

memorandum

date November 21, 2019

to Rosanne Humphrey, City of Carlsbad

cc Alanna Sullivan, Environmental Science Associates

from Adrienne Lee, Environmental Science Associates

subject City of Carlsbad Village H Wildlife Movement Study

This memorandum summarizes the results of wildlife movement monitoring conducted at Village H, using remote wildlife cameras, roadkill monitoring along streets that border Village H, and dog waste studies. Monitoring began prior to and after the Village H open space area was opened to the public on August 1, 2019, to document potential changes in wildlife movement patterns.

Introduction

An undeveloped property known as “Village H” was recently 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 (CNLM). 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**). For the purpose of this memorandum, the “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) that were identified during the planning phase of the HMP.¹ Village H was also identified as an important wildlife movement corridor (M1) in a city-wide wildlife movement study conducted in 2015². This

¹ City of Carlsbad (city). 2004. *Habitat Management Plan (HMP) for Natural Communities in the City of Carlsbad*.

² City of Carlsbad, Environmental Science Associates and Center for Natural Lands Management. 2015. *City of Carlsbad Wildlife Movement Analysis Final Report*.

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 Carlsbad Highlands Ecological Reserve/Lake Calavera area as shown in Figure 2. Four “pinchpoints” were identified in the immediate vicinity of Village H³ (Figure 2). 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 often function as natural wildlife corridors, but when these areas intersect with roadways, with or without underpasses and culverts, movement along these areas can become restricted. Pinchpoint M1-1 has a small (2-foot wide) culvert underneath the road, from the north side of Carlsbad Village Drive, but it does not go directly south into the Village H property (therefore, this acts as 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; M1-3 further east is an at-grade crossing over Glasgow Drive; and 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 culvert (3-feet wide), not identified as a pinchpoint in the 2015 wildlife movement study, is located under Pontiac Drive just east of M1-4.

Historically, the study area, which was privately owned, was used by local residents with off-leash dogs. When the city took ownership of the property, the historic trail onsite was formalized and opened to the public on August 1, 2019; however 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. Several residents expressed a desire to continue to use this area for off-leash dogs; as such, the city is currently considering a variety of options that could include off-leash dogs within some areas of Village H.

The presence of humans and domestic dogs has been shown to deter wildlife and shift their spatial distribution to avoid human activity⁴ and adjust their temporal dynamics by increasing their nocturnality to avoid human diurnal activity patterns⁵. The purpose of this study was to collect baseline data regarding the use of Village H by humans, domestic dogs, and wildlife. 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. The primary focus of this study was to collect quantitative data on wildlife presence on Village H, determine if animals are being killed on the road while moving into or out of the site, qualitatively evaluate wildlife movement patterns, and assess the amount and location of dog waste left onsite. Data was collected before and after the trail was opened to the public. The pre-opening data was collected for a six-week period during which Village H was closed to the public while the city conducted extensive tree trimming and trail improvements. The post-opening data collection is ongoing. Data included in this report were collected from June 25, 2019, to September 7, 2019 so that the pre-and post-opening time period (number of days) is the same for better comparison. Six weeks of data is not extensive enough to fully understand how the site is or was being used by wildlife; however, even a short snapshot like this can give the city insights into how the site is being used. Highlights from data collected through November 15, 2019 are given at the end of this report and an updated report including this information will be prepared. Wildlife cameras will continue to be used throughout the site to better document wildlife movement.

³ ESA. 2019. *Village H: Analysis of Biological Constraints Memorandum*. Prepared for City of Carlsbad.

⁴ Frid, A. and M. Dill. 2002. *Human-caused disturbance stimuli as a form of predation risk*. Conservation Ecology 6 (1).

⁵ Gaynor, K.M., C.E. Hohnowski, N.H. Carter, and J.S. Brashares. 2018. *The influence of human disturbance on wildlife nocturnality*. Science 360: 1232-1235.

Methodology

Remote Wildlife Cameras

On June 13, 2019, ESA biologists Adrienne Lee met with city Habitat Management Program (HMP) staff Hannah Swarthout to determine remote wildlife camera locations within the study area that would likely document the diversity of wildlife species using the site. On June 25, 2019, the same biologists met with City of Carlsbad Department of Parks and Recreation staff to install two Bushnell HD Trophy Cam Trail cameras and six Browning Strike Force Pro Trail cameras in areas where multiple trails intersected and were likely being utilized by wildlife (i.e., signs of scat and/or tracks present) (**Figure 3**). Two additional cameras were installed on July 25, 2019. 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. Target species for this study were coyotes and bobcats because 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.

The cameras were set to have “low sensitivity” to movement such that anything from a small bird to large coyote would likely trigger the cameras to start taking videos but vegetation moving in the wind would not. Once triggered, the wildlife cameras were set to take a video for 20 seconds. 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. Seven of the wildlife cameras were bolted to 4-foot-tall steel posts that had been dug into the ground. The eighth camera was cabled to a chain-link fence and angled toward a culvert. The two additional cameras installed on July 25, 2019, were also bolted to 4-foot-tall steel posts. The cameras were oriented away from the sun (to the extent practical) to protect the lens from over-exposure and were positioned to capture videos of wildlife walking along a trail, headed either toward or away from the wildlife camera. Representative photographs were taken of all 10 wildlife camera locations (**Appendix A**). CNLM also installed two remote wildlife cameras on gates within the Carlsbad Village Drive undercrossing within the northern section of Village H. These cameras’ settings were set to match the 10 installed within the southern section of Village H.

Once installed, all wildlife cameras were turned on and left to record continuously. The 10 cameras within the study area were checked at least once a week by city 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 were then reviewed and categorized based on the species detected. Videos of human activity and/or dogs were categorized as well to make general assumptions regarding amount of human and/or dog traffic within the study area. For the purposes of this memo, only data from June 25, 2019, to September 7, 2019, are analyzed such that data for the same number of days prior to Village H reopening to the public are compared with data for the same number of days post Village H’s reopening to the public, 37 days respectively. Data from the two CNLM wildlife cameras are not included in the results below because these cameras did not fully capture data within the June 25, 2019, to September 7, 2019, survey period; however, their data is included in **Appendix B**. On August 10, 2019, cameras VH2, VH3, VH4, and VH10 were found vandalized and pulled from the ground by the public but left within the study area, and were not reinstalled due to potential for additional vandalism; therefore, no videos were collected at their respective locations from August 10, 2019, onward. Videos are still being captured for the remaining cameras on the ground and a summary of those results can be found in Appendix B.

Roadkill Monitoring

On July 25, 2019, ESA biologist Adrienne Lee met with volunteers and city HMP staff to finalize the roadkill monitoring survey area (**Figure 4**). Roadkill was studied to determine if animals are 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. Roadkill monitoring began July 25, 2019 and is ongoing, with a minimum of three surveys completed per week. For the full list of survey dates, see **Appendix C, Village H Roadkill Survey Dates and Results**. Additionally, the city's Public Works department log of animal disposal pickups from July 2017 to March 2019 were monitored by ESA biologists to supplement roadkill monitoring data.

Monitoring was completed by ESA biologists, volunteers, and a city staff. 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, a photo was taken when road conditions were safe and uploaded onto the citizen scientist mobile application iNaturalist⁶ to create an "observation" within the University of California, Davis California Roadkill Observation System (CROS) Project.⁷ Once the observation was recorded, the surveyor called the city's Public Works department for animal disposal pickup.

Dog Waste Studies

On August 28, 2019, ESA biologist Alanna Sullivan met with volunteers and city HMP staff to finalize the dog waste study methodology. 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., are dogs going into the native habitat or staying 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 currently 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 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 survey. Collected dog waste was weighed at the end of each collecting 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, on August 28, September 11, September 25, October 8, and October 23, 2019. Note that the initial survey on August 28, 2019 includes all previously uncollected waste from the site; therefore, only subsequent collections can be used to determine weekly coyote scat and waste left by dog owners.

Results

Remote Wildlife Cameras

Species detected at the 10 wildlife camera locations included coyote (*Canis latrans*), bobcat (*Lynx rufus*), skunk, rabbit, squirrel, raccoon (*Procyon lotor*), various bird species, off-leash dogs, on-leash dogs, and humans.

Table 1 and **Figure 5** detail the total number of individuals detected at each wildlife camera from June 25, 2019,

⁶ iNaturalist. Available from <https://www.inaturalist.org>.

⁷ iNaturalist. California Roadkill Observation System (CROS). Available from: <https://www.inaturalist.org/projects/california-state-roadkill>

to September 7, 2019. It is important to note that while the number of individuals per camera is useful to show the locations frequently used by different species, the number of individuals detected is not a proxy for relative abundance. For example, certain dogs and humans were frequent visitors to Village H and passed by the same cameras each time. It is likely that for several of the species, the cameras detected many of the same individuals moving within Village H. Cameras 1 and 7 captured the most wildlife activity, with both target species (coyote and bobcat), detected. Cameras 2, 3, 4, 5, 9, and 10 detected coyote but not bobcat; however, Camera 6 detected bobcat but not coyote. Bobcat, rodent/rabbit/raccoon, and bird detections decreased by 55%, 62%, and 80%, respectively, after Village H reopened to the public. The number of coyotes, however, increased by 52% after reopening. The number of off-leash dogs did not significantly increase after Village H reopened to the public (many people with off-leash dogs used the trail when it was officially closed); however, the number of on-leash dogs and humans increased by 578% and 204%, respectively, after Village H reopened to the public. Representative photographs of wildlife species detected are included in **Appendix D**.

**TABLE 1
VILLAGE H REMOTE WILDLIFE CAMERA DETECTIONS JUNE 25 – SEPTEMBER 27, 2019
(NUMBER OF INDIVIDUALS DETECTED)**

Wildlife Camera Location	Coyote		Bobcat		Skunk		Rodents, Rabbits, Raccoons		Bird		Off-Leash Dog		On-Leash Dog		Human		Biker	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
VH1	60	111	3	3	1	1	19	2	59	7	116	134	1	13	52	101	0	0
VH2 ²	22	2	0	0	0	0	13	0	0	0	49	13	1	16	46	64	0	0
VH3 ²	4	0	0	0	0	0	0	0	3	1	174	93	30	102	253	387	0	3
VH4 ²	1	0	0	0	0	0	0	0	0	0	43	68	4	83	50	244	0	0
VH5	0	2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
VH6	0	0	3	2	0	1	0	5	8	3	0	0	0	0	0	1	0	0
VH7	34	26	5	0	1	0	0	4	4	1	0	0	0	0	0	1	0	0
VH8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
VH9 ³	6	53	0	0	0	0	2	2	0	1	17	100	1	0	10	38	0	0
VH10 ^{2,3}	1	0	0	0	0	0	0	0	0	1	1	1	0	0	0	5	0	0
Total	128	194	11	5	2	2	34	13	74	15	400	409	37	214	411	842	0	3

¹ Time Period A: Prior to Public Reopening (6/25/19–7/31/19)

Time Period B: Post Public Reopening (8/1/19–9/7/19)

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 VH9 and VH10 were installed on July 25, 2019.

Roadkill Monitoring

A total of three roadkill occurrences were detected during the 38 survey dates within the current 90 days of monitoring. All roadkill observations were small mammals (opossums and rabbit). Six additional roadkill occurrences within the roadkill monitoring study area were reported through the city’s Public Works department animal disposal pickup records prior to the start of roadkill monitoring. All roadkill observations, including the city’s Public Works records, and their associated survey dates and surveyor information are listed in **Table 2**, and locations of all roadkill observations are displayed in **Figure 3**.

**TABLE 2
VILLAGE H ROADKILL DETECTIONS**

Date	Surveyor	Species
11/9/17	Public Works Animal Disposal Pickup	Skunk
11/9/17	Public Works Animal Disposal Pickup	Skunk
7/15/18	Public Works Animal Disposal Pickup	Dog
7/25/18	Public Works Animal Disposal Pickup	Hawk
8/16/18	Public Works Animal Disposal Pickup	Skunk
12/10/18	Public Works Animal Disposal Pickup	Skunk
8/28/19	A. Sullivan	Opossum
9/19/19	H. Swarthout	Opossum
10/23/19	A. Sullivan	Rabbit

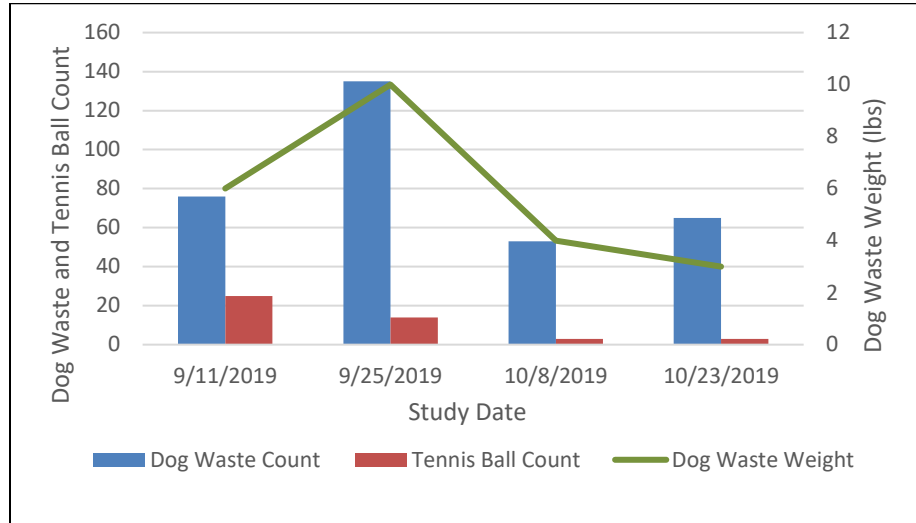
Dog Waste Studies

A total of five dog waste monitoring visits have been conducted within the study area at the time of this memo. **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. The percent change in total dog waste counts between studies were a 73% decrease from August 28, 2019, to September 11, 2019; a 78% increase from September 11, 2019, to September 25, 2019; a 61% decrease from September 25, 2019, to October 8, 2019; and a 123% increase from October 8, 2019, to October 23, 2019. Similarly, the percent change in total weight of dog waste (lbs) between studies were a 65% decrease from August 28, 2019, to September 11, 2019; a 182% increase from September 11, 2019, to September 25, 2019; a 60% decrease from September 25, 2019, to October 8, 2019; and a 25% decrease from October 8, 2019, to October 23, 2019. Representative photographs of dog waste study collections are included in **Appendix E**.

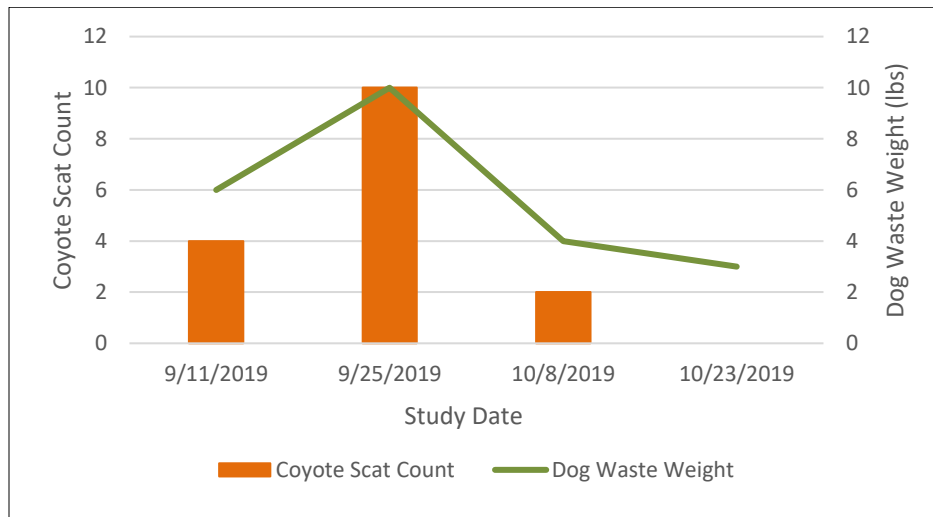
**TABLE 3
VILLAGE H DOG WASTE STUDY RESULTS**

Date	Dog Waste Count	Pounds of Dog Waste	Coyote Scat Count	Tennis Ball Count
8/28/19	286	16	3	1
9/11/19	76	6	4	25
9/25/19	135	10	10	14
10/8/19	53	4	2	3
10/23/19	65	3	0	3
Total	550	36	19	43

GRAPH 1
VILLAGE H DOG WASTE STUDY RESULTS: DOG WASTE AND SIGN



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



Discussion

The primary focus of the aforementioned studies was to collect quantitative and qualitative data on wildlife species, humans and domestic dogs to inform decisions about land management and potential future uses of 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. To determine the effect new public usage within Village H has had on wildlife species and their movement patterns, wildlife camera data from the same number of days prior to Village H reopening to the public were compared with data for the same number of days post

Village H reopening to the public, 37 days respectively. Wildlife, such as bobcat, rodent/rabbit/raccoon, and bird, detections decreased by 55%, 62%, and 80%, respectively after Village H reopened to the public. This trend is consistent with previous studies that found wildlife shifted their spatial distribution patterns to avoid human activity⁸. However, coyote detections increased after Village H reopened to the public. This is likely due to increased activity investigating and scent marking areas with where dogs are present⁹. The number of off-leash dogs did not significantly increase after Village H reopened to the public; however, the number of on-leash dogs and humans increased by 578% and 204%, respectively, after Village H reopened to the public. These results suggest that most wildlife species that utilize Village H are impacted negatively by increased public usage. Additionally, the detection times for all wildlife species shifted from both daytime and nighttime prior to public reopening to predominantly nighttime after public reopening, suggesting that wildlife species movement patterns responded to increased preserve usage by humans and associated on-leash dogs during the day. This finding is consistent with the 2018 Gaynor et al. global meta-analysis that concluded humans had a strong effect on the daily patterns of wildlife activity by influencing animals to become more nocturnal in order to avoid human activity¹⁰.

Hannah Swarthout is continuing to monitor remote wildlife cameras within the study area and the two northern Village H cameras managed by CNLM.

Roadkill Monitoring

Tamarack Avenue and Carlsbad Village Drive are highly traveled, as 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.¹¹ While roadkill monitoring occurred 38 days out of 90 days for the purpose of this memo, it is likely that these results represent all roadkill data for the 90 days, as roadkill typically persists for more than 1 day. All roadkill observations detected during the roadkill monitoring period were small mammals, suggesting that medium to large mammal species, such as coyote, are able to cross pinchpoint M1-1 across Carlsbad Village Drive at street level relatively successfully, as documented on remote wildlife cameras. Additionally, all roadkill observations detected during the roadkill monitoring period were not found at the four pinchpoints previously identified¹².

ESA is continuing to monitor animal disposal pickup records from the city's Public Works department to determine potential pinchpoints within the city that may benefit from future roadkill monitoring. Additional pinchpoint roadkill monitoring is currently being conducted at Faraday Avenue (pinchpoint M5-2).

⁸ Frid, A. and M. Dill. 2002. *Human-caused disturbance stimuli as a form of predation risk*. Conservation Ecology 6 (1).

⁹ Lenth, B., M. Brennan, and R. L. Knight. 2006. *The Effects of Dogs of Wildlife Communities*. City of Boulder Open Space and Mountain Parks.

¹⁰ Gaynor, K.M., C.E. Hojnowski, N.H. Carter, and J.S. Brashares. 2018. *The influence of human disturbance on wildlife nocturnality*. Science 360: 1232-1235.

¹¹ 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.

¹² ESA. 2019. *Village H: Analysis of Biological Constraints Memorandum*. Prepared for City of Carlsbad.

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 might impact on-the-ground conditions in the form of dog waste left along trails and within adjacent open space areas. The first collection, which occurred on August 28, 2019, represented nearly half of the total counts of dog waste across all 5 collection dates and nearly half of the amount of dog waste by pound. This is presumably from waste that had been left onsite prior to the start of this study. It should be noted, much of the dog waste that was onsite was likely covered by the dense layer of eucalyptus mulch left onsite when preparing the trails for reopening. Additionally, older waste had likely degraded and were not represented in the results. The percent change in total dog waste counts between studies were a 73% decrease from August 28, 2019, to September 11, 2019; a 78% increase from September 11, 2019, to September 25, 2019; a 61% decrease from September 25, 2019, to October 8, 2019; and a 123% increase from October 8, 2019, to October 23, 2019. Similarly, the percent change in total weight of dog waste (lbs) between studies were a 65% decrease from August 28, 2019, to September 11, 2019; a 182% increase from September 11, 2019, to September 25, 2019; a 60% decrease from September 25, 2019, to October 8, 2019; and a 25% decrease from October 8, 2019, to October 23, 2019. If the total number of dog waste is used as a proxy for the amount of public usage, these results suggest that public usage within Village H may not be consistent across weeks, assuming dog owners who do not pick up dog waste never pick up dog waste. Currently, there is no apparent trend between dog waste study collection dates, except a general decline since the first date.

ESA, volunteers, college students, and city staff continue to conduct dog waste studies within the study area, with the next one planned for November 6, 2019. This study is expected to continue until a correlation is clear or determined unnecessary.

Highlights from Studies through November 15, 2019

Additional information that has been gathered since the data presented above (runs through October 23, 2019) includes:

- Movement northward out of the site.
 - Coyotes were documented traveling 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. No roadkill has been detected along that portion of Carlsbad Village Drive so far, suggesting that coyotes may be successfully crossing Carlsbad Village Drive into the habitat to the north. Coyotes were observed on camera on the boundary farther east hesitating to leave the site at night as headlights passed by.
 - Based on current roadkill monitoring data and camera data, smaller mammals such as skunks and opossums appear to have difficulties crossing Carlsbad Village Drive near Tamarack Avenue and Glasgow Drive. These animals may be trying to travel into or out of the habitat preserve north of Carlsbad Village Drive in this area.
- East-west movement
 - East-west movement between pinchpoints M1-1 and M1-3, which is the east-west fork of the potential movement pathway on Figure 2, seems to be well-established based on camera data.
 - Prior to opening the gate at pinchpoint M1-2 on August 26, 2019, bobcats were documented attempting to cross under Tamarack Avenue, but they were blocked because the gate was closed (and locked). As soon as the gate was opened by the city, wildlife including bobcats began utilizing this undercrossing

within 2 days. This undercrossing supports heavy traffic from skunks as well, but no coyotes have been documented utilizing it.

- North-south movement
 - It appears that wildlife may have difficulty moving north-south through and beyond (south of) the Village H site.
 - Few animals were detected on cameras placed in the central portion of the site; however, this could be due to camera placement. Cameras have been moved to other locations that are better suited to capture movement.
 - Movement south of Village H appears very constrained. The CMWD property and storage area are completely blocked off with six-foot chain link fences, and no wildlife was captured at the M1-4 pinchpoint (under Pontiac Drive) located at the southern end of the offsite preserve. The area was scouted for additional camera locations or potential movement paths. A deep concrete v-ditch that runs along the eastern portion of the habitat south of Village H near Tamarack Avenue could provide an opportunity for north-south movement; however, there are signs of recent use by skateboarders which might deter wildlife. Also, animals moving along this path would not be able to move out of the ditch westward until the southern end near Pontiac Drive because there are no openings in the adjacent vegetation. Fencing along the eastern edge prevents wildlife from entering onto Tamarack Avenue.
 - No accessible paths were located through the middle of this offsite preserve area, and although there appears to be a trail along the western (top) edge based on aerial photographs, access into the habitat is fenced off.

Conclusions and Future Studies

- Conclusions regarding impacts to wildlife species and their movement patterns from formally opening the trail are limited due to the short survey period, which included a large amount of human activity and noise from construction equipment during the closed period when tree trimming and fencing installation were conducted to get the trail ready for public use. Additionally, the Village H property was heavily used by local homeowners for decades before the city acquired the property and wildlife movement during this time period was not captured. However, the results in this memorandum still provide valuable baseline information regarding wildlife species occurring onsite, a snapshot of wildlife movement patterns, human and dog usage, and fluctuations over time which can inform management decisions about future use of the property.
- Wildlife seem to generally stay away from the trails, even at night. However, all cameras along the trail were stolen during the period when the trail was reopened to the public; therefore, this incidental observation is not conclusive. Additional trail cameras should be installed in a fashion where vandalism and stealing are less likely, so that additional camera data can be collected to see if wildlife are using the trails at night.
- The majority of dog waste was documented either on or within three feet of the city-approved trail, suggesting dogs spend more time on and nearby the trail than in the adjacent open space and HMP hardline preserve areas. However, many tennis balls were documented in the open space and HMP hardline preserve areas, indicating that dogs are entering those areas to play.
- Despite the fact that the trail is a leash-only trail with dog waste stations along the trail and no dogs are allowed elsewhere, there is still a significant amount of dog waste being picked up during the biweekly dog waste studies (i.e., many dog users are not picking up after their dogs).
- The presence, sign, and smell of dogs has been shown to reduce wildlife usage¹³. Small mammals such as squirrels, rabbits, and mice (*Peromyscus* spp., *Reithrodontomys* spp., and *Onychomys* spp.) exhibit reduced

¹³ Lenth, B., M. Brennan, and R. L. Knight. 2006. The Effects of Dogs of Wildlife Communities. City of Boulder Open Space and Mountain Parks.

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-marking¹⁴.

- Wildlife cameras are recommended to be maintained and the results documented for at least one year to assess wildlife usage patterns throughout the year.

Figures

Figure 1 – Study Area Location

Figure 2 – Pinchpoints and Potential Wildlife Movement Corridors

Figure 3 – Remote Wildlife Camera Locations

Figure 4 – Roadkill Monitoring Results

Figure 5 – Remote Wildlife Camera Results

Figure 6 – Dog Waste Study Results

Attachments

Appendix A – Village H Remote Wildlife Camera Representative Photographs

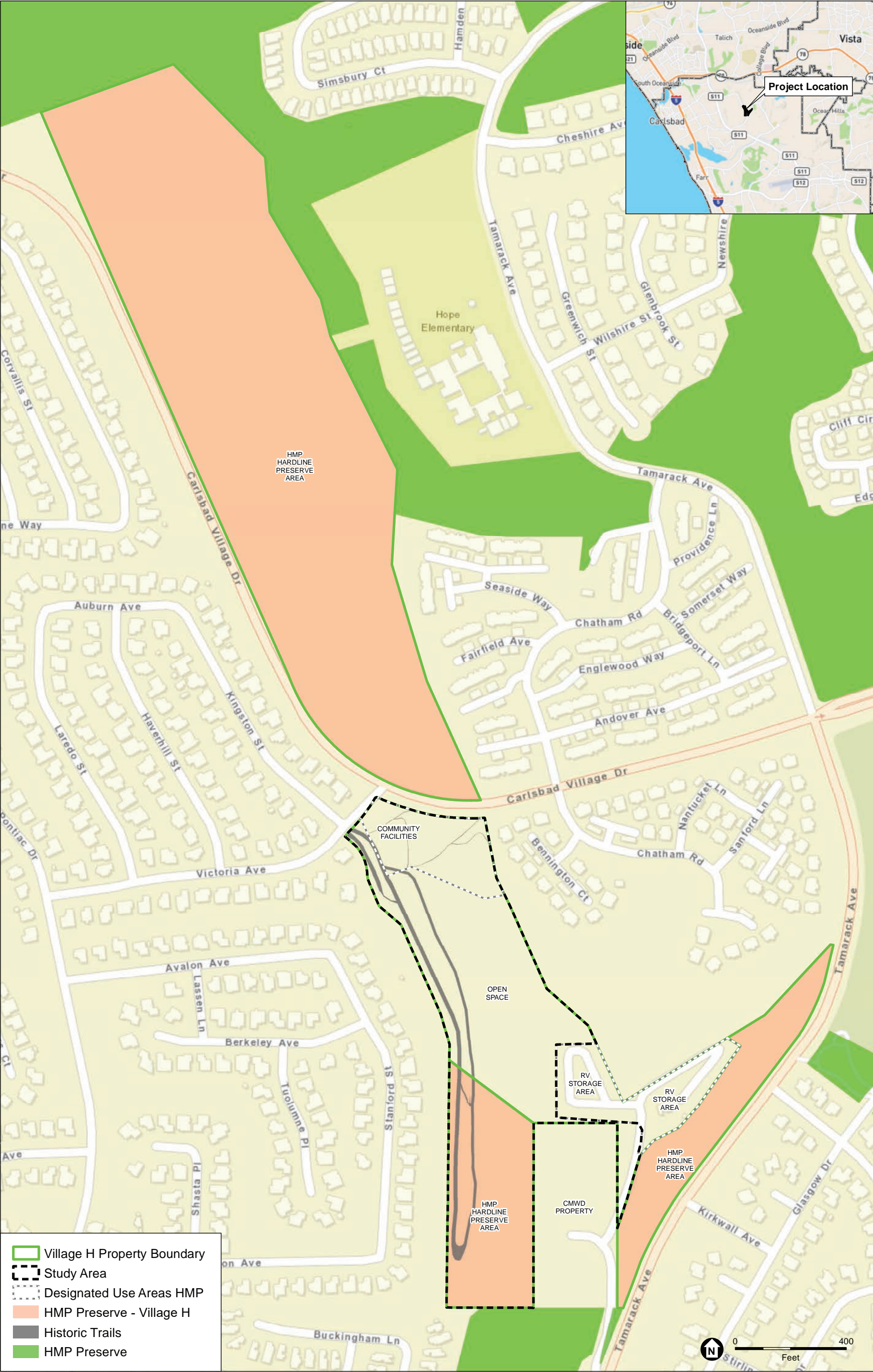
Appendix B – Village H Remote Wildlife Camera Results

Appendix C – Village H Roadkill Survey Dates and Results

Appendix D – Village H Representative Photographs of Wildlife Detected on Remote Wildlife Cameras

Appendix E – Village H Dog Waste Studies Representative Photographs

¹⁴ Lenth, B., M. Brennan, and R. L. Knight. 2006. The Effects of Dogs of Wildlife Communities. City of Boulder Open Space and Mountain Parks.



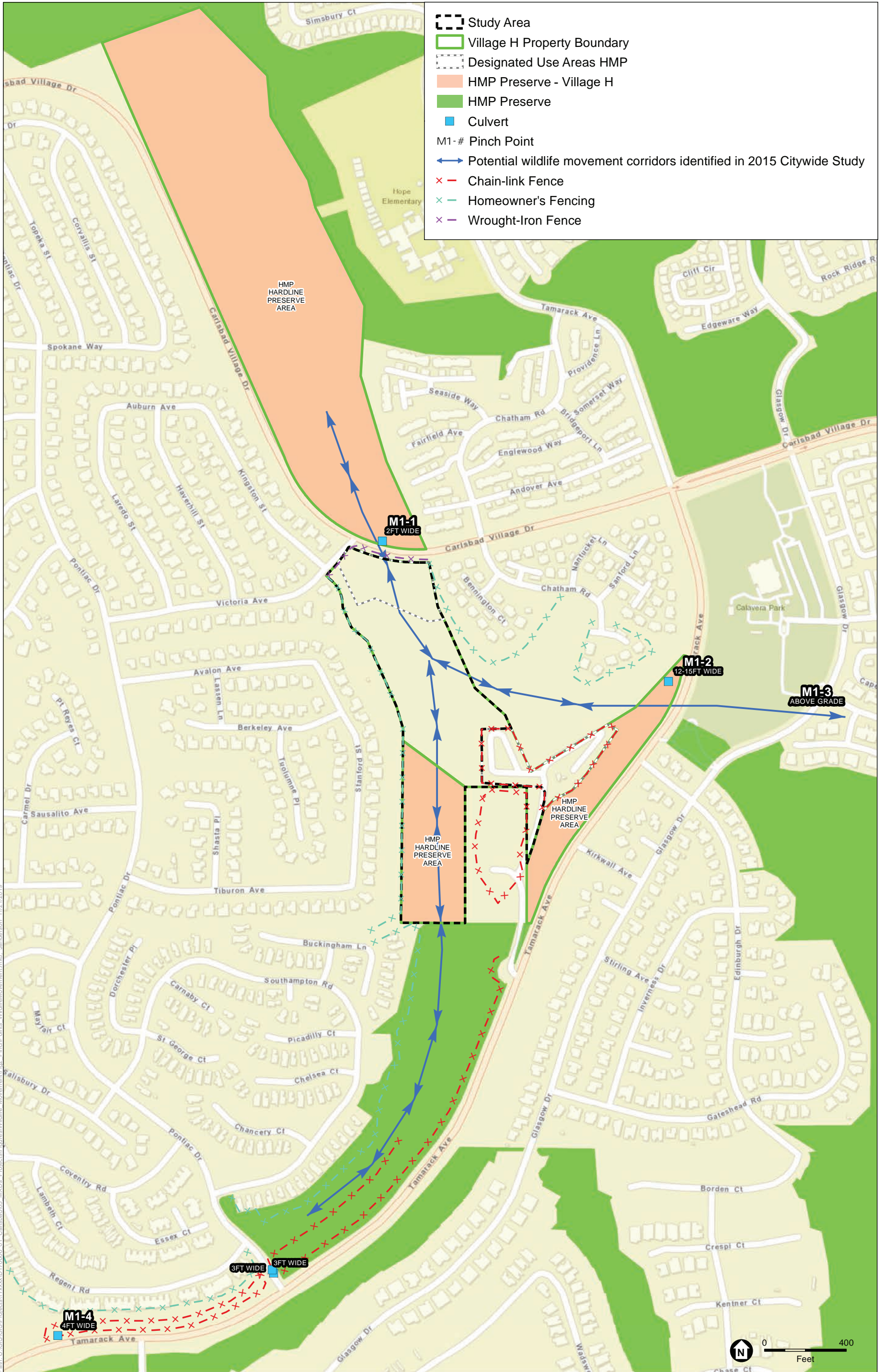
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SOURCE: ESRI

D170606.03 City of Carlsbad Preserve Steward
Village H Wildlife Movement Memo

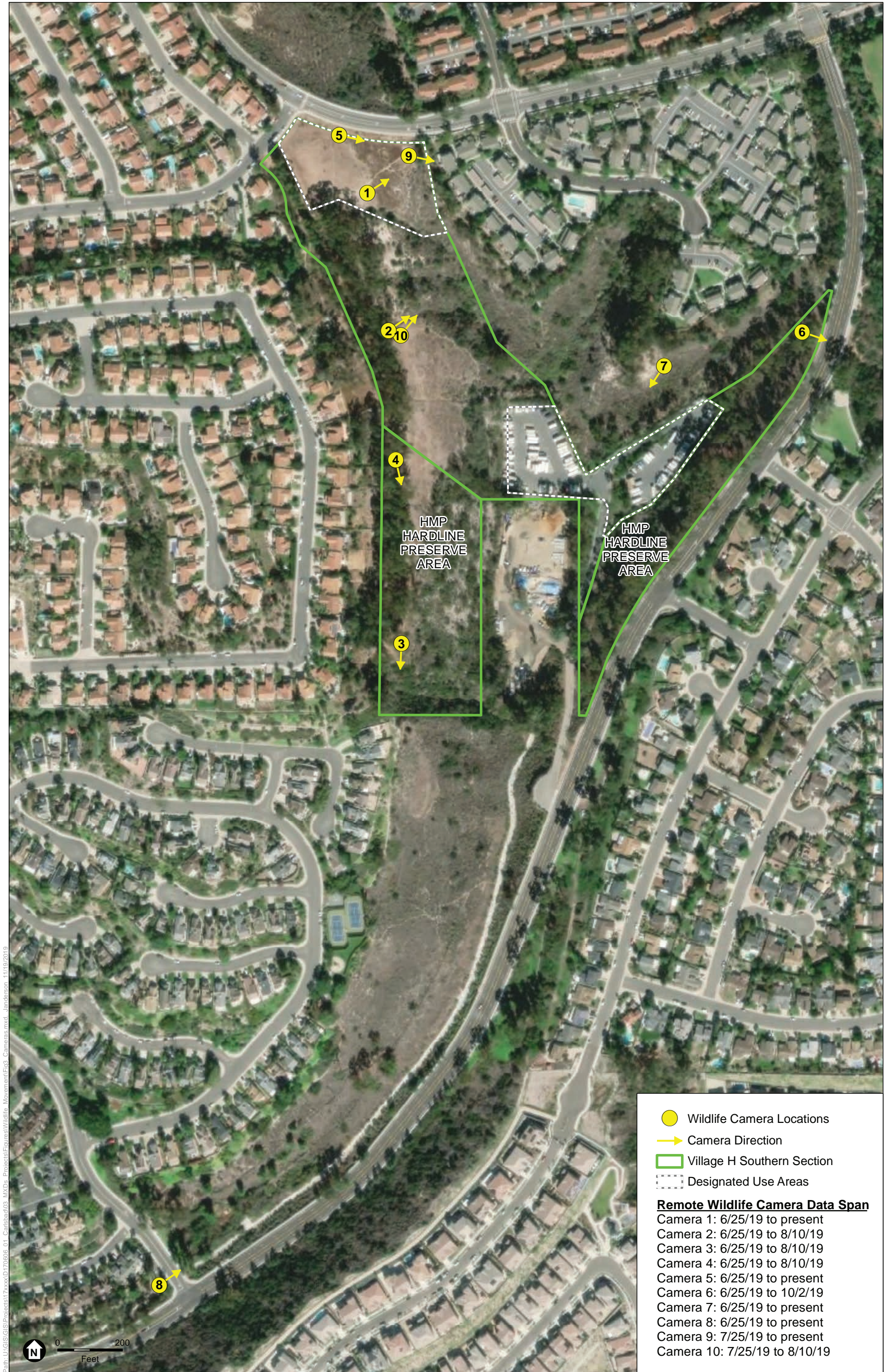
Figure 1
Study Area Location





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

D170606.03 City of Carlsbad Preserve Steward Village H Wildlife Movement Memo



SOURCE: ESRI

D170606.03 City of Carlsbad Preserve Steward
Village H Wildlife Movement Memo

Figure 3
Remote Wildlife Camera Locations



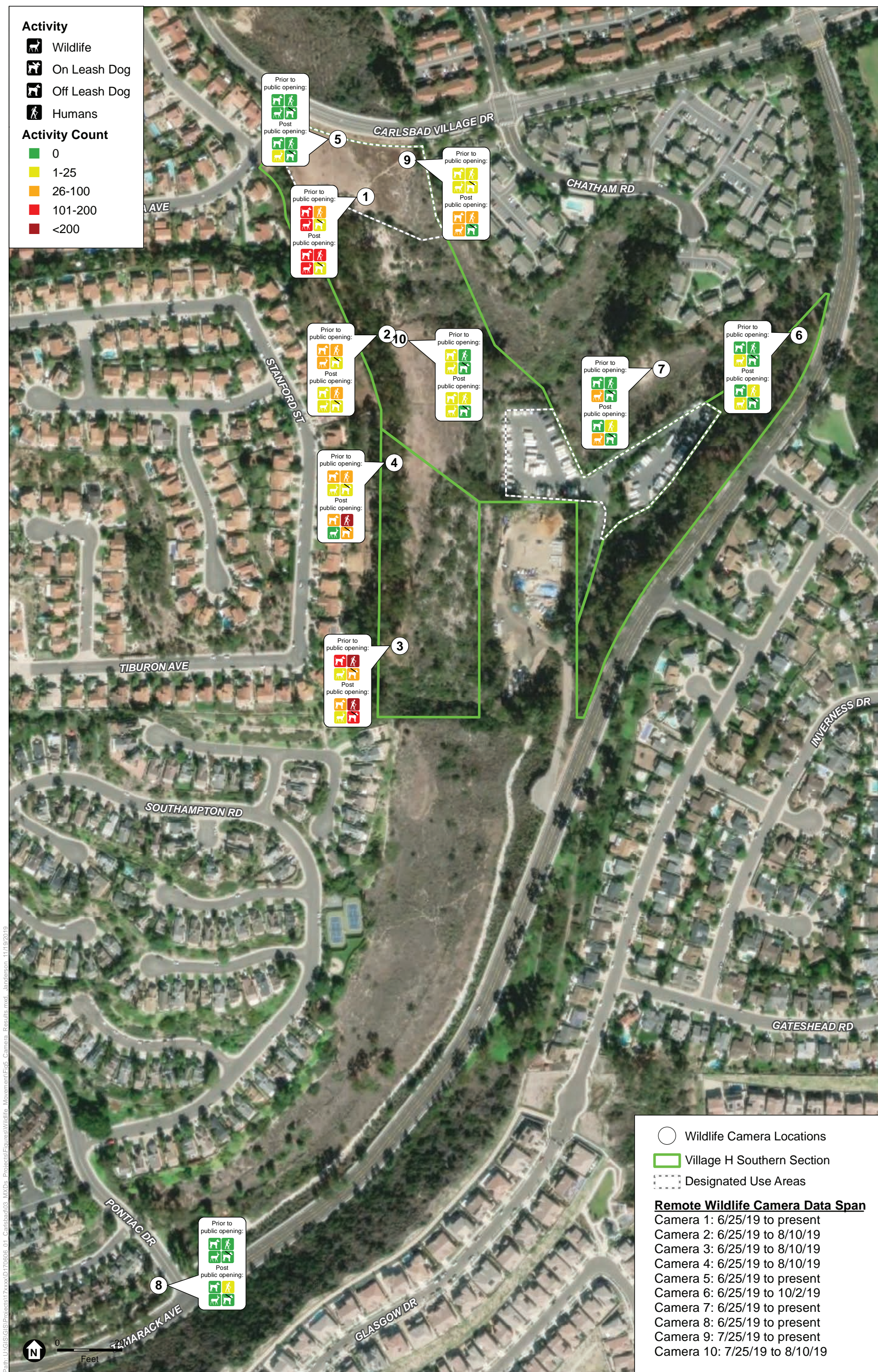


Path: U:\GIS\GIS\Projects\17xxxx\170606_01_Carlsbad\03_MXD\Projects\Figures\Wildlife_Movement\Map4_Roadkill_monitoring_Results.mxd_Janderson_11/19/2019

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

D170606.03 City of Carlsbad Preserve Steward
Village H Wildlife Movement Memo

Figure 4
Roadkill Monitoring Results



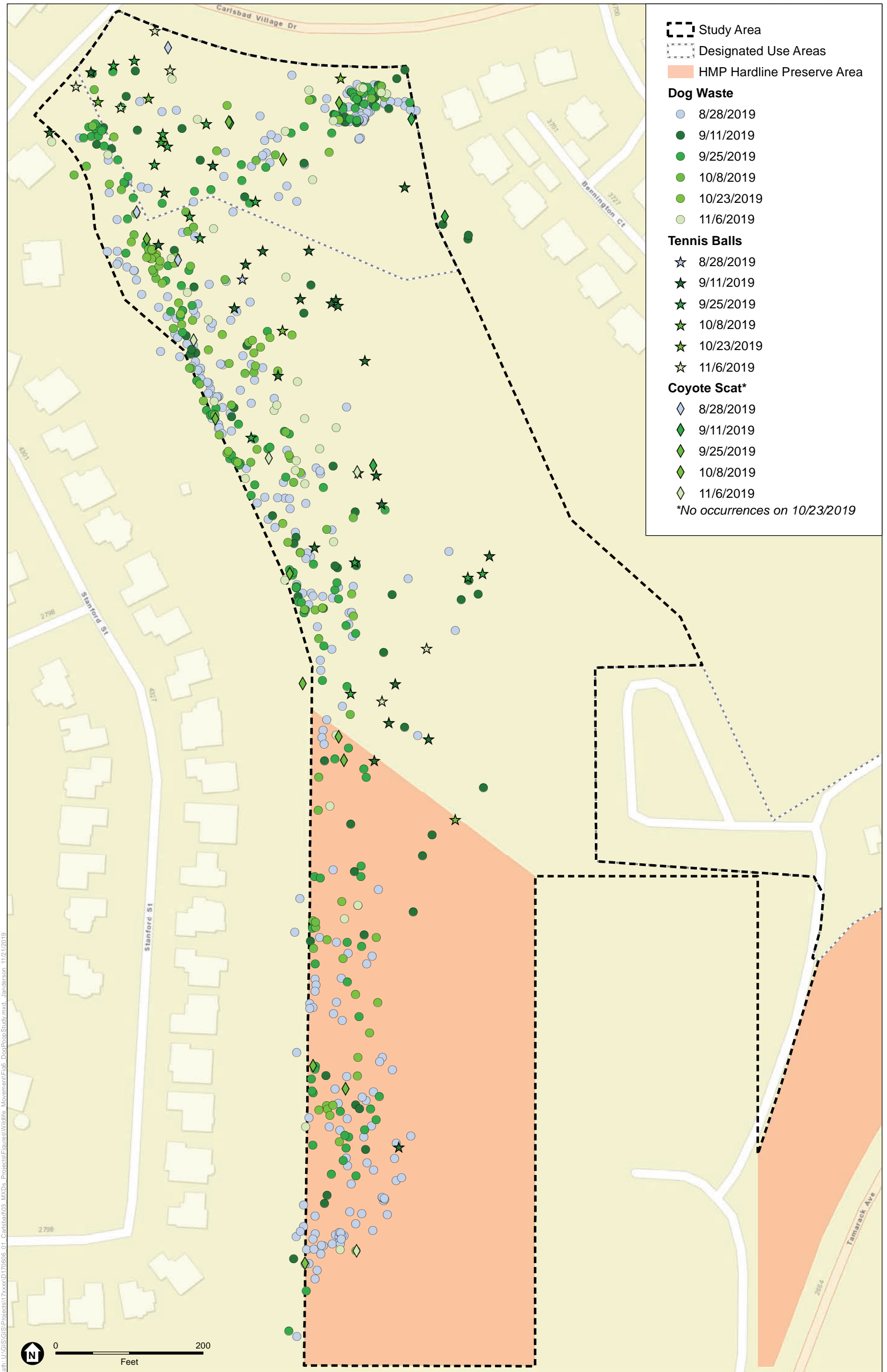
Path: U:\GIS\Projects\720000\01_Carlsbad\03_MXDs_Projects\Reports\Wildlife_Movement\Eng_Camera_Results.mxd_Jarvis.mxd_11/19/2019

SOURCE: ESRI

D170606.03 City of Carlsbad Preserve Steward
Village H Wildlife Movement Memo

Figure 5
Remote Wildlife Camera Results





SOURCE: ESRI; City of Carlsbad

D170606.03 City of Carlsbad Preserve Steward
 Village H Wildlife Movement Memo

Figure 6
 Dog Waste Study Results

Appendix A
**Village H Remote Wildlife
Camera Representative
Photographs**



APPENDIX A – VILLAGE H REMOTE WILDLIFE CAMERA REPRESENTATIVE PHOTOGRAPHS



Wildlife Camera VH1.



Wildlife Camera VH2.



Wildlife Camera VH3.



Wildlife Camera VH4.



Wildlife Camera VH5.



Wildlife Camera VH6.



Wildlife Camera VH7.



Wildlife Camera VH8.



Wildlife Camera VH9.



Wildlife Camera VH10.

Appendix B
**Village H Remote Wildlife
Camera Results**



APPENDIX B – VILLAGE H REMOTE WILDLIFE CAMERA FULL RESULTS

**TABLE 1
VILLAGE H REMOTE WILDLIFE CAMERA DETECTIONS – FULL RESULTS FROM JUNE 25, 2019 THROUGH OCTOBER 16, 2019
(NUMBER OF INDIVIDUALS DETECTED)**

Wildlife Camera Location		Coyote			Bobcat			Skunk			Rodents, Rabbits, Raccoons			Bird			Off-leash Dog			On-leash Dog			Human			Biker		
Time Period ¹	Number of Days Active	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
VH1	113	60	111	55	3	3	4	1	1	3	19	2	0	59	7	20	116	134	79	1	13	6	52	101	65	0	0	2
VH2 ²	46	22	2	NA	0	0	NA	0	0	NA	13	0	NA	0	0	NA	49	13	NA	1	16	NA	46	64	NA	0	0	NA
VH3 ²	46	4	0	NA	0	0	NA	0	0	NA	0	0	NA	3	1	NA	174	93	NA	30	102	NA	253	387	NA	0	3	NA
VH4 ²	46	1	0	NA	0	0	NA	0	0	NA	0	0	NA	0	0	NA	43	68	NA	4	83	NA	50	244	NA	0	0	NA
VH5	113	0	2	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
VH6 ³	99	0	0	0	3	2	0	0	1	0	0	5	2	8	3	0	0	0	0	0	0	0	0	1	0	0	0	0
VH7	113	34	26	11	5	0	2	1	0	3	0	4	0	4	1	0	0	0	0	0	0	0	0	1	0	0	0	0
VH8	113	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
VH9 ⁴	83	6	53	4	0	0	5	0	0	2	2	2	7	0	1	9	17	100	2	1	0	0	10	38	11	0	0	0
VH10 ^{2,4}	16	1	0	NA	0	0	NA	0	0	NA	0	0	NA	0	1	NA	1	1	NA	0	0	NA	0	5	NA	0	0	NA
VH13 ⁵	34	NA	NA	36	NA	NA	13	NA	NA	1	NA	NA	11	NA	NA	13	NA	NA	54	NA	NA	0	NA	NA	22	NA	NA	0
VH14 ^{3,5}	20	NA	NA	1	NA	NA	0	NA	NA	0	NA	NA	0	NA	NA	0	NA	NA	1	NA	NA	0	NA	NA	0	NA	NA	0
VH15 ⁶	27	NA	NA	0	NA	NA	6	NA	NA	2	NA	NA	1	NA	NA	1	NA	NA	0	NA	NA	0	NA	NA	0	NA	NA	0

APPENDIX B – VILLAGE H REMOTE WILDLIFE CAMERA FULL RESULTS

**TABLE 1
VILLAGE H REMOTE WILDLIFE CAMERA DETECTIONS – FULL RESULTS FROM JUNE 25, 2019 THROUGH OCTOBER 16, 2019
(NUMBER OF INDIVIDUALS DETECTED)**

Wildlife Camera Location		Coyote			Bobcat			Skunk			Rodents, Rabbits, Raccoons			Bird			Off-leash Dog			On-leash Dog			Human			Biker		
VH16 ⁶	27	NA	NA	0	NA	NA	8	NA	NA	7	NA	NA	0	NA	NA	2	NA	NA	0	NA	NA	0	NA	NA	0	NA	NA	0
VH20 ⁷	34	1	19	NA	0	3	NA	0	7	NA	0	9	NA	0	0	NA	0	0	NA	0	0	NA	0	0	NA	0	0	NA
Total		129	213	107	11	8	38	2	9	18	34	22	21	74	15	45	400	409	136	37	214	6	411	842	98	0	3	2

NOTES:

NA = Data not available.

¹ Time Period A: Prior to Public Reopening (6/25/19–7/31/19)

Time Period B: Post Public Reopening (8/1/19–9/7/19)

Time Period C: Post Survey Period for Memo (9/8/19–10/16/19)

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 VH13 and VH14 were installed on September 12, 2019.

⁶ Cameras VH15 and VH16 were installed on September 19, 2019.

⁷ Camera VH20 is a CNLM-installed and maintained camera. Data for this camera runs from 7/3/19–9/3/19.

Appendix C
**Village H Roadkill Survey Dates
and Results**



APPENDIX C – VILLAGE H ROADKILL SURVEY DATES AND RESULTS

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

Date	Time (start-end)	Surveyor	Location	Species
10/8/19	9:30-9:45am	A. Sullivan	Village H	None
10/11/19	1:24-1:32pm	H. Swarthout	Village H	None
10/16/19	11:30-11:39am	H. Swarthout	Village H	None
10/19/19	9:06-9:13am	K. Merrill	Village H	None
10/23/19	9:30-9:45am	A. Sullivan	Village H	Rabbit

Appendix D
**Village H Representative
Photographs of Wildlife
Detected on Remote Wildlife
Cameras**



APPENDIX D – VILLAGE H REPRESENTATIVE PHOTOGRAPHS OF WILDLIFE DETECTED ON REMOTE WILDLIFE CAMERAS



Three coyotes detected at Camera 1.



Bobcat detected at Camera 1.



Bobcat detected at Camera 1.



Great horned owl detected at Camera 1.

APPENDIX D – VILLAGE H REPRESENTATIVE PHOTOGRAPHS OF WILDLIFE DETECTED ON REMOTE WILDLIFE CAMERAS



Coyote detected at Camera 2.



Coyote detected at Camera 3.



Coyote detected at Camera 5 crossing under wrought-iron fence.



Two bobcats detected at Camera 6 attempting to cross culvert.

APPENDIX D – VILLAGE H REPRESENTATIVE PHOTOGRAPHS OF WILDLIFE DETECTED ON REMOTE WILDLIFE CAMERAS



VH7.09292019.skunk (2)

54°F 09/29/2019 11:48PM CAMERA7

Striped skunk detected at Camera 7.



VH7.07062019.bobcat

61°F 07/06/2019 11:16PM CAMERA7

Bobcat detected at Camera 7.



62°F

TRAILCAM09

08/02/2019

Two coyotes detected at Camera 9.



57°F

TRAILCAM09

10/15/2019 04:18AM

Four raccoons detected at Camera 9.

Appendix E
**Village H Dog Waste Studies
Representative Photographs**



APPENDIX E – 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.