Final

CITY OF CARLSBAD HABITAT MANAGEMENT PLAN

Triennial Monitoring Summary Report through 2023

Prepared for
City of Carlsbad

March 2024

ESA

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Prepared by
Adrienne Lee
Environmental Science Associates

2355 Northside Drive
Suite 100
San Diego, CA 92108
619.719.4200
esassoc.com

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ACRONYMS AND ABBREVIATIONS

Acronym or Abbreviation	Definition
CBI	Conservation Biology Institute
CDFG	California Department of Fish and Game (prior to 2013)
CDFW	California Department of Fish and Wildlife (2013 and after)
CNLM	Center for Natural Lands Management
city	City of Carlsbad
ESA	Environmental Science Associates
HMP	Habitat Management Plan
HOA	homeowners association
IMG	Rare Plant Inspect and Manage
MCBCP	Marine Corps Base Camp Pendleton
MHCP	Multiple Habitat Conservation Program
MSP Roadmap	Management and Monitoring Strategic Plan for Conserved Lands in Western San Diego County: A Strategic Habitat Conservation Roadmap
SANDAG	San Diego Association of Governments
SDMMP	San Diego Management and Monitoring Program
USFWS	U.S. Fish and Wildlife Service
Wildlife Agencies	CDFW and USFWS

EXECUTIVE SUMMARY

Triennial Monitoring Summary Report through 2023

The Habitat Management Plan (HMP) is a citywide conservation plan describing how the city complies with state and federal environmental laws while remaining consistent with the city's General Plan and Growth Management Plan (City of Carlsbad 2004). The HMP was developed in coordination with the U.S. Fish and Wildlife Service (USFWS) and California Department of Fish and Wildlife (CDFW) (collectively known as the Wildlife Agencies) as part of a regional planning effort under the North County Multiple Habitat Conservation Program (MHCP). As a participant under the MHCP, the City of Carlsbad (city) is required to prepare annual reports summarizing compliance monitoring, take of habitat and species, and monitoring and management actions and results during that period, as well as a comprehensive monitoring report summarizing the resource status and any significant subregional trends in covered species or resources that could significantly impact covered species every three years (CDFG, USFWS, and CBI 2003). This triennial monitoring summary report, covering biological monitoring activities through 2023, fulfills the three-year summary requirement of the MHCP.

The MHCP requires multifaceted biological monitoring and can generally be classified by scale (preserve level versus citywide or subregional level) and by type (compliance monitoring versus effectiveness monitoring). The purpose of the triennial report is to track both compliance and effectiveness monitoring throughout the HMP preserve since its adoption. Monitoring highlights from 2021–2023 included in the report are as follows.

Vegetation Communities

- Habitat conservation totals 6,208 acres, 96% of conservation target.
- New composite vegetation layer developed and analyzed for vegetation changes and potential restoration opportunities.
- Coastal sage shrub monitoring results indicate increased shrub and native forb cover correlated with above average precipitation.

Upland Plants

- **San Diego thornmint.** Species documented on 8 Carlsbad Preserves and monitored at 7 during 2021–2023. Species is thriving and well-protected on Carlsbad Oaks North, Palomar Airport (outside the HMP), and Rancho La Costa Preserves (populations are >1,000 individuals). Monitoring began at The Ranch Preserve population in 2021 and species appears to be thriving. Populations on Carlsbad Raceway, Emerald Pointe, and Rancho Carrillo Master Association Preserves are very small and vulnerable to extirpation

(populations are < 200 individuals). Calavera Hills/Robertson Ranch Preserve population may be extirpated (not surveyed since 2013 after 2 years of negative detections).

- **Thread-leaved brodiaea.** Species documented on 7 Carlsbad Preserves and monitored at 6 during 2021–2023. Species is thriving with populations ranging from nearly 400 to over 60,000 individuals. Life history and pollinator studies for this species were concluded in previous reporting periods.
- **Del Mar Mesa sand aster.** Species documented and monitored on 1 Carlsbad Preserve during 2021–2023. Population is stable at City Ventures Preserve.
- **Del Mar manzanita.** Species documented on 6 Carlsbad Preserves and monitored at 3 during 2021–2023. Species appears to be stable and continues to recover from the Poinsettia Fire.
- **Encinitas baccharis.** Species documented on 1 Carlsbad Preserve in the 1990s and has not been rediscovered since; no monitoring occurred during 2021–2023.
- **Orcutt's hazardia.** Species was transplanted onto 2 Carlsbad Preserves in 2003 and continued to be monitored during 2021–2023. Adult populations appear stable but no seedlings were detected.

Vernal Pool Species

- **Poinsettia Station Preserve.** This vernal pool complex supported 6 vernal pool indicator species (Orcutt's brodiaea [*Brodiaea orcuttii*], San Diego button celery [*Eryngium aristulatum* var. *parishii*, spreading navarretia [*Navarretia fossalis*], California Orcutt grass [*Orcuttia californica*], San Diego fairy shrimp [*Branchinecta sandiegonensis*], and Riverside fairy shrimp [*Streptocephalus woottoni*] during 2021–2023, and likely supports the largest known occurrence of San Diego button celery.
- **Hieatt Property.** This vernal pool complex was not monitored in 2021–2023.
- **Manzanita Partners Preserve.** This vernal pool complex supported 3 vernal pool indicator species (San Diego button celery, little mousetail [*Myosurus minimus*], and San Diego fairy shrimp) during 2021–2023.

Lagoon/Coastal Bird Species

- **Belding's savannah sparrow.** Species documented at all three lagoons. Statewide monitoring did not occur during 2021–2023; however, territories were incidentally estimated with a decline at Agua Hedionda Lagoon and Batiquitos Lagoon and an increase at Buena Vista Lagoon.
- **California least tern.** Species documented at one lagoon and monitored during 2021–2023. This species has declined in both nests and breeding pairs, with number of nests ranging from 228–297 and number of pairs ranging from 205–277 during 2021–2023. However, 2023 had the highest total fledge count since the most recent population peak in 2018.
- **Light-footed Ridgway's rail.** Species documented at all three lagoons and monitored at all three during 2021–2023. Number of pairs at each subpopulation continue to be variable, ranging from 5–40.
- **Western snowy plover.** Species documented at one lagoon and monitored but not detected during 2021–2023.

Riparian Bird Species

- **Least Bell's vireo.** Species documented on 9 Carlsbad Preserves and monitored at all 9 during 2021–2023. Number of detections continue to be variable, with 3–5 males and no pairs detected during 2021–2023.
- **Southwestern willow flycatcher.** Species monitored concurrently with least Bell's vireo surveys and was not detected during 2021–2023.

Upland Bird Species

- **Coastal California gnatcatcher.** Species documented across the city and citywide monitoring occurred in 2022. Number of territories (pairs and single males) detected continues to increase within the city, with 175 territories detected in 2022, a 13 percent increase from the last citywide monitoring effort in 2013.

Additional Monitoring

- **Roadkill monitoring.** Three roadkill monitoring studies conducted at priority pinchpoint locations throughout the city – El Camino Real and Cannon Road, Faraday Avenue and Lionshead Avenue, and Rancho Santa Fe and El Camino Real.
- **Village H wildlife movement monitoring.** Remote wildlife cameras, roadkill monitoring, and dog waste studies were implemented to assess wildlife presence and movement patterns within Village H.
- **Site inspection program.** Eleven unmanaged preserves were inspected to document baseline status of species and habitats, determine threats, and develop management priorities.

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CHAPTER 1
Introduction

The City of Carlsbad (city) adopted the Habitat Management Plan (HMP) in November 2004 as a commitment to conserve the full range of native habitats and species throughout the city and maintain functional wildlife corridors through its implementation and assembly of the HMP preserve system. The HMP encompasses 24,570 acres of land and has the goal of conserving a preserve system of 6,478 acres. The HMP preserve system currently encompasses 6,208 acres of permanently conserved land and is made up of several categories of preserves (**Figure 1**) that can generally be categorized by the level of management.

1.1 Managed Preserves

Established private and city-owned preserves. These Hardline Preserves were established during or after the adoption of the HMP. They have approved preserve management plans implemented by preserve managers and are funded through endowments or other permanent funding sources for active monitoring and management. The city requires site specific annual reports for these preserves. The property owners for these preserves are a preserve management entity, homeowners association (HOA), or the city.

California Department of Fish and Wildlife (CDFW) ecological reserves. These Hardline Preserves were established prior to or subsequent to the adoption of the HMP and are all owned by the State of California and managed by CDFW. According to the HMP Implementing Agreement, the level of monitoring and management of the CDFW preserves is based upon the available state funding and resources. CDFW obtains State Wildlife Grant funding annually for monitoring and management activities on all CDFW preserves except for Buena Vista Creek Ecological Reserve, which is funded by a non-wasting endowment. Aside from Buena Vista Creek Ecological Reserve, there are currently no finalized long-term management plans for the CDFW Ecological Reserves in Carlsbad. Management is guided by draft plans, which have not been submitted to the city.

1.2 Unmanaged Preserves

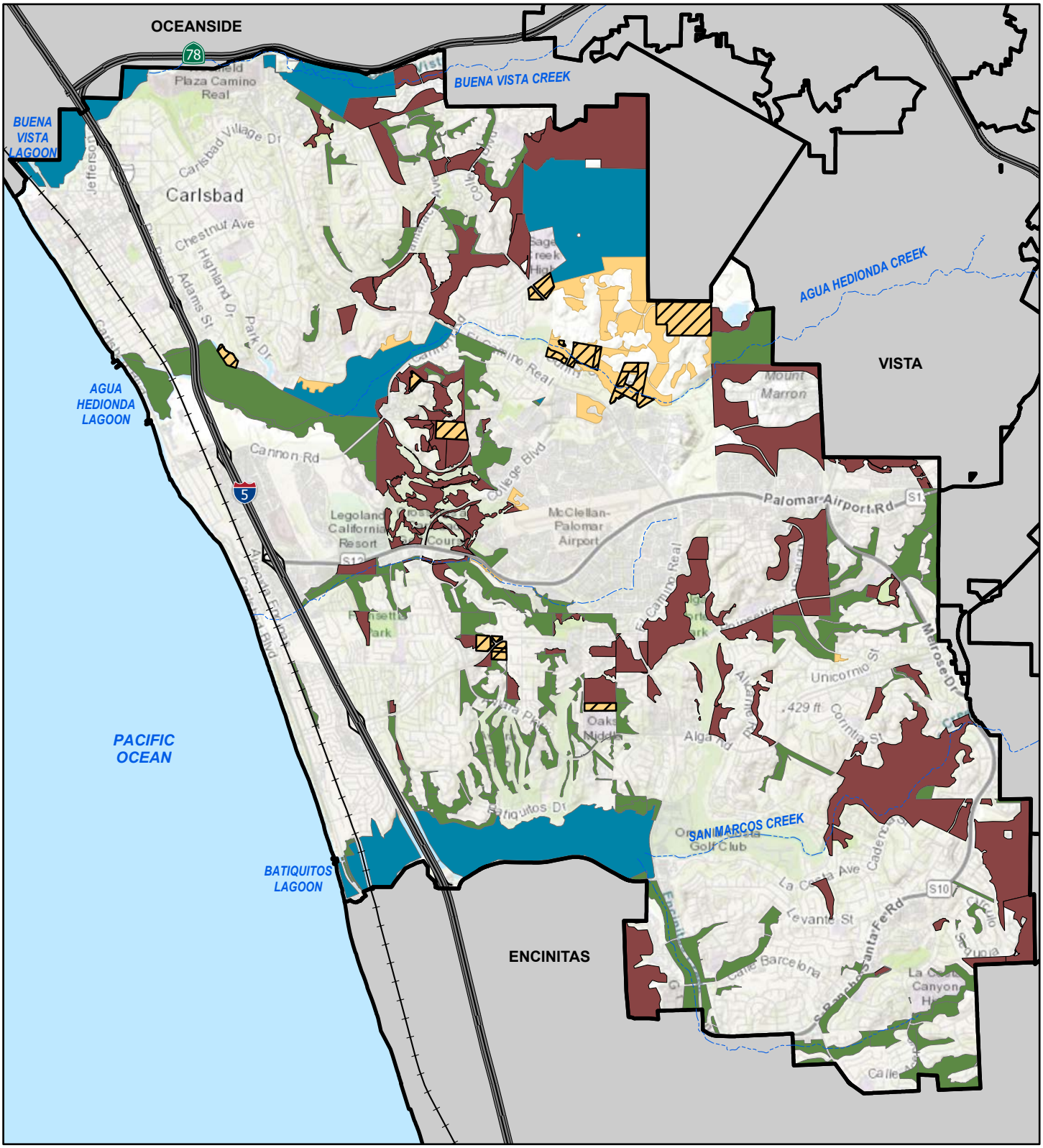
Pre-existing natural open space preserves. These Hardline Preserves were established prior to the adoption of the HMP and are not required to have a funded land manager or were established during the transition period of 2004–2005 that allowed for reduced funding requirements. There are no preserve management plans or active monitoring or management associated with these preserves, and maintenance of the property (e.g., trash pickup and fence maintenance) is the responsibility of the property owner. The property owners for these preserves are HOAs, business owners associations, and public and quasi-public agencies.

Future preserves (Proposed Hardline Preserves and Standard Areas). These areas are identified in the HMP for future conservation, but the preserves have not yet been established and long-term monitoring and management has not been initiated. As a condition of approval for any development on the property, the developer is obligated to establish the preserve by preparing a preserve management plan approved by the city and U.S. Fish and Wildlife Service (USFWS) and CDFW (collectively known as the Wildlife Agencies), contracting with a qualified land manager, funding an endowment or other secure financing mechanism, and recording a conservation easement.

1.3 Purpose of This Report

This report summarizes the results of biological monitoring conducted within the Carlsbad HMP preserve system since adoption of the HMP in November of 2004, with a focus on results from 2021–2023. This monitoring summary is provided every three years, pursuant to the HMP (City of Carlsbad 2004) and North County Multiple Habitat Conservation Program (MHCP) (CDFG, USFWS, and CBI 2003). Monitoring on managed preserves is conducted by the on-site preserve manager of each preserve. The monitoring results are submitted through site-specific annual reports and geographic information system (GIS) data to the HMP Preserve Steward. Monitoring on unmanaged preserves does occur and is conducted by regional monitoring partners and consultants. These monitoring results are requested by the HMP Preserve Steward. The city and HMP Preserve Steward also conduct additional monitoring when resources are available and monitoring results are managed by the HMP Preserve Steward. The HMP Preserve Steward summarizes the data every three years into a triennial monitoring summary report for the city.

For the most part, monitoring data is collected on established private and city-owned preserves and CDFW ecological reserves that are managed. **Figure 2** shows the property owner and preserve manager for individual preserves. Results of monitoring for vegetation communities and species on managed preserves are summarized in Chapter 2, *Vegetation Communities*, and Chapter 3, *Species*. Additional monitoring results occurring within the HMP preserve system on managed and unmanaged preserves are summarized in Chapter 4, *Additional Monitoring*.



Legend

- Established Private and City-owned Preserve
- California Department of Fish and Wildlife Ecological Reserve
- Pre-existing Natural Open Space Preserve
- Future Preserve Proposed Hardline
- Future Preserve Standards Area

Feet
0
6,400

City of Carlsbad

City of Carlsbad
Categories of HMP Preserves

Figure 1

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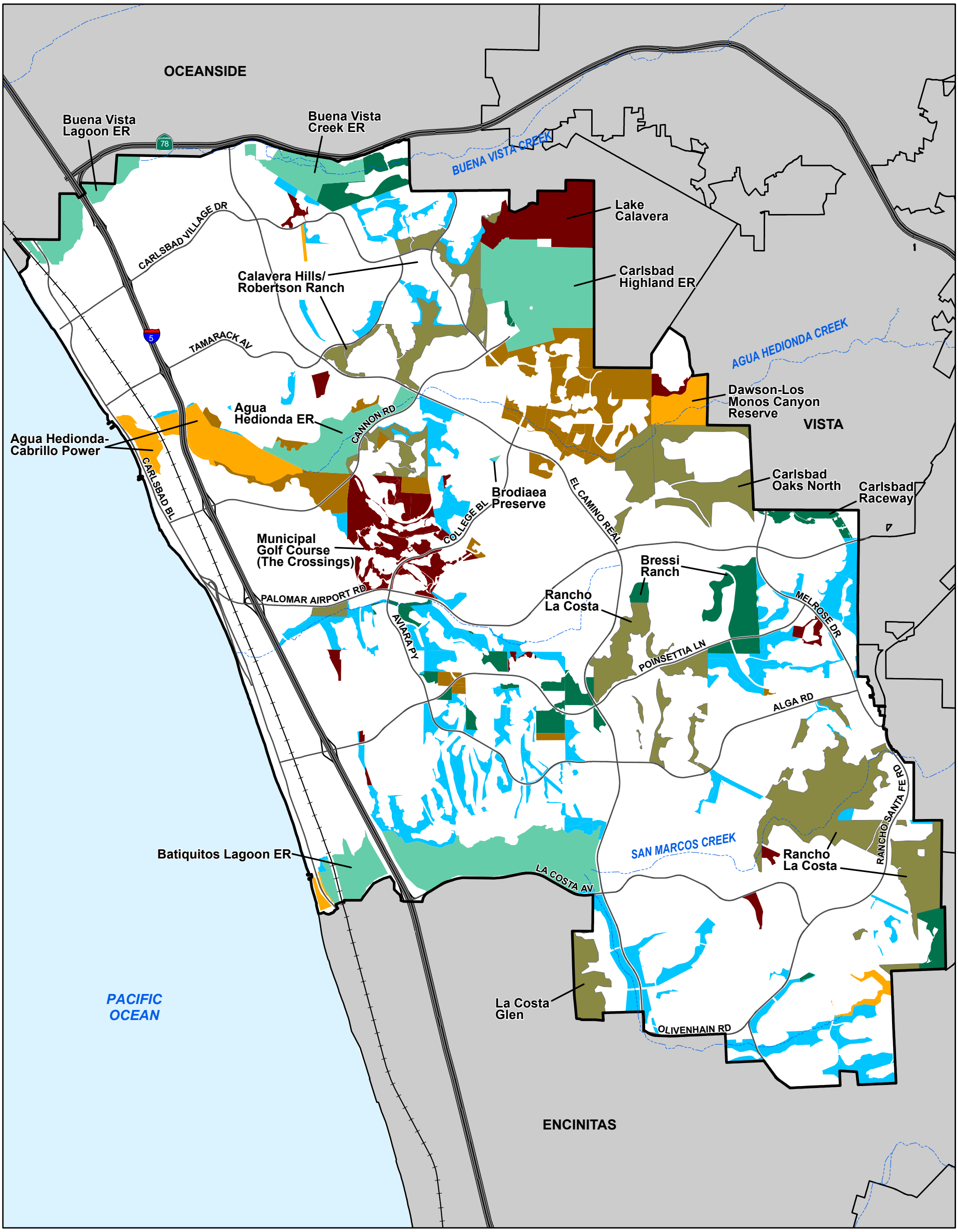

City of Carlsbad

City Preserves*
- Aura Circle
- Aviara Park
- Batiquitos Drive
- Carlsbad Village Dr
- Carrillo Ranch
- Crossings Golf Course
- Faraday
- La Costa Canyon Park
- La Costa/Romeria
- Lagoon Lane
- Lake Calavera
- Los Monos
- Macario Canyon
- Poinsettia Park
- Veteran's Park

Other Public/Semi-Public

Other Public/Semi-Public
- Cabrillo Power
- Dawson-Los Monos Canyon Reserve
- North County Transit District
- Other Public Agencies
- San Diego Gas & Electric
- San Dieguito Union School District
- State of California

Wildlife Agencies

California Department of Fish and Wildlife
- Agua Hedionda ER
- Batiquitos Lagoon ER
- Brodiaea Preserve
- Buena Vista Creek ER
- Buena Vista Lagoon ER
- Carlsbad Highlands ER

Conservation Management Entity

Center for Natural Lands Management
- Calavera Hills II/Robertson Ranch
- Carlsbad Oaks North
- Encinas Creek
- Kelly Ranch
- La Costa Glen
- Rancho La Costa

Other Management Entity
- Habitat Restoration Sciences (HRS)
- Helix Environmental
- San Diego Habitat Conservancy
- San Diego Urban Corps Habitat Services

Private

HOAs
- Aviara HOAs
- Calavera Hills HOAs
- La Costa HOAs
- Other HOAs and Private Open Space
- Rancho Carrillo Master HOA

Future Preserves

Future Preserves
- Other Future Preserve
- Pending Management
- Undeveloped Standards Area

* Managed by Center for Natural Lands Management (CNLM)

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City of Carlsbad
Current Preserve Ownership/Management

Figure 2

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CHAPTER 2
Vegetation Communities

One of the core biological objectives of the HMP is to conserve the full range of vegetation types within the city, with a focus on rare and sensitive habitats (City of Carlsbad 2004). This is documented through the annual vegetation community accounting required by the MHCP. The city is responsible for tracking the acreage, type, and location of vegetation communities conserved and destroyed by permitted land uses and other activities. This section summarizes the monitoring results for vegetation community accounting since the adoption of the HMP. Ongoing monitoring includes compiling annual weather data, tracking vegetation community mapping throughout the HMP preserve, and summarizing long-term coastal sage scrub monitoring results.

2.1 Influence of Weather and Climate Change on the Preserve System

In the past decade, extreme fluctuations in rainfall and wildfire had a significant impact on the condition of the preserve system. Average annual precipitation in Carlsbad based on historical weather data from the McClellan-Palomar Airport is approximately 10 inches. Severe drought conditions were especially prominent during the 2013, 2014, 2018, and 2021 water years (October 1 through September 30), which brought 6.26, 5.19, 6.15, and 5.82 inches of rain, respectively (NOAA 2024) (**Table 1** and **Graph 1**). The drought that occurred in the 2013 and 2014 water years cultivated the conditions that were present in the Poinsettia Fire, which burned over 300 acres in Carlsbad in May 2014, most of which was on HMP preserve lands. Below-average rainfall was observed in the 2016 and 2022 water years, average rainfall was observed in the 2015 water year, and above-average rainfall was observed in the 2017, 2019, 2020, and 2023 water years, with 2023 having the highest precipitation documented across the monitoring period, nearly 240 percent of the historic precipitation average (NOAA 2024).

Projections of climate change in the region include warming by approximately 4°F to 9°F, and a 15 to 25 percent decrease in fall and spring precipitation with an increase in variability (Climate Science Alliance 2018). These projections anticipate more frequent and intense droughts and heat waves punctuated by increasingly rare yet extreme precipitation and flooding events, amplifying the likelihood and frequency of fire events (Climate Science Alliance 2018; Jennings et al. 2018). These climate impacts extreme weather conditions, along with increased human presence, are expected to continue to put added stress onto our already vulnerable natural lands.

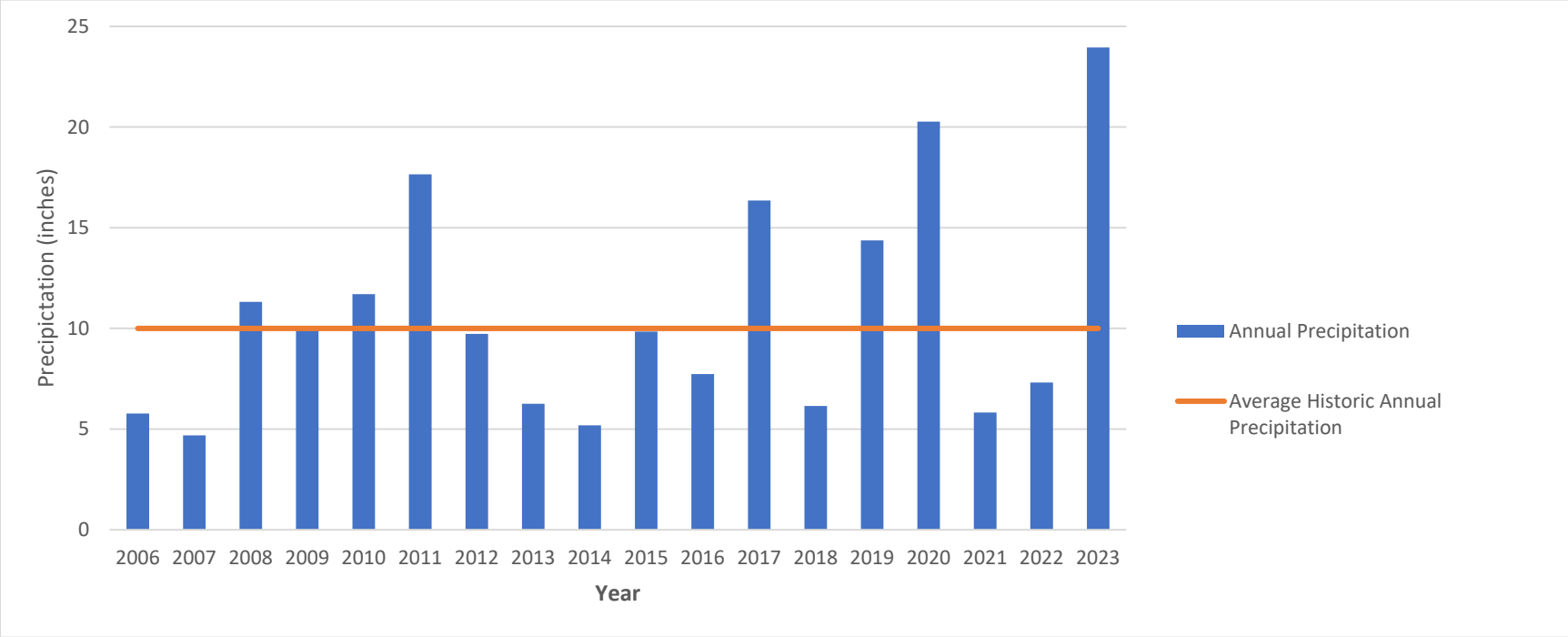
TABLE 1
ANNUAL PRECIPITATION IN CARLSBAD

Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Precipitation Total (inches)*	5.77	4.69	11.32	10.0	11.7	17.65	9.73	6.26	5.19	9.84	7.73	16.35	6.15	14.37	20.27	5.82	7.31	23.95

NOTES:

* Measurements from the McClellan-Palomar Airport in Carlsbad, CA (NOAA 2024). Data represents the total precipitation recorded for each water year, October 1 through September 30. The year presented coincides with the end of the water year (September).

GRAPH 1
TOTAL ANNUAL PRECIPITATION, 2006–2023



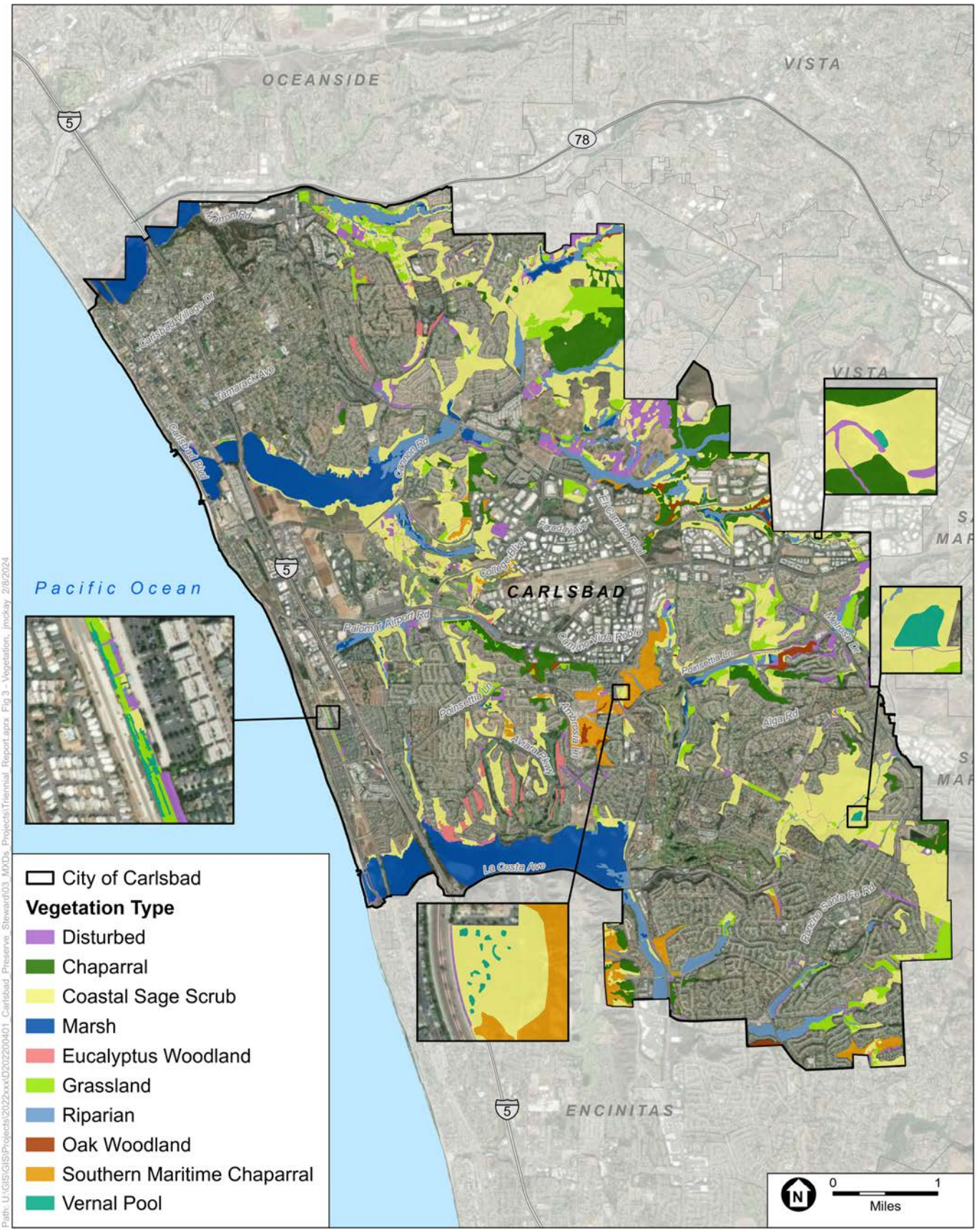
NOTES: Measurements from McClellan-Palomar Airport in Carlsbad, CA (NOAA 2024). Data represents the total precipitation recorded for each water year, October 1 through September 30. The year presented coincides with the end of the water year (September).

2.2 Vegetation Mapping

During the development of the HMP, vegetation mapping for the MHCP subregion was updated and refined within the HMP Plan Area using satellite imagery, project-specific field mapping, and GIS data files maintained independently by the San Diego Association of Governments (SANDAG) and the city. This master map was completed in 1999 and represents the city's original baseline vegetation mapping at the time of HMP adoption.

As a requirement of the HMP and MHCP, long-term vegetation monitoring within the preserve system is accomplished through periodic mapping and focused studies. Mapping is conducted within preserves by the preserve managers every five years to document changes in vegetation community boundaries over time and GIS data files are submitted to the city as part of annual reporting. Vegetation communities were originally mapped using Oberbauer-modified Holland classification system (Holland 1986; Oberbauer 2008), which is the classification system upon which the HMP habitat targets are based. However, the preserve managers now use the Vegetation Classification Manual for Western San Diego County (VCM) (SANDAG 2011), the current standard classification system for the region. VCM is based on alliances and associations, which are defined by the presence and abundance of diagnostic plant species. This classification is much more fine-scaled and provides more information about variation within the habitat. Site-specific vegetation mapping submitted by preserve managers is incorporated into a single citywide geospatial vegetation layer. Because the HMP requirements are tracked in the older classification system, the city's vegetation layer uses a crosswalk to the Oberbauer system for tracking purposes.

In 2023, a new composite vegetation layer was developed for the HMP preserve system using current vegetation mapping from preserve managers, vegetation mapping completed by AECOM in 2012 as part of the regional vegetation mapping for the western San Diego County, and SanGIS county-wide vegetation mapping (ESA 2023a). Mapping provided by preserve managers have been ground-truthed while mapping provided by AECOM and SanGIS are generally GIS-based, using aerial maps and other information. This new composite vegetation layer represents the current vegetation community mapping within the HMP preserve system. The acreages of conserved habitat types within the HMP preserve system using the new composite vegetation layer are presented in **Table 2** and depicted in **Figure 3**. Environmental Science Associates (ESA) used this vegetation layer to analyze potential restoration opportunities within the HMP preserve system and identify how many acres of vegetation have changed since the city's original mapping was completed in 1999. Additional details for these analyses can be found in **Appendix A**, *City of Carlsbad Restoration Opportunities GIS Analysis Memorandum*.



SOURCE: ESRI; City of Carlsbad, 2021; SanGIS, 2022; ESA, 2023

City of Carlsbad Habitat Management Plan
Triennial Monitoring Summary Report through 2023

Figure 3
City of Carlsbad Vegetation Mapping

ESA

TABLE 2
HMP HABITAT TYPE CONSERVATION TARGET AND STATUS

HMP Habitat Type	Target Acres	Total Conserved Acreage[a]	Percent Complete (%)
Coastal sage scrub	2,139	2,410.33	112.7
Chaparral	676	661.73	97.9
Southern maritime chaparral	342	301.94	88.3
Oak woodland	24	64.49	268.7
Riparian	494	641.44	129.8
Marsh	1,252	1,139.66	91.0
Grassland	707	599.04	84.7
Eucalyptus woodland	99	95.16	96.1
Disturbed lands	745	276.16	37.1
Vernal Pool	NA	5.76	NA
Total Target Conservation	***6,478***[b]	***6,195.71***[c]	***95.6***

NOTES:

a. Conserved acreages for each HMP habitat type were calculated within the current HMP preserve system boundaries using the most current vegetation mapping layer (ESA 2023a).
b. Target conservation acreage includes 100% of all Standards Area parcels. However, a portion of these parcels are expected to be developed; therefore, the final total will be slightly less than the target value.
c. Total conserved acreage shown in this table has slight discrepancy with current conserved acreage of 6,208 acres reported throughout this report due to recent updates to HMP boundaries.

2.3 Long-Term Coastal Sage Scrub Monitoring

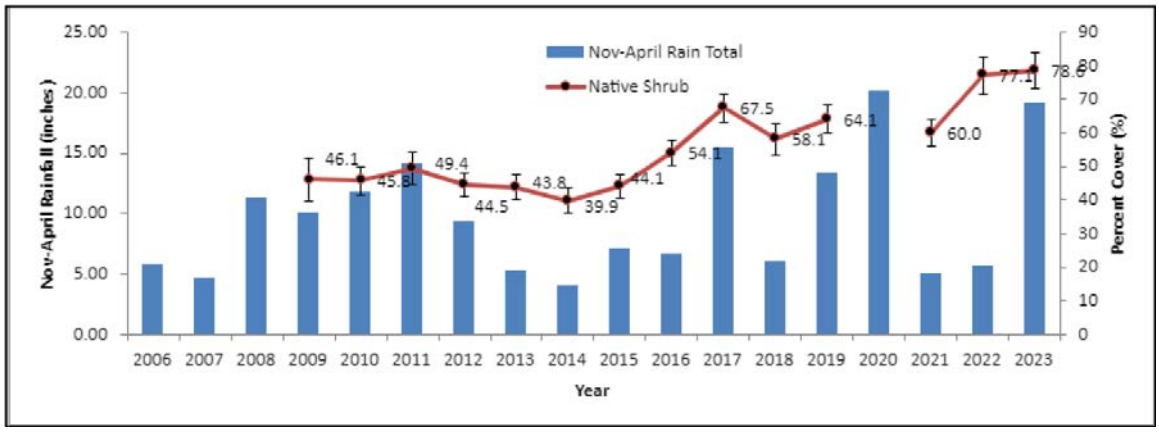
The Center for Natural Lands Management (CNLM) began a long-term monitoring program in coastal sage scrub habitat during the spring of 2009 by setting up modified Whittaker plots (see CNLM 2010a for methods and rationale). Fifty-nine plots, distributed evenly across the landscape in Carlsbad, have been visited every year from 2009 to 2023 on a three-year return interval. The plots are located on CNLM-managed preserves, CDFW Ecological Reserves, and the Aviara Master Association Preserve. One-third of the plots are monitored each year, and thus, each plot is visited every three years (termed rotating panel). The advantages of using a rotating panel design rather than visiting the same plots every year are that (1) it allows for sampling within a broader area, and (2) it reduces potential impacts from trampling from monitoring activities. The purpose of the study is to track and evaluate changes in the structure, composition, and species richness of coastal sage scrub over time. Species richness was collected for nine years (three rotating panels), through 2017; it was stopped at this time as there were no meaningful trends expressed (such as loss of species). Coastal sage scrub monitoring did not occur in 2020 due to the COVID-19 stay-at-home order and resumed in spring 2021.

2.3.1 Results of Coastal Sage Scrub Monitoring

Coastal sage scrub monitoring results from 2006–2023 are provided in **Graphs 2 through 4**. From 2009 to 2016, average percent cover of all shrubs showed a generally even trend, while 2017 showed an increase in percent cover. Shrub cover in 2019 increased from its slight dip in 2018. Shrub cover increased significantly in 2022 and 2023, with the second highest and highest percent cover, respectively, documented across the monitoring period. Native forb percent cover

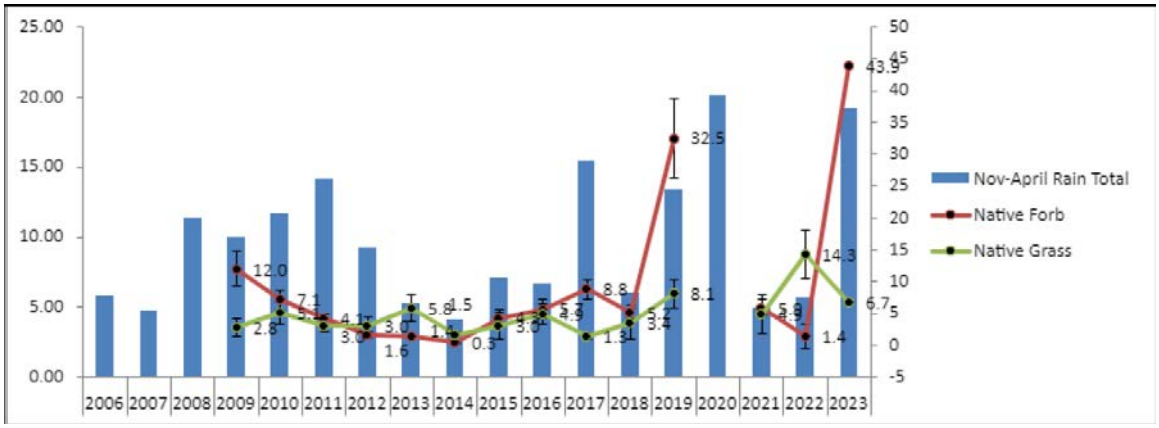
increased dramatically in 2019 and 2023, with the second highest and highest percent cover, respectively, documented across the monitoring period. These large percent increases were likely due to the above-average heavy precipitation levels. Native grass percent cover has remained generally even trend from 2009 to 2018, increasing in 2019 and 2022, and returning to average values in 2021 and 2023. Native grass percent cover was highest on record for the monitoring period in 2022. Percent cover for exotic forbs and exotic grasses both increased in 2023 due to the above-average heavy precipitation levels. Results of coastal sage scrub monitoring from 2009 to 2023 are presented in the following graphs.

GRAPH 2
ANNUAL PRECIPITATION AND COASTAL SAGE SCRUB COVER 2006–2023



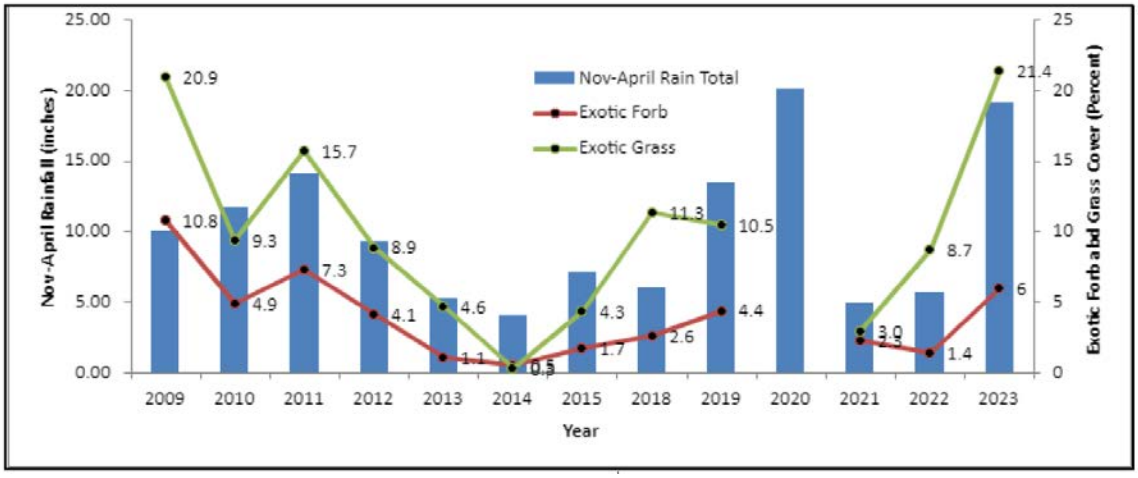
NOTES: Data were collected incorrectly in 2016 and 2017; thus, those data are removed.

GRAPH 3
ANNUAL PRECIPITATION AND NATIVE FORB AND GRASS COVER 2006–2023



NOTES: Data were collected incorrectly in 2016 and 2017 and thus, those data are removed.

GRAPH 4
ANNUAL PRECIPITATION AND EXOTIC FORB AND GRASS COVER 2006–2023



NOTE: Data were collected incorrectly in 2016 and 2017 and thus, those data are removed.

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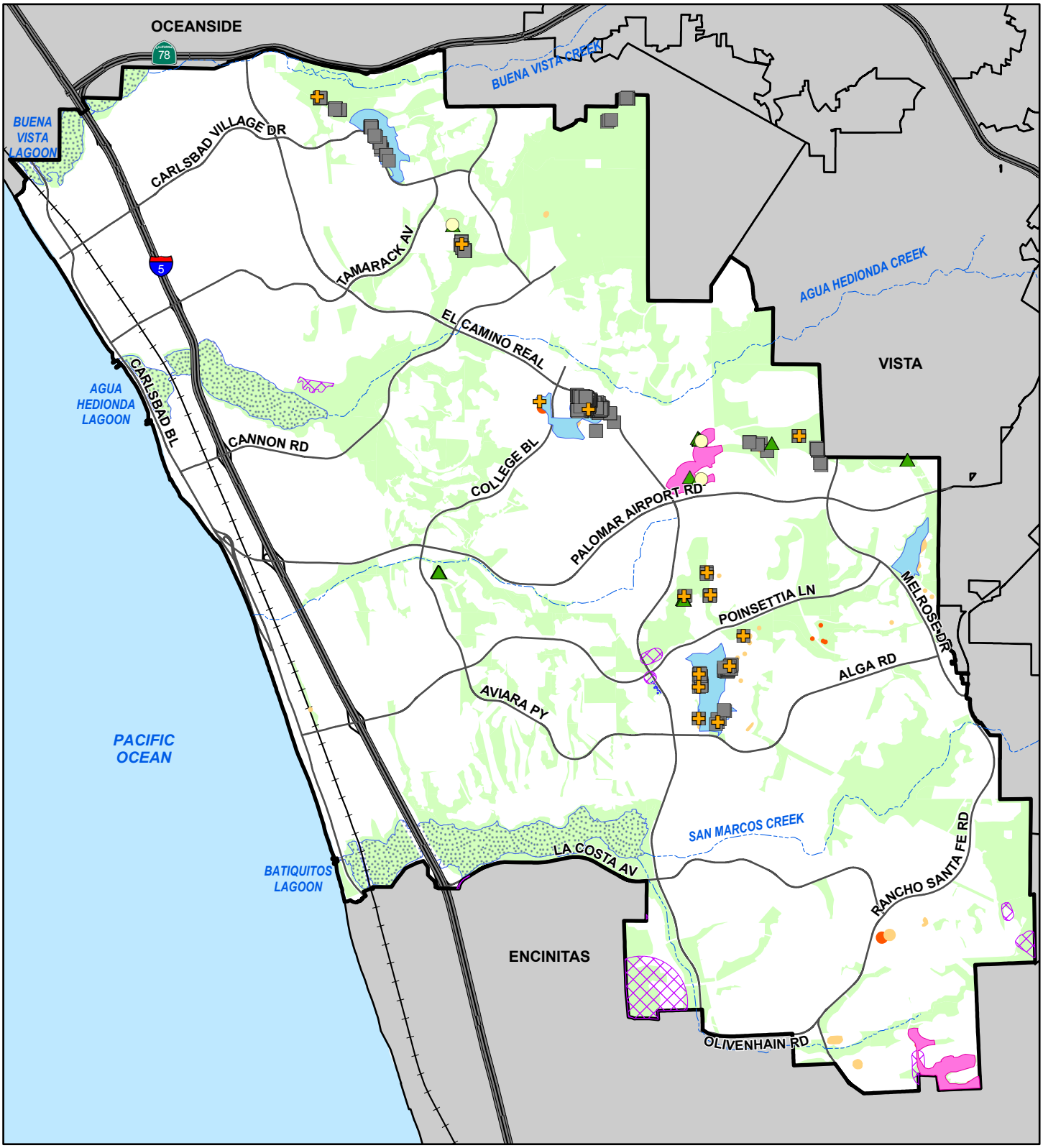
CHAPTER 3
Species

This section summarizes the monitoring results for species with site-specific permit conditions (i.e., those that require individual populations to be monitored over time) per the MHCP (CDFG, USFWS, and CBI 2003). The species are grouped by general type, including upland plants, vernal pool plants and animals, lagoon/coastal birds, riparian birds, and upland birds. Long-term focused species monitoring is conducted to document species persistence in the preserve system, and to inform site-specific management actions. The information summarized in this report comes from site-specific annual reports, regional species monitoring reports, and GIS data. **Table 3** summarizes the years that focused species surveys were conducted on each preserve and demonstrates compliance with species-specific monitoring requirements (see MHCP Volume III, Appendix A.1). **Figure 4 through Figure 9** show the known locations of these species based on data from preserve managers, the California Natural Diversity Database (CNDDB), and USFWS.

Site-specific species monitoring is designed to evaluate preserve-specific presence and status and offers a look at species status at a citywide level. (It is not intended to be used to understand overall species population trends across the region or across the species' range.) Regional monitoring and associated research coordinated by the San Diego Management and Monitoring Program (SDMMP) provides information about species population trends, genetic exchange, and best management practices for individual species across the region. SDMMP prepared a science-based regional *Management and Monitoring Strategic Plan for Conserved Lands in Western San Diego County: A Strategic Habitat Conservation Roadmap* (MSP Roadmap) (SDMMP 2017), which provides regional and local (population-specific) goals and objectives. The MSP Roadmap document is an adaptive management and monitoring implementation plan for priority species and habitats within Western San Diego County and is coordinated across multiple jurisdictions, key organizations, and individuals in an effort to obtain a cohesive management and monitoring strategy for these species, including databases and mapping tools, species-specific monitoring protocols, and management techniques specific to local threats.



USFWS Occurrence:

- San Diego Thornmint
- Thread-leaved Brodiaea

HMP Database:

- San Diego Thornmint
- Thread-leaved Brodiaea

HMP Database:

- Del Mar Mesa Sand Aster

USFWS Critical Habitat:

- San Diego Thornmint
- Thread-leaved Brodiaea

- Existing and Proposed Hardline Preserve

CNDDB Occurence:

- Del Mar Mesa Sand Aster
- San Diego Thornmint
- Thread-leaved Brodiaea

N

0 Feet 6,400

City of Carlsbad

City of Carlsbad
Current Status of Upland Herbs

Figure 4

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Date: 2/7/2024

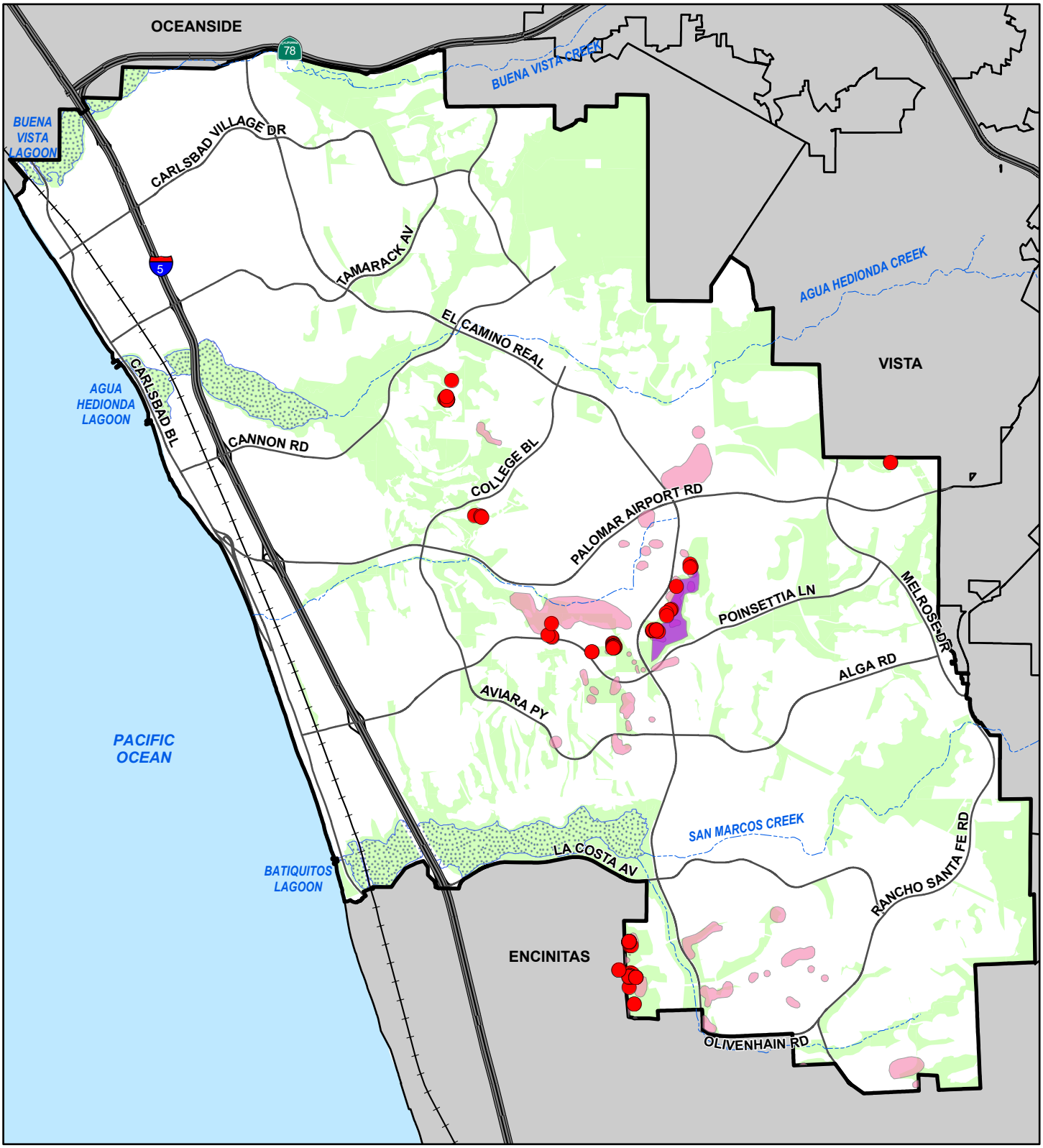
TABLE 3
PRIORITY SPECIES SURVEYS CONDUCTED ON ACTIVELY MANAGED PRESERVES

Preserve	Agua Hedionda Lagoon ER	Batiquitos Lagoon ER	1-Ac Brodiaea Preserve	Buena Vista Creek ER	Buena Vista Lagoon ER	Calavera Hills/ Robertson Ranch	Carlsbad Highlands ER	Carlsbad Oaks North	Carlsbad Raceway	City Preserves	City Ventures	Emerald Pointe	Encinas Creek	Kelly Ranch	La Costa Glen	Manzanita Partners	Morning Ridge	Poinsettia Place	Poinsettia Station	Quarry Creek	Rancho La Costa
Land Manager	**CDFW**	**CDFW**	**CDFW**	**CNLM**	**CDFW**	**CNLM**	**CDFW**	**CNLM**	**SDHC**	**CNLM**	**UC**	**SDHC**	**CNLM**	**CNLM**	**CNLM**	**Dudek**	**UC**	**UC**	**Dudek**	**SDHC**	**CNLM**
Upland Plant Species																					
San Diego thornmint	NP	NP	NP	NP	NP	2008–2012	NP	2007–2023	2010, 2017–2023	NP	NP	2009–2010, 2014–2023	NP	NP	NP	NP	NP	NP	NP	NP	2005–2023
Thread-leaved brodiaea	NP	NP	2015–2020	2011–2019, 2021, 2023	NP	2006–2019, 2021, 2023	2008, 2015, 2016, 2017, 2019, 2021	2007–2019, 2021, 2023	NP	2012–2023	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	2005–2011, 2013–2017, 2019, 2021, 2023
Del Mar mesa sand aster	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	2014–2023	NP	NP	NP	2007, 2014–2017	1998	NP	NP	NP	NP	NP
Del Mar manzanita	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	2009, 2014, 2017, 2018, 2019, 2022	2007, 2013, 2014, 2015, 2017, 2022, 2023	2005, 2013	2005, 2008, 2014	2004, 2014, 2020–2022	NP	NP	2005, 2008, 2014–2017
Encinitas baccharis	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	2013–2015	NP	NP	NP	NP	NP	NP
Orcutt's hazardia *	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	2004–2014, 2016–2023	NP	NP	NP	NP	NP	NP	2004–2006, 2009–2012, 2013–2021, 2023
Vernal Pool Species																					
California Orcutt grass	Vernal pools do not occur on these preserves								NP	Vernal pools do not occur on these preserves						NP	Vernal pools do not occur on these preserves		2019, 2020, 2023	Vernal pools do not occur on these preserves	
Little mousetail									NP							2022, 2023			NP		
San Diego button-celery									NP							2016–2020, 2022, 2023			2019–2023		
Spreading navarretia									NP							NP			2019–2023		
Riverside fairy shrimp									NP							NP			2019, 2020, 2023		
San Diego fairy shrimp									NP							2004, 2005, 2019, 2020, 2023			2020, 2023		

Preserve	Agua Hedionda Lagoon ER	Batiquitos Lagoon ER	1-Ac Brodiaea Preserve	Buena Vista Creek ER	Buena Vista Lagoon ER	Calavera Hills/ Robertson Ranch	Carlsbad Highlands ER	Carlsbad Oaks North	Carlsbad Raceway	City Preserves	City Ventures	Emerald Pointe	Encinas Creek	Kelly Ranch	La Costa Glen	Manzanita Partners	Morning Ridge	Poinsettia Place	Poinsettia Station	Quarry Creek	Rancho La Costa
Land Manager	**CDFW**	**CDFW**	**CDFW**	**CNLM**	**CDFW**	**CNLM**	**CDFW**	**CNLM**	**SDHC**	**CNLM**	**UC**	**SDHC**	**CNLM**	**CNLM**	**CNLM**	**Dudek**	**UC**	**UC**	**Dudek**	**SDHC**	**CNLM**
Lagoon/Coastal Bird Species																					
Belding's savannah sparrow	1973, 1977, 1986, 1991, 1996, 2001, 2006, 2010, 2015	1973, 1977, 1986, 1991, 1996, 2001, 2006, 2010, 2015			1973, 1977, 1986, 1991, 1996, 2001, 2006, 2010, 2015	Lagoon species do not occur on these preserves															
California least tern	NS	2001–2023			NS																
Light-footed Ridgway's rail	2000–2023	2000–2023			2000–2023																
Western snowy plover	2001–2023	2001–2023			2001–2023																
Riparian Bird Species																					
Least Bell's vireo	2008	NSI	NP	2008–2010 2014, 2016, 2018, 2021	NSI	2017, [2022]	NSI	NP	NP	2009–2011, 2013, 2016, 2019, 2022	NP	NP	2008–2019, 2021, 2023	NP	NP	NP	NP	NP	NP	2016, 2019, 2022	2014, 2019, 2023
Southwestern willow flycatcher	NSI	NSI	NP	2008–2010 2014, 2016, 2018, 2021	NSI	2017, [2022]	NSI	NP	NP	2009–2011, 2013, 2016, 2019, 2022	NP	NP	2008–2019, 2021, 2023	NP	NP	NP	NP	NP	NP	NP	NP
Upland Bird Species																					
Coastal California gnatcatcher	2008, 2010, 2013, 2022	2008, 2010, 2013, 2022	NP	2008, 2010, 2013, 2022	NSI	2007, 2010, 2013, 2015, 2016, 2022	2008, 2010, 2013, 2018, 2019, 2022	2007, 2010, 2013, 2022	2014, 2022	2011, 2013, 2018, 2022	2013, 2017, 2020, 2022	2009, 2012, 2022	2008–2020, 2021–2023	2003–2007, 2010, 2013, 2022	2013, 2017, 2022	2016, 2022	2005, 2013, 2018, 2022	2013, 2017, 2020, 2022	NP	2016, 2022	2005, 2007, 2010, 2013, 2018, 2022

NOTES: CDFW = California Department of Fish and Wildlife; CNLM = Center for Natural Lands Management; SDHC = San Diego Habitat Conservancy; UC = Urban Corps of San Diego County.; ER = Ecological Reserve.; NP = not present; NS = not surveyed; NSI = no survey information.

* Transplanted population.



City of Carlsbad

City of Carlsbad
Current Status of Upland Shrubs

Figure 5

Document Path: \\shares\GIS_app\RequestsMarch2015\PublicWorks\PEM\MuniProp\RITM0037566_24\HMP Triennial Monitoring Report\HMP Triennial Monitoring Report.aprx

Date: 2/7/2024

HMP Database:
- Orcutt's Brodiaea

USFWS Occurrence:
- Riverside Fairy Shrimp
- San Diego Fairy Shrimp
- California Orcutt grass

HMP Database:
- California Orcutt's Grass
- San Diego Button-Celery
- Spreading Navarretia
- Riverside Fairy Shrimp
- San Diego Fairy Shrimp

CNDDB Occurrence:
- Riverside Fairy Shrimp
- San Diego Fairy Shrimp

USFWS Critical Habitat:
- San Diego Fairy Shrimp
- Spreading Navarretia

- Existing and Proposed Hardline Preserve

0 6,400 Feet

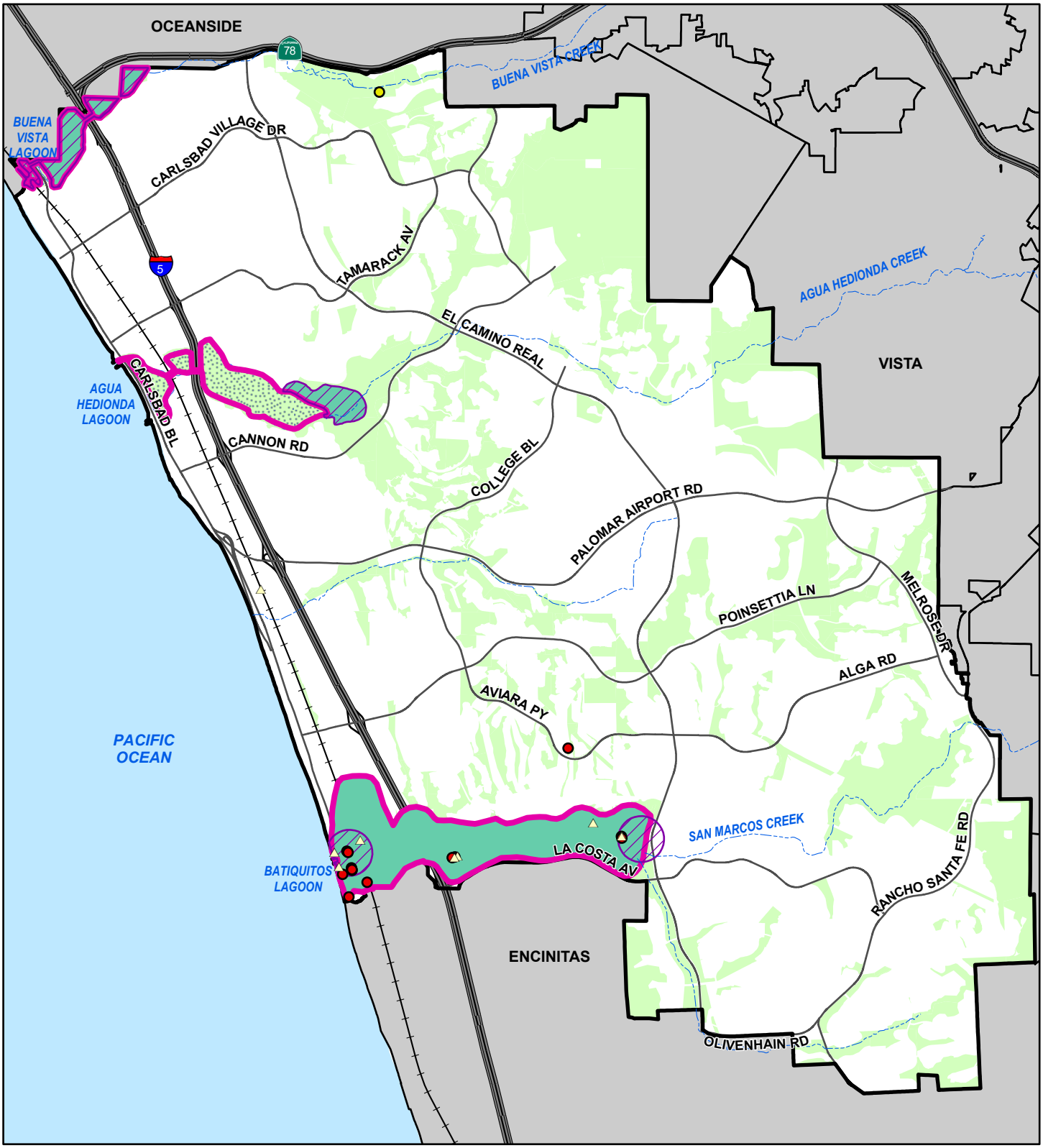
City of Carlsbad

City of Carlsbad
Current Status of Vernal Pool Species

Figure 6

Document Path: \\shares\GIS_app\RequestsMarch2015\PublicWorks\PEM\MuniProp\RITM0037566_24\HMP Triennial Monitoring Report\HMP Triennial Monitoring Report.aprx

Date: 2/7/2024



HMP Database:

- Least Tern

USFWS Occurrence:

- Least Tern
- Western Snowy Plover

CNDDB Occurrence:

- Western Snowy Plover
- Belding's Savannah Sparrow
- Least Tern

Existing and Proposed Hardline Preserve

N

0 Feet 6,400

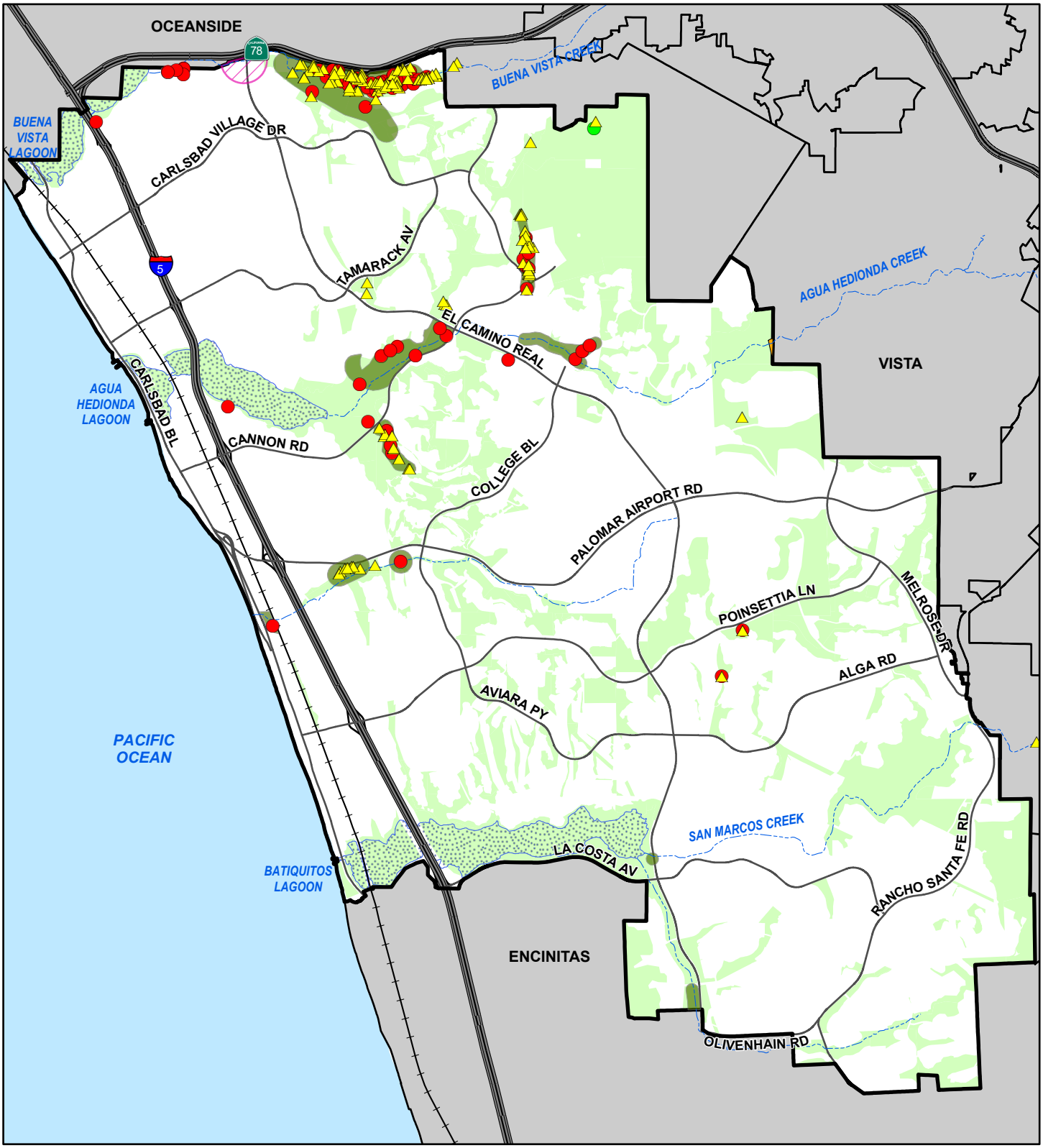
City of Carlsbad

City of Carlsbad
Current Status of Lagoon Species - Birds

Figure 7

Document Path: \\shares\GIS_app\RequestsMarch2015\PublicWorks\PEM\MuniProp\RITM0037566_24\HMP Triennial Monitoring Report\HMP Triennial Monitoring Report.aprx

Date: 2/7/2024



HMP Database:

- Southwestern Willow Flycatcher
- Least Bell's Vireo

USFWS Occurrence:

- Least Bell's Vireo

USFWS Critical Habitat:

- Southwestern Willow Flycatcher

CNDDB Occurrence:

- Least Bell's Vireo
- Southwestern Willow Flycatcher

- Existing and Proposed Hardline Preserve

N

0 Feet 6,400

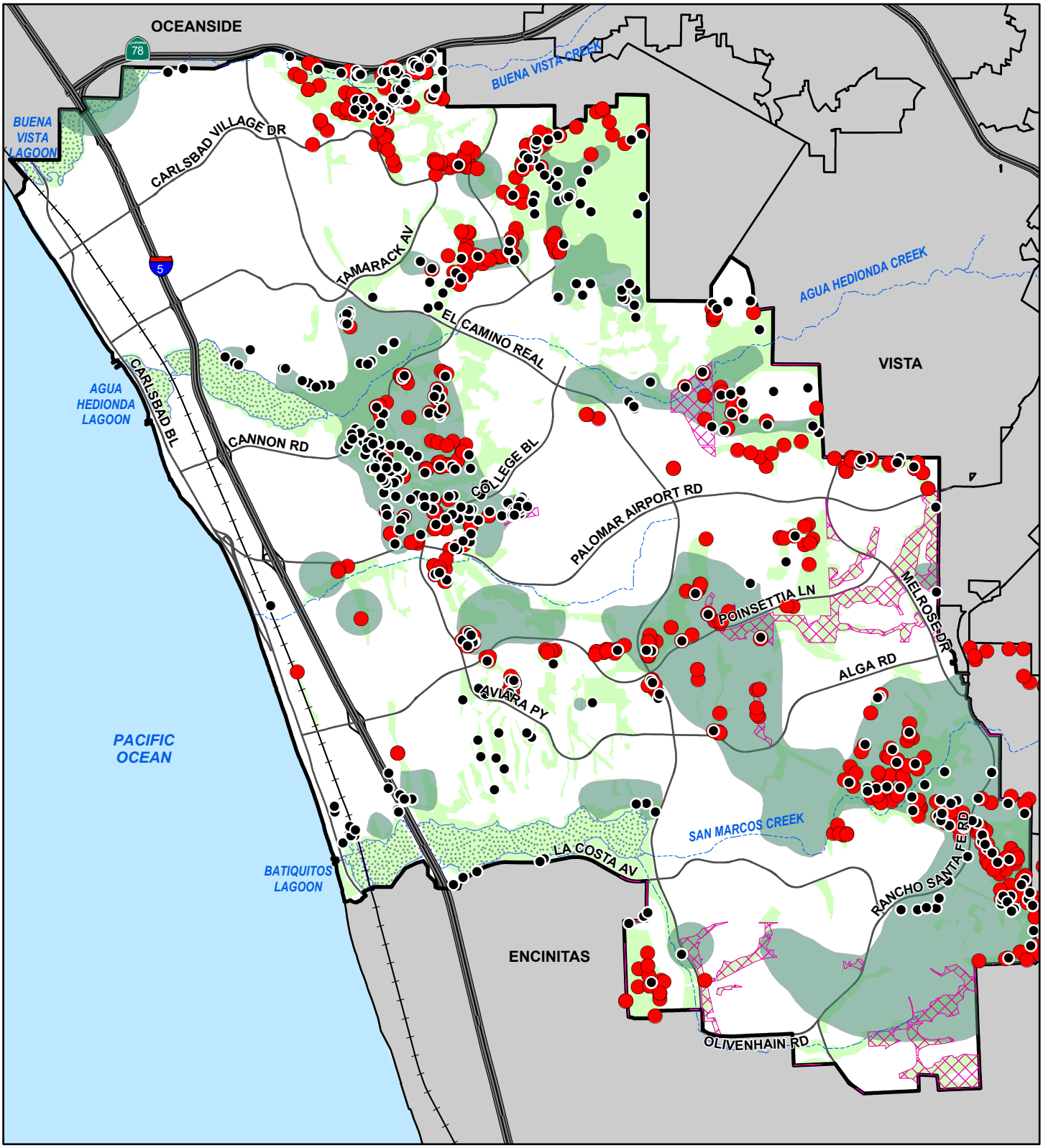
City of Carlsbad

City of Carlsbad
Current Status of Riparian Birds

Figure 8

Document Path: \\shares\GIS_app\RequestsMarch2015\PublicWorks\PEM\MuniProp\RITM0037566_24\HMP Triennial Monitoring Report\HMP Triennial Monitoring Report.aprx

Date: 2/7/2024



USFWS Occurrence:
- Coastal California Gnatcatcher

HMP Database:
- Coastal California Gnatcatcher

USFWS Critical Habitat:
- Coastal California Gnatcatcher

CNDDB Occurrence:
- Coastal California Gnatcatcher

- Existing and Proposed Hardline Preserve

Feet
0
6,400

City of Carlsbad
Current Status of Coastal California Gnatcatcher

Figure 9

Document Path: \\shares\GIS_app\RequestsMarch2015\PublicWorks\PEM\MuniProp\RITM0037566_24\HMP Triennial Monitoring Report\HMP Triennial Monitoring Report.aprx

Date: 2/7/2024

3.1 Upland Plants

Certain MHCP-covered species (i.e., San Diego thornmint [*Acanthomintha ilicifolia*], Del Mar manzanita [*Arctostaphylos glandulosa* ssp. *crassifolia*], Encinitas baccharis [*Baccharis vanessae*], thread-leaved brodiaea [*Brodiaea filifolia*], Del Mar mesa sand aster [*Corethrogyne filaginifolia* var. *linifolia*], Orcutt's hazardia [*Hazardia orcuttii*], and Nuttall's acmispon [*Acmispon prostratus*]) are required to have site-specific monitoring (CDFG, USFWS, and CBI 2003) and long-term monitoring for these species is ongoing within the city. Additionally, the Rare Plant Inspect and Manage (IMG) monitoring program was developed by SDMMP as part of the MSP Roadmap to identify and prioritize management objectives regarding status, threats, and management needs for 30 rare plant species (six of which occur in the City of Carlsbad) on conserved lands in Western San Diego County. The city encourages preserve managers to participate in the regional IMG monitoring program as feasible. The most current IMG monitoring protocol was prepared by SDMMP in 2022 (SDMMP 2022).

3.1.1 San Diego Thornmint

Scientific name: *Acanthomintha ilicifolia*
Status: federally threatened, state endangered

3.1.1.1 MHCP Critical Locations and Major Populations

The MHCP identified critical locations and major populations in scattered locations throughout Carlsbad, mostly in private HOA preserve lands.

3.1.1.2 Long-Term Monitoring

Within Carlsbad, long-term monitoring for selected populations has been ongoing since 2008. Populations of San Diego thornmint at Carlsbad Oaks North, Emerald Pointe, and Rancho La Costa Preserves are regularly monitored by Preserve Managers (Figure 4). Populations monitored as part of the SDMMP rare plant monitoring program include Carlsbad Raceway, Emerald Pointe, Palomar Airport (County-owned preserve), and Rancho Carrillo and The Ranch (HOA-owned and managed preserves).

3.1.1.3 Status

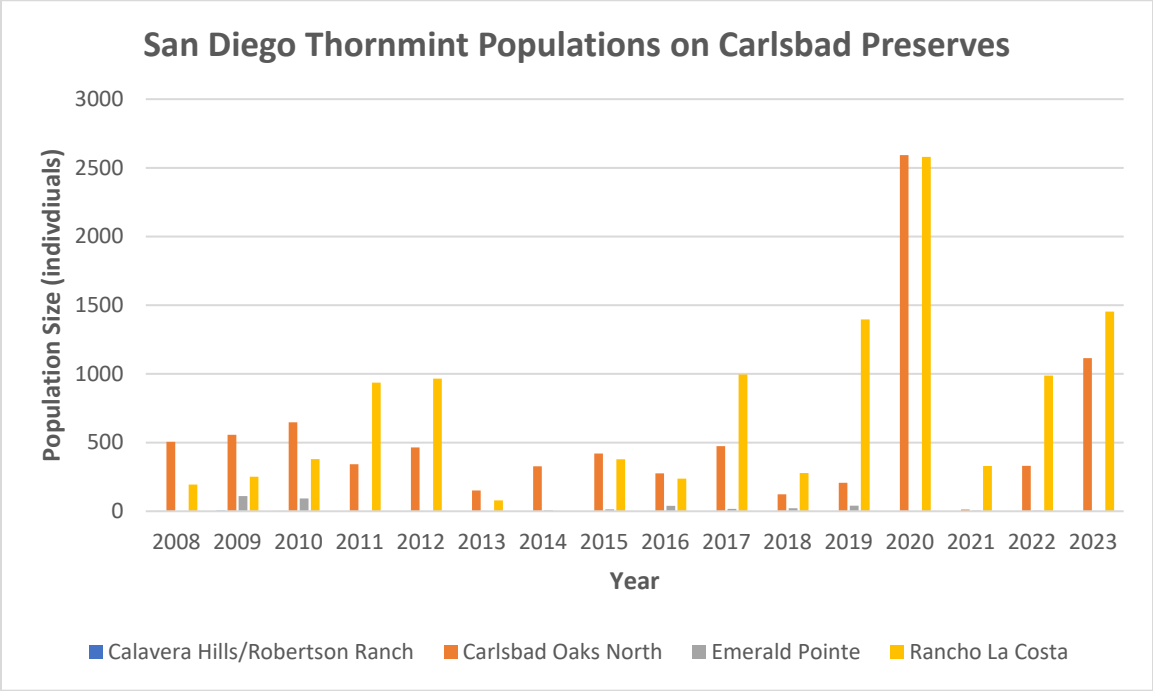
As is typical for many annual species, San Diego thornmint counts varied tremendously at each location between 2008 and 2023 (**Table 4** and **Graph 5**). Due to the high annual variability of the populations, it is difficult to determine the overall trend of a specific population or the species as a whole. To better understand what drives dynamics of the species populations in Carlsbad, CNLM is conducting studies to evaluate the status of the plants in relation to weather, cover of native and non-native forbs and grasses, and invasive non-native plant species removal. CNLM is also conducting genetic studies to understand the genetic diversity and structure of the species.

TABLE 4
SAN DIEGO THORNMINT POPULATION STATUS ON CARLSBAD PRESERVES

	Population (Individuals)															
Preserve	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**
Calavera Hills/Robertson Ranch	2	4	2	0	0	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Carlsbad Oaks North	505	556	648	342	464	151	327	420	276	474	123	207	2,593	13	331	1,115
Carlsbad Raceway	NS	NS	26	NS	NS	NS	NS	NS	NS	3	9	5	15	0	10	25
Emerald Pointe	NS	110	93	NS	NS	NS	6	14	39	17	22	40	0	5	4	0
Palomar Airport (outside HMP)	NS	NS	UR	NS	NS	NS	NS	NS	15,000	35,107	1,708	6,380	363	172	1,105	10,000
Rancho Carrillo	NS	NS	NS	NS	NS	NS	NS	NS	NS	23	3	5	11	33	164	156
Rancho La Costa (the Greens)	194	251	380	936	965	79	652	378	237	996	278	1,396	2,580	329	988	1,454
The Ranch	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	909	2,370	9,700

NOTES: NS = not surveyed; UR = surveyed but unreported

GRAPH 5
SAN DIEGO THORNMINT POPULATIONS ON CARLSBAD PRESERVES



NOTES: Outliers Carlsbad Raceway, Palomar Airport, Rancho Carrillo, and the Ranch not included. Refer to Table 4.

This species appears to be thriving and is well-protected on Carlsbad Oaks North, Palomar Airport (outside the HMP), and Rancho La Costa Preserves. Populations on Carlsbad Raceway, Emerald Pointe, and Rancho Carrillo Preserves are very small and vulnerable to extirpation. Calavera Hills/Robertson Ranch Preserve population may be extirpated.

3.1.1.4 Major Threats

The major threats to San Diego thornmint are invasive non-native plant species, such as tocalote (*Centaurea melitensis*) and purple false brome (*Brachypodium distachyon*); human use and trampling; habitat fragmentation with loss of pollinators; climate change and prolonged drought; and small populations that are more vulnerable to environmental conditions (SDMMP 2017). Where small numbers of the species are found, such as Carlsbad Raceway, Emerald Pointe, and Rancho Carrillo, hand watering, seed bulking, and population augmentation could help ensure that the population does not become extirpated. It is critical to continue intensive invasive non-native plant species removal efforts, as this currently appears to be the largest threat to the species' decline.

3.1.1.5 Management Actions Conducted to Protect the Species

Management and monitoring strategies for San Diego thornmint were developed by SDMMP and CNLM based on the best available science and local knowledge of land managers. The strategies include inspecting conserved occurrences on an annual basis, implementing a seed banking and bulking plan, developing habitat suitability and climate change modeling, and additional refinement of BMPs. Management generally focuses on intensive invasive non-native plant

species removal around San Diego thornmint populations (including hand weeding around plants), thatch removal, and access control.

In addition to general management, CNLM commenced a San Diego thornmint out-seeding program in 2017 to enhance and buffer their existing occurrences (CNLM 2018a). CNLM attained both federal and state permits for these activities. Seed was collected from 2017 to 2020 from within Carlsbad and was distributed to unoccupied habitat in 2018 and 2020 occurring once per out-seeding location. Results have been mixed; San Diego thornmint have flowered in several locations and increased in numbers each year, but at other locations, only a few have flowered. San Diego Habitat Conservancy (SDHC) initiated seed collection and seed bulking in 2022, and will be hand-seeded in 2023–2024 to enhance the small populations and prevent extirpation of this species on Carlsbad Raceway and Emerald Pointe Preserves. SDHC will continue hand-weeding and hand-watering existing San Diego thornmint populations as necessary as well.

3.1.2 Thread-Leaved Brodiaea

Scientific name: *Brodiaea filifolia*
Status: federally threatened, state endangered

3.1.2.1 MHCP Critical Locations and Major Populations

The MHCP identified critical locations and major populations throughout Carlsbad. This is an endemic species to San Diego County and known from 20 occurrences on conserved lands (SDMMP 2017).

3.1.2.2 Long-Term Monitoring

Populations on HOA-owned and managed preserves are monitored as part of the SDMMP rare plant monitoring program and include Fox-Miller and Rancho Carrillo. Additional populations on preserves managed by CNLM and CDFW include Buena Vista Creek Ecological Reserve, Calavera Hills/Robertson Ranch, Carlsbad Highlands Ecological Reserve, Carlsbad Oaks North, and Rancho La Costa Preserves.

Index Plot Monitoring

Long-term monitoring of thread-leaved brodiaea consists of monitoring index plots at preserves managed by CNLM and CDFW. Index plots are used to sample a subset of the entire population to evaluate trends in vegetative individuals and flowering rates. Some occurrences have thousands of individuals, making it difficult and exhaustive to monitor. This is a preferred method to counting just flowers, as vegetative growth occurs annually, and flowering rates vary in relation to total precipitation. Index plots were monitored annually between 2012 and 2017, then every other year thereafter when results indicated the population was stable enough to reduce frequency (CNLM 2019a).

Life-History Study

CNLM initiated a five-year life-history study in the winter of 2013–2014 that was completed in 2018 on its preserves. Life-history plots tracked individual plants throughout the vegetation and

flowering phases of thread-leaved brodiaea each season from year to year, with the purpose of providing information about the degree of flowering, variance of dormancy, and how these factors relate to flowering. This information was used to determine the best method for estimating counts (e.g., whether flowering counts are a suitable replacement for vegetative counts).

Pollinator Study

CNLM and other entities observed a lack of seed pod and seed production on flowering thread-leaved brodiaea individuals. This lack of seed production may be attributed to a reported self-incompatibility issue (Niehaus 1971) but could also be due to a lack of pollinators or effective pollination services. To investigate the lack of seed pod and seed production in thread-leaved brodiaea, CNLM developed a pollinator study to assess pollinator diversity and abundance, flower visitation rates, and seed pod and seed production. The study began in 2019 within known areas of thread-leaved brodiaea occurrences on CNLM Preserves (i.e., Rancho La Costa, Buena Vista Creek, and Calavera Hills).

3.1.2.3 Status

Due to the high annual variability of the populations, it is difficult to determine the overall trend of a specific population or the species as a whole; however, most known populations occur on conserved lands. Results from the SDMMP rare plant monitoring program for populations within Carlsbad are provided in **Table 5**. Vegetative counts of this species appear to be relatively stable but flowering counts vary tremendously year to year depending on timing and amount of precipitation, the season during which the surveys were conducted, and other factors that are undetermined. CNLM determined that the plant count during the flowering season may represent 0 to 35 percent of the actual population size, since only a fraction of a population flowers at a given time. Figure 4 shows known locations of thread-leaved brodiaea in Carlsbad and USFWS critical habitat for this species. **Table 6** and **Graph 6** and **Table 7** and **Graph 7** show the vegetative and flowering counts, respectively.

The results of the life history study concluded that vegetative production is relatively consistent across years despite differences in annual precipitation, and dormancy associated with little precipitation was not observed; individuals with four leaves tend to flower more than individuals with fewer than four; and flowering percentage seems to be correlated with total precipitation (CNLM 2020a).

Pollinator diversity and abundance results from pan traps are included in **Table 8**, and pollinator visitation rates are included in **Table 9**. Seed production results are included in **Table 10**. Based on 2020 pollination study results, specifically the level of seed pod development and seed production, CNLM concluded that pollinators can effectively pollinate thread-leaved brodiaea and produce seed under the right conditions; however, total seed production is low compared to other native plants within the same habitat (CNLM 2020b).

TABLE 5
THREAD-LEAVED BRODIAEA POPULATION STATUS ON CARLSBAD PRESERVES

Preserve	2016	2017	2018	2019	2020	2021	2022	2023
Fox-Miller	7,816	32,037	NS	49,315	NS	78,509	NS	10,500
Rancho Carrillo	NS	56,222	NS	83,229	NS	546	NS	60,400

NOTES: NS = not surveyed.

TABLE 6
THREAD-LEAVED BRODIAEA VEGETATIVE COUNT IN INDEX PLOTS ON CARLSBAD PRESERVES

Preserve	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Buena Vista Creek	647	817	753	979	1,047	1,338	NS	1,684	NS	1,874	NS	1,049
Calavera/Robertson Ranch	226	628	481	505	784	773	NS	1,211	NS	543	NS	389
Carlsbad Oaks North	102	224	189	145	217	325	NS	492	NS	575	NS	394
City Preserves	NA	NA	NA	88	116	81	82	89	63	14	29	50
Rancho La Costa	NS	3,457	2,421	4,833	2,946	3,293	NS	2,662	NS	2,331	NS	1,785

NOTES: NS = not surveyed; NA = not available.

GRAPH 6
THREAD-LEAVED BRODIAEA VEGETATIVE COUNT IN INDEX PLOTS ON CARLSBAD PRESERVES

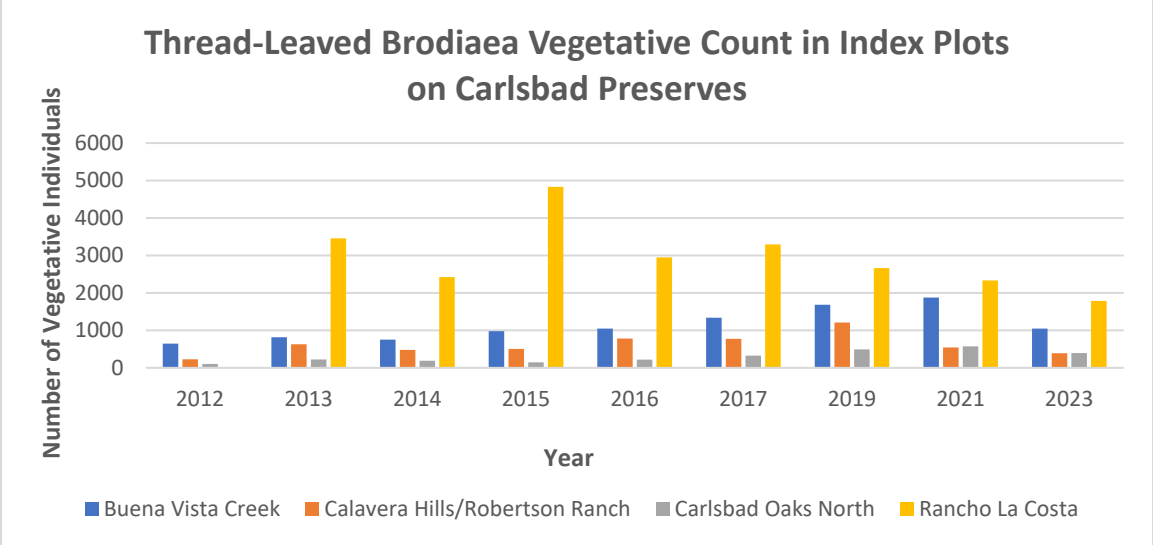


TABLE 7
THREAD-LEAVED BRODIAEA FLOWERING COUNT IN INDEX PLOTS ON CARLSBAD PRESERVES

Preserve	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Buena Vista Creek	0	13	2	6	25	48	NS	139	NS	0	NS	145
Calavera/Robertson Ranch	1	3	0	22	3	26	NS	20	NS	0	NS	18
Carlsbad Oaks North	14	1	4	30	15	67	NS	103	NS	0	NS	105
Rancho La Costa	NS	0	0	29	90	835	NS	323	NS	1	NS	405

NOTES: NS = not surveyed

GRAPH 7
THREAD-LEAVED BRODIAEA FLOWERING COUNT IN INDEX PLOTS ON CARLSBAD PRESERVES

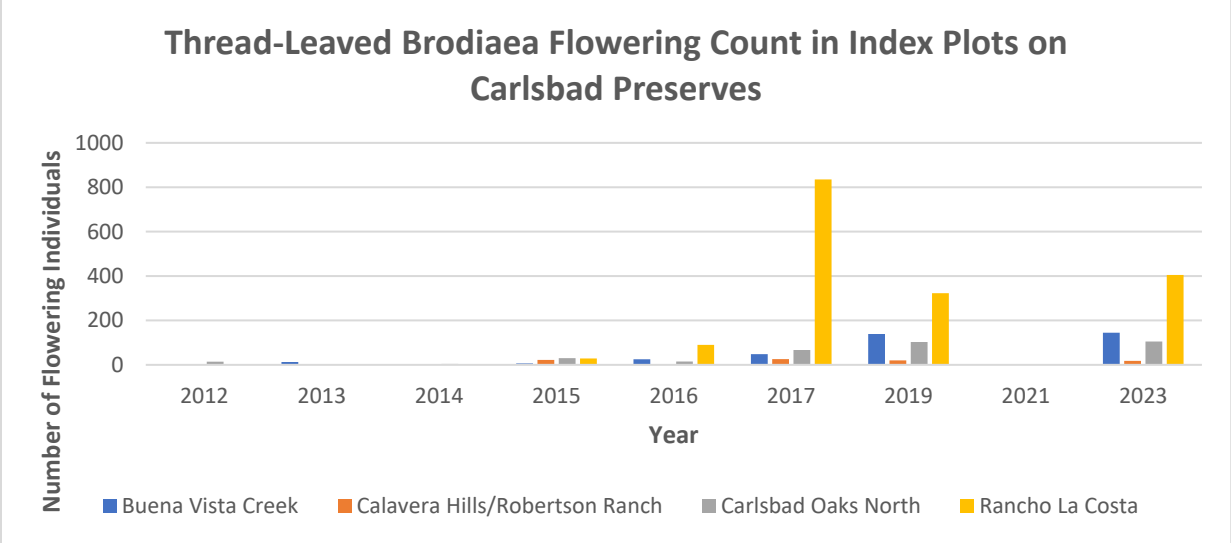


TABLE 8
THREAD-LEAVED BRODIAEA POLLINATOR DIVERSITY AND ABUNDANCE ON CARLSBAD PRESERVES

	Pan Trap Diversity [a]		Pan Trap Abundance [b]		Net Capture Diversity [a]		Net Capture Abundance [b]	
Preserve	**2019**	**2020**	**2019**	**2020**	**2019**	**2020**	**2019**	**2020**
Buena Vista Creek	6	4	43	36	5	3	11	27
Calavera Hills	8	5	80	24	4	3	24	31
Rancho La Costa	5	3	44	13	4	3	12	14

NOTES:

Diversity and abundance are based on pan trap data only.

a. Diversity = number of potential pollinator species detected.
b. Abundance = number of distinct potential pollinator individuals detected.

TABLE 9
THREAD-LEAVED BRODIAEA FLOWER VISITATION RATES ON CARLSBAD PRESERVES

Preserve	2019	2020
Buena Vista Creek	100.0	33.3
Calavera Hills	34.1	29.0
Rancho La Costa	75.0	64.3
Average	***61.4***	***37.5***

NOTES:

* Visitation \rate: average number of minutes between pollinator visits per thread-leaved brodiaea flower.

TABLE 10
SEED PRODUCTION OF PIN-FLAGGED THREAD-LEAVED BRODIAEA ON CARLSBAD PRESERVES

	Total Seeds		Individual Thread-Leaved Brodiaea with Seeds		# Flowers with Seeds	
Preserve	2019 [a]	2020 [b]	2019 [a]	2020 [b]	2019 [a]	2020 [b]
Buena Vista Creek	0	10	0	3	0	3
Calavera Hills	0	0	0	0	0	0
Rancho La Costa	6	62	2	13	2	24

NOTES:

a. In 2019, 25 thread-leaved brodiaea individuals were pin-flagged at each preserve.
b. In 2020, 30 thread-leaved brodiaea individuals were pin-flagged at each preserve.

3.1.2.4 Major Threats

The main threats to this species within Carlsbad are invasive non-native grass species (e.g., slender wild oat [*Avena barbata*] and purple false brome) and invasive non-native forbs (e.g., black mustard [*Brassica nigra*] and bristly ox-tongue [*Helminthotheca echioides*]), thatch build-up, and self-incompatibility limiting seed production (CNLM 2020a). Although it is difficult to determine the population trajectory of Carlsbad occurrences (increasing, decreasing, or stable), the populations managed by CNLM and CDFW appear to be well protected due to intensive, localized management efforts that are regularly conducted. Populations managed by other entities should, at minimum, be inspected to confirm presence and population-specific threats should be identified and addressed.

3.1.2.5 Management Actions Conducted to Protect the Species

A management and monitoring approach developed by SDMMP and CNLM includes inspecting conserved occurrences every two years beginning in 2017, implementing routine management as determined when monitoring, developing habitat suitability and climate change modeling, surveying historical occurrences to determine status, and initiating seed collection and banking. Invasive non-native species management is the primary management for this species.

3.1.3 Del Mar Mesa Sand Aster

Scientific name: *Corethrogyne filaginifolia* var. *linifolia*
Status: California Rare Plant Rank (CRPR) 1B.1

3.1.3.1 MHCP Critical Locations and Major Populations

There are no MHCP critical locations in Carlsbad. The closest MHCP major population is at the southern boundary of Carlsbad. The majority of the population within the MHCP Subregion is in the city of Encinitas but may extend into Carlsbad on private HOA lands.

3.1.3.2 Long-Term Monitoring

Long-term monitoring was initiated in 2014 for the La Costa Collections population of Del Mar Mesa sand aster. The surveys consist of delineating the boundaries of sand aster patches and estimating the density of the patches using 20 stratified, random 0.25-square-meter plots (J. Whalen Associates, Inc. 2014). In 2014, the density was 0.85 per 0.25 square meters. The densities in 2015, 2016, and 2017 were 0.65, 0.8, and 0.95, respectively (J. Whalen Associates, Inc. 2015; J. Whalen Associates, Inc. 2017a; J. Whalen Associates, Inc. 2017b; Cummings 2017). A complete count from 2005 recorded 1,540 total individuals at La Costa Collections Preserve. The preserve manager estimates that numbers have increased from this count, but recent counts have not continued.

Within City Ventures Preserve, a Del Mar Mesa sand aster survey was conducted in 2018 to map the current population boundaries. The 2018 survey effort included flagging the limits of the population and initiated an annual census count, which resulted in 672 individuals. Results of annual census counts from 2018–2023 are provided in **Table 11**. Figure 4 shows the locations of Del Mar Mesa sand aster on actively managed preserves.

TABLE 11
DEL MAR MESA SAND ASTER POPULATION STATUS ON CARLSBAD PRESERVES

	Population (Individuals)					
Preserve	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**
City Ventures	672	662	828	784	909	527

3.1.3.3 Status

Del Mar sand aster seems to be stable.

3.1.3.4 Major Threats

The greatest threats are unauthorized access including trails, trampling, and other edge effects, such as trash and invasive non-native plant species.

3.1.3.5 Management Actions Conducted to Protect the Species

Potentially suitable habitat for this species within the HMP preserve system, which consists of coastal bluff scrub and openings within coastal sage scrub and chaparral, is managed through general habitat stewardship. Populations are managed through general habitat management (e.g., invasive non-native plant species removal, trash removal, access control [HRS 2014; G. Cummings, personal communication, 2018]). Del Mar Mesa sand aster was not identified by the SDMMP as a high priority for regional management and monitoring; therefore, BMPs are not developed for this species.

3.1.4 Del Mar Manzanita

Scientific name: *Arctostaphylos glandulosa* ssp. *crassifolia*
Status: federally endangered

3.1.4.1 MHCP Critical Locations and Major Populations

The MHCP identified critical locations/major populations on preserve lands owned by the city, the County, private HOAs, and La Costa Villages.

3.1.4.2 Long-Term Monitoring

Surveys for Del Mar manzanita are conducted periodically on the following preserves: La Costa Glen, Kelly Ranch, Manzanita Partners, Morning Ridge, Poinsettia Place, and Rancho La Costa (see table below for dates) (Figure 5). Because the non-sensitive Eastwood manzanita (*Arctostaphylos glandulosa* ssp. *glandulosa*) also occurs on Rancho La Costa Preserve and Kelly Ranch Preserve, Del Mar manzanita individuals have been re-mapped to the subspecies level by taxonomic experts (Spiegelberg and Vinje 2008; CNLM 2018b).

3.1.4.3 Status

The number of individuals reported on other actively managed preserves ranges from two clumps (number of individuals unknown) to 313 individuals (**Table 12**). Three preserves burned during the Poinsettia Fire in May 2014. Post-fire surveys did not include Del Mar manzanita census counts to determine how many of the burned individuals survived. However, based on transect studies conducted to determine cover of native and non-native species, most Del Mar manzanita shrubs have resprouted at the stump, as is typical of this fire-adapted species.

The species is likely to persist in Carlsbad with appropriate management of the vegetation community, rather than species-specific management. By protecting and managing the vegetation community as a whole, this species is expected to remain in stable condition.

TABLE 12
DEL MAR MANZANITA POPULATION STATUS ON CARLSBAD PRESERVES

	Population (Individuals)																			
Preserve	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**
La Costa Glen	NS	NS	NS	200 [a]	NS	NS	NS	NS	NS	313	Unk.[b]	Unk.[b]	NS	Unk.[b]	NS	NS	NS	NS	10[c]	10[c]
Kelly Ranch	NS	NS	NS	NS	NS	2 [d]	NS	NS	NS	NS	2	NS	NS	2[d]	5	13	NS	NS	2[d]	NS
Manzanita Partners	NS	117	NS	NS	NS	NS	NS	NS	NS	117	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Morning Ridge	NS	8	NS	NS	8	NS	NS	NS	NS	NS	Burned[e]	NS	NS	NS	NS	NS	NS	NS	NS	NS
Poinsettia Place	53	NS	NS	NS	NS	NS	NS	NS	NS	NS	Burned[e]	NS	NS	NS	NS	NS	38	38	41	NS
Rancho La Costa	NS	>500 [f]	NS	NS	9	NS	NS	NS	NS	NS	Burned[e]	19	19	19	NS	NS	NS	NS	NS	NS

NOTES: NS = not surveyed; Unk. = unknown

a. Conducted for the MHCP, prior to long-term management.
b. Unknown number; survey conducted but exact number of individuals not reported.
c. Beginning in 2022, CNLM began monitoring 10 individual Del Mar manzanita individuals to document size and general health, No additional population counts were conducted.
d. Number of clumps is reported; number of individuals is unknown.
e. Pre-fire surveys were conducted on Morning Ridge, Poinsettia Place, and Rancho La Costa Preserves in 2014. Post-fire counts are presumed to be zero since the entire preserve burned, including above-ground biomass. A post-fire inspection on Rancho La Costa Preserve reported seven resprouting shrubs, and one near, but undamaged by the bulldozed fire line.
f. Survey performed prior to long-term management; taxonomic confirmation of subspecies not yet conducted.

3.1.4.4 Major Threats

Primary threats at this preserve are anthropogenic, such as frequent fire, trespass, and vandalism, as well as the introduction of invasive non-native plant species (CNLM 2019b). Several shrubs on the unmanaged Santa Fe Trails Preserve population were removed to create bike jumps and trails. Prior to the fire, threats to the actively managed Carlsbad populations were considered minimal due to the robustness of woody shrubs (i.e., they are not as vulnerable as small annuals to drought, invasive non-native plant species encroachment, or edge effects) and the inaccessibility of most of the known locations. In freshly burned areas, the major threat to recovery could be erosion—many of the plants occur on very steep slopes that would have little to no vegetation holding the soil in place. However, wildfire is not considered a major threat to Del Mar manzanita as this species evolved with fire. It typically resprouts from a basal burl after it has been burned and the seeds are dependent on fire to germinate (USFWS 2010). Occurrences within the 2014 Poinsettia Fire burn area in Carlsbad have recovered well. However, even with fire-adapted species, if the natural fire regime is altered (e.g., if fires become too frequent or burn too hot), the long-term effect on the species could be detrimental.

3.1.4.5 Management Actions Conducted to Protect the Species

Management actions include invasive non-native plant species removal, access control, and public outreach. Focused outreach has been implemented by the city in recent years to help deter impacts from unauthorized mountain bike use on The Ranch and Santa Fe Trails Preserves, which are owned by private HOAs and do not have a funded land manager. Outreach included installation of interpretive signage and fencing sections to deter access, educational materials for the residents, and site visits with the HOA property managers.

3.1.5 Encinitas Baccharis

Scientific name: *Baccharis vanessae*
Status: federally threatened, state endangered

3.1.5.1 MHCP Critical Locations and Major Populations

The closest MHCP major population is at the southern boundary of Carlsbad. The majority of the population is within Encinitas but may extend into Carlsbad on La Costa Glen Preserve. Within this major population, there are critical locations identified that may occur within Carlsbad; however, presence or absence of these observations has not been confirmed in the field since surveys were conducted in the 1990s for the MHCP except as described below.

3.1.5.2 Long-Term Monitoring

One Encinitas baccharis locality was reported on the La Costa Glen Preserve in the 1990s during surveys conducted for the MHCP. Long-term management for this preserve was established in January of 2013. Focused surveys were performed by CNLM: two in 2013, two in 2014, and one in 2015. Encinitas baccharis was not observed during these surveys.

3.1.5.3 Status

The status of populations within Carlsbad, if they exist, is currently unknown.

3.1.5.4 Major Threats

Major threats to this dioecious (having separate male and female individuals, both necessary for reproduction) species are altered fire regime, low seedling recruitment, low seed viability, reduced reproductive potential at older age classes, fuel modification, trampling, and invasive non-native plant species. Small, isolated occurrences with little connectivity and dioecious life history make this species more vulnerable to changes in environmental conditions (SDMMP 2017).

3.1.5.5 Management Actions Conducted to Protect the Species

A management and monitoring approach was developed by SDMMP (2017) for this species and includes inspecting conserved occurrences every two years, implementing routine management informed by monitoring, surveying historical occurrences to determine status, initiating seed collection and banking, and additional refinement of BMPs. Potentially suitable habitat on actively-managed preserves in Carlsbad is being managed through general invasive non-native plant species removal and access control.

3.1.6 Orcutt's Hazardia

Scientific name: *Hazardia orcuttii*
Status: state threatened

3.1.6.1 MHCP Critical Locations and Major Populations

There are no naturally occurring MHCP critical locations or major populations of Orcutt's hazardia in Carlsbad. If the transplanted populations in Carlsbad prove to be self-sustaining, they would be considered critical populations.

3.1.6.2 Long-Term Monitoring

Orcutt's hazardia was transplanted by CNLM to CNLM's Kelly Ranch and Rancho La Costa Preserves in 2003. Since then, CNLM has been tracking these transplants and documenting flowering adults and recruitment of juveniles and seedlings annually.

3.1.6.3 Status

By 2004, a total of 146 Orcutt's hazardia individuals were transplanted to Kelly Ranch Preserve and 200 individuals were transplanted to Rancho La Costa Preserve. As of 2020, a total of 137 individuals (85 adults, 50 juveniles, and 2 seedlings) were observed on Kelly Ranch Preserve, and 144 individuals (125 adults and 19 juveniles) were observed on Rancho La Costa Preserve (CNLM 2020d; CNLM 2020e [**Table 13** and **Table 14** and **Graphs 8 through 10**]). Overall, the adult plants on both sites have fared well over time, becoming generally stable within a few years after the initial transplantation. The number of juvenile and seedlings at Kelly Ranch Preserve has dropped, for reasons unknown. Monitoring will continue in future years.

TABLE 13
TRANSPLANTED ORCUTT'S HAZARDIA POPULATION STATUS ON KELLY RANCH PRESERVE

	Number of Individuals Counted, by Year																			
Life Stage	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**
Adults (flowering)	146	97	104	104	104	104	104	104	105	103	102	NS	105	105	102	98	85	87	84	97
Juveniles	0	0	0	1	1	4	15	42	119	157	152	NS	141	97	89	91	50	22	21	19
Seedlings	0	0	0	4	17	14	68	77	55	0	0	NS	0	0	0	0	2	0	0	0
Total Count	***146***	***97***	***104***	***109***	***122***	***122***	***187***	***223***	***279***	***260***	***254***	***NS***	***246***	***202***	***191***	***189***	***137***	***109***	***105***	***116***

NOTES: NS = not surveyed; counting was planned in 2015, but could not be completed due to staff attrition

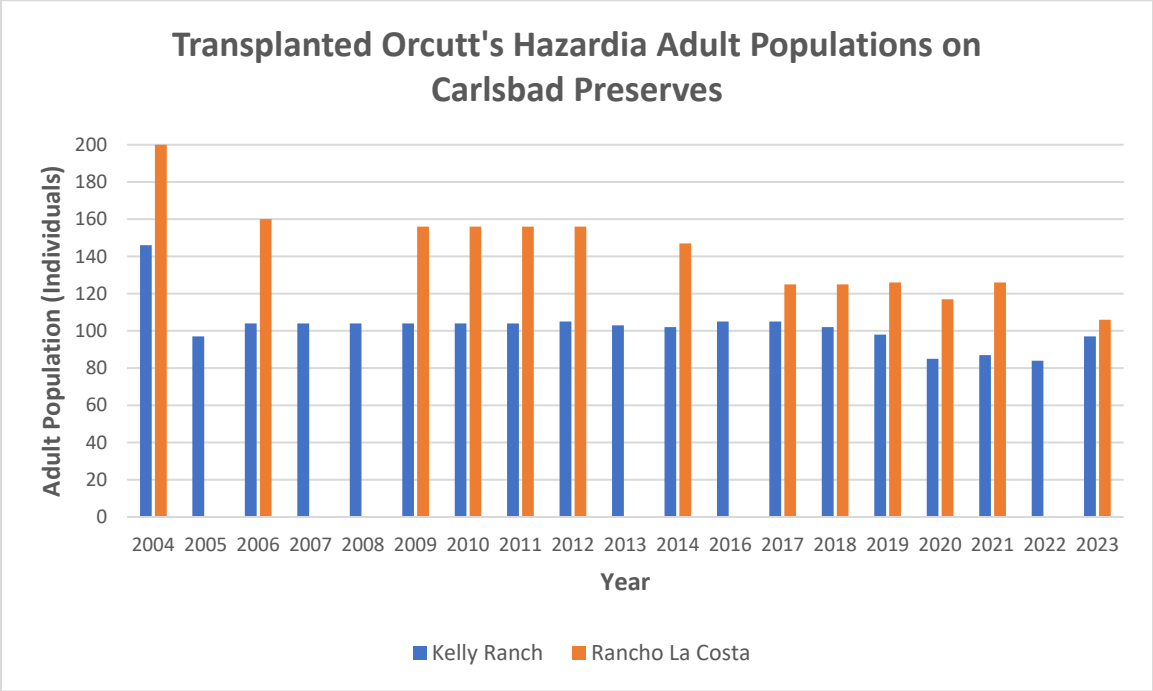
TABLE 14
TRANSPLANTED ORCUTT'S HAZARDIA POPULATION STATUS ON RANCHO LA COSTA PRESERVE

	Number of Individuals Counted, by Year																			
Life Stage	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013[a]**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**
Adults (flowering)	200	NS	160	NS	NS	156	156	156	156	NS	147	NS	NS	125	125	126	117	126	NS	106
Juveniles	NS	NS	NS	NS	NS	NS	2	10	15	NS	24	NS	NS	14	18	16	30	16	NS	29
Seedlings	NS	NS	NS	NS	NS	NS	8	4	1	22	0	NS	NS	0	1	1	0	0	NS	0
Total Count	***200***	***175***	***160***	***Unk.***	***Unk.***	***156***	***166***	***170***	***172***	***Unk.***	***171***	***157***	***157***	***139***	***144***	***142***	***147***	***142***	***Unk.***	***135***

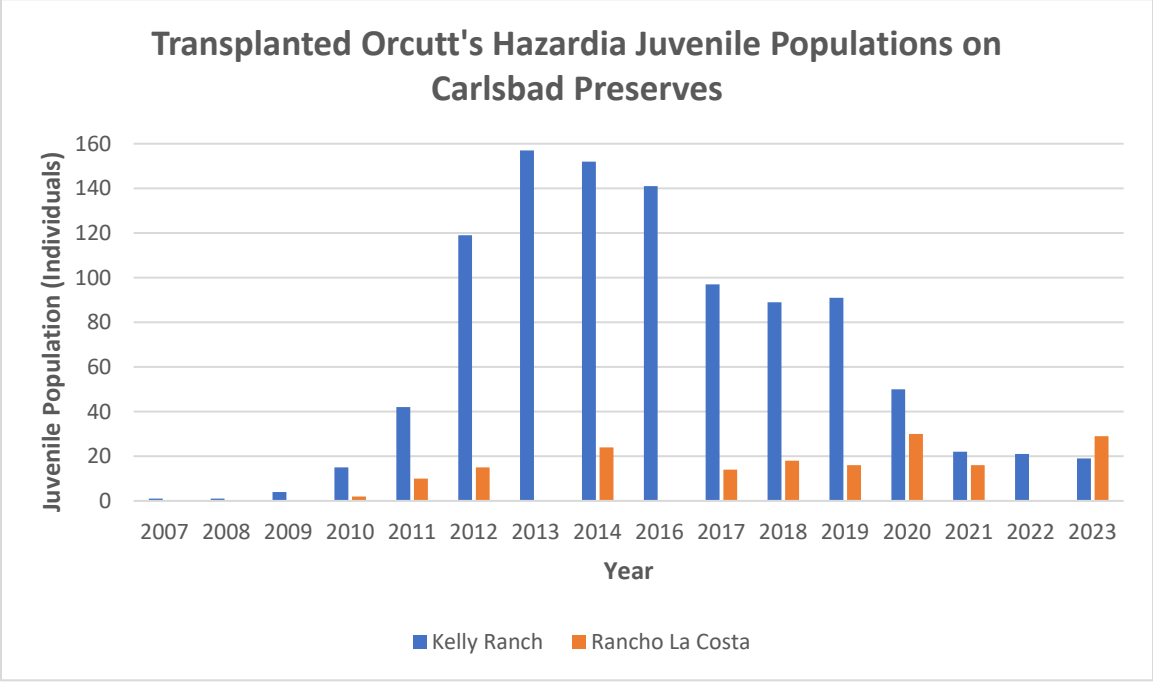
NOTES: NS = not surveyed; Unk. = unknown

a. Only seedling counts were performed.

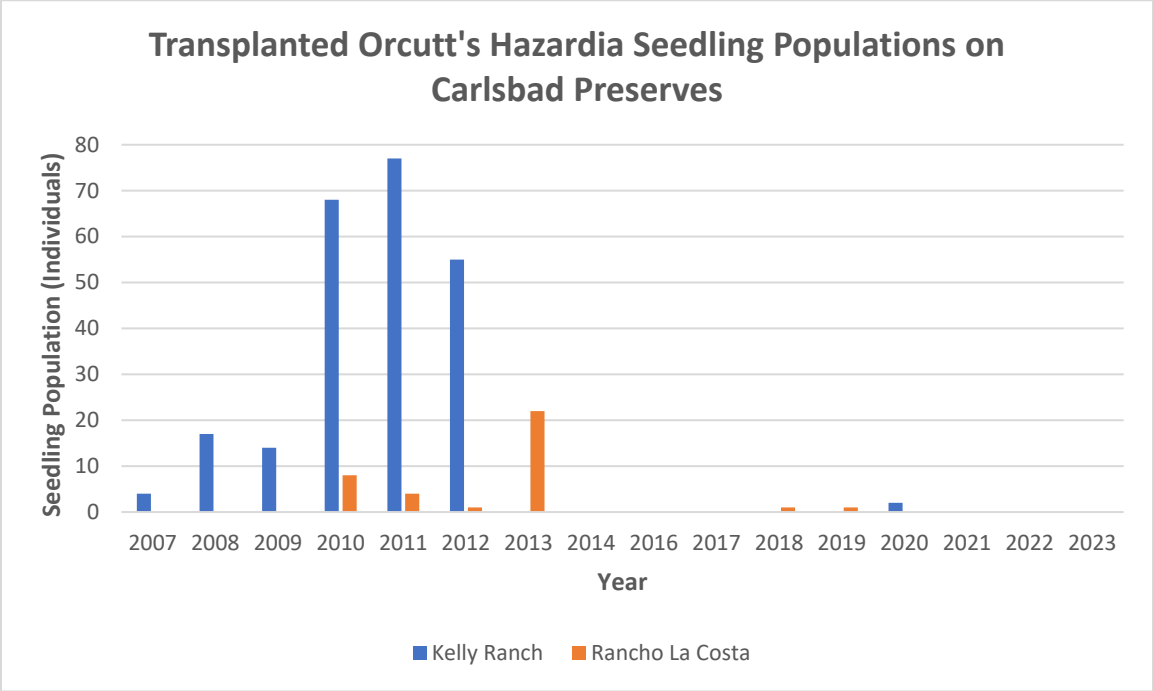
GRAPH 8
TRANSPLANTED ORCUTT'S HAZARDIA ADULT POPULATIONS ON CARLSBAD PRESERVES



GRAPH 9
TRANSPLANTED ORCUTT'S HAZARDIA JUVENILE POPULATIONS ON CARLSBAD PRESERVES



GRAPH 10
TRANSPLANTED ORCUTT'S HAZARDIA SEEDLING POPULATIONS ON CARLSBAD PRESERVES



3.1.6.4 Major Threats

The biggest threat to this species is that it occurs in only a few locations (only one of which is a natural population, located in Encinitas; all others were transplanted), and populations are very small and isolated, making this species highly vulnerable to extirpation by a catastrophic event, such as fire or disease (SDMMP 2017). Ongoing drought also appears to be a major threat to this species.

3.1.6.5 Management Actions Conducted to Protect the Species

All known populations, including the single naturally occurring population in Encinitas and transplanted populations in Carlsbad, are under active management by CNLM. Management activities consist of intensive invasive plant species removal, access control, and transplant studies, which have been approved by the wildlife agencies. By better understanding population dynamics, it is hoped that this program will reduce the possibility of local extinction (the species still occurs in northern Mexico) due to unforeseen events.

3.2 Vernal Pool Species

California Orcutt Grass
Orcuttia californica
Status: federally endangered, state endangered

Little Mousetail
Myosurus minimus ssp. *apus*
Status: CRPR 3.1

San Diego Button Celery
Eryngium aristulatum var. *parishii*
Status: federally endangered, state endangered

Spreading Navarretia
Navarretia fossalis
Status: federally threatened

Riverside Fairy Shrimp
Streptocephalus woottoni
Status: federally endangered

San Diego Fairy Shrimp
Branchinecta sandiegonensis
Status: federally endangered

3.2.1.1 MHCP Critical Locations and Major Populations

There are three vernal pool complexes in the HMP preserve system: (1) Poinsettia Station Preserve, (2) Hieatt Property, north of the airport, and (3) Manzanita Partners Preserve, east of El Camino Real and south of the airport (Figure 6). The Poinsettia Station Preserve vernal pool complex was identified as a MHCP critical location and major population for all vernal pool species listed above. The city received HMP coverage for these species in 2019 as a result of taking over long-term management of the site. Neither Hieatt Property nor Manzanita Partners Preserve were identified by the MHCP as critical locations or major populations.

3.2.1.2 Long-Term Monitoring

Baseline rare plant surveys and hydrological monitoring were conducted by Dudek at the Poinsettia Station Preserve vernal pools in 2019 and 2020 when long-term management by the city was initiated. Long-term monitoring at the Manzanita Partners Preserve consists of annual general condition assessments. Although the Hieatt Property pools are not under active management, a site visit to evaluate status and threats was conducted by the HMP Preserve Steward and the city in January 2018 following a minor rain.

3.2.1.3 Status

Poinsettia Station

In 2019 and 2020, 16 vernal pool indicator plant species were observed on-site during baseline vernal pool floral surveys. Of these 16 species, 4 are recognized as special-status species by USFWS, CDFW, and/or considered a Narrow Endemic under the MHCP: Orcutt's brodiaea (*Brodiaea orcuttii*), San Diego button celery (*Eryngium aristulatum* var. *parishii*), spreading navarretia (*Navarretia fossalis*), and California Orcutt grass (*Orcuttia californica*). Additionally, federally endangered San Diego fairy shrimp (*Branchinecta sandiegonensis*) and Riverside fairy shrimp (*Streptocephalus woottoni*) were detected in 2020 in both pools and 2019–2020 in the southernmost pool, respectively. Subsequent special-status species detections and population estimates are provided in **Table 15**. This preserve likely supports the single largest known occurrence of San Diego button celery, with population estimates consistently over 500,000 individuals. Population estimates of California Orcutt grass fluctuate year-to-year, as this species depends on greater rainfall amounts and longer inundation periods.

TABLE 15
SPECIAL-STATUS VERNAL POOL SPECIES POPULATION STATUS ON POINSETTIA STATION PRESERVE

	Population Estimate (Individuals)				
Species	**2019**	**2020**	**2021**	**2022**	**2023**
Orcutt's brodiaea (*Brodiaea orcuttii*)	30	20	20	ND	6
San Diego button celery (*Eryngium aristulatum* var. *parishii*)	500,000	>500,000	>500,000	>500,000	>500,000
Spreading navarretia (*Navarretia fossalis*)	>500	500	>500	>500	<2,000
California Orcutt grass (*Orcuttia californica*)	>50	100	ND	ND	>2,000
San Diego fairy shrimp (*Branchinecta sandiegonensis*)	ND	50	NS	NS	500
Riverside fairy shrimp (*Streptocephalus woottoni*)	>100[a]	>1,000	NS	NS	1,000

NOTES: ND = not detected; NS = not surveyed.

a. Each small scattered pool within the larger ponded area appeared to contain 100s of Riverside fairy shrimp.

Hieatt Property

When surveyed in 2006, the pools did not contain any sensitive species, but contained the following vernal pool indicator species: dwarf wooly-heads (*Psilocarphus brevissimus* var. *brevissimus*), water pygmyweed (*Crassula aquatica*), chaffweed (*Centunculus minimus*), and grass poly (*Lythrum hyssopifolia*). During the January 2018 visit to the Hieatt Property, there was no sign of ponding; however, there were clear signs of a vernal pool matrix throughout the property, as previously mapped.

Manzanita Partners

San Diego fairy shrimp was observed in four pools during 2019 and 2020 monitoring efforts with thousands to hundreds of thousands of fairy shrimp individuals detected. San Diego fairy shrimp was observed again in 2023 within five pools. San Diego button celery was documented during 2018, 2019, 2020, 2022, and 2023 monitoring. Additional special-status plant species, little mousetail (*Myosurus minimus*) was detected in 2022 and 2023. Invasive non-native loosestrife (*Lythrum hyssopifolia*) was observed in most vernal pools along with patches of non-native grasses in 2023; therefore, control of weeds will continue to be a management priority, especially after the significant above-average rainfall in 2023.

Other Locations

Additional vernal pools have been identified to the north of the Poinsettia Station site along the same NCTD right-of-way (Rosie 2010), although these are outside of the HMP boundary. Several of these pools are reported to support San Diego fairy shrimp. These pools, which are generally in poor condition (few vernal pool species and dense cover of non-native grasses), are not currently protected by a conservation easement or other open space protection.

3.2.1.4 Major Threats

Non-native plants, as well as lack of precipitation, remain key threats to vernal pools. However, with adequate precipitation, non-native plants are drowned out and native species adapted for

vernal pool conditions are able to dominate. Encroachment of upland shrubs and altered hydrology are the primary threats at the Poinsettia Station Preserve.

3.2.1.5 Management Actions Conducted to Protect the Species

Poinsettia Station

The city has recently obtained legal control over the protection, management, and monitoring of the Poinsettia Station vernal pools. Intensive weed removal within the pool basins was performed in 2019 and 2020. Targeted hand-weeding of loosestrife around the spreading navarretia population was conducted in 2021. Line-trimming and hand-weeding to reduce encroachment of native shrubs, remove non-native plant species, and trail trimming was conducted in 2022 and 2023. Future management will focus on annual non-native plant control and control of native shrubs that are encroaching into the pools.

Hieatt Property

The Hieatt Property vernal pools are not being actively managed.

Manzanita Partners

Long-term management focuses on invasive non-native plant species control, trash removal, and access control.

3.3 Lagoon/Coastal Bird Species

3.3.1 Belding's Savannah Sparrow

Scientific name: *Passerculus sandwichensis beldingi*
Status: state endangered

3.3.1.1 MHCP Critical Locations and Major Populations

The MHCP critical locations and major populations for Belding's savannah sparrow are located in Agua Hedionda Lagoon and Batiquitos Lagoon, which are managed by CDFW.

3.3.1.2 Long-Term Monitoring

Surveys are conducted approximately every five years as part of an ongoing statewide census effort. The most recent census information available is from 2015 (Zembal et al. 2015); 2020 surveys were canceled due to the COVID-19 stay-at-home order and have not resumed (R. Zembal, personal communication, 2024). While not part of statewide monitoring, 2023 incidental territory estimates at Agua Hedionda Lagoon, Batiquitos Lagoon, and Buena Vista Lagoon were provided by Richard Zembal from the Huntington Beach Wetlands Conservancy (R. Zembal, personal communication, 2024).

3.3.1.3 Status

The number of territories at Agua Hedionda Lagoon and Batiquitos Lagoon declined, but Buena Vista Lagoon experienced an increase since the 2015 statewide census (**Table 16**, **Graph 11**,

Figure 7). While statewide census monitoring has not been conducted since 2015, incidental territory estimates in 2023 reported 15 territories, a 12 percent decline in territories since 2015, at Agua Hedionda Lagoon; 50 territories, a 14 percent decline in territories since 2015, at Batiquitos Lagoon; and 4 territories at Buena Vista Lagoon, which has not supported territories since 2006.

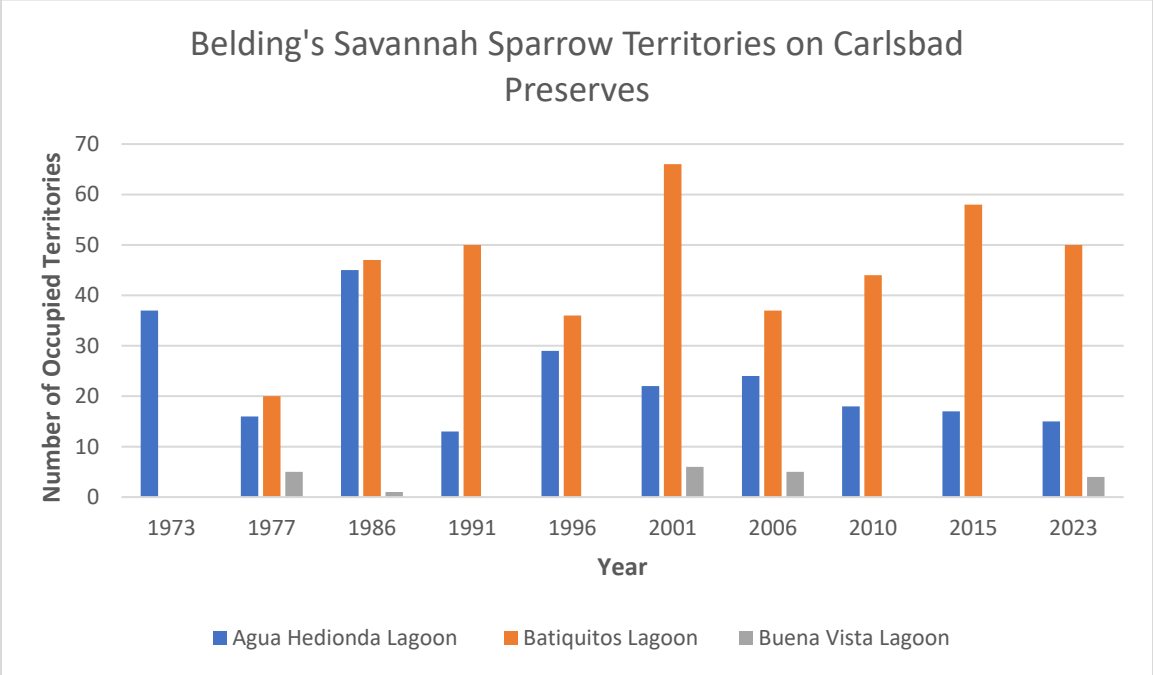
TABLE 16
NUMBER OF OCCUPIED BELDING'S SAVANNAH SPARROW TERRITORIES BY YEAR ON CARLSBAD PRESERVES

Preserve	1973	1977	1986	1991	1996	2001	2006	2010	2015	2023*
Agua Hedionda Lagoon Ecological Reserve	37	16	45	13	29	22	24	18	17	15
Batiquitos Lagoon Ecological Reserve	0	20	47	50	36	66	37	44	58	50
Buena Vista Lagoon Ecological Reserve	0	5	1	0	0	6	5	0	0	3–5

NOTES:

* 2023 population estimates were provided as incidental data and not part of statewide census monitoring (R. Zembal, personal communication, 2024).

GRAPH 11
BELDING'S SAVANNAH SPARROW TERRITORIES ON CARLSBAD PRESERVES



3.3.1.4 Major Threats

Human trespass and off-leash dogs continue to be a problem, resulting in habitat that is too heavily trafficked to support this species in much of Agua Hedionda Lagoon (Zembal et al. 2015). The transition of saltwater marsh habitat to brackish marsh, fed cyclically by storm and urban run-off is the largest threat to this species at Batiquitos Lagoon (Zembal et al. 2015). Encroachment of freshwater and the transition of saltwater marsh habitat to brackish marsh, as well as the

corresponding rise of territorial song sparrows, proliferation of invasive non-native plant species, and human disturbances continue to exert pressure upon Belding's savannah sparrow and the habitat necessary to support the species at Buena Vista Lagoon (Zembal et al. 2015).

3.3.1.5 Management Actions Conducted to Protect the Species

At Agua Hedionda Lagoon, Caltrans installed low fencing along the northern edge of the lagoon, which helped minimally to exclude potential trespassers. Past restoration of Batiquitos Lagoon resulted in the expansion of pickleweed, which is a critical component of Belding's savannah sparrow habitat, and likely led to the doubling of the population between the 1996 and 2001 surveys. CDFW's top management priorities are habitat enhancement, protection, and restoration to improve tidal flushing; sediment control; limiting human disturbances; and the continued funding of a statewide census.

3.3.2 California Least Tern

Scientific name: *Sterna antillarum browni*
Status: federally endangered, state endangered and fully protected

3.3.2.1 MHCP Critical Locations and Major Populations

MHCP critical locations have been identified in all three lagoons. The population at Batiquitos Lagoon is considered an MHCP major population.

3.3.2.2 Long-Term Monitoring

Least tern monitoring, funded by CDFW, is conducted annually at Batiquitos Lagoon from 1973 to 2023 as part of a statewide census (Figure 7).

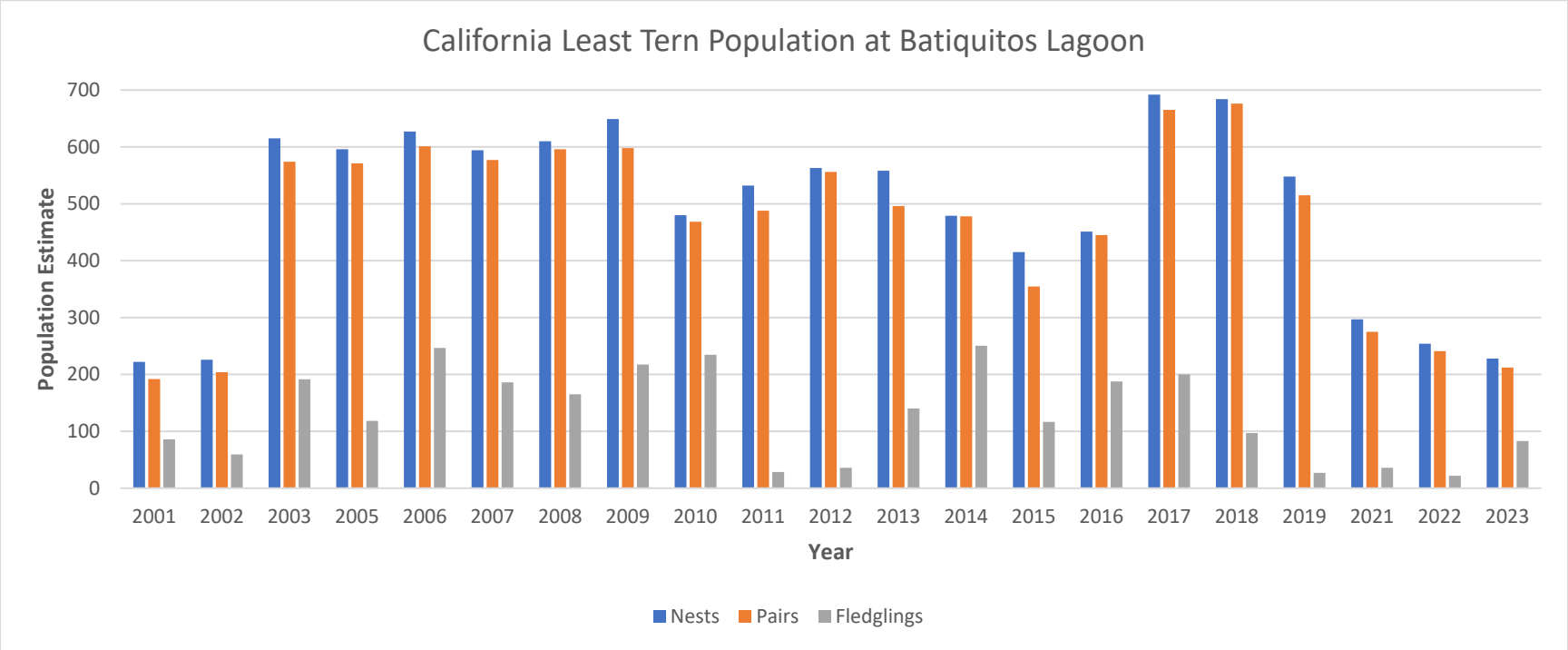
3.3.2.3 Status

Estimated number of breeding pairs, nests, and fledglings are presented in **Table 17** and **Graph 12**. Based on 2016 monitoring data, Batiquitos Lagoon was among six breeding sites within the state of California that had over 300 breeding pairs, which represented 72 percent of the state's total (Frost 2017). Since the 2009 nesting season, there has been an overall decline in both nests and breeding pairs at Batiquitos Lagoon, coinciding with a similar decline statewide (CDFW 2024). Number of surviving fledglings declined more than 80 percent between 2010 and 2011, likely due to the lack of funding for monitoring and predator control (Foster 2011, Sisson 2011). There was a brief increase in breeding pair and nest activity at Batiquitos Lagoon in 2017 through 2019, but this can likely be attributed to breeding pairs from the Marine Corps Base Camp Pendleton (MCBCP) breeding colony renesting at Batiquitos Lagoon after a large predation event at MCBCP that occurred in 2017. Another steep drop in number of fledglings occurred between 2017 and 2019, but the reasons are unknown (J. Boland, personal communication, 2021). While number of nests and breeding pairs have continued to decline in recent years, 2023 had the highest total fledge count (77–89) since 2018, when the site supported over 600 nests and a minimum of 94 fledges (CDFW 2024).

TABLE 17
NUMBER OF CALIFORNIA LEAST TERN NESTS, PAIRS, AND FLEDGLINGS AT BATIQUITOS LAGOON ECOLOGICAL RESERVE

	Number of Individuals Counted, by Year																				
	2001	**2002**	**2003**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2021**	**2022**	**2023**
Nests	222	226	615	596	627	594	610	649	480	532	563	558	479	415	451	692	684	548	297	254	228
Pairs	192	203–205	574	571	601	575–578	596	576–620	457–480	457–519	550–562	433–559	478	296–413	445	658–671	667–684	481–548	273–277	233–246	205–218
Fledglings	73–99	53–66	155–228	109–128	223–270	146–226	143–187	212–233	208–261	20–37	34–38	117–163	232–269	90–143	175–200	175–225	94–99	22–31	32–40	18–26	77–89

GRAPH 12
CALIFORNIA LEAST TERN POPULATION AT BATIQUITOS LAGOON



3.3.2.4 Major Threats

Predation across all life stages (i.e., egg, chick, adult) continues to be the biggest threat to this species. For the Batiquitos Lagoon colony, raptors, particularly great-horned owls (*Bubo virginianus*) and peregrine falcons (*Falco peregrinus*) are the most problematic predators (CDFW 2024). Trespass continues to be an issue at this colony; however, no nests were lost as a result of human trampling in recent years. Resource availability is also suspected to be a limiting factor for this species.

3.3.2.5 Management Actions Conducted to Protect the Species

A management and monitoring approach for this species was developed by SDMMP (2017) and includes predator control at breeding colonies, annual monitoring per CDFW protocols, inspection of habitat and documentation of management needs, and implementation of routine management as necessary. Annual management actions for this species include fencing, interpretative signage, nest marking, chick shelters, vegetation management, and predator management, including trapping (Frost 2017; CDFW 2024).

3.3.3 Light-Footed Ridgway's Rail

Scientific name: *Rallus longirostris levipes* (*Rallus obsoletus levipes*)
Status: federally endangered, state endangered and fully protected

3.3.3.1 MHCP Critical Locations and Major Populations

MHCP critical locations and major populations identified at all three lagoons in Carlsbad.

3.3.3.2 Long-Term Monitoring

In 2023, the 44th annual census of light-footed Ridgway's rails in California coastal wetlands was conducted in 25 locations by assessing call counts. This long-term annual monitoring program, which extends from Mugu Lagoon in Ventura County to Tijuana Marsh National Wildlife Refuge on the Mexican border, is funded by CDFW. Light-footed Ridgway's rails are typically monitored by spring call counts and winter high tide counts.

3.3.3.3 Status

Three subpopulations occur in Carlsbad within the Agua Hedionda Lagoon, Batiquitos Lagoon, and Buena Vista Lagoon Ecological Reserves (Figure 7). These subpopulations accounted for approximately 18 percent of the total California population in 2023, and the annual numbers of pairs through 2023 are presented in **Table 18** and **Graph 13** (Zembal and Hoffman 2023). Batiquitos Lagoon supports the largest subpopulation in Carlsbad. This subpopulation has shown a steady increase since census monitoring began in 1980, with a record high of 52 pairs in 2016, but declined to a low of 16 pairs in 2018. The Agua Hedionda Lagoon and Buena Vista Lagoon subpopulations have been variable over time.

Implementation of the management actions described below appear to be successful in protecting and expanding this species within Carlsbad, although it is unclear if the Batiquitos Lagoon, Agua Hedionda Lagoon, and Buena Vista Lagoon subpopulations are stable and self-sustaining without the introduction of captive-bred individuals.

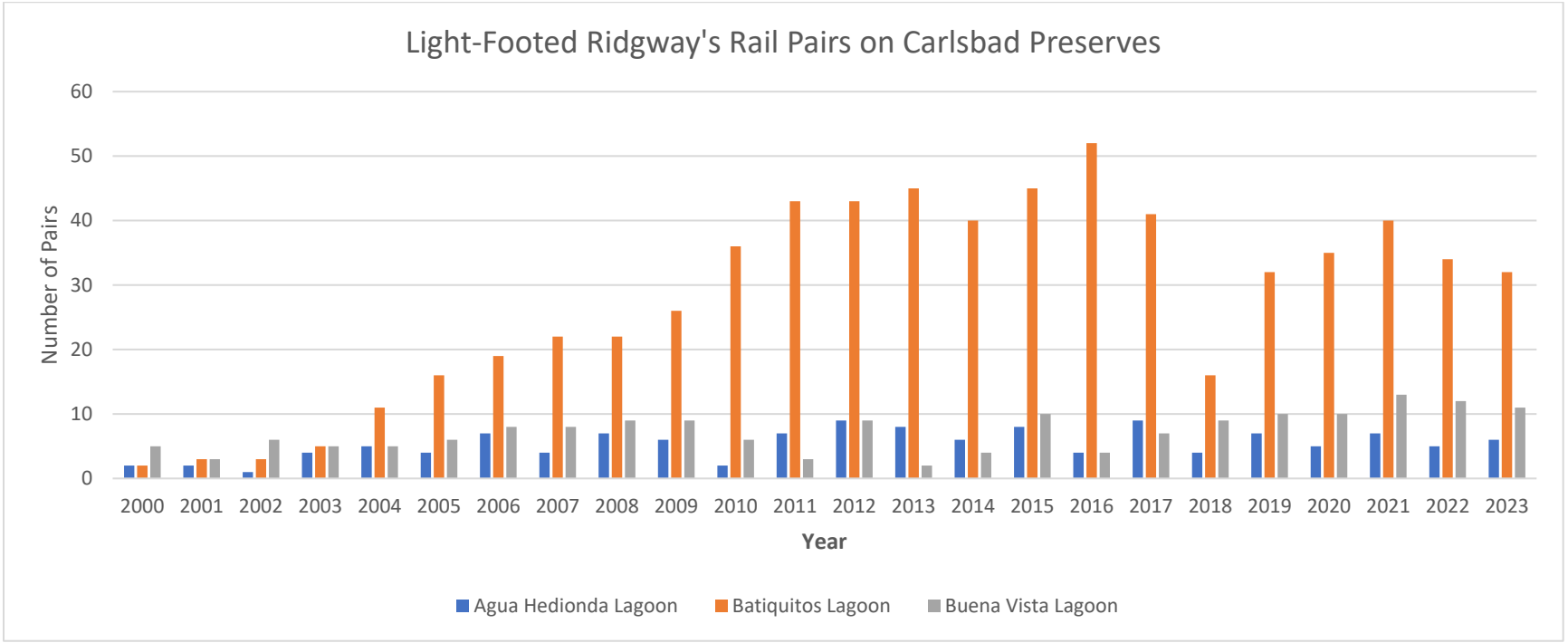
TABLE 18
NUMBER OF LIGHT-FOOTED RIDGWAY'S RAIL PAIRS BY YEAR ON CARLSBAD PRESERVES

Preserve	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Agua Hedionda Lagoon Ecological Reserve	2	2	1	4	5	4*	7*	4	7	6	2*	7	9	8	7*	8	4	9	4	7	5	7	5	6
Batiquitos Lagoon Ecological Reserve	2*	3*	3*	5	11	16*	19*	22	22	26*	36*	43*	43*	45	40	45	52	41	16	32	35	40*	34	32
Buena Vista Lagoon Ecological Reserve	5*	3*	6*	5*	5*	6*	8*	8*	9*	9*	6	3*	9*	2	4	10	4	7	9*	10	10	13*	12	11

NOTES:

* Represents only number of pairs detected, but unpaired rails were also detected.

GRAPH 13
LIGHT-FOOTED RIDGWAY'S RAIL PAIRS ON CARLSBAD PRESERVES



3.3.3.4 Major Threats

Major threats to this species include increasing tides and ocean inlet closures, invasion by non-native trees and shrubs, predators (i.e., raccoons [*Procyon lotor*], and human use (e.g., recreational [paddle boarders, beach goers, and dogs] and homeless) (Zembal and Hoffman 2023).

3.3.3.5 Management Actions Conducted to Protect the Species

A management and monitoring approach for this species was developed by SDMMP (2017). It includes monitoring occurrences annually through 2021 to record abundance, threats, and management needs and implementing routine management of habitat and vegetation per the needs of Ridgway's rail. CDFW priorities for the species are continued habitat enhancement/restoration, and funding of the statewide census.

Management actions at all three lagoons include habitat restoration and tidal enhancement, predator study and control program, nesting site provision, adaptive management studies, captive breeding, genetic and demographic augmentation of smaller subpopulations, and continued long-term monitoring of population status and effects of management actions (Zembal et al. 2020). A total of 67 captive-bred rails were released in Batiquitos Lagoon between 2004 and 2019 and more have been introduced since; 20 captive-bred rails were released between 2011 and 2016 at Buena Vista Lagoon; and 36 captive-bred rails were released between 2004 and 2013 at Agua Hedionda Lagoon; and at Buena Vista Lagoon, (Zembal and Hoffman 2023).

3.3.4 Western Snowy Plover

Scientific name: *Charadrius alexandrinus nivosus*
Status: federally threatened

3.3.4.1 MHCP Critical Locations and Major Populations

MHCP critical locations and major populations for this species have been identified at all three lagoons. Western snowy plover does not nest at Agua Hedionda Lagoon or Buena Vista Lagoon Ecological Reserves and has not been observed at either location during winter surveys. It nests at Batiquitos Lagoon Ecological Reserve (C. Beck, personal communication, 2018).

3.3.4.2 Long-Term Monitoring

Western snowy plover monitoring is conducted annually at Batiquitos Lagoon Ecological Reserve as part of a statewide census (Figure 7).

3.3.4.3 Status

Western snowy plover nests, pairs, and fledgling numbers at Batiquitos Lagoon through 2023 are provided in **Table 19** and **Graph 14**. The numbers of nests, breeding adults, and fledglings at Batiquitos Lagoon plummeted in 2006 and remained low thereafter, which is consistent throughout California (Squires and Wolf 2010). A further decline has occurred at Batiquitos since 2014, which is not consistent with the rest of the state (Feucht et al. 2017). None were observed in 2017 and 2020–2023. The reason for this is unclear.

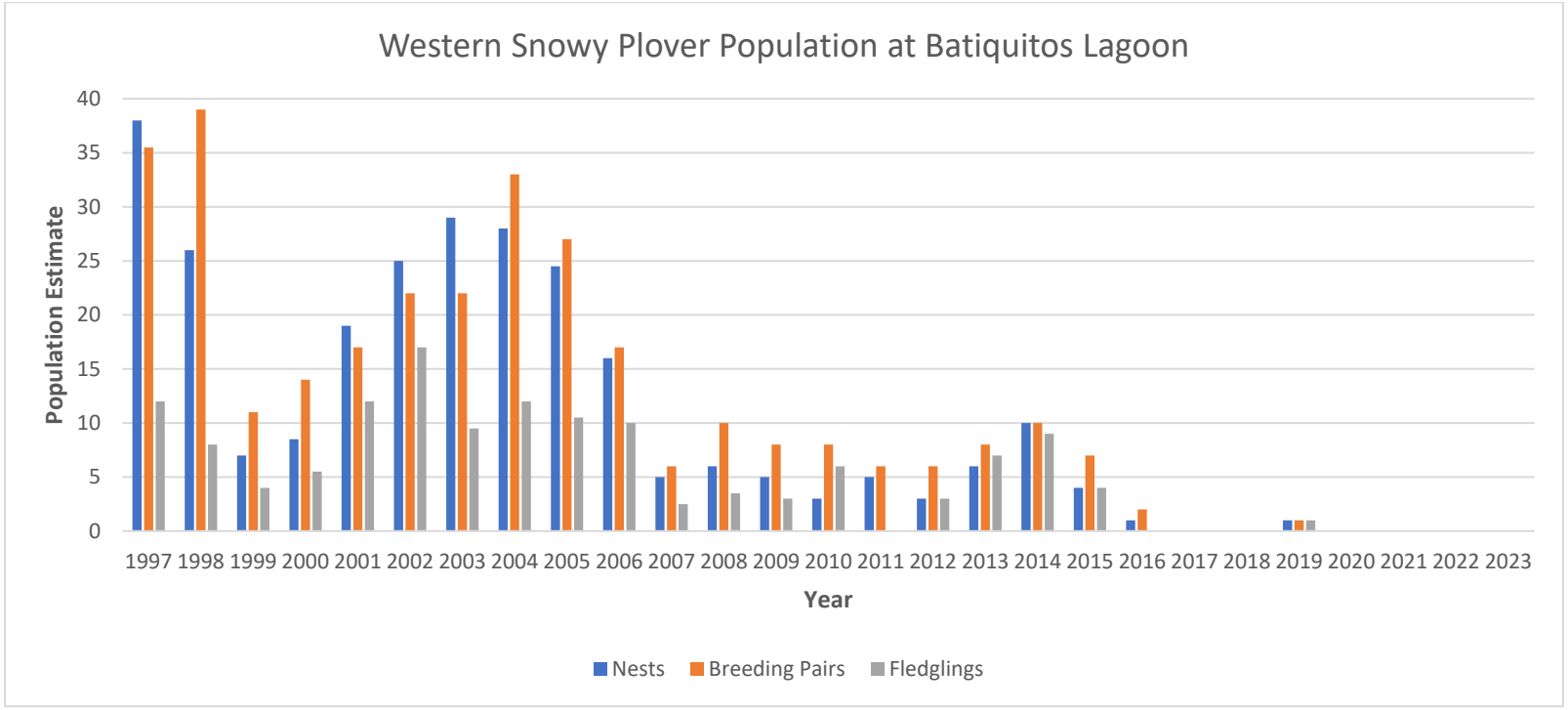
TABLE 19
NUMBER OF WESTERN SNOWY PLOVER NESTS, PAIRS, AND FLEDGLINGS AT BATIQUITOS LAGOON ECOLOGICAL RESERVE

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Nests	38	26	7	9	19	25	29	28	25	16	5	6	5	3	5	3	6	10	4	1	0	UR	1	0	0	0	0
Breeding Pairs	36	39	11	14	17	22	22	33	27	17	6	10	8	8	6	6	8	10	7	2	0	UR	1	0	0	0	0
Fledglings	12	8	4	6	12	17	10	12	11	10	3	4	3	6	0	3	7	9	4	0	0	UR	1	0	0	0	0

NOTES: UR = surveyed but unreported

Averages are displayed for ranges given in original data set.

GRAPH 14
WESTERN SNOWY PLOVER POPULATION AT BATIQUITOS LAGOON



3.3.4.4 Major Threats

Avian predators continue to be a major threat to the western snowy plover, as well as a decline in suitable foraging habitat as loss of salt pan and mud flat areas has reduced typical food sources for this species (C. Beck, personal communication, 2018).

3.3.4.5 Management Actions Conducted to Protect the Species

A management and monitoring approach for this species was developed by SDMMP (2017), which includes monitoring occurrences through 2021 to document abundance, threats, and necessary management actions; refining BMPs based on results; implementing high priority management actions; and monitoring the success of such actions. CDFW performs the following activities to encourage western snowy plover nesting: (1) habitat management – maintaining pathways linking the breeding habitat with the north mudflats; (2) predator control – placing wire cages over active nests to protect the eggs; and (3) vegetation management around nesting sites (Beck 2016).

3.4 Riparian Bird Species

3.4.1 Least Bell's Vireo

Scientific name: *Vireo bellii pusillus*
Status: federally endangered, state endangered

3.4.1.1 MHCP Critical Locations and Major Populations

There are no MHCP critical locations or major populations of least Bell's vireo in Carlsbad.

3.4.1.2 Long-Term Monitoring

Focused species surveys were conducted in suitable habitat on several preserves by CNLM between 2008 and 2023. Incidental observations made during other activities were also recorded. The purpose of the surveys is to periodically inspect suitable habitat, map occurrences, and identify threats to inform site-specific management. Figure 8 shows the locations of observations from focused surveys and incidental observations.

3.4.1.3 Status

Since surveys began in 2008, the number of least Bell's vireo pairs and/or individual males on Buena Vista Creek Ecological Reserve, Calavera Hills/Robertson Ranch, Encinas Creek, and city-owned preserves is variable (**Table 20**). Buena Vista Creek Ecological Reserve has the greatest number of territories as indicated by pairs or territorial males, but number of pairs and males have been variable across the monitoring period. On actively managed preserves, least Bell's vireo habitat is well-protected and appears to be in good condition.

TABLE 20
ESTIMATED NUMBER OF LEAST BELL'S VIREO PAIRS ON CARLSBAD PRESERVES

Preserve	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Buena Vista Creek Ecological Reserve	3–4 pairs	3 pairs 3 males	7 pairs 3 males	3 pairs[a] 2 males[a]	NS	NS	10–12 males[b]	NS	2 pair 7 males	NS	10–12 males[b]	NS	Det.[a]	5 males	NS	Det.[a]
Calavera Hills/ Robertson Ranch	1 pair[a] 1 male[a]	1 indv[a]	NS	NS	NS	3 males[a]	2 males[a]	NS	NS	3 males	1 pair[a] 3 males[a]	Det.[a]	Det.[a]	Det.[a]	3 males	NS
Encinas Creek	1 pair	1 pair 3 males	1 male	1 male	0	1 male	0	0	0	0	0	0	NS[d]	0	NS	0
Quarry Creek	NA	NA	NA	NA	NA	NA	NA	NA	1 pair[a] 1 male	NS	NS	7 indv	2 indv[a]	Det.[a]	3 indv	Det.[a]
Rancho La Costa	NS	NS	NS	2 indv[a]	NS	NS	0[c]	NS	NS	NS	NS	0	Det.[a]	NS	NS	0
City Preserves																
The Crossings Golf Course	NS	1 pair 3 males	1 pair 3 males	0	NS	1 male[c]	NS	NS	0	NS	NS	0	NS	NS	0	NS
Lake Calavera	NS	0	0	0	NS	0	1 male[a]	NS	0	NS	NS	0	NS	NS	0	NS
Poinsettia Park	NS	0	0	0	NS	0	NS	NS	0	NS	NS	0	NS	NS	0	NS
Lagoon Lane	NS	0	0	0	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	0	NS

NOTES: NS = not surveyed; NA = not applicable because preserve was not acquired yet; Det. = detected, but number of individuals not confirmed.

a. Incidental observation
b. Territorial
c. Migratory male
d. Survey canceled/postponed due to COVID-19.

3.4.1.4 Major Threats

Threats to this species include loss of overall riparian habitat, altered hydrological conditions, nest parasitism by the brown-headed cowbird, and habitat degradation through the introduction of tamarisk (*Tamarix* spp.), giant reed (*Arundo donax*), and other invasive non-native plant species. Shothole borer (*Euwallacea* spp.) and the associated *Fusarium* dieback disease, which is known to harm and often kill many riparian tree species such as willows (*Salix* spp.) that least Bell's vireo depend on for habitat, is a major threat to this species. Shothole borer was identified at The Crossings Preserve in 2016 and focused surveys in 2023 reported that while willow tree die-back and some mortality was observed at Poinsettia Park and The Crossings Preserves, signs of recovery and regrowth were also observed and shothole borer does not appear to be widespread throughout the preserves (CNLM 2023).

3.4.1.5 Management Actions Conducted to Protect the Species

This species is managed through general habitat management (e.g., trash pick-up, access control, patrols, invasive non-native plant species removal), as well as brown-headed cowbird trapping (CNLM 2020c). Restoration and habitat enhancement activities are performed annually and have occurred on over 5 and 55 acres, respectively (CNLM 2020e).

Many of the riparian trees that were most impacted from shothole borer at The Crossings Preserve were removed in September 2018. The removal area is monitored annually, with no increase in infected trees since; additionally, about 25 percent of the cut trees have since resprouted (CNLM 2020c). A direct correlation between negative impacts from shothole borer and a decreased presence of least Bell's vireo has not been observed within Carlsbad.

3.4.2 Southwestern Willow Flycatcher

Scientific name: *Empidonax traillii extimus*
Status: federally endangered, state endangered

3.4.2.1 MHCP Critical Locations and Major Populations

There are no MHCP critical locations or major populations in Carlsbad and it appears that there are only two nesting colonies within San Diego County—one along the Upper San Luis Rey River and one along the Santa Margarita River (SDMMP 2017). USFWS proposed critical habitat is located along Agua Hedionda Creek, east of El Camino Real, and along the eastern portion of Agua Hedionda Lagoon, west of El Camino Real (Figure 8).

3.4.2.2 Long-Term Monitoring

Focused species surveys for the southwestern willow flycatcher are conducted concurrently with least Bell's vireo surveys on CNLM-managed preserves, as these species have similar habitat requirements.

3.4.2.3 Status

This species does not appear to breed in Carlsbad, and suitable habitat is limited within the preserve system. A migratory southwestern willow flycatcher was observed many years ago at

The Crossings Preserve (Cotton/Beland/Associates, Inc. 2000), and suitable habitat exists from near Cannon Road up to the old quarry area along Macario Creek and at Lake Calavera (CNLM 2013). One willow flycatcher was also observed at Lake Calavera in 2016, presumed to be a migrant due to the time of year (M. Spiegelberg, personal communication, 2018).

3.4.2.4 Major Threats

Threats to this species in San Diego County include loss of and modification to natural habitat, predation by the brown-headed cowbird, altered hydrology within habitats, urbanization, agricultural practices, and heavy recreational use (SDMMP 2017). Loss of habitat from shothole borer/*Fusarium* dieback may also be a threat. SDMMP has stated that daily management activities alone will not ensure that this species is protected.

3.4.2.5 Management Actions Conducted to Protect the Species

Annual non-native species removal and shothole borer surveillance continue annually to improve riparian habitat on-site (CNLM 2023).

3.5 Upland Bird Species

3.5.1 Coastal California Gnatcatcher

Scientific name: *Polioptila californica californica*
Status: federally threatened

3.5.1.1 MHCP Critical Locations and Major Populations

No MHCP major or critical populations occur in Carlsbad; however, the regional stepping-stone corridor that provides dispersal opportunities between south San Diego County and Camp Pendleton (and into Orange and Riverside Counties) runs through Carlsbad. In addition, several areas of USFWS Critical Habitat were identified within the city (Figure 9).

3.5.1.2 Long-Term Monitoring

Initially, surveys for the coastal California gnatcatcher were conducted by preserve managers annually on a preserve-by-preserve basis. In 2010, the city worked with land managers to coordinate surveys across approximately 1,500 acres of coastal sage scrub to assess the abundance, status and distribution of this species throughout the HMP preserve system (CNLM and TAIC 2010). Citywide surveys were conducted again in 2013, on managed preserves and selected unmanaged preserves in the vicinity of the Aviara Master Association. The city, with approval from the Wildlife Agencies, reduced the monitoring frequency to every 9 years, and the next citywide survey was completed in 2022 (CNLM and ESA 2022). The next citywide survey is scheduled for 2031; however, USFWS, U.S. Geological Survey, and SDMMP will conduct regional monitoring for this species within its range in the United States (South Coast) in 2024.

3.5.1.3 Status

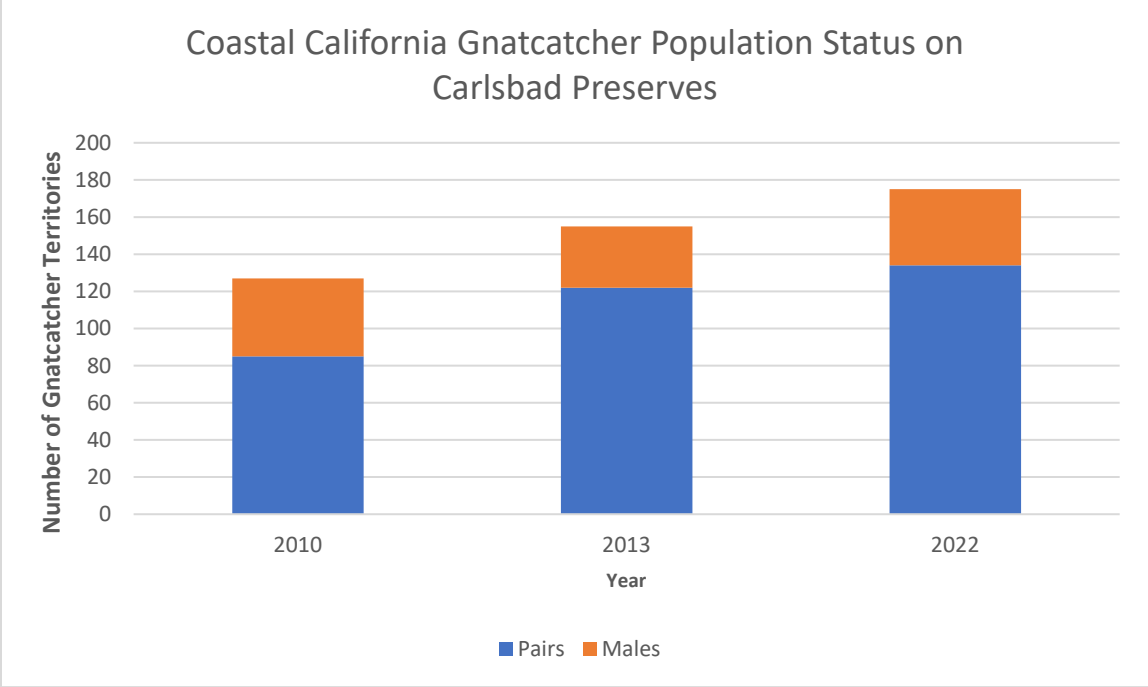
The total number of coastal California gnatcatcher pairs and single males detected across the HMP preserve system during 2010, 2013, and 2022 citywide monitoring is presented in **Table 21**

and **Graph 15**. A total of 134 pairs and 41 males (175 territories) were observed in the most recent citywide survey in 2022. This is an increase of 48 territories since the inaugural citywide survey in 2010 despite the minimal increase in survey acreage (CNLM 2022). Coastal California gnatcatchers were observed in most areas that were surveyed across the city in 2022. While many areas maintained a similar number of territories observed, Carlsbad Oaks North and Lake Calavera had a notable increase in 2022 (from 3 pairs to 13 pairs and 2 pairs to 5 pairs, respectively). In 2022, coastal California gnatcatchers were also detected within some preserves where they had not been previously observed such as Poinsettia Place, Poinsettia Park, and Parcel H North of Aviara Conservation Area. This species appears to be thriving within the HMP preserve system, with stable or increasing number of pairs and total territories since the start of long-term monitoring.

TABLE 21
COASTAL CALIFORNIA GNATCATCHER POPULATION STATUS ON CARLSBAD PRESERVES

Year	Acres Surveyed	# of Pairs	# of Single Males	Total # of Territories
2010	1,805	85	42	127
2013	1,985	122	33	155
2022	2,060	134	41	175

GRAPH 15
COASTAL CALIFORNIA GNATCATCHER POPULATION STATUS ON CARLSBAD PRESERVES



3.5.1.4 Major Threats

The largest threats to this species regionally are habitat degradation and loss of habitat due to wildfire (Kus et al. 2017). In May 2014, the Poinsettia Fire burned occupied habitat supporting three documented coastal California gnatcatcher locations. Post-fire monitoring suggests that the habitat is recovering well, although it may take many more years for the coastal sage scrub communities to attain the composition and cover of native shrubs that can support nesting coastal California gnatcatchers.

3.5.1.5 Management Actions Conducted to Protect the Species

Regional goals for this species include maintaining, enhancing, and restoring coastal sage scrub habitat to be resilient to environmental change and catastrophic events (SDMMP 2023). A regional management strategy, based on long-term monitoring being conducted throughout the species' range, is under development (Kus et al. 2017). Most of the suitable habitat in the city is under active management or is protected by a conservation easement. This species is managed through general habitat stewardship, including invasive non-native plant species removal, patrolling, fence and sign maintenance, erosion control, habitat evaluations, focused monitoring, and targeted restoration.

CHAPTER 4
Additional Monitoring

This section summarizes additional monitoring efforts within the HMP preserve system, including wildlife movement monitoring to fulfill the wildlife corridor functionality component of the MHCP and HMP, and monitoring of unmanaged preserves not required by the MHCP or HMP.

4.1 Wildlife Movement Monitoring

A special conservation objective of the MHCP and HMP is wildlife corridor functionality. In addition to allowing for demographic and genetic exchange by all species between preserve areas, the MHCP and HMP preserve system design is intended to facilitate access by larger predators, particularly coyotes (*Canis latrans*) and bobcats (*Lynx rufus*), between upland scrub and chaparral habitats and coastal habitats. An inventory of potential wildlife movement corridors and pinchpoints within Carlsbad and initial monitoring of key locations was conducted in 2013 to provide a baseline assessment of wildlife movement within the city (City of Carlsbad, ESA, and CNLM 2015). Based on the results of this initial analysis, targeted wildlife movement monitoring studies at priority locations were subsequently developed and implemented and are discussed below in sections 4.1.1 and 4.1.2.

In addition to these studies, preserve managers track wildlife movement on their preserves through incidental scat and track detections and wildlife camera monitoring. Based on targeted monitoring and incidental observations, coyotes and raccoons are very abundant, highly adaptable to urban settings, and occur throughout the city. Bobcats are also generally found throughout the city but tend to be detected more often at night. Mule deer generally occur only in larger core habitat areas in eastern Carlsbad but have been found on or near The Crossings Preserve and North County Habitat Bank.

4.1.1 Roadkill Studies

Roadkill monitoring studies were conducted at priority pinchpoint locations identified in the 2015 wildlife movement analysis (City of Carlsbad, ESA, and CNLM 2015). Each study was conducted by city employees, ESA biologists, and Preserve Calavera volunteers for 1 year. A minimum of two surveys were conducted per week, as roadkill tends to remain visible for multiple days. Monitoring results were supplemented by cross-referencing roadkill pickup logs maintained by the city's Public Works Department throughout the monitoring period. All roadkill study areas are presented in **Figure 10** and complete roadkill monitoring study memorandums are provided in **Appendix B,** *Roadkill Monitoring Memorandums*.

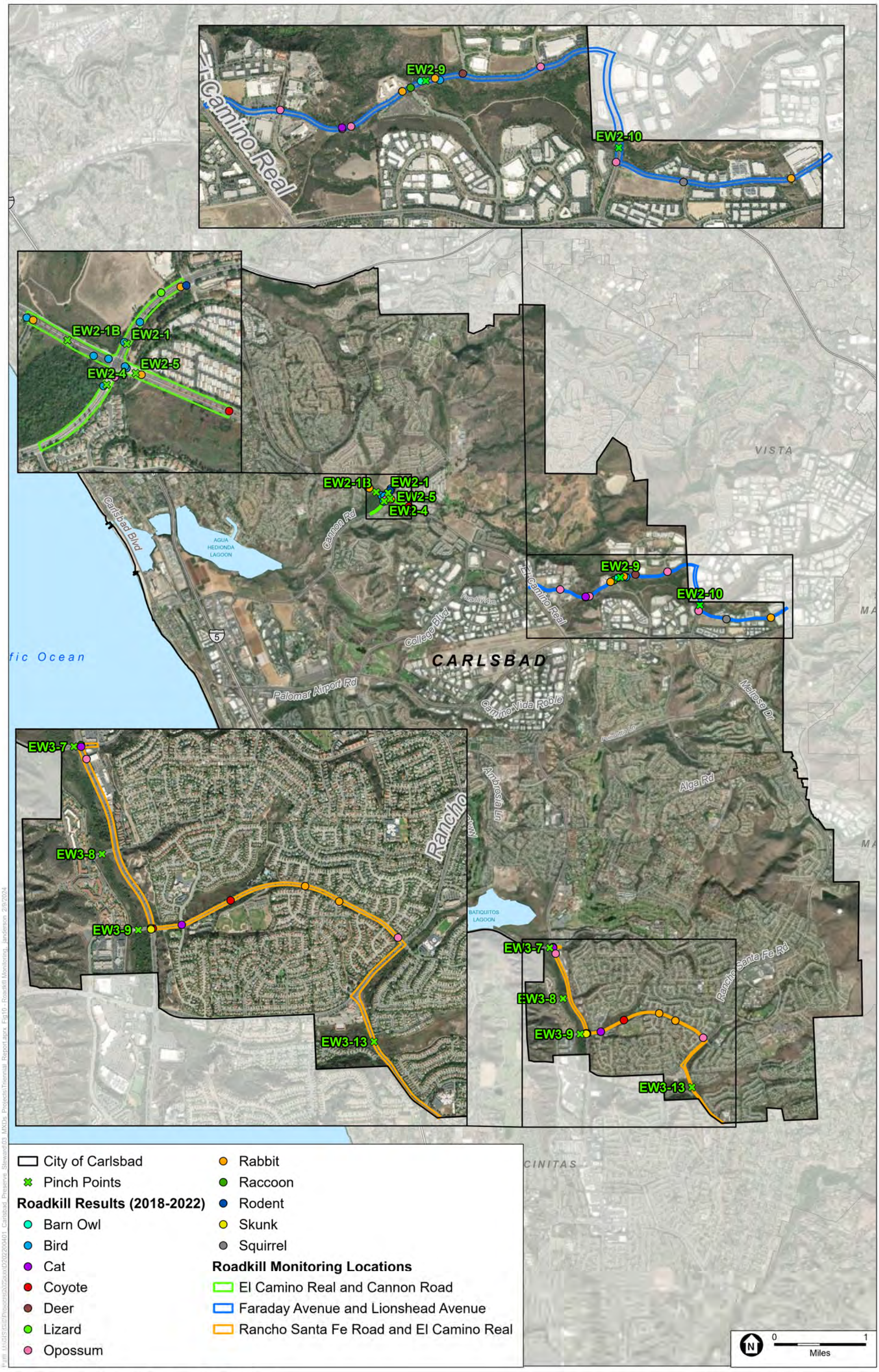
4.1.1.1 El Camino Real and Cannon Road

Monitoring at the intersection of El Camino Real and Cannon Road occurred from August 30, 2018, to August 30, 2019. Four pinch points have been identified at the El Camino Real/Cannon Road intersection that could hinder movement eastward and northward from the lagoon (under Cannon Road [EW2-4] and under El Camino Real [EW2-5], along Agua Hedionda Creek, from the lagoon northward under El Camino Real into Robertson Ranch Preserve [EW2-1], and between Robertson Ranch and habitat east of Cannon Road, north of El Camino Real [EW2-1B]). EW2-4 and EW2-5 are undercrossings approximately 50 feet wide and 7 to 10 feet high, with scattered, open vegetation. These corridors have been documented by wildlife cameras to support a variety of wildlife, including coyote, bobcat, opossum, raccoon, skunk, and cottontail rabbit, among others, and were the focus of this monitoring study.

A total of 16 roadkill occurrences were detected during the 171 survey dates within the 2018–2019 year of monitoring (**Table 22**). A single coyote roadkill was detected during the year of study, suggesting that medium to large mammal species are either able to cross the intersection at street level relatively successfully or are using the EW2-4 and EW2-5 undercrossings instead. Based on the results from wildlife cameras installed at EW2-4 since 2015 (which documented a total of 152 and 94 wildlife during the roadkill survey period, most of which were coyote and bobcat), it appears that these undercrossings are providing an important avenue for wildlife movement.

TABLE 22
ROADKILL DETECTIONS AT EL CAMINO REAL AND CANNON ROAD

Species	Roadkill Detections
Bird	8
Coyote	1
Lizard	1
Opossum	1
Rabbit	3
Rodent	2
Total	***16***



SOURCE: ESRI; City of Carlsbad, 2021; SanGIS, 2022; ESA, 2023

City of Carlsbad Habitat Management Plan
Triennial Monitoring Summary Report through 2023

Figure 10
Roadkill Monitoring

ESA

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4.1.1.2 Faraday Avenue and Lionshead Avenue

Monitoring along Faraday Avenue, between El Camino Real and South Melrose Drive, and Lionshead Avenue, between South Melrose Drive and Business Park Drive, occurred from August 1, 2020, to August 1, 2021. Pinchpoints occur under Faraday Avenue (EW2-9), along the creek to Melrose Drive (EW2-10) and beyond. Both EW2-9 and EW2-10 were considered high priority pinch points, where wildlife movement is restricted or bottle-necked in the 2015 report, as both pinch points have no fencing to guide wildlife away from the road.

A total of 8 roadkill occurrences were detected during the 106 survey dates within the 2020–2021 year of monitoring at Faraday Avenue and a total of 2 roadkill occurrences were detected during the 107 survey dates within the 2020–2021 year of monitoring at Lionshead Avenue (**Table 23**). No medium to large mammal species roadkill were detected during the year of study, suggesting that these species are either able to cross the intersection at street level successfully or are using the EW2-9 and EW2-10 undercrossings instead. However, small mammal and bird species appear to have some difficulty crossing Faraday Avenue.

TABLE 23
ROADKILL DETECTIONS AT FARADAY AVENUE AND LIONSHEAD AVENUE

Species	Roadkill Detections at Faraday Avenue	Roadkill Detections at Lionshead Avenue
Bird	2	ND
Cat	1	ND
Opossum	3	ND
Rabbit	1	1
Raccoon	1	ND
Squirrel	ND	1
Total	***8***	***2***

NOTES: ND = not detected.

4.1.1.3 Rancho Santa Fe and El Camino Real

Monitoring along Rancho Santa Fe Road and El Camino Real occurred from November 15, 2021, to November 15, 2022. Potential pinchpoints were identified at La Costa Avenue (EW3-7), El Camino Real and Rancho Santa Fe Road (EW3-13), Levante Street (EW3-8), and Calle Barcelona (EW3-9).

Twelve roadkill occurrences were recorded during the monitoring period (**Table 24**). No roadkill was detected at EW3-13 or EW3-8, suggesting that current infrastructure around these pinch points is functioning appropriately to support wildlife movement. Potential barriers to wildlife movement occur at EW3-7 as small mammal roadkill were detected at grade. EW3-9 has potential barriers that limit wildlife movement underneath the EW3-9 bridge, causing wildlife to cross at grade at the El Camino Real and Calle Barcelona intersection. This is evidenced by the six roadkill detections at the intersection, ranging from small to medium wildlife species (opossum, raccoon, and skunk) to medium to large wildlife species (coyote). Site conditions

around EW3-9 should be inspected to determine and implement the appropriate management (e.g., vegetation trimming to open up habitat) and pre- and post-management conditions should be documented to determine management effectiveness.

TABLE 24
ROADKILL DETECTIONS AT RANCHO SANTA FE AND EL CAMINO REAL

Species	Roadkill Detections
Cat	2
Coyote	2
Opossum	2
Rabbit	2
Raccoon	2
Skunk	2
Total	***12***

4.1.2 Village H South

The city took ownership of the Village H property in 2019. The southern section of Village H (Village H South) was historically used by local residents and off-leash dogs. Upon accepting ownership of the property, the city formalized the historical trail and performed significant trail improvements and other site improvements. Because off-leash dogs are not allowed on city trails or within HMP hardline areas, this has not been an allowable use of the property since the city took ownership. However, a group of resident advocates wanted the city to explore the possibility of unleashed dog use on the Village H property, and City Council directed staff to evaluate options. An initial biological constraints analysis evaluating on-site vegetation communities, habitat types, special-status species, and wildlife movement was conducted in 2019 (ESA 2019). This analysis provided preliminary wildlife movement patterns within the property, which were further assessed through focused wildlife movement monitoring studies using remote wildlife cameras, roadkill monitoring, and dog waste studies from June 28, 2019, to December 13, 2022 (ESA 2023b). This monitoring period captured changes in allowable uses from specific events such as the trail opening to the public on August 1, 2019, and trail closure during the COVID-19 pandemic from March 23, 2020, to May 4, 2020. The initial biological constrains analysis and wildlife movement monitoring summary memorandum are provided in **Appendix C**, *Village H Memorandums*.

A total of 22 remote wildlife cameras were installed at Village H over the course of the study period to monitor the diversity of wildlife species using the site and determine potential wildlife movement patterns. The first wildlife camera was installed on June 25, 2019, and the last wildlife camera was removed on November 17, 2022. The wildlife cameras captured data spanning a period of 844 days. Species detected at the 22 wildlife camera locations included coyote, bobcat, skunk (*Mephitis mephitis*), rabbit (*Sylvilagus spp.*), California ground squirrel (*Otospermophilus beecheyi*), raccoon, opossum (*Didelphis virginiana*), various bird species, various rodent species, off-leash dogs, on-leash dogs, and humans. The most common wildlife species detected at Village H were coyotes,

small mammals (rodents/rabbits/raccoons), and birds. Wildlife detections, particularly mammals, decreased with increased public use, and detection times shifted towards predominantly nighttime in response to increased daytime trail use by humans and associated on-leash dogs.

Roadkill monitoring was used to determine if animals were being hit by cars while traveling over a road to enter or leave the property. Monitoring occurred at the portions of Tamarack Avenue, Carlsbad Village Drive, and Glasgow Avenue that border Village H, with a minimum of three surveys completed per week. A total of 15 roadkill occurrences were detected during the 129 survey dates from July 25, 2019, to July 25, 2020. All roadkill observations detected during the roadkill monitoring period were small mammals or birds, suggesting that medium to large mammal species, such as coyote, may be able to cross pinchpoint M1-1 across Carlsbad Village Drive at street level relatively successfully, as documented on remote wildlife cameras.

Dog waste studies were conducted to determine how much dog waste is left behind each week (number and weight) and where (e.g., native habitat, on or near the trail). Surveys were conducted approximately every other week from August 28, 2019, to October 23, 2019, and then reduced to once a month in response to the COVID-19 pandemic, through December 13, 2022. A significant amount of dog waste has been picked up during the entire study period, suggesting that many dog owners using Village H are not picking up after their dogs. Most dog waste was documented either on or within 3 feet of the city trail, suggesting that, in general, dogs are likely leashed and not entering the adjacent open space and HMP hardline preserve areas. An exception to this is the grassy area just south of Carlsbad Village Drive, between the trailhead and residences to the east. A high number of dog waste piles were consistently observed between the city trail and residences to the east, and numerous tennis balls (i.e., dog toys) were found in the western half of the same grassy area by the trailhead, indicating that unauthorized off-leash dogs are still an issue on-site and a threat to the adjacent coastal sage scrub habitat. If the total number of dog waste detections is used as a proxy for public usage, these results suggest that public use within Village H varies across months, assuming dog owners who do not pick up dog waste never pick up dog waste.

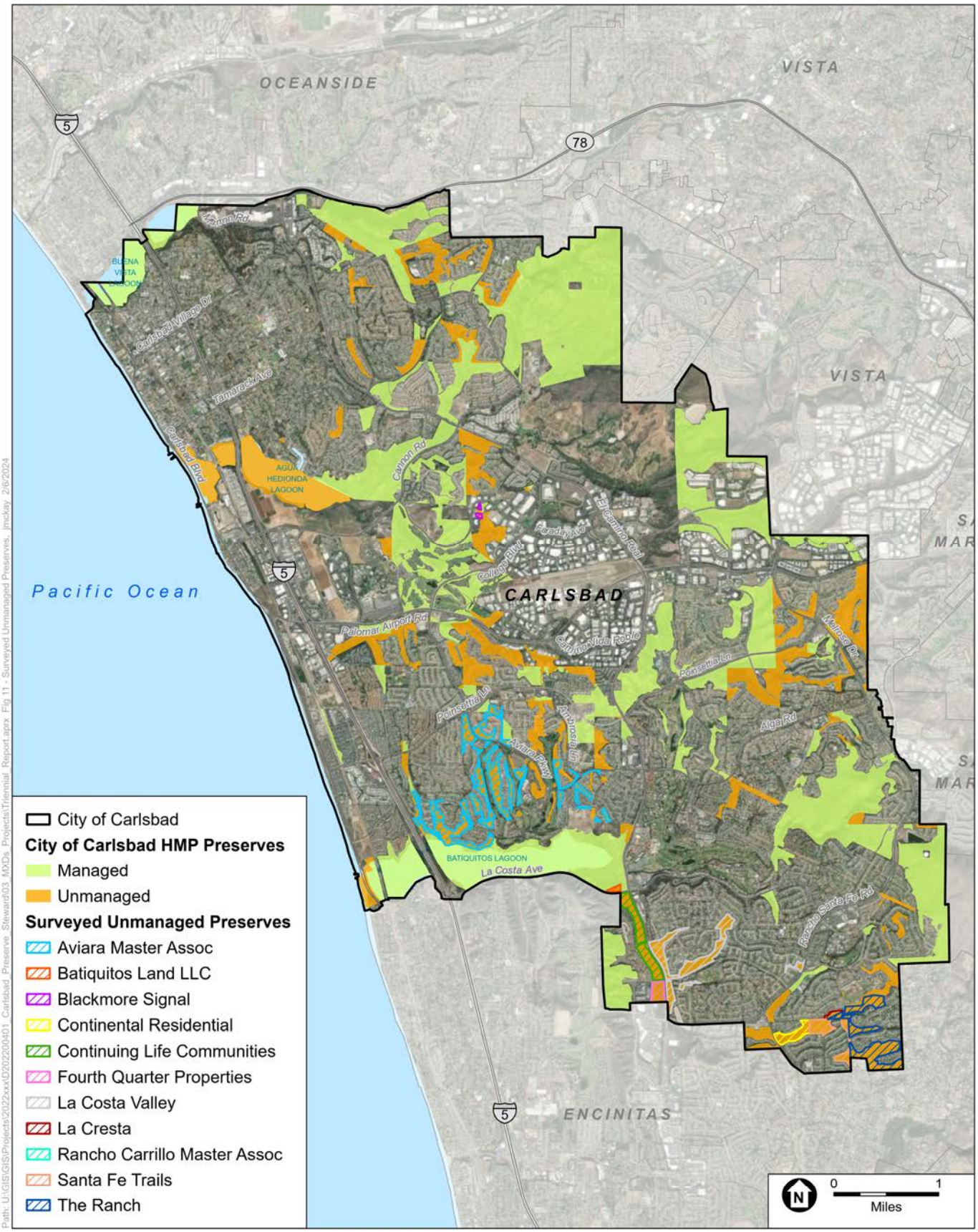
4.2 Site Inspection Program

Preserves established prior to the final adoption of the HMP in 2004 or established during the transition period of 2004–2005 were not required to have a funded land manager or were allowed reduced funding requirements. These preserves receive minimal or no management and are referred to as “unmanaged preserves.” With the HMP preserve system almost fully built out, the city has begun evaluating the status of unmanaged preserves to determine management priorities and implementation feasibility with the resources available.

A site inspection program was developed by the city and ESA to addresses the lack of monitoring and management on the unmanaged preserves by establishing a presence on unmanaged preserves, documenting baseline status of species and habitats, and prioritizing management actions based on available funding and implementation resources (ESA 2023c). Site inspections consisted of assessing threats (i.e., unauthorized access, trail encroachment, trash/dumping, invasive non-native plants, and erosion) and opportunities (i.e., adaptive management

opportunities, adaptive management urgency, restoration potential, grant opportunity, and volunteer opportunity).

Site inspections occurred from September 30, 2021, to June 8, 2022, across eight site inspection survey days, at 11 unmanaged preserves (i.e., Rancho Carrillo Master Association, The Ranch, Santa Fe Trails, La Costa Valley, Continuing Life Communities, Aviara Master Association, La Cresta, Fourth Quarter Properties, Continental Residential, and Batiquitos Land LLC Preserves) totaling approximately 667 acres (**Figure 11**). Priority threats were detected on all surveyed unmanaged preserves, with 10 of the 11 preserves having 3 or more of the five priority threats. Adaptive management priorities were developed based on the opportunity results and resources were available in 2023 to implement Year 1 of a pilot project to conduct and track focused management activities at two unmanaged preserves, Rancho Carrillo Master Association and The Ranch Preserves (ESA 2023d). Focused adaptive management is anticipated to continue in 2024. Site inspection program and adaptive management memorandums are provided in **Appendix D,** *Unmanaged Preserves Memorandums*.



Path: U:\GIS\GIS\Projects\2022xxx\D2022200401_Carlsbad_Preserve_Steward\03_MXDs_Projects\Triennial_Report.aprx Fig 11 - Surveyed Unmanaged Preserves, jmckay 2/6/2024

SOURCE: ESRI; City of Carlsbad, 2021; SanGIS, 2022; ESA, 2023

City of Carlsbad Habitat Management Plan
Triennial Monitoring Summary Report through 2023

Figure 11
Surveyed Unmanaged Preserves

ESA

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CHAPTER 5
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Appendix A

City of Carlsbad Restoration Opportunities GIS Analysis Memorandum

ESA

2355 Northside Drive
Suite 100
San Diego, CA 92108
619.719.4200 phone
619.719.4201 fax

esassoc.com

memorandum

date	October 11, 2023
to	Rosanne Humphrey, City of Carlsbad
cc	Adrienne Lee, Environmental Science Associates
from	Jaclyn Anderson, Environmental Science Associates
subject	City of Carlsbad Restoration Opportunities GIS Analysis Memorandum

Introduction

At the request of the City of Carlsbad (city), Environmental Science Associates (ESA) conducted a geographic information systems (GIS) analysis to (1) identify vegetation communities within the city's Habitat Management Plan (HMP) hardline preserve areas that provide restoration opportunities and (2) determine whether there has been any change in vegetation between the baseline HMP vegetation mapping and current vegetation throughout the city's HMP preserve system. This memorandum summarizes the methodology and results of these analyses.

Methodology

Data Assembly

Data was obtained from the city and downloaded from publicly available sources (**Table 1**).

Composite Vegetation Layer

A composite vegetation layer was created to establish current conditions for the HMP preserve system based on the best available information. A data hierarchy was established as follows using these three datasets: (1) *HMP Current Vegetation*, (2) *Regional Vegetation for the Western San Diego County* (AECOM 2012), and (3) *Regional Vegetation* (SanGIS) (Table 1).

The Holland/Oberbauer vegetation classification system (Holland) was used as the default mapping unit, as this is the system used in the HMP. A new dataset was merged using these three datasets and clipped to the HMP preserve system boundaries. Holland classification codes were pulled into a new field from the appropriate data source, then checked and corrected to ensure consistency. Using data from the site inspection program of unmanaged preserves collected by ESA in 2022 and 2023, some vegetation classifications were adjusted based on field notes.

TABLE 1
DATA SOURCES

Data	Description	Source
Composite Vegetation Layer		
HMP Current Conditions	HMP preserve boundaries and preserve information including preserve name, management plan, and management type	City of Carlsbad, 2023
HMP Current Vegetation	Vegetation mapped by land managers within managed preserves (not city-wide)	City of Carlsbad, 2023
Regional Vegetation for the Western San Diego County (AECOM 2012)	Vegetation mapped by AECOM in 2012 (not city-wide)	SanGIS, 2023
Regional Vegetation (SanGIS)	County-wide vegetation mapped by San Diego County	SanGIS, 2023
HMP Site Inspection Program Data	Vegetation documented during ESA site inspections on unmanaged preserves	ESA, 2022–2023
Potential Restoration Opportunities (additional inputs)		
Local Facilities Management Zones (LFMZ)	Zone numbers assigned throughout the city	City of Carlsbad
California Coastal Zone Boundary	Coastal zone defined by California Coastal Commission, coastal portion of the city	California Coastal Commission, 2023
Vegetation Change Analysis (additional inputs)		
HMP Original Vegetation	Vegetation mapped by San Diego County in 1999, used for HMP baseline vegetation	City of Carlsbad
Other Data		
HMP Current Species	Species occurrence data from HMP land managers (1999–2021)	City of Carlsbad
MHCP Species	Species occurrence data from the MHCP (data from 1982–2000)	City of Carlsbad

NOTES: HMP = Habitat Management Plan; LFMZ = Local Facilities Management Zones; MHCP = Multiple Habitat Conservation Program.

Potential Restoration Opportunities Analysis

At the request of the city, potential restoration opportunities were evaluated within Existing Hardline, Proposed Hardline, and Standards Areas, which consist of areas that are currently conserved or identified for future conservation. Restoration opportunities could be used as mitigation for project impacts, if allowed by the underlying landowner, or to improve the overall condition of the preserve system.

Existing Hardline areas consist of established preserves, including California Department of Fish and Wildlife Ecological Reserves, within the HMP preserve system. Existing Hardline areas established prior to adoption of the HMP generally do not have active land managers. All post-HMP preserves are actively managed and vegetation is remapped by the land manager every five years. Proposed Hardline and Standards Areas are undeveloped areas within the HMP that are anticipated to become established preserves within the HMP preserve system in the future. Proposed Hardline areas have pre-determined conservation boundaries. Standards Areas do not have pre-determined conservation boundaries; therefore, future preserves must be established following

specific standards based on the appropriate City of Carlsbad Local Facility Management Zone. Potential restoration opportunities within the HMP were determined using the following process.

- **Mitigation Vegetation Type (Restoration Opportunities)**. With respect to mitigation, the term "restoration" may be in the form of *enhancement*, *restoration*, *substantial restoration*, or *creation*. In this context, enhancement and restoration generally consist of improving the quality of existing habitat types, whereas substantial restoration or creation consist of converting landcover types with little or no habitat value to high quality habitat. It is difficult or impossible to tell the quality of existing habitat from aerial maps; therefore, most of the areas identified as restoration opportunities are likely to be degraded enough to be used as *creation* or *substantial restoration* mitigation credit. Areas marked as "Yes" for potential mitigation (i.e., restoration opportunities) include Disturbed Habitat, Unvegetated Habitat, Non-native Vegetation, Ornamental, Agriculture, Tamarisk Scrub, Non-native Riparian, Eucalyptus Woodland, Non-native Grasslands, Disturbed Coastal Sage Scrub, and Disturbed Wetland. Additional potential restoration opportunities identified by the city were also marked as "Yes." All other areas were considered to not have potential restoration opportunities and were marked as "No."

  It should be noted that most of the mapped areas in unmanaged preserves have not been ground-truthed. In addition, when evaluating areas for potential mitigation sites, the following areas should be removed from consideration: formal trails, fuel management zones, areas adjacent to roadways, areas that are very small and isolated, areas within maintenance easements, and areas that have already been used as mitigation for a project.

- **Local Facilities Management Zones**. The Local Facilities Management Zones and the Coastal Zone were added as fields, allowing the city to search for restoration opportunities to fulfill mitigation requirements within these zones.

- **Preserve management**. Fields were added indicating whether an HMP hardline preserve is managed or unmanaged for further filtering. Preserves that do not have HMP-required management (e.g., preserves established prior to the final adoption of the HMP in 2004 and not required to have a funded land manager or preserves established during the transition period of 2004–2005 that allowed for reduced funding requirements) are considered "Unmanaged" and all other management types are considered "Managed."

- **Upland or Wetland**. Areas were marked as either "Upland" or "Wetland" mitigation types based on vegetation classification as seen in **Table 2**. The following vegetation categories defined by the city's HMP were used to indicate "Upland" mitigation: Coastal Sage Scrub, Chaparral, Grassland, Woodland, Disturbed, and Agriculture. The following vegetation categories were used to indicate "Wetland" mitigation: Vernal Pool, Marsh, Riparian, and Non-Native Wetland .

- **Filterable results**. The above referenced classifications were standardized as fields to allow for results filtering and data searches.

TABLE 2
MITIGATION OPPORTUNITY BY HOLLAND/OBERBAUER CLASSIFICATION

General Vegetation Type	Specific Vegetation Types (Including Holland Code)	Mitigation Opportunity*	
		Restoration/ Enhancement	Creation/Subst. Restoration
Uplands			
Coastal Sage Scrub	32000 Coastal Scrub, 32400 Maritime Succulent Scrub, 32500 Diegan Coastal Sage Scrub, 32510 Diegan Coastal Sage Scrub: Coastal form, 32530 Diegan Coastal Sage Scrub: Baccharis-dominated	x	
Chaparral	37000 Chaparral, 37120 Southern Mixed Chaparral, 37200 Chamise Chaparral, 37900 Scrub Oak Chaparral, 37C30 Southern Maritime Chaparral, 37G00 Coastal Sage-Chaparral Transition	x	
Native Grassland	42000 Valley and Foothill Grassland, 42100 Native Grassland, 42110 Valley Needlegrass Grassland, 42120 Valley Sacaton Grassland, 42130 Saltgrass Grassland, 42300 Wildflower Field	x	
Oak Woodland	71100 Oak Woodland, 71160 Coast Live Oak Woodland, 71180 Engelmann Oak Woodland	x	
Non-Native Grassland	42200 Non-Native Grassland, 42210 Non-Native Grassland: Broadleaf-Dominated		x
Eucalyptus Woodland	79100 Eucalyptus Woodland		x
Disturbed Habitat	11000 Non-Native Vegetation, 11300 Disturbed Habitat, 11300 Ornamental		x
Agriculture	18000 General Agriculture, 18100 Orchards and Vineyards, 18200 Intensive Agriculture - Dairies, Nurseries, Chicken Ranches, 18300 Extensive Agriculture - Field/Pasture, Row Crops, 18310 Field/Pasture, 18320 Row Crops		x
Wetlands			
Vernal Pool	44000 Vernal Pool	x	
Marsh	45320 Alkali Seep, 52120 Southern Coastal Salt Marsh, 52300 Alkali Marsh, 52310 Cismontane Alkali Marsh, 52400 Freshwater Marsh, 52410 Coastal and Valley Freshwater Marsh	x	
Riparian Forest and Woodland	61300 Southern Riparian Forest, 61310 Southern Coast Live Oak Riparian Forest, 61320 Southern Arroyo Willow Riparian Forest, 61330 Southern Cottonwood-Willow Riparian Forest, 62000 Riparian Woodlands, 62500 Southern Riparian Woodland	x	
Riparian Scrub	63000 Riparian Scrub, 63300 Southern Riparian Scrub, 63310 Mule Fat Scrub, 63320 Southern Willow Scrub	x	
Non-Native Wetland	11200 Disturbed Wetland, 13000 Unvegetated Habitat, 63810 Tamarisk Scrub, 65000 Non-Native Riparian		x

* It is not possible to distinguish between disturbed and high quality habitat; therefore, polygons marked with "Yes" for restoration or mitigation opportunity are generally candidates for creation and substantial restoration, rather than enhancement or restoration.

Vegetation Change Analysis

Using the composite vegetation layer, the HMP baseline vegetation layer was clipped and an intersect was created, adding two fields that represent the comparison between the two vegetation layers. A field was then added indicating whether vegetation was different between the two datasets. The classifications were standardized as fields to allow for results filtering.

Results

The following is a results summary.

- **Composite vegetation layer**. The composite vegetation layer resulted in 60 vegetation types throughout the HMP hardline preserve and standard areas. A single vegetation field describing the Holland classification was created for consistency between the three vegetation layers used when creating this layer. Standardized fields are provided in **Table 3**.
- **Potential restoration opportunities filter**. The potential restoration opportunities filter is a data field within the composite vegetation layer. There are approximately 910 acres of vegetation with potential for restoration opportunities within HMP hardline preserve areas (**Figure 1**). Of these 910 acres, approximately 846 acres are upland restoration opportunities, 59 acres are wetland restoration opportunities, and 4 acres are neither upland nor wetland. The standardized fields allow the user to filter results to display and categorize potential restoration opportunities (Table 3).
- **Vegetation change layer**. Approximately 3,966 acres of vegetation have changed since the city's original mapping was completed in 1999 (**Figure 2**). Of these acres that changed, 999 acres changed from a non-native vegetation type to a native vegetation type and 63 acres changed from native vegetation type to developed. The standardized fields allow the user to identify vegetation change by preserve (**Table 4**).

ESA will provide the two resulting GIS layers from the Restoration Opportunities and Historic Vegetation Overlay within a geodatabase for the city to access and use for further analysis.

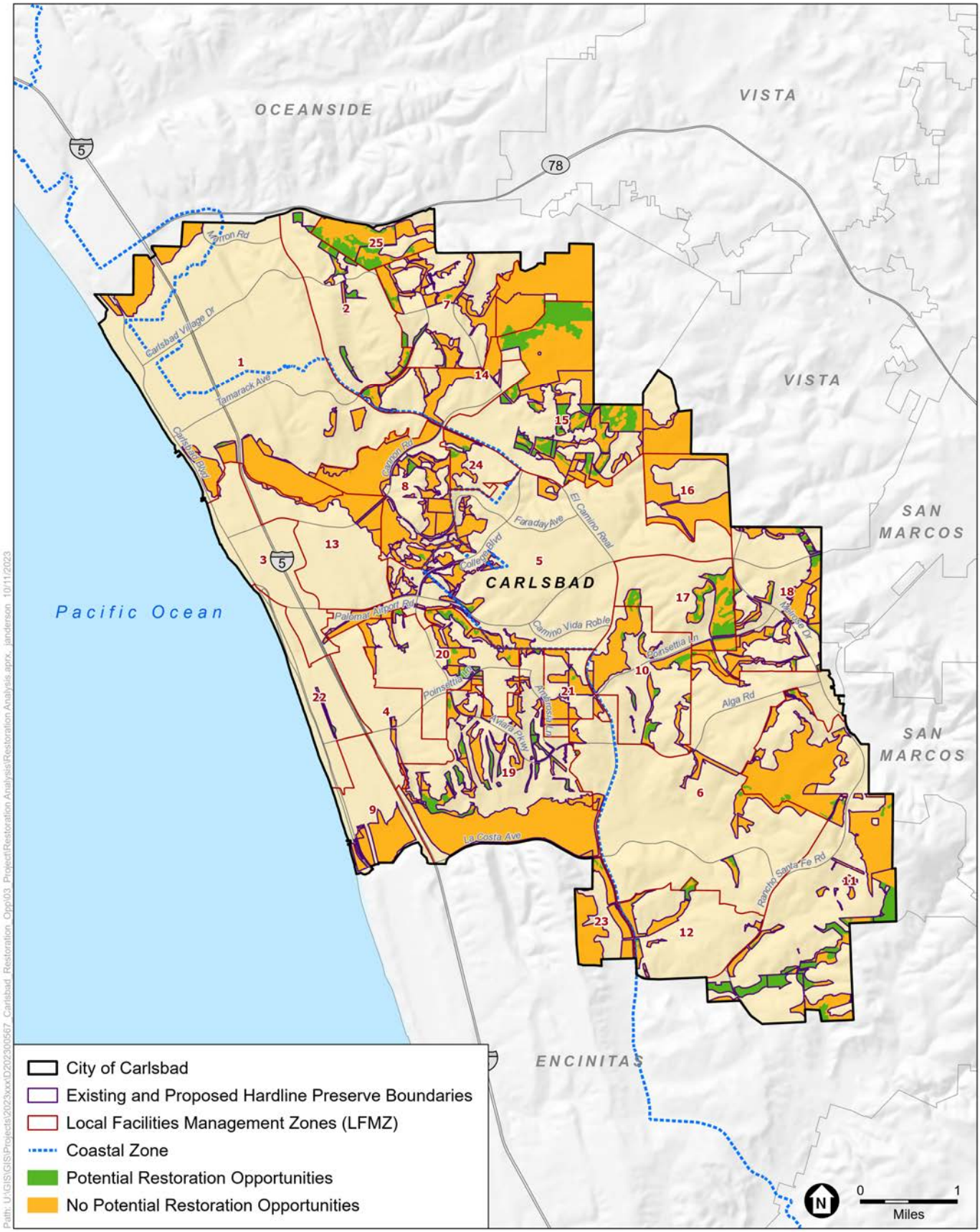
TABLE 3
COMPOSITE VEGETATION AND RESTORATION OPPORTUNITIES ANALYSIS FIELDS

Field Name	Description
Composite Vegetation Layer	
Preserve Name	HMP Preserve Name
Current Habitat Management Plan	Current boundaries of the HMP Existing Hardline, Proposed Hardline and Standards Areas
Holland 2023	Resulting Holland/Oberbauer vegetation classification of composite vegetation layer
Holland Source	Vegetation source based on established hierarchy
Vegetation Comments	Indicates if alternative to hierarchy was used to determine vegetation type
Potential Restoration Opportunities (additional fields)	
Mitigation Vegetation Type	Marked Yes or No for whether vegetation type is considered for restoration or not*
Local Facilities Management Zone	LFMZ number the vegetation falls within
Within Coastal Zone	Marked Yes or No if vegetation type falls within the coastal zone
Managed or Unmanaged	Marks whether the preserve is managed or unmanaged
Upland or Wetland	Marked Upland or Wetland based on vegetation type

* It is not possible to distinguish between disturbed and high quality habitat; therefore, polygons marked with "Yes" for restoration or mitigation opportunity are generally candidates for creation and substantial restoration, rather than enhancement or restoration.

TABLE 4
HISTORIC VEGETATION OVERLAY ANALYSIS FIELDS

Field Name	Description
Preserve Name	HMP Preserve Name
Holland 1999	Baseline vegetation mapping of the HMP using Holland/Oberbauer vegetation classification
Simplified Holland 1999	Simplified vegetation categories for ease when used for analysis
Holland 2023	Resulting Holland/Oberbauer vegetation classification of composite vegetation layer
Simplified Holland 2023	Simplified vegetation categories for ease when used for analysis
Change	Marked Yes or No if the composite vegetation layer and original mapping Holland/Oberbauer classifications are different
Change Quality	Indicator of change quality between 1999 and 2023 mapping as directed by the city
Notes About Changes	Notes for specific cases of change for internal use by the city



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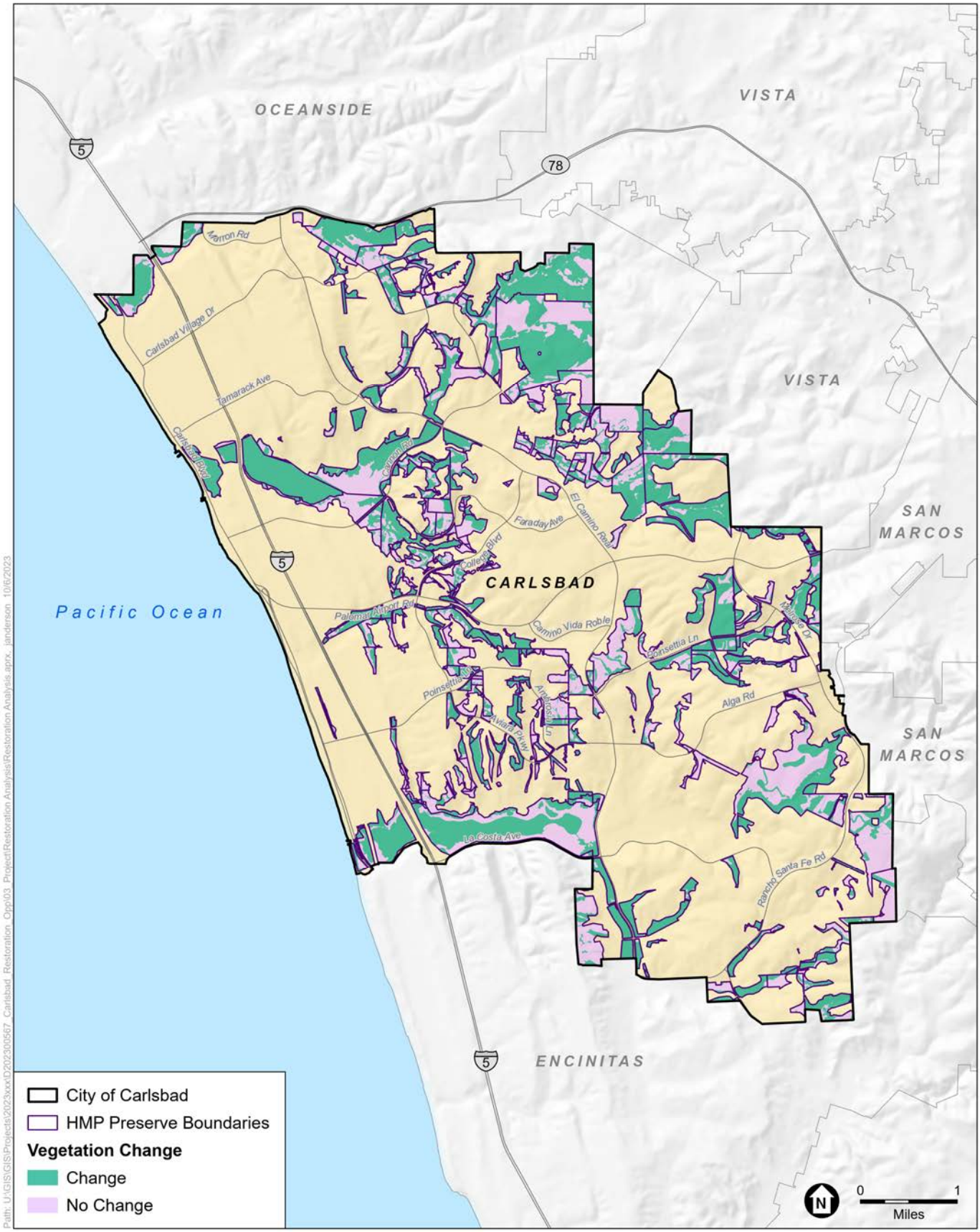
SOURCE: SanGIS, 2023; City of Carlsbad, 2023, California Coastal Commission, 2023.

City of Carlsbad Restoration Opportunities GIS Analysis

Figure 1
Potential Restoration Opportunities

ESA



SOURCE: SanGIS, 2023; City of Carlsbad, 2023.

City of Carlsbad Restoration Opportunities GIS Analysis

Figure 2
Vegetation Change Analysis

ESA

Appendix B

Roadkill Monitoring Memorandums

B-1 El Camino Real and Cannon Road

ESA 50 YEARS 1969-2019

550 West C Street
Suite 750
San Diego, CA 92101
619.719.4200 phone
619.719.4201 fax

esassoc.com

memorandum

date	November 11, 2019
to	Rosanne Humphrey, City of Carlsbad
cc	Alanna Sullivan, Environmental Science Associates
from	Adrienne Lee, Environmental Science Associates
subject	Roadkill Study Results – El Camino Real and Cannon Road

This memorandum summarizes the results of adaptive wildlife movement monitoring, in the form of roadkill monitoring at the intersection of El Camino Real and Cannon Road, that occurred for 1 year between August 30, 2018, and August 30, 2019. All roadkill species detected were recorded.

Introduction

Wildlife movement is the ability for individuals from different wildlife populations to move across the landscape successfully. Wildlife corridors, typically the most efficient wildlife movement pathways, connect fragmented patches of habitat allowing migration, dispersal, and gene flow of wildlife species. However, wildlife movement can become restricted when wildlife corridors intersect with the urban interface, such as through roadways, and become "pinch points" where animal movement becomes funneled into specific locations due to the lack of alternative movement routes. Roads are a significant threat to wildlife movement, particularly when they bisect habitat throughout the city with dense, fast-moving traffic. Wildlife that travel across roads are at high risk of being struck by oncoming traffic and becoming roadkill, in addition to being a road hazard and human safety concern. A safer alternative to traveling across a road would be traveling underneath a road through an underpass, bridge, or culvert.

From 2006 to 2017, on behalf of the City of Carlsbad (city), Environmental Science Associates (ESA) mapped and defined wildlife corridors within the city and identified potential wildlife movement constraints along these corridors.[1] As stated in the 2015 *City of Carlsbad Wildlife Movement Analysis Final Report*,[2] three primary regional east-west corridors within the city were identified, East/West 1 (EW1), East/West 2 (EW2), and East/West 3 (EW3). EW2 is a movement corridor that connects Agua Hedionda Lagoon east to Calavera Mountain/Calavera Lake (northern branch) and along Agua Hedionda Creek/La Mirada Creek out to the Carlsbad Raceway Preserve and city of Vista (southern branch). Four pinch points have been identified at the El Camino

1 Environmental Science Associates (ESA). 2017. *Summary of Wildlife Movement Activities in Carlsbad Memo*. Prepared for City of Carlsbad.

2 ESA. 2015. *City of Carlsbad Wildlife Movement Analysis Final Report*. Prepared for City of Carlsbad.

Real/Cannon Road intersection that could hinder movement eastward and northward from the lagoon (**Figure 1**). Movement along the southern branch occurs from Agua Hedionda Lagoon Ecological Reserve along underpass bridges, under Cannon Road (EW2-4) and under El Camino Real (EW2-5), along Agua Hedionda Creek. Movement through EW2-1 (from the lagoon northward under El Camino Real into Robertson Ranch Preserve) is blocked by very dense vegetation and standing water. There is only one small culvert in this location. Movement through EW2-1B (between Robertson Ranch and habitat east of Cannon Road, north of El Camino Real) is considered to be too small for wildlife movement, as silt has deposited in the box culvert over time, leaving little room for movement.

Both EW2-4 and EW2-5 undercrossings are approximately 50 feet wide and 7 to 10 feet high, with scattered, open vegetation **(Attachment A**). These corridors have been documented by wildlife cameras to support a variety of wildlife, including coyote, bobcat, opossum, raccoon, skunk, and cottontail rabbit, among others. However, the busy intersection of El Camino Real and Cannon Road is a wildlife movement pinch point, funneling wildlife to these areas, which can increase the potential for wildlife to cross "at-grade," above at the street level. El Camino Real and Cannon Road are highly traveled as El Camino Real is a six-lane road with a speed limit of 55 miles per hour and Cannon Road is a four-lane road with a speed limit of 50 miles per hour; therefore, these roads are expected to be a barrier for wildlife movement through direct mortality from vehicle collisions. The primary focus of this study was to determine if medium to large mammal species are moving across the roads at the El Camino Real and Cannon Road intersection and getting hit by cars rather than traveling underneath. Medium to large mammal species were targeted because these species demonstrate longer-range movement patterns and are likely more threatened by habitat fragmentation from roads.[3] In order to assess how frequent wildlife deaths from vehicle strikes occur in the intersection, ESA biologists and volunteers from Preserve Calavera monitored the El Camino Real and Cannon Road intersection for a year to document roadkill occurrences.

Methodology

On August 30, 2018, ESA biologists Alanna Sullivan and Adrienne Lee met with Preserve Calavera volunteers Paige DeCino and Karen Merrill and the city's Habitat Management Plan (HMP) coordinator, Rosanne Humphrey, to finalize the survey area (Figure 1). The El Camino Real and Cannon Road intersection survey area was monitored for a year from August 30, 2018, to August 30, 2019, with a minimum of two surveys completed per week. Because roadkill typically persists for more than 1 day, it is assumed that the data collected represents more than just the dates surveys were conducted. For the full list of survey dates, see **Appendix A**, *El Camino Real/Cannon Road Roadkill Survey Dates and Results*. Additionally, ESA biologists checked the roadkill pick up logs kept by the city's Public Works Department from July 2017 to March 2019 to supplement roadkill monitoring data.

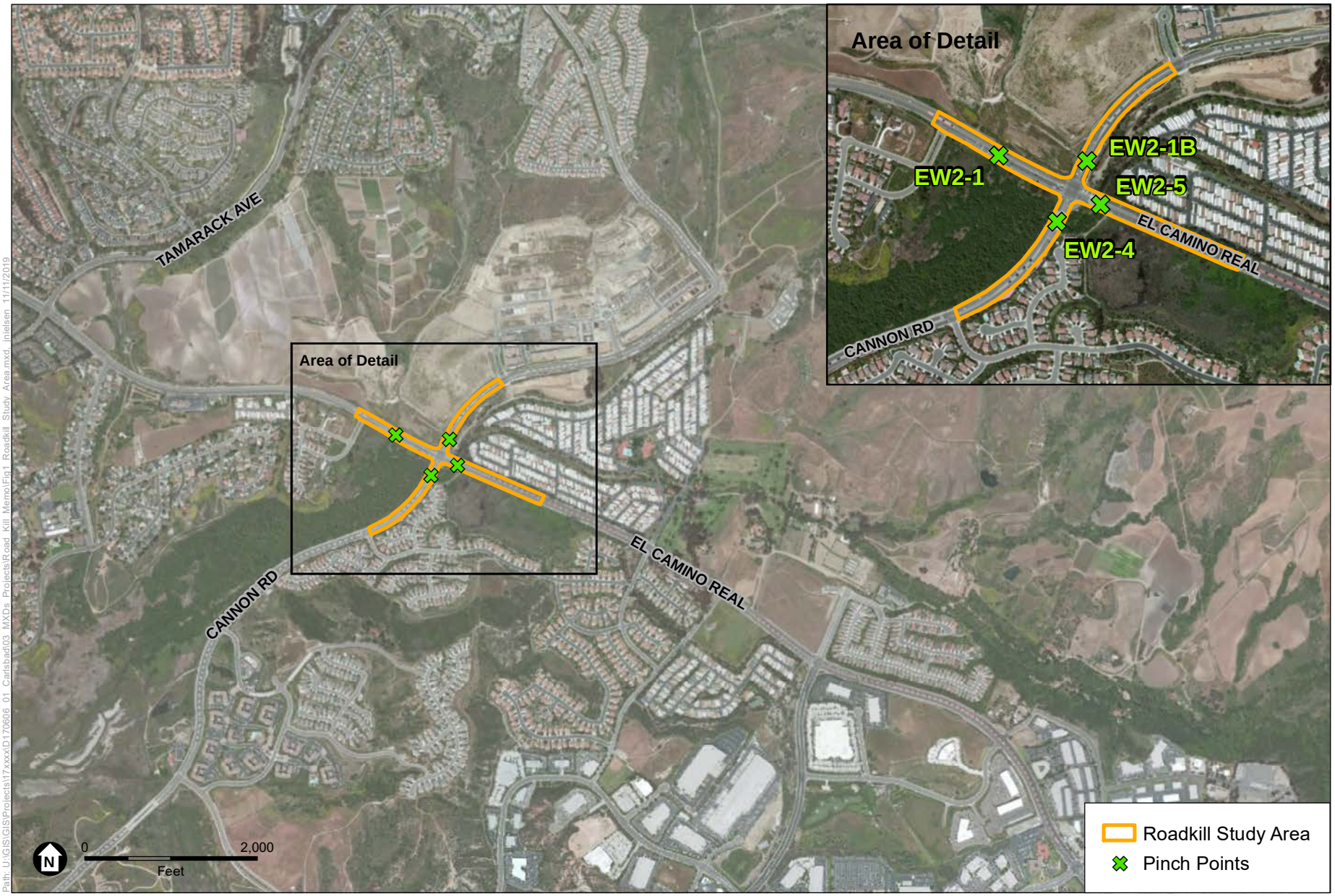
Monitoring was conducted by ESA biologists, Preserve Calavera volunteers, and a city employee. The survey area was monitored by walking or driving the intersection slowly and scanning the entire roadway and adjacent sidewalk for roadkill. If something was not identifiable from the car, the surveyor wore a safety vest and walked the survey area, using binoculars to scan the road. If roadkill was detected, a photo was taken when road conditions were safe and uploaded onto the citizen scientist mobile application iNaturalist[4] to create an

[3] Ng, S.J., J.W. Dole, R.M. Sauvajot, S.P.D. Riley, and T.J. Valone. 2004. *Use of highway undercrossings by wildlife in southern California*. Biological Conservation 115: 499–507.

[4] iNaturalist. Available from https://www.inaturalist.org.

"observation" within the University of California, Davis, California Roadkill Observation System (CROS) Project.[5] Once the observation was recorded, the surveyor called the city's Public Works department for animal disposal pickup.

[5] iNaturalist. California Roadkill Observation System (CROS). Available from: https://www.inaturalist.org/projects/california-state-roadkill



SOURCE: ESRI, 2019; ESA, 2019.

Carlsbad Roadkill Study

Figure 1
El Camino Real x Cannon Road Roadkill Study Area

ESA

Results

A total of 16 roadkill occurrences were detected during the 171 survey dates within the 2018–2019 year of monitoring. One (6.25%) roadkill observation was a medium to large mammal: coyote. Six (37.5%) roadkill observations were small mammals: rodents, rabbits, and opossums. Eight (50.0%) roadkill observations were bird species. One (6.25%) roadkill observation was a reptile species (lizard), but it was detected on the sidewalk, presumably hit by a bicyclist. All roadkill observations and their associated survey dates, times, and surveyor information are listed in **Table 1** and locations of all roadkill observations are displayed in **Figure 2**.

TABLE 1
EL CAMINO REAL X CANNON ROAD ROADKILL DETECTIONS

Date	Survey Time	Surveyor	Species
8/30/18	0800–0900	Team[a]	Opossum
9/2/18	0800–0900	Karen Merrill[b]	Bird
9/4/18	1240–1255	Paige DeCino[b]	Bird
9/7/18	0800–0830	Alanna Sullivan	Bird
9/16/18	0800–0845	Karen Merrill[b]	Rodent
10/10/18	1620–1640	Alanna Sullivan	Rat
11/13/18	1030–1125	Alanna Sullivan	Lizard[c]
11/24/18	0800–0850	Karen Merrill[b]	Bird
1/12/19	0915–0945	Karen Merrill[b]	Rabbit
3/30/19	0815–0900	Karen Merrill[b]	Duck
4/20/19	0810–0825	Karen Merrill[b]	Bird
6/1/19	1020–1045	Karen Merrill[b]	Crow
6/15/19	0915–0940	Karen Merrill[b]	Mourning Dove
6/29/19	0830–0915	Karen Merrill[b]	Coyote
7/10/19	1200–1220	Alanna Sullivan	Rabbit
8/6/19	1130–1150	Hannah Swarthout[d]	Rabbit

[a] Team: Alanna Sullivan and Adrienne Lee (ESA), Paige DeCino and Karen Merrill (Preserve Calavera), and Rosanne Humphrey (city).
[b] Volunteer from Preserve Calavera
[c] Found dead on sidewalk, presumably hit by bicyclist
[d] Employee with the City of Carlsbad

In comparison to roadkill, the number of wildlife detections under Cannon Road was significantly higher during the same time period. Two cameras have been installed under the Cannon Road underpass (EW2-4) since 2015[6]. A total of 152 and 94 wildlife detections were documented by the two cameras during the roadkill survey period (**Table 2**). Note that Camera 2 was pulled in January 2019 due to high water level, which flooded the camera. The greatest number of mammals detected on the cameras was coyotes (69 detections by Camera 1 and 45 by Camera 2, representing 45.4% and 47.9% of the total detections, respectively), and bobcats (67 detections by Camera 1 and 22 by Camera 2, representing 44.1% and 23.4% of the total detections, respectively). Other wildlife species detected included birds, opossums, raccoons, and skunks.

[6] City of Carlsbad, Environmental Science Associates, and Center for Natural Lands Management. 2015. *City of Carlsbad Wildlife Movement Analysis Final Report*. Prepared for City of Carlsbad.

TABLE 2
WILDLIFE CAMERA DETECTIONS (AUGUST 2018–AUGUST 2019)

Species	Number of Detections (%)	
	EW2-4 Camera 1	**EW2-4 Camera 2**
Bird	6 (3.9%)	6 (6.4%)
Bobcat	67 (44.1%)	22 (23.4%)
Coyote	69 (45.4%)	45 (47.9%)
Opossum	2 (1.3%)	7 (7.4%)
Raccoon	6 (3.9%)	13 (13.8%)
Skunk	2 (1.3%)	1 (1.1%)
TOTAL	**152**	**94**

Note: some individuals could have been detected by both cameras.

SOURCE: ESRI, 2019; ESA, 2019.

Carlsbad Roadkill Study

Figure 2
Roadkill Monitoring Results

ESA

Discussion

The primary focus of this study was to determine if medium to large mammal species are moving across the roads at the El Camino Real and Cannon Road intersection and getting hit by cars rather than traveling underneath. Medium to large mammals demonstrate longer-range wildlife movement patterns and are likely more threatened by habitat fragmentation from roads than smaller species.[7] While roadkill monitoring occurred 171 days out of the year, it is likely that these results represent all roadkill data for the year as roadkill typically persists for more than one day, and animal disposal records from the city's Public Works department were also monitored during the survey year. A single coyote roadkill was detected during the year of study, suggesting that medium to large mammal species are either able to cross the intersection at street level relatively successfully or are using the EW2-4 and EW2-5 undercrossings instead. Based on the results from the wildlife cameras, which documented a total of 152 and 94 wildlife during the roadkill survey period, most of which were coyote and bobcat, it appears that these undercrossings are providing an important avenue for wildlife movement.

As seen in Figure 2, roadkill occurrences of birds are congregated around the intersection of El Camino Real and Cannon Road and less so in the extremities of the survey area. Other studies have found that birds are one of the top taxa to be impacted by vehicle collisions,[8, 9, 10] particularly in areas that support native vegetation and full-time or migratory habitat for birds.[11] This may explain the location and why birds represented the highest number of roadkill occurrences in this study, as native vegetation exists adjacent to the intersection along Agua Hedionda Creek.

ESA continues to monitor animal disposal pickup records from the city's Public Works department to determine potential pinch points within the city that may benefit from future roadkill monitoring. Additional pinch point roadkill monitoring is currently being conducted at Faraday Avenue (pinch point M5-2) and Village H (pinch points M1-1 to M1-4).

Attachments

A – Photographs of El Camino Real and Cannon Road Undercrossings

B – Photographs of Roadkill at El Camino Real and Cannon Road

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7 Ng, S.J., J.W. Dole, R.M. Sauvajot, S.P.D. Riley, and T.J. Valone. 2004. *Use of highway undercrossings by wildlife in southern California*. Biological Conservation 115: 499–507.

8 Kioko, J., C. Kiffner, N. Jenkins, and W.J. Collinson. 2015. *Wildlife roadkill patterns on a major highway in northern Tanzania*. African Zoology 50: 17–22.

9 Loss, S.R., T. Will, and P.P. Marra. 2014. *Estimation of bird-vehicle collision mortality on U.S. roads*. The Journal of Wildlife Management 78: 763–771.

10 Wilson, D.D. 2012. *Hotspot analysis of roadkill in Southern California: A GIS Approach*. Master's Thesis for California State University, Northridge.

11 Ha, H. and F. Shilling. 2017. *Modelling potential wildlife-vehicle collisions (WVC) locations using environmental factors and human population density: A case-study from 3 state highways in Central California*. Ecological Informatics 43: 212–221.

ATTACHMENT A

Photographs of El Camino Real and Cannon Road Undercrossings

Looking northeast toward the El Camino Real underpass at EW2-5

Looking south underneath the underpass at EW2-5

Looking southwest toward the Cannon Road underpass at EW2-4

Looking east underneath the underpass at EW2-4

ATTACHMENT B

Photographs of Roadkill at El Camino Real and Cannon Road

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B-2 Faraday Avenue and Lionshead Avenue

550 West C Street
Suite 750
San Diego, CA 92101
619.719.4200 phone
619.719.4201 fax

esassoc.com

memorandum

date	November 5, 2021
to	Rosanne Humphrey, City of Carlsbad
cc	Terah Donovan, Environmental Science Associates
from	Adrienne Lee, Environmental Science Associates
subject	Roadkill Study Results – Faraday Avenue and Lionshead Avenue

This memorandum summarizes the results of adaptive wildlife movement monitoring, in the form of roadkill monitoring along Faraday Avenue, between El Camino Real and South Melrose Drive, and Lionshead Avenue, between South Melrose Drive and Business Park Drive, that occurred for 1 year between August 1, 2020, and August 1, 2021. All roadkill species detected were recorded.

Introduction

As stated in the 2015 *City of Carlsbad Wildlife Movement Analysis Final Report*,[1] three primary regional east-west wildlife movement corridors within the city were identified, East/West 1 (EW1), East/West 2 (EW2), and East/West 3 (EW3). EW2 is a wildlife movement corridor that connects Agua Hedionda Lagoon east to Calavera Mountain/Calavera Lake (northern branch) and along Agua Hedionda Creek/La Mirada Creek out to the Carlsbad Raceway Preserve and city of Vista (southern branch). Wildlife movement along the southern branch occurs from Agua Hedionda Lagoon Ecological Reserve towards Agua Hedionda Creek, which runs in a southwesterly direction, through Rancho Carlsbad Golf Club, under Faraday Avenue (EW2-9), along the creek to Melrose Drive (EW2-10) and beyond (**Figure 1**). Both EW2-9 and EW2-10 were considered high priority pinch points, where wildlife movement is restricted or bottle-necked in the 2015 report, as both pinch points have no fencing to guide wildlife away from the road.

The present study focused on wildlife road mortality at the two high priority pinch points—EW2-9 and EW2-10. EW2-9 consists of an arch culvert approximately 3.25 meters high and 6.50 meters wide with apron fencing, surrounded by relatively dense shrub vegetation. EW2-10 consists of an arch culvert approximately 3.50 meters high and 7.00 meters wide with apron fencing, surrounded by scattered, open grass/forbs vegetation. Camera data at EW2-9 suggests that this is a functional undercrossing based on the bobcat, coyote, deer, raccoon, skunk, squirrel, and opossum detections. However, the busy roadways of Faraday Avenue and Lionshead Avenue and lack of fencing guiding wildlife to the undercrossings in these areas create wildlife movement pinch points, which can increase the potential for wildlife to cross "at-grade," at the street level. Faraday Avenue is a highly-travelled four-lane road with a speed limit of 50 miles per hour. Lionshead Avenue is a moderately-travelled four-lane road

[1] ESA. 2015. *City of Carlsbad Wildlife Movement Analysis Final Report*. Prepared for City of Carlsbad.

with a speed limit of 50 miles per hour. Therefore, both roads are expected to be a barrier for wildlife movement. Direct mortality from vehicle collisions is expected.

The primary focus of this study was to determine if medium to large mammal species are moving across Faraday Avenue and Lionshead Avenue and getting hit by cars. Medium to large mammal species were targeted because these species demonstrate longer-range movement patterns and are likely more threatened by habitat fragmentation from roads.[2] In order to assess how frequent wildlife deaths from vehicle strikes occur in the intersection, ESA biologists, volunteers from Preserve Calavera, and HMP staff monitored Faraday Avenue and Lionshead Avenue for a year to document roadkill occurrences.

Methodology

On August 1, 2020, ESA biologist Alanna Sullivan, Preserve Calavera volunteers Paige DeCino and Karen Merrill, and the city's Habitat Management Program (HMP) staff Rosanne Humphrey and Hannah Swarthout finalized the survey area (Figure 1). Faraday Avenue, east of El Camino Real to South Melrose Drive; South Melrose Drive south to Lionshead Avenue; and Lionshead Avenue east to Business Park Drive, were monitored for a year from August 1, 2020, to August 1, 2021, with a minimum of two surveys completed per week. Because roadkill typically persists multiple days, it is assumed that the data collected is representative of wildlife fatalities in the survey area. For the full list of survey dates, see **Attachment A**, *Faraday Avenue and Lionshead Avenue Roadkill Survey Dates and Results*. Additionally, ESA biologists checked the roadkill pick up logs kept by the city's Public Works Department from July 2017 to September 2021 to supplement roadkill monitoring data.

Monitoring was conducted by ESA biologists, Preserve Calavera volunteers, and a city employee. The survey area was monitored by driving the intersection slowly and scanning the entire roadway and adjacent sidewalk for roadkill. If something was not identifiable from the car, the surveyor wore a safety vest and walked the survey area, using binoculars to scan the road. If roadkill was detected, a photo was taken when road conditions were safe and uploaded onto the citizen scientist mobile application iNaturalist[3] to create an "observation" within the University of California, Davis, California Roadkill Observation System (CROS) Project.[4] Once the observation was recorded, the surveyor called the city's Public Works department for animal disposal pickup.

2 Ng, S.J., J.W. Dole, R.M. Sauvajot, S.P.D. Riley, and T.J. Valone. 2004. *Use of highway undercrossings by wildlife in southern California*. Biological Conservation 115: 499–507.

3 iNaturalist. Available from https://www.inaturalist.org.

4 iNaturalist. California Roadkill Observation System (CROS). Available from: https://www.inaturalist.org/projects/california-state-roadkill

SOURCE: ESRI, 2020; ESA, 2021.

Carlsbad Roadkill Study

Figure 1
Faraday Avenue and Lionshead Avenue Roadkill Survey Area

ESA

Results

Faraday Avenue

A total of 8 roadkill occurrences were detected during the 106 survey dates within the 2020–2021 year of monitoring. Six (75%) roadkill observations were small mammals: cat, opossums, and rabbits. The remaining roadkill observations (two observations, 25%) were bird species. No medium to large mammal roadkill observations were detected during the year of roadkill monitoring. All roadkill observations and their associated survey dates, times, and surveyor information are listed in **Table 1** and locations of all roadkill observations are displayed in **Figure 2**.

TABLE 1
FARADAY AVENUE ROADKILL DETECTIONS

Date	Survey Time	Surveyor	Species
10/24/20	0914–0923	Karen Merrill[a]	Barn owl
12/12/20	0850–0902	Karen Merrill[a]	Cat
12/15/20	0930–0940	Alanna Sullivan	Opossum
1/13/21	1147–1207	P. DeCino[a]	Opossum
2/24/21	0824–0836	P. DeCino[a]	Raccoon
4/29/21	0905–0934	P. DeCino[a]	Opossum
6/2/21	1038–1050	P. DeCino[a]	Roadrunner
8/1/21	0925–0944	Karen Merrill[a]	Rabbit

[a] Volunteer from Preserve Calavera

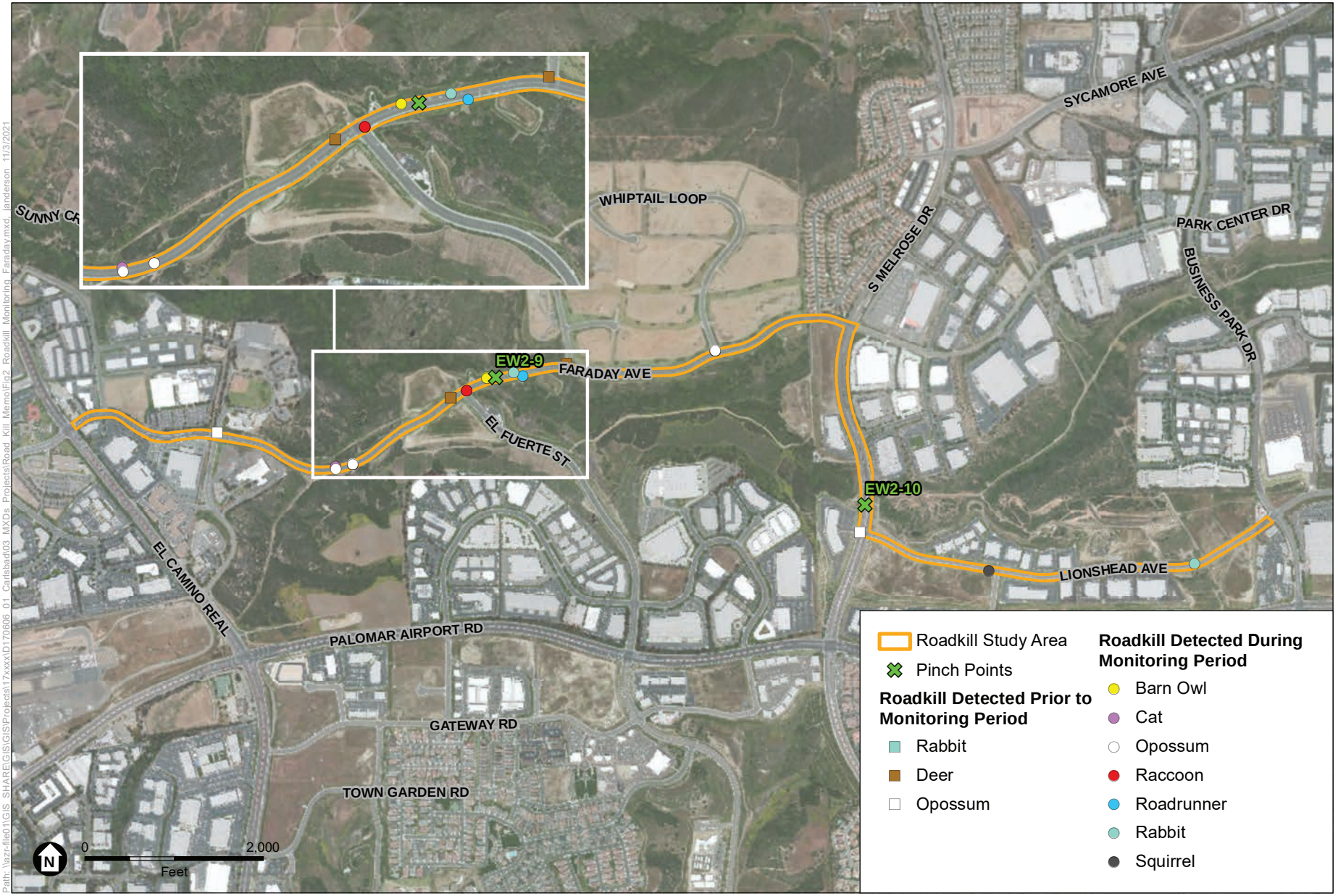
Lionshead Avenue

A total of 2 roadkill occurrences were detected during the 107 survey dates within the 2020–2021 year of monitoring. All roadkill observations were small mammals: rabbit and squirrel. No medium to large mammal roadkill observations were detected during the year of roadkill monitoring. All roadkill observations and their associated survey dates, times, and surveyor information are listed in **Table 2** and locations of all roadkill observations are displayed in Figure 2.

TABLE 2
LIONSHEAD AVENUE ROADKILL DETECTIONS

Date	Survey Time	Surveyor	Species
6/27/21	1002–1012	Karen Merrill[a]	Rabbit
8/1/21	0945–0954	Karen Merrill[a]	Squirrel

[a] Volunteer from Preserve Calavera



SOURCE: ESRI, 2020; ESA, 2021.

Carlsbad Roadkill Study

Figure 2
Roadkill Monitoring Results

ESA

Discussion

The primary focus of this study was to determine if medium to large mammal species are moving across Faraday Avenue and Lionshead Avenue and getting hit by cars. Medium to large mammals demonstrate longer-range wildlife movement patterns and are likely more threatened by habitat fragmentation from roads than smaller species.[5] While roadkill monitoring occurred 106 and 107 days out of the year at Faraday Avenue and Lionshead Avenue, respectively, it is likely that these results represent all roadkill data for the year as roadkill persists for more than one day, and animal disposal records from the city's Public Works department were also monitored during the survey year. No medium to large mammal species roadkill were detected during the year of study, suggesting that these species are either able to cross the intersection at street level successfully or are using the EW2-9 and EW2-10 undercrossings instead.

As seen in Figure 2, small mammal and bird species appear to have some difficulty crossing Faraday Avenue. Other studies have found that birds are one of the top taxa to be impacted by vehicle collisions,[6, 7, 8] particularly in areas that support native vegetation and full-time or migratory habitat for birds.[9] This may explain the location and why birds represented 257 of the roadkill occurrences in this study, as native vegetation exists on both sides of Faraday Avenue.

ESA continues to monitor animal disposal pickup records from the city's Public Works department to determine potential pinch points within the city that may benefit from future roadkill monitoring.

Attachments

A – Faraday Avenue and Lionshead Avenue Roadkill Survey Dates and Results

5 Ng, S.J., J.W. Dole, R.M. Sauvajot, S.P.D. Riley, and T.J. Valone. 2004. *Use of highway undercrossings by wildlife in southern California*. Biological Conservation 115: 499–507.

6 Kioko, J., C. Kiffner, N. Jenkins, and W.J. Collinson. 2015. *Wildlife roadkill patterns on a major highway in northern Tanzania*. African Zoology 50: 17–22.

7 Loss, S.R., T. Will, and P.P. Marra. 2014. *Estimation of bird-vehicle collision mortality on U.S. roads*. The Journal of Wildlife Management 78: 763–771.

8 Wilson, D.D. 2012. *Hotspot analysis of roadkill in Southern California: A GIS Approach*. Master's Thesis for California State University, Northridge.

9 Ha, H. and F. Shilling. 2017. *Modelling potential wildlife-vehicle collisions (WVC) locations using environmental factors and human population density: A case-study from 3 state highways in Central California*. Ecological Informatics 43: 212–221.

Attachment A

Faraday Avenue and Lionshead Avenue Roadkill Survey Dates and Result

Table 1. Faraday Avenue Roadkill Survey Dates and Results

Date	Time (start–end)	Surveyor	Species	Photo/Uploaded to iNaturalist	Spray-Painted
8/1/20	8:47-8:57 am	K. Merrill	None	NA	NA
8/5/20	7:58-8:24 am	P. DeCino	None	NA	NA
8/6/20	11:41-11:53 am	H. Swarthout	None	NA	NA
8/8/20	9:16-9:25 am	K. Merrill	None	NA	NA
8/12/20	11:05-11:30 am	P. DeCino	None	NA	NA
8/16/20	8:35-8:43 am	K. Merrill	None	NA	NA
8/18/20	6:32-6:41 am	P. DeCino	None	NA	NA
8/26/20	4:48-5:04 pm	P. DeCino	None	NA	NA
8/29/20	9:23-9:31 am	K. Merrill	None	NA	NA
9/1/20	8:05-8:17 am	P. DeCino	None	NA	NA
9/3/20	11:21-11:35 am	H. Swarthout	None	NA	NA
9/5/20	8:38-8:45 am	K. Merrill	None	NA	NA
9/9/20	10:22-10:34 am	H. Swarthout	None	NA	NA
9/9/20	5:01-5:15 pm	P. DeCino	None	NA	NA
9/12/20	8:44-8:52 am	K. Merrill	None	NA	NA
9/17/20	10:19-11:37 am	H. Swarthout	None	NA	NA
9/19/20	8:06-8:14 am	K. Merrill	None	NA	NA
9/23/20	5:31-5:41 pm	P. DeCino	None	NA	NA
9/24/20	11:42-11:55 am	H. Swarthout	None	NA	NA
9/27/20	8:50-8:58 am	K. Merrill	None	NA	NA
9/29/20	7:00-7:12 am	P. DeCino	None	NA	NA
10/3/20	8:14-8:21 am	K. Merrill	None	NA	NA
10/7/20	5:05-5:14 pm	P. DeCino	None	NA	NA
10/10/20	8:28-8:35 am	K. Merrill	None	NA	NA
10/12/20	9:11-9:22 am	P. DeCino	None	NA	NA
10/17/20	8:55-9:02 am	K. Merrill	None	NA	NA
10/22/20	8:43-9:30 am	P. DeCino	None	NA	NA
10/24/20	9:14-9:23 am	K. Merrill	Barn owl	Yes	No
10/28/20	10:37-10:40 am	P. DeCino	None	NA	NA
10/31/20	8:45-8:52 am	K. Merrill	None	NA	NA
11/3/20	10:00-10:12 am	A. Sullivan	None	NA	NA
11/8/20	9:00-9:07 am	K. Merrill	None	NA	NA
11/11/20	8:23-8:53 am	P. DeCino	None	NA	NA
11/13/20	11:00-11:10 am	A. Sullivan	None	NA	NA
11/14/20	8:48-8:55 am	K. Merrill	None	NA	NA
11/18/20	11:10-11:25 am	A. Sullivan	None	NA	NA
11/21/20	8:49-8:55 am	K. Merrill	None	NA	NA
11/24/20	10:41-10:55 am	P. DeCino	None	NA	NA
11/29/20	8:48-8:56 am	K. Merrill	None	NA	NA
12/3/20	4:50-5:02 pm	P. DeCino	None	NA	NA
12/5/20	9:06-9:12 am	K. Merrill	None	NA	NA
12/7/20	9:35-9:45 am	A. Sullivan	None	NA	NA
12/9/20	8:58-9:07 am	P. DeCino	None	NA	NA
12/12/20	8:50-9:02 am	K. Merrill	Cat	No	No
12/15/20	9:30-9:40 am	A. Sullivan	Opossum	No	No

Table 1. Faraday Avenue Roadkill Survey Dates and Results

Date	Time (start–end)	Surveyor	Species	Photo/Uploaded to iNaturalist	Spray-Painted
12/16/20	1:23-1:35 pm	P. DeCino	None	NA	NA
12/20/20	8:39-8:46 am	K. Merrill	None	NA	NA
12/24/20	3:41-3:53 pm	P. DeCino	None	NA	NA
12/27/20	9:48-9:56 am	K. Merrill	None	NA	NA
1/3/21	9:39-9:47 am	K. Merrill	None	NA	NA
1/7/21	1:59-2:04 pm	P. DeCino	None	NA	NA
1/9/21	9:21-9:29 am	K. Merrill	None	NA	NA
1/13/21	11:47-12:07 pm	P. DeCino	Opossum	Yes	No
1/17/21	8:48-8:54 am	K. Merrill	None	NA	NA
1/21/21	8:40-8:45 am	P. DeCino	None	NA	NA
1/24/21	8:38-8:46 am	K. Merrill	None	NA	NA
1/27/21	9:50-10:00 am	P. DeCino	None	NA	NA
1/31/21	8:55-9:03 am	K. Merrill	None	NA	NA
2/3/21	10:30-10:40 am	P. DeCino	None	NA	NA
2/7/21	9:22-9:29 am	K. Merrill	None	NA	NA
2/10/21	9:20-9:30 am	P. DeCino	None	NA	NA
2/13/21	8:58-9:06 am	K. Merrill	None	NA	NA
2/15/21	7:30-7:35 am	P. DeCino	None	NA	NA
2/21/21	8:44-8:53 am	K. Merrill	None	NA	NA
2/24/21	8:24-8:36 am	P DeCino	Raccoon	Yes	No
2/27/21	9:22-9:30 am	K. Merrill	None	NA	NA
3/4/21	7:02-7:15 am	P. DeCino	None	NA	NA
3/7/21	8:51-8:58 am	K. Merrill	None	NA	NA
3/14/21	9:59-10:07 am	K. Merrill	None	NA	NA
3/21/21	8:54-9:01 am	K. Merrill	None	NA	NA
3/24/21	9:00-9:11 am	P. DeCino	None	NA	NA
3/30/21	11:05-11:13 am	P. DeCino	None	NA	NA
4/3/21	8:30-8:38 am	K. Merrill	None	NA	NA
4/11/21	8:29-8:36 am	K. Merrill	None	NA	NA
4/15/21	11:28-11:31 am	P. DeCino	None	NA	NA
4/18/21	8:37-8:44 am	K. Merrill	None	NA	NA
4/21/21	9:10-9:21 am	P. DeCino	None	NA	NA
4/25/21	9:28-9:35 am	K. Merrill	None	NA	NA
4/28/21	3:10-3:30 pm	A. Lee	None	NA	NA
4/29/21	9:05-9:34 am	P. DeCino	Opossum	Yes	No
5/2/21	9:46-9:54 am	K. Merrill	None	NA	NA
5/5/21	9:39-9:43 am	P. DeCino	None	NA	NA
5/9/21	8:48-8:55 am	K. Merrill	None	NA	NA
5/11/21	11:00-11:15 am	A. Lee	None	NA	NA
5/12/21	3:47-4:01 pm	P. DeCino	None	NA	NA
5/16/21	11:53 am-12:00 pm	K. Merrill	None	NA	NA
5/20/21	2:15-2:45 pm	A. Lee	None	NA	NA
5/23/21	8:20-8:27 am	K. Merrill	None	NA	NA
5/27/21	11:17-11:21 am	P. DeCino	None	NA	NA

Table 1. Faraday Avenue Roadkill Survey Dates and Results

Date	Time (start–end)	Surveyor	Species	Photo/Uploaded to iNaturalist	Spray-Painted
5/29/21	10:30-10:37 am	K. Merrill	None	NA	NA
6/2/21	10:38-10:50 am	P. DeCino	Roadrunner	Yes	No
6/6/21	9:12-9:21 am	K. Merrill	None	NA	NA
6/9/21	12:59-1:11 pm	P. DeCino	None	NA	NA
6/10/21	8:05-8:20 am	A. Lee	None	NA	NA
6/13/21	9:27-9:34 am	K. Merrill	None	NA	NA
6/20/21	8:51-8:59 am	K. Merrill	None	NA	NA
6/27/21	9:54-10:01am	K. Merrill	None	NA	NA
6/30/21	10:23-10:27 am	P. DeCino	None	NA	NA
7/5/21	2:39-2:45 pm	K. Merrill	None	NA	NA
7/8/21	9:30-9:32 am	P. DeCino	None	NA	NA
7/11/21	8:16-8:23 am	K. Merrill	None	NA	NA
7/14/21	8:44-8:54 am	P. DeCino	None	NA	NA
7/18/21	8:04-8:11 am	K. Merrill	None	NA	NA
7/21/21	11:36-11:39 am	P. DeCino	None	NA	NA
7/27/21	9:25-9:33 am	K. Merrill	None	NA	NA
8/1/21	9:25-9:44 am	K. Merrill	Rabbit	Yes	No

Table 2. Lionshead Avenue Roadkill Survey Dates and Results

Date	Time (start–end)	Surveyor	Species	Photo/Uploaded to iNaturalist	Spray-Painted
8/1/20	8:59-9:05 am	K. Merrill	None	NA	NA
8/5/20	7:58-8:24 am	P. DeCino	None	NA	NA
8/6/20	12:00-12:05 am	H. Swarthout	None	NA	NA
8/8/20	9:26-9:31 am	K. Merrill	None	NA	NA
8/12/20	11:09-11:14 am	P. DeCino	None	NA	NA
8/16/20	8:44-8:49 am	K. Merrill	None	NA	NA
8/18/20	6:32-6:36 am	P. DeCino	None	NA	NA
8/26/20	5:54-5:59 pm	P. DeCino	None	NA	NA
8/29/20	9:32-9:37am	K. Merrill	None	NA	NA
9/1/20	8:10-8:14 am	P. DeCino	None	NA	NA
9/3/20	11:26-11:30 am	H. Swarthout	None	NA	NA
9/5/20	8:46-8:50 am	K. Merrill	None	NA	NA
9/9/20	10:26-10:29 am	H. Swarthout	None	NA	NA
9/9/20	5:06-5:10 pm	P. DeCino	None	NA	NA
9/12/20	8:53-8:58 am	K. Merrill	None	NA	NA
9/17/20	10:24-11:34 am	H. Swarthout	None	NA	NA
9/19/20	8:15-8:19 am	K. Merrill	None	NA	NA
9/23/20	5:35-5:38 pm	P. DeCino	None	NA	NA
9/24/20	11:47-11:50 am	H. Swarthout	None	NA	NA
9/27/20	8:59-9:03 am	K. Merrill	None	NA	NA
9/29/20	7:04-7:07 am	P. DeCino	None	NA	NA
10/3/20	8:22-8:26 am	K. Merrill	None	NA	NA

Table 2. Lionshead Avenue Roadkill Survey Dates and Results

Date	Time (start–end)	Surveyor	Species	Photo/Uploaded to iNaturalist	Spray-Painted
10/7/20	5:05-5:08 pm	P. DeCino	None	NA	NA
10/10/20	8:36–8:40 am	K. Merrill	None	NA	NA
10/12/20	9:15-9:18 am	P. DeCino	None	NA	NA
10/17/20	9:03-9:07 am	K. Merrill	None	NA	NA
10/22/20	9:10-9:17 am	P. DeCino	None	NA	NA
10/24/20	9:24-9:28 am	K. Merrill	None	NA	NA
10/28/20	10:41-10:44 am	P. DeCino	None	NA	NA
10/31/20	8:53-8:57 am	K. Merrill	None	NA	NA
11/2/20	12:30-12:45 pm	A. Sullivan	None	NA	NA
11/3/20	10:04-10:07 am	P. DeCino	None	NA	NA
11/8/20	9:08-9:12 am	K. Merrill	None	NA	NA
11/11/29	8:29-8:32 am	P. DeCino	None	NA	NA
11/13/20	11:13-11:25 am	A. Sullivan	None	NA	NA
11/14/20	8:56-9:00 am	K. Merrill	None	NA	NA
11/18/20	11:25-11:35 am	A. Sullivan	None	NA	NA
11/21/20	8:56-9:00 am	K. Merrill	None	NA	NA
11/24/20	10:45-10:50 am	P. DeCino	None	NA	NA
11/29/20	8:57-9:01 am	K. Merrill	None	NA	NA
12/3/20	4:54-4:57 pm	P. DeCino	None	NA	NA
12/5/20	9:01-9:05 am	K. Merrill	None	NA	NA
12/7/20	9:35-9:45 am	A. Sullivan	None	NA	NA
12/9/20	9:02-9:05 am	P. DeCino	None	NA	NA
12/12/20	9:04-9:09 am	K. Merrill	None	NA	NA
12/15/20	9:30-9:40 am	A. Sullivan	None	NA	NA
12/16/20	1:28-1:31 pm	P. DeCino	None	NA	NA
12/20/20	8:47-8:51 am	K. Merrill	None	NA	NA
12/24/20	3:45-3:49 pm	P. DeCino	None	NA	NA
12/27/20	9:57-10:02 am	K. Merrill	None	NA	NA
1/3/21	9:48-9:52 am	K. Merrill	None	NA	NA
1/7/21	1:56-1:59 pm	P. DeCino	None	NA	NA
1/9/21	9:30-9:34 am	K. Merrill	None	NA	NA
1/13/21	12:08-12:10 pm	P. DeCino	None	NA	NA
1/17/21	8:43-8:47 am	K. Merrill	None	NA	NA
1/21/21	8:42-8:44 am	P. DeCino	None	NA	NA
1/24/21	8:47-8:51 am	K. Merrill	None	NA	NA
1/27/21	8:50-8:54 am	P. DeCino	None	NA	NA
1/31/21	9:04-9:07 am	K. Merrill	None	NA	NA
2/3/21	10:44-10-50 am	P. DeCino	None	NA	NA
2/7/21	9:30-9:34 am	K. Merrill	None	NA	NA
2/10/21	9:24-9:28 am	P. DeCino	None	NA	NA
2/13/21	9:07-9:11 am	K. Merrill	None	NA	NA
2/15/21	7:40-7:44 am	P. DeCino	None	NA	NA
2/21/21	8:54-8:58 am	K. Merrill	None	NA	NA
2/24/21	8:42-8:35 am	P. DeCino	None	NA	NA
2/27/21	9:31-9:35 am	K. Merrill	None	NA	NA

Table 2. Lionshead Avenue Roadkill Survey Dates and Results

Date	Time (start–end)	Surveyor	Species	Photo/Uploaded to iNaturalist	Spray-Painted
3/4/21	7:08-7:11 am	P. DeCino	None	NA	NA
3/7/21	8:59-9:03 am	K. Merrill	None	NA	NA
3/14/21	10:08-10:12 am	K. Merrill	None	NA	NA
3/21/21	9:02-9:06 am	K. Merrill	None	NA	NA
3/24/21	9:03-9:07 am	P. DeCino	None	NA	NA
3/30/21	11:08-11:11 am	P. DeCino	None	NA	NA
4/3/21	8:39-8:43 am	K. Merrill	None	NA	NA
4/11/21	8:37-8:41 am	K. Merrill	None	NA	NA
4/15/21	11:32-11:35 am	P. DeCino	None	NA	NA
4/18/21	8:45-8:50 am	K. Merrill	None	NA	NA
4/21/21	9:15-9:18 am	P. DeCino	None	NA	NA
4/25/21	9:36-9:40 am	K. Merrill	None	NA	NA
4/28/21	3:10-3:30 pm	A. Lee	None	NA	NA
4/29/21	9:27-9:30 am	P. DeCino	None	NA	NA
5/2/21	9:55-9:59 am	K. Merrill	None	NA	NA
5/5/21	9:43-9:47 am	P. DeCino	None	NA	NA
5/9/21	8:56-8:59 am	K. Merrill	None	NA	NA
5/11/21	11:00-11:15 am	A. Lee	None	NA	NA
5/12/21	4:01-4:04 pm	P. DeCino	None	NA	NA
5/16/21	12:01-12:04 pm	K. Merrill	None	NA	NA
5/20/21	2:15-2:45 pm	A. Lee	None	NA	NA
5/23/21	8:28-8:32 am	K. Merrill	None	NA	NA
5/27/21	11:21-11:25 am	P. DeCino	None	NA	NA
5/29/21	10:38-10:42 am	K. Merrill	None	NA	NA
6/2/21	10:34-10:37 am	P. DeCino	None	NA	NA
6/6/21	9:23-9:26 am	K. Merrill	None	NA	NA
6/9/21	1:04-1:07 pm	P. DeCino	None	NA	NA
6/10/21	8:05-8:20 am	A. Lee	None	NA	NA
6/13/21	9:35-9:52 am	K. Merrill	None	NA	NA
6/20/21	9:00-9:04 am	K. Merrill	None	NA	NA
6/27/21	10:02-10:12 am	K. Merrill	Rabbit	Yes	No
6/30/21	10:21-10:23 am	P. DeCino	None	NA	NA
7/5/21	2:46-2:50 pm	K. Merrill	None	NA	NA
7/8/21	9:33-9:37 am	P. DeCino	None	NA	NA
7/11/21	8:25-9:29 am	K. Merrill	None	NA	NA
7/14/21	8:47-8:49 am	P. DeCino	None	NA	NA
7/18/21	8:12-8:15 am	K. Merrill	None	NA	NA
7/21/21	10:54-10:55 am	P. DeCino	None	NA	NA
7/27/21	9:35-9:38 am	K. Merrill	None	NA	NA
8/1/21	9:45-9:54 am	K. Merrill	Squirrel	Yes	No

B-3 Rancho Santa Fe and El Camino Real

ESA

2355 Northside Drive
Suite 100
San Diego, CA 92108
619.719.4200 phone
619.719.4201 fax

esassoc.com

memorandum

date	October 11, 2023
to	Rosanne Humphrey, City of Carlsbad
cc	Karla Alcaraz, Environmental Science Associates
from	Adrienne Lee, Environmental Science Associates
subject	Roadkill Study Results – Rancho Santa Fe and El Camino Real

This memorandum summarizes the results of roadkill monitoring along Rancho Santa Fe Road and El Camino Real for one year from November 2021 to November 2022.

Introduction

The City of Carlsbad (city) identified the following three primary regional east-west wildlife movement corridors within the city during wildlife movement studies conducted in 2015: East/West 1 (EW1), East/West 2 (EW2), and East/West 3 (EW3).[1] EW3 is a crucial wildlife movement corridor, connecting Batiquitos Lagoon to Rancho La Costa Preserve via two routes, one along the San Marcos Creek and the other following the Encinitas Creek. The resulting report highlighted potential wildlife movement barriers (i.e., pinch points) at La Costa Avenue (EW3-7), El Camino Real and Rancho Santa Fe Road (EW3-13), as depicted in **Figure 1** (see **Attachment A, Figures**). Additionally, Levante Street (EW3-8) and Calle Barcelona (EW3-9) were identified as potential pinch points. All identified pinch points pose barriers to wildlife movement, and the risk of direct harm from vehicle collisions is a concern. Pinch points were grouped into two types based on shared characteristics:

- **Priority pinch points**. EW3-7 is a box culvert 17 meters high and 2 meters wide with apron fencing, surrounded by relatively dense shrub vegetation. EW3-13 is a box culvert 9.2 meters high and 1.6 meters wide, surrounded by scattered, open tree vegetation. The pinch points EW3-7 and EW3-13 were recognized as *priority* due to their role as bottlenecks that hinder wildlife passage. EW3-7 lacks fencing that could guide wildlife to the undercrossings in these areas creating pinch points, which can increase the potential for wildlife to cross "at grade," at the street level. Rancho Santa Fe Road, Calle Barcelona, and El Camino Real are all highly traveled four-lane roads with speed limits of 45 to 50 miles per hour. Culverts like EW3-13 might face challenges with sedimentation, leading to a reduction in undercrossing height and hindering movement for certain species, particularly deer.
- **Potential pinch points**. EW3-8 is a bridge 5.2 meters high and 40 meters wide dominated by trees but remaining relatively open under the bridge, allowing for easy movement. EW3-9 is a bridge approximately 3.8 meters high and 30 meters wide dominated by dense tree vegetation on each end, but it should allow for easy movement. Species detected within EW3 included: coyote, mule deer, rabbit, raccoon, skunk, and opossum. EW3-8 and EW3-9 were labeled as *potential* because they provide relatively unimpeded wildlife

[1] ESA. 2015. *City of Carlsbad Wildlife Movement Analysis Final Report*. Prepared for City of Carlsbad.

movement but are still vulnerable due to dense vegetation potentially obstructing entrances, as well as the frequent presence of people.

The present study documented roadkill at the pinch points along Rancho Santa Fe Road to Calle Barcelona and El Camino Real. Since 2017, Environmental Science Associates (ESA) has been monitoring animal disposal logs from the city's Public Works department to identify pinch points and monitoring locations. City records indicated three coyote fatalities at Calle Barcelona and Rancho Santa Fe Road, as well as along Rancho Santa Fe Road near Las Olas Court, which is close to pinch point EW3-13. Thus, the year-long study was initiated along this route to document roadkill.

Methodology

On November 15, 2021, ESA biologists, Preserve Calavera volunteers, and the city's Habitat Management Program staff finalized the survey area (Figure 1). The survey area—from Gelson's shopping area off La Costa Avenue, west to the El Camino Real intersection, south on El Camino Real until Calle Barcelona, east on Calle Barcelona until Rancho Santa Fe Road, and south on Rancho Santa Fe Road until Olivenhain Pioneer Elementary School—was monitored for one year from November 15, 2021, to November 15, 2022, with a minimum of two surveys completed per week.

Roadkill tends to remain visible for multiple days. The collected data is assumed to accurately represent wildlife fatalities within the survey area. For the full list of survey dates, see **Attachment B, Rancho Santa Fe Road and El Camino Real Roadkill Survey Dates and Results**. Monitoring results were supplemented by cross-referencing roadkill pickup logs maintained by the city's Public Works Department throughout the monitoring period.

Monitoring was conducted by ESA biologists and Preserve Calavera volunteers. The survey area was monitored by driving the intersection slowly and scanning the entire roadway and adjacent sidewalk for roadkill. If something was not identifiable from the car, the surveyor wore a safety vest and walked the survey area, using binoculars to scan the road. If roadkill was detected, a photo was taken when road conditions were safe and uploaded it onto the citizen scientist mobile application iNaturalist[2] to create an "observation" within the University of California, Davis, California Roadkill Observation System (CROS) Project.[3] Once the observation was recorded, the surveyor notified the city's Public Works department to arrange for the pickup and disposal of the deceased animals.

Results

Rancho Santa Fe Road and El Camino Real

Twelve roadkill occurrences were recorded during the survey year. The recorded instances included various animal species, such as skunks, rabbits, coyotes, opossums, cats, and raccoons. Of these incidents, ten were small- to medium-sized mammals (rabbits, opossums, skunks, raccoons, and cats) and two were medium- to large-sized mammals (coyotes). All roadkill observations and their associated survey dates, surveyor information, and locations are listed in **Table 1**. Locations of all roadkill observations are displayed in **Figure 2** (see Attachment A).

2 iNaturalist. Available from https://www.inaturalist.org.

3 iNaturalist. California Roadkill Observation System (CROS). Available from: https://www.inaturalist.org/projects/california-state-roadkill

TABLE 1
RANCHO SANTA FE AND EL CAMINO REAL ROADKILL DETECTIONS

Date	Surveyor/Source	Species	Location
4/22/22	City of Carlsbad[a]	Skunk	Southbound El Camino Real - Calle Barcelona and Leucadia
4/25/22	ESA[b]	Rabbit	Near the intersection of El Camino Real and La Costa Avenue
4/26/22	City of Carlsbad[a]	Rabbit	Calle Barcelona - Paseo Avellano and Paseo Arrayan
5/18/22	City of Carlsbad[a]	Skunk	Southbound El Camino Real and Calle Barcelona
7/14/22	City of Carlsbad[a]	Coyote	El Camino Real and Calle Barcelona
7/18/22	City of Carlsbad[a]	Cat	Paseo Aliso and Calle Barcelona
8/7/22	Preserve Calavera[c]	Opossum	South of El Camino Real, just beyond La Costa Avenue
8/9/22	City of Carlsbad[a]	Coyote	Calle Barcelona - Paseo Aliso and Paseo Avellano
9/6/22	City of Carlsbad[a]	Raccoon	Eastbound La Costa Avenue and El Camino Real
10/11/22	Preserve Calavera[c]	Opossum	Rancho Santa Fe, west of Calle Barcelona
10/11/22	City of Carlsbad[a]	Cat	Westbound La Costa Avenue and El Camino Real
11/7/22	City of Carlsbad[a]	Raccoon	Paseo Aliso and Calle Barcelona

Notes:

[a] City Disposal Log
[b] Environmental Science Associates biologist
[c] Volunteer from Preserve Calavera

Discussion

ESA continues to monitor animal disposal logs from the city's Public Works department to determine potential pinch points within the city that may benefit from future roadkill monitoring. The present study resulted in the following re-grouping of pinch point types and recommendations.

- **Priority pinch point**. EW3-9 has potential barriers that limit wildlife movement underneath the EW3-9 bridge, causing wildlife to cross at grade at the El Camino Real and Calle Barcelona intersection. This is evidenced by the six roadkill detections at the intersection, ranging from small to medium wildlife species (opossum, raccoon, and skunk) to medium to large wildlife species (coyote).

  It is recommended that management and monitoring occur at this location. Site conditions around EW3-9 should be inspected to determine and implement the appropriate management (e.g., vegetation trimming to open up habitat). Before-and-after photographs should be taken to document conditions before and after management. Wildlife cameras should be installed and monitored to document management effectiveness.

- **Potential pinch point**. Potential barriers to wildlife movement occur at EW3-7 as small mammal roadkill were detected at grade. No management or monitoring is recommended based on study results.

- **No pinch point**. No roadkill was detected at EW3-13 or EW3-8, suggesting that current infrastructure around these pinch points is functioning appropriately to support wildlife movement. No management or monitoring is recommended based on study results.

Attachments

A. Figures

B. Rancho Santa Fe and El Camino Real Roadkill Survey Dates and Results

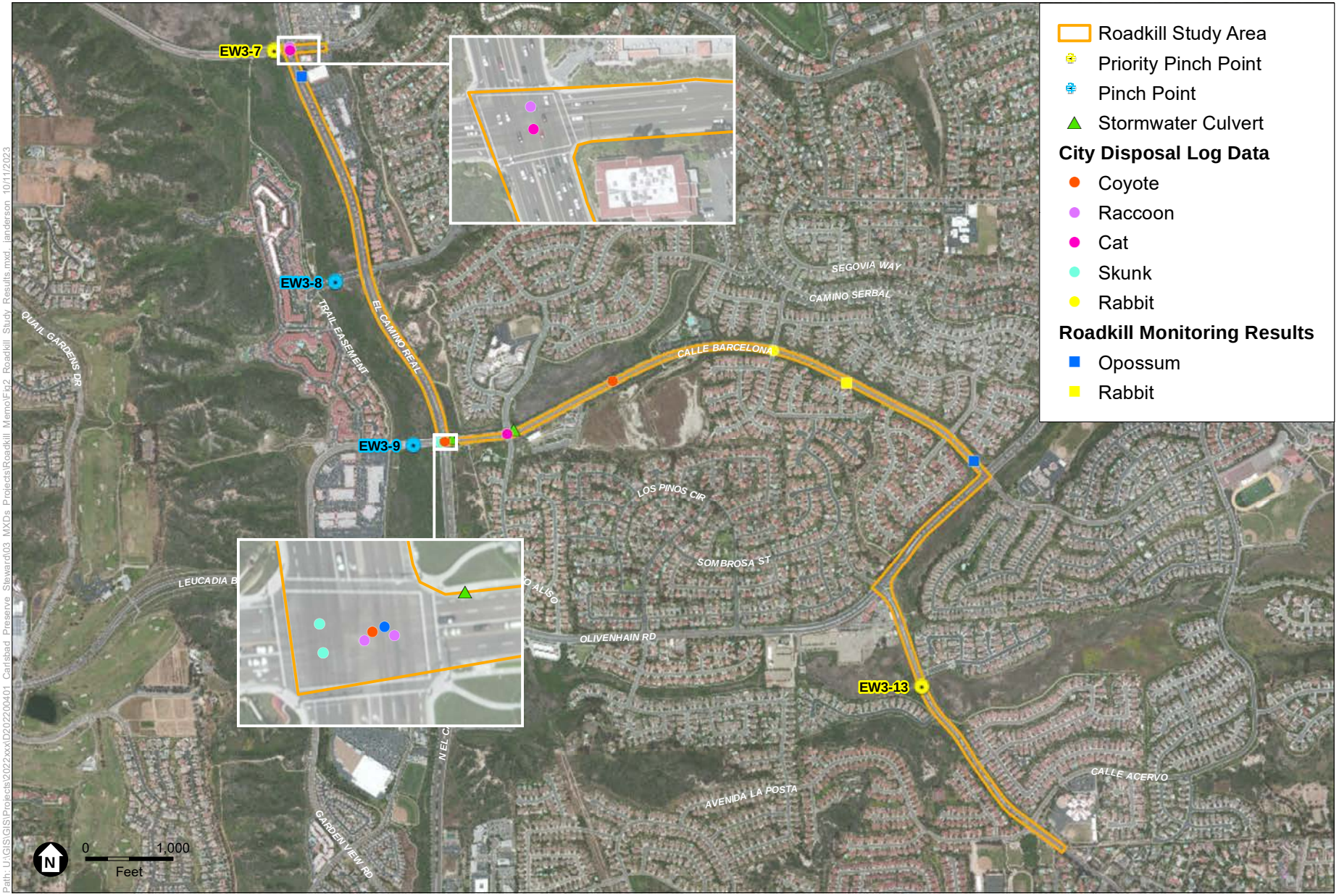
Attachment A
Figures

SOURCE: ESRI, 2023; ESA, 2023.

Carlsbad Roadkill Study

Figure 1
Rancho Santa Fe Road and El Camino Real Roadkill Survey Area

ESA



SOURCE: ESRI, 2023; ESA, 2023.

Carlsbad Roadkill Study

Figure 2
Roadkill Monitoring Results

Attachment B

Rancho Santa Fe and El Camino Real Roadkill Survey Dates and Results

TABLE B-1
RANCHO SANTA FE AND EL CAMINO REAL ROADKILL SURVEY DATES AND RESULTS

Date	Time (Start-End)	Surveyor	Species	Photo/Uploaded to iNaturalist	Spray-Painted
11/15/2021	12:20-12:27 pm	K. Merrill	None	N/A	N/A
11/21/2021	8:48-9:00 am	K. Merrill	None	N/A	N/A
11/30/2021	8:52-9:15 am	P. DeCino	None	N/A	N/A
12/8/2021	10:54-11:06 am	K. Merrill	None	N/A	N/A
12/10/2021	8:40-8:55 am	P. DeCino	None	N/A	N/A
12/19/2021	11:05-11:20 am	K. Merrill	None	N/A	N/A
12/21/2021	11:16-11:40 am	S. Vargas	None	N/A	N/A
12/23/2021	10:25-10:35 am	K. Merrill	None	N/A	N/A
12/29/2021	12:58-1:08 pm	K. Merrill	None	N/A	N/A
1/6/2022	9:10-9:20 am	K. Merrill	None	N/A	N/A
1/17/2022	12:15-12:30 pm	K. Merrill	None	N/A	N/A
1/27/2022	9:30-9:42 am	K. Merrill	None	N/A	N/A
2/1/2022	9:35-9:45 am	K. Merrill	None	N/A	N/A
2/1/2022	11:04-11:25 am	P. DeCino	None	N/A	N/A
2/10/2022	7:17-7:34 am	P. DeCino	None	N/A	N/A
2/14/2022	1:35-1:50 pm	K. Merrill	None	N/A	N/A
2/24/2022	3:25-3:51 pm	P. DeCino	None	N/A	N/A
3/6/2022	10:20-10:35 am	K. Merrill	None	N/A	N/A
3/9/2022	11:03-11:22 am	S. Vargas	None	N/A	N/A
3/17/2022	8:33-8:52 am	P. DeCino	None	N/A	N/A
3/22/2022	9:50-10:05 am	K. Merrill	None	N/A	N/A
3/30/2022	1:02-1:25 pm	P. DeCino	None	N/A	N/A
3/31/2022	10:00-10:20 am	A. Lee	None	N/A	N/A
4/4/2022	9:00-9:12 am	K. Merrill	None	N/A	N/A
4/14/2022	10:00-10:12 am	K. Merrill	None	N/A	N/A
4/22/2022	10:30-10:45 am	P. DeCino	None	N/A	N/A
4/24/2022	2:45-2:55 pm	K. Merrill	None	N/A	N/A
4/25/2022	11:16-11:40 am	S. Vargas	Rabbit	Yes	No
5/4/2022	10:10-10:26 am	P. DeCino	None	N/A	N/A
5/13/2022	10:15-10:30 am	K. Merrill	None	N/A	N/A
5/23/2022	1:40-1:55 pm	K. Merrill	None	N/A	N/A

Date	Time (Start-End)	Surveyor	Species	Photo/Uploaded to iNaturalist	Spray-Painted
6/8/2022	9:20-9:32 am	K. Merrill	None	N/A	N/A
6/15/2022	11:11-11:22 am; 12:20-12:29 pm	S. Vargas/K. Alcaraz	None	N/A	N/A
6/27/2022	8:40-8:52 am	K. Merrill	None	N/A	N/A
7/13/2022	10:35-10:45 am	K. Merrill	None	N/A	N/A
7/24/2022	3:45-4:00 pm	K. Merrill	None	N/A	N/A
8/2/2022	9:30-9:50 am	K. Merrill	None	N/A	N/A
8/7/2022	10:40-10:52 am	K. Merrill	Opossum	No	No
8/16/2022	10:50-11:05 am	S. Vargas/M. Cozy	None	N/A	N/A
8/21/2022	9:15-9:30 am	K. Merrill	None	N/A	N/A
8/26/2022	10:00-10:13 am	K. Merrill	None	N/A	N/A
9/8/2022	10:46-11:05 am	K. Merrill	None	N/A	N/A
9/15/2022	9:16-9:31 am	K. Merrill	None	N/A	N/A
9/24/2022	8:50-9:05 am	K. Merrill	None	N/A	N/A
10/11/2022	11:15-11:35 am	K. Merrill	Opossum	No	No
10/20/2022	11:02-11:19 am	K. Alcaraz	None	N/A	N/A

Appendix C
Village H Memorandums

C-1 Analysis of Biological Constraints

ESA

550 West C Street
Suite 750
San Diego, CA 92101
619.719.4200 phone
619.719.4201 fax

www.esassoc.com

memorandum

date June 17, 2019

to Rosanne Humphrey, HMP Coordinator, City of Carlsbad

from Alanna Sullivan, Environmental Science Associates

subject Village H: Analysis of Biological Constraints

1. Introduction, Project Description, Location

Environmental Science Associates (ESA) has prepared this memorandum to document and assess biological resources and potential constraints identified within a portion of Calavera Hills Village H (Village H), a 60.9-acre property located in the City of Carlsbad (city) in San Diego County **(Figure 1)**. The study area is located at an elevation of approximately 154 to 308 feet above mean sea level (AMSL) and is within the Agua Hedionda land grant in the San Luis Rey U.S. Geological Survey (USGS) Quadrangle (Figure 1). The study area consists of Assessor's Parcel Number (APN) 1671011900.

Village H is part of a 2013 legal settlement that was deeded to the city by Presidio Cornerstone QC, LLC. In January 2019, the property was formally accepted by Carlsbad City Council. The property is divided laterally by Carlsbad Village Drive and consists of a 36.1-acre preserve to the north and a 24.8-acre area to the south. The northern section is completely within the Carlsbad Habitat Management Plan (HMP) "hardline" area, which means it was set aside as a preserve and protected in perpetuity by a conservation easement in 2006. It is under long-term management by the Center for Natural Lands Management (CNLM), which is funded by an endowment held by CNLM. This northern portion of Village H is not part of the study area discussed in this memorandum.

The 23.9-acre southern section of Village H consists of a 2.8-acre recreational vehicle storage area, 11.1 acres of undeveloped open space (including an area previously designated for a community facility), and two HMP hardline preserve areas (a 4.2-acre area to the southwest, and a 4.4-acre area to the southeast) **(Figure 2)**. Prior to being deeded to the city, no long-term management or endowment was associated with these areas. For the purpose of this memorandum, the "study area" refers only to the 11.1-acre undeveloped open space area and the 4.2-acre HMP hardline preserve area. This is the portion of Village H within which the city is evaluating potential future recreational uses. Historically, the study area, which was privately owned, was used by local residents and off-leash dogs. Currently, the city does not allow off-leash dogs on city trails or within HMP hardline areas; however, in addition to formalizing the historical trail on the western portion of the study area, the city is considering a variety of options that could include off-leash dogs within the non-hardline open space area.

This report includes biological resources information based on a desktop data review and reconnaissance-level field survey conducted by ESA biologist Alanna Sullivan on May 30, 2019, to document and assess biological resources and potential constraints in the study area as they relate to human use and off-leash dogs. Consistency with federal, state and local rules and regulations, including the California Environmental Quality Act (CEQA), Migratory Bird Treaty Act (MBTA), and Carlsbad's Habitat Management Plan (HMP), was considered. During the biological survey, a plant and wildlife species inventory was compiled, vegetation communities were mapped using ArcGIS, wildlife movement was assessed, and site photographs were taken throughout the study area **(Attachments A, B, and C)**.

2. Habitats and Vegetation Communities

Vegetation community classifications used in this report follow Holland (1986) and Oberbauer et al. (2008). The study area comprises a mix of native and non-native habitats **(Tables 1 and 2)**. Native habitats include Diegan coastal sage scrub and native grassland. Non-native habitats include eucalyptus woodland, non-native grassland, non-native grassland: broadleaf-dominated, disturbed (trails), and urban developed (ornamental).

TABLE 1
VEGETATION COMMUNITIES BY AREA

Vegetation Community	Acreage
Community Facilities	**(2.46)**
Diegan Coastal Sage Scrub	0.36
Native Grassland	0.01
Non-Native Grassland	1.00
Non-Native Grassland: Broadleaf-Dominated	0.85
Eucalyptus Woodland	0.19
Disturbed (trail)	0.06
Urban/Developed (ornamental)	0.00
Open Space	**(8.67)**
Diegan Coastal Sage Scrub	2.71
Native Grassland	0.23
Non-Native Grassland	0.04
Non-Native Grassland: Broadleaf-Dominated	1.74
Eucalyptus Woodland	3.31
Disturbed (trail)	0.57
Urban/Developed (ornamental)	0.07
Preserve Area	**(5.52)**
Diegan Coastal Sage Scrub	1.40
Native Grassland	0.00
Non-Native Grassland	0.00
Non-Native Grassland: Broadleaf-Dominated	0.51
Eucalyptus Woodland	3.17
Disturbed (trail)	0.41
Urban/Developed (ornamental)	0.03
Total Acres	**16.65**

TABLE 2
VEGETATION COMMUNITIES TOTALED WITHIN THE STUDY AREA

Vegetation Community	Total Acreage within the Study Area
Diegan Coastal Sage Scrub	4.47
Native Grassland	0.23
Non-Native Grassland	1.04
Non-Native Grassland: Broadleaf-Dominated	3.10
Eucalyptus Woodland	6.67
Disturbed (trail)	1.03
Urban/Developed (ornamental)	0.10
Total Acres	16.65

Diegan Coastal Sage Scrub

Diegan coastal sage scrub is the dominant native vegetation type in the study area. This habitat is sensitive and considered locally important because it supports many native and endemic species, including the federally threatened coastal California gnatcatcher (*Polioptila californica californica*). Coastal sage scrub is located in the eastern half of the open space area and the southern portion of the HMP hardline preserve area (Figure 2). Dominant species include lemonadeberry (*Rhus integrifolia*), California sagebrush (*Artemisia californica*), black sage (*Salvia mellifera*), and coyote brush (*Baccharis pilularis*). Scattered toyon (*Heteromeles arbutifolia*), coast live oak (*Quercus agrifolia*), Mexican elderberry (*Sambucus nigra* ssp. *caerulea*), western sycamore (*Platanus racemosa*), golden yarrow (*Eriophyllum confertiflorum*), and foothill needlegrass (*Stipa lepida*) were also observed. A relatively uniform understory of red brome (*Bromus madritensis* ssp. *rubens*) and wild oats (*Avena* spp.) occur within the site as well as a variety of other non-native species sprinkled throughout, including poison hemlock (*Conium maculatum*), crown daisy (*Glebionis coronaria*), and scarlet pimpernel (*Lysimachia arvensis*). Within the HMP hardline, the coastal sage scrub is mature and dense, and it forms a closed canopy of medium to tall shrubs dominated by lemonade berry.

Native Grassland

The native grassland community is located in a small patch in the northern portion of the open space area; this extends just slightly into the southern border of the community facilities area (Figure 2). This community is located partially under the canopy of the eucalyptus woodland. Dominant species include native foothill needlegrass, as well as non-native grasses such as wild oat, rye grass (*Festuca perennis*), and brome grasses (*Bromus* spp.); deerweed (*Acmispon glaber*) and lemonade berry are located in scattered patches throughout. The presence of non-native grasses, as well as trampling, are an immediate a threat to this community, as it borders an existing trail. Native grassland is a rare habitat and of local importance. Native grassland communities within San Diego County have undergone substantial historical losses of overall acreage via agriculture, cattle grazing, and development. Native grasslands are important to protect, in part, because they often support several special-status plant and animal species that occur in Carlsbad, such as San Diego thornmint (*Acanthomintha ilicifolia*), thread-leaved brodiaea (*Brodiaea filifolia*), and grasshopper sparrow (*Ammodramus savannarum*), among others.

Eucalyptus Woodland

Eucalyptus woodland, dominated by several species of *Eucalyptus,* occurs along the historic trails in the western portion of the study area and adjacent to the Carlsbad Municipal Water District (CMWD) property and storage

area (Figure 2). The eucalyptus trees are large, creating a closed canopy over much of the woodland area; however, during the survey period, the city was conducting significant trimming, thinning, chipping and mulching in anticipation of formalizing the existing historic trail. Eucalyptus woodland areas away from the trails are thicker and denser. The woodland understory is minimal, presumably due to the allelopathic effect of the leaves (i.e. the release of volatile oils which inhibit the growth of other plant species). Generally, the understory consists of unauthorized trails and other unvegetated areas, scattered native and non-native shrubs such as lemonadeberry, toyon, oleander (*Nerium oleander*), myoporum (*Myoporum parviflorum*), and acacia (*Acacia* sp.), and non-native herbs such as pigweed (*Amaranthus albus*). Although eucalyptus woodland suppresses the growth of native species, the trees provide habitat for a variety of raptors and other birds, such as red-shouldered hawk (*Buteo lineatus*), Cooper's hawk (*Accipiter cooperii*), Nuttall's woodpecker (*Picoides nuttallii*), and Anna's hummingbird (*Calypte anna*).

Non-Native Grassland

Non-native grassland onsite occurs in a small patch on the northern portion of the study area (Figure 2). This community is dominated by wild oat and brome grasses with some presence of non-native broadleaf species such as Russian thistle (*Salsola tragus*), fennel (*Foeniculum vulgare*), and wild radish (*Raphanus sativus*). Scattered coyote brush shrubs also occur. It is likely this area was previously disturbed by humans because of the dominance of non-native plant species, flattened topography, and proximity to the road. Although dominated by non-native species, non-native grassland has ecological value as foraging habitat for raptors, and acts as a home for ground-burrowing wildlife, such as Botta's pocket gopher (*Thomomys bottae*).

Non-Native Grassland: Broadleaf-Dominated

The non-native grassland: broadleaf-dominated community is a subtype of non-native grassland that is dominated by non-native forbs rather than grasses. This vegetation type occurs in two patches in the study area– a small patch on the northern end and larger patch within the central portion of the site (Figure 2). This community is dominated by densely growing black mustard (*Brassica nigra*), crown daisy, and Russian thistle, but other species occur as well, including prickly sow thistle (*Sonchus asper* ssp. *asper*), cheeseweed (*Malva parviflora*), and stork's bill (*Erodium* spp.). Non-native grasses and sparsely scattered native shrubs such as coyote brush and deerweed also occur. The weedy non-natives have choked out most native plants, resulting in little to no habitat value for native insects and wildlife, including raptor prey such as rodents and rabbits.

Disturbed

Disturbed land cover generally consists of highly degraded, hard packed soils with little to no vegetation. Within the survey area, disturbed areas are limited to informal historic trails, which generally run north-south on the western portion of the study area (Figure 2). The overstory throughout the majority of this community is eucalyptus woodland. The trails are highly compacted and receive daily foot traffic, and therefore have limited ability for either native or non-native plants to grow. This land cover type offers some ecological value in that it allows for north-to-south wildlife movement along the trail when humans and pets are not present.

Urban/Developed

Urban/developed areas have been physically permanently or temporarily altered to the extent that native vegetation is no longer supported. Within the study area, this category is used for two small areas consisting of ornamental vegetation. One area borders the trail on the northwest side of the site, and the other is adjacent to a

residence on the southwestern corner of the site (Figure 2). This land cover type has little to no ecological value due to the inability for most native plant species and wildlife to inhabit these areas.

3. Special-Status Species

Results of the California Natural Diversity Database (CNDDB) and San Diego Management and Monitoring Plan (SDMMP) database searches were used to analyze the potential for special-status species to occur within the study area. **Figure 3** shows the CNDDB and SDMMP species occurrences within approximately 1 mile of the study area.

During the general biological survey, two special status plant species were incidentally noted, Engelmann oak (*Quercus engelmannii*)—a California Rare Plant Rank (CRPR) 4.2 species, and California adolphia (*Adolphia californica*)—a CRPR 2B.1 species. One Engelmann oak tree was noted within the coastal sage scrub of the open space and one patch of about 10 California adolphia plants was noted within the eucalyptus woodland of the open space, as well as one California adolphia on the edge of the coastal sage scrub within the preserve area. In order to capture all rare plants occurring within the study area, focused rare plant surveys should be performed by a qualified biologist during the time(s) of year in which rare plants that have a potential to occur within the study area can be seen in peak bloom (generally April – May).

In addition, breeding bird surveys should be conducted to identify potentially occurring sensitive bird species. Because of the presence of appropriate coastal sage scrub habitat for coastal California gnatcatcher and known historical occurrences nearby, surveys for coastal California gnatcatchers should also occur to determine presence or absence. Coastal California gnatcatcher is a federally threatened species, a California species of special concern, and an HMP-covered species. Populations of coastal California gnatcatchers within the city are important to the overall viability of this species. Carlsbad offers a critical link between populations within San Diego, Orange, and Riverside Counties. Surveys should follow the most current U.S. Fish and Wildlife Service protocol for presence/absence surveys. This area may also act as a nesting and foraging area for other special-status and locally important species such as Cooper's hawk (*Accipiter cooperii*) and northern harrier (*Circus hudsonius*). Baseline surveys for breeding birds between February 15 - August 31 would determine the species that inhabit, forage, and nest within the study area plus a 500-foot survey buffer. Surveys outside of this window might not capture all species. (Note that pre-construction nest-clearance surveys require a broader survey window, as described in Section 5 below.)

4. Wildlife Movement

Wildlife corridors link together areas of suitable habitat that are otherwise separated by rugged terrain, changes in vegetation, or human disturbance. A key objective of the HMP is to "maintain functional wildlife corridors… within the city and to the region" (City of Carlsbad 2004). These corridors, typically the most efficient wildlife movement pathways, connect fragmented patches of habitat and allow migration, dispersal, and gene flow of wildlife species. The fragmentation of open space areas by urbanization creates isolated "islands" of wildlife habitat. In the absence of habitat linkages that allow movement to adjoining open space areas, various studies have concluded that some wildlife species, especially larger and more mobile mammals, will not likely persist over time in fragmented or isolated habitat areas (Bennett 1990).

Channels and natural drainages often function as natural wildlife corridors, but when these areas intersect with roadways, with or without underpasses and culverts, they can become restrictive "pinch points," where animal movement becomes funneled into specific locations within linkages due to the lack of alternative movement routes. Roads are a significant threat to wildlife movement and they bisect habitat throughout the city with dense, fast-moving traffic. Wildlife that travels across roads are at high risk of being struck by oncoming traffic; therefore, traveling under roads through culverts and bridges is commonly a safer alternative for wildlife, when available.

During the development of the HMP, the Village H area was identified as part of an important linkage (Link B) between core habitat areas (Core #2 and Core #4). In addition, during a more detailed wildlife movement analysis conducted by the city, ESA and CNLM in 2015 (*Carlsbad Wildlife Movement Analysis Final Report*), Village H was identified as part of a key linkage M1a. This linkage connects the Buena Vista Creek Ecological Reserve southward through Robertson Ranch West to Agua Hedionda Lagoon, and potentially eastward to Robertson Ranch East and Carlsbad Highlands Ecological Reserve/Lake Calavera area. For the purposes of this biological constraints evaluation, only the areas in the immediate vicinity of the study area were assessed.

Four pinch points identified in the 2015 wildlife movement study, occur in the immediate vicinity of the study site **(Figure 4)**. For wildlife movement to occur at pinch point M1-1 across Carlsbad Village Drive, wildlife would have to either (1) cross three lanes of traffic and move through 4-inch openings in the wrought-iron fence or through a space beneath the fence, or (2) pass under the road through a dark, narrow storm drain (approximately 2-foot-diameter). Vegetation is dense in the area surrounding the storm drain, so with no clear path, it is less unlikely wildlife will commonly come across this drain. In addition, the storm drain is dark, and light cannot be seen at the other end; therefore, chances wildlife will use this as a crossing is low. A wildlife camera has been set up here at the northern side of the road by CNLM to document any animals that may enter the storm drain. There are, however, clear signs of animals moving underneath the wrought-iron fence at the northern boundary of the study area (Figure 4). Sign of digging and at least 8 inches of clearance beneath the fence, as well as a wildlife trail leading south onto the southern section of Village H were observed in at least one area. Small- to medium-sized mammals such and coyotes (*Canis latrans*) and bobcats (*Lynx rufus*) could use this as an access point, but it is not expected large mammals such as the southern mule deer (*Odocoileus hemionus* ssp. *fuliginatus*) would be able to easily move through this pinch point, as it would require jumping over the 6-foot-high fence. Recommended maximum fencing height to allow for mule deer movement is 42 inches (Mule Deer Working Group 2014).

Pinch point M1-2 occurs at an uphill crossing of five-lane Tamarack Avenue. Underneath Tamarack Avenue is a large, approximately 12- to 15-foot in diameter culvert that is well-lit and would offer a safer option for wildlife to move, including movement of large mammals, such as mule deer. However, because of the presence of closed metal gates on both ends, this culvert is not available for wildlife use except possibly very small mammals such as California ground squirrel (*Otospermophilus beecheyi*). There are no gaps that allow for animal movement where that gates meet the culvert and the gaps in between the metal bars are approximately 2.5 inches.

Pinch point M1-3 is located just southeast of M1-2 and wildlife movement requires crossing Glasgow Drive. No culvert or storm drain runs beneath the road to allow for movement. Although a road crossing is not ideal, Glasgow Drive is a two-lane, at-grade road with minimal traffic. There is no fence on either side of this road. The area to east leads to Calavera Hills open space, an HMP hardline area. This area connects south toward Agua Hedionda Lagoon.

Wildlife are presumed to move north-south through the study area, parallel to Tamarack Avenue. A chain-link fence borders Tamarack Avenue and a concrete-lined channel, which is also lined by surrounding vegetation, runs parallel to the fence and road; a chain-link fence also runs along the channel on the opposite side for a majority of the channel length (Figure 4). Two adjacent, approximately 3 feet in diameter, storm drains run beneath Pontiac Drive (see bottom of Figure 4). These storm drains allow small- to medium-sized wildlife to cross beneath the two-lane road at the busy intersection. During the biological survey on May 28, 2019, a juvenile bobcat was observed passing southwest through this storm drain. It should, however, be noted that a break in the fence at the corner of Pontiac Drive and Tamarack Avenue, presumably due to damage from a car crash, also offers wildlife the option to cross five-lane Tamarack Avenue. Pinch point M1-4 is located at the end of the chain-link fencing, and leads wildlife to an approximately 4-foot-wide by 3-foot-high box culvert underneath Tamarack Avenue. This culvert leads south to Calavera Hills, a large, unfenced open space area. Wildlife also likely occurs outside of the fenced channel area, just to the north. For wildlife located outside the fenced area, the culvert is not available for use, and thus crossing at Tamarack Avenue in this area may nevertheless occur.

The southern section of Village H operates as an important local wildlife movement linkage for animals, likely including small- to medium-sized mammals such as coyotes, bobcats, raccoons (*Procyon lotor*), and desert cottontails (*Sylvilagus audubonii*), as well as insects, reptiles, and foraging, nesting, and migratory birds. The habitat within the study area connects Village H and the surrounding habitats of Robertson Ranch West and Agua Hedionda Lagoon. Movement is constrained by Carlsbad Village Drive to the north, Tamarack Avenue to the east and south, and residences to the west. Further wildlife studies, including additional wildlife camera studies, would need to be performed in this area to confirm the species and frequency of usage, as well as to determine whether storm drains, culverts, and/or roads are being successfully utilized at pinch points.

5. Constraints

Biological resources and associated constraints should be considered in the decision-making and prior to planning the next steps for the future recreational uses in Village H. Maintaining native habitats and local wildlife movement aligns with HMP goals and policies and is important for the persistence of a quality environment for the people as well as the stability of the environment.

California Environmental Quality Act

Per California state regulations, any expansion of use within the study area beyond formalizing the existing trail, including allowing off-leash dogs, grading, placement of fencing, change of surface covering, or recreation outside of the existing trail, would require a full CEQA analysis to assess potential environmental impacts. An impacts assessment, or Initial Study, would assess any potentially significant environmental impacts and whether these impacts can be mitigated to the point that impacts are no longer considered significant (Mitigated Negative Declaration).

Migratory Bird Treaty Act

Under the federal MBTA of 1918, nesting birds require specific consideration. It is a violation of the MBTA to disturb actively nesting birds either directly (e.g., brush and tree removal) or indirectly (e.g., noise, harassment (including too close of proximity to nest)). Any activities that result in nest abandonment, nest destruction (of an active nest), or the death of eggs, young, or adults are referred to as “take” and are a violation of the MBTA. Should take occur during trail construction, trail reclamation, exotic plant removal, tree trimming, fuel

modification, other maintenance or management activities, or as the result of humans or off-leash dogs, it would represent a potentially significant impact and mitigation would be warranted. Take can also result in fines and misdemeanor charges.

Construction activities should be avoided during the bird breeding season if feasible (TAIC 2008). If any construction, including trail improvements, fence installation, and tree trimming, is to occur within this area, a nesting bird clearance survey by a qualified biologist should be conducted within 300 feet (for songbirds) and 500 feet (for raptors or coastal California gnatcatchers) of any areas that may be impacted. This is to ensure no birds protected under the MBTA and/or State Fish and Game Code Section 3503 et seq. are harmed or harassed. Surveys should be conducted no more than 3 days prior to construction or other activities. To capture all breeding birds, including raptors, which tend to breed earlier than other species, the pre-construction nest clearance surveys should be conducted for any work performed between January 1 – September 15.

Habitat Management Plan

Per the HMP, impacts to biological resources are not allowed within hardline areas, and any impacts outside of hardline areas must be mitigated. This includes native habitats and native species, including nesting birds. Within the study area, the coastal sage scrub should not be impacted within the hardline preserve area, and any permanent impacts to native grassland, coastal sage scrub, or annual (non-native) grassland outside of the hardline preserve require mitigation at specific ratios provided in the HMP (**Table 3**). City projects can mitigate Types D, E, and F impacts at the Lake Calavera mitigation parcel and are not required to pay an *in-lieu* mitigation fee, which is required of non-city projects.

Table 3. Mitigation Ratios for Impacts to HMP Habitats Onsite

Habitat Group and Type	Mitigation Ratio/Requirement by Type of Impacted Habitat
A. Wetlands and oak woodlands – none onsite	N/A
B. Native grassland	3:1
C. Gnatcatcher - Occupied coastal sage scrub	2:1[1]
D. Unoccupied coastal sage scrub	1:1[2]
E. Annual (non-native) grassland	0.5:1[2]
F. Disturbed lands, eucalyptus	Mitigation Fee[2]

1. Maximum avoidance and onsite conservation of Group C habitat is encouraged.
2. City projects that impact Type C, D, and E habitats will not pay an *in-lieu* mitigation fee, but will instead mitigate at the Lake Calavera Mitigation Parcel. These projects may mitigate out-of-kind because the objective is to build the preserve system by combining small mitigation requirements into a larger, more contiguous area. City projects that impact Type A and B habitats must mitigate in-kind at the ratios stated above.

Source: HMP Table 11

Contrary to CEQA standards, the HMP does not consider historic, unauthorized trails as an existing condition. Therefore, baseline conditions would be considered as those prior to the unauthorized trail activity; therefore, formalization of trails onsite would require mitigation for impacts to sensitive habitat that was present prior to initial habitat disturbance. Within the study area, it appears that the baseline vegetation for the majority of the historic trails was non-sensitive land cover types (eucalyptus woodland, broadleaf dominated non-native grassland, urban/developed) except for the loop at the southern end within HMP hardline preserve, which was coastal sage scrub. **Table 4** shows potential habitat impacts if the new, formalized trail has the same footprint as

the existing historic trail. The acreages are based on presumed pre-trail habitat and estimated trail boundary. Actual trail impacts will depend on actual future trail alignment and width.

Table 4. Potential Trail Impacts to Habitat, Assuming New Trail will be the Same as Historic Trail

Vegetation Community	Acreage
Community Facilities	**(0.06)**
Non-Native Grassland	0.02
Urban/Developed	0.04
Open Space	**(0.57)**
Non-Native Grassland: Broadleaf-Dominated	0.06
Eucalyptus Woodland	0.51
Preserve Area	**(0.41)**
Diegan Coastal Sage Scrub	0.08
Non-Native Grassland: Broadleaf-Dominated	0.08
Eucalyptus Woodland	0.25
Total Acres	**1.04**

HMP Adjacency Standards include specific requirements for any properties adjacent to an existing hardline area. Within the study area, this would include the undeveloped open space area, which is adjacent to the hardline preserve. Signage and fencing should be used as necessary to prevent harmful or unauthorized use of the adjacent preserve, and to protect wildlife. Fences that restrict wildlife movement across movement corridors and habitat linkages should be removed. A key objective of the HMP is to "maintain functional wildlife corridors… within the city and to the region" (City of Carlsbad 2004).

In addition, current local and state regulations do not allow dogs to be off-leash on trails or habitat; therefore, allowing off-leash dogs in Village H would be precedent-setting. If the city formally allows off-leash dogs within any portion of the open space at Village H, local public awareness of this area could increase significantly. Human use would likely increase from current neighboring residents to city-wide or regional usage. Local residents may strive to further the allowance of off-leash dogs within other trails and open space areas within the city. This would likely result not only in increased human and dog presence but also inflated traffic, noise, trash, and dog feces, as well as increased risk of disease transmission from dog feces and urine.

Human/Dog Use and Effects of Wildlife and Water Quality

"Recreation activity has been linked to declines in wildlife species occupancy, abundance and density (Banks & Bryant 2007; Reed & Merenlender 2008), changes in spatial or temporal habitat use (George & Crooks 2006; Cardoni et al. 2008), increased physiological stress (Arlettaz et al. 2007), reduced reproductive success (Finney et al. 2005), and behavioral effects such as increased vigilance and flight (Taylor & Knight 2003)" (Reed et al. 2014). Additionally, the presence, sign, and smell of dogs has been shown to reduce wildlife usage (Lenth et al. 2006). Small mammals such as squirrels, rabbits, and mice (*Peromyscus* spp., *Reithrodontomys* spp., and *Onychomys* spp.) exhibit reduced activity with 50 meters or more to trails with dogs. Bobcat detections also decrease with dog presence; however, coyote activity has shown to increase with the presence of dogs, in the form of activity investigating and scent-marking (Lenth et al. 2006).

If human use were to increase within the study area, the effect of humans on nesting birds is also expected to increase. In a 2007 study that compared 90 sites, in which half allowed dog walking and half prohibited dog walking, the areas where dog walking was allowed exhibited 41 percent fewer bird individuals and a 35 percent reduction in species richness (Banks 2007). The effects on birds and other wildlife occurs via trampling and direct predation, as well as indirect predation. Indirect predation consists of chasing, particularly of pregnant females or young, which may cause harmful energy expenditure, and predator stress, resulting in an overall decrease in health of the population (Chester 2005).

Where dog walking occurs, dog feces and discarded disposable bags with dog feces, presumably also occurs. If dogs were allowed to roam off-leash in any area of Village H, dog feces would likely be more prevalent than if this was prohibited. If dogs were to roam both off-trail and off-leash in the open space, dog waste would be difficult to locate and remove, being hidden by vegetation or unseen by the owner. The presence of dog feces can lead to a water quality issue. In heavy rain events, water would flow south through the center of the site (where brow ditches currently exist) to the concrete-lined drainage channel to the south (Figure 4). Pet waste has been identified as a significant contributor to a serious water pollutant, *E.coli* bacteria (Hennings 2016). Humans can also catch parasites and diseases such as hookworms, roundworms, and salmonella from dog waste.

Wildlife are also susceptible to the transmittance of disease, including canine distemper virus, of which wild carnivores such as raccoons and coyotes are highly susceptible; bacterial *Leptospirosis* disease that affects the kidneys and urinary tract of most species of mammals; and parasites such as *E.coli*., ticks, tapeworms, and fleas are all risks that increase with increased canine presence (Lenth et al. 2006).

Recommendations to Improve Wildlife Movement

To alleviate current wildlife movement constraints, the area under the wrought-iron fence at Carlsbad Village Drive where there is an indication that wildlife is passing beneath, should remain un-obstructed (Figure 4). Soil should be removed in these areas to ensure wildlife can cross Carlsbad Village Drive as quickly and safely as possible. It would be beneficial to conduct a study to determine where wildlife is entering and exiting from the northern side of the road; determinations could be made from the results as to whether vegetation should be cleared at entry/exit points to allow for wildlife crossing. Additionally, “wildlife crossing” signs would allow for public awareness and potential slowing of passing vehicles at the crossing point.

For wildlife moving east to west through Tamarack Avenue, opening the gated culvert at the M1-2 pinch point would allow a safe option for small to large mammals, such as mule deer. The presence of humans in this culvert would effectively eliminate wildlife movement at this location. Once gates are opened, this area should be patrolled by the city rangers to ensure the culvert remains free of trash and transient encampments. If these gates are opened, CNLM, the preserve manager of the adjacent 4.4-acre preserve, volunteered to make weekly visits to further ensure this culvert remains free from human presence. Wildlife crossing signs at Tamarack Avenue are also recommended in case wildlife does not use the culvert; however, wildlife crossing of the busy five-lane road is dangerous for both animals and people and this should not be encouraged at any point along Tamarack Avenue. It is recommended wildlife be directed to safer alternatives such as the culvert at M1-2 and M1-4.

Movement underneath Pontiac Drive by small and medium-sized mammals should be encouraged by fixing the break in the chain-link fence, which currently allows for the option to cross Tamarack Avenue at an especially high traffic area near the El Camino Real intersection. The chain-link gate on the western side of Pontiac Drive, a part of the chain-link fencing that encompasses the drainage, should also be kept closed and locked to both keep

humans out and direct wildlife movement within culverts. To allow for easier movement underneath Tamarack Avenue onto Calavera Hills, the sediment buildup at the culvert at M1-4 should be scraped and cleared. This would more easily allow for medium-sized mammals to move through this pinch point.

6 Conclusions

Prior to formalizing public use within any area of Village H, including allowing off-leash dogs, local, state, and federal policies require additional assessment of potential environmental impacts. If recreational use by humans and off-dogs continues, formal efforts to protect the biological resources within the study area would need to be implemented. A CEQA analysis would assess all environmental impacts and propose mitigation to off-set all potentially significant impacts.

In order to minimize impacts and keep in line with the mission of the HMP, to "preserve the diversity of habitat and protect sensitive biological resources within the city," formal changes may include fencing off all native habitats (generally all areas located east of the existing mapped trial) with fencing that does not allow for dogs to cross into the native open space habitat, including anywhere outside of the existing trail within the preserve area.

Additionally, any trail design should ensure that wildlife movement at Village H linkage will not be significantly impeded. Wildlife movement patterns, as shown in Figure 4, are thought to traverse the study area north–south and east–west. These movement patterns should not be inhibited with additional human presence, canine presence, fencing, nighttime lighting, etc. Dogs should not be allowed to roam in the wildlife movement areas either on or off-leash. Because wildlife movement tends to increase from dusk to dawn, it is recommended that human usage be restricted to daylight hours. A CEQA analysis would provide a full assessment of biological resources within the study area and immediate vicinity, potential significant biological impacts, and measures that would mitigate such impacts in order to allow for Village H to be enjoyed recreationally while minimizing environmental effects.

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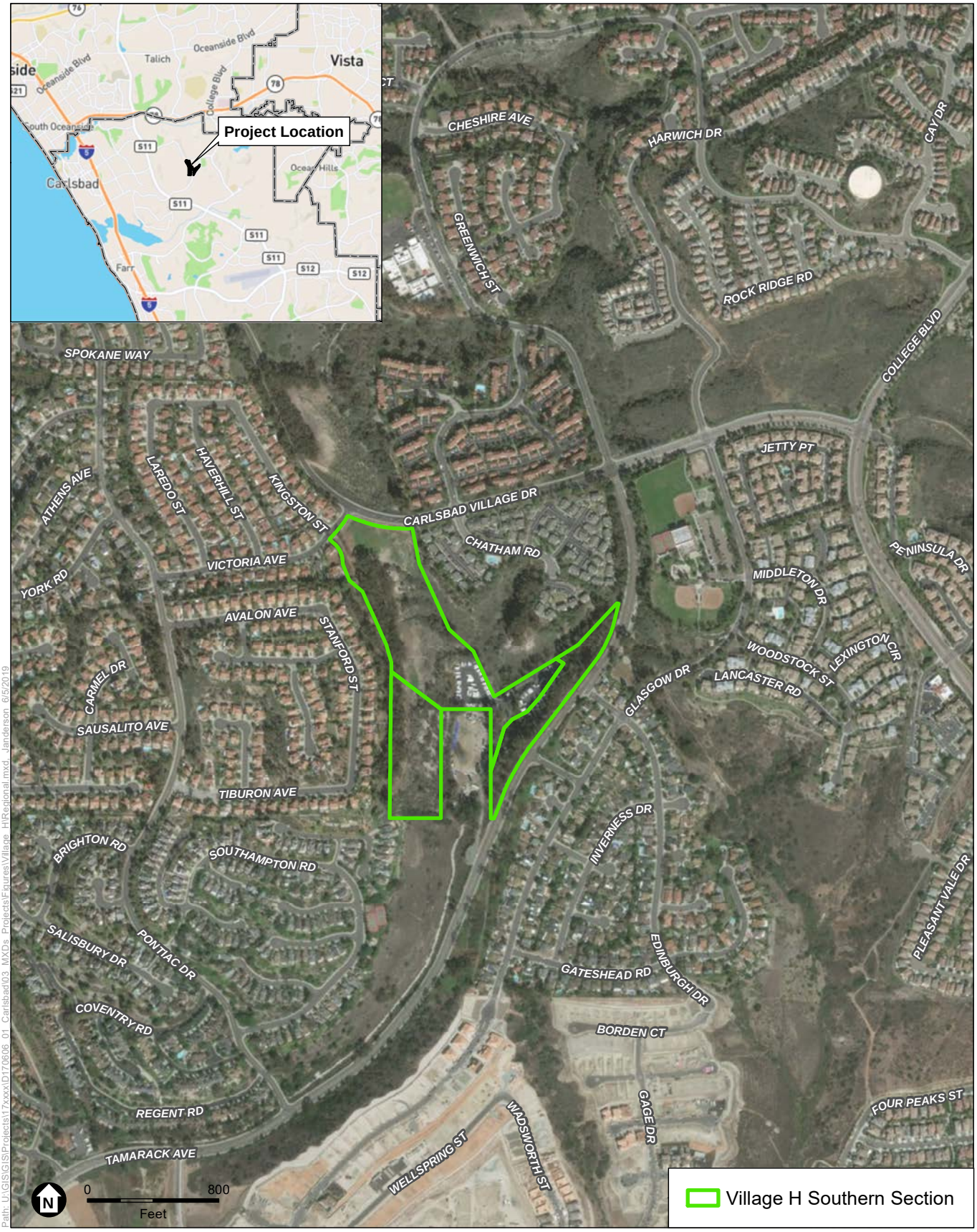
7. Attachments

A – Plant Species Inventory

B – Wildlife Species Inventory

C – Photographs of Survey Area

FIGURES



SOURCE: ESRI

Carlsbad

Figure 1
Project Location

ESA

SOURCE: ESRI

Carlsbad

Figure 2
Vegetation Communities

ESA

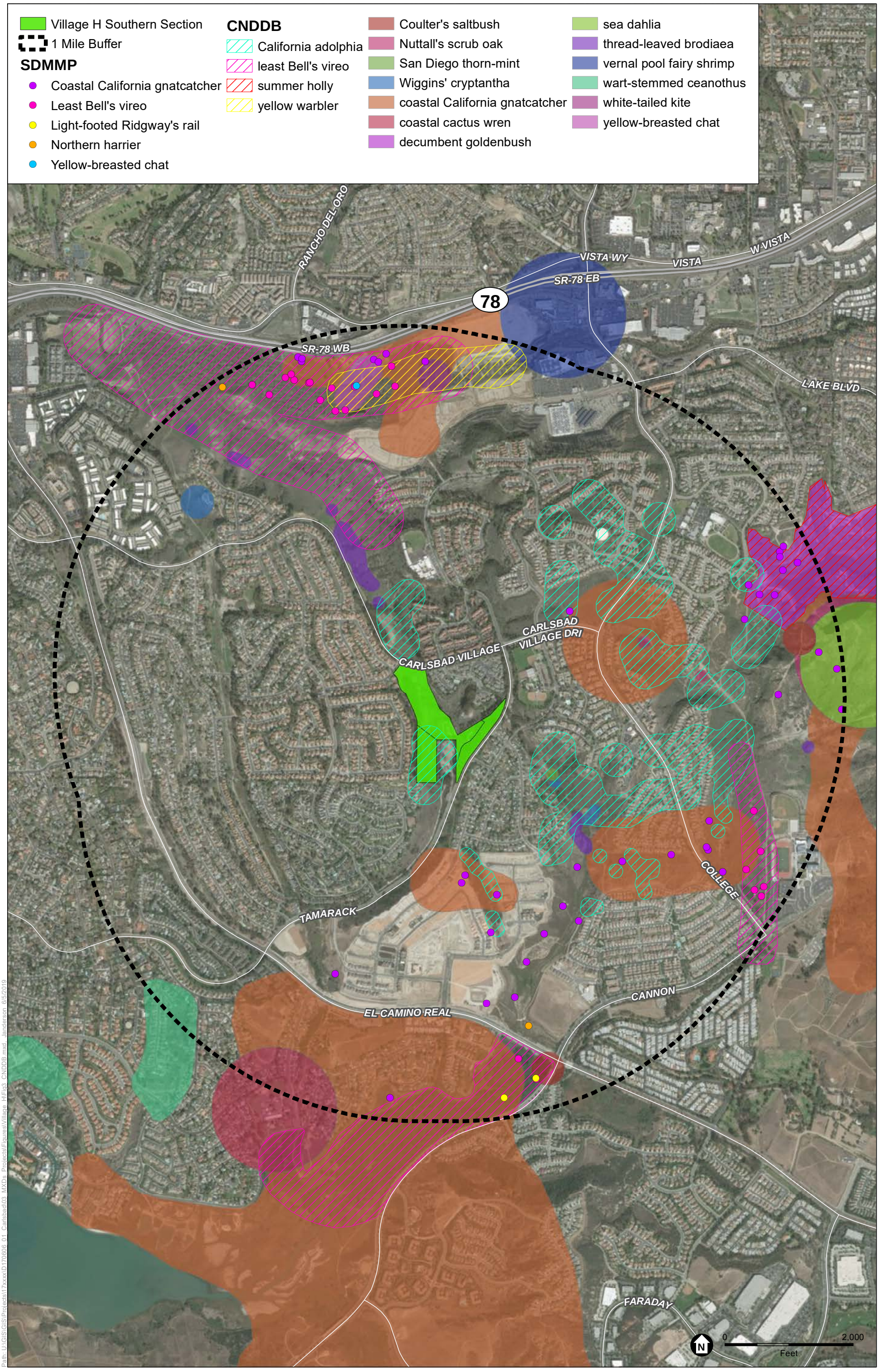
Village H Southern Section
1 Mile Buffer

SDMMP
- Coastal California gnatcatcher
- Least Bell's vireo
- Light-footed Ridgway's rail
- Northern harrier
- Yellow-breasted chat

CNDDB
- California adolphia
- least Bell's vireo
- summer holly
- yellow warbler

- Coulter's saltbush
- Nuttall's scrub oak
- San Diego thorn-mint
- Wiggins' cryptantha
- coastal California gnatcatcher
- coastal cactus wren
- decumbent goldenbush

- sea dahlia
- thread-leaved brodiaea
- vernal pool fairy shrimp
- wart-stemmed ceanothus
- white-tailed kite
- yellow-breasted chat



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SOURCE: ESRI; SanGIS; CNDDB

Carlsbad

Figure 3
Special-Status Species Historical Occurrences

ESA

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SOURCE: ESRI

Carlsbad

Figure 4
Wildlife Movement

ESA

ATTACHMENT A

Plant Species Inventory

Scientific Name	Common Name	Special Status (CRPR) or Invasive (Cal-IPC) Ranking
Acacia cultriformis	Knife acacia*	
Acacia sp.	Acacia*	
Acmispon glaber	Deerweed	
Adolphia californica	California adolphia	CRPR 2.1
Amaranthus albus	Pigweed*	
Apiastrum angustifolium	Mock parsley	
Artemisia californica	California sagebrush	
Avena spp.	Wild oat*	Cal-IPC Moderate
Baccharis pilularis	Coyote brush	
Bloomeria crocea	Common goldenstar	
*Brachypodium distachyon**	False brome*	Cal-IPC Moderate
Brassica nigra	Black mustard*	Cal-IPC Moderate
Bromus diandrus	Ripgut grass*	Cal-IPC Moderate
Bromus hordeaceus	Soft chess*	Cal-IPC Limited
Bromus madritensis ssp. *rubens*	Red brome*	Cal-IPC High
Calystegia macrostegia	Island false bindweed	
Carduus pycnocephalus ssp. *pycnocephalus*	Italian thistle*	Cal-IPC Moderate
Centaurea melitensis	Tocalote	Cal-IPC Moderate
Conium maculatum	Poison hemlock	Cal-IPC Moderate
Croton setiger	Turkey-Mullein	
Daucus pusillus	American wild carrot	
Deinandra fasciculata	Clustered tarweed	
Diplaucus puniceus	Sticky monkeyflower	
Ehrharta erecta	Panic veldt grass*	Cal-IPC Moderate
Encelia californica	California brittlebush	
Erigeron sp.	Fleabane	
Eriophyllum confertiflorum	Golden yarrow	
Erodium spp.	Stork's bill*	
Eucalyptus spp.	Eucalyptus*	
Festuca perennis	Rye grass*	Cal-IPC Moderate
Foeniculum vulgare	Fennel*	Cal-IPC High
Glebionis coronaria	Garland or crown daisy*	Cal-IPC Moderate

Hazardia squarrosa	Saw-toothed goldenbush	
Helminthotheca echioides	Bristly ox-tongue*	Cal-IPC Limited
Heteromeles arbutifolia	Toyon	
Hordeum sp.	Barley*	
Hypochaeris glabra	Smooth cat's-ear*	Cal-IPC Limited
Lactuca serriola	Prickly lettuce*	
Lupinus bicolor	Miniature lupine	
Lysimachia arvensis	Scarlet pimpernel*	
Malosma laurina	Laurel sumac	
Malva parviflora	Cheeseweed	
Marah macrocarpa	Chilicothe	
Myoporum parviflorum	Slender myoporum*	
Nerium oleander	Oleander*	
Nicotiana glauca	Tree tobacco*	Cal-IPC Moderate
Opuntia littoralis	Coastal prickly-pear	
Paspalum dilatatum	Dallis grass*	
Pelargonium hortorum	Garden geranium*	
Pseudognaphalium californicum	Ladies' tobacco	
Pseudognaphalium luteoalbum	Jersey cudweed*	
Quercus agrifolia	Coast live oak	
Quercus engelmannii	Engelmann oak	CRPR 4.2
Raphanus sativus	Radish*	Cal-IPC Limited
Rhus integrifolia	Lemonade berry	
Rumex crispus	Curly dock*	Cal-IPC Limited
Salsola tragus	Russian thistle, tumbleweed*	
Salvia mellifera	Black sage	
Sambucus nigra ssp. *caerulea*	Mexican elderberry	
Selaginella sp.	Spike-moss	
Sisyrinchium bellum	Western blue-eyed-grass	
Sonchus asper ssp. asper	Prickly sow thistle*	
Stipa lepida	Foothill needlegrass	
Verbena lasiostachys	Western vervain	
Washingtonia robusta	Mexican fan palm*	Cal-IPC Moderate
Zeltnera venusta	Charming centaury	

* introduced/non-native species

Cal-IPC High – These species have severe ecological impacts on physical processes, plant and animal communities, and vegetation structure. Their reproductive biology and other attributes are conducive to moderate to high rates of dispersal and establishment. Most are widely distributed ecologically.

Cal-IPC Moderate – These species have substantial and apparent—but generally not severe—ecological impacts on physical processes, plant and animal communities, and vegetation structure. Their reproductive biology and other attributes are conducive to moderate to high rates of dispersal, though establishment is generally dependent upon ecological disturbance. Ecological amplitude and distribution may range from limited to widespread.

Cal-IPC Limited – These species are invasive but their ecological impacts are minor on a statewide level or there was not enough information to justify a higher score. Their reproductive biology and other attributes result in low to moderate rates of invasiveness. Ecological amplitude and distribution are generally limited, but these species may be locally persistent and problematic.

CRPR 2B.2 *– Fairly threatened in California, but more common elsewhere*

CRPR 4.2 *– Fairly threatened in California, placed on a watch-list due to limited distribution throughout its range*

ATTACHMENT B

Wildlife Species Inventory

Scientific Name	Common Name
INVERTEBRATES	
Danaus plexippus	Monarch
Leptotes marina	Marine blue
REPTILES	
Sceloporus occidentalis	Western fence lizard
BIRDS	
Aphelocoma californica	California scrub-jay
Buteo lineatus	Red-shouldered hawk
Callipepla californica	California quail
Calypte anna	Anna's hummingbird
Calypte costae	Costa's hummingbird
Carpodacus mexicanus	House finch
Empidonax difficilis	Pacific-slope flycatcher
Melospiza melodia	Song sparrow
Melozone crissalis	California towhee
Mimus polyglottos	Northern mockingbird
Phainopepla nitens	Phainopepla
Pheucticus melanocephalus	Black-headed grosbeak
Pipilo maculatus	Spotted towhee
Psaltriparus minimus	Bushtit
Spinus psaltria	Lesser goldfinch
Zenaida macroura	Mourning dove
MAMMALS	
Thomomys bottae	Botta's pocket gopher
Canis latrans	Coyote (tracks)
Lynx rufus	Bobcat
Sylvilagus audubonii	Desert cottontail (scat)

ATTACHMENT C

Photographs of Survey Area

Coastal sage scrub habitat within the undeveloped open space portion of the survey area.

Trails beneath eucalyptus woodland canopy.

Native grassland community, partially under eucalyptus woodland canopy.

Non-native grassland in the foreground, non-native grassland: broad-leaf dominated in the background.

Gated culvert at M1-2 pinch point.

Possible wildlife movement and wildlife trail under wrought-iron fence.

C-2 Wildlife Movement Study Summary

2355 Northside Drive
Suite 100
San Diego, CA 92108
619.719.4200 phone
619.719.4201 fax

esassoc.com

memorandum

date	February 16, 2023
to	Rosanne Humphrey, City of Carlsbad
cc	Terah Donovan, Environmental Science Associates
from	Adrienne Lee, Environmental Science Associates Karla Alcaraz, Environmental Science Associates
subject	City of Carlsbad Village H Wildlife Movement Study Summary

This memorandum summarizes wildlife movement monitoring studies conducted at Village H from June 28, 2019, to December 13, 2022, capturing changes in allowable uses from specific events such as the trail opening to the public on August 1, 2019, and trail closure during the COVID-19 pandemic from March 23, 2020, to May 4, 2020. Wildlife movement monitoring studies included remote wildlife cameras, roadkill monitoring along streets bordering Village H, and dog waste studies.

Introduction

An undeveloped property known as "Village H" was acquired by the City of Carlsbad (city) as part of a 2013 legal settlement. The property was deeded to the city by Presidio Cornerstone QC, LLC, and was formally accepted by Carlsbad City Council in January 2019. The property is bisected by Carlsbad Village Drive, which divides the property into a 36.1-acre area to the north and a 24.8-acre area to the south. The northern area is an existing hardline within the Carlsbad Habitat Management Plan (HMP) preserve, set aside and protected in perpetuity by a conservation easement in 2006. It is under long-term management by the Center for Natural Lands Management. The 23.9-acre southern section of Village H consists of a 2.8-acre recreational vehicle storage area, 11.1 acres of undeveloped open space (including an area previously designated for a community facility), and two HMP hardline preserve areas (a 4.2-acre area to the southwest and a 4.4-acre area to the southeast, **Figure 1, Study Area Location**; see figures at the end of this memorandum). For the purpose of this memorandum, *study area* refers to southern section of Village H.

The Village H area is part of an important wildlife movement linkage (Link B) between core habitat areas (Core #2 and Core #4) identified during the planning phase of the HMP (City of Carlsbad 2004). Village H was identified as an important wildlife movement corridor (M1) in a citywide wildlife movement study conducted in 2015 (City of Carlsbad et al. 2015). The corridor connects the Buena Vista Creek Ecological Reserve southward through Robertson Ranch West to Agua Hedionda Lagoon, and potentially eastward to Robertson Ranch East and the Carlsbad Highlands Ecological Reserve/Lake Calavera area, as shown in **Figure 2, Carlsbad HMP Linkages**. Four "pinchpoints" were identified in the immediate vicinity of Village H (ESA 2019) (**Figure 3,**

Pinchpoints and Potential Wildlife Movement Corridors). Pinchpoints are areas where animal movement becomes funneled into specific locations within linkages due to the lack of alternative movement routes. Channels and natural drainages function as natural wildlife corridors, but when these areas intersect with roadways, with or without underpasses and culverts, movement along these areas enters a pinchpoint. Pinchpoint M1-1 has a small (2-foot-wide) culvert underneath the road, from the north side of Carlsbad Village Drive. The culvert does not go directly south into the Village H property, resulting in an at-grade crossing. M1-2 to the east has a large (12- to 15-foot-wide) culvert under Tamarack Avenue, which was gated on both sides at the time of this study, resulting in an at-grade crossing. M1-3, further east, is an at-grade crossing over Glasgow Drive. M1-4, south of Village H, has a 4-foot-wide culvert under Tamarack Avenue connecting a small drainage area south to Robertson Ranch Preserve. An additional (3-foot-wide) culvert (not identified as a pinchpoint in the 2015 wildlife movement study) is located under Pontiac Drive, just east of M1-4.

When the study area was privately owned, it was used by local residents with off-leash dogs. When the city took ownership of the property, the historic on-site trail was formalized and opened to the public on August 1, 2019. Off-leash dog use was no longer allowed because the city does not allow off-leash dogs on city trails or within HMP hardline areas, as HMP hardline areas are managed for habitat and native wildlife. Several residents expressed a desire to continue to use this area for off-leash dogs. The presence of humans and domestic dogs deters wildlife and shifts their distribution to avoid human activity (Frid and Dill 2002). Wildlife adjust their time of use to be more active in the night to avoid human daytime activities (Gaynoret al. 2018). This can interfere with their ability to forage and breed.

The purpose of wildlife movement monitoring studies at Village H was to (1) collect quantitative data on wildlife presence, humans, and domestic dogs on Village H, (2) determine if wildlife are being killed on the road while moving into or out of the site, (3) qualitatively evaluate wildlife movement patterns, and (4) assess the amount and location of dog waste left on-site, which can deter wildlife from using the site, and (5) assess the amount of dog waste left off trail as a proxy for off-leash dog use within Village H. This information will help the city evaluate the current use by wildlife and changes in wildlife behavior potentially caused by changes in the allowable uses of the Village H site.

Data collection spanned from June 28, 2019, to December 13, 2022, capturing changes in allowable uses from specific events such as the trail opening to the public on August 1, 2019, and trail closure during the COVID-19 pandemic from March 23, 2020, to May 4, 2020. Memorandums discussing the trail opening to the public and the trail closure during the COVID-19 pandemic and their effects on wildlife movement within Village H were previously prepared for the City of Carlsbad (ESA 2019, 2020). The purpose of this memorandum is to present all wildlife movement studies conducted on Village H to date, summarize trends detected, and provide management recommendations.

Methodology

Remote Wildlife Cameras

A total of 22 remote wildlife cameras were installed at Village H over the course of the study period to monitor the diversity of wildlife species using the site and determine potential wildlife movement patterns. The first wildlife camera was installed on June 25, 2019, and the last wildlife camera was removed on November 17, 2022. The duration of monitoring for each wildlife camera varied as some cameras were vandalized or stolen and some

camera locations did not detect wildlife and were moved to new locations. Specific data on the location and duration of monitoring at each remote wildlife camera are provided in **Table 1** and locations are depicted in **Figure 4, Remote Wildlife Camera Locations**. Target species for this study were coyotes and bobcats. These are wider-ranging species than smaller mammals. Movement of these species on a broad scale could help the city evaluate the wildlife movement functionality of the preserve system.

TABLE 1
REMOTE WILDLIFE CAMERA LOCATIONS

Camera	Deployment Date	Monitoring Duration	Location
VH1	6/25/2019–11/8/2019	136 days	Lat: 33.16580357° Long: -117.30507829°
VH2	6/25/2019–8/10/2019	42 days	Lat: 33.16459953° Long: -117.30472425°
VH3	6/25/2019–8/10/2019	44 days	Lat: 33.16199145° Long: -117.30468584°
VH4	6/25/2019–8/10/2019	11 days	Lat: 33.16354744° Long: -117.30476386°
VH5a	6/25/2019–12/19/19	177 days	Lat: 33.16635432° Long: -117.30534393°
VH5b	6/30/21–11/17/2022	505 days	Lat: 33.163276° Long: -117.303591°
VH6	6/25/2019–10/2/2019	99 days	Lat: 33.16466320° Long: -117.30068579°
VH7	6/25/2019–12/13/2019	174 days	Lat: 33.16436649° Long: -117.30207108°
VH8a	6/25/2019–11/8/2019	136 days	Lat: 33.15654051° Long: -117.30705798°
VH8b	11/8/2019–7/3/2020	62 days	Lat: 33.156719° Long: -117.306682°
VH9	7/25/2019–11/8/2019	106 days	Lat: 33.166116° Long: -117.304649°
VH10	7/25/2019–8/10/2019	14 days	Lat: 33.164600° Long: -117.304724°
VH11	8/23/2019–8/28/2019	5 days	Lat: 33.161924° Long: -117.304864°
VH12	8/23/2019–8/28/2019	5 days	Lat: 33.161811° Long: -117.304715°
VH13	9/12/2019–12/19/2019	98 days	Lat: 33.165786° Long: -117.304340°
VH14	9/12/2019–10/2/2019	20 days	Lat: 33.1564289° Long: -117.304627°
VH15	9/19/2019–1/17/2020	112 days	Lat: 33.164716° Long: -117.300571°
VH16	9/19/2019–1/17/2020	112 days	Lat: 33.164437° Long: -117.300078°
VH17a	11/8/2019–4/30/2020	112 days	Lat: 33.161395° Long: -117.303399°
VH17b	5/28/2021–11/17/2022	538 days	Lat: 33.161395° Long: -117.303399°
VH18	12/13/2019–5/21/2020	49 days	Lat: 33.165401° Long: -117.305199°
VH19	12/13/2019–12/30/2019	16 days	Lat: 33.165195° Long: -117.304995°
VH20	12/13/2019–7/3/2020	49 days	Lat: 33.165137° Long: -117.304918°
VH21a	11/8/2019–12/13/2019	34 days	Lat: 33.164612° Long: -117.304370°
VH21b	7/9/2020–1/6/2021	181 days	Lat: 33.163550° Long: -117.304069°
VH21c	1/6/2021–11/17/2022	680 days	Lat: 33.163240° Long: -117.303070°

All cameras were positioned approximately 1 to 3 feet off the ground to best record all potential wildlife species and signs of movement on and off the property. Cameras were set to have “low sensitivity” to movement such that anything from a small bird to a large coyote would likely trigger the cameras to start taking videos or photographs, but vegetation moving in the wind would not. To prevent vandalism and theft, each camera was locked inside specialized security boxes and the words “City of Carlsbad” and “wildlife movement study” were written on the boxes to further deter theft and inform the public. Wildlife cameras were either bolted to 4-foot-tall

steel posts dug into the ground, cabled to a chain-link fence and angled toward a culvert, or cabled onto a tree. The cameras were oriented away from the sun (to the extent practical) to protect the lens from over-exposure and positioned to capture videos or photographs of wildlife walking along a trail, headed either toward or away from the wildlife camera.

Once installed, all wildlife cameras were turned on to record and capture videos or photographs continuously (24 hours), once triggered. Each motion trigger would result in one photograph or a 10-second video. Unique camera detections were defined as a photograph or video triggered at least 30 minutes apart. The wildlife cameras within the study area were checked at least once a week by city staff and then reduced to once a month by Environmental Science Associates (ESA) staff to confirm that each camera was still in place and in working order and memory cards and batteries were switched out as necessary. Videos and photographs were then reviewed and categorized based on the species detected. Videos and photographs of human activity and/or dogs were categorized as well to make general assumptions regarding the amount of human and/or dog traffic within the study area. Wildlife camera data from June 25, 2019, to November 17, 2022, were analyzed; a summary of the results can be found in **Attachment A**.

Roadkill Monitoring

Roadkill was studied to determine if animals were being hit by cars while traveling over a road to enter or leave the site. To ensure all four pinchpoints were monitored, portions of Tamarack Avenue, Carlsbad Village Drive, and Glasgow Avenue that border Village H were included in the study area (**Figure 5, Roadkill Monitoring Results**). Roadkill monitoring began July 25, 2019, and ended on July 25, 2020, with a minimum of three surveys completed per week. For the full list of survey dates, see **Attachment B**.

ESA biologists, volunteers, and a city staff member conducted the monitoring. The survey area was monitored by walking or driving the roadkill monitoring survey area slowly and scanning the entire roadway for roadkill. If something was not identifiable from the car, the surveyor wore a safety vest and walked the survey area using binoculars to scan the road. If roadkill was detected, the surveyor would take a photo when road conditions were safe and upload the photo onto the citizen scientist mobile application iNaturalist[1] to create an "observation" within the University of California, Davis California Roadkill Observation System (CROS) Project (iNaturalist 2022). Once the observation was recorded, the surveyor called the city's Public Works department for animal disposal pickup.

Dog Waste Study

The purpose of this study was to determine how much dog waste is being left behind each week (number and weight) and where (e.g., native habitat, on or near the trail). Dog waste stations were installed as part of the trail improvements, so this study captures dog waste left by dog owners along a leash-only trail and surrounding area that is off-limits to dogs. Surveyors walked meandering transects throughout the Village H site (western parcel only) in areas that were open enough to walk through. When dog waste, coyote scat, or tennis balls (i.e., dog toys) were encountered, these locations were recorded using the ArcGIS Collector (Collector app) mobile application. Dog waste, coyote scat, tennis balls, and any litter found were then collected to be thrown away at the end of each

1 iNaturalist. Available from https://www.inaturalist.org.

survey. Collected dog waste was weighed at the end of each collection period. Coyote scat was distinguished from dog waste by the presence of berries, animal bones, and/or large amounts of fur.

Surveys were conducted approximately every other week from August 28, 2019, to October 23, 2019, and then reduced to once a month in response to the COVID-19 pandemic, through December 13, 2022. Note that the initial survey on August 28, 2019, includes all previously uncollected waste from the site; therefore, only subsequent collections were used to determine weekly and monthly coyote scat and waste left by dog owners.

Results

Remote Wildlife Cameras

The wildlife cameras captured data spanning a period of 844 days. Species detected at the 22 wildlife camera locations included coyote (*Canis latrans*), bobcat (*Lynx rufus*), skunk (*Mephitis mephitis*), rabbit (*Sylvilagus spp.*), California ground squirrel (*Otospermophilus beecheyi*), raccoon (*Procyon lotor*), opossum (*Didelphis virginiana*), various bird species, various rodent species, off-leash dogs, on-leash dogs, and humans. The most common wildlife species detected at Village H were coyotes, small mammals (rodents/rabbits/raccoons), and birds. Based on wildlife camera data, updated presumed wildlife movement patterns within Village H are depicted in **Figure 6, Updated Wildlife Movement Corridors**. Representative photographs of wildlife species detected are included in **Attachment C**.

Roadkill Monitoring

A total of 15 roadkill occurrences were detected during the 129 survey dates from July 25, 2019, to July 25, 2020. All roadkill observations ranged from birds to small mammals. All roadkill observations and their associated survey dates and surveyor information are listed in **Table 2**, and locations of all roadkill observations are displayed in Figure 5.

TABLE 2
VILLAGE H ROADKILL DETECTIONS

Date	Surveyor	Species
8/28/2019	A. Sullivan	Opossum
9/19/2019	H. Swarthout	Opossum
10/23/2019	A. Sullivan	Rabbit
12/5/2019	A. Sullivan	Rabbit and Bird
12/13/2019	H. Swarthout	Hawk
12/15/2019	K. Merrill	Barn Owl
12/18/2019	A. Lee	Barn Owl
12/26/2019	A. Sullivan	Skunk
12/27/2019	H. Swarthout	Rabbit
12/31/2019	A. Sullivan	Bird
1/24/2020	H. Swarthout	Hawk
2/9/2020	K. Merrill	California Quail
3/8/2020	K. Merrill	Rabbit
3/12/2020	H. Swarthout	Squirrel
7/25/2020	K. Merrill	Rabbit

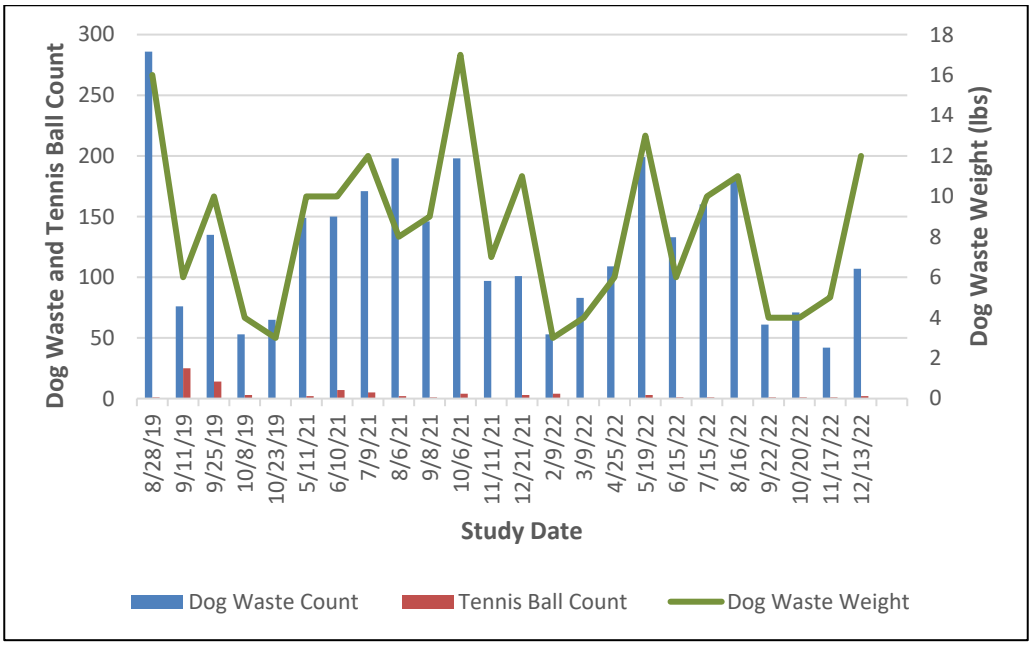
Dog Waste Study

A total of 22 dog waste monitoring visits have been conducted within the study area at the time of this memo. Apart from the general decline since the initial collection date, the total number of dog waste piles and the weight of dog waste has fluctuated between collection days. **Table 3** and **Graphs 1** and **2** detail the total number of dog waste piles, weight of dog waste in pounds, coyote scat, and tennis balls detected during each study. Locations of dog waste, coyote scat, and tennis balls observed during all monitoring visits are depicted in **Figure 7, Dog Waste Study Results**. Representative photographs of dog waste study collections are included in **Attachment D**.

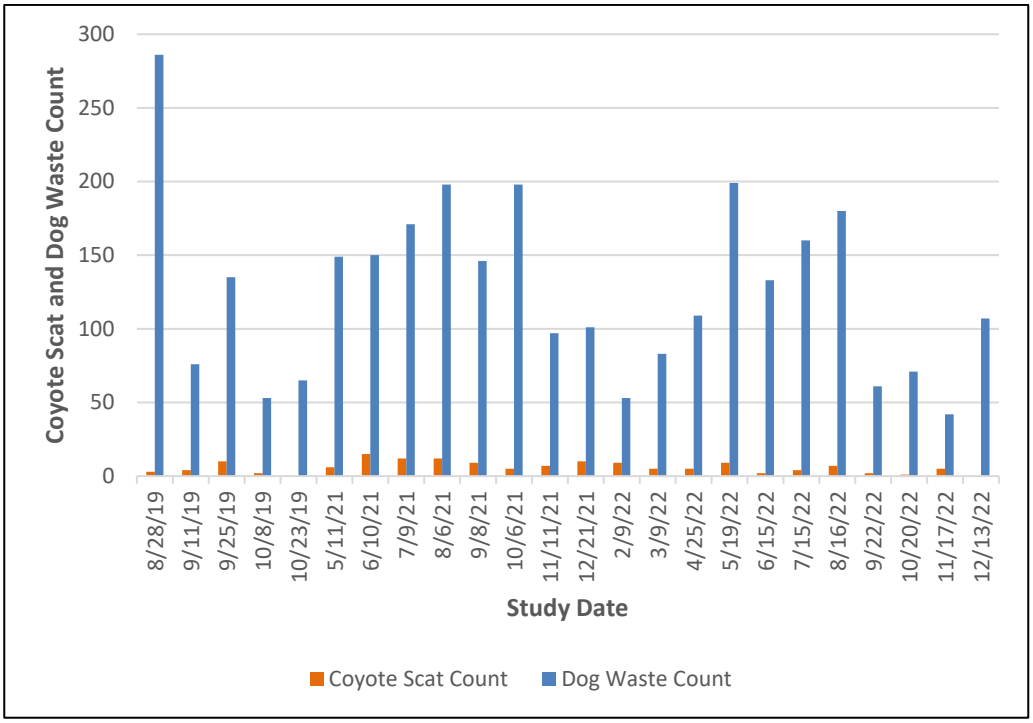
TABLE 3
VILLAGE H DOG WASTE STUDY RESULTS

Date	Pounds of Dog Waste	Dog Waste Count	Coyote Scat Count	Tennis Ball Count
8/28/2019	16	286	3	1
9/11/2019	6	76	4	25
9/25/2019	10	135	10	14
10/8/2019	4	53	2	3
10/23/2019	3	65	0	3
5/11/2021	10	149	6	2
6/10/2021	10	150	15	7
7/9/2021	12	171	12	5
8/6/2021	8	198	12	2
9/8/2021	9	146	9	1
10/6/2021	17	198	5	4
11/11/2021	7	97	7	0
12/21/2021	11	101	10	3
2/9/2022	3	53	9	4
3/9/2022	4	83	5	0
4/25/2022	6	109	5	0
5/19/2022	13	199	9	3
6/15/2022	6	133	2	1
7/15/2022	10	160	4	1
8/16/2022	11	180	7	0
9/22/2022	4	61	2	1
10/20/2022	4	71	1	1
11/17/2022	5	42	5	1
12/13/2022	12	107	0	2
Total	**201**	**3,023**	**144**	**81**

GRAPH 1
VILLAGE H DOG WASTE STUDY RESULTS



GRAPH 2
VILLAGE H DOG WASTE STUDY RESULTS: COYOTE SCAT VERSUS DOG WASTE



Discussion

Wildlife monitoring studies at Village H ran from June 28, 2019, to December 13, 2022, for a total of 1,265 days. Using a subset of the data, previous memorandums summarized wildlife monitoring results related to specific changes in public use – trail opening to the public in August 2019 and trail closure from March 23, 2020, to May 4, 2020, during the COVID-19 pandemic (ESA 2019, 2020). Relevant results from these memorandums are referenced below to provide a holistic discussion on wildlife presence and movement patterns at Village H. Results from the three wildlife monitoring studies provide a baseline for the types of wildlife and their movement patterns at Village H.

Remote Wildlife Cameras

Remote wildlife cameras were installed to identify wildlife species utilizing Village H and general movement patterns, such as frequently used pathways and time of usage. Previous memorandums concluded that wildlife detections decreased after Village H reopened to the public and also during the 30-day trail closure during the COVID-19 pandemic (ESA 2019, 2020), suggesting that wildlife species', particularly mammals, use of Village H was negatively impacted by public use. The detection times for all wildlife species, other than birds, were predominantly at night (see individual camera graphs provided in Attachment A), suggesting that wildlife species movement patterns may be responding to increased daytime preserve use by humans and associated on-leash dogs. This result was further supported by the fact that detections for all wildlife species at Camera 18 (located on the Village H trail) shifted from both daytime and nighttime prior to the trail closure to predominantly daytime during the trail closure due to reduced human and domestic dog use during the COVID-19 pandemic and stay-at-home order (ESA 2020). This finding is consistent with the 2018 Gaynor et al. global meta-analysis that concluded humans have a strong effect on the daily patterns of wildlife activity by influencing animals to become more nocturnal to avoid human activity (Gaynor et al. 2018). Note that wildlife movement studies were not conducted prior to city ownership; therefore, these results cannot be compared to previous conditions onsite before the trail was established. However, the site had been heavily used by people and off-leash dogs prior to city ownership.

Wildlife cameras also confirmed and provided additional local movement patterns within Village H (Figure 6). Coyotes were the most common wildlife species detected and were documented traveling into and out of the Village H property under the wrought-iron gate on the northern boundary of the site adjacent to Carlsbad Village Drive, close to Victoria Avenue. East-west movement between pinchpoints M1-1 and M1-3, through the two east-west movement pathways on Figure 6, seems to be well established based on camera data. Bobcats and smaller mammals (mainly skunks) were documented using the undercrossing at pinchpoint M1-2. Coyotes, bobcats, and smaller mammals (mainly raccoons, opossums, and skunks) were documented using the brow ditch between the chain-link fencing associated with the RV storage area and Carlsbad Municipal Water District (CMWD) property. This movement pathway is likely the main pathway wildlife are using to move between the two HMP hardline preserve areas. Very little wildlife was captured at the M1-4 pinchpoint located at the southern end of the off-site preserve.

Roadkill Monitoring

Tamarack Avenue and Carlsbad Village Drive are high-use vehicular roads. Tamarack is a four-lane road with a speed limit of 35 miles per hour and Carlsbad Village Drive is a four-lane road with a speed limit of 40 miles per hour; therefore, these roads are expected to be a barrier for wildlife movement through direct mortality from

vehicle collisions. Roadkill monitoring was conducted along portions of Tamarack Avenue, Carlsbad Village Drive, and Glasgow Avenue that border Village H to determine if these areas were a pinchpoint for medium to large mammal species, as these species demonstrate longer-range wildlife movement patterns and are likely more threatened by habitat fragmentation from roads (Ng et al. 2004). All roadkill observations detected during the roadkill monitoring period were small mammals or birds, suggesting that medium to large mammal species, such as coyote, may be able to cross pinchpoint M1-1 across Carlsbad Village Drive at street level relatively successfully, as documented on remote wildlife cameras.

Dog Waste Studies

As the study area was historically used by local residents and off-leash dogs, dog waste studies were initiated to gather data on how reopening Village H to the public impacted on-the-ground conditions in the form of dog waste left along trails and within adjacent open space areas. Once the city trail was opened to the public, a dog waste station was installed and on-leash dogs were allowed only on the authorized trail within Village H. A significant amount of dog waste has been picked up during the entire study period, suggesting that many dog owners using Village H are not picking up after their dogs. Most dog waste was documented either on or within 3 feet of the city trail, suggesting that, in general, dogs are likely leashed and not entering the adjacent open space and HMP hardline preserve areas. An exception to this is the grassy area just south of Carlsbad Village Drive, between the trailhead and residences to the east. A high number of dog waste piles were consistently observed between the city trail and residences to the east, and numerous tennis balls (i.e., dog toys) were found in the western half of the same grassy area by the trailhead, indicating that unauthorized off-leash dogs are still an issue on-site and a threat to the adjacent coastal sage scrub habitat. If the total number of dog waste detections is used as a proxy for public usage, these results suggest that public use within Village H varies across months, assuming dog owners who do not pick up dog waste never pick up dog waste. Higher amounts of dog waste were present during the summer months (June, July, and August) versus lower amounts of dog waste collected during the fall months (September, October, and November). There is a general decline in dog waste since the first collection date which included all previously uncollected dog waste from the site. It should be noted that some dog waste might remain on-site as it is likely covered by the dense layer of leaf litter in addition to older waste that has likely degraded, and these exceptions are not represented in the results.

ESA and volunteers continue to conduct dog waste studies within the study area, with the next survey date planned for February 28, 2023.

Recommendations

Based on the trends detected from the results presented above, we recommend the following:

- Install additional dog waste stations: Dog waste continues to be detected during monthly dog waste studies. Installing additional dog waste stations along the city trail could increase accessibility for dog owners and may help decrease the overall amount of dog waste present on Village H.
- Install additional signage: Installing signage at the start of the city trail stating allowed public uses, signage reminding dog owners to pick up after their dogs, and signage along the boundary of the adjacent open space and HMP hardline preserve areas could help deter dog owners from allowing their dogs to be off-leash, encourage them to pick up after their dogs, and define areas that are off-limits to the general public and their pets, respectively.

- Maintain wildlife movement corridors: Wildlife camera data confirmed wildlife movement patterns on Village H. These movement corridors should be maintained to ensure wildlife can continue to enter, utilize, and leave the site effectively.
- Increase public engagement: Engaging the public and educating them on the HMP preserve system, Village H, and the wildlife that use it may help spread awareness of why and how to properly dispose of dog waste in an effort to promote accountability and stewardship of Village H.

References

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iNaturalist. 2022. California Roadkill Observation System (CROS). Available from: https://www.inaturalist.org/projects/california-state-roadkill

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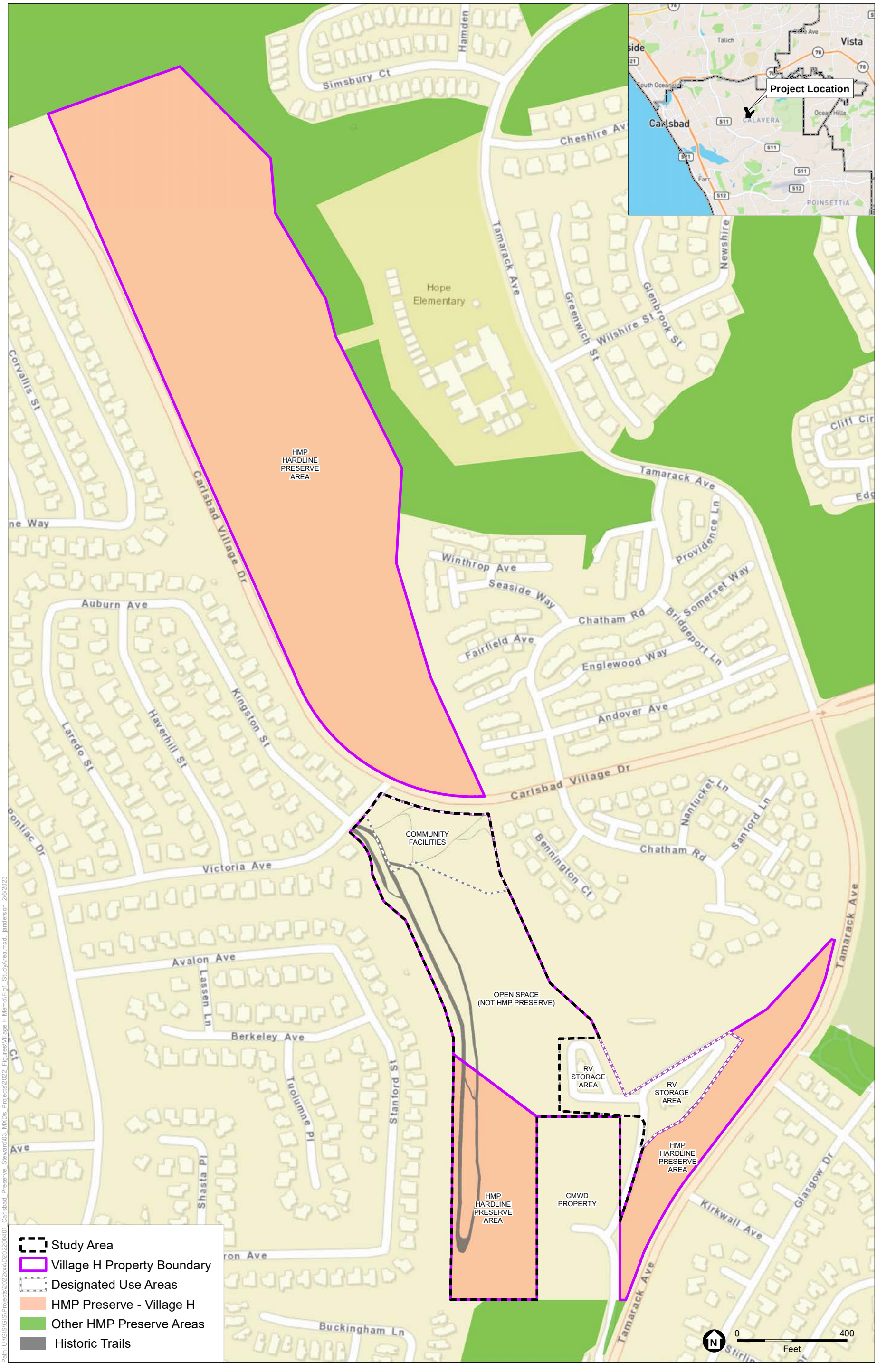
Figures

Figure 1 – Study Area Location
Figure 2 – Carlsbad HMP Linkages
Figure 3 – Pinchpoints and Potential Wildlife Movement Corridors
Figure 4 – Remote Wildlife Camera Locations
Figure 5 – Roadkill Monitoring Results
Figure 6 – Updated Wildlife Movement Corridors
Figure 7 – Dog Waste Study Results

Attachments

A – Village H Remote Wildlife Camera Full Results
B – Village H Roadkill Survey Dates and Results
C – Village H Representative Photographs of Wildlife Detected on Remote Wildlife Cameras
D – Village H Dog Waste Studies Representative Photographs



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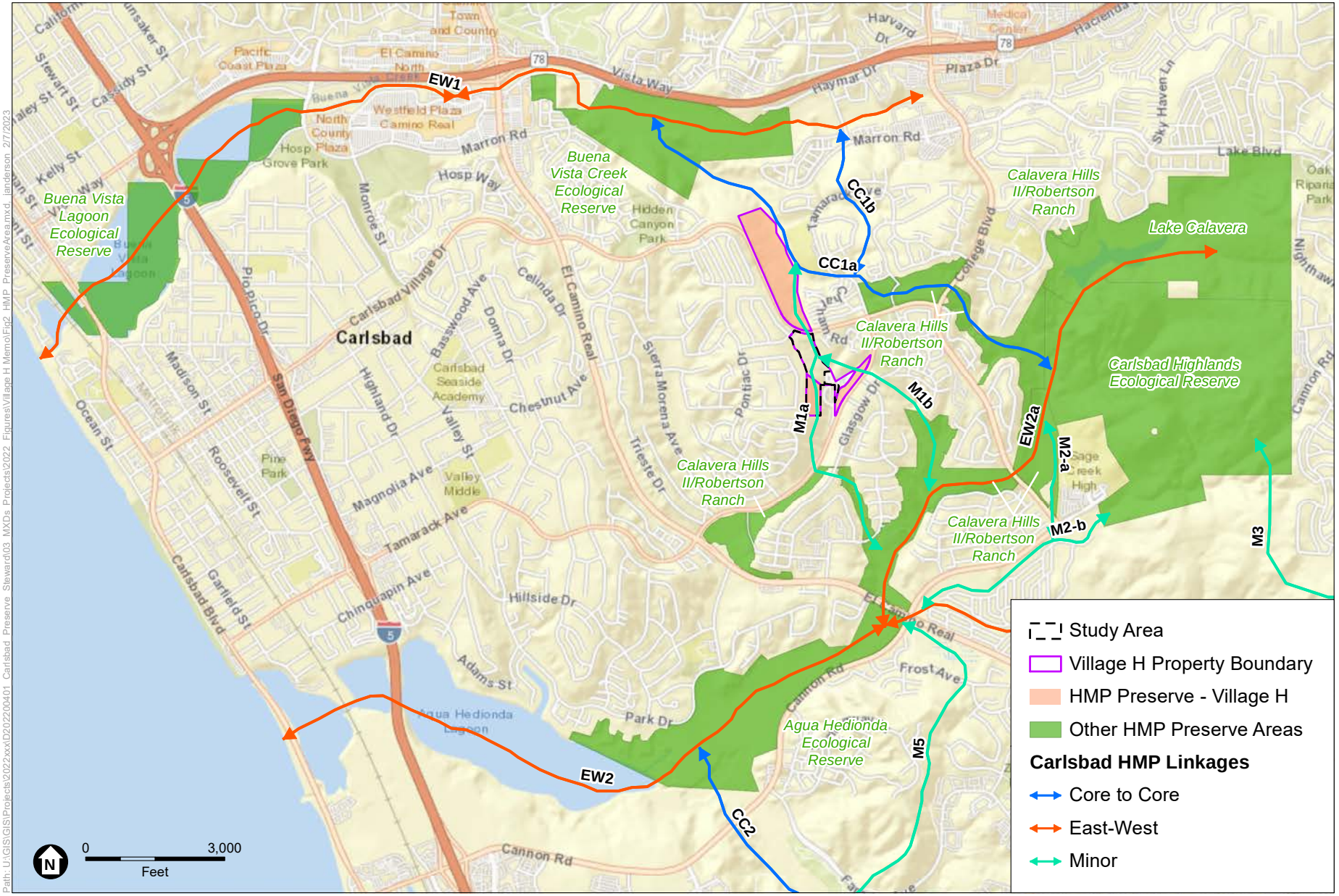
SOURCE: ESRI

City of Carlsbad Village H Wildlife Movement Study Summary

Figure 1
Study Area Location

ESA

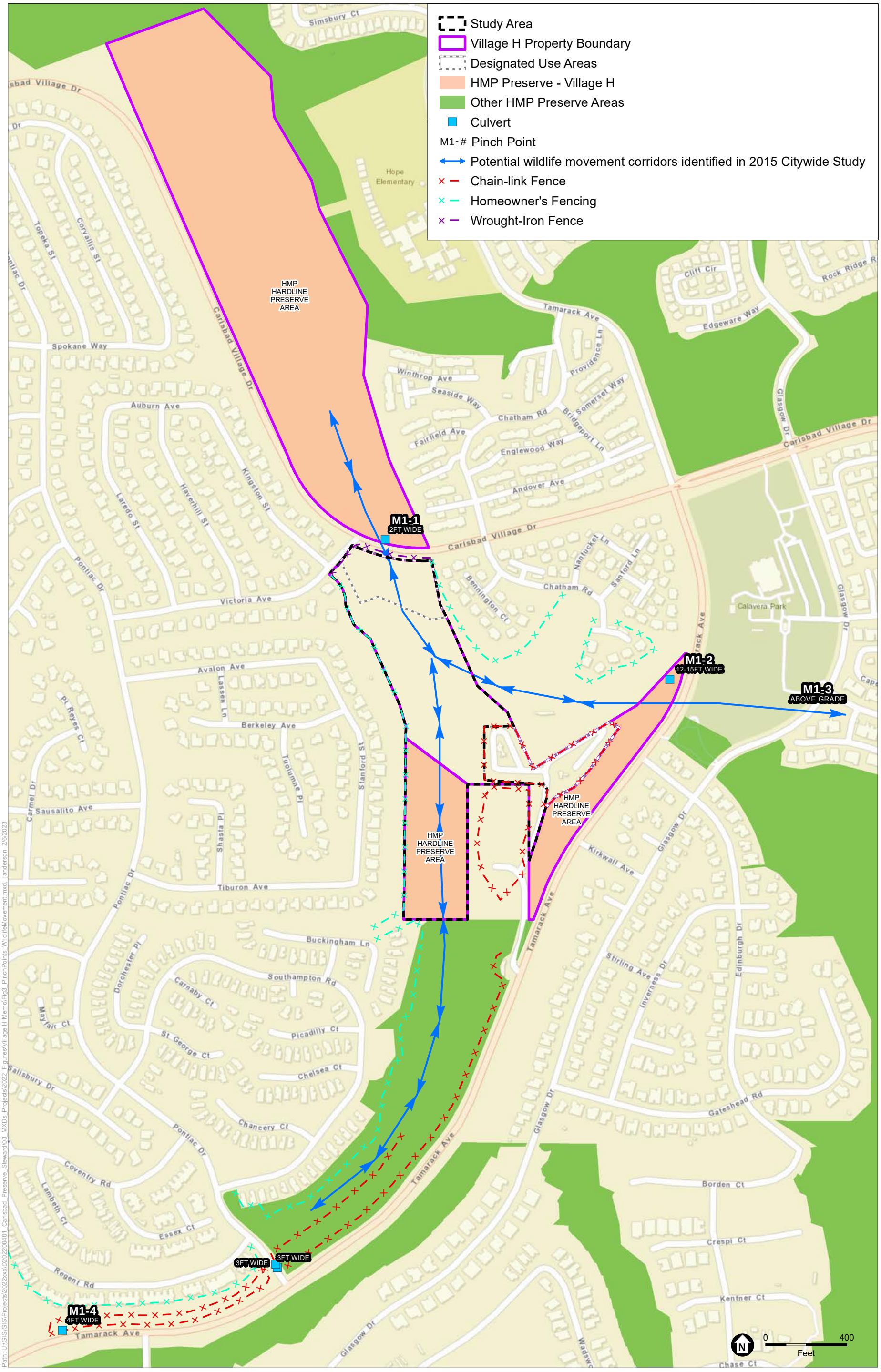


SOURCE: ESRI; City of Carlsbad, Environmental Science Associates and Center for Natural Lands Management. 2015.

City of Carlsbad Village H Wildlife Movement Study Summary

Figure 2
Carlsbad HMP Linkages

ESA

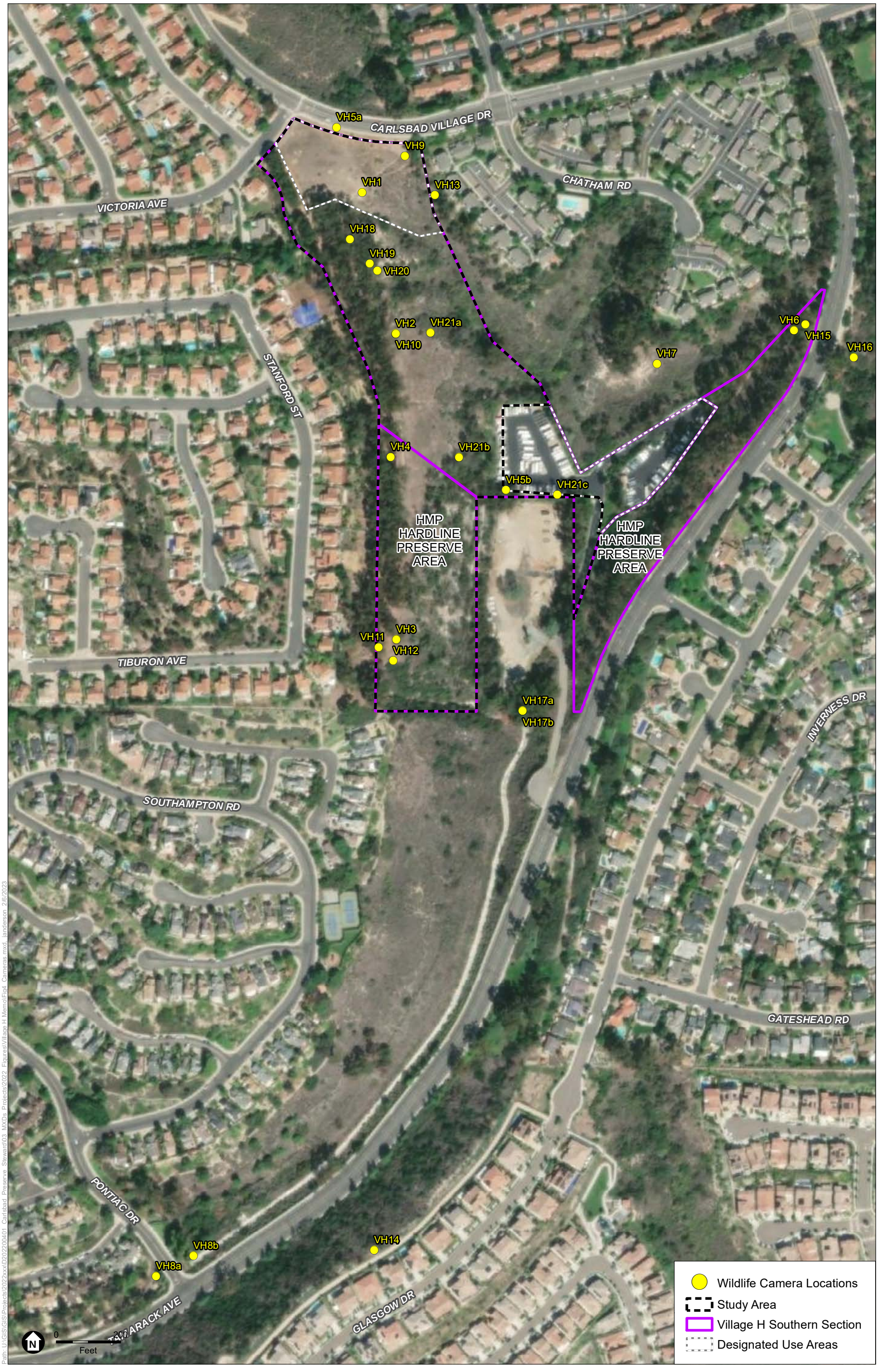


SOURCE: ESRI; City of Carlsbad, Environmental Science Associates and Center for Natural Lands Management. 2015.

City of Carlsbad Village H Wildlife Movement Study Summary

Figure 3
Pinchpoints and Potential Wildlife Movement Corridors

ESA



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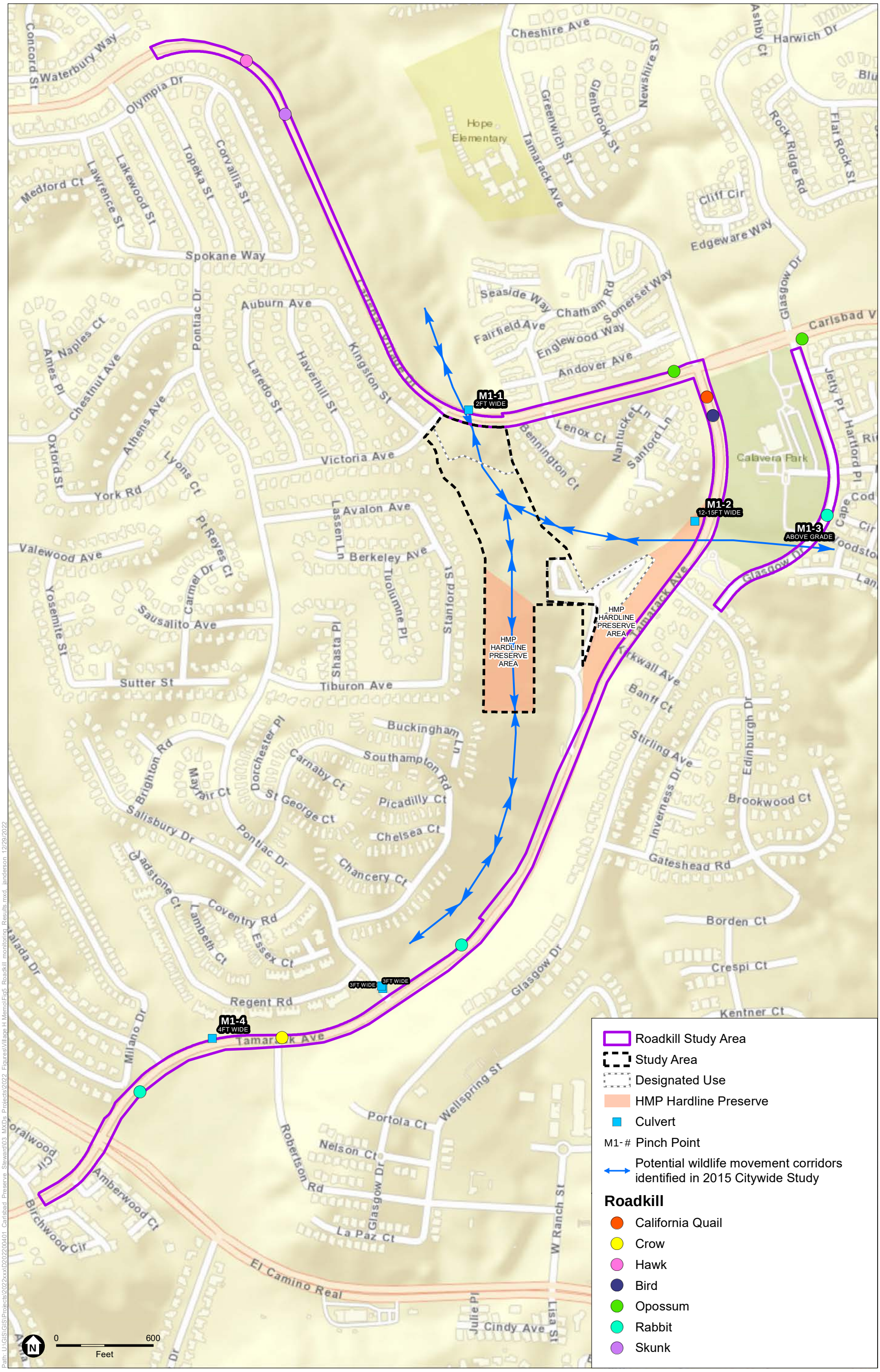
SOURCE: ESRI

City of Carlsbad Village H Wildlife Movement Study Summary

Figure 4
Remote Wildlife Camera Locations

ESA



SOURCE: ESRI; City of Carlsbad, Environmental Science Associates and Center for Natural Lands Management. 2015.

City of Carlsbad Village H Wildlife Movement Study Summary

Figure 5
Roadkill Monitoring Results

ESA

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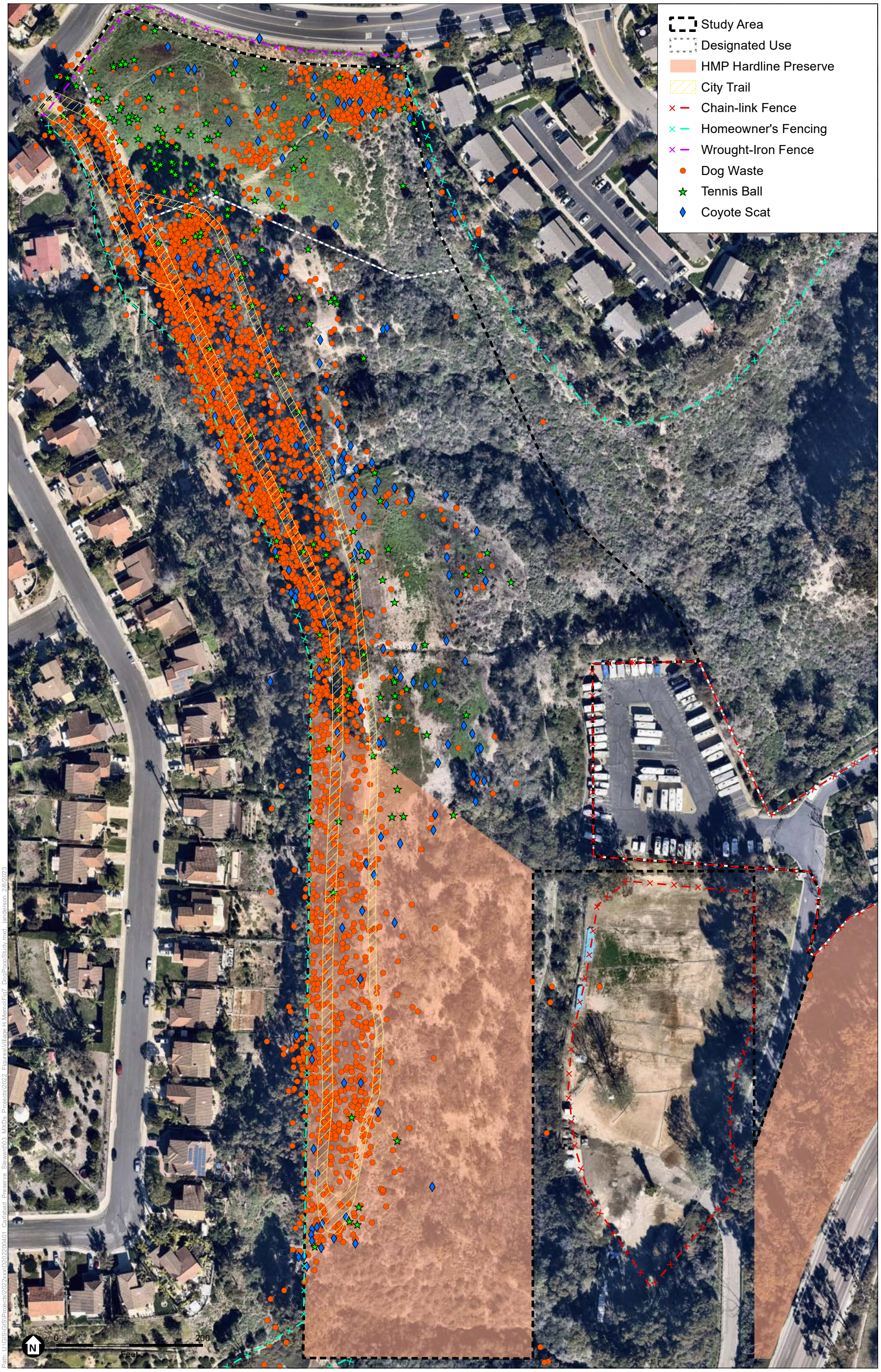
SOURCE: ESRI; City of Carlsbad, Environmental Science Associates and Center for Natural Lands Management. 2015.

City of Carlsbad Village H Wildlife Movement Study Summary

Figure 6
Updated Wildlife Movement Corridors

ESA



SOURCE: ESRI; City of Carlsbad

City of Carlsbad Village H Wildlife Movement Study Summary

Figure 7
Dog Waste Study Results

ESA

Attachment A

Village H Remote Wildlife Camera Full Results

TABLE 1
VILLAGE H REMOTE WILDLIFE CAMERA DETECTIONS – FULL RESULTS FROM JUNE 25, 2019, THROUGH NOVEMBER 17, 2022
(NUMBER OF INDIVIDUALS DETECTED)

Wildlife Camera Location		Coyote		Bobcat		Skunk		Rodents, Rabbits, Raccoons		Bird		Off-leash Dog		On-leash Dog		Human	
Time Period[1]	Number of Days Active	D	N	D	N	D	N	D	N	D	N	D	N	D	N	D	N
VH1	136	64	281	1	12	0	11	16	5	28	6	407	10	26	0	286	4
VH2[2]	42	1	23	0	0	0	0	5	8	0	0	72	4	31	2	149	4
VH3[2]	44	2	4	0	0	0	0	0	0	1	1	264	1	127	4	634	6
VH4[2]	11	0	1	0	0	0	0	0	0	0	0	105	6	84	3	283	9
VH5a	177	0	2	0	0	0	0	0	2	0	1	0	0	0	0	1	0
VH5b	505	8	101	4	26	0	3	0	9	6	1	0	0	0	0	0	0
VH6[3]	99	7	0	1	9	0	7	7	4	3	1	0	0	0	0	1	0
VH7	174	16	141	3	8	0	16	0	5	2	0	0	0	0	0	1	0
VH8a	136	0	0	0	0	0	0	0	0	0	0	0	1	0	0	8	3
VH8b	62	4	20	6	22	0	4	4	103	14	0	2	1	1	0	166	60
VH9[4]	106	8	76	1	13	0	2	4	7	1	0	160	0	6	0	104	0
VH10[2,4]	14	0	1	0	0	0	0	0	0	1	0	2	0	0	0	5	0
VH11[5]	5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
VH12[5]	5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
VH13[6]	98	4	141	2	21	0	7	5	17	22	0	210	5	1	0	75	1
VH14[3,6]	20	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0
VH15[7]	112	0	5	9	27	0	82	4	32	10	0	0	0	0	0	17	4
VH16[7]	112	0	1	11	38	2	122	17	66	10	0	1	0	2	0	0	0
VH17a	112	11	27	8	15	0	21	2	50	23	2	1	0	0	0	76	0
VH17b	538	37	55	12	40	0	1	62	26	116	1	1	0	0	0	1	0
VH18	49	12	43	0	0	0	0	0	0	0	1	579	32	619	27	1848	60
VH19	16	0	6	0	1	0	1	0	0	0	0	8	0	1	0	12	0
VH20[8]	49	7	13	0	0	0	0	1	6	5	0	85	2	6	0	90	2

TABLE 1
VILLAGE H REMOTE WILDLIFE CAMERA DETECTIONS – FULL RESULTS FROM JUNE 25, 2019, THROUGH NOVEMBER 17, 2022
(NUMBER OF INDIVIDUALS DETECTED)

Wildlife Camera Location		Coyote		Bobcat		Skunk		Rodents, Rabbits, Raccoons		Bird		Off-leash Dog		On-leash Dog		Human	
Time Period[1]	Number of Days Active	D	N	D	N	D	N	D	N	D	N	D	N	D	N	D	N
VH21a	34	2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
VH21b	181	15	172	2	9	0	0	0	1	17	1	0	0	0	0	2	0
VH21c	680	50	283	8	25	0	5	4	41	198	3	0	0	0	0	2	0
	Total	***248***	***1397***	***68***	***266***	***2***	***282***	***131***	***382***	***457***	***18***	***1899***	***62***	***904***	***36***	***3813***	***162***

NOTES:

[1] Time Period D: Day defined as when it is light out; not defined by time.
Time Period N: Night defined as when it is dark out; not defined by time.

[2] Cameras VH2, VH3, VH4, and VH10 were pulled from the ground on August 10, 2019, and were not reinstalled due to potential for additional vandalism. No video data was collected at these locations after August 10, 2019.

[3] Cameras VH6 and VH14 were pulled from the ground on October 2, 2019 and were not reinstalled due to potential for additional vandalism. No video data was collected this location after October 2, 2019.

[4] Cameras VH9 and VH10 were installed on July 25, 2019.

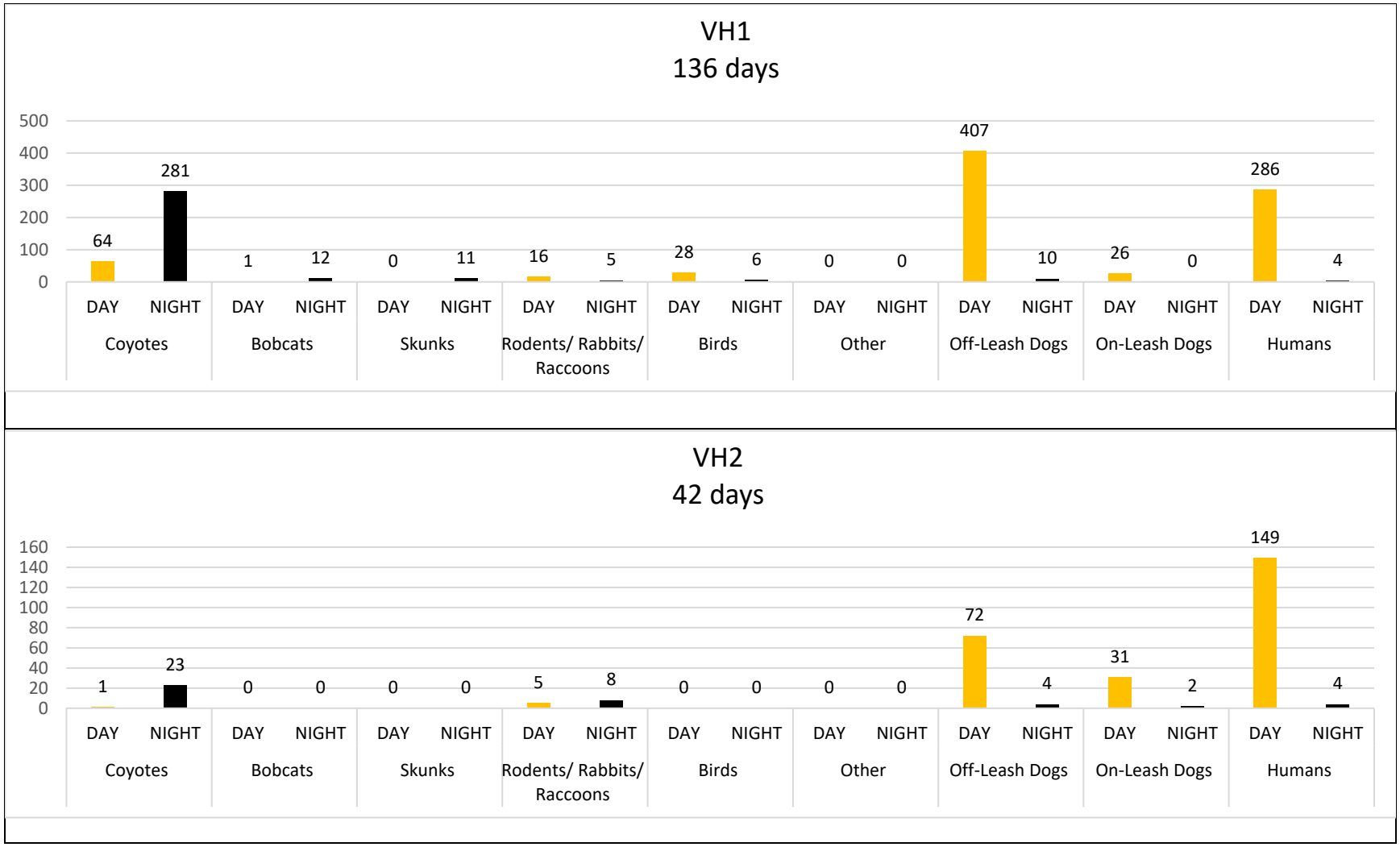
[5] Cameras VH11 and VH12 were installed on August 23, 2019, and were stolen a few days later. No video data was collected from this location after August 23, 2019.

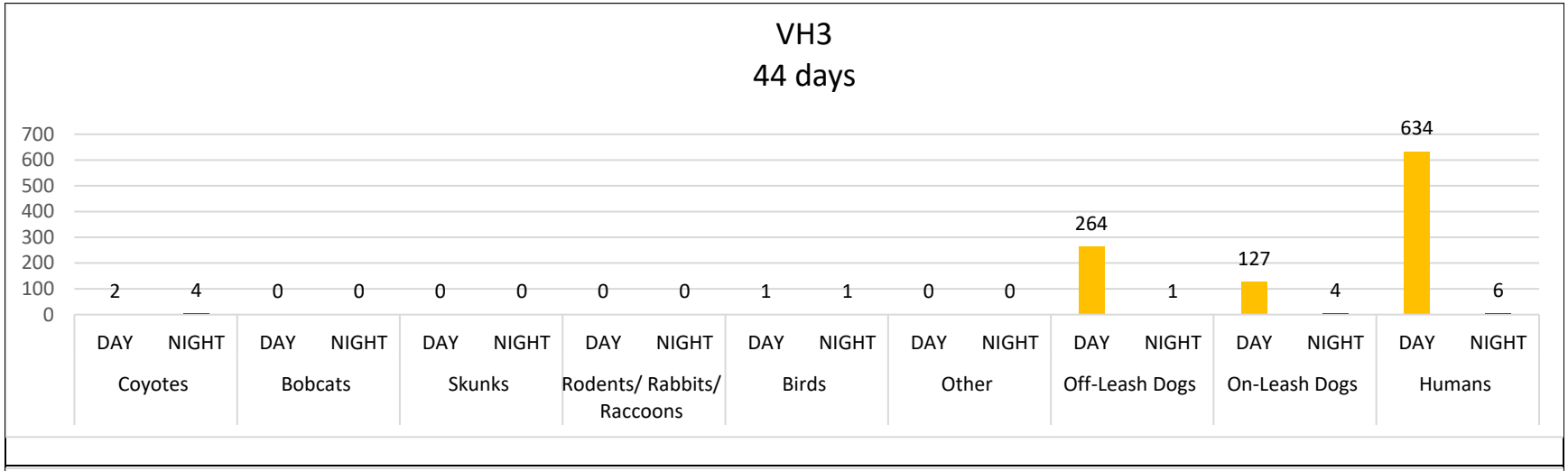
[6] Cameras VH13 and VH14 were installed on September 12, 2019.

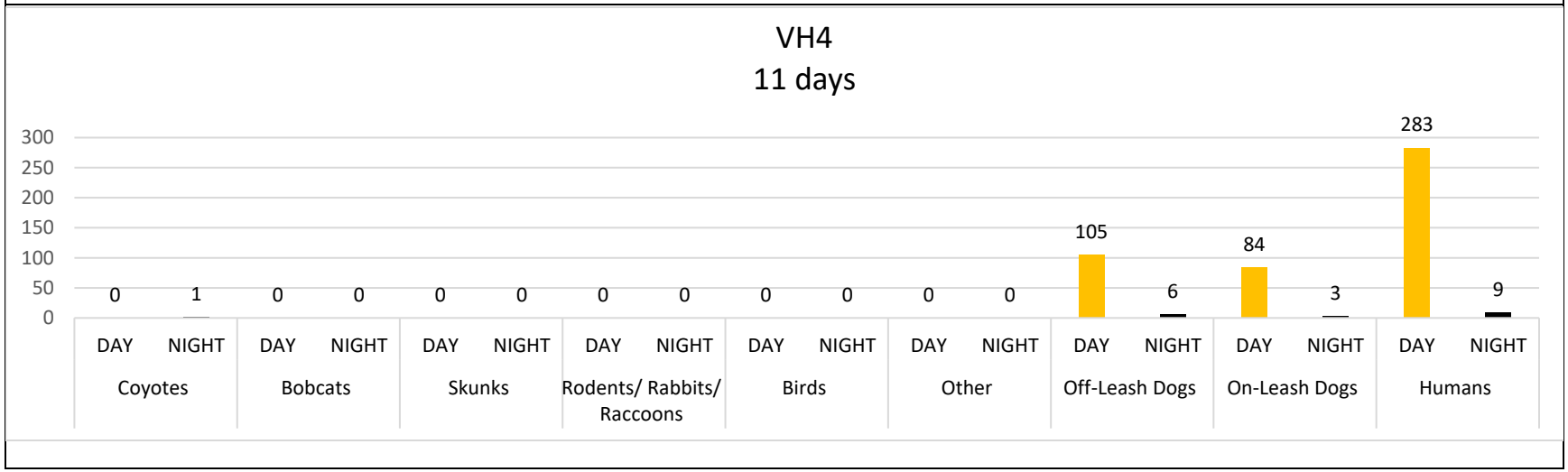
[7] Cameras VH15 and VH16 were installed on September 19, 2019.

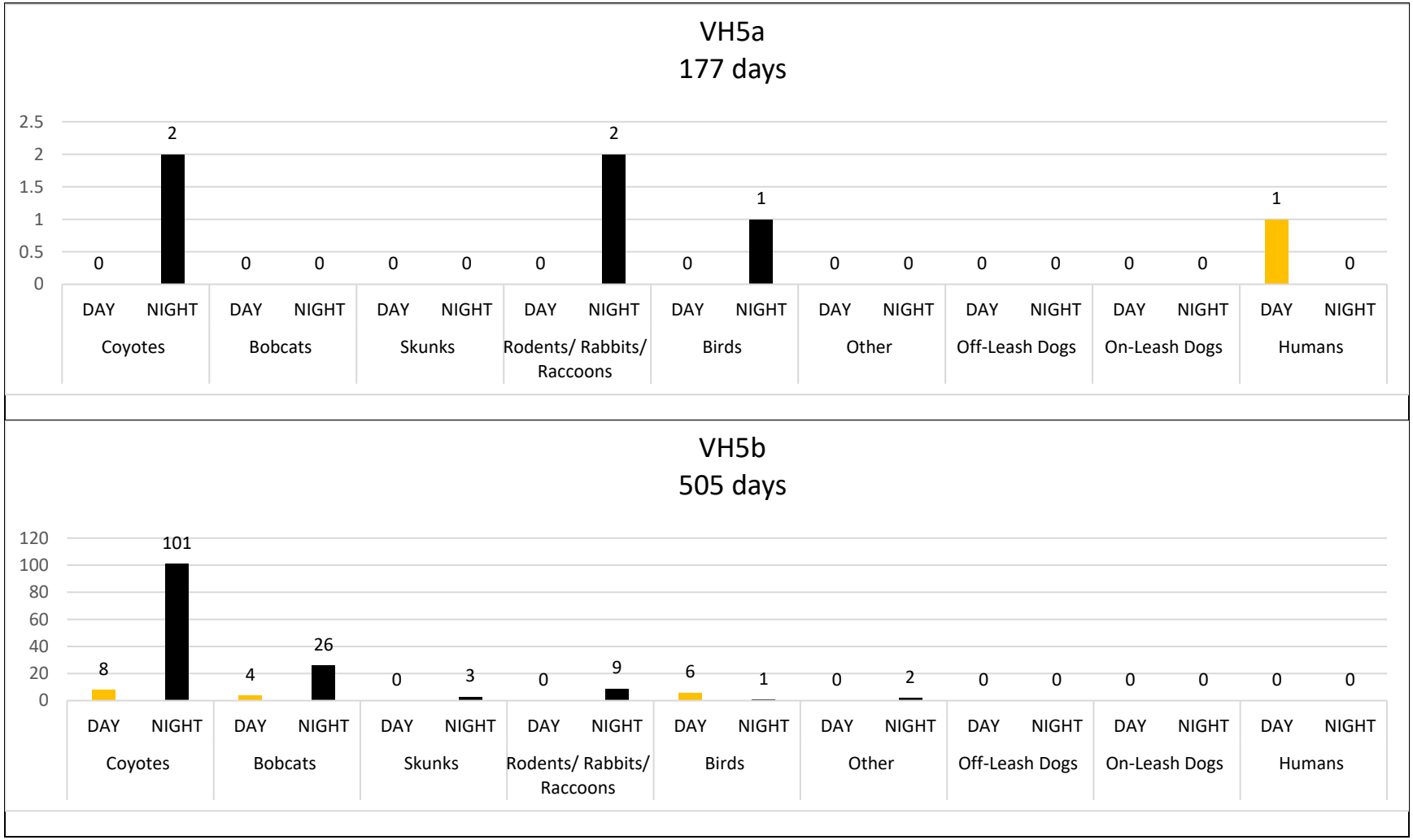
[8] Camera VH20 is a CNLM-installed and maintained camera. Data for this camera runs from July 3, 2019, to September 3, 2019.

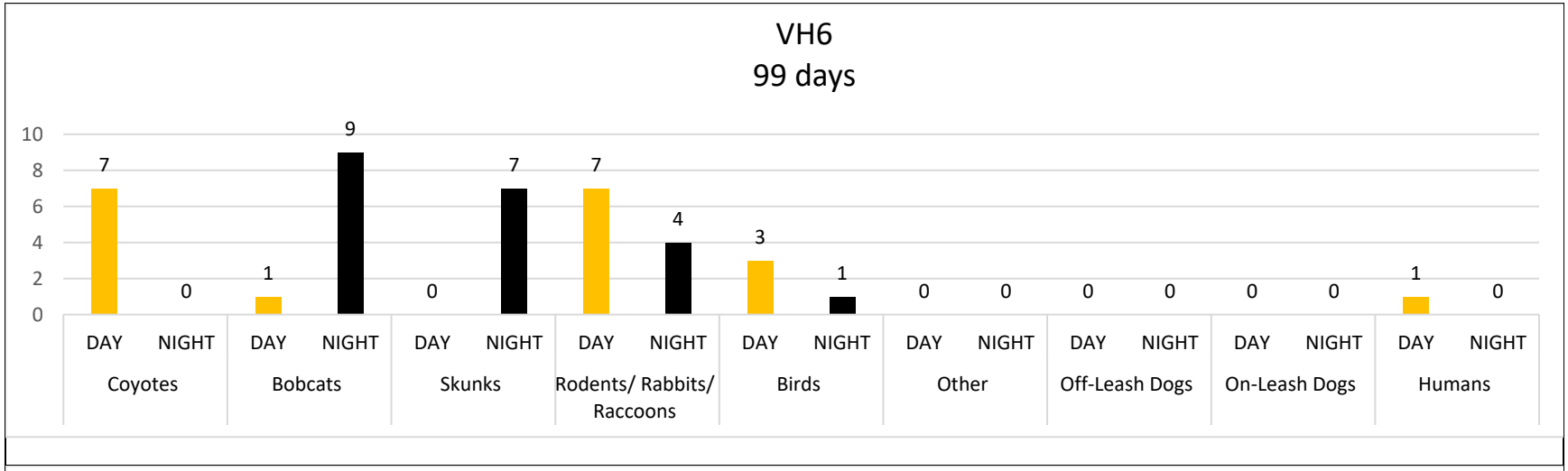
Village H Remote Wildlife Camera Detections – Relative Number of Wildlife, Humans, and Dogs at Selected Locations

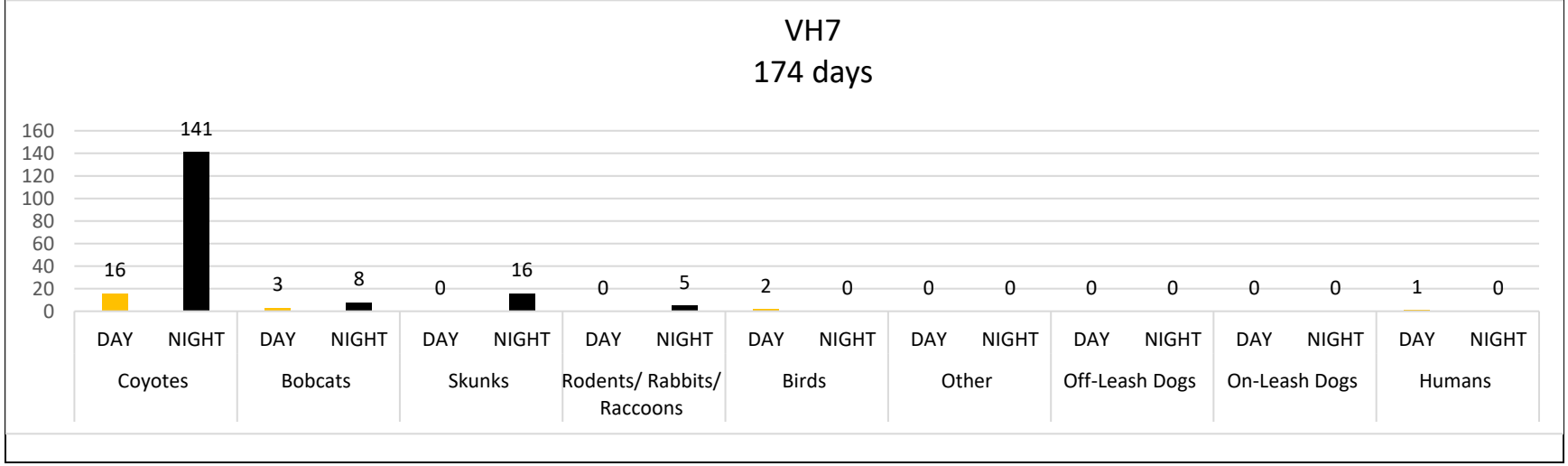


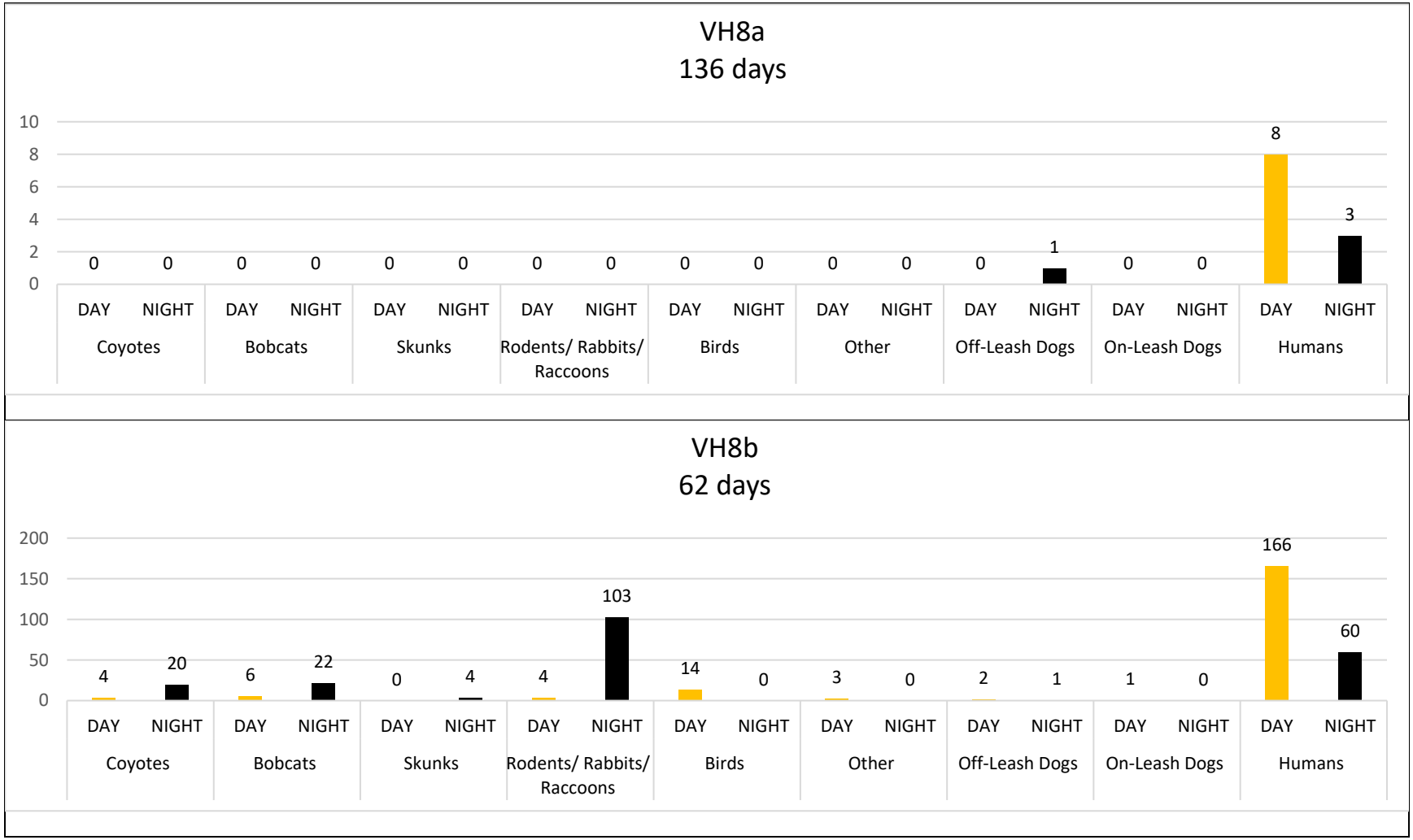

VH3
44 days
700
600
500
400
300
200
100
0
2
4
0
0
0
0
0
0
1
1
0
0
264
1
127
4
634
6
DAY
NIGHT
Coyotes
Bobcats
Skunks
Rodents/ Rabbits/ Raccoons
Birds
Other
Off-Leash Dogs
On-Leash Dogs
Humans

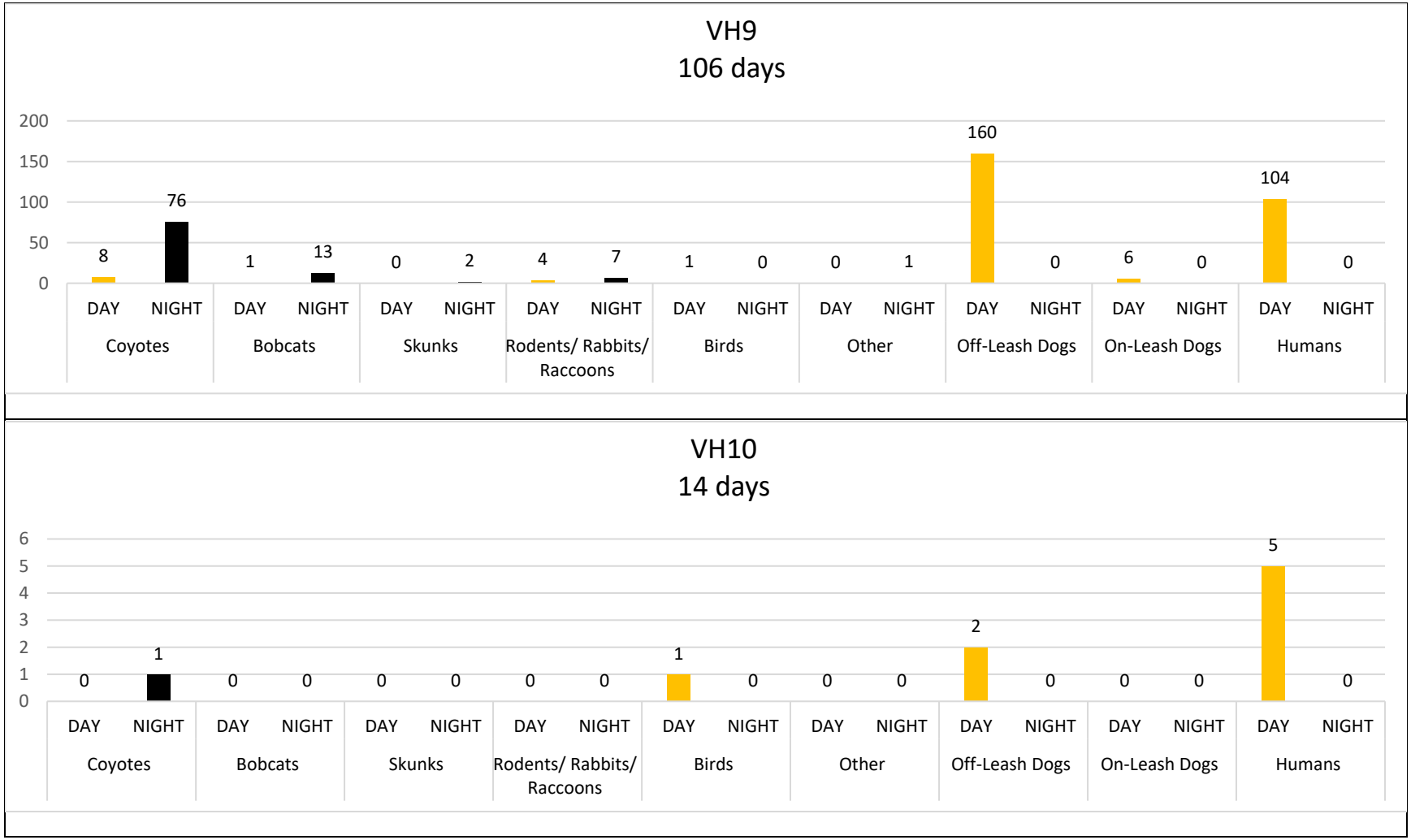

VH4
11 days
300
250
200
150
100
50
0
0
1
0
0
0
0
0
0
0
0
0
0
105
6
84
3
283
9
DAY
NIGHT
Coyotes
Bobcats
Skunks
Rodents/ Rabbits/ Raccoons
Birds
Other
Off-Leash Dogs
On-Leash Dogs
Humans

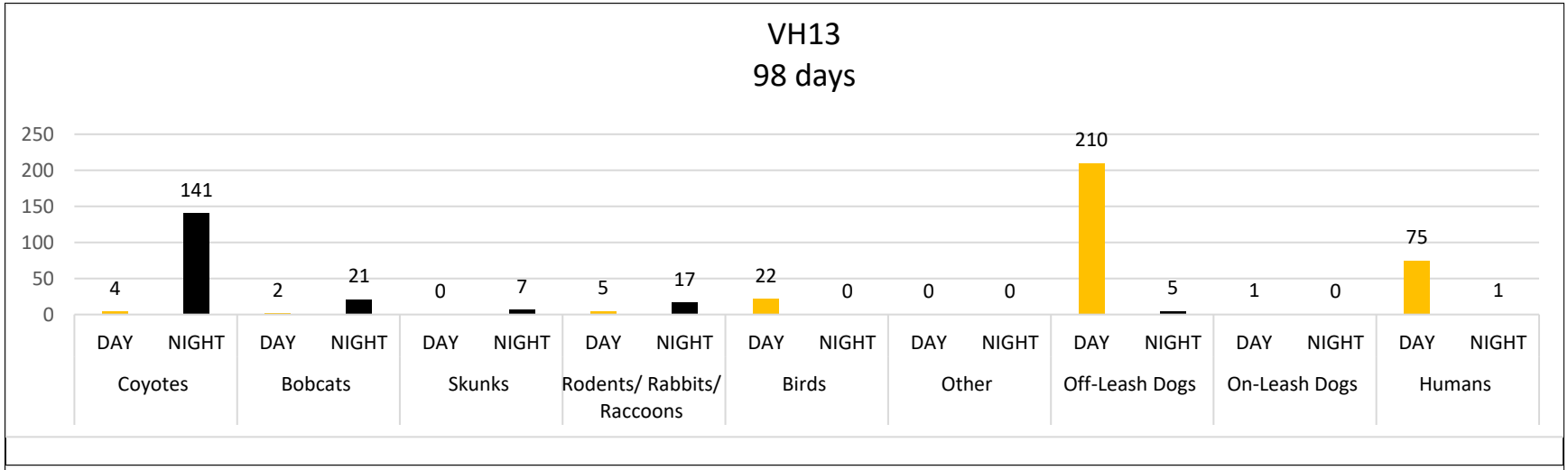

VH5a
177 days
2.5
2
1.5
1
0.5
0
0
2
0
0
0
0
0
2
0
1
0
0
0
0
0
0
1
0
DAY
NIGHT
Coyotes
Bobcats
Skunks
Rodents/ Rabbits/ Raccoons
Birds
Other
Off-Leash Dogs
On-Leash Dogs
Humans
VH5b
505 days
120
100
80
60
40
20
0
8
101
4
26
0
3
0
9
6
1
0
2
0
0
0
0
0
0
Coyotes
Bobcats
Skunks
Rodents/ Rabbits/ Raccoons
Birds
Other
Off-Leash Dogs
On-Leash Dogs
Humans

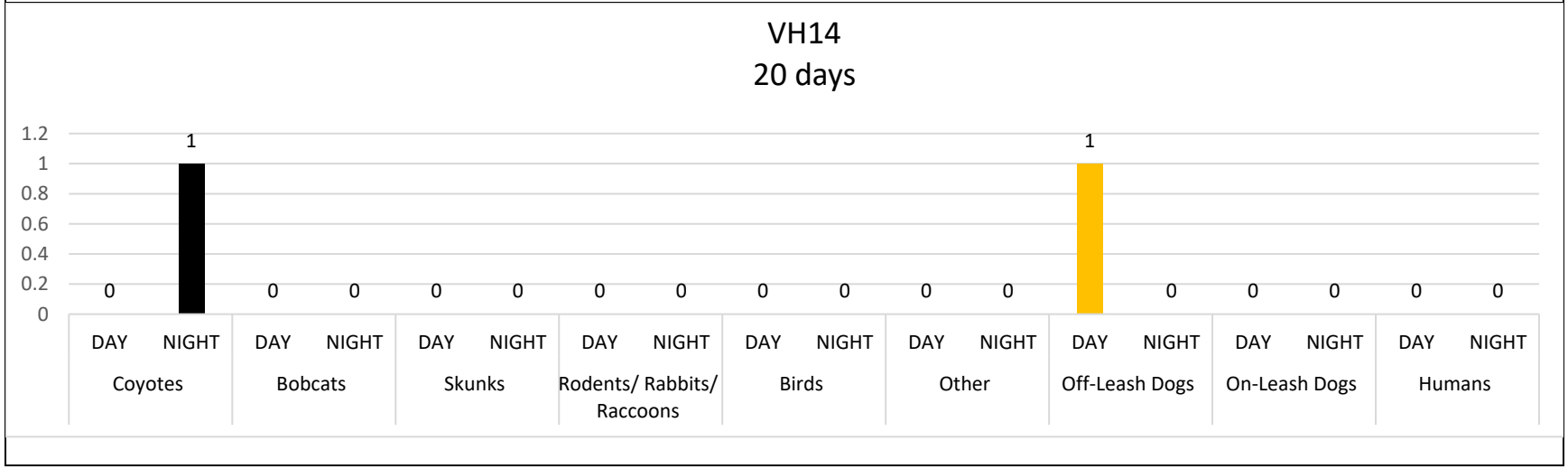

VH6
99 days
10
8
6
4
2
0
7
0
1
9
0
7
7
4
3
1
0
0
0
0
0
0
1
0
DAY
NIGHT
Coyotes
Bobcats
Skunks
Rodents/ Rabbits/ Raccoons
Birds
Other
Off-Leash Dogs
On-Leash Dogs
Humans

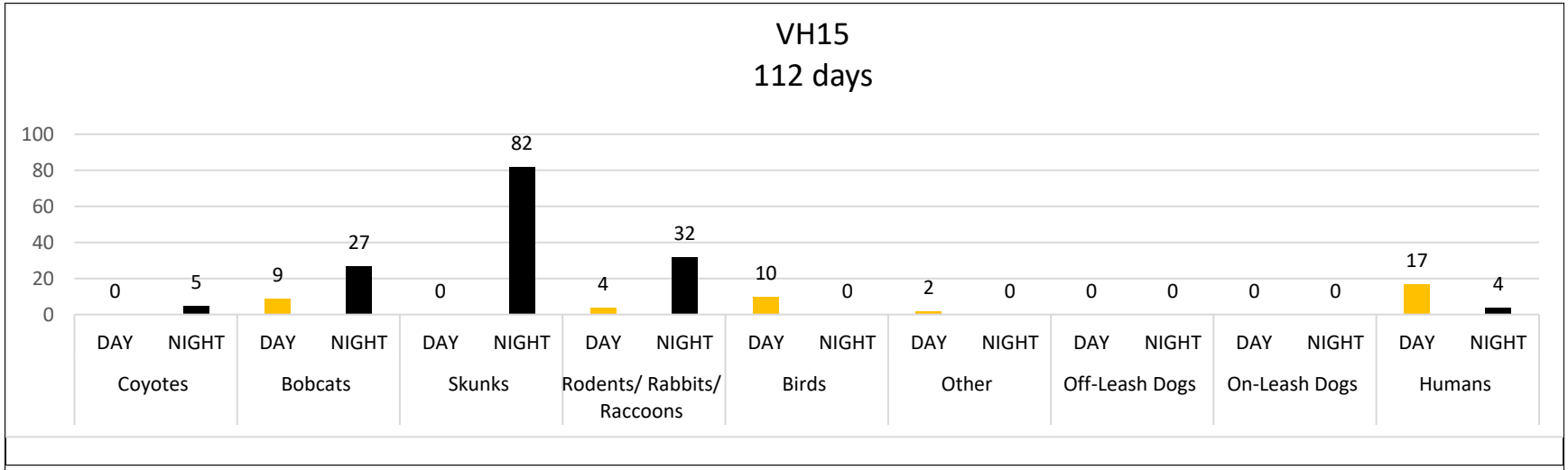

VH7
174 days
160
140
120
100
80
60
40
20
0
16
141
3
8
0
16
0
5
2
0
0
0
0
0
0
0
0
1
0
DAY
NIGHT
Coyotes
Bobcats
Skunks
Rodents/ Rabbits/ Raccoons
Birds
Other
Off-Leash Dogs
On-Leash Dogs
Humans

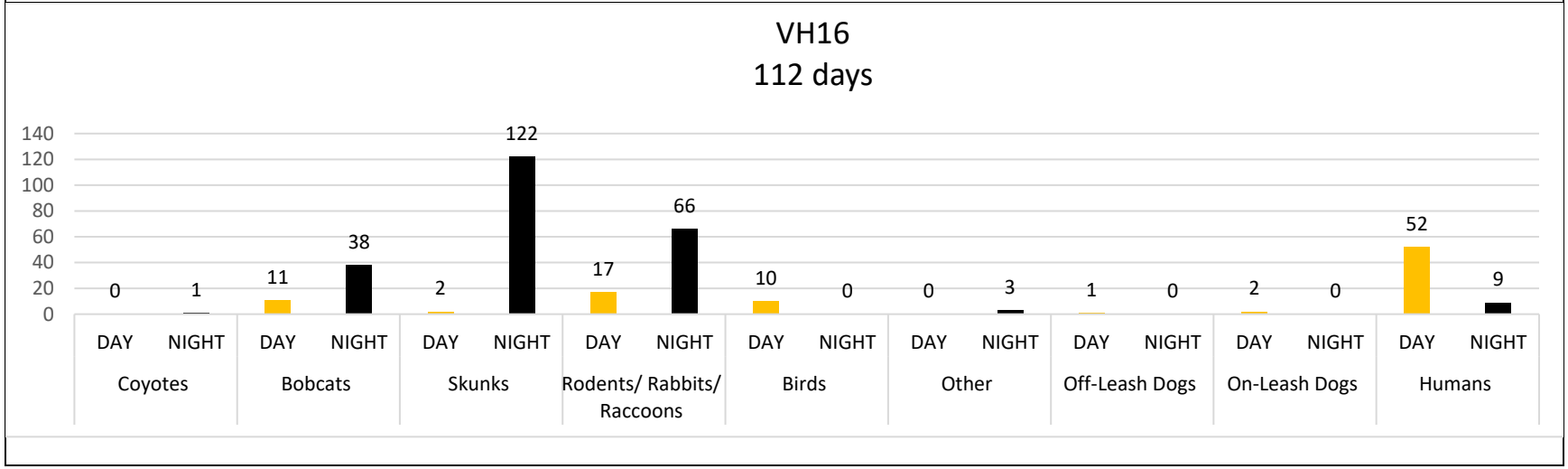

VH8a
136 days
10
8
6
4
2
0
0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 8 3
DAY NIGHT DAY NIGHT DAY NIGHT DAY NIGHT DAY NIGHT DAY NIGHT DAY NIGHT DAY NIGHT DAY NIGHT
Coyotes
Bobcats
Skunks
Rodents/ Rabbits/ Raccoons
Birds
Other
Off-Leash Dogs
On-Leash Dogs
Humans
VH8b
62 days
200
150
100
50
0
4 20 6 22 0 4 4 103 14 0 3 0 2 1 1 0 166 60
DAY NIGHT DAY NIGHT DAY NIGHT DAY NIGHT DAY NIGHT DAY NIGHT DAY NIGHT DAY NIGHT DAY NIGHT
Coyotes
Bobcats
Skunks
Rodents/ Rabbits/ Raccoons
Birds
Other
Off-Leash Dogs
On-Leash Dogs
Humans

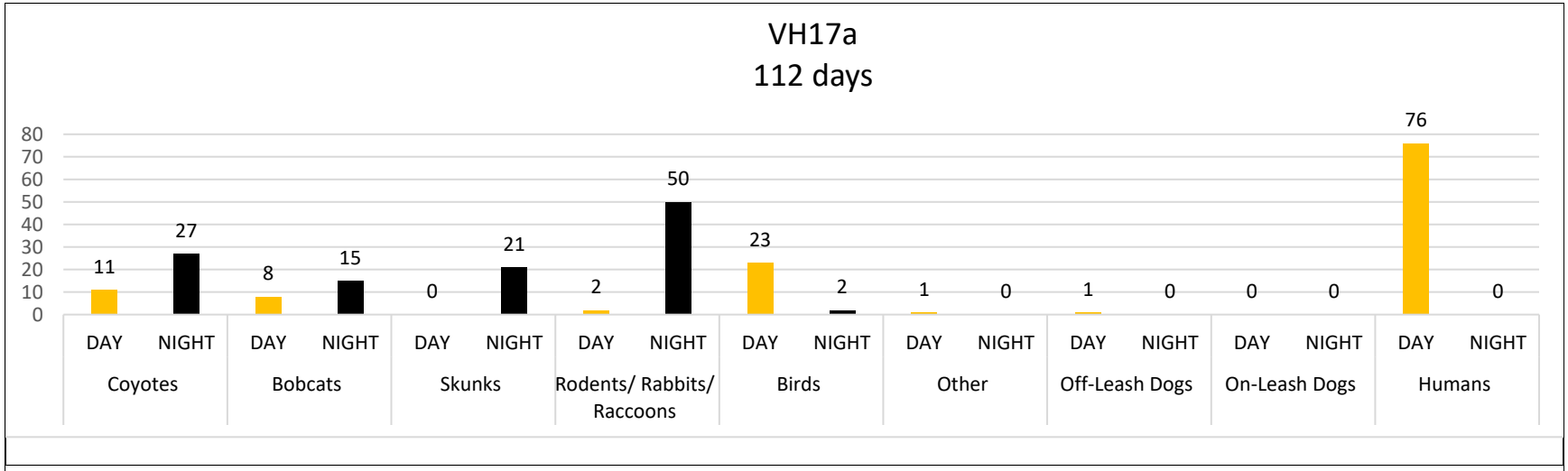

VH9
106 days
200
150
100
50
0
8
76
1
13
0
2
4
7
1
0
0
1
160
0
6
0
104
0
DAY
NIGHT
Coyotes
Bobcats
Skunks
Rodents/ Rabbits/ Raccoons
Birds
Other
Off-Leash Dogs
On-Leash Dogs
Humans
VH10
14 days
6
5
4
3
2
1
0
0
1
0
0
0
0
0
0
1
0
0
0
2
0
0
0
5
0

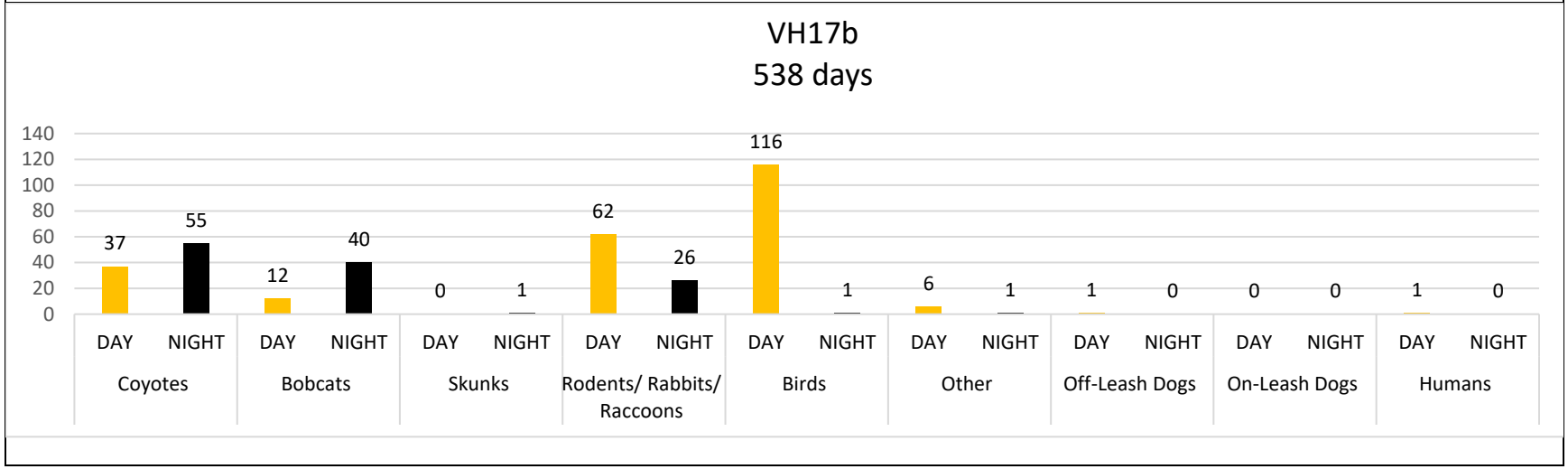

VH13
98 days
250
200
150
100
50
0
4
141
2
21
0
7
5
17
22
0
0
0
210
5
1
0
75
1
DAY NIGHT
Coyotes
Bobcats
Skunks
Rodents/ Rabbits/ Raccoons
Birds
Other
Off-Leash Dogs
On-Leash Dogs
Humans

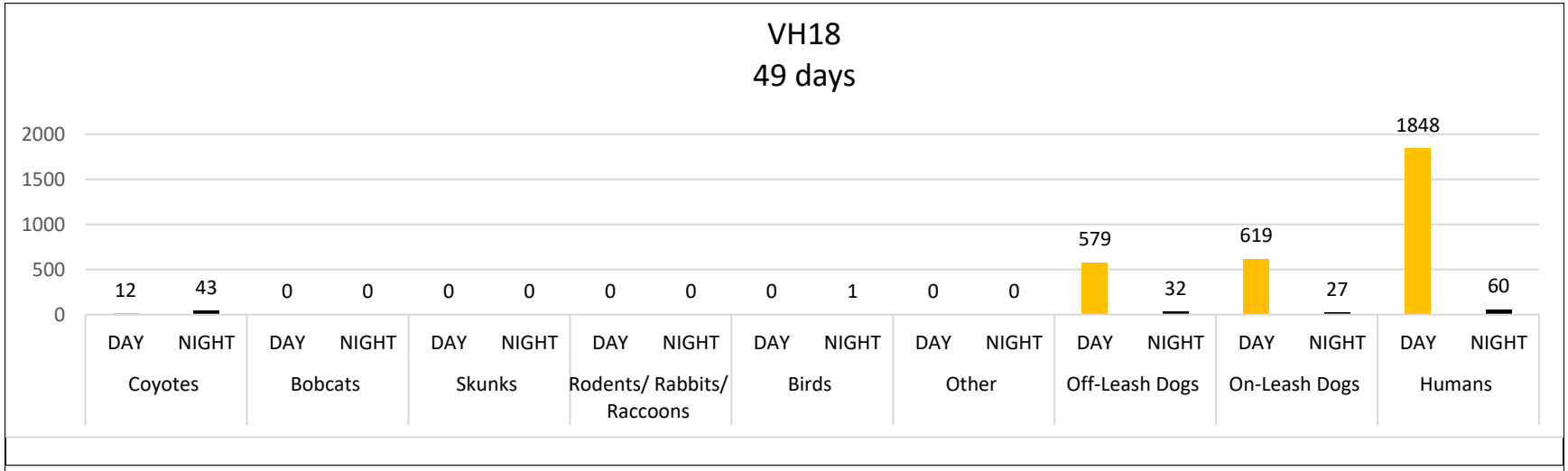

VH14
20 days
1.2
1
0.8
0.6
0.4
0.2
0
0
1
0
0
0
0
0
0
0
0
0
0
1
0
0
0
0
0
DAY NIGHT
Coyotes
Bobcats
Skunks
Rodents/ Rabbits/ Raccoons
Birds
Other
Off-Leash Dogs
On-Leash Dogs
Humans

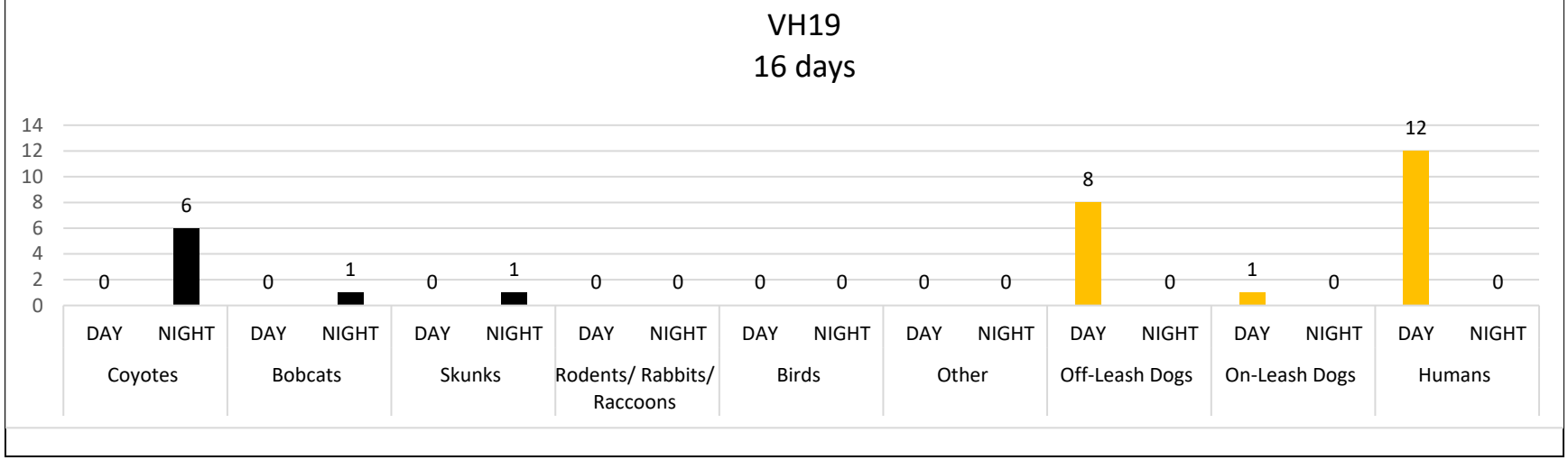

VH15
112 days
100
80
60
40
20
0
0
5
9
27
0
82
4
32
10
0
2
0
0
0
0
0
17
4
DAY
NIGHT
Coyotes
Bobcats
Skunks
Rodents/ Rabbits/ Raccoons
Birds
Other
Off-Leash Dogs
On-Leash Dogs
Humans

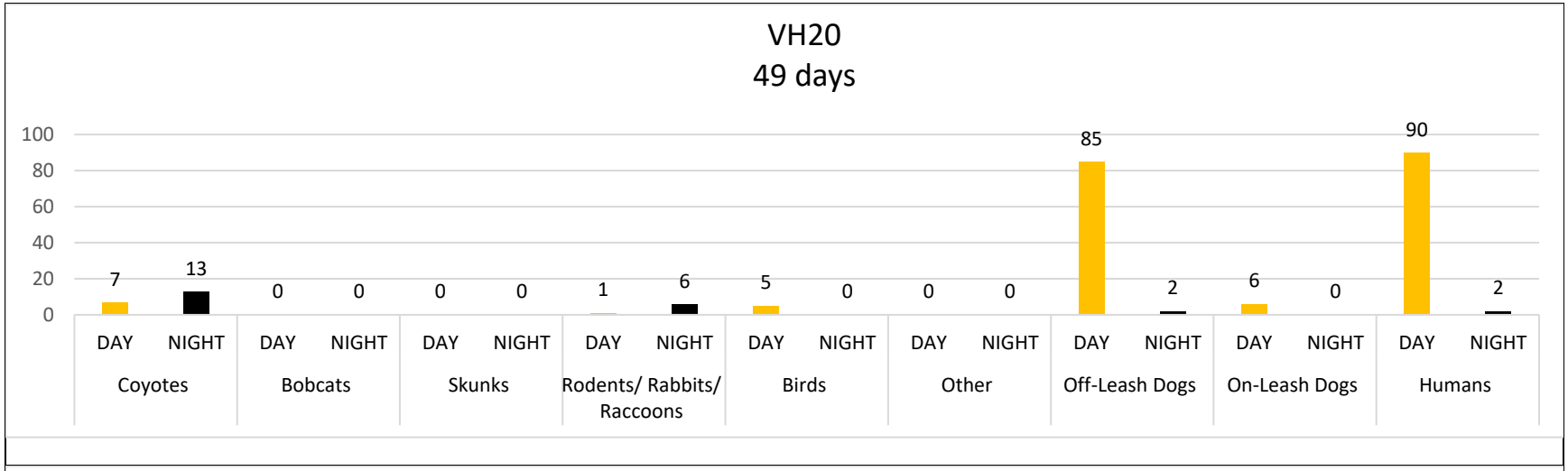

VH16
112 days
140
120
100
80
60
40
20
0
0
1
11
38
2
122
17
66
10
0
0
3
1
0
2
0
52
9
DAY
NIGHT
Coyotes
Bobcats
Skunks
Rodents/ Rabbits/ Raccoons
Birds
Other
Off-Leash Dogs
On-Leash Dogs
Humans

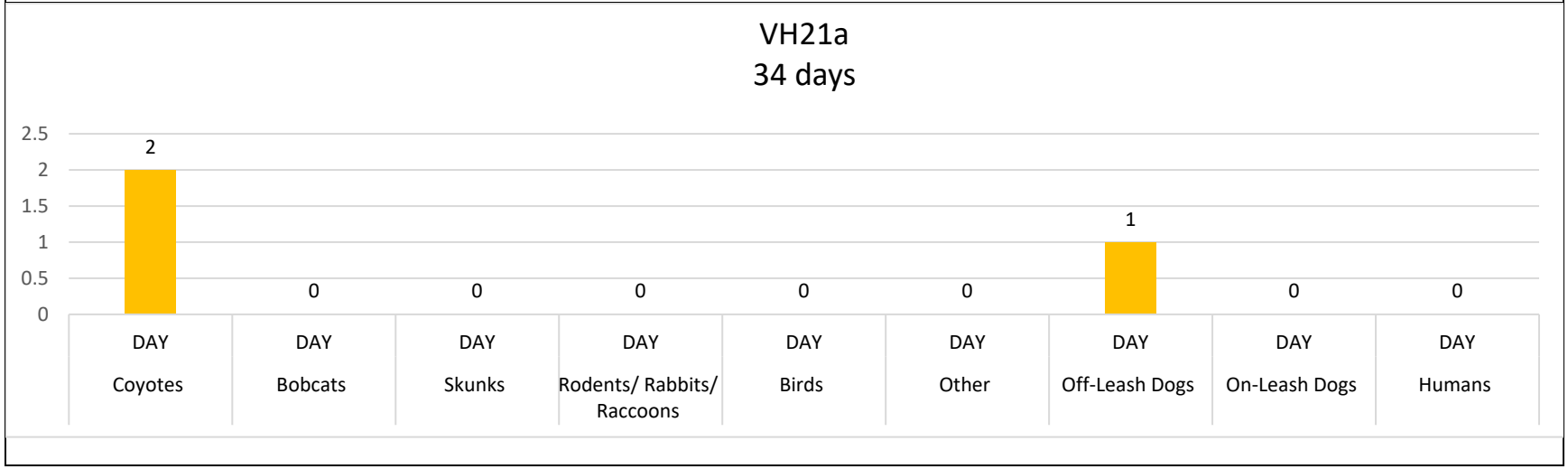

VH17a
112 days
80
70
60
50
40
30
20
10
0
11
27
8
15
0
21
2
50
23
2
1
0
1
0
0
0
76
0
DAY
NIGHT
Coyotes
Bobcats
Skunks
Rodents/ Rabbits/ Raccoons
Birds
Other
Off-Leash Dogs
On-Leash Dogs
Humans

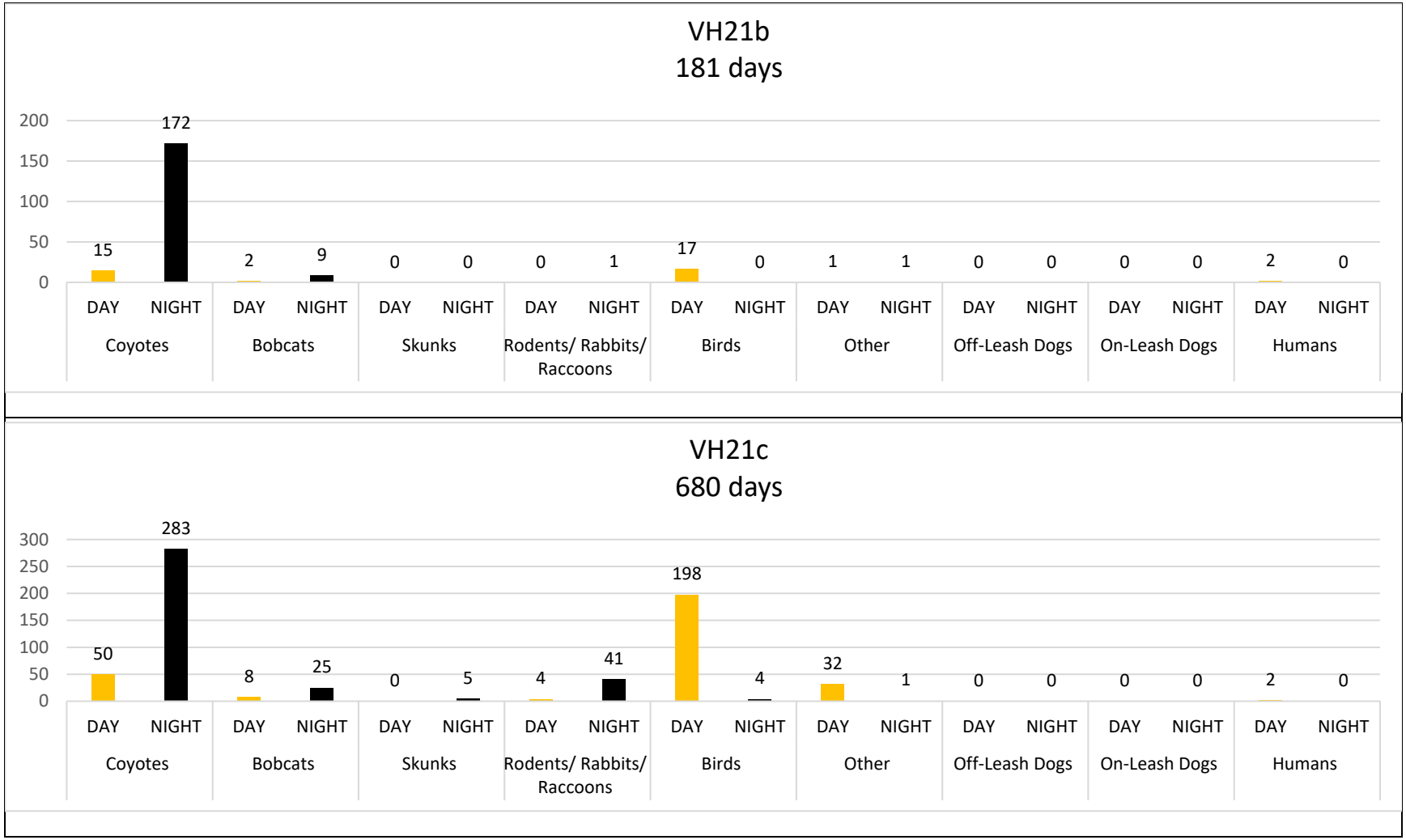

VH17b
538 days
140
120
100
80
60
40
20
0
37
55
12
40
0
1
62
26
116
1
6
1
1
0
0
0
1
0
DAY
NIGHT
Coyotes
Bobcats
Skunks
Rodents/ Rabbits/ Raccoons
Birds
Other
Off-Leash Dogs
On-Leash Dogs
Humans


VH18
49 days
2000
1500
1000
500
0
12
43
0
0
0
0
0
0
0
1
0
0
579
32
619
27
1848
60
DAY NIGHT
Coyotes
Bobcats
Skunks
Rodents/ Rabbits/ Raccoons
Birds
Other
Off-Leash Dogs
On-Leash Dogs
Humans


VH19
16 days
14
12
10
8
6
4
2
0
0
6
0
1
0
1
0
0
0
0
0
0
8
0
1
0
12
0
DAY NIGHT
Coyotes
Bobcats
Skunks
Rodents/ Rabbits/ Raccoons
Birds
Other
Off-Leash Dogs
On-Leash Dogs
Humans


VH20
49 days
100
80
60
40
20
0
7
13
0
0
0
0
1
6
5
0
0
0
85
2
6
0
90
2
DAY
NIGHT
Coyotes
Bobcats
Skunks
Rodents/ Rabbits/ Raccoons
Birds
Other
Off-Leash Dogs
On-Leash Dogs
Humans


VH21a
34 days
2.5
2
1.5
1
0.5
0
2
0
0
0
0
0
1
0
0
DAY
Coyotes
Bobcats
Skunks
Rodents/ Rabbits/ Raccoons
Birds
Other
Off-Leash Dogs
On-Leash Dogs
Humans


VH21b
181 days
200
150
100
50
0
15
172
2
9
0
0
0
1
17
0
1
1
0
0
0
0
2
0
DAY
NIGHT
Coyotes
Bobcats
Skunks
Rodents/ Rabbits/ Raccoons
Birds
Other
Off-Leash Dogs
On-Leash Dogs
Humans
VH21c
680 days
300
250
200
150
100
50
0
50
283
8
25
0
5
4
41
198
4
32
1
0
0
0
0
2
0

Attachment B

Village H Roadkill Survey Dates and Results

TABLE 1
VILLAGE H ROADKILL SURVEY DATES AND RESULTS

Date	Time (start-end)	Surveyor	Location	Species
7/25/19	11:20-11:30 am	Team	Village H	None
7/30/19	2:20-2:30 pm	H. Swarthout	Village H	None
8/1/19	12:45-1:00 pm	A. Sullivan	Village H	None
8/4/19	8:35-8:50 am	K. Merrill	Village H	None
8/6/19	12:50-1:10 pm	H. Swarthout	Village H	None
8/7/19	10:00-10:15 am	A. Lee	Village H	None
8/9/19	2:35-2:50 pm	H. Swarthout	Village H	None
8/10/19	6:55-7:10 am	K. Merrill	Village H	None
8/14/19	10:40-10:55 am	A. Lee	Village H	None
8/16/19	2:45-2:55 pm	H. Swarthout	Village H	None
8/17/19	9:10-9:25 am	K. Merrill	Village H	None
8/18/19	12:40 pm	K. Merrill	Village H	None
8/21/19	11:20-11:35 am	A. Lee	Village H	None
8/23/19	3:28-3:40 pm	H. Swarthout	Village H	None
8/25/19	10:07-10:15 am	K. Merrill	Village H	None
8/28/19	12:15-12:30 pm	A. Sullivan	Village H	Opossum
8/30/10	1:25-1:35 pm	H. Swarthout	Village H	None
8/31/19	9:50-10:00 am	K. Merrill	Village H	None
9/4/19	9:35-9:50 am	A. Lee	Village H	None
9/6/19	10:20-10:35 am	H. Swarthout	Village H	None
9/8/19	9:18-9:28 am	K. Merrill	Village H	None
9/11/19	10:40-11:00 am	A. Lee	Village H	None
9/12/19	10:05-10:17 am	H. Swarthout	Village H	None
9/14/19	8:35-8:45 am	K. Merrill	Village H	None
9/18/19	9:20-9:35 am	A. Lee	Village H	None
9/19/19	9:28-9:46 am	H. Swarthout	Village H	Opossum
9/21/19	9:25-9:36 am	K. Merrill	Village H	None
9/25/19	10:30-10:45 am	A. Sullivan	Village H	None
9/26/19	10:13-10:21 am	H. Swarthout	Village H	None
9/28/19	11:21-11:31 am	K. Merrill	Village H	None
10/2/19	3:30-3:45 pm	A. Sullivan	Village H	None
10/4/19	1:35-1:43 pm	H. Swarthout	Village H	None
10/5/19	8:35-8:45 am	K. Merrill	Village H	None
10/8/19	9:30-9:45 am	A. Sullivan	Village H	None
10/11/19	1:24-1:32 pm	H. Swarthout	Village H	None
10/16/19	11:30-11:39 am	H. Swarthout	Village H	None
10/19/19	9:06-9:13 am	K. Merrill	Village H	None

Date	Time (start-end)	Surveyor	Location	Species
10/23/19	9:30-9:45 am	A. Sullivan	Village H	Rabbit
10/27/19	9:15-9:25 am	K. Merrill	Village H	None
10/30/19	10:00-10:15 am	A. Sullivan	Village H	None
11/2/19	11:09-11:20 am	K. Merrill	Village H	None
11/6/19	9:45-10:00 am	A. Lee	Village H	None
11/8/19	11:06-11:16 am	H. Swarthout	Village H	None
11/9/19	8:27-8:33 am	K. Merrill	Village H	None
11/13/19	1:00-1:15 pm	A. Sullivan	Village H	None
11/15/19	10:19-10:30 am	H. Swarthout	Village H	None
11/16/19	8:32-8:41 am	K. Merrill	Village H	None
11/21/19	11:00-11:15 am	A. Sullivan	Village H	None
11/22/19	3:13-3:27 pm	H. Swarthout	Village H	None
11/23/19	10:04-10:14 am	K. Merrill	Village H	None
11/30/19	12:53-1:03 pm	K. Merrill	Village H	None
12/4/19	12:23-12:33 pm	H. Swarthout	Village H	None
12/5/19	12:45-1:00 pm	A. Sullivan	Village H	Rabbit and Bird
12/6/19	10:28-10:38 am	H. Swarthout	Village H	None
12/8/19	8:45-8:55 am	K. Merrill	Village H	None
12/11/19	3:31-3:42 pm	H. Swarthout	Village H	None
12/13/19	4:15-4:27 pm	H. Swarthout	Village H	Hawk
12/15/19	10:00-10:15 am	K. Merrill	Village H	Barn Owl
12/18/19	10:25-10:35 am	A. Lee	Village H	Barn Owl (same as above)
12/20/19	1:28-1:39 pm	H. Swarthout	Village H	None
12/21/19	9:06-9:13 am	K. Merrill	Village H	None
12/26/19	9:15-9:30 am	A. Sullivan	Village H	Skunk
12/27/19	11:34-11:48 am	H. Swarthout	Village H	Rabbit
12/28/19	8:57-9:07 am	K. Merrill	Village H	None
12/30/19	4:21-4:32 pm	H. Swarthout	Village H	None
12/31/19	11:30-11:45 am	A. Sullivan	Village H	Bird
1/5/20	8:40-8:50 am	K. Merrill	Village H	None
1/8/20	11:00-11:15 am	A. Sullivan	Village H	None
1/10/20	12:16-12:27 pm	H. Swarthout	Village H	None
1/12/20	10:27-10:37 am	K. Merrill	Village H	None
1/13/20	3:30-3:45 pm	A. Sullivan	Village H	None
1/15/20	9:30-9:40 am	A. Sullivan	Village H	None
1/17/20	12:31-12:42 pm	H. Swarthout	Village H	None
1/18/20	10:14-10:23 am	K. Merrill	Village H	None
1/22/20	12:10-12:20 pm	A. Lee	Village H	None

Date	Time (start-end)	Surveyor	Location	Species
1/24/20	12:39-12:50 pm	H. Swarthout	Village H	Hawk
1/26/20	10:14-10:22 am	K. Merrill	Village H	None
1/30/20	10:16-10:25 am	H. Swarthout	Village H	None
2/1/20	8:30-8:40 am	K. Merrill	Village H	None
2/7/20	11:41-11:51 am	H. Swarthout	Village H	None
2/9/20	8:32-8:44 am	K. Merrill	Village H	California Quail
2/13/20	10:14-10:25 am	H. Swarthout	Village H	None
2/16/20	9:05-9:15 am	K. Merrill	Village H	None
2/20/20	11:00-11:09 am	H. Swarthout	Village H	None
2/22/20	8:58-9:06 am	K. Merrill	Village H	None
2/26/20	11:50-12:03 pm	H. Swarthout	Village H	None
3/1/20	10:28-10:37 am	K. Merrill	Village H	None
3/5/20	9:54-10:05 am	H. Swarthout	Village H	None
3/8/20	10:26-10:38 am	K. Merrill	Village H	Rabbit
3/12/20	9:53-10:02 am	H. Swarthout	Village H	Squirrel
3/14/20	9:37-9:47 am	K. Merrill	Village H	None
3/19/20	1:37-1:50 pm	H. Swarthout	Village H	None
3/21/20	10:38-10:48 am	K. Merrill	Village H	None
3/26/20	9:40-9:50 am	H. Swarthout	Village H	None
3/28/20	10:00-10:11 am	K. Merrill	Village H	None
4/2/20	10:39-10:49 am	H. Swarthout	Village H	None
4/4/20	11:07-11:16 am	K. Merrill	Village H	None
4/9/20	9:23-9:33 am	H. Swarthout	Village H	None
4/11/20	9:01-9:09 am	K. Merrill	Village H	None
4/16/20	10:28-10:37 am	H. Swarthout	Village H	None
4/18/20	9:36-9:44 am	K. Merrill	Village H	None
4/23/20	10:16-10:27 am	H. Swarthout	Village H	None
4/25/20	10:22-10:31 am	K. Merrill	Village H	None
4/30/20	9:56-10:07 am	H. Swarthout	Village H	None
5/2/20	11:54 am-12:04 pm	K. Merrill	Village H	None
5/7/20	10:40-10:52 am	H. Swarthout	Village H	None
5/9/20	9:52-9:59 am	K. Merrill	Village H	None
5/14/20	10:04-10:17 am	H. Swarthout	Village H	None
5/16/20	8:11-8:21 am	K. Merrill	Village H	None
5/21/20	11:31-11:43 am	H. Swarthout	Village H	None
5/23/20	9:03-9:12 am	K. Merrill	Village H	None
5/28/20	11:20-11:32 am	H. Swarthout	Village H	None
5/30/20	9:29-9:35 am	K. Merrill	Village H	None
6/4/20	10:14-10:25 am	H. Swarthout	Village H	None

Date	Time (start-end)	Surveyor	Location	Species
6/6/20	9:12-9:21 am	K. Merrill	Village H	None
6/11/20	9:40-9:50 am	H. Swarthout	Village H	None
6/14/20	8:16-8:26 am	K. Merrill	Village H	None
6/18/20	9:56-10:02 am	H. Swarthout	Village H	None
6/20/20	9:31-9:40 am	K. Merrill	Village H	None
6/27/20	9:48-9:58 am	K. Merrill	Village H	None
7/2/20	2:39-2:48 pm	H. Swarthout	Village H	None
7/5/20	9:10-9:20 am	K. Merrill	Village H	None
7/9/20	10:28-10:38 am	H. Swarthout	Village H	None
7/11/20	9:56–10:07 am	K. Merrill	Village H	None
7/16/20	1:35-1:43 pm	H. Swarthout	Village H	None
7/18/20	9:43-9:53 am	K. Merrill	Village H	None
7/23/20	10:00-10:11 am	H. Swarthout	Village H	None
7/25/20	8:56-9:07 am	K. Merrill	Village H	Rabbit

Attachment C

Village H Representative Photographs of Wildlife Detected on Remote Wildlife Cameras

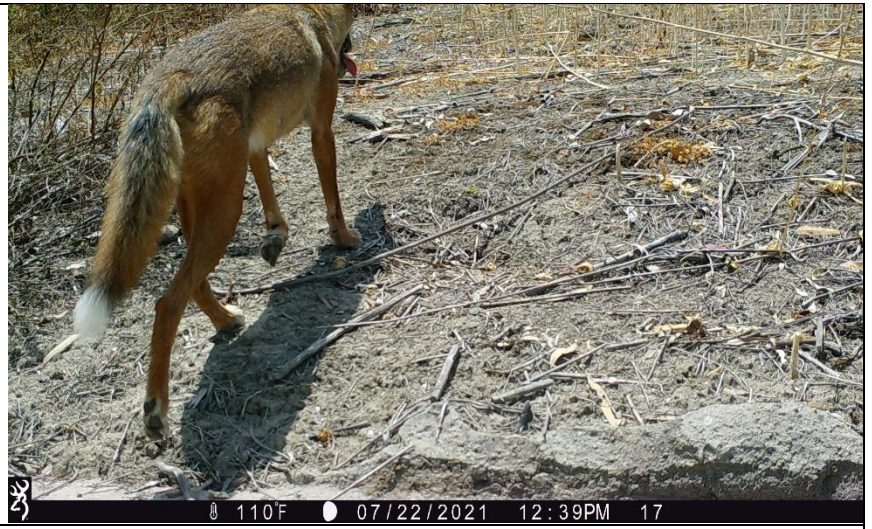
Opossum detected at VH5 Camera.

Bobcat detected at VH5 Camera.

Coyote detected at VH5 Camera.

Raccoon detected at VH5 Camera.

California ground squirrel detected at VH17 Camera.



Coyote detected at VH17 Camera.

Bobcat detected at VH17 Camera.

California quail detected at VH17 Camera.

California scrub jay detected at VH21 Camera.

Coyote detected at VH21 Camera.

Bobcat detected at VH21 Camera.

Raccoon detected at VH21 Camera.

Attachment D

Village H Dog Waste Studies
Representative Photographs

Collection from dog waste study on September 25, 2019.

Collection from dog waste study on October 8, 2019.

Collection from dog waste study on May 11, 2021.

Collection from dog waste study on June 10, 2021.

Collection from dog waste study on July 9, 2021.

Collection from dog waste study on August 6, 2021.

Collection from dog waste study on September 8, 2021.

Collection from dog waste study on October 6, 2021.

Collection from dog waste study on November 11, 2021.

Collection from dog waste study on December 21, 2021.

Collection from dog waste study on February 9, 2022.

Collection from dog waste study on March 9, 2022.

Collection from dog waste study on April 25, 2022.

Collection from dog waste study on May 19, 2022.

Collection from dog waste study on June 15, 2022.

Collection from dog waste study on July 15, 2022.

Collection from dog waste study on August 16, 2022.

Collection from dog waste study on September 22, 2022.

Collection from dog waste study on October 20, 2022.

Collection from dog waste study on November 17, 2022.

Collection from dog waste study on December 13, 2022.

Appendix D

Unmanaged Preserves Memorandums

D-1 Site Inspection Program 2021–2022 Summary

ESA

2355 Northside Drive
Suite 100
San Diego, CA 92108
619.719.4200 phone
619.719.4201 fax

esassoc.com

memorandum

date	January 18, 2023
to	Rosanne Humphrey, City of Carlsbad
cc	Terah Donovan, Environmental Science Associates
from	Adrienne Lee, Environmental Science Associates Brenda McMillan, Environmental Science Associates
subject	HMP Unmanaged Preserves Site Inspection Program 2021–2022 Summary

Introduction

The City of Carlsbad (city) adopted the Habitat Management Plan (HMP) in November 2004 as a commitment to conserve the full range of native habitats and species throughout the city and maintain functional wildlife corridors through its implementation. Most of the city's current HMP preserve system (70 percent) is under long-term management through various land managers (i.e., city, California Department of Fish and Wildlife [CDFW], Center for Natural Lands Management, San Diego Habitat Conservancy, Urban Corps of San Diego, Dudek/Habitat Restoration Sciences, Inc., and HELIX Environmental, Inc.). The remaining preserves receive minimal or no management and are referred to as "unmanaged preserves" (**Figure 1**; see figures in **Attachment A**). Typically, the unmanaged preserves were (1) established prior to the final adoption of the HMP in 2004 and were not required to have a funded land manager, or (2) established during the transition period of 2004–2005 that allowed for reduced funding requirements. The city has no obligation to dedicate resources to monitor or manage for the unmanaged preserves per the HMP Implementing Agreement. With the HMP preserve system almost fully built out, the city wanted to evaluate the status of unmanaged preserves and determine management priorities and implementation feasibility with the resources available.

The prioritization of unmanaged preserves resulted in the development of the site inspection program by the city and Environmental Science Associates (ESA). The site inspection program addresses the lack of monitoring and management on the unmanaged preserves. The city and ESA conduct rapid assessments with the goals of establishing a presence on unmanaged preserves, documenting baseline status of species and habitats, and prioritizing management actions based on available funding and implementation resources. This memorandum describes the site inspection program methodology, results, and next steps.

Methodology

The site inspection program methodology included four steps: desktop analysis, field form development, site inspections, and post-field processing. Each of these steps is described in detail as follows.

1. **Desktop analysis.** A desktop analysis was conducted for all unmanaged preserves within the HMP preserve system to determine which should be prioritized for in-person site inspections. Priority criteria identified for the desktop analysis consisted of on-site biological resources and potential threats (**Table 1**). Based on available sensitive species data and associated habitat requirements from the Multiple Habitat Conservation Plan (AMEC Earth & Environmental, Inc. & Conservation Biology Institute 2003), HMP (City of Carlsbad 2004), and CDFW's California Natural Diversity Database (CDFW 2021), each priority criterion was assigned a number representing its assumed presence or absence on the preserve (Table 1). Once all priority criteria were assessed, a total score was calculated for each preserve. The higher the resulting score, the higher the priority that preserve was to be inspected in-person. High-priority sites were advanced for site inspections.

TABLE 1
PRIORITY CRITERIA RANKING

	Points		
Priorities	**Total Possible**	**Score**	**Comments**
Biological Resources			
High-priority plant/animal population	1/pop[1]		
Priority habitat 1	2		
Priority habitat 2	1		
Potential or confirmed wildlife movement corridor	1/per		
Threats			
Adjacent to development	1		
Trail	1		
Unauthorized access into preserve[2]	1		
Other threats – specify[3]	1/threat		
Access			
Sites for which access has been granted	1		
TOTAL SCORE			

[1] One point given for each species or distinct population/occurrence. For very large preserves such as Rancho Carrillo, each distinct area can be scored separately.

[2] If there is more than one significant unauthorized access issue, one point was given per issue

[3] One point given per "other" threat (e.g., post-fire, high-priority invasive non-native species [gold-spotted oak borer, shothole borer, Ward's weed, Italian white snail], homeless encampments, known off-leash dog issues, unauthorized mountain bike usage).

2. **Field form development**. Electronic field forms supported by mobile data collection applications ArcGIS Field Maps and Survey123 were developed for use during in-person site inspections.
   - **ArcGIS Field Map**. An ArcGIS Field Map was developed using the HMP preserve system boundaries, unmanaged preserve boundaries, Poinsettia Fire burn boundary, known HMP wildlife linkages and pinchpoints, and known Ward's weed populations. Data collection options included

color-coded points, lines, and polygons. A color code was assigned to biological resources, threats, and adaptive management or restoration opportunities. A geo-tagging feature allowed photos to be associated with a geo-tagged point, line, or polygon.

- **Survey123 form**. A Survey123 form was developed to (1) document the overall condition of the unmanaged preserve, including the status of plant populations or other sensitive resources, status of fencing and signage, and presence/sign of wildlife movement corridors, and (2) determine the urgency and potential opportunities for adaptive management or restoration.

3. **Site inspections**. Site inspections were conducted generally from south to north for prioritized unmanaged preserves. Maps, aerial imagery, and sensitive species information (e.g., San Diego Management and Monitoring Program database, regional Multiple Species Habitat Conservation Plans, and California Natural Diversity Database) were reviewed prior to conducting in-person site inspections. Preserves with the potential to support listed or sensitive species were given priority during months with the best opportunity for detection. Inspections were conducted in good weather, on foot, during daylight hours, keeping to authorized trails as much as possible. In areas that were difficult to access, binoculars were used to aid in surveying. The Survey123 field form was completed, and management data features were collected on the ArcGIS Field Map. Data collection requirements were as follows.

   - **Baseline Assessment**. The ArcGIS Field Map color-coded features were used to record and differentiate between biological resources, threats, and adaptive management or restoration opportunities. Photos taken during the site inspection were associated with a geo-tagged point, line, or polygon.
   - **Threats Assessment**. Five priority threats were assessed and documented to determine preserve condition using the Survey123 form and the ArcGIS Field Map.
     - Unauthorized access. Any activities outside of the allowed uses in the HMP are considered unauthorized access. This could include mountain bike users building bike jumps within conserved habitat, homeless encampments, and other types of activities resulting in habitat damage.
     - Trail encroachment. Authorized city trails are present in many unmanaged preserves; however, new trails off-shooting from authorized trails, such as from private residences, through or around fenced areas, or shortcuts between segments of authorized trails are considered unauthorized trail encroachment.
     - Trash or dumping. Trash or dumping are not allowed within the HMP preserve system and can include discarded landscape materials, dumping of large objects, litter left behind from homeless encampments, household trash, food wrappers, and bottles.
     - Invasive non-native plants. Detected species identified by the California Invasive Plant Council (Cal-IPC) as invasive, or species known to be a local or regional threat to native flora and vegetation communities were documented. Detections consist of dense stands or a significant population.
     - Erosion. Soil erosion could include surface areas on trails , steep slopes, and open soil areas within scrub communities, where soil material is transported away during rain events, resulting in cracks, crevices, and gullies.
   - **Opportunity Assessment**. Five criteria were assessed and documented to determine adaptive management urgency and opportunities using the Survey123 form.
     - Adaptive management opportunities. Adaptive management opportunities assessed include enhancement, restoration, invasive non-native species control, trash removal, trail repair, erosion control, improving fencing and signage, and increasing public awareness and

education. Opportunities were ranked from 0 to 3, from *no opportunity* to *opportunity present and implementation recommended*.

- Adaptive management urgency. For identified adaptive management opportunities, urgency of implementation was ranked from 0 to 3, from *no urgency* to *urgent.*
- Restoration potential. Areas that could benefit from restoration to support priority habitat or species were mapped on the ArcGIS Field Map and ranked from 0 to 3, from *no opportunity* to *high restoration potential*.
- Grant opportunity. For adaptive management opportunities and restoration potential areas identified, a grant opportunity ranking was assigned 0 or 1, *no opportunity* or *opportunity*.
- Volunteer opportunity. For identified adaptive management opportunities and restoration potential areas, a volunteer opportunity ranking was assigned 0 or 1, *no opportunity* or *opportunity*.

4. **Post-field processing**. Photos and data collected on the ArcGIS Field Map were reviewed for accuracy and the Survey123 data forms were exported and saved onto the Microsoft Teams channel shared between ESA and the city. Adaptive management opportunities and urgency rankings were entered into the *HMP Unmanaged Preserves Matrix* (matrix) on the Microsoft Teams channel shared between ESA and the city. The matrix is a live file where changes can be viewed in real time by all team members.

Results and Discussion

ESA biologists conducted site inspections for 11 unmanaged preserves totaling approximately 667 acres (**Figure 2**). Site inspections occurred from September 30, 2021, to June 8, 2022, across eight site inspection survey days. Examining threats and opportunities, the highest ranked were Santa Fe Trails, La Costa Valley, The Ranch, La Cresta, and Aviara Master Association.

Threats. Four preserves were ranked with urgent adaptive management needs: Santa Fe Trails, La Costa Valley, The Ranch, and La Cresta. These preserves were found to support dense populations and high numbers of invasive non-native species and trash accumulation as well as supporting suitable habitat for sensitive species such as thread-leaved brodiaea (*Brodiaea filifolia*; federally threatened, state endangered). Targeted removal of invasive non-native and competitive species in suitable habitat areas and seeding with native species can establish areas that can help resist invasion from non-native species. Unauthorized access, including trail encroachment, was noted in seven preserves where signage and fencing would help deter unauthorized usages. Detected priority threats are depicted in **Figure 3**.

Opportunities. Ten preserves had three or more adaptive management opportunities. The highest ranked are the four named above, plus Aviara Master Association. Enhancement and restoration opportunities in sensitive vegetation communities such as grasslands that support native grasses and forbs and chaparral that supports Nuttall's scrub oak (*Quercus dumosa*) and Del Mar Manzanita (*Arctostaphylos glandulosa* ssp. *crassifolia*) are identified in **Figure 4**. Thatch removal and targeted invasive non-native species control in non-native grasslands not only provides resources for native wildflowers and sensitive species but also reduces the fire fuel load in areas adjacent to neighborhoods.

Threats and opportunities identified across all the preserves are as follows.

Threats

Priority threats were detected on all unmanaged preserves. The priority threats are unauthorized access, trail encroachment, trash or dumping, invasive non-native plants, and erosion. Ten preserves had three or more of the five priority threats, and the remaining preserve had one (**Table 2**).

- Unauthorized access. Three unmanaged preserves had unauthorized experienced access, including illegal mountain bike trails and mountain bike ramps installed in native habitat. The Ranch, Santa Fe Trails, and La Costa Valley were ranked as urgent for adaptive management implementation.
- Trail encroachment. Many unmanaged preserves had well-used authorized trails in good condition. Eight had established unauthorized trails through fenced areas, off-shoot trails from authorized trails, or access trails from neighboring communities. Of the eight unmanaged preserves, four, La Cresta, La Costa Valley, Santa Fe Trails, and The Ranch, were ranked as urgent for adaptive management implementation.
- Trash or dumping. Eight unmanaged preserves had trash or dumping present. Trash or dumping observed consisted predominantly of discarded landscape materials, food wrappers, and bottles. Of the eight unmanaged preserves, three, Santa Fe Trails, La Costa Valley, and La Cresta, were ranked as urgent for adaptive management implementation. Trash accumulation invites unwanted pests and is unsightly, and many of the preserves have downstream connections to sewers and the Pacific Ocean; trash removal will benefit the preserve and neighboring communities.
- Invasive non-native plants. All 11 unmanaged preserves had invasive non-native plant species present. Twenty-two Cal-IPC priority species were documented—five high priority, four moderate-alert, seven moderate priority, and one watch priority. Four additional non-native species were documented due to their proximity to sensitive resources despite not having a Cal-IPC ranking. **Table 3** provides a summary of the invasive non-native plant species detected during site inspections. Invasive species such as purple false brome (*Brachypodium distachyon*), artichoke thistle (*Cynara cardunculus*), and pampas grass (*Cortaderia selloana*) not only impact native species abundance and composition, they also increase fire fuel loads and should be prioritized for targeted removal and control.
- Erosion. Six of the unmanaged preserves had areas of noticeable erosion. Erosion was usually associated with landscape irrigation and areas where unauthorized activities were occurring, such as unauthorized mountain bike trails. Of the six unmanaged preserves, three, The Ranch, Ranch Carrillo Master Association, and La Costa Valley, were ranked as urgent for adaptive management implementation. Erosion control measures provide trail protection and help keep native soil and seeds on-site.

TABLE 2
SITE INSPECTION THREATS AND URGENCY SUMMARY

Threats	Rancho Carrillo Master Assoc.	The Ranch	Santa Fe Trails	La Costa Valley	Continuing Life Communities	Aviara Master Assoc.	La Cresta	Fourth Quarter Properties	Continental Residential	Batiquitos Land LLC	Blackmore Signal
Unauthorized access	1	0	3	3	0	0	0	0	0	0	0
Trail encroachment	1	2	3	2	1	2	0	1	0	0	1
Trash or dumping	1	0	2	3	0	1	2	1	1	0	1
Invasive non-native plants	3	3	3	3	3	3	3	1	2	1	1
Erosion	2	2	1	3	0	1	0	0	0	0	1

Threats Ranking:

0 = No threats detected during site inspection; native species and habitats presumed to be in good condition.
1 = Low priority threats detected during site inspection; native species and habitats are presumed to be in good condition still.
2 = Moderate priority threats detected during site inspection; native species and habitats would benefit from adaptive management.
3 = High priority threats detected during site inspection; native species and habitats require immediate adaptive management.

TABLE 3
INVASIVE NON-NATIVE PLANT SPECIES DETECTED

Common Name	Scientific Name	Cal-IPC Rating[1]	No. of Preserves Species Observed
Arundo	*Arundo donax*	High	3
Red Brome	*Bromus rubens*	High	3
Iceplant	*Carpobrotus edulis*	High	5
Pampas Grass	*Cortaderia sellonana*	High	7
Sweet Fennel	*Foeniculum vulgare*	High	3
Algerian Ivy	*Hedera canariensis*	High	2
Tamarisk	*Tamarix ramosissima*	High	4
Purple false brome	*Brachypodium distachyon*	Moderate - Alert	2
Stinkwort	*Dittrichia graveolens*	Moderate - Alert	2
Treasure Flower	*Gazania linearis*	Moderate - Alert	1
Brazilian pepper tree	*Schinus terebinthifolia*	Moderate - Alert	4
Black Mustard	*Brassica nigra*	Moderate	2
Ripgut Grass	*Bromus diandrus*	Moderate	3
Tocalote	*Centaurea melitensis*	Moderate	1
Artichoke Thistle	*Cynara cardunculus*	Moderate	4
Shortpod mustard	*Hirschfeldia incana*	Moderate	4
Tree Tobacco	*Nicotiana glauca*	Moderate	2
Mexican Fan Palm	*Washingtonia robusta*	Moderate	4
Soft Chess	*Bromus hordaceus*	Limited	4
Veldt Grass	*Ehrharta longiflora*	Limited	1
Canary Island Date palm	*Phoenix canariensis*	Limited	5
Russian thistle	*Salsola tragus*	Limited	3
Peruvian Pepper Tree	*Schinus molle*	Limited	3
Sydney Golden Wattle	*Acacia longifolia*	Watch	6
Eucalyptus	*Eucalyptus* spp.	Watch	5

[1] Cal-IPC Rating:

High – These species have severe ecological impacts on physical processes, plant and animal communities, and vegetation structure. Their reproductive biology and other attributes are conducive to moderate to high rates of dispersal and establishment. Most are widely distributed ecologically.

Moderate – These species have substantial and apparent—but generally not severe—ecological impacts on physical processes, plant and animal communities, and vegetation structure. Their reproductive biology and other attributes are conducive to moderate to high rates of dispersal, though establishment is generally dependent upon ecological disturbance. Ecological amplitude and distribution may range from limited to widespread.

Limited – These species are invasive, but their ecological impacts are minor on a statewide level or there was not enough information to justify a higher score. Their reproductive biology and other attributes result in low to moderate rates of invasiveness. Ecological amplitude and distribution are generally limited, but these species may be locally persistent and problematic.

Alert – An Alert is listed on species with High or Moderate impacts that have limited distribution in California, but may have the potential to spread much further.

Watch – These species have been assessed as posing a high risk of becoming invasive in the future in California.

Opportunities

Adaptive management, enhancement, restoration, and volunteer opportunities exist across the unmanaged preserves (**Table 4**). Adaptive management recommendations to address priority threats were discussed in the Threats section above. Additional adaptive management recommendations to improve overall preserve condition are described below:

- Enhancement. Thatch removal, non-native tree removal, trail repair, erosion control, and signage and fencing to control unauthorized access and activities. Signage and public education could increase public awareness such that preserve users value onsite natural resources and deter them from engaging in unauthorized activities such as constructing bike jumps and creating new unauthorized trails at The Ranch, Santa Fe Trails, La Cresta, La Costa Valley, and Aviara Master Association.
- Restoration. Thatch removal, non-native species removal in areas with the potential to support sensitive species, trail repair, planting and seeding with native and sensitive species. Signage and public education would be beneficial at The Ranch, La Cresta, La Costa Valley, and Santa Fe Trails with urgent needs as well as Aviara Master Association where it is located next to Batiquitos Lagoon.
- Volunteer opportunities. Trail repair, non-native species removal, trash and landscape material removal, and signage and public education. Volunteer opportunities were observed in the 11 preserves listed in Table 4 and would help with preserve management and serve as a means for public outreach through homeowners associations (HOAs).
- Grant opportunities. Grant opportunities exist for preserve management and can include non-native grass and forb removal and control for sensitive species restoration and enhancement (e.g., San Diego thornmint [*Acanthomintha ilicifolia*], thread-leaved brodiaea, native grasslands). Non-native grass removal helps reduce fuel loads for fires and creates open areas for native species recruitment, which is an important component to native habitat management. In riparian areas, removal of non-native trees and invasive non-native arundo (*Arundo donax*) provides opportunities for nesting birds, invertebrates, and native plants to become established. Grants can help provide funds for trash removal, trail repair, and public (HOA) outreach and education.

Next Steps

The unmanaged preserves connect native habitats, support sensitive resources, and provide recreational opportunities to residents. These preserves offer a rich diversity of species and habitats that need adaptive management to maintain ecological function and prevent them from becoming a source of invasive non-native species as well as from preventing unauthorized activities that can impact native species. Seeking out grants and engaging volunteers are essential for the long-term management of the preserves. Invasive non-native species control, unauthorized trail repair, and trash removal are the priority actions recommended for the high-urgency ranked preserves: Santa Fe Trails, La Costa Valley, The Ranch, La Cresta, and Aviara Master Association. These actions, in addition to increased signage, can be implemented with volunteers to increase public awareness and outreach to engage users in preserve stewardship.

TABLE 4
SITE INSPECTION ADAPTIVE MANAGEMENT OPPORTUNITIES SUMMARY

Opportunities	Rancho Carrillo Master Assoc.	The Ranch	Santa Fe Trails	La Costa Valley	Continuing Life Communities	Aviara Master Assoc.	La Cresta	Fourth Quarter Properties	Continental Residential	Batiquitos Land LLC	Blackmore Signal
Enhancement /Restoration	3	3	3	2	3	3	3	2	2	1	2
Volunteer Opportunities	1	1	1	1	1	1	1	0	1	1	0
Grant Opportunities	1	1	1	1	1	1	1	1	1	0	0
Urgency	2	3	3	3	1	2	3	2	2	1	1

Adaptive Management Opportunities Ranking:

Adaptive management = 0–3, from *no opportunity* to *opportunity present and implementation recommended*
Adaptive management urgency = 0–3, from *no urgency* to *urgent*
Restoration potential = 0–3, from *no opportunity* to *high restoration potential*
Grant opportunity = 0 or 1, *no opportunity* or *opportunity*
Volunteer opportunity = 0 or 1, *no opportunity* or *opportunity*

ESA will continue to conduct site inspections of the remaining prioritized unmanaged preserves in 2023 to assess baseline conditions, threats, and opportunities. The results will be used to prioritize preserves for adaptive management when resources and funding are available. Future site inspections will prioritize preserves that currently or historically have supported sensitive natural resources, are adjacent to other conserved open spaces, and/or are known or have the potential to support highly invasive non-native species such as Ward's weed (*Carrichtera annua),* arundo, and purple false brome. As Preserve Steward, ESA will continue coordinate with the city and use the monitoring results to inform and make directed recommendations regarding high-priority threats and the associated adaptive management decisions needed to maintain a healthy HMP preserve system.

References

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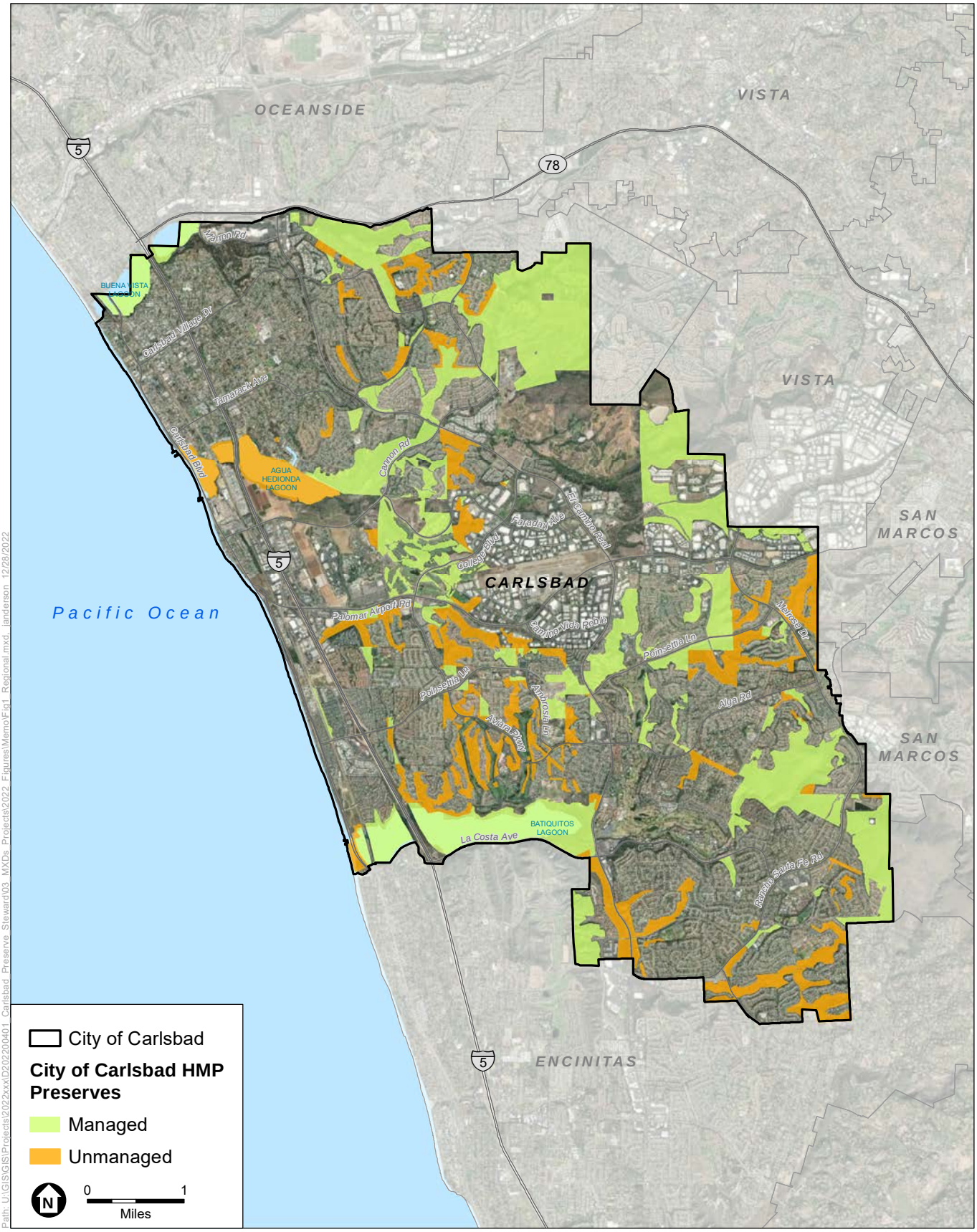
City of Carlsbad. 2004. *Habitat Management Plan for Natural Communities in the City of Carlsbad*. November 2004.

Attachment A
Figures

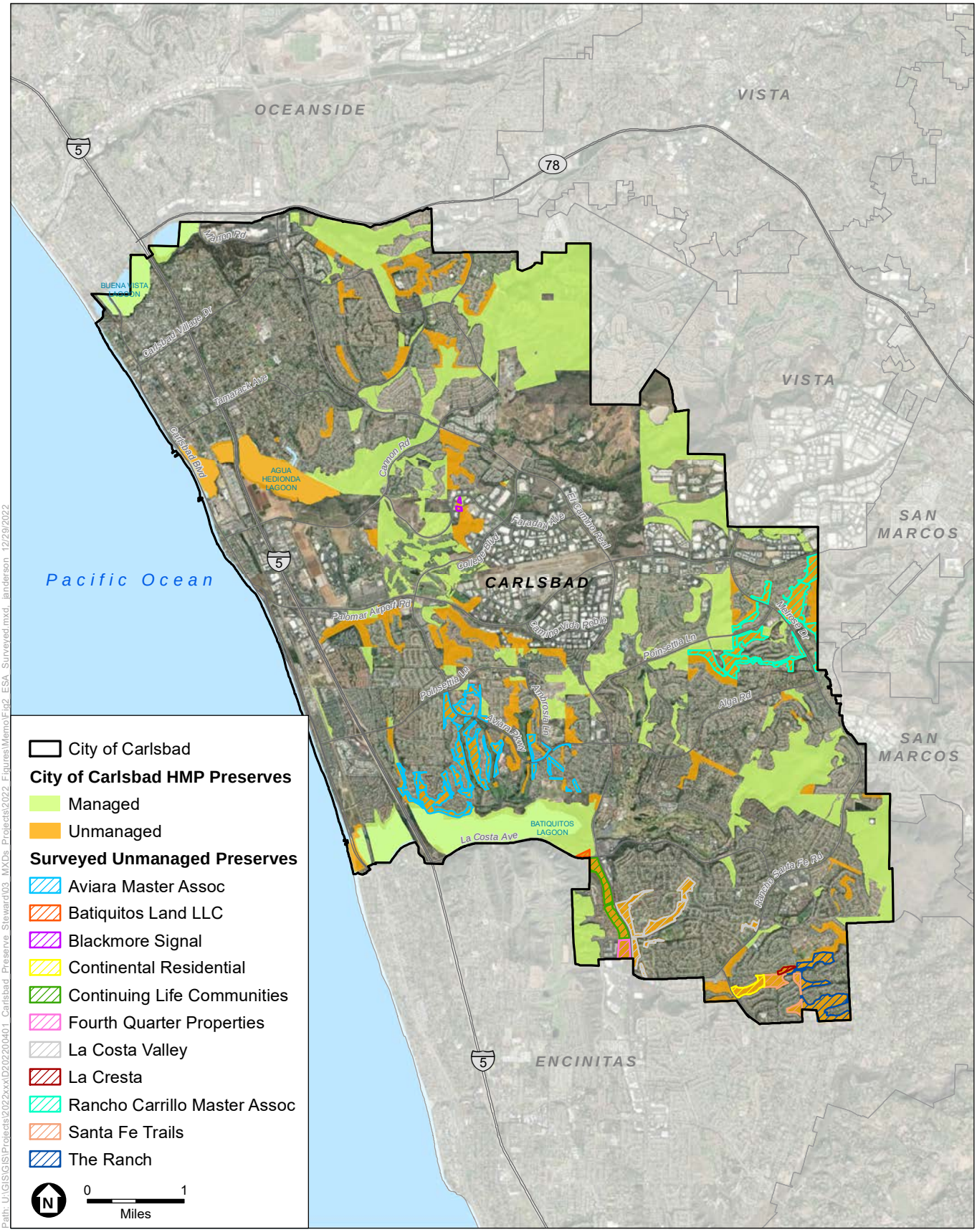


SOURCE: SanGIS, 2022; City of Carlsbad, 2021.

HMP Unmanaged Preserves Site Inspection Program 2021–2022 Summary

Figure 1
Managed and Unmanaged Preserves in City of Carlsbad

ESA

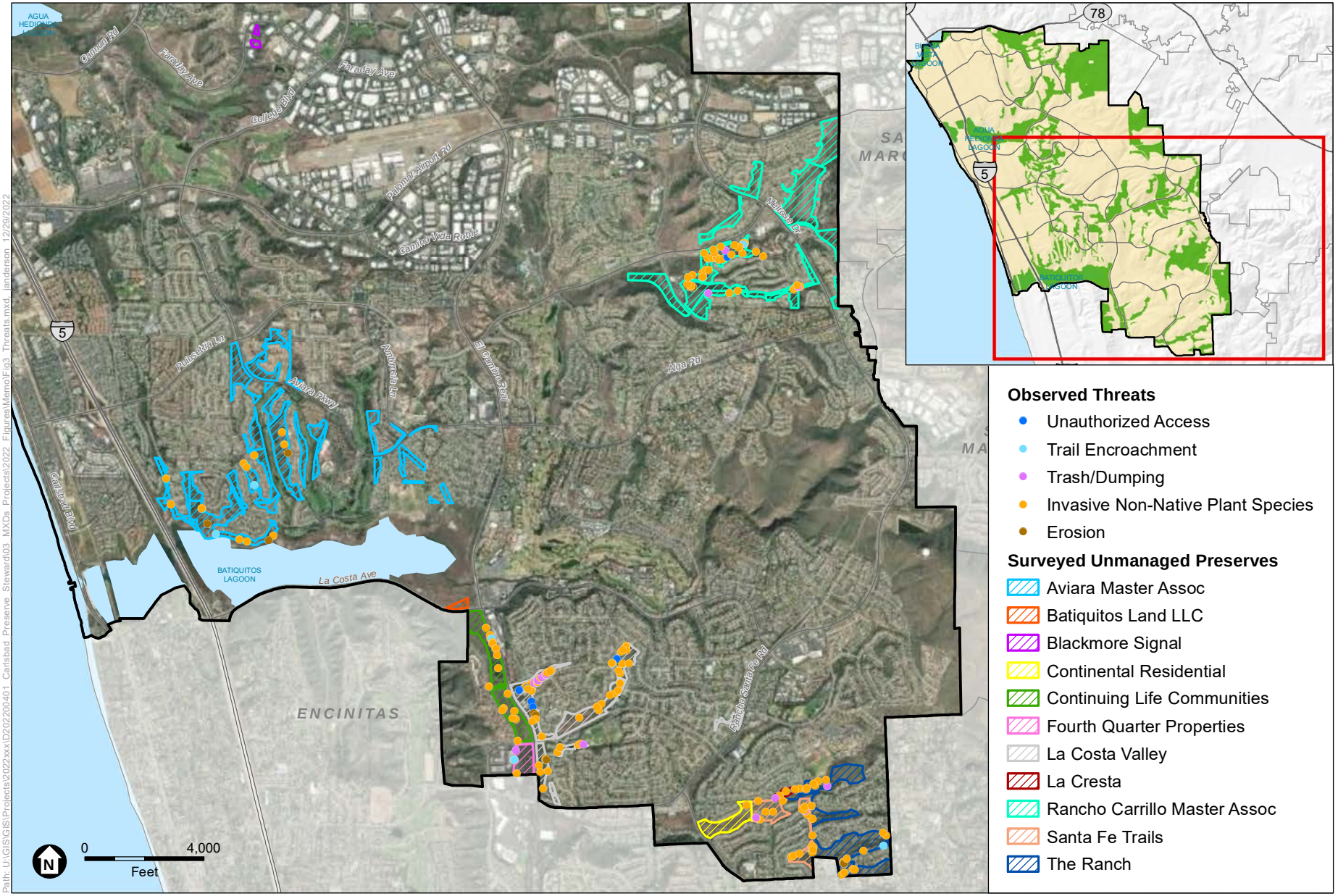


SOURCE: ESRI; SanGIS, 2022; City of Carlsbad, 2021.

HMP Unmanaged Preserves Site Inspection Program 2021–2022 Summary

Figure 2
Surveyed Preserves

ESA

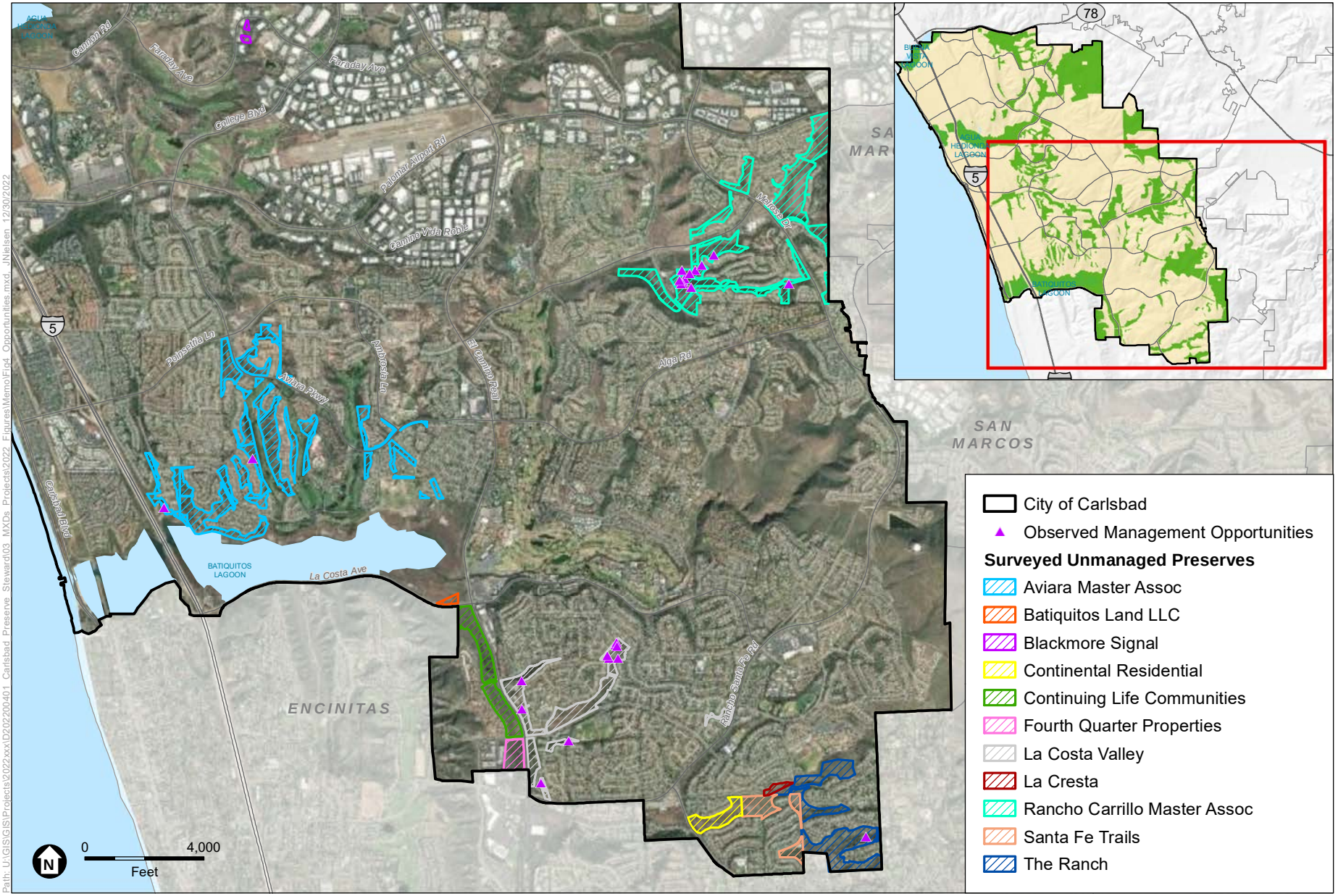


SOURCE: ESRI; SanGIS, 2022; City of Carlsbad, 2021; ESA, 2022.

HMP Unmanaged Preserves Site Inspection Program 2021–2022 Summary

Figure 3
Observed Threats

ESA



SOURCE: ESRI; SanGIS, 2022; City of Carlsbad, 2021; ESA, 2022.

HMP Unmanaged Preserves Site Inspection Program 2021–2022 Summary

Figure 4
Observed Opportunities

D-2 2023 Adaptive Management

ESA

2355 Northside Drive
Suite 100
San Diego, CA 92108
619.719.4200 phone
619.719.4201 fax

esassoc.com

memorandum

date	December 29, 2023
to	Rosanne Humphrey, City of Carlsbad
cc	Jason Allen, Black Sage Environmental, Inc.
from	Adrienne Lee, Environmental Science Associates
subject	HMP Unmanaged Preserves: 2023 Adaptive Management

Introduction

The City of Carlsbad (city) adopted the Habitat Management Plan (HMP) in November 2004 as a commitment to conserve the full range of native habitats and species throughout the city and maintain functional wildlife corridors through its implementation. Most of the city's current HMP preserve system (70 percent) is under long-term management through various land managers. The remaining preserves receive minimal or no management and are referred to as "unmanaged preserves" (**Figure 1**; see figures in **Attachment A**). Typically, the unmanaged preserves were (1) established prior to the final adoption of the HMP and were not required to have a funded land manager, or (2) established during the transition period of 2004–2005 that allowed for reduced funding requirements. The city has no obligation to dedicate resources to monitor or manage the unmanaged preserves per the HMP Implementing Agreement. However, with the HMP preserve system almost fully built out, the city began evaluating the status of unmanaged preserves to identify threats and management priorities, and to determine if it would be feasible to implement high-priority adaptive management using available resources. This effort resulted in the development of the site inspection program and pilot adaptive management project by the city and Environmental Science Associates (ESA) (ESA 2023). The status of unmanaged preserves and results of the site inspection program are described in the 2019 and 2023 memorandums prepared by ESA (ESA 2019; ESA 2023). The results of the first year of the pilot adaptive management project are described in this memorandum.

Resources were available in 2023 to implement Year 1 of the pilot project to conduct and track focused management activities. Two unmanaged preserves, Rancho Carrillo Master Association and The Ranch Preserves, were chosen for the management pilot program (Figure 1). Implementing management at both unmanaged preserves will support ongoing monitoring and coordination efforts within the city and the greater San Diego region. The specific management targets in the pilot project were selected based on the following priorities: rarest species and vegetation communities, highly vulnerable plant populations, populations that are high priority both locally (HMP) and regionally, populations that are being actively monitored by the regional long-term Rare Plant Inspect and Manage monitoring program, good relationship with the Homeowners

Association (HOA) landowner, preserve with current right-of-entry authorization, and feasible management location (relatively easy to access).

- **Rancho Carrillo Master Association Preserve** was selected because it supports vulnerable populations of two special-status plant species—San Diego thornmint (*Acanthomintha ilicifolia*) and thread-leaved brodiaea (*Brodiaea filifolia*), both of which are state endangered and federally threatened. Permanent monitoring plots were established for both species in 2017 and are monitored on an annual and biennial frequency, respectively, through the regional long-term Rare Plant Inspect and Manage monitoring program by the San Diego Management and Monitoring Program (SDMMP).Based on past monitoring results, invasive non-native plant species were identified as one of the greatest threats to the persistence of these populations; therefore, management through focused invasive non-native plant species removal is critical. It is expected that subsequent monitoring will document a reduction in non-native plant cover and show an improvement in the growth and vigor of these populations.
- **The Ranch Preserve** was selected because it supports a large patch of sensitive native grassland habitat. It has been estimated that native grasslands in California have been reduced by 99 percent (California Native Grasslands Association 2023). Native grasslands are able to remove and store vast amounts of atmospheric carbon, provide soil stability, capture and filter water, prevent erosion and flooding, and support a high biodiversity, including soil microbes, plants, invertebrates, and vertebrates. The target area was identified by ESA and recommended for enhancement as part of the city's site inspection program. The greatest threat to the native grassland habitat is encroachment of invasive non-native artichoke thistle (*Cynara cardunculus*) and other invasive non-native forb and grass species. An advantage of working in The Ranch Preserve is that the HOA recently hired RECON Environmental, Inc., (RECON) to conduct quarterly monitoring visits and implement minor habitat enhancement, such as weed control targeting artichoke thistle. The city (through ESA) is partnering with the HOA and RECON to complement each other's weed abatement efforts.

Methodology and Results

The management pilot program included identifying management areas, developing field form to track management activities, and implementing management.

Identifying Management Areas

Rancho Carrillo Master Association Preserve

The one San Diego thornmint permanent monitoring plot and the two thread-leaved brodiaea permanent monitoring plots being actively monitored by SDMMP were the management targets at Rancho Carrillo Master Association Preserve. Monitoring consists of:

- Mapping the perimeter of the current extent of the occurrence and estimating or counting and recording the number of plants within the current mapped extent.
- Conducting photo monitoring by taking a picture from the previously established permanent photo point facing toward the center point of the plot.
- Conducting a habitat assessment within the permanent monitoring plot using the most recent MSP Rare Plant Occurrence Monitoring Form to identify and record number of target plants per plot; phenological stages of plants; evidence of herbivory, disease, and stunted growth; and associated species.
- Conducting a threats assessment within the current maximum extent of the occurrence and adjacent 10-meter buffer.

- Providing management recommendations for the site using the most recent MSP Rare Plant Occurrence Monitoring Form.

ESA reviewed the management recommendations provided in past Rare Plant Inspect and Manage monitoring results and coordinated with lead surveyor Jessie Vinje for more specific management recommendations, including timing of management and species to target. Based on her feedback, the management area delineated for San Diego thornmint encompassed the San Diego thornmint population on-site. A management buffer was not included due to the presence of Baja California oatgrass (*Sphenopholis interrupta* ssp. *californica*), a recently rediscovered rare native grass species thought to be extinct for over 134 years (San Diego Natural History Museum 2020), adjacent to the San Diego thornmint population. The management area delineated for thread-leaved brodiaea was the population's maximum extent.

The Ranch Preserve

The native grassland habitat identified and mapped during the site inspection survey was the management target at the Ranch Preserve. This sensitive habitat has the possibility to support rare plant species such as San Diego thornmint and thread-leaved brodiaea due to presence of suitable soils and common associated plant species; however, it is surrounded by non-native grassland habitat and has encroaching invasive non-native forb and grass species. Management of the area focused on the native grassland habitat area and a large portion of the surrounding non-native grassland habitat. Routine communication with RECON occurred from January through August to coordinate management targets, timing, and efforts.

Field Form Development

Electronic field forms supported by mobile data collection applications ArcGIS Field Maps and Survey123 were developed for use during management implementation. The ArcGIS Field Map developed for the site inspection program was used for tracking management areas. Survey123 forms were developed for ESA biologists and Black Sage Environmental, Inc. (Black Sage) staff to document pre-, during, and post-management conditions within management areas. Specific management details are provided below. Management forms are provided in **Attachment B**.

Management Implementation

Per the city's Integrated Pest Management (IPM) Plan, health conscious and environmentally sensitive pest management strategies should be implemented (City of Carlsbad 2017). Organic herbicides are an allowable option compliant with the IPM Plan; however, discussions with Jessie Vinje and ESA restoration biologist Mark Dodero suggested that organic herbicide usage may also impact rare plant species due to their broad-scale, non-selective, and caustic nature. Additionally, organic herbicides generally need to be applied in large quantities with repeat applications to be effective as they lack residual effects and can be very expensive (UC Nursery and Floriculture Alliance 2023). Also, they are more effective on smaller, younger weeds, while those in the target management areas are larger, established plants (UC Nursery and Floriculture Alliance 2023). Additionally, there are concerns that organic herbicides can potentially change soil chemistry, which can negatively impact the sensitive soil conditions required for rare plants and sensitive vegetation communities. Therefore, manual and mechanical removal methods were prioritized over organic and synthetic herbicides as the management methods.

Black Sage conducted focused management with oversight from ESA restoration biologist Mark Dodero. Mark met Black Sage on-site to orient staff, identify and discuss avoidance strategies, and provide management recommendations (**Table 1**).

TABLE 1
2023 MANAGEMENT SUMMARY

Location	Dates	Species/Habitat Benefited	Management Action	Method	Management Area (acres)
Rancho Carrillo Master Association	April 4, 2023	San Diego thornmint	Invasive non-native plant species management	Hand clipping	0.01
Rancho Carrillo Master Association	April 24–27, 2023 July 17 and 27, 2023	Thread-leaved brodiaea	Invasive non-native plant species management	Mechanical removal	7.81
The Ranch	June 13–14, 20, and 22, 2023	Native grassland habitat	Invasive non-native plant species management	Weed whacking and mechanical removal	3.01
				Total	**10.83**

All biomass was manually collected (raking when necessary), bagged and bundled, hauled off-site, and properly disposed of at an approved off-site facility. Specific management by site is as follows.

Rancho Carrillo Master Association Preserve

Due to the overall small size and vegetative status of all plants in the management area, limited number of invasive non-native plant species, and presence of rare Baja California oatgrass, manual removal (e.g., hand-clipping) was prioritized as opposed to mechanical (e.g., weed-whipping) for the San Diego thornmint management area. San Diego thornmint management consisted of carefully hand-clipping target invasive non-native plant species, predominantly tocalote (*Centaurea melitensis*), bristly ox-tongue (*Helminthotheca echioides*), scarlet pimpernel (*Lysimachia arvensis*), and spiny sowthistle (*Sonchus asper*), within and around the San Diego thornmint population, for an approximately 0.01-acre management area (**Figure 2**). This management area encompassed the entire San Diego thornmint population on-site and did not include a buffer due to the proximity and sensitivity of Baja California oatgrass.

Thread-leaved brodiaea management consisted of mechanically cutting target invasive non-native plant species, predominantly artichoke thistle and fennel (*Foeniculum vulgare*), within the maximum extent of the thread-leaved brodiaea population, for an approximately 7.81-acre management area (Figure 2). Tri-blades were used to cut entire artichoke thistle and fennel individuals to reduce the amount of plant fragments needed to be raked and hauled out. If entire individuals were not feasible to cut and remove due to time and budget constraints, flower and seed heads were cut and removed to reduce reproductive success. Approximately 75 percent of the artichoke thistle within the management area was mechanically treated.

The Ranch Preserve

Based on coordination with RECON, city management (implemented by Black Sage and ESA) prioritized dethatching invasive non-native grasses while RECON prioritized treating artichoke thistle. Native grassland habitat management consisted of weed-whacking invasive non-native grasses using string trimmers, within and around the native grassland habitat, for an approximately 3.01-acre management area (**Figure 3**). As time and

budget permitted, large invasive non-native forb species such as artichoke thistle, fennel, short-pod mustard (*Hirschfeldia incana*), and black mustard (*Brassica nigra*) were targeted for mechanical removal using tri-blades. Invasive non-native grass biomass was raked, bagged and bundled, and hauled off-site. Invasive forb species individuals that were cut using tri-blades were hauled out in their entirety to reduce the amount of plant fragments needing to be raked and hauled out. Approximately 90 percent of the invasive non-native grasses and mustards and 5 percent of the artichoke thistle were mechanically treated by Black Sage.

RECON, on behalf of the Ranch HOA, performed weed maintenance targeting artichoke thistle in the same management area on August 29. Artichoke seed heads were cut and then dispersed seeds and seed heads were raked and bagged (approximately 35 50-gallon bags) and removed from the site.

Discussion and Next Steps

Management was consistent with the city's IPM Plan and prioritized manual and mechanical methods over organic and synthetic herbicides. However, many perennial invasive non-native plant species (e.g., artichoke thistle, fennel, mustard) require repeat maintenance due to their deep taproots and ability to resprout. Management consisted of only manual and mechanical removal of invasive non-native plant species, and many target invasive non-native plant species were observed resprouting post-maintenance. Synthetic chemical herbicides have been shown to be effective and cost-efficient at successful treatment and eradication of these perennial invasive non-native plant species. Because manual and mechanical management in 2023 was not effective in eradicating the target invasive non-native species and organic herbicides are not recommended to be used in these management areas, prudent use of synthetic chemical herbicides is recommended 2024 to continue management efforts around the sensitive species and habitats within Rancho Carrillo Master Association and The Ranch Preserves. Based on the results of 2023 management, the following next steps were identified:

- Coordinate with Jessie Vinje to determine if 2023 management activities were detected during 2023 Rare Plant Inspect and Manage monitoring that occurred post-management.
- Continue the pilot management program in 2024 to implement Year 2 if resources are available.
- Coordinate with RECON on upcoming weed maintenance activities at The Ranch Preserve. It is recommended that follow-up synthetic herbicide treatment targeting artichoke thistle should occur in April 2024 after artichoke thistle has produced new vegetative growth and before it goes to seed, as was noted in RECON's Quarter 1 Monitoring Report.
- Black Sage will prepare a Pesticide Application Request for the city's approval that documents the lack of effectiveness of 2023 manual/mechanical methods and recommends using more stringent synthetic chemical methods and/or a combination of mechanical and synthetic chemical methods to achieve the requisite purpose. The Pesticide Application Request shall list the recommended synthetic chemical(s) and the proposed usage methods. Any synthetic chemicals would be applied only by a qualified applicator licensed in the State of California in a manner that is least impactful, such as dabbing rather than spraying.
- If the Pesticide Application Request is approved by the city, ESA and Black Sage will implement targeted invasive non-native plant management using manual/mechanical methods and synthetic herbicides to treat and eradicate threats to sensitive San Diego thornmint, thread-leaved brodiaea, and native grassland habitat. Small invasive non-native plants are recommended to be treated with the appropriate synthetic herbicide. Larger invasive non-native plants may require cutting and then dabbing with the appropriate synthetic herbicide for maximum effectiveness. Any synthetic herbicide use would be under the supervision of a qualified botanist to avoid any negative effects to sensitive plant species.

- ESA will provide additional ArcGIS capabilities to Black Sage for more streamlined data collection.
- If mechanical removal is implemented in 2024, all biomass shall be hauled off-site. Based on Year 1 implementation, additional time should be budgeted towards raking, bundling, and hauling biomass off site due to amount of biomass and accessibility of management sites.
- ESA, Black Sage, and the city will continue to coordinate with regional monitoring entities (i.e., SDMMP and Jessie Vinje) and preserve manager RECON on monitoring and management activities within the Rancho Carrillo Master Association and The Ranch Preserves, respectively, to ensure all entities are informed of activities occurring on the preserves, particularly around rare plant species and sensitive habitats.

Attachments

Attachment A – Figures

Attachment B – Management Forms

References

California Native Grasslands Association. 2023. *What is a grassland?* Accessed at: https://www.cnga.org/page-1831102.

City of Carlsbad. 2017. *Integrated Pest Management Plan*. Parks and Recreation Department and Public Works Department. November 2017.

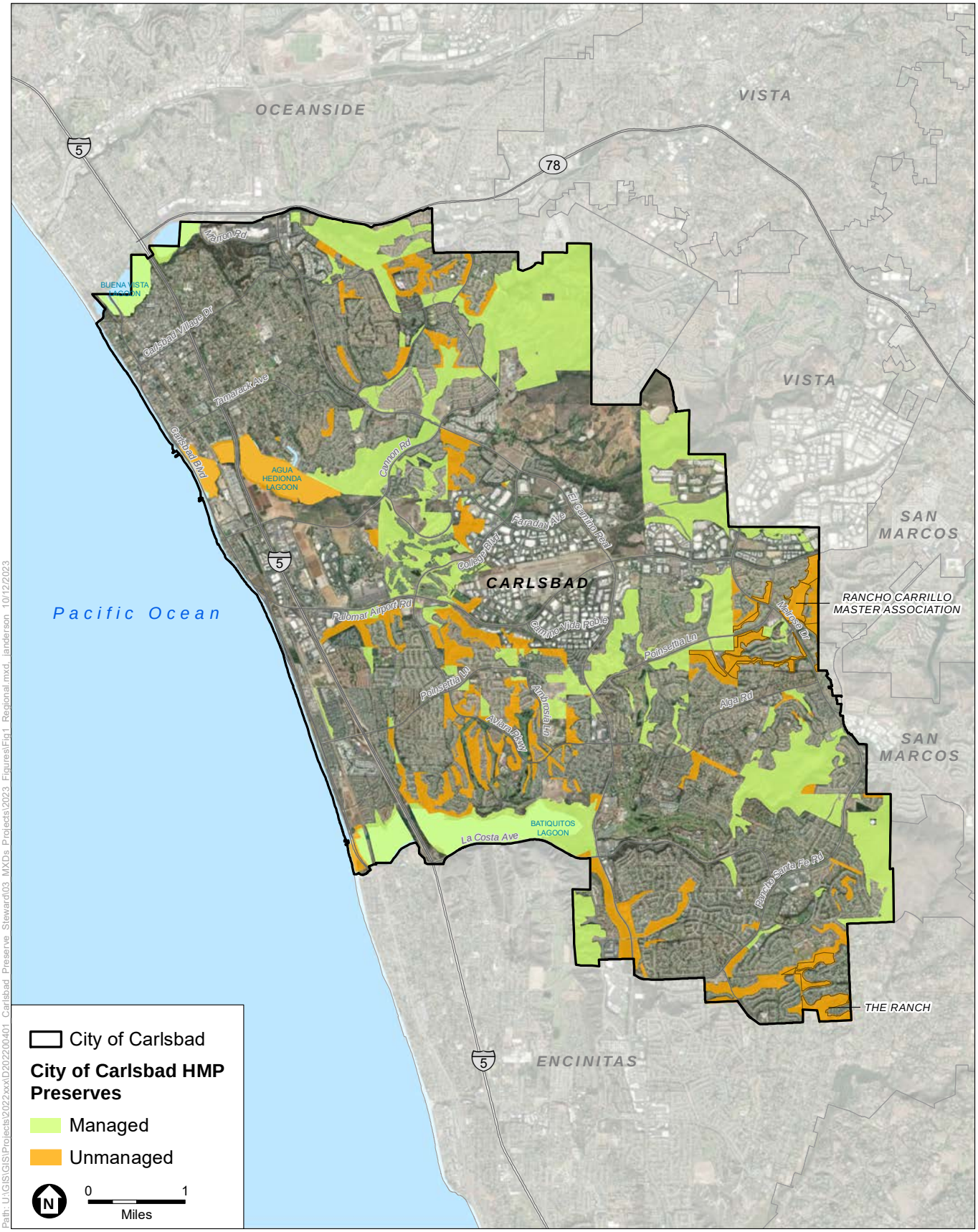
Environmental Science Associates (ESA). 2019. *Current Status of Selected Unmanaged Preserves within Carlsbad Habitat Management Program Preserve System*. November 2019.

ESA. 2023. *HMP Unmanaged Preserves Site Inspection Program 2021–2022 Summary*. January 2023.

San Diego Natural History Museum. 2020. *Rediscovering a "Lost" Plant in San Diego*. Accessed at: https://www.sdnhm.org/blog/blog_details/rediscovering-a-lost-plant-in-san-diego/149/.

UC Nursery and Floriculture Alliance. 2023. *Organic Herbicides – Do They Work?* Accessed at: Organic Herbicides - Do They Work? - UC Nursery and Floriculture Alliance (UCNFA) News (ucanr.edu).

Attachment A
Figures



SOURCE: SanGIS, 2022; City of Carlsbad, 2021.

HMP Unmanaged Preserves: 2023 Adaptive Management Memorandum

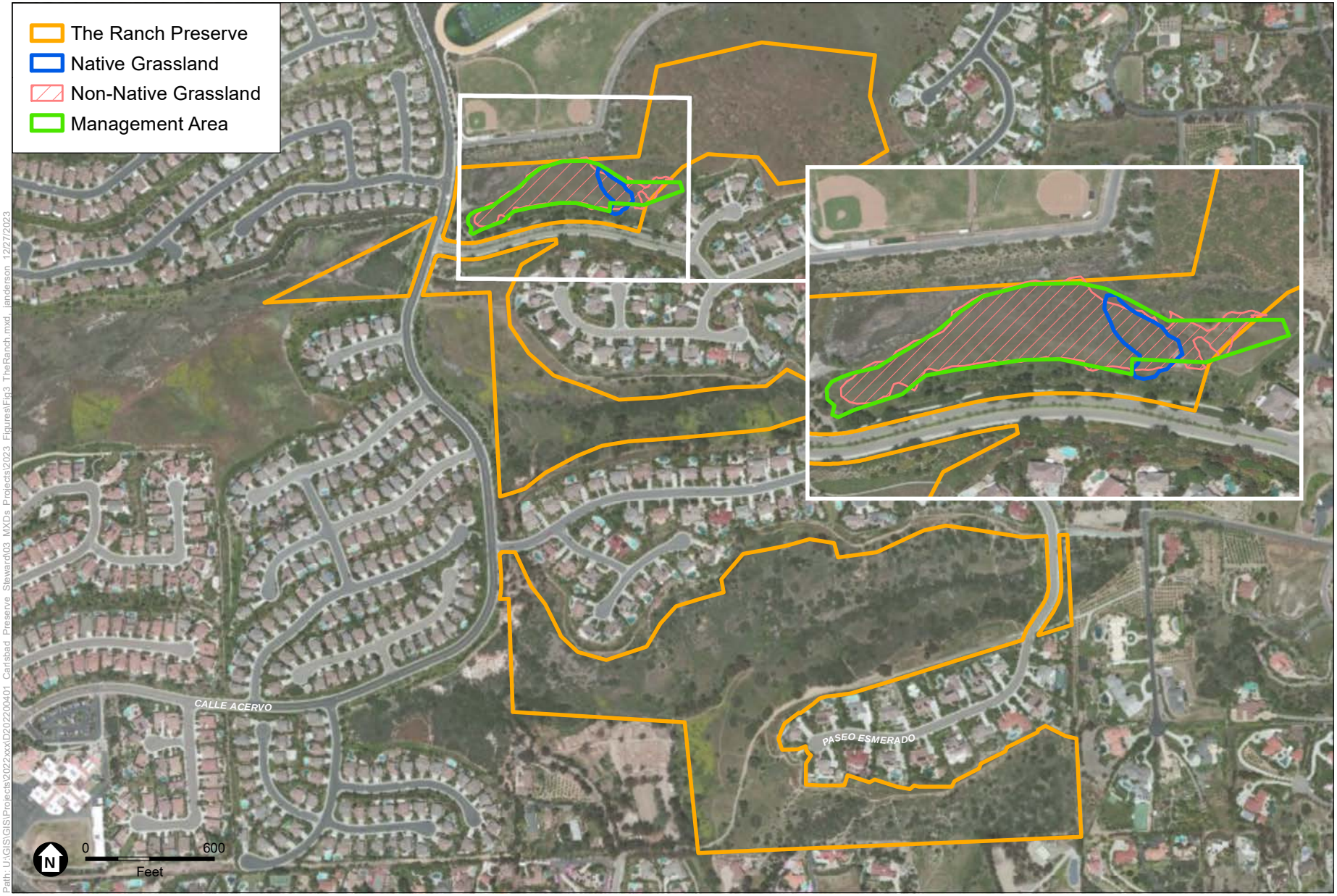
Figure 1
Managed and Unmanaged Preserves in City of Carlsbad

ESA

SOURCE: ESRI, 2023; ESA, 2023.

Figure 2
Rancho Carrillo Master Association Preserve – 2023 Management

ESA



SOURCE: ESRI, 2023; ESA, 2023.

Figure 3
The Ranch Preserve – 2023 Management

ESA

Attachment B
Management Forms

B-1 ESA Management Forms

Site Visit Memo

City of Carlsbad Land Management

Date/Time: April 4, 2023 8:11 AM

Observer: Adrienne Lee, Mark Dodero

Survey Type: Land Management

Property Name: Rancho Carrillo Master Association

Notes: Black Sage management visit for San Diego Thornmint

Start Weather:

Start - Time: 08:12
Start - Temperature: 45
Start - Cloud Cover (%): 0
Start - Precipitation: 0

End Weather:

End - Time: 09:15
End - Temperature: 51
End - Cloud Cover (%): 0
End - Precipitation: 0

General Site Photos:

Photo Description: Permanent photo point pre-maintenance

Photo Description: San Diego Thornmint close up growing with tocalote, spiny sow-thistle, fascicled tarweed

Photo Description: Black Sage conducting management (hand-clipping)

Photo Description: Overview of San Diego Thornmint population during maintenance

Photo Description: Non-natives and natives in foreground. Thornmint population in background with Black Sage conducting management.

Photo Description: Native grassland habitat (soap plant, Plantago, Dichelostemma)

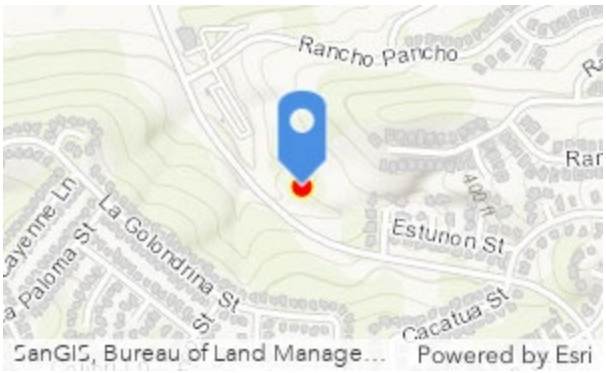
Observations:

Observation Type: Sensitive Plants
Common Name: Baja California oatgrass
Latin Name: Spenopholis interrupta ssp. californica
Sensitive? Yes

Observation Notes:
Lifeform: Plant
Count of Individuals: 10

New Observation? No

Location:

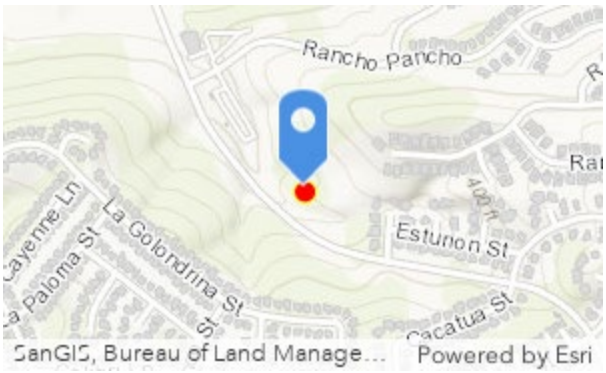

Rancho Pancho
Estunon St
La Golondrina St
Cacatua St
SanGIS, Bureau of Land Manage...
Powered by Esri

Photos:

Observation Type: Sensitive Plants
Common Name: San Diego thornmint
Latin Name: Acanthomintha ilicifolia
Sensitive? Yes

Observation Notes:
Lifeform: Plant
Count of Individuals: 30
New Observation? No

Location:


Rancho Pancho
Estunon St
La Golondrina St
Cacatua St
SanGIS, Bureau of Land Manage...
Powered by Esri

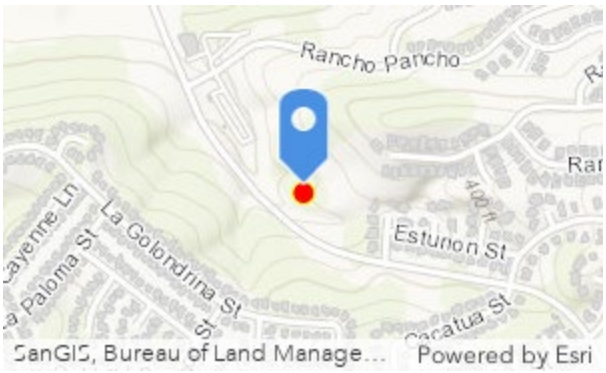
Photos:

Observation Type: Non-Native Invasive Species

Common Name: Sowthistle
Latin Name: Sonchus sp.
Sensitive? No

Observation Notes: Target invasives for maintenance
Lifeform: Plant
Count of Individuals: 100
New Observation? No

Location:


Rancho Pancho
Estunon St
La Golondrina St
Cacatua St
SanGIS, Bureau of Land Manage...
Powered by Esri

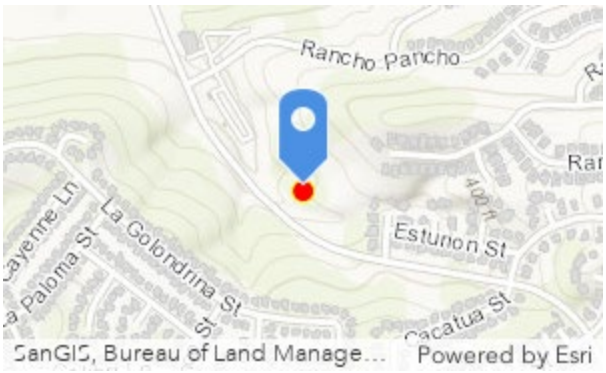
Photos:

Observation Type: Non-Native Invasive Species

Common Name: Tocalote
Latin Name: Centaurea melitensis
Sensitive? No

Observation Notes: Target invasive for management
Lifeform: Plant
Count of Individuals: 50
New Observation? No

Location:


Rancho Pancho
Estunon St
La Golondrina St
Cacatua St
SanGIS, Bureau of Land Manage...
Powered by Esri

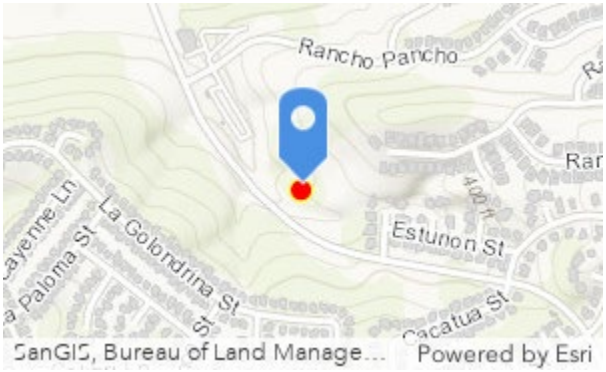
Photos:

Observation Type: Non-Native Invasive Species

Common Name: Scarlet pimpernel
Latin Name: Lysimachia arvensis
Sensitive? No

Observation Notes: Target invasive for management
Lifeform: Plant
Count of Individuals: 100
New Observation? No

Location:



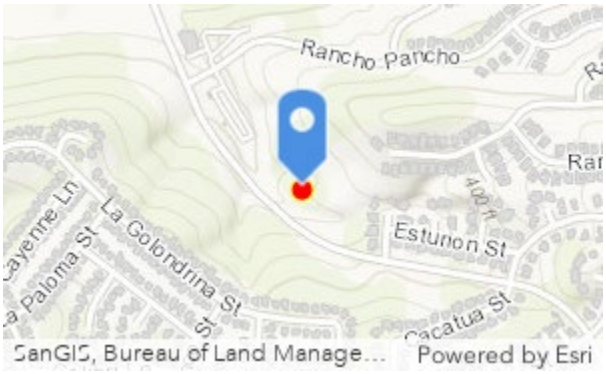
Photos:

Observation Type: Non-Native Invasive Species

Common Name: Bristly ox-tongue
Latin Name: Helminthotheca echioides
Sensitive? No

Observation Notes: Target invasive for management
Lifeform: Plant
Count of Individuals: 200
New Observation? No

Location:



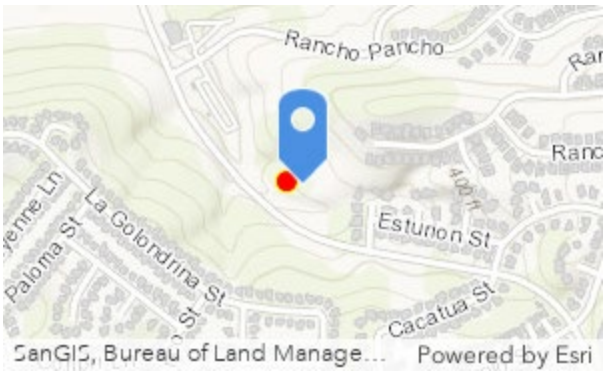
Photos:

Observation Type: Sensitive Plants
Common Name: Baja California oatgrass
Latin Name: Spenopholis interrupta ssp. californica
Sensitive? Yes

Observation Notes:
Lifeform: Plant
Count of Individuals: 10

New Observation? No

Location:

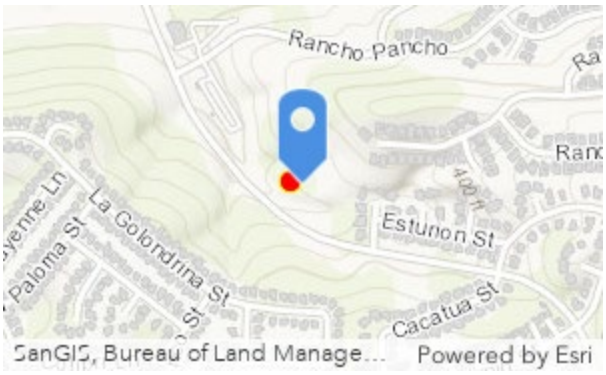

Rancho Pancho
Ranc
Estunion St
La Golondrina St
Paloma St
Cacatua St
SanGIS, Bureau of Land Manage...
Powered by Esri

Photos:

Observation Type: Sensitive Plants
Common Name: California adolphia
Latin Name: Adolphia californica
Sensitive? Yes

Observation Notes:
Lifeform: Plant
Count of Individuals: 25
New Observation? No

Location:

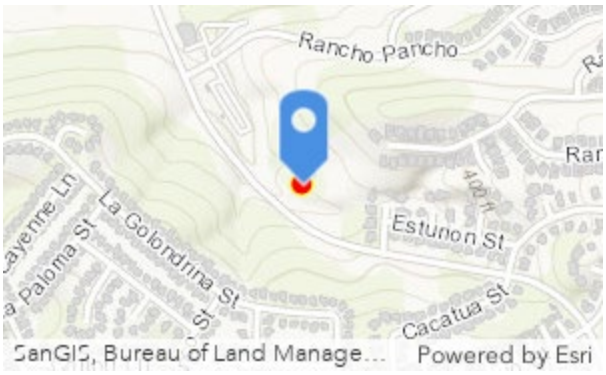

Rancho Pancho
Estunon St
La Golondrina St
Paloma St
Cacatua St
SanGIS, Bureau of Land Manage...
Powered by Esri

Photos:

Observation Type: Sensitive Plants
Common Name: Palmer's grappling hook
Latin Name: Harpagonella palmeri
Sensitive? Yes

Observation Notes:
Lifeform: Plant
Count of Individuals: 10
New Observation? No

Location:


Rancho Pancho
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La Golondrina St
Cacatua St
SanGIS, Bureau of Land Manage...
Powered by Esri

Photos:

Site Visit Memo

City of Carlsbad Land Management

Date/Time: April 24, 2023 8:36 AM

Observer: Mark Dodero

Survey Type: Land Management

Property Name: Rancho Carrillo Master Association

Notes: Photo point 2 photo 2

Start Weather:

Start - Time: 08:37
Start - Temperature: 58
Start - Cloud Cover (%): 100
Start - Precipitation: 0

End Weather:

End - Time: 10:20
End - Temperature: 59
End - Cloud Cover (%): 100
End - Precipitation: 0

General Site Photos:

Photo Description: Photo at IMG BRFI_6RACA017_1 Photo point 1

Photo Description: Photo at IMG BRFI_6RACA017_1 Photo point 2

Photo Description: Photo at IMG BRFI_6RACA017_2 Photo point 1

Photo Description: Photo at IMG BRFI_6RACA017_2 Photo point 2

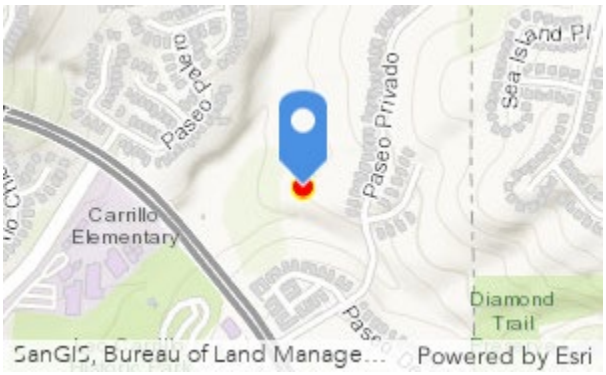
Observations:

Observation Type: Maintenance

Common Name: Artichoke thistle
Latin Name: Cynara cardunculus
Sensitive? No

Observation Notes: Maintenance for artichoke and fennel
Lifeform: Plant
Count of Individuals:
New Observation?

Location:



Photos:

B-2 Black Sage Management Forms

Site Visit Memo

City of Carlsbad Land Management

Date/Time: April 26, 2023 11:32 AM

Observer: Mark Dodero

Survey Type: Land Management

Property Name: Rancho Carrillo Master Association

Notes:

Start Weather:

Start - Time: 10:44
Start - Temperature: 64
Start - Cloud Cover (%): 10
Start - Precipitation: 0

End Weather:

End - Time: 12:05
End - Temperature: 69
End - Cloud Cover (%): 5
End - Precipitation: 0

General Site Photos:

Photo Description: Photo at IMG BRFI_6RACA017_1 Photo point 1

Photo Description: Photo at IMG BRFI_6RACA017_1 Photo point 2

Photo Description: Photo at IMG BRFI_6RACA017_2 Photo point 1

Photo Description: Photo at IMG BRFI_6RACA017_2 Photo point 2

Photo Description: Artichoke after cutting

Photo Description: Fennel after cutting

Photo Description: Crew gathering debris for removal

Photo Description: Crew gathering artichoke debris for removal

Site Visit Memo

City of Carlsbad Land Management

Date/Time: June 13, 2023 8:37 AM

Observer: Mark Dodero

Survey Type: Land Management

Property Name: The Ranch

Notes: Black Sage weed whipping non-native grass

Start Weather:

Start - Time: 08:37
Start - Temperature: 63
Start - Cloud Cover (%): 100
Start - Precipitation: 0

End Weather:

End - Time: 09:44
End - Temperature: 64
End - Cloud Cover (%): 0
End - Precipitation: 0

General Site Photos:

Photo Description: Native grass avoidance area with artichoke thistle

Photo Description: Crew weed whipping

Photo Description: Crew weed whipping

Photo Description: Crew weed whipping

Photo Description: Crew weed whipping

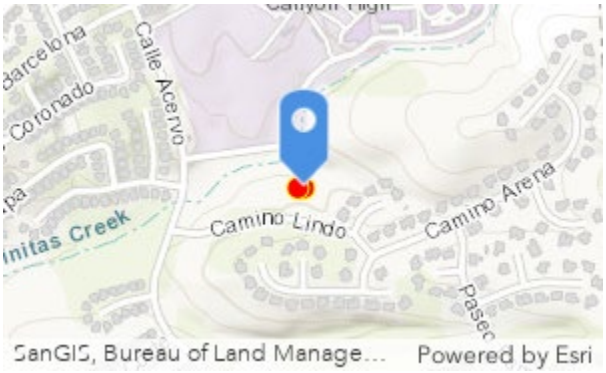
Observations:

Observation Type: Maintenance

Common Name: Artichoke thistle
Latin Name: Cynara cardunculus
Sensitive? No

Observation Notes: Native grassland dominated by Stipa. Sensitive Convolvulus simulans observed.
Lifeform: Plant
Count of Individuals:
New Observation? Yes

Location:



Photos:

Site Visit Memo

City of Carlsbad Land Management

Date/Time: June 14, 2023 8:43 AM

Observer: Mark Dodero

Survey Type: Land Management

Property Name: The Ranch

Notes:

Start Weather:

Start - Time: 08:44
Start - Temperature: 61
Start - Cloud Cover (%): 100
Start - Precipitation: 0

End Weather:

End - Time: 09:35
End - Temperature: 62
End - Cloud Cover (%): 100
End - Precipitation: 0

General Site Photos:

Photo Description: Area after weed whipping

Photo Description: Area before weed whipping

Photo Description: Crew weed whipping

Photo Description: Crew weed whipping

Photo Description: Crew weed whipping

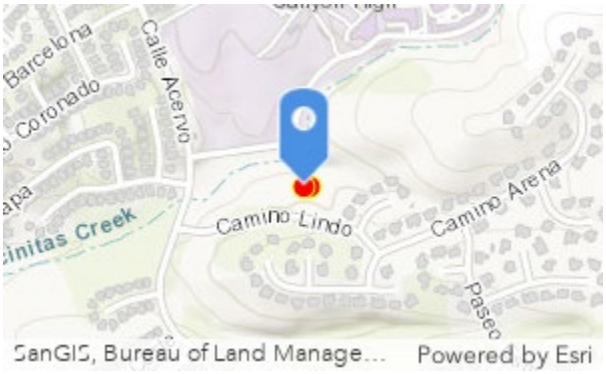
Photo Description: Sensitive Convolvulus simulans observed

Observations:

Observation Type: Sensitive Plants
Common Name: Small flowered morning glory
Latin Name: Convolvulus simulans
Sensitive? Yes

Observation Notes:
Lifeform: Plant
Count of Individuals: 50
New Observation? Yes

Location:



Photos:

Carlsbad Maintenance Form

Rancho Carillo Master Association

Date/Time: April 4, 2023 08:00

Visit Number: 1

Staff: Black Sage Environmental: Emmy Johnson, Cody Miller

Maintenance Methods: Hand pull, clippers to not disturb soil, bagged and removed biomass

Target Invasives: Scarlet pimpernel, tocalote, bristly ox-tongue, spiny sowthistle, filaree, mustard

Status/Notes: Hand-weeded area about 30 ft out from flagging/bush line, focusing first in thornmint population area detailed pulling and working out from there

Photos:

Photo Type: Before

Notes/Caption: Site conditions prior to management

Photo Type: General

Notes/Caption: San Diego thornmint

Photo Type: Before

Notes/Caption: Invasive non-native plant species targets (sowthistle, tocalote)

Photo Type: Work in Progress

Notes/Caption: Hand-pulling/clipping

Photo Type: Work in Progress

Notes/Caption: Hand-pulling/clipping

Photo Type: General

Notes/Caption: San Diego thornmint

Photo Type: Work in Progress

Notes/Caption: Hand-pulled/clipped invasive plant species

Photo Type: After

Notes/Caption: Site conditions post-management

Photo Type: After

Notes/Caption: Site conditions post-management

Photo Type: After

Notes/Caption: Site conditions post-management

Photo Type: After

Notes/Caption: Invasives bagged for disposal off-site

Photo Type: After

Notes/Caption: Site conditions post-management

Photo Type: After

Notes/Caption: Site conditions post-management

Carlsbad Maintenance Form

Rancho Carrillo Master Association

Date/Time: April 24, 2023 08:26

Visit Number: 2

Staff: Black Sage Environmental: Alex, Josh, Joey, Cody Miller

Maintenance Methods: Weed whacking

Target Invasives: Artichoke thistle, fennel

Status/Notes: One more day of cutting, followed by two days of bagging and taking to the dump.

Photos:

Photo Type: Work in Progress

Notes/Caption: Cut down artichoke ready to be bagged and hauled away

Photo Type: Work in progress

Notes/Caption: Cut down artichoke ready to be bagged and hauled away

Carlsbad Maintenance Form

Rancho Carrillo Master Association

Date/Time: April 25, 2023 08:38

Visit Number: 3

Staff: Black Sage Environmental: Alex, Marcel, Cody Miller

Maintenance Methods: Weed whacking

Target Invasives: Artichoke thistle, fennel

Status/Notes: Weed whacked 5 acres of thistle

Photos:

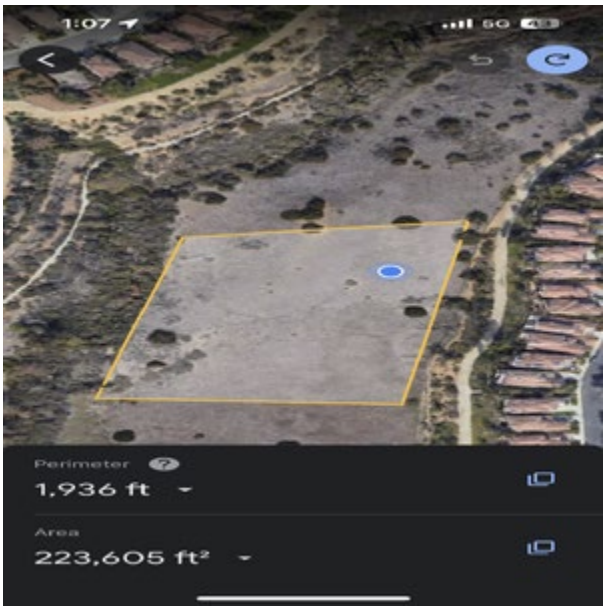


Photo Type: After

Notes/Caption: Map of area completed

Carlsbad Maintenance Form

The Ranch

Date/Time: June 13, 2023 14:36

Visit Number: 1

Staff: Black Sage Environmental: Emmy Johnson, Alex, Cody Miller

Maintenance Methods: Weed-whack

Target Invasives: Non-native grasses

Status/Notes: Weed-whacked grasses and some small fennel, mustard, and artichoke thistle. Worked from E slope to W.

Photos:

Photo Type: Before

Notes/Caption: Non-native grasses and thatch to be removed

Photo Type: Before

Notes/Caption: Non-native grasses and thatch to be removed

Photo Type: Before

Notes/Caption: Non-native grasses and thatch to be removed

Photo Type: General

Notes/Caption: Native priority

Photo Type: General

Notes/Caption: Native

Photo Type: After

Notes/Caption: Site conditions post-management

Photo Type: After

Notes/Caption: Site conditions post-management

Photo Type: After

Notes/Caption: Site conditions post-management

Photo Type: After

Notes/Caption: Site conditions post-management

Photo Type: After

Notes/Caption: Site conditions post-management

Carlsbad Maintenance Form

The Ranch

Date/Time: 13:11

Visit Number: 2

Staff: Black Sage Environmental: AJ, EJ, CM

Maintenance Methods: Weed whacking

Target Invasives: Non-native grasses

Status/Notes: Continued weed whacking around the native species. Leaving the artichoke thistle as we were instructed to do so.

Photos:

Photo Type: After

Notes/Caption: Artichoke thistle left unmanaged for RECON to treat.

Photo Type: After

Notes/Caption: Artichoke thistle left unmanaged for RECON to treat.

Photo Type: After

Notes/Caption: Artichoke thistle left unmanaged for RECON to treat.

Photo Type: After

Notes/Caption: Artichoke thistle left unmanaged for RECON to treat.

Carlsbad Maintenance Form

Rancho Carrillo Master Association

Date/Time: 15:00

Visit Number: 4

Staff: Black Sage Environmental: Assistant Supervisor Kurt

Maintenance Methods: Tri blades, drag bags

Target Invasives: Artichoke thistle

Status/Notes: Cut artichoke thistle and hauled out biomass in designated area

Photos:

Photo Type: Before

Notes/Caption:

Photo Type: Before

Notes/Caption:

Photo Type: Before

Notes/Caption:

Photo Type: After

Notes/Caption:

Photo Type: After

Notes/Caption:

Photo Type:

Notes/Caption:

Photo Type: Work in Progress

Notes/Caption:

Photo Type: Work in Progress

Notes/Caption: