likely be attributed to nest monitoring and cowbird management in the area. In 2018, the estimated territory size of vireo in San Jacinto ranged between 0.46 to 6.17 acres.

Thirty-four pairs and 60 fledglings were detected in 2018. Nesting success was 63% based on 30 well-tracked nests. Nest losses were primarily due to predation (23%); two nests (7%) were lost due to parasitism and two nests (7%) were lost due to reproductive failure. Eighteen well-monitored pairs had a 2.2 reproductive success rate and produced 40 fledglings (Table 5). Nesting success is 55% over 14 years of monitoring (n=143 well-tracked nests), ranging from a low of 0% in 2004 (n=1) to a high of 100% in 2006 (n=2). Depredation has been the major cause of nest loss in the last 14 years (34%). Reproductive success based on productivity of well-monitored pairs in the last 14 years is 2.6 and has ranged from a low of 0 in 2004 and 2005 to a high of 4.5 in 2008

(Appendices D and C-3-A). Narrowleaf willow (50%) and mulefat (22%) have been the primary plant species used for nest placement in San Jacinto since 2003. Goodding's black willow and coyote brush held another 10% and 5%, respectively. Six nests (4%) found from 2003 to 2018 were placed in non-native vegetation (Appendix C-2-A).

Cowbird trapping has occurred in San Jacinto since 2003 (excluding 2015) and a total of 24,686 cowbirds have been removed during this time, mostly from local dairies (Appendix C-1-A). Parasitism has occurred consistently over the years, including the 2018 breeding season. During 2018, three well-tracked nests were parasitized by cowbirds. In addition to the parasitized vireo nests, many cowbirds were observed in the habitat throughout the breeding season.

Current threats to the riparian habitat primarily involve human encroachment, including the use of OHV's in the riverbed and trash dumping. In the San Jacinto River, approximately 1.5 miles upstream from State St., numerous homeless camps have been established, which have resulted in refuse in the habitat and vegetation clearing for the camps. On May 10, 2018 a fire started at one homeless encampment (N. Housel, personal observation), consuming over seven acres. This is the second consecutive year a fire started on site during vireo breeding season. Ongoing drought conditions have also impacted the habitat within the river, with many trees in the upstream portion showing severe stress.

Several proposed commercial, residential, and infrastructure projects pose potential future impacts to the San Jacinto River and areas adjacent the San Jacinto Wildlife Area. The indirect impacts associated with construction and future use of a 40-million-square-foot World Logistics Center (Esquivel 2015; Patch CA 2016), the San Jacinto Gateway (Webb 2014), as well as 11,350 residential units (The Villages of Lakeview 2017) remain to be seen.

### ***San Timoteo Canyon***

In 2018, 156 vireo territories were documented in San Timoteo Canyon, down 9% from the 172 documented in 2017 (Table 1). Some of this decrease may be attributed to the Palmer fire that occurred in September 2017 that destroyed dozens of acres of riparian habitat in San Timoteo Creek. Eighteen historical territories in the burn areas were not documented in 2018. However, the population in San Timoteo has experienced a greater than 30-fold increase in 18 years. This increase can be attributed to the removal of invasive species and subsequent restoration of native vegetation, nest monitoring, and cowbird management. In 2018, estimated territory size of the vireo in San Timoteo ranged between 0.3 to 2.0 acres.

One hundred-four pairs and 161 fledglings were detected in 2018. Nesting success was 44%, down from 63% in 2017 (Appendix C-3-B). Nesting success is 56% over 18 years of



monitoring (n=998 well-tracked nests), ranging from a low of 29% in 2004 (n=31 nests) to a high of 100% in 2001 (n=4 nests). Thirty well-monitored pairs had a 2.9 reproductive success rate, down from 4.2 in 2017. Overall reproductive success based on productivity of well-monitored pairs in the last 18 years is 3.0 and has ranged from a low in 2004 of 0.8 to a high of 4.2 in 2017. Nest losses in 2018 were primarily due to depredation (48%). Depredation has been the major cause of nest loss in the last 18 years (36%) (Appendix C-3-B and Appendix D). Mulefat (27%), arroyo willow (23%) and red willow (16%) have been the primary plant species used for nest placement in San Timoteo since 2001. Desert wild grape and Goodding's black willow held another 8% and 7%, respectively. Only ten nests found from 2001-2018 were placed in non-native vegetation (n=1,093 total nests; Appendix C-2-B).

Cowbird trapping has occurred in San Timoteo Canyon since 2001, and a total of 2,656 cowbirds have been removed during this time (Appendix C-1-B). In 2018, a nest containing only two cowbird eggs was found abandoned. This nest was not considered parasitized since no vireo eggs were seen in the nest. One nest was parasitized in 2017; however, no parasitism occurred in San Timoteo in 2016 or 2015. These low rates remain a marked decrease from a high of 75% in 2001. Although parasitism by cowbirds still occurs, at a rate of 12% (115/998 nests) over 18 years, only 3% of nests have failed due to parasitism (Appendix C-3-B and Appendix D). This low failure rate is primarily a result of intensive nest monitoring efforts which include nest manipulation.

Although the riparian area is protected under existing laws, residential and utility development continues in San Timoteo Canyon. Current threats to the riparian habitat include removal of vegetation by landowners, human encroachment (e.g. all-terrain vehicle activity), fire, and domestic sheep and cattle grazing. Feral pigs continue to disturb the habitat throughout the canyon.

### ***Santa Ana River (SAR) - Upstream***

Prior to 2015, data from the four sites grouped into the SAR - Upstream section were reported separately. In 2015, the upstream section did not include Goose Creek, Norco to I-15; however, data from all four sites (Riverside Ave. to Van Buren Blvd., Hidden Valley - North side of river, Hidden Valley - South side of river, and Goose Creek, Norco to I-15) are now incorporated in this overall summary for comparison and individual site data are discussed in the subsequent sub sections.

In 2018, 458 vireo territories were documented, an increase of 18% from the 387 documented in 2017. Two hundred-fifty pairs and 334 fledglings were also documented (combined from Appendix C-1-F to C-1-I). Documented vireo abundance has increased



throughout the upstream section since monitoring began in 2000, and may be attributed to increased monitoring efforts, addition of new survey areas, removal of invasive vegetation, mowing in the Riverside Flood Control channel upstream, as well as vireo nest monitoring and cowbird management. In 2018, estimated territory size of vireo in SAR - Upstream ranged between 0.18 and 1.36 acres. Differential nest monitoring efforts have been undertaken since 2000. In 2018, nesting success for SAR - Upstream was 56% (n=119 well-tracked nests), lower than the overall site nesting success of 63% from 2000-2018 (combined from Appendix C-3-F to C-3-I). Nest losses in 2018 were primarily due to depredation (42%). Five nests (4%) were parasitized by cowbirds in 2018 (Table 2); however, none of these failed due to parasitism (Table 5). The overall site parasitism rate since 2000 is 7% (combined from Appendix C-1-F to C-1-I).

Mulefat (32%) and arroyo willow (28%) have been the primary plant species used for nest placement in the upstream section of the Santa Ana River since 2000 (n= 940 nests). Goodding's black willow held another 11%. Only eleven nests found from 2000-2018 were placed in non-native vegetation, including combinations with at least one non-native species (combined from Appendix C-2-F to C-2-I).

Cowbird trapping has occurred in SAR - Upstream since 2000 and total of 2,092 cowbirds have been removed during this time (combined from Appendix C-1-F to C-1-I). In 2018, five traps were located in this section of the river and a total of 44 cowbirds were removed over 489 trap days (Table 6). One trap was stolen during the trapping season and four male and five female cowbirds were presumed to have escaped. The trap was not replaced. Observed disturbances are reported below for the four individual sites that comprise SAR - Upstream.

#### *SAR - Riverside Ave. to Van Buren Blvd.*

In 2018, 164 vireo territories were documented along the Santa Ana River from Riverside Ave. to Van Buren Blvd., a 6% increase from the 155 detected in 2017 (Table 1). Since adding approximately 2.9 miles to the survey site in 2013 (n=77 territories), there has been an increase in reported vireo numbers. While efforts are made to count all territories and pairs, the dangers in some parts of this site (e.g. homeless camps and marijuana grows) limit the number of areas that can be safely monitored. Prior to the start of the 2014, 2016 and 2018 nesting seasons, Riverside County Flood Control conducted routine mowing of vegetation from Riverside Ave. to Mission Blvd. While there was a decline in vireo territories detected in the immediate area of mowing those years, the overall survey site did not see a significant decrease in territories, suggesting the vireo shifted to new areas downstream. In the years following mowing, monitoring efforts showed an increase in vireo territories. This suggests as the vireo move into different areas of the site immediately following mowing, the offspring, or possibly the breeding birds themselves, return to those newly inhabited territories, thus expanding the extent of

habitat occupied. The exception is 2018, where there was a slight increase (6%) instead of decrease in detected vireo territories immediately following mowing. Research suggests vireo show strong natal-site fidelity, as well as strong site fidelity between different breeding seasons (Greaves 1990, Smith et al. 2000). The occupancy and distribution observed at this site appears to support these conclusions.

Ninety-six pairs and 95 fledglings were detected in 2018 (Table 2). Nesting success was 63% (n=24) as compared to 59% in 2017 (n=46). Nest losses in 2018 were primarily due to depredation (38%) and 12 well-monitored pairs had a reproductive success rate of 2.0 (Appendix C-3-F). Mulefat (29%), arroyo willow (22%), and Goodding's black willow (11%) have been the primary plant species used for nest placement in this section of the Santa Ana River since 2002 (n= 232 nests). Only three nests found from 2002-2018 have been placed in non-native vegetation (Appendix C-2-F).

Brown-headed Cowbird trapping at this site has occurred on public land, private business and residential properties since 2002, and 779 cowbirds have been removed during this time (Appendix C-1-F). Nest parasitism was 21% in 2018 (n=5) and although all five nests were manipulated, only three successfully fledged vireo. These three manipulated nests fledged eight vireo (Table 5). In 2018, 17 cowbirds were detected in the survey area.

Recreational use and human encroachment, such as homeless camps, continue to be a threat to the habitat. Recreational activity was particularly heavy at Martha McLean - Anza Narrows Park in the vireo occupied habitat near the railroad bridge. This area was used as a swimming hole and was inundated with garbage (especially food trash, alcohol containers and used diapers), off leash dogs, latrines from day users, and trails all the way to the main river corridor. A similar disturbance was observed near the Van Buren bridge, though not as widespread as Anza Narrows. Homeless camps are a greater threat to the site with observed clearing of understory or whole areas of vegetation, compaction of dirt, unleashed dogs, chicken coops, chain-link or wooden fences, solar panels, generators, large scale latrines, small landfills and OHV's in the habitat. While homeless camps have always been an issue at this site, the level of homeless inundation observed is becoming quite detrimental to the habitat and vireo.

#### *SAR - Hidden Valley - North (north side of river)*

Sixty-two territories were detected in 2018, a 72% increase from 36 territories detected in 2017. Thirty-eight males were determined to be paired with females, though not all territories were monitored sufficiently to determine pairing success. Sixty-five fledglings were detected across all pairs in 2018, 35 of which fledged from 11 well-monitored pairs resulting in an average of 3.2 fledglings produced per well-monitored pair in 2018. The average number of fledglings

produced per well-monitored pair has ranged from 2.0 in 2014 (n = 4) to 4.0 in 2017 (n = 6; Appendix C-3-G). In 2018, estimated territory size of the vireo ranged between 0.18 to 1.2 acres.

Nest monitoring occurred at Hidden Valley – North in 2010, 2014, and 2016-2018. In 2018, apparent nest success was 56% (n = 25), lower than in 2017 (70%; n = 10) and lower than in all monitored years combined (60%; n = 52). Depredation (44%) was the primary cause of nest failure in 2018. Cowbird nest parasitism was not observed in 2018 compared to 20% of nests in 2017 (n = 10) and 10% in all monitored years combined (n = 52; Appendix C-1-G). No cowbirds were incidentally observed at the site in 2018. Mulefat was used as nesting substrate for 60% of nests in 2018 (n = 25). Arroyo willow was the second most frequently used substrate accounting for another 20% of nests. One nest was placed in arundo and the remaining four nests were placed in other native substrates (Table 4). Substrates used in 2018 were comparable to those used in previously monitored years (Appendix C-2-G).

Although potential effects have not been quantified, homeless encampments may threaten habitat quality at Hidden Valley – North. New encampments were observed being established in 2018 which involved direct removal of vireo habitat through vegetation clearing. Numerous encampments were established prior to 2018 and likely involved habitat removal at the time they were established. In addition, several homeless people at Hidden Valley – North keep unleashed dogs which could possibly disturb vireo breeding behavior. Improper garbage and human waste disposal from the sizable homeless population adds pollutants to the environment that could possibly affect vireo, but these potential effects are currently not very well known. Recreationists are possibly an additional threat. The City of Jurupa Valley park located on Downey Street is a popular location for swimming, barbecuing, picnicking and occasionally for bands to play music. The recreational use of Hidden Valley – North results in additional noise and refuse in the vireo habitat.

#### *SAR - Hidden Valley - South (south side of the river)*

In 2018, 141 territories were detected at Hidden Valley – South, a 15% increase from 123 territories detected in 2017. Sixty males were determined to be paired with females, though not all territories were monitored sufficiently to determine pairing success (Table 1). Twenty-eight of the pairs were well-monitored. Eighty-eight fledglings were detected across all pairs in 2018, 67 of which fledged from the 28 well-monitored pairs resulting in an average of 2.4 fledglings produced per well-monitored pair in 2018 (Table 5). Average number of fledglings produced per well-monitored pair has ranged from 2.1 in 2010 (n = 9) to 4.8 in 2017 (n = 4; Appendix C-3-H and Appendix D). In 2018, estimated territory size of the vireo ranged between 0.25 to 1.36 acres.

Nest monitoring has occurred at Hidden Valley – South every year since 2000 with widely varying numbers of nests monitored (Appendix C-3-H). Forty-seven nests were found in 2018, 45 of which were well-monitored. In 2018, apparent nest success was 49% (n = 45), slightly higher than in 2017 (44%; n = 16) and lower than in all monitored years combined (61%; n = 208). Depredation was the primary cause of failure for 21 (47%) nests in 2018. The remaining two unsuccessful nests (4%) failed due to reproductive failure (Table 5). Depredation has been the leading cause of failure every year nests were monitored (Appendix C-3-H). Cowbird nest parasitism was not observed in 2018 (n = 46), down from a high of 44% in 2007 (n = 9; Appendix D). Parasitism has not been observed at Hidden Valley - South since 2011 (Appendix C-1-H). One male cowbird was incidentally observed onsite in 2018. Mulefat and arroyo willow were the two substrates most frequently used (36% each) for nest placement in 2018. One nest was found in tamarisk (2%; n = 47) and the remaining nests were found in other native substrates (Table 4). Substrates used in 2018 were comparable to those used in previous years (Appendix C-2-H).

There were no active homeless encampments encountered during the course of fieldwork at Hidden Valley – South in 2018, unlike adjacent vireo habitat. Conservation officers regularly patrol Hidden Valley – South and seem to be effectively eliminating illegal encampments. Hidden Valley – South is used frequently by equestrians and hikers which could plausibly disturb vireo breeding behavior, but the potential effect of recreation on vireo is not currently well studied. Large swaths of exotic plant monocultures (arundo) still exist at this location, particularly in the western part of hidden valley south. Areas with high concentrations of arundo tend not to be selected for territory or nest placement (A. Locatelli, personal observation).

#### *SAR - Goose Creek, Norco to I-15*

In 2018, 91 vireo territories were documented along the SAR - Goose Creek, an increase of 25% from the 73 vireo documented in 2017. Fifty-six pairs and 86 fledglings were also documented (Table 2). Nesting success for 25 well-tracked nests was 64%, a decrease from 68% in 2017. Nest losses in 2018 were due to depredation (36%). The reproductive success rate of well-monitored pairs was 2.7 in 2018 (Table 5). Since 2010, this rate has ranged from 2.3 in 2016 to 3.6 in 2012 (Appendix C-3-I). In 2018, nests were primarily placed in mulefat (32%), red willow (21%), and arroyo willow (18%). Overall, since 2000, most nests have been placed in mulefat (34%) and arroyo willow (30%). Less frequently, they have been placed in Goodding's black willow (13%) desert wild grape (5%), and Fremont cottonwood and red willow (both at 4%), (Appendix C-2-I).

Cowbird trapping has occurred in Goose Creek, Norco to I-15 since 2004 and data are reported as part of the SAR - Upstream route. Five hundred eighty-six cowbirds have been removed from this area in over 2,918 trap days (Appendix C-1-I). Parasitism has been

documented on the site in seven out of 18 years surveyed; however, parasitism has only been documented in one of the last nine years (2013). Overall parasitism is low, with a rate of 5% (n=351 nests) since 2000 (Appendix C-1-I). In 2018, one male cowbird was detected in the habitat, and three adults were observed directly adjacent to the habitat, but no nest parasitism was documented during the 2018 nesting season.

On June 21, 2018, it was discovered that an individual (or individuals) accessed one of the IERCD Goose Creek mitigation parcels with a large industrial vehicle, possibly an excavator. The vehicle appeared to have driven down equestrian trails, into clearings, and through sandy washes, knocking over and crushing shrubs, small cottonwood trees, and prickly pear cactus (*Opuntia* sp.). This caused extensive damage to the habitat and equestrian trails, however, no known vireo nests were damaged or destroyed in this event. The area of damage was recorded and reported to both IERCD and CDFW. Current threats to the riparian habitat include the ongoing development of residential housing adjacent to the habitat, which creates dust, noise, and easier access to the habitat. In the future, this development may result in increased human and domestic animal disturbance as people move into the houses. Other threats to the habitat include equestrian recreation and the associated unauthorized creation of trails, OHV use, dumping, and damage caused by feral pigs.

### ***Norco Bluffs, I-15 to River Rd.***

In 2018, a total of 112 vireo territories were detected; thirty-six vireo territories were detected in the area monitored by SAWA,<sup>1</sup> and 76 vireo territories were detected by an USACE consultant.

The following results pertain only to the SAWA monitored area. The 2018 total of 36 territories represents a 17% increase from 30 in 2015. Seventeen were known to be paired, though not all territories were monitored sufficiently to determine pairing success, and 39 fledged young were documented (Table 2). A total of 16 nests were found, 15 of which were well-tracked. Nesting success of well-tracked nests was 73% in 2018, a decrease from 77% in 2017, but higher than 2016 and 2015 which were 58% and 69%, respectively. The reproductive success rate also decreased from 3.5 in 2017 to 2.7 in 2018, much lower than the peak rate of 3.7 in 2015. Average clutch size was 3.6, the same as in 2017, compared to 3.4 in both 2016 and 2015. Of the 15 well-tracked nests, 20% (n=3) were lost due to depredation, compared to 18% in 2017, 33% in 2016, and 15% in 2015. A single nest failed due to reproductive failure in 2018 (7%), 2017 (5%),

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<sup>1</sup> Vireos were monitored in select areas within Norco Bluffs and excluded a 250-acre parcel monitored the previous two seasons; vireo within the parcel were surveyed by a USACE consultant as part of a 1-year maintenance contract. The on-going changes in the survey area preclude the possibility of comparing all data across all years; comparable population level data is as follows: 2015 and 2018, 2016 and 2017. One territory within the area monitored by SAWA has been reported by Ultrasystems as well. See Table 1 "SAR-Norco Bluffs ACOE Mitigation Areas."

and 2016 (8%), compared to two (15%) in 2015. Parasitism was not observed in 2018 (Appendix C-3-J). Size of vireo territories ranged from approximately 0.6 to 2.1 acres.

SAWA did not conduct cowbird trapping at this location; however, a contractor retained by USACE conducts trapping in this area. No cowbirds were detected in vireo habitat over the course of the season.

As in the past two seasons, the primary sources of habitat degradation in 2018 were invasive plants and the continued negative impacts of the polyphagous shot hole borer (*Euwallacea* sp., hereafter PSHB). This beetle drills into trees and brings with it a pathogenic fungus (*Fusarium* sp.) that can infect, and kill, many different tree species. Fortunately, the large-scale dieback of riparian habitat, as observed in the Tijuana River Valley (Boland 2016), from PSHB infestation has yet to occur; nonetheless, arroyo willow have been significantly impacted by PSHB in Norco Bluffs. The majority of arroyo willows show signs characteristic of heavy infestation, e.g. heavy staining and branch dieback, or are completely dead. The Goodding's black willows infested with the beetle/fungus are declining in health as well, albeit at a slower rate. Over the long term, the loss of cover from these species may have a negative impact on the local vireo population as 50% (n=8/16 nests) were placed in these two species in 2018 (Table 4). Before the arrival of PSHB, the Norco Bluffs habitat was characterized as healthy where arundo had yet to become dominant, but some large areas are completely dominated by arundo and provide little habitat value to native wildlife. In addition to arundo there is a relatively small, yet highly dense, stand of mature Mexican fan palm (*Washingtonia robusta*) that appears to have a rapid rate of recruitment. The understory within the stand of palms consists primarily of younger palms with little presence of native plant species. Much like arundo, the palms provide relatively low-quality habitat compared to the surrounding areas dominated by native plant species. Assuming not all of the trees are eventually killed by PSHB, removal of arundo and palms would allow for natural recruitment of native riparian plant species, thereby dramatically increasing the total area of functional habitat for vireo and other sensitive species.

### ***Santa Ana Canyon (SAC)***

These results are compiled from three sites (Upper Canyon, Green River Golf Club, and Featherly Park), collectively known as SAC. One hundred forty vireo territories were detected in the Santa Ana Canyon (SAC) in 2018, a slight increase from the 131 territories detected in 2017 (compiled from Table 1). In 2018, mean clutch size was 3.2 (n=35), a decrease of 0.5 from 2017. Nesting success for 38 well-tracked nests in SAC was 39% overall, a substantial decrease from 59% in 2017. Twenty-one of 38 well-tracked nests were lost to depredation (55%) and two were lost to unknown reasons (5%). No parasitism was detected in 2018. The reproductive success rate



in SAC for 2018 was 1.7, vastly different from a success rate of 3.7 in 2017. This rate had been decreasing annually in SAC since 2011 when the rate was 2.7 (compiled from C-3-M to C-3-O; Appendix D). For comparison, the watershed-wide rate of reproductive success in 2018 was 2.5 (n= 148 well-monitored pairs) and the watershed-wide rate of fledglings produced from 2001-2018 was 2.8 (n= 1,612 well-monitored pairs; Appendix B-3). Sixty-eight fledglings were documented in 2018, less than half of the 165 fledglings documented in 2017. However, this is on par with the 68 fledglings documented in 2016, which was also a severe drought year, with a similar survey effort (compiled from Table 5). A total of 1,270 fledglings have been documented in SAC over the last 18 years (compiled from Appendix C-1). Vireo used a variety of plant species (n= 14) for nest substrate in 2018. Of the 51 total nests found, the highest number of nests were found in mulefat (35%), laurel sumac (18%), Fremont cottonwood (16%), Peruvian pepper tree (6%), and blue elderberry (6%; compiled from Table 4). Vireo territory size in SAC is estimated to be between 0.7 acre and 9.6 acres.

SAWA began cowbird trapping in the SAC in 2001 when parasitism was documented in five of 19 nests (26%). Parasitism was again documented in one of 21 nests (5%) in 2009 after five years of no occurrences (Appendix D). SAWA deployed two traps within a mile of that location and no parasitism has been recorded since. In 2018, four traps were deployed and 119 cowbirds were removed over 440 trap days (Table 6). Since 2001, a total of 2,363 cowbirds have been removed from the canyon over 12,859 trap days during the vireo breeding season (compiled from Appendix C-1-M to C-1-O). There were no un-trapped cowbirds detected in vireo habitat in the Santa Ana Canyon in 2018.

In 2018, three different phases of the USACE Reach 9 project were active in Featherly Park and the BNSF bridge project commenced in Green River Golf Club. These on-going construction projects will continue for several years and may challenge future vireo recovery in the impact areas. However, proposed mitigation should expand and enhance vireo habitat in the post-construction years. For example, several vireo have already moved into restored areas in Phase 3, only three years after installation and in Phase 4 by the second year.

At this time, riparian habitat in the Santa Ana Canyon is becoming infested with arundo at all three sites. The restoration edges between the golf course and the homes have opened new areas for arundo to infest along the river, while the arundo patches in the Upper Canyon continue to spread. In the lower section (Featherly Regional Park) the arundo had been treated with Imazapyr, which damaged many of the surrounding native trees. Though much, not all, of the arundo at this location is dead, the biomass remains, hampering native regeneration at this site. Additionally, there are multiple native trees that are suffering from Imazapyr over-spray.

Trees damaged by Imazapyr continue to suffer and many were found dead in 2016. Additional damage was observed in 2018.

The polyphagous shot-hole borer (PSHB) is known to have infested trees in the Canyon RV Park within Featherly Regional Park and several trees in the riparian zone appear to have been infested (unconfirmed). There is no significant native tree die-off caused by the invasive PSHB observed in SAC at this time. SAWA has deployed PSHB traps in this area to assist in a monitoring program coordinated with the University of California, Riverside (UCR). The County of Orange has implemented the Santa Ana River Canyon Habitat Management Plan and SAWA biologists sit on two subcommittees overseeing implementation of the plan, though no meetings have occurred in the last four years. Although the USACE riverbank stabilization (Reach 9) and BNSF bridge projects are expected to continue for several years, as well as the Santa Ana River Trail project set to begin, we hope active management of the canyon will improve to maintain optimum conditions for its native species.

### *Upper Canyon*

In 2018, 32 vireo territories were documented in Upper Canyon, two more than 2017. Twenty-five were known to be paired and 23 fledglings were documented (Table 2). Nesting success for ten well-tracked nests was 50%. The seven well-monitored pairs successfully produced a total of 13 fledglings (Table 5). Overall success of well-tracked nests for this site from 2001 to 2018 is 66% and the overall reproductive success rate of well-monitored pairs during the same time is 2.5. A total of 359 fledglings have been documented over the last 18 years (Appendix C-3-M). No cowbirds were detected in the habitat in 2018. Estimated territory size of the vireo in Upper Canyon ranged between 0.65 to 4.23 acres in 2018.

Cowbird trapping has occurred in the Upper Canyon since 2001 when the first vireo were detected on-site. To date, 801 cowbirds have been removed from this area (Appendix C-1-M). Parasitism has only been documented two of the 18 years monitored and reached its highest rate in 2003 (18%). There has been no parasitism detected in the Upper Canyon since 2003 (Appendix D).

Construction activities relating to the Reach 9 project did not occur during the 2018 breeding season at this location. Reach 9 Phase 2 restoration is complete, however, vireo do not appear to be using the site. Unfortunately, this site continues to be plagued by other human-related impacts including fishing, trash dumping and branch-cutting, as well as large areas of invasive species (e.g. arundo) infestation.



### *Green River Golf Club*

In 2018, 42 territories were documented, an increase of 27% from 2016 (n= 33; Table 1). The vireo population at Green River Golf Club has more than quadrupled since monitoring began in 2001 when only ten vireo were detected (Appendix D). Of the 42 males found, 38 were known to be paired, though not all territories were monitored sufficiently to determine pairing success, and 20 fledglings were documented in 2018 (Table 2). Nesting success for 16 well-tracked nests was only 25%, the lowest recorded rate at this site (Table 5). Conversely, nest success was a record high of 76% in 2017. Overall nest success from 2001 to 2018 is 57%. Eleven (69%) unsuccessful well-tracked nests were lost to depredation and one (6%) nest was lost to an unknown cause (Appendix C-3-N). The reproductive success rate in 2018 was only 0.6, the lowest rate documented at this site, whereas the overall reproductive success rate from 2001-2018 of well-monitored pairs is 2.3. A total of 447 fledglings have been documented over the last 18 years (Appendix C-3-N). Well-tracked nests were most frequently placed in mulefat (30%), Fremont cottonwood (20%), and laurel sumac (15%; Table 4). Four nests were placed in non-native vegetation which included Peruvian pepper tree (10%), tree of heaven (5%), and tree tobacco (*Nicotiana glauca*, 5%). Two banded vireo were detected in this section in 2016. One of those birds was not detected in 2017 or 2018, though an un-banded, paired male was in its territory. In 2018, estimated territory size of the vireo at Green River Golf Club ranged between 0.8 to 8.0 acres.

Although the number of territories remained unchanged from last year, the new BNSF construction project impacted four vireo territories. Riparian habitat for two territories was completely removed and habitat for two additional territories were partially removed. The pair of vireo located directly upstream from the construction work exhibited signs of reproductive stress. Their nest was built approximately 50 feet from the construction fence line and initially contained four eggs. However, after a week, only three eggs remained, a week after that, only two nestlings were present, and at the end, only one nestling successfully fledged from that nest. In addition, the pair was observed on numerous occasions encroaching into an adjacent vireo territory to forage. Although construction activities impact nearby vireo at this site, the Phase 3 restoration area inhabits several vireo this year.

Cowbird trapping has occurred at the golf club since 2001 when the first vireo were detected on-site and a total of 1,066 cowbirds have been removed from this area (Appendix C-1-N). When SAWA began monitoring this site, the parasitism rate was 44%. There has been no parasitism detected since 2001 when cowbird trapping was initiated (Appendix D). For 2018, access to the highly productive cowbird traps located in the golf course maintenance yard was limited due to the new BNSF construction project and a new temporary location was utilized. This

new BHCO trap location was located in the south end of the golf course parking lot and did not capture any cowbirds over 83 trap days. It is unknown whether access to the maintenance yard will be limited next year, however, SAWA will continue to coordinate with USACE and the project contractor.

Management at the Green River Golf Club has continued its cooperative relationship with SAWA and is supportive of SAWA's efforts to control cowbirds, manage vireo and other sensitive species, and enhance habitat.

### *Featherly Regional Park*

In 2018, 66 territorial vireo were detected in Featherly Regional Park, seven more than 2017. Twenty-five were known to be paired, though not all territories were monitored sufficiently to determine pairing success, and 25 fledglings were detected. A total of 464 fledglings have been observed over the last 18 years (Appendix C-1-O). These numbers emphasize the vireo population recovery at this site over the last seventeen years given that no vireo were detected in 2001, the first year of monitoring. The population's first major increase came in 2004 when it quadrupled from six in 2003 to 24 the following year (Appendix D). However, productivity has greatly fluctuated at this site from a high of 3.7 in 2003 to a low of 0.6 in 2016 (Appendix C-3-O; Appendix D). In 2018, estimated territory size of the vireo in Featherly Park ranged between 0.6 to 9.6 acres.

Nesting success for 12 well-tracked nests in 2018 was 50%, the same as last year and higher than the overall nesting success from 2002 to 2018 of 44%. Five of 12 tracked nests (42%) were lost to depredation. Eight closely monitored pairs had a 2.1 reproductive success rate in 2018. The overall reproductive success rate of well-monitored pairs over 18 years of monitoring is 1.9 (Appendix C-3-O). Of the 18 total nests found in 2018, all except one nest were placed in native vegetation, with the highest number of nests (28%) placed equally in mulefat and laurel sumac (Table 4).

The California Scrub-Jay, a well-known avian nest-predator, occurs in large numbers throughout Featherly Regional Park. One such depredation was observed as a scrub-jay took three seven-day old nestlings from one nest in 2015. Another nest invader found in large numbers throughout the site is the Argentine ant. One nest was found with ants entering a small hole in the eggs on hatch day in 2015. A later visit found the eggs to be completely empty with only the same small hole in each egg. In 2016, ants were observed eating two Black-headed Grosbeak (*Pheucticus melanocephalus*) nestlings and one egg. In 2017, Argentine ants were observed preying on vireo nestlings in a well-tracked nest. In 2018, ants again were observed consuming nestlings in one nest and hatch-day eggs in another nest. Although there was no nest

parasitism found at this site in 2018, one well-tracked nest failed due to reproductive failure (unknown cause). One banded vireo that held the same territory from 2013 to 2017 was again detected in this section.

Cowbird trapping has occurred in Featherly Regional Park since 2001 when the first vireo were detected on-site and 496 cowbirds have been removed during this time. Parasitism has been documented three out of the 18 years surveyed, reaching its highest rate in 2002 (67%). No parasitism has been detected in Featherly Regional Park since 2009 (Appendix C-1-O).

The habitat at Featherly Regional Park had become extremely drought-stressed, with the exception of the area immediately adjacent to the riverbanks, until the abundant winter rains in 2016/2017. The dramatic increase in breeding success in 2017 at this site was likely due to the decrease in drought stress and resulted in higher recruitment in 2018. Unfortunately, 2018 was another severe drought year. The PHSB has been detected within the park, though no large die-off has been observed. Other ongoing disturbances at this site include habitat destruction during nesting season by the orange grove lessee, illegal fishing, and increasing homeless camps. Invasive plants are still a problem at this site. The highly invasive arundo began re-sprouting two weeks after the Freeway Complex Fire in 2008 and has since spread throughout the site. In an effort to take advantage of the arundo biomass removed by the fire, Orange County Public Works management was able to spray herbicide on the rapid arundo regrowth before the following nesting season, which helped control a large amount of regrowth. Unfortunately, many patches have re-established since that time and a large amount of dead arundo biomass remains, hampering native plant regeneration. Additionally, the subsequent use of Imazapyr on arundo was found to be damaging over 200 nearby native trees in 2013. Trees damaged by Imazapyr continue to suffer and many were found dead in 2016. More damage was observed in 2018. Three different phases of the USACE Reach 9 project were active in Featherly Park in 2018. However, proposed mitigation should expand and enhance vireo habitat in the post-construction years. In fact, vireo (n=3) have already begun inhabiting the Phase 4 restoration area this year. The 8% decrease of territorial males at this site from 2016 (n=64) to 2017 (n=59) was likely due to habitat loss during construction. However, those numbers rebounded in 2018 (n=64).

### ***Sampled Sites***

Thirty-six sites were sampled in 2018 and 440 additional vireo territories were documented. No vireo were detected at three of the 36 sampled sites. Thirteen sites sampled in 2018 reported an increase in detected vireo territories, while 12 sites reported a decrease in detected vireo territories. Nine sites reported the same number of territories in 2017 and 2018, while two sites were surveyed in 2018 but not 2017. (Table 1).

Cowbirds were reported at seven of the 11 sites: Alessandro/Prenda Arroyo, Box Springs, Carbon Canyon Regional Park, City Creek, Harrison Reservoir, Kabian Park, Lake Perris, Meridian CA (formerly March SKR Preserve), Mead Valley, Poorman Reservoir, Santiago Canyon (Irvine Park), and Plunge Creek. Cowbirds at Meridian CA were reported from captures in cowbird traps; cowbirds were not observed in the habitat. Traps operated by another agency were on site at Irvine Lake.

### ***Mockingbird Canyon***

In 2018, 43 vireo territories were detected in Mockingbird Canyon, nearly double the 29 territories in 2017. Fifteen pairs and 10 fledglings were detected (Table 2). Measures of reproductive success have varied over the years due in part to differential monitoring efforts; over all the survey years there has been a low of 1.3, which occurred in 2003, and a high of 5.0 in 2009 (Appendix C-3-E) with two well-tracked pairs. Excluding 2009, the highest reported reproductive successes were 3.0 in 2012 and 2016 (Appendices D and C-3-E). Since 2003, overall nesting success of the 158 well-tracked nests is 53% (n=84), with a low of 15% in 2003 (n=13) and a high of 83% in 2009 (n=12; Appendices D and C-3-E). Four hundred fifty-one vireo fledglings have been reported over all the survey years (Appendix C-3-E). Nest placement has primarily occurred in red willow (31%), Goodding's black willow (17%), and blue elderberry (16%; Appendix C-2-E).

In 2018, there was no documented nest parasitism or detection of cowbirds in the habitat. Beginning in 2003, an intensive cowbird management program was initiated. In this same year, 62% of nests (n=13) were parasitized, the highest recorded in all survey years. The parasitism rate decreased sharply after this trapping program began, and though parasitism continues to occur episodically, it seems to be controlled. The overall parasitism rate is 10% (n=158), with 4% of nests failing as a result of parasitism. Since 2003, a total of 2,103 cowbirds have been removed from Mockingbird Canyon (Appendix C-1-E).

Despite SAWA's efforts within its conservation easement, habitat destruction and disturbance still occurs at Mockingbird Canyon. In 2016, a huge portion of habitat was removed along the north strip of land behind the homes off Owl Tree Rd., just west of SAWA's easement site. Although this area is not part of the easement, it historically had vireo nesting activity. In 2017, another portion of riparian habitat was bulldozed at the Markham Street entrance to the site, adjacent to SAWA's easement. These disturbances may have impacted or greatly stressed nesting birds that were on site. In addition, the possibility of Cal Fire beginning a fuel modification project on site may put a number of vireo territories in the area at risk. During the 2018 nesting season, large amounts of vegetation showed signs of heat and drought stress, such as early senescence and desiccation.

### ***Temescal Canyon***

One hundred-six territorial male vireo were detected in 2018, compared to 109 in 2017 and 93 in 2016. The 2018 count represents a 19% decrease from the count of 131 territorial vireo in 2013, which to date, was the peak year (Table 1; Appendix D). It is likely that this decrease is attributed to the reduced survey area since 2017. The Dos Lagos Golf Course typically contains several vireo territories. SAWA biologists were prohibited from surveying this area in 2014 and cowbird trapping no longer occurs at this location. Without nest monitoring and/or trapping, these vireo will likely begin to decrease in number. Forty-eight pairs and 19 nests were found incidentally in 2018. Only sixteen fledglings were detected, a large decrease from the 48 detected in 2017 (Appendix C-1-K).

In 2018 a total of eight cowbirds were observed in the riparian habitat of Temescal Canyon: four in the most northern area within the property owned by 3M Corporation, two at Lake Elsinore, one in the habitat south of the intersection at Highway 74 and Baker Street, and one at Railroad Canyon creek. Five cowbird traps were open for the 2018 season in Temescal Canyon. Four traps were located adjacent to riparian habitat and the fifth at a small dairy near Lake Elsinore where the highest parasitism rates typically occur. The five traps caught a total of 212 cowbirds over 547 trap days. Cowbird trapping has occurred during the nesting season in Temescal Canyon since 2001 and a total of 4,012 cowbirds have been removed during this time (Appendix C-1-K). Even with on-site cowbird trapping, parasitism has been documented in Temescal in ten out of the 18 years it has been surveyed, reaching a peak rate of 42% (n=5/12 nests) in 2007 (Appendix D).

Apart from 2017, several of the past years have received below average precipitation which continues to cause drought stress throughout Temescal Wash, especially downstream of Dos Lagos Golf Course where effluent outflow by City of Corona Wastewater Treatment Plant #3 was suspended in 2013. In 2014, a SAWA biologist familiar with that area reported to CDFW massive vegetation die-off due to lack of water from the historical water treatment outflow. This die-off has been amplified by the ongoing drought conditions and habitat quality has continued to decline since the effluent outflow was halted. In addition to these stressors, the habitat in Temescal Canyon and Lake Elsinore is regularly impacted during the nesting season by off-road vehicle use, illegal vegetation removal, and understory clearing to deter homeless encampments around Lake Elsinore. Management recommendations for this area include removal of tamarisk, enforcement of illegal vegetation removal during avian nesting season, continued cowbird trapping including placement of additional traps near locations where juvenile cowbirds have been detected, and most importantly, re-establishing outflow to the creek near Dos Lagos Golf Course.

### ***Chino Hills***

In 2018, Chino Hills was not monitored extensively due to inaccessibility to all vireo locations. Even though fewer site visits were conducted and survey effort was reduced, 26 territories, nine pairs, and three fledglings were documented in 2018, representing an increase in territories from 2017 (n=25) and 2016 (n=18) (Appendix C-1-L). One of two nests found this year was parasitized and both nests were closely monitored throughout the season. However, neither nest was successful. In 2018, estimated territory size of the vireo in Chino Hills ranged between 0.35 to 2.85 acres.

One cowbird trap was deployed in Chino Hills in 2018. The trap was located near the Chino Hills Community Center at English Channel and captured 23 cowbirds over 92 trap days, comparable to 22 cowbirds captured over 113 trap days in 2017. Compared to 2016, 53 cowbirds were removed over 262 trap days, utilizing two cowbird traps. Trapping has occurred in Chino Hills since 2008, and a total of 239 cowbirds have been removed during this time (Appendix C-1-L). Before 2018, parasitism ranged from 0% (0/2 nests) in 2016 to 60% (3/5 nests) in 2007 (Appendix D). Since 2008, when cowbird control began, only one nest was found to be parasitized in 2015 and again in 2018. No vireo were observed with cowbird fledglings and no cowbirds were detected in the habitat during monitoring in 2018. Parasitism, development, human activity, cattle grazing, and small fragmented habitat patches are factors that may threaten vireo and reduce productivity throughout the Chino Hills area.

### ***Incidental Sites***

In 2018, forty-three additional vireo territories were documented incidentally at eight sites in which no formal surveys were conducted (Table 1). Of those 43 territories, five were incidentally determined to be paired and seven fledglings were detected across those five territories. At the Santa Ana River – San Bernardino County Flood Control site, San Bernardino County staff detected an additional 17 territories that SAWA did not (Table 1). GPS coordinates of incidental locations can be found in Appendix A.

## **SIGHTINGS OF INTEREST – INCIDENTAL SPECIES OBSERVATIONS**

Incidental species sightings were documented at monitored sites and only sensitive species were documented at sampled sites during vireo monitoring. One hundred sixty-four avian, 19 mammal, 19 herpetofauna and 5 fish species were observed at monitored and sampled sites. Sensitive species were documented by site and a combined total of 42 sensitive species were detected (Table 10). Sensitive species are defined as those listed as endangered, threatened, or a species of concern by resource agencies, and those covered by the Western

Riverside County Multiple Species Habitat Conservation Plan (MSHCP). Observations are verified detections and are considered presence at each location, and should not be considered as a complete species list for each site. For example, California Gnatcatcher (*Poliophtila californica*) were detected at three sites adjacent to vireo habitat; however, other gnatcatchers likely occur in adjacent areas of other sites where biologists do not frequent and hence there may be many undetected gnatcatchers. Similarly, some species are difficult to detect, such as the long-tailed weasel, and may occur in locations other than those reported here. Sensitive species sightings are reported annually to the appropriate resource agencies.

### ***Southwestern Willow Flycatcher***

Southwestern Willow Flycatchers (SWFL) have been documented sporadically in Prado Basin since 1996, and a total of 37 nests have been discovered on site from 1996-2013 (Pike et al. 2015). There were no detections of SWFL in the Prado Basin in 2018 (Bonnie Johnson personal communication, 26 September 2018). In past years, the highest number of detections in the Prado Basin occurred in 2003, with nine individuals present.

In 2018, SAWA biologists detected 20 individual migrant Willow Flycatchers (WIFL). Eighteen were within the watershed, and two were detected outside of the watershed. No breeding pairs were detected.

Within the watershed, one male was detected in Temescal/3M on 5/9. On 5/14, one singing male was detected at San Jacinto Wildlife (SJWA). On 5/16, three males were detected in Prado Basin at Reuben's Field Edge along Chino Creek. On 5/17, a second male was found at SJWA countering with the first. Both were detected a final time on 6/7. One male was detected in Temescal/Gunderson Pond on 5/17. On 5/21 one adult was observed foraging along the San Jacinto River. On 5/22, singing males were detected at Kabian Park (n=1), Meniffee/Salt Creek (n=2), and Poorman Reservoir (n=1). One singing male was heard at Telegraph Canyon in Chino Hills State Park on 5/23. Three males were found at Carbon Canyon Regional Park on 5/24. Also detected on 5/24 was a male at Hidden Valley Golf Course. On 5/25, one male was detected in Prado Basin at Reuben's Field Edge along Chino Creek.

Outside of the watershed, two singing males were detected on 5/15 in Wildomar in Murrieta Creek.

Migrant Willow Flycatchers have been observed periodically throughout the rest of the watershed over the years, however SAWA has not documented any breeding attempts at monitored or sampled sites. All migrant Willow Flycatcher sightings are reported electronically to USGS Riparian Birds Working Group and to the California Natural Diversity Database.



## **BROWN-HEADED COWBIRD TRAPPING RESULTS**

### ***Brown-headed Cowbird Trapping, March-July 2018***

Thirty-nine cowbird traps were deployed during the 2018 vireo season and 3,039 cowbirds were removed from all sites over 4,182 trap days. The sex and ages of the cowbirds removed in 2018 were: 2,230 adult males, 719 adult females, and 90 juveniles. SAWA biologists and field assistants spent 2,114 hours servicing traps during the vireo season, including installation and removal of traps from the field (Table 6).

In 2018, cowbird captures increased 15% from 2017 (n=2,644) despite having four less traps deployed. Thirty-seven percent more males, 3% fewer females, and 67% fewer juveniles were trapped during the 2018 breeding season. In 2018, the overall capture rate was 0.73 cowbirds per trap day, an increase from 0.51 in 2017. Over 40,500 cowbirds have been removed from the watershed by SAWA during the breeding season since cowbird management began (Aimar et al. 2017).

In 2018, one trap was stolen in the SAR – Upstream portion of the watershed. Four male and five female cowbirds were presumed to have escaped. The trap was not replaced.

### ***Non-Target Captures in Cowbird Traps, March-July 2018***

Twenty-three non-target native species, consisting of 2,997 individual trapping occurrences, were captured in 39 traps. It should be noted that many of these trapping occurrences are most likely the same individuals returning to the same traps. In order of most frequently captured, the most common species were California Towhee (*Melospiza crissalis*), Red-winged Blackbird (*Agelaius phoeniceus*), House Finch (*Haemorhous mexicanus*), and Yellow-headed Blackbird (*Xanthocephalus xanthocephalus*). The percent of trapping occurrences that resulted in mortality was 0.8% in 2018 (Table 7). Numbers of European Starlings, House Sparrows and other non-native species either removed or released from cowbird traps are also listed in Table 7.

### ***Fall/Winter 2017-2018 Brown-headed Cowbird Trapping and Non-Target Captures***

Four cowbird traps were deployed at dairies during the non-breeding season (fall/winter) of 2017-2018. One trap was located at a dairy in Temescal Canyon (Lake Elsinore) and three traps were located at two different dairies in the Prado Basin.



A total of 3,893 cowbirds were removed (853 adult males, 1,656 adult females, and 1,384 juveniles) over 598 trap days (Table 8). In the fall/winter of 2016-17, 6,259 cowbirds were removed from seven dairy traps over 871 trap days (Aimar et al. 2017). In 2017-2018, the capture rate was 6.5 cowbirds per trap day, a decrease from 7.2 in 2016-2017. Over 77,000 cowbirds have been removed from the watershed by SAWA during the fall/winter since cowbird management began.

Eight non-target native species, consisting of 108 individual trapping occurrences, were documented in the four dairy traps in 2017-2018. The most common species captured was the Red-winged Blackbird. The percent of trapping occurrences that resulted in mortality was 0.9%. Numbers of European Starlings, House Sparrows and other non-native species either removed or released from cowbird traps are reported in Table 9.

## DISCUSSION

With the exception of a few years, vireo abundance has increased annually in the Santa Ana Watershed since monitoring began in 2000. In 2018, 2,105 vireo territories were documented watershed-wide (including data from Prado Basin and other reporting agencies), an 18% increase from 2017 (n=1,781) and the highest recorded since monitoring began (Figure 5). The significant population increase over 19 seasons of monitoring at four sites is illustrated in Figure 6. The 1,347 vireo detected by SAWA biologists in 2018, up 12% from 2017 (n=1,208), includes 30 (2%) territories in San Bernardino County that were not reported in 2017. Most survey sites throughout the watershed showed an increase in territory numbers. The two exceptions being San Timoteo, with a 9% decrease and Peters Canyon, with a 15% decrease, both of which lost habitat to large fires. Survey efforts were similar at most sites with two exceptions. Mockingbird Canyon showed a 48% (n=43) increase that was likely due to increased survey efforts in the same survey area; whereas, Norco Bluff's had a similar survey effort in a much smaller survey area. SAWA and a USACE consultant share the Norco Bluffs site surveys. In 2018, the consultant surveyed 250 acres of SAWA's 2017 survey area. Combined territory numbers for Norco Bluffs were 83 in 2017 and 112 in 2018, an increase of 35% (Table 1).

Of the areas sampled during the nesting season, one site that has shown a dramatic decline in territory numbers with a similar survey effort is Chino Hills State Park (CHSP). Although there was a 60% increase in territories in 2018 (n=32) from 2017 (n=20), numbers in this area are still 31% below the 51 territories detected in 2010. These declining numbers can likely be attributed to severe habitat degradation in the riparian areas of the park, caused mostly by damage from illegal cattle grazing in Lower Aliso Canyon. Although this park was devastated by the Freeway Complex Fire in 2008, the riparian habitat recovered well and the vireo numbers

appeared stable in 2010. However, the adjacent native upland habitat converted to primarily invasive plant species. Since vireo are known to use adjacent areas for foraging and nesting, especially when the riparian area is as narrow as it is in CHSP, there may be a fire-related relationship to explore. Of the monitored sites, the Santa Ana Canyon has been suffering near constant disturbance by fire and construction activities from the USACE Reach 9 stabilization project for over a decade. After the devastating Complex Fire in 2009, most of the habitat recovered within the following 2 years. The SAC vireo population spiked in 2013 ( $n=114$ ), up 75% from 2012 ( $n=65$ ), though some of that increase may have been due to increased effort. While the construction activities obviously impact habitat and likely cause reproductive stress to nearby pairs, overall the SAC vireo population has been steadily increasing to a high of 140 territories in 2018. Like other areas throughout the watershed, this increase is likely attributed to the continued cowbird trapping and nest monitoring at this location. However, the USACE post-project habitat restoration in SAC is expanding early successional riparian habitat, which is highly desirable to vireo and offers increased habitat availability.

Nesting success watershed-wide was 52% in 2018, down from 60% in 2017 and lower than the overall nesting success of 58% ( $n=2,880$  well-tracked nests) in the last 18 years. In 2018, the overall reproductive success rate (average number of fledglings produced by well-monitored pairs) was 2.5, down from the rate of 3.6 in 2017 and below the 18-year average of 2.8. Depredation remains the primary cause of nest failure, with an overall 42% of nests lost to depredation in 2018, higher than the 34% watershed-wide spanning all years of monitoring (Appendix B-3). Overall nest loss from cowbird parasitism was a low 1% (18-year average of 3%). Nest loss due to reproductive failure and other unknown factors in 2018 was 4% and 1%, respectively. Examples of nest loss due to reproductive failure are non-parasitized egg abandonment, failure of the entire clutch to hatch, or failure of the vegetation to support the nest to a successful fledging.

Parasitism continues to be episodic throughout the watershed. Three percent of nests were parasitized in 2018. The watershed-wide parasitism rate has ranged from 2% to 5% in the last five years (Appendix B-3) and these low rates can likely be attributed to SAWA's cowbird trapping program and nest monitoring. Kus and Whitfield (2005) showed that cowbird trapping reduces parasitism of vireo nests, thus enhancing productivity of nesting pairs and in turn increasing the population level. Figure 7 shows the increase in vireo territories in relation to the rate of cowbird parasitism in the Santa Ana Watershed from 2001-2018. A comparison of watershed-wide nesting success, predation, and parasitism rates from 2003-2018 are shown in Figure 8.

The two primary causes of vireo decline in the past, parasitism by the Brown-headed Cowbird and the loss of riparian habitat, are being successfully managed by SAWA through cowbird trapping and habitat restoration. SAWA and OCWD biologists have removed over 150,000 cowbirds from the watershed, including Prado Basin, in the last 18 years (Figure 9). SAWA has also removed over 4,600 acres of invasive arundo from the watershed, allowing for as many acres of riparian recovery.

The lack of documented nesting Southwestern Willow Flycatchers in the watershed in 2018 is not surprising given the dwindling numbers over the last decade. No breeding activity from this species has been documented in the watershed since 2014. The habitat in the higher elevations of the watershed has had willow flycatcher territories in the past, and should be surveyed to ascertain the status of this imperiled species in the mountains. SAWA and OCWD have plans to survey these areas in 2019.

## **MANAGEMENT RECOMMENDATIONS**

Parasitism by Brown-headed Cowbirds continues to occur episodically throughout the watershed. Vireo monitoring and cowbird trapping should continue along with the removal of non-native vegetation. The removal of arundo and other invasive vegetation, in conjunction with cowbird management, have had a positive influence on vireo territory numbers in the watershed since 2000. With the removal of over 4,600 acres of arundo and other invasive plants, SAWA has had extraordinary success with riparian habitat restoration along the Santa Ana River and its tributaries. Since invasive plants like arundo cannot typically be eradicated within a five-year mitigation term, we recommend that long-term maintenance of invasive plant regrowth become a mitigation requirement much like cowbird trapping.

In recent years, large homeless encampments have become increasingly prevalent throughout the Santa Ana River. In 2018, multiple homeless camps were found for the first time in Featherly Park (Orange County). These encampments have a strong negative effect on habitat and water quality, and cause increasing safety issues for biological monitors. In addition to restoration, as well as maintenance and procurement of new land, there needs to be increased protection of lands for wildlife values. Specifically, enforcement of current laws that restrict illegal activities in sensitive riparian areas. Local landscapes are scarred with off-highway vehicle (OHV) tracks and the activity is damaging riparian habitat in areas such as Mockingbird Canyon, San Timoteo Canyon, the San Jacinto River, and the Santa Ana River. Additionally, laws meant to prevent other human disturbances such as streambed alteration, illegal fishing, and homeless encampments must be enforced. A positive development in this area is the County of Riverside's code enforcement program that targets illegal dumping. Enforcement of these laws can protect

riparian habitat from degradation. There is also increasing awareness of the need to control feral pigs throughout the watershed. Some multi-organizational planning attempts to control this destructive species have been publicized; however, a management plan has yet to be implemented.

Although existing laws are meant to protect these resources, even on private land, we must strive to invest the public in these resources and identify effective ways to ensure that floodplains are protected for future generations of humans and wildlife. We will attempt this through a combination of public education, public involvement through volunteerism, and partnerships with enforcement agencies and landowners. Priorities for SAWA's vireo recovery program in the near future will continue to be based primarily on cowbird trapping and nest monitoring, which we believe provides the most immediate support for the recovering vireo population, the availability of ample invasive-free riparian habitat notwithstanding. SAWA will continue to provide accurate annual data on vireo status, distribution and reproductive productivity as funding allows.

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Figure 1. Map of the Santa Ana Watershed.

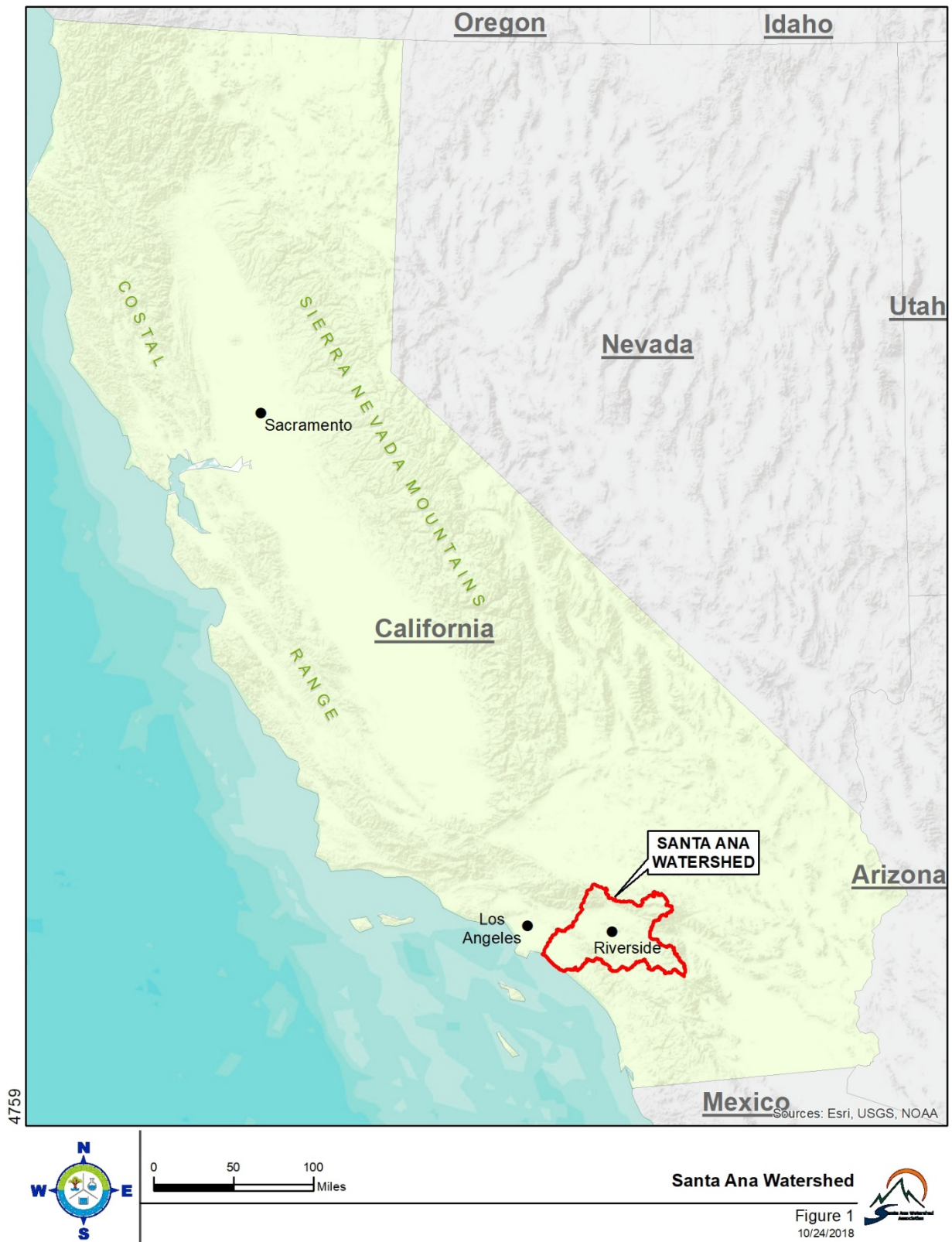




Figure 2. Least Bell's Vireo survey sites in the Santa Ana Watershed, 2018.

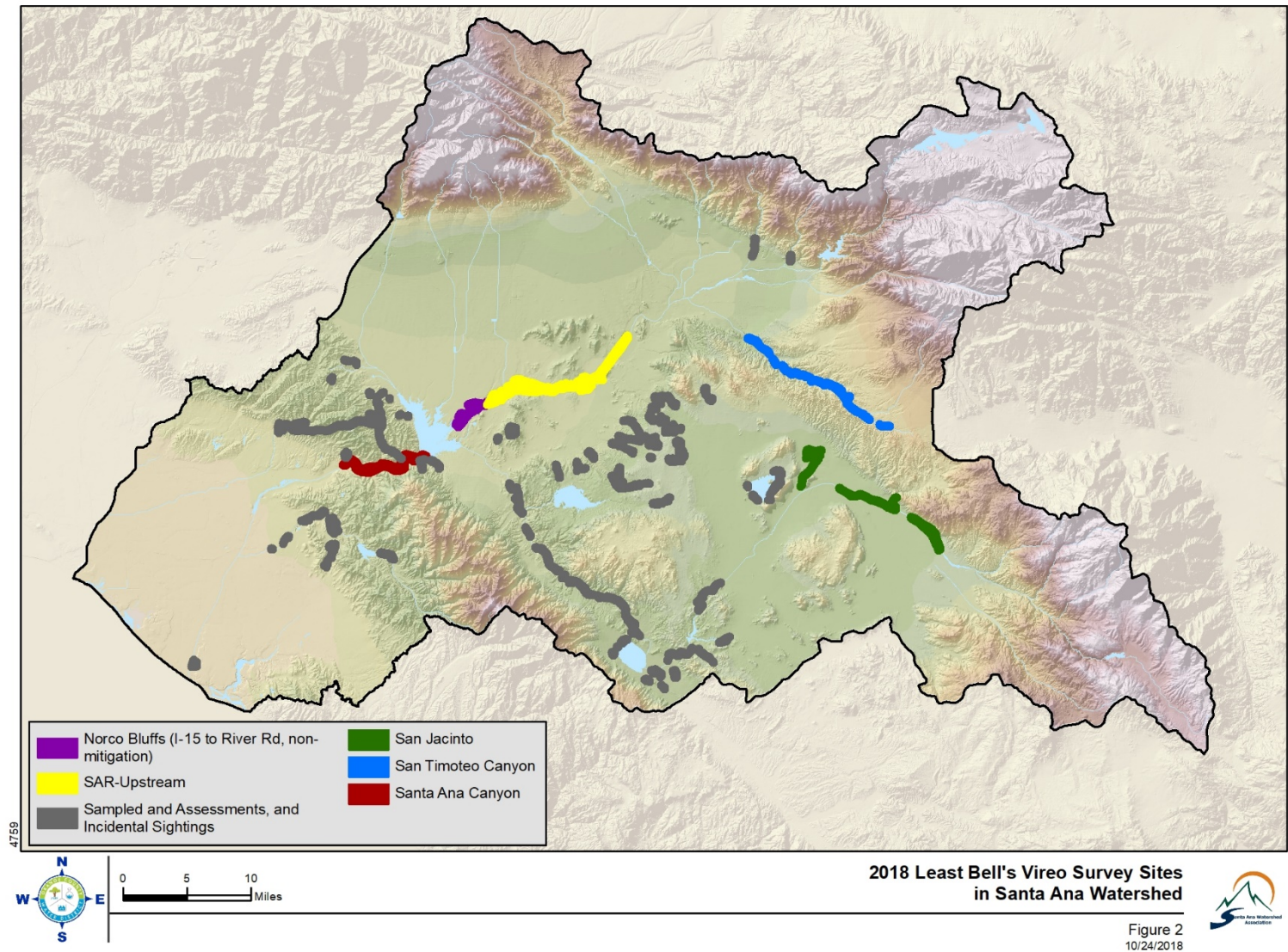




Figure 3. Brown-headed Cowbird trap locations in the Santa Ana Watershed, 2018.

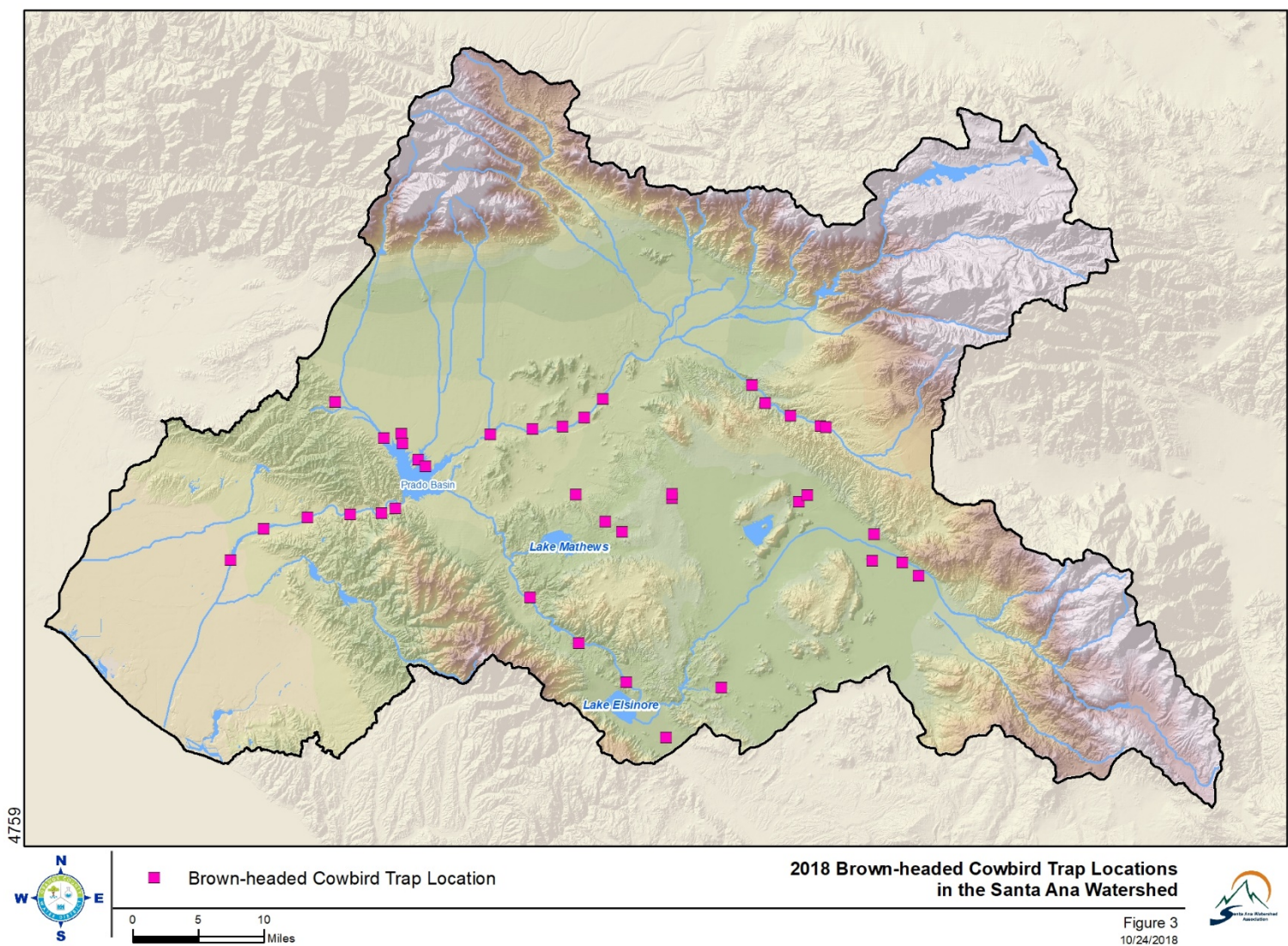
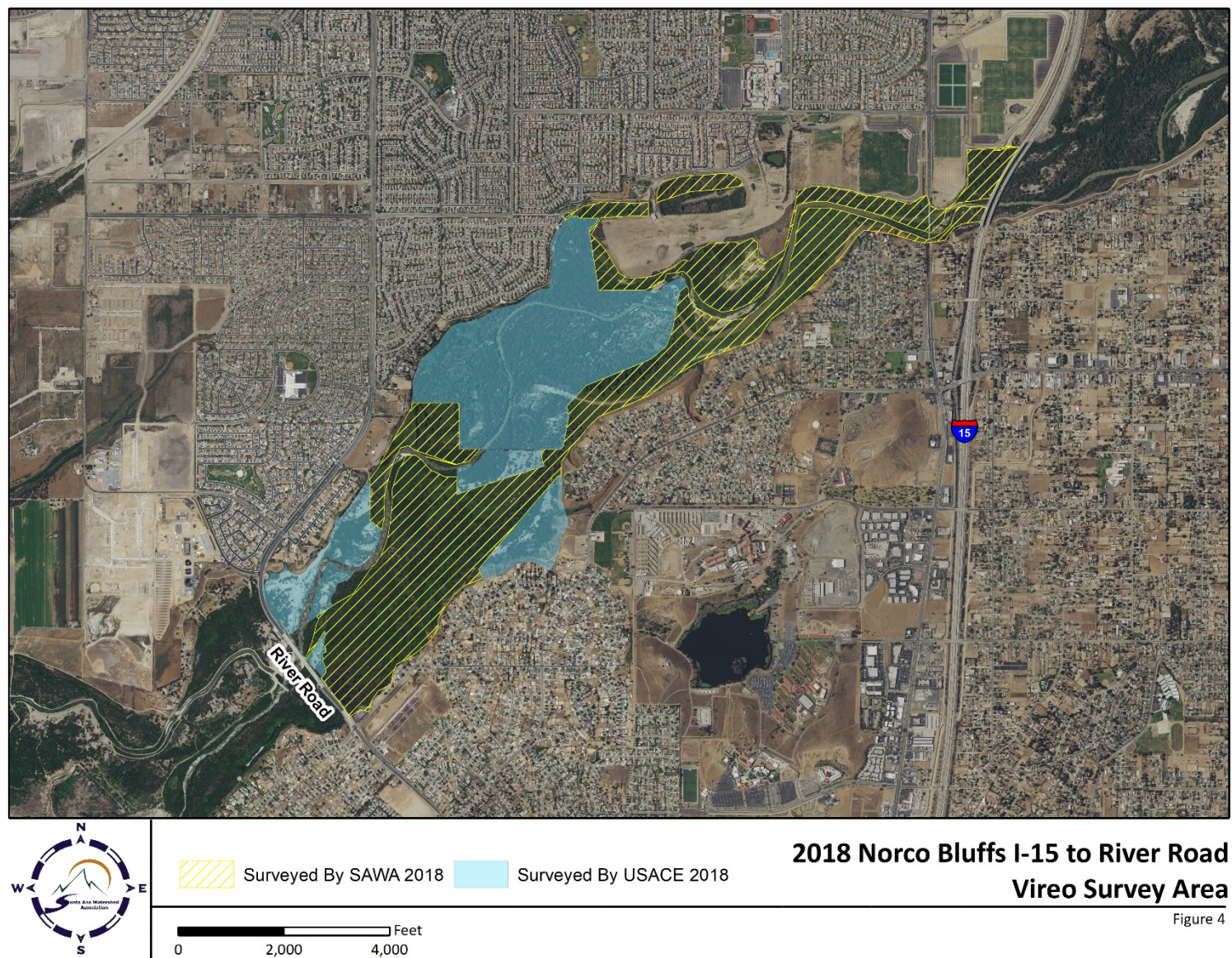




Figure 4. Norco Bluffs Vireo Survey Area.



**2018 Norco Bluffs I-15 to River Road  
Vireo Survey Area**

Figure 4

Figure 5. Least Bell's Vireo abundance in the Santa Ana Watershed, including Prado Basin, 2000-2018.

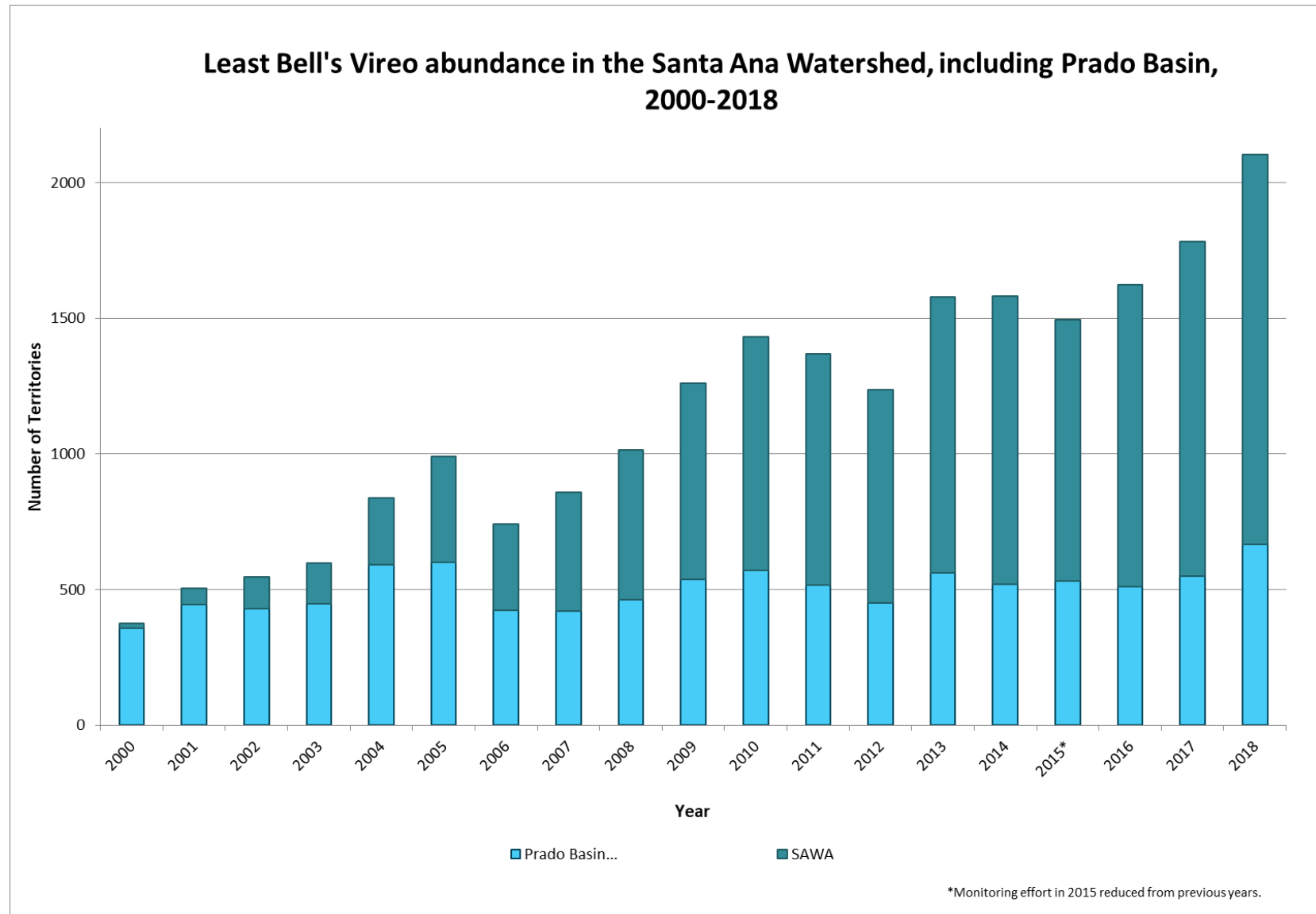


Figure 6. Least Bell's Vireo territories at four sites in the Santa Ana Watershed, 2000-2018.

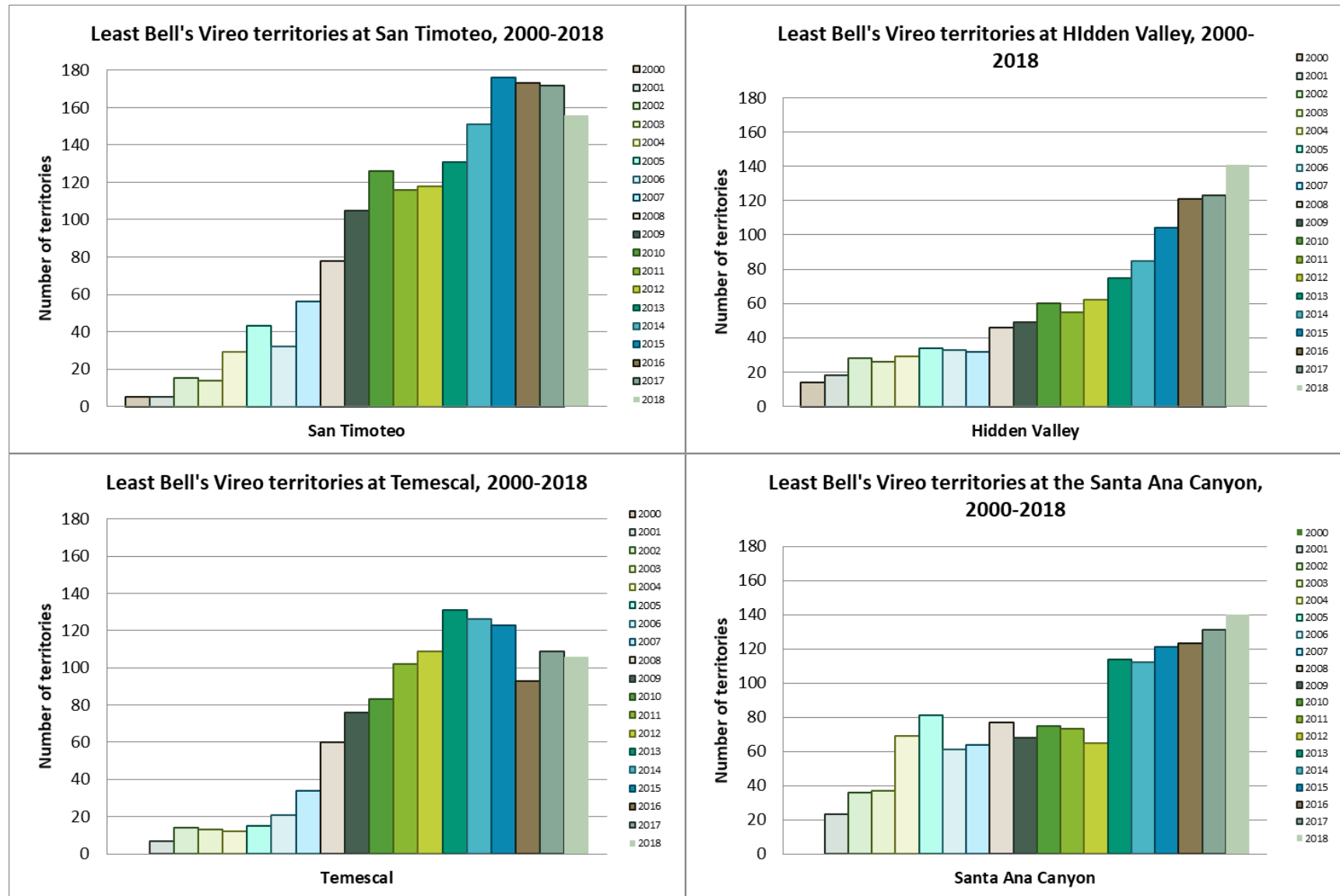


Figure 7. Vireo Territories vs. Parasitism Rates in the Santa Ana Watershed, 2001-2018.

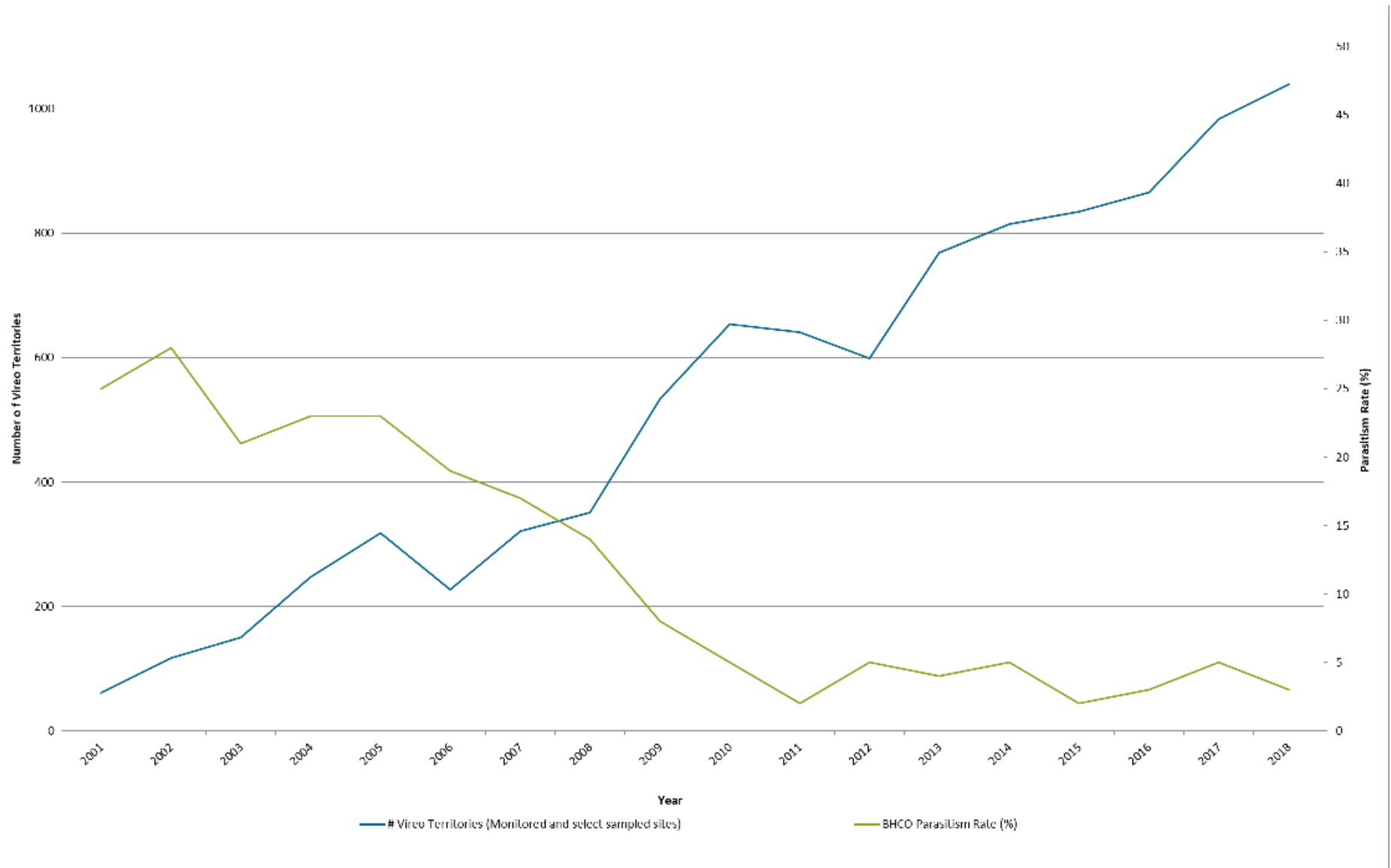




Figure 8. Least Bell's Vireo nesting success, depredation rates, and parasitism rates in the Santa Ana Watershed, 2001-2018.

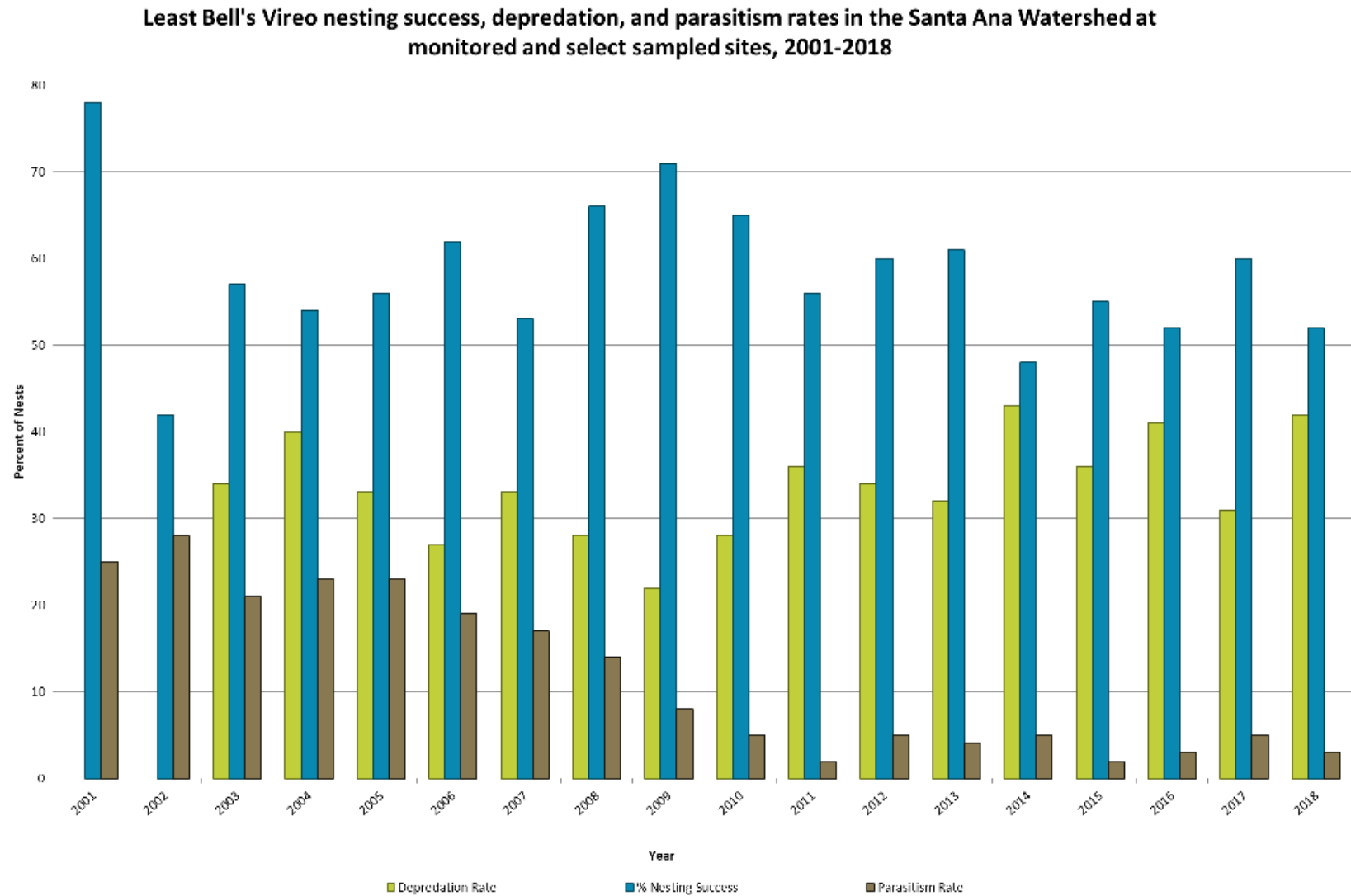




Figure 9. Brown-headed Cowbirds removed from sites in the Santa Ana Watershed, 2000-2018.

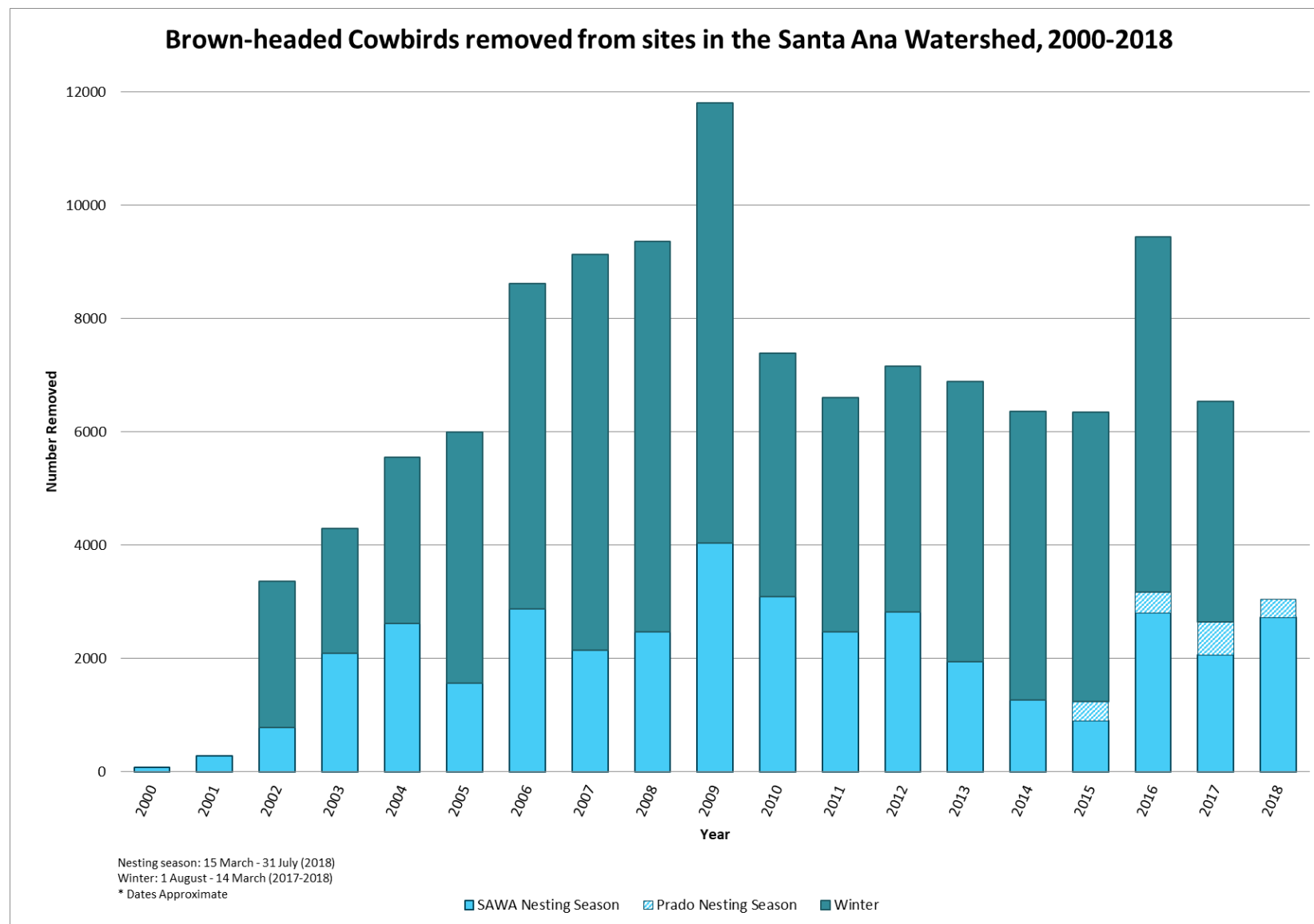


Table 1. Least Bell's Vireo abundance and distribution in the Santa Ana Watershed, 2014-2018. Numbers of territories, pairs, and fledglings detected.

Site Name	2014	2015	2016	2017	2018
<b>Monitored Locations</b>					
San Jacinto	45 / 19 / 12	29 / 7 / 8	37 / 17 / 12	45 / 27 / 48	74 / 34 / 60
San Timoteo Canyon	151 / 135 / 206	176 / 141 / 287	173 / 124 / 222	172 / 109 / 272	156 / 104 / 161
<b>Santa Ana River (SAR) - Upstream</b>					
Riverside Ave. to Van Buren Blvd.	66 / 19 / 15	109 / 37 / 33	109 / 43 / 62	155 / 95 / 169	164 / 96 / 95
Hidden Valley, north side of river	21 / 14 / 19	39 / 23 / 15	40 / 27 / 33	36 / 17 / 34	62 / 38 / 65
Hidden Valley, south side of river	85 / 32 / 28	104 / 27 / 22	121 / 66 / 97	123 / 67 / 87	141 / 60 / 88
Goose Creek, Norco to I-15 (includes Goose Creek mitigation funded by IERCD) <sup>1</sup>	110 / 32 / 36	71 / 36 / 63	63 / 31 / 45	73 / 34 / 54	91 / 56 / 86
Norco Bluffs (I-15 to River Rd., non-mitigation) <sup>1</sup>	n/a	30 / 17 / 43	63 / 28 / 45	69 / 31 / 76	36 / 17 / 39
<b>Santa Ana Canyon (SAC)</b>					
Upper Canyon	27 / 18 / 28	25 / 9 / 10	26 / 12 / 18	30 / 21 / 32	32 / 25 / 23
Green River Golf Club	26 / 19 / 29	31 / 23 / 35	33 / 26 / 27	42 / 33 / 76	42 / 38 / 20
Featherly Regional Park	59 / 39 / 35	65 / 38 / 37	64 / 39 / 23	59 / 36 / 57	66 / 25 / 25
<b>Sampled Locations</b>					
<b>Santa Ana River &amp; Tributaries:</b>					
Alessandro Arroyo/Prenda Arroyo	23 / 4 / 5	n/s	19 / 4 / 3	23 / 7 / 10	20 / 5 / 3
Arlington Falls	0 / 0 / 0	n/s	n/s	n/s	n/s
Box Springs	3 / 2 / 1	n/s	4 / 3 / 4	7 / 1 / 0	3 / 0 / 0
Cajon Wash	n/s	n/s	0 / 0 / 0	n/s	n/s
Canyon Crest	1 / 1 / 0	n/s	1 / 0 / 0	0 / 0 / 0	n/s
Carbon Canyon (Chino Hills Pkwy.)	n/s	n/s	0 / 0 / 0	n/s	n/s
Carbon Canyon Regional Park	16 / 6 / 5	12 / 4 / 4	10 / 2 / 0	14 / 5 / 2	26 / 9 / 5
Castlevue Park	n/s	n/s	n/s	0 / 0 / 0	n/s
Chino Hills	10 / 2 / 3	24 / 6 / 4	18 / 11 / 10	25 / 7 / 3	26 / 9 / 3
Chino Hills (Eucalyptus/Del Monte)	0 / 0 / 0	n/s	n/s	n/s	n/s

Table 1 continued. Least Bell's Vireo abundance and distribution in the Santa Ana Watershed, 2014-2018. Numbers of territories, pairs, and fledglings detected.

Site Name	2014	2015	2016	2017	2018
<b>Sampled Locations</b>					
<b>Santa Ana River &amp; Tributaries:</b>					
Chino Hills (Eucalyptus/Rancho Hills)	2 / 0 / 0	n/s	See Chino Hills	See Chino Hills	See Chino Hills
Chino Hills (Soquel Canyon/Pipeline)	4 / 2 / 3	n/s	See Chino Hills	See Chino Hills	See Chino Hills
Chino Hills Community Park (Eucalyptus/Peyton)	4 / 0 / 0	n/s	See Chino Hills	See Chino Hills	See Chino Hills
Chino Hills State Park (CHSP)	21 / 6 / 4	n/s	15 / 4 / 4	20 / 4 / 4	32 / 9 / 0
City Creek (Highland)	4 / 0 / 0	n/s	2 / 0 / 0	1 / 1 / 0	1 / 0 / 0
Clearwater Pkwy. @ Glen Helen	1 / 0 / 0	0 / 0 / 0	2 / 0 / 0	0 / 0 / 0	n/s
Corona Ave. at Gilmore	3 / 1 / 2	n/s	1 / 0 / 0	1 / 0 / 0	n/s
Fontana Power Plant	0 / 0 / 0	0 / 0 / 0	0 / 0 / 0	n/s	n/s
Fresno Canyon	2 / 0 / 0	2 / 0 / 0	2 / 1 / 0	2 / 0 / 0	0 / 0 / 0
Gavilan Hills	0 / 0 / 0	n/s	n/s	n/s	n/s
Goldenstar	2 / 1 / 0	0 / 0 / 0	1 / 0 / 0	2 / 1 / 2	2 / 0 / 0
Harrison Reservoir (aka McAllister Creek)	3 / 0 / 0	3 / 1 / 0	3 / 2 / 2	5 / 2 / 3	5 / 4 / 1
Hidden Valley Golf Club	8 / 1 / 0	5 / 2 / 2	7 / 2 / 0	9 / 1 / 0	9 / 1 / 1
La Sierra	5 / 1 / 1	n/s	3 / 0 / 0	5 / 2 / 1	2 / 1 / 1
Little Sand Basin	0 / 0 / 0	n/s	0 / 0 / 0	n/s	n/s
Mead Valley (Cajalco/Aqueduct)	5 / 2 / 0	4 / 0 / 0	7 / 3 / 3	13 / 8 / 7	9 / 4 / 0
Meridian Conservation Area (former March SKR Preserve)	21 / 16 / 23	7 / 3 / 3	14 / 5 / 6	16 / 9 / 23	20 / 2 / 2
Mockingbird Canyon	23 / 7 / 7	37 / 23 / 19	25 / 7 / 11	29 / 15 / 15	43 / 15 / 10
Norco Hills Park Mitigation	0 / 0 / 0	n/s	0 / 0 / 0	0 / 0 / 0	n/s
Plunge Creek	3 / 1 / 0	n/s	1 / 1 / 2	2 / 0 / 0	5 / 0 / 0
Poorman Reservoir	6 / 3 / 2	n/s	8 / 2 / 1	9 / 4 / 5	6 / 2 / 0
Promenade	2 / 1 / 1	n/s	n/s	n/s	n/s

Table 1 continued. Least Bell's Vireo abundance and distribution in the Santa Ana Watershed, 2014-2018. Numbers of territories, pairs, and fledglings detected.

Site Name	2014	2015	2016	2017	2018
<b>Sampled Locations</b>					
<b>Santa Ana River &amp; Tributaries:</b>					
Pyrite Channel	0 / 0 / 0	n/s	1 / 0 / 0	0 / 0 / 0	n/s
Quail Run	0 / 0 / 0	n/s	1 / 0 / 0	0 / 0 / 0	3 / 1 / 2
Riverwalk Park	0 / 0 / 0	n/s	n/s	n/s	n/s
Ryan Bonaminio Park	n/s	n/s	n/s	0 / 0 / 0	n/s
Sun Canyon Park	n/s	n/s	0 / 0 / 0	n/s	n/s
Sycamore Canyon	17 / 5 / 2	4 / 1 / 1	13 / 4 / 6	18 / 9 / 9	20 / 8 / 5
Talbert Park (Orange County)	5 / 1 / 0	1 / 0 / 0	7 / 1 / 0	8 / 0 / 0	6 / 0 / 0
Temescal Canyon	126 / 24 / 17	123 / 21 / 22	93 / 9 / 5	109 / 59 / 48	106 / 48 / 16
Tequesquite Arroyo	0 / 0 / 0	n/s	0 / 0 / 0	0 / 0 / 0	n/s
Van Buren Blvd. (Bountiful)	1 / 0 / 0	2 / 0 / 0	2 / 0 / 0	1 / 0 / 0	0 / 0 / 0
Van Buren Blvd. (Porter Rd.)	0 / 0 / 0	n/s	0 / 0 / 0	0 / 0 / 0	n/s
Wardlow Wash	n/s	n/s	n/s	n/s	2 / 1 / 0
Woodcrest	1 / 0 / 0	1 / 1 / 3	1 / 0 / 0	1 / 0 / 0	1 / 0 / 0
Wyle Labs	1 / 0 / 0	0 / 0 / 0	1 / 0 / 0	1 / 0 / 0	3 / 1 / 1
Yorba Linda (San Antonio Rd.)	2 / 1 / 1	1 / 1 / 2	n/s	0 / 0 / 0	n/s
Yorba Linda (Starlight Dr.)	4 / 1 / 1	4 / 1 / 1	1 / 1 / 0	4 / 0 / 0	5 / 0 / 0
Yorba Linda Lakebed Park	1 / 0 / 0	0 / 0 / 0	1 / 0 / 0	0 / 0 / 0	n/s
<b>San Jacinto River Sub-watershed:</b>					
Cottonwood Canyon	2 / 1 / 1	n/s	2 / 1 / 1	2 / 0 / 0	2 / 1 / 1
Kabian Park	7 / 4 / 3	n/s	9 / 4 / 3	8 / 3 / 3	7 / 5 / 2
Lake Perris	20 / 7 / 8	n/s	n/s	n/s	8 / 3 / 0
Menifee (Salt Creek)	10 / 4 / 4	6 / 1 / 1	9 / 3 / 3	9 / 4 / 3	10 / 5 / 2

Table 1 continued. Least Bell's Vireo abundance and distribution in the Santa Ana Watershed, 2014-2018. Numbers of territories, pairs, and fledglings detected.

Site Name	2014	2015	2016	2017	2018
<b>Sampled Locations</b>					
<b>Santiago Creek Sub-watershed:</b>					
Irvine Trust Management Area	1 / 0 / 0	1 / 0 / 0	n/s	0 / 0 / 0	n/s
Limestone Canyon	4 / 4 / 4	n/s	n/s	1 / 0 / 0	n/s
Peter's Canyon	15 / 11 / 7	18 / 4 / 6	25 / 11 / 6	27 / 8 / 9	23 / 7 / 1
Santiago Canyon (Irvine Park)	27 / 9 / 12	24 / 1 / 2	17 / 1 / 0	14 / 1 / 0	18 / 5 / 2
Santiago Creek (above Irvine Lake)	13 / 6 / 7	n/s	2 / 0 / 0	5 / 0 / 0	12 / 2 / 1
Santiago Creek (Cambridge Road)	0 / 0 / 0	0 / 0 / 0	0 / 0 / 0	1 / 0 / 0	1 / 0 / 0
Santiago Creek (Chapman Ave.)	0 / 0 / 0	0 / 0 / 0	0 / 0 / 0	0 / 0 / 0	0 / 0 / 0
Santiago Oaks Regional Park (to Cannon Rd.)	0 / 0 / 0	n/s	n/s	2 / 0 / 0	1 / 0 / 0
Silverado Canyon	0 / 0 / 0	n/s	0 / 0 / 0	n/s	n/s
Smith Basin	2 / 0 / 0	2 / 1 / 0	4 / 0 / 0	3 / 1 / 0	3 / 0 / 0
<b>Incidental Sightings</b>					
Burriss Basin	n/s	n/s	2 / 1 / 4	1 / 1 / 0	0 / 0 / 0
Chino Creek Wetlands Park	1 / 0 / 0	1 / 0 / 0	1 / 0 / 0	1 / 0 / 0	4 / 1 / 1
Conrock Basin FHQ	0 / 0 / 0	0 / 0 / 0	1 / 0 / 0	0 / 0 / 0	1 / 0 / 0
Hwy 71	n/s	n/s	n/s	n/s	1 / 0 / 0
Irvine Lake	n/s	n/s	2 / 1 / 1	2 / 0 / 0	1 / 0 / 0
Raceway Ford	n/s	n/s	n/s	n/s	1 / 0 / 0
Rancho La Sierra West, Riverside	1 / 0 / 0	0 / 0 / 0	1 / 0 / 0	See Hidden Valley, south side of river	See Hidden Valley, south side of river
RLC Alessandro Arroyo - 1.52 ac	See Alessandro Arroyo/Prenda Arroyo	See Alessandro Arroyo/Prenda Arroyo	1 / 0 / 0	See Alessandro Arroyo/Prenda Arroyo	See Alessandro Arroyo/Prenda Arroyo
Santiago Basin	1 / 0 / 0	1 / 0 / 0	1 / 0 / 0	3 / 0 / 0	3 / 0 / 0
Santa Ana River - San Bernardino County Flood Control	See Santa Ana River - San Bernardino County <sup>7</sup>	See Santa Ana River - San Bernardino County <sup>7</sup>	See Santa Ana River - San Bernardino County <sup>7</sup>	See Santa Ana River - San Bernardino County <sup>7</sup>	30 / 3 / 5
Wolfskill	n/s	n/s	n/s	n/s	2 / 1 / 1
<b>SUBTOTAL</b>	1,024 / 462 / 532	962 / 429 / 623	1,070 / 497 / 659	1,208 / 623 / 1,052	1,347 / 646 / 728

Table 1 continued with footnotes. Least Bell's Vireo abundance and distribution in the Santa Ana Watershed, 2014-2018. Numbers of territories, pairs, and fledglings detected.

Site Name	2014	2015	2016	2017	2018
<b>Reported by other agencies</b>					
Lake Perris <sup>2</sup>	See Lake Perris	Not reported	14 / 0 / 0	10 / 0 / 0	See Lake Perris
SAR - Norco Bluffs ACOE Mitigation Areas <sup>3/4/5/6</sup>	38 / 19 / 16	Not reported	14 / 0 / 0	14 / n/a / n/a	76 / n/a / n/a
Santa Ana River - San Bernardino County <sup>7</sup>	Not reported	Not reported	14 / 0 / 0	Not reported	17 / 0 / 0
<b>TOTAL FOR SANTA ANA WATERSHED EXCLUDING PRADO BASIN</b>					
	<b>1,062 / 481 / 548</b>	<b>962 / 429 / 623</b>	<b>1,112 / 497 / 659</b>	<b>1,232 / 623 / 1,052</b>	<b>1,440 / 646 / 728</b>
PRADO BASIN <sup>8</sup>	520 / 172 / 194	532 / 186 / 225	511 / 208 / 328	549 / 218 / 409	665 / n/a / n/a
<b>TOTAL FOR SANTA ANA WATERSHED</b>	<b>1,582 / 653 / 742</b>	<b>1,494 / 615 / 848</b>	<b>1,623 / 705 / 987</b>	<b>1,781 / 841 / 1,461</b>	<b>2,105 / 646 / 728</b>
<b>Outside Watershed</b>					
French Valley, Benton Channel <sup>9</sup>	n/s	n/s	n/s	n/s	1 / 0 / 0
French Valley, Warm Springs <sup>9</sup>	n/s	n/s	n/s	n/s	1 / 0 / 0
Temecula, Santa Gertrudis <sup>9</sup>	n/s	n/s	n/s	n/s	6 / 1 / 0
Wildomar, Helash Mitigation <sup>9</sup>	n/s	n/s	n/s	n/s	4 / 0 / 0

a. Entries correspond to numbers of territorial males/pairs/'known fledged young' for designated time and locale.

b. "n/a" indicates that no data were available.

c. "n/s" indicates that no surveys were conducted.

<sup>1</sup>2010-2014 data combined with data previously reported as "Hidden Valley to River Rd." In 2015 and 2018, USACE mitigation areas excluded from SAWA surveys included 250-acre site; In 2016-2017, SAWA surveys included the 250-acre mitigation area.

<sup>2</sup>Reported by California State Parks.

<sup>3</sup>AECOM personal communication.

<sup>4</sup>Ultrasystems Environmental Inc. Compiled from maps in report by Ryan Ecological Consulting. "Results of Least Bell's Vireo and Southwestern Willow Flycatcher Focus Surveys for the USACE in Target Areas #1-4, April-July 2016."

<sup>5</sup>Ultrasystems Environmental Inc. Compiled from maps in report by Ryan Ecological Consulting. "Results of Least Bell's Vireo and Southwestern Willow Flycatcher Focus Surveys for the USACE in Target Areas #1-4, April-July 2017."

<sup>6</sup>Ultrasystems Environmental Inc. Compiled from maps in report by Ryan Ecological Consulting. "Results of Least Bell's Vireo and Southwestern Willow Flycatcher Focus Surveys for the USACE in Target Areas #1-4, April-July 2018."

<sup>7</sup>Reported by San Bernardino County Flood Control biologist Theresa Sims.

<sup>8</sup>Preliminary data. Bonnie Johnson personal communication.

<sup>9</sup>Outside Santa Ana Watershed, not included in totals.

Table 2. Least Bell's Vireo status and management data, at monitored and select sampled sites in the Santa Ana Watershed, California, 2018.

	Parameter	San Jacinto	San Timoteo Canyon	Mockingbird Canyon	Santa Ana River (SAR) - Upstream				Norco Bluffs (I-15 to River Rd., non-mitigation)	Temescal Canyon	Chino Hills	Santa Ana Canyon (SAC)			Combined
					Riverside Ave. to Van Buren Blvd.	Hidden Valley, north side of river	Hidden Valley, south side of river	Goose Creek, Norco to I-15 (includes Goose Creek mitigation funded by IERCD)				Upper Canyon	Green River Golf Club	Featherly Reg. Park	
A.	Number of territorial males	74	156	43	164	62	141	91	36	106	26	32	42	66	1,039
B.	Number of known pairs (breeding and non-breeding)	34	104	15	96	38	60	56	17	48	9	25	38	25	565
C.	Number of fledged young observed	60	161	10	95	65	88	86	39	16	3	23	20	25	691
D.	Projected total of recruitment of vireo young <sup>1</sup>	75	302	n/a	192	122	144	151	46	n/a	n/a	48	23	53	1,413
E.	Average number of fledglings per pair (C/B)	1.8	1.5	n/a	1.0	1.7	1.5	1.5	2.3	n/a	n/a	0.9	0.5	1.0	1.2
F.	Projected number of fledglings per pair (D/B)	2.2	2.9	n/a	2.0	3.2	2.4	2.7	2.7	n/a	n/a	1.9	0.6	2.1	2.5
G.	This row purposefully omitted.														
H.	Rate of cowbird nest parasitism (well-tracked nests)	10% 3 / 30	0% 0 / 63	n/a	21% 5 / 24	0% 0 / 25	0% 0 / 45	0% 0 / 25	0% 0 / 15	n/a	50% 1 / 2	0% 0 / 10	0% 0 / 16	0% 0 / 12	3% 9 / 267
I.	Number of cowbirds removed from study area <sup>2</sup>	2,099	88	52	14	19	n/a	11	n/a	212	23	94	-1	26	2,637
J.	This row purposefully omitted.														
K.	Number of trap days (1 operative trap day in the field for one day = 1 trap day) <sup>2</sup>	659	574	295	266	113	n/a	110	n/a	547	92	118	83	239	3,096
L.	Average number of cowbirds trapped per trap day (I/K)	3.19	0.15	0.18	0.05	0.17	n/a	0.10	n/a	0.39	0.25	0.80	0.00	0.11	0.85
M.	Number of field hours - LBVI	295	366	60	367	128	278	151	130	170	35	133	152	207	2,472
N.	Number of field hours - BHCO	356	235	192	303				n/a	328	n/a	184			1,598

<sup>1</sup>Survival rate of fledglings in well-tracked nests was applied to nests not visited as frequently by the function (avg. # fledglings produced by well-tracked pairs x total number of pairs). These data represent minimum recruitment as defined by the Least Bell's Vireo Working Group "known fledged young."

<sup>2</sup>All traps are not accounted for in this total. See Table 6.



Table 3. Least Bell's Vireo survey dates and breeding chronology, monitored and select sampled sites, 2018.

	San Jacinto	San Timoteo Canyon	Mockingbird Canyon	Santa Ana River (SAR) - Upstream				Norco Bluffs (I-15 to River Rd., non-mitigation)	Temescal Canyon	Chino Hills	Santa Ana Canyon (SAC)		
				Riverside Ave. to Van Buren Blvd.	Hidden Valley, north side of river	Hidden Valley, south side of river	Goose Creek, Norco to I-15 (includes Goose Creek mitigation funded by IERCD)				Upper Canyon	Green River Golf Club	Featherly Reg. Park
Survey Start Date <sup>1</sup>	26-Mar	27-Mar	10-Apr	21-Mar	27-Mar	13-Mar	28-Mar	20-Mar	3-Apr	5-Apr	2-Apr	3-Apr	28-Mar
Survey End Date	23-Jul	7-Aug	18-Jul	22-Aug	20-Jul	24-Jul	23-Jul	30-Jul	20-Jul	12-Jul	24-Jul	19-Jul	2-Aug
Date First Detected	21-Mar	29-Mar	10-Apr	30-Mar	2-Apr	29-Mar	26-Mar	28-Mar	3-Apr	5-Apr	2-Apr	28-Mar	2-Apr
50% Arrival Observed	5-Apr	13-Apr	3-May	20-Apr	23-Apr	26-Apr	10-Apr	18-Apr	26-Apr	n/a	11-Apr	9-Apr	24-Apr
50% Pairs Observed	18-Apr	19-Apr	n/a	7-May	27-Apr	7-May	25-Apr	4-May	n/a	n/a	26-Apr	23-Apr	n/a
First Nest Found	5-Apr	5-Apr	11-Jul	24-Apr	20-Apr	11-Apr	16-Apr	18-Apr	3-May	14-May	26-Apr	16-Apr	25-Apr
Last Nest Found	21-Jun	6-Jul	11-Jul	25-Jun	27-Jun	14-Jun	5-Jul	14-Jun	27-Jun	18-Jun	2-Jul	20-Jun	22-Jun
First Nest Fledge	16-May	13-May	n/a	12-May	14-May	21-May	13-May	14-May	n/a	n/a	14-May	21-May	24-Jun
Last Nest Fledge	16-Jul	6-Jul	n/a	15-Jul	17-Jul	17-Jul	11-Jul	17-Jul	n/a	n/a	16-Jul	1-Jul	6-Jul
Date Last Detected <sup>2</sup>	22-Aug	28-Aug	18-Jul	22-Aug	20-Jul	24-Jul	23-Jul	30-Jul	20-Jul	12-Jul	24-Jul	29-Aug	2-Aug

<sup>1</sup> First date of full survey specifically for Least Bell's Vireo

<sup>2</sup> May vary from last survey date as an incidental sighting as opposed to a targeted survey.

Table 4. Least Bell's Vireo nest placement preferences for all nests discovered at monitored and select sampled sites in the Santa Ana River Watershed, 2018.

Host Plant Species (listed in taxonomic order)	San Jacinto	San Timoteo Canyon	Mockingbird Canyon	Santa Ana River (SAR) - Upstream				Norco Bluffs (I-15 to River Rd., non-mitigation)	Temescal Canyon	Chino Hills	Santa Ana Canyon (SAC)			Combined	Percentage of Combined
				Riverside Ave. to Van Buren Blvd.	Hidden Valley, north side of river	Hidden Valley, south side of river	Goose Creek, Norco to I-15 (includes Goose Creek mitigation funded by IERCD)				Upper Canyon	Green River Golf Club	Featherly Reg. Park		
Giant Reed <sup>ie</sup> ( <i>Arundo donax</i> )					1									1	<1%
Western Sycamore ( <i>Platanus racemosa</i> )					1								1	2	1%
California Scrub Oak ( <i>Quercus berberidifolia</i> )		1												1	<1%
Southern California Black Walnut <sup>r</sup> ( <i>Juglans californica</i> )		1												1	<1%
Fremont Cottonwood ( <i>Populus fremontii</i> )	1	8			1		3				1	4	3	21	6%
Narrowleaf Willow ( <i>Salix exigua</i> )	23	1				1	1							26	8%
Goodding's Black Willow ( <i>Salix gooddingii</i> )	5	3		5	2	5		3				1		24	7%
Red Willow ( <i>Salix laevigata</i> )		6		6		2	6				1		1	22	7%
Arroyo Willow ( <i>Salix lasiolepis</i> )		26		3	5	17	5	5					1	62	19%
Dead Arroyo Willow ( <i>Salix lasiolepis</i> )								1						1	<1%
Willow sp. ( <i>Salix</i> sp.)				1			2							3	1%
Tamarisk <sup>ie</sup> ( <i>Tamarix ramosissima</i> )	3					1							1	5	2%
California Wild Rose ( <i>Rosa californica</i> )								1						1	<1%
Desert Wild Grape ( <i>Vitis girdiana</i> )		8		4		4	1	2						19	6%
Laurel Sumac ( <i>Malosma laurina</i> )											1	3	5	9	3%

Table 4 continued. Least Bell's Vireo nest placement preferences for all nests discovered at monitored and select sampled sites in the Santa Ana River Watershed, 2018.

Host Plant Species (listed in taxonomic order)	San Jacinto	San Timoteo Canyon	Mockingbird Canyon	Santa Ana River (SAR) - Upstream				Norco Bluffs (I-15 to River Rd., non-mitigation)	Temescal Canyon	Chino Hills	Santa Ana Canyon (SAC)			Combined	Percentage of Combined
				Riverside Ave. to Van Buren Blvd.	Hidden Valley, north side of river	Hidden Valley, south side of river	Goose Creek, Norco to I-15 (includes Goose Creek mitigation funded by IERCD)				Upper Canyon	Green River Golf Club	Featherly Reg. Park		
Peruvian Pepper Tree <sup>ie</sup> ( <i>Schinus molle</i> )										1	1	2		4	1%
Sugar Sumac ( <i>Rhus ovata</i> )		1												1	<1%
Tree of Heaven <sup>ie</sup> ( <i>Ailanthus altissima</i> )												1		1	<1%
Tree Tobacco <sup>ie</sup> ( <i>Nicotiana glauca</i> )												1		1	<1%
Black Sage ( <i>Salvia mellifera</i> )													1	1	<1%
Blue Elderberry ( <i>Sambucus nigra</i> ssp. <i>caerulea</i> )		1								1	2	1		5	2%
Arrowweed ( <i>Pluchea sericea</i> )	1													1	<1%
Coyote Brush ( <i>Baccharis pilularis</i> )	3											1		4	1%
Mulefat ( <i>Baccharis salicifolia</i> )	1	19		10	15	17	9	4			7	6	5	93	28%
California Sagebrush ( <i>Artemisia californica</i> )							1							1	<1%
Goodding's Black Willow ( <i>S. gooddingii</i> ) and Desert Wild Grape ( <i>V. girdiana</i> )				1										1	<1%
Unknown/No Data	1			2					19					22	7%
Total	38	75	0	32	25	47	28	16	19	2	13	20	18	333	100%

<sup>i</sup> = invasive

<sup>e</sup> = non-native

<sup>r</sup> = endangered, threatened, or sensitive

Table 5. Least Bell's Vireo reproductive success and breeding biology data at monitored and select sampled sites in the Santa Ana River Watershed, 2018.

	Parameter	San Jacinto	San Timoteo Canyon	Mockingbird Canyon	Santa Ana River (SAR) - Upstream				Norco Bluffs (I-15 to River Rd., non-mitigation)	Temescal Canyon	Chino Hills	Santa Ana Canyon (SAC)			Combined
					Riverside Ave. to Van Buren Blvd.	Hidden Valley, north side of river	Hidden Valley, south side of river	Goose Creek, Norco to I-15 (includes Goose Creek mitigation funded by IERCD)				Upper Canyon	Green River Golf Club	Featherly Reg. Park	
A.	Number of known pairs	34	104	15	96	38	60	56	17	48	9	25	38	25	565
B.	Number of known breeding (nesting) pairs	30	85	10	68	35	46	46	17	21	5	15	22	18	418
C.	Number of breeding pairs that were well-monitored throughout the breeding season	18	30	0	12	11	28	16	13	0	0	7	5	8	148
D.	Number of 'known fledged young' OBSERVED	60	161	10	95	65	88	86	39	16	3	23	20	25	691
E.	Number of known fledged young produced by pairs monitored throughout the breeding season	40	86	n/a	24	35	67	43	35	n/a	n/a	13	3	17	363
F.	Average number of fledglings produced per breeding pair (minimum; D/B = 'productivity or breeding success')	2.0	1.9	n/a	1.4	1.9	1.9	1.9	2.3	n/a	n/a	1.5	0.9	1.4	1.7
G.	Average number of fledglings produced by well-monitored pairs (E/C = reproductive success)	2.2	2.9	n/a	2.0	3.2	2.4	2.7	2.7	n/a	n/a	1.9	0.6	2.1	2.5
H.	Number of nests that were discovered	38	75	0	32	25	47	28	16	19	2	13	20	18	333
I.	Number of well-tracked nests	30	63	n/a	24	25	45	25	15	0	2	10	16	12	267
J.	Number of well-tracked nests that were successful (% = J/I x 100)	63% 19 / 30	44% 28 / 63	n/a	63% 15 / 24	56% 14 / 25	49% 22 / 45	64% 16 / 25	73% 11 / 15	n/a	0% 0 / 2	50% 5 / 10	25% 4 / 16	50% 6 / 12	52% 140 / 267
K.	This row purposefully omitted														
L.	Number of well-tracked nests that were parasitized by cowbirds (% = L/I x 100)	10% 3 / 30	0% 0 / 63	n/a	21% 5 / 24	0% 0 / 25	0% 0 / 45	0% 0 / 25	0% 0 / 15	n/a	50% 1 / 2	0% 0 / 10	0% 0 / 16	0% 0 / 12	3% 9 / 267
M.	A. Number of well-tracked nests that failed as a result of reproductive failure	7% 2 / 30	8% 5 / 63	n/a	0% 0 / 24	0% 0 / 25	4% 2 / 45	0% 0 / 25	7% 1 / 15	n/a	0% 0 / 2	0% 0 / 10	0% 0 / 16	0% 0 / 12	4% 10 / 267
	B. Number of well-tracked nests that failed as a result of parasitism	7% 2 / 30	0% 0 / 63	n/a	0% 0 / 24	0% 0 / 25	0% 0 / 45	0% 0 / 25	0% 0 / 15	n/a	0% 0 / 2	0% 0 / 10	0% 0 / 16	0% 0 / 12	1% 2 / 267
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	23% 7 / 30	48% 30 / 63	n/a	38% 9 / 24	44% 11 / 25	47% 21 / 45	36% 9 / 25	20% 3 / 15	n/a	100% 2 / 2	50% 5 / 10	69% 11 / 16	42% 5 / 12	42% 113 / 267

Table 5 continued. Least Bell's Vireo reproductive success and breeding biology data at monitored and select sampled sites in the Santa Ana River Watershed, 2018.

	Parameter	San Jacinto	San Timoteo Canyon	Mockingbird Canyon	Santa Ana River (SAR) - Upstream				Norco Bluffs (I-15 to River Rd., non-mitigation)	Temescal Canyon	Chino Hills	Santa Ana Canyon (SAC)			Combined
					Riverside Ave. to Van Buren Blvd.	Hidden Valley, north side of river	Hidden Valley, south side of river	Goose Creek, Norco to I-15 (includes Goose Creek mitigation funded by IERCD)				Upper Canyon	Green River Golf Club	Featherly Reg. Park	
M.	D. Number of well-tracked nests that failed for unknown reasons	0 / 30	0 / 63		0% 0 / 24	0% 0 / 25	0% 0 / 45	0% 0 / 25	0 / 15		0 / 2	0% 0 / 10	6% 1 / 16	8% 1 / 12	<1% 2 / 267
	Average clutch size	3.0	3.4	n/a	3.2	3.7	3.5	3.8	3.6	n/a	n/a	3.1	3.4	3.0	3.4
N.	Number of eggs/Number of clutches	85 / 28	201 / 60	n/a	67 / 21	85 / 23	157 / 45	94 / 25	57 / 16	n/a	n/a	31 / 10	48 / 14	33 / 11	858 / 253
O.	Number of cowbird eggs found in or near vireo nests	3	2	n/a	6	0	0	0	0	n/a	1	0	0	0	12
P.	Number of cowbird nestlings removed from vireo nests	0	0	n/a	0	0	0	0	0	n/a	0	0	0	0	0
Q.	Number of cowbird young fledged by vireo	0	0	n/a	0	0	0	0	0	n/a	0	0	0	0	0
R.	Number of 'manipulated' parasitized nests	3	0	n/a	5	n/a	n/a	n/a	n/a	n/a	1	n/a	n/a	n/a	9
S.	Number of 'successful, manipulated' nests (% = S/R x 100)	33% 1 / 3	n/a	n/a	60% 3 / 5	n/a	n/a	n/a	n/a	n/a	0% 0 / 1	n/a	n/a	n/a	44% 4 / 9
T.	Number of vireo fledged from 'manipulated' parasitized nests	1	n/a	n/a	8	n/a	n/a	n/a	n/a	n/a	0	n/a	n/a	n/a	9
U.	Number of repaired nests	0	1	n/a	0	0	1	1	0	n/a	1	0	0	0	4
V.	% of successful repaired nests	n/a	0% 0 / 1	n/a	n/a	n/a	100% 1 / 1	100% 1 / 1	n/a	n/a	0% 0 / 1	n/a	n/a	n/a	50% 2 / 4
W.	Number of vireo fledged from repaired nests	n/a	0	n/a	n/a	n/a	3	3	n/a	n/a	0	n/a	n/a	n/a	6

Table 6. Brown-headed Cowbird trapping results, March-July 2018 (grouped by funding source).

Site Name	Trap/Location	2018 Dates of Operation	Number of Trap Days	Cowbirds Removed				Daily Removed Averages	
				Total	Male	Female	Juveniles	Adults	All
USFWS/USACE-SARM Project									
San Jacinto	SJWA A1	3/26-7/11	97	32	18	14	0	0.33	0.33
	SJWA E1	3/26-7/25	108	217	113	97	7	1.94	2.01
	Diaz	3/26-7/19	111	8	4	3	1	0.06	0.07
Subtotal			316	257	135	114	8	0.79	0.81
Santa Ana River (upstream)	Fairmount Park	3/26-7/24	115	18	17	1	0	0.16	0.16
	Crestmore	3/26-7/24	114	2	3	-1	0	0.02	0.02
	Sunnyslope	3/26-5/7	37	-6	-2	-4	0	-0.16	-0.16
	Riverdale	3/26-7/22	113	19	9	8	2	0.15	0.17
	Goose Creek 2	3/26-7/21	110	11	7	2	2	0.08	0.10
Subtotal			489	44	34	6	4	0.08	0.09
Mockingbird Canyon	Reservoir	3/27-7/25	112	35	21	14	0	0.31	0.31
	Estates	3/28-7/25	113	17	12	5	0	0.15	0.15
	Ungerer	3/28-6/12	70	0	1	-1	0	0.00	0.00
Subtotal			295	52	34	18	0	0.18	0.18
Prado/Chino Hills	McCoy	4/20-7/23	92	23	15	8	0	0.25	0.25
	IEUA	3/26-7/23	117	60	27	31	2	0.50	0.51
	Regional Park	3/26-6/27	92	0	0	0	0	0.00	0.00
	Olive Grove	3/27-7/5	73	5	2	2	1	0.05	0.07
	Trailer	3/27-7/24	105	11	5	6	0	0.10	0.10
Subtotal			479	99	49	47	3	0.20	0.21

Table 6 continued. Brown-headed Cowbird trapping results, March-July 2018 (grouped by funding source).

Site Name	Trap/Location	2018 Dates of Operation	Number of Trap Days	Cowbirds Removed				Daily Removed Averages	
				Total	Male	Female	Juveniles	Adults	All
<b>Temescal</b>	New Sump	3/27-7/24	112	4	1	3	0	0.04	0.04
	Rockery	3/28-7/25	112	12	11	0	1	0.10	0.11
	Baker	3/26-7/16	105	18	10	8	0	0.17	0.17
	Salt Creek	3/26-7/16	105	17	8	9	0	0.16	0.16
<b>Subtotal</b>			<b>434</b>	<b>51</b>	<b>30</b>	<b>20</b>	<b>1</b>	<b>0.12</b>	<b>0.12</b>
<b>San Jacinto, Prado and Lake Elsinore Dairies</b>	Vanderwoude 2	3/27-7/25	112	688	598	70	20	5.96	6.14
	Tuls 1	3/27-7/25	116	602	527	65	10	5.10	5.19
	Scott Bros	3/26-7/25	115	552	445	95	12	4.70	4.80
	Euclid 1	3/26-7/27	121	228	114	94	20	1.72	1.88
	Euclid 2	3/27-7/27	120	20	-5	22	3	0.14	0.17
	Dejongs	3/27-7/25	113	161	90	67	4	1.39	1.42
<b>Subtotal</b>			<b>697</b>	<b>2,251</b>	<b>1,769</b>	<b>413</b>	<b>69</b>	<b>3.13</b>	<b>3.23</b>
<b>Santa Ana Canyon</b>	Yorba Park	3/28-7/24	119	26	18	8	0	0.22	0.22
	RV Park E	3/27-7/24	120	0	0	0	0	0.00	0.00
	GR Golf W	5/2-7/23	83	-1	0	-1	0	0.00	0.00
	GR Eq	3/27-7/23	118	94	63	31	0	0.80	0.80
<b>Subtotal</b>			<b>440</b>	<b>119</b>	<b>81</b>	<b>38</b>	<b>0</b>	<b>0.27</b>	<b>0.27</b>
<b>Anaheim</b>	Burris Basin	3/29-7/25	117	8	1	7	0	0.07	0.07
	Conrock	3/28-7/25	120	64	39	23	2	0.52	0.53
<b>Subtotal</b>			<b>237</b>	<b>72</b>	<b>40</b>	<b>30</b>	<b>2</b>	<b>0.30</b>	<b>0.30</b>
<b>TOTAL (USFWS/USACE-SARM Project)</b>			<b>3,387</b>	<b>2,945</b>	<b>2,172</b>	<b>686</b>	<b>87</b>	<b>0.84</b>	<b>0.87</b>



Table 6 continued. Brown-headed Cowbird trapping results, March-July 2018 (grouped by funding source).

Site Name	Trap/Location	2018 Dates of Operation	Number of Trap Days	Cowbirds Removed				Daily Removed Averages	
				Total	Male	Female	Juveniles	Adults	All
<b>IERCD</b>									
<b>San Timoteo</b>	Bees	3/29-7/23	111	14	11	3	0	0.13	0.13
	Headlee	3/26-7/23	118	23	7	16	0	0.19	0.19
	Harned	3/26-7/24	119	10	8	0	2	0.07	0.08
	Fishermans	3/26-7/20	111	37	23	13	1	0.32	0.33
	Younglove 1	3/26 -7/20	115	4	4	0	0	0.03	0.03
<b>Subtotal</b>			<b>574</b>	<b>88</b>	<b>53</b>	<b>32</b>	<b>3</b>	<b>0.15</b>	<b>0.15</b>
<b>Riverside Land Conservancy</b>									
<b>Meridian C.A.</b>	Meridian 1	3/27-7/23	110	4	4	0	0	0.04	0.04
<b>(former March SKR Preserve)</b>	Meridian 2	3/27-7/24	111	2	1	1	0	0.02	0.02
<b>Subtotal</b>			<b>221</b>	<b>6</b>	<b>5</b>	<b>1</b>	<b>0</b>	<b>0.03</b>	<b>0.03</b>
<b>GRAND TOTAL</b>			<b>4,182</b>	<b>3,039</b>	<b>2,230</b>	<b>719</b>	<b>90</b>	<b>0.71</b>	<b>0.73</b>
<b>*TOTAL BHCO FIELD HOURS</b>		<b>2,114</b>							

\*hours also include installation and removal of traps from field

Table 7. Non-target avian captures in Brown-headed Cowbird traps, March-July 2018.

2018 Non-target Species*		USFWS/USACE-SARM Project																IERCD		Riverside Land Conservancy		2018 Total	
		San Jacinto		Santa Ana River (upstream)		Mockingbird Canyon		Prado		Temescal		Prado, San Jacinto, and Lake Elsinore Dairies		Santa Ana Canyon		Anaheim		San Timoteo		Meridian C.A.			
Common Name	Scientific Name	caught	died	caught	died	caught	died	caught	died	caught	died	caught	died	caught	died	caught	died	caught	died	caught	died	caught	died
California Towhee	<i>Melospiza crissalis</i>	5	0	8	0	30	0	57	1	307	1			20	0	11	1	588	6	190	0	1,216	9
Red-winged Blackbird	<i>Agelaius phoeniceus</i>	431	0			3	0			3	0	36	1			7	0	404	1	24	0	908	2
House Finch	<i>Haemorhous mexicanus</i>	5	0	18	1	199	6	41	1	2	0	1	0	3	0	22	0	3	0	43	0	337	8
Yellow-headed Blackbird	<i>Xanthocephalus xanthocephalus</i>	1	0			112	0	1	0			54	0	2	0			95	0	6	0	271	0
White-crowned Sparrow	<i>Zonotrichia leucophrys</i>							1	0									58	0			59	0
Northern Mockingbird	<i>Mimus polyglottos</i>	17	1	2	0			2	0	3	0			3	0	6	0	1	0	2	0	36	1
Tri-colored Blackbird	<i>Agelaius tricolor</i>	8	0					1	0			30	0	3	0							42	0
Song Sparrow	<i>Melospiza melodia</i>							37	0	3	0							1	0			41	0
Lark Sparrow	<i>Chondestes grammacus</i>																	24	0	1	0	25	0
Hooded Oriole	<i>Icterus cucullatus</i>			9	1													4	0			13	1
Brewer's Blackbird	<i>Euphagus cyanocephalus</i>	1	0									10	0									11	0
Black-headed Grosbeak	<i>Pheucticus melanocephalus</i>	1	0	1	0							1	0					3	0	1	0	7	0
Common Ground Dove	<i>Columbina passerina</i>			1	1			1	0									4	1			6	2
Cooper's Hawk	<i>Accipiter cooperii</i>					3	0					2	0			1	0					6	0
Loggerhead Shrike	<i>Lanius ludovicianus</i>	3	0																			3	0
American Kestrel	<i>Falco sparverius</i>									2	0	1	0									3	0
California Scrub Jay	<i>Aphelocoma californica</i>					1	0	1	0	1	0											3	0
Bewick's Wren	<i>Thryomanes bewickii</i>									2	0					1	0					3	0
Say's Phoebe	<i>Sayornis saya</i>	2	0																			2	0
Great-tailed Grackle	<i>Quiscalus mexicanus</i>															1	0	1	0			2	0
Mourning Dove	<i>Zenaidura macroura</i>	1	0																			1	0
Black Phoebe	<i>Sayornis nigricans</i>	1	0																			1	0

Table 7 continued. Non-target avian captures in Brown-headed Cowbird traps, March-July 2018.

2018 Non-target Species*		USFWS/USACE/SARM Project																IERCD		Riverside Land Conservancy		2018 Total	
		San Jacinto		Santa Ana River (upstream)		Mockingbird Canyon		Prado		Temescal		Prado, San Jacinto, and Lake Elsinore Dairies		Santa Ana Canyon		Anaheim		San Timoteo		Meridian C.A.			
Common Name	Scientific Name	caught	died	caught	died	caught	died	caught	died	caught	died	caught	died	caught	died	caught	died	caught	died	caught	died	caught	died
Bullock's Oriole	<i>Icterus bullockii</i>															1	0					1	0
TOTAL		476	1	39	3	348	6	142	2	323	1	135	1	31	0	50	1	1,186	8	267	0	2,997	23
#/trap day		1.5		0.1		1.2		0.3		0.7		0.2		0.1		0.2		2.1		1.2		0.7	
Mortality %			0.2%		7.7%		1.7%		1.4%		0.3%		0.7%		0.0%		2.0%		0.7%		0.0%		0.8%

\*Number of dead non-targets included in number caught

Non-native captures in Brown-headed Cowbird Traps, March-July 2018.

2018 Non-native Species**		USFWS/USACE/SARM Project																IERCD		Riverside Land Conservancy		2018 Total	
		San Jacinto		Santa Ana River (upstream)		Mockingbird Canyon		Prado		Temescal		Prado, San Jacinto, and Lake Elsinore Dairies		Santa Ana Canyon		Anaheim		San Timoteo		Meridian C.A.			
Common Name	Scientific Name	Rel1	Rem2	Rel1	Rem2	Rel1	Rem2	Rel1	Rem2	Rel1	Rem2	Rel1	Rem2	Rel1	Rem2	Rel1	Rem2	Rel1	Rem2	Rel1	Rem2	Rel1	Rem2
House Sparrow	<i>Passer domesticus</i>	33	53	7	3	2	0	1	36	3	0	10	120			19	56	15	30			90	298
European Starling	<i>Sturnus vulgaris</i>	14	0	0	2	1	0	0	1	1	0	44	97	0	33	0	18	10	1			70	152
Eurasian Collared Dove	<i>Streptopelia decaocto</i>											3	0									3	0
Scaly-breasted Munia	<i>Lonchura punctulata</i>															1	0					1	0
Red-crested Cardinal	<i>Paroaria coronata</i>							1	0													1	0
TOTAL		47	53	7	5	3	0	2	37	4	0	57	217	0	33	20	74	25	31	0	0	165	450

\*\*Non-natives removed under CDFW authorization to control Brown-headed Cowbirds

Rel1: Released from trap and back into habitat.

Rel2: Removed from trap and habitat.

Table 8. Brown-headed Cowbird trapping results, winter 2017-2018.

Site Name	Trap/Location	Dates of Operation	Number of Trap Days	Cowbirds Removed				Daily Removed Averages	
				Total	Male	Female	Juveniles	Adults	All
<b>Temescal</b>	Dejong's Dairy	7/31/17-2/22/18	137	984	284	335	365	4.5	7.2
<b>Prado</b>	Euclid Dairy	7/31/17-3/16/18	156	1,664	348	686	630	6.6	10.7
	Weststeyn 1 Dairy	8/3/17-3/16/18	153	1,056	200	506	350	4.6	6.9
	Weststeyn 2 Dairy	8/3/17-3/15/18	152	189	21	129	39	1.0	1.2
<b>Subtotal</b>			<b>461</b>	<b>2,909</b>	<b>569</b>	<b>1,321</b>	<b>1,019</b>	<b>4.1</b>	<b>6.3</b>
<b>TOTAL</b>			<b>598</b>	<b>3,893</b>	<b>853</b>	<b>1,656</b>	<b>1,384</b>	<b>4.2</b>	<b>6.5</b>

Table 9. Non-target avian captures in Brown-headed Cowbird traps, winter, 2017-2018.

2017-2018 Winter Non-target Species		Temescal		Prado		TOTAL	
Common Name	Scientific Name	caught	died	caught	died	caught	died
Red-winged Blackbird	<i>Agelaius phoeniceus</i>	59	1	16	0	75	1
Yellow-headed Blackbird	<i>Xanthocephalus xanthocephalus</i>	16	0	2	0	18	0
Great-tailed Grackle	<i>Quiscalus mexicanus</i>			6	0	6	0
Cooper's Hawk	<i>Accipiter cooperii</i>			5	0	5	0
Sharp-shinned Hawk	<i>Accipiter striatus</i>	1	0			1	0
House Finch	<i>Haemorhous mexicanus</i>			1	0	1	0
Lark Sparrow	<i>Chondestes grammacus</i>			1	0	1	0
Brewer's Blackbird	<i>Euphagus cyanocephalus</i>			1	0	1	0
TOTAL		76	1	32	0	108	1
#/trap day		0.6		0.1		0.2	
Mortality %			1.3%		0.0%		0.9%

Non-native captures in Brown-headed Cowbird traps, winter 2017-18.

2017-2018 Winter Non-native Species		Temescal		Prado		TOTAL	
Common Name	Scientific Name	released	removed	released	removed	released	removed
European Starling	<i>Sturnus vulgaris</i>	0	554	1	651	1	1,205
House Sparrow	<i>Passer domesticus</i>			0	32	0	32
Zebra Finch	<i>Taeniopygia guttata</i>	1	0			1	0
TOTAL		1	554	1	683	2	1,237

Table 10. Observations of all species by location, 2018.

		San Jacinto	San Timoteo Canyon	Santa Ana River (SAR) - Upstream	Norco Bluffs (I-15 to River Rd, non-mitigation)	Santa Ana Canyon (SAC)	Other <sup>1</sup>
<b>Avian</b>							
Canada Goose	<i>Branta canadensis</i>			x		x	
Egyptian Goose <sup>i</sup>	<i>Alopochen aegyptiaca</i>			x			
Mandarin Duck <sup>i</sup>	<i>Aix galericulata</i>					x	
Wood Duck	<i>Aix sponsa</i>	x				x	
Cinnamon Teal	<i>Spatula cyanoptera</i>	x		x			
Northern Shoveler	<i>Spatula clypeata</i>	x		x			
Gadwall	<i>Mareca strepera</i>	x					
American Wigeon	<i>Mareca americana</i>	x					
Mallard	<i>Anas platyrhynchos</i>	x	x	x	x	x	
Green-winged Teal	<i>Anas crecca</i>	x					
Ring-necked Duck	<i>Aythya collaris</i>			x			
Bufflehead	<i>Bucephala albeola</i>	x					
Ruddy Duck	<i>Oxyura jamaicensis</i>	x					
California Quail	<i>Callipepla californica</i>	x	x	x		x	
Domestic Fowl (Chicken) <sup>i</sup>	<i>Gallus gallus domesticus</i>			x			
Green Pheasant <sup>i</sup>	<i>Phasianus versicolor</i>			x			
Ring-necked Pheasant <sup>i</sup>	<i>Phasianus colchicus</i>	x		x			
Pied-billed Grebe	<i>Podilymbus podiceps</i>	x				x	
Eared Grebe	<i>Podiceps nigricollis</i>	x					
Rock Pigeon <sup>i</sup>	<i>Columba livia</i>			x		x	
Band-tailed Pigeon	<i>Patagioenas fasciata</i>					x	
Eurasian Collared-Dove <sup>i</sup>	<i>Streptopelia decaocto</i>	x		x		x	
Common Ground-Dove	<i>Columbina passerina</i>	x	x	x	x		
Mourning Dove	<i>Zenaida macroura</i>	x	x	x	x	x	
Greater Roadrunner	<i>Geococcyx californianus</i>	x	x	x	x	x	
Vaux's Swift	<i>Chaetura vauxi</i>			x			
White-throated Swift	<i>Aeronautes saxatalis</i>	x		x		x	
Black-chinned Hummingbird	<i>Archilochus alexandri</i>	x	x	x		x	
Anna's Hummingbird	<i>Calypte anna</i>	x	x	x	x	x	
Costa's Hummingbird	<i>Calypte costae</i>	x	x	x			
Rufous Hummingbird	<i>Selasphorus rufus</i>			x			
Allen's Hummingbird	<i>Selasphorus sasin</i>	x	x	x	x	x	
Ridgway's Rail <sup>r</sup>	<i>Rallus obsoletus</i>						x
Sora	<i>Porzana carolina</i>	x					
Common Gallinule	<i>Gallinula galeata</i>	x		x			
American Coot	<i>Fulica americana</i>	x	x	x		x	
Black-necked Stilt	<i>Himantopus mexicanus</i>	x		x			
American Avocet	<i>Recurvirostra americana</i>	x		x			
Killdeer	<i>Charadrius vociferus</i>	x	x	x	x	x	
Least Sandpiper	<i>Calidris minutilla</i>			x			
Western Sandpiper	<i>Calidris mauri</i>	x		x			
Long-billed Dowitcher	<i>Limnodromus scolopaceus</i>	x					
Greater Yellowlegs	<i>Tringa melanoleuca</i>	x		x			
Ring-billed Gull	<i>Larus delawarensis</i>	x					
California Gull	<i>Larus californicus</i>			x			
Gull spp.	<i>Larus spp.</i>	x					
Double-crested Cormorant <sup>r</sup>	<i>Phalacrocorax auritus</i>					x	x

Table 10 continued. Observations of all species by location, 2018.

		San Jacinto	San Timoteo Canyon	Santa Ana River (SAR) - Upstream	Norco Bluffs (I-15 to River Rd, non-mitigation)	Santa Ana Canyon (SAC)	Other <sup>1</sup>
<b>Avian</b>							
American White Pelican	<i>Pelecanus erythrorhynchos</i>	x				x	
American Bittern <sup>†</sup>	<i>Botaurus lentiginosus</i>	x					
Great Blue Heron <sup>†</sup>	<i>Ardea herodias</i>	x	x	x		x	x
Great Egret	<i>Ardea alba</i>	x		x		x	
Snowy Egret	<i>Egretta thula</i>	x		x		x	
Green Heron	<i>Butorides virescens</i>			x	x	x	
Black-crowned Night-Heron <sup>†</sup>	<i>Nycticorax nycticorax</i>	x					x
White-faced Ibis <sup>†</sup>	<i>Plegadis chihi</i>	x		x			
Turkey Vulture <sup>†</sup>	<i>Cathartes aura</i>	x		x		x	x
Osprey <sup>†</sup>	<i>Pandion haliaetus</i>	x		x			
White-tailed Kite <sup>†</sup>	<i>Elanus leucurus</i>	x	x				x
Golden Eagle <sup>†</sup>	<i>Aquila chrysaetos</i>	x					
Northern Harrier <sup>†</sup>	<i>Circus hudsonius</i>	x					x
Sharp-shinned Hawk <sup>†</sup>	<i>Accipiter striatus</i>			x			
Cooper's Hawk <sup>†</sup>	<i>Accipiter cooperii</i>	x	x	x	x	x	x
Bald Eagle <sup>†</sup>	<i>Haliaeetus leucocephalus</i>	x					x
Red-shouldered Hawk	<i>Buteo lineatus</i>	x	x	x	x	x	
Swainson's Hawk	<i>Buteo swainsoni</i>	x					x
Red-tailed Hawk	<i>Buteo jamaicensis</i>	x	x	x	x	x	
Barn Owl	<i>Tyto alba</i>	x	x	x			
Great Horned Owl	<i>Bubo virginianus</i>	x	x	x			
Burrowing Owl <sup>†</sup>	<i>Athene cunicularia</i>	x					
Belted Kingfisher	<i>Megaceryle alcyon</i>	x		x			
Acorn Woodpecker	<i>Melanerpes formicivorus</i>	x	x	x		x	
Downy Woodpecker <sup>†</sup>	<i>Dryobates pubescens</i>	x	x	x	x	x	x
Nuttall's Woodpecker	<i>Dryobates nuttallii</i>	x	x	x	x	x	
Northern Flicker	<i>Colaptes auratus</i>	x	x	x	x	x	
American Kestrel	<i>Falco sparverius</i>	x	x	x	x	x	
Merlin	<i>Falco columbarius</i>			x			
Prairie Falcon	<i>Falco mexicanus</i>			x			
Rose-ringed Parakeet <sup>†</sup>	<i>Psittacula krameri</i>			x			
Ash-throated Flycatcher	<i>Myiarchus cinerascens</i>	x	x	x	x	x	
Cassin's Kingbird	<i>Tyrannus vociferans</i>	x		x		x	
Western Kingbird	<i>Tyrannus verticalis</i>	x	x	x	x	x	
Olive-sided Flycatcher	<i>Contopus cooperi</i>	x		x			
Western Wood-Pewee	<i>Contopus sordidulus</i>	x	x	x		x	
Willow Flycatcher <sup>†</sup>	<i>Empidonax traillii</i>	x					x
Pacific-slope Flycatcher	<i>Empidonax difficilis</i>	x	x	x		x	
Black Phoebe	<i>Sayornis nigricans</i>	x	x	x	x	x	
Say's Phoebe	<i>Sayornis saya</i>	x	x	x	x	x	
Vermilion Flycatcher	<i>Pyrocephalus rubinus</i>					x	
Loggerhead Shrike <sup>†</sup>	<i>Lanius ludovicianus</i>	x					
Hutton's Vireo	<i>Vireo huttoni</i>		x	x	x	x	
Cassin's Vireo	<i>Vireo cassinii</i>			x			
Warbling Vireo	<i>Vireo gilvus</i>	x	x	x		x	
California Scrub-Jay	<i>Aphelocoma californica</i>	x	x	x	x	x	
American Crow	<i>Corvus brachyrhynchos</i>	x	x	x	x	x	

Table 10 continued. Observations of all species by location, 2018.

		San Jacinto	San Timoteo Canyon	Santa Ana River (SAR) - Upstream	Norco Bluffs (I-15 to River Rd, non-mitigation)	Santa Ana Canyon (SAC)	Other <sup>1</sup>
<b>Avian</b>							
Common Raven	<i>Corvus corax</i>	x	x	x		x	
Horned Lark <sup>r</sup>	<i>Eremophila alpestris</i>	x		x			x
Tree Swallow <sup>r</sup>	<i>Tachycineta bicolor</i>	x		x	x	x	x
Violet-green Swallow	<i>Tachycineta thalassina</i>			x			
Northern Rough-winged Swallow	<i>Stelgidopteryx serripennis</i>	x	x	x	x	x	
Cliff Swallow	<i>Petrochelidon pyrrhonota</i>	x		x		x	
Barn Swallow	<i>Hirundo rustica</i>	x		x	x	x	
Oak Titmouse	<i>Baeolophus inornatus</i>		x				
Bushtit	<i>Psaltiriparus minimus</i>	x	x	x	x	x	
Rock Wren	<i>Salpinctes obsoletus</i>	x					
House Wren	<i>Troglodytes aedon</i>	x	x	x	x	x	
Marsh Wren	<i>Cistothorus palustris</i>	x					
Bewick's Wren	<i>Thryomanes bewickii</i>	x	x	x	x	x	
Coastal Cactus Wren <sup>r</sup>	<i>Campylorhynchus brunneicapillus</i>					x	x
Blue-gray Gnatcatcher	<i>Polioptila caerulea</i>	x	x	x	x	x	x
California Gnatcatcher <sup>r</sup>	<i>Polioptila californica</i>	x				x	x
Ruby-crowned Kinglet	<i>Regulus calendula</i>	x	x	x	x	x	
Wrentit	<i>Chamaea fasciata</i>	x	x	x	x	x	
Western Bluebird	<i>Sialia mexicana</i>	x	x	x		x	
Swainson's Thrush	<i>Catharus ustulatus</i>			x	x	x	
Hermit Thrush	<i>Catharus guttatus</i>	x	x	x	x		
American Robin	<i>Turdus migratorius</i>			x		x	
California Thrasher	<i>Toxostoma redivivum</i>	x	x	x	x	x	
Northern Mockingbird	<i>Mimus polyglottos</i>	x	x	x	x	x	
European Starling <sup>i</sup>	<i>Sturnus vulgaris</i>	x	x	x		x	
Phainopepla	<i>Phainopepla nitens</i>	x	x	x		x	
Pin-tailed Whydah <sup>i</sup>	<i>Vidua macroura</i>					x	
Scaly-breasted Munia <sup>i</sup>	<i>Lonchura punctulata</i>			x		x	
House Sparrow <sup>i</sup>	<i>Passer domesticus</i>	x	x	x		x	
American Pipit	<i>Anthus rubescens</i>	x		x		x	
House Finch	<i>Haemorhous mexicanus</i>	x	x	x	x	x	
Lesser Goldfinch	<i>Spinus psaltria</i>	x	x	x	x	x	
Lawrence's Goldfinch	<i>Spinus lawrencei</i>	x	x	x	x	x	
American Goldfinch	<i>Spinus tristis</i>	x	x	x	x	x	
Spotted Towhee	<i>Pipilo maculatus</i>	x	x	x	x	x	
Rufous-crowned Sparrow <sup>r</sup>	<i>Aimophila ruficeps canescens</i>						x
California Towhee	<i>Melospiza crissalis</i>	x	x	x	x	x	
Black-chinned Sparrow	<i>Spizella atrogularis</i>	x					
Vesper Sparrow	<i>Poocetes gramineus</i>	x					
Lark Sparrow	<i>Chondestes grammacus</i>	x	x			x	
Savannah Sparrow	<i>Passerculus sandwichensis</i>	x		x			
Grasshopper Sparrow <sup>r</sup>	<i>Ammodramus savannarum</i>						x
Fox Sparrow	<i>Passerella iliaca</i>			x			
Song Sparrow	<i>Melospiza melodia</i>	x	x	x	x	x	
Lincoln's Sparrow <sup>r</sup>	<i>Melospiza lincolnii</i>	x	x	x			
White-crowned Sparrow	<i>Zonotrichia leucophrys</i>	x	x	x	x	x	
Golden-crowned Sparrow	<i>Zonotrichia atricapilla</i>		x	x			



Table 10 continued. Observations of all species by location, 2018.

		San Jacinto	San Timoteo Canyon	Santa Ana River (SAR) - Upstream	Norco Bluffs (I-15 to River Rd, non-mitigation)	Santa Ana Canyon (SAC)	Other <sup>1</sup>
<b>Avian</b>							
Yellow-breasted Chat <sup>r</sup>	<i>Icteria virens</i>	x	x	x	x	x	x
Yellow-headed Blackbird <sup>r</sup>	<i>Xanthocephalus xanthocephalus</i>	x	x				x
Western Meadowlark	<i>Sturnella neglecta</i>	x	x	x			
Hooded Oriole	<i>Icterus cucullatus</i>	x	x	x	x	x	
Bullock's Oriole	<i>Icterus bullockii</i>	x	x	x			
Red-winged Blackbird	<i>Agelaius phoeniceus</i>	x	x	x		x	
Tricolored Blackbird <sup>r</sup>	<i>Agelaius tricolor</i>	x					x
Brown-headed Cowbird <sup>i</sup>	<i>Molothrus ater</i>	x	x	x		x	
Brewer's Blackbird	<i>Euphagus cyanocephalus</i>	x					
Great-tailed Grackle	<i>Quiscalus mexicanus</i>	x	x				
Orange-crowned Warbler	<i>Oreothlypis celata</i>	x	x	x	x	x	
Nashville Warbler	<i>Oreothlypis ruficapilla</i>	x		x			
MacGillivray's Warbler	<i>Geothlypis tolmiei</i>	x					
Common Yellowthroat	<i>Geothlypis trichas</i>	x	x	x	x	x	
Yellow Warbler <sup>r</sup>	<i>Setophaga petechia</i>	x	x	x	x	x	x
Yellow-rumped Warbler	<i>Setophaga coronata</i>	x	x	x	x	x	
Black-throated Gray Warbler	<i>Setophaga nigrescens</i>		x	x			
Townsend's Warbler	<i>Setophaga townsendi</i>			x			
Wilson's Warbler <sup>r</sup>	<i>Cardellina pusilla</i>	x	x	x		x	x
Western Tanager	<i>Piranga ludoviciana</i>	x	x	x		x	
Black-headed Grosbeak	<i>Pheucticus melanocephalus</i>	x	x	x	x	x	
Blue Grosbeak	<i>Passerina caerulea</i>	x	x	x		x	
Lazuli Bunting	<i>Passerina amoena</i>	x	x	x		x	
<b>Mammals (tracks/other evidence used)</b>							
Virginia Opossum <sup>i</sup>	<i>Didelphis virginiana</i>	x	x	x			
Raccoon	<i>Procyon lotor</i>	x	x	x	x		
Long-tailed Weasel <sup>r</sup>	<i>Mustela frenata</i>	x					x
Striped Skunk	<i>Mephitis mephitis</i>	x	x	x	x	x	
Coyote <sup>r</sup>	<i>Canis latrans</i>	x	x	x	x	x	x
Feral Dog <sup>i</sup>	<i>Canis familiaris</i>	x		x			
Bobcat <sup>r</sup>	<i>Lynx rufus</i>	x	x	x		x	x
California Ground Squirrel	<i>Otospermophilus beecheyi</i>	x	x	x	x	x	
Eastern Fox Squirrel <sup>i</sup>	<i>Sciurus niger</i>		x			x	
Botta's Pocket Gopher	<i>Thomomys bottae</i>	x			x		
Kangaroo Rat sp. (tracks)	<i>Dipodomys sp.</i>	x				x	
Western Harvest Mouse	<i>Reithrodontomys megalotis</i>	x					
Dusky-footed Woodrat	<i>Neotoma fuscipes</i>					x	
Woodrat sp. (nest)	<i>Neotoma sp.</i>		x			x	
Norway Rat <sup>i</sup>	<i>Rattus norvegicus</i>					x	
San Diego Black-tailed Jackrabbit <sup>r</sup>	<i>Lepus californicus bennettii</i>	x					x
Desert Cottontail	<i>Sylvilagus audubonii</i>	x	x	x	x	x	
Feral Pig <sup>i</sup>	<i>Sus scrofa</i>		x	x	x		
Mule Deer	<i>Odocoileus hemionus</i>		x			x	
<b>Herpetofauna</b>							
Western Toad	<i>Anaxyrus boreas</i>			x		x	
American Bullfrog <sup>i</sup>	<i>Lithobates catesbeianus</i>	x		x	x	x	
Baja California Treefrog	<i>Pseudacris hypochondriaca</i>	x	x	x	x		

Table 10 continued. Observations of all species by location, 2018.

		San Jacinto	San Timoteo Canyon	Santa Ana River (SAR) - Upstream	Norco Bluffs (I-15 to River Rd, non-mitigation)	Santa Ana Canyon (SAC)	Other <sup>1</sup>
<b>Herpetofauna</b>							
Orange-throated Whiptail <sup>r</sup>	<i>Aspidoscelis hyperythra beldingi</i>		x	x			x
San Diegan Tiger Whiptail <sup>r</sup>	<i>Aspidoscelis tigris stejnegeri</i>	x	x			x	x
Zebra-tailed Lizard	<i>Callisaurus draconoides</i>			x			
Southern Alligator Lizard	<i>Elgaria multicarinata</i>		x	x			
Blainville's Horned Lizard <sup>r</sup>	<i>Phrynosoma blainvillii</i>	x		x			
Western Fence Lizard	<i>Sceloporus occidentalis</i>	x	x	x	x	x	
Granite Spiny Lizard <sup>r</sup>	<i>Sceloporus orcutti</i>			x			x
Side-blotched Lizard	<i>Uta stansburiana</i>	x	x	x	x	x	
Red Racer/Coachwhip	<i>Coluber flagellum piceus</i>	x	x	x	x	x	
California Striped Racer	<i>Coluber lateralis lateralis</i>					x	
Southern Pacific Rattlesnake	<i>Crotalus oreganus helleri</i>		x			x	
Red Diamond Rattlesnake <sup>r</sup>	<i>Crotalus ruber</i>						x
California Kingsnake	<i>Lampropeltis californiae</i>	x	x	x			
San Diego Gopher Snake	<i>Pituophis catenifer annectens</i>	x	x	x		x	
South Coast Garter Snake <sup>r</sup>	<i>Thamnophis sirtalis ssp. parietalis</i>			x			
Red-eared Slider <sup>i</sup>	<i>Trachemys scripta elegans</i>	x				x	
<b>Fish</b>							
Arroyo Chub <sup>r</sup>	<i>Gila orcuttii</i>			x			
Santa Ana Sucker <sup>r</sup>	<i>Catostomus santaanae</i>			x			
Mosquitofish <sup>i</sup>	<i>Gambusia affinis</i>			x			
Lepomis sp. <sup>i</sup>	<i>Lepomis sp.</i>			x			
Largemouth Bass <sup>i</sup>	<i>Micropterus salmoides</i>			x	x		

<sup>1</sup> - Includes detections of sensitive species at sampled and incidental locations. Observations have been reported to CNDDB.

<sup>i</sup> = invasive or non-native

<sup>r</sup> = endangered, threatened, or sensitive: are those that are listed as endangered, threatened, or species of concern by the resource agencies and those that are covered by the Western Riverside County Multiple Species Habitat Conservation Plan (MSHCP).

Note: This list is not intended as a complete species list for these sites. This is a list of species observed in the riparian zone and adjacent habitat, caught in cowbird traps, or otherwise observed during the vireo monitoring from March 15, 2018 to September 7, 2018.

## APPENDIX A – SURVEY SITES, STARTING AND ENDING COORDINATES

[All coordinates –WGS 1984 (Zone 11N) except where noted otherwise]

### Monitored Locations

<u>Survey Site</u>	<u>Starting Coordinates</u>	<u>Ending Coordinates</u>
<u>San Jacinto:</u>		
-San Jacinto River	506079, 3738423	493412, 3746014
-San Jacinto Wildlife Area	488443, 3746279	490979, 3750919
<u>San Timoteo Canyon:</u>		
-Riverside County	484812, 3762433	499659, 3753988
-San Bernardino County	481628, 3764975	484406, 3762944
<u>Santa Ana River (SAR):</u>		
-Riverside Ave. to Van Buren Blvd.	466416, 3765008	456998, 3758228
-Hidden Valley, north side of river	456941, 3758360	451647, 3758651
-Hidden Valley, south side of river	456057, 3758181	451093, 3757549
-Hidden Valley to River Rd. <sup>1</sup>		
-SAR-Goose Creek, Norco to I-15	451560, 3758574	448816, 3756435
-Goose Creek Mitigation, Norco	451091, 3757964	450042, 3757480
-Norco Bluffs (I-15 to River Rd, non-mitigation)	448907, 3756725	444876, 3753717
<u>Santa Ana Canyon (SAC):</u>		
-Upper Canyon	441121, 3749692	438609, 3749795
-Green River Golf Club	438609, 3749795	436613, 3748409
-Featherly Park	436604, 3748585	430713, 3748516

### Sampled Locations and Incidental Sighting Locations

<u>Survey Site</u>	<u>Starting Coordinates</u>	<u>Ending Coordinates</u>
<u>Santa Ana River &amp; Tributaries:</u>		
Alessandro Arroyo/Prenda Arroyo	465993, 3754419	470391, 3751168
	465354, 3752493	468066, 3751913
Arlington Falls <sup>2</sup>	453856, 3748925	454753, 3748301
Box Springs	472592, 3756430	471086, 3757494
Burris Basin <sup>3</sup>	419850, 3743943	419150, 3742378
Cajalco Creek <sup>2</sup>	453805, 3742988	453767, 3743230
Cajon Wash <sup>2</sup>	456784, 3796197	457285, 3791752
Canyon Crest <sup>2</sup>	468329, 3757116	468644, 3756933
Carbon Canyon (Chino Hills Pkwy) <sup>2</sup>	431500, 3760294	431143, 3759777
Carbon Canyon (Western Hills Golf Club) <sup>2</sup>	429466, 3758320	429755, 3758496
Carbon Canyon Regional Park	422957, 3752929	425648, 3754031
Castleview Park <sup>2</sup>	467826, 3755173	468565, 3754997

**Sampled Locations and Incidental Sighting Locations (cont.)**

<b><u>Survey Site</u></b>	<b><u>Starting Coordinates</u></b>	<b><u>Ending Coordinates</u></b>
Chino Creek Wetlands Park	437541, 3758309	437358, 3758832
Chino Hills	438794, 3754812	429061, 3759386
Chino Hills (Bayberry Dr.) <sup>2</sup>	432335, 3758297	431780, 3758507
Chino Hills (End of Eucalyptus) <sup>2</sup>	428612, 3759298	428291, 3759409
Chino Hills Community Park (Euc/Peyton) <sup>2</sup>	432645, 3761036	430652, 3761849
Chino Hills State Park (Bane Cyn)	435061, 3757365	435376, 3753499
Chino Hills State Park (Easy Street Trail) <sup>2</sup>	427838, 3752393	427876, 3752942
Chino Hills State Park (Lower Aliso Cyn)	435288, 3753302	438033, 3749528
Chino Hills State Park (Telegraph Cyn)	434818, 3753694	424101, 3753165
Chino Hills State Park (Upper Aliso Cyn)	435114, 3753304	433810, 3754990
City Creek (Highland)	482136, 3775290	482454, 3777612
Clearwater Pkwy @ Glen Helen <sup>2</sup>	462009, 3784622	461556, 3783760
Conrock Basin (FHQ) <sup>3</sup>	423314, 3746089	423465, 3746370
Corona Ave. at Gilmore <sup>2</sup>	448093, 3750572	448406, 3750398
Fontana Power Plant <sup>2</sup>	463472, 3779349	463819, 3779791
Fresno Canyon	440631, 3748012	440954, 3749370
Gavilan Hills <sup>2</sup>	466730, 3741552	466846, 3740837
Golden Star	465359, 3751458	467227, 3750525
Harrison Reservoir (aka McAllister Creek)	460113, 3749435	460002, 3747712
Hidden Valley Golf Club	451635, 3752238	451557, 3754114
La Sierra	457824, 3747117	457473, 3748848
Little Sand Basin <sup>2</sup>	478157, 3779714	478805, 3780527
Mead Valley (Cajalco/aqueduct)	471930, 3744796	469980, 3743887
Menifee-Haun Rd <sup>2</sup>	483716, 3725045	483706, 3724364
Menifee-Paloma H. S. <sup>2</sup>	482515, 3725307	481557, 3724847
Meridian CA (former March SKR Preserve)	471761, 3749213	473777, 3752145
Mockingbird Canyon	461624, 3750450	469316, 3746499
Motte Rimrock Preserve <sup>2</sup>	475973, 3740183	475893, 3739398
Norco Hills Park Mitigation <sup>2</sup>	449570, 3751384	449818, 3751233
Oak Glen Preserve <sup>2</sup>	505148, 3766841	505153, 3766838
Plunge Creek	486953, 3774720	486987, 3775572
Poorman Reservoir	476434, 3758610	477243, 3757320
Promenade <sup>2</sup>	451350, 3749618	451336, 3749919
Pyrite Channel <sup>2</sup>	456489, 3762199	455222, 3760761
Quail Run	471038, 3757541	469907, 3757374
Riverwalk Park <sup>2</sup>	454365, 3751010	454281, 3752276
Ryan Bonaminio Park <sup>2</sup>	463782, 3759521	463195, 3759424
Santa Rosa Mine Road <sup>2</sup>	471840, 3737819	471012, 3738146
Steele Valley <sup>2</sup>	471322, 3736485	471266, 3735608
Sun Canyon Park <sup>2</sup>	454614, 3749211	454788, 3749119
Sycamore Canyon	470209, 3757079	473225, 3753435

**Sampled Locations and Incidental Sighting Locations (cont.)**

<b><u>Survey Site</u></b>	<b><u>Starting Coordinates</u></b>	<b><u>Ending Coordinates</u></b>
Talbert Park (Orange County)	411746, 3722974	411911, 3723740
Tequesquite Arroyo <sup>2</sup>	467671, 3756303	468003, 3757103
Van Buren Blvd. (Bountiful)	469378, 3749894	469639, 3749825
Van Buren (Porter Road) <sup>2</sup>	467009, 3749689	466421, 3750042
Wardlow Wash	442819, 3748289	441873, 3749262
Woodcrest	464548, 3751638	464847, 3751471
Wyle Labs (at El Paso only)	450068, 3751818	450200, 375228
Yorba Linda (Mud Canyon) <sup>2</sup>	431693, 3750752	431200, 3750802
Yorba Linda (San Antonio Rd) <sup>2</sup>	429199, 3750653	429494, 3751473
Yorba Linda (Starlight Dr.)	431134, 3749819	430989, 3750218
Yorba Linda Lakebed Park <sup>2</sup>	424747, 3748248	424886, 3748817
<b>San Jacinto River Sub-watershed:</b>		
Cottonwood Canyon	475769, 3725678	477572, 3723954
Kabian Park	477916, 3733876	475650, 3730501
Lake Perris	483092, 3744484	485461, 3748329
Meniffee (Salt Creek)	478164, 3726524	479548, 3727246
Temescal Canyon	471486, 3720612	450724, 3746925
<b>Santiago Creek Sub-watershed:</b>		
Irvine Lake <sup>3</sup>	432717, 3736629	433854, 3736885
Irvine Trust Management Area <sup>2</sup>	429806, 3738346	429896, 3738306
Limestone Canyon <sup>2</sup>	434012, 3736548	434897, 3735784
Peters Canyon	429752, 3738563	428604, 3735584
Santiago Basin <sup>3</sup>	425344, 3740796	424678, 3740612
Santiago Canyon (Irvine Park)	430063, 3740268	428977, 3741769
Santiago Creek (above Irvine Lake)	437041, 3736718	435376, 3737521
Santiago Canyon Rd <sup>2</sup>	434949, 3735740	431995, 3736775
Santiago Creek (Cambridge Road)	421800, 3737876	421425, 3737985
Santiago Creek (Chapman Ave.)	423094, 3738524	423740, 3739316
Santiago Oaks Regional Park (to Cannon Rd) <sup>4</sup>	425540, 3741436	428440, 3742642
Silverado Canyon <sup>2</sup>	437692, 3734768	438878, 3734047
Smith Basin <sup>4</sup>	425362, 3741441	426377, 3741912

**Miscellaneous Locations**

<b><u>Survey Site</u></b>	<b><u>Starting Coordinates</u></b>	<b><u>Ending Coordinates</u></b>
East Coyote Hills Preserve <sup>2</sup>	415417, 3750601	417337, 3751214
Etiwanda Preserve <sup>2</sup>	451769, 3780654	451186, 3787544
French Valley, Benton Channel	489786, 3716781	489650, 3716452

**Miscellaneous Locations (cont.)**

<b><u>Survey Site</u></b>	<b><u>Starting Coordinates</u></b>	<b><u>Ending Coordinates</u></b>
French Valley, Warm Springs	490405, 3719448	489494, 3718197
Mount Baldy (Shinn Rd) <sup>2</sup>	437794, 3781816	437765, 3782398
Murrieta Creek <sup>2</sup>	476609, 3716171	476299, 3715809
Raceway Ford	472468, 3756062	472500, 3755984
Rancho La Sierra West <sup>5</sup>	453521, 3757910	453547, 3757077
Temecula, Santa Gertrudis	487521, 3711044	485036, 3709578
University of California, Riverside <sup>2</sup>	470131, 3759262	470131, 3759262
Wildomar, Helash Mitigation	476016, 3716642	476481, 3716264
Wolfskill	498097, 3747887	498135, 3748626

<sup>1</sup> In 2015, Hidden Valley to River Rd was divided into separate sites due to funding constraints. These sites are SAR-Goose Creek, Norco to I-15, which also includes Goose Creek Mitigation (funded by IERCD), and Norco Bluffs (I-15 to River Rd, non-mitigation), which as of 2016 includes an additional 250 acres that was not surveyed by SAWA in 2015.

<sup>2</sup> Denotes sites that were not surveyed this year.

<sup>3</sup> Incidental observation of LBVI at this site.

<sup>4</sup> In 2018, Santiago Creek (to Cannon, including Smith Basin) was broken out to make Smith Basin a separate site and Santiago Oaks Regional Park was expanded to include area up to Cannon Road.

<sup>5</sup> In 2017, Rancho La Sierra West was added to SAR – Upstream, Hidden Valley south side of river.

## **APPENDIX B: WATERSHED-WIDE ANNUAL RESULTS, 2000-2018**

Appendix B-1. Least Bell's Vireo status and management and Brown-headed Cowbird management data at closely monitored and select sampled sites in the Santa Ana River Watershed, 2000-2018.

	Parameter	2000-2013	2014	2015	2016	2017	2018	Combined
A.	Number of territorial males	n/a	814	834	865	983	1,039	n/a
B.	Number of known pairs (breeding and non-breeding)	3,360	390	401	440	560	565	5,716
C.	Number of fledged young observed	5,554	472	590	610	994	691	8,911
D.	Projected total of recruitment of vireo young <sup>1</sup>	9,408	858	1,123	1,144	2,016	1,413	16,005
E.	Average number of fledglings per pair (C/B)	1.7	1.2	1.5	1.4	1.8	1.2	1.6
F.	Projected number of fledglings per pair (D/B)	2.8	2.2	2.8	2.6	3.6	2.5	2.8
G.	Rate of missing eggs/chicks from nests (successful and unsuccessful nests)	40% 724 / 1,817	54% 80 / 149	n/a	n/a	n/a	n/a	41% 804 / 1,966
H.	Rate of cowbird nest parasitism (well-tracked nests) <sup>2</sup>	13% 229 / 1,817	5% 8 / 149	2% 4 / 188	3% 6 / 180	5% 13 / 279	3% 9 / 267	9% 269 / 2,880
I.	Numbers of cowbirds removed from study area <sup>3</sup>	28,895	1,271	1,245	3,177	1,953	2,637	39,178
J.	This row purposefully omitted.							
K.	Number of trap days (1 operative trap day in the field for one day = 1 trap day) <sup>3</sup>	66,561	5,290	4,252	5,707	4,061	3,096	88,967
L.	Average number of cowbirds trapped per trap day (I/K)	0.43	0.24	0.29	0.56	0.48	0.85	0.44
M.	Number of field hours – LBVI	61,884	1,952	2,192	2,444	2,969	2,472	84,474
N.	Number of field hours - BHCO		2,724	2,052	2,163	2,024	1,598	

<sup>1</sup>Survival rate of fledglings in well-tracked nests was applied to nests not visited as frequently by the function (avg. # fledglings produced by well-tracked pairs x total number of pairs). These data represent minimum recruitment as defined by the Least Bell's Vireo Working Group "known fledged young."

<sup>2</sup>Calculation error in 2017 rectified in 2018 report.

<sup>3</sup>All traps are not accounted for in this total.



Appendix B-2. Least Bell's Vireo nest placement preferences at closely monitored and select sampled sites in the Santa Ana River Watershed, 2000-2018.

Host Plant Species (listed in taxonomic order)	2000-2013	2014	2015	2016	2017	2018	Combined	Percentage of Combined
Giant Reed <sup>ie</sup> ( <i>Arundo donax</i> )	1					1	2	<1%
Coulter's Matilija Poppy <sup>r</sup> ( <i>Romneya coulteri</i> )				1			1	<1%
Fourwing Saltbush ( <i>Atriplex canescens</i> )	2						2	<1%
Cape Leadwort <sup>e</sup> ( <i>Plumbago auriculata</i> )	2						2	<1%
Western Sycamore ( <i>Platanus racemosa</i> )	3	3			3	2	11	<1%
White Alder ( <i>Alnus rhombifolia</i> )	1				1		2	<1%
Coast Live Oak ( <i>Quercus agrifolia</i> )	2						2	<1%
California Scrub Oak ( <i>Quercus berberidifolia</i> )	4		2			1	7	<1%
Oak sp. ( <i>Quercus</i> sp.)			1				1	<1%
Southern California Black Walnut <sup>r</sup> ( <i>Juglans californica</i> )	11		1		5	1	18	1%
Fremont Cottonwood ( <i>Populus fremontii</i> )	80	9	15	6	14	21	145	4%
Dead Fremont Cottonwood ( <i>Populus fremontii</i> )	2						2	<1%
Black Cottonwood ( <i>Populus balsamifera</i> ssp. <i>trichocarpa</i> )	1			1			2	<1%
Narrowleaf Willow ( <i>Salix exigua</i> )	95	8	5	4	20	26	158	5%
Dead Narrowleaf Willow ( <i>Salix exigua</i> )	1						1	<1%
Goodding's Black Willow ( <i>Salix gooddingii</i> )	277	3	20	19	28	24	371	11%
Dead Goodding's Black Willow ( <i>Salix gooddingii</i> )	1						1	<1%
Dead Goodding's Black Willow covered with living Goodding's Black Willow ( <i>S. gooddingii</i> )	1						1	<1%
Red Willow ( <i>Salix laevigata</i> )	221	8	26	25	30	22	332	10%
Arroyo Willow ( <i>Salix lasiolepis</i> )	423	28	30	46	73	62	662	19%
Dead Arroyo Willow ( <i>Salix lasiolepis</i> )	1					1	2	<1%
Yellow Willow ( <i>Salix lasiandra</i> )	13	1	2	3			19	1%
Willow sp. ( <i>Salix</i> sp.)	6		2			3	11	<1%
Dead Willow sp. ( <i>Salix</i> sp.)	3	1			1		5	<1%

Appendix B-2 continued. Least Bell's Vireo nest placement preferences at closely monitored and select sampled sites in the Santa Ana River Watershed, 2000-2018.

Host Plant Species (listed in taxonomic order)	2000-2013	2014	2015	2016	2017	2018	Combined	Percentage of Combined
Tamarisk <sup>ie</sup> ( <i>Tamarix ramosissima</i> )	8		1		1	5	15	<1%
Chinese Elm <sup>e</sup> ( <i>Ulmus parvifolia</i> )				1			1	<1%
White Mulberry <sup>e</sup> ( <i>Morus alba</i> )		1					1	<1%
Hoary Nettle ( <i>Urtica dioica</i> )	1						1	<1%
Castorbean <sup>ie</sup> ( <i>Ricinus communis</i> )	1				1		2	<1%
Black Mustard <sup>ie</sup> ( <i>Brassica nigra</i> )	4		1				5	<1%
Mustard sp. <sup>ie</sup> ( <i>Brassica</i> sp.)	7						7	<1%
Perennial Pepperweed <sup>ie</sup> ( <i>Lepidium latifolium</i> )	5		1				6	<1%
Dead Perennial Pepperweed <sup>ie</sup> ( <i>Lepidium latifolium</i> )	1						1	<1%
Golden Currant ( <i>Ribes aureum</i> )	3	1		1			5	<1%
California Wild Rose ( <i>Rosa californica</i> )	5			2	1	1	9	<1%
California Blackberry ( <i>Rubus ursinus</i> )	1				2		3	<1%
Toyon ( <i>Heteromeles arbutifolia</i> )	20	4	3		1		28	1%
Hollyleaf Cherry ( <i>Prunus ilicifolia</i> )	1						1	<1%
Bank Catclaw <sup>e</sup> ( <i>Acacia redolens</i> )				1			1	<1%
Western False Indigo ( <i>Amorpha fruticosa</i> )	1						1	<1%
Desert Wild Grape ( <i>Vitis girdiana</i> )	74	21	17	14	21	19	166	5%
Boxelder ( <i>Acer negundo</i> )	1		1				2	<1%
Laurel Sumac ( <i>Malosma laurina</i> )	9	2	1	2	6	9	29	1%
Peruvian Pepper Tree <sup>ie</sup> ( <i>Schinus molle</i> )	10		2		3	4	19	1%
Brazilian Pepper Tree <sup>ie</sup> ( <i>Schinus terebinthifolius</i> )	1						1	<1%
Poison Oak ( <i>Toxicodendron diversilobum</i> )	13	2	3	4	2		24	1%
Sugar Sumac ( <i>Rhus ovata</i> )	2					1	3	<1%

Appendix B-2 continued. Least Bell's Vireo nest placement preferences at closely monitored and select sampled sites in the Santa Ana River Watershed, 2000-2018.

Host Plant Species (listed in taxonomic order)	2000-2013	2014	2015	2016	2017	2018	Combined	Percentage of Combined
Fragrant Sumac ( <i>Rhus aromatica</i> )	1						1	<1%
Tree of Heaven <sup>ie</sup> ( <i>Ailanthus altissima</i> )		1				1	2	<1%
Orange Tree <sup>e</sup> ( <i>Citrus sinensis</i> )	3						3	<1%
Wild Celery <sup>e</sup> ( <i>Apium graveolens</i> )	1						1	<1%
Poison Hemlock <sup>ie</sup> ( <i>Conium maculatum</i> )	10		1				11	<1%
Tree Tobacco <sup>ie</sup> ( <i>Nicotiana glauca</i> )	1					1	2	<1%
Thickleaf Yerba Santa ( <i>Eriodictyon crassifolium</i> )	1		2				3	<1%
Yerba Santa sp. ( <i>Eriodictyon</i> sp.)		1					1	<1%
Fiddleneck sp. ( <i>Amsinckia</i> sp.)	1						1	<1%
Privet sp. <sup>e</sup> ( <i>Ligustrum</i> sp.)	1						1	<1%
Black Sage ( <i>Salvia mellifera</i> )		1				1	2	<1%
Ash sp. ( <i>Fraxinus</i> sp.)	1						1	<1%
Lollypop Tree <sup>ie</sup> ( <i>Myoporum laetum</i> )	1						1	<1%
Blue Elderberry ( <i>Sambucus nigra</i> ssp. <i>caerulea</i> )	121	15	18	8	13	5	180	5%
Dead Blue Elderberry ( <i>Sambucus nigra</i> ssp. <i>caerulea</i> )					1		1	<1%
Milk Thistle <sup>ie</sup> ( <i>Silybum marianum</i> )	1						1	<1%
Yellowspine Thistle <sup>ie</sup> ( <i>Cirsium ochrocentrum</i> )	2						2	<1%
Arrowweed ( <i>Pluchea sericea</i> )	3				1	1	5	<1%
Coyote Brush ( <i>Baccharis pilularis</i> )	7	1		3	2	4	17	1%
Mulefat ( <i>Baccharis salicifolia</i> )	620	57	49	55	75	93	949	28%
Dead Mulefat ( <i>Baccharis salicifolia</i> )	5			2	1		8	<1%
Willow Baccharis ( <i>Baccharis salicina</i> )	3						3	<1%
Desertbroom Baccharis ( <i>Baccharis sarothroides</i> )	1						1	<1%

Appendix B-2 continued. Least Bell's Vireo nest placement preferences at closely monitored and select sampled sites in the Santa Ana River Watershed, 2000-2018.

Host Plant Species (listed in taxonomic order)	2000-2013	2014	2015	2016	2017	2018	Combined	Percentage of Combined
California Sagebrush ( <i>Artemisia californica</i> )	1					1	2	<1%
Douglas' Sagewort ( <i>Artemisia douglasiana</i> )	21	2	1				24	1%
Common Sunflower ( <i>Helianthus annuus</i> )	1						1	<1%
Brittlebush ( <i>Encelia farinosa</i> )	1						1	<1%
Rough Cockelburr ( <i>Xanthium strumarium</i> )	2						2	<1%
Goodding's Black Willow ( <i>S. gooddingii</i> ) and Perennial Pepperweed <sup>ie</sup> ( <i>L. latifolium</i> )	1						1	<1%
Goodding's Black Willow ( <i>S. gooddingii</i> ) and Desert Wild Grape ( <i>V. girdiana</i> )						1	1	<1%
Goodding's Black Willow ( <i>S. gooddingii</i> ) and Poison Hemlock <sup>ie</sup> ( <i>C. maculatum</i> )	1						1	<1%
Goodding's Black Willow ( <i>S. gooddingii</i> ) and Blue Elderberry ( <i>S. n. caerulea</i> )	1						1	<1%
Dead Goodding's Black Willow ( <i>S. gooddingii</i> ) and Hoary Nettle ( <i>U. dioica</i> )	1						1	<1%
Red Willow ( <i>S. laevigata</i> ) and Wild Cucumber ( <i>Marah macrocarpa</i> )					1		1	<1%
Red Willow ( <i>S. laevigata</i> ) and dead Hoary Nettle ( <i>U. dioica</i> )	1						1	<1%
Red Willow ( <i>S. laevigata</i> ) and Unknown	1						1	<1%
Arroyo Willow ( <i>S. lasiolepis</i> ) and Black Mustard <sup>ie</sup> ( <i>B. nigra</i> )	1						1	<1%
Arroyo Willow ( <i>S. lasiolepis</i> ) and Sweet Fennel <sup>i</sup> ( <i>Foeniculum vulgare</i> )	1						1	<1%
Willow sp. ( <i>Salix</i> sp.) and Perennial Pepperweed <sup>ie</sup> ( <i>L. latifolium</i> )	1						1	<1%
Willow sp. ( <i>Salix</i> sp.) and California Blackberry ( <i>Rubus ursinus</i> )	1						1	<1%
Castorbean <sup>ie</sup> ( <i>R. communis</i> ) and Mulefat ( <i>B. salicifolia</i> )	1						1	<1%
Black Mustard <sup>ie</sup> ( <i>B. nigra</i> ) and Mulefat ( <i>B. salicifolia</i> )	1						1	<1%
Desert Wild Grape ( <i>V. girdiana</i> ) and Goodding's Black Willow ( <i>S. gooddingii</i> )	1						1	<1%
Desert Wild Grape ( <i>V. girdiana</i> ) and Arroyo Willow ( <i>S. lasiolepis</i> )	1						1	<1%
Desert Wild Grape ( <i>V. girdiana</i> ) and California Wild Rose ( <i>R. californica</i> )	1						1	<1%
Desert Wild Grape ( <i>V. girdiana</i> ) and Peruvian Pepper Tree <sup>ie</sup> ( <i>S. molle</i> )	1						1	<1%

Appendix B-2 continued. Least Bell's Vireo nest placement preferences at closely monitored and select sampled sites in the Santa Ana River Watershed, 2000-2018.

Host Plant Species (listed in taxonomic order)	2000-2013	2014	2015	2016	2017	2018	Combined	Percentage of Combined
Desert Wild Grape ( <i>V. girdiana</i> ) and Blue Elderberry ( <i>S. n. caerulea</i> )	1						1	<1%
Desert Wild Grape ( <i>V. girdiana</i> ) and Mulefat ( <i>B. salicifolia</i> )	3		1		1		5	<1%
Coyote Brush ( <i>B. pilularis</i> ) and Mulefat ( <i>B. salicifolia</i> )	1						1	<1%
Mulefat ( <i>B. salicifolia</i> ) and Poison Hemlock <sup>ie</sup> ( <i>C. maculatum</i> )	1						1	<1%
Deadfall	4		1				5	<1%
Unknown/No data	8	4	3	8	4	22	49	1%
<b>Total</b>	<b>2,163</b>	<b>174</b>	<b>210</b>	<b>206</b>	<b>312</b>	<b>333</b>	<b>3,398</b>	<b>100%</b>

<sup>i</sup> = invasive

<sup>e</sup> = non-native

<sup>r</sup> = endangered, threatened, or sensitive

Appendix B-3. Least Bell's Vireo reproductive success and breeding biology data at closely monitored and select sampled sites in the Santa Ana River Watershed, 2000-2018.

	Parameter	2000-2013	2014	2015	2016	2017	2018	Combined
A.	Number of known pairs	3,360	390	401	440	560	565	5,716
B.	Number of known breeding (nesting) pairs	2,884	301	322	353	486	418	4,764
C.	Number of breeding pairs that were well-monitored throughout the breeding season	1,060	81	93	95	135	148	1,612
D.	Number of 'known fledged young' OBSERVED	5,554	472	590	610	994	691	8,911
E.	Number of known fledged young produced by pairs monitored throughout the breeding season	2,926	178	256	248	490	363	4,461
F.	Average number of fledglings produced per breeding pair (minimum; D/B = 'productivity or breeding success')	1.9	1.6	1.8	1.7	2.0	1.7	1.9
G.	Average number of fledglings produced by well-monitored pairs(E/C = reproductive success)	2.8	2.2	2.8	2.6	3.6	2.5	2.8
H.	Number of nests that were discovered	2,209	178	220	206	316	333	3,462
I.	Number of well-tracked nests	1,817	149	188	180	279	267	2,880
J.	Number of well-tracked nests that were successful (% = J/I x 100)	61% 1,101 / 1,817	48% 72 / 149	55% 103 / 188	52% 93 / 180	60% 167 / 279	52% 140 / 267	58% 1,676 / 2,880
K.	Rate of missing eggs/chicks from nests (includes successful and unsuccessful nests)	40% 724 / 1,817	54% 80 / 149	n/a	n/a	n/a	n/a	28% 804 / 2,880
L.	Number of well-tracked nests that were parasitized by cowbirds (% = L/I x 100)	13% 229 / 1,817	5% 8 / 149	2% 4 / 188	3% 6 / 180	5% 13 / 279	3% 9 / 267	9% 269 / 2,880
M.	A. Number of well-tracked nests that failed as a result of reproductive failure	4% 74 / 1,817	5% 7 / 149	10% 18 / 188	6% 10 / 180	4% 11 / 279	4% 10 / 267	5% 130 / 2,880
	B. Number of well-tracked nests that failed as a result of parasitism	4% 71 / 1,817	3% 5 / 149	0% 0 / 188	1% 1 / 180	2% 6 / 279	1% 2 / 267	3% 85 / 2,880
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	31% 567 / 1,817	43% 64 / 149	36% 67 / 188	41% 74 / 180	31% 86 / 279	42% 113 / 267	34% 971 / 2,880
	D. Number of well-tracked nests that failed for unknown reasons	<1% 5 / 1,817	1% 1 / 149	0% 0 / 188	1% 2 / 180	1% 4 / 279	1% 2 / 267	<1% 14 / 2,880
N.	Average clutch size	n/a	1.5	3.3	3.4	3.7	3.4	n/a
O.	Number of cowbird eggs found in or near vireo nests	281	8	4	8	13	12	326
P.	Number of cowbird nestlings removed from well-tracked nests	15	1	0	0	0	0	16
Q.	Number of cowbird young fledged by vireo	12	2	1	0	2	0	17
R.	Number of 'manipulated' parasitized nests	187	5	4	6	11	9	222
S.	Number of 'successful, manipulated' nests (% = S/R x 100)	48% 90 / 187	40% 2 / 5	25% 1 / 4	33% 2 / 6	9% 1 / 11	44% 4 / 9	45% 100 / 222
T.	Number of vireo fledged from 'manipulated' parasitized nests	191	5	2	6	3	9	216
U.	Number of repaired nests	31	3	0	0	3	4	41
V.	% of successful repaired nests	74% 23 / 31	67% 2 / 3	n/a	n/a	33% 1 / 3	50% 2 / 4	68% 28 / 41
W.	Number of vireo fledged from repaired nests	65	5	n/a	n/a	4	6	80

## **APPENDIX C: SUMMARY TABLES BY MANAGED SITE, 2000-2018**

Appendix C-1-A. Least Bell's Vireo status and management and Brown-headed Cowbird management data at survey sites in the Santa Ana River Watershed, California.

**San Jacinto**

	Parameter	2000-2013	2014	2015	2016	2017	2018	Combined
A.	Number of territorial males	n/a	45	29	37	45	74	n/a
B.	Number of known pairs (breeding and non-breeding)	151	19	7	17	27	34	255
C.	Number of fledged young observed	238	12	8	12	48	60	378
D.	Projected total of recruitment of vireo young <sup>1</sup>	423 (n = 6yrs)	n/a	n/a	20	76	75	663
E.	Average number of fledglings per pair (C/B)	1.6	0.6	1.1	0.7	1.8	1.8	1.5
F.	Projected number of fledglings per pair (D/B)	2.8	n/a	n/a	1.2	2.8	2.2	2.6
G.	Rate of missing eggs/chicks from nests (successful and unsuccessful nests)	33% 39 / 93	0% 0 / 1	n/a	n/a	n/a	n/a	n/a
H.	Rate of cowbird nest parasitism (well-tracked nests) <sup>2</sup>	11% 8 / 93	100% 1 / 1	n/a	75% 6 / 8	9% 1 / 11	10% 3 / 30	13% 19 / 143
I.	Numbers of cowbirds removed from study area	18,368	713	n/a	2,101	1,405	2,099	24,686
J.	This row purposefully omitted.							
K.	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	10,422	945	n/a	390	589	659	13,005
L.	Average number of cowbirds trapped per trap day (I/K)	1.76	0.75	n/a	5.39	2.39	3.19	1.90
M.	Number of field hours - LBVI	7,225	72	n/a	83	201	295	9,300
N.	Number of field hours - BHCO		462	n/a	223	383	356	

<sup>1</sup>Survival rate of fledglings in well-tracked nests was applied to nests not visited as frequently by the function (avg. # fledglings produced by well-tracked pairs x total number of pairs). These data represent minimum recruitment as defined by the Least Bell's Vireo Working Group "known fledged young."

<sup>2</sup>Calculation error in 2017 rectified in 2018 report.



Appendix C-1-B. Least Bell's Vireo status and management and Brown-headed Cowbird management data at survey sites in the Santa Ana River Watershed, California.

**San Timoteo Canyon**

	Parameter	2000-2013	2014	2015	2016	2017	2018	Combined
A.	Number of territorial males	n/a	151	176	173	172	156	n/a
B.	Number of known pairs (breeding and non-breeding)	701	135	141	124	109	104	1,314
C.	Number of fledged young observed	1,300	206	287	222	272	161	2,448
D.	Projected total of recruitment of vireo young <sup>1</sup>	2,033 (n = 13yrs)	338	451	384	458	302	3,942
E.	Average number of fledglings per pair (C/B)	1.9	1.5	2.0	1.8	2.5	1.5	1.9
F.	Projected number of fledglings per pair (D/B)	2.9	2.5	3.2	3.1	4.2	2.9	3.0
G.	Rate of missing eggs/chicks from nests (successful and unsuccessful nests)	44% 246 / 569	52% 46 / 88	n/a	n/a	n/a	n/a	n/a
H.	Rate of cowbird nest parasitism (well-tracked nests) <sup>2</sup>	31% 109 / 569	6% 5 / 88	0% 0 / 114	0% 0 / 73	1% 1 / 91	0% 0 / 63	12% 115 / 998
I.	Numbers of cowbirds removed from study area	2,076	143	169	87	93	88	2,656
J.	This row purposefully omitted.							
K.	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	10,947	1,058	996	832	794	574	15,201
L.	Average number of cowbirds trapped per trap day (I/K)	0.23	0.14	0.17	0.10	0.12	0.15	0.17
M.	Number of field hours - LBVI	10,423	442	750	415	442	366	14,583
N.	Number of field hours - BHCO		504	399	329	278	235	

<sup>1</sup>Survival rate of fledglings in well-tracked nests was applied to nests not visited as frequently by the function (avg. # fledglings produced by well-tracked pairs x total number of pairs). These data represent minimum recruitment as defined by the Least Bell's Vireo Working Group "known fledged young."

<sup>2</sup>Calculation error in 2017 rectified in 2018 report.

Appendix C-1-C. Least Bell's Vireo status and management and Brown-headed Cowbird management data at survey sites in the Santa Ana River Watershed, California.

**Meridian Conservation Area\***

	Parameter	2000-2013	2014	2015	2016	2017	2018	Combined
A.	Number of territorial males	n/a	21	7	14	16	20	n/a
B.	Number of known pairs (breeding and non-breeding)	78	16	3	5	9	2	113
C.	Number of fledged young observed	131	23	3	6	23	2	188
D.	Projected total of recruitment of vireo young <sup>1</sup> (n = 5yrs)	374	48	n/a	n/a	27	n/a	486
E.	Average number of fledglings per pair (C/B)	1.7	1.4	1.0	1.2	2.6	n/a	1.7
F.	Projected number of fledglings per pair (D/B)	4.8	3.0	n/a	n/a	3.0	n/a	4.3
G.	Rate of missing eggs/chicks from nests (successful and unsuccessful nests)	27% 6 / 22	67% 2 / 3	n/a	n/a	n/a	n/a	n/a
H.	Rate of cowbird nest parasitism (well-tracked nests) <sup>2</sup>	0% 0 / 22	0% 0 / 3	n/a	n/a	0% 0 / 5	n/a	0% 0 / 30
I.	Numbers of cowbirds removed from study area	207	1	8	3	18	6	243
J.	This row purposefully omitted.							
K.	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	2,168	178	260	248	260	221	3,335
L.	Average number of cowbirds trapped per trap day (I/K)	0.10	0.01	0.03	0.01	0.07	0.03	0.07
M.	Number of field hours - LBVI	656	81	n/a	29	61	16	843
N.	Number of field hours - BHCO	847	68	123	87	69	145	1,339

<sup>1</sup>Survival rate of fledglings in well-tracked nests was applied to nests not visited as frequently by the function (avg. # fledglings produced by well-tracked pairs x total number of pairs). These data represent minimum recruitment as defined by the Least Bell's Vireo Working Group "known fledged young."

<sup>2</sup>Calculation error in 2017 rectified in 2018 report.

\*Former March SKR Preserve

Appendix C-1-D. Least Bell's Vireo status and management and Brown-headed Cowbird management data at survey sites in the Santa Ana River Watershed, California.

**Sycamore Canyon**

	Parameter	2000-2013	2014	2015	2016	2017	2018	Combined
A.	Number of territorial males	n/a	17	4	13	18	20	n/a
B.	Number of known pairs (breeding and non-breeding)	55	5	1	4	9	8	82
C.	Number of fledged young observed	60	2	1	6	10	5	84
D.	Projected total of recruitment of vireo young <sup>1</sup>	110 (n = 4yrs)	n/a	n/a	n/a	n/a	n/a	164
E.	Average number of fledglings per pair (C/B)	1.1	0.4	1.0	1.5	1.1	n/a	1.0
F.	Projected number of fledglings per pair (D/B)	2.0	n/a	n/a	n/a	n/a	n/a	2.0
G.	Rate of missing eggs/chicks from nests (successful and unsuccessful nests)	33% 3 / 9	100% 4 / 4	n/a	n/a	n/a	n/a	n/a
H.	Rate of cowbird nest parasitism (well-tracked nests) <sup>2</sup>	22% 2 / 9	50% 2 / 4	n/a	n/a	n/a	n/a	31% 4 / 13
I.	Numbers of cowbirds removed from study area	81	9	n/a	n/a	n/a	n/a	90
J.	This row purposefully omitted.							
K.	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	635	75	n/a	n/a	n/a	n/a	710
L.	Average number of cowbirds trapped per trap day (I/K)	0.13	0.12	n/a	n/a	n/a	n/a	0.13
M.	Number of field hours - LBVI	596	43	n/a	15	15	35	704
N.	Number of field hours - BHCO	469	31	n/a	n/a	n/a	n/a	500

<sup>1</sup>Survival rate of fledglings in well-tracked nests was applied to nests not visited as frequently by the function (avg. # fledglings produced by well-tracked pairs x total number of pairs). These data represent minimum recruitment as defined by the Least Bell's Vireo Working Group "known fledged young."

<sup>2</sup>Calculation error in 2017 rectified in 2018 report.

Appendix C-1-E. Least Bell's Vireo status and management and Brown-headed Cowbird management data at survey sites in the Santa Ana River Watershed, California.

**Mockingbird Canyon**

	Parameter	2000-2013	2014	2015	2016	2017	2018	Combined
A.	Number of territorial males	n/a	23	37	25	29	43	n/a
B.	Number of known pairs (breeding and non-breeding)	236	7	23	7	15	15	303
C.	Number of fledged young observed	389	7	19	11	15	10	451
D.	Projected total of recruitment of vireo young <sup>1</sup> (n = 10yrs)	708	n/a	n/a	21	n/a	n/a	909
E.	Average number of fledglings per pair (C/B)	1.6	1.0	0.8	1.6	1.0	n/a	1.5
F.	Projected number of fledglings per pair (D/B)	3.0	n/a	n/a	3.0	n/a	n/a	3.0
G.	Rate of missing eggs/chicks from nests (successful and unsuccessful nests)	45% 66 / 146	50% 1 / 2	n/a	n/a	n/a	n/a	n/a
H.	Rate of cowbird nest parasitism (well-tracked nests) <sup>2</sup>	11% 16 / 146	0% 0 / 2	0% 0 / 5	0% 0 / 3	0% 0 / 2	n/a	10% 16 / 158
I.	Numbers of cowbirds removed from study area	1,781	71	63	52	84	52	2,103
J.	This row purposefully omitted.							
K.	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	8,598	603	256	385	451	295	10,588
L.	Average number of cowbirds trapped per trap day (I/K)	0.21	0.12	0.25	0.14	0.19	0.18	0.20
M.	Number of field hours - LBVI	5,677	62	77	157	87	60	7,150
N.	Number of field hours - BHCO		307	117	193	221	192	

<sup>1</sup>Survival rate of fledglings in well-tracked nests was applied to nests not visited as frequently by the function (avg. # fledglings produced by well-tracked pairs x total number of pairs). These data represent minimum recruitment as defined by the Least Bell's Vireo Working Group "known fledged young."

<sup>2</sup>Calculation error in 2017 rectified in 2018 report.

Appendix C-1-F. Least Bell's Vireo status and management and Brown-headed Cowbird management data at survey sites in the Santa Ana River Watershed, California.

**Santa Ana River (SAR) - Upstream - Riverside Ave. to Van Buren Blvd.**

	Parameter	2000-2013	2014	2015	2016	2017	2018	Combined
A.	Number of territorial males	n/a	66	109	109	155	164	n/a
B.	Number of known pairs (breeding and non-breeding)	252	19	37	43	95	96	542
C.	Number of fledged young observed	387	15	33	62	169	95	761
D.	Projected total of recruitment of vireo young <sup>1</sup>	653 (n = 7yrs)	23	n/a	172	276	192	1,407
E.	Average number of fledglings per pair (C/B)	1.5	0.8	0.9	1.4	1.8	1.0	1.4
F.	Projected number of fledglings per pair (D/B)	2.6	1.2	n/a	4.0	2.9	2.0	2.6
G.	Rate of missing eggs/chicks from nests (successful and unsuccessful nests)	32% 31 / 96	67% 2 / 3	n/a	n/a	n/a	n/a	n/a
H.	Rate of cowbird nest parasitism (well-tracked nests) <sup>2</sup>	14% 13 / 96	0% 0 / 3	100% 3 / 3	0% 0 / 12	13% 6 / 46	21% 5 / 24	15% 27 / 184
I.	Numbers of cowbirds removed from study area	607	17	30	65	46	14	779
J.	This row purposefully omitted.							
K.	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	5,787	256	302	534	513	266	7,658
L.	Average number of cowbirds trapped per trap day (I/K)	0.10	0.07	0.10	0.12	0.09	0.05	0.10
M.	Number of field hours - LBVI	4,274	123	175	439	557	367	7,196
N.	Number of field hours - BHCO		188	104	380	286	303	

<sup>1</sup>Survival rate of fledglings in well-tracked nests was applied to nests not visited as frequently by the function (avg. # fledglings produced by well-tracked pairs x total number of pairs). These data represent minimum recruitment as defined by the Least Bell's Vireo Working Group "known fledged young."

<sup>2</sup>Calculation error in 2017 rectified in 2018 report.

Appendix C-1-G. Least Bell's Vireo status and management and Brown-headed Cowbird management data at survey sites in the Santa Ana River Watershed, California.

**Santa Ana River (SAR) - Upstream - Hidden Valley, north side of river**

	Parameter	2000-2013	2014	2015	2016	2017	2018	Combined
A.	Number of territorial males	n/a	21	39	40	36	62	n/a
B.	Number of known pairs (breeding and non-breeding)	19	14	23	27	17	38	138
C.	Number of fledged young observed	24	19	15	33	34	65	190
D.	Projected total of recruitment of vireo young <sup>1</sup>	44	28	n/a	100	68	122	428
E.	Average number of fledglings per pair (C/B)	1.3	1.4	0.7	1.2	2.0	1.7	1.4
F.	Projected number of fledglings per pair (D/B)	2.3	2.0	n/a	3.7	4.0	3.2	3.1
G.	Rate of missing eggs/chicks from nests (successful and unsuccessful nests)	11% 1 / 9	33% 1 / 3	n/a	n/a	n/a	n/a	n/a
H.	Rate of cowbird nest parasitism (well-tracked nests) <sup>2</sup>	33% 3 / 9	0% 0 / 3	n/a	0% 0 / 5	20% 2 / 10	0% 0 / 25	10% 5 / 52
I.	Numbers of cowbirds removed from study area	n/a	n/a	n/a	n/a	n/a	19	19
J.	This row purposefully omitted.							
K.	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	n/a	n/a	n/a	n/a	n/a	113	n/a
L.	Average number of cowbirds trapped per trap day (I/K)	n/a	n/a	n/a	n/a	n/a	0.17	n/a
M.	Number of field hours - LBVI	256	133	17	87	105	128	726
N.	Number of field hours - BHCO	n/a	n/a	n/a	n/a	n/a	n/a	n/a

<sup>1</sup>Survival rate of fledglings in well-tracked nests was applied to nests not visited as frequently by the function (avg. # fledglings produced by well-tracked pairs x total number of pairs). These data represent minimum recruitment as defined by the Least Bell's Vireo Working Group "known fledged young."

<sup>2</sup>Calculation error in 2017 rectified in 2018 report.

Appendix C-1-H. Least Bell's Vireo status and management and Brown-headed Cowbird management data at survey sites in the Santa Ana River Watershed, California.

**Santa Ana River (SAR) - Upstream - Hidden Valley, south side of river\***

	Parameter	2000-2013	2014	2015	2016	2017	2018	Combined
A.	Number of territorial males	n/a	85	104	121	123	141	n/a
B.	Number of known pairs (breeding and non-breeding)	388	32	27	66	67	60	640
C.	Number of fledged young observed	612	28	22	97	87	88	934
D.	Projected total of recruitment of vireo young <sup>1</sup>	1,009 (n = 14yrs)	n/a	n/a	198	322	144	1,664
E.	Average number of fledglings per pair (C/B)	1.6	0.9	0.8	1.5	1.3	1.5	1.5
F.	Projected number of fledglings per pair (D/B)	2.6	n/a	n/a	3.0	4.8	2.4	2.6
G.	Rate of missing eggs/chicks from nests (successful and unsuccessful nests)	40% 51 / 128	67% 2 / 3	n/a	n/a	n/a	n/a	n/a
H.	Rate of cowbird nest parasitism (well-tracked nests) <sup>2</sup>	7% 9 / 128	0% 0 / 3	n/a	0% 0 / 16	0% 0 / 16	0% 0 / 45	4% 9 / 208
I.	Numbers of cowbirds removed from study area	705	3	n/a	n/a	n/a	n/a	708
J.	This row purposefully omitted.							
K.	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	5,517	252	n/a	n/a	n/a	n/a	5,769
L.	Average number of cowbirds trapped per trap day (I/K)	0.13	0.01	n/a	n/a	n/a	n/a	0.12
M.	Number of field hours - LBVI	5,935	225	133	234	189	278	7,094
N.	Number of field hours - BHCO		100	n/a	n/a	n/a	n/a	

<sup>1</sup>Survival rate of fledglings in well-tracked nests was applied to nests not visited as frequently by the function (avg. # fledglings produced by well-tracked pairs x total number of pairs). These data represent minimum recruitment as defined by the Least Bell's Vireo Working Group "known fledged young."

<sup>2</sup>Calculation error in 2017 rectified in 2018 report.

\*As of 2010, reported as south side of the river.



Appendix C-1-I. Least Bell's Vireo status and management and Brown-headed Cowbird management data at survey sites in the Santa Ana River Watershed, California.

**Santa Ana River (SAR) - Upstream - Goose Creek, Norco to I-15**

	Parameter	2000-2013	2014	2015*	2016**	2017	2018	Combined
A.	Number of territorial males	n/a	110	71	63	73	91	n/a
B.	Number of known pairs (breeding and non-breeding)	459	32	36	31	34	56	648
C.	Number of fledged young observed	888	36	63	45	54	86	1,172
D.	Projected total of recruitment of vireo young <sup>1</sup>	1,423 (n = 13yrs)	n/a	90	71	99	151	1,944
E.	Average number of fledglings per pair (C/B)	1.9	1.1	1.8	1.5	1.6	1.5	1.8
F.	Projected number of fledglings per pair (D/B)	3.1	n/a	2.5	2.3	2.9	2.7	3.0
G.	Rate of missing eggs/chicks from nests (successful and unsuccessful nests)	37% 96 / 263	56% 5 / 9	n/a	n/a	n/a	n/a	n/a
H.	Rate of cowbird nest parasitism (well-tracked nests) <sup>2</sup>	6% 16 / 263	0% 0 / 9	0% 0 / 13	0% 0 / 22	0% 0 / 19	0% 0 / 25	5% 16 / 351
I.	Numbers of cowbirds removed from study area	523	4	29	12	7	11	586
J.	This row purposefully omitted.							
K.	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	2,099	218	226	136	129	110	2,918
L.	Average number of cowbirds trapped per trap day (I/K)	0.25	0.02	0.13	0.09	0.05	0.10	0.20
M.	Number of field hours - LBVI	3,205	204	352	234	270	151	4,416
N.	Number of field hours - BHCO	1,241	100	118	n/a	n/a	n/a	n/a

<sup>1</sup>Survival rate of fledglings in well-tracked nests was applied to nests not visited as frequently by the function (avg. # fledglings produced by well-tracked pairs x total number of pairs). These data represent minimum recruitment as defined by the Least Bell's Vireo Working Group "known fledged young."

<sup>2</sup>Calculation error in 2017 rectified in 2018 report.

\*Starting in 2015 Goose Creek Golf Club to I-15 only. Formerly monitored as Goose Creek Golf Club to River Rd.

\*\*Includes Goose Creek mitigation funded by IERCD.

Appendix C-1-J. Least Bell's Vireo status and management and Brown-headed Cowbird management data at survey sites in the Santa Ana River Watershed, California.

**Norco Bluffs (I-15 to River Rd., non-mitigation)\***

	Parameter	2000-2013	2014	2015	2016	2017	2018	Combined
A.	Number of territorial males	n/a	n/a	30	63	69	36	n/a
B.	Number of known pairs (breeding and non-breeding)	n/a	n/a	17	28	31	17	93
C.	Number of fledged young observed	n/a	n/a	43	45	76	39	203
D.	Projected total of recruitment of vireo young <sup>1</sup>	n/a	n/a	63	84	109	46	288
E.	Average number of fledglings per pair (C/B)	n/a	n/a	2.5	1.6	2.5	2.3	2.2
F.	Projected number of fledglings per pair (D/B)	n/a	n/a	3.7	3.0	3.5	2.7	3.1
G.	Rate of missing eggs/chicks from nests (successful and unsuccessful nests)	n/a	n/a	n/a	n/a	n/a	n/a	n/a
H.	Rate of cowbird nest parasitism (well-tracked nests) <sup>2</sup>	n/a	n/a	0% 0 / 13	0% 0 / 12	0% 0 / 22	0% 0 / 15	0% 0 / 62
I.	Numbers of cowbirds removed from study area	n/a	n/a	n/a	n/a	n/a	n/a	n/a
J.	This row purposefully omitted.							
K.	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	n/a	n/a	n/a	n/a	n/a	n/a	n/a
L.	Average number of cowbirds trapped per trap day (I/K)	n/a	n/a	n/a	n/a	n/a	n/a	n/a
M.	Number of field hours - LBVI	n/a	n/a	124	180	190	130	624
N.	Number of field hours - BHCO	n/a	n/a	n/a	n/a	n/a	n/a	n/a

<sup>1</sup>Survival rate of fledglings in well-tracked nests was applied to nests not visited as frequently by the function (avg. # fledglings produced by well-tracked pairs x total number of pairs). These data represent minimum recruitment as defined by the Least Bell's Vireo Working Group "known fledged young."

<sup>2</sup>Calculation error in 2017 rectified in 2018 report.

\*Formerly monitored as part of Goose Creek Golf Club to River Rd.

Appendix C-1-K. Least Bell's Vireo status and management and Brown-headed Cowbird management data at survey sites in the Santa Ana River Watershed, California.

**Temescal Canyon**

	Parameter	2000-2013	2014	2015	2016	2017	2018	Combined
A.	Number of territorial males	n/a	126	123	93	109	106	n/a
B.	Number of known pairs (breeding and non-breeding)	391	24	21	9	59	48	552
C.	Number of fledged young observed	644	17	22	5	48	16	752
D.	Projected total of recruitment of vireo young <sup>1</sup>	1,095 (n = 11yrs)	n/a	n/a	n/a	177	n/a	1,546
E.	Average number of fledglings per pair (C/B)	1.6	0.7	1.0	0.6	0.8	n/a	1.4
F.	Projected number of fledglings per pair (D/B)	2.8	n/a	n/a	n/a	3.0	n/a	2.8
G.	Rate of missing eggs/chicks from nests (successful and unsuccessful nests)	34% 66 / 192	n/a	n/a	n/a	n/a	n/a	n/a
H.	Rate of cowbird nest parasitism (well-tracked nests) <sup>2</sup>	16% 31 / 192	n/a	n/a	n/a	23% 3 / 13	n/a	17% 34 / 205
I.	Numbers of cowbirds removed from study area	2,634	194	435	297	240	212	4,012
J.	This row purposefully omitted.							
K.	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	10,345	1,077	93	644	652	547	13,358
L.	Average number of cowbirds trapped per trap day (I/K)	0.25	0.18	4.68	0.46	0.37	0.39	0.30
M.	Number of field hours - LBVI	9,606	90	96	146	263	170	12,225
N.	Number of field hours - BHCO		550	n/a	485	491	328	

<sup>1</sup>Survival rate of fledglings in well-tracked nests was applied to nests not visited as frequently by the function (avg. # fledglings produced by well-tracked pairs x total number of pairs). These data represent minimum recruitment as defined by the Least Bell's Vireo Working Group "known fledged young."

<sup>2</sup>Calculation error in 2017 rectified in 2018 report.

Appendix C-1-L. Least Bell's Vireo status and management and Brown-headed Cowbird management data at survey sites in the Santa Ana River Watershed, California.

**Chino Hills**

	Parameter	2000-2013	2014	2015	2016*	2017	2018	Combined
A.	Number of territorial males	n/a	10	24	18	25	26	n/a
B.	Number of known pairs (breeding and non-breeding)	62	2	6	11	7	9	97
C.	Number of fledged young observed	70	3	4	10	3	3	93
D.	Projected total of recruitment of vireo young <sup>1</sup>	87 (n = 6yrs)	n/a	8	n/a	n/a	n/a	136
E.	Average number of fledglings per pair (C/B)	1.1	1.5	0.7	0.9	0.4	n/a	1.0
F.	Projected number of fledglings per pair (D/B)	1.4	n/a	1.3	n/a	n/a	n/a	1.4
G.	Rate of missing eggs/chicks from nests (successful and unsuccessful nests)	65% 15 / 23	n/a	n/a	n/a	n/a	n/a	n/a
H.	Rate of cowbird nest parasitism (well-tracked nests) <sup>2</sup>	26% 6 / 23	n/a	20% 1 / 5	0% 0 / 2	n/a	50% 1 / 2	25% 8 / 32
I.	Numbers of cowbirds removed from study area	61	4	76	53	22	23	239
J.	This row purposefully omitted.							
K.	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	714	119	219	262	113	92	1,519
L.	Average number of cowbirds trapped per trap day (I/K)	0.09	0.03	0.35	0.20	0.19	0.25	0.16
M.	Number of field hours - LBVI	581	24	60	83	31	35	814
N.	Number of field hours - BHCO	630	75	95	128	n/a	n/a	928

<sup>1</sup>Survival rate of fledglings in well-tracked nests was applied to nests not visited as frequently by the function (avg. # fledglings produced by well-tracked pairs x total number of pairs). These data represent minimum recruitment as defined by the Least Bell's Vireo Working Group "known fledged young."

<sup>2</sup>Calculation error in 2017 rectified in 2018 report.

\*2016 includes former assessment sites

Appendix C-1-M. Least Bell's Vireo status and management and Brown-headed Cowbird management data at survey sites in the Santa Ana River Watershed, California.

**Santa Ana Canyon (SAC) - Upper Canyon**

	Parameter	2000-2013	2014	2015	2016	2017	2018	Combined
A.	Number of territorial males	n/a	27	25	26	30	32	n/a
B.	Number of known pairs (breeding and non-breeding)	153	18	9	12	21	25	238
C.	Number of fledged young observed	248	28	10	18	32	23	359
D.	Projected total of recruitment of vireo young <sup>1</sup>	398 (n = 10yrs)	54	18	28	42	48	595
E.	Average number of fledglings per pair (C/B)	1.6	1.6	1.1	1.5	1.5	0.9	1.5
F.	Projected number of fledglings per pair (D/B)	2.6	3.0	2.0	2.3	2.0	1.9	2.5
G.	Rate of missing eggs/chicks from nests (successful and unsuccessful nests)	39% 28 / 71	33% 2 / 6	n/a	n/a	n/a	n/a	n/a
H.	Rate of cowbird nest parasitism (well-tracked nests) <sup>2</sup>	6% 4 / 71	0% 0 / 6	0% 0 / 1	0% 0 / 3	0% 0 / 5	0% 0 / 10	4% 4 / 96
I.	Numbers of cowbirds removed from study area	608	56	14	28	1	94	801
J.	This row purposefully omitted.							
K.	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	2,874	137	129	134	47	118	3,439
L.	Average number of cowbirds trapped per trap day (I/K)	0.21	0.41	0.11	0.21	0.02	0.80	0.23
M.	Number of field hours - LBVI	10,030	365	408	386	573	492	13,977
N.	Number of field hours - BHCO		339	479	425	296	184	

<sup>1</sup>Survival rate of fledglings in well-tracked nests was applied to nests not visited as frequently by the function (avg. # fledglings produced by well-tracked pairs x total number of pairs). These data represent minimum recruitment as defined by the Least Bell's Vireo Working Group "known fledged young."

<sup>2</sup>Calculation error in 2017 rectified in 2018 report.

Appendix C-1-N. Least Bell's Vireo status and management and Brown-headed Cowbird management data at survey sites in the Santa Ana River Watershed, California.

### Santa Ana Canyon (SAC) - Green River Golf Club

	Parameter	2000-2013	2014	2015	2016	2017	2018	Combined
A.	Number of territorial males	n/a	26	31	33	42	42	n/a
B.	Number of known pairs (breeding and non-breeding)	162	19	23	26	33	38	301
C.	Number of fledged young observed	260	29	35	27	76	20	447
D.	Projected total of recruitment of vireo young <sup>1</sup>	389 (n = 12yrs)	44	37	29	145	23	692
E.	Average number of fledglings per pair (C/B)	1.6	1.5	1.5	1.0	2.3	0.5	1.5
F.	Projected number of fledglings per pair (D/B)	2.4	2.3	1.6	1.1	4.4	0.6	2.3
G.	Rate of missing eggs/chicks from nests (successful and unsuccessful nests)	34% 30 / 88	25% 2 / 8	n/a	n/a	n/a	n/a	n/a
H.	Rate of cowbird nest parasitism (well-tracked nests) <sup>2</sup>	5% 4 / 88	0% 0 / 8	0% 0 / 15	0% 0 / 13	0% 0 / 17	0% 0 / 16	3% 4 / 157
I.	Numbers of cowbirds removed from study area	957	15	32	36	27	-1	1,066
J.	This row purposefully omitted.							
K.	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	3,881	131	237	260	130	83	4,722
L.	Average number of cowbirds trapped per trap day (I/K)	0.25	0.11	0.14	0.14	0.21	0.00	0.23
M.	Number of field hours - LBVI	*See Upper Canyon Summary Sheet for all Santa Ana Canyon hours						
N.	Number of field hours - BHCO							

<sup>1</sup>Survival rate of fledglings in well-tracked nests was applied to nests not visited as frequently by the function (avg. # fledglings produced by well-tracked pairs x total number of pairs). These data represent minimum recruitment as defined by the Least Bell's Vireo Working Group "known fledged young."

<sup>2</sup>Calculation error in 2017 rectified in 2018 report.

Appendix C-1-O. Least Bell's Vireo status and management and Brown-headed Cowbird management data at survey sites in the Santa Ana River Watershed, California.

### Santa Ana Canyon (SAC) - Featherly Regional Park

	Parameter	2000-2013	2014	2015	2016	2017	2018	Combined
A.	Number of territorial males	n/a	59	65	64	59	66	n/a
B.	Number of known pairs (breeding and non-breeding)	234	39	38	39	36	25	411
C.	Number of fledged young observed	287	35	37	23	57	25	464
D.	Projected total of recruitment of vireo young <sup>1</sup>	445 (n = 10yrs)	43	49	39	126	53	781
E.	Average number of fledglings per pair (C/B)	1.2	0.9	1.0	0.6	1.6	1.0	1.1
F.	Projected number of fledglings per pair (D/B)	1.9	1.1	1.3	1.0	3.5	2.1	1.9
G.	Rate of missing eggs/chicks from nests (successful and unsuccessful nests)	51% 48 / 95	64% 9 / 14	n/a	n/a	n/a	n/a	n/a
H.	Rate of cowbird nest parasitism (well-tracked nests) <sup>2</sup>	5% 5 / 95	0% 0 / 14	0% 0 / 19	0% 0 / 12	0% 0 / 22	0% 0 / 12	3% 5 / 174
I.	Numbers of cowbirds removed from study area	367	41	44	8	10	26	496
J.	This row purposefully omitted.							
K.	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	2,942	241	495	398	383	239	4,698
L.	Average number of cowbirds trapped per trap day (I/K)	0.12	0.17	0.09	0.02	0.03	0.11	0.11
M.	Number of field hours - LBVI	*See Upper Canyon Summary Sheet for all Santa Ana Canyon hours						
N.	Number of field hours - BHCO							

<sup>1</sup>Survival rate of fledglings in well-tracked nests was applied to nests not visited as frequently by the function (avg. # fledglings produced by well-tracked pairs x total number of pairs). These data represent minimum recruitment as defined by the Least Bell's Vireo Working Group "known fledged young."

<sup>2</sup>Calculation error in 2017 rectified in 2018 report.



Appendix C-1-P. Least Bell's Vireo status and management and Brown-headed Cowbird management data at survey sites in the Santa Ana River Watershed, California.

### Santiago Canyon (Irvine Park)

	Parameter	2000-2013	2014	2015	2016	2017	2018	Combined
A.	Number of territorial males	n/a	27	24	17	14	18	n/a
B.	Number of known pairs (breeding and non-breeding)	36	9	1	1	1	5	53
C.	Number of fledged young observed	40	12	2	0	0	2	56
D.	Projected total of recruitment of vireo young <sup>1</sup>	119 (n = 2yrs)	14	n/a	n/a	n/a	n/a	175
E.	Average number of fledglings per pair (C/B)	1.1	1.3	n/a	n/a	n/a	n/a	1.1
F.	Projected number of fledglings per pair (D/B)	3.3	1.6	n/a	n/a	n/a	n/a	3.3
G.	Rate of missing eggs/chicks from nests (successful and unsuccessful nests)	20% 1 / 5	80% 4 / 5	n/a	n/a	n/a	n/a	n/a
H.	Rate of cowbird nest parasitism (well-tracked nests) <sup>2</sup>	0% 0 / 5	0% 0 / 5	n/a	n/a	n/a	n/a	0% 0 / 10
I.	Numbers of cowbirds removed from study area	n/a	n/a	n/a	n/a	n/a	n/a	n/a
J.	This row purposefully omitted.							
K.	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	n/a	n/a	n/a	n/a	n/a	n/a	n/a
L.	Average number of cowbirds trapped per trap day (I/K)	n/a	n/a	n/a	n/a	n/a	n/a	n/a
M.	Number of field hours - LBVI	56	89	n/a	7	8	33	193
N.	Number of field hours - BHCO	n/a	n/a	n/a	n/a	n/a	n/a	n/a

<sup>1</sup>Survival rate of fledglings in well-tracked nests was applied to nests not visited as frequently by the function (avg. # fledglings produced by well-tracked pairs x total number of pairs). These data represent minimum recruitment as defined by the Least Bell's Vireo Working Group "known fledged young."

<sup>2</sup>Calculation error in 2017 rectified in 2018 report.

Appendix C-2-A. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2018.

**San Jacinto**

Host Plant Species (listed in taxonomic order)	2000-2013	2014	2015	2016	2017	2018	Combined	Percentage of Combined
Fremont Cottonwood ( <i>Populus fremontii</i> )						1	1	1%
Narrowleaf Willow ( <i>Salix exigua</i> )	55			1	5	23	84	50%
Dead Narrowleaf Willow ( <i>Salix exigua</i> )	1						1	1%
Goodding's Black Willow ( <i>Salix gooddingii</i> )	5			4	3	5	17	10%
Red Willow ( <i>Salix laevigata</i> )				2	1		3	2%
Tamarisk <sup>ie</sup> ( <i>Tamarix ramosissima</i> )	2					3	5	3%
Black Mustard <sup>ie</sup> ( <i>Brassica nigra</i> )	1						1	1%
Arrowweed ( <i>Pluchea sericea</i> )					1	1	2	1%
Coyote Brush ( <i>Baccharis pilularis</i> )		1		3	2	3	9	5%
Mulefat ( <i>Baccharis salicifolia</i> )	34			1	1	1	37	22%
Unknown/No data	3	1			3	1	8	5%
<b>Total</b>	<b>101</b>	<b>2</b>	<b>0</b>	<b>11</b>	<b>16</b>	<b>38</b>	<b>168</b>	<b>100%</b>

<sup>i</sup> = invasive

<sup>e</sup> = non-native

<sup>r</sup> = endangered, threatened, or sensitive

Appendix C-2-B. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2018.

**San Timoteo Canyon**

Host Plant Species (listed in taxonomic order)	2000-2013	2014	2015	2016	2017	2018	Combined	Percentage of Combined
Fourwing Saltbush ( <i>Atriplex canescens</i> )	1						1	<1%
Western Sycamore ( <i>Platanus racemosa</i> )	1						1	<1%
California Scrub Oak ( <i>Quercus berberidifolia</i> )			1			1	2	<1%
Oak sp. ( <i>Quercus</i> sp.)			1				1	<1%
Southern California Black Walnut <sup>r</sup> ( <i>Juglans californica</i> )	1				1	1	3	<1%
Fremont Cottonwood ( <i>Populus fremontii</i> )	24	5	8	3	3	8	51	5%
Dead Fremont Cottonwood ( <i>Populus fremontii</i> )	1						1	<1%
Narrowleaf Willow ( <i>Salix exigua</i> )	16	4	2	1	6	1	30	3%
Goodding's Black Willow ( <i>Salix gooddingii</i> )	62	2	5	4	3	3	79	7%
Red Willow ( <i>Salix laevigata</i> )	108	6	20	16	14	6	170	16%
Arroyo Willow ( <i>Salix lasiolepis</i> )	130	20	24	22	33	26	255	23%
Yellow Willow ( <i>Salix lasiandra</i> )	7	1	1	3			12	1%
Willow sp. ( <i>Salix</i> sp.)			1				1	<1%
Dead Willow sp. ( <i>Salix</i> sp.)	1						1	<1%
Tamarisk <sup>ie</sup> ( <i>Tamarix ramosissima</i> )	1		1				2	<1%
White Mulberry <sup>e</sup> ( <i>Morus alba</i> )		1					1	<1%
Black Mustard <sup>ie</sup> ( <i>Brassica nigra</i> )	1						1	<1%
Mustard sp. <sup>ie</sup> ( <i>Brassica</i> sp.)	4						4	<1%
Perennial Pepperweed <sup>ie</sup> ( <i>Lepidium latifolium</i> )			1				1	<1%
Golden Currant ( <i>Ribes aureum</i> )	3	1		1			5	<1%
California Wild Rose ( <i>Rubus californica</i> )					1		1	<1%
Desert Wild Grape ( <i>Vitis girdiana</i> )	28	18	10	8	13	8	85	8%

Appendix C-2-B continued. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2018.

### San Timoteo Canyon

Host Plant Species (listed in taxonomic order)	2000-2013	2014	2015	2016	2017	2018	Combined	Percentage of Combined
Toyon ( <i>Heteromeles arbutifolia</i> )	10	4	3		1		18	2%
Boxelder ( <i>Acer negundo</i> )	1		1				2	<1%
Fragrant Sumac ( <i>Rhus aromatica</i> )	1						1	<1%
Sugar Sumac ( <i>Rhus ovata</i> )						1	1	<1%
Tree of Heaven <sup>ie</sup> ( <i>Ailanthus altissima</i> )		1					1	<1%
Blue Elderberry ( <i>Sambucus nigra</i> ssp. <i>caerulea</i> )	25	4	9	1	5	1	45	4%
Mulefat ( <i>Baccharis salicifolia</i> )	179	26	34	19	14	19	291	27%
Willow Baccharis ( <i>Baccharis salicina</i> )	1						1	<1%
Douglas' Sagewort ( <i>Artemisia douglasiana</i> )	17	1	1				19	2%
Arroyo Willow ( <i>S. lasiolepis</i> ) and Sweet Fennel <sup>i</sup> ( <i>Foeniculum vulgare</i> )	1						1	<1%
Desert Wild Grape ( <i>V. girdiana</i> ) and Arroyo Willow ( <i>S. lasiolepis</i> )	1						1	<1%
Deadfall	1		1				2	<1%
Unknown/No data			2				2	<1%
<b>Total</b>	<b>626</b>	<b>94</b>	<b>126</b>	<b>78</b>	<b>94</b>	<b>75</b>	<b>1,093</b>	<b>100%</b>

<sup>i</sup> = invasive

<sup>e</sup> = non-native

<sup>r</sup> = endangered, threatened, or sensitive

Appendix C-2-C. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2018.

**Meridian Conservation Area\***

Host Plant Species (listed in taxonomic order)	2000-2013	2014	2015	2016	2017	2018	Combined	Percentage of Combined
Goodding's Black Willow ( <i>Salix gooddingii</i> )	10						10	32%
Red Willow ( <i>Salix laevigata</i> )	6	1			2		9	29%
Arroyo Willow ( <i>Salix lasiolepis</i> )	6	2			1		9	29%
Dead Willow sp. ( <i>Salix</i> sp.)					1		1	3%
Mulefat ( <i>Baccharis salicifolia</i> )	1				1		2	6%
<b>Total</b>	<b>23</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>5</b>	<b>0</b>	<b>31</b>	<b>100%</b>

<sup>i</sup> = invasive

<sup>e</sup> = non-native

<sup>r</sup> = endangered, threatened, or sensitive

\*Former March SKR Preserve

Appendix C-2-D. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2018.

**Sycamore Canyon**

Host Plant Species (listed in taxonomic order)	2000-2013	2014	2015	2016	2017	2018	Combined	Percentage of Combined
Fremont Cottonwood ( <i>Populus fremontii</i> )		1					1	7%
Goodding's Black Willow ( <i>Salix gooddingii</i> )	9						9	64%
Arroyo Willow ( <i>Salix lasiolepis</i> )		1					1	7%
Blue Elderberry ( <i>Sambucus nigra</i> ssp. <i>caerulea</i> )	1	2					3	21%
<b>Total</b>	<b>10</b>	<b>4</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>14</b>	<b>100%</b>

<sup>i</sup> = invasive

<sup>e</sup> = non-native

<sup>r</sup> = endangered, threatened, or sensitive

Appendix C-2-E. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2018.

**Mockingbird Canyon**

Host Plant Species (listed in taxonomic order)	2000-2013	2014	2015	2016	2017	2018	Combined	Percentage of Combined
Fourwing Saltbush ( <i>Atriplex canescens</i> )	1						1	1%
Western Sycamore ( <i>Platanus racemosa</i> )	1						1	1%
Southern California Black Walnut <sup>r</sup> ( <i>Juglans californica</i> )	1						1	1%
Fremont Cottonwood ( <i>Populus fremontii</i> )	2						2	1%
Narrowleaf Willow ( <i>Salix exigua</i> )			1				1	1%
Goodding's Black Willow ( <i>Salix gooddingii</i> )	31						31	17%
Red Willow ( <i>Salix laevigata</i> )	54		2				56	31%
Arroyo Willow ( <i>Salix lasiolepis</i> )	15			1			16	9%
Willow sp. ( <i>Salix</i> sp.)	1						1	1%
Dead Willow sp. ( <i>Salix</i> sp.)	1						1	1%
Perennial Pepperweed <sup>ie</sup> ( <i>Lepidium latifolium</i> )	4						4	2%
Dead Perennial Pepperweed <sup>ie</sup> ( <i>Lepidium latifolium</i> )	1						1	1%
Hollyleaf Cherry ( <i>Prunus ilicifolia</i> )	1						1	1%
Desert Wild Grape ( <i>Vitis girdiana</i> )	7						7	4%
Peruvian Pepper Tree <sup>ie</sup> ( <i>Schinus molle</i> )	4						4	2%
Wild Celery <sup>e</sup> ( <i>Apium graveolens</i> )	1						1	1%
Blue Elderberry ( <i>Sambucus nigra</i> ssp. <i>caerulea</i> )	24	1	2	2			29	16%
Arrowweed ( <i>Pluchea sericea</i> )	1						1	1%
Mulefat ( <i>Baccharis salicifolia</i> )	15						15	8%
Willow Baccharis ( <i>Baccharis salicina</i> )	2						2	1%
Goodding's Black Willow ( <i>S. gooddingii</i> ) and Perennial Pepperweed <sup>ie</sup> ( <i>L. latifolium</i> )	1						1	1%
Willow sp. ( <i>Salix</i> sp.) and Perennial Pepperweed <sup>ie</sup> ( <i>L. latifolium</i> )	1						1	1%

Appendix C-2-E continued. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2018.

### Mockingbird Canyon

Host Plant Species (listed in taxonomic order)	2000-2013	2014	2015	2016	2017	2018	Combined	Percentage of Combined
Desert Wild Grape ( <i>V. girdiana</i> ) and Goodding's Black Willow ( <i>S. gooddingii</i> )	1						1	1%
Coyote Brush ( <i>B. pilularis</i> ) and Mulefat ( <i>B. salicifolia</i> )	1						1	1%
Unknown/No data		2					2	1%
<b>Total</b>	<b>171</b>	<b>3</b>	<b>5</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>182</b>	<b>100%</b>

<sup>i</sup> = invasive

<sup>e</sup> = non-native

<sup>r</sup> = endangered, threatened, or sensitive

Appendix C-2-F. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2018.

### Santa Ana River (SAR) - Upstream - Riverside Ave. to Van Buren Blvd.

Host Plant Species (listed in taxonomic order)	2000-2013	2014	2015	2016	2017	2018	Combined	Percentage of Combined
Western Sycamore ( <i>Platanus racemosa</i> )					3		3	1%
White Alder ( <i>Alnus rhombifolia</i> )					1		1	<1%
California Scrub Oak ( <i>Quercus berberidifolia</i> )	2						2	1%
Fremont Cottonwood ( <i>Populus fremontii</i> )	8				4		12	5%
Narrowleaf Willow ( <i>Salix exigua</i> )	3	2			5		10	4%
Goodding's Black Willow ( <i>Salix gooddingii</i> )	11			2	7	5	25	11%
Dead Goodding's Black Willow ( <i>Salix gooddingii</i> )	1						1	<1%
Red Willow ( <i>Salix laevigata</i> )	8			1	5	6	20	9%
Arroyo Willow ( <i>Salix lasiolepis</i> )	37			3	9	3	52	22%
Yellow Willow ( <i>Salix lasiandra</i> )	1						1	<1%
Willow sp. ( <i>Salix</i> sp.)	1					1	2	1%



Appendix C-2-F continued. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2018.

**Santa Ana River (SAR) - Upstream - Riverside Ave. to Van Buren Blvd.**

Host Plant Species (listed in taxonomic order)	2000-2013	2014	2015	2016	2017	2018	Combined	Percentage of Combined
Tamarisk <sup>ie</sup> ( <i>Tamarix ramosissima</i> )	1				1		2	1%
Hoary Nettle ( <i>Urtica dioica</i> )	1						1	<1%
California Wild Rose ( <i>Rosa californica</i> )	1			1			2	1%
California Blackberry ( <i>Rubus ursinus</i> )					1		1	<1%
Desert Wild Grape ( <i>Vitis girdiana</i> )	3	1	2	2	4	4	16	7%
Poison Oak ( <i>Toxicodendron diversilobum</i> )				1			1	<1%
Tree Tobacco <sup>ie</sup> ( <i>Nicotiana glauca</i> )	1						1	<1%
Blue Elderberry ( <i>Sambucus nigra</i> ssp. <i>caerulea</i> )	4			1	2		7	3%
Mulefat ( <i>Baccharis salicifolia</i> )	35	2		5	16	10	68	29%
Goodding's Black Willow ( <i>S. gooddingii</i> ) and Desert Wild Grape ( <i>V. girdiana</i> )						1	1	<1%
Dead Goodding's Black Willow ( <i>S. gooddingii</i> ) and Hoary Nettle ( <i>U. dioica</i> )	1						1	<1%
Unknown/No Data						2	2	1%
<b>Total</b>	<b>119</b>	<b>5</b>	<b>2</b>	<b>16</b>	<b>58</b>	<b>32</b>	<b>232</b>	<b>100%</b>

<sup>i</sup> = invasive

<sup>e</sup> = non-native

<sup>r</sup> = endangered, threatened, or sensitive

Appendix C-2-G. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2018.

**Santa Ana River (SAR) - Upstream - Hidden Valley, north side of river**

Host Plant Species (listed in taxonomic order)	2000-2013	2014	2015	2016	2017	2018	Combined	Percentage of Combined
Arundo <sup>i</sup> ( <i>Arundo donax</i> )						1	1	2%
Western Sycamore ( <i>Platanus racemosa</i> )						1	1	2%
Fremont Cottonwood ( <i>Populus fremontii</i> )				1	3	1	5	9%
Narrowleaf Willow ( <i>Salix exigua</i> )		1					1	2%
Goodding's Black Willow ( <i>Salix gooddingii</i> )						2	2	4%
Red Willow ( <i>Salix laevigata</i> )	2				1		3	5%
Arroyo Willow ( <i>Salix lasiolepis</i> )	1			2	2	5	10	18%
California Blackberry ( <i>Rubus ursinus</i> )					1		1	2%
Desert Wild Grape ( <i>Vitis girdiana</i> )	3						3	5%
Blue Elderberry ( <i>Sambucus nigra</i> ssp. <i>caerulea</i> )	2	1					3	5%
Mulefat ( <i>Baccharis salicifolia</i> )	4	2		2	4	15	27	47%
<b>Total</b>	<b>12</b>	<b>4</b>	<b>0</b>	<b>5</b>	<b>11</b>	<b>25</b>	<b>57</b>	<b>100%</b>

<sup>i</sup> = invasive

<sup>e</sup> = non-native

<sup>r</sup> = endangered, threatened, or sensitive

Appendix C-2-H. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2018.

**Santa Ana River (SAR) - Upstream - Hidden Valley, south side of river\***

Host Plant Species (listed in taxonomic order)	2000-2013	2014	2015	2016	2017	2018	Combined	Percentage of Combined
Fremont Cottonwood ( <i>Populus fremontii</i> )				1			1	<1%
Narrowleaf Willow ( <i>Salix exigua</i> )	3			1		1	5	2%
Goodding's Black Willow ( <i>Salix gooddingii</i> )	18			1	2	5	26	11%
Red Willow ( <i>Salix laevigata</i> )	9	1		3	5	2	20	8%
Arroyo Willow ( <i>Salix lasiolepis</i> )	54	2		2	4	17	79	32%
Yellow Willow ( <i>Salix lasiandra</i> )	1						1	<1%
Willow sp. ( <i>Salix</i> sp.)	2						2	1%
Tamarisk <sup>ie</sup> ( <i>Tamarix ramosissima</i> )						1	1	<1%
California Wild Rose ( <i>Rosa californica</i> )				1			1	<1%
Desert Wild Grape ( <i>Vitis girdiana</i> )	10	1		1		4	16	7%
Poison Oak ( <i>Toxicodendron diversilobum</i> )	1						1	<1%
Blue Elderberry ( <i>Sambucus nigra</i> ssp. <i>caerulea</i> )	3			1	1		5	2%
Dead Blue Elderberry ( <i>Sambucus nigra</i> ssp. <i>caerulea</i> )					1		1	<1%
Coyote Brush ( <i>Baccharis pilularis</i> )	1						1	<1%
Mulefat ( <i>Baccharis salicifolia</i> )	46			4	2	17	69	28%
Dead Mulefat ( <i>Baccharis salicifolia</i> )					1		1	<1%
Red Willow ( <i>S. laevigata</i> ) and Wild Cucumber ( <i>Marah macrocarpa</i> )					1		1	<1%
Red Willow ( <i>S. laevigata</i> ) and Unknown	1						1	<1%
Willow sp. ( <i>Salix</i> sp.) and California Blackberry ( <i>Rubus ursinus</i> )	1						1	<1%
Desert Wild Grape ( <i>V. girdiana</i> ) and California Wild Rose ( <i>R. californica</i> )	1						1	<1%
Mulefat ( <i>B. salicifolia</i> ) and Poison Hemlock <sup>ie</sup> ( <i>C. maculatum</i> )	1						1	<1%
Unknown/No data	2			6	1		9	4%
<b>Total</b>	<b>154</b>	<b>4</b>	<b>0</b>	<b>21</b>	<b>18</b>	<b>47</b>	<b>244</b>	<b>100%</b>

<sup>i</sup> = invasive

<sup>e</sup> = non-native

<sup>r</sup> = endangered, threatened, or sensitive

\*As of 2010, reported as south side of the river

Appendix C-2-I. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2018.

**Santa Ana River (SAR) - Upstream - Goose Creek, Norco to I-15**

Host Plant Species (listed in taxonomic order)	2000-2013	2014	2015	2016	2017	2018	Combined	Percentage of Combined
Southern California Black Walnut <sup>r</sup> ( <i>Juglans californica</i> )	1						1	<1%
Fremont Cottonwood ( <i>Populus fremontii</i> )	14				1	3	18	4%
Dead Fremont Cottonwood ( <i>Populus fremontii</i> )	1						1	<1%
Narrowleaf Willow ( <i>Salix exigua</i> )	10	1	1		1	1	14	3%
Goodding's Black Willow ( <i>Salix gooddingii</i> )	47		4	2			53	13%
Red Willow ( <i>Salix laevigata</i> )	4		3	1	2	6	16	4%
Arroyo Willow ( <i>Salix lasiolepis</i> )	100	1		9	6	5	121	30%
Dead Arroyo Willow ( <i>Salix lasiolepis</i> )	1						1	<1%
Yellow Willow ( <i>Salix lasiandra</i> )			1				1	<1%
Willow sp. ( <i>Salix</i> sp.)			1			2	3	1%
Dead Willow sp. ( <i>Salix</i> sp.)		1					1	<1%
Desert Wild Grape ( <i>Vitis girdiana</i> )	15		4		1	1	21	5%
Poison Hemlock <sup>ie</sup> ( <i>Conium maculatum</i> )	4						4	1%
Ash sp. ( <i>Fraxinus</i> sp.)	1						1	<1%
Blue Elderberry ( <i>Sambucus nigra</i> ssp. <i>caerulea</i> )	3				1		4	1%
Mulefat ( <i>Baccharis salicifolia</i> )	100	10	4	8	7	9	138	34%
Dead Mulefat ( <i>Baccharis salicifolia</i> )	2			2			4	1%
California Sagebrush ( <i>Artemisia californica</i> )						1	1	<1%
Goodding's Black Willow ( <i>S. gooddingii</i> ) and Poison Hemlock <sup>ie</sup> ( <i>C. maculatum</i> )	1						1	<1%
Unknown/No data	3						3	1%
<b>Total</b>	<b>307</b>	<b>13</b>	<b>18</b>	<b>22</b>	<b>19</b>	<b>28</b>	<b>407</b>	<b>100%</b>

<sup>i</sup> = invasive

<sup>e</sup> = non-native

<sup>r</sup> = endangered, threatened, or sensitive

\*Starting in 2015 Goose Creek Golf Club to I-15 only. Formerly monitored as Goose Creek Golf Club to River Rd.

\*\*Includes Goose Creek mitigation funded by IERCD

Appendix C-2-J. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2018.

**Norco Bluffs (I-15 to River Rd., non-mitigation)\***

Host Plant Species (listed in taxonomic order)	2000-2013	2014	2015	2016	2017	2018	Combined	Percentage of Combined
Narrowleaf Willow ( <i>Salix exigua</i> )				1	1		2	3%
Goodding's Black Willow ( <i>Salix gooddingii</i> )			3	2	5	3	13	19%
Arroyo Willow ( <i>Salix lasiolepis</i> )			5	5	10	5	25	37%
Dead Arroyo Willow ( <i>Salix lasiolepis</i> )						1	1	1%
California Wild Rose ( <i>Rosa californica</i> )						1	1	1%
Desert Wild Grape ( <i>Vitis girdiana</i> )				3	2	2	7	10%
Mulefat ( <i>Baccharis salicifolia</i> )			5	1	6	4	16	24%
Desert Wild Grape ( <i>V. girdiana</i> ) and Mulefat ( <i>B. salicifolia</i> )			1		1		2	3%
<b>Total</b>	<b>0</b>	<b>0</b>	<b>14</b>	<b>12</b>	<b>25</b>	<b>16</b>	<b>67</b>	<b>100%</b>

<sup>i</sup> = invasive

<sup>e</sup> = non-native

<sup>r</sup> = endangered, threatened, or sensitive

\*Formerly monitored as part of Goose Creek Golf Club to River Rd.

Appendix C-2-K. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2018.

**Temescal Canyon**

Host Plant Species (listed in taxonomic order)	2000-2013	2014	2015	2016	2017	2018	Combined	Percentage of Combined
Western Sycamore ( <i>Platanus racemosa</i> )	1						1	<1%
Fremont Cottonwood ( <i>Populus fremontii</i> )	4				1		5	2%
Narrowleaf Willow ( <i>Salix exigua</i> )	1				1		2	1%
Goodding's Black Willow ( <i>Salix gooddingii</i> )	30			1	4		35	13%
Red Willow ( <i>Salix laevigata</i> )	14						14	5%
Arroyo Willow ( <i>Salix lasiolepis</i> )	72				5		77	28%
Yellow Willow ( <i>Salix lasiandra</i> )	4						4	1%
Dead Willow sp. ( <i>Salix</i> sp.)	1						1	<1%
Tamarisk <sup>ie</sup> ( <i>Tamarix ramosissima</i> )	4						4	1%
Mustard sp. <sup>ie</sup> ( <i>Brassica</i> sp.)	1						1	<1%
Perennial Pepperweed <sup>ie</sup> ( <i>Lepidium latifolium</i> )	1						1	<1%
California Blackberry ( <i>Rubus ursinus</i> )	1						1	<1%
Toyon ( <i>Heteromeles arbutifolia</i> )	1						1	<1%
Poison Oak ( <i>Toxicodendron diversilobum</i> )	1						1	<1%
Sugar Sumac ( <i>Rhus ovata</i> )	2						2	1%
Blue Elderberry ( <i>Sambucus nigra</i> ssp. <i>caerulea</i> )	8						8	3%
Arrowweed ( <i>Pluchea sericea</i> )	2						2	1%
Coyote Brush ( <i>Baccharis pilularis</i> )	2						2	1%
Mulefat ( <i>Baccharis salicifolia</i> )	81				5		86	31%
Dead Mulefat ( <i>Baccharis salicifolia</i> )	3						3	1%
Douglas' Sagewort ( <i>Artemisia douglasiana</i> )	1						1	<1%
Common Sunflower ( <i>Helianthus annuus</i> )	1						1	<1%

Appendix C-2-K continued. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2018.

### Temescal Canyon

Host Plant Species (listed in taxonomic order)	2000-2013	2014	2015	2016	2017	2018	Combined	Percentage of Combined
Brittlebush ( <i>Encelia farinosa</i> )	1						1	<1%
Red Willow ( <i>S. laevigata</i> ) and dead Hoary Nettle ( <i>U. dioica</i> )	1						1	<1%
Deadfall	3						3	1%
Unknown/No data						19	19	7%
<b>Total</b>	<b>241</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>16</b>	<b>19</b>	<b>277</b>	<b>100%</b>

<sup>i</sup> = invasive

<sup>e</sup> = non-native

<sup>r</sup> = endangered, threatened, or sensitive



Appendix C-2-L. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2018.

**Chino Hills**

Host Plant Species (listed in taxonomic order)	2000-2013	2014	2015	2016	2017	2018	Combined	Percentage of Combined
Coast Live Oak ( <i>Quercus agrifolia</i> )	1						1	2%
California Scrub Oak ( <i>Quercus berberidifolia</i> )			1				1	2%
Goodding's Black Willow ( <i>Salix gooddingii</i> )	9		5	1			15	36%
Red Willow ( <i>Salix laevigata</i> )	6			1			7	17%
Arroyo Willow ( <i>Salix lasiolepis</i> )	1						1	2%
Chinese Elm <sup>e</sup> ( <i>Ulmus parvifolia</i> )				1			1	2%
Toyon ( <i>Heteromeles arbutifolia</i> )	1						1	2%
Bank Catclaw <sup>e</sup> ( <i>Acacia redolens</i> )				1			1	2%
Desert Wild Grape ( <i>Vitis girdiana</i> )	1						1	2%
Peruvian Pepper Tree <sup>ie</sup> ( <i>Schinus molle</i> )						1	1	2%
Blue Elderberry ( <i>Sambucus nigra</i> ssp. <i>caerulea</i> )	2					1	3	7%
Mulefat ( <i>Baccharis salicifolia</i> )	5		1				6	14%
Douglas' Sagewort ( <i>Artemisia douglasiana</i> )	3						3	7%
<b>Total</b>	<b>29</b>	<b>0</b>	<b>7</b>	<b>4</b>	<b>0</b>	<b>2</b>	<b>42</b>	<b>100%</b>

<sup>i</sup> = invasive

<sup>e</sup> = non-native

<sup>r</sup> = endangered, threatened, or sensitive

Appendix C-2-M. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2018.

**Santa Ana Canyon (SAC) - Upper Canyon**

Host Plant Species (listed in taxonomic order)	2000-2013	2014	2015	2016	2017	2018	Combined	Percentage of Combined
Coast Live Oak ( <i>Quercus agrifolia</i> )	1						1	1%
Scrub Oak ( <i>Quercus berberidifolia</i> )	2						2	1%
Fremont Cottonwood ( <i>Populus fremontii</i> )	7	1				1	9	7%
Narrowleaf Willow ( <i>Salix exigua</i> )	1						1	1%
Goodding's Black Willow ( <i>Salix gooddingii</i> )	11				1		12	9%
Red Willow ( <i>Salix laevigata</i> )	3					1	4	3%
Arroyo Willow ( <i>Salix lasiolepis</i> )	3						3	2%
Willow sp. ( <i>Salix</i> sp.)	1						1	1%
Castorbean <sup>ie</sup> ( <i>Ricinus communis</i> )	1						1	1%
Mustard sp. <sup>ie</sup> ( <i>Brassica</i> sp.)	2						2	1%
California Wild Rose ( <i>Rosa californica</i> )	3						3	2%
Toyon ( <i>Heteromeles arbutifolia</i> )	1						1	1%
Desert Wild Grape ( <i>Vitis girdiana</i> )	4						4	3%
Laurel Sumac ( <i>Malosma laurina</i> )						1	1	1%
Peruvian Pepper Tree <sup>ie</sup> ( <i>Schinus molle</i> )	1		1			1	3	2%
Poison Oak ( <i>Toxicodendron diversilobum</i> )	5						5	4%
Poison Hemlock <sup>ie</sup> ( <i>Conium maculatum</i> )	2						2	1%
Blue Elderberry ( <i>Sambucus nigra</i> ssp. <i>caerulea</i> )	18			1	1	2	22	16%
Milk Thistle <sup>ie</sup> ( <i>Silybum marianum</i> )	1						1	1%
Coyote Brush ( <i>Baccharis pilularis</i> )	1						1	1%
Mulefat ( <i>Baccharis salicifolia</i> )	36	7		2	2	7	54	39%
Desertbroom Baccharis ( <i>Baccharis sarothroides</i> )	1						1	1%

Appendix C-2-M continued. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2018.

### Santa Ana Canyon (SAC) - Upper Canyon

Host Plant Species (listed in taxonomic order)	2000-2013	2014	2015	2016	2017	2018	Combined	Percentage of Combined
Rough Cockelburr ( <i>Xanthium strumarium</i> )	1						1	1%
Goodding's Black Willow ( <i>S. gooddingii</i> ) and Poison Hemlock <sup>ie</sup> ( <i>C. maculatum</i> )	1						1	1%
Desert Wild Grape ( <i>V. girdiana</i> ) and Mulefat ( <i>B. salicifolia</i> )	1						1	1%
<b>Total</b>	<b>108</b>	<b>8</b>	<b>1</b>	<b>3</b>	<b>4</b>	<b>13</b>	<b>137</b>	<b>100%</b>

<sup>i</sup> = invasive

<sup>e</sup> = non-native

<sup>r</sup> = endangered, threatened, or sensitive

Appendix C-2-N. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2018.

### Santa Ana Canyon (SAC) - Green River Golf Club

Host Plant Species (listed in taxonomic order)	2000-2013	2014	2015	2016	2017	2018	Combined	Percentage of Combined
Giant Reed <sup>ie</sup> ( <i>Arundo donax</i> )	1						1	1%
Cape Leadwort <sup>e</sup> ( <i>Plumbago auriculata</i> )	2						2	1%
Southern California Black Walnut <sup>r</sup> ( <i>Juglans californica</i> )	1				3		4	2%
Fremont Cottonwood ( <i>Populus fremontii</i> )	4	1	2		2	4	13	7%
Narrowleaf Willow ( <i>Salix exigua</i> )	2						2	1%
Goodding's Black Willow ( <i>Salix gooddingii</i> )	11		2	1	2	1	17	9%
Red Willow ( <i>Salix laevigata</i> )	4		1	1			6	3%
Arroyo Willow ( <i>Salix lasiolepis</i> )	2	2		1	1		6	3%
Toyon ( <i>Heteromeles arbutifolia</i> )	2						2	1%
Desert Wild Grape ( <i>Vitis girdiana</i> )	2		1		1		4	2%
Laurel Sumac ( <i>Malosma laurina</i> )	3			2	2	3	10	5%
Peruvian Pepper Tree <sup>ie</sup> ( <i>Schinus molle</i> )	5		1		3	2	11	6%
Brazilian Pepper Tree <sup>ie</sup> ( <i>Schinus terebinthifolius</i> )	1						1	1%

Appendix C-2-N continued. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2018.

### Santa Ana Canyon (SAC) - Green River Golf Club

Host Plant Species (listed in taxonomic order)	2000-2013	2014	2015	2016	2017	2018	Combined	Percentage of Combined
Poison Oak ( <i>Toxicodendron diversilobum</i> )	1	1	1	2			5	3%
Tree of Heaven <sup>i</sup> ( <i>Ailanthus altissima</i> )						1	1	1%
Poison Hemlock <sup>i</sup> ( <i>Conium maculatum</i> )	2						2	1%
Tree Tobacco <sup>i</sup> ( <i>Nicotiana glauca</i> )						1	1	1%
Yerba Santa sp. ( <i>Eriodictyon</i> sp.)		1					1	1%
Privet sp. <sup>e</sup> ( <i>Ligustrum</i> sp.)	1						1	1%
Lollypop Tree <sup>i</sup> ( <i>Myoporum laetum</i> )	1						1	1%
Blue Elderberry ( <i>Sambucus nigra</i> ssp. <i>caerulea</i> )	8	2	3	2	1	1	17	9%
Coyote Brush ( <i>Baccharis pilularis</i> )	3					1	4	2%
Mulefat ( <i>Baccharis salicifolia</i> )	44	2	4	5	7	6	68	37%
California Sagebrush ( <i>Artemisia californica</i> )	1						1	1%
Douglas' Sagewort ( <i>Artemisia douglasiana</i> )		1					1	1%
Goodding's Black Willow ( <i>S. gooddingii</i> ) and Blue Elderberry ( <i>S. n. caerulea</i> )	1						1	1%
Desert Wild Grape ( <i>V. girdiana</i> ) and Peruvian Pepper Tree <sup>i</sup> ( <i>S. molle</i> )	1						1	1%
Desert Wild Grape ( <i>V. girdiana</i> ) and Blue Elderberry ( <i>S. n. caerulea</i> )	1						1	1%
Unknown/No data			1				1	1%
<b>Total</b>	<b>104</b>	<b>10</b>	<b>16</b>	<b>14</b>	<b>22</b>	<b>20</b>	<b>186</b>	<b>100%</b>

<sup>i</sup> = invasive

<sup>e</sup> = non-native

<sup>r</sup> = endangered, threatened, or sensitive

Appendix C-2-O. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2018.

**Santa Ana Canyon (SAC) - Featherly Regional Park**

Host Plant Species (listed in taxonomic order)	2000-2013	2014	2015	2016	2017	2018	Combined	Percentage of Combined
Coulter's Matilija Poppy <sup>r</sup> ( <i>Romneya coulteri</i> )				1			1	<1%
Western Sycamore ( <i>Platanus racemosa</i> )		3				1	4	2%
White Alder ( <i>Alnus rhombifolia</i> )	1						1	<1%
Southern California Black Walnut <sup>r</sup> ( <i>Juglans californica</i> )	7		1		1		9	4%
Fremont Cottonwood ( <i>Populus fremontii</i> )	17	1	5	1		3	27	11%
Black Cottonwood ( <i>Populus balsamifera</i> ssp. <i>trichocarpa</i> )	1		1	1			3	1%
Narrowleaf Willow ( <i>Salix exigua</i> )	4		1		1		6	3%
Goodding's Black Willow ( <i>Salix gooddingii</i> )	19		1	1	1		22	9%
Dead Goodding's Black Willow covered with living Goodding's Black Willow ( <i>Salix gooddingii</i> )	1						1	<1%
Red Willow ( <i>Salix laevigata</i> )	4					1	5	2%
Arroyo Willow ( <i>Salix lasiolepis</i> )	4		1	1	2	1	9	4%
Willow sp. ( <i>Salix</i> sp.)	1						1	<1%
Tamarisk <sup>ie</sup> ( <i>Tamarix ramosissima</i> )						1	1	<1%
Castorbean <sup>ie</sup> ( <i>Ricinus communis</i> )					1		1	<1%
Black Mustard <sup>ie</sup> ( <i>Brassica nigra</i> )	2		1		2		5	2%
Toyon ( <i>Heteromeles arbutifolia</i> )	1						1	<1%
Desert Wild Grape ( <i>Vitis girdiana</i> )	1						1	<1%
Laurel Sumac ( <i>Malosma laurina</i> )	6	2	1		4	5	18	8%
Poison Oak ( <i>Toxicodendron diversilobum</i> )	5	1	2	1	2		11	5%
Orange Tree <sup>e</sup> ( <i>Citrus sinensis</i> )	3						3	1%
Poison Hemlock <sup>ie</sup> ( <i>Conium maculatum</i> )	2		1				3	1%

Appendix C-2-0 continued. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2018.

**Santa Ana Canyon (SAC) - Featherly Regional Park**

Host Plant Species (listed in taxonomic order)	2000-2013	2014	2015	2016	2017	2018	Combined	Percentage of Combined
Thickleaf Yerba Santa ( <i>Eriodictyon crassifolium</i> )	1		2				3	1%
Fiddleneck sp. ( <i>Amsinckia</i> sp.)	1						1	<1%
Black Sage ( <i>Salvia mellifera</i> )		1				1	2	1%
Blue Elderberry ( <i>Sambucus nigra</i> ssp. <i>caerulea</i> )	20	5	4		2		31	13%
Yellowspine Thistle <sup>ie</sup> ( <i>Cirsium ochrocentrum</i> )	2						2	1%
Mulefat ( <i>Baccharis salicifolia</i> )	29	4	1	8	8	5	55	23%
Rough Cockelburr ( <i>Xanthium strumarium</i> )	1						1	<1%
Arroyo Willow ( <i>S. lasiolepis</i> ) and Black Mustard <sup>ie</sup> ( <i>B. nigra</i> )	1						1	<1%
Castorbean <sup>ie</sup> ( <i>R. communis</i> ) and Mulefat ( <i>B.</i> <i>salicifolia</i> )	1						1	<1%
Desert Wild Grape ( <i>V. girdiana</i> ) and Mulefat ( <i>B. salicifolia</i> )	2						2	1%
Unknown/No data		1		2			3	1%
<b>Total</b>	<b>137</b>	<b>18</b>	<b>22</b>	<b>16</b>	<b>24</b>	<b>18</b>	<b>235</b>	<b>100%</b>

<sup>i</sup> = invasive

<sup>e</sup> = non-native

<sup>r</sup> = endangered, threatened, or sensitive

Appendix C-2-P. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2018.

**Santiago Canyon (Irvine Park)**

Host Plant Species (listed in taxonomic order)	2000-2013	2014	2015	2016	2017	2018	Combined	Percentage of Combined
Goodding's Black Willow ( <i>Salix gooddingii</i> )		1					1	8%
Western False Indigo ( <i>Amorpha fruticosa</i> )	1						1	8%
Desert Wild Grape ( <i>Vitis girdiana</i> )		1					1	8%
Blue Elderberry ( <i>Sambucus nigra</i> ssp. <i>caerulea</i> )	2						2	17%
Mulefat ( <i>Baccharis salicifolia</i> )	3	4					7	58%
<b>Total</b>	<b>6</b>	<b>6</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>12</b>	<b>100%</b>

<sup>i</sup> = invasive

<sup>e</sup> = non-native

<sup>r</sup> = endangered, threatened, or sensitive

Appendix C-3-A. Least Bell's Vireo reproductive success and breeding biology data at survey sites in the Santa Ana Watershed, 2000-20178

San Jacinto

	Parameter	2000-2013	2014	2015	2016	2017	2018	Combined
A.	Number of known pairs	151	19	7	17	27	34	255
B.	Number of known breeding (nesting) pairs	124	15	7	10	25	30	211
C.	Number of breeding pairs that were well-monitored throughout the breeding season	45	0	0	5	8	18	76
D.	Number of 'known fledged young' OBSERVED	238	12	8	12	48	60	378
E.	Number of known fledged young produced by pairs monitored throughout the breeding season	127	n/a	n/a	6	22	40	195
F.	Average number of fledglings produced per breeding pair (minimum; D/B = 'productivity or breeding success')	1.9	0.8	1.1	1.2	1.9	2.0	1.8
G.	Average number of fledglings produced by well-monitored pairs (E/C = reproductive success)	2.8	n/a	n/a	1.2	2.8	2.2	2.6
H.	Number of nests that were discovered	110	2	0	11	17	38	178
I.	Number of well-tracked nests	93	1	n/a	8	11	30	143
J.	Number of well-tracked nests that were successful (% = J/I x 100)	54% 50 / 93	0% 0 / 1	n/a	25% 2 / 8	64% 7 / 11	63% 19 / 30	55% 78 / 143
K.	Rate of missing eggs/chicks from nests (includes successful and unsuccessful nests)	42% 39 / 93	0% 0 / 1	n/a	n/a	n/a	n/a	41% 39 / 94
L.	Number of well-tracked nests that were parasitized by cowbirds (% = L/I x 100)	9% 8 / 93	100% 1 / 1	n/a	75% 6 / 8	9% 1 / 11	10% 3 / 30	13% 19 / 143
M.	A. Number of well-tracked nests that failed as a result of reproductive failure	4% 4 / 93	0% 0 / 1	n/a	0% 0 / 8	9% 1 / 11	7% 2 / 30	5% 7 / 143
	B. Number of well-tracked nests that failed as a result of parasitism	4-5% 4-5* / 93	0% 0 / 1	n/a	13% 1 / 8	9% 1 / 11	7% 2 / 30	5-6% 8-9* / 143
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	37% 34 / 93	0% 0 / 1	n/a	63% 5 / 8	18% 2 / 11	23% 7 / 30	34% 48 / 143
	D. Number of well-tracked nests that failed for unknown reasons	0% 0 / 93	0% 0 / 1	n/a	0% 0 / 8	0% 0 / 11	0% 0 / 30	0% 0 / 143
N.	Average clutch size	n/a	3.0	n/a	4.0	3.8	3.0	n/a
O.	Number of cowbird eggs found in or near vireo nests	11	1	n/a	8	1	3	24
P.	Number of cowbird nestlings removed from vireo nests	0	0	n/a	0	0	0	0
Q.	Number of cowbird young fledged by vireo	5	2	n/a	0	0	0	7
R.	Number of 'manipulated' parasitized nests	6	0	n/a	6	0	3	15
S.	Number of 'successful, manipulated' nests (% = S/R x 100)	50% 3 / 6	n/a	n/a	33% 2 / 6	n/a	33% 1 / 3	40% 6 / 15
T.	Number of vireo fledged from 'manipulated' parasitized nests	7	n/a	n/a	6	n/a	1	14
U.	Number of repaired nests	3	0	n/a	0	0	0	3
V.	% of successful repaired nests	100% 3 / 3	n/a	n/a	n/a	n/a	n/a	100% 3 / 3
W.	Number of vireo fledged from repaired nests	10	n/a	n/a	n/a	n/a	n/a	10

\*corrected from Appendix D



Appendix C-3-B. Least Bell's Vireo reproductive success and breeding biology data at survey sites in the Santa Ana Watershed, 2000-2018.

**San Timoteo Canyon**

	Parameter	2000-2013	2014	2015	2016	2017	2018	Combined
A.	Number of known pairs	701	135	141	124	109	104	1,314
B.	Number of known breeding (nesting) pairs	581	114	126	107	99	85	1,112
C.	Number of breeding pairs that were well-monitored throughout the breeding season	305	48	56	39	48	30	526
D.	Number of 'known fledged young' OBSERVED	1,300	206	287	222	272	161	2,448
E.	Number of known fledged young produced by pairs monitored throughout the breeding season	885	121	181	119	202	86	1,594
F.	Average number of fledglings produced per breeding pair (minimum; D/B = 'productivity or breeding success')	2.2	1.8	2.3	2.1	2.7	1.9	2.2
G.	Average number of fledglings produced by well-monitored pairs (E/C = reproductive success)	2.9	2.5	3.2	3.1	4.2	2.9	3.0
H.	Number of nests that were discovered	650	94	126	78	94	75	1,117
I.	Number of well-tracked nests	569	88	114	73	91	63	998
J.	Number of well-tracked nests that were successful (% = J/I x 100)	58% 331 / 569	48% 42 / 88	58% 66 / 114	51% 37 / 73	63% 57 / 91	44% 28 / 63	56% 561 / 998
K.	Rate of missing eggs/chicks from nests (includes successful and unsuccessful nests)	43% 246 / 569	52% 46 / 88	n/a	n/a	n/a	n/a	44% 292 / 657
L.	Number of well-tracked nests that were parasitized by cowbirds (% = L/I x 100)	19% 109 / 569	6% 5 / 88	0% 0 / 114	0% 0 / 73	1% 1 / 91	0% 0 / 63	12% 115 / 998
M.	A. Number of well-tracked nests that failed as a result of reproductive failure	4% 21 / 569	6% 5 / 88	10% 11 / 114	7% 5 / 73	2% 2 / 91	8% 5 / 63	5% 49 / 998
	B. Number of well-tracked nests that failed as a result of parasitism	5% 26 / 569	2% 2 / 88	0% 0 / 114	0% 0 / 73	0% 0 / 91	0% 0 / 63	3% 28 / 998
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	33% 188 / 569	44% 39 / 88	32% 37 / 114	42% 31 / 73	35% 32 / 91	48% 30 / 63	36% 357 / 998
	D. Number of well-tracked nests that failed for unknown reasons	1% 3 / 569	0% 0 / 88	0% 0 / 114	0% 0 / 73	0% 0 / 91	0% 0 / 63	<1% 3 / 998
N.	Average clutch size	n/a	3.2	3.3	3.5	3.8	3.4	n/a
O.	Number of cowbird eggs found in or near vireo nests	124	4	0	0	1	2	131
P.	Number of cowbird nestlings removed from vireo nests	6	1	0	0	0	0	7
Q.	Number of cowbird young fledged by vireo	2	0	0	0	0	0	2
R.	Number of 'manipulated' parasitized nests	89	4	n/a	n/a	1	0	94
S.	Number of 'successful, manipulated' nests (% = S/R x 100)	51% 45 / 89	50% 2 / 4	n/a	n/a	0% 0 / 1	n/a	50% 47 / 94
T.	Number of vireo fledged from 'manipulated' parasitized nests	97	5	n/a	n/a	0	n/a	102
U.	Number of repaired nests	8	0	0	0	1	1	10
V.	% of successful repaired nests	75% 6 / 8	n/a	n/a	n/a	0% 0 / 1	0% 0 / 1	60% 6 / 10
W.	Number of vireo fledged from repaired nests	18	n/a	n/a	n/a	0	0	18

Appendix C-3-C. Least Bell's Vireo reproductive success and breeding biology data at survey sites in the Santa Ana Watershed, 2000-2018.

**Meridian Conservation Area\***

	Parameter	2000- 2013**	2014	2015	2016	2017	2018	Combined
A.	Number of known pairs	78	16	3	5	9	2	113
B.	Number of known breeding (nesting) pairs	58	16	3	1	8	2	88
C.	Number of breeding pairs that were well-monitored throughout the breeding season	12	1	0	0	3	0	16
D.	Number of 'known fledged young' OBSERVED	131	23	3	6	23	2	188
E.	Number of known fledged young produced by pairs monitored throughout the breeding season	57	3	n/a	n/a	9	n/a	69
F.	Average number of fledglings produced per breeding pair (minimum; D/B = 'productivity or breeding success')	2.3	1.4	1.0	6.0	2.9	n/a	2.1
G.	Average number of fledglings produced by well-monitored pairs (E/C = reproductive success)	4.8	3.0	n/a	n/a	3.0	n/a	4.3
H.	Number of nests that were discovered	23	3	0	1	5	0	32
I.	Number of well-tracked nests	22	3	n/a	0	5	n/a	30
J.	Number of well-tracked nests that were successful (% = J/I x 100)	77% 17 / 22	33% 1 / 3	n/a	n/a	100% 5 / 5	n/a	77% 23 / 30
K.	Rate of missing eggs/chicks from nests (includes successful and unsuccessful nests)	27% 6 / 22	67% 2 / 3	n/a	n/a	n/a	n/a	32% 8 / 25
L.	Number of well-tracked nests that were parasitized by cowbirds (% = L/I x 100)	0% 0 / 22	0% 0 / 3	n/a	n/a	0% 0 / 5	n/a	0% 0 / 30
M.	A. Number of well-tracked nests that failed as a result of reproductive failure	0% 0 / 22	0% 0 / 3	n/a	n/a	0% 0 / 5	n/a	0% 0 / 30
	B. Number of well-tracked nests that failed as a result of parasitism	0% 0 / 22	0% 0 / 3	n/a	n/a	0% 0 / 5	n/a	0% 0 / 30
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	23% 5 / 22	67% 2 / 3	n/a	n/a	0% 0 / 5	n/a	23% 7 / 30
	D. Number of well-tracked nests that failed for unknown reasons	0% 0 / 22	0% 0 / 3	n/a	n/a	0% 0 / 5	n/a	0% 0 / 30
N.	Average clutch size	n/a	3.3	n/a	4.0	3.8	n/a	n/a
O.	Number of cowbird eggs found in or near vireo nests	1	0	n/a	0	0	n/a	1
P.	Number of cowbird nestlings removed from vireo nests	0	0	n/a	0	0	n/a	0
Q.	Number of cowbird young fledged by vireo	0	0	n/a	n/a	0	n/a	0
R.	Number of 'manipulated' parasitized nests	0	n/a	n/a	n/a	n/a	n/a	0
S.	Number of 'successful, manipulated' nests (% = S/R x 100)	n/a	n/a	n/a	n/a	n/a	n/a	n/a
T.	Number of vireo fledged from 'manipulated' parasitized nests	n/a	n/a	n/a	n/a	n/a	n/a	n/a
U.	Number of repaired nests	0	0	n/a	0	0	n/a	0
V.	% of successful repaired nests	n/a	n/a	n/a	n/a	n/a	n/a	n/a
W.	Number of vireo fledged from repaired nests	n/a	n/a	n/a	n/a	n/a	n/a	n/a

\*Former March SKR Preserve

\*\*n = 8 years

Appendix C-3-D. Least Bell's Vireo reproductive success and breeding biology data at survey sites in the Santa Ana Watershed, 2000-2018.

**Sycamore Canyon**

	Parameter	2000-2013	2014	2015	2016	2017	2018	Combined
A.	Number of known pairs	55	5	1	4	9	8	82
B.	Number of known breeding (nesting) pairs	32	3	1	0	6	5	47
C.	Number of breeding pairs that were well-monitored throughout the breeding season	6	0	0	0	0	0	6
D.	Number of 'known fledged young' OBSERVED	60	2	1	6	10	5	84
E.	Number of known fledged young produced by pairs monitored throughout the breeding season	12	n/a	n/a	n/a	n/a	n/a	12
F.	Average number of fledglings produced per breeding pair (minimum; D/B = 'productivity or breeding success')	1.9	0.7	1.0	n/a	1.7	n/a	1.8
G.	Average number of fledglings produced by well-monitored pairs (E/C = reproductive success)	2.0	n/a	n/a	n/a	n/a	n/a	2.0
H.	Number of nests that were discovered	10	4	0	0	0	1	15
I.	Number of well-tracked nests	9	4	n/a	n/a	n/a	0	13
J.	Number of well-tracked nests that were successful (% = J/I x 100)	67% 6 / 9	25% 1 / 4	n/a	n/a	n/a	n/a	54% 7 / 13
K.	Rate of missing eggs/chicks from nests (includes successful and unsuccessful nests)	33% 3 / 9	100% 4 / 4	n/a	n/a	n/a	n/a	54% 7 / 13
L.	Number of well-tracked nests that were parasitized by cowbirds (% = L/I x 100)	22% 2 / 9	50% 2 / 4	n/a	n/a	n/a	n/a	31% 4 / 13
M.	A. Number of well-tracked nests that failed as a result of reproductive failure	0% 0 / 9	0% 0 / 4	n/a	n/a	n/a	n/a	0% 0 / 13
	B. Number of well-tracked nests that failed as a result of parasitism	11% 1 / 9	50% 2 / 4	n/a	n/a	n/a	n/a	23% 3 / 13
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	22% 2 / 9	25% 1 / 4	n/a	n/a	n/a	n/a	23% 3 / 13
	D. Number of well-tracked nests that failed for unknown reasons	0% 0 / 9	0% 0 / 4	n/a	n/a	n/a	n/a	0% 0 / 13
N.	Average clutch size	n/a	3.3	n/a	n/a	n/a	n/a	n/a
O.	Number of cowbird eggs found in or near vireo nests	2	3	n/a	n/a	n/a	n/a	5
P.	Number of cowbird nestlings removed from vireo nests	0	0	n/a	n/a	n/a	n/a	0
Q.	Number of cowbird young fledged by vireo	0	0	n/a	n/a	n/a	n/a	0
R.	Number of 'manipulated' parasitized nests	1	1	n/a	n/a	n/a	n/a	2
S.	Number of 'successful, manipulated' nests (% = S/R x 100)	100% 1 / 1	0% 0 / 1	n/a	n/a	n/a	n/a	50% 1 / 2
T.	Number of vireo fledged from 'manipulated' parasitized nests	1	0	n/a	n/a	n/a	n/a	1
U.	Number of repaired nests	0	0	n/a	n/a	n/a	n/a	0
V.	% of successful repaired nests	n/a	n/a	n/a	n/a	n/a	n/a	n/a
W.	Number of vireo fledged from repaired nests	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Appendix C-3-E. Least Bell's Vireo reproductive success and breeding biology data at survey sites in the Santa Ana Watershed, 2000-2018.

**Mockingbird Canyon**

	Parameter	2000-2013	2014	2015	2016	2017	2018	Combined
A.	Number of known pairs	236	7	23	7	15	15	303
B.	Number of known breeding (nesting) pairs	210	4	16	4	13	10	257
C.	Number of breeding pairs that were well-monitored throughout the breeding season	64	0	0	1	0	0	65
D.	Number of 'known fledged young' OBSERVED	389	7	19	11	15	10	451
E.	Number of known fledged young produced by pairs monitored throughout the breeding season	194	n/a	n/a	3	n/a	n/a	197
F.	Average number of fledglings produced per breeding pair (minimum; D/B = 'productivity or breeding success')	1.9	1.8	1.2	2.8	1.2	n/a	1.8
G.	Average number of fledglings produced by well-monitored pairs (E/C = reproductive success)	3.0	n/a	n/a	3.0	n/a	n/a	3.0
H.	Number of nests that were discovered	172	3	5	3	2	0	185
I.	Number of well-tracked nests	146	2	5	3	2	n/a	158
J.	Number of well-tracked nests that were successful (% = J/I x 100)	53% 78 / 146	50% 1 / 2	40% 2 / 5	67% 2 / 3	50% 1 / 2	n/a	53% 84 / 158
K.	Rate of missing eggs/chicks from nests (includes successful and unsuccessful nests)	45% 66 / 146	50% 1 / 2	n/a	n/a	n/a	n/a	45% 67 / 148
L.	Number of well-tracked nests that were parasitized by cowbirds (% = L/I x 100)	11% 16 / 146	0% 0 / 2	0% 0 / 5	0% 0 / 3	0% 0 / 2	n/a	10% 16 / 158
M.	A. Number of well-tracked nests that failed as a result of reproductive failure	7% 10 / 146	0% 0 / 2	20% 1 / 5	0% 0 / 3	0% 0 / 2	n/a	7% 11 / 158
	B. Number of well-tracked nests that failed as a result of parasitism	4% 6 / 146	0% 0 / 2	0% 0 / 5	0% 0 / 3	0% 0 / 2	n/a	4% 6 / 158
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	35% 51 / 146	0% 0 / 2	40% 2 / 5	33% 1 / 3	50% 1 / 2	n/a	35% 55 / 158
	D. Number of well-tracked nests that failed for unknown reasons	1% 1 / 146	50% 1 / 2	0% 0 / 5	0% 0 / 3	0% 0 / 2	n/a	1% 2 / 158
N.	Average clutch size	n/a	3.0	3.4	3.3	3.5	n/a	n/a
O.	Number of cowbird eggs found in or near vireo nests	27	0	0	0	0	n/a	27
P.	Number of cowbird nestlings removed from vireo nests	2	0	0	0	0	n/a	2
Q.	Number of cowbird young fledged by vireo	1	0	0	0	0	n/a	1
R.	Number of 'manipulated' parasitized nests	13	n/a	n/a	n/a	n/a	n/a	13
S.	Number of 'successful, manipulated' nests (% = S/R x 100)	31% 4 / 13	n/a	n/a	n/a	n/a	n/a	31% 4 / 13
T.	Number of vireo fledged from 'manipulated' parasitized nests	8	n/a	n/a	n/a	n/a	n/a	8
U.	Number of repaired nests	3	0	0	0	0	n/a	3
V.	% of successful repaired nests	100% 3 / 3	n/a	n/a	n/a	n/a	n/a	100% 3 / 3
W.	Number of vireo fledged from repaired nests	7	n/a	n/a	n/a	n/a	n/a	7

Appendix C-3-F. Least Bell's Vireo reproductive success and breeding biology data at survey sites in the Santa Ana Watershed, 2000-2018.

**Santa Ana River (SAR) - Upstream - Riverside Ave. to Van Buren Blvd.**

	Parameter	2000-2013	2014	2015	2016	2017	2018	Combined
A.	Number of known pairs	252	19	37	43	95	96	542
B.	Number of known breeding (nesting) pairs	214	10	27	29	87	68	435
C.	Number of breeding pairs that were well-monitored throughout the breeding season	67	5	0	7	27	12	118
D.	Number of 'known fledged young' OBSERVED	385	15	33	62	169	95	759
E.	Number of known fledged young produced by pairs monitored throughout the breeding season	173	6	n/a	28	78	24	309
F.	Average number of fledglings produced per breeding pair (minimum; D/B = 'productivity or breeding success')	1.8	1.5	1.2	2.1	1.9	1.4	1.7
G.	Average number of fledglings produced by well-monitored pairs (E/C = reproductive success)	2.6	1.2	n/a	4.0	2.9	2.0	2.6
H.	Number of nests that were discovered	123	6	11	16	58	32	246
I.	Number of well-tracked nests	96	3	3	12	46	24	184
J.	Number of well-tracked nests that were successful (% = J/I x 100)	66% 63 / 96	67% 2 / 3	33% 1 / 3	83% 10 / 12	59% 27 / 46	63% 15 / 24	64% 118 / 184
K.	Rate of missing eggs/chicks from nests (includes successful and unsuccessful nests)	32% 31 / 96	67% 2 / 3	n/a	n/a	n/a	n/a	33% 33 / 99
L.	Number of well-tracked nests that were parasitized by cowbirds (% = L/I x 100)	14% 13 / 96	0% 0 / 3	100% 3 / 3	0% 0 / 12	13% 6 / 46	21% 5 / 24	15% 27 / 184
M.	A. Number of well-tracked nests that failed as a result of reproductive failure	3% 3 / 96	0% 0 / 3	0% 0 / 3	0% 0 / 12	7% 3 / 46	0% 0 / 24	3% 6 / 184
	B. Number of well-tracked nests that failed as a result of parasitism	7% 7 / 96	0% 0 / 3	0% 0 / 3	0% 0 / 12	9% 4 / 46	0% 0 / 24	6% 11 / 184
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	24% 23 / 96	33% 1 / 3	67% 2 / 3	17% 2 / 12	26% 12 / 46	38% 9 / 24	27% 49 / 184
	D. Number of well-tracked nests that failed for unknown reasons	0% 0 / 96	0% 0 / 3	0% 0 / 3	0% 0 / 12	0% 0 / 46	0% 0 / 24	0% 0 / 184
N.	Average clutch size	n/a	3.5	3.7	3.9	3.7	3.2	n/a
O.	Number of cowbird eggs found in or near vireo nests	18	0	3	0	6	6	33
P.	Number of cowbird nestlings removed from vireo nests	0	0	0	0	0	0	0
Q.	Number of cowbird young fledged by vireo	2	0	1	0	1	0	4
R.	Number of 'manipulated' parasitized nests	11	n/a	3	n/a	6	5	25
S.	Number of 'successful, manipulated' nests (% = S/R x 100)	18% 2 / 11	n/a	33% 1 / 3	n/a	0% 0 / 6	60% 3 / 5	24% 6 / 25
T.	Number of vireo fledged from 'manipulated' parasitized nests	5	n/a	2	n/a	0	8	15
U.	Number of repaired nests	1	0	0	0	0	0	1
V.	% of successful repaired nests	0% 0 / 1	n/a	n/a	n/a	n/a	n/a	0% 0 / 1
W.	Number of vireo fledged from repaired nests	0	n/a	n/a	n/a	n/a	n/a	0

Appendix C-3-G. Least Bell's Vireo reproductive success and breeding biology data at survey sites in the Santa Ana Watershed, 2000-2018.

**Santa Ana River (SAR) - Upstream -Hidden Valley, north side of river**

	Parameter	2000-2013	2014	2015	2016	2017	2018	Combined
A.	Number of known pairs	19	14	23	27	17	38	138
B.	Number of known breeding (nesting) pairs	15	10	11	20	16	35	107
C.	Number of breeding pairs that were well-monitored throughout the breeding season	6	4	0	3	6	11	30
D.	Number of 'known fledged young' OBSERVED	24	19	15	33	34	65	190
E.	Number of known fledged young produced by pairs monitored throughout the breeding season	14	8	n/a	11	24	35	92
F.	Average number of fledglings produced per breeding pair (minimum; D/B = 'productivity or breeding success')	1.6	1.9	1.4	1.7	2.1	1.9	1.8
G.	Average number of fledglings produced by well-monitored pairs (E/C = reproductive success)	2.3	2.0	n/a	3.7	4.0	3.2	3.1
H.	Number of nests that were discovered	12	4	0	5	11	25	57
I.	Number of well-tracked nests	9	3	n/a	5	10	25	52
J.	Number of well-tracked nests that were successful (% = J/I x 100)	56% 5 / 9	67% 2 / 3	n/a	60% 3 / 5	70% 7 / 10	56% 14 / 25	60% 31 / 52
K.	Rate of missing eggs/chicks from nests (includes successful and unsuccessful nests)	11% 1 / 9	33% 1 / 3	n/a	n/a	n/a	n/a	17% 2 / 12
L.	Number of well-tracked nests that were parasitized by cowbirds (% = L/I x 100)	33% 3 / 9	0% 0 / 3	n/a	0% 0 / 5	20% 2 / 10	0% 0 / 25	10% 5 / 52
M.	A. Number of well-tracked nests that failed as a result of reproductive failure	0% 0 / 9	0% 0 / 3	n/a	0% 0 / 5	0% 0 / 10	0% 0 / 25	0% 0 / 52
	B. Number of well-tracked nests that failed as a result of parasitism	33% 3 / 9	0% 0 / 3	n/a	0% 0 / 5	10% 1 / 10	0% 0 / 25	8% 4 / 52
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	11% 1 / 9	33% 1 / 3	n/a	20% 1 / 5	20% 2 / 10	44% 11 / 25	31% 16 / 52
	D. Number of well-tracked nests that failed for unknown reasons	0% 0 / 9	0% 0 / 3	n/a	20% 1 / 5	0% 0 / 10	0% 0 / 25	2% 1 / 52
N.	Average clutch size	n/a	4.0	n/a	3.4	4.0	3.7	n/a
O.	Number of cowbird eggs found in or near vireo nests	4	0	n/a	0	2	0	6
P.	Number of cowbird nestlings removed from vireo nests	0	0	n/a	0	0	0	0
Q.	Number of cowbird young fledged by vireo	0	0	n/a	0	0	0	0
R.	Number of 'manipulated' parasitized nests	2	n/a	n/a	n/a	2	n/a	4
S.	Number of 'successful, manipulated' nests (% = S/R x 100)	0% 0 / 2	n/a	n/a	n/a	50% 1 / 2	n/a	25% 1 / 4
T.	Number of vireo fledged from 'manipulated' parasitized nests	0	n/a	n/a	n/a	3	n/a	3
U.	Number of repaired nests	0	0	n/a	0	0	0	0
V.	% of successful repaired nests	n/a	n/a	n/a	n/a	n/a	n/a	n/a
W.	Number of vireo fledged from repaired nests	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Appendix C-3-H. Least Bell's Vireo reproductive success and breeding biology data at survey sites in the Santa Ana Watershed, 2000-2018.

**Santa Ana River (SAR) - Upstream -Hidden Valley, south side of river**

	Parameter	2000-2013	2014	2015	2016	2017	2018	Combined
A.	Number of known pairs	388	32	27	66	67	60	640
B.	Number of known breeding (nesting) pairs	349	25	18	57	54	46	549
C.	Number of breeding pairs that were well-monitored throughout the breeding season	82	0	0	7	4	28	121
D.	Number of 'known fledged young' OBSERVED	612	28	22	97	87	88	934
E.	Number of known fledged young produced by pairs monitored throughout the breeding season	210	n/a	n/a	21	19	67	317
F.	Average number of fledglings produced per breeding pair (minimum; D/B = 'productivity or breeding success')	1.8	1.1	1.2	1.7	1.6	1.9	1.7
G.	Average number of fledglings produced by well-monitored pairs (E/C = reproductive success)	2.6	n/a	n/a	3.0	4.8	2.4	2.6
H.	Number of nests that were discovered	161	4	0	21	18	47	251
I.	Number of well-tracked nests	128	3	n/a	16	16	45	208
J.	Number of well-tracked nests that were successful (% = J/I x 100)	65% 83 / 128	67% 2 / 3	n/a	75% 12 / 16	44% 7 / 16	49% 22 / 45	61% 126 / 208
K.	Rate of missing eggs/chicks from nests (includes successful and unsuccessful nests)	37% 47 / 128	67% 2 / 3	n/a	n/a	n/a	n/a	37% 49 / 131
L.	Number of well-tracked nests that were parasitized by cowbirds (% = L/I x 100)	7% 9 / 128	0% 0 / 3	n/a	0% 0 / 16	0% 0 / 16	0% 0 / 45	4% 9 / 208
M.	A. Number of well-tracked nests that failed as a result of reproductive failure	2% 3 / 128	0% 0 / 3	n/a	0% 0 / 16	0% 0 / 16	4% 2 / 45	2% 5 / 208
	B. Number of well-tracked nests that failed as a result of parasitism	5% 6 / 128	0% 0 / 3	n/a	0% 0 / 16	0% 0 / 16	0% 0 / 45	3% 6 / 208
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	28% 36 / 128	33% 1 / 3	n/a	25% 4 / 16	44% 7 / 16	47% 21 / 45	33% 69 / 208
	D. Number of well-tracked nests that failed for unknown reasons	0% 0 / 128	0% 0 / 3	n/a	0% 0 / 16	13% 2 / 16	0% 0 / 45	1% 2 / 208
N.	Average clutch size	n/a	3.0	n/a	3.5	3.6	3.5	n/a
O.	Number of cowbird eggs found in or near vireo nests	8	0	n/a	0	0	0	8
P.	Number of cowbird nestlings removed from vireo nests	2	0	n/a	0	0	0	2
Q.	Number of cowbird young fledged by vireo	0	0	n/a	0	0	0	0
R.	Number of 'manipulated' parasitized nests	3	n/a	n/a	n/a	n/a	n/a	3
S.	Number of 'successful, manipulated' nests (% = S/R x 100)	100% 3 / 3	n/a	n/a	n/a	n/a	n/a	100% 3 / 3
T.	Number of vireo fledged from 'manipulated' parasitized nests	8	n/a	n/a	n/a	n/a	n/a	8
U.	Number of repaired nests	0	0	n/a	0	0	1	1
V.	% of successful repaired nests	n/a	n/a	n/a	n/a	n/a	100% 1 / 1	100% 1 / 1
W.	Number of vireo fledged from repaired nests	n/a	n/a	n/a	n/a	n/a	3	3

\*As of 2010, reported as south side of the river

Appendix C-3-I. Least Bell's Vireo reproductive success and breeding biology data at survey sites in the Santa Ana Watershed, 2000-2018.

**Santa Ana River (SAR) - Upstream -Goose Creek, Norco to I-15**

	Parameter	2000-2013	2014	2015*	2016**	2017	2018	Combined
A.	Number of known pairs	459	32	36	31	34	56	648
B.	Number of known breeding (nesting) pairs	438	28	29	28	32	46	601
C.	Number of breeding pairs that were well-monitored throughout the breeding season	157	0	13	9	7	16	202
D.	Number of 'known fledged young' OBSERVED	888	36	63	45	54	86	1,172
E.	Number of known fledged young produced by pairs monitored throughout the breeding season	487	n/a	33	21	20	43	604
F.	Average number of fledglings produced per breeding pair (minimum; D/B = 'productivity or breeding success')	2.0	1.3	2.2	1.6	1.7	1.9	2.0
G.	Average number of fledglings produced by well-monitored pairs (E/C = reproductive success)	3.1	n/a	2.5	2.3	2.9	2.7	3.0
H.	Number of nests that were discovered	309	13	18	22	19	28	409
I.	Number of well-tracked nests	263	9	13	21	19	25	350
J.	Number of well-tracked nests that were successful (% = J/I x 100)	67% 177 / 263	44% 4 / 9	77% 10 / 13	43% 9 / 21	68% 13 / 19	64% 16 / 25	65% 229 / 350
K.	Rate of missing eggs/chicks from nests (includes successful and unsuccessful nests)	37% 96 / 263	56% 5 / 9	n/a	n/a	n/a	n/a	37% 101 / 272
L.	Number of well-tracked nests that were parasitized by cowbirds (% = L/I x 100)	6% 17 / 263	0% 0 / 9	0% 0 / 13	0% 0 / 21	0% 0 / 19	0% 0 / 25	5% 17 / 350
M.	A. Number of well-tracked nests that failed as a result of reproductive failure	4% 11 / 263	0% 0 / 9	8% 1 / 13	0% 0 / 21	0% 0 / 19	0% 0 / 25	3% 12 / 350
	B. Number of well-tracked nests that failed as a result of parasitism	2% 4 / 263	0% 0 / 9	0% 0 / 13	0% 0 / 21	0% 0 / 19	0% 0 / 25	1% 4 / 350
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	26% 69 / 263	56% 5 / 9	15% 2 / 13	52% 11 / 21	32% 6 / 19	36% 9 / 25	29% 102 / 350
	D. Number of well-tracked nests that failed for unknown reasons	1% 2 / 263	0% 0 / 9	0% 0 / 13	5% 1 / 21	0% 0 / 19	0% 0 / 25	1% 3 / 350
N.	Average clutch size	n/a	3.3	3.5	3.4	3.5	3.8	n/a
O.	Number of cowbird eggs found in or near vireo nests	22	0	0	0	0	0	22
P.	Number of cowbird nestlings removed from vireo nests	1	0	0	0	0	0	1
Q.	Number of cowbird young fledged by vireo	0	0	0	0	0	0	0
R.	Number of 'manipulated' parasitized nests	16	n/a	n/a	n/a	n/a	n/a	16
S.	Number of 'successful, manipulated' nests (% = S/R x 100)	69% 11 / 16	n/a	n/a	n/a	n/a	n/a	69% 11 / 16
T.	Number of vireo fledged from 'manipulated' parasitized nests	18	n/a	n/a	n/a	n/a	n/a	18
U.	Number of repaired nests	2	0	0	0	1	1	4
V.	% of successful repaired nests	50% 1 / 2	n/a	n/a	n/a	100% 1 / 1	100% 1 / 1	75% 3 / 4
W.	Number of vireo fledged from repaired nests	4	n/a	n/a	n/a	4	3	11

\*Starting in 2015 Goose Creek Golf Club to I-15 only. Formerly monitored as Goose Creek Golf Club to River Rd.

\*\*Includes Goose Creek mitigation funded by IERCD



Appendix C-3-J. Least Bell's Vireo reproductive success and breeding biology data at survey sites in the Santa Ana Watershed, 2000-2018.

**Norco Bluffs (I-15 to River Rd., non-mitigation)\***

	Parameter	2000-2013	2014	2015	2016	2017	2018	Combined
A.	Number of known pairs	n/a	n/a	17	28	31	17	93
B.	Number of known breeding (nesting) pairs	n/a	n/a	17	28	30	17	92
C.	Number of breeding pairs that were well-monitored throughout the breeding season	n/a	n/a	3	5	12	13	33
D.	Number of 'known fledged young' OBSERVED	n/a	n/a	43	45	76	39	203
E.	Number of known fledged young produced by pairs monitored throughout the breeding season	n/a	n/a	11	15	42	35	103
F.	Average number of fledglings produced per breeding pair (minimum; D/B = 'productivity or breeding success')	n/a	n/a	2.5	1.6	2.5	2.3	2.2
G.	Average number of fledglings produced by well-monitored pairs (E/C = reproductive success)	n/a	n/a	3.7	3.0	3.5	2.7	3.1
H.	Number of nests that were discovered	n/a	n/a	14	12	25	16	67
I.	Number of well-tracked nests	n/a	n/a	13	12	22	15	62
J.	Number of well-tracked nests that were successful (% = J/I x 100)	n/a	n/a	69% 9 / 13	58% 7 / 12	77% 17 / 22	73% 11 / 15	71% 44 / 62
K.	Rate of missing eggs/chicks from nests (includes successful and unsuccessful nests)	n/a	n/a	n/a	n/a	n/a	n/a	n/a
L.	Number of well-tracked nests that were parasitized by cowbirds (% = L/I x 100)	n/a	n/a	0% 0 / 13	0% 0 / 12	0% 0 / 22	0% 0 / 15	0% 0 / 62
M.	A. Number of well-tracked nests that failed as a result of reproductive failure	n/a	n/a	15% 2 / 13	8% 1 / 12	5% 1 / 22	7% 1 / 15	8% 5 / 62
	B. Number of well-tracked nests that failed as a result of parasitism	n/a	n/a	0% 0 / 13	0% 0 / 12	0% 0 / 22	0% 0 / 15	0% 0 / 62
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	n/a	n/a	15% 2 / 13	33% 4 / 12	18% 4 / 22	20% 3 / 15	21% 13 / 62
	D. Number of well-tracked nests that failed for unknown reasons	n/a	n/a	0% 0 / 13	0% 0 / 12	0% 0 / 22	0% 0 / 15	0% 0 / 62
N.	Average clutch size	n/a	n/a	3.4	3.4	3.6	3.6	n/a
O.	Number of cowbird eggs found in or near vireo nests	n/a	n/a	0	0	0	0	0
P.	Number of cowbird nestlings removed from vireo nests	n/a	n/a	0	0	0	0	0
Q.	Number of cowbird young fledged by vireo	n/a	n/a	0	0	0	0	0
R.	Number of 'manipulated' parasitized nests	n/a	n/a	n/a	n/a	n/a	n/a	n/a
S.	Number of 'successful, manipulated' nests (% = S/R x 100)	n/a	n/a	n/a	n/a	n/a	n/a	n/a
T.	Number of vireo fledged from 'manipulated' parasitized nests	n/a	n/a	n/a	n/a	n/a	n/a	n/a
U.	Number of repaired nests	n/a	n/a	0	0	0	0	0
V.	% of successful repaired nests	n/a	n/a	n/a	n/a	n/a	n/a	n/a
W.	Number of vireo fledged from repaired nests	n/a	n/a	n/a	n/a	n/a	n/a	n/a

\*Formerly monitored as part of Goose Creek Golf Club to River Rd.

Appendix C-3-K. Least Bell's Vireo reproductive success and breeding biology data at survey sites in the Santa Ana Watershed, 2000-2018.

**Temescal Canyon**

	Parameter	2000-2013	2014	2015	2016	2017	2018	Combined
A.	Number of known pairs	391	24	21	9	59	48	552
B.	Number of known breeding (nesting) pairs	331	n/a	20	4	39	21	415
C.	Number of breeding pairs that were well-monitored throughout the breeding season	118	n/a	0	0	1	0	119
D.	Number of 'known fledged young' OBSERVED	644	17	22	5	48	16	752
E.	Number of known fledged young produced by pairs monitored throughout the breeding season	327	n/a	n/a	n/a	3	n/a	330
F.	Average number of fledglings produced per breeding pair (minimum; D/B = 'productivity or breeding success')	1.9	n/a	1.1	1.3	1.2	n/a	1.8
G.	Average number of fledglings produced by well-monitored pairs (E/C = reproductive success)	2.8	n/a	n/a	n/a	3.0	n/a	2.8
H.	Number of nests that were discovered	242	3	0	1	16	19	281
I.	Number of well-tracked nests	192	0	n/a	0	13	0	205
J.	Number of well-tracked nests that were successful (% = J/I x 100)	65% 124 / 192	n/a	n/a	n/a	38% 5 / 13	n/a	63% 129 / 205
K.	Rate of missing eggs/chicks from nests (includes successful and unsuccessful nests)	34% 66 / 192	n/a	n/a	n/a	n/a	n/a	34% 66 / 192
L.	Number of well-tracked nests that were parasitized by cowbirds (% = L/I x 100)	16% 31 / 192	n/a	n/a	n/a	23% 3 / 13	n/a	17% 34 / 205
M.	A. Number of well-tracked nests that failed as a result of reproductive failure	3% 5 / 192	n/a	n/a	n/a	15% 2 / 13	n/a	3% 7 / 205
	B. Number of well-tracked nests that failed as a result of parasitism	3% 6 / 192	n/a	n/a	n/a	0% 0 / 13	n/a	3% 6 / 205
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	30% 57 / 192	n/a	n/a	n/a	31% 4 / 13	n/a	30% 61 / 205
	D. Number of well-tracked nests that failed for unknown reasons	0% 0 / 192	n/a	n/a	n/a	15% 2 / 13	n/a	1% 2 / 205
N.	Average clutch size	n/a	n/a	n/a	4.0	3.3	n/a	n/a
O.	Number of cowbird eggs found in or near vireo nests	39	0	n/a	0	3	n/a	42
P.	Number of cowbird nestlings removed from vireo nests	2	n/a	n/a	n/a	0	n/a	2
Q.	Number of cowbird young fledged by vireo	2	n/a	n/a	n/a	1	n/a	3
R.	Number of 'manipulated' parasitized nests	32	n/a	n/a	n/a	2	n/a	34
S.	Number of 'successful, manipulated' nests (% = S/R x 100)	47% 15 / 32	n/a	n/a	n/a	0% 0 / 2	n/a	44% 15 / 34
T.	Number of vireo fledged from 'manipulated' parasitized nests	34	n/a	n/a	n/a	0	n/a	34
U.	Number of repaired nests	3	0	n/a	0	0	n/a	3
V.	% of successful repaired nests	67% 2 / 3	n/a	n/a	n/a	n/a	n/a	67% 2 / 3
W.	Number of vireo fledged from repaired nests	3	n/a	n/a	n/a	n/a	n/a	3

Appendix C-3-L. Least Bell's Vireo reproductive success and breeding biology data at survey sites in the Santa Ana Watershed, 2000-2018.

**Chino Hills**

	Parameter	2000-2013	2014	2015	2016*	2017	2018	Combined
A.	Number of known pairs	62	2	6	11	7	9	97
B.	Number of known breeding (nesting) pairs	48	0	3	8	3	5	67
C.	Number of breeding pairs that were well-monitored throughout the breeding season	20	0	3	0	0	0	23
D.	Number of 'known fledged young' OBSERVED	70	3	4	10	3	3	93
E.	Number of known fledged young produced by pairs monitored throughout the breeding season	28	n/a	4	n/a	n/a	n/a	32
F.	Average number of fledglings produced per breeding pair (minimum; D/B = 'productivity or breeding success')	1.5	n/a	1.3	1.3	1.0	n/a	1.4
G.	Average number of fledglings produced by well-monitored pairs (E/C = reproductive success)	1.4	n/a	1.3	n/a	n/a	n/a	1.4
H.	Number of nests that were discovered	29	n/a	7	4	0	2	42
I.	Number of well-tracked nests	24	n/a	5	2	n/a	2	33
J.	Number of well-tracked nests that were successful (% = J/I x 100)	38% 9 / 24	n/a	20% 1 / 5	50% 1 / 2	n/a	0% 0 / 2	33% 11 / 33
K.	Rate of missing eggs/chicks from nests (includes successful and unsuccessful nests)	58% 14 / 24	n/a	n/a	n/a	n/a	n/a	58% 14 / 24
L.	Number of well-tracked nests that were parasitized by cowbirds (% = L/I x 100)	25% 6 / 24	n/a	20% 1 / 5	0% 0 / 2	n/a	50% 1 / 2	24% 8 / 33
M.	A. Number of well-tracked nests that failed as a result of reproductive failure	4% 1 / 24	n/a	20% 1 / 5	50% 1 / 2	n/a	0% 0 / 2	9% 3 / 33
	B. Number of well-tracked nests that failed as a result of parasitism	8% 2 / 24	n/a	0% 0 / 5	0% 0 / 2	n/a	0% 0 / 2	6% 2 / 33
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	50% 12 / 24	n/a	60% 3 / 5	0% 0 / 2	n/a	100% 2 / 2	52% 17 / 33
	D. Number of well-tracked nests that failed for unknown reasons	0% 0 / 24	n/a	0% 0 / 5	0% 0 / 2	n/a	0% 0 / 2	0% 0 / 33
N.	Average clutch size	n/a	n/a	3.4	3.0	n/a	n/a	n/a
O.	Number of cowbird eggs found in or near vireo nests	9	n/a	1	0	0	1	11
P.	Number of cowbird nestlings removed from vireo nests	0	n/a	0	0	0	0	0
Q.	Number of cowbird young fledged by vireo	0	n/a	0	0	0	0	0
R.	Number of 'manipulated' parasitized nests	6	n/a	1	n/a	n/a	1	8
S.	Number of 'successful, manipulated' nests (% = S/R x 100)	0% 0 / 6	n/a	0% 0 / 1	n/a	n/a	0% 0 / 1	0% 0 / 8
T.	Number of vireo fledged from 'manipulated' parasitized nests	0	n/a	0	n/a	n/a	0	0
U.	Number of repaired nests	0	n/a	0	0	0	1	1
V.	% of successful repaired nests	n/a	n/a	n/a	n/a	n/a	0% 0 / 1	0% 0 / 1
W.	Number of vireo fledged from repaired nests	n/a	n/a	n/a	n/a	n/a	0	0

\*2016 includes former assessment sites

Appendix C-3-M. Least Bell's Vireo reproductive success and breeding biology data at survey sites in the Santa Ana Watershed, 2000-2018.

**Santa Ana Canyon (SAC) - Upper Canyon**

	Parameter	2000-2013	2014	2015	2016	2017	2018	Combined
A.	Number of known pairs	153	18	9	12	21	25	238
B.	Number of known breeding (nesting) pairs	134	16	6	11	18	15	200
C.	Number of breeding pairs that were well-monitored throughout the breeding season	51	4	1	3	1	7	67
D.	Number of 'known fledged young' OBSERVED	248	28	10	18	32	23	359
E.	Number of known fledged young produced by pairs monitored throughout the breeding season	133	12	2	7	2	13	169
F.	Average number of fledglings produced per breeding pair (minimum; D/B = 'productivity or breeding success')	1.9	1.8	1.7	1.6	1.8	1.5	1.8
G.	Average number of fledglings produced by well-monitored pairs (E/C = reproductive success)	2.6	3.0	2.0	2.3	2.0	1.9	2.5
H.	Number of nests that were discovered	109	8	1	3	6	13	140
I.	Number of well-tracked nests	71	6	1	3	5	10	96
J.	Number of well-tracked nests that were successful (% = J/I x 100)	66% 47 / 71	83% 5 / 6	100% 1 / 1	100% 3 / 3	40% 2 / 5	50% 5 / 10	66% 63 / 96
K.	Rate of missing eggs/chicks from nests (includes successful and unsuccessful nests)	39% 28 / 71	33% 2 / 6	n/a	n/a	n/a	n/a	39% 30 / 77
L.	Number of well-tracked nests that were parasitized by cowbirds (% = L/I x 100)	6% 4 / 71	0% 0 / 6	0% 0 / 1	0% 0 / 3	0% 0 / 5	0% 0 / 10	4% 4 / 96
M.	A. Number of well-tracked nests that failed as a result of reproductive failure	4% 3 / 71	0% 0 / 6	0% 0 / 1	0% 0 / 3	0% 0 / 5	0% 0 / 10	3% 3 / 96
	B. Number of well-tracked nests that failed as a result of parasitism	3% 2 / 71	0% 0 / 6	0% 0 / 1	0% 0 / 3	0% 0 / 5	0% 0 / 10	2% 2 / 96
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	27% 19 / 71	17% 1 / 6	0% 0 / 1	0% 0 / 3	60% 3 / 5	50% 5 / 10	29% 28 / 96
	D. Number of well-tracked nests that failed for unknown reasons	0% 0 / 71	0% 0 / 6	0% 0 / 1	0% 0 / 3	0% 0 / 5	0% 0 / 10	0% 0 / 96
N.	Average clutch size	n/a	3.2	4.0	3.3	3.7	3.1	n/a
O.	Number of cowbird eggs found in or near vireo nests	3	0	0	0	0	0	3
P.	Number of cowbird nestlings removed from vireo nests	1	0	0	0	0	0	1
Q.	Number of cowbird young fledged by vireo	0	0	0	0	0	0	0
R.	Number of 'manipulated' parasitized nests	1	n/a	n/a	n/a	n/a	n/a	1
S.	Number of 'successful, manipulated' nests (% = S/R x 100)	100% 1 / 1	n/a	n/a	n/a	n/a	n/a	100% 1 / 1
T.	Number of vireo fledged from 'manipulated' parasitized nests	1	n/a	n/a	n/a	n/a	n/a	1
U.	Number of repaired nests	2	0	0	0	0	0	2
V.	% of successful repaired nests	0% 0 / 2	n/a	n/a	n/a	n/a	n/a	0% 0 / 2
W.	Number of vireo fledged from repaired nests	0	n/a	n/a	n/a	n/a	n/a	0

Appendix C-3-N. Least Bell's Vireo reproductive success and breeding biology data at survey sites in the Santa Ana Watershed, 2000-2018.

**Santa Ana Canyon (SAC) - Green River Golf Club**

	Parameter	2000-2013	2014	2015	2016	2017	2018	Combined
A.	Number of known pairs	162	19	23	26	33	38	301
B.	Number of known breeding (nesting) pairs	141	18	19	22	30	22	252
C.	Number of breeding pairs that were well-monitored throughout the breeding season	61	4	8	8	7	5	93
D.	Number of 'known fledged young' OBSERVED	260	29	35	27	76	20	447
E.	Number of known fledged young produced by pairs monitored throughout the breeding season	149	9	13	9	31	3	214
F.	Average number of fledglings produced per breeding pair (minimum; D/B = 'productivity or breeding success')	1.8	1.6	1.8	1.2	2.5	0.9	1.8
G.	Average number of fledglings produced by well-monitored pairs (E/C = reproductive success)	2.4	2.3	1.6	1.1	4.4	0.6	2.3
H.	Number of nests that were discovered	105	10	16	14	21	20	186
I.	Number of well-tracked nests	88	8	15	13	17	16	157
J.	Number of well-tracked nests that were successful (% = J/I x 100)	64% 56 / 88	63% 5 / 8	47% 7 / 15	31% 4 / 13	76% 13 / 17	25% 4 / 16	57% 89 / 157
K.	Rate of missing eggs/chicks from nests (includes successful and unsuccessful nests)	34% 30 / 88	25% 2 / 8	n/a	n/a	n/a	n/a	33% 32 / 96
L.	Number of well-tracked nests that were parasitized by cowbirds (% = L/I x 100)	5% 4 / 88	0% 0 / 8	0% 0 / 15	0% 0 / 13	0% 0 / 17	0% 0 / 16	3% 4 / 157
M.	A. Number of well-tracked nests that failed as a result of reproductive failure	6% 5 / 88	13% 1 / 8	7% 1 / 15	23% 3 / 13	0% 0 / 17	0% 0 / 16	6% 10 / 157
	B. Number of well-tracked nests that failed as a result of parasitism	1% 1 / 88	0% 0 / 8	0% 0 / 15	0% 0 / 13	0% 0 / 17	0% 0 / 16	1% 1 / 157
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	30% 26 / 88	25% 2 / 8	47% 7 / 15	46% 6 / 13	24% 4 / 17	69% 11 / 16	36% 56 / 157
	D. Number of well-tracked nests that failed for unknown reasons	0% 0 / 88	0% 0 / 8	0% 0 / 15	0% 0 / 13	0% 0 / 17	6% 1 / 16	1% 1 / 157
N.	Average clutch size	n/a	3.0	2.8	2.7	3.5	3.4	n/a
O.	Number of cowbird eggs found in or near vireo nests	4	0	0	0	0	0	4
P.	Number of cowbird nestlings removed from vireo nests	0	0	0	0	0	0	0
Q.	Number of cowbird young fledged by vireo	0	0	0	0	0	0	0
R.	Number of 'manipulated' parasitized nests	2	n/a	n/a	n/a	n/a	n/a	2
S.	Number of 'successful, manipulated' nests (% = S/R x 100)	100% 2 / 2	n/a	n/a	n/a	n/a	n/a	100% 2 / 2
T.	Number of vireo fledged from 'manipulated' parasitized nests	6	n/a	n/a	n/a	n/a	n/a	6
U.	Number of repaired nests	4	1	0	0	0	0	5
V.	% of successful repaired nests	75% 3 / 4	100% 1 / 1	n/a	n/a	n/a	n/a	80% 4 / 5
W.	Number of vireo fledged from repaired nests	7	3	n/a	n/a	n/a	n/a	10

Appendix C-3-O. Least Bell's Vireo reproductive success and breeding biology data at survey sites in the Santa Ana Watershed, 2000-2018.

**Santa Ana Canyon (SAC) - Featherly Regional Park**

	Parameter	2000-2013	2014	2015	2016	2017	2018	Combined
A.	Number of known pairs	234	39	38	39	36	25	411
B.	Number of known breeding (nesting) pairs	193	34	30	25	32	18	332
C.	Number of breeding pairs that were well-monitored throughout the breeding season	58	10	9	8	11	8	104
D.	Number of 'known fledged young' OBSERVED	287	35	37	23	57	25	464
E.	Number of known fledged young produced by pairs monitored throughout the breeding season	110	11	12	8	38	17	196
F.	Average number of fledglings produced per breeding pair (minimum; D/B = 'productivity or breeding success')	1.5	1.0	1.2	0.9	1.8	1.4	1.4
G.	Average number of fledglings produced by well-monitored pairs (E/C = reproductive success)	1.9	1.1	1.3	1.0	3.5	2.1	1.9
H.	Number of nests that were discovered	137	18	22	16	24	18	235
I.	Number of well-tracked nests	95	14	19	12	22	12	174
J.	Number of well-tracked nests that were successful (% = J/I x 100)	48% 46 / 95	29% 4 / 14	32% 6 / 19	25% 3 / 12	50% 11 / 22	50% 6 / 12	44% 76 / 174
K.	Rate of missing eggs/chicks from nests (includes successful and unsuccessful nests)	51% 48 / 95	64% 9 / 14	n/a	n/a	n/a	n/a	52% 57 / 109
L.	Number of well-tracked nests that were parasitized by cowbirds (% = L/I x 100)	5% 5 / 95	0% 0 / 14	0% 0 / 19	0% 0 / 12	0% 0 / 22	0% 0 / 12	3% 5 / 174
M.	A. Number of well-tracked nests that failed as a result of reproductive failure	4% 4 / 95	7% 1 / 14	5% 1 / 19	0% 0 / 12	9% 2 / 22	0% 0 / 12	5% 8 / 174
	B. Number of well-tracked nests that failed as a result of parasitism	2% 2 / 95	0% 0 / 14	0% 0 / 19	0% 0 / 12	0% 0 / 22	0% 0 / 12	1% 2 / 174
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	45% 43 / 95	64% 9 / 14	63% 12 / 19	75% 9 / 12	41% 9 / 22	42% 5 / 12	50% 87 / 174
	D. Number of well-tracked nests that failed for unknown reasons	0% 0 / 95	0% 0 / 14	0% 0 / 19	0% 0 / 12	0% 0 / 22	8% 1 / 12	1% 1 / 174
N.	Average clutch size	n/a	3.1	3.2	3.2	3.8	3.0	n/a
O.	Number of cowbird eggs found in or near vireo nests	4	0	0	0	0	0	4
P.	Number of cowbird nestlings removed from vireo nests	1	0	0	0	0	0	1
Q.	Number of cowbird young fledged by vireo	0	0	0	0	0	0	0
R.	Number of 'manipulated' parasitized nests	3	n/a	n/a	n/a	n/a	n/a	3
S.	Number of 'successful, manipulated' nests (% = S/R x 100)	33% 1 / 3	n/a	n/a	n/a	n/a	n/a	33% 1 / 3
T.	Number of vireo fledged from 'manipulated' parasitized nests	2	n/a	n/a	n/a	n/a	n/a	2
U.	Number of repaired nests	5	2	0	0	1	0	8
V.	% of successful repaired nests	100% 5 / 5	50% 1 / 2	n/a	n/a	0% 0 / 1	n/a	75% 6 / 8
W.	Number of vireo fledged from repaired nests	16	2	n/a	n/a	0	n/a	18

Appendix C-3-P. Least Bell's Vireo reproductive success and breeding biology data at survey sites in the Santa Ana Watershed, 2000-2018.

**Santiago Canyon (Irvine Park)**

	Parameter	2000-2013	2014	2015	2016	2017	2018	Combined
A.	Number of known pairs	36	9	24	1	1	5	76
B.	Number of known breeding (nesting) pairs	25	8	1	0	0	3	37
C.	Number of breeding pairs that were well-monitored throughout the breeding season	4	5	0	0	n/a	0	9
D.	Number of 'known fledged young' OBSERVED	40	12	2	0	0	2	56
E.	Number of known fledged young produced by pairs monitored throughout the breeding season	13	8	n/a	n/a	n/a	n/a	21
F.	Average number of fledglings produced per breeding pair (minimum; D/B = 'productivity or breeding success')	1.6	1.5	n/a	n/a	n/a	n/a	1.5
G.	Average number of fledglings produced by well-monitored pairs (E/C = reproductive success)	3.3	1.6	n/a	n/a	n/a	n/a	2.3
H.	Number of nests that were discovered	6	6	0	0	0	3	15
I.	Number of well-tracked nests	5	5	n/a	n/a	n/a	0	10
J.	Number of well-tracked nests that were successful (% = J/I x 100)	80% 4 / 5	60% 3 / 5	n/a	n/a	n/a	n/a	70% 7 / 10
K.	Rate of missing eggs/chicks from nests (includes successful and unsuccessful nests)	20% 1 / 5	80% 4 / 5	n/a	n/a	n/a	n/a	50% 5 / 10
L.	Number of well-tracked nests that were parasitized by cowbirds (% = L/I x 100)	0% 0 / 5	0% 0 / 5	n/a	n/a	n/a	n/a	0% 0 / 10
M.	A. Number of well-tracked nests that failed as a result of reproductive failure	0% 0 / 5	0% 0 / 5	n/a	n/a	n/a	n/a	0% 0 / 10
	B. Number of well-tracked nests that failed as a result of parasitism	0% 0 / 5	0% 0 / 5	n/a	n/a	n/a	n/a	0% 0 / 10
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	20% 1 / 5	40% 2 / 5	n/a	n/a	n/a	n/a	30% 3 / 10
	D. Number of well-tracked nests that failed for unknown reasons	0% 0 / 5	0% 0 / 5	n/a	n/a	n/a	n/a	0% 0 / 10
N.	Average clutch size	n/a	3.2	n/a	n/a	n/a	n/a	n/a
O.	Number of cowbird eggs found in or near vireo nests	4	0	n/a	n/a	n/a	n/a	4
P.	Number of cowbird nestlings removed from vireo nests	0	0	n/a	n/a	n/a	n/a	0
Q.	Number of cowbird young fledged by vireo	0	0	n/a	n/a	n/a	n/a	0
R.	Number of 'manipulated' parasitized nests	n/a	n/a	n/a	n/a	n/a	n/a	n/a
S.	Number of 'successful, manipulated' nests (% = S/R x 100)	n/a	n/a	n/a	n/a	n/a	n/a	n/a
T.	Number of vireo fledged from 'manipulated' parasitized nests	n/a	n/a	n/a	n/a	n/a	n/a	n/a
U.	Number of repaired nests	0	0	n/a	n/a	n/a	n/a	0
V.	% of successful repaired nests	n/a	n/a	n/a	n/a	n/a	n/a	n/a
W.	Number of vireo fledged from repaired nests	n/a	n/a	n/a	n/a	n/a	n/a	n/a

## **APPENDIX D: SUMMARY TABLES BY MANAGED SITE, 2000-2013**

*Available by request under separate cover.*