

San Diego Association of Governments
The San Diego River Park Foundation's Boulder Creek – Townsends Big-Eared Bat Project
Last Quarterly Progress Report and Final Report
Progress Reporting Period: October 1 – November 15, 2020
Project Period: November 15, 2018 – November 15, 2020
SANDAG Contract Number: 5005510



Executive Summary:

The goal of this project is to increase the suitability of roosting habitat for Townsend's big-eared bat (MSP Category SO (Significant occurrence(s) at risk of loss from MSPA)) by installing a gate in the entrance of a mine and controlling the existing erosion threat there. The project also includes creation of interpretive materials to increase community awareness about these sensitive species and the habitats upon which they rely.

The Notice to Proceed (NTP) was received on November 15, 2018. An amendment was executed on April 10, 2020 to extend the project end date to November 15, 2020 as a result of COVID-19 related project delays.

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Project Background:

Townsend's big-eared bat is an MSP Category SO [Significant occurrence(s) at risk of loss from MSPA] species. The MSP identifies an overarching goal of protecting diurnal, nocturnal, and maternity roosts from destruction and human disturbance and enhancing foraging habitat. The MSP also identifies the need for monitoring this species to collect data regarding seasonal changes in behavior and population, potential threats, and develop management recommendations. This project addressed direct threats to Townsend's big-eared bat habitat and established preliminary monitoring of individuals and the surrounding habitat. The mine is located on the Boulder Creek Preserve along Boulder Creek Road, south of Julian and north of Descanso, in eastern San Diego County. The parcels that make up the Boulder Creek Preserve were purchased by The San Diego River Park Foundation in 2012 and 2013.

Prior to project, a database search showed that Townsend's big-eared bat were observed in a mine in this area in June of 1976. A total of 11 females and 9 males were collected. These numbers indicate that this was a colony. Townsend's big-eared bat were also observed in this area in 1990 and 1996. It is not known if the collection in 1976 or the subsequent sightings occurred at the Boulder Creek Preserve mine or another mine in the area, however, SDRPF staff have observed at least three individuals and recorded photo documentation of Townsend's big-eared bats in the mine in 2016, and species ID was confirmed by local bat biologist (which is included in the SDMMMP MOM database). At the time of the project proposal, SDRPF staff had documented about eight inches of increased sediment build up at the mine entrance as a result of erosion, which threatened to potentially close the mine to bat use in the future. Reducing and/or eliminating these two threats (human disturbance and sediment build-up closing the mine entrance) were the primary focus of this project.

Project Goals:

This project worked to fulfill MSP objectives MGT-IMP PLETOW-2 and MGT-IMP PLETOW-3. Specifically, project goals included:

- Installation of gate at mine entrance that allowed bat passage but excluded human access
- Erosion control around mine gate entrance
- Engaging an expert in initial survey to record signs of bat activity within the mine and to confirm the mine's suitability for Townsend's big-eared bat
- Ongoing monitoring of bat activity using acoustic monitoring equipment
- Produce Preserve Assessment Report with assessment of surrounding habitat and recommendations for species management
- Develop educational signage and materials to increase public and visitor awareness and knowledge about this project and the Townsend's big-eared bat

Work Performed this Period:

Task 1 – Field Assessment (Pre-Implementation Monitoring)

Budget: \$2,645.96

Spent: \$2,657.53 (the additional \$11.57 in excess of grant total was paid for using organizational funds)

Match for Task: \$0

Task 1 was mostly completed in previous quarters, though in this final quarter, staff reviewed task description and deliverables to ensure completion. SDRPF contracted with the San Diego Natural History Museum, enabling Drew Stokes, local bat biologist and bat expert, and his team to conduct pre-

project monitoring in May and July of 2019, as well as preparation of a letter memo with assessment results (provided in previous reporting).

Task 2 – Mine Gate Installation

Budget: \$7,556.40

Spent: \$7,563.14 (the additional \$6.74 in excess of grant total was paid for using organizational funds)

Match for Task: \$0

Task 2 was largely completed in previous quarters, though this final quarter, staff coordinated to complete documentation and completion of contract with Frontier Environmental, the contractor. Staff reviewed task description and deliverables to ensure completion. Task 2 included contracting with Frontier Environmental, an expert in mine gates specifically to allow at movement but restrict human access. Contractor advised on purchase of locks for the gate, which they custom fabricated onsite. As a result of COVID-19 and scheduling changes related to red flag warnings and fire risk, this task was delayed from originally anticipated, but was completed in September 2020, and reported on in previous reports.

Task 3 – Erosion Control

Budget: \$4,412.82

Spent: \$4,419.46 (the additional \$6.64 in excess of grant total was paid for using organizational funds)

Match for Task: \$0

This quarter, the planned erosion control measures were installed by contractor RECON Environmental, following the completion of the bat gate. The contractor installed straw waddles on slopes of exposed soil leading up to the mine to prevent further deterioration of the surrounding areas (as pictured in required photodocumentation, Photo 1). The contractor also collected native seeds and dispersed them in areas of disturbed soil to help promote natural revegetation (Photo 2).

The contractor considered the evidence of erosion patterns previous to this project, as well as the minimal disturbance caused by the gate installation itself, and designed the erosion control measures to address both. San Diego River Park Foundation staff also added monitoring of the condition of the erosion control measures to the ongoing preserve visit checklist for this property.

Photo 1. Erosion control materials installed at the entrance of mine (*photo courtesy of RECON Envr.*)



Photo 2. Native seeds being dispersed by hand leading up to mine entrance for revegetation purposes.
(photo courtesy of RECON Environmental)



Task 4 – Bat Monitoring Equipment Installation

Budget: \$11,938.85

Spent: \$11,955.21 (the additional \$16.36 in excess of grant total was paid for using organizational funds)

Match for Task: \$0

SDRPF purchased both an Anabat acoustic monitoring device, recommended by bat biologist for multi-day deployment for data collection at the mine gate entrance, as well as an Echometer, a less sophisticated and less expensive monitoring device suitable for interpretation. While COVID-19 limited onsite interpretation, the device was featured in a virtual interpretive video, and acoustic data was featured in printed interpretive panel. Data from the Anabat device was collected by SDRPF staff over three deployments in October 2019, July 2020, and September/October 2020. A summary report of the data that was collected is included in the below Figures 1-3.

This quarter, bat recording equipment was deployed for an 18-night period before and after the mine gate was installed. Data collected was later reviewed and analyzed by a local bat expert under contract with the San Diego Natural History Museum (SDNHM). Results showed 12 different bat species, including Townsend's big eared bat and pocked free tailed bat. In addition, a migratory bat species, big free-tailed bat, was also identified from our recording equipment, a species that is rare to be recorded in San Diego County. Sonograms from were also provided from the bat expert to be used as visuals for the interpreted sign and education material. In total, during the three monitoring device deployments, at

least 13 species were recorded, possibly 15 species of bats (gray rows are suspected identification, but not confirmed).

Figure 1. Bats recorded outside the SDRPF Boulder Creek Mine with a passive Anabat Swift (full spectrum mode) from October 2 through October 6, 2019 (5 nights)

Common name	Species	4-letter code	Count
Pocketed free-tailed bat*	<i>Nyctinomops femorosaccus</i> *	NYFE	726
California myotis	<i>Myotis californicus</i>	MYCA	264
Mexican free-tailed bat	<i>Tadarida brasiliensis</i>	TABR	99
Townsend's big-eared bat*	<i>Corynorhinus townsendii</i> *	COTO	75
Big brown bat	<i>Eptesicus fuscus</i>	EPFU	53
Canyon bat	<i>Parastrellus hesperus</i>	PAHE	37
Western small-footed myotis	<i>Myotis ciliolabrum</i>	MYCI	26
Western long-eared myotis	<i>Myotis evotis</i>	MYEV	11
Yuma myotis	<i>Myotis yumanensis</i>	MYYU	6
Western red bat*	<i>Lasiurus blossevillei</i> *	LABL	1
Fringed myotis	<i>Myotis thysanodes</i>	MYTH	1
* California species of special concern		Total =	1299
** AFPN = Anabat files per night (1299/5 nights)		AFPN** =	259.8

Figure 2. Bats recorded outside the SDRPF Boulder Creek Mine with a passive Anabat Swift (zero crossing mode) from July 25 through July 27, 2020 (3 nights)

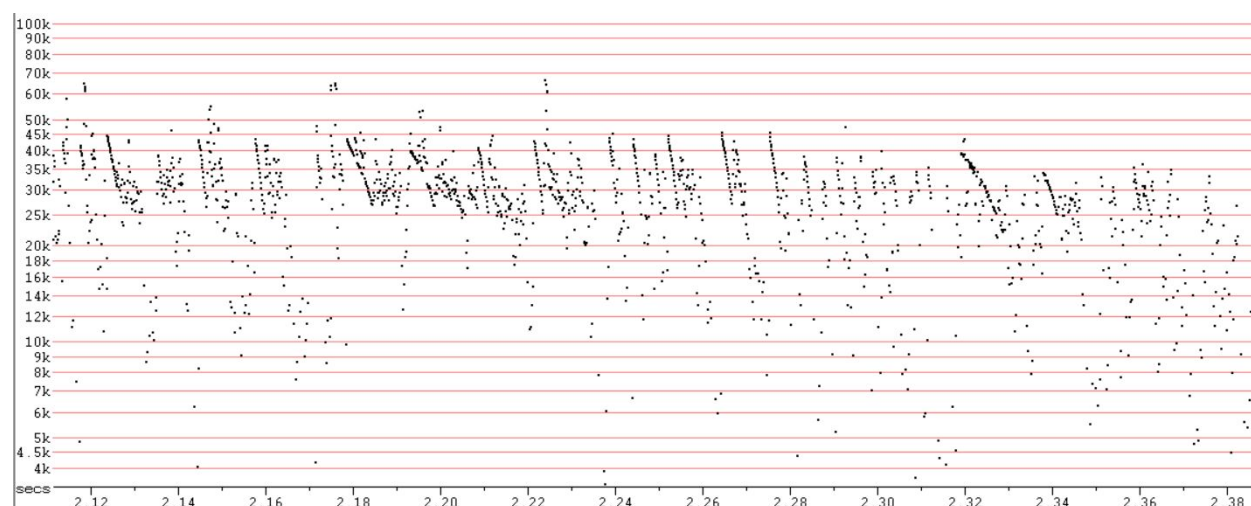
Common name	Species	4-letter code	# Calls
California myotis	<i>Myotis californicus</i>	MYCA	60
Big brown bat	<i>Eptesicus fuscus</i>	EPFU	34
Western small-footed myotis	<i>Myotis ciliolabrum</i>	MYCI	10
Pocketed free-tailed bat*	<i>Nyctinomops femorosaccus</i> *	NYFE	6
Western long-eared myotis	<i>Myotis evotis</i>	MYEV	4
Pallid bat*	<i>Antrozous pallidus</i> *	ANPA	1
Canyon bat	<i>Parastrellus hesperus</i>	PAHE	1
*California species of special concern		Total =	116
CPN = Calls per night		CPN =	38.67

Figure 3. Bats recorded outside the SDRPF Boulder Creek Mine with a passive Anabat Swift (zero crossing mode) from September 22 through October 9, 2020 (18 nights).

Common name	Species	4-letter code	# Calls
Mexican free-tailed bat	<i>Tadarida brasiliensis</i>	TABR	1522
Pocketed free-tailed bat*	<i>Nyctinomops femorosaccus</i> *	NYFE	1290
California myotis	<i>Myotis californicus</i>	MYCA	302
Canyon bat	<i>Parastrellus hesperus</i>	PAHE	150
Big brown bat	<i>Eptesicus fuscus</i>	EPFU	138
Western small-footed myotis	<i>Myotis ciliolabrum</i>	MYCI	48
Western long-eared myotis	<i>Myotis evotis</i>	MYEV	15
Townsend's big-eared bat*	<i>Corynorhinus townsendii</i> *	COTO	13
Hoary bat	<i>Lasiurus cinereus</i>	LACI	7
Fringed myotis	<i>Myotis thysanodes</i>	MYTH	7
Long-legged myotis	<i>Myotis volans</i>	MYVO	1
Big free-tailed bat	<i>Nyctinomops macrotis</i>	NYMA	1
*California species of special concern		Total =	3494
CPN = Calls per night		CPN =	194.11

The bat calls summarized above represent several gigabytes of acoustic data, such as the sonogram sample below (Figure 3), which is a Townsend's big-eared bat from the fall monitoring. These sonogram profiles were analyzed and species assigned. This analysis also removes other non-target sounds, such as crickets or frogs.

Figure 4. Sonogram sample of a Townsend's big-eared bat pulses recorded from bat equipment. (Provided by Drew Stokes, SDNHM)



Photodocumentation of the installed monitoring devices (a deliverable for this project) is included as Photos 3-5, and can also be viewed in this educational video, shared with the public this quarter: <https://youtu.be/fnu91-8pJPE>.

Photos 3-4. Acoustic monitoring device installed at mine gate entrance.



Photo 5. Screenshot of educational video created to raise awareness about monitoring and conservation efforts, available for viewing here: <https://youtu.be/fnu91-8pJPE>.



Task 5 – Preserve Assessment

Budget: \$2,418.57

Spent: \$2,449.75 (the additional \$31.18 in excess of grant total was paid for using organizational funds)

Match for Task: \$0

SDRPF contracted with RECON Environmental to conduct site assessment and provide preliminary recommendations. This quarter, staff reviewed assessment results from RECON Environmental contractor, and compiled the Preserve Assessment and Management Recommendations Report. Chief Associate Director reviewed report and provided edits, which were returned to staff to finalize. The complete report is included with this final report as an attachment.

Task 6 – Educational Materials Development

Budget: \$11,208.84

Spent: \$11,221.63 (the additional \$12.79 in excess of grant total was paid for using organizational funds)

Match for Task: \$0

Final education materials were completed including the bat monitoring video referenced in Task 4 section above and the interpretive panel. As a result of the COVID-19 pandemic and restrictions on gatherings and school trips, this project included virtual educational materials that were shared electronically, as well as preparation of educational lesson to be held in the future on site. Below, please find a complete list of the educational videos and activities shared with children and families, as well as adult supporters:

- Bat Facts Video: <https://youtu.be/l4ljZnkD2Fg>
- Drawing a Bat #1: <https://youtu.be/MBUhAoTWJZY>
- Drawing a Bat #2: <https://youtu.be/BGFiQIR2LgU>
- Bat Monitoring: <https://youtu.be/fnu91-8pJPE>

In addition, staff worked with program partners to develop, design, fabricate and install an interpretive panel to feature bat conservation and work to protect the Townsend's big-eared bat specifically. The sign was installed on an existing panel on the property some distance away from the actual mine gate, so as not to protect the specific location of the gate and any disturbance or vandalism. The sign was instead installed near other volunteer and visitor support amenities on the property across the road from the mine itself, as shown in Pictures 6-8 (a deliverable). The sign is included here as Figure 4, and for better readability, also provided electronically with the submission of this report.

Pictures 6-7. Photodocumentation of the interpretive sign being installed at Boulder Creek Preserve



Picture 8. Installed interpretive sign at the Boulder Creek Preserve



Figure 5. Interpretive Panel

BATS ARE COOL!

Bats are an important part of the Boulder Creek ecosystem.

Of the 22 species of bats found in San Diego County, we have identified more than a dozen of them right here at Boulder Creek Preserve (including those pictured below)! Bats play an important and unique role in ecosystems along the San Diego River and its tributaries, like Boulder Creek. In fact, every living thing in the river ecosystem depends on one another and exist in a balance. The existence of each organism is crucial for the survival of all the other organisms in this ecosystem.

Bats eat a variety of foods, but our local bats are especially fond of bugs! Bats are also food for larger predators, including snakes, owls, hawks, raccoons, and big cats. Bats are especially helpful to humans because they help to control pest insects that may bite us, carry diseases, and eat our crops.

Mexican free-tailed bat
Photo credit: Stu Nathan

Pallid bat
Photo credit: Michael Durham/Wildlife Researcher

Townsend's big-eared bat
Photo credit: Don Endicott

Pocketed free-tailed bat
Photo credit: Don Endicott

Bat research and conservation efforts

Unfortunately, bat populations are decreasing around the world due to various threats, such as habitat destruction, pollution, and disturbance. Three of the species we have identified here are listed as California Species of Special Concern, including the pallid bat, Townsend's big-eared bat, and the pocketed free-tailed bat (pictured above). This means that the populations of these bats are decreasing and/or that the survival of this species is at risk. Our protected spaces are important to the survival of these species!

Bats are nocturnal and active at night. Since we often can't see them, we study them by listening. However, most bat calls are at a frequency that human ears cannot detect. We study bats on our preserves using special equipment that can record and analyze bat noises, called bioacoustic monitoring. Each bat species has a unique series of calls used for navigation and hunting that can be used for identification, like in these sonograms recorded at this preserve.

The sonograms of Townsend's big-eared bat calls (top) look different than Mexican free-tailed bat calls (below)

We're working to help bats... and you can too!

- Be a bat ambassador:** Learn all about bats and tell a friend. Bats need YOUR help to spread the word that they aren't scary and that they are very important to our environment.
- Avoid disturbing bats:** Human presence can disturb bats and cause them to abandon their roost, leave their young, and disrupt their resting periods. Humans can also spread bat diseases, like white-nose syndrome. Stay away from areas where bats roost and hibernate.
- Protect natural land:** Bats need natural lands with lots of native plants and bugs to roost and hunt.
- Observe bats where you live:** Look and listen for bats just around twilight and dawn, especially near places where there is open water or a light that attracts insects.

Species Highlight: Townsend's big-eared bat

Townsend's big-eared bats have enormous ears! When their ears are laid back, they extend to cover almost half their body. These bats like to roost and hibernate in caves or old mines, which is just where we found ours here on this preserve!

Like many bats, these bats are very sensitive to disturbance, and may even abandon a roost if disturbed by humans. They are rare in our region, so finding them here at the preserve means that this habitat is healthy enough to support them, and is a good reason for us to try and conserve and protect this land!

Did you know?

Bats are in the order Chiroptera, which means "hand-wing." Most of the bones in their wing evolved from the bones that form a hand in humans.

Bat research and conservation efforts at this preserve are supported by The San Diego River Park Foundation's volunteer scientists and stewards, and with support from:

Special thank you to the San Diego Natural History Museum for analysis of bat acoustic data, and to Don Endicott for use of local bat photographs.

Task 7 – Administration

Budget: \$7,105.02

Spent: \$7,340.03 (the additional \$235.01 in excess of grant total was paid for using organizational funds)

Match for Task: \$0

This task included ongoing invoice preparation, payment to vendors and contracts, coordination related to labor compliance, budgeting, securing an extension as a result of COVID-19 related delays, and COVID-19 adaptive management of each tasks.

During the reporting period, project administration focused on general project coordination with SDRPF staff to ensure project completion, project funder and partners, preparation of final invoices and reports, compiling of deliverables, contract review, and coordination with DIR regarding labor compliance.

Conclusions:

Overall, this project achieved stated performance objectives. The bat biologist confirmed in the pre-implementation assessments that the mine was indeed suitable for the Townsend's big-eared bat. He determined that the mine appears to serve as an opportunistic roost for single Townsend's big-eared bats during both the winter and summer, and perhaps as a night roost for this species and the California myotis. He also determined that it has the potential to serve as a maternity site for the Townsend's big-eared bat, though a maternity colony has not been documented here in recent years. In fact, during the project, it was determined that the mine actually may have a small vent hole in addition to the large entrance, which could increase suitability.

The mine gate and the erosion control measures were successfully installed to prevent two main threats to this habitat: human disturbance and sediment build-up closing the mine entrance. These objectives were delayed first by COVID-19 and restrictions on gatherings. In addition, these field activities were delayed by red flag days and fire risk, but were completed within the extended timeframe.

SDRPF plans to secure additional funds to continue acoustic monitoring at the mine gate to document ongoing trends in bat activity and use of the mine. We hope to work with SDNHM bat biologist in the future to conduct appropriate additional surveys to document use of the mine now that the gate is in place.

While we had originally anticipated the education effort to include more in-person interaction at the project site (away from the mine itself, but on other parts of the preserve), COVID-19 resulted in adaptive management to create virtual education and outreach. An interpretive panel featuring the data collected as part of the project was created and installed at the preserve, too continue to reach future visitors and volunteers as events resume.

The Preserve Assessment and Management Recommendations Report provides a guide for future investment in protection of the surrounding habitat area, and will be used to leverage and inform future grants.

Appendices Attached:

Boulder Creek Preserve Assessment and Management Recommendations Report (Task 5 deliverable)

Interpretive Panel (Task 6 deliverable - full resolution PDF)

2020 Boulder Creek Preserve Management Report

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November 13, 2020

Chase Stafford

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Summary

The goal of the project is to protect and increase suitability of roosting habitat for Townsend's big-eared bat by installing a gate at the entrance of a mine to restrict human or other disturbances occurring within the mine and controlling the existing erosion threat surrounding the site. Also, development of education materials serve to educate the public about the role of bats in our local ecosystems and bat conservation efforts. The education effort for this project included installation of an interpretive panel at the wildlife preserve and educational videos.

1.0 Background Information

Boulder Creek Preserve is a 13.11-acre wildlife preserve located in the headwaters of the San Diego River watershed 12 miles north of Descanso, CA. Boulder Creek, a tributary to the San Diego River, runs through the property. The preserve is comprised of mostly undeveloped land, including native riparian habitat along the creek and upland habitat on the adjacent hillsides. A dirt access road and small dirt parking area occur in the western portion of the preserve, along with scattered structures associated with an old homestead and with ongoing land management.

Prior to the San Diego River Park Foundation's acquisition of Boulder Creek Preserve, it was once known as Fisherman's Camp, initially developed in the 1920's. The camp mainly attracted anglers from all around to fish the historic rainbow trout stream, Boulder Creek. Remnants of the Fisherman's Camp can still be observed today within the preserve. Shortly following the Julian's Gold Rush in the 1870's, ten mining rights were claimed along Boulder Creek by late 19th century. It is presumed the mine involved with the project was established around this time period as well.

The San Diego River Park Foundation (SDRPF) acquired the now 13.11 acres along Boulder Creek in 2012. SDRPF was contacted by a local fish conservation group about the recent findings of a small population of wild rainbow trout surviving in Boulder Creek within the San Diego River Watershed and was seeking a partner to conserve the privately-owned land along the creek. During the initial site visit in 2012 and before the acquisition, 11 rainbow trout were observed in the stream. The purpose of acquiring the portion of creek and the surrounding area was to support conservation efforts of trout, improve and protect the native habitats, restore the creek habitat, and monitor stream health.

It should also be noted that upstream of preserve, Lake Cuyamaca was established by damming Boulder Creek in 1888. The damming has changed the historic hydrology and sediment flow of Boulder Creek downstream of Lake Cuyamaca. Discharges from the dam have been observed during random months of the year.

This preserve management report is being prepared by SDRPF as part of the Townsend's Big-eared Bat Project (project), thanks to support from the San Diego Association of

Governments and the TransNet Environmental Mitigation Program – Land Management Grant Program. Townsend’s big-eared bat (*Corynorhinus townsendii*) is known to occur within the mine onsite. The goal of this project is to increase the suitability of roosting habitat for Townsend’s big-eared bat by installing a gate in the entrance of a mine and to manage the habitat within the preserve to support this species. More details regarding the occurrence of Townsend’s big-eared bat and its habitat preferences can be found in Section 1.2 below.

The objectives of this preserve assessment survey and report are to document any threats to habitat within the preserve, especially those that impact the suitability of habitat for Townsend’s big-eared bat or other sensitive species. This report also provides recommendations for management of these threats and other activities, including use of pesticide on the preserve to treat invasive gold-spotted oak borer (*Agrilus auroguttatus*). These recommendations will be reviewed by SDRPF to determine what future management activities would be beneficial for Townsend’s big-eared bat and other biological resources at the Boulder Creek Preserve.

1.1 Preserve Management

Since the acquisition of Boulder Creek Preserve in 2012, amenities have been added to the preserve to support management and restoration efforts. Access control to sensitive areas has been installed and existing access control maintained. A small storage container, and irrigation systems have been installed on the property to support restoration efforts including tree-planting events, understory species restoration, and reforesting the oak woodland habitat that is under immense threat from gold spotted oak borer infestation. The irrigation system utilizes a well, pump and water storage tank that were already present when the property was purchased. Amenities have also been added to the preserve to allow SDRPF to host public events and educational field trips including an educational shed, small amphitheater, benches and tables. Volunteer engagement in stewardship activities is a critical component for achieving the organization’s management and education goals, so these amenities are included at the preserve to support volunteer presence while limiting negative impacts.

In 2014, SDRPF began conducting habitat restoration within portions of the preserve in accordance with the plans established as part of the Boulder Creek Habitat Restoration Project 2014-2017, with funding from the State of California Proposition 84. The purpose of the habitat restoration was to restore 4.4 acres of riparian oak woodland along Boulder Creek to improve habitat quality by re-establishing the riparian canopy and expanding the wetland buffer. Much of the riparian habitat had been previously damaged and destroyed by wildfire, the most recent being the 2003 Cedar Fire. Increased canopy cover will aid aquatic biota through stream cooling and improve refuge habitat for sensitive aquatic species found on-site.

Restoration components that have been implemented to date include invasive non-native plant species removal and revegetation within selected areas along Boulder Creek within the preserve. Plants installed include a mixture of woody and herbaceous natives.

1.2 Townsend's Big-eared Bat

The Townsend's big-eared bat is state listed as a Species of Special Concern due mostly to the destruction or disturbance of roost sites. Fragility of disturbance at roosting sites can lead to total abandonment.

A database search shows that Townsend's big-eared bat was observed in a mine in this area in June of 1976. A total of 11 females and 9 males were collected as part of that study. As part of this project, surveys of the mine within the Boulder Creek Preserve were conducted on July 8 and July 11, 2019 by Drew Stokes, a bat biologist with the San Diego Natural History Museum. A total of four bats were visually observed during that survey, of which two were Townsend's big-eared bats, and two were too high in the mine to identify. In addition, an acoustic recording device was set up at the entrance to the mine to record bat calls for five nights, from October 2 through 6, 2019. The acoustic recordings were analyzed and the data indicate that Townsend's big-eared bat, as well as a number of other bat species, are active in this area. Given these occurrences, it is assumed that Townsend's big-eared bat is consistently utilizing the mine for roosting.

The Townsend's big-eared bat is found in a variety of communities including coastal conifer and broadleaf woodlands, grasslands, deserts, and meadows. Throughout most of its geographic range, it is most common in mesic sites (Kunz and Martin 1982). In San Diego County, the Townsend's western big-eared bat is most commonly found in the foothills and mountain canyon areas in oak woodland, pine-oak woodland, juniper woodland, and chaparral habitats. Townsend's western big-eared bat roosts in caves, mines, tunnels, buildings, or other human-made structures and may use different locations as day roosts, night roosts, maternity roosts, and hibernacula. Males often roost in small groups, while females often occupy large colonial maternity colonies. Townsend's big-eared bats have a high degree of site fidelity for specific foraging locations.

Foraging habitat is mosaic of forested and edge habitats, including riparian zones, which are also used for commuting and drinking from pools of waters (Tremor et al. 2017). They tend to avoid open grasslands, including grazed areas, both when traveling and foraging. If foraging over open areas, Townsend's big-eared bats will stay close to scattered trees and shrubs (Tremor et al. 2017). With highly maneuverable flight, they likely glean prey from foliage of plants. Their diet consists mainly of small moths, but also will prey upon beetles and soft-bodied insects (Harris 1983). This, and its inability to fly long distances, makes Townsend's big-eared bat vulnerable to habitat fragmentation (Tremor et al. 2017). This species is highly sensitive to human contact and much of its decline has been attributed to roost abandonment brought on by human activities.

2.0 Preserve Assessment

A preserve assessment survey was conducted on August 28, 2020 by RECON biologist, Andrew Smisek, SDRPF Field Coordinator, Chase Stafford, and SDRPF intern Mackenzie Woods. The survey was conducted by hiking through accessible portions of the preserve, stopping frequently to observe plant and wildlife species and assess habitat assemblages and quality. Areas of potential preserve issues were noted, including portions that lacked native

vegetation and/or had a prevalence of non-native plant species. Any potential access or disturbance issues were noted as well. Because the preserve is known to contain oak trees damaged by gold-spotted oak borer, the preserve assessment included an evaluation of the general prevalence of gold-spotted oak borer among the oak trees within the preserve. The restoration areas within the preserve, as discussed above, were checked for general implementation success and native plant growth.

3.0 Preserve Management Recommendations

3.1 General Issues

Although the preserve is mostly dominated by native vegetation communities, certain portions contain a significant prevalence of non-native plant species. Common non-natives observed include tocalote (*Centaurea melitensis*), wild oat (*Avena* sp.), rabbitfoot grass (*Polypogon monspeliensis*), short-pod mustard (*Hirschfeldia incana*), red brome (*Bromus rubens*), and smooth cat's-ear (*Hypochaeris glabra*). These non-native species are most common in areas of soil disturbance in the lowland portions of the preserve within and adjacent to the floodplain of the creek. Non-native species are mostly absent from the portions of the preserve that contain chaparral habitat.

It is recommended that areas containing a significant prevalence of non-native species be treated as part of active restoration and maintenance. The reduction in these non-natives will allow for natural recruitment of native plant species as well as increase the successful establishment of any native species installed during restoration efforts. A significant factor in reducing the prevalence of non-native species would include the reduction of soil disturbance caused by cattle.

The continued encroachment of cattle within the floodplain portions of the preserve, specifically east of Boulder Creek Road, appears to have caused significant ground disturbance and herbivory of native plants. The lack of success of the past restoration efforts mentioned above can likely be attributed, at least in part, to this cattle encroachment. Therefore, it is recommended that SDRPF work with adjacent land owners to prevent encroachment within the active restoration portions of the preserve. The addition of fencing may be necessary to ensure no cattle encroachment occurs.

3.2 Townsend's Big-eared Bat

Riparian habitat within the preserve is likely used by this species for foraging – as described above, Townsend's big-eared bat prefers to forage along riparian habitat edges. The western portion of the preserve contains dense and diverse riparian habitats along the creek that are highly suitable for this species' foraging. Additionally, this portion of the creek contained

areas of ponded or flowing water during the survey. The presence of ponded water during the dry time of year (August) indicates that this portion provides nearly a perennial water source. Townsend's big-eared bats likely utilize these ponded areas for drinking water.

The riparian habitat along the creek east of Boulder Creek Road is sparse with an inconsistent canopy and is, therefore, less suitable for Townsend's big-eared bat to utilize for foraging. Additionally, this portion of the creek was not observed as containing any ponded or flowing water. Therefore, it is recommended that restoration efforts within open portions of the floodplain be implemented again.

The previous restoration plan provides sufficient guidance for restoring these areas, but it is recommended that cattle exclusions/protection be included and maintenance be conducted on a consistent basis. The increase in shade from a more consistent riparian canopy, as well as the removal of cattle disturbance, may increase the consistency and duration of surface water within this portion of the creek.

With the installation of the mine gate and restoration of the riparian habitat along the creek, the Boulder Creek Preserve would provide increased suitable foraging and roosting and/or maternity colony habitat for Townsend's big-eared bat.

3.3 Gold-spotted Oak Borer

During the survey, it was noted that the preserve contains oaks in different stages of gold-spotted oak borer infection. There are a handful of mature trees with mostly dead canopies, stained and dying bark, and a lot of gold-spotted oak borer exit holes. But, the majority of mature oaks have only a small number of gold-spotted oak borer exit holes, minor bark staining, and some canopy thinning, but appear mostly healthy otherwise. The younger oaks, with a diameter at breast height (DBH) of less than 12 inches, appear totally healthy with no evidence of gold-spotted oak borer infection. Additionally, the understory beneath many of the mature oak trees contain many oak saplings.

Because gold-spotted oak borer is known to continue infecting the same tree for many generations, the mostly dead oak trees likely act as a gold-spotted oak borer population source within the preserve. It is recommended that these trees be treated by being cut down and ground into mulch, which has been shown to kill gold-spotted oak borer larvae (Paine 690). Mulching the treated and cut down trees is preferred over the netting and solarization method. Solarization often fails because GSOB escapes the plastic netting and the interior of the bark needs to reach an internal temperature of 160 degrees to kill GSOB. Also, the stump should be cut or ground down to the ground surface. Anecdotal observations by land managers and biologists has indicated that GSOB can live in a stump for years.

The oak trees within the preserve that do not appear infected by gold-spotted oak borer (mostly 12 DBH or less) should be regularly monitored and actively supported, if needed. Potential methods of support include early insecticide treatments of individuals if GSOB is found, mulching/watering these trees if they appear stressed, and even pruning or protection to

make sure the next generation of oak trees grows healthy. GSOB transfers to new trees more easily if they are stressed from drought or stressed for other reasons.

It is recommended that a gold-spotted oak borer management plan be established for the mature trees that shows signs of infection but appear mostly healthy. A potential plan includes regular monitoring of trees and options to cut down trees that are determined to be too infected. Other options should include treatment with insecticides that have been proven to be effective. Currently, the best management practices have not shown to completely eradicate gold spotted oak borers, but it can be manageable with the right plan and resources in place. Additional funding is needed to address this issue, and can benefit management of other species on the property.

It is also recommended that SDRPF work with adjacent landowners, including the Cleveland National Forest, to address gold-spotted oak borer along this portion of Boulder Creek. Successful management of gold-spotted oak borer within the preserve may only be possible if nearby infections are managed as well.

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BATS ARE COOL!

Bats are an important part of the Boulder Creek ecosystem.

Of the 22 species of bats found in San Diego County, we have identified more than a dozen of them right here at Boulder Creek Preserve (including those pictured below)! Bats play an important and unique role in ecosystems along the San Diego River and its tributaries, like Boulder Creek. In fact, every living thing in the river ecosystem depends on one another and exist in a balance. The existence of each organism is crucial for the survival of all the other organisms in this ecosystem.

Bats eat a variety of foods, but our local bats are especially fond of bugs! Bats are also food for larger predators, including snakes, owls, hawks, raccoons, and big cats. Bats are especially helpful to humans because they help to control pest insects that may bite us, carry diseases, and eat our crops.



Mexican free-tailed bat

Photo credit: ITU Pictures



Pallid bat

Photo credit: Michael Durham/Minden Pictures, BCI



Townsend's big-eared bat

Photo credit: Don Endicott



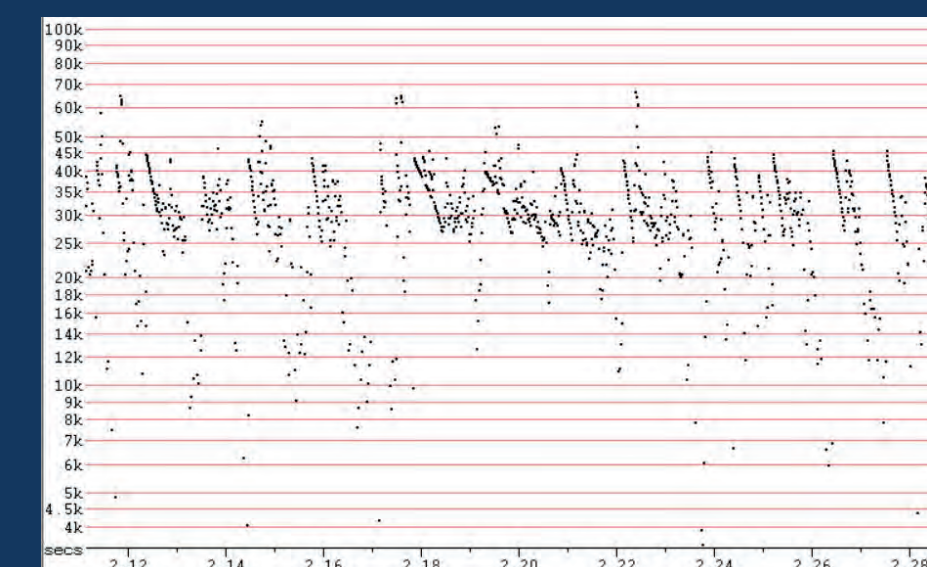
Pocketed free-tailed bat

Photo credit: Don Endicott

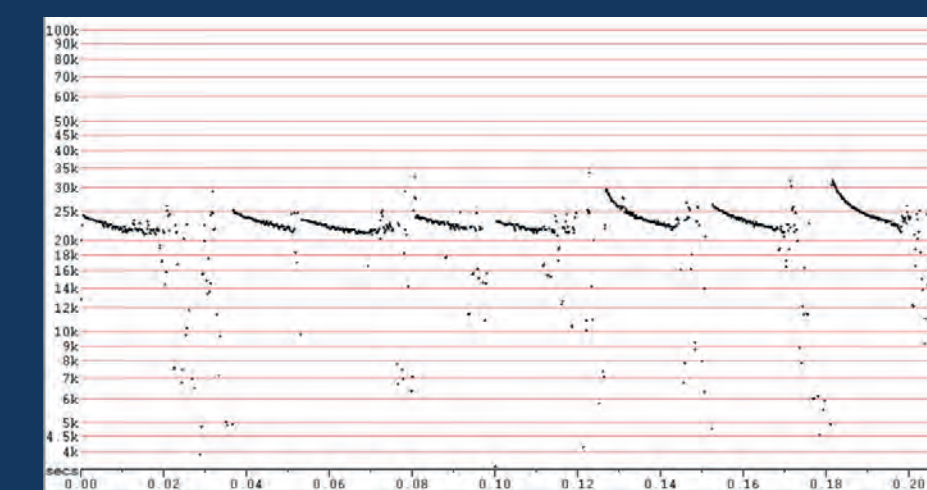
Bat research and conservation efforts

Unfortunately, bat populations are decreasing around the world due to various threats, such as habitat destruction, pollution, and disturbance. Three of the species we have identified here are listed as California Species of Special Concern, including the pallid bat, Townsend's big-eared bat, and the pocketed free-tailed bat (pictured above). This means that the populations of these bats are decreasing and/or that the survival of this species is at risk. Our protected spaces are important to the survival of these species!

Bats are nocturnal and active at night. Since we often can't see them, we study them by listening. However, most bat calls are at a frequency that human ears cannot detect. We study bats on our preserves using special equipment that can record and analyze bat noises, called bioacoustic monitoring. Each bat species has a unique series of calls used for navigation and hunting that can be used for identification, like in these sonograms recorded at this preserve.



The sonograms of Townsend's big-eared bat calls (top) look different than Mexican free-tailed bat calls (below)



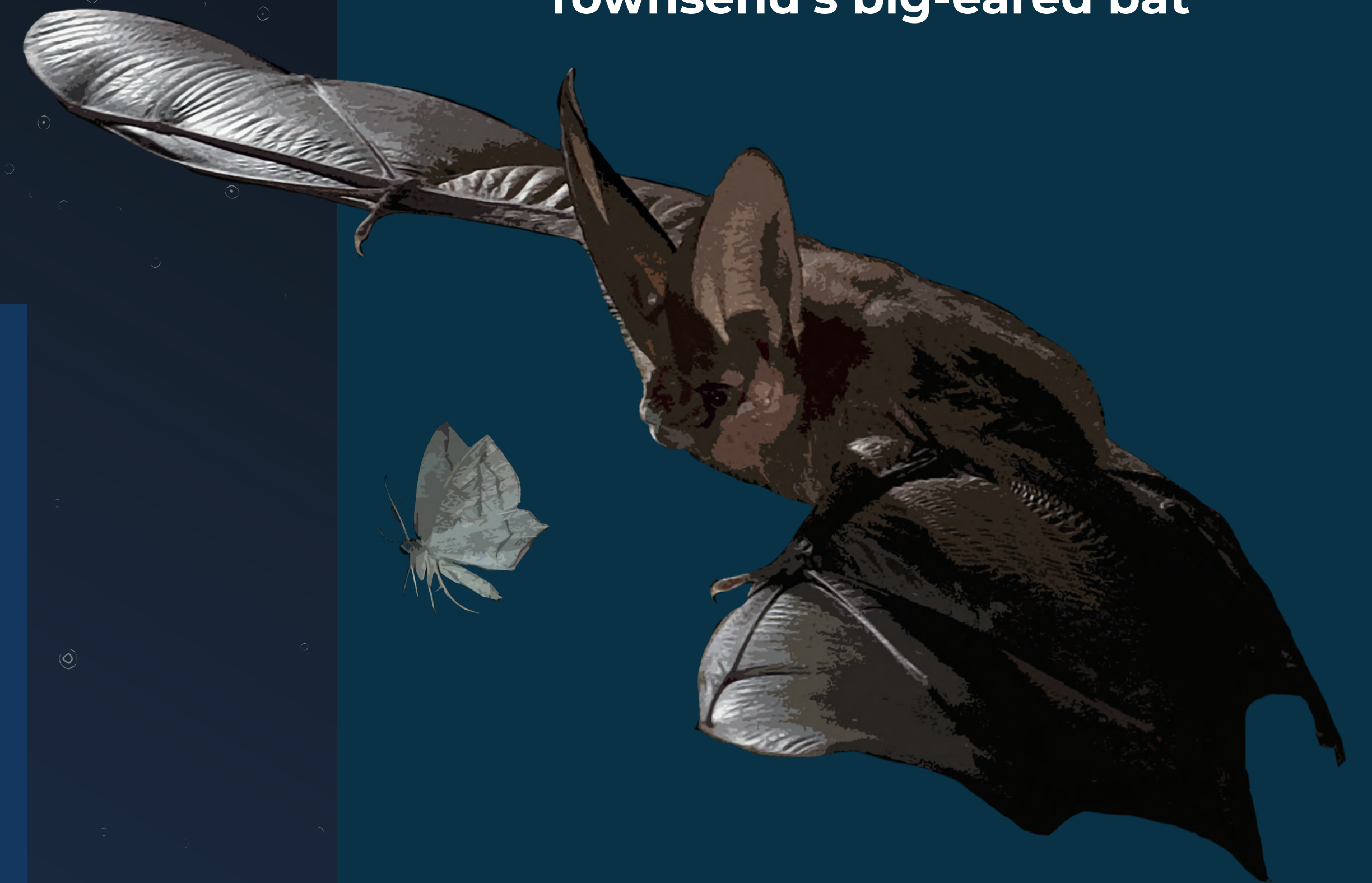
We're working to help bats... and you can too!

- 1. Be a bat ambassador:** Learn all about bats and tell a friend. Bats need YOUR help to spread the word that they aren't scary and that they are very important to our environment.
- 2. Avoid disturbing bats:** Human presence can disturb bats and cause them to abandon their roost, leave their young, and disrupt their resting periods. Humans can also spread bat diseases, like white-nose syndrome. Stay away from areas where bats roost and hibernate.
- 3. Protect natural land:** Bats need natural lands with lots of native plants and bugs to roost and hunt.
- 4. Observe bats where you live:** Look and listen for bats just around twilight and dawn, especially near places where there is open water or a light that attracts insects.

Did you know?

Bats are in the order Chiroptera, which means "hand-wing." Most of the bones in their wing evolved from the bones that form a hand in humans.

Species Highlight: Townsend's big-eared bat



Townsend's big-eared bats have enormous ears! When their ears are laid back, they extend to cover almost half their body. These bats like to roost and hibernate in caves or old mines, which is just where we found ours here on this preserve!

Like many bats, these bats are very sensitive to disturbance, and may even abandon a roost if disturbed by humans. They are rare in our region, so finding them here at the preserve means that this habitat is healthy enough to support them, and is a good reason for us to try and conserve and protect this land!



Bat research and conservation efforts at this preserve are supported by The San Diego River Park Foundation's volunteer scientists and stewards, and with support from:



Special thank you to the San Diego Natural History Museum for analysis of bat acoustic data, and to Don Endicott for use of local bat photographs.