SR-152 Pacheco Pass Regional Wildlife Connectivity Study 2021-2022

NCCP Local Assistance Grant # Q2030902

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Pathways for Wildlife

For

California Department of Fish and Wildlife and the Santa Clara Valley Habitat Agency

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Coyote at a SR-152 Pacheco Pass culvert.

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1.0 Executive Summary

The study area includes a 20 mile stretch of State Route 152 (SR-152) from San Felipe Lake to the San Luis Reservoir Wildlife Area and Pacheco State Park. The purpose of the study is to determine the most suitable locations for additional wildlife connectivity enhancements by monitoring bridges and culverts that are three-feet or larger in diameter or height, and conducting weekly roadkill surveys. The study's goal is to have a comprehensive understanding of how wildlife are traversing the highway to understand the most important areas to develop and work on wildlife connectivity improvements.

A total of 7,554 species passages were recorded from 32 cameras placed at 23 culverts and 6 bridges during the 12-month monitoring period. In our experience from monitoring many different highways throughout the Bay Area the past ten years, this is a high overall passage rate for a study area. The species with the highest passage rates for the entire study area include coyote (*Canis latrans*) with 1,932 passages, striped skunk (*Mephitis mephitis*) with 1,394 passages, wild pig (*Sus scrofa*) with 1,000 passages, bobcat (*lynx rufus*) with 928 passages), and mule deer (*Odocoileus hemionus*) with 777 passages.

A 100 Trap Night Analysis was performed to standardize the data to be able to compare each monitoring site, as various sites encountered camera theft and malfunctioned, resulting in data gaps. The five monitoring sites with the highest recorded passages were: B3 Pacheco Creek Reserve Bridge (370431) with 840 passages, C2 PM 17.24 with 776 passages, C1 PM 16.58 with 668 passages, C8 PM 22.81 with 599 passages and C11 PM 27.09 with 528 passages.

There were only seven sites where we recorded deer passages. The sites with the highest rates of deer passages were B2 Pacheco Creek Bridge (370430) Fire Station Bridge with 288 passages, B3 Pacheco Creek Reserve Bridge (370431) with 282 passages, B6 South Fork Pacheco Creek Bridge (370466) with 106 passages, and B4 Cedar Creek Bridge (370030) with 51 passages, and C2 PM 17.24 with 39 passages, while B5 Pacheco Creek Bridge (370441) past Bell Station only had 10 passages and C15 PM 29.6 only had one passage. These data show that even though there are six bridges and 23 culverts, there are only five sites facilitating higher frequencies of large mammal passages. There were only two sites in which mountain lions were recorded within the study area: C12 PM 27.24 and C17 PM 32.3. There were ten detections of a mountain lion at C12 PM 27.24, with two confirmed passages through the culvert. The other eight detections were likely passages, but the camera data did not provide adequate footage for true confirmation.

A total of 42 wildlife-vehicle collisions were recorded during the study period. The species most detected included bobcat, coyote, and deer. The majority of animals were hit between San Felipe Lake and just east of Cedar Creek. The combination of camera data and roadkill information helps substantiate the need to provide a suitable wildlife crossing such as a wildlife overpass or underpass at SR-152 for species such as deer, mountain lion, and tule elk.

2.0 Introduction

2.1 Study Purpose & Need

State Route 152 is listed in California Department of Wildlife's (CDFW) *California Wildlife Barriers 2020* report and is a "top 12 priority for CDFW Region 3 (Figure 1). CDFW has prioritized this location because Pacheco Pass represents a substantial barrier to the movement of mountain lions, mesocarnivores, and tule elk. The region also supports a tremendous amount of biodiversity and has been shown to hold water and be critical in supporting wildlife species during the ongoing drought.

The entirety of SR-152 east of its intersection with State Route 156 constitutes a substantial barrier for the movement of wildlife due to existing traffic volumes. Small, medium, and large mammals have been detected traveling through SR-152 underpasses; however, the same species are found dead on the highway in large numbers. Other development pressures in the region – like the planned California High-Speed Rail Project and the Pacheco Reservoir Expansion Project– would contribute to cumulative impacts on wildlife movement and worsen existing conditions.

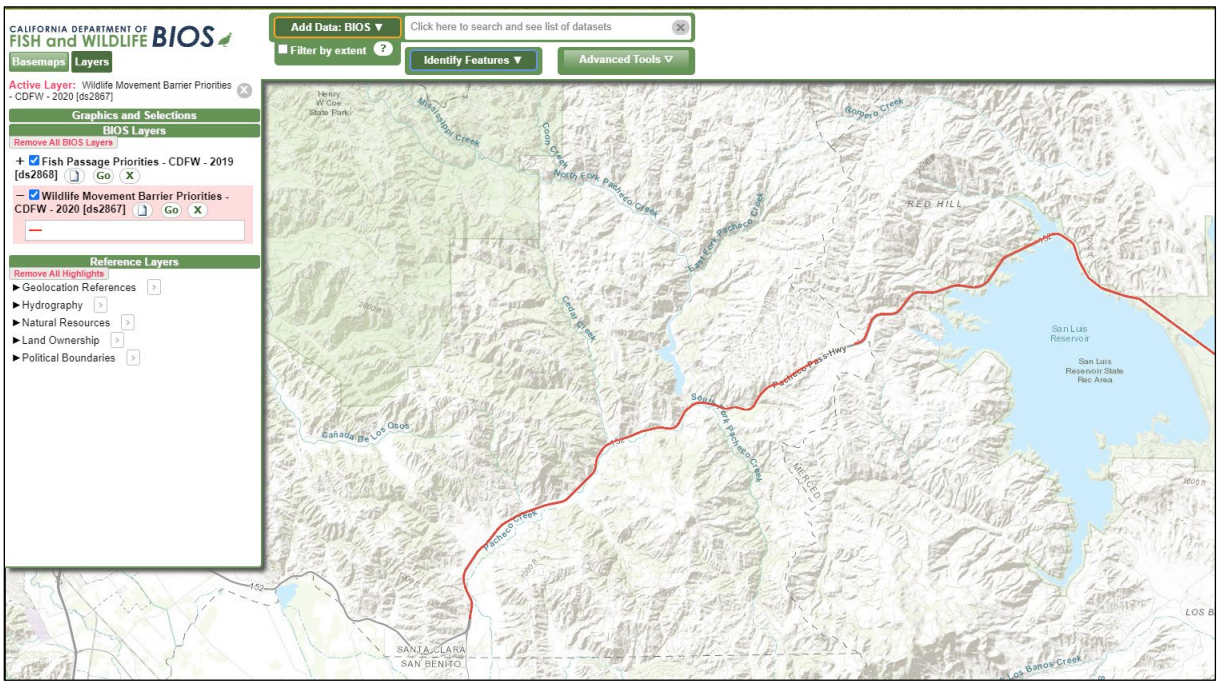

Figure 1. CDFW's 2020 Wildlife Movement Barrier Priorities list from DFW's BIOS website, SR-152 Pacheco Pass.

Additionally, the *CDFW 2020 California Action Plan Update to the State Wildlife Action Plan* lists SR-152 as a priority location for constructing a wildlife overpass for tule elk (2020 California Action Plan Update). SR-152 is also ranked as the highest scoring area for connectivity in the state by the Caltrans connectivity tool (Figure 2).

Figure 2. Caltrans connectivity tool SR-152 Pacheco Pass: highest scoring area for connectivity in the state.

2.2 Introduction

State Route 152 bisects the Diablo Range-Inner Coast Linkage as identified in the Bay Area Critical Linkages Project (Figure 3). The Santa Clara Valley Habitat Conservation Plan/Natural Community Conservation Plan (NCCP) recognizes the importance of landscape linkages, and specifically identifies Pacheco Pass on SR-152 as a focal area in the Biological Goals and Objectives, Reserve System design, and long-term monitoring (ICF International 2012).

State Route 152 is built upon a south facing hillslope with the upland and lowland habitats on either side of SR-152 consisting of primarily undeveloped lands with a few rural residential parcels and cattle grazing operations. The upland habitat consists almost entirely of oak woodland savanna, while the lowlands consist of the Pacheco Creek riparian corridor, which supports rare sycamore-alluvial woodland habitat.

There are several protected lands on both sides of the highway. On the north side and upslope from the highway, protected lands include Henry Coe State Park and the Cañada de los Osos Ecological Reserve (Figure 3). On the south and downslope side of the highway, protected lands include the Habitat Agency's Pacheco Creek Reserve. Pacheco Creek is perennial, making it an important habitat for wildlife. The creek provides year-round resources such as water, food, and vegetation cover. The study area also provides a significant amount of climate change resilience, which is important as the upland habitats become hotter and drier (Appendix A). Please see Appendix A for a discussion on climate change resilience in relation to the study area and the benefits that provides in relation to wildlife connectivity.

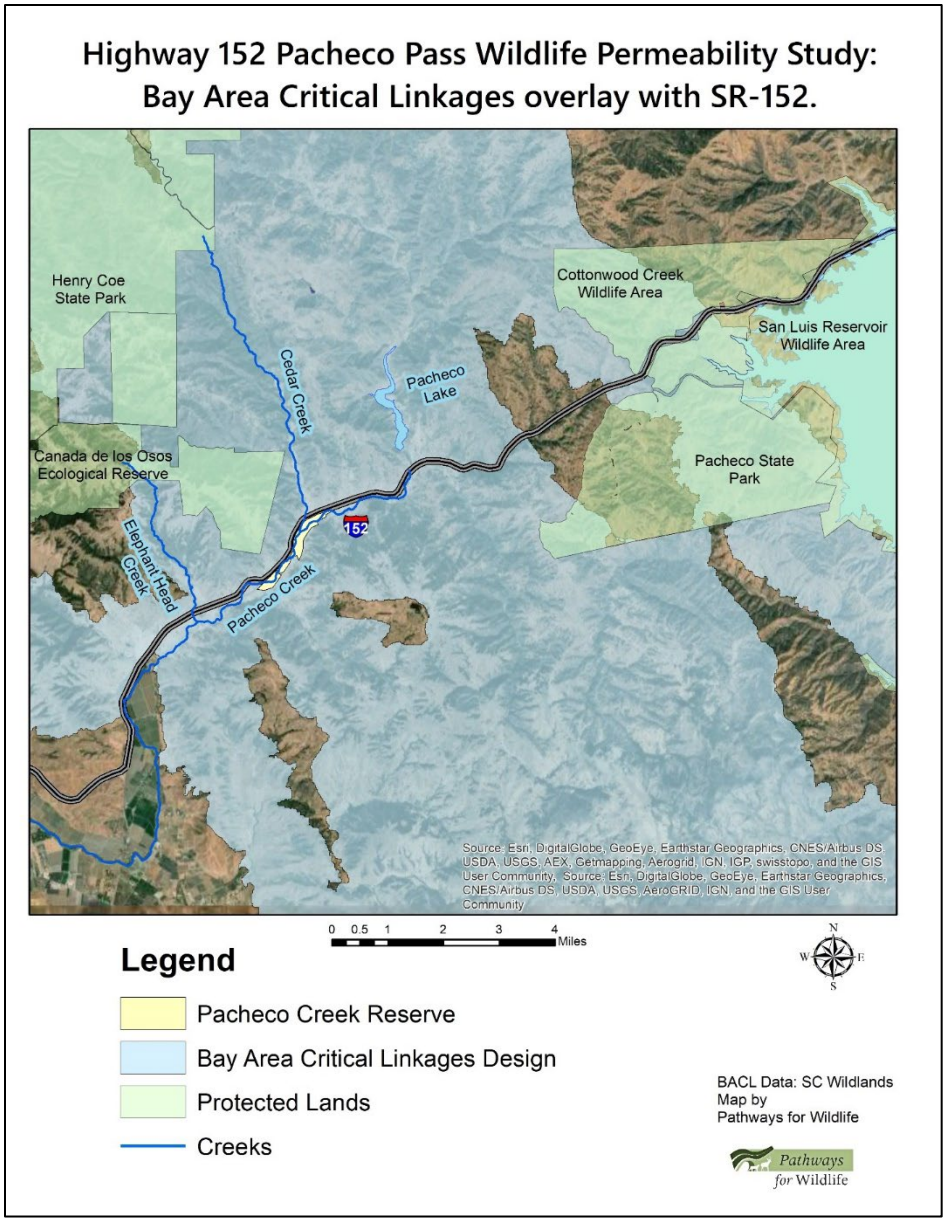

Figure 3. Bay Area Critical Linkage Design: Diablo Range to the Inner Coast Linkage.

Over the past ten years of roadkill data collection on various highways throughout the Bay Area, Pathways for Wildlife (PWF) have found that the SR-152 study area includes a segment in which most of the badger roadkills have been recorded. American badgers are a Species of Special Concern and this stretch of SR-152 could be a badger roadkill Hot Spot. Badgers have also been recorded using one of the culverts to travel under SR-152 in this area. At this culvert, a badger and coyote were documented to have traveled through a culvert together for the Southern Santa Cruz Mountains Wildlife Connectivity Study conducted by Pathways for Wildlife and POST. The San Luis Reservoir area is important to include as kit fox have been documented just east of the reservoir and tule elk have been reported hit on the highway (Cristen Langner, CDFW biologist, pers. comm. 2019).

Roadkill data represent wildlife–vehicle collisions (WVC) and can indicate where wildlife attempt to cross roads at-grade and are hit and killed by vehicles. WVC data together with camera monitoring data of under crossings and connectivity modeling can help inform where new or improved wildlife crossing structures could facilitate safe passages under or over roads. Data on where animals are killed on roads can also inform placement and extent of directional fencing to guide wildlife to crossing structures or culverts and bridges where wildlife have been recorded traveling safely under the road.

Since 2018, the Santa Clara Valley Habitat Agency (Habitat Agency) has received two NCCP Local Assistance Grant (LAG) awards from CDFW to fund high priority tasks needed to implement the Santa Clara Valley HCP/NCCP. Both grants focused on identifying key movement corridors across the highway, collecting roadkill data, and documenting safe passage opportunities for wildlife by monitoring bridges and culverts.

Results from the first (FY 2017-2018) LAG pilot study (P1730901) demonstrated numerous species were utilizing the corridor and that SR-152 was a substantial movement barrier for wildlife (Pathways for Wildlife 2020). Camera monitoring occurred at only a few bridges and culverts, yet a high number of wildlife-vehicle collisions were documented within the larger Pacheco Pass study area.

In 2021, the Habitat Agency was awarded a second LAG (Q2030902) and again, contracted with PFW, this time to monitor the entire stretch of SR-152 Pacheco Pass from the Pajaro Valley floor at San Felipe Lake to the San Luis Reservoir Wildlife Area and Pacheco State Park near the Merced County line. The purpose of the study was to determine the most suitable locations for additional wildlife connectivity enhancements by monitoring every bridge and culvert that was three feet or larger in diameter and conducting weekly roadkill surveys. The study's goal was to have a comprehensive understanding of how wildlife were traversing the highway to understand the most important areas to develop and work on wildlife connectivity improvements.

3.0 Study Area

The study area included a 20-mile stretch of State Route 152 from San Felipe Lake to the San Luis Reservoir Wildlife Area and Pacheco State Park. A total of six bridges and 23 culverts were monitored, culminating in 29 sites utilizing 34 cameras (Figure 4). We monitored every culvert three feet in diameter or larger, except for eight culverts, which are excluded from Figure 4. Of those eight, five culverts, PM 16.31, PM 16.83, PM 21.78, PM 22.36 and PM 24.65 were partially or completely blocked by sediment so were not monitored. The camera at culvert PM 24.03 was repeatedly stolen, so that site was removed from the study, but we did record medium size mammal passage through it during the first month of monitoring. Culverts PM 33.95 and PM 34.3 provided no safe location to pull off the highway to access the culverts or were in very steep terrain and too difficult to access on foot.

Roadkill surveys were conducted along SR-152 beginning near San Felipe Lake at approximately 36.968912, -121.414072 and ending at 37.085291, -121.180359, roughly 2.5 miles past the Merced County line, at the first safe turn-around location.

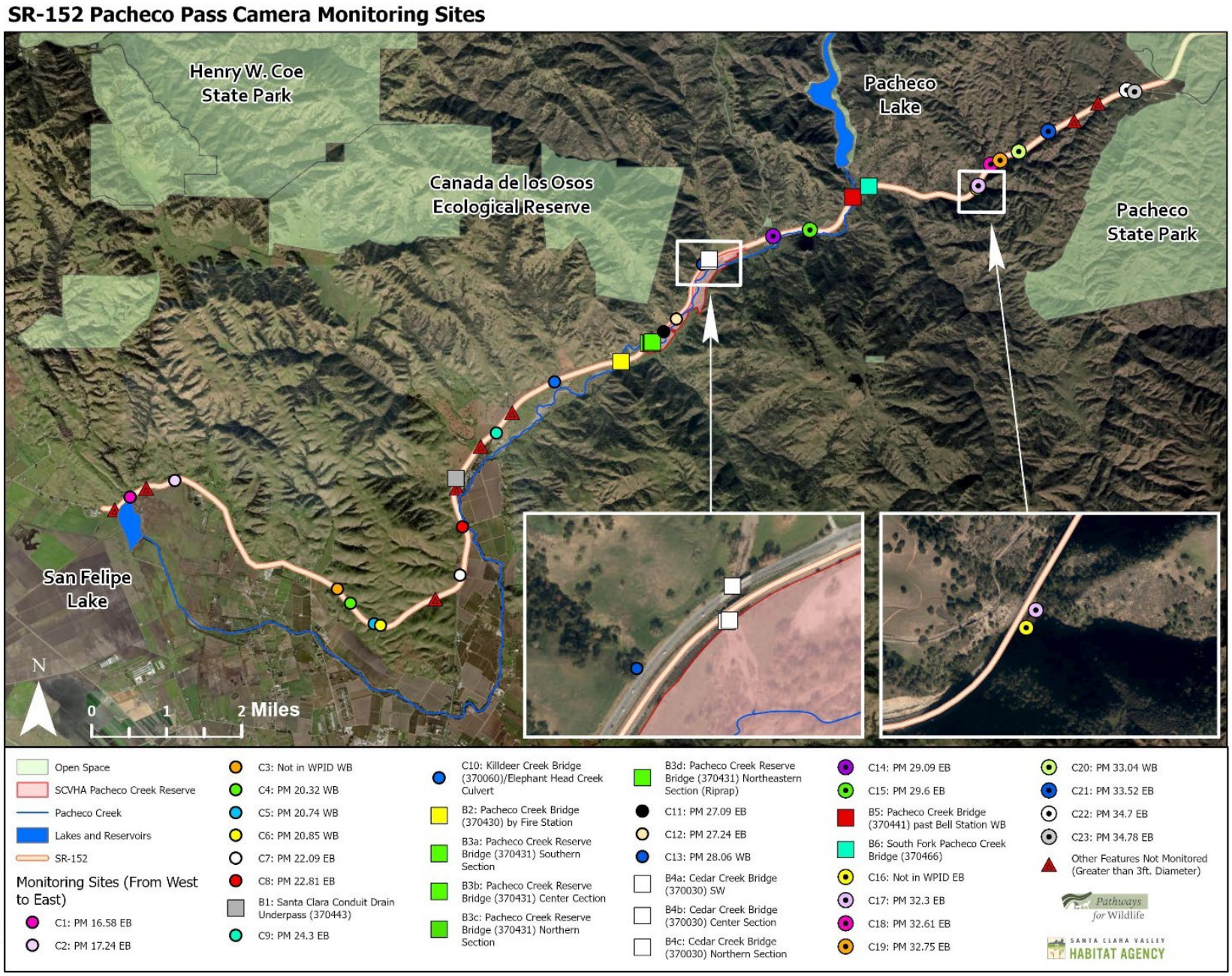

Figure 4. SR-152 Pacheco Pass wildlife camera monitoring sites June 2021-June 2022.

4.0 Goals and Objectives

Given the importance of the study area for regional connectivity and ongoing human population growth and development, this study sought to evaluate the region's current ecological connectivity and identify opportunities to improve regional connectivity.

Our goals for this study were as follows:

Identify where habitat connectivity is currently supported and should be maintained, using medium- and large-sized terrestrial mammals as focal species.

- Identify locations where maintenance and/or upgrades for existing transportation infrastructure could increase the permeability of the landscape and reduce wildlife–vehicle collisions.
- Identify locations where new wildlife passage infrastructure may be beneficial to increase the permeability of the landscape and reduce wildlife–vehicle conflict.

Our specific objectives for this study were as follows:

- Document species passages and occurrences at existing below-grade passages (undercrossings)
- Identify areas of roadkill occurrence
- Develop a list of site-specific recommendations to protect and/or enhance connectivity for wildlife

We addressed these goals and objectives using two complementary methods: wildlife camera trapping at existing highway undercrossings and roadkill surveys along highways within the study area. We then synthesized and integrated data from these two methods to develop recommendations to improve ecological connectivity in the study area.

5.0 Methods

5.1 Field Camera Monitoring

We obtained Caltrans encroachment permits to access the culverts and other undercrossings, then placed Stealthcam DS4K, Stealthcam G45NG MAX2 or Bushnell HD Trophy Cam digital infrared "no-glow" cameras at each site in such a way that they were non-invasive to wildlife. Cameras were secured to t-posts, fences, or trees and were not affixed to any Caltrans structure. The cameras were motion-activated, and settings were changed throughout the survey period to adjust to the environmental conditions. Settings ranged from single photos, to 10-30 second videos, to 1-5 photo bursts followed by a 10-15 second video. At each monitoring site, a single camera was deployed on either the east-bound (EB) or west-bound (WB) side of the culvert or single-span bridge. Two bridges, Pacheco Creek Bridge (370431) and Cedar Creek Bridge (370030) had center cement medians, so cameras were set up on the northern, center, and southern sections. We serviced the cameras approximately every two months from May 2021 through June 2022 and tabulated all animals passing through the site by species and entered the data into a master camera database.

5.2 Field Camera Data Analysis

Trap nights across the camera monitoring sites varied, and over the course of the year, not all sites recorded 365 nights due to issues such as camera theft and camera malfunctions. To compare data of successful passages from all sites, we standardized data for each site to represent 100 trap nights by summing all detections for each species over all days, dividing by the total number of days the camera was operational, and then multiplying by 100 (Jenks et al. 2011).

We tabulated the frequency and type of use (investigation, successful passage) of each undercrossing by native and non-native species. When possible, we also noted additional information such as use by individual animals, animals traveling with juveniles, species interactions, and presence of non-native species.

5.3 Roadkill Surveys

Weekly roadkill surveys were conducted from a vehicle each month, June 2021 – June 2022. Data collected during these standardized surveys as well as during incidental roadkill detections included geographic coordinates, species, number of individuals, and photographs when possible. Some locations were too dangerous to pull over to take photos.

5.4 Roadkill Data Analysis

The results from the roadkill surveys were used to identify roadkill cluster locations where wildlife was routinely being hit on the highway. These locations are potential candidates for wildlife connectivity enhancements, such as directional fencing to guide wildlife to bridges and culverts that wildlife was recorded traveling through by the camera surveys.

5.4 Recommendations for Wildlife Connectivity Enhancements

The combination of the roadkill data and camera analyses were used to develop the other recommendations for wildlife connectivity enhancement:

- Potential modifications to existing crossing structures animals are using to cross under roads (or could use with modification/maintenance.
- Conceptual permeability improvements that could enhance the ability for wildlife to safely travel across roads (e.g. culvert or bridge retrofitting).
- Roadkill locations in which a wildlife crossing structure is needed.

6.0 Camera Data Results

6.1 Species Results

The number of passages by individuals of each species, both native and domestic, was recorded and summarized by monitoring site (Table 1). Each camera was serviced an average of 6.5 times following set-up during the study period. A total of 7,554 species passages were recorded during the 12-month monitoring period at the 29 monitoring sites. In our experience from monitoring many different highways throughout the Bay Area the past ten years, this is a high overall passage rate for a study area. The species with the highest passage rates for the entire study area include coyote (*Canis latrans*) with 1,932 passages (26% of all species passages), striped skunk (*Mephitis mephitis*) with 1,394 passages (18% of all species passages), wild pig (*Sus scrofa*) with 1,000 passages (13% of all species passages), bobcat (*Lynx rufus*)

with 928 passages (12% of all species passages), and mule deer (*Odocoileus hemionus*) with 777 passages (10% of all species passages) (Table 1, Figures 5 & 6).

Site	American badger	Bobcat	Coyote	Mule Deer	Domestic cat	Domestic dog	Gray fox	Long-tailed weasel	Mountain lion	Opossum	Raccoon	Striped skunk	Wild pig	Grand Total
C1 PM 16.58	0	66	172	0	1	0	10	1	0	10	320	89	3	**672**
C2 PM 17.24	0	10	359	39	1	0	37	0	0	1	39	291	65	**842**
C3 (Not in WPID)	2	10	72	0	9	0	0	0	0	18	3	19	0	**133**
C4 PM 20.32	0	22	193	0	0	0	0	0	0	0	2	125	0	**342**
C5 PM 20.74	0	0	23	0	0	0	0	0	0	0	0	11	0	**34**
C6 PM 20.85	0	6	181	0	0	0	0	0	0	0	1	37	0	**225**
C7 PM 22.09	0	0	0	0	21	0	7	0	0	2	3	2	0	**35**
C8 PM 22.81	0	139	3	0	45	19	55	0	0	10	135	257	0	**663**
B1 (370443)	0	11	8	0	2	0	0	0	0	2	25	0	0	**48**
C9 PM 24.36	0	0	5	0	3	0	0	0	0	0	1	0	0	**9**
C10 (370060)	0	12	90	0	0	0	0	0	0	0	1	22	0	**125**
B2 (370430)	0	8	112	288	0	0	0	0	0	0	0	0	41	**449**
B3 (370431)	0	67	29	282	4	0	4	0	0	4	0	8	446	**844**
C11 PM 27.09	0	32	1	0	432	0	0	0	0	125	10	379	0	**979**
C12 PM 27.24	0	85	8	0	0	0	0	0	10	9	5	19	0	**136**
C13 PM 28.06	0	68	28	0	0	0	0	0	0	1	1	8	7	**113**
B4 (370030)	0	45	146	51	0	0	1	0	0	5	2	11	18	**279**
C14 PM 29.09	0	64	218	0	0	0	17	0	0	0	32	83	25	**439**
C15 PM 29.6	0	139	27	1	0	0	6	0	0	2	15	16	50	**256**
B5 (370441)	0	8	0	10	0	0	2	0	0	0	4	0	55	**79**
B6 (370466)	0	11	17	106	0	0	0	0	0	0	5	0	290	**429**
C16 (Not in WPID)	0	8	1	0	0	0	0	0	0	0	2	0	0	**11**
C17 PM 32.3	0	16	16	0	0	0	4	0	0	0	5	0	0	**41**
C18 PM 32.65	0	2	0	0	0	0	0	0	0	0	0	0	0	**2**
C19 PM 32.75	0	4	1	0	0	0	0	0	0	0	0	0	0	**5**
C20 PM 33.04	0	24	167	0	0	0	1	0	0	0	0	12	0	**204**
C21 PM 33.52	0	2	19	0	0	0	0	0	0	0	2	1	0	**24**
C22 PM 34.7	0	69	27	0	0	0	0	0	0	0	36	4	0	**136**
C23 PM 34.78	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Grand Total	2	928	1923	777	518	19	144	1	10	189	649	1394	1000	7554

Table 1. Total number of species passages recorded at each of the 29 monitoring sites, June 2021-June 2022.

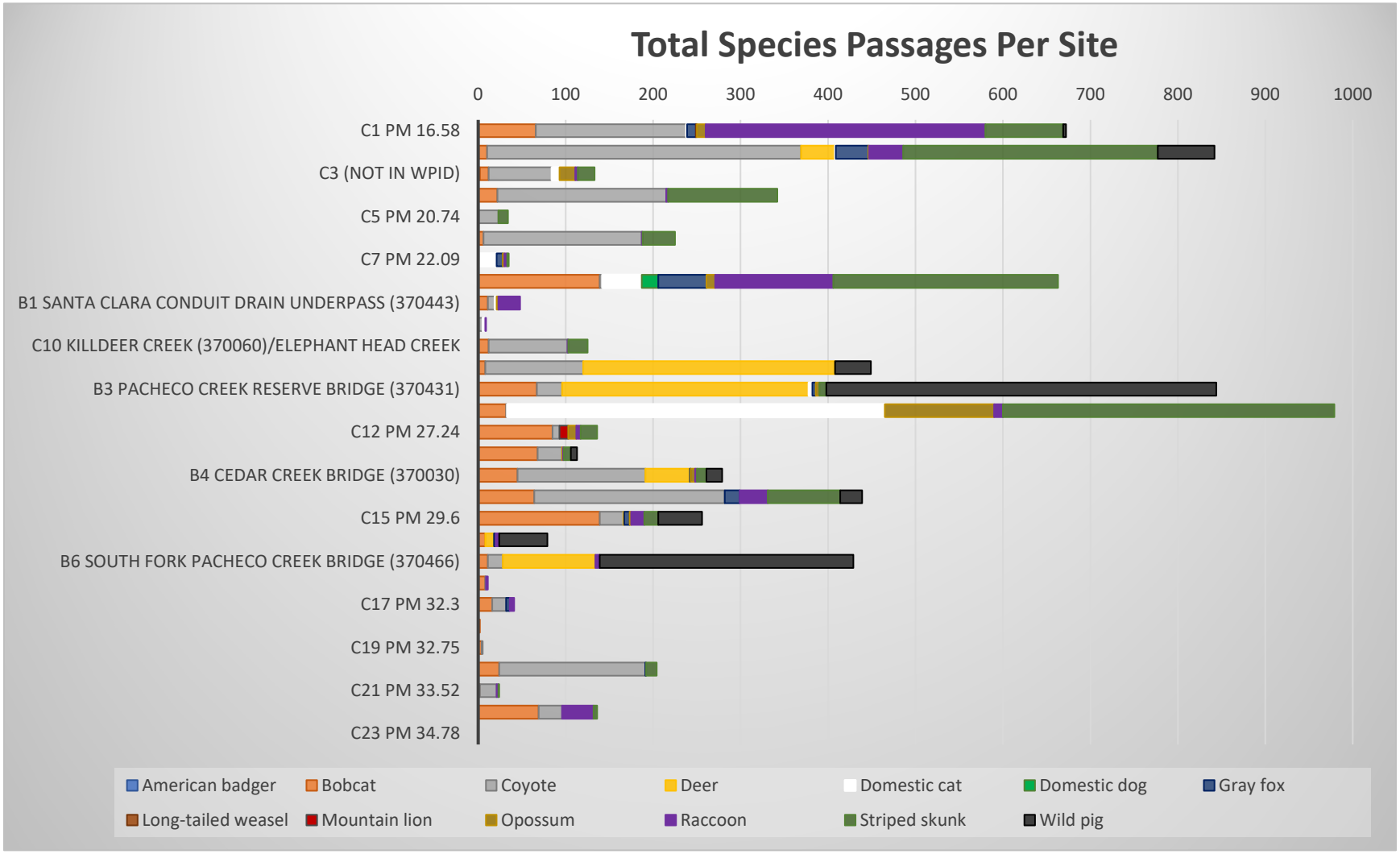

Figure 5. Passages by species per monitoring site June 2021-June 2022.

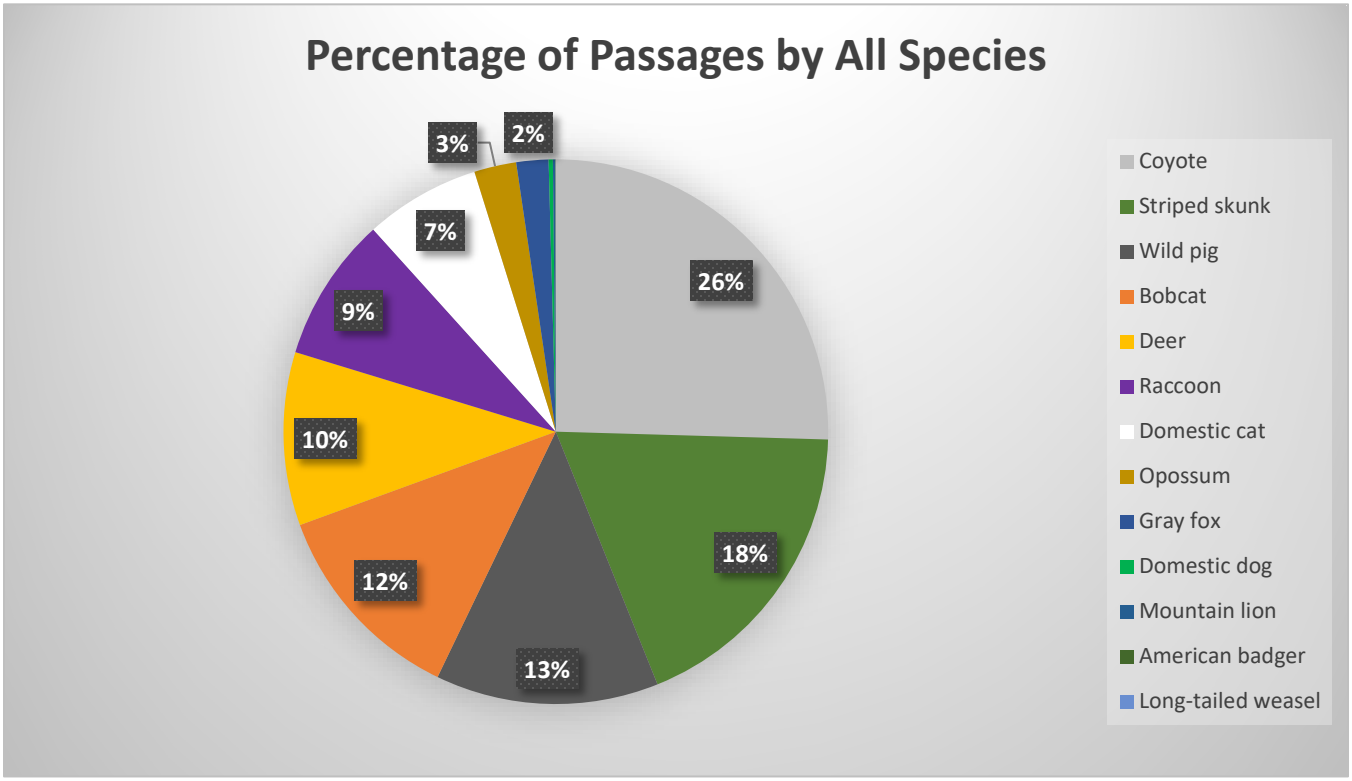

Figure 6. Passages by species per monitoring site.

6.2 100 Trap Night Analysis

We cannot compare the camera sites with these passage rates however, as there were data gaps at various study sites due to issues such as camera theft and cameras malfunctioning. To correct these data gaps, we used a 100-Trap Night calculation to standardize the data to be able to compare the monitoring sites. We performed this calculation for each site and did not include domestic animals such as cats and dogs, so the data was not skewed by domestic animals. However, we did include wild pig, as pigs were also recorded hit on the road and are considered a safety hazard for drivers. Therefore, it is important to know which sites are facilitating wild pig movement under the road and locations in which wild pigs are attempting to cross the road.

The monitoring sites with the highest rates of passages were C14 PM 29.09 with 276 passages, C8 PM 22.81 with 248 passages, B3 Pacheco Creek Reserve Bridge (370431) with 232 passages, C2 PM 71.24 with 230 passages, and C1 PM 16.58 with 210 passages. Both C14 PM 29.09 and C8 PM 22.81 facilitated a high number of mesocarnivore passages (Table 1). By contrast, B3 Pacheco Creek Reserve Bridge (370431) and C2 PM 17.24 facilitated not only mesocarnivore movement, but also deer passage.

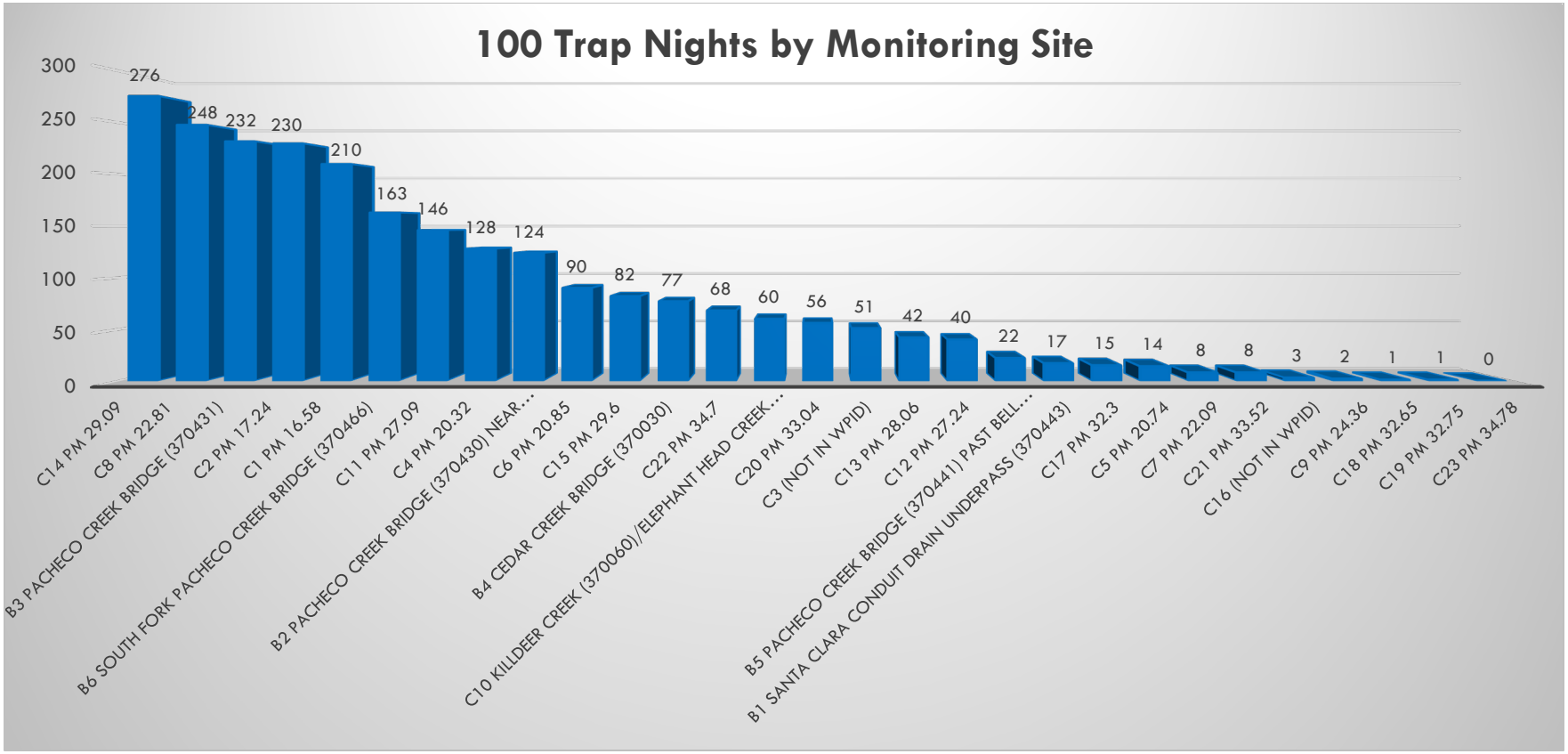

Figure 7. 100 Trap Night Analysis results with native species and wild pig (domestic animals not included).

We also graphed native species without wild pigs or domestic animals to identify sites that are facilitating high rates of native species passages. Eighteen of the 29 sites facilitated 100 or more species passages during the 12-month monitoring period (Figure 8). This included four bridges and 14 culverts. There was a decline in native species passage rates in the most eastern section of the study area.

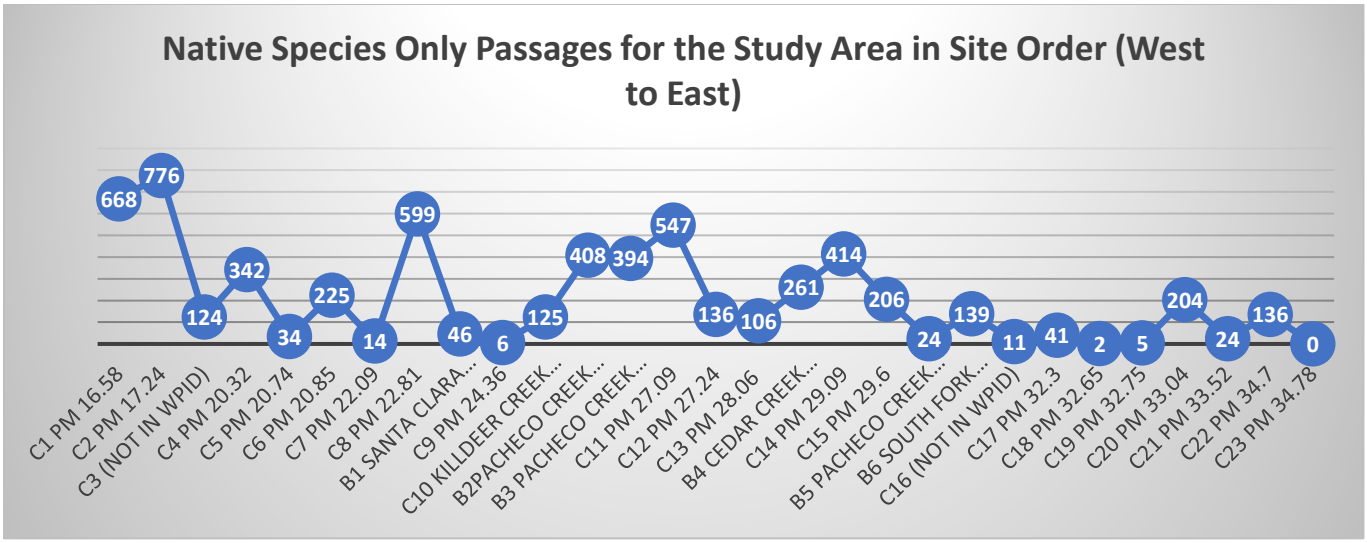

Figure 8. Native species only passages.

6.3 Camera Data Results Discussion

There were only seven sites where we recorded deer passages. The sites with the highest rates of deer passages were B2 Pacheco Creek Bridge (370430) by Fire Station with 288 passages, B3 Pacheco Creek Reserve Bridge (370431) with 282 passages, B6 South Fork Pacheco Creek Bridge (370466) with 106 passages, and B4 Cedar Creek Bridge (370030) with 51 passages, and C2 PM 17.24 with 39 passages. In contrast, B5 Pacheco Creek Bridge (370441) past Bell Station only had ten passages and C15 PM 29.6 only had one passage (Table 1). These data indicate even though there are six bridges and 23 culverts, there are only five sites facilitating higher rates of large mammal passages. This information seems to support the importance of providing a suitable wildlife crossing such as a wildlife overpass for species such as deer, mountain lion, and tule elk.

There were only two sites in which mountain lions were recorded within the study area: C12 PM 27.24 PCR Culvert 2 and C17 PM 32.3. There were ten documented passages by mountain lion at C12 PM 27.24 PCR Culvert 2. At C17 PM 32.3, we recorded a mountain lion jumping down from the culvert entrance. We could not confirm if it was a passage.

6.4 Camera Data Results per Monitoring Site

For each camera station, the number of native species passages was graphed to determine if seasonal variation might influence wildlife movement through the structure. We included this information along with the best photos for each site, when relevant.

C1 PM 16.58 EB

The C1 PM 16.58 San Felipe Lake round culverts have high mesocarnivore use (Table 1 and Figure 9). The culverts were flooded for the last part of January 2022 and are now filled halfway with sediment. This culvert would benefit from clearing as we recorded multiple species moving through the culvert each

month, but also recorded a bobcat and coyote hit on the highway in the vicinity of the culvert. The camera was knocked over by pigs in May 2022, resulting in a data gap (Figure 10).

Figure 9. Bobcat traveling through C1 PM 16.58 San Felipe Lake dual round culvert.

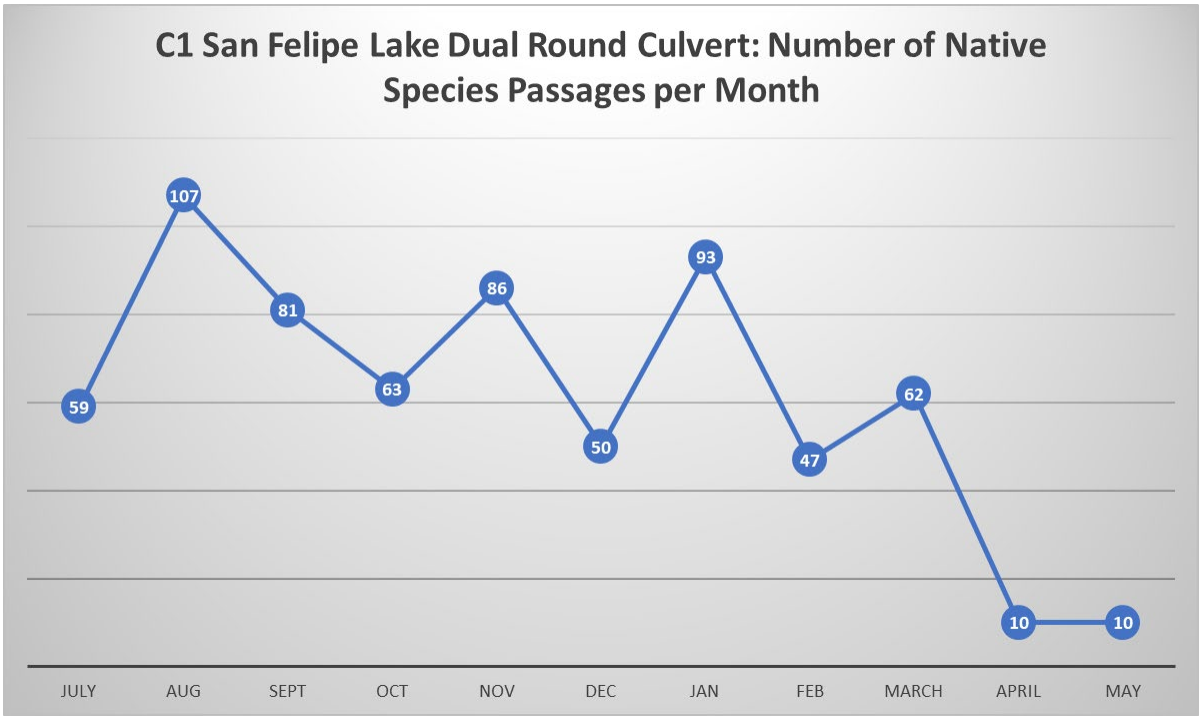

Figure 10. C1 PM 16.58 San Felipe Lake culvert: seasonal variation.

C2 PM 17.24 EB

This culvert had multiple species use ranging from large mammals such as mule deer to smaller mammals such as gray fox (Table 1). Interestingly, we recorded 39 mule deer passages through the culvert. These passages included three different bucks and at least two individual does (Figures 11 & 12). This is important information to note as there were only seven sites deer were using to travel through and this culvert is only 5 feet high.

This culvert became flooded in January and March 2022, but some animals still used the culvert to cross under the highway (Figure 13). San Felipe Lake remained full of water throughout the summer months, which may be a draw for wildlife to travel from the foothills into the valley floor to access water. We also recorded multiple species such as bobcat, a coyote pair, gray fox, and a family of skunks consistently traveling through the culvert since the cameras were set up in June 2021.

Figure 11. Buck traveling through C2 PM 17.24 culvert on July 21, 2021, heading north towards the foothills.

Figure 12. Mule deer buck traveling south through C2 PM 17.24 San Felipe Lake culvert on July 5, 2021.

Figure 13. C2 PM 17.24 San Felipe Lake box culvert: two mule deer yearlings.

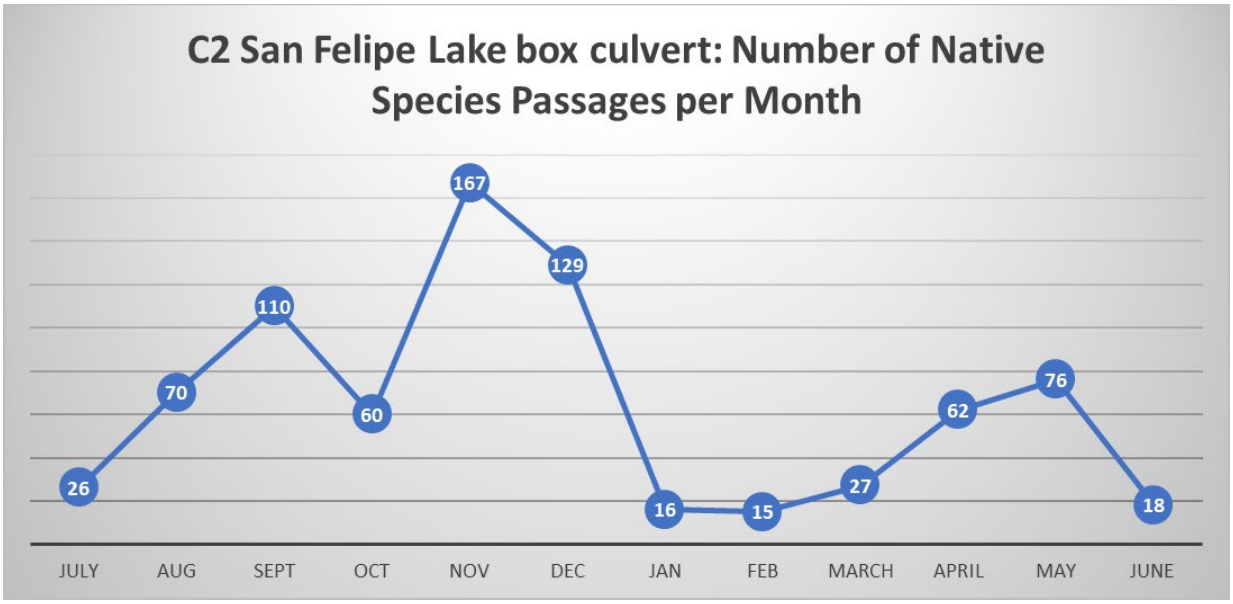

Figure 13. C2 PM 17.24 San Felipe Lake box culvert: seasonal variation.

C3 (Not in WPID) WB

This culvert was found while field scouting during camera deployment. It is an 8-foot x 8-foot cement box culvert which connects two ranch properties. There is a property gate beyond the eastbound opening, and a chain link fence beyond the westbound opening. Both the gate and fencing are not directly in front of the openings. Instead, they are set back from the culvert. Woven-wire mesh fencing has been erected to funnel cattle from the private property on the north side of SR-152 through the Caltrans right-of-way fencing and through the culvert. Upon initial assessment, there were tracks within the culvert, and even numerous trails leading to/from the gate and fencing. This culvert is not in the WPID nor the Caltrans culvert database and has no associated PM yet. There were two American badger passages through this culvert along with a GPS-collared collar bobcat and several coyotes.

Figure 14. C3 large box culvert. Gate visible at opposite opening.

Figure 15. American badger detected at site C3.

The camera was functioning in January and recording animals traveling adjacent to the culvert both east and west, but not south through the culvert, including an American badger on January 14, 2022. The majority of detections included coyotes investigating the culvert, but not traveling through it anymore, with just a few crossings including a bobcat and coyote. It could be possible that more restrictive fencing was set up on the south side of the culvert.

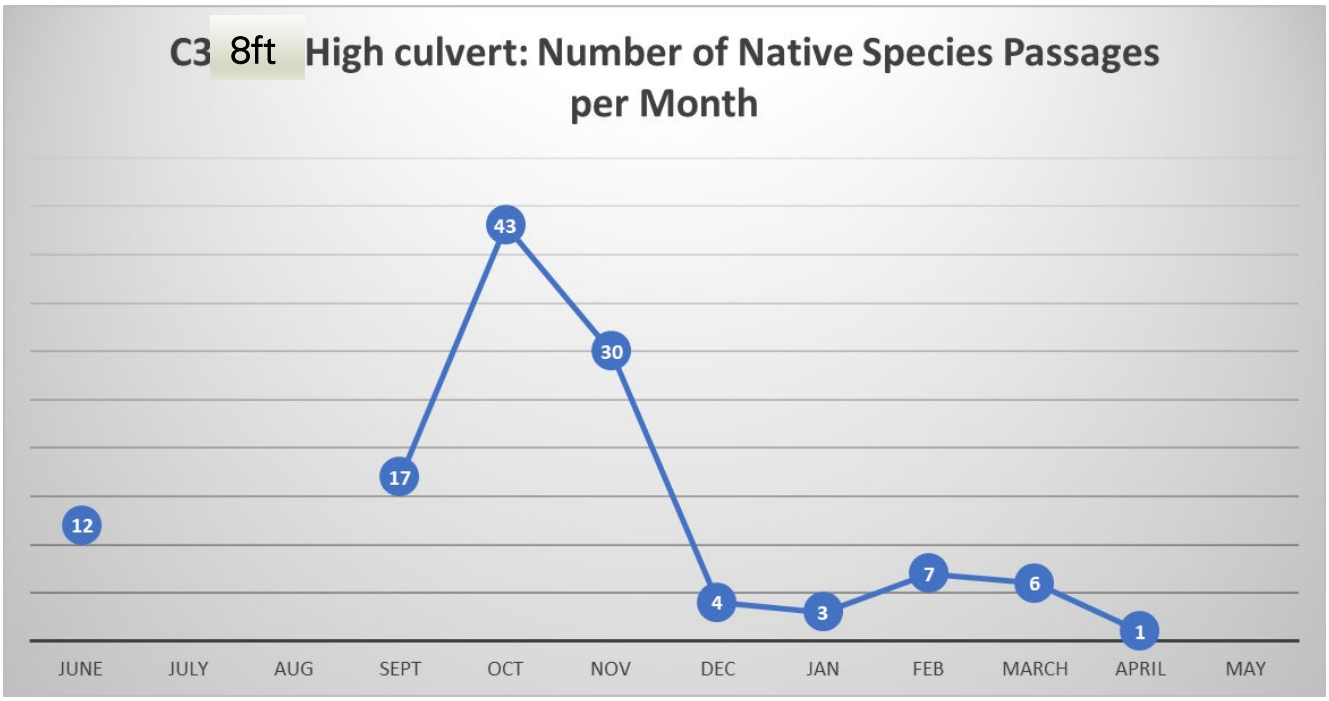

Figure 16. C3 culvert seasonal variation in species passages.

C4 PM 20.32 WB

This culvert leads to rolling hills immediately beyond the northbound and southbound openings. This is a very active culvert with a high coyote presence (Figures 17 & 18). Other species using this culvert include bobcat, raccoon, and striped skunk. An important note is the abundance of brush rabbit (*Sylvilagus bachmani*), and California ground squirrel (*Otospermophilus beecheyi*) at this site and on the hillsides. There were ground squirrel colonies residing in an old badger (*Taxidea taxus*) burrows that were documented on the hillsides in previous years.

Figure 17. Coyote entering C4 PM 20.32 on January 5, 2022.

Figure 18. A pair of coyotes at C4 PM 20.32 on January 18, 2022.

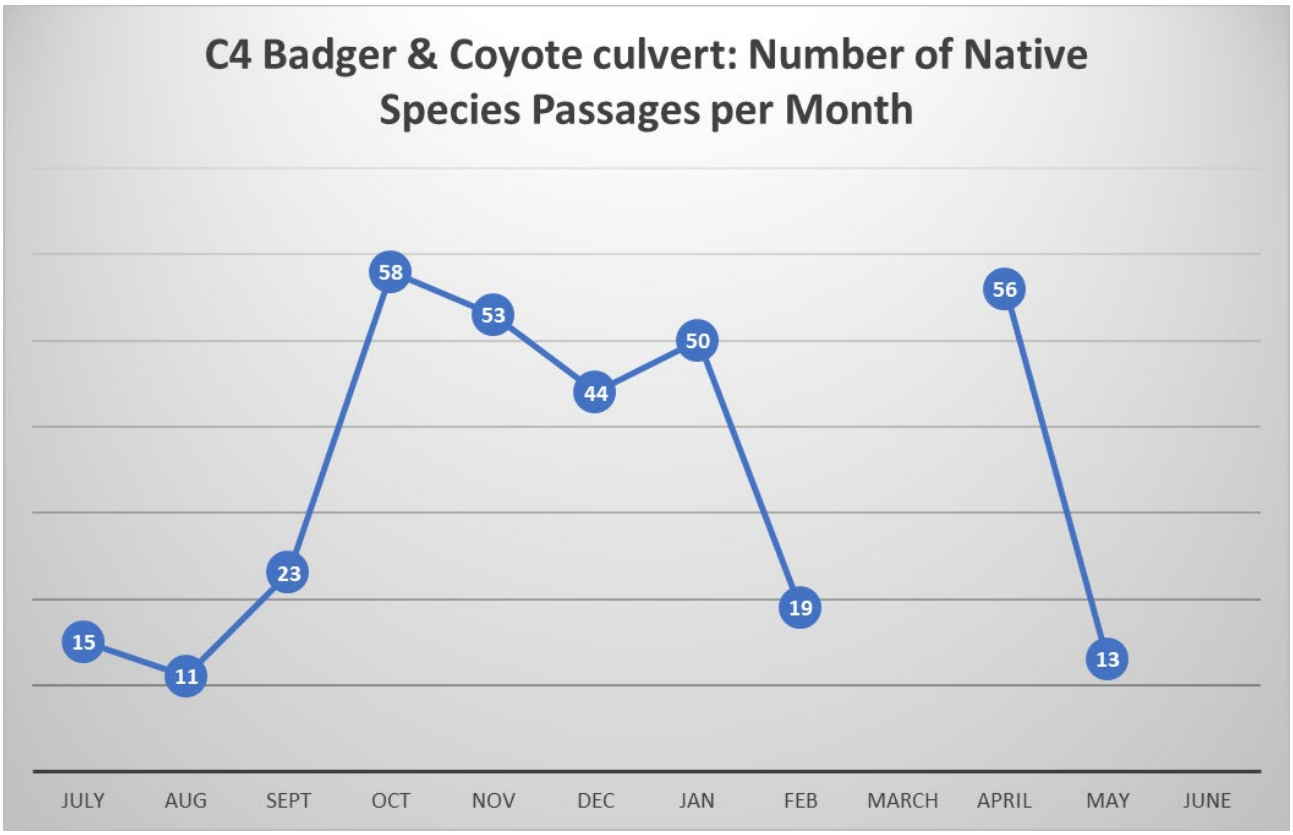

Figure 19. C4 PM 20.32 seasonal variation in native species passages.

C5 PM 20.74 WB

This culvert is not in the Caltrans database as it is only 2.5 feet in diameter but is in the Southern Santa Cruz Mountains Wildlife Connectivity Study (SSCMWCS) WPID. It is a round cement culvert with a steady decline toward the eastbound opening and is the second of three culverts within 1.1 kilometers (3/4 of a mile) of each other. The most interesting find at this culvert is the presence of an overwintering burrowing owl (*Athene cunicularia)* on two different occasions. The first detection was on February 16, 2022, the second was on February 27, 2022 (Figures 20-21). This culvert leads to ranch properties on both sides, and the grass had been quite low. There are also old badger and ground squirrel burrows on the northern hillsides.

Figure 20. Burrowing owl at C5 PM 20.74 WB culvert opening on February 17, 2022.

Figure 21. Overwintering burrowing owl at C5 PM 20.74 culvert opening on February 27, 2022.

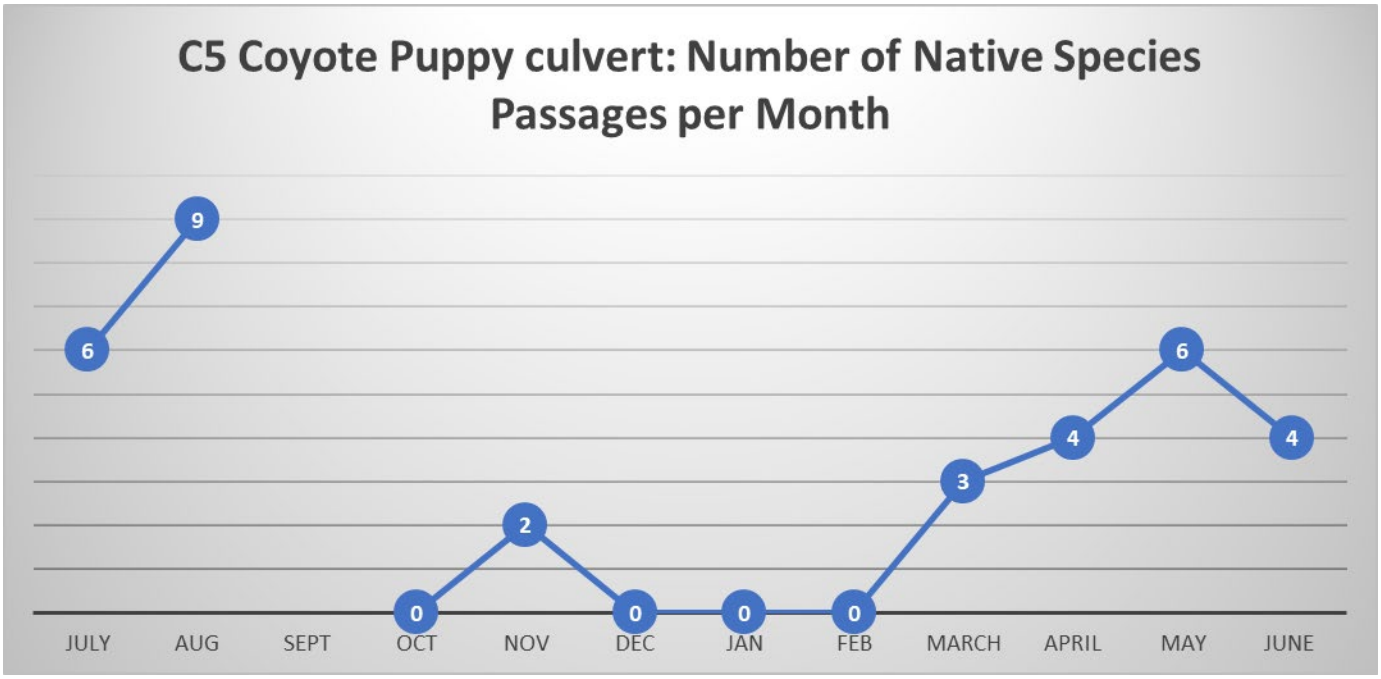

Figure 22. C5 PM 20.74 culvert seasonal variation in native species passages.

C6 PM 20.85 WB

This is the third culvert in the set of three culverts along a 0.75-mile stretch. Like the previous culvert to the west, this culvert is also a 2.5-foot round cement culvert with a decline to the eastbound opening. This culvert had medium- to high-use with many coyote, bobcat, striped skunk and raccoon passages regularly documented (Figure 23).

Figure 23. Coyote approaching C6 PM 20.85 2.5-foot round culvert on March 15, 2022.

C7 PM 22.09 EB

Culvert C7 PM 22.09 is located at the SR-152 and SR-156 junction. It is a three-foot high triple box cement culvert, with each section being six feet wide. It also happens to be the longest culvert in the study area at 90 meters (295 feet) from eastbound opening to westbound opening. This culvert had very low wildlife use with only domestic cats and the occasional raccoon successfully crossing through (Figures 25-26). Deer were documented walking along the opening of the culvert periodically, but did not cross through the culvert. Barbed wire and welded wire livestock fencing it located just beyond both openings so deer have to jump over the fence(s) to and from the highway side to access the culvert.

Figure 24. Domestic cat a culvert C7 PM 22.09 on April 1, 2022.

Figure 25. Raccoon at culvert C7 PM 22.09 on April 1,2022.

C8 PM 22.81 EB

This is a five-foot-high box culvert which leads from a ranch property to the west and drains into Pacheco Creek to the east. This culvert has a high rate of successful bobcat crossings which were mainly due to a female who was consistently traveling with her two offspring. However, from January to March 2022, we only recorded two different individuals. One looked healthy, and the other had a severe case of mange. This culvert was also regularly used by gray fox, and striped skunk (Figures 26-27).

Figure 26. Female bobcat and two juveniles at culvert C8 PM 22.81.

Figure 27. A gray fox at culvert C8 PM 22.81 on March 18, 2022.

B1 Santa Clara Conduit Drain Underpass (370487)

During 2021, we recorded bobcats and coyotes occasionally traveling under the bridge (Figure 28). In February 2022 one coyote was recorded and then there have been no passages in the spring by wildlife, but an increase in human trespassing (Figure 29).

Figure 28. Bobcat traveling through the Santa Clara Conduit Drain Underpass (370443), also referred to as Casa de Fruta Bridge.

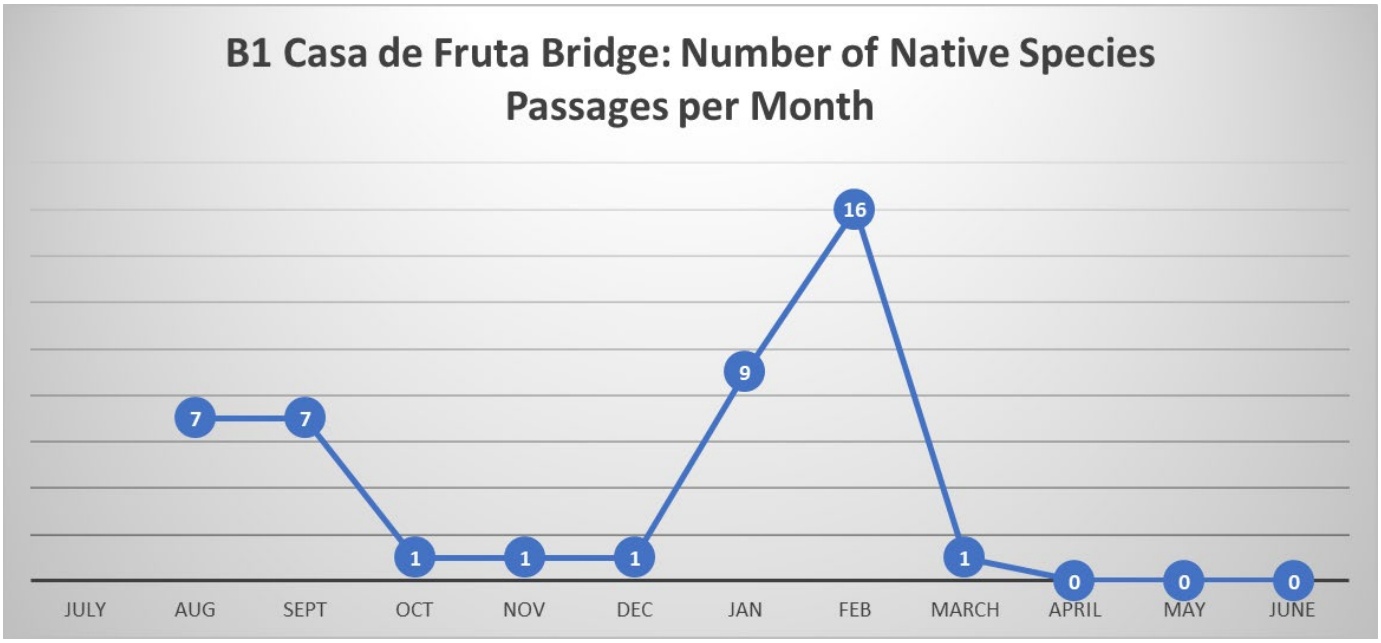

Figure 29. B1 Santa Clara Conduit Drain Underpass (370443) seasonal variation in native species passages.

C9 PM 24.36 EB

The culvert was blocked by a large board that was put up by the private landowner on the westbound, north side of the culvert. We have documented very few wildlife passages, mainly by a coyote juvenile in July 2022, after the survey period had ended (Figure 30 and 31). However, we have recorded bobcats, coyotes, and raccoons approaching the culvert, but then walking away. People have also been documented walking by the culvert and camera station.

Figure 30. Juvenile coyote at culvert PM 24.3 in July 2022.

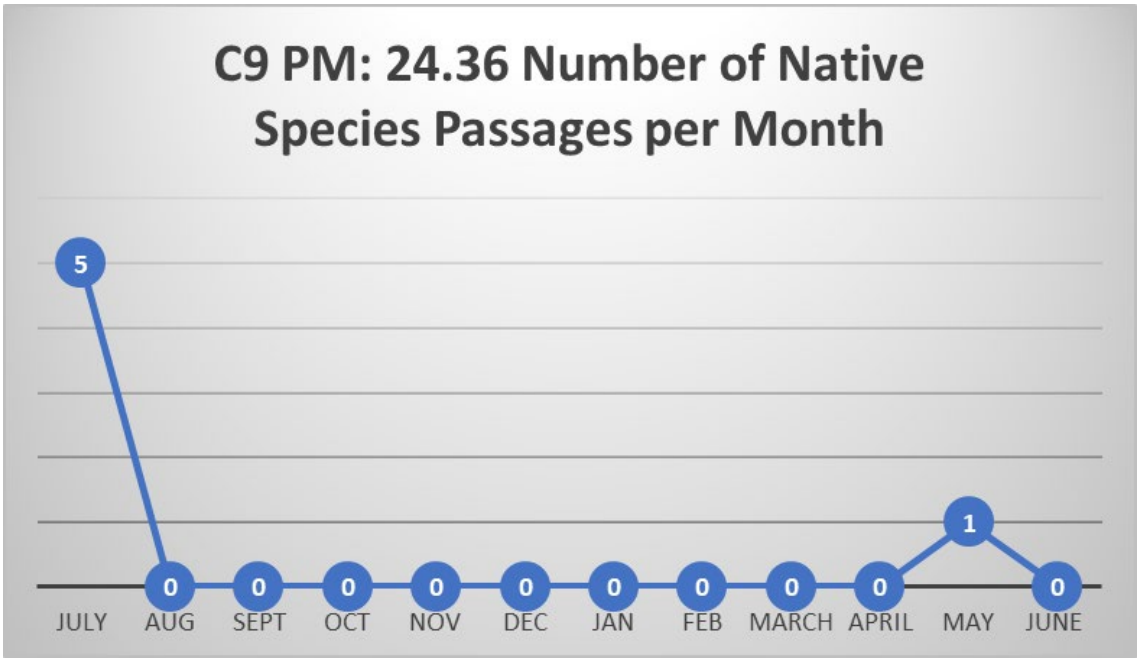

Figure 31. C9 PM 24.36 seasonal variation in wildlife passages.
*Note July represents July 2022, after the study period while August begins data collection in 2021.

C10 Killdeer Creek bridge (370060)/ Elephant Head Creek Culvert

Elephant Head creek drains under this bridge. This drainage spans from Canada de los Osos Ecological Reserve across SR-152 into the Pacheco Creek watershed. Bobcats, coyotes, raccoons, and skunks have been recorded using this 5-ft x 10-ft dual box culvert (considered a bridge in the Caltrans database) on a consistent basis before human trespassing began occurring in spring. There was a significant decrease in wildlife passages as trespassers were recorded camping in the culvert (Figures 32-36).

Figure 32. Bobcat successfully crossing through C10 Killdeer Creek bridge (370060)/Elephant Head Creek Culvert

Figure 33. Female coyote at C10 Killdeer Creek bridge (370060)/Elephant Head Culvert.

Figure 34. Trespasser at the C10 Killdeer Creek bridge (370060)/Elephant Head Culvert

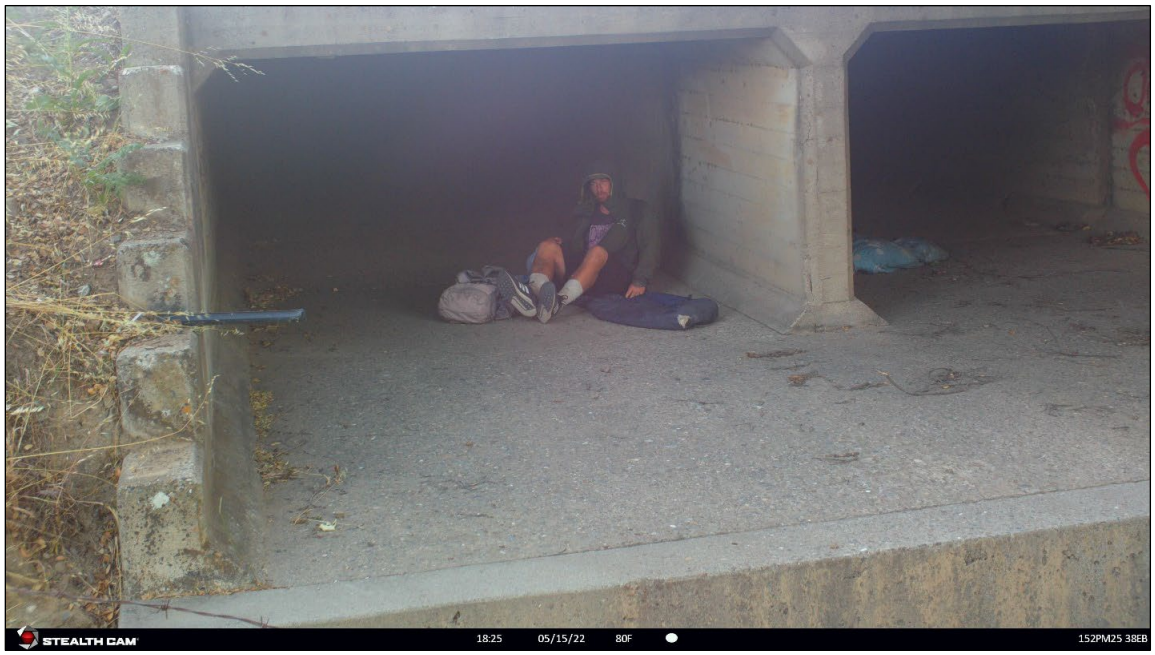

Figure 35. Second trespasser at the C10 Killdeer Creek bridge (370060)/Elephant Head Culvert.

Figure 36. Bobcat investigating a human sleeping bed at the C10 Killdeer Creek bridge (370060)/Elephant Head Culvert.

B2 Pacheco Creek Bridge (370430) by Fire Station

This is a large bridge with three sections. There are multiple species such as deer, coyote, and bobcat, using this bridge on a consistent basis to travel under the highway (Figures 37-39). Cattle were present periodically July 2021 through March 2022. No fencing restricts cattle or wildlife movement here as the same landowner has property on both sides of this bridge, allowing for unobstructed movement under the highway.

Figure 37. Mule deer at the SR-152 Pacheco Creek Bridge (370430) by the Fire Station on January 17, 2022.

Figure 38. Mule deer buck traveling under the Pacheco Creek Bridge (370430) by the Fire Station.

Figure 39. Coyote with a short tail at the SR-152 Pacheco Creek Bridge (370430) by the Fire Station on January 7, 2022.

B3 Pacheco Creek Reserve Bridge (370431)

After the water levels substantially receded at the Pacheco Creek Reserve bridge, we recorded deer, coyotes and bobcats traveling through each section of the bridge where there is an available bank (Figure 40). In late summer however, there were cattle that were using the bridge as shelter and standing/laying down in the east and west sections of the bridge for long periods through each day that we recorded them (Figures 41-43).

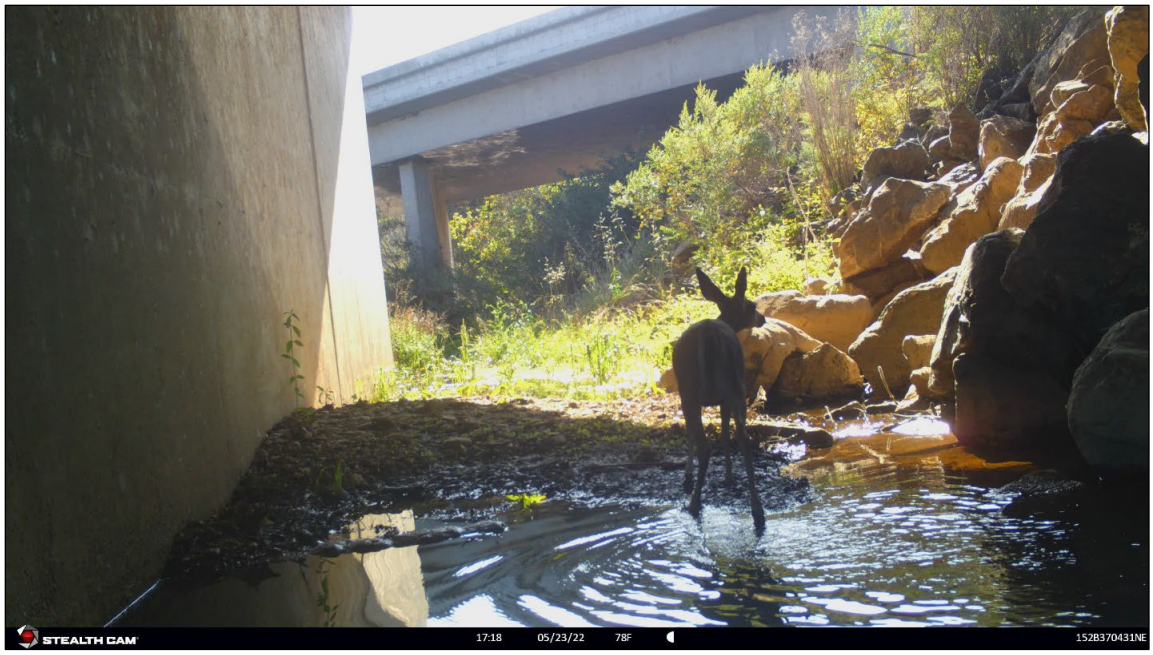

Figure 40. Deer successfully crossing through the east section of the Pacheco Creek Reserve bridge 370431.

Figure 41. Cows laying down under the SW section of bridge 370431. *Representative photo outside of survey period.

Figure 42. Cows laying down under the east section of bridge (370431). *Representative photo outside of survey period.

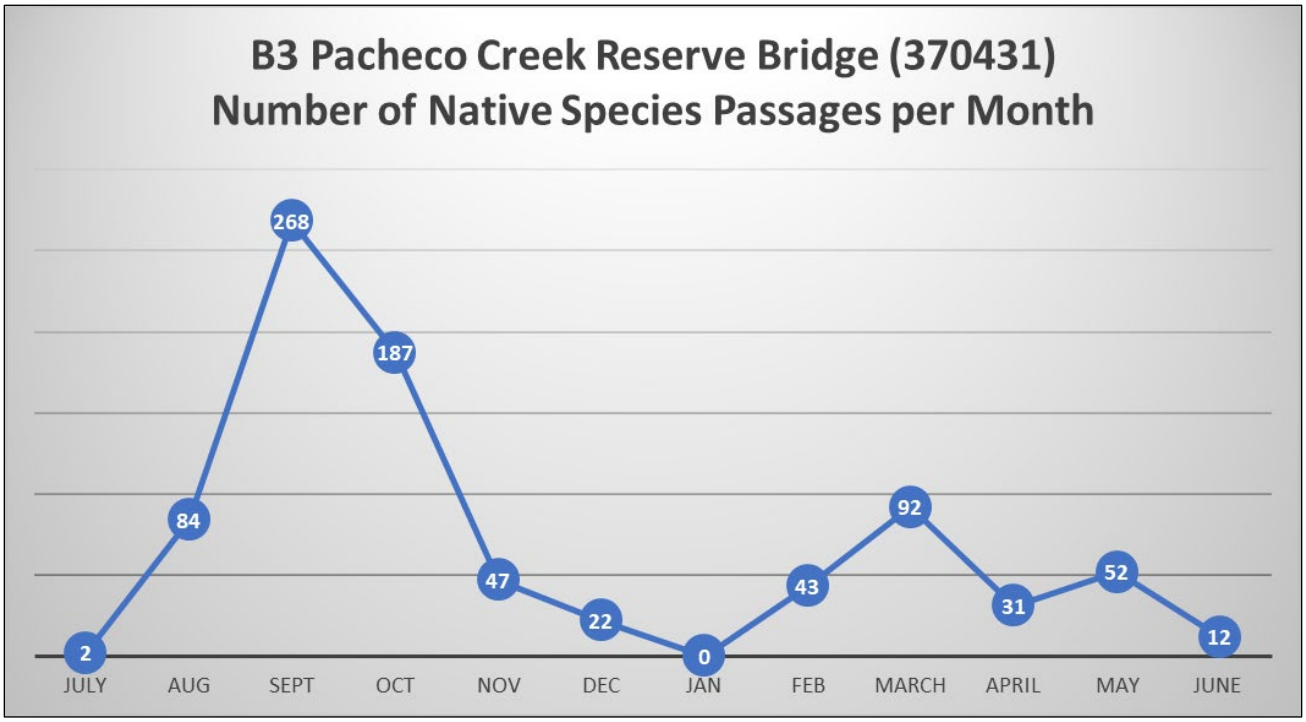

Figure 43. B3 Pacheco Creek Reserve Bridge (370431) seasonal variation in wildlife passage.

C11 PM 27.09 EB

This site is a dual box cement culvert draining south into Pacheco Creek. It is also located on the Santa Clara Valley Habitat Agency's Pacheco Creek Reserve. This culvert exhibited high use by wildlife, with multiple species passing through to and from the Pacheco Creek Reserve. Our cameras consistently recorded bobcat, coyote, raccoon, and striped skunk (Figure 44). However, there is a significant decline in passage rates when the culvert is flooded with water (Figure 45).

Figure 44. Bobcat at culvert C11 PM 27.09 February 2, 2022.

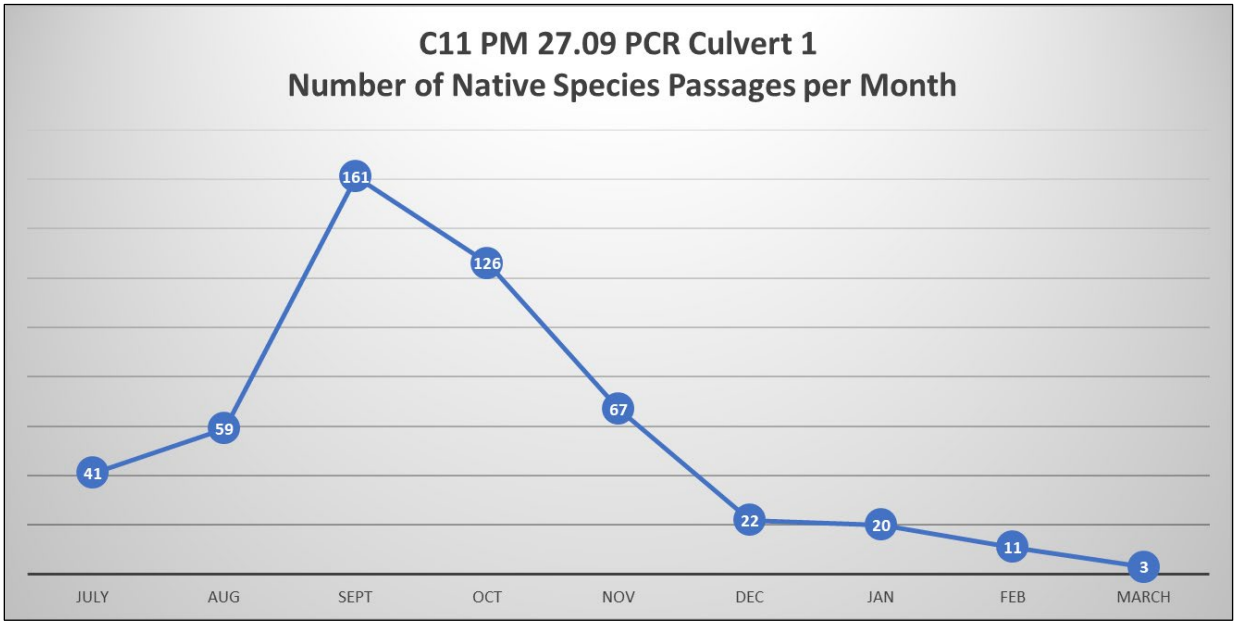

Figure 45. Culvert C11 PM 27.09 seasonal variation in species passages.

C12 PM 27.24 EB

This culvert is a four-foot high by four-foot wide cement box culvert surrounded by an extensive structural retaining wall. It diverts water into Pacheco Creek to the southeast and is located on the Pacheco Creek Reserve. Multiple species such as gray fox, bobcat, coyote, raccoon, and striped skunk were recorded crossing though this culvert each month (Figure 46).

Figure 46. Two bobcats traveling through C12 PM 27.24.

We have documented ten occasions where a mountain lion (*Puma concolor*) approached, and several times successfully crossed through the culvert during a period ranging from November 2021 to February 2022 (Table 1, Figures 47-49). The interesting aspect of these detections are the fact that this culvert is only 4'x4' with low visibility to the opposite opening (Figure 50). For example, it is more common for mountain lions to cross under a bridge or large culvert, than a four-foot box culvert with less visibility. Nonetheless, it is not unheard of for mountain lions to cross through medium sized culverts, however culverts of this size are not a desired recommendation for mountain lion safe passage.

This location might benefit from installing a larger structure as we did not record any deer traveling through the culvert but did record them investigating the culvert on the north side. During the height of the drought, this location of Pacheco Creek retained water, which is an important resource considering climate change and providing refuge habitat for animals on the north side of the culvert.

Figure 47. Mountain lion crossing through culvert C12 PM 27.24 on November 25, 2021.

Figure 48. Mountain lion crossing through culvert C12 PM 27.24 into the Pacheco Creek Reserve on December 3, 2021.

Figure 48. Mountain lion heading northwest through culvert C12 PM 27.24 on January 23, 2022.

Figure 49. Mountain lion walking in front of culvert C12 PM 27.24 on February 23, 2022.

Figure 50. View from within eastbound opening of culvert C12 PM 27.24.

C13 PM 28.06 WB

Culvert PM 28.06 is a three-foot-high by three-foot-wide cement box culvert. It has a steady decline from the westbound opening to the eastbound opening allowing water to drain into Pacheco Creek on the Pacheco Creek Reserve. There is a barbed wire fence in front of the westbound opening, which acts as a catch for large debris.

Even though the opening was partially blocked, there have been consistent successful crossings by bobcats and coyotes (Table 1, Figures 51 and 52). Also, the fence is in disrepair and could benefit from being fixed with wildlife friendly fencing or a directional fencing design. There are cattle present on the property on the westbound side of the highway, owned by Pacheco Pass Land and Cattle LLC.

Figure 51. Male bobcat at culvert C13 PM 28.06 on January 28, 2022.

Figure 52. Coyote at culvert C13 PM 28.06 on February 15, 2022.

B4 Cedar Creek Bridge (370030)

Cedar Creek has heavy flow during rain events but does not hold water like other bridges in the study area. This bridge had consistent passages by bobcats, coyotes, and especially deer throughout most of the year (Table 1, Figures 53 and 55). This bridge is an important wildlife thoroughfare within the greater linkage.

Figure 53. Mule deer buck successfully crossing under Cedar Creek Bridge (370030).

Figure 54. Coyote successfully crossing under Cedar Creek Bridge (370030).

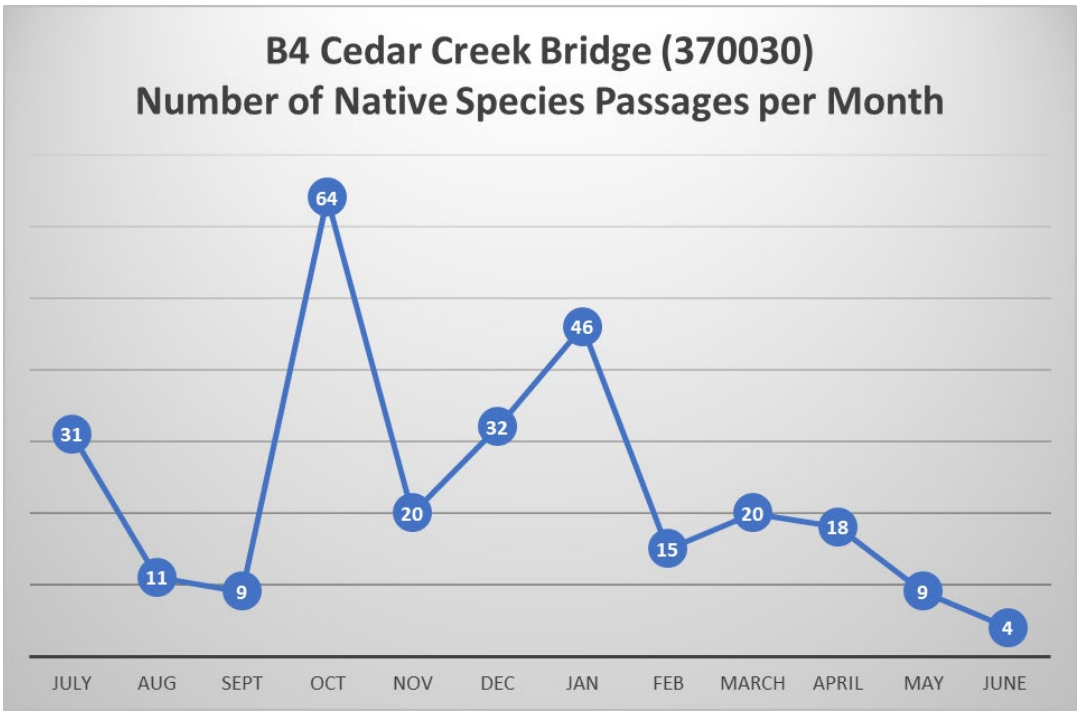

Figure 55. B4 Cedar Creek Bridge (370030) seasonal variation in wildlife passages detected.

C14 Culvert PM 29.09 EB

This culvert has high passage rates by mesocarnivores when the culvert is not inundated with water (Figures 56 and 57). There was a significant decline in the passages rates in January 2022 when the culvert was flooded with water (Figure 58).

Figure 56. Bobcat traveling through C14 PM 29.09.

Figure 57. Gray fox traveling through C14 PM 29.09

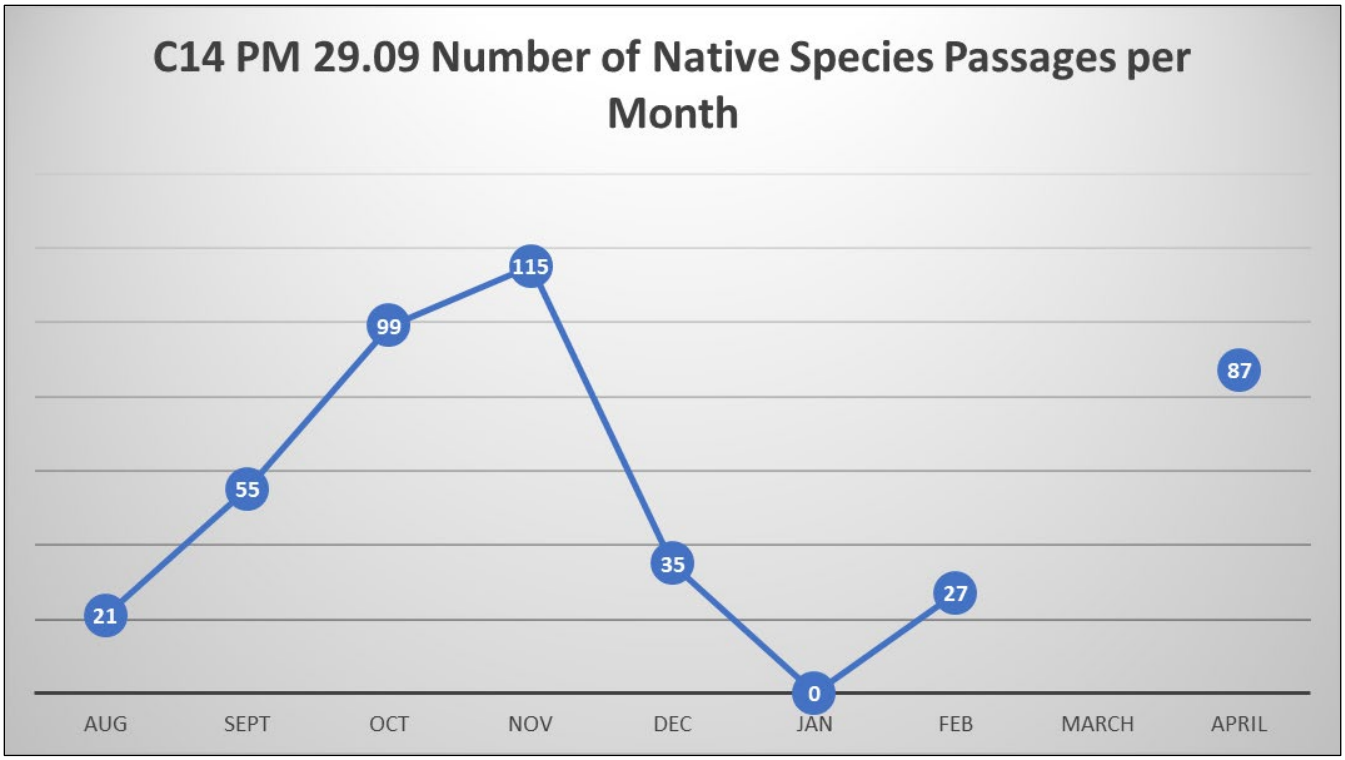

Figure 58. C14 PM 29.09 seasonal variation in native species passages.

C15 PM 29.6 EB

Culvert PM 29.6 is four-foot-high culvert with quite a bit of vegetation cover beyond both openings. For example, beyond the eastbound opening there is sycamore habitat which leads to Pacheco Creek and the Malech Ranch property. Beyond the westbound opening, there is a ravine with oak woodland habitat and the 15,000+ acre El Toro Ranch. The culvert floor is filled with a thin layer of rocks making the substrate quite natural and since the decline to the south is slight, the culvert floor is quite level. Species recorded traveling through this culvert on a regular basis during most of the year included bobcat, coyote, gray fox, and wild pig (Figures 59-63).

Figure 59. Coyote at the SR-152 culvert C15 PM 29.6 on February 27, 2022.

Figure 60. Bobcat at the SR-152 culvert C15 PM 29.6 on March 1, 2022.

Figure 61. Coyote at the SR-152 culvert C15 PM 29.6 on March 4, 2022.

Figure 62. Bobcat at the SR-152 culvert C15 PM 29.6 on March 6, 2022.

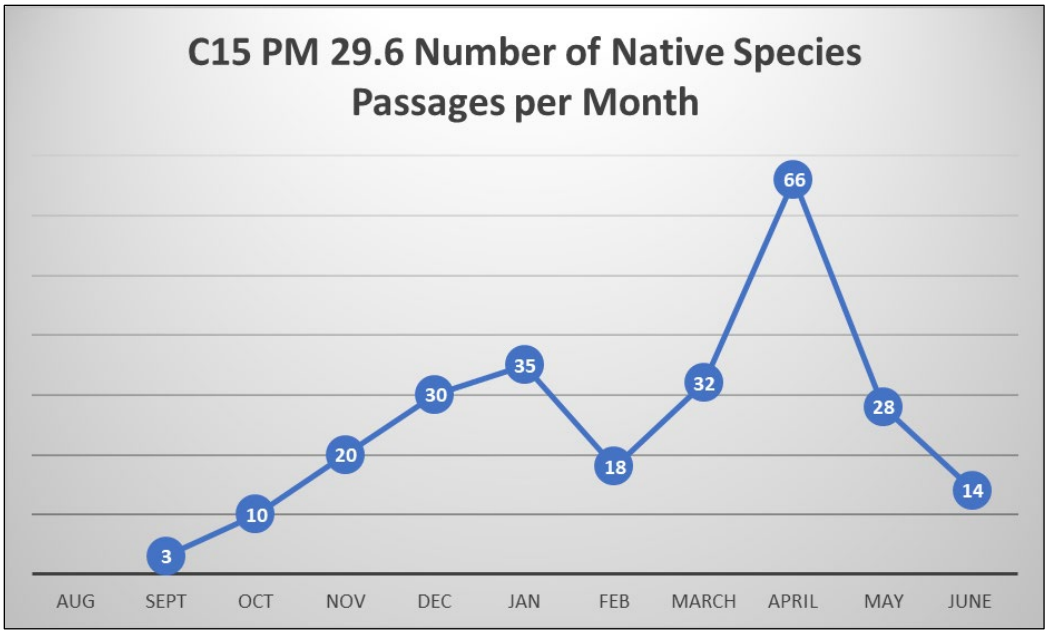

Figure 63. C15 PM 29.6 seasonal variation of native species passages.

B5 Pacheco Creek Bridge (370441) past Bell Station

This bridge is large enough for deer safe passage under SR-152, especially during rain events because the center section diverts most of the water. This leaves the outer sections clear for safe passage. We have recorded bobcat, coyote, deer, raccoon, and wild pig successfully crossing under bridge 370441 (Figures 64 and 65).

Figure 64. Bobcat at the SR-152 bridge 370441 on February 3, 2022.

Figure 65. Deer at the SR-152 bridge 370441 on February 11, 2022.

B6 South Fork Pacheco Creek Bridge (370466)

Bridge 370466 is a great thoroughfare for deer (Figures 66-69). We have recorded deer crossing under the bridge throughout the entire study period at this site. There is a barbed wire fence at the westbound opening, and an electrified fence on the northeastern section. In addition to deer, there were also numerous bobcat, coyote and wild pigs successfully crossing under the bridge. We found that mule deer are only using the bridges to travel under the highway versus the culverts with the only exception being C2 PM17.24 the San Felipe Lake box culvert.

Figure 66. Mule deer doe crossing under the South Fork Pacheco Creek Bridge (370466) heading toward barbed wire fence.

Figure 67. Two mule deer does crossing under the South Fork Pacheco Creek Bridge (370466).

Figure 68. Sounder of wild pigs crossing under the South Fork Pacheco Creek Bridge (370466).

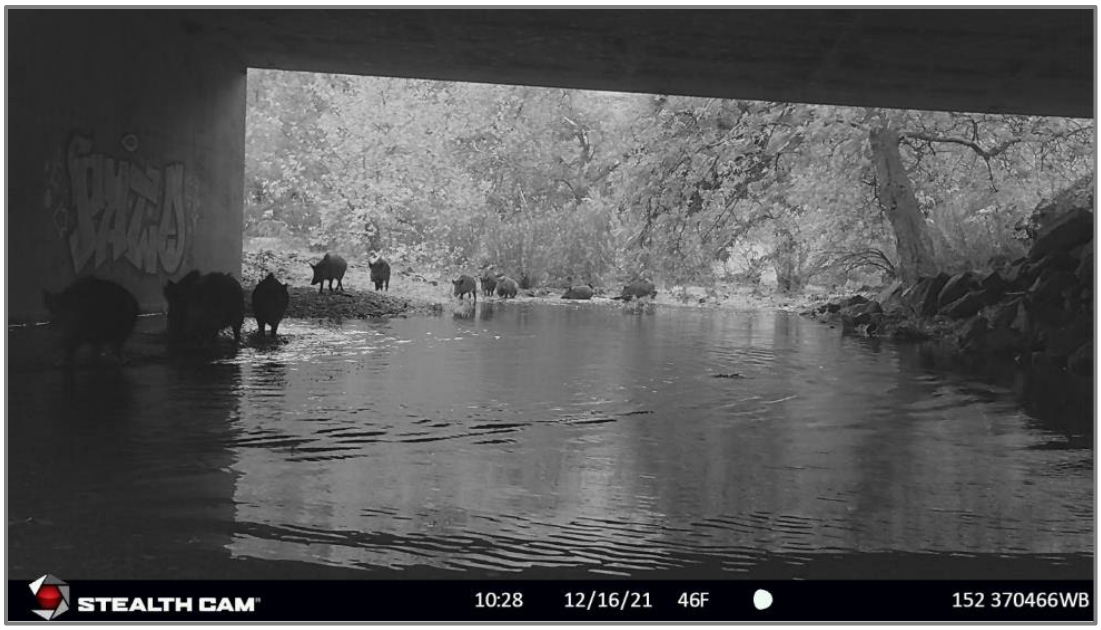

Figure 69. Sounder of wild pigs crossing under the South Fork Pacheco Creek Bridge (370466).

C16 (not included in WPID nor Caltrans database) EB

This is a large arch culvert which was discovered during field scouting and is not in the WPID nor the Caltrans culvert database. The eastbound opening is very large 12-14 feet high, however there is no visibility because halfway through the culvert it splits in two directions (east and west). The opposite opening has yet to be found. One possible explanation is that the westbound opening(s) is/are smaller drainages, which is common with culverts that change directions. Nonetheless, we installed a camera at this site as it is in between two passable culverts. We have recorded deer, coyote, bobcat, and gray fox traveling by this culvert, but very few successful crosses (Table 1 and Figure 70).

Figure 70. Bobcat at the SR-152 large arch culvert on 2/1/2022.

C17 PM 32.3 EB

This culvert had moderate levels of use by wildlife. The key features at this site are the pond at the eastbound opening, and we found California red-legged frog (*Rana draytonii*) and western pond turtles (*Actinemys marmorata*) residing in the pond (Figures 71 and 72). Throughout March 2022, there were two individual western pond turtles spotted while we serviced cameras.

Figure 71. California red-legged frog recorded at C17 PM 32.3. on June 18, 2021.

Figure 72. Western pond turtles recorded at C17 PM 32.3 on June 18, 2021.

This culvert was used primarily by bobcats, coyotes, gray fox and raccoons to cross under the SR-152 (Table 1, Figures 73 and 74). A mountain lion was recorded at the culvert entrance on May 24,2021 but it was not a confirmed crossing (Figure 75).

Figure 73. A bobcat crossing through culvert C17 PM 32.3 on April 17, 2022.

Figure 74. A gray fox crossing through culvert C17 PM 32.3.

Figure 75. Mountain lion at culvert C17 PM 32.3 on May 24, 2022.

C18 PM 32.61 WB

This is the third large arch culvert and we recorded very low use by wildlife. It is quite similar in type, size, and shape, to culvert PM 32.3 to the west. We recorded only two bobcat passages through the culvert (Figure 76).

Figure 76. Bobcat successfully crossing through SR-152 culvert PM 32.61

C19 PM 32.75 EB

There have been very few mammal passages at this culvert, however the pond at the westbound opening is great western pond turtle habitat. Throughout the study, three western pond turtles were observed while servicing cameras (Figure 77). The large pond at the westbound opening could be an explanation of why there were little to no safe passages for terrestrial mammals.

Figure 77. Western pond turtles at culvert PM 32.75 westbound opening pond on February 18, 2022.

C20 PM 33.04 WB

Culvert C20 PM 33.04 had consistent use by coyote and bobcats throughout the study period (Table 1, Figure 81). There is a smaller culvert serving as a drainage below this culvert which helps divert water away from this culvert. As a result, this culvert remains relatively dry. There was steady wildlife use at this culvert since camera deployment (Figures 78-81). There were no detections of deer successfully crossing through this culvert despite good visibility and the length of the culvert only spans the four lanes of SR-152.

Figure 78. A coyote pair crossing through SR-152 culvert C20 PM 33.04 on January 30, 2022.

Figure 79. A coyote crossing through SR-152 culvert C20 PM 33.04 on February 5, 2022.

Figure 80. A bobcat crossing through SR-152 culvert C20 PM 33.04 on February 6, 2022.

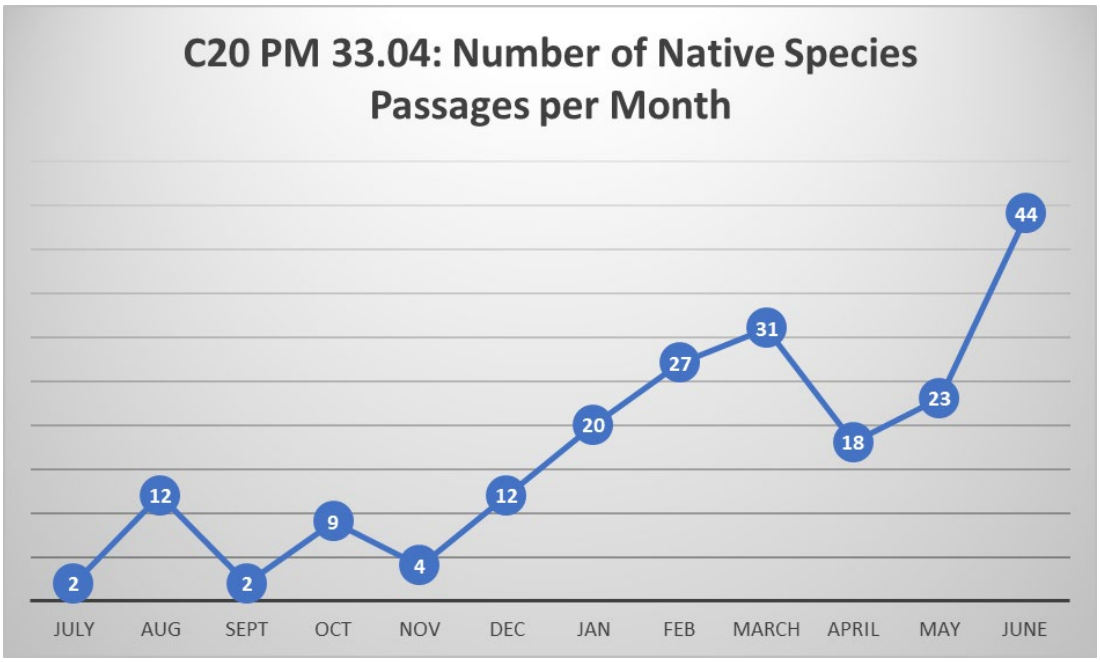

Figure 81. Culvert C20 PM 33.04 seasonal variation in wildlife passages.

C21 PM 33.52 WB

Culvert PM 33.52 is a four-foot round cement culvert with a decline and angle change toward the eastbound side of the highway. Interestingly, even with the angle and semi-steep decline, there are occasional coyote and bobcat crossings. A coyote crossed 14 times in August 2021, but then there were only several crosses by coyote for the rest of the study period. Deer were documented approaching the culvert, but none entered or passed through (Figures 82-85).

Figure 82. Deer approaching SR-152 culvert C21 PM 33.52 on January 16, 2022.

Figure 83. Deer turning away from SR-152 culvert C21 PM 33.52 on January 16, 2022.

Figure 84. Bobcat approaching SR-152 culvert C21 PM 33.52 on February 8, 2022.

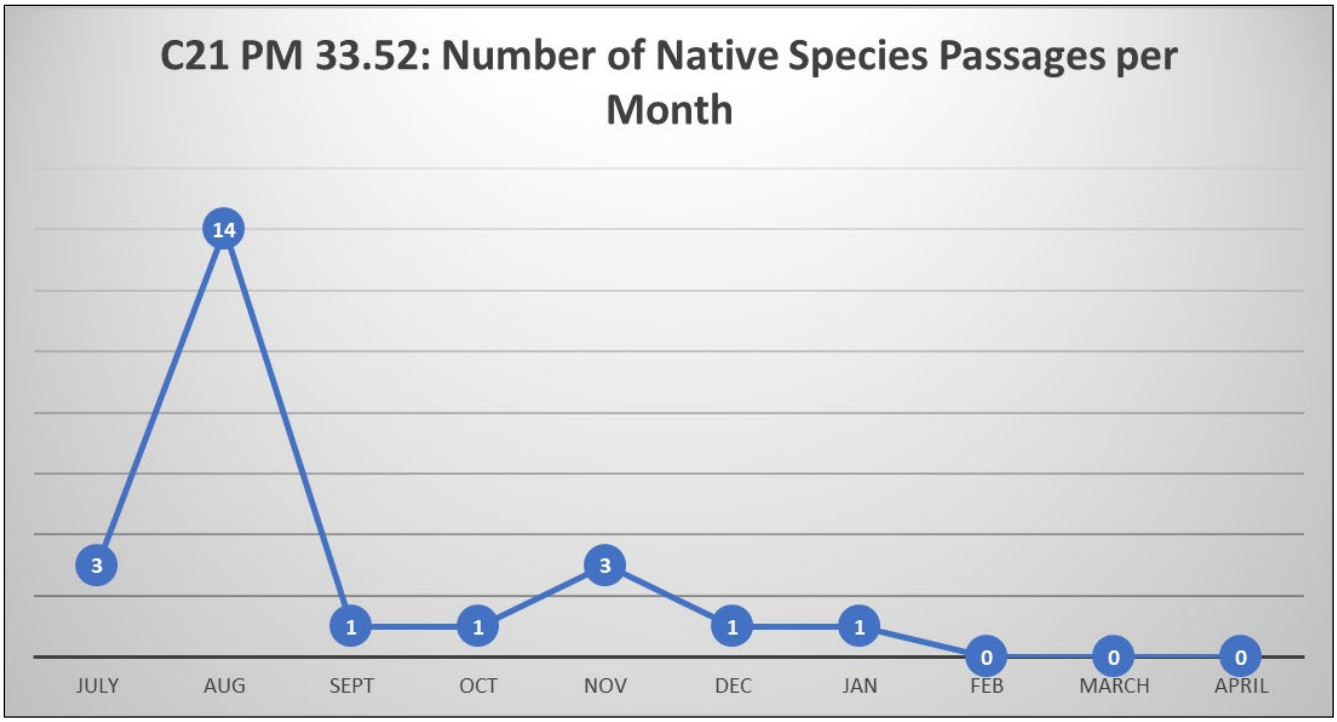

Figure 85. Culvert C21 PM 33.52 seasonal variation in wildlife passages.

C22 PM 34.7 WB

This culvert has a high bobcat passage rate with 69 passages, along with 27 passages by coyotes (Table 1, Figures 86 and 87). This culvert is slightly elevated from the ground outside the eastbound and westbound openings which helps keep it from retaining water. Because of the elevated floor of the culvert, the floor was inundated with water during the heavy rain in November 2021, December 2021, and January 2022.

During January 2022 we recorded a sharp decline in passage rates when the culvert was flooded and there was no wildlife movement through the culvert (Figure 88). Immediately after the rain, the culvert floor was clear of water and wildlife began using the culvert again. There is a gate at the westbound opening, but it has been up since the study began.

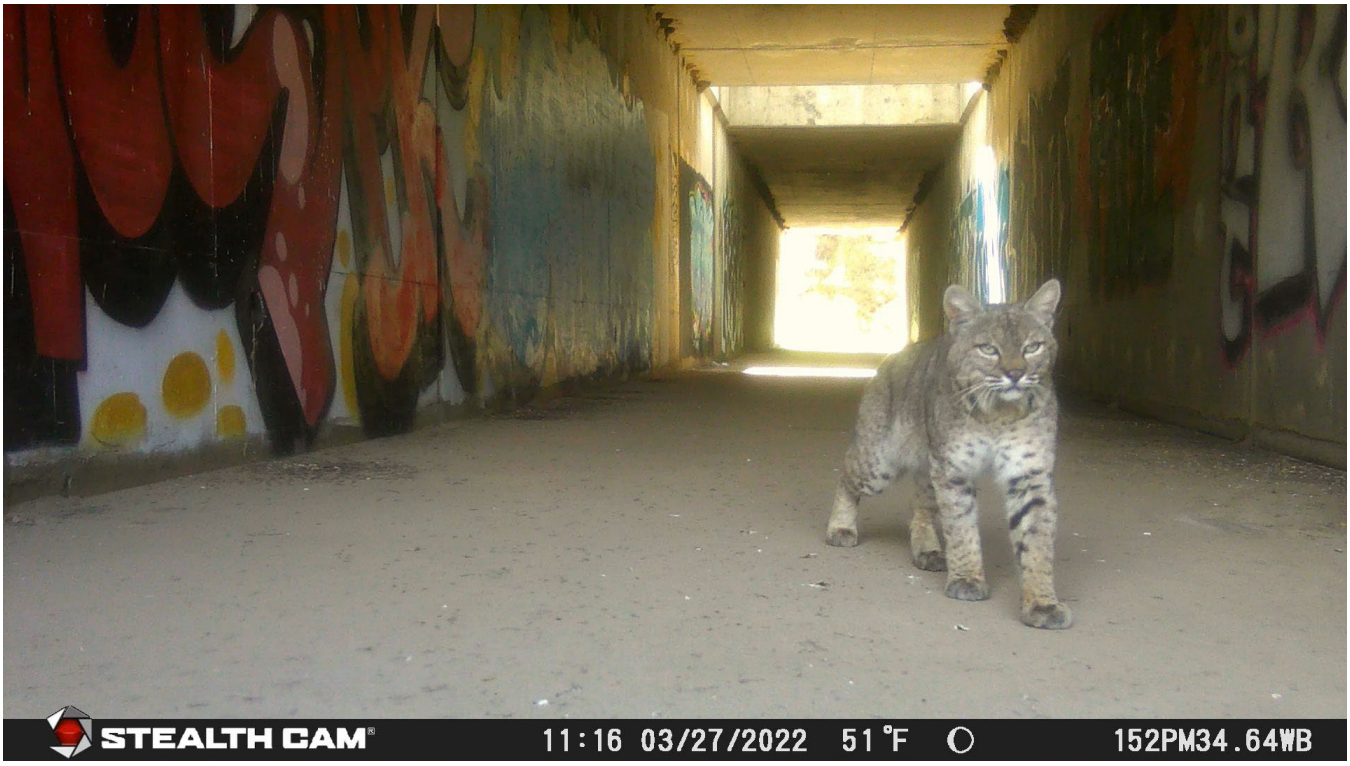

Figure 86. A bobcat crossing through SR-152 culvert C22 PM 34.7. Gate is behind camera.

Figure 87. A coyote crossing through SR-152 culvert C22 PM 34.7.

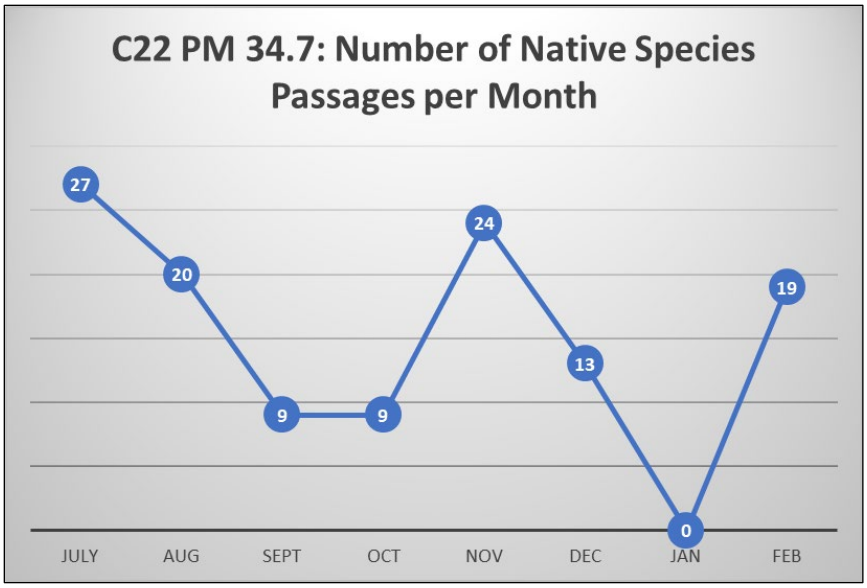

Figure 88. Culvert C22 PM 34.7 seasonal variation in species passages. Note July crossings were collected July 2022 and inserted before August 2021 when data collection began.

C23 PM 34.78 EB

Culvert C23 PM 34.78 is the easternmost monitoring site in the study area. It is a four-foot cement round culvert (Figure 89). The water flows toward the westbound opening into a shallow pond. There is a very wide shoulder and turnout that Semi trucks and cars use as a rest stop. Unfortunately, because of the number of cars at the turn out, people are consistently coming down to the culvert to use it as a restroom or place to take drugs. Human presence may be a factor in why this is a very low, if not the lowest, use culvert. We did not record any successful passages by wildlife through the culvert (Table 1).

Figure 89. Example of a brush rabbit at SR-152 culvert C23 34.78 on January 11, 2021.

7.0 Records of Bobcats with Mange

At four study sites we recorded pictures of a bobcat with mange traveling through the three culverts and the Pacheco Creek Reserve bridge. This could possibly be the same bobcat or several different bobcats. This is of concern as we have documented the decline of healthy bobcats in the Southern Santa Cruz Mountains as we began to record only several bobcats, most with mange during 2018-2019 instead of many different healthy bobcats in 2013-2014 (Diamond, et al. 2022).

Pacheco Creek culvert PM 27.24: We recorded two different individual bobcats, and one bobcat has severe mange (Figure 90).

Figure 90. Bobcat with mange at C12, PM 27.24.

PM 28.06 WB: We have identified four different bobcats at this location. One large male with a right flat ear, a female who looked like she was pregnant, a young subadult, and another adult with mange. This bobcat with mange looks like it might be the same bobcat that is using the Pacheco Creek Culvert 2, the Pacheco Creek bridge, and the Elephant Head Creek culvert /Killdeer Creek bridge (Figures 90-94).

Figure 91. Bobcat with mange at C13 PM 28.06 WB.

Elephant Head Creek culvert

Figure 92. Bobcat with mange at the Killdeer Creek Bridge/Elephant Head Creek culvert.

Pacheco Creek Reserve Bridge Southeast section

Figure 93. Bobcat with mange at the Pacheco Creek bridge, southeast section.

Figure 94. Bobcat with mange at the Pacheco Creek bridge, southeast section.

8.0 Wildlife Vehicle Collision Data Results

8.1 Wildlife Vehicle Collision Results

Forty-six weekly roadkill surveys were conducted between June 1, 2021 and June 30, 2022. There were a total of 42 animals recorded as hit by vehicles, however the majority of species were detected outside of the standardized weekly surveys. There were only seven days when roadkill surveys occurred that animals (n=12) were found dead on the road. The other 15 days when wildlife were observed hit by vehicles (n=31), they were detected incidentally while driving sections of SR-152 to service cameras. The species detected most frequently included striped skunk (10), coyote (9), mule deer (8), and bobcat (6) (Table 2). The majority of the roadkill data was found between San Felipe Lake and just east of Cedar Creek (Figure 95). Key findings about the wildlife vehicle collision data are discussed in Section 8.2, along with providing detailed information about the tule elk that was found hit by the San Luis Reservoir (Figure 95).

Species (common name)	Roadkill Records
Bobcat	6
Coyote	9
Deer	8
Gray fox	1
Mountain Lion	1
Opossum	1
Raccoon	5
Striped skunk	10
Wild pig	1
Grand Total	**42**

Table 2. Roadkill data recorded during the June 2021-June 2022 study period.

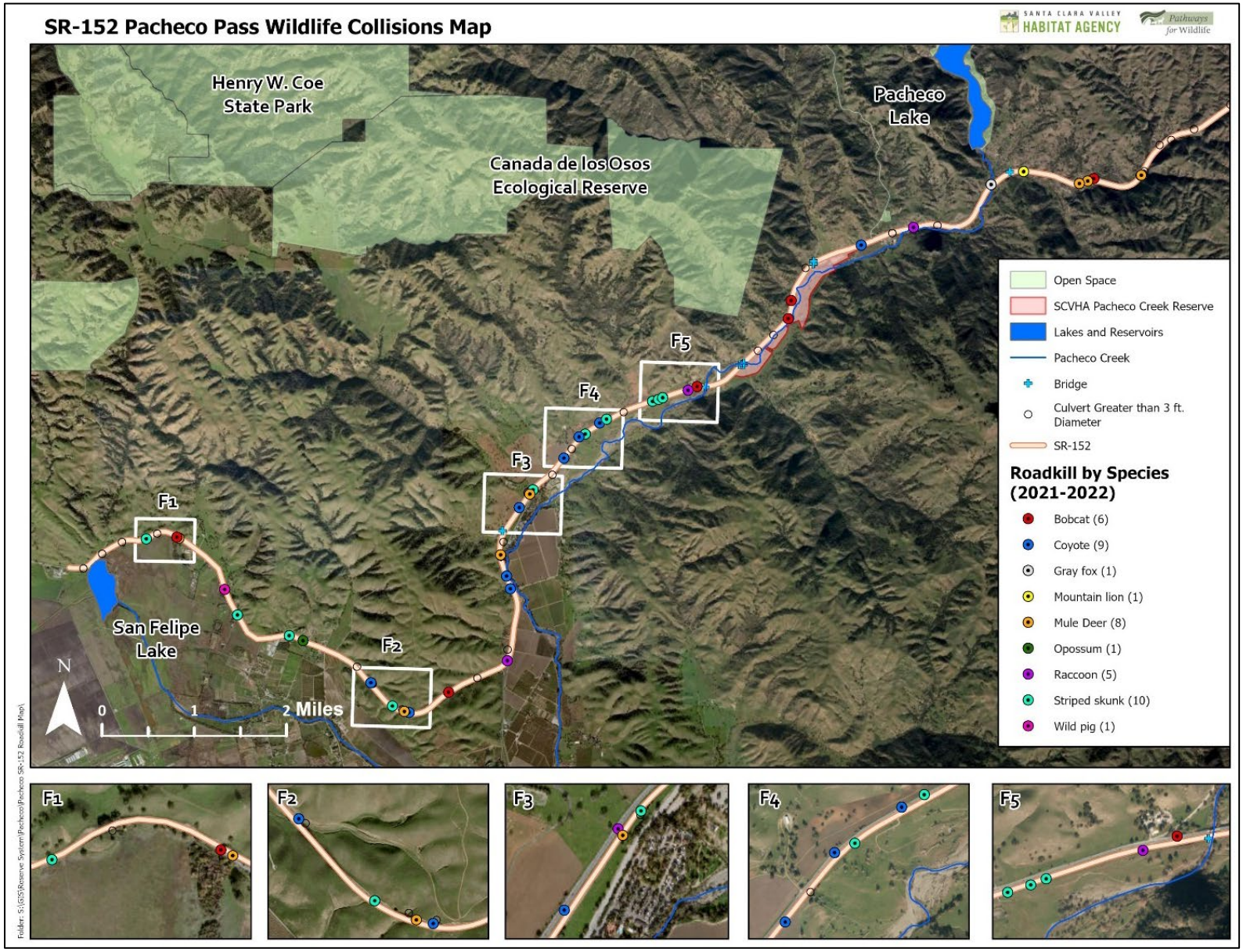

Figure 95. Forty-two roadkill data records collected from June 1, 2021-June 30, 2022.

8.2 Key Findings & Wildlife Vehicle Collision Discussion

On February 17, 2022, an adult male tule elk (*Cervus canadensis nannodes*) was observed hit on SR-152 by Julie King, Principal Land Management Specialist with the Santa Clara Valley Habitat Agency. Pathways for Wildlife went out and documented all relevant information relating to this tule elk roadkill. The GPS location where the elk was hit is UTM E 670642 N 4104838 and the nearest postmile marker is 152 MER R9.50 EB. The elk was hit at the median of the eastbound lane by the San Luis Reservoir (Figures 96-98). This was an incidental observation as the location is outside of the routine roadkill survey area and is not included as one of the 42 individuals detected.

Figure 96. Male tule elk hit on February 17, 2022.

Figure 97. Landscape view of male tule elk hit on February 17, 2022.

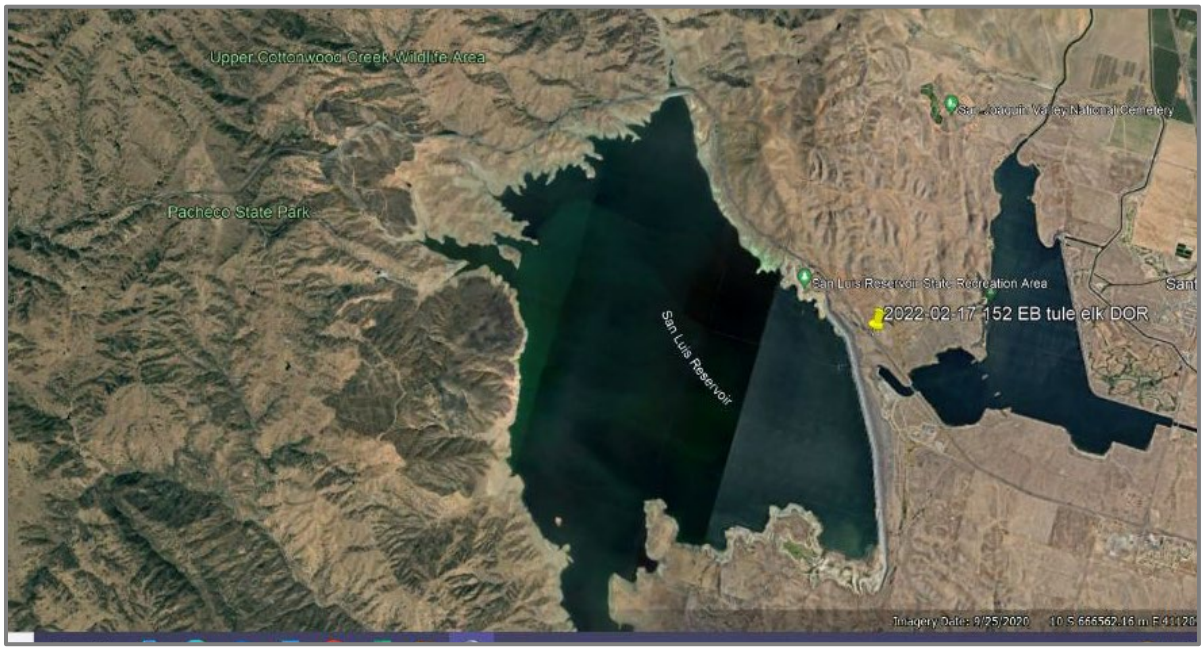

Figure 98. Location of where the male tule elk was hit on February 17, 2022.

As we scouted the area, we saw an adult female tule elk browsing on the hillside. We also noticed a large trail leading down from the western hillside to the eastbound lanes of SR-152. Upon closer inspection of the trail, we found numerous tule elk tracks heading in both directions on the trail. We then followed the trail and it led us to a fence in disrepair. The fence had the top two barbed wire strands missing, and there was a fair amount of exposed soil on both sides indicating frequent movement at that section. The height of the fence, not including the top two missing strands, is approximately three feet high. Also, the bottom portion of the fence is woven wire mesh fencing (Figure 98).

Figure 98. Fence line where trail led from highway, disturbed soil, top missing strands of barbed wire, and woven wire fencing at base.

On February 10, 2022 during our routine roadkill survey, we documented a male bobcat dead on road on the right shoulder of the westbound lane after the SR-156/152 junction (Figures 99-100). We contacted Rachel Roberts, the Senior Environmental Scientist Bobcat Program Lead at CDFW, who had her Region 3 bobcat staff collect the carcass to send to their lab.

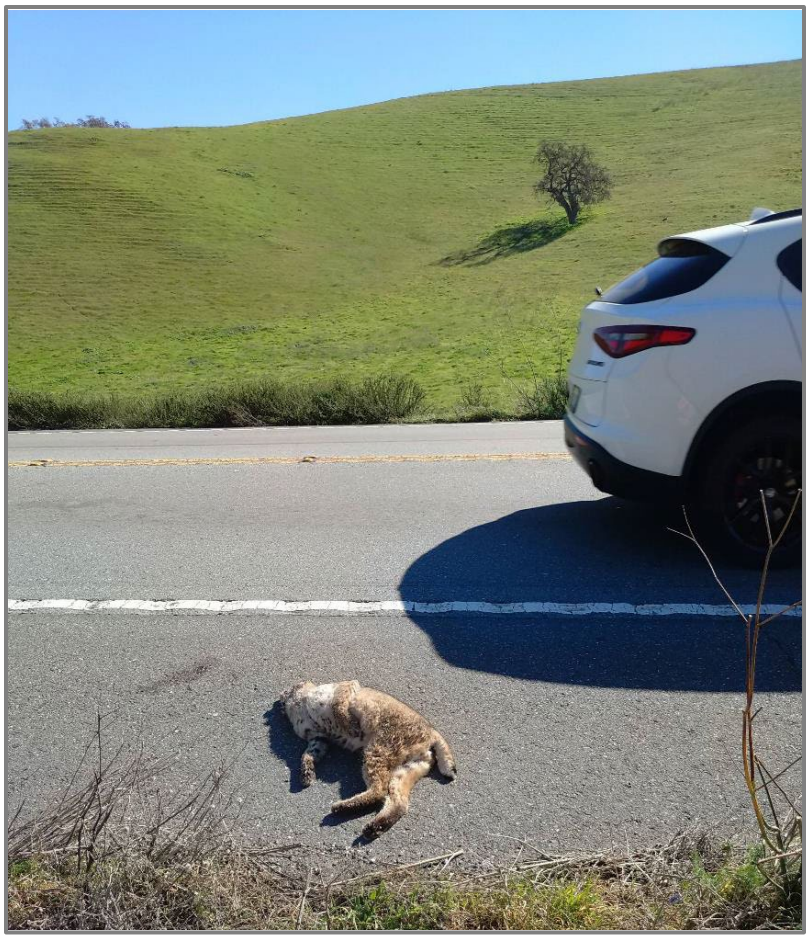

Figure 99. SR-152 bobcat hit on February 10, 2022.

Figure 100. Location where the bobcat was hit on February 10, 2022.

Then, on the following day February 11, 2022, during field work, another bobcat was found dead on the SR-152 on the right shoulder of the eastbound lane by the Pacheco Creek Reserve (Figures 101-102). This was very close to culvert PM 27.24, which has frequent successful crosses from multiple bobcats. We notified Rachel Roberts, the Senior Environmental Scientist Bobcat Program Lead at CDFW, again and her staff was able to collect both carcasses for lab testing.

Figure 101. SR-152 bobcat hit on February 11, 2022.

Figure 102. Location where the bobcat was hit on February 11, 2022 by the Pacheco Creek Reserve.

The following are examples of the wildlife we documented hit in summer, from June to September 2021. Multiple species such as coyotes, raccoons, and skunks were found hit on SR-152 throughout the study area during the months of July-September (Figures 103-106). The locations varied in terms of habitat types and the type of median present. Even with a more permeable thrie-beam median barrier or lack of median present, we found animals hit in these locations.

Figure 103. Coyote hit on SR-152 on July 28,2021.

Figure 104. Raccoon hit on SR-152 on August 13, 2021.

Figure 105. Coyote hit on SR-152 on August 24,2021.

Figure 106. Skunk hit on SR-152 on August 24, 2021.

The following are examples of the wildlife we documented hit in spring, from April to June 2022 (Figures 28-32). On May 15, 2022, a female mule deer was found hit on the westbound right shoulder, just east of the Cedar Creek bridge (Figures 28-29). Multiple deer have been recorded routinely using this bridge to travel every month throughout the study period.

Figure 107. Female mule deer hit on May 15, 2022 on SR-152 by the Cedar Creek bridge, west facing view.

Figure 108. Female mule deer hit on May 15, 2022 on SR-152 by the Cedar Creek bridge, east facing view.

Figure 109. Female mule deer hit on May 15, 2022 on SR-152, right shoulder, east of the Santa Clara Conduit Drain Underpass (370443).

Figure 110. Bobcat found hit on June 26, 2022, westbound lane at the median, near C12 PM 27.24, in which we have been recording multiple bobcat individuals and mountain lion passages through the culvert.

Figure 111. Coyote found hit on June 24, 2022, westbound lane by Walnut Ave. This is by the culvert where domestic dogs have been recorded chasing wildlife through the culvert.

9.0 Wildlife Connectivity Enhancement Recommendations

9.1 Potential wildlife friendly fencing designs

As noted in the Section 6.3 Camera Data Results Discussion, there are several culverts and bridges with restrictive fencing designs or boards set up at the culvert entrances. We recommend removing the restrictive fencing or boarding at culverts and bridges and replace with wildlife friendly fencing designs within the Caltrans right of way.

The cattle have access to several of the bridges year-round. Several of the bridges are critical for large species such as mountain lion and deer movement. There have been extensive studies in the literature that document the incompatibility with cattle operations and wildlife movement. Cows tend to outcompete other ungulates such as deer and tule elk for resources such as food and water (Simpson et al. 2011, Brown et al. 2010, Langner, C. pers. comm. 11/23/2022). However, other studies include guidance for cattle

operation management regimes that are compatible with restoration efforts (Vernon et al. 2022). We highly recommend the following for maintaining both the wildlife linkage (corridor) and cattle operations:

- Create a section of wildlife friendly fencing design within the bridges to allow for wildlife movement and habitat restoration.
- Exclude cattle from this area.

9.2 Directional fencing designs

Many of the culverts and bridges have high to moderate rates of wildlife passages (Table 1). It would be highly beneficial to install directional fencing between these culverts and bridges to guide wildlife to them as wildlife have also been recorded hit on the highway in the vicinity of the culverts and bridges (Figure 95).

There were only seven sites where we recorded deer passages. The sites with the highest rates of deer passages were B2 Pacheco Creek Bridge (370430) by Fire Station with 288 passages, B3 Pacheco Creek Reserve Bridge (370431) with 282 passages, B6 South Fork Pacheco Creek Bridge (370466) with 106 passages, B4 Cedar Creek Bridge (370030) with 51 passages, and C2 PM 17.24 with 39 passages (Table 1). By comparison, B5 Pacheco Creek Bridge past Bells Station (370441) only had 10 passages and C15 PM 29.6 only had 1 passage. Including directional fencing between these bridges where possible would benefit deer and other species.

These data reveal that even though there are 6 bridges and 19 culverts four-feet tall or higher that were monitored in the study area, there are only 5 sites (4 bridges and 1 culvert) facilitating higher rates of large mammal (i.e. deer) passages. A mountain lion was only documented passing through a single 4-ft x 4-ft culvert, C12 PM 27.24. The combination of camera data and roadkill information helps substantiate the need to provide a suitable wildlife crossing such as a wildlife overpass or underpass at SR-152 for species such as deer, mountain lion, and tule elk.

9.3 Culvert Modifications and Retrofits

Many of the culverts flood during storm events as noted in Section 6.0 Camera Data Results Discussion. There are various options including retrofitting culverts with animal walkways. We recommend culvert retrofits with animal walkways as designed by Ken Russo, Senior Environmental Planner, Branch Chief Unit M5 (Acting), Resource Biologist, Caltrans, District 3. The culvert retrofit in Figure 111, was a modified culvert that had documented roadkill in the vicinity of the culvert on SR-89. Ken Russo and his Team retrofitted the culvert by including an elevated walkway to provide a pathway for wildlife movement while the culvert still allowed for water drainage during storm events. The culvert was monitored and proven successful as wildlife used the culvert during storm season, while water was flowing through it.

Figure 111. Culvert retrofit on SR-89 by Ken Russo, Senior Environmental Planner, Branch Chief Unit M5, Resource Biologist, Caltrans, District 3.

10.0 Literature Cited

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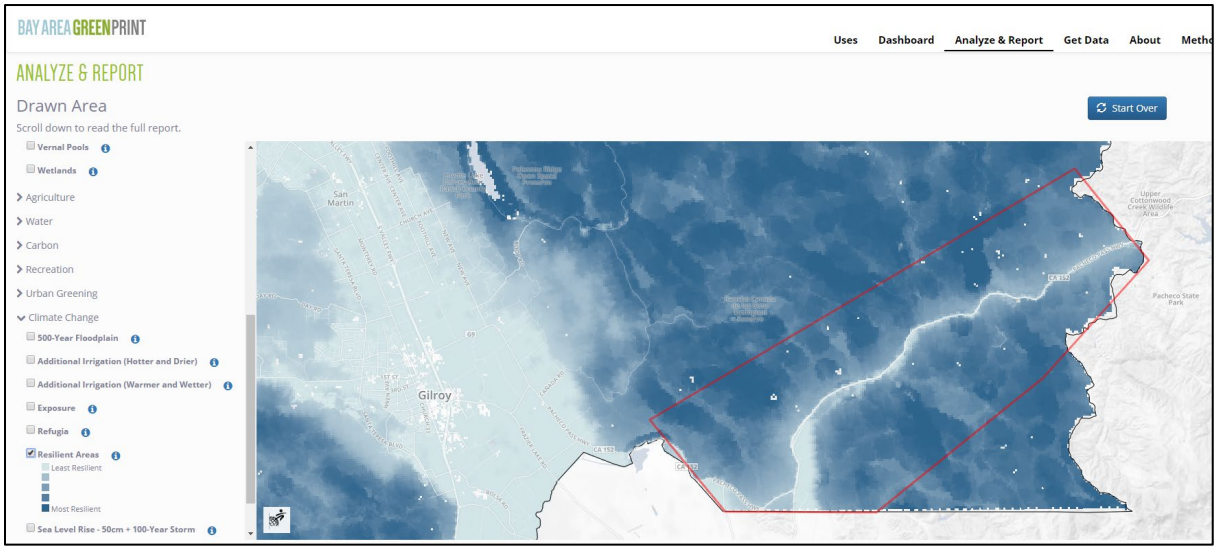
Appendix A. Study Area in relation to Climate Change Resilience & Habitat Connectivity

In terms of climate change, as the upland grassland and oak woodland savannah habitats become hotter and drier on the north side of SR-152, wildlife will need to be able to travel from the upland habitats of the Diablo Range down south to the Pacheco Creek watershed. The majority of the study area provides habitat that would be considered most resilient to climate change- the intact habitats with low levels of development upslope and downslope of the side of SR-152 (Figure 1). Henry Coe State Park is located on the north side of SR-152 while Pacheco Creek, a perennial stream, is on the south side of SR-152. The study area is also important refugia for wildlife as the city of Gilroy to the west is considered least resilient and highly fragmented by human development.



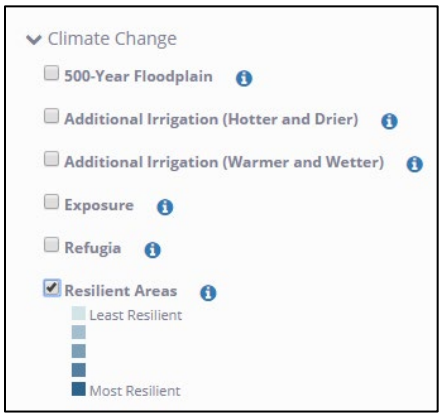
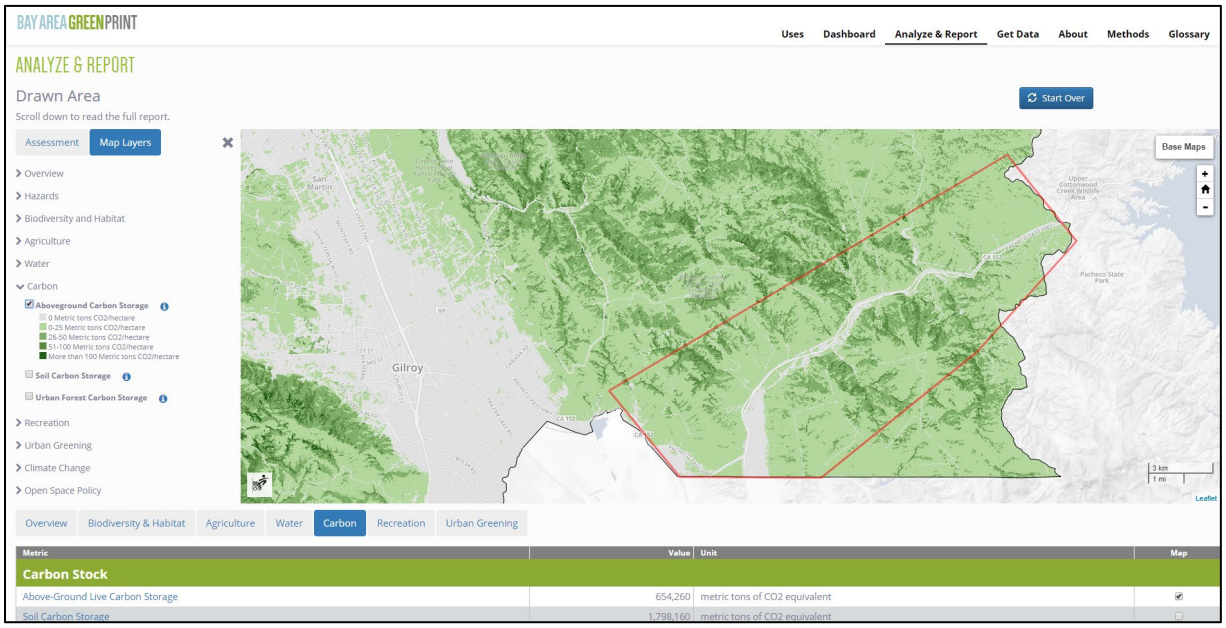


Figure 1. Climate Change Resilience within the Study Area (red outline).

The study area also provides a significant amount of above-ground soil carbon storage in providing landscape climate change resilience (Figure 2).



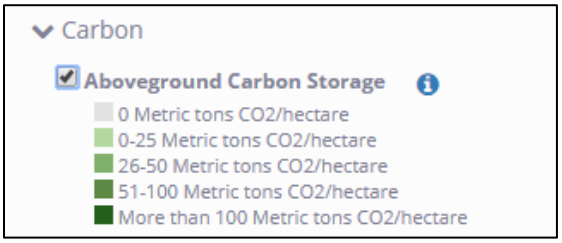


Figure 2. Above-ground carbon storage within the Study Area (red outline).

Enhancing connectivity is an essential conservation strategy in the face of climate change. Without habitat linkages animals will not be able to seek out refugia as the landscape transforms as a result of climate change. Landscape connectivity is the most frequently recommended conservation strategy to protect biodiversity as climate changes (Kostyack, John, et al. 2011).

As the climate warms, plants and animals are moving to cooler places. Yet, their path to cooler places may be blocked by human-created barriers such as cities or roads. Where species ranges need to shift, it is important to ensure that individual plants and animals are able to move through landscapes so they can make it to new climates that are now suitable, and corridors can provide a path to those new places. Climate change may also increase population variability and reduce the likelihood of local extinction; corridors provide paths for individuals to recolonize habitats where populations have been lost. Since many species' response to climate change is still unpredictable, habitat linkages can provide the necessary outlet for species to expand as needed throughout the landscape and ensure that fewer local populations go extinct.