Status and Management of the Least Bell's Vireo and Southwestern Willow Flycatcher in the Santa Ana River Watershed, 2024, and Summary Data by Site and Watershed-wide, 2000-2024

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Prepared for
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January 2025

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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 monitoring and protection of endangered, threatened, and other sensitive species. Since 2000, populations of endangered Least Bell's Vireo (*Vireo bellii pusillus*; hereafter "vireo") have been monitored 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*; hereafter "cowbird") trapping was conducted concurrently in or near riparian habitat as well as during the fall and winter of 2023-2024 at two dairies in Prado Basin, three dairies in San Jacinto, and one dairy in Temescal. Two habitat traps remained open in Prado Basin until mid-November 2023. SAWA biologists documented 1,586 vireo territories in the Santa Ana Watershed (excluding Prado Basin) in 2024, of which 694 were known to be paired. This represents a 14% increase in territories from 2023 (n=1,394), and the highest number documented since monitoring began in 2000. One thousand twenty-seven fledglings were also documented. Prado Basin reported another 773 vireos in 2024, an 8% increase from the 715 documented in 2023. Excluding Prado Basin, watershed-wide nesting success was 62% overall and 145 well-monitored pairs had a 3.3 reproductive success rate. Ninety percent of 328 vireo nests were placed in native vegetation, almost half of which were placed in mulefat (*Baccharis salicifolia*), arroyo willow (*Salix lasiolepis*), and red willow (*Salix laevigata*).

In 2024, the watershed-wide cowbird parasitism rate of well-tracked vireo nests was 0%. This is the second consecutive year in which no well-tracked nests were found to have been parasitized. During the nesting season, 1,572 cowbirds were removed from 42 traps in the watershed. Additionally, 8,006 cowbirds were removed from the watershed during the fall and winter of 2023-2024. Over 173,000 cowbirds have been removed from the watershed by SAWA since cowbird management began.

Breeding Southwestern Willow Flycatchers (*Empidonax traillii extimus*) were not detected by SAWA biologists in 2024; however, five individual migrant Willow Flycatchers (*Empidonax traillii* ssp.) were documented within the watershed. All wildlife species detected (145 avian, 25 mammalian, 19 herpetofauna, and four 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 six 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. SAWA was formed in 1996 to implement the Santa Ana River (SAR) Watershed Program by conducting watershed-wide restoration. Our major focuses are the removal of invasive species, native habitat enhancement, as well as protection and monitoring of endangered, threatened, and other sensitive species.

The extremely prolific invasive weed *Arundo donax* (hereafter "arundo") poses a large threat to natural habitat within the Santa Ana River watershed. Arundo chokes riverine systems while outcompeting native vegetation, resulting in a loss of habitat for native species and hampering flood control efforts. It can consume nearly three times the amount of water as native plants (Watermaster, 2022), thereby stressing a region that already has little available water. In addition, arundo is highly flammable and contributes to the spread and severity of wildfires. SAWA and its habitat restoration partners have removed and treated approximately 6,917 acres of arundo to date, accounting for the bulk of the 8,250 acres of arundo estimated to have been removed from the watershed since the late 1990s (Watermaster, 2022).

Efforts to control arundo in the SAR watershed were initiated in San Timoteo Creek in 1997. San Timoteo Creek is a tributary of the Santa Ana River that originates on the south face of the San Bernardino Mountains north of the City of Banning. San Timoteo Creek was selected as the first arundo-removal site on account of the extreme difficulties inherent in eradicating weeds from this canyon: creek-bank erosion had left 30-40 ft high vertical sidewalls, and access was very limited. Those who thought eradicating arundo on the river might be impossible also held the view that if it could be done in San Timoteo, it could be done anywhere else on the river. To date, 239 acres of arundo and other invasives have been removed and maintained using a designated maintenance fund. As a result, endangered territorial Least Bell's Vireos (*Vireo bellii pusillus*; hereafter "vireo") have increased from five territories in 2000 to a high of 176 territories in 2015. SAWA's ultimate goal is to replicate such successful riparian habitat and bird management over the entire watershed. SAWA is dedicated to the restoration of the Santa Ana River Watershed with the interest of reestablishing natural riverine functions and enhancing riparian habitat in an effort to aid in the recovery of the endangered vireo and Southwestern Willow Flycatcher (*Empidonax traillii extimus*; SWFL).

The Least Bell's Vireo is a small, gray, insectivorous bird that nests in riparian habitat in southern California and northern Baja Mexico. Vireos typically place nests in dense riparian understory, though they are also found nesting in adjacent upland habitat. As a neotropical migrant,

they spend winters in Mexico, arrive on their breeding grounds in Southern California around mid-March, and leave around mid-September (Kus et al., 2022). This subspecies is listed as endangered by both the State of California and the federal government due to loss of riparian habitat and brood parasitism by the Brown-headed Cowbird (*Molothrus ater*, hereafter "cowbird"; USFWS, 1998).

Since vireos are known to readily occupy newly available habitat (Kus et al., 2022), SAWA's riparian restoration through arundo removal is an important strategy to aid in species recovery. Restoration efforts create additional suitable habitat and thereby increase geographical area for vireos to occupy, but population size as well as recruitment into new areas are ultimately determined by reproductive success rates. Brood parasitism is cited as a primary cause of this species' decline (USFWS, 1998), and cowbird control has been found to result in a substantial increase to reproductive success in vireos affected by cowbird brood parasitism (Griffith and Griffith, 2000; Kus and Whitfield, 2005; Kus et al., 2022). SAWA's combined recovery strategy is comprised of riparian habitat restoration in conjunction with cowbird trapping and vireo nest monitoring including removal of cowbird eggs; this strategy has proved beneficial to the species' recovery in the Santa Ana Watershed.

Vireo monitoring and cowbird control in the Santa Ana Watershed began in 1986, when only 19 vireo territories were detected at the Orange County Water District's Prado Basin (Hays, 1987). The Prado Basin population has since increased to a high of 719 territorial males in 2020 (Pike, 2020). As an expansion of the program, in 2000, SAWA began the same vireo monitoring and cowbird control program outside of Prado Basin at Hidden Valley – South, where 14 territories were documented. In 2001, SAWA expanded survey and monitoring efforts to include areas of large contiguous riparian habitat in the watershed at San Timoteo Canyon, Santa Ana River mainstem upstream of River Road through Hidden Valley, Temescal Wash, and the Santa Ana Canyon, and found a total of 63 territories (Hoffman and Zembal, 2001). In 2005, SAWA further expanded vireo survey efforts to include smaller and/or fragmented riparian patches that were deemed suitable for vireo and reported a total of 391 territories in the watershed, excluding Prado Basin (Hoffman and Zembal, 2005). The watershed-wide population, excluding Prado Basin, has since increased to a high of 1,574 territories in 2020.

The Southwestern Willow Flycatcher also 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 to that of the vireo, and remains in severe decline (Howell et al., 2022). Although it is unclear why SWFL continue to decline, there are ongoing disturbances to the riparian habitat, including homeless encampments, noise and light pollution, and catastrophic wildfires throughout the watershed that may negatively affect riparian birds (Kus et al., 2022). These two endangered species and several other sensitive species have been monitored and managed in the Prado Basin annually since 1986 by the Orange County Water District (OCWD) and throughout the rest of the watershed by SAWA

since 2000.

The work reported herein is an expansion upon the Prado Basin monitoring efforts into other portions of the watershed from 2000-2024 through the implementation of the Santa Ana Watershed Program by SAWA and OCWD. Data collected in Prado Basin is reported separately by OCWD. Monitoring is conducted during the avian nesting season to determine the number of vireos and SWFL present, 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, though the monitoring effort has varied over the years depending on funding. In 2024, nest monitoring occurred at several locations discussed herein as monitored sites: San Timoteo Canyon, proposed and current restoration areas within Santa Ana River (SAR – Upstream) from Riverside Avenue downstream to I-15, Norco Bluffs, and the Santa Ana Canyon (SAC) below Prado Dam. Some subsections of the Santa Ana River mainstem (Hidden Valley – North, Evans Lake Drain, and Riverside Avenue to Van Buren Boulevard) as well as 37 additional peripheral drainages within the watershed were sampled (≥3 visits) for abundance and distribution. Incidental vireo sightings were documented at 10 sites visited on one or two occasions.

METHODS

Study Location

The Santa Ana watershed covers nearly 3,000 square miles in Southern California and includes parts of San Bernardino, Riverside, Orange, and Los Angeles counties (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, which contains more than 50 tributaries.

Study sites contain typical southern California 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 commonly found invasive plant species include perennial pepperweed (*Lepidium latifolium*), castor bean (*Ricinus communis*), poison hemlock (*Conium maculatum*), stinknet (*Oncosiphon pilulifer*), 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 homeless encampments, horseback riding, creation of

unauthorized trails, picnicking, swimming, fishing, off-highway vehicle (OHV) use, construction projects, and trash dumping.

Monitored Sites

Monitored sites, for the purposes of this study, are those sites in which ≥ eight surveys were conducted, regular nest monitoring occurred, and territories were well-monitored. Vireos were monitored in the Santa Ana River and tributaries from Riverside Avenue in the city of Riverside downstream through the Santa Ana Canyon to Weir Canyon Road, excluding Prado Basin. These sites included Hidden Valley – South, Sunnyslope Restoration, Goose Creek mitigation areas, Norco Bluffs, and Santa Ana Canyon (Upper Canyon, Green River Golf Club, and Featherly Regional Park). San Timoteo Canyon, a tributary of the Santa Ana River, was also monitored (Figure 2). See Appendix A for specific survey area coordinates.

Sampled Sites

Sampled sites, for the purposes of this study, are sites that were surveyed three or more times throughout the breeding season, but in which no or minimal nest monitoring occurred. A subset of sampled sites, referred to as assessment sites, were surveyed exactly three times during designated time frames at the peak of the vireo breeding season. In 2024, the first assessment surveys were conducted between April 18-30, the second surveys between May 16-31, and the third between June 14-July 11. At all sites, the objectives were to document vireo occupancy and quantify a minimum number of territorial males. Incidental observations of females and fledglings were also documented.

Incidental Sites

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

Site Descriptions

San Jacinto (Sampled)

San Jacinto is located in Riverside County near the city of San Jacinto. The survey area at this site includes over 1,000 acres (412 ha) along approximately 14 miles (23 km) of the San Jacinto River

from Lake Park Drive downstream to the San Jacinto Wildlife Area; some reaches of the river are not surveyed due to access restrictions and/or the absence of suitable vireo habitat. The San Jacinto Wildlife Area is managed by the California Department of Fish and Wildlife (CDFW), and the San Jacinto River is managed by multiple authorities.

The riparian zone in the San Jacinto River mainstem is classified as a *Populus fremontii* Forest & Woodland Alliance, with narrowleaf willow (*Salix exigua*) and mulefat as co-dominants (Sawyer et al., 2009). The habitat is also interspersed with Goodding's black willow. The dominant invasive plant in the riparian zone is tamarisk. The riparian zone in the San Jacinto Wildlife Area is 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 and mulefat. Dominant non-natives in the adjacent upland are perennial pepperweed and Russian thistle (*Salsola tragus*). Dense stands of perennial pepperweed are now present in the section of the river from Sanderson Avenue to Bridge Street. Stinknet is increasing in prevalence in the riparian sections from Sanderson Avenue through the San Jacinto Wildlife Area. Burr chervil (*Anthriscus caucaulis*) has become common in the riparian vegetation along Soboba Road. To date, SAWA's non-native management efforts have been limited to the removal of tamarisk from Mystic Lake. The lands surrounding the survey area include upland coastal sage scrub, grasslands, dairy farms, agricultural land, golf courses, major roads, and residential development.

Current threats to the riparian habitat in San Jacinto primarily involve human encroachment, including the use of OHVs and other vehicles in the riverbed and trash dumping. In the San Jacinto River between State Street and Lake Park Drive, homeless encampments are common. In 2023 and 2024, these encampments decreased due to inundation at the beginning of the season but increased in both size and number as the river stopped flowing, which again resulted in refuse in the habitat, vegetation clearing, habitat modification in the form of tarps and fences used as encampment walls, feral dogs, and brush fires. In the section from Sanderson Avenue to Bridge Street, illegal disposal of farm animal carcasses was documented from 2021-23; dumping of carcasses in the habitat was not observed in 2024.

San Timoteo Canyon (Monitored)

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 a maintenance program continues 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 overgrazed 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 where the creek becomes channelized. In 2024, some areas of the creek were not surveyed due to access restrictions.

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 include poison hemlock, Russian thistle, mustard (*Brassica* sp.), and perennial pepperweed.

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 cattle grazing. Feral pigs continue to disturb the habitat throughout the canyon.

Mockingbird Canyon (Sampled)

Mockingbird Canyon is located in the city of Riverside in Riverside County. Its arroyo serves as a drainage tributary to the Santa Ana River. The riparian zone is classified as a *Salix gooddingii* Woodland Alliance, with Fremont cottonwood as a co-dominant (Sawyer et al., 2009). Red willow and arroyo willow are also interspersed throughout the riparian vegetation. The dominant invasive plant in the riparian zone is perennial pepperweed. Mustard species are the dominant invasive species in the adjacent upland zone; however, stinknet is becoming more prevalent.

There are a multitude of threats to vireo habitat in Mockingbird Canyon. Although the reservoir and basin are currently protected from development, residential development remains an issue in Mockingbird Canyon. Throughout Mockingbird Canyon, residents extend their properties into the arroyo, which causes damage to the habitat and potential harm to nesting vireos. Much of the adjacent upland habitat is already developed and the arroyo is becoming more fragmented by culverts and bridges. Creation of a new subdivision between Mockingbird Canyon Road and Washington Street has resulted in additional habitat fragmentation. SAWA manages an 11-acre easement in Mockingbird Canyon east of Roosevelt Street and Markham Street, and will continue to work with local stakeholders to enhance and protect the canyon's natural resources.

Despite SAWA's efforts within its conservation easement, important habitat was bulldozed and destroyed in adjacent areas to both the west and east in 2016 and 2017. Residential development continues to occur throughout the site, creating noise disturbance and fragmenting riparian habitat in the area. Much of the vegetation that had previously shown signs of heat and drought stress has died. In some areas, including the SAWA easement, large trees have died, resulting in a lack of canopy. In other areas, dead understory vegetation has been scoured, resulting

in a lack of preferred vireo nesting habitat. Immediately southeast of the Mockingbird Reservoir, much of the riparian vegetation has died and upland invasive species have become established. In addition to these threats, Mockingbird Canyon has extensive OHV use, trash dumping, hiking, dog-walking, and equestrian use along the narrow strips of riparian habitat. The area is also highly impacted by invasive species encroachment.

Santa Ana River (SAR) – Upstream (Monitored/Sampled)

The SAR – Upstream section encompasses 3,300 acres (1,340 ha) of riparian and upland habitat along a 15-mile reach of the Santa Ana River from Riverside Avenue in the City of Riverside downstream to Interstate 15 in Norco. The section is divided into five different sites for reporting purposes: Riverside Avenue to Van Buren Boulevard, Lower Hole Creek, Hidden Valley – North, Hidden Valley – South, and Goose Creek (Figure 3).

Prior to 2015, these sites were not grouped together as "SAR – Upstream"; all sites were reported separately. In 2016, a change in funding source incorporated Goose Creek into SAR – Upstream. A small portion of the Goose Creek section includes a mitigation area managed by the Inland Empire Resource Conservation District (IERCD). Hidden Valley – South is analyzed as a whole and by two subsites (Hidden Valley South – Restoration and Hidden Valley – South Non-Restoration) to isolate a restoration area proposed by the San Bernardino Valley Municipal Water District (SBVMWD). In 2019, a previously unsurveyed site, Lower Hole Creek, was added to SAR – Upstream as it is contiguous with the Santa Ana River ecosystem. The Riverside Avenue to Van Buren Boulevard site was modified in 2019 to include two SBVMWD restoration areas: Evans Lake Drain (approximately 87 acres of previously unsurveyed land in and near Fairmount Park in Riverside) and Anza/Old Ranch Creeks (321 acres total, approximately 20 acres of which were previously unsurveyed, near the eastern terminus of Rubidoux Avenue in Riverside). In 2023, the Riverside Avenue to Van Buren Boulevard section was further modified to delimit an additional SBVMWD proposed restoration area: Sunnyslope Restoration (235 acres east of Louis Robidoux Nature Center in Riverside). The Riverside Avenue to Van Buren Boulevard site is analyzed as a whole and by its four subsites: Non-Restoration, Evans Lake Drain, Anza/Old Ranch Creeks, and Sunnyslope Restoration. This location description and site history discuss SAR – Upstream in its entirety, with individual site descriptions thereafter.

There are a variety of vegetation types throughout the SAR – Upstream section of the Santa Ana River. The riparian zone can be classified as a *Salix gooddingii* Forest & Woodland Alliance with Fremont cottonwood as a co-dominant, with *Baccharis salicifolia* Shrubland Alliance in the drier uplands (Sawyer et al., 2009). Arundo is the most common invasive plant in the riparian zone. Other invasive plant species include tamarisk, castor bean, perennial pepperweed, tree-of-heaven (*Ailanthus altissima*), golden crownbeard (*Verbesina encelioides*), poison hemlock, stinknet, 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. Surrounding land use includes industrial, commercial, residential, recreational areas, parks, and golf courses. SAWA biologists often observe vegetation clearing, trash dumping, burned habitat, and inappropriate disposal of human waste in this area.

Brush fires occur regularly in and near the river bottom, most of which are caused by human activity. On October 31, 2019, the 46 Fire burned approximately 325 acres of the Santa Ana River bottom in the Riverside Avenue to Van Buren Boulevard/Sunnyslope Restoration sites, near and including the Louis Robidoux Nature Center. Approximately 180 acres of Hidden Valley – South Non-Restoration burned in the Mann Fire on March 3, 2020. On May 24-25, 2021, the Lake Fire burned 115 acres along the north side of the Santa Ana River near the Van Buren Boulevard bridge, affecting parts of the Riverside Avenue to Van Buren Boulevard Non-Restoration and Hidden Valley – North sites. The Boy Scout Fire burned 32 acres of vegetation in Evans Lake Drain on August 26, 2021. From June 25-29, 2022, the Union Fire burned 110 acres of upland and riparian habitat in the Riverside Avenue to Van Buren Boulevard Non-Restoration site, on the north side of the river between Van Buren Boulevard and the Metropolitan Water District Upper Feeder Bridge off of Wilderness Avenue. The Marlatt Fire burned approximately seven acres of riparian upland vegetation in Hidden Valley South – Non-restoration on July 8, 2022. The Peralta Fire burned 46 acres in Anza/Old Ranch Creeks from July 21-22, 2022.

SAR – Riverside Avenue to Van Buren Boulevard

Historically, SAR-Riverside Avenue to Van Buren Boulevard was analyzed as one site starting at Riverside Avenue in Riverside and encompassing the riparian habitat on both sides of the Santa Ana River downstream to the Van Buren Boulevard bridge. In 2019, SAR-Riverside Avenue to Van Buren Boulevard was divided into three subsites (Non-Restoration, Evans Lake Drain, and Anza/Old Ranch Creeks) due to two new SBVMWD restoration projects. In 2023, the creation of another restoration project at Sunnyslope Channel led to a fourth subsite called “Sunnyslope Restoration”. To maintain consistency with prior reporting years, results are reported herein for “SAR-Riverside Avenue to Van Buren Boulevard Overall” as well as for the four subsites.

SAR – Riverside Avenue to Van Buren Boulevard Overall

SAR – Riverside Avenue to Van Buren Boulevard Overall encompasses 1,558 acres (630 ha) of surveyed habitat on both sides of an eight-mile reach of the Santa Ana River starting at Riverside Avenue and continuing downstream to the bridge at Van Buren Boulevard.

Homeless encampments and associated safety concerns are common in the portion of SAR in the vicinity of and upstream from Van Buren Boulevard. Some areas containing dense

concentrations of homeless encampments are avoided due to safety concerns. Each camp hosts an unknown number of individuals, and it is likely that some camps are inhabited by multiple individuals. Some camps are compounds with multiple tents, structures, and vehicles. Observations related to encampments include clearing of understory vegetation, damage to and removal of large trees, soil compaction, public drug use, unleashed dogs, free-roaming cats, chicken coops, chain-link and wooden structures, solar panels, generators, large scale latrines, small landfills, and various types of vehicles in the habitat. Alteration of the levee occurs near the denser encampment areas, with trails and stairs cut into the levee leading to trails and camps in the habitat. Many camps have been abandoned in the habitat near the river at the end of Wilderness Avenue, with large amounts of trash left behind. Law enforcement activity related to encampments, including officers on foot, officers driving OHVs through the river bottom, and low flying helicopters broadcasting announcements, may result in additional disturbance to nesting vireos in this part of the river.

Riverside County Flood Control and Water Conservation District conducted routine mowing of vegetation from Riverside Avenue to Mission Boulevard prior to the start of the 2014, 2016, 2018, 2021, 2022, and 2023 nesting seasons. Prior to the 2023 season, habitat removal was conducted between Mission Inn Avenue and SR-60 for the Riverside Levees rehabilitation project. Increased volume and flow of the Santa Ana River during the winter of 2022-2023 also scoured some areas of riparian vegetation, thereby reducing available habitat.

SAR – Riverside Avenue to Van Buren Boulevard Non-Restoration

Riverside Avenue to Van Buren Boulevard Non-Restoration encompasses 911 acres (368 ha) of surveyed habitat between Riverside Avenue and the bridge across the Santa Ana River at Van Buren Boulevard, excluding the separately monitored restoration areas at Evans Lake Drain, Anza/Old Ranch Creeks, and Sunnyslope Restoration. Riverside County Flood Control and Water Conservation District conducted routine mowing of vegetation from Riverside Avenue to Mission Boulevard prior to the start of the 2014, 2016, 2018, 2021, 2022, and 2023 nesting seasons.

From May 24-25, 2021, the Lake Fire burned 115 acres of predominately riparian habitat near the Van Buren Bridge and displaced at least two territories in SAR-Riverside Avenue to Van Buren Boulevard. The Union Fire, which occurred June 25-29, 2002, burned 110 acres of upland and riparian habitat on the north side of the river between Van Buren Boulevard and the Metropolitan Water District Upper Feeder Bridge off of Wilderness Avenue. At least six territories and one active nest were affected.

SAR – Riverside Avenue to Van Buren Boulevard Evans Lake Drain

The Evans Lake Drain site was established in 2019. The survey area is approximately 94 acres (38 ha) of land in and near Fairmount Park in Riverside. Prior to 2019, only a small portion of Evans

Lake Drain had been surveyed by SAWA, so historical population numbers are unavailable.

In 2020, the site was not formally surveyed due to concerns associated with high density of homeless encampments and the COVID-19 outbreak. Monitoring resumed at this site in 2021.

On August 26, 2021, nearly 30 acres of Evans Lake Drain burned in the Boy Scout Fire. While vireos had completed nesting by this time, the fire burned most of the occupied habitat. Only one of the five territories documented prior to the fire returned in 2022. In 2023, three vireo territories were documented.

SAR – Riverside Avenue to Van Buren Boulevard Sunnyslope Restoration

Sunnyslope Restoration was established as an independent subsite of Riverside Avenue to Van Buren Boulevard in 2023. The survey area at this site is approximately 235 acres (95 ha) and is located east of Louis Robidoux Nature Center in Riverside.

The habitat in Sunnyslope Restoration is regularly affected during the nesting season by off-road vehicles, feral pigs, homeless encampments, and equestrian use. Trash from areas surrounding Sunnyslope Creek is carried into the habitat during high flow periods and is abundant around the creek boundaries. On October 31, 2019, the 46 Fire burned approximately 325 acres of the Santa Ana River bottom near the old Louis Robidoux Nature Center. Though effects of that fire remain apparent, vegetation is recovering and in 2023 vireos reestablished historic territories in the burned area. Surrounding land use includes residential, commercial, recreational parks, and a golf course.

SAR – Riverside Avenue to Van Buren Boulevard Anza/Old Ranch Creeks

Anza/Old Ranch Creeks was established in 2019. The survey area at this site is 321 acres (130 ha) total, approximately 20 acres of which were previously unsurveyed, and is located near the eastern terminus of Rubidoux Avenue in Riverside. Homeless encampments, OHV use, trash dumping, and a substantial amount of non-native and invasive plant species, along with associated increases in flammable biomass, negatively impact habitat quality at Anza/Old Ranch Creeks.

In 2020, due to safety concerns regarding homeless encampments and COVID-19, Anza/Old Ranch Creeks was not surveyed. Monitoring resumed in 2021.

The Peralta Fire burned 46 acres in Anza/Old Ranch Creeks from July 21-22, 2022.

SAR – Lower Hole Creek

Lower Hole Creek was added to SAR – Upstream in 2019, as it is contiguous with the Santa Ana River ecosystem. The survey area at this site is approximately seven acres (3 ha) and contains the majority of Hole Lake/Lower Hole Creek, a tributary which runs south from the Santa Ana River mainstem immediately west of the Van Buren Bridge to and past Jurupa Avenue in Riverside. The

strip of riparian habitat that continues south of Jurupa Avenue is not surveyed due to safety issues related to homeless encampments.

Homeless encampment density at this site has historically been high, as the riparian habitat is easily accessible from Van Buren Boulevard. In 2023, extensive site cleanup and restoration began, and most of the unhoused population relocated elsewhere. Other threats to habitat quality include invasive species, occasional dumping, and pervasive traffic noise.

SAR – Hidden Valley – North

Hidden Valley – North encompasses 345 acres (140 ha) of surveyed riparian and upland habitat along an approximately four-mile-long reach on the northern side of the Santa Ana River from the bridge at Van Buren Boulevard in Riverside to Etiwanda Avenue in Jurupa Valley.

On May 24 and 25, 2021, the Lake Fire burned 115 acres along the Santa Ana River, predominately in Hidden Valley – North and in a small section of Riverside Avenue to Van Buren Boulevard, which displaced at least nine territories that year (Zembal et al., 2021).

Although their environmental effects have not been quantified, homeless encampments and recreational use of the river threaten habitat quality at Hidden Valley – North. Multiple encampments were observed in 2024; the creation of these encampments likely involved removal of understory vegetation critical to vireo nesting habitat. In addition, unleashed dogs kept as pets at several encampments could potentially disturb vireo breeding behavior. SAWA biologists observed campfires, burning of trash, and firework fragments on site which may increase the risk of potential wildfires. Improper disposal of trash and human waste in this area adds pollutants to the environment, which may also impact vireos.

The Santa Ana River Regional Park, located on Downey Street, is a popular location for swimming, barbecuing, picnicking, and occasionally for bands to play music. The parking lot has been closed since 2020; however, large groups still access the river and riparian habitat via the city park trails. These recreational uses of Hidden Valley – North result in additional noise and refuse in the vireo habitat. The City of Jurupa Valley has installed several large dumpsters at the park near the parking area, but large amounts of trash and human waste continue to accumulate in the riparian habitat near the riverbank.

SAR – Hidden Valley – South Overall

Hidden Valley – South currently encompasses 935 acres (378 ha) of surveyed riparian and upland habitat on the southern side of an approximately four-mile reach of the Santa Ana River from Crest Avenue in Riverside to California Avenue in Norco. The site includes riparian vegetation as well as expansive upland habitat. In 2019, the site was divided into two subsites to delimit an SBVMWD-proposed restoration area on the east side, now called Hidden Valley South – Restoration. As the

area has been monitored by SAWA since 2000, results are reported for Hidden Valley – South Overall as well as separately for the two subsites.

SAR – Hidden Valley – South Restoration

Hidden Valley – South Restoration is composed of 134 acres (54 ha) of surveyed riparian and upland habitat along a one-mile reach of the southern side of the Santa Ana River located on the eastern side of Hidden Valley – South between Hidden Valley – North and Hidden Valley – South Non-Restoration. This portion of Hidden Valley – South Overall was isolated in 2019 after SBVMWD proposed the area for restoration.

As the beach area at this site is easily accessible from the Santa Ana River bicycle trail, it is frequently used by recreational swimmers and picnickers, who occasionally leave large amounts of trash and human waste behind in addition to removing native vegetation. In 2023, one active vireo nest was found to have been first disturbed and subsequently removed (failed), with food waste, litter, diapers, and toilet paper strewn about the nest location, suggesting that recreational beachgoers cleared vegetation to increase the size of their picnic location.

Homeless encampments in this portion of SAR are less numerous than in the immediate upstream sites. The site is regularly patrolled by Riverside County Regional Park and Open Space District rangers, who respond to reported safety incidents as well as actively clean up trash left behind at vacated encampments and river picnics. Illegal off-road vehicle use is increasing in the survey area.

SAR – Hidden Valley – South Non-Restoration

Hidden Valley South – Non-Restoration occupies 801 acres (324 ha) of surveyed riparian and upland habitat along a three-mile reach south of the Santa Ana River, on the western side of Hidden Valley – South.

Portions of Hidden Valley – South Non-Restoration are used for recreational swimming and picnicking. Abundant litter, human waste, and unauthorized removal of native vegetation are frequently documented in these areas. The site has been used by equestrians and hikers since SAWA began monitoring in 2000, which could plausibly disturb vireo breeding behavior; however, the potential effect recreation has on vireos is not well studied. This portion of SAR – Upstream is regularly patrolled by Riverside County Regional Park and Open Space District rangers and has far fewer homeless encampments than the rest of SAR – Upstream.

Approximately 180 acres of Hidden Valley – South Non-Restoration burned in the Mann Fire on March 3, 2020. Vireos were generally not detected in historically occupied areas within the burn area in 2020 and 2021, but one vireo established a territory in the burn area in 2022 and returned in 2023. On July 8, 2022, the Marlatt Fire burned approximately seven acres in a different area of

Hidden Valley South Non-Restoration. Vegetation was affected at two vireo territories, but the vireos returned to these territories within one week.

SAR – Goose Creek, Norco to I-15

Goose Creek, Norco to I-15 occupies 465 acres (188 ha) of surveyed habitat along a two-mile reach on the north side of the Santa Ana River from Goose Creek Golf Club in Riverside to the I-15 bridge in Norco, and on the south side from Pedley Avenue in Norco to the I-15 bridge. A small section of the site is monitored and funded by IERCD.

Impacts to vireo habitat at Goose Creek are primarily due to human encroachment. A housing development near the west end of the IERCD Goose Creek mitigation parcels (southwest of the golf course) was finished prior to the 2020 breeding season. This housing development includes a neighborhood park with access to the habitat, resulting in increased human and domestic animal use, including a feral cat observed on site during the 2022 breeding season. Construction activity on the I-15 bridge over the Santa Ana River was completed prior to the 2021 season, and there has been an influx of homeless encampments in this area between 2021-2024. Vegetation is recovering in this area from a small fire that occurred prior to the 2020 breeding season and vireos have not re-established territories in this area since. Feral pigs are prevalent on the site and damage the habitat. The site is impacted by human recreational use on an equestrian trail system and in areas where there is easy access to the river on the south side of the site. At these access points, there are groups swimming in the river, littering, and small structures built.

In addition to these direct human impacts, the quality and amount of riparian habitat at Goose Creek have been declining since 2019, potentially due to low winter precipitation preceding the 2020-2022 breeding seasons, invasive polyphagous shot hole borer (*Euwallacea* sp.; PSHB), and changes to the flow of the river.

Norco Bluffs, I-15 to River Rd. (Monitored)

The Norco Bluffs survey area is comprised of 766 acres (310 ha) of a three-mile-long riparian zone located along a 3.5 mile reach of the river between I-15 and River Road in Riverside County (Figure 4). The U.S Army Corps of Engineers (USACE) considers most of this area to be within the Prado Basin (566-feet elevation and below). In 2024, SAWA surveyed most of this riparian area, excluding a 101-acre easement belonging to Riverside-Corona Resource Conservation District. The survey effort in 2024 was consistent with efforts from 2019-2023. Prior to 2019, the survey area changed from year-to-year; therefore, data are not comparable across all years. Comparable years of population-level data are as follows: 2015 and 2018, 2016 and 2017, and 2019-2024.

SAWA has two habitat restoration projects within the Norco Bluffs survey area, one immediately south of Eastvale Community Park and another one mile upstream of River Road

Bridge. In the winters of 2006 and 2007, SAWA removed arundo from the 15-acre area south of Eastvale Community Park. After reviewing the mitigation files in 2017, mitigation was necessary on only 4.6 acres of habitat. Before nesting season that year, SAWA removed small patches of reestablished arundo and treated the patches with herbicide. In 2020, SAWA removed approximately 200 acres of arundo using Proposition 84 funds from the area upstream of River Road Bridge. SAWA has conducted regular follow-up treatments in both areas with biological monitoring as needed.

In addition to restoration projects, several construction projects have impacted the Norco Bluffs survey area. Prior to the 2018 breeding season, riparian vegetation growing beneath and alongside I-15 was removed in preparation for the I-15 Express Lanes Project. Active construction occurred at the site throughout the 2019 and 2020 nesting seasons and was completed during the 2021 season. Prior to the 2021 nesting season, approximately 100 feet of riparian vegetation was cleared along both sides of the Hamner Avenue Bridge as part of an expansion project; active construction occurred throughout the 2021, 2022, 2023, and 2024 nesting seasons. Finally, in the winter of 2021-2022, USACE began construction on the Lower Norco Bluffs Toe Protection Project. The 75-acre linear project area was cleared of all vegetation and a sound wall was erected along the entirety of the project; active construction occurred throughout the 2023 and 2024 nesting seasons.

Norco Bluffs is almost exclusively comprised of riparian vegetation without adjacent upland. Native species of willow, predominantly Goodding's black willow and arroyo willow, dominate much of the landscape. The area is classified as *Salix gooddingii* Woodland Alliance with arundo as a sub-dominant (Sawyer et al., 2009). Although SAWA has eradicated many of the large stands of arundo, some large patches remain, particularly in areas that SAWA does not have permission to access. Poison hemlock and mustard species are the other predominant invasive species within the site.

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, or where substantial native recruitment has occurred after removal of arundo. Riparian vegetation in the more recently disturbed areas is composed of Goodding's black willow, arroyo willow, Pacific willow (*Salix lasiandra*), and narrowleaf willow.

Primary sources of habitat degradation at Norco Bluffs include invasive plants and the continued negative impacts of the PSHB. This beetle drills into trees and brings a pathogenic fungus (*Fusarium* sp.) with it that can infect, and subsequently kill, many different tree species. Fortunately, large-scale dieback of riparian habitat, as observed in the Tijuana River Valley (Boland, 2016), has not occurred yet. Nonetheless, arroyo willows have been significantly impacted by PSHB in Norco Bluffs and continue to show signs characteristic of heavy infestation (e.g., heavy staining and branch dieback) or are completely dead. Goodding's black willows infested with the beetle and 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 since these species make up two

(42%) of the three predominant nest substrates over all monitoring years at Norco Bluffs (n=318; Appendix D).

Prior to the arrival of PSHB, the Norco Bluffs habitat was characterized as healthy in areas where arundo had not become dominant. Many mature arundo stands were removed by OCWD and SAWA in Norco Bluffs through the winter of 2019-2020. Several removal areas already have recruitment of native species, including willows. 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. During the winter of 2019-2020, SAWA treated palms with herbicide within OCWD property; however, numerous palms within USACE property will need to be treated as well. Treating the remaining arundo stands and palms would allow for additional natural recruitment of native riparian plant species and thereby increase functional habitat for vireos and other native species.

Temescal Canyon (Sampled)

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

SAWA has surveyed for vireos in Temescal Canyon since 2001, when an arundo removal program began along a section of Temescal Creek in El Cerrito, southeast of the city of Corona. Temescal Wash is currently being managed for arundo regrowth, and native vegetation has begun to reestablish. Differential survey and monitoring efforts have been undertaken in Temescal Canyon since 2001; however, some riparian areas of the canyon are not surveyed because access has been denied. Additionally, areas on the northeast and northwest sides of Lake Elsinore were not accessible in 2024 due to inundation at the beginning of the season and concerns associated with the high density of homeless encampments.

The habitat within Temescal Canyon is characterized by fragmented patches of dense riparian vegetation. Privately owned sand and gravel mines operate downstream adjacent to Temescal 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 in the most downstream section of the wash. Many sections of the wash are channelized with riprap and berms, but still allow some meandering of water 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, however, is dominated by tamarisk. Semi-natural shrubland stands also occur alongside patches of sparse Goodding's black willow.

Habitat in Temescal Canyon and Lake Elsinore is regularly impacted during the nesting season by OHV use, illegal vegetation removal, homeless encampments, and understory clearing intended to deter the establishment of additional homeless encampments around Lake Elsinore. Management recommendations for this area include increased cowbird management, removal of tamarisk, enforcement of codes and laws governing vegetation removal during nesting bird season, and reestablishing outflow to the creek near Dos Lagos Golf Course.

Santa Ana Canyon (SAC)

Santa Ana Canyon (SAC) is located downstream of the Prado Dam to Weir Canyon Road along an approximately nine-mile (14 km) reach of the Santa Ana River. Due to the differences in habitat throughout the canyon, it is divided into three sites: Upper Canyon, Green River Golf Club, and Featherly Regional Park. Upper Canyon is approximately 220 acres (88 ha) and is located along a 1.6-mile (2.6-km) reach from just below Prado Dam downstream to the beginning of Green River Golf Club. Green River Golf Club covers approximately 395 acres (160 ha) of habitat along a two-mile (3.7 km) reach, and the remaining 630 acres (255 ha) along a five-mile (8 km) reach 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 several years. Construction associated with the USACE Reach 9 bank stabilization project in SAC has been ongoing since 2005. In 2014, Phase 3 of the USACE stabilization project began and subsequently impacted the habitat of 10 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 10 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 in 2019, removing vegetation from another three and a half territories. In 2019, Phase 5b and Phase 4 construction activities continued throughout the season. Phase 5a concluded and mitigation was installed prior to nesting season. Construction activities in Phase 5b continued throughout the 2022 nesting season and restoration began in the fall of 2022. The Burlington Northern Santa Fe (BNSF) railroad bridge construction project commenced in 2018

and continued through 2021. The project located in Green River Golf Club removed vegetation from two territories and partially impacted two additional territories in 2018. The project appeared to be complete as of 2022 with no construction activities and vegetation restoration in progress. The Blue Ridge Fire that began on October 26, 2020, burned habitat in both Green River and Upper Canyon; six total vireo territories were subsequently affected in the 2021 nesting season. Patches of burned habitat continue to recover. Prior to the nesting season in 2022, vegetation removal and other repairs were done on an ornamental lake on the golf course. Substantial vegetation was removed from the shore. Despite the drastic vegetation loss, the area was occupied by a vireo pair that successfully fledged a nest. Landscape waste from the lake project was piled on the periphery of nearby habitat and became occupied by a second vireo territory that subsequently fledged a nest. In 2022, USACE construction activities began in the easternmost section of the site, by the Prado Dam. As a result, SAWA did not nest-monitor four historically monitored territories; they were instead monitored by a consulting company. In February 2023, Caltrans began reconstruction of the SR 71/SR 91 interchange near the Prado Dam spillway, which restricted SAWA monitoring of an additional four territories.

As of 2023, all USACE projects in Featherly Park have been completed and restoration of habitat has begun on the most recent work sites, which should expand and enhance vireo habitat in the post-construction years. For example, several vireos have already moved into previously restored areas in Phase 2b, Phase 3, and Phase 4. Caltrans construction at the interchange of SR 71 and SR 91 impacted monitoring activities in Upper Canyon, though no vireo habitat appeared to be removed during the season. No major projects occurred at Green River Golf Club and areas previously impacted by the BNSF bridge project continue to recover.

A variety of habitat types occur throughout SAC. Vireos 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). Several areas adjacent to the riparian habitat are in various stages of restoration and cannot be classified at this time. Additionally, some adjacent upland areas are non-native dominant, such as the Green River Golf Club and Chino Hills State Park areas. The dominant invasive plants in the riparian zone are poison hemlock, castor bean, and arundo. 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, perennial pepperweed, gum tree (*Eucalyptus* sp.), and Peruvian pepper tree (*Schinus molle*). In 2023, a single stinknet was found in the 5a restoration site and removed by hand. Additional stinknet plants were found upstream at Green River and Upper Canyon.

Arundo infestation is increasing at all SAC sites. The restoration edges between the golf course and the residential area have opened new areas for arundo to infest along the river, while

the arundo patches in Upper Canyon continue to spread. In the downstream section (Featherly Regional Park), arundo was treated with Imazapyr in 2013, which damaged many of the surrounding native trees. Though much of the arundo at this location is dead, the biomass remains, hampering regeneration of native species. Castor bean has also infiltrated the habitat at the edges of the restoration areas.

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. There is no significant native tree die-off caused by the invasive PSHB observed in SAC at this time. In the past, SAWA 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 many years. With several projects in SAC completed, work on the Santa Ana River Trail is expected to resume in the future.

Upper Canyon (Monitored)

Upper Canyon is located adjacent to SR 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 SAC. In the last decade, Upper Canyon has undergone a number of habitat disturbances including native vegetation removal, subsequent restoration, additional vegetation removal, and a devastating fire.

Construction on a portion of the Santa Ana River trail began during the winter of 2018 and continued into April 2019. Trail construction did not occur during the 2020-2023 monitoring seasons, and it is not known when construction will resume. The trail is planned to proceed through Upper Canyon and Green River Golf Club to connect to the existing Santa Ana River Trail located south of the golf course. In 2022, USACE construction activities occurred in the easternmost section of the site, by the Prado Dam. As a result, SAWA did not nest-monitor four historically monitored territories; they were instead monitored by a consulting company. Construction activities continued in this section in 2023 and continued to be monitored by a private consulting company. In February 2023, Caltrans began reconstruction of the SR 71/SR 91 interchange near the Prado Dam spillway. Caltrans used biological monitors, so SAWA did not monitor an additional four territories that historically occupied this area. This interchange project is expected to continue through 2025. Substantial winter and spring rains further impacted monitoring access in Upper Canyon. Chino Hills State Park was temporarily closed to give its rain-soaked dirt roads and trails time to dry out. This resulted in an approximate two-week delay in monitoring work. The rain also resulted in prolific vegetation growth, especially of mustard on the south side of the river, limiting access to the riparian habitat. Access to the north side of Upper Canyon was affected due to Caltrans construction

activities on east portion of the site. To the west, the trail was damaged at the Aliso Creek crossing, affecting access until repairs were done in late June. These combined access constraints resulted in less intensive monitoring at this site in 2023.

Unfortunately, this site continues to be affected by human-related impacts including illegal fishing, trash dumping, and illegal trail creation. Additionally, large areas are infested with invasive plant species (e.g., arundo, tamarisk, etc.).

Green River Golf Club (Monitored)

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

Phase 3 of the USACE Reach 9 bank stabilization project started during the fall and winter of 2011 with the removal of several acres of riparian habitat from this site, which included mature willow and cottonwood trees. This area supported 13 vireo territories during the 2011 breeding season. The 2011 project phase was roughly 75% complete at the end of the 2012 nesting season with some replanting underway, but habitat loss and construction activities could have contributed to the 27% decrease in territory numbers between 2011 and 2012. In 2014, construction continued in the beginning of the nesting season adjacent to occupied habitat upstream of the railroad bridge. On May 1, 2014, a vireo nest was found within 100 feet of disruptive construction activities. The USACE and the U.S. Fish and Wildlife Service (USFWS) were notified immediately. Still, work continued toward the nest, and it was abandoned with two eggs. Other vireo nests were found near construction activities and work stopped in this area for the rest of the 2014 season. No additional habitat was removed in 2014.

The BNSF rail bridge construction project was active from 2018-2021. Four vireo territories were impacted prior to the avian nesting season in 2018. Riparian habitat in two territories was completely removed, and habitat in two other territories was partially removed. In 2021, construction activity and resulting noise disturbance occurred near the remaining habitat, but no vegetation was removed. The areas in which construction activity occurred supported six vireo territories. Nests were found in four of the territories outside of the construction zone, and fledglings were documented from three of these territories. On May 11, 2021, a small (approximately ½ acre) fire occurred in an occupied patch of habitat near the construction site. The vireos' active nest was destroyed, but enough habitat remained for the birds to stay and make two more nesting attempts, which were unsuccessful. Since 2022, no construction activities have taken place at this site.

Habitat restoration work on-site, which included mowing, spraying, and hand-pulling of invasive plants, followed the completion of phases 2 and 3 of the Reach 9 project. Work that began

in 2019 on Chino Hills State Park property adjacent to the golf course continued in 2021. During the 2021 nesting season, restoration workers were provided with vireo territory and nest information and asked to avoid those areas. In 2022, no large-scale removal or disturbance to vegetation or vireos was observed at this site. In 2023 and 2024, restoration workers continued maintenance of the site, mowing fields of invasive mustard and hemlock and spraying herbicide. No impacts on vireo territories were observed.

A project to replace a golf cart bridge spanning Aliso Creek was completed at the beginning of the 2021 nesting season. Historically, there have been one to two vireo territories located along this section of Aliso Creek. Work on the project, which started in 2020, had been paused in June of 2020 to accommodate vireo fledglings using the area. The project resumed in the fall/winter. Chain link and safety fencing were used to restrict access to the habitat in 2021. Upon completion of the project in April 2021, the chain link was removed with no impact to the habitat. The safety fencing remained through the season due to birds nesting beside it and has since been removed.

On October 26, 2020, the Blue Ridge Fire started near Green River Golf Club and burned riparian and upland habitat in the northern parts of the golf course, near the railroad tracks and border of Chino Hills State Park. Some habitat was partially damaged, while other habitat was completely destroyed by the fire. No vireos returned to the destroyed sections in 2021, but vireos did occupy some of the less damaged patches. In 2022, recovery was noted in some of the seriously burned patches, and one location that was unoccupied in 2021 hosted a vireo pair in 2022. In 2023, recovery of burned patches continued and the patch occupied in 2022 hosted a territory again.

Prior to the nesting season in 2022, vegetation removal and other repairs were done on an ornamental lake on the golf course. Substantial vegetation was removed from the shore. Despite the drastic vegetation removal, the area was occupied by a vireo territory that successfully fledged a nest. Landscape waste from the lake project was piled on the periphery of nearby habitat near a second vireo territory. That territory was also occupied and fledged a nest. That territory was not observed to be occupied in 2023. The vireo pair near the landscape waste pile continues to return to occupy that patch. While it appears that the area is being maintained to keep it open, no additional vegetation was observed to be removed in 2023, and no work activity was noted during the nesting season.

Featherly Regional Park (Monitored)

Featherly Regional Park is located along the Santa Ana River, between the west end of the Green River Golf Club and the bridge on Yorba Linda Boulevard and Weir Canyon Road in Orange County. This site is the downstream portion of SAC.

The Santa Ana River Trail and Parkway runs adjacent to the park. Public access is restricted; however, little fencing is in place to deter entry into the riparian habitat. Phase 4 of the USACE Santa

Ana River Mainstem Reach 9 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. 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. Phase 4 construction expanded on the south side of the river upstream of Canyon RV Park, 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 upstream to Brush Canyon in 2019 and downstream in 2020, removing vegetation from another three and a half and one and a half territories, respectively. In 2019, Phase 5a was completed and restoration began before the breeding season. Phase 4 habitat restoration began in 2020 and has since been completed. Construction activities in Phase 5b of the USACE Reach 9 project were completed in 2023; restoration began in 2023 and was completed in late 2024. The proposed mitigation from these projects should expand and enhance vireo habitat in the post-construction years but will need continued invasive maintenance. Vireos have already begun inhabiting the Phase 4 and 5a restoration areas.

Until the abundant winter rains in 2016 and 2017, the habitat at Featherly Regional Park had become extremely drought-stressed, with the exception of the area immediately adjacent to the riverbanks. The dramatic increase in breeding success in 2017 and 2019 at this site was likely due to the increased precipitation and resulted in higher recruitment in 2018 and 2020. Unfortunately, 2021 brought another extreme drought year with low reproductive success at this site. Continued drought conditions in 2022 did not appear to affect reproductive success, perhaps aided by a few small precipitation events throughout the season. The increased precipitation during the winter of 2022-2023 may have alleviated local drought concerns but increased the inundation of invasive plants and flood risk to vireo. However, the reproductive success rate increased dramatically. The winter of 2023-2024 had similar heavy precipitation. PSHB has been detected within the park, though no large die-off has been observed. Other ongoing disturbances at this site include habitat destruction during the nesting season by illegal fishing and sporadic homeless camps.

Orange grove maintenance continues to impact some adjacent vireo habitat. Grove maintenance did not occur during the 2022-2023 winter; as a result, a vegetative understory emerged and subsequently a few vireos began expanding their territories into the groves. When a new grove lessee began maintenance and harvest during the nesting season, a SAWA biologist informed them of nesting vireos in the groves. The grove lessee worked closely with the biologist to avoid any impacts to vireo nests throughout the remainder of the season. It was recommended they maintain the groves and remove emerging understory prior to nesting season in the future in hopes that vireos will no longer choose the grove area for nesting. Invasive plants continue to be a problem

at this site.

Arundo began re-sprouting two weeks after the Freeway Complex Fire in 2008 and has since spread sporadically 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 reestablished 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 have damaged over 200 nearby native trees in 2013. More damage was observed in 2020. Poison hemlock and mustard spp. have become dominant invasives throughout a large portion of the site, outcompeting native understory plants and offering a poor choice of nest substrate to vireos. Although these plants have good cover and appear appropriate for vireo nests in the beginning of the season, they quickly dry, lose cover and become flimsy, and are rarely able to hold a heavier nest as nestlings age.

Vireo Monitoring

SAWA's vireo management program includes habitat restoration, biological monitoring, and cowbird control. The primary purpose of surveys at monitored sites was to locate all vireos and SWFL to determine accurate territory numbers and breeding status, and to enhance breeding output through management. 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. Location, behavior, and reproductive status of all vireos encountered were noted on each visit. Not all territories were monitored sufficiently to determine pairing success. No playback of vireo vocalizations was used during surveys. GPS coordinates were taken in the approximate center of the territory, if known. Each point denotes a territory (an area occupied and defended by one territorial male), not just a sighting. Great care was taken to identify individual territories and avoid duplication. Territory size range was estimated at monitored sites. Shapefile 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 is included in the shapefiles submitted to the USACE, CDFW, SBVMWD, and the USFWS. All electronic data is shared with Barbara Kus of the U. S. Geological Survey (USGS), and banded vireos are reported annually to the original bander and the appropriate agencies. Field data were collected using an iPhone with ESRI's ArcGIS Field Maps and Survey123 applications. 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-839480-5.7, California Scientific

Collecting Permit (S-190600002-19065-001), and a Memorandum of Understanding with the CDFW.

Surveys were conducted five or six days per week throughout the nesting season (March through July). Occasional visits to determine continued vireo presence occurred through September. Biologists watched for nesting behavior from a distance and did 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 visitation was avoided if there was a chance of inducing premature fledging of nestlings, if approaching the nest would result in habitat destruction or trail creation, 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. Beginning in 2019, nests that were predated before it could be determined if they had been parasitized (seven days after incubation began) were excluded from parasitism rate calculations (Pike et al., 1999; Sharp & Kus, 2006).

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

Survey: any visit to a site(s) for the purpose of collecting data regardless of the duration or distance traveled. The term survey is used synonymously with visit.

Incidental: any other species detection documented while conducting an unrelated activity. Vireo detection in an area not sampled for vireo with less than three visits.

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 exhibiting other reproductive behavior, or who 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 pair to build a nest. Includes carrying nest material, even if a nest is not found.

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

Well-tracked nest: a complete nest observed with vireo egg(s) and/or nestling(s), and if successful, nestling(s) were observed at ≥ 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 egg(s) or nestling(s) but did not fledge young.

Presumed failure (nest): a complete nest in which no egg(s) or eggshell(s) were observed; no powder from pin feathers seen in nest; adults seen without fledgling(s).

Presumed successful (nest): a well-tracked nest with powder from pin feathers seen in the nest, or adults observed with fledgling(s).

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

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

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

Unknown failure: classified as such when the cause of failure of nest could not be determined.

Manipulated nest: cowbird egg(s) or nestling(s) removed from a well-tracked nest.

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

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

Reproductive success: the average number of fledglings produced by well-monitored pairs.

Migrant Willow Flycatchers (*Empidonax traillii* ssp.) were documented in conjunction with visual and auditory searches for vireos. 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 at monitored sites is provided with sensitive species noted. GPS points were taken for all sensitive species and cowbirds detected in vireo habitat.

Brown-headed Cowbird Trapping

In the 2024 breeding season, a total of 42 traps were deployed: thirty-six traps were deployed in or near vireo habitat and the remaining six were placed on dairy farms (Figure 5). With the exception of the Cielo Vista trap, which was opened May 1, all traps were opened by April 11 and were closed by July 12.

Trapping is also conducted at local dairies outside of the vireo breeding season. In fall/winter 2023-2024, eight traps were deployed; six at local dairies and two in the vicinity of Prado Basin. All

dairy traps were opened on July 17, 2023. One dairy trap was closed on December 1, 2023. All other dairy traps remained open until March 29, 2024. The Prado traps were opened on September 6 and closed on November 14, 2023.

Traps are designed after Australian crow traps. The trap is a cubic wood frame covered in wire mesh and fitted with cloth to provide shade for the birds. Ideal trap locations are in accessible open areas near riparian habitat or near cowbird 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 adhered to 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 as soon as possible to minimize stress. Due to CDFW permit conditions dated September 3, 2020, SAWA is required to dispatch all 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. Due to these extenuating circumstances, some of these non-native species were released to avoid unnecessary distress to the birds.

Field assistants recorded 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 plumage developed. 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 five females for larger habitat traps. Large traps placed on dairies were typically baited with a ratio of six males to nine females. The flight feathers on each cowbird were trimmed so that if a cowbird escaped, it would be more likely to return to the trap or at least be unlikely to resume reproducing. A lock was placed on each 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 pen until the falconer could collect the birds. Holding pens 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. In mid-July, birds, food, and water were removed from all traps. The trap entry point was closed, and the door was locked in an open position to prevent unintended captures.

SAWA removed traps from sites in or near vireo habitat after they had been closed; dairy traps remain in place year-round.

RESULTS

Vireo Abundance

In 2024, SAWA documented a total of 1,586 vireo territories, including 694 known pairs and 1,027 known fledglings, at all monitored, sampled, and incidental sites. This represents a 14% increase from 2023 (n=1,394), and the highest number documented since monitoring began in 2000. Most monitored sites showed an increase in abundance, most notably Green River Golf Club (22%), Hidden Valley – South (21%), and San Timoteo (17%). One sampled site (Chino Hills State Park) increased by 56%. OCWD reported 773 vireo territories in Prado Basin in 2024 (preliminary data; David McMichael, personal communication) for a total of 2,359 vireo territories watershed-wide, the highest number since monitoring began (Table 1; Appendix D). Watershed-wide abundance data over time (excluding Prado Basin) can be found in Appendix B-1 and by site in Appendix C-1.

Monitoring efforts at most sites in 2024 were similar to 2023, with the exception of Anza/Old Ranch Creeks, which was sampled instead of monitored due to increased homeless activity and related safety hazards (Table 3B). As in 2023, numerous concerns about homeless encampments continued to hamper observer visits at San Jacinto River and SAR – Upstream (including Riverside Avenue to Van Buren Boulevard, Evans Lake Drain, Anza/Old Ranch Creeks, Lower Hole Creek, and Hidden Valley – North), and little to no nest monitoring occurred in these areas. A total of 3,341 SAWA biologist hours were spent surveying and monitoring vireos in 2024.

Chronology of Breeding Activity

Surveys at monitored sites began between March 12 and March 21 and ended between September 12 and September 19. The first vireos were detected on March 19 at Hidden Valley – South. The estimated earliest date for the arrival of 50% of vireo males was on April 5 at Hidden Valley–South. The estimated earliest date for 50% of males paired was April 15 at SAC – Upper Canyon. The first nests were found on April 2 at San Timoteo Canyon and Hidden Valley –South. The first date a nest fledged was May 5 at Norco Bluffs. The last date a nest fledged was July 23 at Riverside Avenue to Van Buren Boulevard, specifically at the proposed Sunnyslope Restoration site. The last date vireos were detected was September 13 at SAC – Featherly Regional Park (Table 2).

Reproductive Success

Reproductive success, as measured by productivity of well-monitored pairs, was 3.3 (n=145) watershed-wide in 2024, lower than 4.3 in 2023 (n=106), which was the highest rate ever recorded by SAWA. However, the 2024 rate is higher than the rate recorded in 2022 of 2.7 (n=190). Nest success was 62% in 2024 (n=298), a slight decrease from 63% (n=284) in 2023 (Appendix B-1). Average clutch size was 3.6 based on 287 complete clutches (Table 3). See Appendix C-1 for individual site data over time. Metrics specific to SBVMWD restoration sites can be found in Table 3B.

Nesting Site Preferences

Nesting site preferences followed those 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 (25%), arroyo willow (15%), red willow (8%), and desert wild grape (*Vitis girdiana*; 7%) were the primary plant species used for nest placement by vireos in 2024 (n=328; Table 4). Other abundantly used riparian plant species were narrowleaf willow (6%), Fremont cottonwood (5%), and blue elderberry (*Sambucus mexicana;* 5%). Thirty-four (10%) nests were placed in non-native vegetation. Two (1%) nests were placed in deadfall (Table 4). This suggests that vireos 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 vireos supports the need for careful monitoring of all plants during the nesting season. A complete list of plant species utilized by nesting vireos in 2024 can be found in Table 4. Historical nest site preference data across the watershed can be found in Appendix B-2; site-specific nest site preference data can be found in Appendix C-2.

Predation Rates

Nests are assumed predated if all eggs or unfledged young were destroyed or removed. In 2024, the watershed-wide predation rate for well-tracked nests was 28% (n=298), one percent lower than the rate of 29% (n=284) in 2023 (Appendix B-1). Predation rates varied at each site and can be found in individual site results. At sites with five or more well-tracked nests, predation rates varied between 0% and 46% (Table 3). Over all years, nest loss due to predation is 33% watershed-wide (n=4,989; Appendix B-1).

Nest losses are typically due to unknown predators, but several predator observations were made throughout the season (Table 5). Vireos were observed scolding or chasing California Scrub-Jays (*Aphelocoma californica*), Cooper's Hawks (*Accipiter cooperii*), Red-shouldered Hawks (*Buteo lineatus*), Common Ravens (*Corvus corax*), Greater Roadrunners (*Geococcyx californianus*), bobcats

(*Lynx rufus*), coyotes (*Canis latrans*), Eastern fox squirrels (*Sciurus niger*), a long-tailed weasel (*Mustela frenata*), a California striped racer (*Coluber lateralis lateralis*), California kingsnakes (*Lampropeltis californiae*), and gopher snakes (*Pituophis catenifer*) within territories, though no direct predation events by these animals were observed. On two occasions, Argentine ants (*Linepethima humile*) were observed consuming vireo nestlings in Santa Ana Canyon, though it was unknown if the ants caused the deaths of the nestlings. At Norco Bluffs, an adult vireo was killed by an unknown predator during a nest predation event; all nest contents were missing, and partially consumed remains of the adult were found beneath the nest.

Other suspected nest predators not mentioned above include Great Horned Owl (*Bubo virginianus*), American Crow (*Corvus brachyrhynchos*, Barn Owl (*Tyto furcata*), raccoon (*Procyon lotor*), Virginia opossum (*Didelphis virginiana*), gray fox (*Urocyon cinereoargenteus*), Southern California alligator lizard (*Elgaria multicarinata*), and various snake species. These predator species occur at most sites throughout the watershed (Table 5). Feral pigs (*Sus scrofa*) are another potential predator that occurs in high numbers in San Timoteo Canyon, Norco Bluffs, and the upstream portion of the Santa Ana River. 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. One failed nest in Norco Bluffs in 2024 was observed to have a new pig trail directly underneath. The branches to which the predated nest was attached had been pulled downward but were not broken, implying that pigs may have pulled the host branches down and consumed the nest while foraging.

Brown-headed Cowbird Parasitism

In 2024, zero (n=261) well-tracked nests were parasitized by cowbirds. This is the second year since SAWA began vireo monitoring in which no well-tracked nests were found to have been parasitized; no parasitism was documented in well-tracked nests in 2023. However, San Jacinto was not nest monitored in 2023 or 2024, and parasitism is common at this site. The combined watershed-wide parasitism rate over time is 8% (n=4,690; Appendix B-1). Prior to 2024, the lowest annual watershed-wide parasitism rates recorded occurred in 2011 and 2015 (both 2%, n=204 and n=188, respectively; Hoffman et al., 2011, 2015). The absence of parasitism in 2024 continues the declining trend in watershed-wide parasitism rates compared with the high rates of 21-28% recorded in the early 2000s, likely due to SAWA's extensive cowbird trapping program.

From 2020-2024, failure of well-tracked nests due to parasitism ranged from 0-2% (Appendix B-1). The criterion for judging nest failure of well-tracked nests due to parasitism is the loss or abandonment of vireo eggs in the presence of a cowbird egg or nestling. In previous years, nest "manipulation", which is the removal of cowbird eggs and nestlings by SAWA biologists, accounted for the low rate of nest failure due to parasitism, as almost all parasitized vireo nests fail in the

absence of nest manipulation (Parker, 1999). Since SAWA began nest monitoring in 2000, 318 nests have been manipulated, and 145 of these nests successfully fledged 317 vireos (Appendix B-1).

Repaired Vireo Nests

Thirteen nests were repaired in 2024, nine (69%) of which were ultimately successful and fledged 27 young. Since SAWA began monitoring vireos in the watershed, 108 nests have been repaired and successfully fledged 191 young (Appendix B-1).

Results and Discussion by Site

San Jacinto (Sampled)

In 2024, 87 territories were detected at San Jacinto, a four percent increase from 84 territories detected in 2023, but an overall decrease of 19% from the record high of 108 territories detected in 2020. Thirty males were determined to be paired, though not all territories were monitored sufficiently to determine pairing success. Sixteen fledglings were detected across all pairs in 2024 (Table 1).

Eighty cowbirds were detected in vireo habitat over the course of the season, and one pair of vireos was observed feeding a juvenile cowbird. Though no nests were monitored, cowbird eggs were incidentally discovered in and removed from two vireo nests in 2024.

With the exception of 2015, Brown-headed Cowbird trapping has occurred in San Jacinto since 2003, and a total of 31,769 cowbirds have been removed during the breeding season over 16,117 trap days, mostly from local dairies (Appendix C-1-A). In 2024, two traps placed adjacent to riparian habitat caught 70 cowbirds over 86 trap days. Three additional traps were placed at local dairies during the breeding season and captured 692 cowbirds over 256 trap days (Table 6). Altogether, the five traps captured 762 cowbirds over 342 trap days during vireo nesting season. Biologists spent a total of 81 hours monitoring vireos, including associated activities, at San Jacinto in 2024.

San Timoteo Canyon (Monitored)

In 2024, 112 vireo territories were documented in San Timoteo Canyon, up 17% from the 96 documented in 2023 (Table 1) but 36% lower than the high of 176 territories documented in 2015 (Appendix D); as in 2023, some areas of the creek surveyed in 2022 were not surveyed in 2024 due to access restrictions. However, the population in San Timoteo Canyon has experienced a 22-fold increase in 24 years (Appendix D). This increase can be attributed to the removal of invasive species and subsequent restoration of native vegetation, nest monitoring, and cowbird management. In

2024, estimated territory size of the vireos in San Timoteo Canyon ranged between 0.2 to 2.3 acres. Biologists spent a total of 426 hours monitoring vireos, including associated activities, in 2024.

Seventy pairs and 155 fledglings were detected in 2024, though not all territories were monitored sufficiently to determine pairing success. Apparent nest success was 61% (n=70), slightly higher than the 58% (n=73) documented in 2023. Nesting success is 55% over 24 years of monitoring (n=1,466). Forty-one well-monitored pairs had a 2.9 reproductive success rate in 2024, significantly lower than 4.1 in 2023. Overall reproductive success based on productivity of well-monitored pairs since 2001 is 3.0 (n=776). Nest losses in 2024 were primarily due to predation, accounting for 30% of total nest outcomes. Predation (36%) has been the major cause of nest loss in the last 24 years (n=1,466; Appendix C-1-B).

Arroyo willow (27%), red willow (23%), mulefat (16%), and desert wild grape (12%) were the most frequently used substrates for nest placement in 2023 (n=73). Four nests were found in non-native vegetation in 2024; the remaining nests were built in various native substrates (Table 4). Arroyo willow (24%), mulefat (22%), and red willow (18%) have been the primary plant species used for nest placement in San Timoteo Canyon since 2001. Only 33 (2%) nests found from 2001-2024 have been placed in non-native vegetation (n=1,586; Appendix C-2-B).

Brown-headed Cowbird trapping has occurred in San Timoteo Canyon since 2001 and a total of 3,133 cowbirds have been removed during this time. No cowbirds were detected in vireo habitat over the course of the season. No parasitism by cowbirds of well-tracked nests was documented between 2020-2024 (Appendix C-1-B). In 2019, 12 nests (15%; n=80) were parasitized by cowbirds and subsequently seven nests (8%; n=90) failed as a result. However, in 2019 cowbird traps were not placed in the area in which the majority of parasitism occurred. Since 2020, at least one trap has been deployed in the vicinity of where most parasitism was documented in 2019 and cowbirds were removed from the habitat. The 2019 parasitism rate (15%) remains a marked decrease from a high of 75% (n=4) in 2001 (Appendix D). Although parasitism by cowbirds still occurs at a rate of 9% (n=1,398) over 24 years, only 2% (n=1,466) of nests have failed due to parasitism (Appendix C-1-B).

Mockingbird Canyon (Sampled)

In 2024, 23 vireo territories, nine pairs, and six fledglings were detected in Mockingbird Canyon, an increase of 10% from 21 territories in 2023, and a decrease of 49% from 45 territories in 2020 (Table 1). No nests were well-monitored in 2024 (Appendix C-1-C).

In 2003, an intensive cowbird management program was initiated in Mockingbird Canyon. In the same year, 62% of nests (n=13) were parasitized, the highest recorded at this site in all survey years (Appendix D). The parasitism rate decreased sharply after the trapping program began, though parasitism has occurred episodically over subsequent years, resulting in an overall parasitism rate of 10% (n=185). Two cowbirds were detected in or near vireo habitat in 2024. Since 2003, a total of

2,433 cowbirds have been removed from Mockingbird Canyon (Appendix C-1-C). Biologists spent a total of 34 hours monitoring vireo, including associated activities, at the Mockingbird Canyon site in 2024.

Santa Ana River (SAR) – Upstream

In 2024, 410 vireo territories were documented in the upstream section of the Santa Ana River, an 8% increase from 381 territories in 2023 (Table 3B; Zembal et al., 2023). The total number of vireo territories remains 16% lower than the record high of 488 territories detected in 2020 (Zembal et al., 2020). Overall, vireo abundance has increased throughout the upstream section since monitoring began in 2000 (Appendix D) and may be attributed to increased monitoring efforts, addition of new survey areas in some years, removal of invasive vegetation allowing for native plant regeneration, and cowbird management.

In 2024, 235 pairs and 339 fledglings were documented. Of these, 40 pairs were well-monitored and produced 137 fledglings for a reproductive success rate of 3.4. Apparent nest success was 63% (n=83), a slight increase from 61% (n=57) documented in 2023 (Table 3B; Zembal et al., 2023). No parasitism was documented in SAR – Upstream in 2024 (0%; n=73). Nest losses were primarily due to predation, accounting for 25% of total nest outcomes (n=83). Other causes of nest failure were unknown (10%) and reproductive failure (2%; Table 3B). Eleven cowbird traps were placed in SAR – Upstream in 2024 and a total of 31 cowbirds were removed over 810 trap days (Table 6). One cowbird was detected in vireo habitat (at Hidden Valley – North) over the course of the season. Seventy-eight homeless encampments and 47 human-related safety issues were documented by SAWA within the riparian habitat in 2024. A total of 1,117 biologist hours were spent monitoring vireos at SAR – Upstream in 2024.

SAR-Riverside Avenue to Van Buren Boulevard

Historically, SAR-Riverside Avenue to Van Buren Boulevard was analyzed as one site. In 2019, the site was divided into three subsites (Non-Restoration, Evans Lake Drain, and Anza/Old Ranch Creeks) due to two new restoration projects. In 2023, the creation of another restoration project at Sunnyslope Channel led to a fourth subsite called “Sunnyslope Restoration”. In order to maintain consistency with prior reporting years, results are reported herein for SAR-Riverside Avenue to Van Buren Boulevard Overall as well as for the four subsites.

SAR-Riverside Avenue to Van Buren Boulevard Overall

In 2024, 135 territories were detected at SAR-Riverside Avenue to Van Buren Boulevard, a 7% decrease from 145 territories detected in 2023. Sixty-two males were determined to be paired,

though not all territories were monitored sufficiently to determine pairing success. Seventy-three fledglings were detected across all pairs, eleven of which fledged from three well-monitored pairs, resulting in an average of 3.7 fledglings produced per well-monitored pair. Ten nests were found, eight of which were well-tracked. Apparent nest success was 50%, higher than the rate observed in 2023 (36%, n=11). Predation (38%) was the main cause of nest failures; the remaining nests (13%) failed for unknown reasons. Nest failures resulting from parasitism or reproductive failure were not observed in well-tracked nests at this site in 2024 (Appendix C-1-D).

Arroyo willow (20%), mulefat (20%), desert wild grape (20%), and arundo (20%) were the most frequently used substrates for nest placement in 2024. Thirty percent of nests found were placed in non-native substrates. (n=10, Table 4).

Brown-headed Cowbird trapping at this site has occurred on public land, private business, and residential properties since 2002 and 1,016 cowbirds have been removed during this time (Appendix C-1-D). In 2024, 33 cowbirds were removed from the study area over 459 trap days (Table 3B). No cowbirds were detected in vireo habitat over the course of the season. Some previously inaccessible areas were surveyed this year with the assistance of a Riverside County Regional Park and Open Space District ranger. However, some areas were avoided due to safety concerns and dense concentrations of homeless encampments, which limited access to vireo territories.

Approximately 48 homeless camps, compounds, and human-related safety hazards were documented by SAWA in this reach of the Santa Ana River in 2024. Though the number of documented hazards is lower than in previous years, the number of camps is likely an underestimate as some areas remain unsafe for biologists to survey.

SAR-Riverside Avenue to Van Buren Boulevard Non-Restoration (Sampled)

In 2024, 95 vireo territories were documented in the Riverside Avenue to Van Buren Boulevard Non-Restoration site, a 7% decrease from 102 territories in 2023 (Table 3B; Zembal et al., 2023). Thirty-four pairs were documented, none of which were well-monitored. Twenty-seven fledglings were detected. One nest was discovered but was not well-tracked. No parasitism was documented at this site in 2024. In 2024, five cowbirds were removed from the study area over 137 trap days (Table 3B). No cowbirds were detected in vireo habitat over the course of the season.

SAR-Riverside Avenue to Van Buren Boulevard Evans Lake Drain (Sampled)

Three territories were detected at Evans Lake Drain in 2024, the same number as in 2023; however, this represents a decrease of 40% from the five territories detected in 2021. Two pairs and two fledglings were detected in 2024 (Table 3B; Zembal et al., 2021).

Fourteen cowbirds were captured over 81 trap days in a trap located approximately 0.25 miles away at Fairmount Park (Table 3B). No cowbirds were detected in vireo habitat over the course

of the season. No parasitism was detected in 2024, as in 2023 and 2022; however, no nests have been well-tracked since 2021. In 2021, two out of the four well-tracked nests were parasitized (Zembal et al., 2021).

SAR-Riverside Avenue to Van Buren Boulevard Sunnyslope Restoration (Monitored)

Twenty-one territories were detected at Sunnyslope Restoration in 2024, a decrease of 13% from 24 territories documented in 2023 (Table 3B; Zembal et al., 2023). Sixteen pairs and 33 fledglings were detected, though not all territories were monitored sufficiently to determine pairing success (Table 3B). In 2024, the estimated territory size of the vireos at Sunnyslope Restoration ranged between 0.48 and 1.0 acre.

Three well-monitored pairs had a reproductive success rate of 3.7 in 2024. Nine nests were found, eight of which were well-tracked. Apparent nest success was 50%; predation (38%) was the most common cause of nest failures, and the remaining nest failed due to unknown reasons (13%). Parasitism and reproductive failure were not observed in well-tracked nests at this site in 2024 (Table 3B).

In 2024, there were no homeless encampments documented at this site, though recently vacated areas were observed. Most encampments in this section of the river are established on the opposite side of the river at Anza/Old Ranch Creeks. Though effects of the 2019 46 Fire can still be seen, suitable habitat has recovered, and vireos were observed resettling in historic territories in 2023 and 2024.

Brown-headed Cowbird trapping has occurred at this site for several years at two water treatment stations adjacent to riparian habitat. In 2024, 14 cowbirds were removed from the study area over 160 trap days (Table 3B). There were no cowbirds detected in vireo habitat at Sunnyslope Restoration in 2024.

SAR-Riverside Avenue to Van Buren Boulevard Anza/Old Ranch Creeks (Sampled)

In 2024, 16 territories were detected in Anza/Old Ranch Creeks (Table 3B), the same number that was detected in 2023 (Zembal et al, 2023). Ten males were determined to be paired, though not all territories were monitored sufficiently to determine pairing success. Eleven fledglings were detected across all pairs. No nests were found in 2024 and no pairs were well-monitored (Table 3B). No cowbirds were detected in the habitat over the course of the season.

At least one vireo that was documented in 2022 in the footprint of the 2022 Peralta Fire did not return in 2023 or 2024 (or possibly shifted its territory/home range).

SAR-Hidden Valley — North (Sampled)

Sixty-six territories were detected in 2024, a 20% increase from 55 territories detected in 2023. Thirty-four males were determined to be paired, though not all territories were monitored sufficiently to determine pairing success. Twenty-six fledglings were incidentally observed. No pairs were well-monitored in 2024 (Table 3B). One cowbird was detected in vireo habitat over the course of the season.

No nest monitoring occurred at Hidden Valley – North in 2024. Nest monitoring was conducted at this site in 2010, 2014, 2016-2018, and 2022 (Appendix D). In years in which nest monitoring was conducted, the average number of fledglings produced per well-monitored pair ranged from 2.0 in 2014 (n=4) to 4.0 in 2017 (n=6; Appendix D). The sample sizes used to calculate these averages are small and may not accurately represent the vireo population at Hidden Valley – North.

Vegetation in the area burned by the 2021 Lake Fire has not yet recovered, as a majority of the canopy layer was destroyed. However, the understory has shown substantial regrowth and contains suitable nesting habitat for vireos. In 2024, vireos recolonized most of the territories that have been vacant since the fire occurred.

SAR-Hidden Valley — South Overall (Monitored)

In 2024, 133 territories were detected at Hidden Valley – South, a 21% increase from 110 territories in 2023, but a 24% decrease from the high of 176 recorded in 2020 (Table 1). One hundred-nine males were determined to be paired, though not all territories were monitored sufficiently to determine pairing success. Thirty-two pairs were well-monitored. Two hundred fledglings were detected across all pairs in 2024, 113 of which fledged from 32 well-monitored pairs, resulting in a reproductive success rate of 3.5 (Table 3B). Reproductive success has ranged from 2.1 in 2010 (n=9; Appendix D) to 5.0 in 2023 (n=9; Appendix C-1-E). Estimated territory size ranged from approximately 0.23 to 2.4 acres. Biologists spent 563 hours monitoring vireo, including associated activities, at Hidden Valley – South in 2024.

Nest monitoring has occurred at Hidden Valley – South every year since 2000 with widely varying numbers of nests monitored. Sixty-eight nests were found in 2024, 62 of which were well-tracked. Apparent nest success was 68% (n=62), lower than 77% in 2023 (n=31; Appendix C-1-E). Predation was the most common cause of nest failure in 2024, accounting for 12 (19%) nest losses. One (2%) nest failed due to reproductive failure, and the cause of the remaining seven (11%) nest failures was unknown. Zero (0%) nests failed due to parasitism (Table 3B). Predation (33%) has been the leading cause of failure every year since 2002 (n=682; Appendix D).

For the second consecutive year, zero nests were parasitized. Parasitism was down from a high of 44% (n=9; Appendix D) in 2007, and from the 2022 rate of 20% (n=82; Appendix C-1-E). A

total of one cowbird was removed from a trap adjacent to the study area. Unfortunately, twelve cowbirds escaped from traps adjacent to the study area: five during a wildfire emergency, five as a result of vandalism of the cowbird trap, and two additional cowbirds which escaped while an assistant was servicing the traps, resulting in a negative number of cowbirds removed from the study area (-11; Table 3B). No cowbirds were detected in the habitat over the course of the season.

Mulefat (25%), narrowleaf willow (16%), and arroyo willow (13%) were most frequently used for nest placement in 2024. Six nests (9%) were placed in invasive substrates: five were built in poison hemlock and one in arundo. The remaining nests were placed in various native substrates (n=68; Table 4).

Nine homeless camps and 18 human-related safety hazards were documented during fieldwork at Hidden Valley – South in 2024. Many additional encampments are established on the north side of the river directly across from this site. Portions of Hidden Valley – South are used for recreational swimming. The shore of the Santa Ana River in these areas often has abundant litter and human waste strewn about. The site has been used frequently by equestrians and hikers since SAWA began monitoring in 2000, which could plausibly disturb vireo breeding behavior, but the potential effect recreation has on vireos is not well studied.

SAR-Hidden Valley — South Restoration

In 2024, 22 territories were detected at Hidden Valley – South Restoration, the same as in 2023 (Table 3B; Zembal et al., 2023). Seventeen males were determined to be paired, seven of which were well-monitored. Thirty-seven fledglings were detected across all pairs in 2024, 26 of which fledged from the seven well-monitored pairs, resulting in a reproductive success rate of 3.7. Sixteen nests were found, 15 of which were well-tracked. Apparent nest success was 53% (n=15). Predation was the most common cause of nest failure in 2024, accounting for six (40%; n=15) nest losses. One (7%) nest failed for unknown reasons. As in 2023, the parasitism rate was 0% (n=14; Table 3B), a marked decrease from the 2022 rate of 36% (n=22; Zembal et al., 2022). No cowbirds were detected in the habitat over the course of the season. Additional information specific to Hidden Valley – South Restoration can be found in Table 3B.

SAR-Hidden Valley — South Non-Restoration

In 2024, 111 territories were detected at Hidden Valley – South Non-Restoration, a 26% increase from 88 in 2023, though an overall decrease of 23% from the high of 145 observed in 2020 (Table 3B; Zembal et al., 2020). Ninety-two males were determined to be paired, 25 of which were well-monitored. One hundred sixty-three fledglings were detected across all pairs in 2024, 87 of which fledged from the 25 well-monitored pairs, resulting in a reproductive success rate of 3.5. Fifty-two nests were found, 47 of which were well-tracked. Apparent nest success was 72% (n=47).

Predation and failure due to unknown reasons were the most common causes of nest failure in 2024, each accounting for six (13%; n=47) nest losses. One nest (2%) failed due to reproductive failure. As in 2023, the parasitism rate was 0% (n=43) in 2024, down from a high of 25% (n=63) in 2021 (Zembal et al., 2021). No cowbirds were detected in the habitat over the course of the season. Additional information specific to Hidden Valley – South Non-Restoration can be found in Table 3B.

A portion of Hidden Valley – South Non-Restoration burned in the Mann Fire during the winter of 2019-2020. Vireos were not detected in historically occupied areas within the burn area in 2020 and 2021, but one territory was detected in the Mann Fire footprint in 2022 and 2023. In 2024, four territories were detected in the Mann Fire footprint. Vireos have also recolonized the area burned by the July 2022 Marlatt Fire.

In 2024, two fires occurred in Hidden Valley – South Non-Restoration. The first was the Limonite Fire, which started on May 31, 2024 and burned approximately 18 acres of habitat, affecting five vireo territories. Four territories were completely burned, but all vireos were subsequently detected in adjacent habitat. One known active nest was present in the burned area; this nest survived and was successful, fledging two young. The second fire was the Beach Fire, which burned approximately 34 acres from August 22-23, 2024. Most of the vegetation consumed by the Beach Fire burned completely to the ground, with few stumps remaining. Though a majority of the habitat burned by the Beach Fire was covered in dense non-natives (mustard and/or poison hemlock) prior to the fire, vireos from five territories were frequently detected foraging in the area. Three of these territories had nests adjacent to or within the burned acreage; however, this fire was less problematic than the Limonite Fire, as vireos were no longer nesting when the fire occurred. Vireos were detected in or near all five of the affected territories during a post-fire survey.

In 2024, substantial disturbance to native vegetation was documented in five vireo territories; three of these territories were affected by paths cleared to homeless encampments. One active vireo nest was located three meters from one of the cleared paths and another was directly above a path; nest searching in the third territory was aborted due to safety issues. Both nests were successful. In the fourth territory affected by unauthorized vegetation removal, most of the native vegetation was removed along the river's edge; a monitored vireo pair was suspected to have been building a second nest in the area, but remnants were not found. In this case, picnic trash and alcohol bottles left in the cleared area implicated recreational beachgoers. The fifth territory affected by unauthorized vegetation removal had vegetation cleared, food waste, and human excrement left near an active nest in an area frequented by beachgoers that also had an active encampment directly across the river; though the nest was ultimately successful, only one of three eggs hatched to produce one young. All safety issues and habitat disturbances were reported to Riverside County Regional Park and Open-Space District.

SAR-Goose Creek, Norco to I-15 (Monitored)

In 2024, 73 vireo territories were documented in Goose Creek, a 7% increase from the 68 territories documented in 2023, though still a 17% decrease from the high of 88 recorded in 2020 (Table 1). Twenty-nine males were determined to be paired, though not all territories were monitored sufficiently to determine pairing success. Thirty-eight fledglings were documented (Appendix C-1-F).

Nest success for 13 well-tracked nests in 2024 was 46%, a slight decrease from 47% in 2023 (n=15), and 16% lower than the overall nesting success from 2001 to 2024 of 62% (n=521; Appendix C-1-F). In 2024, six (46%) nests were lost to predation and one (8%) failed due to reproductive failure (n=13; Table 3). Like 2023, none of the well-tracked nests were parasitized, a welcome decrease from the 2021 rate of 21%, which was the highest recorded parasitism rate since 2006 (n=29; Appendix D). Five well-monitored pairs had a reproductive success rate of 2.6 in 2024, slightly lower than the site average of 3.0 from 2001 to 2024 (Appendix C-1-F), and lower than the 2024 watershed-wide rate of 3.3 (Appendix B-1).

In 2020, USGS banded four territorial males as part of a genetic study. From 2020 to 2023, only one of these males was observed; this male remained throughout the season and nested in the same (greatly expanded) territory as in previous years. However, none of the banded males were resighted in 2024.

In 2024, nests were primarily placed in poison hemlock (31%), arroyo willow (23%), and narrowleaf willow (15%). Four nests (31%) were placed in non-native substrates: all were found in poison hemlock (n=13; Table 4), and none successfully fledged any young. Since 2001, the majority of nests in Goose Creek have been placed in arroyo willow (28%) and mulefat (26%). Less frequently, nests have been placed in Goodding's black willow (10%) and Fremont cottonwood (7%). Less than 4% of all nests have been placed in non-native substrates since monitoring began (n=589; Appendix C-2-F).

Cowbird trapping has occurred at this site since 2004 and a total of 605 cowbirds have been removed over 3,406 trap days (Appendix C-1-F). In 2024, three cowbirds were removed from one trap located at the Goose Creek Golf Club over 73 trap days (Table 3). No cowbirds were detected in vireo habitat over the course of the season. Parasitism was not documented at this site from 2022-2024, though parasitism was recorded in 2021 (21%; n=29) and 2020 (3%; n=30). From 2001 to 2024, the parasitism rate is 5% at this site (n=497; Appendix C-1-F).

Norco Bluffs, I-15 to River Rd. (Monitored) [1]

In 2024, a total of 132 vireo territories were detected in Norco Bluffs, a 2% increase from the 130 documented in 2023, and similar to the high of 133 recorded in 2020 (Table 1). Sixty-two males were known to be paired, though not all territories were monitored sufficiently to determine pairing success; 139 fledglings were documented (Table 1).

A total of 53 nests were found, 51 of which were well-tracked. Nesting success of well-tracked nests was 67% (n=51), a decrease from 76% (n=50) in 2023 and lower than the site average since 2015 of 74% (n=305; Appendix C-1-G). Overall, nest success at Norco Bluffs is much higher than the average across all monitored sites across all years of 58% (n=4,989; Appendix B-1). The reproductive success rate of well-monitored pairs decreased from 5.2 in 2023 to 4.2, still above the site average of 3.9 (Appendix C-1-G). Of the well-tracked nests, 27% were lost due to predation, 4% failed due to unknown causes and 2% were lost due to reproductive failure (n=51; Table 3). Across all monitoring years, predation rates (21%) at Norco Bluffs (n=305; Appendix C-1-G) are much lower than the average of 33% from all monitored sites (n=4,989; Appendix B-1).

SAWA did not conduct any cowbird trapping in Norco Bluffs in 2024. No cowbirds were detected in vireo habitat over the course of the season. Parasitism was not observed in 2024 and has not been documented since regular monitoring began in 2015 (Appendix D). Biologists spent a total of 340 hours monitoring vireo, including associated activities, at Norco Bluffs in 2024.

Nests were primarily placed in arroyo willow (19%), mulefat (17%), and pacific willow (17%) in 2024 (n=53). Three nests (2%) were placed in non-native substrates: one in black mustard, another in poison hemlock, and the other in tree tobacco. The nest in black mustard fledged two young and was the only successful nest placed in non-native substrate. Across all monitoring years, nests at Norco Bluffs have been predominantly placed in arroyo willow (30%), mulefat (22%), and Goodding's black willow (12%; n= 318; Appendix C-2-G.).

Temescal Canyon (Sampled)

One hundred sixty-three territorial male vireos were detected in 2024, surpassing the previous highest count of 147 in 2020 , and a 13% increase from the 144 detected in 2023 (Table 1). The highest number of observed territories observed in Temescal Canyon prior to 2020 was 131 in 2013 (Appendix D), though the 2013 sampling effort included surveying of the Dos Lagos Golf Course. SAWA biologists have been prohibited from accessing the Dos Lagos Golf Course for vireo surveys since 2017; this may affect observed territory numbers (Appendix D). Seventeen pairs and

[1] Prior to 2019 vireos were monitored in select areas within Norco Bluffs and excluded a 250-acre parcel monitored the previous two seasons; vireos within the parcel were surveyed using a different methodology by a USACE consultant. 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: 2015/2018, 2016/2017, and 2019-2024.

11 fledglings were detected in 2024; no pairs were well-monitored (Table 1). Three nests were incidentally observed in 2024.

Four cowbird traps were open during the 2024 breeding season in Temescal Canyon (Table 6). Three traps were located adjacent to riparian habitat and the fourth at a small dairy near Lake Elsinore where the highest parasitism rates typically occur. The four traps caught a total of 183 cowbirds over 278 trap days. Cowbird trapping has occurred during the nesting season in Temescal Canyon since 2001 and a total of 5,532 cowbirds have been removed during this time (Appendix D). Even with on-site cowbird trapping, parasitism has been documented in Temescal Canyon in 10 out of the 13 years in which the site was monitored, reaching a peak rate of 42% in 2007 (n=12; Appendix D). Eight cowbirds were detected in or near the habitat in 2024.

Santa Ana Canyon (SAC)

The following results are compiled from three sites in the Santa Ana Canyon (Upper Canyon, Green River Golf Club, and Featherly Regional Park), collectively known as SAC. One hundred eighty-six vireo territories were detected in SAC in 2024, a 13% increase from the 165 detected in 2023, and just above the high of 185 recorded in 2020 (Table 1). One hundred-twelve males were determined to be paired, though not all territories were monitored sufficiently to determine pairing success. Two hundred thirty-four fledglings were documented in SAC in 2024. A total of 2,467 fledglings have been documented in SAC over the last 24 years; of these, 1,283 fledged from 503 well-tracked pairs. The reproductive success rate for 46 well-monitored pairs in SAC in 2024 was 3.3, a decrease from 3.7 (n=29) in 2023, but higher than the average rate of 2.6 from 2001-2024 (n=503); Appendix C-1-K). For comparison, the watershed-wide rate of reproductive success for well-monitored pairs in 2024 was 3.3 (n=145) and 2.9 (n=2,649) from 2001-2024 (Appendix B-1). Vireo territory size in SAC is estimated to be between 0.3 acres and 2.2 acres.

One hundred-eleven nests were found in 2024, 94 of which were well-tracked. Apparent nest success was 61% (n=94), the same as 2023 (n=99). Nest losses in 2024 were primarily due to predation, accounting for 30% (n=94) of total nest outcomes. Seven (7%) nests were unsuccessful for unknown reasons and two (2%) were unsuccessful due to reproductive failure (n=94; Appendix C-1-K). Vireo used a variety of plant species for nest substrates in 2024; mulefat (37%), laurel sumac (*Malosma laurina*; 10%) blue elderberry (9%), thick-leafed yerba santa (*Eriodictyon crassifolium*, 5%), and Fremont cottonwood (5%) were the most common native species used for nest placement. Fourteen (13%) nests were placed in non-native substrates including black mustard (*Brassica nigra*; 4%), orange tree (*Citrus sinensis*; 4%), arundo (1%), and poison hemlock (1%). The remaining nests were placed in various native substrates (n=111; Appendix C-2-K).

SAWA began cowbird trapping in SAC in 2001 when parasitism was documented in five (26%) of 19 nests. Parasitism was again documented in one (5%) of 21 nests in 2009 after four years of no

occurrence (Appendix D). SAWA deployed two traps within a mile of that location and no parasitism had been recorded until 2020, when a productive trap was inaccessible due to the BNSF bridge project and five nests were subsequently parasitized in Green River Golf Club (Appendix C-1-I). In 2021, four nests were parasitized in Featherly Park (Appendix C-1-J). SAWA deployed one trap near the habitat mid-season. No parasitism was detected after the trap was deployed. In 2023 and 2024, no nests were found to have been parasitized. Two cowbirds were detected in vireo habitat over the course of the season: one at Green River Golf Club, and the other at Featherly Regional Park. Since 2001, a total of 2,535 cowbirds have been removed from SAC over 15,865 trap days during the vireo breeding season (Appendix C-1-K).

Upper Canyon (Monitored)

In 2024, 39 territories were detected at Upper Canyon, the same as in 2022 and 2023 (Table 1). Twenty-one males were determined to be paired, though not all territories were monitored sufficiently to determine pairing success. Forty fledglings were detected across all pairs in 2024, 16 of which fledged from five well-monitored pairs, resulting in a 3.2 reproductive success rate (Table 3). Estimated territory size of the vireos in Upper Canyon ranged from 0.3 to 0.9 acres in 2024.

Eleven nests were found in 2024, nine of which were well-tracked. In 2024, apparent nest success was 78% (n=9), an increase from 44% success in 2023 (n=9). Reproductive failure was the cause of one (11%) nest failure and the second (11%) failed due to unknown reasons. Overall success of well-tracked nests from 2001 to 2024 is 63% (n=177), with a reproductive success rate of 2.8 (n=108). A total of 625 fledglings have been documented over the last 24 years (Appendix C-1-H). Mulefat (73%) was most frequently used for nest placement in 2024. Other hosts included blue elderberry (9%), Goodding's black willow (9%), and coast live oak (*Quercus agrifolia*; 9%). All nests found in 2024 were placed in native substrates. Historically, mulefat (43%) has been the most common substrate used for nest placement at this site, followed by blue elderberry (17%), Goodding's black willow (7%), and Fremont cottonwood (6%, n=237; Appendix C-2-H).

No nests were parasitized in 2024. Parasitism has only been documented in two of the 24 years of monitoring in Upper Canyon and has not been documented since 2003 when 18% (n=17) of well-tracked nests were parasitized (Appendix D). Cowbird trapping has occurred in Upper Canyon since 2001 when the first vireo was detected at the site. To date, 854 cowbirds have been removed from this area (Appendix C-1-H). No cowbirds were detected in the habitat in 2024. A total of 90 biologist hours were spent monitoring vireos, including associated activities, at Upper Canyon in 2024.

Green River Golf Club (Monitored)

In 2024, 67 territories were documented at Green River Golf Club, a 22% increase from 55 territories in 2023 and surpassing the previous high of 61 by 10% in 2020 (Table 1). In October 2020, the Blue Ridge Fire burned vireo habitat in the northern parts of the golf course near the railroad tracks and border of Chino Hills State Park. In the years following the fire (2021-2023), vireo territories decreased from 61 in 2020 to a low of 47 in 2021. Additionally, habitat that had been impacted around the BNSF bridge project site was still recovering during that time frame. The increase in 2024 suggests that vireo habitat in those areas has recovered enough that vireo are finding it suitable to use again. The overall vireo population at Green River Golf Club has increased since monitoring began in 2001, when only 10 vireo territories were detected (Appendix D).

In 2024, 48 males were known to be paired, though not all territories were monitored sufficiently to determine pairing success. One hundred nineteen fledglings were detected across all pairs, 88 of which fledged from 25 well-monitored pairs, resulting in a 3.5 reproductive success rate, a decrease from 3.9 in 2023 (n=16; Appendix C-1-I). In comparison, the highest reproductive success rate was 4.4 in 2017 (n=7; Appendix D). The overall reproductive success rate of well-monitored pairs from 2001-2024 is 2.7 (n=210). A total of 990 fledglings have been documented over the last 24 years (Appendix C-1-I).

In 2024, the estimated territory size of the vireos at Green River Golf Club ranged between 0.3 to 1.7 acres. In 2020, five territorial males and a paired female were banded as part of a USGS genetic study. None of these individuals were resighted in 2024.

Fifty-six nests were discovered in 2024, 49 of which were well-tracked. Nesting success was 67%, a decrease from 74% (n=50) in 2023. Fourteen (29%) well-tracked nests failed due to predation, one (2%) failed for unknown reasons, and one (2%) failed due to reproductive failure. Overall nest success from 2001 to 2024 is 61% (n=381; Appendix C-1-I). Nests were most frequently placed in mulefat (39%), laurel sumac (18%), blue elderberry (14%), and arroyo willow (9%; Table 4).

Cowbird trapping has occurred at Green River Golf Club since 2001, and a total of 1,140 cowbirds have been removed during this time (Appendix C-1-I). When SAWA began monitoring this site in 2001, the parasitism rate was 44% (n=9; Appendix D). Between 2002 and 2019, no parasitism was observed. Cowbird trapping did not occur in 2020 due to access limitation from the BNSF construction, and five (17%) well-tracked nests were parasitized (n=29). All five parasitized nests were manipulated; however, only two of these nests were successful. Trapping resumed in 2021, with two cowbird traps deployed at the site, and a total of six cowbirds were removed. In 2024, thirty-three cowbirds were removed, and no nests were found to be parasitized (Appendix C-1-I). One cowbird was detected in vireo habitat over the course of the season. A total of 273 biologist hours were spent monitoring vireos at Green River Golf Club in 2024.

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 vireos and other sensitive species, and enhance habitat.

Featherly Regional Park (Monitored)

In 2024, 80 territorial males were detected in Featherly Regional Park, a 13% increase from 2023 (n=71) and just surpassing the previous high of 79 in 2020. Forty-three territories were known to be paired, though not all territories were monitored sufficiently to determine pairing success. Seventy-five fledglings were detected across all pairs, 49 of which fledged from 16 well-monitored pairs, resulting in a reproductive success rate of 3.1. A total of 852 fledglings have been observed over the last 24 years at this site (Appendix C-1-J). The overall reproductive success rate of well-monitored pairs over 24 years of monitoring is 2.3 (n=185; Appendix C-1-J), compared to the watershed wide rate of 2.9 (n=2,649; Appendix B-1). These numbers continue to emphasize the vireo population recovery at this site over the last 24 years given that no vireos were detected in 2001, the first year of monitoring. The population's first major increase at this site came in 2004 when it quadrupled from six in 2003 to 24 the following year (Appendix D). However, reproductive success has greatly fluctuated at this site from a high of 5.6 (n=8) in 2019 to a low of 0.0 in 2002 (n=3) and 2012 (n=4; Appendix D). The 8% decrease of territorial males at this site from 2016 (n=64) to 2017 (n=59) was likely due to habitat loss during USACE construction; however, territories increased until 2020 (n=79), then subsequently decreased in 2021 (n=64) and have since steadily increased to 80 territories in 2024 (Appendix D).

In 2024, estimated territory size of the vireos in Featherly Regional Park ranged between 0.4 and 2.2 acres. None of the four territorial males banded in 2020 as part of a USGS genetic study were resighted in 2024.

Nesting success for 36 well-tracked nests in 2024 was 47%, slightly above the overall nesting success of 45% (n=376) from 2002 to 2024. Fourteen (39%) well-tracked nests were lost to predation and five (14%) failed for unknown reasons (n=36; Appendix C-1-J). No parasitism was documented in 2024.

Of the 44 nests found in 2024, eleven (25%) were placed in mulefat and six (14%) in thick-leaved yerba santa. Nine (20%) nests were placed in non-native vegetation; four in orange tree, three in black mustard and one each in arundo and castor bean. Nests were placed in 17 different plant species, seven of which are not considered riparian plants (Table 4).

Cowbird trapping has occurred in Featherly Regional Park since 2002 when the first vireos were detected on-site, and 541 cowbirds have been removed during this time. While no parasitism was documented in 2024, parasitism has been documented in four out of the 24 years monitored, reaching its highest rate (67%) in 2002 (n=3; Appendix D). Parasitism had not been documented at

this site since 2009 when 9% of nests were parasitized (n=11; Appendix D) and then again until 2021, when four (21%) of 19 well-tracked nests were found to be parasitized; however, no nests failed due to parasitism in 2021 after cowbird eggs were removed. One female cowbird was observed as a flyover in 2024. A total of 331 biologist hours were spent monitoring vireos at Featherly Regional Park in 2024.

The California Scrub-jay, a well-known avian nest-predator, occurs in large numbers throughout Featherly Regional Park. One such predation was observed when a scrub-jay pair 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. In 2020, one nest was found containing three nestlings covered in Argentine ants while the adults were frantically trying to defend the nestlings. Other indications of ant predation in prior years include: in 2015, a nest found with ants entering a pip hole in the eggs on hatch day (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 and 2018, ants were observed preying on vireo nestlings and hatch-day eggs; in 2021, ants were found to have consumed all but a few nestling bone fragments; in 2022, nestlings were consumed by ants at about 4-5 days and unhatched eggs were consumed by ants in a different nest that had recently fledged two young. In 2024, ants were observed consuming vireo nestling skeletons at one nest.

Sampled Sites

Thirty-seven sites were sampled in 2024, and 798 vireo territories were documented. Vireos were not detected at three of the 37 sampled sites (Table 1). In 2024, 24 (75%) out of a subset of 32 sites classified as “sampled sites” both in 2023 and 2024 reported an increase in detected vireo territories compared to 2023, while two (6%) sites reported a decrease. Six (19%) of the sampled sites reported the same number of territories in 2023 and 2024; of those, two (6%) sites had zero territories detected. Two hundred forty-five pairs and 183 fledglings were also documented at the 37 sites (Table 1). SAWA biologists spent approximately 764 hours surveying vireos at all sampled sites in the watershed in 2024.

Incidental Sites

In 2024, seventeen additional vireo territories were documented at ten sites in which no formal surveys were conducted. Five of the males were determined to be paired and a total of five fledglings were incidentally detected (Table 1). Location names and GPS coordinates of incidental vireo detections can be found in Appendix A.

SIGHTINGS OF INTEREST – INCIDENTAL SPECIES OBSERVATIONS

All incidental species sightings were documented at monitored sites and only sensitive species were documented at sampled and incidental sites during vireo monitoring. One hundred forty-five avian, 25 mammalian, 19 herpetofauna, and four fish species were observed at monitored, sampled, and incidental sites. Twenty-four exotic species (12 avian, six mammalian, two herpetofauna, and four fish) were detected. Sensitive species were documented by site and a combined total of 39 sensitive species (30 avian, four mammalian, and five herpetofauna) were detected (Table 5). Sensitive species are defined as those listed as endangered, threatened, or a species of concern by resource agencies as well as those covered by the Western Riverside County Multiple Species Habitat Conservation Plan (MSHCP). Observations are verified detections and are considered presence at each location; this should not be considered a complete species list for each site. For example, California Gnatcatchers (*Polioptila californica*) were detected at 22 sites adjacent to vireo habitat; however, other California Gnatcatchers likely occur in adjacent areas of other sites where biologists do not frequent, thus many may go undetected. 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 were discovered on site from 1996-2013. The highest number of detections in Prado Basin occurred in 2003, when nine territories were documented; however, the SWFL population in the basin has suffered a continued decline since then. No SWFL territories were found in Prado Basin from 2017-2023 (Pike, 2023).

In 2024, SAWA biologists detected five individual migrant Willow Flycatchers within the watershed. Willow Flycatchers are deemed migrants if they fail to remain on-site through June; none of the five flycatchers detected by SAWA biologists remained through June. The first adult was detected at Hidden Valley — South Non-Restoration on May 15. On May 17, two individuals were detected, one at Hidden Valley — South Non-Restoration and the other at Hidden Valley — South Restoration. On June 4, two individuals were detected at Green River Golf Club in Santa Ana Canyon.

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 to USGS Riparian Birds Working Group and to the California Natural Diversity Database.

BROWN-HEADED COWBIRD TRAPPING RESULTS

Brown-headed Cowbird Trapping, April-July 2024

Forty-two cowbird traps were deployed during the 2024 vireo season and 1,572 cowbirds were removed from all sites over 3,162 trap days. Six of the 42 traps were deployed at local dairies. The sex and ages of the cowbirds removed were 989 adult males, 492 adult females, and 91 juveniles. SAWA biologists and field assistants spent 2,547 hours servicing traps during the vireo season, including installation and removal of traps from the field (Table 6). Cowbird captures increased by 11% from 2023 (n=1,420), despite a decrease of 9% in number of trap days (n=3,476). Thirteen percent more males (n=875), 15% more females (n=428), and 22% fewer juveniles (n=117) were trapped during the 2024 breeding season compared to 2023 (Appendix B-3). In 2024, the overall capture rate was 0.50 cowbirds per trap day (Table 6), an increase from 0.41 in 2023 (Zembal et al, 2023). Since cowbird management began in 2001, SAWA has removed nearly 56,000 cowbirds from the watershed during the breeding season (Appendix B-3).

Non-target Captures in Cowbird Traps, April-July 2024

Twenty-two non-target native species, one non-nuisance exotic species, and one unidentified species were captured in 42 traps in 2024. There were 1,450 non-target trapping occurrences (1,448 native and two non-nuisance exotic); exotic nuisance species are excluded from these totals. It should be noted that many of these trapping occurrences are likely the same individuals returning to the same traps. In order of most frequently captured, the most common species were California Towhee (*Melozone crissalis*), Red-winged Blackbird (*Agelaius phoeniceu*s), and Yellow-headed Blackbird (*Xanthocephalus xanthocephalus*). The percentage of trapping occurrences that resulted in mortality was 1.79% in 2024 (Table 7). Numbers of the two nuisance exotic species (European Starlings and House Sparrows) released and removed are also listed in Table 7.

Fall/Winter 2023-2024 Brown-headed Cowbird Trapping and Non-target Captures

Eight cowbird traps were deployed during the non-breeding season (fall/winter) of 2023-2024. One dairy in the Prado Basin had two traps, three dairies near the San Jacinto River each had one trap, and one dairy in Lake Elsinore had one trap. Two additional traps were deployed in the vicinity of Prado Basin for part of the winter season.

A total of 8,006 cowbirds were removed (2,435 adult males, 2,607 adult females, and 2,964 juveniles) over 776 trap days for a capture rate of 10.32 cowbirds per trap day. This represents a decrease from the capture rate of 13.11 cowbirds per trap day recorded in fall/winter 2022-2023, when 9,504 cowbirds were removed from eight dairy traps over 725 trap days (Table 8; Zembal et al., 2023). SAWA biologists and field assistants spent 742 hours servicing traps during the fall/winter of 2023-2024, including installation and removal of traps from the field. Nearly 118,000 cowbirds have been removed from the watershed by SAWA during the fall/winter since cowbird management began (Appendix B-3).

Nine non-target native species, consisting of 384 individual trapping occurrences, were captured in the eight traps in fall/winter 2023-2024. The most common species captured was the Red-winged Blackbird (n=310). Six Red-winged Blackbirds perished in traps in fall/winter 2023-2024, resulting in a mortality rate of 1.56 percent. No mortality occurred for other non-target species. Numbers of European Starlings and House Sparrows removed and 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 SAWA's monitoring outside of Prado Basin began in 2000. In 2024, 2,359 vireo territories were documented watershed-wide (includes preliminary data from Prado Basin), a 12% increase from 2023 (n=2,112; Table 1; Figure 6), and a record number since monitoring began. The significant population increase over 24 seasons of monitoring at four sites is illustrated in Figure 7. The 1,586 vireos detected by SAWA biologists outside of Prado Basin in 2024 represent a 14% increase in territories from 2023 (n=1,394). Survey efforts were similar at most sites with the exception of: Tin Mine Road, which was not accessible in 2024; Lake Perris, which was surveyed in 2024, but not in 2023; Meridian Conservation Area, which was sampled instead of monitored in 2024; and Irvine Lake, which was a sampled instead of incidental site as in previous years. The following watershed-wide discussion excludes Prado Basin.

Nesting success watershed-wide was 62% (n=298) in 2024, higher than the overall nesting success of 58% (n=4,989) in the last 24 years and similar to the rate of 63% in 2023 (n=284; Appendix B-1); both years had well above average rainfall (NOAA, 2023; NOAA, 2024). The overall reproductive success rate (average number of fledglings produced by well-monitored pairs) was 3.3 (n=145), lower than last year's rate of 4.3 (n=106), but higher than the 24-year average of 2.9 (n=2,649). The previous highest rate documented was 3.8 in 2019 (n=151; Zembal et al., 2023). Southern California received well above average precipitation during the winters of 2018-2019, 2022-2023, and 2023-2024 (NOAA, 2019; NOAA, 2023; NOAA 2024), which may have resulted in increased resource availability for nesting vireos and potentially contributed to higher reproductive success rates in all three years. Studies have shown that reproductive success increases and predation decreases during wet years as compared to drought years in Rufous-crowned Sparrows (Morrison and Bolger, 2002), Song Sparrows (Chase et al., 2005), and Black-capped Vireos (Colon et al., 2017). Predation remains the primary cause of nest failure, with an overall 28% (n=298) of nests lost due to predation in 2024, similar to 2023 (29%; n=284), and less than the 33% (n=4,989) watershed-wide spanning all years of monitoring (Appendix B-1). For the first time since monitoring began in 2000 (Appendix D), no parasitism of well-tracked nests was documented in 2023 (n=249) or in 2024 (n=261; Appendix B-1), which can largely be attributed to SAWA's cowbird control program. Prior to the 2023 nesting season, we reevaluated trap locations and moved some traps to key locations that had been parasitized heavily from 2020-2022 (Appendix C-1). These trap locations remained in 2024. The watershed-wide parasitism rate has ranged from 0% to 11% in the last five years (Appendix B-1). 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 8 shows the increase in vireo territories in relation to the rate of cowbird parasitism in the Santa Ana Watershed from 2001-2024. A comparison of watershed-wide nesting success, predation,

and parasitism rates from 2003-2024 are shown in Figure 9. Nest losses due to reproductive failure and other unknown factors in 2024 were 3% and 7%, respectively (n=298; Appendix B-1). Examples of nest loss due to reproductive failure are failure of the vegetation to support the nest and non-parasitized egg abandonment.

The two primary causes of vireo decline cited as the reasons for its endangered status, parasitism by the Brown-headed Cowbird and the loss of riparian habitat (USFWS, 1998), are being successfully managed at most sites by SAWA through cowbird trapping and habitat restoration. SAWA biologists have removed over 173,000 cowbirds from the watershed in the last 24 years (Figure 10). SAWA has also removed over 6,900 acres of invasive arundo from the watershed, allowing for almost as many acres of riparian habitat recovery.

Finally, the lack of documented nesting Willow Flycatchers in the watershed in 2024 is not surprising given the dwindling numbers over the last decade. No breeding activity from this subspecies has been documented in the watershed below Seven Oaks Dam since 2014. Southwestern Willow Flycatcher territories have been reported in riparian habitat located in the higher elevations of the watershed (around and above Seven Oaks Dam) in the past and should be surveyed to ascertain the status of this imperiled subspecies in the mountains.

MANAGEMENT RECOMMENDATIONS

Parasitism by Brown-headed Cowbirds continues to occur episodically throughout the watershed and was particularly pervasive at Hidden Valley – South in 2020 through 2022 (≥20%; Appendix C-1-E). However, after reassessing trap locations in the area and subsequently moving some traps to more productive locations, we did not document any parasitism of well-tracked nests at Hidden Valley – South or anywhere else in the watershed in either 2023 or 2024. SAWA's well-designed trapping program has been successful in reducing parasitism and reinforces the importance of cowbird trapping in areas where parasitism rates are higher than what a population can sustain. Vireo monitoring and cowbird trapping should continue along with the removal of non-native vegetation to further aid in the recovery of this endangered species. The removal of arundo and other invasive vegetation, in conjunction with cowbird control and vireo management, has had a positive impact on vireo territory numbers in the watershed since 2000. With the removal of approximately 6,917 acres of arundo and other invasive plants to date, SAWA continues to have 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 opportunity much like cowbird trapping.

In recent years, large homeless encampments have become increasingly prevalent throughout the Santa Ana and San Jacinto Rivers. These encampments likely have a 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 newly conserved lands, further protection of lands for wildlife values is recommended. Increased enforcement of current laws that restrict illegal activities in sensitive riparian areas is needed. Local landscapes are scarred with trash, OHV tracks and abandoned vehicles. Such activities are damaging riparian habitat in 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 camping require increased enforcement to protect riparian habitat from degradation. There is also increasing awareness of the need to control highly invasive 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.

FUNDING ACKNOWLEDGEMENTS

SAWA gratefully acknowledges the U.S. Fish and Wildlife Service, U.S. Army Corps of Engineers, and San Bernardino Valley Municipal Water District, who provided the majority of funding for vireo monitoring and cowbird management. Our thanks to Orange County Water District for providing funding for seasonal cowbird trapping in Anaheim and the fall/winter cowbird trapping at dairies in San Jacinto. An endowment provided by the USACE, held by SAWA, and managed through the Inland Empire Resource Conservation District provided funding for vireo monitoring and cowbird trapping in San Timoteo Canyon. SAWA also thanks the IERCD, who funded vireo monitoring within mitigation areas in the vicinity of the Goose Creek Golf Club in Norco, and the Rivers and Lands Conservancy, who provided funding for cowbird trapping at the Meridian Conservation Area in 2024. Additional cowbird trapping funds are provided through a variety of mitigation generated contracts on an annual basis.

ACKNOWLEDGEMENTS

We earnestly thank our field and cowbird assistants: Henry Armijo, Alicia Barajas Reninger, Jeremy Flores, Reginald Leonen, Oscar Martinez, Danielle Phillipi, Alex Jesus Quezada, Roberto Terrones, and Krystal Truong. We would also like to thank our hard-working restoration technicians: Edgar Alcantar, Aaron Castrejon, Luis Garcia, Anthony Hernandez, Arcenio Hernandez, Faydra Patora, Britton Porterfield, Joshua Savage, field supervisor Oliver Barrett, and Habitat Restoration Services manager James Law. We thank Park Rangers Martha Carmona and Adrian Ortiz of Riverside County Regional Park and Open-Space District for their time and effort helping SAWA biologists safely survey upstream reaches of the Santa Ana River. Additionally, we wish to thank David McMichael (OCWD), Mandy Parkes and Aaron Echols (IERCD), and Jim Pike for their dedication to

natural resources and support of SAWA's biological monitoring and management program.

We would also like to thank the following individuals and agencies for their continued assistance: Christine Medak, Rebecca Christensen, and Karin Cleary-Rose from USFWS. Naeem Siddiqui, Chris Solek, Marissa McGowen, Tiffany Armenta, Jenni Snibbe, and Haley Lovan from USACE. CDFW Environmental Scientists Kim Freeburn-Marquez, Stefan Awender, Eric Chan, and Heather Pert. Heather Dyer, Joanna Gibson, Chris Jones, and Kai Palenscar of SBVMWD. The staff and partners of the Regional Conservation Authority and the MSHCP Biological Monitoring Program. Special thanks go to the staff of Riverside County Regional Park and Open-Space District: Bureau Chief of Parks and Natural Resources Dustin McLain; Natural Resources Managers Robert Williams, Oscar Serrato, and Kalee Koeslag-Schellerup; Natural Resource Manager-MSHCP, Jonathan Reinig; Park Ranger Supervisor Joshua Rivera; and Park Rangers Mitch Moore and Jason Timme. Senior Environmental Scientist (Supervisory) for California State Parks (Inland Empire District) Ken Kietzer. Miguel Valdez of Rubidoux Community Services District. The staff at Hidden Valley Wildlife Area. Jerry Aguirre and Randy Sheppeard of Riverside County Flood Control and Water Conservation District. Mike Sotelo and Karen Carter of San Bernardino County Operations. Steve Parino and the staff of Goose Creek Golf Club. Stacy Bunchek of City of Riverside Parks and Recreation. The staff at Hidden Valley Golf Club. Robert Scott of Griffith Construction. Sonja Trefethen of Sunshine and Daydreams Horseback Riding. Josh Sissler of Riverside County Animal Services. Ron Hinkley of PlasCor Inc. San Jacinto Wildlife Area manager Scott Sewell and the staff at SJWA (CDFW). The staff at Tuls Dairy, Scott Brothers Dairy, Dyt Dairy, and Fisherman's Retreat. Joey Zambrano and the staff at Gage Canal Company. Denis Charbonneau, Nicole Padron, Michael Viramontes and Rebecca O'Connor from the Rivers and Lands Conservancy. Dave Haugen of KB Homes. The Inland Empire Utilities Agency, Euclid Dairy, and Jaime Munoz of Prado Regional Park. Herman DeJong and family at DeJong's Dairy. The 3M Company, Elsinore Valley Municipal Water District, Kraig Williamson of the Temescal Canyon Rockery, and Jeff Pape of Temescal County Water District. Orange County Flood Control. Yorba Regional Park Manager Jamie Montgomery. Brian and Dana Busch and the staff at the Canyon RV Park. Jorge Mendoza and the staff of Green River Golf Club. Brett Hamara of Lennar Homes.

Special thanks go out to the following residents of San Timoteo Canyon for their assistance in cowbird trap placement: Bill Merrill of Buffalo Meadows Ranch and the Harned Family. Special thanks also go out to Heiko Schoenfuss and the staff at Alta Nursery in San Jacinto for their assistance in cowbird trap placement.

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FIGURES AND TABLES

Figure 1. Location of the Santa Ana Watershed. The watershed, delineated in red, covers nearly 3,000 square miles in southern California and includes parts of San Bernardino, Riverside, Orange, and Los Angeles counties.

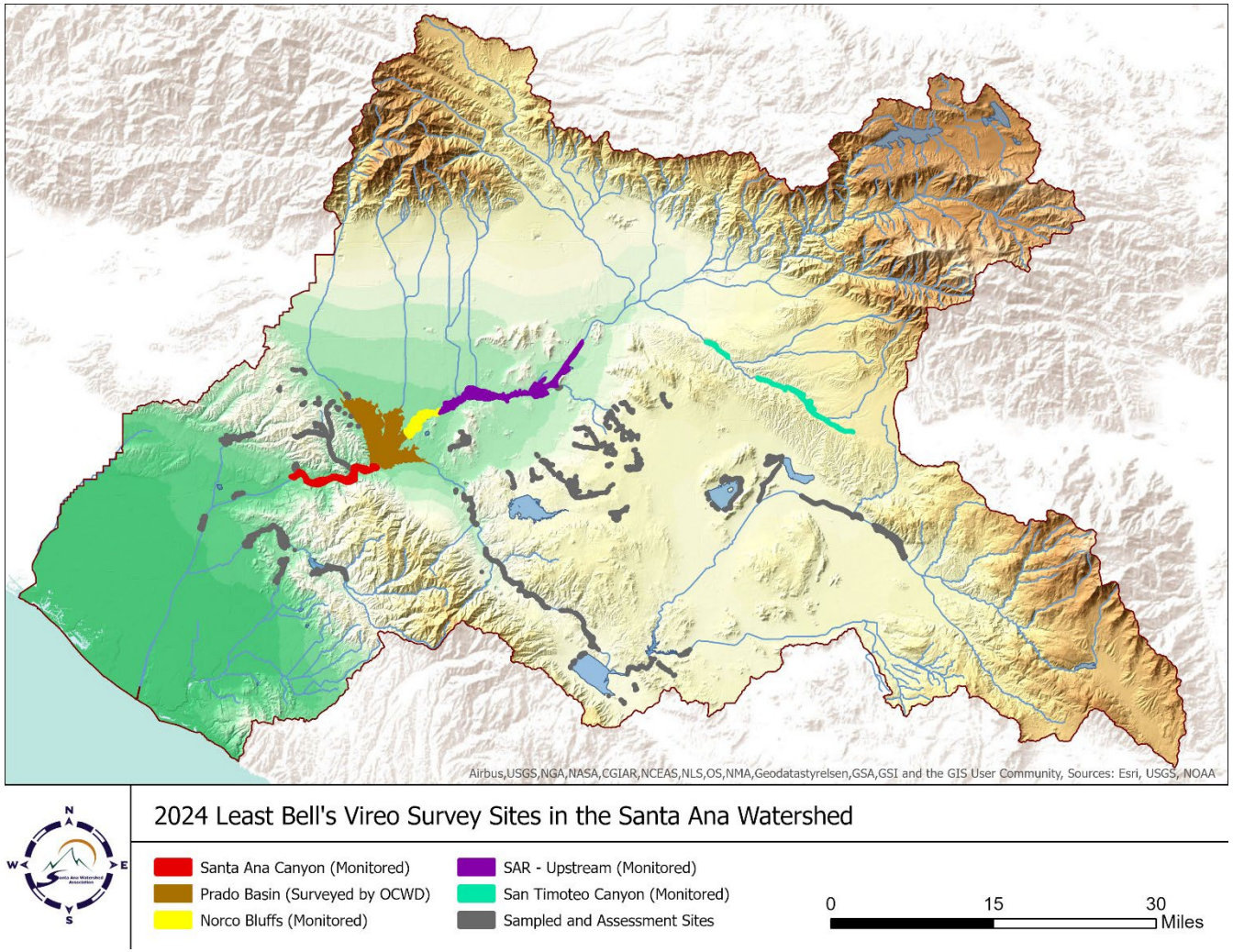

Figure 2. Least Bell's Vireo Survey Sites in the Santa Ana Watershed, 2024. Monitored sites are shown in various colors, while sampled/assessment sites are shown in gray. Refer to Table 1 for a list of sampled/assessment sites and Appendix A for a corresponding list of site coordinates. Monitored sites had well-monitored vireo territories, with eight or more visits and nest monitoring. Sampled/assessment sites were visited three or more times during the breeding season, and no or minimal nest monitoring occurred.

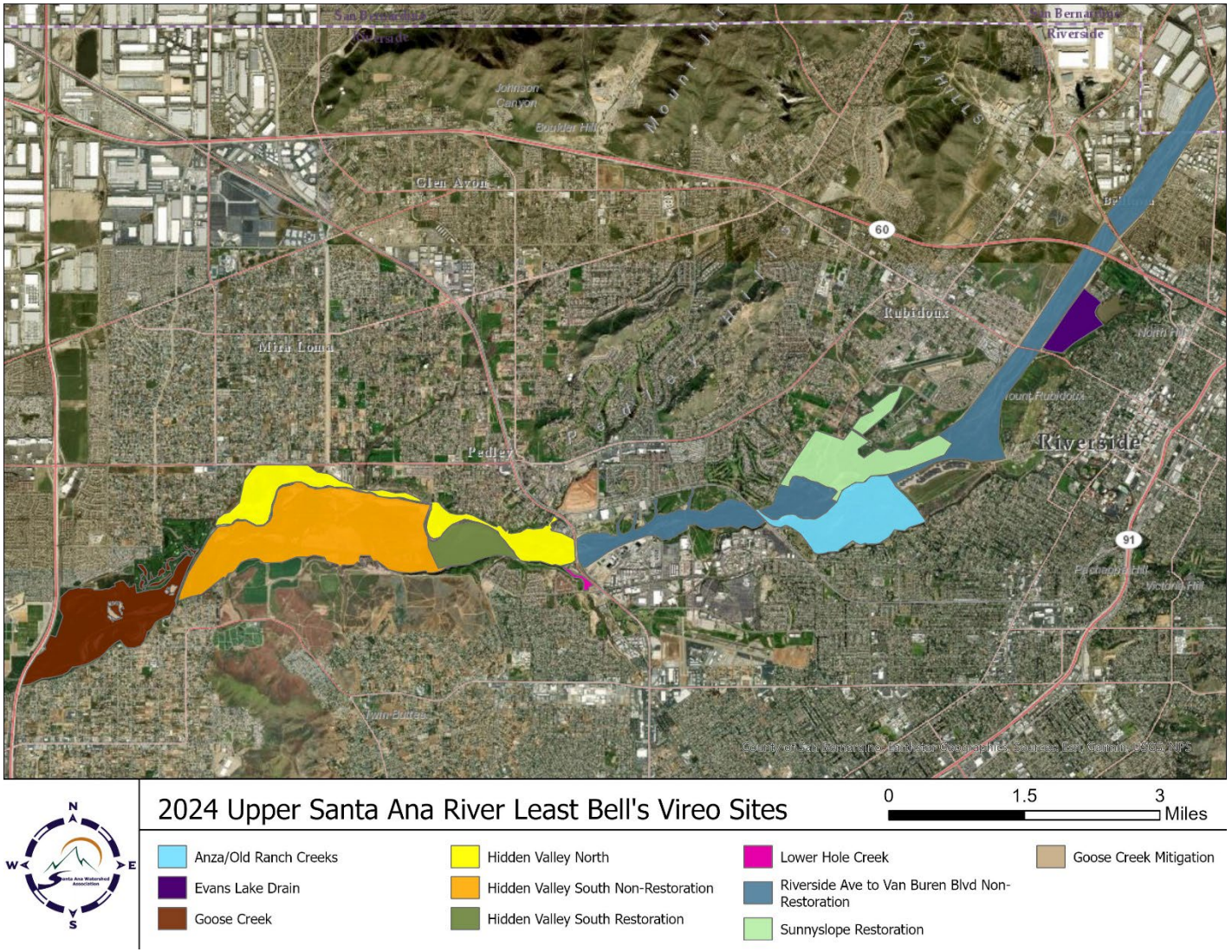

Figure 3. Upper Santa Ana River Least Bell's Vireo Sites, 2024. Goose Creek and Goose Creek Mitigation, Hidden Valley – South Non-restoration and Restoration, and Sunnyslope Restoration were monitored in 2024 (territories well-monitored with eight or more visits and regular nest monitoring). All other sites were sampled (three or more visits with no or minimal nest monitoring).

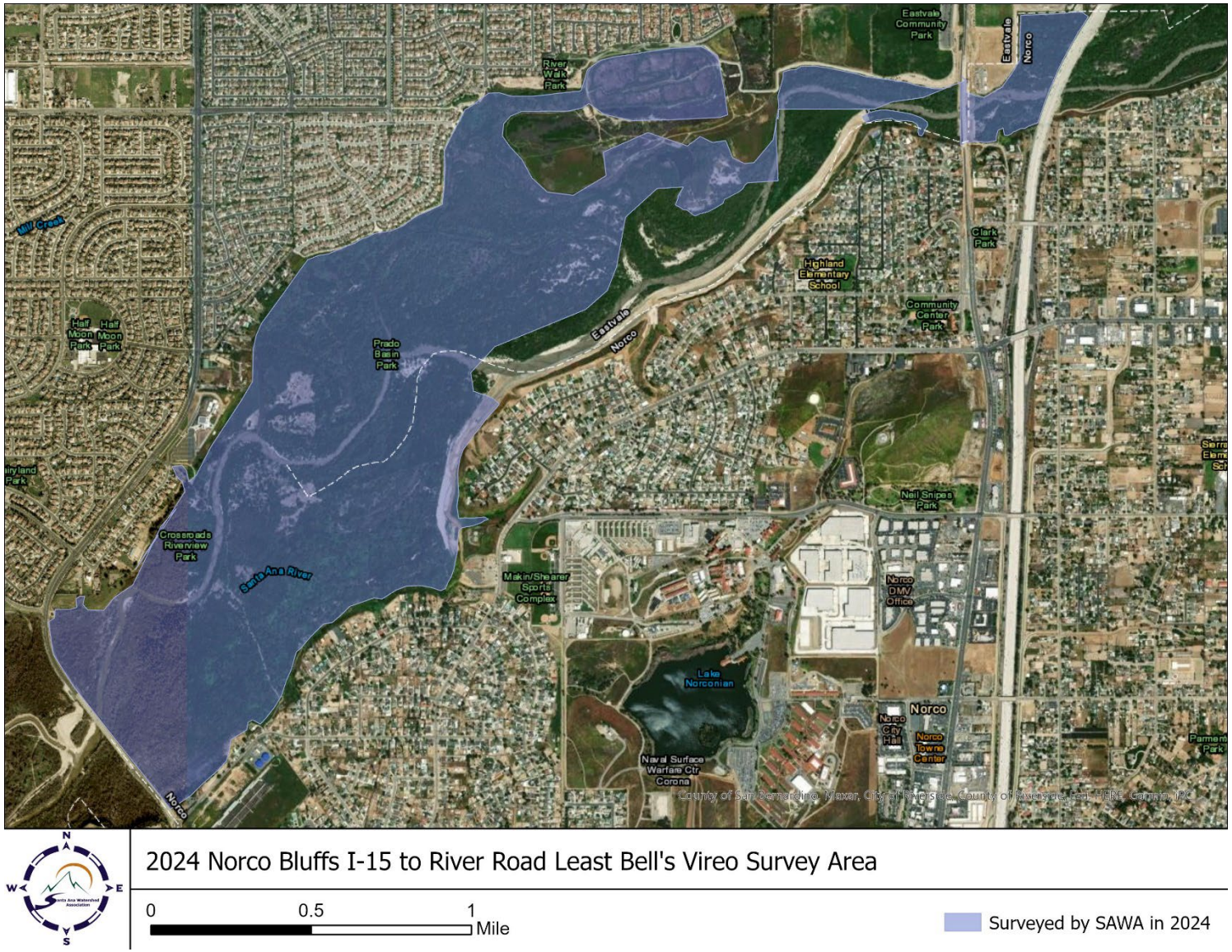

Figure 4. Norco Bluffs Least Bell's Vireo Survey Area, 2024. Norco Bluffs has been a monitored site since 2015 (territories well-monitored, with eight or more visits and regular nest monitoring). The area outside of the shaded polygon was not monitored due to denial of access.

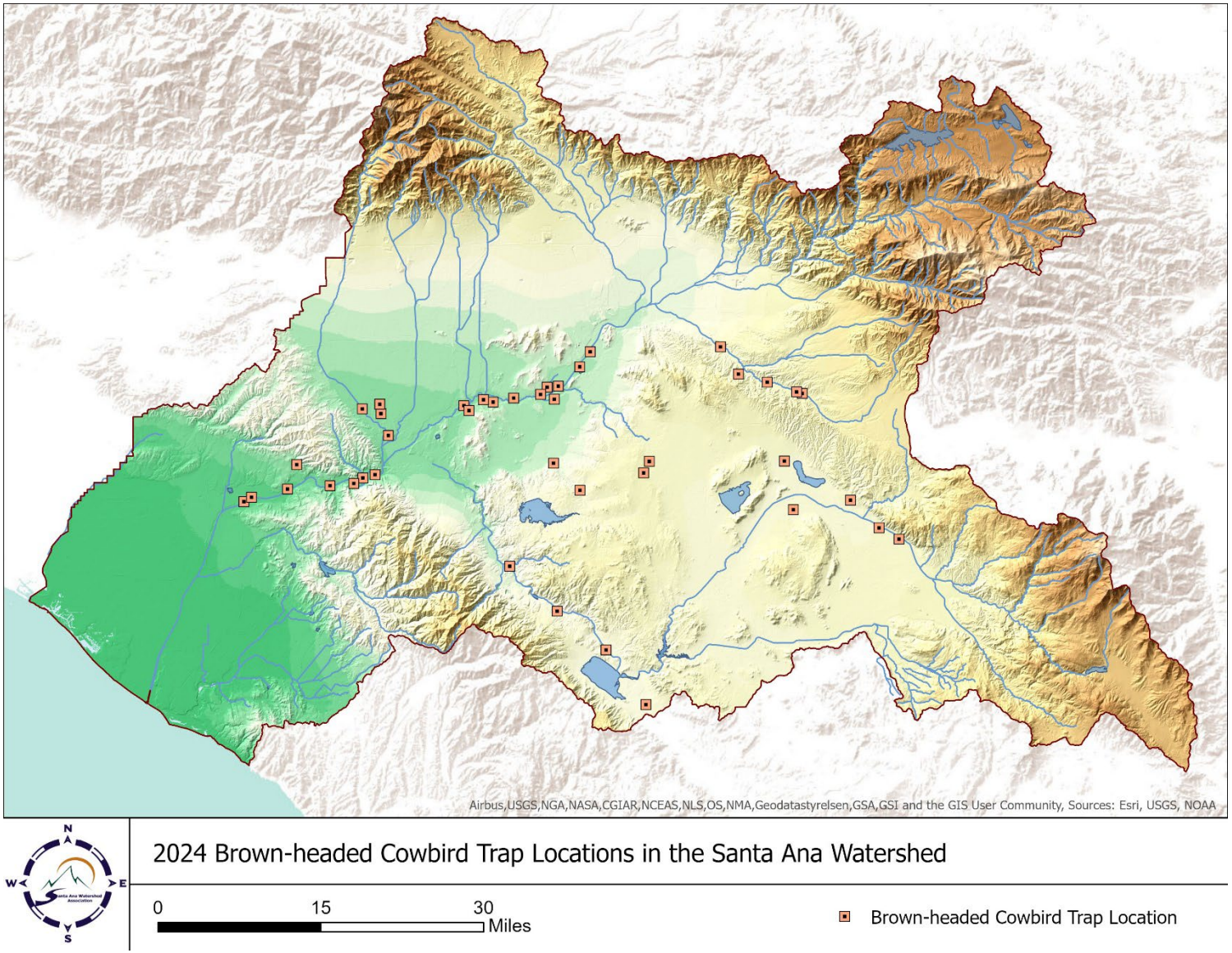

Figure 5. Brown-headed Cowbird Trap Locations in the Santa Ana Watershed, 2024. Forty-two Brown-headed Cowbird traps were deployed and maintained in the Santa Ana Watershed during the 2024 vireo nesting season (April – July).

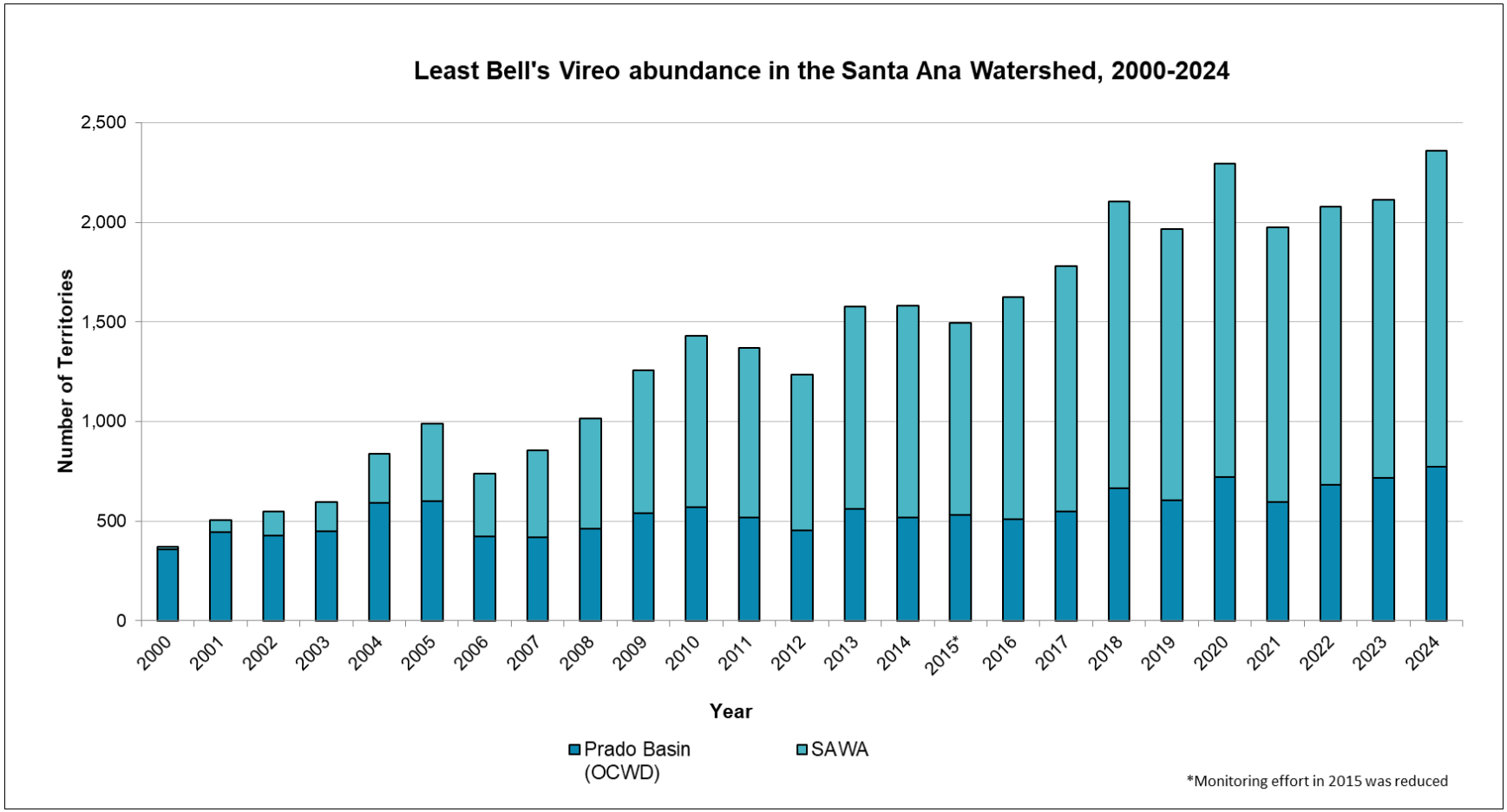

Figure 6. Least Bell's Vireo Abundance in the Santa Ana Watershed, Including Prado Basin, 2000-2024. Vireo population monitoring outside of Prado Basin began in 2000. Vireo abundance in the Santa Ana Watershed has increased dramatically in the past two decades.

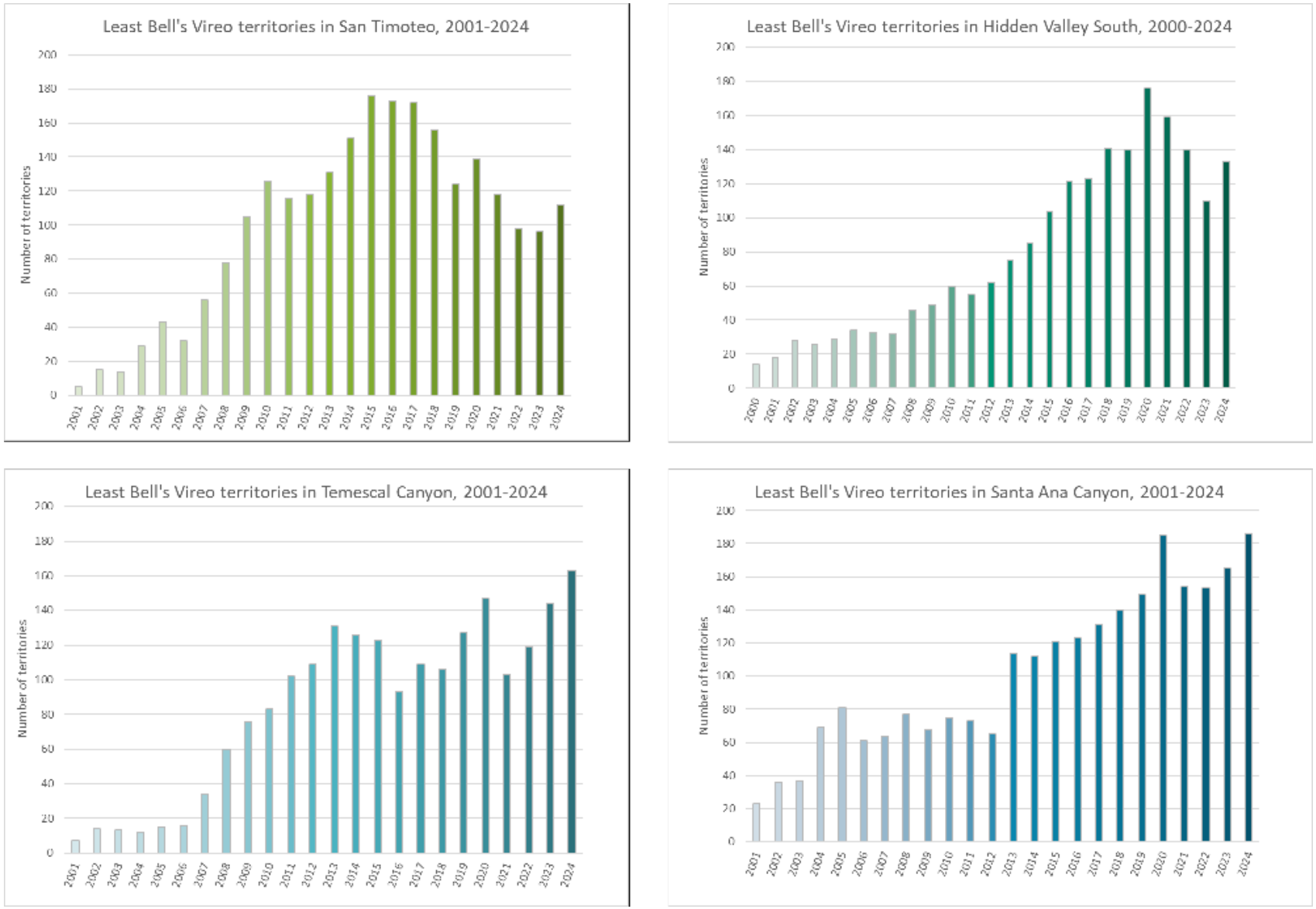

Figure 7. Least Bell's Vireo Territories at Four Sites in the Santa Ana Watershed, 2000-2024. Number of vireo territories at four sites that were comparatively monitored in the watershed. Data shows how vireo abundance has increased substantially over 25 seasons.

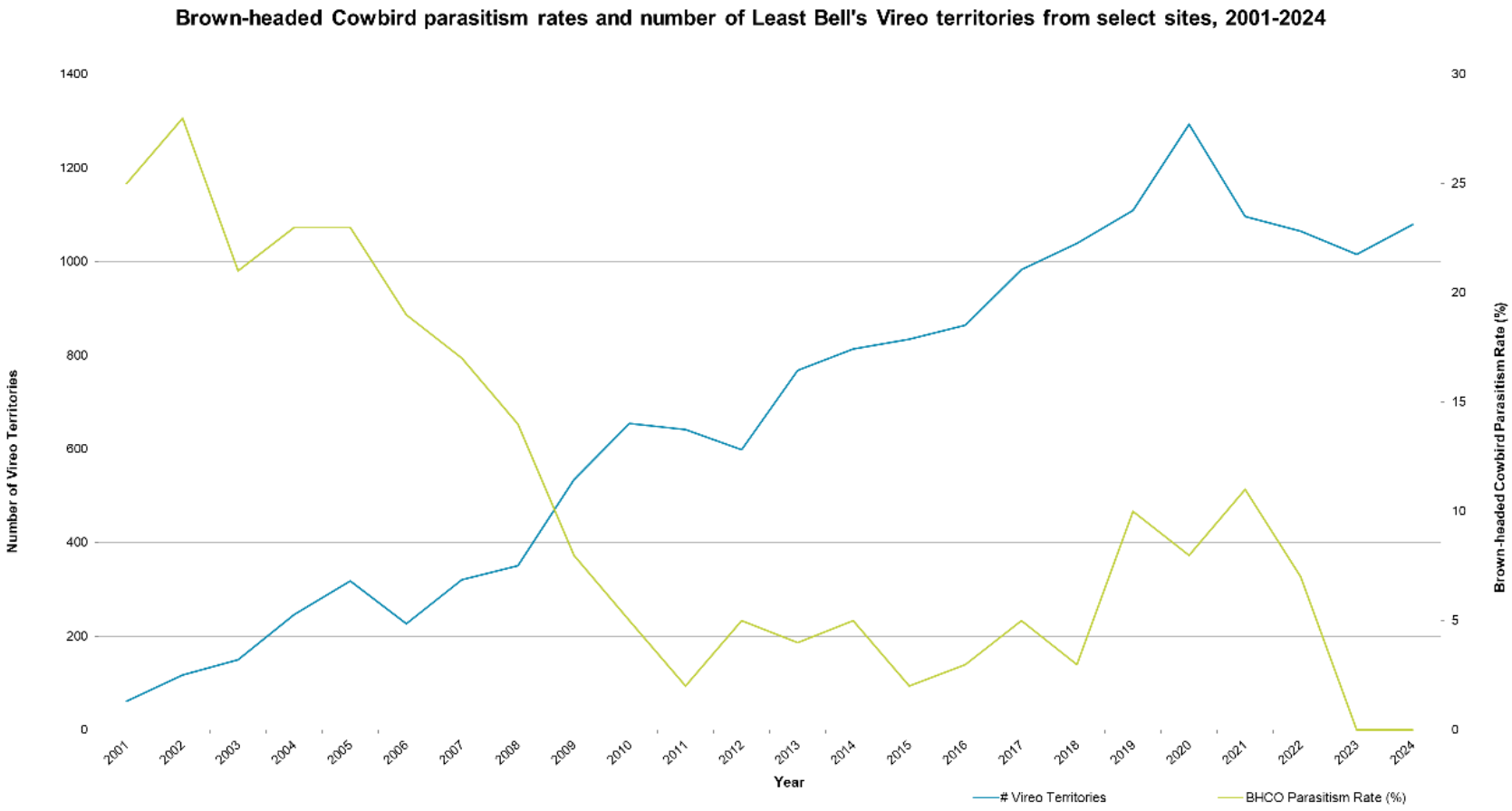

Figure 8. Vireo Territories vs. Parasitism Rates in the Santa Ana Watershed, 2001-2024. This graph shows the inverse relationship between vireo abundance and parasitism rates. Vireo territories have generally increased in number since 2001, while Brown-headed Cowbird parasitism rates have decreased due to intensive cowbird management. Parasitism data are only collected for well-tracked nests. Beginning in 2019, nests that were predated before it could be determined if they had been parasitized (seven days after the start of incubation) were excluded from parasitism rate calculations, slightly increasing the rates.

Source data: "Least Bell's Vireo reproductive success and breeding biology data at monitored and select sampled sites in the Santa Ana River Watershed" tables, 2001-2024. In 2022, Chino Hills, Mockingbird Canyon, and Temescal Canyon data were omitted from the table but are included in this figure for consistency with prior years. In 2023-24, Chino Hills, Mockingbird Canyon, San Jacinto, and Temescal were omitted from the table but are included here for consistency with prior years.

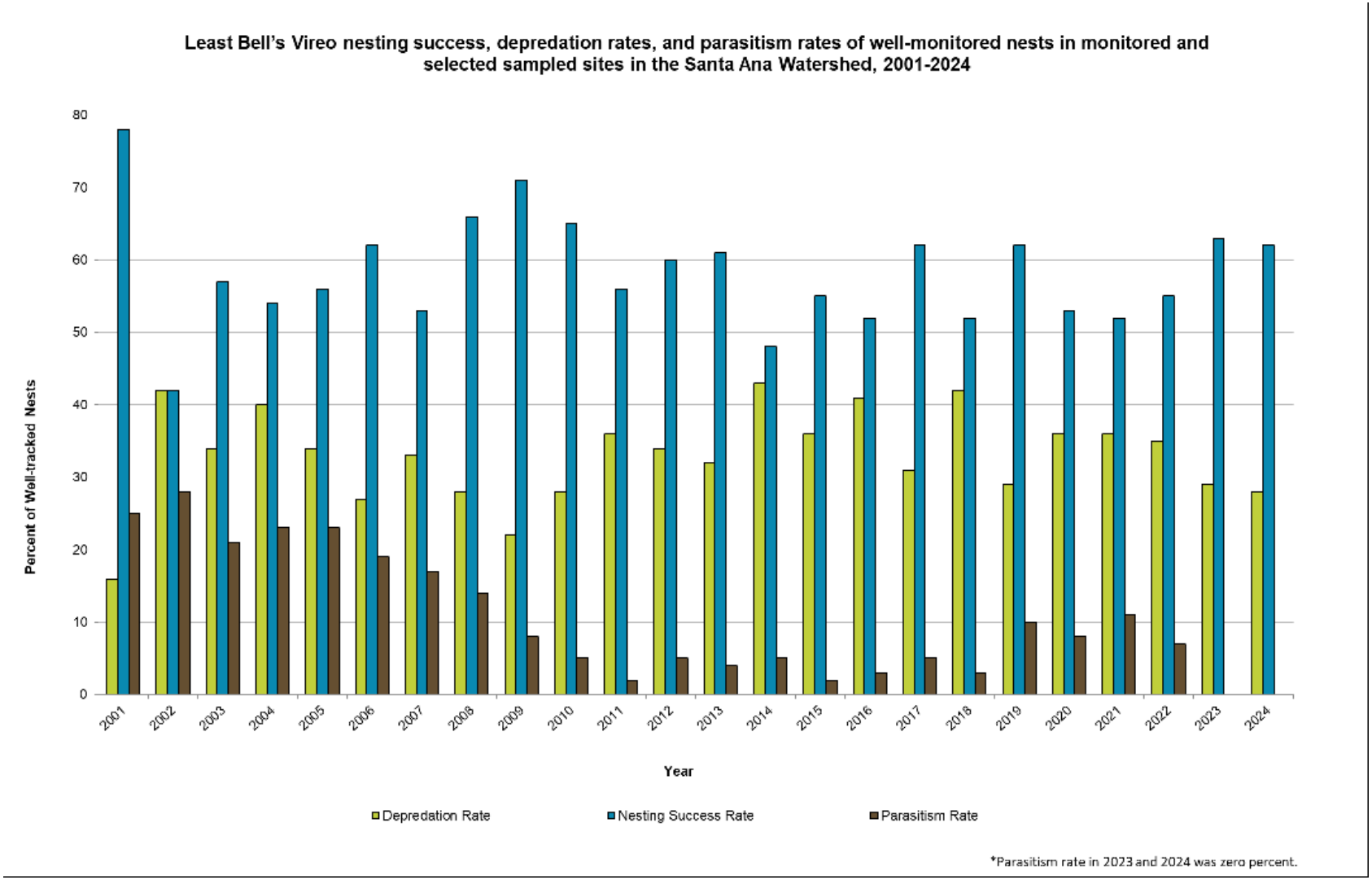

Figure 9. Least Bell's Vireo Nesting Success, Depredation Rates, and Parasitism Rates in the Santa Ana Watershed, 2001-2024. Nest failure due to parasitism remains low due to SAWA's cowbird management program, which includes trapping and removing cowbird eggs from vireo nests when found. Beginning in 2019, nests that were predated before it could be determined if they had been parasitized (seven days after start of incubation) were excluded from parasitism rate calculations, slightly increasing the rates.

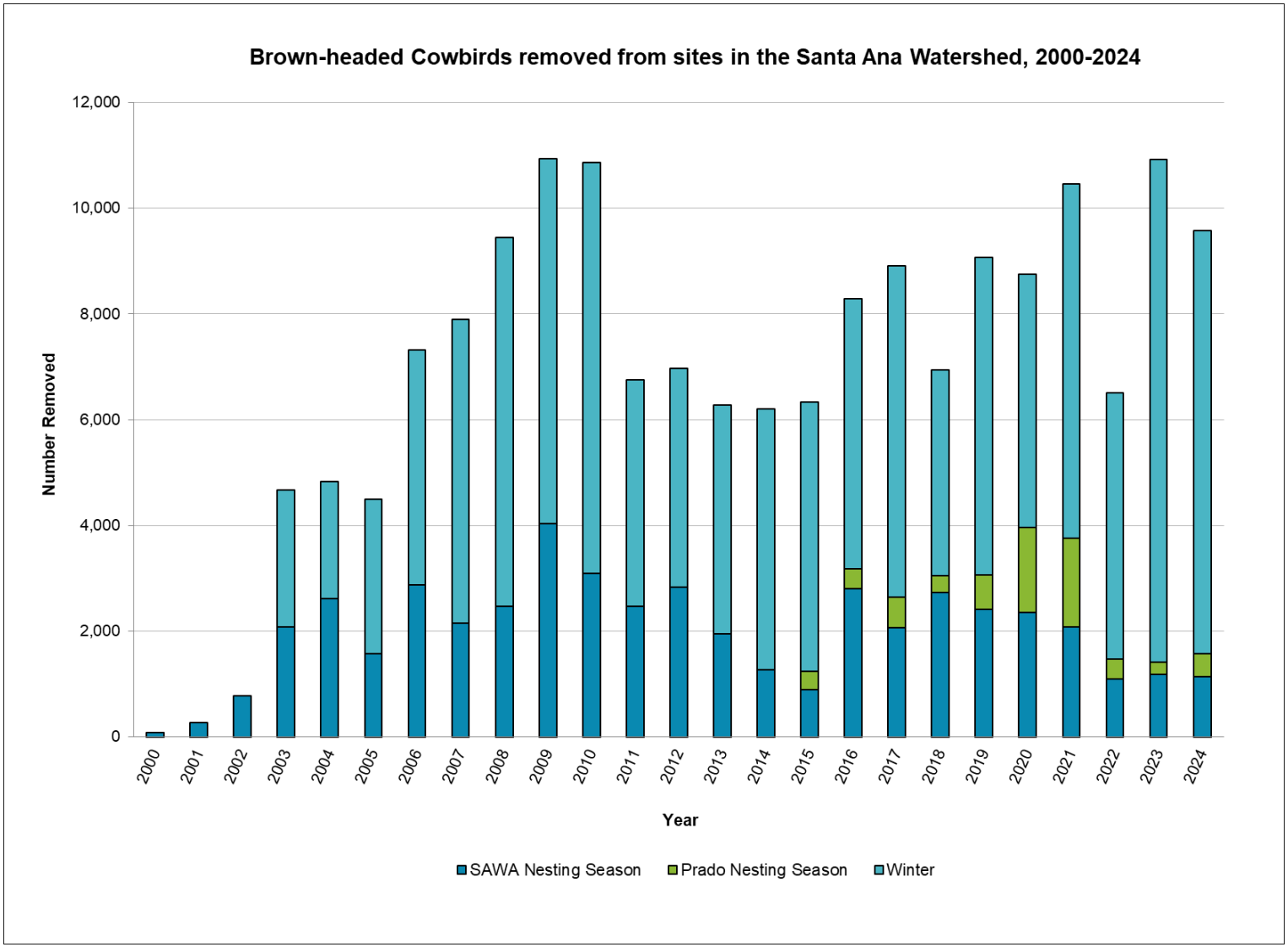

Figure 10. Brown-headed Cowbirds Removed from Sites in the Santa Ana Watershed, 2000-2024. SAWA biologists have trapped and removed nearly 174,000 cowbirds from the watershed in the last 25 years. "Winter" for each year refers to the period outside of vireo nesting season that ended in March of that year, i.e., "Winter 2022" refers to the trapping season that ran from August 2021 through March 2022.

Table 1. Least Bell's Vireo abundance and distribution in the Santa Ana Watershed, 2020-2024. Numbers of territories, pairs, and fledglings detected.

Site Name	2020	2021	2022	2023	2024
	Monitored Locations				
San Timoteo Canyon	139 / 105 / 207	118 / 83 / 149	98 / 59 / 118	96 / 64 / 170	112 / 70 / 155
San Jacinto	108 / 83 / 145	See Sampled Locations	73 / 41 / 53	See Sampled Locations	See Sampled Locations
Santa Ana River (SAR) - Upstream					
Riverside Avenue to Van Buren Boulevard	128 / 54 / 55	154 / 78 / 58	161 / 67 / 90	145 / 63 / 71	135 / 62 / 73
Lower Hole Creek	2 / 1 / 1	3 / 3 / 3	3 / 3 / 5	See Sampled Locations	See Sampled Locations
Hidden Valley, south side of river	176 / 102 / 187	159 / 118 / 200	140 / 91 / 180	110 / 79 / 172	133 / 109 / 200
Goose Creek, Norco to I-15 (includes Goose Creek mitigation funded by IERCD)	88 / 58 / 114	73 / 47 / 73	67 / 47 / 102	68 / 29 / 48	73 / 29 / 38
Meridian Conservation Area (former March SKR Preserve)	14 / 9 / 24	See Sampled Locations	See Sampled Locations	19 / 13 / 25	See Sampled Locations
Mockingbird Canyon	45 / 17 / 26	See Sampled Locations	See Sampled Locations	See Sampled Locations	See Sampled Locations
Norco Bluffs (I-15 to River Rd.)	133 / 65 / 159	113 / 48 / 125	137 / 62 / 119	130 / 78 / 175	132 / 62 / 139
Santa Ana Canyon (SAC)					
Upper Canyon	45 / 30 / 52	43 / 34 / 50	39 / 23 / 32	39 / 20 / 34	39 / 21 / 40
Green River Golf Club	61 / 42 / 63	47 / 35 / 63	48 / 36 / 71	55 / 44 / 131	67 / 48 / 119
Featherly Regional Park	79 / 48 / 66	64 / 34 / 43	66 / 43 / 52	71 / 45 / 76	80 / 43 / 75
	Sampled Locations				
Santa Ana River & Tributaries:					
Alessandro Arroyo/Prenda Arroyo	26 / 7 / 8	22 / 4 / 3	23 / 4 / 3	24 / 7 / 4	20 / 4 / 4
Box Springs	7 / 5 / 3	4 / 0 / 0	4 / 0 / 0	6 / 1 / 1	6 / 1 / 1
Burris Basin	1 / 0 / 0	0 / 0 / 0	0 / 0 / 0	0 / 0 / 0	0 / 0 / 0
Canyon Crest	n/s	0 / 0 / 0	n/s	n/s	n/s
Carbon Canyon Regional Park	See Incidentals	30 / 9 / 4	31 / 10 / 9	33 / 5 / 0	34 / 11 / 8
Chino Creek Wetlands Park	n/s	5 / 1 / 0	4 / 3 / 3	6 / 2 / 2	7 / 5 / 2
Chino Hills	36 / 10 / 10	30 / 9 / 5	28 / 5 / 3	33 / 12 / 13	36 / 8 / 2
Chino Hills State Park (CHSP)	n/s	n/s	48 / 30 / 22	48 / 24 / 20	75 / 23 / 19
Conrock Basin FHQ	1 / 1 / 0	1 / 0 / 0	2 / 0 / 0	1 / 0 / 0	2 / 1 / 2
Goldenstar	0 / 0 / 0	n/s	n/s	n/s	n/s
Harrison Reservoir (aka McAllister Creek)	7 / 3 / 5	6 / 1 / 0	7 / 1 / 0	7 / 3 / 0	9 / 0 / 0
Hidden Valley Golf Club	12 / 3 / 3	16 / 10 / 9	16 / 3 / 3	15 / 8 / 7	17 / 10 / 6
Hidden Valley, north side of river	94 / 61 / 74	61 / 38 / 39	62 / 45 / 50	55 / 31 / 37	66 / 34 / 26
Huckleberry Basin	n/s	n/s	1 / 1 / 0	0 / 0 / 0	0 / 0 / 0
La Sierra	5 / 2 / 0	4 / 3 / 2	4 / 1 / 1	7 / 2 / 0	10 / 3 / 3
Lower Hole Creek	See Monitored Locations	See Monitored Locations	See Monitored Locations	3 / 1 / 2	3 / 1 / 2

Table 1 continued. Least Bell's Vireo abundance and distribution in the Santa Ana Watershed, 2020-2024. Numbers of territories, pairs, and fledglings detected.

Site Name	2020	2021	2022	2023	2024
	Sampled Locations				
Santa Ana River & Tributaries:					
Mead Valley (Cajalco/Aqueduct)	9 / 5 / 1	6 / 1 / 1	6 / 3 / 0	5 / 2 / 1	7 / 2 / 3
Meridian Conservation Area (former March SKR Preserve)	See Monitored Locations	13 / 8 / 4	14 / 5 / 7	See Monitored Locations	20 / 14 / 9
Mills Pond	n/s	n/s	n/s	2 / 1 / 0	0 / 0 / 0
Mockingbird Canyon	See Monitored Locations	37 / 16 / 8	24 / 4 / 1	21 / 8 / 6	23 / 9 / 6
Plunge Creek	2 / 0 / 0	n/s	n/s	n/s	See Incidental Locations
Poorman Reservoir	6 / 4 / 3	7 / 4 / 2	6 / 2 / 2	5 / 2 / 2	6 / 4 / 3
Pyrite Channel	n/s	1 / 0 / 0	n/s	n/s	n/s
Quail Run	1 / 1 / 1	0 / 0 / 0	3 / 0 / 0	See Reported by Other Agencies	See Incidental Locations
Ryan Bonaminio Park	See Incidental Locations	See Incidental Locations	1 / 1 / 2	n/s	1 / 0 / 0
Sycamore Canyon	43 / 28 / 19	35 / 12 / 8	28 / 19 / 18	33 / 13 / 11	51 / 20 / 19
Talbert Park (Orange County)	n/s	2 / 0 / 0	n/s	3 / 1 / 0	n/s
Temescal Canyon	147 / 30 / 20	103 / 35 / 24	119 / 33 / 28	144 / 50 / 38	163 / 17 / 11
Tin Mine Rd. (Temescal)	10 / 1 / 1	8 / 3 / 3	8 / 4 / 3	8 / 4 / 3	n/s
Van Buren Blvd. (Bountiful)	0 / 0 / 0	1 / 0 / 0	1 / 0 / 0	n/s	1 / 1 / 2
Woodcrest	0 / 0 / 0	n/s	n/s	n/s	n/s
Wyle Labs	13 / 4 / 2	10 / 3 / 4	10 / 6 / 6	11 / 5 / 3	12 / 6 / 5
Yorba Linda (Starlight Dr.)	15 / 4 / 4	11 / 0 / 0	7 / 3 / 1	10 / 9 / 10	11 / 4 / 7
Yorba Linda Lakebed Park	n/s	0 / 0 / 0	n/s	n/s	n/s
San Jacinto River Sub-watershed:					
San Jacinto	See Monitored Locations	91 / 52 / 24	See Monitored Locations	84 / 27 / 22	87 / 30 / 16
Cottonwood Canyon	n/s	2 / 2 / 3	3 / 2 / 1	6 / 4 / 4	9 / 3 / 3
Lake Perris	8 / 6 / 1	5 / 2 / 2	3 / 0 / 0	n/s	6 / 1 / 1
Menifee (Salt Creek)	18 / 12 / 13	14 / 4 / 2	14 / 10 / 3	11 / 7 / 7	14 / 5 / 6
Santiago Creek Sub-watershed:					
Irvine Lake	See Incidental Locations	See Incidental Locations	See Incidental Locations	See Incidental Locations	13 / 5 / 1
Irvine Trust Management Area	2 / 0 / 0	1 / 0 / 0	1 / 0 / 0	1 / 0 / 0	1 / 0 / 0
Peters Canyon	24 / 9 / 6	22 / 8 / 6	25 / 6 / 2	22 / 12 / 8	22 / 6 / 5
Santiago Basin	5 / 0 / 0	2 / 0 / 0	2 / 0 / 0	4 / 3 / 5	7 / 2 / 2
Santiago Canyon (Irvine Park)	28 / 13 / 17	29 / 10 / 8	30 / 8 / 8	29 / 16 / 12	33 / 13 / 8
Santiago Creek (above Irvine Lake)	12 / 2 / 1	10 / 2 / 1	11 / 2 / 1	10 / 2 / 2	17 / 1 / 1
Santiago Creek (Cambridge Road)	0 / 0 / 0	0 / 0 / 0	0 / 0 / 0	n/s	n/s

Table 1 continued. Least Bell's Vireo abundance and distribution in the Santa Ana Watershed, 2020-2024. Numbers of territories, pairs, and fledglings detected.

Site Name	2020	2021	2022	2023	2024
	Sampled Locations				
Santiago Creek Sub-watershed:					
Santiago Creek (Chapman Ave.)	0 / 0 / 0	0 / 0 / 0	0 / 0 / 0	n/s	See Incidental Locations
Santiago Creek (Lower Channel)	n/s	0 / 0 / 0	n/s	n/s	n/s
Santiago Oaks Regional Park (to Cannon Rd.)	n/s	2 / 0 / 0	3 / 1 / 0	5 / 2 / 1	6 / 1 / 0
Smith Basin	3 / 2 / 0	4 / 0 / 0	5 / 1 / 1	2 / 0 / 0	3 / 0 / 0
	Incidental Sightings				
Ambriz Park (Orange)	n/s	2 / 0 / 0	n/s	2 / 0 / 0	2 / 0 / 0
Carbon Canyon Regional Park	14 / 0 / 0	See Sampled Locations	See Sampled Locations	See Sampled Locations	See Sampled Locations
Cielo Vista	1 / 0 / 0	2 / 1 / 1	n/d	n/s	1 / 1 / 1
Green River Stables Trap	n/s	n/s	n/s	1 / 0 / 0	n/s
Gum Grove Park	n/s	n/s	n/s	n/s	1 / 0 / 0
Irvine Lake	n/s	n/s	5 / 3 / 5	1 / 0 / 0	See Sampled Locations
Murrieta Creek	n/s	n/s	1 / 0 / 0	n/s	n/s
Plunge Creek	See Sampled Locations	n/s	n/s	n/s	1 / 1 / 1
Quail Run	See Sampled Locations	See Sampled Locations	See Sampled Locations	See Reported by Other Agencies	3 / 2 / 3
Riverside (Van Buren & Jurupa)	1 / 0 / 0	n/s	1 / 0 / 0	1 / 0 / 0	1 / 0 / 0
Riverside (Near Alessandro Arroyo)	n/s	1 / 1 / 1	n/s	n/s	n/s
Rock Vista Park	2 / 0 / 0	n/s	n/s	n/s	n/s
Ryan Bonaminio Park	n/s	1 / 0 / 0	See Sampled Locations	n/s	See Sampled Locations
Santa Ana River - San Bernardino County Flood Control	2 / 0 / 0	1 / 0 / 0	n/s	n/s	n/s
Santiago Creek (Chapman Ave.)	See Sampled Locations	See Sampled Locations	See Sampled Locations	See Sampled Locations	1 / 0 / 0
Scully Hill	n/s	n/s	n/s	1 / 0 / 0	3 / 1 / 0
Weeping Willow	n/s	n/s	n/s	n/s	2 / 0 / 0
Wolfskill	1 / 1 / 1	2 / 1 / 1	n/s	1 / 1 / 1	2 / 0 / 0
SUBTOTAL	1,574 / 828 / 1,292	1,378 / 720 / 929	1,393 / 688 / 1,005	1,394 / 700 / 1,124	1,586 / 694 / 1,027
Reported by other agencies					
Irvine Lake (north side)[1]	n/a	n/a	n/a	2 / 0 / 0	n/a
Quail Run[1]	See Sampled Locations	See Sampled Locations	See Sampled Locations	1 / 0 / 0	See Incidental Locations
Santa Ana River - San Bernardino County[2]	Not Reported	Not Reported	Not Reported	Not Reported	Not Reported

Table 1 continued. Least Bell's Vireo abundance and distribution in the Santa Ana Watershed, 2020-2024. Numbers of territories, pairs, and fledglings detected.

Site Name	2020	2021	2022	2023	2024
TOTAL FOR SANTA ANA WATERSHED EXCLUDING PRADO BASIN	**1,574 / 828 / 1,292**	**1,378 / 720 / 929**	**1,393 / 688 / 1,005**	**1,397 / 700 / 1,124**	**1,586 / 694 / 1,027**
PRADO BASIN[3]	719 / 373 / 577	596 / 281 / 417	683 / 326 / 546	715 / 324 / 533	773 / 303 / 352
TOTAL FOR SANTA ANA WATERSHED	**2,293 / 1,201 / 1,869**	**1,974 / 1,001 / 1,346**	**2,076 / 1,014 / 1,551**	**2,112 / 1,024 / 1,657**	**2,359 / 997 / 1,379**

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

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

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

d." n/d" indicates the site was visited during the breeding season, but no vireos were detected. Site was not visited enough to declare absence.

[1] Reported by Endemic Environmental Services

[2] Reported by San Bernardino County Flood Control biologist Theresa Sims.

[3] Preliminary data. David McMichael (OCWD) personal communication.

Table 2. Least Bell's Vireo survey dates and breeding chronology, monitored and select sampled sites, 2024.

		Santa Ana River (SAR) - Upstream				Santa Ana Canyon (SAC)		
	San Timoteo Canyon	Riverside Avenue to Van Buren Boulevard	Hidden Valley, south side of river	Goose Creek, Norco to I-15 (includes Goose Creek mitigation funded by IERCD)	Norco Bluffs (I-15 to River Rd., non-mitigation)	Upper Canyon	Green River Golf Club	Featherly Regional Park
Survey Start Date[1]	20-Mar	20-Mar	13-Mar	12-Mar	13-Mar	21-Mar	20-Mar	20-Mar
Date First Detected	20-Mar	27-Mar	19-Mar	21-Mar	21-Mar	26-Mar	20-Mar	20-Mar
50% Arrival Observed	8-Apr	15-Apr	5-Apr	31-Mar	9-Apr	9-Apr	10-Apr	10-Apr
50% Pairs Observed	17-Apr	29-Apr	22-Apr	22-Apr	19-Apr	15-Apr	24-Apr	3-May
First Nest Found	2-Apr	22-Apr	2-Apr	16-Apr	4-Apr	7-Apr	9-Apr	10-Apr
First Nest Fledge	11-May	29-May	14-May	22-May	5-May	15-May	12-May	15-May
Last Nest Found	5-Jul	1-Jul	5-Jul	20-Jun	26-Jun	25-Jun	18-Jun	12-Jul
Last Nest Fledge	18-Jul	23-Jul	16-Jul	25-Jun	12-Jul	16-Jun	9-Jul	22-Jul
Date Last Detected	6-Sep	11-Sep	12-Sep	12-Sep	4-Sep	29-Aug	29-Aug	13-Sep
Survey End Date	12-Sep	18-Sep	19-Sep	19-Sep	12-Sep	12-Sep	12-Sep	13-Sep

[1] First date of full survey specifically for Least Bell's Vireo

Table 3. Least Bell's Vireo reproductive success and breeding biology data at monitored and select sampled sites in the Santa Ana River Watershed, 2024.

			Santa Ana River (SAR) - Upstream				Santa Ana Canyon (SAC)			
	Parameter	San Timoteo Canyon	Riverside Avenue to Van Buren Boulevard	Hidden Valley, south side of river	Goose Creek, Norco to I-15 (includes Goose Creek mitigation funded by IERCD)	Norco Bluffs (I-15 to River Rd., non-mitigation)	Upper Canyon	Green River Golf Club	Featherly Regional Park	Combined
A.	Number of territorial males	112	135	133	73	132	39	67	80	771
B.	Number of known pairs	70	62	109	29	62	21	48	43	444
C.	Number of known breeding (nesting) pairs	62	47	95	24	49	20	44	38	379
D.	Number of breeding pairs that were well-monitored throughout the season	41	3	32	5	18	5	25	16	145
E.	Number of known fledged young observed	155	73	200	38	139	40	119	75	839
F.	Number of known fledged young produced by pairs monitored throughout the breeding season	119	11	113	13	76	16	88	49	485
G.	Average number of fledglings produced per breeding pair (minimum; E/C = 'productivity or breeding success')[1]	2.5	1.6	2.1	1.6	2.8	2.0	2.7	2.0	2.2
H.	Average number of fledglings produced by well-monitored pairs (F/D = reproductive success)	2.9	3.7	3.5	2.6	4.2	3.2	3.5	3.1	3.3
I.	Number of nests that were discovered	73	10	68	13	53	11	56	44	328
J.	Number of well-tracked nests	70	8	62	13	51	9	49	36	298
K.	Number of successful well-tracked nests	61% 43 / 70	50% 4 / 8	68% 42 / 62	46% 6 / 13	67% 34 / 51	78% 7 / 9	67% 33 / 49	47% 17 / 36	62% 186 / 298
L.	Rate of cowbird parasitism (well-tracked nests)[3]	0% 0 / 62	0% 0 / 5	0% 0 / 57	0% 0 / 11	0% 0 / 44	0% 0 / 9	0% 0 / 45	0% 0 / 28	0% 0 / 261
	A. Number of well-tracked nests that failed as a result of reproductive failure	4% 3 / 70	0% 0 / 8	2% 1 / 62	8% 1 / 13	2% 1 / 51	11% 1 / 9	2% 1 / 49	0% 0 / 36	3% 8 / 298
	B. Number of well-tracked nests that failed as a result of parasitism	0% 0 / 70	0% 0 / 8	0% 0 / 62	0% 0 / 13	0% 0 / 51	0% 0 / 9	0% 0 / 49	0% 0 / 36	0% 0 / 298
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	30% 21 / 70	38% 3 / 8	19% 12 / 62	46% 6 / 13	27% 14 / 51	0% 0 / 9	29% 14 / 49	39% 14 / 36	28% 84 / 298
M.	D. Number of well-tracked nests that failed for unknown reasons	4% 3 / 70	13% 1 / 8	11% 7 / 62	0% 0 / 13	4% 2 / 51	11% 1 / 9	2% 1 / 49	14% 5 / 36	7% 20 / 298
	Average clutch size	3.6	3.8	3.6	3.5	3.7	3.8	3.5	3.7	3.6
N.	Number of eggs/Number of clutches	240 / 67	23 / 6	218 / 60	46 / 13	185 / 50	34 / 9	176 / 50	117 / 32	1,039 / 287
O.	Number of cowbird eggs or nestlings found in or near vireo nests	0	0	0	0	0	0	0	0	0
P.	Number of 'manipulated' parasitized nests[3]	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Q.	Number of successful 'manipulated' nests[3]	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
R.	Number of vireo fledged from 'manipulated' nests[2]	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
S.	Number of cowbird young fledged by vireo observed	0	0	0	0	0	0	0	0	0
T.	Number of repaired nests[3]	0	0	6	0	2	1	4	0	13
U.	% of successful repaired nests	n/a	n/a	83% 5 / 6	n/a	0% 0 / 2	100% 1 / 1	75% 3 / 4	n/a	69% 9 / 13
V.	Number of vireo fledged from repaired nests	n/a	n/a	14	n/a	0	4	9	n/a	27
W.	Number of cowbirds removed from study area[4]	30	33	-11	3	n/a	1	33	-1	88
X.	Number of trap days (1 operative trap day in the field for one day = 1 trap day)[3]	345	459	199	73	n/a	91	125	184	1,476
Y.	Average number of cowbirds trapped per day (W/X)	0.09	0.07	-0.06	0.04	n/a	0.01	0.26	-0.01	0.06

[1]Productivity numbers in a given year may be biased lower at some unmonitored sites due to low sample size as a consequence of variations in the frequency in which a site is visited

[2]Thirty-seven of the 298 "well-tracked" nests were depredated or otherwise failed before it could be determined if they had been parasitized. Therefore, these 37 nests were excluded from the calculation of the rate of cowbird parasitism (Pike et al., 1999; Sharp & Kus, 2006)

[3]Only well-tracked nests are counted for these parameters

[4]All traps are not accounted for in this total. See Table 6.

Table 3B. Least Bell's Vireo breeding biology data detailed for surveys funded by the San Bernardino Valley Municipal Water District at monitored (restoration) and sampled (non-restoration) sites in upper Santa Ana River, 2024.

	Parameter	Evans Lake Drain	Anza/Old Ranch Creeks Restoration[7]	Sunnyslope Restoration[6]	SAR - Riverside Avenue to Van Buren Boulevard Non-Restoration	SAR - Riverside Avenue to Van Buren Boulevard - Overall	Hidden Valley, north side of river	Lower Hole Creek	Hidden Valley South - Restoration	Hidden Valley South - Non-Restoration	Hidden Valley South - Overall	Goose Creek[5]	SAR Upstream - Overall
A.	Number of territorial males	3	16	21	95	135	66	3	22	111	133	73	410
B.	Number of known pairs	2	10	16	34	62	34	1	17	92	109	29	235
C.	Number of known breeding (nesting) pairs	2	9	14	22	47	26	1	15	80	95	24	193
D.	Number of breeding pairs that were well-monitored throughout the season	0	0	3	0	3	0	0	7	25	32	5	40
E.	Number of known fledged young observed	2	11	33	27	73	26	2	37	163	200	38	339
F.	Number of known fledged young produced by pairs monitored throughout the breeding season	n/a	n/a	11	n/a	11	n/a	n/a	26	87	113	13	137
G.	Average number of fledglings produced per breeding pair (minimum; E/C = 'productivity or breeding success')[1]	1.0	1.2	2.4	1.2	1.6	1.0	2.0	2.5	2.0	2.1	1.6	1.8
H.	Average number of fledglings produced by well- monitored pairs (F/D = reproductive success)	n/a	n/a	3.7	n/a	3.7	n/a	n/a	3.7	3.5	3.5	2.6	3.4
I.	Number of nests that were discovered	0	0	9	1	10	2	0	16	52	68	13	93
J.	Number of well-tracked nests	n/a	n/a	8	0	8	0	n/a	15	47	62	13	83
K.	Number of successful well-tracked nests	n/a	n/a	50% 4 / 8	n/a	50% 4 / 8	n/a	n/a	53% 8 / 15	72% 34 / 47	68% 42 / 62	46% 6 / 13	63% 52 / 83
L.	Rate of cowbird parasitism (well-tracked nests)[3]	n/a	n/a	0% 0 / 5	n/a	0% 0 / 5	n/a	n/a	0% 0 / 14	0% 0 / 43	0% 0 / 57	0% 0 / 11	0% 0 / 73
	A. Number of well-tracked nests that failed as a result of reproductive failure	n/a	n/a	0% 0 / 8	n/a	0% 0 / 8	n/a	n/a	0% 0 / 15	2% 1 / 47	2% 1 / 62	8% 1 / 13	2% 2 / 83
	B. Number of well-tracked nests that failed as a result of parasitism	n/a	n/a	0% 0 / 8	n/a	0% 0 / 8	n/a	n/a	0% 0 / 15	0% 0 / 47	0% 0 / 62	0% 0 / 13	0% 0 / 83
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	n/a	n/a	38% 3 / 8	n/a	38% 3 / 8	n/a	n/a	40% 6 / 15	13% 6 / 47	19% 12 / 62	46% 6 / 13	25% 21 / 83
M.	D. Number of well-tracked nests that failed for unknown reasons	n/a	n/a	13% 1 / 8	n/a	13% 1 / 8	n/a	n/a	7% 1 / 15	13% 6 / 47	11% 7 / 62	0% 0 / 13	10% 8 / 83
	Average clutch size	n/a	n/a	3.8	n/a	3.8	4.0	n/a	3.7	3.6	3.6	3.5	3.6
N.	Number of eggs/Number of clutches	n/a	n/a	23 / 6	n/a	23 / 6	4 / 1	n/a	55 / 15	163 / 45	218 / 60	46 / 13	291 / 80

Table 3B continued. Least Bell's Vireo breeding biology data detailed for surveys funded by the San Bernardino Valley Municipal Water District at monitored (restoration) and sampled (non-restoration) sites in upper Santa Ana River, 2024.

	Parameter	Evans Lake Drain	Anza/Old Ranch Creeks Restoration[7]	Sunnyslope Restoration[6]	SAR - Riverside Avenue to Van Buren Boulevard Non-Restoration	SAR - Riverside Avenue to Van Buren Boulevard - Overall	Hidden Valley, north side of river	Lower Hole Creek	Hidden Valley South - Restoration	Hidden Valley South - Non-Restoration	Hidden Valley South - Overall	Goose Creek[5]	SAR Upstream - Overall
O.	Number of cowbird eggs or nestlings found in or near vireo nests	n/a	n/a	0	0	0	0	n/a	0	0	0	0	0
P.	Number of 'manipulated' parasitized nests[3]	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Q.	Number of successful 'manipulated' nests[3]	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
R.	Number of vireo fledged from 'manipulated' nests[2]	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
S.	Number of cowbird young fledged by vireo observed	0	0	0	0	0	0	0	0	0	0	0	0
T.	Number of repaired nests[3]	n/a	n/a	0	0	0	0	n/a	1	5	6	0	6
U.	% of successful repaired nests	n/a	n/a	n/a	n/a	n/a	n/a	n/a	100% 1 / 1	80% 4 / 5	83% 5 / 6	n/a	83% 5 / 6
V.	Number of vireo fledged from repaired nests	n/a	n/a	n/a	n/a	n/a	n/a	n/a	3	11	14	n/a	14
W.	Number of cowbirds removed from study area[4]	14	0	14	5	33	6	n/a	n/a	-11	-11	3	31
X.	Number of trap days (1 operative trap day in the field for one day = 1 trap day)[3]	81	81	160	137	459	79	n/a	n/a	199	199	73	810
Y.	Average number of cowbirds trapped per day (W/X)	0.17	0.00	0.09	0.04	0.07	0.08	n/a	n/a	-0.06	-0.06	0.04	0.04

[1]Productivity numbers in a given year may be biased lower at some unmonitored sites due to low sample size as a consequence of variations in the frequency in which a site is visited

[2]Ten of the 83 "well-tracked" nests were depredated or otherwise failed before it could be determined if they had been parasitized. Therefore, these 6 nests were excluded from the calculation of the rate of cowbird parasitism (Pike et al., 1999; Sharp & Kus, 2006)

[3]Only well-tracked nests are counted for these parameters

[4]All traps are not accounted for in this total. See Table 6.

[5]This site includes mitigation areas funded by IERCD

[6]Sunnyslope restoration data were previously included in SAR- Riverside to Van Buren Non-Restoration

[7]In 2024, Anza/Old Ranch Creeks Restoration was sampled rather than monitored due to safety concerns

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, 2024.

Host Plant Species (listed alphabetically by scientific name)	San Timoteo Canyon	Santa Ana River (SAR) - Upstream			Norco Bluffs (I-15 to River Rd., non-mitigation)	Santa Ana Canyon (SAC)			Combined	Percentage of Combined
		Riverside Avenue to Van Buren Boulevard	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 Regional Park		
California Sagebrush (*Artemisia californica*)								1	1	<1%
Giant Reed[ie] (*Arundo donax*)		2	1					1	4	1%
Coyote Brush (*Baccharis pilularis*)			2		1				3	1%
Mulefat (*Baccharis salicifolia*)	12	2	17		9	8	22	11	81	25%
Bougainvillea[e] (*Bougainvillea* sp.)	1								1	<1%
Black Mustard[ie] (*Brassica nigra*)					1		1	3	5	2%
Orange Tree[e] (*Citrus sinensis*)								4	4	1%
Poison Hemlock[ie] (*Conium maculatum*)			5	4	1		1		11	3%
Brittlebush (*Encelia farinosa*)	1								1	<1%
Thick-leaved Yerba Santa (*Eriodictyon crassifolium*)								6	6	2%
Fig Tree[e] (*Ficus carica*)		1							1	<1%
Ash sp. (*Fraxinus* sp.)	1								1	<1%
Common Sunflower (*Helianthus annuus*)	1								1	<1%
Toyon (*Heteromeles arbutifolia*)							1		1	<1%
Southern California Black Walnut (*Juglans californica*)	1								1	<1%
Chaparral Mallow (*Malacothamnus fasciculatus*)	1								1	<1%
Laurel Sumac (*Malosma laurina*)							10	1	11	3%
Tree Tobacco[ie] (*Nicotiana glauca*)					1		1		2	1%
Western Sycamore (*Platanus racemosa*)							1	1	2	1%
Fremont Cottonwood (*Populus fremontii*)	2		6	1			3	3	15	5%
Callery Pear[e] (*Pyrus calleriana*)	1								1	<1%
Coast Live Oak (*Quercus agrifolia*)						1	1		2	1%
California Scrub Oak (*Quercus berberidifolia*)		1							1	<1%
Sugar Sumac (*Rhus ovata*)	1								1	<1%
Castor Bean[ie] (*Ricinus communis*)								1	1	<1%
California Blackberry (*Rubus ursinus*)					2				2	1%

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, 2024.

Host Plant Species (listed alphabetically by scientific name)	San Timoteo Canyon	Santa Ana River (SAR) - Upstream			Norco Bluffs (I-15 to River Rd., non-mitigation)	Santa Ana Canyon (SAC)			Combined	Percentage of Combined
		Riverside Avenue to Van Buren Boulevard	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 Regional Park		
Narrowleaf Willow (*Salix exigua*)			11	2	2			4	19	6%
Goodding's Black Willow (*Salix gooddingii*)	2		7		3	1		2	15	5%
Red Willow (*Salix laevigata*)	17		2		4			2	25	8%
Pacific Willow (*Salix lasiandra)*				1	9				10	3%
Arroyo Willow (*Salix lasiolepis*)	20	2	9	3	10		5		49	15%
Willow sp. (*Salix* sp.)			1						1	<1%
Blue Elderberry (*Sambucus mexicana*)	1		4	1	2	1	8	1	18	5%
Peruvian Pepper Tree[ie] (*Schinus molle*)							2		2	1%
African Sumac[e] (*Searsia lancia*)	2								2	1%
Poison Oak (*Toxicodendron diversilobum*)								1	1	<1%
Desert Wild Grape (*Vitis girdiana*)	9	2	2	1	7			1	22	7%
Deadfall			1		1				2	1%
Unknown/No Data								1	1	<1%
Total	73	10	68	13	53	11	56	44	328	100%

[i] = invasive

[e] = non-native

[r] = endangered, threatened, or sensitive

Table 5. Observations of all species by location, 2024.

		San Timoteo	Santa Ana River (SAR) - Upstream	Norco Bluffs (I-15 to River Rd., non-mitigation)	Santa Ana Canyon (SAC)	Other
Avian Species						
Common Name	**Scientific Name**					
Canada Goose	*Branta canadensis*		x	x	x	
Egyptian Goose[i]	*Alopochen aegyptiaca*				x	
Wood Duck	*Aix sponsa*			x	x	
Cinnamon Teal	*Spatula cyanoptera*	x		x		
Mallard	*Anas platyrhynchos*	x	x	x	x	
Ruddy Duck	*Oxyura jamaicensis*	x				
California Quail	*Callipepla californica*	x	x		x	
Domestic Fowl (Chicken)[i]	*Gallus domesticus*		x			
Pied-billed Grebe	*Podilymbus podiceps*		x	x		
Rock Pigeon[i]	*Columba livia*		x			
Eurasian Collared-Dove[i]	*Streptopelia decaocto*				x	
Common Ground-Dove	*Columbina passerina*		x	x		
Mourning Dove	*Zenaida macroura*	x	x	x	x	
Greater Roadrunner	*Geococcyx californianus*	x	x	x	x	
Lesser Nighthawk	*Chordeiles acutipennis*				x	
Vaux's Swift	*Chaetura vauxi*				x	
White-throated Swift	*Aeronautes saxatalis*			x	x	
Black-chinned Hummingbird	*Archilochus alexandri*	x	x			
Anna's Hummingbird	*Calypte anna*	x	x	x	x	
Costa's Hummingbird	*Calypte costae*				x	
Allen's Hummingbird	*Selasphorus sasin*	x	x	x	x	
Virginia Rail	*Rallus limicola*			x		
Sora	*Porzana carolina*		x	x		
Common Gallinule	*Gallinula galeata*			x		
American Coot	*Fulica americana*	x	x	x		
Killdeer	*Charadrius vociferus*	x	x	x	x	
Wilson's Snipe	*Gallinago delicata*		x	x		
Spotted Sandpiper	*Actitis macularius*			x		
Greater Yellowlegs	*Tringa melanoleuca*		x			
Ring-billed Gull	*Larus delawarensis*		x			
Double-crested Cormorant[r]	*Nannopterum auritum*	x	x	x	x	x
American White Pelican	*Pelecanus erythrorhynchos*	x				
Least Bittern	*Botaurus exilis*			x		
Snowy Egret	*Egretta thula*	x	x			
Black-crowned Night-Heron[r]	*Nycticorax nycticorax*	x	x			x
Green Heron	*Butorides virescens*			x	x	
Great Egret	*Ardea alba*	x	x	x	x	
Great Blue Heron[r]	*Ardea herodias*		x	x	x	
White-faced Ibis[r]	*Plegadis chihi*					x
Turkey Vulture[r]	*Cathartes aura*	x	x	x	x	x
Osprey[r]	*Pandion haliaetus*	x		x		

Table 5 continued. Observations of all species by location, 2024.

		San Timoteo	Santa Ana River (SAR) - Upstream	Norco Bluffs (I-15 to River Rd., non-mitigation)	Santa Ana Canyon (SAC)	Other
Avian Species						
Common Name	**Scientific Name**					
White-tailed Kite[r]	*Elanus leucurus*					x
Northern Harrier[r]	*Circus hudsonius*		x			x
Sharp-shinned Hawk	*Accipiter striatus*		x			
Cooper's Hawk[r]	*Accipiter cooperii*	x	x	x	x	x
Bald Eagle[r]	*Haliaeetus leucocephalus*			x		x
Red-shouldered Hawk	*Buteo lineatus*	x	x	x	x	
Red-tailed Hawk	*Buteo jamaicensis*	x	x	x	x	
Barn Owl	*Tyto furcata*	x	x		x	
Western Screech-Owl	*Megascops kennicottii*			x		
Great Horned Owl	*Bubo virginianus*		x		x	
Belted Kingfisher	*Megaceryle alcyon*		x		x	
Acorn Woodpecker	*Melanerpes formicivorus*	x	x	x	x	
Downy Woodpecker[r]	*Dryobates pubescens*	x	x	x	x	
Nuttall's Woodpecker	*Dryobates nuttallii*	x	x	x	x	
Hairy Woodpecker	*Dryobates villosus*		x			
Northern Flicker	*Colaptes auratus*	x	x	x	x	
American Kestrel	*Falco sparverius*	x	x	x	x	
Peregrine Falcon[r]	*Falco peregrinus*					x
Red-crowned Parrot[i]	*Amazona viridigenalis*				x	
Red-lored Parrot[i]	*Amazona autumnalis*				x	
Ash-throated Flycatcher	*Myiarchus cinerascens*	x	x	x	x	
Cassin's Kingbird	*Tyrannus vociferans*	x	x	x	x	
Western Kingbird	*Tyrannus verticalis*	x	x			
Western Wood-Pewee	*Contopus sordidulus*		x		x	
Willow Flycatcher[r]	*Empidonax traillii*		x		x	
Western Flycatcher	*Empidonax difficilis*		x		x	
Black Phoebe	*Sayornis nigricans*	x	x	x	x	
Say's Phoebe	*Sayornis saya*	x	x		x	
Vermilion Flycatcher	*Pyrocephalus rubinus*				x	
Least Bell's Vireo[r]	*Vireo bellii pusillus*	x	x	x	x	x
Hutton's Vireo	*Vireo huttoni*	x	x		x	
Cassin's Vireo	*Vireo cassinii*		x		x	
Warbling Vireo	*Vireo gilvus*		x	x	x	
Loggerhead Shrike[r]	*Lanius ludovicianus*					x
California Scrub-Jay	*Aphelocoma californica*	x	x		x	
American Crow	*Corvus brachyrhynchos*	x	x	x	x	
Common Raven	*Corvus corax*	x	x	x	x	
California Horned Lark[r]	*Eremophila alpestris actia*		x			x
Tree Swallow[r]	*Tachycineta bicolor*			x	x	x
Violet-green Swallow	*Tachycineta thalassina*			x	x	
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*	x	x	x	x	

Table 5 continued. Observations of all species by location, 2024.

		San Timoteo	Santa Ana River (SAR) - Upstream	Norco Bluffs (I-15 to River Rd., non-mitigation)	Santa Ana Canyon (SAC)	Other
Avian Species						
Common Name	**Scientific Name**					
Barn Swallow	*Hirundo rustica*		x	x	x	
Cliff Swallow	*Petrochelidon pyrrhonota*	x	x	x	x	
Bushtit	*Psaltriparus minimus*	x	x	x	x	
Red-whiskered Bulbul[i]	*Pycnonotus jocosus*				x	
Wrentit	*Chamaea fasciata*	x	x	x	x	
Ruby-crowned Kinglet	*Corthylio calendula*	x	x	x	x	
Cedar Waxwing	*Bombycilla cedrorum*				x	
Phainopepla	*Phainopepla nitens*	x	x	x	x	
White-breasted Nuthatch	*Sitta carolinensis*				x	
Blue-gray Gnatcatcher	*Polioptila caerulea*	x	x	x	x	
California Gnatcatcher[r]	*Polioptila californica*		x		x	x
Rock Wren	*Salpinctes obsoletus*		x		x	
Coastal Cactus Wren[r]	*Campylorhynchus brunneicapillus sandiegensis*					x
Bewick's Wren	*Thryomanes bewickii*	x	x	x	x	
Northern House Wren	*Troglodytes aedon*	x	x	x	x	
Marsh Wren	*Cistothorus palustris*			x		
California Thrasher	*Toxostoma redivivum*	x	x	x	x	
Northern Mockingbird	*Mimus polyglottos*	x	x		x	
European Starling[i]	*Sturnus vulgaris*	x			x	
Western Bluebird	*Sialia mexicana*	x	x	x	x	
Swainson's Thrush	*Catharus ustulatus*	x	x	x	x	
Hermit Thrush	*Catharus guttatus*		x		x	
American Robin	*Turdus migratorius*	x	x	x	x	
Scaly-breasted Munia[i]	*Lonchura punctulata*		x	x	x	
House Sparrow[i]	*Passer domesticus*	x	x		x	
House Finch	*Haemorhous mexicanus*	x	x	x	x	
Lesser Goldfinch	*Spinus psaltria*	x	x	x	x	
Lawrence's Goldfinch[r]	*Spinus lawrencei*	x	x		x	x
American Goldfinch	*Spinus tristis*	x	x	x	x	
Lark Sparrow	*Chondestes grammacus*				x	
Chipping Sparrow	*Spizella passerina*				x	
Dark-eyed Junco	*Junco hyemalis*				x	
White-crowned Sparrow	*Zonotrichia leucophrys*	x	x	x	x	
Bell's Sparrow[r]	*Artemisiospiza belli*					x
Song Sparrow	*Melospiza melodia*	x	x	x	x	
Lincoln's Sparrow[r]	*Melospiza lincolnii*		x			
California Towhee	*Melozone crissalis*	x	x	x	x	
Southern California Rufous-crowned Sparrow[r]	*Aimophila ruficeps canescens*		x		x	x
Green-tailed Towhee	*Pipilo chlorurus*		x			
Spotted Towhee	*Pipilo maculatus*	x	x	x	x	
Yellow-breasted Chat[r]	*Icteria virens*	x	x	x	x	x

Table 5 continued. Observations of all species by location, 2024.

		San Timoteo	Santa Ana River (SAR) - Upstream	Norco Bluffs (I-15 to River Rd., non-mitigation)	Santa Ana Canyon (SAC)	Other
Avian Species						
Common Name	**Scientific Name**					
Yellow-headed Blackbird[r]	*Xanthocephalus xanthocephalus*					x
Western Meadowlark	*Sturnella neglecta*		x			
Hooded Oriole	*Icterus cucullatus*	x	x	x	x	
Bullock's Oriole	*Icterus bullockii*	x			x	
Red-winged Blackbird	*Agelaius phoeniceus*	x	x	x	x	
Tricolored Blackbird[r]	*Agelaius tricolor*					x
Brown-headed Cowbird[i]	*Molothrus ater*	x	x		x	
Great-tailed Grackle	*Quiscalus mexicanus*	x	x			
Orange-crowned Warbler	*Leiothlypis celata*	x	x	x	x	
Nashville Warbler[r]	*Leiothlypis ruficapilla*					x
MacGillivray's Warbler[r]	*Geothlypis tolmiei*					x
Common Yellowthroat	*Geothlypis trichas*	x	x	x	x	
Yellow Warbler[r]	*Setophaga petechia*	x	x	x	x	x
Yellow-rumped Warbler	*Setophaga coronata*	x	x	x	x	
Black-throated Gray Warbler	*Setophaga nigrescens*		x			
Townsend's Warbler	*Setophaga townsendi*		x		x	
Wilson's Warbler[r]	*Cardellina pusilla*	x	x	x	x	x
Western Tanager	*Piranga ludoviciana*				x	
Northern Cardinal[i]	*Cardinalis cardinalis*				x	
Black-headed Grosbeak	*Pheucticus melanocephalus*	x	x	x	x	
Blue Grosbeak	*Passerina caerulea*	x	x		x	
Lazuli Bunting	*Passerina amoena*		x		x	
Mammalian Species (tracks/other evidence used)						
Common Name	**Scientific Name**					
Virginia Opossum[i]	*Didelphis virginiana*		x	x		
San Diego Black-tailed Jackrabbit[r]	*Lepus californicus bennettii*					x
Desert Cottontail	*Sylvilagus audubonii*	x	x	x	x	
Broad-footed Mole	*Scapanus latimanus*			x		
Unknown Bat	*Chiroptera sp.*		x			
Feral Dog[i]	*Canis familiaris*		x			
Coyote[r]	*Canis latrans*	x	x	x	x	x
Gray Fox	*Urocyon cinereoargenteus*				x	
Feral Cat[i]	*Felis catus*		x			
Bobcat[r]	*Lynx rufus*		x	x		x
Striped Skunk	*Mephitis mephitis*	x	x		x	
Long-tailed Weasel[r]	*Mustela frenata*	x			x	
American Black Bear	*Ursus americanus*	x				
Raccoon	*Procyon lotor*	x	x	x	x	
Feral Donkey[i]	*Equis asinus*	x				
Mule Deer	*Odocoileus hemionus*	x			x	
Feral Pig[i]	*Sus scrofa*	x	x	x		

Table 5 continued. Observations of all species by location, 2024.

		San Timoteo	Santa Ana River (SAR) - Upstream	Norco Bluffs (I-15 to River Rd., non-mitigation)	Santa Ana Canyon (SAC)	Other
Mammalian Species (tracks/other evidence used)						
Common Name	**Scientific Name**					
California Vole	*Microtus californicus*		x			
Dusky-footed Woodrat	*Neotoma fuscipes*				x	
Woodrat - Unknown	*Neotoma sp.*	x	x		x	
North American Deer Mouse	*Peromyscus maniculatus*				x	
Botta's Pocket Gopher	*Thomomys bottae*	x	x		x	
California Ground Squirrel	*Otospermophilus beecheyi*	x	x	x	x	
Western Gray Squirrel	*Sciurus griseus*	x				
Eastern Fox Squirrel[i]	*Sciurus niger*		x	x	x	
Herpetofauna Species						
Common Name	**Scientific Name**					
Western Toad	*Anaxyrus boreas*		x	x	x	
Baja California Treefrog	*Pseudacris hypochondriaca*	x	x	x	x	
American Bullfrog[i]	*Lithobates catesbeianus*		x	x	x	
Southern Alligator Lizard	*Elgaria multicarinata*	x	x	x	x	
Belding's Orange-throated Whiptail[r]	*Aspidoscelis hyperthra beldingii*	x				x
San Diegan Tiger Whiptail[r]	*Aspidoscelis tigris stejnegeri*	x	x		x	x
Blainville's Horned Lizard[r]	*Phrynosoma blainvillii*		x			
Western Fence Lizard	*Sceloporus occidentalis*	x	x	x	x	
Granite Spiny Lizard[r]	*Sceloporus orcutti*		x			x
Western Skink	*Plestiodon skiltonianus*		x			
Western Side-blotched Lizard	*Uta stansburiana elegans*	x	x	x	x	
Rosy Boa	*Lichanura orcuttii*					
Red Racer/Coachwhip	*Coluber flagellum*	x	x		x	
California Striped Racer	*Coluber lateralis lateralis*				x	
California Kingsnake	*Lampropeltis californiae*		x			
San Diego Gopher Snake	*Pituophis catenifer annectens*	x	x		x	
Southern Pacific Rattlesnake	*Crotalus oreganus helleri*	x			x	
Red Diamond Rattlesnake[r]	*Crotalus ruber*					x
Red-eared Slider[i]	*Trachemys scripta elegans*	x	x	x	x	
Fish Species						
Common Name	**Scientific Name**					
Common Carp[i]	*Cyprinus carpio*		x		x	
Mosquitofish[i]	*Gambusia affinis*		x	x		
Green Sunfish[i]	*Lepomis cyanellus*		x			
Largemouth Bass[i]	*Micropterus salmoides*			x		

[1] - Includes detections of sensitive species at sampled and incidental locations. Observations have been reported to CNDDB.

[i] = invasive or non-native

[r] = 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 12, 2024 to September 19, 2024.

Table 6. Brown-headed Cowbird trapping results, April-July 2024 (grouped by funding source).

Funding Source	Site Name	Trap/Location	2024 Dates of Operation	Number of Trap Days	Cowbirds Removed				Daily Removed Averages	
					Total	Male	Female	Juveniles	Adults	All
USFWS/USACE/SARM Project										
	San Jacinto	Alta	4/2 - 6/28	40	**-5**	-2	-4	1	-0.15	-0.13
		SJWA E1	4/11 - 6/4	46	**75**	25	50	0	1.63	1.63
	Subtotal			**86**	**70**	**23**	**46**	**1**	**0.80**	**0.81**
	Mockingbird Canyon	Mariposa	4/1 - 7/10	82	**12**	9	3	0	0.15	0.15
		Reservoir	4/2 - 7/10	82	**15**	8	5	2	0.16	0.18
	Subtotal			**164**	**27**	**17**	**8**	**2**	**0.15**	**0.16**
	Prado/Chino Hills	Cuckoo Pond	4/4 - 7/11	89	**-4**	-1	-3	0	-0.04	-0.04
		IEUA	4/2 - 7/12	95	**15**	10	5	0	0.16	0.16
		Prado Regional Park	4/2 - 6/12	49	**2**	0	2	0	0.04	0.04
	Subtotal			**233**	**13**	**9**	**4**	**0**	**0.06**	**0.06**
	Temescal	Baker	4/1 - 7/11	59	**9**	6	3	0	0.15	0.15
		New Sump	4/2 - 7/11	58	**18**	16	2	0	0.31	0.31
		Rockery	4/1 - 7/11	59	**4**	1	3	0	0.07	0.07
	Subtotal			**176**	**31**	**23**	**8**	**0**	**0.18**	**0.18**
	San Jacinto, Prado and Lake Elsinore Dairies	Dyt	4/2 - 7/12	85	**72**	32	30	10	0.73	0.85
		Scott Bros	4/2 - 7/12	86	**400**	293	76	31	4.29	4.65
		Tuls 1	4/2 - 7/12	85	**220**	185	15	20	2.35	2.59
		Euclid 1	4/2 - 7/12	93	**220**	124	86	10	2.26	2.37
		Euclid 2	4/2 - 7/12	89	**203**	115	84	4	2.24	2.28
		Dejongs	4/1 - 7/12	102	**152**	86	65	1	1.48	1.49
	Subtotal			**540**	**1,267**	**835**	**356**	**76**	**2.21**	**2.35**
	Santa Ana Canyon	Chino Hills State Park	4/4 - 7/11	91	**1**	0	1	0	0.01	0.01
		Green River Golf Maintenance	4/1 - 7/11	94	**35**	22	13	0	0.37	0.37
		Green River Golf West	4/1 - 5/7	31	**-2**	-1	-1	0	-0.06	-0.06
		RV Park E	4/2 - 7/10	92	**0**	0	0	0	0.00	0.00
		Yorba Park	4/2 - 7/10	92	**-1**	0	-1	0	-0.01	-0.01
	Subtotal			**400**	**33**	**21**	**12**	**0**	**0.08**	**0.08**
	TOTAL (USFWS/USACE/SARM)			**1,599**	**1,441**	**928**	**434**	**79**	**0.85**	**0.90**
OCWD										
	Anaheim	Conrock	4/5 - 7/9	88	**56**	22	27	7	0.56	0.64

Table 6 continued. Brown-headed Cowbird trapping results, April-July 2024 (grouped by funding source).

Funding Source	Site Name	Trap/Location	2024 Dates of Operation	Number of Trap Days	Cowbirds Removed				Daily Removed Averages	
					Total	Male	Female	Juveniles	Adults	All
OCWD										
		Huckleberry	4/5 - 7/9	88	**7**	2	4	1	0.07	0.08
	Subtotal			**176**	**63**	**24**	**31**	**8**	**0.31**	**0.36**
SBVMWD										
	Santa Ana River (upstream)	Anza	4/1 - 7/11	81	**0**	0	0	0	0.00	0.00
		Crestmore Manor 2	4/2 - 7/2	59	**4**	3	1	0	0.07	0.07
		Fairmount Park	4/2 - 7/12	81	**14**	8	4	2	0.15	0.17
		Goose Creek 2	4/2 - 7/10	73	**3**	1	2	0	0.04	0.04
		Hidden Valley South	4/1 - 7/10	77	**-6**	-3	-3	0	-0.08	-0.08
		Hidden Valley South-Habitat	4/3 - 6/4	51	**-6**	-2	-4	0	-0.12	-0.12
		Regional Lift Station	4/1 - 7/8	78	**14**	8	5	1	0.17	0.18
		Rivera	4/2 - 7/12	78	**1**	0	0	1	0.00	0.01
		Shelter	4/1 - 7/11	79	**6**	3	3	0	0.08	0.08
		Sunnyslope Lift Station	4/1 - 7/12	82	**0**	0	0	0	0.00	0.00
		Sunshine	4/1 - 7/10	71	**1**	1	0	0	0.01	0.01
	Subtotal			**810**	**31**	**19**	**8**	**4**	**0.03**	**0.04**
Brett Hamara/Lennar Homes										
	Santa Ana Canyon	Cielo Vista	5/1 - 7/10	68	**5**	2	3	0	0.07	0.07
	Subtotal			**68**	**5**	**2**	**3**	**0**	**0.07**	**0.07**
IERCD/SAWA										
	San Timoteo	Bees 2	4/2 - 6/27	71	**0**	0	0	0	0.00	0.00
		Buffalo Meadows	4/2 - 6/27	71	**1**	1	0	0	0.01	0.01
		Fisherman's Retreat	4/2 - 6/28	65	**20**	10	10	0	0.31	0.31
		Harned	4/2 - 6/27	68	**5**	4	1	0	0.07	0.07
		Younglove	4/2 - 6/28	70	**4**	2	2	0	0.06	0.06
	Subtotal			**345**	**30**	**17**	**13**	**0**	**0.09**	**0.09**
Rivers and Lands Conservancy										
	Meridian Conservation Area	Meridian 1	4/1 - 7/10	82	**7**	1	6	0	0.09	0.09
		Meridian South	4/1 - 7/10	82	**-5**	-2	-3	0	-0.06	-0.06
	Subtotal			**164**	**2**	**-1**	**3**	**0**	**0.01**	**0.01**
	GRAND TOTAL			**3,162**	**1,572**	**989**	**492**	**91**	**0.47**	**0.50**
	***TOTAL BHCO FIELD HOURS**		**2,547**							

*hours also include installation and removal of traps from field

Table 7. Non-target avian captures in Brown-headed Cowbird traps, April-July 2024.

2024 Non-target Species*		USFWS/USACE/SARM Project												OCWD		SBVMWD		Lennar Homes		IERCD		Rivers and Lands Conservancy		2024 Total	
		San Jacinto		Mockingbird Canyon		Prado		Temescal		San Jacinto, Prado, and Lake Elsinore Dairies		Santa Ana Canyon		Anaheim		Santa Ana River (upstream)		Cielo Vista		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	caught	died
Mourning Dove	*Zenaida macroura*	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	**2**	**0**
Acorn Woodpecker	*Melanerpes formicivorus*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	**1**	**0**
Northern Flicker	*Colaptes auratus*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	**1**	**0**
Say's Phoebe	*Sayornis saya*	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**1**	**0**
Loggerhead Shrike	*Lanius ludovicianus*	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**1**	**0**
California Scrub-Jay	*Aphelocoma californica*	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**1**	**0**
Bewick's Wren	*Thryomanes bewickii*	0	0	0	0	0	0	4	2	0	0	2	0	0	0	6	2	0	0	3	0	0	0	**15**	**4**
Northern House Wren	*Troglodytes aedon*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	2	0	0	0	0	0	0	**3**	**2**
California Thrasher	*Toxostoma redivivum*	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**1**	**0**
Northern Mockingbird	*Mimus polyglottos*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	2	0	0	5	0	0	0	**11**	**2**
House Finch	*Haemorhous mexicanus*	2	0	1	0	0	0	0	0	3	1	2	0	3	0	14	1	0	0	0	0	0	0	**25**	**2**
Lark Sparrow	*Chondestes grammacus*	31	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	21	0	**54**	**0**
Dark-eyed Junco	*Junco hyemalis*	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	**5**	**0**
Song Sparrow	*Melospiza melodia*	0	0	0	0	26	1	12	2	0	0	0	0	1	0	7	0	0	0	4	0	0	0	**50**	**3**
California Towhee	*Melozone crissalis*	46	1	77	1	1	0	17	0	0	0	63	1	0	0	214	0	8	1	254	5	122	1	**802**	**10**
Yellow-headed Blackbird	*Xanthocephalus xanthocephalus*	0	0	0	0	0	0	0	0	68	0	0	0	0	0	0	0	0	0	0	0	0	0	**68**	**0**
Hooded Oriole	*Icterus cucullatus*	0	0	0	0	0	0	1	0	0	0	0	0	2	0	2	0	0	0	3	1	0	0	**8**	**1**
Red-winged Blackbird	*Agelaius phoeniceus*	8	0	1	0	0	0	0	0	40	1	0	0	180	0	2	0	0	0	155	0	0	0	**386**	**1**
Tricolored Blackbird	*Agelaius tricolor*	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	**2**	**0**
Brewer's Blackbird	*Euphagus cyanocephalus*	1	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	**7**	**0**
Great-tailed Grackle	*Quiscalus mexicanus*	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	**2**	**0**
Black-headed Grosbeak	*Pheucticus melanocephalus*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	**1**	**0**
Unknown species	*n/a*	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	**1**	**1**
Exotic Non-targets																									
Zebra Finch	*Taenopygia guttata*	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	**2**	**0**
TOTAL		**90**	**1**	**81**	**1**	**28**	**1**	**35**	**4**	**121**	**2**	**74**	**2**	**189**	**0**	**256**	**7**	**8**	**1**	**425**	**6**	**143**	**1**	**1,450**	**26**
Number of Trap Days**		86		164		233		176		540		400		176		810		68		345		164		3,162	
#/Trap Day		1.05		0.49		0.12		0.20		0.22		0.19		1.07		0.32		0.12		1.23		0.87		0.46	
Mortality %		1.11%		1.23%		3.57%		11.43%		1.65%		2.70%		0.00%		2.73%		12.50%		1.41%		0.70%		1.79%	

*Number of dead non-targets included in number caught

**Trap days from total trap days for each route in Table 6

Exotic Nuisance Species Captures in Brown-headed Cowbird Traps, April-July 2024.

2024 Exotic Nuisance Species**		USFWS/USACE/SARM Project												OCWD		SBVMWD		Lennar Homes		IERCD/SBCTA		Rivers and Lands Conservancy		2024 Total	
		San Jacinto		Mockingbird Canyon		Prado		Temescal		Prado, San Jacinto, and Lake Elsinore Dairies		Santa Ana Canyon		Anaheim		Santa Ana River (upstream)		Cielo Vista		San Timoteo		Meridian C.A.			
Common Name	**Scientific Name**	released	removed	released	removed	released	removed	released	removed	released	removed	released	removed	released	removed	released	removed	released	removed	released	removed	released	removed	released	removed
European Starling	*Sturnus vulgaris*	0	1	0	0	2	2	0	4	483	126	0	2	65	3	34	0	0	0	6	1	0	0	**590**	**139**
House Sparrow	*Passer domesticus*	0	0	0	0	3	1	0	0	2	114	1	1	20	31	3	96	0	0	3	14	0	0	**32**	**257**
TOTAL		**0**	**1**	**0**	**0**	**5**	**3**	**0**	**4**	**485**	**240**	**1**	**3**	**85**	**34**	**37**	**96**	**0**	**0**	**9**	**15**	**0**	**0**	**622**	**396**

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

Table 8. Brown-headed Cowbird trapping results, winter 2023-2024.

Site Name	Trap/Location	Dates of Operation	Number of Trap Days	Cowbirds Removed				Daily Removed Averages	
				Total	Male	Female	Juveniles	Adults	All
San Jacinto	Dyt	7/17 - 3/29	112	218	28	125	65	1.37	1.95
	Scott Bros	7/17 - 3/29	102	2,406	1,106	681	619	17.52	23.59
	Tuls 1	7/17 - 3/29	109	877	254	248	375	4.61	8.05
Subtotal			**323**	**3,501**	**1,388**	**1,054**	**1,059**	**7.56**	**10.84**
Prado	Euclid 1	7/17 - 3/29	123	1,491	357	534	600	7.24	12.12
	Euclid 2	7/17 - 3/29	119	1,810	402	710	698	9.34	15.21
	Prado Regional Park	9/6 - 11/14	37	0	0	0	0	0.00	0.00
	Raahauges	9/6 - 11/14	37	0	0	0	0	0.00	0.00
Subtotal			**316**	**3,301**	**759**	**1,244**	**1,298**	**6.34**	**10.45**
Temescal	DeJongs	7/17 - 12/1	137	1,204	288	309	607	4.36	8.79
Subtotal			**137**	**1,204**	**288**	**309**	**607**	**4.36**	**8.79**
GRAND TOTAL			**776**	**8,006**	**2,435**	**2,607**	**2,964**	**6.50**	**10.32**

Table 9. Non-target avian captures in Brown-headed Cowbird traps, winter 2023-2024.

2023-2024 Winter Non-target Species*		San Jacinto		Prado		Temescal		Total	
Common Name	**Scientific Name**	**caught**	**died**	**caught**	**died**	**caught**	**died**	**caught**	**died**
Northern Mockingbird	*Mimus polyglottos*	0	0	3	0	0	0	3	0
House Finch	*Haemorhous mexicanus*	2	0	0	0	0	0	2	0
Song Sparrow	*Melospiza melodia*	0	0	1	0	0	0	1	0
California Towhee	*Melozone crissalis*	0	0	1	0	0	0	1	0
Yellow-headed Blackbird	*Xanthocephalus xanthocephalus*	21	0	1	0	12	0	34	0
Red-winged Blackbird	*Agelaius phoeniceus*	56	0	45	0	209	6	310	6
Tricolored Blackbird	*Agelaius tricolor*	3	0	0	0	0	0	3	0
Brewer's Blackbird	*Euphagus cyanocephalus*	4	0	2	0	0	0	6	0
Great-tailed Grackle	*Quiscalus mexicanus*	1	0	23	0	0	0	24	0
Exotic Non-targets									
None	*n/a*	0	0	0	0	0	0	0	0
TOTAL		**87**	**0**	**76**	**0**	**221**	**6**	**384**	**6**
Number of Trap Days**		323		316		137		776	
#/Trap Day		0.27		0.24		1.61		0.49	
Mortality %		0.00%		0.00%		2.71%		1.56%	

*Number of dead non-targets included in number caught

**Trap days from total trap days for each route in Table 8

Exotic nuisance species captures in Brown-headed Cowbird traps, winter 2023-2024.

2023-2024 Winter Exotic Nuisance Species		San Jacinto		Prado		Temescal		Total	
Common Name	**Scientific Name**	**released**	**removed**	**released**	**removed**	**released**	**removed**	**released**	**removed**
European Starling	*Sturnus vulgaris*	0	317	169	4	0	248	169	569
House Sparrow	*Passer domesticus*	2	64	1	81	0	1	3	146
TOTAL		**2**	**381**	**170**	**85**	**0**	**249**	**172**	**715**

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

APPENDIX A – SURVEY SITES, STARTING AND ENDING COORDINATES

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

Monitored Locations

Survey Site	Starting Coordinates	Ending Coordinates
San Timoteo Canyon:		
-Riverside County	487618, 3760678	499652, 3753988
-San Bernardino County	481628, 3764975	484320, 3763100
Santa Ana River (SAR):		
Riverside Ave. to Van Buren Blvd.	466416, 3765008	456998, 3758228
-Sunnyslope Restoration[6]	462397, 3759971	460117, 3759212
-Evans Lake Drain	464761, 3761889	464031, 3761150
-Anza/Old Ranch Creeks	462172, 3758697	459646, 3758831
Hidden Valley, south side of river	456067, 3758152	451089, 3757558
-Hidden Valley South - Restoration	456067, 3758152	454817, 3758428
-Hidden Valley South – Non-Restoration	454835, 3758920	451089, 3757558
Hidden Valley to River Rd[1]		
-SAR-Goose Creek, Norco to I-15	451560, 3758574	448772, 3756316
-Goose Creek Mitigation, Norco	451083, 3757763	450045, 3757296
-Norco Bluffs (I-15 to River Rd, non-mitigation)	448907, 3756725	444876, 3753717
Santa Ana Canyon (SAC):		
-Upper Canyon	441121, 3749692	438609, 3749795
-Green River Golf Club	438609, 3749795	436613, 3748409
-Featherly Park	436604, 3748585	430808, 3748480

Sampled Locations and Incidental Sighting Locations

Survey Site	Starting Coordinates	Ending Coordinates
Santa Ana River & Tributaries:		
Alessandro Arroyo/Prenda Arroyo	465500, 3754365	470391, 3751168
	465354, 3752493	468066, 3751913
Ambriz Park (Orange)[3]	420574, 3744672	420616, 3744503
Box Springs	471086, 3757494	472592, 3756430
Burris Basin[3]	419850, 3743943	419377, 3742243
Cajon Wash[2]	456784, 3796197	457285, 3791752
Canyon Crest[2]	468329, 3757116	468644, 3756933
Carbon Canyon (Chino Hills Pkwy)[2]	431500, 3760294	431143, 3759777
Carbon Canyon Regional Park	422957, 3752929	425648, 3754031
Castleview Park[2]	467826, 3755173	468565, 3754997
Chino Creek Wetlands Park	437600, 3758292	437225, 3758829
Chino Hills	438794, 3754812	429061, 3759386
Chino Hills State Park (Bane Cyn)	435061, 3757365	435376, 3753499
Chino Hills State Park (Lower Aliso Cyn)	438033, 3749528	435288, 3753302
Chino Hills State Park (Telegraph Cyn)	430805, 3753684	434834, 3753687
Chino Hills State Park (Upper Aliso Cyn)	435111, 3753336	433834, 3755029
Cielo Vista[3]	429825, 3750579	429883, 3750566
City Creek (Highland)[2]	482136, 3775290	482454, 3777612
Conrock Basin (FHQ)[3]	423314, 3746089	423465, 3746370

Sampled Locations and Incidental Sighting Locations (cont.)

Survey Site	Starting Coordinates	Ending Coordinates
Santa Ana River & Tributaries:		
Fresno Canyon[2]	440631, 3748012	440954, 3749370
Goldenstar[2]	465359, 3751458	466469, 3750869
Gum Grove Park[3]	398092, 3734916	398879, 3734923
Green River Stable Trap[2]	439347, 3748873	439347, 3748873
Harrison Reservoir (aka McAllister Creek)	460113, 3749435	460002, 3747712
Hidden Valley Golf Club	451611, 3752495	452390, 3753455
Hidden Valley, north side of river	456941, 3758360	451647, 3758651
Highway 71[2]	439575, 3753329	439937, 3752095
Huckleberry Basin[3]	423609, 3746463	424296, 3746653
La Sierra	457172, 3749115	457824, 3747117
Little Sand Basin[2]	478157, 3779714	478805, 3780527
Lower Hole Creek	457147, 3757662	456737, 3758025
Mead Valley (Cajalco/aqueduct)	471930, 3744796	469980, 3743887
Meridian CA (former March SKR Preserve)	471730, 3749646	473128, 3751158
Mills Pond	424328, 3746804	424563, 3746728
Mockingbird Canyon	460788, 3751123	469580, 3747044
Moreno Valley[2]	475810, 3758624	474960, 3759974
Murrieta Creek[2]	486516, 3705027	486516, 3705027
Norco Hills Park Mitigation[2]	449570, 3751384	449818, 3751233
Plunge Creek[3]	486953, 3774720	486987, 3775572
Poorman Reservoir	476434, 3758610	477243, 3757320
Pyrite Channel[2]	455758, 3761346	455222, 3760761
Quail Run[3]	469907, 3757374	471038, 3757541
Riverside (Van Buren at Jurupa)[3]	457145, 3757620	457172, 3757560
Ryan Bonaminio Park	463782, 3759521	463195, 3759424
San Bernardino Flood Control[2]	468779, 3767632	471561, 3769060
Scully Hill[3]	437516, 3748472	437393, 3748746
Sun Canyon Park[2]	454614, 3749211	454788, 3749119
Sycamore Canyon	470209, 3757079	473184, 3753080
Talbert Park (Orange County)[2]	411679, 3722998	411932, 3723803
Temescal Canyon	471444, 3720561	450812, 3746987
Tequesquite Arroyo[2]	467671, 3756303	468003, 3757103
Tin Mine Road[2]	455337, 3747953	455530, 3744748
Van Buren Blvd. (Bountiful)	469382, 3749787	469934, 3750036
Van Buren (Porter Road)[2]	467009, 3749689	466421, 3750042
Wardlow Wash[2]	442819, 3748289	441873, 3749262
Weeping Willow[3]	420733, 3744845	421094, 3745093
Woodcrest[2]	464548, 3751638	464847, 3751471
Wyle Labs (at El Paso only)	450013, 3751824	451585, 3752523
Yorba Linda (San Antonio Rd)[2]	429199, 3750653	429494, 3751473
Yorba Linda (Starlight Dr.)	431058, 3749142	431153, 3750250
Yorba Linda Lakebed Park[2]	424692, 3749150	425273, 3748223
San Jacinto River Sub-watershed:		
San Jacinto:		
-San Jacinto River	506079, 3738423	493412, 3746014
-San Jacinto Wildlife Area	488055, 3745444	490979, 3750919
Cottonwood Canyon	475769, 3725678	477572, 3723954

Sampled Locations and Incidental Sighting Locations (cont.)

Survey Site	Starting Coordinates	Ending Coordinates
San Jacinto River Sub-watershed:		
Kabian Park[2]	478467, 3734032	475650, 3730501
Lake Perris	483092, 3744484	485461, 3748329
Menifee (Salt Creek)	478298, 3726507	479627, 3727241
Wolfskill[3]	498077, 3748108	497980, 3747499
Santiago Creek Sub-watershed:		
Irvine Lake	435290, 3737601	432859, 3736658
Irvine Trust Management Area	429808, 3738428	429834, 3738307
Limestone Canyon[2]	434012, 3736548	434897, 3735784
Peter's Canyon	429752, 3738563	428604, 3735584
Santiago Basin	424716, 3740614	425842, 3741365
Santiago Canyon (Irvine Park)	430063, 3740268	428977, 3741769
Santiago Creek (above Irvine Lake)	437228, 3736131	435312, 3737614
Santiago Creek (Cambridge Road)[2]	421800, 3737876	421425, 3737985
Santiago Creek (Chapman Ave.)[3]	423094, 3738524	423849, 3739651
Santiago Canyon (Lower Channel)[2]	419351, 3737174	417489, 3736996
Santiago Oaks Regional Park (to Cannon Rd)[4]	426419, 3741900	428961, 3742024
Silverado Canyon[2]	437692, 3734768	438878, 3734047
Smith Basin[4]	425362, 3741441	426377, 3741912

[l] 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.

[2] Denotes sites that were not surveyed this year.

[3] Incidental observations of LBVI at this site.

[4] Beginning 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 the area up to Cannon Road.

[5] In 2017, Rancho La Sierra West was added to SAR – Upstream, Hidden Valley south side of the river.

[6] In 2023, Sunnyslope was broken out into its own unique survey area from the larger Santa Ana River Riverside Ave to Van Buren Blvd. site.

APPENDIX B: WATERSHED-WIDE ANNUAL RESULTS, 2000-2024

Appendix B-1. Least Bell's Vireo reproductive success and breeding biology data at monitored and select sampled sites in the Santa Ana River Watershed, 2000-2024 (sites vary by year).

	Parameter	2000-2019	2020	2021	2022	2023	2024	Combined
A.	Number of territorial males	n/a	1,293	1,096	894	733	771	n/a
B.	Number of known pairs	6,341	714	630	517	435	444	9,081
C.	Number of known breeding (nesting) pairs	5,301	590	510	443	373	379	7,596
D.	Number of breeding pairs that were well-monitored throughout the season	1,772	247	189	190	106	145	2,649
E.	Number of known fledged young observed	10,119	1,202	864	872	902	839	14,798
F.	Number of known fledged young produced by pairs monitored throughout the breeding season	5,064	692	494	507	457	485	7,699
G.	Average number of fledglings produced per breeding pair (minimum; E/C = 'productivity or breeding success')	1.9	2.0	1.7	2.0	2.4	2.2	1.9
H.	Average number of fledglings produced by well-monitored pairs (F/D = reproductive success)	2.9	2.8	2.6	2.7	4.3	3.3	2.9
I.	Number of nests that were discovered	3,893	520	412	408	307	328	5,868
J.	Number of well-tracked nests	3,249	455	336	367	284	298	4,989
K.	Number of successful well-tracked nests	59% 1,911 / 3,249	53% 241 / 455	52% 174 / 336	55% 203 / 367	63% 179 / 284	62% 186 / 298	58% 2,894 / 4,989
L.	Rate of cowbird parasitism (well-tracked nests)[1]	9% 302 / 3,201	8% 32 / 384	11% 30 / 278	7% 21 / 317	0% 0 / 249	0% 0 / 261	8% 385 / 4,690
	A. Number of well-tracked nests that failed as a result of reproductive failure	5% 152 / 3,249	4% 17 / 455	7% 22 / 336	2% 6 / 367	2% 5 / 284	3% 8 / 298	4% 210 / 4,989
	B. Number of well-tracked nests that failed as a result of parasitism	3% 98 / 3,249	2% 8 / 455	2% 7 / 336	2% 7 / 367	0% 0 / 284	0% 0 / 298	2% 120 / 4,989
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	33% 1075 / 3,249	36% 165 / 455	36% 120 / 336	35% 128 / 367	29% 83 / 284	28% 84 / 298	33% 1,655 / 4,989
M.	D. Number of well-tracked nests that failed for unknown reasons	<1% 13 / 3,249	5% 24 / 455	4% 13 / 336	6% 23 / 367	6% 17 / 284	7% 20 / 298	2% 110 / 4,989
N.	Average clutch size	n/a	3.6	3.5	3.4	3.7	3.6	n/a
O.	Number of cowbird eggs or nestlings found in or near vireo nests	375	35	39	22	0	0	471
P.	Number of 'manipulated' parasitized nests[2]	248	30	26	14	n/a	n/a	318
Q.	Number of successful 'manipulated' nests[2]	45% 112 / 248	33% 10 / 30	62% 16 / 26	50% 7 / 14	n/a	n/a	46% 145 / 318
R.	Number of vireo fledged from 'manipulated' nests[2]	242	21	35	19	n/a	n/a	317
S.	Number of cowbird young fledged by vireo observed	18	0	0	0	0	0	18
T.	Number of repaired nests[2]	47	16	10	11	11	13	108
U.	% of successful repaired nests	68% 32 / 47	63% 10 / 16	40% 4 / 10	45% 5 / 11	91% 10 / 11	69% 9 / 13	65% 70 / 108
V.	Number of vireo fledged from repaired nests	89	27	9	11	28	27	191
W.	Number of cowbirds removed from study area[3]	41,605	2,292	1,987	848	185	88	47,005
X.	Number of trap days (1 operative trap day in the field for one day = 1 trap day)[3]	92,117	3,581	4,619	3,165	1,821	1,476	106,779
Y.	Average number of cowbirds trapped per day (W/X)	0.45	0.64	0.43	0.27	0.10	0.06	0.44

[1] Starting in 2019, SAWA adjusted the parasitism rate to exclude "well-tracked" nests that were depredated or otherwise failed before it could be determined if they had been parasitized (Pike et al., 1999; Sharp & Kus, 2006).

[2] Only well-tracked nests are counted for these parameters

[3] All traps are not accounted for in this total. See Table 6.

Appendix B-2. Least Bell's Vireo nest placement preferences at closely monitored and select sampled sites in the Santa Ana River Watershed, 2000-2024.

Host Plant Species (listed alphabetically by scientific name)	2000-2019	2020	2021	2022	2023	2024	Combined	Percentage of Combined
Bank Catclaw[e] (*Acacia redolens*)	1						1	<1%
Boxelder (*Acer negundo*)	2						2	<1%
Tree of Heaven[ie] (*Ailanthus altissima*)	3						3	<1%
White Alder (*Alnus rhombifolia*)	2						2	<1%
Western False Indigo (*Amorpha fruticosa*)	2						2	<1%
Fiddleneck sp. (*Amsinckia* sp.)	1						1	<1%
Wild Celery[e] (*Apium graveolens*)	1						1	<1%
California Sagebrush (*Artemisia californica*)	2		1	1	4	1	9	<1%
Douglas' Sagewort (*Artemisia douglasiana*)	26	2	2		1		31	1%
Giant Reed[ie] (*Arundo donax*)	3	1	4	4	1	4	17	<1%
Fourwing Saltbush (*Atriplex canescens*)	4	1					5	<1%
Big Saltbush (*Atriplex lentiformes*)	0		2		1		3	<1%
Coyote Brush (*Baccharis pilularis*)	30	5	6	6	1	3	51	1%
Mulefat (*Baccharis salicifolia*)	1,019	106	89	102	82	81	1,479	26%
Willow Baccharis (*Baccharis salicina*)	3						3	<1%
Desertbroom Baccharis (*Baccharis sarothroides*)	1						1	<1%
Bougainvillea sp.[e] (*Bougainvillea* sp.)	0					1	1	<1%
Black Mustard[ie] (*Brassica nigra*)	19	3	1		4	5	32	1%
Yellowspine Thistle[ie] (*Cirsium ochrocentrum*)	2						2	<1%
Orange Tree[e] (*Citrus sinensis*)	3	1			4	4	12	<1%
Poison Hemlock[ie] (*Conium maculatum*)	17	12		3	8	11	51	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, 2000-2024.

Host Plant Species (listed alphabetically by scientific name)	2000-2019	2020	2021	2022	2023	2024	Combined	Percentage of Combined
Carrotwood[e] (*Cupaniopsis anacardioides*)	0	1			1		2	<1%
Brittlebush (*Encelia farinosa*)	3					1	4	<1%
Thickleaf Yerba Santa (*Eriodictyon crassifolium*)	3		1	2	2	6	14	<1%
Yerba Santa sp. (*Eriodictyon* sp.)	1						1	<1%
Fig[e] (*Ficus carica*)	0					1	1	<1%
Fig[e] (*Ficus* sp.)	1						1	<1%
Shamel Ash[e] (*Fraxinus udei*)	0			1			1	<1%
Arizona Ash (*Fraxinus velutina*)	0	1		1			2	<1%
Ash sp. (*Fraxinus* sp.)	1	3	2	1	2	1	10	<1%
Common Sunflower (*Helianthus annuus*)	1	1				1	3	<1%
Toyon (*Heteromeles arbutifolia*)	29					1	30	1%
Coast Goldenbush (*Isocoma menziesii*)	0			1			1	<1%
Southern California Black Walnut[r] (*Juglans californica*)	19	2	1	1		1	24	<1%
Summer Cypress[e] (*Kochia scoparia*)	0	1					1	<1%
Perennial Pepperweed[ie] (*Lepidium latifolium*)	8	2		1			11	<1%
Privet sp.[e] (*Ligustrum* sp.)	2						2	<1%
Chaparral Mallow (*Malacothamnus fasciculatus*)	1	2			3	1	7	<1%
Bush mallow sp. (*Malacothamnus* sp.)	0		1				1	<1%
Laurel Sumac (*Malosma laurina*)	37	11	9	7	9	11	84	1%
Wild Cucumber (*Marah macrocarpa*)	0	1					1	<1%
White Mulberry[e] (*Morus alba*)	3	2	2	1			8	<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, 2000-2024.

Host Plant Species (listed alphabetically by scientific name)	2000-2019	2020	2021	2022	2023	2024	Combined	Percentage of Combined
Lollypop Tree[ie] (*Myoporum laetum*)	1						1	<1%
Tree Tobacco[ie] (*Nicotiana glauca*)	4	1				2	7	<1%
Olive[e] (*Olea europaea*)	1						1	<1%
Blue Palo Verde (*Parkinsonia florida*)	1	1					2	<1%
Western Sycamore (*Platanus racemosa*)	13	4	10	5		2	34	1%
Arrowweed (*Pluchea sericea*)	7	2		2			11	<1%
Cape Leadwort[e] (*Plumbago auriculata*)	2				1		3	<1%
Black Cottonwood (*Populus balsamifera* ssp. *trichocarpa*)	3			1			4	<1%
Fremont Cottonwood (*Populus fremontii*)	164	45	33	36	17	15	310	5%
Holly Leaf Cherry (*Prunus ilicifolia*)	1	1					2	<1%
Spanish False Fleabane[e] (*Pulicaria paludosa*)	0		1				1	<1%
Callery Pear[e] (*Pyrus calleryana*)[1]	1	1		3		1	6	<1%
Coast Live Oak (*Quercus agrifolia*)	2		3	2		2	9	<1%
California Scrub Oak (*Quercus berberidifolia*)	8	4	2	1		1	16	<1%
Oak sp. (*Quercus* sp.)	1						1	<1%
Fragrant Sumac (*Rhus aromatica*)	1						1	<1%
Sugar Sumac (*Rhus ovata*)	3					1	4	<1%
Golden Currant (*Ribes aureum)*	5						5	<1%
Castor bean[ie] (*Ricinus communis*)	2					1	3	<1%
Coulter's Matilija Poppy[r] (*Romneya coulteri*)	1						1	<1%
California Wild Rose (*Rosa californica*)	10	1	2		2		15	<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, 2000-2024.

Host Plant Species (listed alphabetically by scientific name)	2000-2019	2020	2021	2022	2023	2024	Combined	Percentage of Combined
California Blackberry (*Rubus ursinus*)	3	5	6	6		2	22	<1%
Narrowleaf Willow (*Salix exigua*)	199	43	28	15	10	19	314	5%
Goodding's Black Willow (*Salix gooddingii*)	408	35	40	29	10	15	537	9%
Red Willow (*Salix laevigata*)	363	35	34	38	28	25	523	9%
Pacific Willow (*Salix lasiandra)*	21	6	3		8	10	48	1%
Arroyo Willow (*Salix lasiolepis*)	734	98	69	86	56	49	1,092	19%
Willow sp. (*Salix* sp.)	16	3	5		1	1	26	<1%
Black Sage (*Salvia mellifera*)	2						2	<1%
Blue Elderberry (*Sambucus mexicana*)	217	30	20	10	22	18	317	5%
Peruvian Pepper Tree[ie] (*Schinus molle*)	20	3	3	3	1	2	32	1%
Brazilian Pepper Tree[ie] (*Schinus terebinthifolius*)	1						1	<1%
African Sumac[e] (*Searsia lancia*)	0					2	2	<1%
Milk Thistle[ie] (*Silybum marianum*)	1						1	<1%
Tamarisk[ie] (*Tamarix ramosissima*)	21	7	2	5	1		36	1%
Poison Oak (*Toxicodendron diversilobum*)	25	3	3	4	4	1	40	1%
Chinese Elm[e] (*Ulmus parvifolia*)	1						1	<1%
Hoary Nettle (*Urtica dioica*)	2						2	<1%
Desert Wild Grape (*Vitis girdiana*)	193	21	18	22	19	22	295	5%
Rough Cockelburr (*Xanthium strumarium*)	2						2	<1%
Fresh water reed (*Typha* sp.) and Arroyo Willow (*S. lasiolepis*)	1						1	<1%
Desert Wild Grape (*V. girdiana*) and Goodding's Black Willow (*S. gooddingii*)	2						2	<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, 2000-2024.

Host Plant Species (listed alphabetically by scientific name)	2000-2019	2020	2021	2022	2023	2024	Combined	Percentage of Combined
Desert Wild Grape (*V. girdiana*) and Arroyo Willow (*S. lasiolepis*)	1						1	<1%
Desert Wild Grape (*V. girdiana*) and California Wild Rose (*R. californica*)	1						1	<1%
Desert Wild Grape (*V. girdiana*) and Peruvian Pepper Tree[ie] (*S. molle*)	1						1	<1%
Desert Wild Grape (*V. girdiana*) and Mulefat (*B. salicifolia*)	5						5	<1%
Desert Wild Grape (*V. girdiana*) and Blue Elderberry (*S. n. caerulea*)	1						1	<1%
Dead Goodding's Black Willow (*S. gooddingii*) and Hoary Nettle (*U. dioica*)	1						1	<1%
Goodding's Black Willow (*S. gooddingii*) and Perennial Pepperweed[ie] (*L. latifolium*)	1						1	<1%
Goodding's Black Willow (*S. gooddingii*) and Poison Hemlock[ie] (*C. maculatum*)	1						1	<1%
Goodding's Black Willow (*S. gooddingii*) and Blue Elderberry (*S. n. caerulea*)	1						1	<1%
Red Willow (*S. laevigata*) and Wild Cucumber (*Marah macrocarpa*)	1						1	<1%
Arroyo Willow (*S. lasiolepis*) and dead Hoary Nettle (*U. dioica*)	1						1	<1%
Arroyo Willow (*S. lasiolepis*) and Black Mustard[ie] (*B. nigra*)	1						1	<1%
Arroyo Willow (*S. lasiolepis*) and Sweet Fennel[ie] (*Foeniculum vulgare*)	1						1	<1%
Willow sp. (*Salix* sp.) and California Blackberry (*Rubus ursinus*)	1						1	<1%
Willow sp. (*Salix* sp.) and Perennial Pepperweed[ie] (*L. latifolium*)	1						1	<1%
Castor bean[ie] (*R. communis*) and Mulefat (*B. salicifolia*)	1						1	<1%
California Blackberry (*Rubus ursinus*) and dead unknown	0	1					1	<1%
Black Mustard[ie] (*B. nigra*) and Poison Hemlock[ie] (*C. maculatum*)	1						1	<1%
Black Mustard[ie] (*B. nigra*) and Mulefat (*B. salicifolia*)	1						1	<1%
Coyote Brush (*B. pilularis*) and Mulefat (*B. salicifolia*)	1						1	<1%
Mulefat (*B. salicifolia*) and Poison Hemlock[ie] (*C. maculatum*)	2						2	<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, 2000-2024.

Host Plant Species (listed alphabetically by scientific name)	2000-2019	2020	2021	2022	2023	2024	Combined	Percentage of Combined
Deadfall	5	6	7	5	2	2	27	<1%
Unknown/No data	78	6	2	3	2	1	92	2%
Total	**3,821**	**520**	**412**	**408**	**307**	**328**	**5,796**	**100%**

[1] Misidentified as *Cydonia oblonga* from 2019-21

[i] = invasive

[e] = non-native

[r] = endangered, threatened, or sensitive

Appendix B-3. Brown-headed Cowbird trapping effort and results, 2000-2024.

Parameter	2000-2019	2020	2021	2022	2023	2024	Combined**
Fall/Winter[1]							
Number of Traps	n/a	7	6	8	8	8	n/a
Number of Trap Days	n/a	639	722	977	725	776	n/a
Number of Males Removed	n/a	1,656	1,836	1,613	1,691	2,435	n/a
Number of Females Removed	n/a	1,506	2,347	2,427	2,105	2,607	n/a
Number of Juveniles Removed	n/a	1,626	2,515	1,006	5,708	2,964	n/a
Total Number of Cowbirds Removed	83,592	4,788	6,698	5,046	9,504	8,006	117,634
Spring/Summer[2]							
Number of Traps	n/a	44	50	51*	42	42	n/a
Number of Trap Days	n/a	4,925	6,217	5,674	3,476	3,162	n/a
Number of Males Removed	27,183	2,596	2,210	893	875	989	34,746
Number of Females Removed	12,029	1,003	1,395	376	428	492	15,723
Number of Juveniles Removed	4,515	358	150	195	117	91	5,426
Total Number of Cowbirds Removed	43,727	3,957	3,755	1,464	1,420	1,572	55,895
Total							
Number of Trap Days	n/a	5,564	6,939	6,651	4,201	3,938	n/a
Number of Cowbirds Removed	127,319	8,745	10,453	6,510	10,924	9,578	173,529
Average Number of Cowbirds Removed Per Day	n/a	1.57	1.51	0.98	2.60	2.43	n/a

*One trap in the Prado/Chino Hills area was relocated mid-season due to a persistent wasp infestation. GPS coordinates were recorded for 52 different trap locations; however, only 51 traps were concurrently in operation during the season.

**Cumulative totals are not provided if data for that parameter is not available for one or more years. Fall/Winter trapping "Total Number of Cowbirds Removed" included even though trapping did not occur until 2003.

[1]"Fall/Winter" for each year refers to the trapping period outside of vireo nesting season that ended in March of that year; i.e., "Winter 2022" reflects the trapping season that ran from August 2021 through March 2022.

[2]"Spring/Summer" refers to the trapping period during vireo nesting season from mid-March through August.

APPENDIX C: SUMMARY TABLES BY MANAGED SITE, 2000-2024

Appendix C-1-A. Least Bell's Vireo reproductive success and breeding biology data at survey sites in the Santa Ana River Watershed, California.

San Jacinto

	Parameter	2003-2019 (n=17 years)	2020	2021	2022	2023	2024	Combined
A.	Number of territorial males	n/a	108	91	73	84	87	n/a
B.	Number of known pairs	299	83	52	41	27	30	532
C.	Number of known breeding (nesting) pairs	255	72	27	36	23	23	436
D.	Number of breeding pairs that were well-monitored throughout the breeding season	83	29	0	6	0	0	118
E.	Number of known fledged young observed	495	145	24	53	22	16	755
F.	Number of known fledged young produced by pairs monitored throughout the season	230	77	n/a	10	n/a	n/a	317
G.	Average number of fledglings produced per breeding pair (minimum; E/C = 'productivity or breeding success')[1]	1.9	2.0	0.9	1.5	1.0	0.7	1.7
H.	Average number of fledglings produced by well- monitored pairs (F/D = reproductive success)	2.8	2.7	n/a	1.7	n/a	n/a	2.7
I.	Number of nests that were discovered	225	69	20	29	5	7	355
J.	Number of well-tracked nests	178	56	0	26	0	0	260
K.	Number of successful well-tracked nests	57% 102 / 178	63% 35 / 56	n/a	50% 13 / 26	n/a	n/a	58% 150 / 260
L.	Rate of cowbird parasitism (well-tracked nests)[2]	15% 24 / 162	15% 7 / 46	n/a	13% 3 / 24	n/a	n/a	15% 34 / 232
	A. Number of well-tracked nests that failed as a result of reproductive failure	4% 8 / 178	4% 2 / 56	n/a	8% 2 / 26	n/a	n/a	5% 12 / 260
	B. Number of well-tracked nests that failed as a result of parasitism	6% 11 / 178	4% 2 / 56	n/a	12% 3 / 26	n/a	n/a	6% 16 / 260
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	32% 57 / 178	27% 15 / 56	n/a	23% 6 / 26	n/a	n/a	30% 78 / 260
M.	D. Number of well-tracked nests that failed for unknown reasons	0% 0 / 178	4% 2 / 56	n/a	8% 2 / 26	n/a	n/a	2% 4 / 260
N.	Average clutch size	n/a	3.5	n/a	3.2	3.0	3.3	n/a
O.	Number of cowbird eggs or nestlings found in or near vireo nests	30	9	6	4	0	2	51
P.	Number of 'manipulated' parasitized nests[3]	20	7	n/a	0	n/a	n/a	29
Q.	Number of successful 'manipulated' nests[3]	50% 10 / 20	29% 2 / 7	n/a	n/a	n/a	n/a	41% 12 / 29
R.	Number of vireo fledged from 'manipulated' nests[3]	25	4	n/a	n/a	n/a	n/a	29
S.	Number of cowbird young fledged by vireo observed	7	0	0	0	0	1	8
T.	Number of repaired nests[3]	3	2	n/a	1	n/a	n/a	7
U.	% of successful repaired nests	100% 3 / 3	50% 1 / 2	n/a	0% 0 / 1	n/a	n/a	57% 4 / 7
V.	Number of vireo fledged from repaired nests	10	1	n/a	n/a	n/a	n/a	11
W.	Numbers of cowbirds removed from study area	26,460	1,674	1,376	716	781	762	31,769
X.	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	13,492	586	719	566	412	342	16,117
Y.	Average number of cowbirds trapped per trap day (W/X)	1.96	2.86	1.91	1.27	1.90	2.23	1.97

[1]Productivity numbers in a given year may be biased lower at some unmonitored sites due to low sample size as a consequence of variations in the frequency in which a site is visited.

[2] Starting in 2019, SAWA adjusted the parasitism rate to exclude "well-tracked" nests that were depredated or otherwise failed before it could be determined if they had been parasitized. (Pike et al., 1999; Sharp & Kus, 2006).

[3]Only well-tracked nests are counted for these parameters.

Appendix C-1-B. Least Bell's Vireo reproductive success and breeding biology data at survey sites in the Santa Ana River Watershed, California.

San Timoteo Canyon

	Parameter	2001-2019 (n=19 years)	2020	2021	2022	2023	2024	Combined
A.	Number of territorial males	n/a	139	118	98	96	112	n/a
B.	Number of known pairs	1,404	105	83	59	64	70	1,785
C.	Number of known breeding (nesting) pairs	1,187	86	69	51	59	62	1,514
D.	Number of breeding pairs that were well-monitored throughout the breeding season	565	58	43	34	35	41	776
E.	Number of known fledged young observed	2,616	207	149	118	170	155	3,415
F.	Number of known fledged young produced by pairs monitored throughout the season	1,717	173	117	96	143	119	2,365
G.	Average number of fledglings produced per breeding pair (minimum; E/C = 'productivity or breeding success')[1]	2.2	2.4	2.2	2.3	2.9	2.5	2.3
H.	Average number of fledglings produced by well- monitored pairs (F/D = reproductive success)	3.0	3.0	2.7	2.8	4.1	2.9	3.0
I.	Number of nests that were discovered	1,213	104	79	63	73	73	1,605
J.	Number of well-tracked nests	1,088	99	77	59	73	70	1,466
K.	Number of successful well-tracked nests	55% 601 / 1,088	52% 51 / 99	49% 38 / 77	61% 36 / 59	58% 42 / 73	61% 43 / 70	55% 811 / 1,466
L.	Rate of cowbird parasitism (well-tracked nests)[2]	12% 127 / 1,078	0% 0 / 85	0% 0 / 62	0% 0 / 46	0% 0 / 65	0% 0 / 62	9% 127 / 1,398
M.	A. Number of well-tracked nests that failed as a result of reproductive failure	5% 53 / 1,088	6% 6 / 99	9% 7 / 77	2% 1 / 59	3% 2 / 73	4% 3 / 70	5% 72 / 1,466
	B. Number of well-tracked nests that failed as a result of parasitism	3% 35 / 1,088	0% 0 / 99	0% 0 / 77	0% 0 / 59	0% 0 / 73	0% 0 / 70	2% 35 / 1,466
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	36% 396 / 1,088	34% 34 / 99	36% 28 / 77	32% 19 / 59	32% 23 / 73	30% 21 / 70	36% 521 / 1,466
	D. Number of well-tracked nests that failed for unknown reasons	<1% 3 / 1,088	8% 8 / 99	5% 4 / 77	5% 3 / 59	8% 6 / 73	4% 3 / 70	2% 27 / 1,466
N.	Average clutch size	n/a	3.6	3.6	3.4	3.7	3.6	n/a
O.	Number of cowbird eggs or nestlings found in or near vireo nests	150	0	0	0	0	0	150
P.	Number of 'manipulated' parasitized nests[3]	102	n/a	n/a	n/a	n/a	n/a	102
Q.	Number of successful 'manipulated' nests[3]	49% 50 / 102	n/a	n/a	n/a	n/a	n/a	49% 50 / 102
R.	Number of vireo fledged from 'manipulated' nests[3]	106	n/a	n/a	n/a	n/a	n/a	106
S.	Number of cowbird young fledged by vireo observed	2	0	0	0	0	0	2
T.	Number of repaired nests[3]	13	4	3	2	0	0	22
U.	% of successful repaired nests	54% 7 / 13	75% 3 / 4	33% 1 / 3	50% 1 / 2	n/a	n/a	55% 12 / 22
V.	Number of vireo fledged from repaired nests	21	11	3	1	n/a	n/a	36
W.	Numbers of cowbirds removed from study area	2,728	139	76	59	101	30	3,133
X.	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	15,701	700	758	676	442	345	18,622
Y.	Average number of cowbirds trapped per trap day (W/X)	0.17	0.20	0.10	0.09	0.23	0.09	0.17

[1]Productivity numbers in a given year may be biased lower at some unmonitored sites due to low sample size as a consequence of variations in the frequency in which a site is visited.

[2] Starting in 2019, SAWA adjusted the parasitism rate to exclude "well-tracked" nests that were depredated or otherwise failed before it could be determined if they had been parasitized. (Pike et al., 1999; Sharp & Kus, 2006).

[3]Only well-tracked nests are counted for these parameters.

Appendix C-1-C. Least Bell's Vireo reproductive success and breeding biology data at survey sites in the Santa Ana River Watershed, California.

Mockingbird Canyon

	Parameter	2003-2019 (n=17 years)	2020	2021	2022	2023	2024	Combined
A.	Number of territorial males	n/a	45	37	24	21	23	n/a
B.	Number of known pairs	322	17	16	4	8	9	376
C.	Number of known breeding (nesting) pairs	269	14	12	3	7	6	311
D.	Number of breeding pairs that were well-monitored throughout the breeding season	68	9	0	0	0	0	77
E.	Number of known fledged young observed	475	26	8	1	6	6	522
F.	Number of known fledged young produced by pairs monitored throughout the season	200	20	n/a	n/a	n/a	n/a	220
G.	Average number of fledglings produced per breeding pair (minimum; E/C = 'productivity or breeding success')[1]	1.8	1.9	0.7	0.3	0.9	1.0	1.7
H.	Average number of fledglings produced by well- monitored pairs (F/D = reproductive success)	2.9	2.2	n/a	n/a	n/a	n/a	2.9
I.	Number of nests that were discovered	197	18	5	3	0	0	223
J.	Number of well-tracked nests	169	17	0	2	n/a	n/a	188
K.	Number of successful well-tracked nests	52% 88 / 169	35% 6 / 17	n/a	0% 0 / 2	n/a	n/a	50% 94 / 188
L.	Rate of cowbird parasitism (well-tracked nests)[2]	11% 18 / 167	6% 1 / 17	n/a	0% 0 / 1	n/a	n/a	10% 19 / 185
	A. Number of well-tracked nests that failed as a result of reproductive failure	7% 12 / 169	6% 1 / 17	n/a	0% 0 / 2	n/a	n/a	7% 13 / 188
	B. Number of well-tracked nests that failed as a result of parasitism	4% 7 / 169	0% 0 / 17	n/a	0% 0 / 2	n/a	n/a	4% 7 / 188
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	36% 60 / 169	53% 9 / 17	n/a	100% 2 / 2	n/a	n/a	38% 71 / 188
M.	D. Number of well-tracked nests that failed for unknown reasons	1% 2 / 169	6% 1 / 17	n/a	0% 0 / 2	n/a	n/a	2% 3 / 188
N.	Average clutch size	n/a	3.6	n/a	3.0	n/a	n/a	n/a
O.	Number of cowbird eggs or nestlings found in or near vireo nests	31	1	0	0	n/a	n/a	32
P.	Number of 'manipulated' parasitized nests[3]	14	1	n/a	n/a	n/a	n/a	15
Q.	Number of successful 'manipulated' nests[3]	29% 4 / 14	0% 0 / 1	n/a	n/a	n/a	n/a	27% 4 / 15
R.	Number of vireo fledged from 'manipulated' nests[3]	8	0	n/a	n/a	n/a	n/a	8
S.	Number of cowbird young fledged by vireo observed	1	0	0	0	0	0	1
T.	Number of repaired nests[3]	3	0	n/a	0	n/a	n/a	3
U.	% of successful repaired nests	100% 3 / 3	n/a	n/a	n/a	n/a	n/a	100% 3 / 3
V.	Number of vireo fledged from repaired nests	7	n/a	n/a	n/a	n/a	n/a	7
W.	Numbers of cowbirds removed from study area	2,176	89	84	34	23	27	2,433
X.	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	10,971	500	529	422	178	164	12,764
Y.	Average number of cowbirds trapped per trap day (W/X)	0.20	0.18	0.16	0.08	0.13	0.16	0.19

[1]Productivity numbers in a given year may be biased lower at some unmonitored sites due to low sample size as a consequence of variations in the frequency in which a site is visited.

[2] Starting in 2019, SAWA adjusted the parasitism rate to exclude "well-tracked" nests that were depredated or otherwise failed before it could be determined if they had been parasitized. (Pike et al., 1999; Sharp & Kus, 2006).

[3]Only well-tracked nests are counted for these parameters.

Appendix C-1-D. Least Bell's Vireo reproductive success and breeding biology data at survey sites in the Santa Ana River Watershed, California.

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

	Parameter	2002-2019 (n=18 years)	2020	2021	2022	2023	2024	Combined
A.	Number of territorial males	n/a	128	154	161	145	135	n/a
B.	Number of known pairs	613	54	78	67	63	62	937
C.	Number of known breeding (nesting) pairs	493	43	55	52	50	47	740
D.	Number of breeding pairs that were well-monitored throughout the breeding season	126	0	8	11	2	3	150
E.	Number of known fledged young observed	834	55	58	90	71	73	1,181
F.	Number of known fledged young produced by pairs monitored throughout the season	320	n/a	6	32	7	11	376
G.	Average number of fledglings produced per breeding pair (minimum; E/C = 'productivity or breeding success')[1]	1.7	1.3	1.1	1.7	1.4	1.6	1.6
H.	Average number of fledglings produced by well- monitored pairs (F/D = reproductive success)	2.5	n/a	0.8	2.9	3.5	3.7	2.5
I.	Number of nests that were discovered	270	18	15	21	12	10	346
J.	Number of well-tracked nests	202	3	13	16	11	8	253
K.	Number of successful well-tracked nests	62% 125 / 202	0% 0 / 3	15% 2 / 13	63% 10 / 16	36% 4 / 11	50% 4 / 8	57% 145 / 253
L.	Rate of cowbird parasitism (well-tracked nests)[2]	17% 34 / 201	n/a	20% 2 / 10	0% 0 / 16	0% 0 / 8	0% 0 / 5	15% 36 / 240
M.	A. Number of well-tracked nests that failed as a result of reproductive failure	5% 10 / 202	0% 0 / 3	15% 2 / 13	0% 0 / 16	0% 0 / 11	0% 0 / 8	5% 12 / 253
	B. Number of well-tracked nests that failed as a result of parasitism	7% 14 / 202	0% 0 / 3	0% 0 / 13	0% 0 / 16	0% 0 / 11	0% 0 / 8	6% 14 / 253
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	26% 53 / 202	100% 3 / 3	54% 7 / 13	25% 4 / 16	55% 6 / 11	38% 3 / 8	30% 76 / 253
	D. Number of well-tracked nests that failed for unknown reasons	0% 0 / 202	0% 0 / 3	15% 2 / 13	13% 2 / 16	9% 1 / 11	13% 1 / 8	2% 6 / 253
N.	Average clutch size	n/a	n/a	3.2	3.4	3.7	3.8	n/a
O.	Number of cowbird eggs or nestlings found in or near vireo nests	40	0	2	0	0	0	42
P.	Number of 'manipulated' parasitized nests[3]	30	n/a	2	n/a	n/a	n/a	32
Q.	Number of successful 'manipulated' nests[3]	23% 7 / 30	n/a	0% 0 / 2	n/a	n/a	n/a	22% 7 / 32
R.	Number of vireo fledged from 'manipulated' nests[3]	18	n/a	0	n/a	n/a	n/a	18
S.	Number of cowbird young fledged by vireo observed	4	0	0	0	0	0	4
T.	Number of repaired nests[3]	1	0	0	0	1	0	2
U.	% of successful repaired nests	0% 0 / 1	n/a	n/a	n/a	0% 0 / 1	n/a	0% 0 / 2
V.	Number of vireo fledged from repaired nests	0	n/a	n/a	n/a	n/a	n/a	0
W.	Numbers of cowbirds removed from study area	822	25	46	51	39	33	1,016
X.	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	8,060	359	724	736	460	459	10,798
Y.	Average number of cowbirds trapped per trap day (W/X)	0.10	0.07	0.06	0.07	0.08	0.07	0.09

[1]Productivity numbers in a given year may be biased lower at some unmonitored sites due to low sample size as a consequence of variations in the frequency in which a site is visited.

[2] Starting in 2019, SAWA adjusted the parasitism rate to exclude "well-tracked" nests that were depredated or otherwise failed before it could be determined if they had been parasitized. (Pike et al., 1999; Sharp & Kus, 2006).

[3]Only well-tracked nests are counted for these parameters.

Appendix C-1-E. Least Bell's Vireo reproductive success and breeding biology data at survey sites in the Santa Ana River Watershed, California.

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

	Parameter	2000-2019 (n=20 years)	2020	2021	2022	2023	2024	Combined
A.	Number of territorial males	n/a	176	159	140	110	133	n/a
B.	Number of known pairs	719	102	118	91	79	109	1,218
C.	Number of known breeding (nesting) pairs	626	91	97	76	73	95	1,058
D.	Number of breeding pairs that were well-monitored throughout the breeding season	163	51	53	45	9	32	353
E.	Number of known fledged young observed	1143	187	200	180	172	200	2,082
F.	Number of known fledged young produced by pairs monitored throughout the season	472	126	156	134	45	113	1,046
G.	Average number of fledglings produced per breeding pair (minimum; E/C = 'productivity or breeding success')[1]	1.8	2.1	2.1	2.4	2.4	2.1	2.0
H.	Average number of fledglings produced by well- monitored pairs (F/D = reproductive success)	2.9	2.5	2.9	3.0	5.0	3.5	3.0
I.	Number of nests that were discovered	332	113	109	98	37	68	757
J.	Number of well-tracked nests	284	109	102	94	31	62	682
K.	Number of successful well-tracked nests	61% 174 / 284	46% 50 / 109	54% 55 / 102	51% 48 / 94	77% 24 / 31	68% 42 / 62	58% 393 / 682
L.	Rate of cowbird parasitism (well-tracked nests)[2]	6% 15 / 272	21% 18 / 86	22% 18 / 83	20% 16 / 82	0% 0 / 30	0% 0 / 57	11% 67 / 610
M.	A. Number of well-tracked nests that failed as a result of reproductive failure	3% 8 / 284	0% 0 / 109	3% 3 / 102	0% 0 / 94	0% 0 / 31	2% 1 / 62	2% 12 / 682
	B. Number of well-tracked nests that failed as a result of parasitism	2% 7 / 284	5% 5 / 109	5% 5 / 102	4% 4 / 94	0% 0 / 31	0% 0 / 62	3% 21 / 682
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	33% 93 / 284	43% 47 / 109	34% 35 / 102	35% 33 / 94	19% 6 / 31	19% 12 / 62	33% 226 / 682
	D. Number of well-tracked nests that failed for unknown reasons	1% 2 / 284	6% 7 / 109	4% 4 / 102	10% 9 / 94	3% 1 / 31	11% 7 / 62	4% 30 / 682
N.	Average clutch size	n/a	3.7	3.5	3.5	3.7	3.6	n/a
O.	Number of cowbird eggs or nestlings found in or near vireo nests	16	18	19	16	0	0	69
P.	Number of 'manipulated' parasitized nests[3]	9	17	14	12	n/a	n/a	52
Q.	Number of successful 'manipulated' nests[3]	78% 7 / 9	35% 6 / 17	71% 10 / 14	50% 6 / 12	n/a	n/a	56% 29 / 52
R.	Number of vireo fledged from 'manipulated' nests[3]	16	11	21	15	n/a	n/a	63
S.	Number of cowbird young fledged by vireo observed	0	0	0	0	0	0	0
T.	Number of repaired nests[3]	1	1	2	3	3	6	16
U.	% of successful repaired nests	100% 1 / 1	0% 0 / 1	50% 1 / 2	33% 1 / 3	100% 3 / 3	83% 5 / 6	69% 11 / 16
V.	Number of vireo fledged from repaired nests	3	0	2	1	10	14	30
W.	Numbers of cowbirds removed from study area	708	1	1	4	10	-11	713
X.	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	5,215	61	134	244	236	199	6,089
Y.	Average number of cowbirds trapped per trap day (W/X)	0.14	0.02	0.01	0.02	0.04	-0.06	0.12

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

[1]Productivity numbers in a given year may be biased lower at some unmonitored sites due to low sample size as a consequence of variations in the frequency in which a site is visited

[2] Starting in 2019, SAWA adjusted the parasitism rate to exclude "well-tracked" nests that were depredated or otherwise failed before it could be determined if they had been parasitized. (Pike et al., 1999; Sharp & Kus, 2006).

[3]Only well-tracked nests are counted for these parameters.

Appendix C-1-F. Least Bell's Vireo reproductive success and breeding biology data at survey sites in the Santa Ana River Watershed, California.

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

	Parameter	2001-2019 (n=19 years)	2020	2021	2022	2023	2024	Combined
A.	Number of territorial males	n/a	88	73	67	68	73	n/a
B.	Number of known pairs	706	58	47	47	29	29	916
C.	Number of known breeding (nesting) pairs	653	47	42	45	24	24	835
D.	Number of breeding pairs that were well-monitored throughout the breeding season	212	22	21	30	6	5	296
E.	Number of known fledged young observed	1,282	114	73	102	48	38	1,657
F.	Number of known fledged young produced by pairs monitored throughout the season	645	78	43	77	25	13	881
G.	Average number of fledglings produced per breeding pair (minimum; E/C = 'productivity or breeding success')[1]	2.0	2.4	1.7	2.3	2.0	1.6	2.0
H.	Average number of fledglings produced by well- monitored pairs (F/D = reproductive success)	3.0	3.5	2.0	2.6	4.2	2.6	3.0
I.	Number of nests that were discovered	434	36	41	52	15	13	591
J.	Number of well-tracked nests	374	34	34	51	15	13	521
K.	Number of successful well-tracked nests	66% 247 / 374	68% 23 / 34	44% 15 / 34	51% 26 / 51	47% 7 / 15	46% 6 / 13	62% 324 / 521
L.	Rate of cowbird parasitism (well-tracked nests)[2]	5% 17 / 373	3% 1 / 30	21% 6 / 29	0% 0 / 41	0% 0 / 13	0% 0 / 11	5% 24 / 497
M.	A. Number of well-tracked nests that failed as a result of reproductive failure	4% 15 / 374	6% 2 / 34	3% 1 / 34	2% 1 / 51	7% 1 / 15	8% 1 / 13	4% 21 / 521
	B. Number of well-tracked nests that failed as a result of parasitism	1% 4 / 374	3% 1 / 34	6% 2 / 34	0% 0 / 51	0% 0 / 15	0% 0 / 13	1% 7 / 521
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	29% 107 / 374	24% 8 / 34	44% 15 / 34	45% 23 / 51	47% 7 / 15	46% 6 / 13	32% 166 / 521
	D. Number of well-tracked nests that failed for unknown reasons	<1% 1 / 374	0% 0 / 34	3% 1 / 34	2% 1 / 51	0% 0 / 15	0% 0 / 13	1% 3 / 521
N.	Average clutch size	n/a	3.8	3.6	3.4	3.6	3.5	n/a
O.	Number of cowbird eggs or nestlings found in or near vireo nests	23	1	8	0	0	0	32
P.	Number of 'manipulated' parasitized nests[3]	16	0	6	n/a	n/a	n/a	22
Q.	Number of successful 'manipulated' nests[3]	69% 11 / 16	n/a	67% 4 / 6	n/a	n/a	n/a	68% 15 / 22
R.	Number of vireo fledged from 'manipulated' nests[3]	18	n/a	10	n/a	n/a	n/a	28
S.	Number of cowbird young fledged by vireo observed	0	0	0	0	0	0	0
T.	Number of repaired nests[3]	4	1	1	1	0	0	7
U.	% of successful repaired nests	75% 3 / 4	100% 1 / 1	0% 0 / 1	0% 0 / 1	n/a	n/a	57% 4 / 7
V.	Number of vireo fledged from repaired nests	11	4	0	n/a	n/a	n/a	15
W.	Numbers of cowbirds removed from study area	588	0	8	3	3	3	605
X.	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	3,014	4	136	123	56	73	3,406
Y.	Average number of cowbirds trapped per trap day (W/X)	0.20	0.00	0.06	0.02	0.05	0.04	0.18

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

**Starting in 2016 includes Goose Creek mitigation funded by IERCD

[1]Productivity numbers in a given year may be biased lower at some unmonitored sites due to low sample size as a consequence of variations in the frequency in which a site is visited.

[2] Starting in 2019, SAWA adjusted the parasitism rate to exclude "well-tracked" nests that were depredated or otherwise failed before it could be determined if they had been parasitized. (Pike et al., 1999; Sharp & Kus, 2006).

[3]Only well-tracked nests are counted for these parameters.

Appendix C-1-G. Least Bell's Vireo reproductive success and breeding biology data at survey sites in the Santa Ana River Watershed, California.

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

	Parameter	2015-2019 (n=5 years)	2020	2021	2022	2023	2024	Combined
A.	Number of territorial males	n/a	133	113	137	130	132	n/a
B.	Number of known pairs	143	65	48	62	78	62	458
C.	Number of known breeding (nesting) pairs	140	65	47	55	57	49	413
D.	Number of breeding pairs that were well-monitored throughout the breeding season	49	25	22	14	23	18	151
E.	Number of known fledged young observed	342	159	125	119	175	139	1,059
F.	Number of known fledged young produced by pairs monitored throughout the season	190	81	85	43	119	76	594
G.	Average number of fledglings produced per breeding pair (minimum; E/C = 'productivity or breeding success')[1]	2.4	2.4	2.7	2.2	3.1	2.8	2.6
H.	Average number of fledglings produced by well- monitored pairs (F/D = reproductive success)	3.9	3.2	3.9	3.1	5.2	4.2	3.9
I.	Number of nests that were discovered	102	47	30	34	52	53	318
J.	Number of well-tracked nests	97	43	30	34	50	51	305
K.	Number of successful well-tracked nests	77% 75 / 97	70% 30 / 43	90% 27 / 30	68% 23 / 34	76% 38 / 50	67% 34 / 51	74% 227 / 305
L.	Rate of cowbird parasitism (well-tracked nests)[2]	0% 0 / 97	0% 0 / 41	0% 0 / 28	0% 0 / 31	0% 0 / 47	0% 0 / 44	0% 0 / 288
	A. Number of well-tracked nests that failed as a result of reproductive failure	7% 7 / 97	2% 1 / 43	0% 0 / 30	0% 0 / 34	2% 1 / 50	2% 1 / 51	3% 10 / 305
	B. Number of well-tracked nests that failed as a result of parasitism	0% 0 / 97	0% 0 / 43	0% 0 / 30	0% 0 / 34	0% 0 / 50	0% 0 / 51	0% 0 / 305
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	15% 15 / 97	26% 11 / 43	10% 3 / 30	32% 11 / 34	18% 9 / 50	27% 14 / 51	21% 63 / 305
M.	D. Number of well-tracked nests that failed for unknown reasons	0% 0 / 97	2% 1 / 43	0% 0 / 30	0% 0 / 34	4% 2 / 50	4% 2 / 51	2% 5 / 305
N.	Average clutch size	n/a	3.7	3.8	3.6	3.7	3.7	n/a
O.	Number of cowbird eggs or nestlings found in or near vireo nests	0	0	0	0	0	0	0
P.	Number of 'manipulated' parasitized nests[3]	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Q.	Number of successful 'manipulated' nests[3]	n/a	n/a	n/a	n/a	n/a	n/a	n/a
R.	Number of vireo fledged from 'manipulated' nests[3]	n/a	n/a	n/a	n/a	n/a	n/a	n/a
S.	Number of cowbird young fledged by vireo observed	0	0	0	0	0	0	0
T.	Number of repaired nests[3]	0	0	0	0	2	2	4
U.	% of successful repaired nests	n/a	n/a	n/a	n/a	100% 2 / 2	0% 0 / 2	50% 2 / 4
V.	Number of vireo fledged from repaired nests	n/a	n/a	n/a	n/a	6	0	6
W.	Numbers of cowbirds removed from study area	2	3	2	0	n/a	n/a	7
X.	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	113	130	128	124	n/a	n/a	495
Y.	Average number of cowbirds trapped per trap day (W/X)	0.02	0.02	0.02	0.00	n/a	n/a	0.01

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

[1]Productivity numbers in a given year may be biased lower at some unmonitored sites due to low sample size as a consequence of variations in the frequency in which a site is visited

[2] Starting in 2019, SAWA adjusted the parasitism rate to exclude "well-tracked" nests that were depredated or otherwise failed before it could be determined if they had been parasitized. (Pike et al., 1999; Sharp & Kus, 2006).

[3]Only well-tracked nests are counted for these parameters

Appendix C-1-H. Least Bell's Vireo reproductive success and breeding biology data at survey sites in the Santa Ana River Watershed, California.

Santa Ana Canyon (SAC) - Upper Canyon

	Parameter	2001-2019 (n=19 years)	2020	2021	2022	2023	2024	Combined
A.	Number of territorial males	n/a	45	43	39	39	39	n/a
B.	Number of known pairs	262	30	34	23	20	21	390
C.	Number of known breeding (nesting) pairs	219	27	33	22	19	20	340
D.	Number of breeding pairs that were well-monitored throughout the breeding season	76	8	9	9	1	5	108
E.	Number of known fledged young observed	417	52	50	32	34	40	625
F.	Number of known fledged young produced by pairs monitored throughout the season	206	26	19	23	7	16	297
G.	Average number of fledglings produced per breeding pair (minimum; E/C = 'productivity or breeding success')[1]	1.9	1.9	1.5	1.5	1.8	2.0	1.8
H.	Average number of fledglings produced by well- monitored pairs (F/D = reproductive success)	2.7	3.3	2.1	2.6	7.0	3.2	2.8
I.	Number of nests that were discovered	162	14	19	22	11	11	239
J.	Number of well-tracked nests	115	12	17	15	9	9	177
K.	Number of successful well-tracked nests	67% 77 / 115	67% 8 / 12	47% 8 / 17	53% 8 / 15	44% 4 / 9	78% 7 / 9	63% 112 / 177
L.	Rate of cowbird parasitism (well-tracked nests)[2]	4% 4 / 113	0% 0 / 11	0% 0 / 17	0% 0 / 13	0% 0 / 6	0% 0 / 9	2% 4 / 169
	A. Number of well-tracked nests that failed as a result of reproductive failure	3% 3 / 115	0% 0 / 12	6% 1 / 17	7% 1 / 15	0% 0 / 9	11% 1 / 9	3% 6 / 177
	B. Number of well-tracked nests that failed as a result of parasitism	2% 2 / 115	0% 0 / 12	0% 0 / 17	0% 0 / 15	0% 0 / 9	0% 0 / 9	1% 2 / 177
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	29% 33 / 115	25% 3 / 12	47% 8 / 17	33% 5 / 15	33% 3 / 9	0% 0 / 9	29% 52 / 177
M.	D. Number of well-tracked nests that failed for unknown reasons	0% 0 / 115	8% 1 / 12	0% 0 / 17	7% 1 / 15	22% 2 / 9	11% 1 / 9	3% 5 / 177
N.	Average clutch size	n/a	3.7	3.4	3.3	3.8	3.8	n/a
O.	Number of cowbird eggs or nestlings found in or near vireo nests	4	0	0	0	0	0	4
P.	Number of 'manipulated' parasitized nests[3]	1	n/a	n/a	n/a	n/a	n/a	1
Q.	Number of successful 'manipulated' nests[3]	100% 1 / 1	n/a	n/a	n/a	n/a	n/a	100% 1 / 1
R.	Number of vireo fledged from 'manipulated' nests[3]	1	n/a	n/a	n/a	n/a	n/a	1
S.	Number of cowbird young fledged by vireo observed	0	0	0	0	0	0	0
T.	Number of repaired nests[3]	3	0	1	0	0	1	5
U.	% of successful repaired nests	33% 1 / 3	n/a	0% 0 / 1	n/a	n/a	100% 1 / 1	40% 2 / 5
V.	Number of vireo fledged from repaired nests	3	n/a	0	n/a	n/a	4	7
W.	Numbers of cowbirds removed from study area	842	-1	8	3	1	1	854
X.	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	3,552	128	126	119	89	91	4,105
Y.	Average number of cowbirds trapped per trap day (W/X)	0.24	0.00*	0.06	0.03	0.01	0.01	0.21

[1]Productivity numbers in a given year may be biased lower at some unmonitored sites due to low sample size as a consequence of variations in the frequency in which a site is vi

[2]Starting in 2019, SAWA adjusted the parasitism rate to exclude "well-tracked" nests that were depredated or otherwise failed before it could be determined if they had been parasitized. (Pike et al., 1999; Sharp & Kus, 2006).

[3]Only well-tracked nests are counted for these parameters.

*Prior to 2022, negative results for "Y. Average number of cowbirds trapped per trap day (W/X)" were reported as zeroes.

Appendix C-1-I. Least Bell's Vireo reproductive success and breeding biology data at survey sites in the Santa Ana River Watershed, California.

Santa Ana Canyon (SAC) - Green River Golf Club

	Parameter	2001-2019 (n=19 years)	2020	2021	2022	2023	2024	Combined
A.	Number of territorial males	n/a	61	47	48	55	67	n/a
B.	Number of known pairs	335	42	35	36	44	48	540
C.	Number of known breeding (nesting) pairs	284	31	33	35	42	44	469
D.	Number of breeding pairs that were well-monitored throughout the breeding season	105	22	19	23	16	25	210
E.	Number of known fledged young observed	543	63	63	71	131	119	990
F.	Number of known fledged young produced by pairs monitored throughout the season	265	49	43	56	62	88	563
G.	Average number of fledglings produced per breeding pair (minimum; E/C = 'productivity or breeding success')[1]	1.9	2.0	1.9	1.9	3.1	2.7	2.1
H.	Average number of fledglings produced by well- monitored pairs (F/D = reproductive success)	2.5	2.2	2.3	2.4	3.9	3.5	2.7
I.	Number of nests that were discovered	219	34	35	37	52	56	433
J.	Number of well-tracked nests	185	33	33	31	50	49	381
K.	Number of successful well-tracked nests	60% 111 / 185	48% 16 / 33	48% 16 / 33	61% 19 / 31	74% 37 / 50	67% 33 / 49	61% 232 / 381
L.	Rate of cowbird parasitism (well-tracked nests)[2]	2% 4 / 183	17% 5 / 29	0% 0 / 28	0% 0 / 27	0% 0 / 47	0% 0 / 45	3% 9 / 359
	A. Number of well-tracked nests that failed as a result of reproductive failure	6% 11 / 185	0% 0 / 33	18% 6 / 33	3% 1 / 31	2% 1 / 50	2% 1 / 49	5% 20 / 381
	B. Number of well-tracked nests that failed as a result of parasitism	1% 1 / 185	0% 0 / 33	0% 0 / 33	0% 0 / 31	0% 0 / 50	0% 0 / 49	<1% 1 / 381
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	33% 1 / 185	45% 15 / 33	33% 11 / 33	29% 9 / 31	18% 9 / 50	29% 14 / 49	31% 119 / 381
M.	D. Number of well-tracked nests that failed for unknown reasons	1% 1 / 185	6% 2 / 33	0% 0 / 33	6% 2 / 31	6% 3 / 50	2% 1 / 49	2% 9 / 381
N.	Average clutch size	n/a	3.9	3.5	3.3	3.6	3.5	n/a
O.	Number of cowbird eggs or nestlings found in or near vireo nests	4	6	0	0	0	0	10
P.	Number of 'manipulated' parasitized nests[3]	2	5	n/a	n/a	n/a	n/a	7
Q.	Number of successful 'manipulated' nests[3]	100% 2 / 2	40% 2 / 5	n/a	n/a	n/a	n/a	57% 4 / 7
R.	Number of vireo fledged from 'manipulated' nests[3]	6	6	n/a	n/a	n/a	n/a	12
S.	Number of cowbird young fledged by vireo observed	0	0	0	0	0	0	0
T.	Number of repaired nests[3]	7	5	2	3	2	4	23
U.	% of successful repaired nests	86% 6 / 7	60% 3 / 5	100% 2 / 2	67% 2 / 3	100% 2 / 2	75% 3 / 4	78% 18 / 23
V.	Number of vireo fledged from repaired nests	13	8	4	6	5	9	45
W.	Numbers of cowbirds removed from study area	1,070	n/a	6	8	23	33	1,140
X.	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	4,836	n/a	254	229	172	125	5,616
Y.	Average number of cowbirds trapped per trap day (W/X)	0.22	n/a	0.02	0.03	0.13	0.26	0.20

[1]Productivity numbers in a given year may be biased lower at some unmonitored sites due to low sample size as a consequence of variations in the frequency in which a site is vi

[2] Starting in 2019, SAWA adjusted the parasitism rate to exclude "well-tracked" nests that were depredated or otherwise failed before it could be determined if they had been parasitized. (Pike et al., 1999; Sharp & Kus, 2006).

[3]Only well-tracked nests are counted for these parameters.

[*]Prior to 2022, negative results for "Y. Average number of cowbirds trapped per trap day (W/X)" were reported as zeroes.

Appendix C-1-J. Least Bell's Vireo reproductive success and breeding biology data at survey sites in the Santa Ana River Watershed, California.

Santa Ana Canyon (SAC) - Featherly Regional Park

	Parameter	2001-2019 (n=19 years)	2020	2021	2022	2023	2024	Combined
A.	Number of territorial males	n/a	79	64	66	71	80	n/a
B.	Number of known pairs	444	48	34	43	45	43	657
C.	Number of known breeding (nesting) pairs	360	42	27	32	37	38	536
D.	Number of breeding pairs that were well-monitored throughout the breeding season	112	17	13	15	12	16	185
E.	Number of known fledged young observed	540	66	43	52	76	75	852
F.	Number of known fledged young produced by pairs monitored throughout the season	241	40	23	31	39	49	423
G.	Average number of fledglings produced per breeding pair (minimum; E/C = 'productivity or breeding success')[1]	1.5	1.6	1.6	1.6	2.1	2.0	1.6
H.	Average number of fledglings produced by well- monitored pairs (F/D = reproductive success)	2.2	2.4	1.8	2.1	3.3	3.1	2.3
I.	Number of nests that were discovered	265	46	30	31	48	44	464
J.	Number of well-tracked nests	202	41	28	29	40	36	376
K.	Number of successful well-tracked nests	47% 94 / 202	37% 15 / 41	39% 11 / 28	48% 14 / 29	48% 19 / 40	47% 17 / 36	45% 170 / 376
L.	Rate of cowbird parasitism (well-tracked nests)[2]	3% 5 / 200	0% 0 / 31	21% 4 / 19	0% 0 / 25	0% 0 / 28	0% 0 / 28	3% 9 / 331
	A. Number of well-tracked nests that failed as a result of reproductive failure	6% 12 / 202	10% 4 / 41	7% 2 / 28	0% 0 / 29	0% 0 / 40	0% 0 / 36	5% 18 / 376
	B. Number of well-tracked nests that failed as a result of parasitism	1% 2 / 202	0% 0 / 41	0% 0 / 28	0% 0 / 29	0% 0 / 40	0% 0 / 36	1% 2 / 376
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	46% 93 / 202	49% 20 / 41	46% 13 / 28	48% 14 / 29	48% 19 / 40	39% 14 / 36	46% 173 / 376
M.	D. Number of well-tracked nests that failed for unknown reasons	<1% 1 / 202	5% 2 / 41	7% 2 / 28	3% 1 / 29	5% 2 / 40	14% 5 / 36	3% 13 / 376
N.	Average clutch size	n/a	3.5	3.4	3.3	3.8	3.7	n/a
O.	Number of cowbird eggs or nestlings found in or near vireo nests	5	0	4	0	0	0	9
P.	Number of 'manipulated' parasitized nests[3]	3	n/a	4	n/a	n/a	n/a	7
Q.	Number of successful 'manipulated' nests[3]	33% 1 / 3	n/a	50% 2 / 4	n/a	n/a	n/a	43% 3 / 7
R.	Number of vireo fledged from 'manipulated' nests[3]	2	n/a	4	n/a	n/a	n/a	6
S.	Number of cowbird young fledged by vireo observed	0	0	0	0	0	0	0
T.	Number of repaired nests[3]	8	3	1	0	3	0	15
U.	% of successful repaired nests	75% 6 / 8	67% 2 / 3	0% 0 / 1	n/a	100% 3 / 3	n/a	73% 11 / 15
V.	Number of vireo fledged from repaired nests	18	3	0	n/a	7	n/a	28
W.	Numbers of cowbirds removed from study area	495	15	22	10	0	-1	541
X.	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	4,935	245	316	269	195	184	6,144
Y.	Average number of cowbirds trapped per trap day (W/X)	0.10	0.06	0.07	0.04	0.00	-0.01	0.09

[1]Productivity numbers in a given year may be biased lower at some unmonitored sites due to low sample size as a consequence of variations in the frequency in which a site is vi

[2] Starting in 2019, SAWA adjusted the parasitism rate to exclude "well-tracked" nests that were depredated or otherwise failed before it could be determined if they had been parasitized. (Pike et al., 1999; Sharp & Kus, 2006).

[3]Only well-tracked nests are counted for these parameters.

*Prior to 2022, negative results for "Y. Average number of cowbirds trapped per trap day (W/X)" were reported as zeroes.

Appendix C-1-K. Least Bell's Vireo reproductive success and breeding biology data at survey sites in the Santa Ana River Watershed, California.

Santa Ana Canyon (SAC) – Combined

	Parameter	2001-2019 (n=19 years)	2020	2021	2022	2023	2024	Combined
A.	Number of territorial males	n/a	185	154	153	165	186	n/a
B.	Number of known pairs	1041	120	103	102	109	112	1,587
C.	Number of known breeding (nesting) pairs	863	100	93	89	98	102	1,345
D.	Number of breeding pairs that were well-monitored throughout the breeding season	293	47	41	47	29	46	503
E.	Number of known fledged young observed	1500	181	156	155	241	234	2,467
F.	Number of known fledged young produced by pairs monitored throughout the season	712	115	85	110	108	153	1,283
G.	Average number of fledglings produced per breeding pair (minimum; E/C = 'productivity or breeding success')[1]	1.7	1.8	1.7	1.7	2.5	2.3	1.8
H.	Average number of fledglings produced by well- monitored pairs (F/D = reproductive success)	2.4	2.4	2.1	2.3	3.7	3.3	2.6
I.	Number of nests that were discovered	646	94	84	90	111	111	1,136
J.	Number of well-tracked nests	502	86	78	75	99	94	934
K.	Number of successful well-tracked nests	56% 282 / 502	45% 39 / 86	45% 35 / 78	55% 41 / 75	61% 60 / 99	61% 57 / 94	55% 514 / 934
L.	Rate of cowbird parasitism (well-tracked nests)[2]	3% 13 / 496	7% 5 / 71	6% 4 / 64	0% 0 / 65	0% 0 / 81	0% 0 / 82	3% 22 / 859
M.	A. Number of well-tracked nests that failed as a result of reproductive failure	5% 26 / 502	5% 4 / 86	12% 9 / 78	3% 2 / 75	1% 1 / 99	2% 2 / 94	5% 44 / 934
	B. Number of well-tracked nests that failed as a result of parasitism	1% 5 / 502	0% 0 / 86	0% 0 / 78	0% 0 / 75	0% 0 / 99	0% 0 / 94	1% 5 / 934
	C. Number of well-tracked nests that failed as a result of predation - Predation Rate according to Vireo Working Group	37% 187 / 502	44% 38 / 86	41% 32 / 78	37% 28 / 75	31% 31 / 99	30% 28 / 94	37% 344 / 934
	D. Number of well-tracked nests that failed for unknown reasons	<1% 2 / 502	6% 5 / 86	3% 2 / 78	5% 4 / 75	7% 7 / 99	7% 7 / 94	3% 27 / 934
N.	Average clutch size	n/a	n/a	n/a	n/a	n/a	n/a	n/a
O.	Number of cowbird eggs or nestlings found in or near vireo nests	13	6	4	0	0	0	23
P.	Number of 'manipulated' parasitized nests[3]	6	5	4	n/a	n/a	n/a	15
Q.	Number of successful 'manipulated' nests[3]	67% 4 / 6	40% 2 / 5	50% 2 / 4	n/a	n/a	n/a	53% 8 / 15
R.	Number of vireo fledged from 'manipulated' nests[3]	9	6	4	0	0	0	19
S.	Number of cowbird young fledged by vireo observed	0	0	0	0	0	0	0
T.	Number of repaired nests[3]	18	8	4	3	5	5	43
U.	% of successful repaired nests	72% 13 / 18	63% 5 / 8	50% 2 / 4	67% 2 / 3	100% 5 / 5	80% 4 / 5	72% 31 / 43
V.	Number of vireo fledged from repaired nests	34	11	4	6	12	13	80
W.	Numbers of cowbirds removed from study area	2,407	14	36	21	24	33	2,535
X.	Number of trap days (1 operative trap day in the field for one day = 1 trap day)	13,323	373	696	617	456	400	15,865
Y.	Average number of cowbirds trapped per trap day (W/X)	0.18	0.04	0.05	0.03	0.05	0.08	0.16

[1]Productivity numbers in a given year may be biased lower at some unmonitored sites due to low sample size as a consequence of variations in the frequency in which a site is vi

[2] Starting in 2019, SAWA adjusted the parasitism rate to exclude "well-tracked" nests that were depredated or otherwise failed before it could be determined if they had been parasitized. (Pike et al., 1999; Sharp & Kus, 2006).

[3]Only well-tracked nests are counted for these parameters.

*Prior to 2022, negative results for "Y. Average number of cowbirds trapped per trap day (W/X)" were reported as zeroes.

Appendix C-2-A. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2024.

San Jacinto

Host Plant Species (listed alphabetically by scientific name)	2004-2019 (n=15 years)1	2020	2021	2022	2023	2024	Combined	Percentage of Combined
Western False Indigo (*Amorpha fruticosa*)	1						1	<1%
Coyote Brush (*Baccharis pilularis*)	18		1	4			23	7%
Mulefat (*Baccharis salicifolia*)	38	17	6	6		1	68	20%
Black Mustard[ie] (*Brassica nigra*)	1	1					2	1%
Blue Palo Verde (*Parkinsonia florida*)	0	1					1	<1%
Arrowweed (*Pluchea sericea*)	4	2					6	2%
Fremont Cottonwood (*Populus fremontii*)	2	3		3		1	9	3%
California Scrub Oak (*Quercus berberidifolia*)	0	1					1	<1%
Narrowleaf Willow (*Salix exigua*)	109	22	3	5	1	1	141	41%
Goodding's Black Willow (*Salix gooddingii*)	21	13	9	9	4	1	57	17%
Red Willow (*Salix laevigata*)	3						3	1%
Arroyo Willow (*Salix lasiolepis*)	0	1					1	<1%
Blue Elderberry (*Sambucus mexicana)*	0	3	1			1	5	1%
Tamarisk[ie] (*Tamarix ramosissima*)	9	5		2		2	18	5%
Unknown/No data	9						9	3%
Total	**215**	**69**	**20**	**29**	**5**	**7**	**345**	**100%**

[1]= Number of years in which nests were found

[i] = invasive

[e] = non-native

[r] = endangered, threatened, or sensitive

Appendix C-2-B. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2024.

San Timoteo Canyon

Host Plant Species (listed alphabetically by scientific name)	2001-2019 (n=19 years)[1]	2020	2021	2022	2023	2024	Combined	Percentage of Combined
Boxelder (*Acer negundo*)	2						2	<1%
Tree of Heaven[ie] (*Ailanthus altissima*)	1						1	<1%
Douglas' Sagewort (*Artemisia douglasiana*)	20	1					21	1%
Fourwing Saltbush (*Atriplex canescens*)	2	1					3	<1%
Coyote Brush (*Baccharis pilularis*)	0		1				1	<1%
Mulefat (*Baccharis salicifolia*)	299	6	13	4	13	12	347	22%
Willow Baccharis (*Baccharis salicina*)	1						1	<1%
Bougainvillea sp.[e] (*Bougainvillea* sp.)	0					1	1	<1%
Black Mustard[ie] (*Brassica nigra*)	2						2	<1%
Mustard sp.[ie] (*Brassica* sp.)	4						4	<1%
Orange Tree[e] (*Citrus sinensis*)	0	1					1	<1%
Poison Hemlock[ie] *(Conium maculatum)*	1						1	<1%
Brittlebush (*Encelia farinosa*)	2					1	3	<1%
Ash sp. (*Fraxinus* sp.)	0		1			1	2	<1%
Common Sunflower (*Helianthus annuus*)	0					1	1	<1%
Toyon (*Heteromeles arbutifolia*)	23						23	1%
Southern California Black Walnut[r] *(Juglans californica)*	3					1	4	<1%
Perennial Pepperweed[ie] (*Lepidium latifolium*)	1			1			2	<1%
Chaparral Mallow (*Malacothamnus fasciculatus*)	1	2			3	1	7	<1%

Appendix C-2-B continued. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2024.

San Timoteo Canyon

Host Plant Species (listed alphabetically by scientific name)	2001-2019 (n=19 years)[1]	2020	2021	2022	2023	2024	Combined	Percentage of Combined
White Mulberry[e] (*Morus alba*)	3	2	2	1			8	1%
Tree Tobacco[ie] (*Nicotiana glauca*)	1						1	<1%
Olive[e] (*Olea europaea*)	1						1	<1%
Western Sycamore (*Platanus racemosa*)	1		1				2	<1%
Fremont Cottonwood (*Populus fremontii*)	58	13	4	5	3	2	85	5%
Callery Pear[e] (*Pyrus calleryana*)*	1	1		3		1	6	<1%
California Scrub Oak (*Quercus berberidifolia*)	3	1					4	<1%
Oak sp. (*Quercus* sp.)	1						1	<1%
Golden Currant (*Ribes aureum)*	5						5	<1%
California Wild Rose (*Rosa californica*)	2						2	<1%
Fragrant Sumac (*Rhus aromatica*)	1						1	<1%
Sugar Sumac (*Rhus ovata*)	1					1	2	<1%
Narrowleaf Willow (*Salix exigua*)	34				2		36	2%
Goodding's Black Willow (*Salix gooddingii*)	88	3	4		2	2	99	6%
Red Willow (*Salix laevigata*)	193	22	27	9	15	17	283	18%
Arroyo Willow (*Salix lasiolepis*)	273	33	13	28	20	20	387	24%
Pacific Willow (*Salix lasiandra)*	12	4	1				17	1%
Willow sp. (*Salix* sp.)	2						2	<1%
Blue Elderberry (*Sambucus mexicana*)	52	5	2	1	3	1	64	4%

Appendix C-2-B continued. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2024.

San Timoteo Canyon

Host Plant Species (listed alphabetically by scientific name)	2001-2019 (n=19 years)[1]	2020	2021	2022	2023	2024	Combined	Percentage of Combined
Peruvian Pepper Tree[ie] (*Schinus molle*)	0			1			1	<1%
African Sumac[e] (*Searsia lancia*)	0					2	2	<1%
Tamarisk[ie] (*Tamarix ramosissima*)	2						2	<1%
Hoary Nettle (*Urtica dioica*)	1						1	<1%
Desert Wild Grape (*Vitis girdiana*)	90	9	9	9	12	9	138	9%
Desert Wild Grape (*V. girdiana*) and Arroyo Willow (*S. lasiolepis*)	1						1	<1%
Arroyo Willow (*S. lasiolepis*) and Sweet Fennel[ie] (*Foeniculum vulgare*)	1						1	<1%
Deadfall	2		1	1			4	<1%
Unknown/No data	3						3	<1%
Total	**1,194**	**104**	**79**	**63**	**73**	**73**	**1,586**	**100%**

[1]=Number of years in which nests were found

[i] = invasive

[e] = non-native

[r] = endangered, threatened, or sensitive

*misidentified as *Cydonia oblonga* in 2019-21 reports

Appendix C-2-C. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2024.

Mockingbird Canyon

Host Plant Species (listed alphabetically by scientific name)	2003-2019 (n=14 years)[1]	2020	2021	2022	2023	2024	Combined	Percentage of Combined
Wild Celery[e] (*Apium graveolens*)	1						1	<1%
Fourwing Saltbush (*Atriplex canescens*)	2						2	1%
Coyote Brush (*Baccharis pilularis*)	1	3					4	2%
Mulefat (*Baccharis salicifolia*)	15	1					16	7%
Willow Baccharis (*Baccharis salicina*)	2						2	1%
Southern California Black Walnut[r] (*Juglans californica)*	1						1	<1%
Perennial Pepperweed[ie] (*Lepidium latifolium*)	5	1					6	3%
Western Sycamore (*Platanus racemosa*)	1						1	<1%
Arrowweed (*Pluchea sericea*)	1						1	<1%
Fremont Cottonwood (*Populus fremontii*)	3	2					5	2%
Hollyleaf Cherry (*Prunus ilicifolia*)	1						1	<1%
Narrowleaf Willow (*Salix exigua*)	1						1	<1%
Goodding's Black Willow (*Salix gooddingii*)	33		1				34	15%
Red Willow (*Salix laevigata*)	56	4	2	1			63	29%
Arroyo Willow (*Salix lasiolepis*)	17	3					20	9%
Willow sp. (*Salix* sp.)	2						2	1%
Blue Elderberry (*Sambucus mexicana*)	34	1		2			37	17%
Peruvian Pepper Tree[ie] (*Schinus molle*)	4						4	2%
Tamarisk[ie] (*Tamarix ramosissima*)	1	1					2	1%

Appendix C-2-C continued. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2024.

Mockingbird Canyon

Host Plant Species (listed alphabetically by scientific name)	2003-2019 (n=14 years)[1]	2020	2021	2022	2023	2024	Combined	Percentage of Combined
Desert Wild Grape (*Vitis girdiana*)	7						7	3%
Desert Wild Grape (*V. girdiana*) and Goodding's Black Willow (*S. gooddingii*)	1						1	<1%
Goodding's Black Willow (*S. gooddingii*) and Perennial Pepperweed[ie] (*L.*	1						1	<1%
Willow sp. (*Salix* sp.) and Perennial Pepperweed[ie] (*L. latifolium*)	1						1	<1%
Coyote Brush (*B. pilularis*) and Mulefat (*B. salicifolia*)	1						1	<1%
Deadfall	0	2	1				3	1%
Unknown/No data	2		1				3	1%
Total	**194**	**18**	**5**	**3**	**0**	**0**	**220**	**100%**

[1]=Number of years in which nests were found

[i] = invasive

[e] = non-native

[r] = endangered, threatened, or sensitive

Appendix C-2-D. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2024.

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

Host Plant Species (listed alphabetically by scientific name)	2002-2019 (n=16 years)[1]	2020	2021	2022	2023	2024	Combined	Percentage of Combined
White Alder (*Alnus rhombifolia*)	1						1	<1%
Giant Reed[ie] (*Arundo donax*)	0					2	2	1%
Coyote Brush (*Baccharis pilularis*)	1		1				2	1%
Mulefat (*Baccharis salicifolia*)	71	1	1	2	1	2	78	23%
Poison Hemlock[ie] (*Conium maculatum*)	1				1		2	1%
Fig Tree[e] (*Ficus carica*)	0					1	1	<1%
Ash sp. (*Fraxinus* sp.)	0	3			2		5	2%
Tree Tobacco[ie] (*Nicotiana glauca*)	2						2	1%
Western Sycamore (*Platanus racemosa*)	3			2			5	2%
Fremont Cottonwood (*Populus fremontii*)	14	3	4	1			22	7%
Holly Leaf Cherry (*Prunus ilicifolia*)	0	1					1	<1%
California Scrub Oak (*Quercus berberidifolia*)	2		2	1		1	6	2%
California Wild Rose (*Rosa californica*)	2				1		3	1%
California Blackberry (*Rubus ursinus*)	1	1					2	1%
Narrowleaf Willow (*Salix exigua*)	10	4		1			15	5%
Goodding's Black Willow (*Salix gooddingii*)	27		2				29	9%
Red Willow (*Salix laevigata*)	21	2		3			26	8%
Arroyo Willow (*Salix lasiolepis*)	55	1	2	9	5	2	74	22%
Pacific Willow (*Salix lasiandra)*	1						1	<1%

Appendix C-2-D continued. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2024.

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

Host Plant Species (listed alphabetically by scientific name)	2002-2019 (n=16 years)[1]	2020	2021	2022	2023	2024	Combined	Percentage of Combined
Willow sp. (*Salix* sp.)	2	1			1		4	1%
Blue Elderberry (*Sambucus mexicana*)	7		1				8	2%
Tamarisk[ie] (*Tamarix ramosissima*)	2						2	1%
Poison Oak (*Toxicodendron diversilobum*)	1						1	<1%
Hoary Nettle (*Urtica dioica*)	1						1	<1%
Desert Wild Grape (*Vitis girdiana*)	21	1	2	1	1	2	28	8%
Desert Wild Grape (*V. girdiana*) and Goodding's Black Willow (*S. gooddingii*)	1						1	<1%
Dead Goodding's Black Willow (*S. gooddingii*) and Hoary Nettle (*U. dioica*)	1						1	<1%
Unknown/No Data	8			1			9	3%
Total	**256**	**18**	**15**	**21**	**12**	**10**	**332**	**100%**

[1]=Number of years in which nests were found

[i] = invasive

[e] = non-native

[r] = endangered, threatened, or sensitive

Appendix C-2-E. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2024.

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

Host Plant Species (listed alphabetically by scientific name)	2000-2019 (n=19 years)[1]	2020	2021	2022	2023	2024	Combined	Percentage of Combined
Douglas' Sagewort (*Artemisia douglasiana*)	0	1					1	<1%
Giant Reed[ie] (*Arundo donax*)	0			1		1	2	<1%
Big Saltbush (*Atriplex lentiformis*)	0		2		1		3	<1%
Coyote Brush (*Baccharis pilularis*)	2					2	4	1%
Mulefat (*Baccharis salicifolia*)	86	24	34	27	12	17	200	27%
Poison Hemlock[ie] *(Conium maculatum)*	0	5		2	4	5	16	2%
Arizona Ash (*Fraxinus velutina*)	0	1		1			2	<1%
Ash sp. (*Fraxinus* sp.)	0		1	1			2	<1%
Common Sunflower (*Helianthus annuus*)	0	1					1	<1%
Summer Cypress[e] (*Kochia scoparia*)	0	1					1	<1%
Perennial Pepperweed[ie] (*Lepidium latifolium*)	1	1					2	<1%
Tree Tobacco[ie] (*Nicotiana glauca*)	0	1					1	<1%
Western Sycamore (*Platanus racemosa*)	1	1					2	<1%
Fremont Cottonwood (*Populus fremontii*)	4	9	8	10	1	6	38	5%
(*Quercus agrifolia*)	0			1			1	<1%
California Wild Rose (*Rosa californica*)	2	1					3	<1%
California Blackberry (*Rubus ursinus*)	0		2	1			3	<1%
Narrowleaf Willow (*Salix exigua*)	8	7	9	2	3	11	40	5%
Goodding's Black Willow (*Salix gooddingii*)	34	10	13	8		7	72	10%

Appendix C-2-E continued. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2024.

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

Host Plant Species (listed alphabetically by scientific name)	2000-2019 (n=19 years)[1]	2020	2021	2022	2023	2024	Combined	Percentage of Combined
Red Willow (*Salix laevigata*)	25	3		18	4	2	52	7%
Arroyo Willow (*Salix lasiolepis*)	109	28	30	21	10	9	207	28%
Pacific Willow (*Salix lasiandra)*	1						1	<1%
Willow sp. (*Salix* sp.)	2					1	3	<1%
Blue Elderberry (*Sambucus mexicana*)	9	7	3	1		4	24	3%
Tamarisk[ie] (*Tamarix ramosissima*)	1	1	2	2			6	1%
Poison Oak (*Toxicodendron diversilobum*)	1	2			1		4	1%
Desert Wild Grape (*Vitis girdiana*)	20	6	5	2	1	2	36	5%
Fresh water reed (Typha sp.) an Arroyo Willow (S. *lasiolepis*)	1						1	<1%
Desert Wild Grape (*V. girdiana*) and California Wild Rose (*R. californica*)	1						1	<1%
Red Willow (*S. laevigata*) and Wild Cucumber (*Marah macrocarpa*)	1						1	<1%
Willow sp. (*Salix* sp.) and California Blackberry (*Rubus ursinus*)	1						1	<1%
Mulefat (*B. salicifolia*) and Poison Hemlock[ie] (*C. maculatum*)	1						1	<1%
Deadfall	0					1	1	<1%
Unknown/No data	11	3					14	2%
Total	**322**	**113**	**109**	**98**	**37**	**68**	**747**	**100%**

[1]=Number of years in which nests were found

[i] = invasive

[e] = non-native

[r] = endangered, threatened, or sensitive

Appendix C-2-F. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2024.

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

Host Plant Species (listed alphabetically by scientific name)	2001-2019 (n=19 years)[1]	2020	2021	2022	2023	2024	Combined	Percentage of Combined
Tree of Heaven[ie] (*Ailanthus altissima*)	1						1	<1%
California Sagebrush (*Artemisia californica*)	1		1	1	1		4	1%
Giant Reed[ie] (*Arundo donax*)	0	1	3	2			6	1%
Coyote Brush (*Baccharis pilularis*)	0		3	1			4	1%
Mulefat (*Baccharis salicifolia*)	146	2	1	5			154	26%
Poison Hemlock[ie] *(Conium maculatum)*	4	1		1	1	4	11	2%
Ash sp. (*Fraxinus* sp.)	1						1	<1%
Southern California Black Walnut[r] *(Juglans californica)*	1						1	<1%
Arrowweed (*Pluchea sericea*)	0			2			2	<1%
Fremont Cottonwood (*Populus fremontii*)	20	5	9	6	3	1	44	7%
California Wild Rose (*Rosa californica*)	0		2				2	<1%
California Blackberry (*Rubus ursinus*)	0	3	4	2			9	2%
Narrowleaf Willow (*Salix exigua*)	15	3	3	2	2	2	27	5%
Goodding's Black Willow (*Salix gooddingii*)	58	1	1	1			61	10%
Red Willow (*Salix laevigata*)	17	2	3	6			28	5%
Pacific Willow *(Salix lasiandra)*	1	1	1		1	1	5	1%
Arroyo Willow (*Salix lasiolepis*)	129	8	5	13	5	3	163	28%
Willow sp. (*Salix* sp.)	4						4	1%
Blue Elderberry (*Sambucus mexicana*)	5	3	2	4		1	15	3%

Appendix C-2-F continued. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2024.

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

Host Plant Species (listed alphabetically by scientific name)	2001-2019 (n=19 years)[1]	2020	2021	2022	2023	2024	Combined	Percentage of Combined
Tamarisk[ie] (*Tamarix ramosissima*)	1			1	1		3	1%
Desert Wild Grape (*Vitis girdiana*)	24	2	1	4		1	32	5%
Goodding's Black Willow (*S. gooddingii*) and Poison Hemlock[ie] (*C. maculatum*)	1						1	<1%
Deadfall	0	3	2	1	1		7	1%
Unknown/No data	3	1					4	1%
Total	**432**	**36**	**41**	**52**	**15**	**13**	**589**	**100%**

[1]=Number of years in which nests were found

[i] = invasive

[e] = non-native

[r] = endangered, threatened, or sensitive

*Starting in 2015 Goose Creek Golf Club to 1-15 only. Formerly monitored as Goose Creek Golf Club to River Rd.

**Includes Goose Creek mitigation funded by IERCD

Appendix C-2-G. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2024.

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

Host Plant Species (listed alphabetically by scientific name)	2015-2019 (n=5 years)[1]	2020	2021	2022	2023	2024	Combined	Percentage of Combined
Giant Reed[ie] (*Arundo donax*)	0				1		1	<1%
Douglas' Sagewort (*Artemisia douglasiana*)	0		1				1	<1%
Coyote Brush (*Baccharis pilularis*)	1					1	2	1%
Mulefat (*Baccharis salicifolia*)	24	15	3	9	10	9	70	22%
Black Mustard[ie] (*Brassica nigra*)	0					1	1	<1%
Poison Hemlock[ie] (*Conium maculatum*)	0					1	1	<1%
Tree Tobacco[ie] (*Nicotiana glauca*)	0					1	1	<1%
Fremont Cottonwood (*Populus fremontii*)	0			1	2		3	1%
California Wild Rose (*Rosa californica*)	1				1		2	1%
California Blackberry (*Rubus ursinus*)	0	1		2		2	5	2%
Narrowleaf Willow (*Salix exigua*)	4	3	6	5	3	2	23	7%
Goodding's Black Willow (*Salix gooddingii*)	15	7	4	5	4	3	38	12%
Red Willow (*Salix laevigata*)	0	1			5	4	10	3%
Pacific Willow (*Salix lasiandra)*	2	1	1		7	9	20	6%
Arroyo Willow (*Salix lasiolepis*)	37	15	12	8	12	10	94	30%
Blue Elderberry (*Sambucus mexicana*)	2		1		1	2	6	2%
Desert Wild Grape (*Vitis girdiana*)	13	3	1	4	4	7	32	10%
Desert Wild Grape (*V. girdiana*) and Mulefat (*B. salicifolia*)	2						2	1%
California Blackberry (*Rubus ursinus*) and dead unknown	0	1					1	<1%

Appendix C-2-G continued. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2024.

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

Host Plant Species (listed alphabetically by scientific name)	2015-2019 (n=5 years)[1]	2020	2021	2022	2023	2024	Combined	Percentage of Combined
Deadfall	0		1		1	1	3	1%
Unknown/No Data	1				1		2	1%
Total	**102**	**47**	**30**	**34**	**52**	**53**	**318**	**100%**

[1]=Number of years in which nests were found

[i] = invasive

[e] = non-native

[r] = endangered, threatened, or sensitive

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

Appendix C-2-H. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2024.

Santa Ana Canyon (SAC) – Upper Canyon

Host Plant Species (listed alphabetically by scientific name)	2001-2019 (n=19 years)[1]	2020	2021	2022	2023	2024	Combined	Percentage of Combined
Coyote Brush (*Baccharis pilularis*)	1	1					2	1%
Mulefat (*Baccharis salicifolia*)	62	7	6	14	4	8	101	43%
Desertbroom Baccharis (*Baccharis sarothroides*)	1						1	<1%
Mustard sp.[ie] (*Brassica* sp.)	2						2	1%
Poison Hemlock[ie] (*Conium maculatum*)	2						2	1%
Toyon (*Heteromeles arbutifolia*)	1						1	<1%
Southern California Black Walnut[r] (*Juglans californica*)	0		1	1			2	1%
Laurel Sumac (*Malosma laurina*)	2			1			3	1%
Western Sycamore (*Platanus racemosa*)	1	1					2	1%
Fremont Cottonwood (*Populus fremontii*)	10		4	1			15	6%
Coast Live Oak (*Quercus agrifolia*)	1		2			1	4	2%
California Scrub Oak (*Quercus berberidifolia*)	2	1					3	1%
Castorbean[ie] (*Ricinus communis*)	1						1	<1%
California Wild Rose (*Rosa californica*)	3						3	1%
Narrowleaf Willow (*Salix exigua*)	1						1	<1%
Goodding's Black Willow (*Salix gooddingii*)	15					1	16	7%
Red Willow (*Salix laevigata*)	4						4	2%
Arroyo Willow (*Salix lasiolepis*)	3	1			1		5	2%
Willow sp. (*Salix* sp.)	1						1	<1%

Appendix C-2-H continued. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2024.

Santa Ana Canyon (SAC) - Upper Canyon

Host Plant Species (listed alphabetically by scientific name)	2001-2019 (n=19 years)[1]	2020	2021	2022	2023	2024	Combined	Percentage of Combined
Blue Elderberry (*Sambucus mexicana*)	28	2	4		5	1	40	17%
Peruvian Pepper Tree[ie] (*Schinus molle*)	3						3	1%
Milk Thistle[ie] (*Silybum marianum*)	1						1	<1%
Poison Oak (*Toxicodendron diversilobum*)	6		2	4	1		13	5%
Desert Wild Grape (*Vitis girdiana*)	6						6	3%
Rough Cockelbur (*Xanthium strumarium*)	1						1	<1%
Desert Wild Grape (*V. girdiana*) and Mulefat (*B. salicifolia*)	1						1	<1%
Black Mustard[ie] (*B.nigra*) and Mulefat (*B. salicifolia*)	1						1	<1%
Unknown/No Data	0	1		1			2	1%
Total	**160**	**14**	**19**	**22**	**11**	**11**	**237**	**100%**

[1]=Number of years in which nests were found

[i] = invasive

[e] = non-native

[r] = endangered, threatened, or sensitive

Appendix C-2-I. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2024.

Santa Ana Canyon (SAC) - Green River Golf Club

Host Plant Species (listed alphabetically by scientific name)	2001-2019 (n=19 years)[1]	2020	2021	2022	2023	2024	Combined	Percentage of Combined
Tree of Heaven[ie] (*Ailanthus altissima*)	1						1	<1%
California Sagebrush (*Artemisia californica*)	1						1	<1%
Douglas' Sagewort (*Artemisia douglasiana*)	1						1	<1%
Giant Reed[ie] (*Arundo donax*)	2						2	<1%
Coyote Brush (*Baccharis pilularis*)	4				1		5	1%
Mulefat (*Baccharis salicifolia*)	75	11	14	14	24	22	160	37%
Black Mustard[ie] (*Brassica nigra*)	4				2	1	7	2%
Poison Hemlock[ie] (*Conium maculatum*)	2					1	3	1%
Carrotwood[e] (*Cupaniopsis anacardioides*)	0	1			1		2	<1%
Yerba Santa sp. (*Eriodictyon* sp.)	1						1	<1%
Toyon (*Heteromeles arbutifolia*)	2					1	3	1%
Southern California Black Walnut[r] (*Juglans californica)*	5						5	1%
Privet sp.[e] (*Ligustrum* sp.)	1						1	<1%
Bush mallow sp. (*Malacothamnus* sp.)	0		1				1	<1%
Laurel Sumac (*Malosma laurina*)	14	5	6	4	6	10	45	10%
Lollypop Tree[ie] (*Myoporum laetum*)	1						1	<1%
Tree Tobacco[ie] (*Nicotiana glauca*)	1					1	2	<1%

Appendix C-2-I continued. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2024.

Santa Ana Canyon (SAC) - Green River Golf Club

Host Plant Species (listed alphabetically by scientific name)	2001-2019 (n=19 years)[1]	2020	2021	2022	2023	2024	Combined	Percentage of Combined
Western Sycamore (*Platanus racemosa*)	0					1	1	<1%
Cape Leadwort[e] (*Plumbago auriculata*)	2				1		3	1%
Black Cottonwood (*Populus balsamifera* ssp. *trichocarpa*)	0			1			1	<1%
Fremont Cottonwood (*Populus fremontii*)	14	4	1	4	3	3	29	7%
Coast Live Oak (*Quercus agrifolia*)	0		1	1		1	3	1%
California Scrub Oak (*Quercus berberidifolia*)	0	1					1	<1%
California Blackberry (*Rubus ursinus*)	0			1			1	<1%
Narrowleaf Willow (*Salix exigua*)	2		1				3	1%
Goodding's Black Willow (*Salix gooddingii*)	18		2	4	3		27	6%
Red Willow (*Salix laevigata*)	6		1				7	2%
Arroyo Willow (*Salix lasiolepis*)	6		1	3	2	5	17	4%
Blue Elderberry (*Sambucus mexicana*)	27	7	3	3	7	8	55	13%
Peruvian Pepper Tree[ie] (*Schinus molle*)	12	3	3	2	1	2	23	5%
Brazilian Pepper Tree[ie] (*Schinus terebinthifolius*)	1						1	<1%
Poison Oak (*Toxicodendron diversilobum*)	5	1	1				7	2%
Desert Wild Grape (*Vitis girdiana*)	6						6	1%
Desert Wild Grape (*V. girdiana*) and Peruvian Pepper Tree[ie] (*S. molle*)	1						1	<1%

Appendix C-2-I continued. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2024.

Santa Ana Canyon (SAC) - Green River Golf Club

Host Plant Species (listed alphabetically by scientific name)	2001-2019 (n=19 years)[1]	2020	2021	2022	2023	2024	Combined	Percentage of Combined
Desert Wild Grape (*V. girdiana*) and Blue Elderberry (*S. n. caerulea*)	1						1	<1%
Goodding's Black Willow (*S. gooddingii*) and Blue Elderberry (*S. n. caerulea*)	1						1	<1%
Unknown/No data	2	1			1		4	1%
Total	**219**	**34**	**35**	**37**	**52**	**56**	**433**	**100%**

[1]=Number of years in which nests were found

[i] = invasive

[e] = non-native

[r] = endangered, threatened, or sensitive

Appendix C-2-J. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2024.

Santa Ana Canyon (SAC) - Featherly Regional Park

Host Plant Species (listed alphabetically by scientific name)	2002-2019 (n=18 years)[1]	2020	2021	2022	2023	2024	Combined	Percentage of Combined
White Alder (*Alnus rhombifolia*)	1						1	<1%
Fiddleneck sp. (*Amsinckia* sp.)	1						1	<1%
California Sagebrush (*Artemisia californica*)	0				3	1	4	1%
Douglas' Sagewort (*Artemisia douglasiana*)	1		1		1		3	1%
Giant Reed[ie] (*Arundo donax*)	0					1	1	<1%
Coyote Brush (*Baccharis pilularis*)	0	1		1			2	<1%
Mulefat (*Baccharis salicifolia*)	62	17	7	13	16	11	126	27%
Black Mustard[ie] (*Brassica nigra*)	7	2	1		2	3	15	3%
Yellowspine Thistle[ie] (*Cirsium ochrocentrum*)	2						2	<1%
Orange Tree[e] (*Citrus sinensis*)	3				4	4	11	2%
Poison Hemlock[ie] (*Conium maculatum*)	7	6			2		15	3%
Thickleaf Yerba Santa (*Eriodictyon crassifolium*)	3		1	2	2	6	14	3%
Toyon (*Heteromeles arbutifolia*)	1						1	<1%
Coast Goldenbush (*Isocoma menziesii*)	0			1			1	<1%
Southern California Black Walnut[r] (*Juglans californica)*	9	2					11	2%
Laurel Sumac (*Malosma laurina*)	21	6	3	2	3	1	36	8%
Wild Cucumber (*Marah macrocarpa*)	0	1					1	<1%
Blue Palo Verde (*Parkinsonia florida*)	1						1	<1%
Western Sycamore (*Platanus racemosa*)	5	2	7	2		1	17	4%

Appendix C-2-J continued. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2024.

Santa Ana Canyon (SAC) - Featherly Regional Park

Host Plant Species (listed alphabetically by scientific name)	2002-2019 (n=18 years)[1]	2020	2021	2022	2023	2024	Combined	Percentage of Combined
Black Cottonwood (*Populus balsamifera* ssp. *trichocarpa*)	3						3	1%
Fremont Cottonwood (*Populus fremontii*)	28	5	2	5	4	3	47	10%
Spanish False Fleabane[e] (*Pulicaria paludosa*)	0		1				1	<1%
Castor bean[ie] (*Ricinus communis*)	1					1	2	<1%
Coulter's Matilija Poppy[r] (*Romneya coulteri*)	1						1	<1%
Narrowleaf Willow (*Salix exigua*)	12		2			4	18	4%
Goodding's Black Willow (*Salix gooddingii*)	23		1	1		2	27	6%
Red Willow (*Salix laevigata*)	6				2	2	10	2%
Arroyo Willow (*Salix lasiolepis*)	9			1			10	2%
Willow sp. (*Salix* sp.)	1	2	1				4	1%
Black Sage (*Salvia mellifera*)	2						2	<1%
Blue Elderberry (*Sambucus mexicana*)	33	2	2	1	6	1	45	10%
Tamarisk[ie] (*Tamarix ramosissima*)	1						1	<1%
Poison Oak (*Toxicodendron diversilobum*)	11				2	1	14	3%
Desert Wild Grape (*Vitis girdiana*)	1			2	1	1	5	1%
Rough Cockelburr (*Xanthium strumarium*)	1						1	<1%
Desert Wild Grape (*V. girdiana*) and Mulefat (*B. salicifolia*)	2						2	<1%
Arroyo Willow (*S. lasiolepis*) and Black Mustard[ie] (*B. nigra*)	1						1	<1%
Castorbean[ie] (*R. communis*) and Mulefat (*B. salicifolia*)	1						1	<1%

Appendix C-2-J continued. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2024.

Santa Ana Canyon (SAC) - Featherly Regional Park

Host Plant Species (listed alphabetically by scientific name)	2002-2019 (n=18 years)[1]	2020	2021	2022	2023	2024	Combined	Percentage of Combined
Black Mustard (*B. nigra*) and Poison Hemlock (*C. maculatum*)	1						1	<1%
Unknown/No data	**3**		1			1	5	1%
Total	**265**	**46**	**30**	**31**	**48**	**44**	**464**	**100%**

[1]=Number of years in which nests were found

[i] = invasive

[e] = non-native

[r] = endangered, threatened, or sensitive

Appendix C-2-K. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2024.

Santa Ana Canyon (SAC) – Combined

Host Plant Species (listed alphabetically by scientific name)	2001-2019 (n=19 years)[1]	2020	2021	2022	2023	2024	Combined	Percentage of Combined
Tree of Heaven[ie] (*Ailanthus altissima*)	1						1	<1%
White Alder (*Alnus rhombifolia*)	1						1	<1%
Fiddleneck sp. (*Amsinckia* sp.)	1						1	<1%
California Sagebrush (*Artemisia californica*)	1				3	1	5	<1%
Douglas' Sagewort (*Artemisia douglasiana*)	2		1		1		4	<1%
Giant Reed[ie] (*Arundo donax*)	2					1	3	<1%
Coyote Brush (*Baccharis pilularis*)	5	2		1	1		9	1%
Mulefat (*Baccharis salicifolia*)	199	35	27	41	44	41	387	34%
Desertbroom Baccharis (*Baccharis sarothroides*)	1						1	<1%
Black Mustard[ie] (*Brassica nigra*)	11	2	1		4	4	22	2%
Mustard sp.[ie] (*Brassica* sp.)	2						2	<1%
Yellowspine Thistle[ie] (*Cirsium ochrocentrum*)	2						2	<1%
Orange Tree[e] (*Citrus sinensis*)	3				4	4	11	1%
Poison Hemlock[ie] (*Conium maculatum*)	11	6			2	1	20	2%
Carrotwood[e] (*Cupaniopsis anacardioides*)	0	1			1		2	<1%
Thickleaf Yerba Santa (*Eriodictyon crassifolium*)	3		1	2	2	6	14	1%
Yerba Santa sp. (*Eriodictyon* sp.)	1						1	<1%
Toyon (*Heteromeles arbutifolia*)	4					1	5	<1%
Coast Goldenbush (*Isocoma menziesii*)	0			1			1	<1%
Southern California Black Walnut[r] (*Juglans californica)*	14	2	1	1			18	2%

Appendix C-2-K continued. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2024.

Santa Ana Canyon (SAC) – Combined

Host Plant Species (listed alphabetically by scientific name)	2001-2019 (n=19 years)[1]	2020	2021	2022	2023	2024	Combined	Percentage of Combined
Privet sp.[e] (*Ligustrum* sp.)	1						1	<1%
Bush mallow sp. (*Malacothamnus* sp.)	0		1				1	<1%
Laurel Sumac (*Malosma laurina*)	37	11	9	7	9	11	84	7%
Wild Cucumber (*Marah macrocarpa*)	0	1					1	<1%
Lollypop Tree[ie] (*Myoporum laetum*)	1						1	<1%
Tree Tobacco[ie] (*Nicotiana glauca*)	1					1	2	<1%
Blue Palo Verde (*Parkinsonia florida*)	1						1	<1%
Western Sycamore (*Platanus racemosa*)	6	3	7	2		2	20	2%
Cape Leadwort[e] (*Plumbago auriculata*)	2				1		3	<1%
Black Cottonwood (*Populus balsamifera* ssp. *trichocarpa*)	3			1			4	<1%
Fremont Cottonwood (*Populus fremontii*)	52	9	7	10	7	6	91	8%
Spanish False Fleabane[e] (*Pulicaria paludosa*)	0		1				1	<1%
Coast Live Oak (*Quercus agrifolia*)	1		3	1		2	7	1%
California Scrub Oak (*Quercus berberidifolia*)	2	2					4	<1%
Castor bean[ie] (*Ricinus communis*)	2					1	3	<1%
Coulter's Matilija Poppy[r] (*Romneya coulteri*)	1						1	<1%
California Wild Rose (*Rosa californica*)	3						3	<1%
California Blackberry (*Rubus ursinus*)	0			1			1	<1%
Narrowleaf Willow (*Salix exigua*)	15		3			4	22	2%
Goodding's Black Willow (*Salix gooddingii*)	55		3	5	3	3	69	6%

Appendix C-2-K continued. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2024.

Santa Ana Canyon (SAC) – Combined

Host Plant Species (listed alphabetically by scientific name)	2001-2019 (n=19 years)[1]	2020	2021	2022	2023	2024	Combined	Percentage of Combined
Live and dead Goodding's Black Willow (*Salix gooddingii*)	1						1	<1%
Red Willow (*Salix laevigata*)	16		1		2	2	21	2%
Arroyo Willow (*Salix lasiolepis*)	18	1	1	4	3	5	32	3%
Willow sp. (*Salix* sp.)	2	2	1				5	<1%
Black Sage (*Salvia mellifera*)	2						2	<1%
Blue Elderberry (*Sambucus mexicana*)	88	11	9	4	18	10	140	12%
Peruvian Pepper Tree[ie] (*Schinus molle*)	15	3	3	2	1	2	26	2%
Brazilian Pepper Tree[ie] (*Schinus terebinthifolius*)	1						1	<1%
Milk Thistle[ie] (*Silybum marianum*)	1						1	<1%
Tamarisk[ie] (*Tamarix ramosissima*)	1						1	<1%
Poison Oak (*Toxicodendron diversilobum*)	22	1	3	4	3	1	34	3%
Desert Wild Grape (*Vitis girdiana*)	13			2	1	1	17	1%
Rough Cockelbur (*Xanthium strumarium*)	2						2	<1%
Black Mustard[ie] (*B.nigra*) and Mulefat (*B. salicifolia*)	1						1	<1%
Black Mustard (*B. nigra*) and Poison Hemlock (*C. maculatum*)	1						1	<1%
Castorbean[ie] (*R. communis*) and Mulefat (*B. salicifolia*)	1						1	<1%
Goodding's Black Willow (*S. gooddingii*) and Blue Elderberry (*S. mexicana*)	1						1	<1%
Arroyo Willow (*S. lasiolepis*) and Black Mustard[ie] (*B. nigra*)	1						1	<1%
Desert Wild Grape (*V. girdiana*) and Mulefat (*B. salicifolia*)	3						3	<1%
Desert Wild Grape (*V. girdiana*) and Blue Elderberry (*S. mexicana*)	1						1	<1%

Appendix C-2-K continued. Least Bell's Vireo nest placement preferences at survey sites in the Santa Ana Watershed, 2000-2024.

Santa Ana Canyon (SAC) – Combined

Host Plant Species (listed alphabetically by scientific name)	2001-2019 (n=19 years)[1]	2020	2021	2022	2023	2024	Combined	Percentage of Combined
Desert Wild Grape (*V. girdiana*) and Peruvian Pepper Tree[ie] (*S. molle*)	1						1	<1%
Unknown/No data	5	2	1	1	1	1	11	1%
Total	**644**	**94**	**84**	**90**	**111**	**111**	**1134**	**100%**

[1]=Number of years in which nests were found

[i] = invasive

[e] = non-native

[r] = endangered, threatened, or sensitive

APPENDIX D: SUMMARY TABLES BY MANAGED SITE, 2000-2024

Available by request under separate cover.

APPENDIX E: ERRATA

While we have made every effort to accurately represent our data and results, the reader should recognize that data management and analysis are ongoing activities. In an effort to maintain a high level of accuracy, this erratum was produced to document *minor* errors that do not invalidate or alter the conclusions of the associated report. The following numbers were corrected after the release of the *Status and Management of the Least Bell's Vireo and Southwestern Willow Flycatcher in the Santa Ana River Watershed, 2023, and Summary Data by Site and Watershed-wide, 2000-2023* report.

Appendix C-1. Least Bell's Vireo reproductive success and breeding biology data at survey sites in the Santa Ana River Watershed, California.

Appendix Number	Page Number	Row	Parameter	Data Listed in the 2023 Report		Corrected Data	
				2023 Column	Combined Column	2023 Column	Combined Column
C-1-A	C-1	Y.	Average number of cowbirds trapped per day (W/X)	3.06	1.99	1.90	1.97