APPENDIX 3c

HCP Covered Species

3.8 Covered Species

As described in Chapter 1, this HCP covers 22 species (Table 1-1). The following discussion provides species accounts for each of the 22 Covered Species. These accounts summarize important life history traits of the species. The accounts represent a summary of the best available scientific data for each species on which to base this HCP. The species accounts are not intended to summarize all biological information known about a species. Rather, each account summarizes scientific information that is relevant to the issues that must be considered when developing and implementing this HCP. The biological data in these profiles support the impact analysis (Chapter 4) and conservation strategy (Chapter 5) in this HCP.

3.8.1 Species Occurrence Data

Covered Species occurrence data was obtained from a variety of sources (Table 3-14) and combined to create a single species occurrence database for analysis in the HCP. The database was screened for duplicate records, which were removed when identified. The species occurrence database represents a composite of Covered Species occurrence over time. In most cases, it is incidental observational data and therefore subject to survey bias, depending upon where and when Covered Species are most likely to be observed. Therefore, it should not be interpreted as an indication of species abundance or spatial distribution. However, it can be useful to compare species occurrences to species distribution models as a way of subjectively evaluating the ability of the model to capture species distribution.

Table 3-14. Species Occurrence Data Sources

Data Layer	Data Description
Audubon and Cornell Lab of Ornithology eBird Database	These data identify documented and reported bird species occurrences. Source: Audubon and Cornell Lab of Ornithology at http://ebird.org/ebird/map/.
USGS – Annual Fish Survey Data (2015–2018)	Wulff, M.L., Brown, L.R., May, J.T., and Gusto, E. 2019. *Native Fish Population and Habitat Study, Santa Ana River, California, 2018*: U.S. Geological Survey data release. Wulff, M.L., Brown, L.R., May, J.T., and Gusto, E. 2018. *Native Fish Population and Habitat Study, Santa Ana River, California, 2017*: U.S. Geological Survey data release. Wulff, M.L., Brown, L.R., and May, J.T. 2017. *Native Fish Population and Habitat Study, Santa Ana River, California, 2016* (ver. 2.0, August 2017): U.S. Geological Survey data release. Wulff, M.L., Brown, L.R., and May, J.T. 2017. *Native Fish Population and Habitat Study, Santa Ana River, California, 2015*: U.S. Geological Survey data release.
CDFW – Cactus Wren Occurrence Data	Western Riverside County MSHCP Biological Monitoring Program cactus wren occurrences. Source: California Department of Fish and Wildlife.
CDFW – California Natural Diversity Database (CNDDB) Species Occurrence Data	These data identify documented and reported occurrences of special-status plant communities, as well as special-status plant and animal species within the Planning Area. They are also available to view with the Biogeographic Information and Observation System.

Data Layer	Data Description
	Source: CDFW at http://www.dfg.ca.gov/biogeodata/cnddb/rf_ftpinfo.asp.
Coastal Cactus Wren Working Group	Dataset identifies coastal cactus wren occurrences and appropriate cactus wren habitat in Western Riverside and San Bernardino Counties. Source: Santa Ana Watershed Association.
Herpetological Education and Research Project	The North American Herpetological Education and Research Project database is a repository of sightings and information on North American herpetofauna contributed by amateur citizen scientists and professional herpetologists. Source: http://www.naherp.com/
San Bernardino County Museum – Species Occurrence Data	These data identify additional documented species occurrences within San Bernardino County. Source: San Bernardino Association of Governments regional database.
San Diego Zoo	San Bernardino kangaroo rat trapping data. Source: San Diego Zoo, Institute for Conservation Research.
Tricolored Blackbird Portal	Database of publicly accessible records of locations of tricolored blackbird colonies and aggregations in San Bernardino and Riverside Counties. Source: http://tricolor.ice.ucdavis.edu/locations/public/xls.
USFWS – Species Occurrence Data	These data identify documented and reported occurrences of Federally endangered or threatened species within the Planning Area. Source: Carlsbad USFWS office, geographic information systems (GIS), at http://www.fws.gov/carlsbad/GIS/CFWOGIS.html.
Upper Santa Ana River Wash Plan	Dataset from 2014 identifies coastal cactus wren occurrences and appropriate cactus wren habitat in the Wash Plan boundary. Source: San Bernardino Valley Water Conservation District.

3.8.2 Species Distribution Modeling

It is important to have a good understanding of the distribution of each Covered Species in the Planning Area so that the potential effects of Covered Activities can be estimated (estimation of take for wildlife and impacts for plants), and so that areas for mitigation of those effects can be identified. Species habitat distribution models are important tools to use when evaluating species effects at a landscape scale, especially when it is not feasible to conduct comprehensive species surveys across the entire Planning Area. These models tend to be conservative from an impact estimation point of view (i.e., over predict impacts), and the results generally overstate the probable actual effects on species. Not all of the predicted suitable habitat is expected to be occupied by the subject species at any one time due to the population dynamics of species that change local distribution over space and time. In addition, there are small-scale habitat features that are not mapped in the geographic information system (GIS) database that can affect the suitability of habitat. The species distribution model for each Covered Species is described within its account.

It is important to note that the predicted suitable habitat distribution models are one of many tools used in developing the HCP. The models are helpful in developing the initial estimate of incidental take that may occur so that the appropriate amount of incidental take can be quantified for the effects analyses and ultimately authorized with the issuance of the incidental take permit (ITP). The actual amount of incidental take that does occur will be quantified and reported during implementation of the HCP. This will be accomplished through pre-activity surveys, post-activity surveys, and biological monitoring. The pre-activity surveys will accurately document current habitat condition and species presence or absence on the ground immediately prior to initiation of a Covered Activity. Post-activity monitoring of the project site will accurately quantify the direct and indirect effects that result from implementation of a Covered Activity. Biological monitoring during a Covered Activity will help avoid and minimize impacts on species and document any incidental take that may occur during the implementation.

Expert-based species distribution modeling has been used successfully in many HCPs and is the modeling approach used for the Covered Species. Expert-based species distribution modeling uses the GIS data layers expected to have meaningful correlations with the distribution of each species based on their biological or life-history traits (e.g., vegetation community type, soil type, and elevation). The decisions regarding how these data are related to the distribution of each species are made through expert knowledge. The expert-based models use Boolean "and/or" relationships to formulate the habitat distribution. For example, a species would be predicted to occur in an area if it had the right vegetation community and the right soil type, and the correct elevation range where the species is known to occur. The primary source of expert knowledge is the scientific literature. Additional consultation with species experts and review of draft model results provide further insight and refinements to the selection of the best criteria to model the distribution of each species habitat.

For this HCP, the expert-based species distribution models were developed based on the species profiles, and, when available, on other models created for the same species for other species conservation programs in or near the Planning Area. The draft predicted–species distribution model results were evaluated relative to the distribution of known occurrences in the Planning Area to assess the accuracy of the model. When known occurrences were located in areas not predicted by the draft model, the GIS data layers were examined in these areas to identify any additional species-habitat relationship supported by expert knowledge that could be included in the model to improve the accuracy. Such changes to the draft model were only made when the change was generally consistent with known species' habitat requirements as described in the species profile. Some of the species models also incorporate critical habitat as designated by USFWS.

Covered Species occurrence data are used for modeling the distribution of potential Covered Species habitat primarily to evaluate how well the modeled habitat performs at known occupied locations. A number of sources of Covered Species occurrence data were used (Table 3-14). The vegetation/land cover communities and physical properties (such as elevation and soils) data were compiled from a variety of sources. Additional GIS processing was conducted to construct a land cover layer with full coverage of the Planning Area, using the most current land cover data available as described above in Section 3.7, *Vegetation and Land Cover*.

As described under *Wetted Area as a Measure of Aquatic Habitat*, above, the potential wetted area (area of in-channel aquatic habitat) was also calculated for aquatic species (except Santa Ana sucker and arroyo chub, see Section 3.8.3) based on the wetted area modeling methods described in Section 3.6.4, *HCP Existing Condition Hydrologic Period*. Wetted area was only modeled for reaches downstream of Covered Activities and therefore does not include the total wetted area of aquatic habitat in the Planning Area. Table 3-16 provides the area of modeled wetted area that co-occurs with aquatic species modeled suitable habitat downstream of Covered Activities.

The model for each species is described within each species account, and the resulting species distribution models are shown in the associated figures. Table 3-15 provides the amount of modeled habitat in the Planning Area for each Covered Species.

Table 3-15. Covered Species Modeled Suitable Habitat and Designated Critical Habitat in Planning Area

Common Name	Scientific Name	Federal Status	State Status	Amount of Modeled Suitable Habitat and Designated Critical Habitat in the Planning Area
Slender-horned spineflower	*Dodecahema leptoceras*	E	E	Current Occupied Habitat: 18 acres Historic Occupied Habitat: 35 acres Potentially Suitable Habitat: 93,006 acres
Santa Ana River woolly-star	*Eriastrum densifolium* ssp. *Sanctorum*	E	E	Potentially Suitable Habitat: 16,434 acres
Delhi Sands flower-loving fly	*Rhaphiomida terminatus abdominalis*	E	None	Potentially Suitable Habitat: 1,362 acres Potentially Suitable Habitat (Extirpated): 1,742 acres
Santa Ana sucker	*Catostomus santaanae*	T	None	Modeled Preferred Habitat: 2.15 acres (occurring intermittently across approximately 6 miles of the mainstem Santa Ana River that contains suitable hard substrates) Designated Critical Habitat-Wet: 4,342 acres[1] Designated Critical Habitat-Dry: 2,108 acres[1]
Arroyo chub	*Gila orcuttii*	None	SSC	Modeled Preferred Habitat: 3.7 acres (occurring intermittently across approximately 21.1 miles of the mainstem Santa Ana River)
Santa Ana speckled dace	*Rhinichthys osculus*	None	SSC	Suitable Habitat: 37.5 miles (portions of Fredabla Creek, Hemlock Creek, Lytle Creek, and Waterman Creek, Strawberry Creek, East Twin Creek, and possibly Horsethief Creek) Wetted Area Downstream of Covered Activities: 0.01 acre
Arroyo toad	*Anaxyrus californicus*	E	SSC	Suitable Breeding Habitat: 1,754 acres Non-Breeding Upland Habitat: 5,884 acres Permeable Movement Area: 1,659 acres Designated Critical Habitat: 1,777 acres
Mountain yellow-legged frog	*Rana muscosa*	E	E	Potentially Suitable Aquatic Habitat: 2,189 acres Refugia/Foraging/ Dispersal Habitat: 91,854 acres Designated Critical Habitat: 2,216 acres Wetted Area Downstream of Covered Activities: 0.2 acres
Western spadefoot	*Spea hammondii*	None	SSC	Potentially Suitable Habitat: 38,252 acres Wetted Area Downstream of Covered Activities: 198.7 acres
California glossy snake	*Arizona elegans occidentalis*	None	SSC	Potentially Suitable Habitat: 146,338 acres

Common Name	Scientific Name	Federal Status	State Status	Amount of Modeled Suitable Habitat and Designated Critical Habitat in the Planning Area
South coast garter snake	*Thamnophis sirtalis* sp.	None	None	Potentially Suitable Habitat: 7,703 acres Wetted Area Downstream of Covered Activities: 188.6 acres
Southwestern pond turtle	*Emys pallida*	None	SSC	Aquatic Habitat: 1,245 acres Potentially Suitable Upland Habitat: 14,944 acres Wetted Area Downstream of Covered Activities: 191.8 acres
Tricolored blackbird	*Agelaius tricolor*	None	T	Occupied Colony Habitat: 10 acres Suitable Colony Habitat: 1,868 acres Breeding Season Foraging - Natural: 38,222 acres Breeding Season Foraging - Agriculture: 40,641 acres Non-Breeding Season Foraging - Natural: 1,919 acres Non-Breeding Season Foraging - Agriculture: 758 acres
Burrowing owl	*Athene cunicularia*	None	SSC	Potentially Suitable Habitat: 141,791 acres
Cactus wren	*Campylorhynchus brunneicapillus*	None	None	Known Suitable Nesting Habitat: 677 acres Potential Nesting and Foraging Habitat: 127,918 acres Recently Burned (2008–2018): 9,470 acres
Yellow-breasted chat	*Icteria virens*	None	SSC	Potentially Suitable Habitat: 15,329 acres
Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	T	E	High Value Breeding Habitat: 2,773 acres Other Potentially Suitable Breeding Habitat: 1,999 acres
Southwestern willow flycatcher	*Empidonax traillii extimus*	E	E	Core Southwestern Willow Flycatcher Habitat: 1,844 acres Very High Value Habitat: 1,564 acres High Value Habitat: 613 acres Moderate Value Habitat: 360 acres Other Potentially Suitable Habitat: 10,949 acres Designated Critical Habitat: 4,431 acres
Coastal California gnatcatcher	*Polioptila californica californica*	T	SSC	Very High Value Habitat: 8,298 acres High Value Habitat: 9,918 acres Moderate Value Habitat: 12,345 acres Low Value Habitat: 30,081 acres Other Suitable Habitat: 5,441 acres Designated Critical Habitat: 13,589 acres

Common Name	Scientific Name	Federal Status	State Status	Amount of Modeled Suitable Habitat and Designated Critical Habitat in the Planning Area
Least Bell's vireo	*Vireo bellii pusillus*	E	E	Core Breeding Habitat: 5,463 acres Other Breeding Habitat: 9,867 acres Designated Critical Habitat: 9,900 acres
Los Angeles pocket mouse	*Perognathus longimembris brevinasus*	None	SSC	Potentially Suitable Habitat: 67,500 acres
San Bernardino kangaroo rat	*Dipodomys merriami parvus*	E	Can	Suitable Habitat: 21,120 acres Designated Critical Habitat: 27,745 acres Refugia: 11,577 acres Assumed Occupied[1]: 18,460 acres

Can = Candidate; E = endangered; SSC = species of special concern; T = threatened.

[1] Designated critical habitat for Santa Ana sucker is presented by unoccupied intermittently flowing portions of the Santa Ana River (i.e., designated critical habitat – dry) that provide a source of coarse sediment to be supplied to downstream-occupied reaches (i.e., designated critical habitat – wet), where the fish depend on coarse substrate for feeding and spawning.

[2] "Assumed Occupied" is not a modeled dataset; it is a separate data layer that was estimated to indicate all areas where San Bernardino kangaroo rat (SBKR) may be present. All areas outside of this data layer have extremely limited potential for SBKR to occur. The layer was generated from review of available trapping data (positive and negative) and known extant occurrences, and estimates of likely occupied areas where data were absent. It provides a conservative estimate of all areas where SBKR has the potential to be found.

Table 3-16. Predicted Wetted Area for Aquatic Covered Species[1]

Common Name	Scientific Name	Amount of Modeled Wetted Area within Aquatic Species Modeled Habitat[2]
Santa Ana speckled dace	*Rhinichthys osculus*	0.01 acre
Mountain yellow-legged frog	*Rana muscosa*	0.2 acre
Western spadefoot	*Spea hammondii*	199 acres
South coast garter snake	*Thamnophis sirtalis* sp.	189 acres
Southwestern pond turtle	*Emys pallida*	192 acres

[1] Santa Ana sucker and arroyo chub habitat suitability models integrate hydrology directly; therefore, they are not included in this table.

[2] Wetted area was only available from the HCP Hydrology Model for habitat downstream of covered activities.

3.8.3 Covered Species Accounts

Slender-Horned Spineflower (*Dodecahema leptoceras*)

Current Status and Distribution

The slender-horned spineflower (*Dodecahema leptoceras*) is Federally listed as endangered, California listed as endangered, and is on the California Rare Plant Rank list. This species is found in 27 known extant occurrences throughout coastal foothill drainages of Riverside, San Bernardino, and Los Angeles Counties, ranging from the Temecula area northwestwards to Santa Clarita. One historic record was collected near Palm Springs (CNPS 2020, CCH 2014).

Within the Planning Area the known occurrences are concentrated east of San Bernardino along the Santa Ana River and along the southern portion of Cajon Creek. Smaller populations are known at the south end of the Planning Area near Lake Elsinore, at the western boundary of the Planning Area near Rancho Cucamonga, and near Yucaipa (ICF 2014).

Habitat Affinities

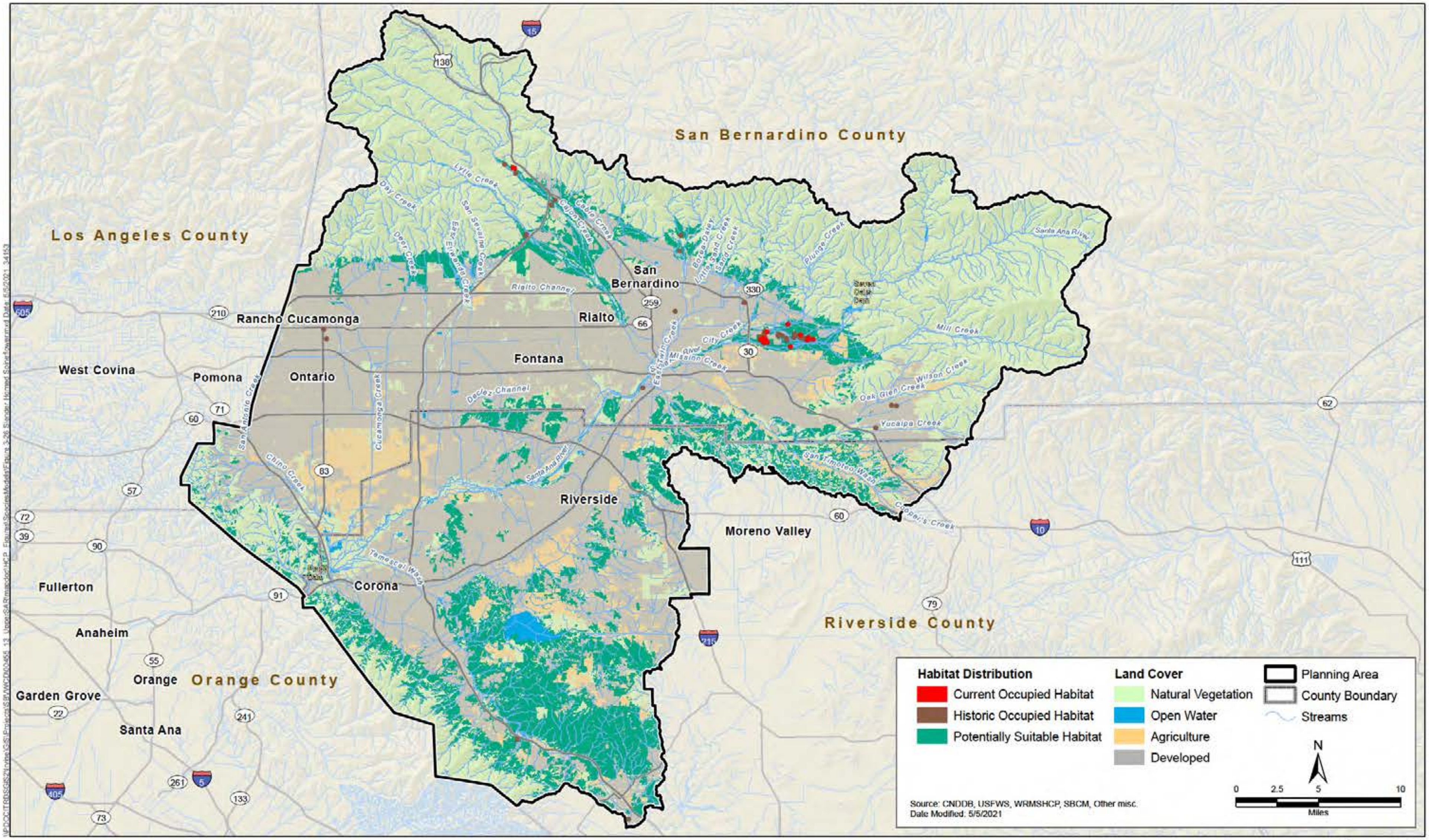
Slender-horned spineflower occurs on stable older alluvium away from active channels in areas with little flooding disturbance and infrequent surface flows between 656 and 2,493 feet in elevation (CNPS 2020). This species occurs in slightly acidic silt soil with low salinity, little organic matter, and low nutrient content, in silt-filled shallow depressions on relatively flat surfaces (Allen 1996). Its preferred habitat is transient in nature and a mid to late successional stage that requires disturbance to maintain over a larger scale. Some populations are known in denser woody habitats that are thought to arise from successional changes from past alluvial flow (USFWS 2010a).

Distribution of Modeled Habitat and Documented Occurrences in the Planning Area

Distribution of modeled slender-horned spineflower habitat and documented occurrences in the Planning Area are illustrated on Figure 3-26 and quantified in Table 3-15. The following modeled habitat types are used to represent the species' habitat distribution in the Planning Area; this includes a listing of the data and/or parameters used to create each modeled habitat type.

Potentially Suitable Habitat:

- **Land Cover**: California Chaparral (Chamise), California Coastal Scrub, California Coastal Scrub (Black Sage), California Coastal Scrub (Brittle Bush), California Coastal Scrub (Brittlebush), California Coastal Scrub (Bush Penstemon), California Coastal Scrub (Bush Poppy), California Coastal Scrub (California buckwheat), California Coastal Scrub (California Juniper), California Coastal Scrub (California sagebrush), California Coastal Scrub (Chamise), California Coastal Scrub (Deerweed), California Coastal Scrub (Laurel Sumac), California Coastal Scrub (Prickly Pear), California Coastal Scrub (Toyon), California Coastal Scrub (White Sage), California Coastal Scrub (Yerba Santa), Great Basin-Intermountain Xeric-Riparian Scrub, and North American Warm-Desert Xeric-Riparian Scrub; **AND**
- **Elevation**: 700–2,500 feet.



Upper Santa Ana River
Habitat Conservation Plan

Figure 3-26
Slender-horned spineflower, *Dodecahema leptoceras*
Potential Habitat Distribution and Known Occurrence Records

Current Occupied Habitat (modeled)

- Current Occupied Habitat was modeled by including areas within a 100-foot buffer around known current occurrences within Potentially Suitable Habitat. This model category highlights the potentially suitable habitat where the species has been recently documented (post-2005). Where this category of modeled Current Occupied Habitat occurs, it replaces the Potentially Suitable Habitat or Historic Occupied Habitat (below) such that there is not overlap between the model categories.

Historic Occupied Habitat (modeled)

- Historic Occupied Habitat was modeled by including areas within a 100-foot buffer around known historic occurrences, outside of Current Occupied Habitat, within Potentially Suitable Habitat. This model category highlights the potentially suitable habitat where the species has been historically documented (pre-2005) but has not recently been documented. Where this category of modeled Historic Occupied Habitat occurs, it replaces the Potentially Suitable Habitat such that there is not overlap between the model categories.

Taxonomy and Genetics

This species was first described as *Centrostegia leptoceras* in 1870 and was then published as *Chorizanthe leptoceras* in 1877. The original name is the name under which the species was listed by State and Federal agencies. Taxonomists changed the name to the current name *Dodecahema leptoceras* in 1989 based on its morphological and phylogenetic distinctiveness (IPNI 2014, USFWS 2010a). Genetic diversity is high for the entire population; however, this is due to the population in Los Angeles, which is genetically distinct from populations in Riverside and San Bernardino Counties (USFWS 2010a). Despite differences in population sizes between locations, Ferguson and Ellstrand (1999) found that there was no evidence of lack of genetic diversity or homozygosity within locations. Plants are mostly outcrossing but are also self-fertile.

Life History and Demography

This spineflower is an annual herb. The involucre number per individual varies and depends on climactic and genetic factors and has been observed to range from 1 to 169 involucres (USFWS 2010a). The typical arrangement is three flowers per involucre, one fruit per flower, and one seed per fruit (Reveal 2005).

Pollination and Seed Dispersal

Information and studies about pollination are limited on this species. Spineflower is thought to be pollinated by various small insects (USFWS 2010a). The single-seeded fruits are located in involucres with hooked spines that may attach to wildlife for dispersal. Seeds are glabrous with no dispersal mechanisms of their own (Reveal 2005).

Seasonal Phenology

This species typically germinates with a 6 to 52% survival rate in February (USFWS 2010a, Ferguson and Ellstrand 1999). The blooming period generally occurs between April and June (CNPS 2020) (Table 3-17). Seed banks are known to occur with this species and are relatively long-lasting, which helps maintain demographics and genetic diversity of the species in dry years (Ferguson and

Ellstrand 1999). Within each population there are often wide fluctuations in population size due to seasonal rainfall (USFWS 2010a).

Table 3-17. Phenology of Slender-Horned Spineflower

Life Stage/ Activity Period	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Blooming				■	■	■						
Fruiting		■										

Sources: CNPS 2014, USFWS 2010a

Threats and Special Management Considerations

The primary threat is habitat modification or destruction from development, mining, proposed flood control measures and other hydrologic alteration, off-highway vehicles, illegal dumping, and nonnative invasive species. The USFWS also cites inadequacy of state and local plans to fully protect this species, specifically attributing this to discretionary impacts that are allowed by state and local laws, and to the fact that most populations of this species do not occur on protected or otherwise conserved lands. Other general threats include climate change, sand and gravel mining, off-highway vehicles, nonnative invasive plants, herbivory, and the small population size present at each location (CNPS 2020, USFWS 2010a). The slender-horned spineflower is also affected by groundwater management and merits consideration by Groundwater Sustainability Agencies under the Sustainable Groundwater Management Act; however, specific threats to this species from groundwater changes have not been assessed (Rohde et al. 2019).

Due to the potential presence of long-lived propagules in the seed bank, the areas of the model indicated current or historic occurrences will be avoided and/or impacts minimized associated with implementation of Covered Activities. When possible, restoration, rehabilitation, and/or research of modeled Historic Occupied Habitat areas will be prioritized to benefit slender-horned spineflower.

Santa Ana River Woolly-Star (*Eriastrum densifolium* ssp. *sanctorum*)

Current Status and Distribution

The Santa Ana River woolly-star (*Eriastrum densifolium* ssp. *sanctorum*) is Federally listed as endangered, California listed as endangered, and on the California Rare Plant Rank list. All 27 known occurrences are highly restricted to the Santa Ana River complex, occurring along the Santa Ana River, Mill Creek, Lytle Creek, Plunge Creek, and Cajon Creek. Most known occurrences are in San Bernardino County, and the remaining extant occurrences are in Riverside County (USFWS 2010b, CNPS 2014). All known occurrences are within the Planning Area.

Habitat Affinities

This species is found on the alluvial terraces of open floodplains in chaparral or coastal scrub with intermittent flooding, light surface disturbance, on south- to west- facing aspects, and relatively low cover of annuals or perennials in areas with nutrient-poor sands between 885 and 2,625 feet in elevation (CNPS 2020, DeGroot 2016). It is most competitive in early stage habitats with 97% or greater sand particles, but can also compete with other species in moderate stage habitats with 90–97% sand particles. Woolly-star is a pioneer plant that is often outcompeted in more stable shrubby ecosystems (USFWS 2010b). This habitat type is transient in nature and is an early to mid-successional stage, which requires disturbance to maintain over a large scale.

Distribution of Modeled Habitat and Documented Occurrences in the Planning Area

Distribution of Santa Ana River woolly-star modeled habitat and documented occurrences in the Planning Area are illustrated on Figure 3-27 and quantified in Table 3-15. The following modeled habitat types are used to represent the species' habitat distribution in the Planning Area; this includes a listing of the data and/or parameters used to create each modeled habitat type.

Potentially Suitable Habitat

- **Land Cover**: Californian Coastal Scrub, Great Basin-Intermountain Xeric-Riparian Scrub, North American Warm-Desert Xeric-Riparian Scrub, and Water – Seasonal (except within existing groundwater recharge basins); **AND**
- **Soil Texture**: sand, loamy sand, coarse sand, and loamy fine sand, **AND**
- **Elevation**: 0–2,100 feet.
- **Post-processing**: Excludes existing groundwater recharge basins and areas of the Devil's Creek, Etiwanda Fan, and Jurupa Hills that are known to be out of the species range.

Taxonomy and Genetics

This taxon was originally described as *Hugelia densiflorum* and changed to *Eriastrum* in 1945. Currently five total subspecies are described for this species (IPNI 2014). This species is also thought to hybridize with other subspecies, namely the subspecies *elongatum* around Cajon Creek and Lytle Creek, and the subspecies *austromontanum* in Lytle Creek and La Cadeña Drive (USFWS 2010b).

Life History and Demography

This species is a perennial subshrub that typically lives for 5 years, but some individuals are known to live for 10 years (USFWS 2010b). Each head typically produces 4 to 30 flowers, each flower has 1 fruit (a capsule), and each fruit has 6 to 33 seeds (De Groot 2014). Seeds germinate with the first major fall rainfall, and few seeds remain in the seed bank (USFWS 2010b).

Pollination and Seed Dispersal

Santa Ana River woolly-star is self-incompatible and an obligate outcrosser. Primary pollinators vary with location and include the giant flower-loving fly (*Rhaphiomidas acton* ssp. *acton*), the sphinx moth (*Hyles lineata*), two bee species (*Micranthophora flavocinata* and *Bombus californicus*) and two hummingbirds (black-chinned hummingbird [*Archilochus alexandri*] and Anna's hummingbird [*Calypte anna*]). Seeds have a smooth surface morphology with a coating that becomes mucilaginous on contact with water and attaches the seed to the soil. Most seeds drop within a foot of the plant, but some stay in the capsule, which can remain on the plant for several years. Seeds and capsules can be transported longer distances by floodwater (USFWS 2010b).

Seasonal Phenology

Blooming typically occurs between April and September but is most heavy in June (CNPS 2014) (Table 3-18). Fruiting typically occurs between mid-July and mid-October (USFWS 2010b).

Table 3-18. Phenology of Santa Ana River Woolly-Star

Life Stage/ Activity Period	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Blooming				■	■	■	■	■	■			
Fruiting							■	■	■	■		

Sources: CNPS 2014, USFWS 2010b

Threats and Special Management Considerations

The primary threat to Santa Ana River woolly-star is habitat alteration resulting from development, mining, hydrologic changes (specifically those resulting from operation of the Seven Oaks Dam), grading for flood control, and off-highway vehicle activity. USFWS cites the inadequacy of state and local plans to fully protect this species, specifically in that discretionary impacts are allowed by state and local laws, and most occurrences are not on conserved lands. More broadly, climate change and hybridization at one-third of the known locations could threaten this species (USFWS 2010b). The Santa Ana River woolly-star is also affected by groundwater management and merits consideration by Groundwater Sustainability Agencies under the Sustainable Groundwater Management Act; however, specific threats to this species from groundwater changes have not been assessed (Rohde et al. 2019).

Delhi Sands Flower-Loving Fly (*Rhaphiomidas terminatus abdominalis*)

Current Status and Distribution

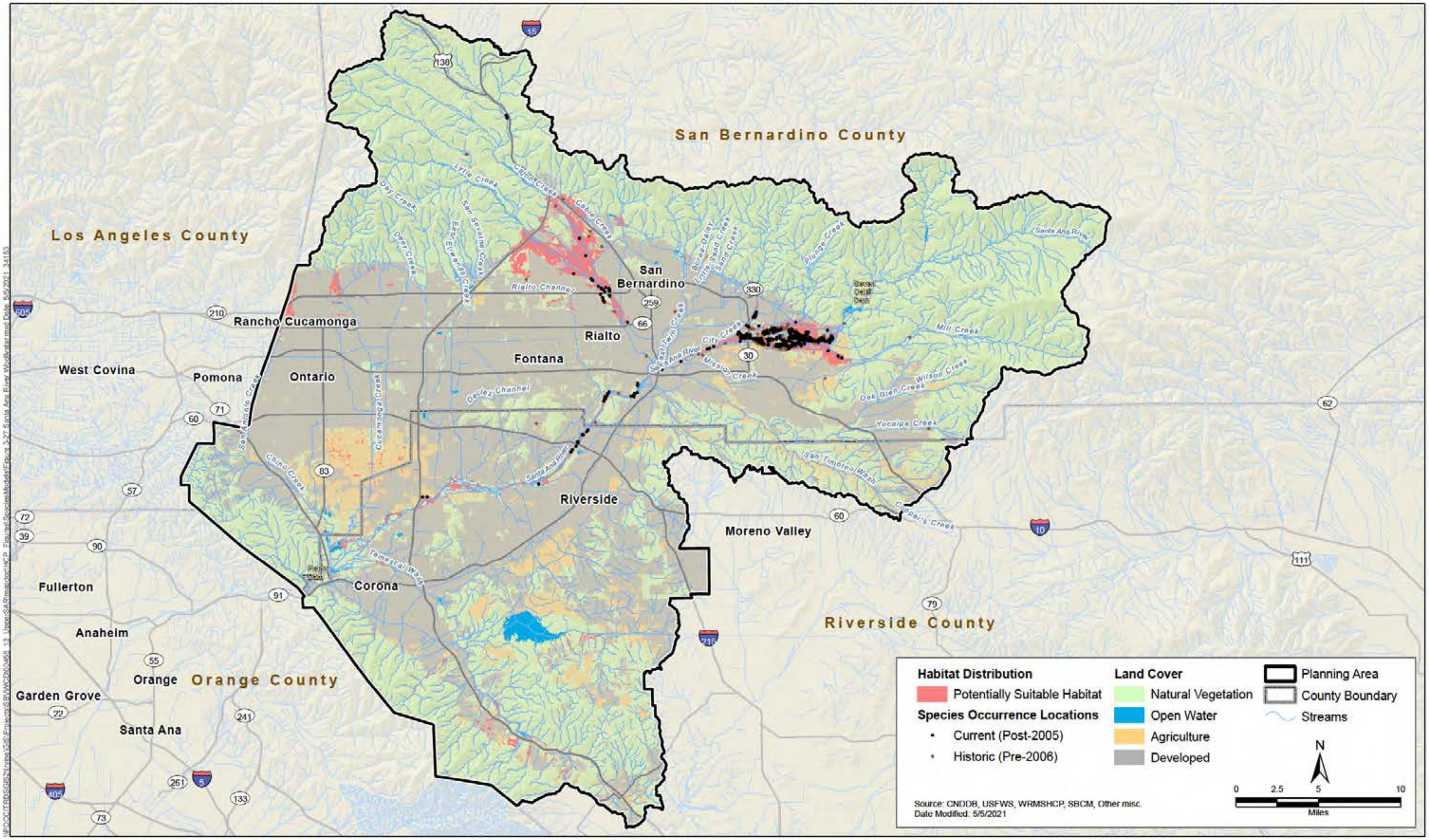
The Delhi Sands flower-loving fly (*Rhaphiomidas terminatus abdominalis*) is Federally listed as endangered. It is a subspecies endemic to the Colton Dunes Ecosystem of Southern California and is only known to occur in Riverside and San Bernardino Counties, with most of the occupied habitat located within a limited area of southwestern San Bernardino County (USFWS 2008).

Habitat Requirements

The characteristic feature of this species' occupied habitat is fine wind-blown sandy soils, often wholly or partly within sand dunes stabilized by sparse native vegetation. Plant species in the Colton Dunes include California buckwheat, California croton, deerweed, telegraph weed, and California evening primrose. Adults do not appear to use areas of dense vegetation. The fly can utilize Delhi sands in moderately disturbed areas such as abandoned vineyards or grazed lands (USFWS 1997). Larvae can be found within relatively moist soil several feet below the soil surface (Osborne and Ballmer pers. comm).

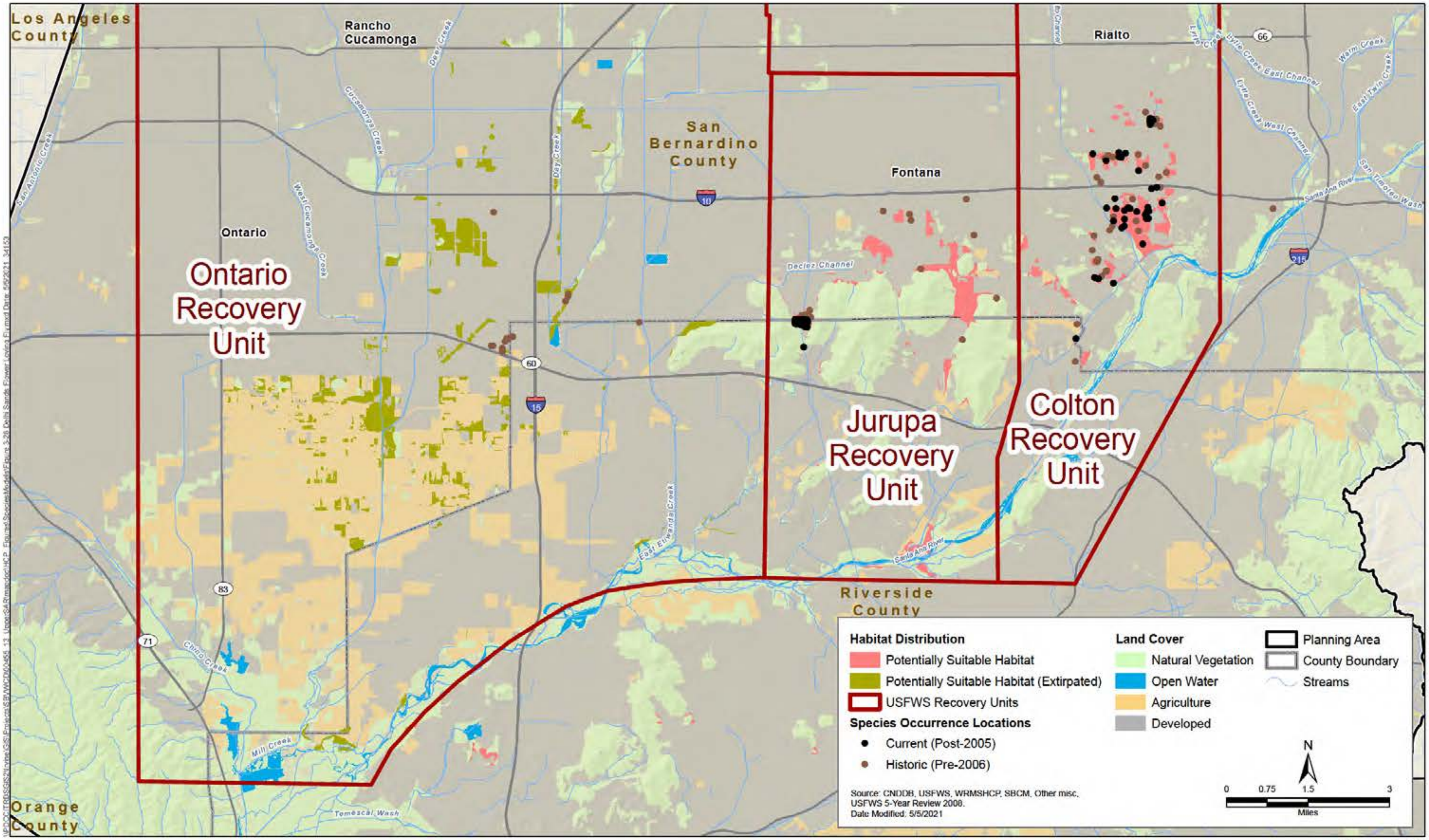
Distribution of Modeled Habitat and Documented Occurrences in the Planning Area

Distribution of Delhi Sands flower-loving fly modeled habitat and documented occurrences in the Planning Area are illustrated on Figure 3-28. The following modeled habitat types are used to



Upper Santa Ana River Habitat Conservation Plan

Figure 3-27
Santa Ana River woolly-star, *Eriastrum densifolium ssp. sanctorum*
Potential Habitat Distribution and Known Occurrence Records



Upper Santa Ana River Habitat Conservation Plan

Figure 3-28
Delhi sands flower-loving fly, *Rhaphiomidas terminatus abdominalis*
Potential Habitat Distribution and Known Occurrence Records

represent the species' habitat distribution in the Planning Area; this includes a listing of the data and/or parameters used to create each modeled habitat type.

Potentially Suitable Habitat

- **Land Cover**: All land cover types except Developed and Agriculture; **AND**
- **Soil Component Name**: Delhi Sands.

Potentially Suitable Habitat (Extirpated)

- Potentially suitable habitat that is within the USFWS Ontario Recovery Unit.

Taxonomy and Genetics

Taxonomic studies have shown that the genus Rhaphiomidas (giant flower-loving flies) belongs in the family Mydidae (no common name) (Cazier 1985), and, as a result, some researchers believe that the Delhi Sands flower-loving fly name should be changed to the Delhi Sands giant flower-loving fly (USFWS 2008).

Reproduction

Delhi Sands flower-loving fly undergoes a complete metamorphosis from egg to larva to pupa to adult. Oviposition (egg-laying) occurs within loose, sandy soils in the late summer (Kingsley 1996). Eggs are placed 1 to 2 inches beneath the surface of the sand (Rogers and Mattoni 1993). Larval stages develop completely underground and emerge as adults from July through September (Mattoni and Ballmer 1998).

Dispersal, Territoriality, and Home Range

Dispersal distances, territorial behavior, and home range sizes have not been documented.

Daily and Seasonal Activity

This species is very difficult to observe because only the adult/flying stage occurs above ground between July and September (Table 3-19). Adults are most active during the warmest sunniest parts of the day (USFWS 2008). Larvae are capable of indeterminate development, molting two to three times per year for at least 3 years prior to pupation (Osborne and Ballmer pers. comm).

Table 3-19. Seasonal Activity of Delhi Sands Flower-Loving Fly

Life Stage/Activity Period	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Adult Flight Season (breeding)							X	X	X			

Sources: USFWS 1997, USFWS 2008

Diet and Foraging

Both males and females extract nectar from California buckwheat and other plants. It is not clear if nectar feeding is essential for adult survival or reproduction (Kingsley 1996).

Threats and Special Management Considerations

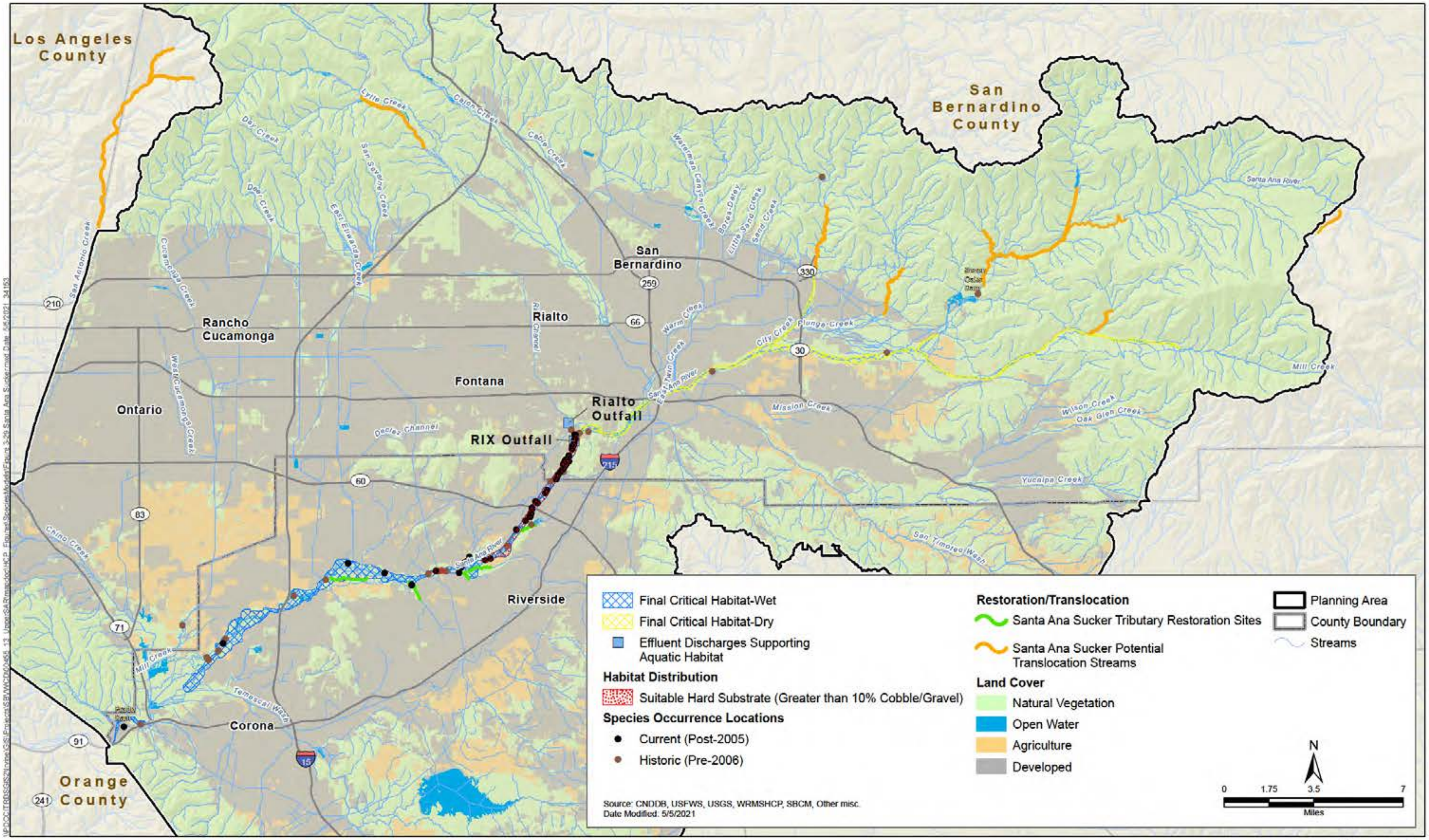
The primary threat to the Delhi Sands flower-loving fly is loss of habitat, habitat degradation, and habitat fragmentation (USFWS 2008). Activities that result in habitat degradation include grading, plowing, disking, and off-highway vehicle use. Occupied sites have become increasingly isolated by surrounding development. Nonnative invasive plants also degrade suitable habitat by increasing the vegetation cover or by altering soil conditions through dune stabilization and changes to soil moisture conditions (Western Riverside County MSHCP Biological Monitoring Program 2011).

Currently, there are only three known populations where management must be focused. The Slover/Pepper population is located east of Riverside Avenue, south of I-10, north of the Santa Ana River, and west of the cement plant. This population is partially protected through the establishment of the 7.5-acre Colton Transmission Facility Reserve and the 150-acre Vulcan Materials, Inc., Colton Dunes Conservation Bank. These conserved sites are surrounded by additional undeveloped Delhi Sands flower-loving fly habitats that are currently not protected but are needed to provide adequate protection for this population. A second population is located at Pepper Avenue adjacent to I-10 and the Pepper Avenue on- and off-ramps, which is an area partially protected within the Hospital Reserve; additional habitat in this area would need to be protected to sustain a robust population (Osborne 2016a, 2016b). The third population is the Jurupa Hills population located in the City of Jurupa Valley, north of SR-60 and south of I-10, which has been protected with conservation of 52 acres of Delhi Sands flower-loving fly habitat. There are no other conserved sites that are large enough and adequately managed to support a Delhi Sands flower-loving fly population. In 2005, USFWS estimated that approximately 2,826 acres of potential Delhi Sands flower-loving fly habitat remains (USFWS 2008).

Santa Ana Sucker (*Catostomus santaanae*)

Current Status and Distribution

The Santa Ana sucker (SAS; *Catostomus santaanae*) is Federally listed as threatened and is a California Species of Special Concern. Listed populations occur in the Santa Ana and San Gabriel Rivers and Big Tujunga Creek (USFWS 2009a). In the Santa Ana River, the species' range is officially from the Weir Canyon drop structure downstream of the Prado Dam all the way upstream to the La Cadena drop structure, and suitable habitat extends between Van Buren Boulevard in the Jurupa Valley upstream to the RIX outfall (Figure 3-29). Surveys conducted annually since 2015 by the USGS over a 5-mile stretch of the Santa Ana River noted that the highest abundance of Santa Ana sucker have recently been concentrated in the upper 1.25 miles of the perennial stream (484 [2018] to 4,983 [2015] fish per mile), from immediately downstream of the RIX facility discharge to approximately Riverside Avenue (Wulff et al. 2020). Over the USGS's approximately 5-mile survey area the mean density of SAS was stable from 2015 to 2017 (2015, 6,802 SAS; 2016, 7,208 SAS; 2017, 6,424 SAS) but the population dropped in 2018 (935 SAS) associated with several impacts on the river that occurred in late 2017 (stoppage of flow from the RIX facility). The cause of these impacts has since been alleviated by the City of San Bernardino in coordination with the USFWS, avoiding and/or minimizing future impacts on native fishes. A low-effect habitat conservation plan has been drafted by the City of San Bernardino for operation of the RIX facility to provide incidental take of Santa Ana sucker when future shutdowns of the RIX facility occur. This document is currently in review by the USFWS. It is anticipated that an ITP will be issued for this proposed low-effect HCP prior to issuance of the ITPs for the Upper SAR HCP.



Upper Santa Ana River Habitat Conservation Plan

Figure 3-29
Santa Ana sucker, *Catostomus santaanae*
Potential Habitat Distribution and Known Occurrence Records

Habitat Requirements

Santa Ana sucker is most abundant in unpolluted, clear water, at temperatures that are typically less than 72°F (Moyle 2002). Optimal stream conditions include coarse substrates (e.g., gravel, cobble, boulders), a combination of shallow riffles and deeper pools with algae present, and consistent flow (USFWS 2011, Palenscar 2014). Adults prefer deeper habitats such as pools and runs and utilize streams with gravelly substrates for spawning; juveniles occupy primarily riffle habitats (Haglund et al. 2010, Paramo et al. 2013). No sucker have been found in reaches with greater than 7% gradient (USFWS 2010c), and sucker rarely use habitat with less than 10% gravel and cobble substrate (USFWS 2010c, Thompson et al. 2010). In-stream or bank habitat with riparian vegetation providing shade is important for larvae and juveniles as are tributary habitat inflows that create refugia (USFWS 2011). Sucker tolerate reduced flows and elevated temperatures in the summer months, and turbid conditions associated with high flows that typically occur during winter months (Moyle 2002). The USFWS description of critical habitat *Physical and Biological Features* includes a functioning hydrological system that provides sources of water and coarse sediment necessary to maintain all life stages, including adults, juveniles, larvae, and eggs (Moyle 2002, USFWS 2010c).

Distribution of Modeled Habitat and Documented Occurrences in the Planning Area

The existing distribution of potentially occupied Santa Ana sucker habitat in the Planning Area is based on habitat suitability modeling, aquatic surveys for native fishes and other aquatic species (Wulff et al. 2020), USGS assessments of preferred microhabitats for Santa Ana sucker, and long-term surveys (citizen science) estimating the availability of Santa Ana sucker suitable habitats with hard river bottom substrates (surveys described below). The distribution of modeled suitable habitat and documented occurrences is shown on Figure 3-29, along with designated Critical Habitat. The Critical Habitat is designated over wetted portions of the river from the confluence with Rialto Channel downstream, and designated for generally dry portions of the river upstream from Rialto Channel to protect these areas as sediment sources for transport into occupied habitat during high storm flow events. Areas with known suitable hard river bottom substrates (>10% gravel and cobble) are shown in the figure. Occurrence data are from the sources listed in Table 3-12 above, including data from the USGS SAR Native Fishes Survey, conducted annually from 2015–2019 (Wulff et al. 2020). Habitat suitability modeling for Santa Ana sucker is described later in this section.

USGS Annual Fish Surveys

The San Bernardino Valley Municipal Water District has employed the services of the USGS to conduct native fish surveys in the Santa Ana River on an annual basis since 2015. The USGS also collects physical habitat data in the same reaches where native fish surveys are carried out. Physical habitat survey data collection includes information related to channel morphology, flow rate, substrate type, and streamside vegetation. The focus of the USGS effort is centered on the native fish census; therefore, the survey area is limited in geographic scope to areas where native fish are typically encountered. The survey area includes from the Rialto Channel, in the City of Colton, downstream along the mainstem of the Santa Ana River to just downstream of Mission Boulevard, in the City of Riverside. The downstream terminus of the survey reach is approximately 2.5 miles upstream of the confluence with Anza Creek. Results from the 2019 SAR Native Fishes Survey and draft results from the 2020 Survey suggest that the majority of the Santa Ana sucker in the Santa Ana River have shifted downstream. Future SAR Native Fishes Surveys will survey a longer reach of the river in order to better assess population size and distribution of native fishes.

Riverwalk Annual Channel Morphology Surveys (Citizen Science)

The Riverwalk is a volunteer based aquatic habitat survey that takes place on an annual basis along an 18-mile stretch of the Santa Ana River. The first Riverwalk occurred in 2006. Data are collected along permanent transects spaced at 300-meter intervals in the fall from the Rialto Channel confluence with the Santa Ana River downstream to I-15 in an effort to inform the quantity, quality, and distribution of suitable habitat for the Santa Ana sucker. Basic data on channel morphology, substrate, and streamside vegetation are collected at predetermined cross-section transects. The size and location of gravel bars are also noted wherever they are encountered along the river. The areas with suitable hard river bottom substrates (>10% gravel and cobble) are shown on Figure 2-29.

Santa Ana Sucker Designated Critical Habitat

There are 6,450 acres of designated critical habitat for Santa Ana sucker in the Planning Area. The upper reaches of the mainstem Santa Ana River (above Rialto Channel) and two of its tributaries, City Creek and Mill Creek, comprise approximately 2,108 acres of the total designated critical habitat for Santa Ana sucker (75 *Federal Register* 77962). The species is extirpated from these reaches due to historic manipulation of the floodplain and surface flow; however, these areas provide essential sources of new coarse sediment (gravel and cobble) needed to maintain the balance of sediment within the occupied lower reaches of the Santa Ana River. Channel maintenance flows are necessary to maintain the process of coarse sediment transport through the river system. Areas downstream of Rialto Channel provide live-in habitat for Santa Ana sucker. Approximately 4,342 acres of designated critical habitat occurs downstream of Rialto Channel within the Planning Area.

Preferred Habitat Criteria for Habitat Distribution Modeling

The amount of modeled preferred habitat for the Santa Ana sucker in occupied reaches of the Santa Ana River was predicted using an approach that incorporated components of the USFWS Instream Flow Incremental Methodology (IFIM) (Bovee et al. 1998) and Physical Habitat Simulation System (PHABSIM) (Milhous & Waddle 2012) methodologies. The approach described below was developed in coordination with a technical advisory committee that consisted of representatives from resource agencies, nongovernmental organizations, and academic institutions. A detailed description of the approach and results are available in *Santa Ana Sucker Habitat Suitability Analysis* (Appendix E).

The Santa Ana sucker habitat suitability model predicts the amount of potentially occupied (preferred) habitat available at various flows. Three variables were used to define and quantify Santa Ana sucker preferred habitat along approximately 21 miles of the Santa Ana River between the Rialto Channel and Prado Dam: water velocity, water depth, and presence of cobble and/or gravel substrate (Table 3-20 and Figure 3-29). The area is considered preferred habitat if it meets the depth and velocity conditions, and has an average of 10% or greater cover of coarse substrate (cobble and/or gravel) as indicated by previous research on Santa Ana sucker habitat preference (Thompson et al. 2010). The sum of all the predicted preferred habitat meeting these criteria over the 21.1-mile-long study reach is 2.15 acres. Although additional portions of the stream are anticipated to be used by this species at any time, the focus of this analysis was on those habitats that meet the water depth, velocity, and substrate criteria for preferred habitat. These criteria are discussed further below.

Water velocity was collected within Santa Ana sucker use areas during native fish surveys (fall season). The minimum velocity found correlated to Santa Ana sucker use, 1.3 feet per second (Table 3-20), approximates the minimum velocity needed to transport sand (1.2 feet per second); therefore, the minimum water velocity preferred by Santa Ana sucker indicates a selection for substrates with exposed substrates larger than sand (fine gravel or larger). In fall months (typical survey period) these habitats can be rare but are vital for providing higher quality substrates for foraging. During periods of limited rainfall (drought) the exposure and/or turning of existing coarse substrate is limited. During these times, baseflow, derived from discharged wastewater, provides the majority of the foraging (year-round) and spawning (primarily late winter and spring) habitats for Santa Ana sucker in the Santa Ana River.

Water depths of habitat commonly used by Santa Ana sucker were also measured during native fish surveys (minimum, 1.3 feet, Table 3-20). Commonly, Santa Ana sucker were found to use deeper portions of the channel created by a stream width constriction or scour pool (e.g., presence of large woody debris), a vegetated stream margin with emergent vegetation or undercut bank, or the outer margin of a meander where the greatest water velocity and depth co-occur. The availability of coarse substrates in these areas and greater water depth provides forage (most commonly various algal species) and added protection from non-aquatic predators, respectively. During the spawning season, exposed coarse substrate (small to medium sized gravel) on the margins of high velocity flow areas (e.g., riffles or runs) or at the downstream end of scour pools (i.e., glide) provides opportunities for reproduction. The extended spawning period observed for Santa Ana sucker (protracted spawning) combined with the production of thousands of eggs, allows a greater opportunity for female fish to search and find multiple appropriate spawning areas throughout the spawning season. This adaptation is well-suited for successful reproduction and recruitment in an ever-changing alluvial stream like the Santa Ana River.

Channel bottom data (substrate) was collected during Riverwalk surveys as described above. Estimates of exposed coarse substrate, presented as average percent cover, were made at each of 109 transects, placed at 300-meter intervals, over approximately 14 miles of potentially occupied stream (Rialto Channel to River Road Bridge), Figure 3-29. This dataset was used to estimate the portions of the stream that consistently were found to have greater than 10% exposed coarse substrate (sum of boulder, cobble, and gravel) over the majority of the collection period of the Riverwalk, including 13 years of data from 2006 to 2018.

While there are other elements of the sucker habitat that could have been included to predict the distribution of preferred habitat (e.g., riparian cover type and amount), the depth and flow velocity are the habitat features most easily measured and integrated into a hydrology model in the context of the IFIM/PHABSIM approach, and amount of coarse substrate has been annually surveyed since 2006. Furthermore, many of the Covered Activities evaluated by this HCP directly affect flow velocity and depth such that these effects can be included in the model to analyze the effects of these Covered Activities (see Chapter 4).

Habitat use data were derived from intensive surveys conducted by USGS on the Upper Santa Ana River. Wulff et al. (2018) provided raw suitability scores for depth and water velocity. These suitability scores were based on direct observations of Santa Ana sucker habitat use over two field seasons in the Santa Ana River in the Planning Area. For this habitat distribution model the suitability scores for Santa Ana sucker habitat preferences (depth and velocity) from 2 years of data collection were combined and the higher of the values for each year was used. When calculating depth suitability, maximum values presented an appropriate use curve (Figure 3-30). However, the data on velocity values were noisy and varied between field seasons. For the purposes of estimating an appropriate velocity suitability curve, maximum values were selected for peaks and median values were inferred for valleys (Figure 3-31). The smoothing of the curve provides a conservative estimate of the preferred habitat use areas for Santa Ana sucker during the periods of sampling. Sampling was confined to daylight hours during the fall when only large young-of-the-year (YOY, 60- to 100-millimeter fork length) and adult Santa Ana sucker were present in the stream. The cohorts of Santa Ana sucker present during the fall season are generally found to overlap in use areas, with adult and YOY fish foraging side by side.

A habitat suitability matrix for water depth and velocity was created by multiplying the velocity suitability scores by the depth suitability scores derived from Wulff et al. (2018). Combined suitability scores greater than 0.50 were considered to represent habitat with suitable velocity and depth, while scores less than 0.50 represent unsuitable habitat, as is consistent with the IFIM/PHABSIM approach (Table 3-20). An assumption supporting these criteria is that flow velocities greater than 1.2 feet per second result in decreased sand deposition and the maintenance of coarser substrates on which the Santa Ana sucker is dependent (based on field observations of reaches of the Santa Ana River occupied by Santa Ana sucker; ESA 2015).

Table 3-20. Santa Ana Sucker Depth by Velocity Habitat Suitability Matrix

	Velocity (feet/second)	**0.66**	**1.31**	**1.97**	**2.62**	**3.28**	**3.94**	**4.59**	**5.25**	**5.91**
Depth (feet)	Habitat Suitability Index	0.09	0.62	0.81	1.00	0.96	0.93	0.90	0.03	0.00
0.33	0.08	0.01	0.05	0.06	0.08	0.08	0.07	0.07	0.00	0.00
0.66	0.09	0.01	0.06	0.07	0.09	0.09	0.08	0.08	0.00	0.00
0.98	0.26	0.02	0.16	0.21	0.26	0.25	0.24	0.23	0.01	0.00
1.31	0.74	0.07	0.46	**0.60**	**0.74**	**0.71**	**0.69**	**0.67**	0.02	0.00
1.64	1.00	0.09	**0.62**	**0.81**	**1.00**	**0.96**	**0.93**	**0.90**	0.03	0.00
1.97	1.00	0.09	**0.62**	**0.81**	**1.00**	**0.96**	**0.93**	**0.90**	0.03	0.00
2.30	1.00	0.09	**0.62**	**0.81**	**1.00**	**0.96**	**0.93**	**0.90**	0.03	0.00
2.62	1.00	0.09	**0.62**	**0.81**	**1.00**	**0.96**	**0.93**	**0.90**	0.03	0.00
2.95	1.00	0.09	**0.62**	**0.81**	**1.00**	**0.96**	**0.93**	**0.90**	0.03	0.00
3.28	1.00	0.09	**0.62**	**0.81**	**1.00**	**0.96**	**0.93**	**0.90**	0.03	0.00
3.61	1.00	0.09	**0.62**	**0.81**	**1.00**	**0.96**	**0.93**	**0.90**	0.03	0.00
3.94	1.00	0.09	**0.62**	**0.81**	**1.00**	**0.96**	**0.93**	**0.90**	0.03	0.00

Combined Suitability Index Range	**Combined Depth and Velocity**
0–.49	Not Suitable
0.50–1.00	**Suitable**

ft/s = feet per second

Modeling the Distribution of Suitable Habitat

The modeling of depth and velocity conditions was performed at seven different assessment sites by applying the Santa Ana sucker habitat suitability criteria to the flow depths and flow velocities

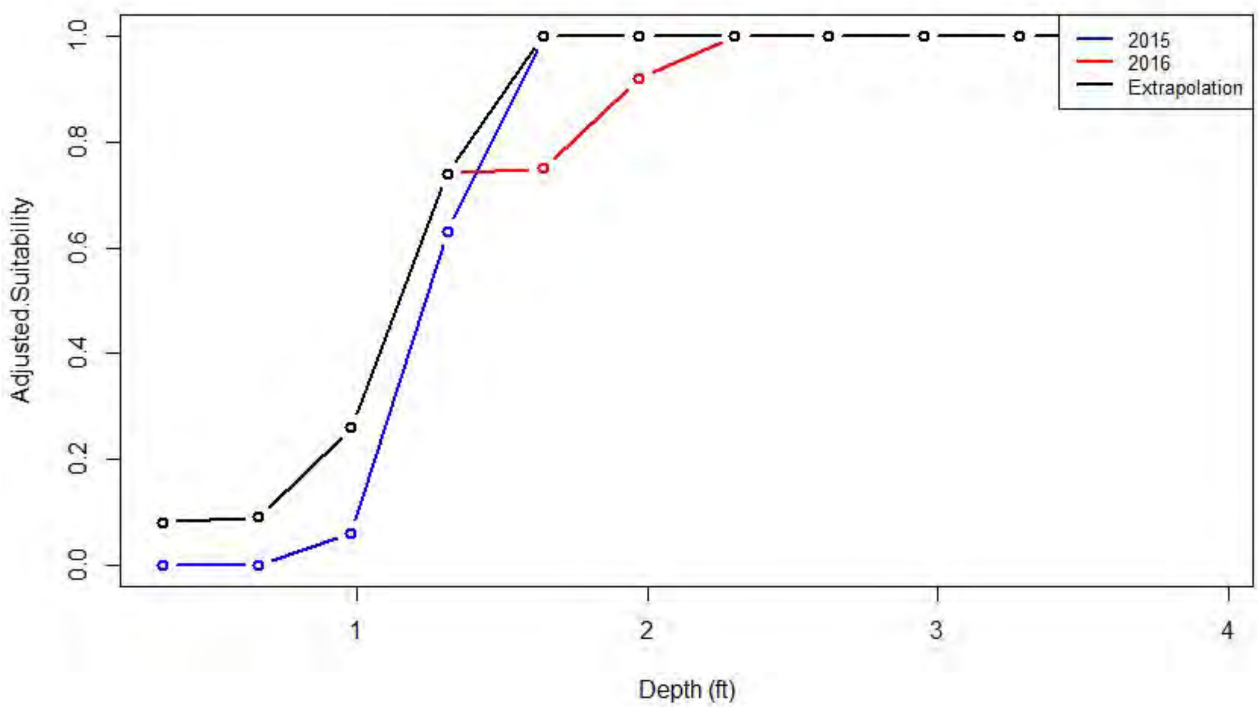


Figure 3-30
Sucker Habitat Flow Depth Suitability Curve
Upper Santa Ana River Habitat Conservation Plan

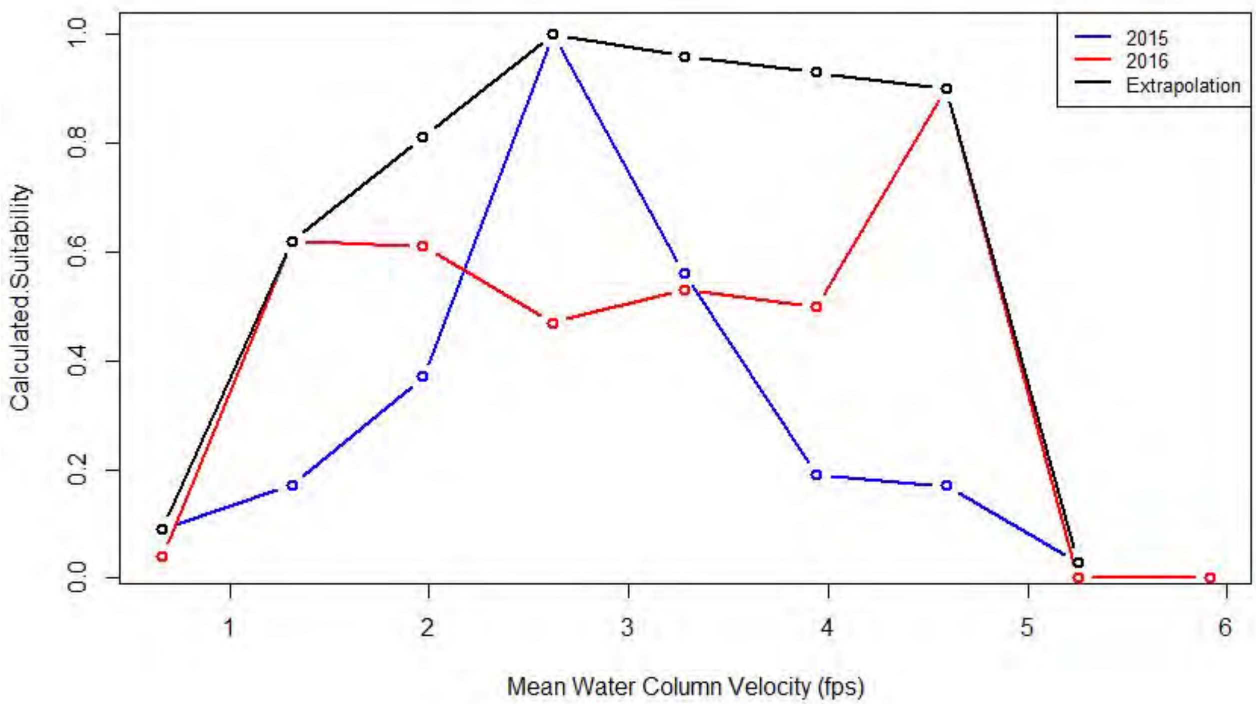


Figure 3-31
Sucker Habitat Flow Velocity Suitability Curve
Upper Santa Ana River Habitat Conservation Plan

modeled in a Two-Dimensional Sedimentation and River Hydraulics model (2D hydraulic model) that was developed for the HCP. Six of the sites are located on the Santa Ana River, from just downstream of the RIX discharge outfall (ESA Upper Reach) to the downstream site (3A) located near Prado Basin Park downstream of I-15. One site is located on the Rialto Channel downstream of the Rialto discharge outfall (see mapped locations on Figure 3-32). The total assessed channel length from the Rialto Channel to the downstream end of the Santa Ana River near Prado is 21.1 miles.

The 2D hydraulic model requires an elevation surface of channel and floodplain elevations. Elevations outside of the low-flow channel were obtained from 2015 LiDAR. All of the assessment sites have perennial flow and thus require bathymetric data of the low-flow channel to supplement the 2015 LiDAR data because LiDAR does not capture underwater elevations. Bathymetry data was available for four of the sites from studies conducted in 2015 (ESA Upper Reach, ESA Middle Reach, ESA Lower Reach, and USGS Reach 9) (ESA 2015, Wright and Minear 2019). New bathymetry surveys were conducted at Reach 3, Reach 3A, and Rialto Reach in 2017. Model elevation surfaces made from the combined bathymetry and LiDAR sources have nodes spaced typically around 3 feet from each other.

A series of flows were modeled for each site that span the range of low flows that typically occur at the sites. The model output for each model node along the continuous 2D modeling surface was queried to assess the combination of depth and velocity at each node. For each modeled flow, calculations were performed to determine the percentage of wetted area in which the combination of depth and velocity values are within the sucker habitat "preferred" range shown in the combined habitat suitability matrix in Table 3-20.

Table 3-21 summarizes the amount of preferred habitat (contains both suitable depth and velocity) determined for all seven of the 2D hydraulic model assessment sites. The table lists the August through October 95% exceedance flow (i.e., base flow conditions, or statistically the flow in the channel is equal to or greater than this magnitude 95% of the time from August through October) for the existing hydrology condition (also shown on Figure 3-33). The months of August through October were selected because this time of year typically has the lowest base flow and conversely the least amount of modeled preferred habitat (foraging habitat) for the year. Habitat quality during the spawning season is maintained by high flow events (storm flow) when sediment is re-activated and larger sediments (gravel and cobble) are turned in the active channel, creating interstitial voids. During periods of drought, storm flow is reduced and limited maintenance of spawning habitat occurs. Spawning during these periods is reliant on baseflow to winnow fine sands off of coarser substrates, exposing appropriate spawning substrates, yet spawning sediments are typically embedded with fine sediment throughout the year. USGS data suggests an increase in recruitment of sucker during years with greater precipitation. The 2015 precipitation year was lower than 2016 (USGS https://waterwatch.usgs.gov, precipitation data not presented) and the Santa Ana sucker population was found to increase from 6,802 to 7,208 fish. Draft data collected by the USFWS in cooperation with the Riverside-Corona Resource Conservation District found a large increase in larval and juvenile Santa Ana sucker in 2016 following high flow storm flow events that turned coarse sediment in active channel. Figures 3-34 through 3-40, show the resulting mapping of suitable depth and velocity for each of the seven assessment sites.

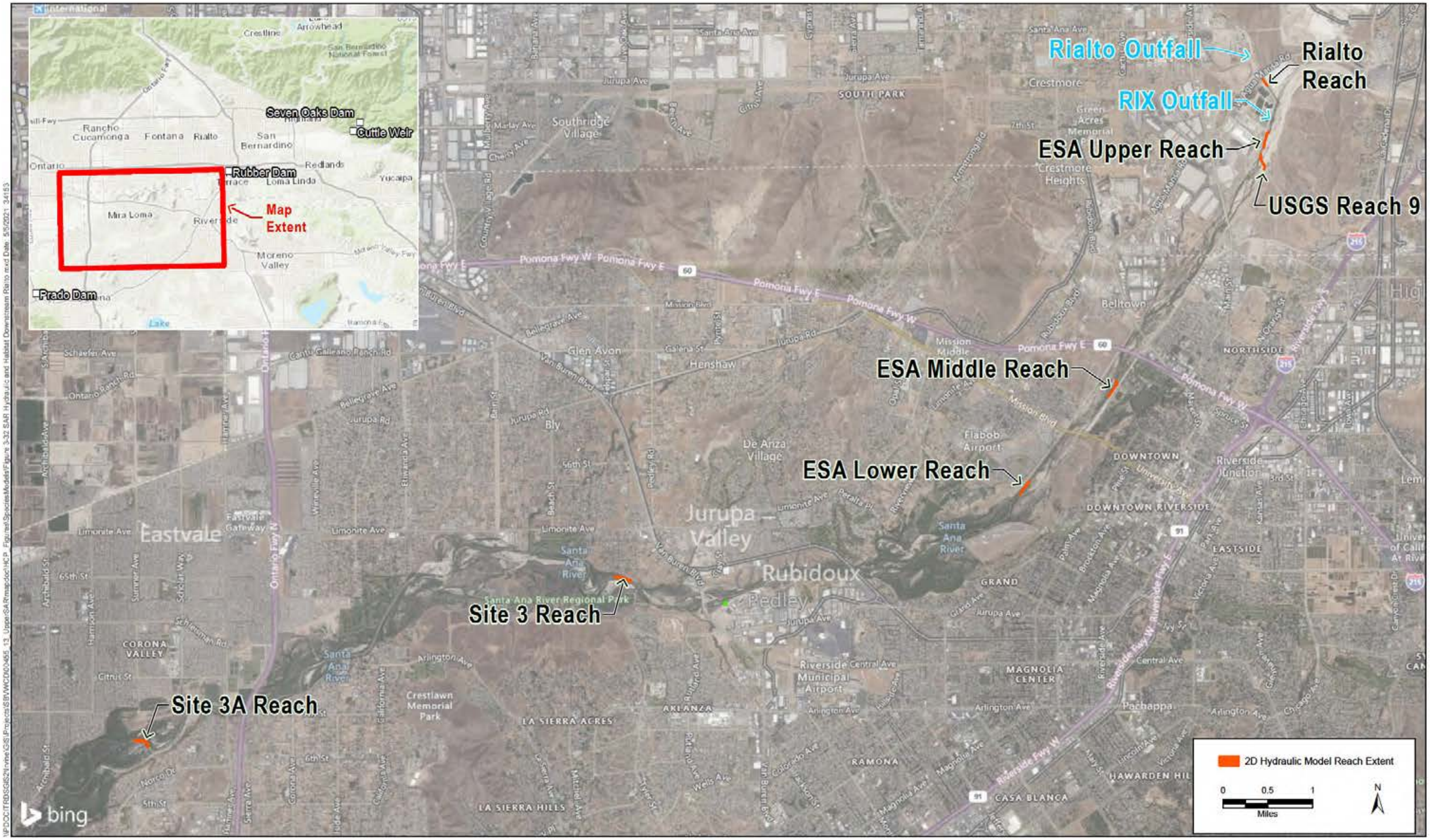
Table 3-21. Summary of Hydrologic Model Characteristics by Santa Ana Sucker Habitat Modeling Site (Upstream to Downstream)

Hydrologic Model Characteristic	Rialto Channel	ESA Upper	USGS Reach 9	ESA Middle	ESA Lower	SAR Site 3	SAR Site 3a
Low Flow Channel Length (feet)	507	1,132	975	1,195	1,048	1,032	1,099
Reach Average Bed Slope (percent)	0.77	0.32	0.39	0.36	0.38	0.25	0.24
Existing Condition Aug–Oct 95% Exceedance Flow (cfs)	9.2	49.0	49.0	31.1	31.1	87.4	63.6
Average Modeled Wetted Channel Width under Existing Condition Aug–Oct 95% Exceedance Flow (feet)	14	26	35	24	40	84	81
Area of Suitable Depth and Velocity under Existing Condition Aug–Oct 95% Exceedance Flow (acres)	0.006	0.202	0.110	0.071	0.012	0.107	0.045
Unit Area of Suitable Depth and Velocity under Existing Condition Aug–Oct 95% Exceedance Flow (acres/1,000 feet of channel length)	0.011	0.179	0.112	0.059	0.011	0.103	0.041
Suitable Depth and Velocity as percent of Total Channel Wetted Area under Existing Condition Aug–Oct 95% Exceedance Flow (percent)	3.3	30.3	14.2	11.0	1.2	5.3	2.2

cfs = cubic feet per second

The process for using the results from the individual assessment sites to interpolate suitability for the entire 21.1-mile long study reach (starting at the Rialto Outfall and extending down the Rialto Channel and then down the Santa Ana River to Prado) is described in Appendix E. The acreage of habitat with suitable depth and velocity, in acres per 1,000 feet of channel length, over the 21.1-mile long study reach is illustrated on Figure 3-41.

There are 110 transects along this 21.1-mile portion of the river that have been surveyed annually from 2006 to 2018 to quantify the amount of coarse substrate (gravel and cobble) along with several other habitat features. The mean percent of gravel and cobble over this 12-year period was calculated. When multiple transects occurred between model nodes the average of the means was taken. Areas were determined to be suitable habitat when the depth and velocity was suitable and the proportion of cobble and gravel substrate was greater than 10% (USFWS 2010c). Table 3-22 shows the acres in each reach meeting all three criteria (depth, velocity, and substrate). The sum of all the predicted preferred habitat meeting these criteria over the 21.1-mile long study reach is 2.15 acres. The reach of river that generally provides suitable habitat for Santa Ana sucker (10% or greater cover of coarse substrate) over the 21.1-mile-long study reach is approximately 6 miles of stream (Rialto channel to Tequesquite Arroyo).



Upper Santa Ana River
Habitat Conservation Plan

Figure 3-32
Santa Ana River Hydraulic & Habitat Modeling Reaches Downstream of Rialto

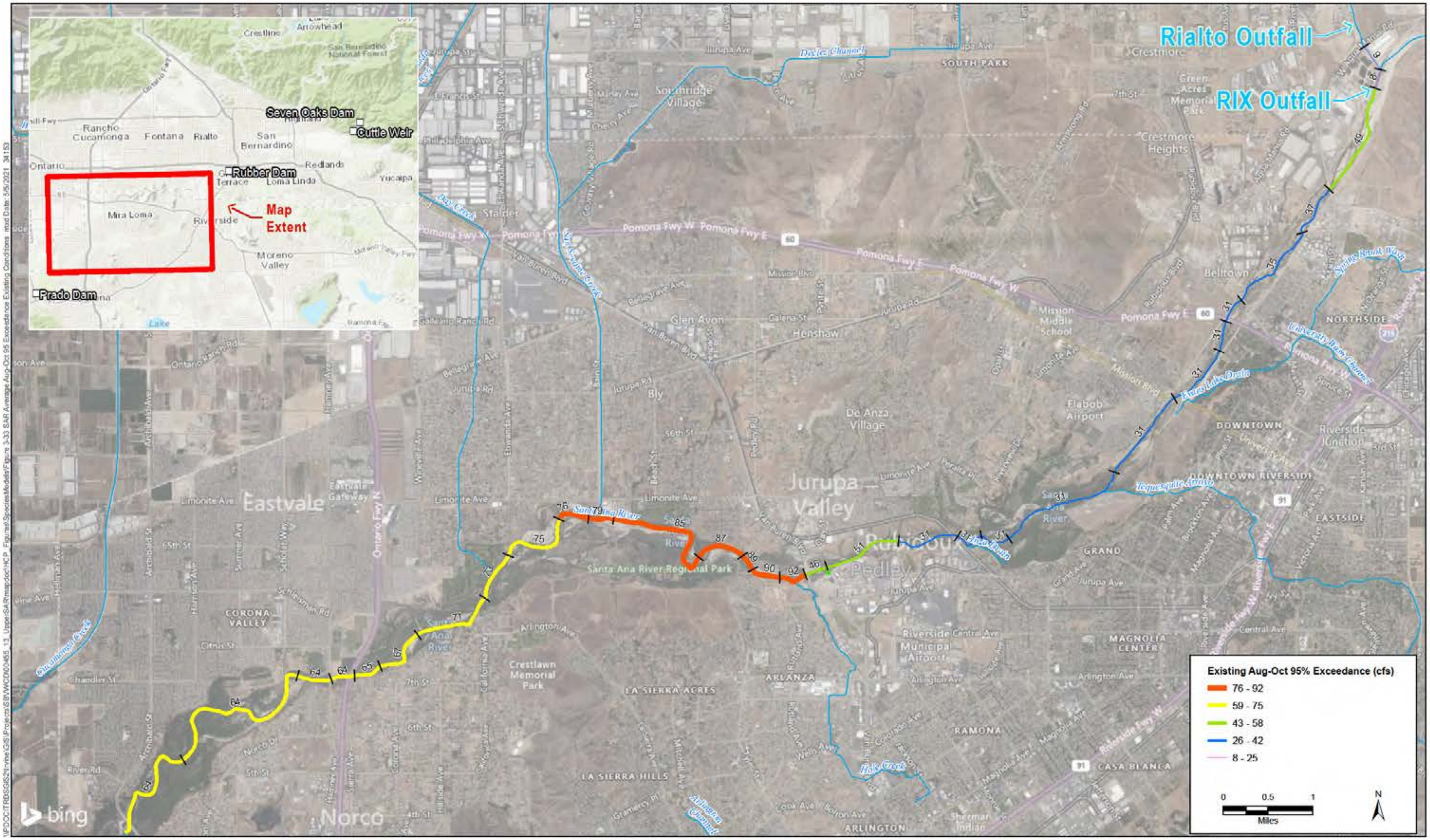


Figure 3-33
Average August-October 95% Exceedance Flow (cfs) for the Existing Condition

Figure 3-34
Santa Ana Sucker Suitable Depth and Velocity
Rialto Reach - Modeled Flow of 9.0 cfs
Upper Santa Ana River Habitat Conservation Plan

Figure 3-35
Santa Ana Sucker Suitable Depth and Velocity
ESA Upper Reach - Downstream of RIX - Modeled Flow of 51.5 cfs
Upper Santa Ana River Habitat Conservation Plan

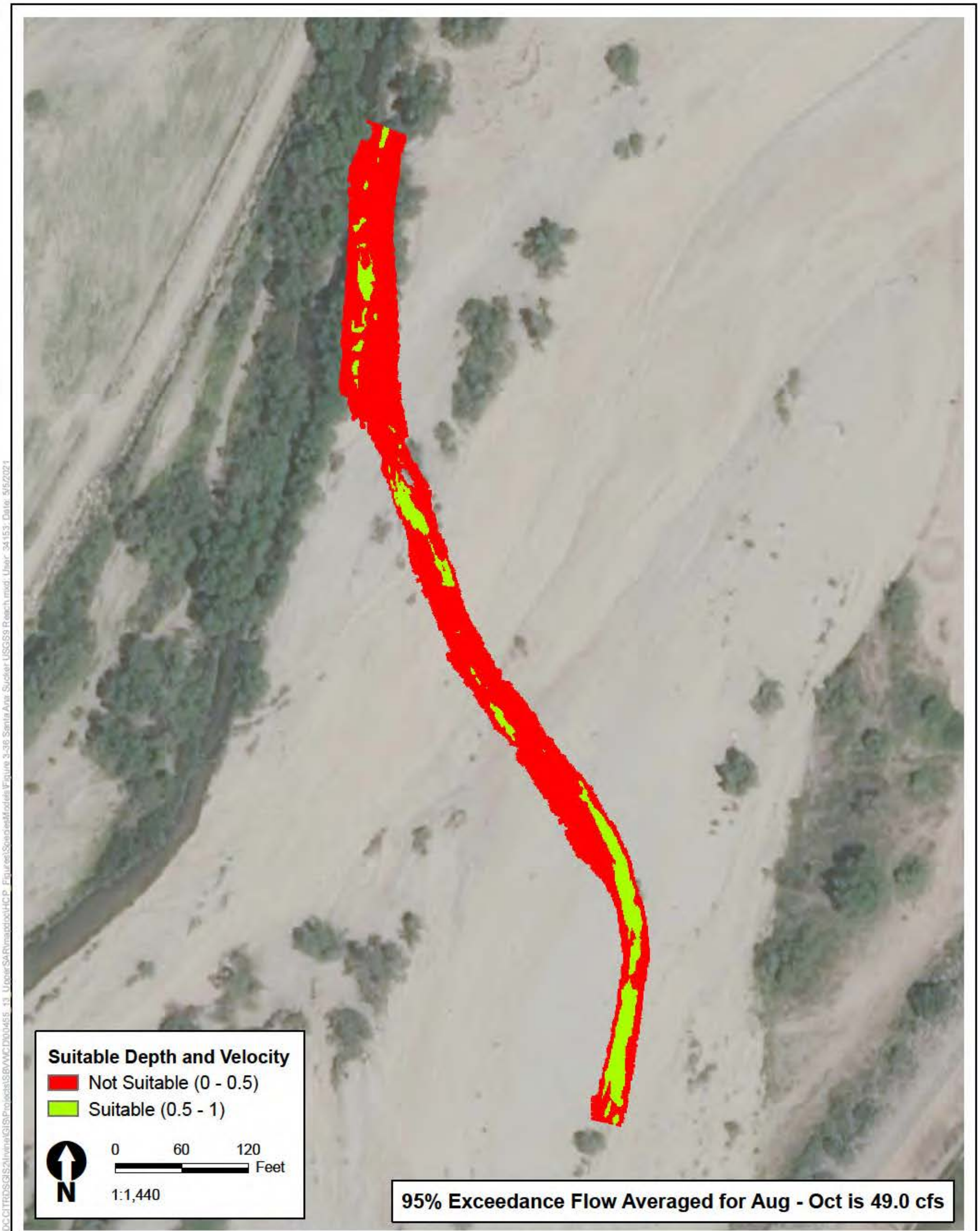


Figure 3-36
Santa Ana Sucker Suitable Depth and Velocity
USGS Reach 9 - Downstream of RIX - Modeled Flow of 51.5 cfs
Upper Santa Ana River Habitat Conservation Plan

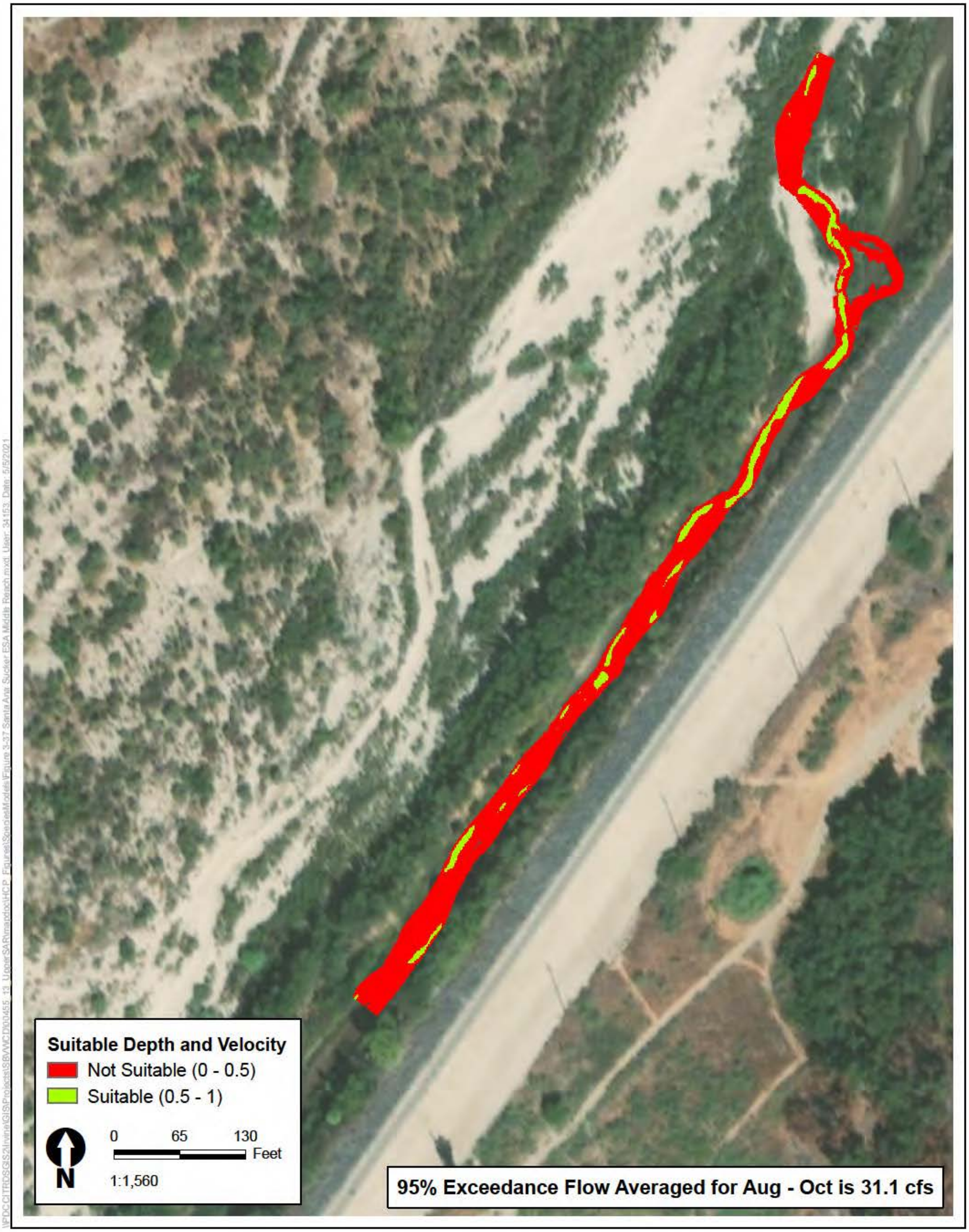


Figure 3-37
Santa Ana Sucker Suitable Depth and Velocity
ESA Middle Reach - Downstream of RIX - Modeled Flow of 32.4 cfs
Upper Santa Ana River Habitat Conservation Plan

Figure 3-38
Santa Ana Sucker Suitable Depth and Velocity
ESA Lower Reach - Downstream of RIX - Modeled Flow of 32.4 cfs
Upper Santa Ana River Habitat Conservation Plan

Figure 3-39
Santa Ana Sucker Suitable Depth and Velocity
Site 3 Reach - Downstream of RIX - Modeled Flow of 67.0 cfs
Upper Santa Ana River Habitat Conservation Plan

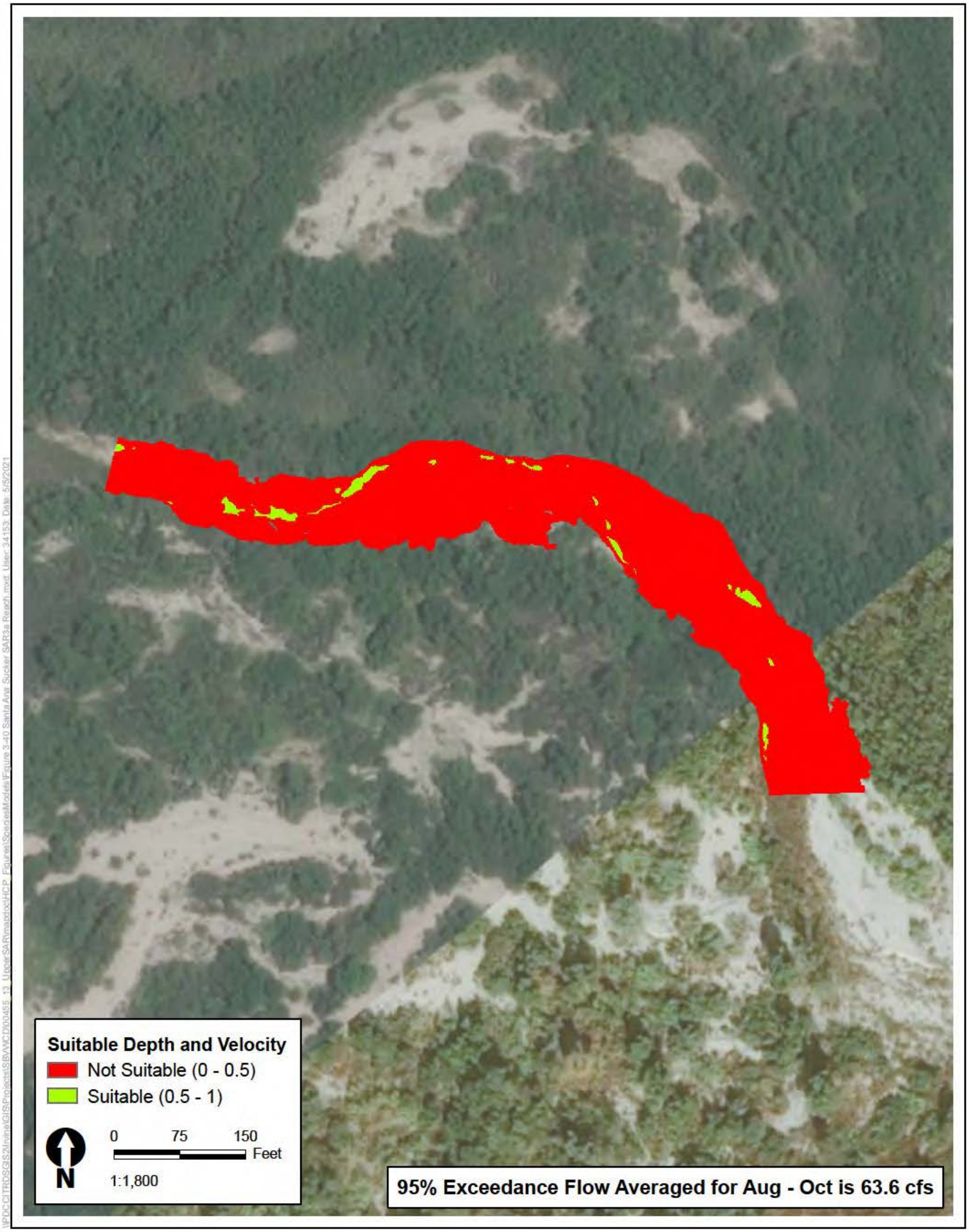
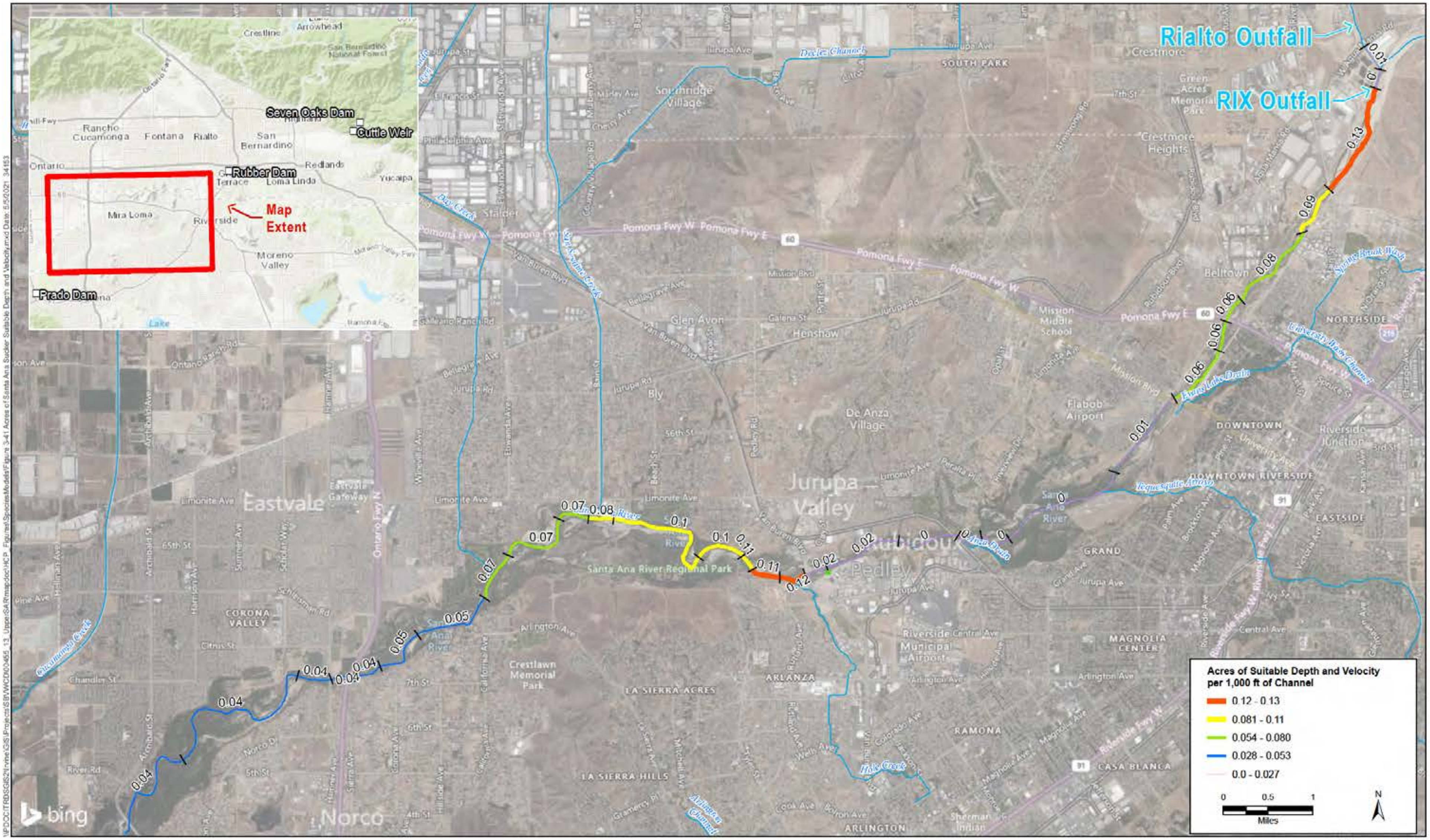


Figure 3-40
Santa Ana Sucker Suitable Depth and Velocity
Site 3a Reach - Downstream of RIX - Modeled Flow of 67.0 cfs
Upper Santa Ana River Habitat Conservation Plan



Upper Santa Ana River Habitat Conservation Plan

Figure 3-41
Acres of Santa Ana Sucker Suitable Depth and Velocity per 1,000 ft of Channel Length under Existing Condition Average Aug-Oct 95% Exceedance Flow

Table 3-22. Acres of Existing Santa Ana Sucker Modeled Habitat in the Planning Area

Reach Description[1]	Hydro Model Node[1]	Reach Length (feet)	Acres of Area with Preferred Depth and Velocity per 1,000 feet	Acres of Area with Preferred Depth and Velocity	Suitable Habitat (>10% Gravel/Cobble Substrate per Riverwalk Surveys[2])
Reaches with Suitable Substrate (>10% Gravel/Cobble)					
Rialto Channel DS of Rialto outfall	NFRC-06	1,705	0.01	0.019	Suitable (55.2%)
SAR DS Rialto Channel & US RIX outfall	NSAR19	1,141	0.00	0.000	Suitable (51.1%)
SAR DS RIX outfall & US Riverside Ave (@ ESA Upper model site)	NSAR20	6,865	0.13	0.910	Suitable (67.6%)
SAR DS Riverside Ave & US node NSAR 22	NSAR21	3,242	0.09	0.279	Suitable (59.2%)
SAR DS node NSAR 22 & US Market St	NSAR22	5,624	0.08	0.425	Suitable (44.2%)
SAR DS Market St & US Hwy 60	NSAR23	1,576	0.06	0.093	Suitable (34.1%)
SAR DS Hwy 60 and US node NSAR 232	NSAR231	1,804	0.06	0.106	Suitable (27.8%)
SAR DS Hwy 60 & US Mission Blvd (@ ESA Middle model site)	NSAR232	4,000	0.06	0.236	Suitable (24.7%)
SAR DS Mission Blvd & US node NSAR 241 (@ ESA Lower model site)	NSAR24	5,679	0.01	0.064	Suitable (20.7%)
SAR DS node NSAR 241 & US node NSAR 242 (Tequesquite Arroyo reach)	NSAR241	7,883	0.00	0.016	Suitable (10.8%)
Total Preferred Habitat				**2.15**	
Reaches without Suitable Substrate (>90% Sand/Silt)					
SAR DS node NSAR 242 & US node NSAR 243	NSAR242	1,842	0.00	0.004	Not Suitable (7.0%)
SAR Anza Creek reach	NSAR243	1,826	0.00	0.004	Not Suitable (8.9%)
SAR DS of Anza Creek/railroad bridge & US pipeline crossing	NSAR244	3,703	0.00	0.008	Not Suitable (6.9%)
SAR DS of pipeline crossing & US RWQCP	NSAR25	4,700	0.02	0.114	Not Suitable (4.6%)
SAR DS of RWQCP & US of Van Buren Blvd	NSAR26	1,305	0.02	0.022	Not Suitable (5.3%)
SAR DS Van Buren Blvd (Hole Creek reach)	NSAR27	1,647	0.12	0.190	Not Suitable (9.2%)

Reach Description[1]	Hydro Model Node[1]	Reach Length (feet)	Acres of Area with Preferred Depth and Velocity per 1,000 feet	Acres of Area with Preferred Depth and Velocity	Suitable Habitat (>10% Gravel/Cobble Substrate per Riverwalk Surveys[2])
SAR DS node NSAR 28 & US node NSAR 29	NSAR28	1,777	0.11	0.197	Not Suitable (6.6%)
SAR DS node NSAR 29 & US node NSAR 30	NSAR29	1,010	0.11	0.107	Not Suitable (4.3%)
SAR DS node NSAR 30 & US node NSAR 301	NSAR30	2,990	0.10	0.306	Not Suitable (3.8%)
SAR DS node NSAR 301 & US node NSAR 31	NSAR301	7,793	0.10	0.741	Not Suitable (5.1%)
SAR DS node NSAR 31 & US node NSAR 311 (San Antonio Creek reach)	NSAR31	1,493	0.08	0.119	Not Suitable (3.9%)
SAR DS node NSAR 311 & US node NSAR 32	NSAR311	1,900	0.07	0.140	Not Suitable (4.3%)
SAR DS node NSAR 32 & US node NSAR 321	NSAR32	4,855	0.07	0.342	Not Suitable (2.4%)
SAR DS node NSAR 321 & US node NSAR 33 (Day Creek reach)	NSAR321	2,968	0.07	0.195	Not Suitable (1.1%)
SAR DS node NSAR 33 & US node NSAR 331	NSAR33	4,953	0.05	0.261	Not Suitable (1.6%)
SAR DS node NSAR 331 & US node NSAR 332	NSAR331	3,354	0.05	0.154	Not Suitable (0.9%)
SAR DS node NSAR 332 & US node NSAR 34 (I-15)	NSAR332	1,724	0.04	0.074	Not Suitable (0.1%)
SAR DS node NSAR 34 (I-15) & US node NSAR 35	NSAR34	1,388	0.04	0.058	Not Suitable (0.8%
SAR DS node NSAR 35 & US node NSAR 351	NSAR35	2,064	0.04	0.086	Not Suitable (0.8%)
SAR DS node NSAR 351 & US node NSAR 352	NSAR351	11,399	0.04	0.474	Not Suitable (0.7%)
SAR DS node NSAR 352 & US node NSAR 36 (entrance into Prado)	NSAR352	7,293	0.04	0.303	Not Suitable (0.0%)

[1] Defines upstream boundary of reach: DS=downstream, US=upstream; NSAR = node Santa Ana River, an identifier from the Wildermuth hydrology model; RWQCP = Regional Water Quality Control Plant.
[2] Average percent gravel/cobble substrate within reach.

Taxonomy and Genetics

Santa Ana sucker is closely related to mountain suckers. The species was originally described as *Pantosteus santaanae*. Subsequently, the genus was reduced to subgenus *Catostomus*. Santa Ana sucker exhibits higher variability in anatomical characteristics than other members of the subgenus *Pantosteus*. Santa Ana suckers hybridize with introduced Owens sucker (*Catostomus fumeiventris*) in Santa Clara River (Moyle 2002). Richmond et al. (2017) studied the metapopulation structure in

Santa Ana sucker using microsatellites and mitochondrial DNA sequence data, finding that only the population on the Santa Clara River upstream of Piru Gap is free of genetic input from *C. fumeiventris*.

Reproduction

Santa Ana sucker become reproductively mature by the first year and spawn during the first and second years (Moyle et al. 1995). Spawning takes place over gravelly riffles (Moyle 2002). Eggs are demersal and adhesive and hatch in 15 days at 55°F (Moyle 2002). Fecundity is high for a small sucker species and increases with size (Greenfield et al. 1970, Moyle 2002). Sucker are able to recolonize suitable habitat rapidly due to high reproductive rates from short generation time, high fecundity, and long spawning period (Moyle 2002, Moyle et al. 1995).

Dispersal, Territoriality, and Home Range

Santa Ana sucker is limited by dams or other impassable structures that preclude further upstream dispersal or migration (i.e., Prado Dam and La Cadena drop structure) in the Santa Ana River (USFWS 2011). The species is highly adaptable to periodic flooding that occurs in Southern California; high reproductive rates allow for recolonization of suitable habitat (Moyle 2002). Territoriality and home range are undocumented.

Daily and Seasonal Activity

Santa Ana sucker spawning typically occurs mid-February to early July, with peak activity in April (Moyle 2002) (Table 3-23).

Table 3-23. Seasonal Spawning Activity of Santa Ana Sucker

Life Stage/ Activity Period	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Spawning												

Source: Moyle 2002, amended to include February.

Diet and Foraging

Algae, diatoms, and detritus make up 98% of the diet of Santa Ana sucker, scraped from coarse substrate with a subterminal mouth. Aquatic insects are also prey as size increases (Greenfield et al. 1970). The Riverside-Corona Resource Conservation District has observed large adults taking insects from the surface on occasion.

Threats and Special Management Considerations

The primary threat to Santa Ana sucker is modification, fragmentation, and loss of habitat through hydrologic modifications (USFWS 2017b). Additional threats include ongoing negative trends in water quantity and quality through reduced availability of surface water; modification to stream processes through reduced flows inhibiting downstream transport of coarse sediments needed for habitat; spread of nonnative giant reed (*Arundo donax*) and other nonnative invasive plant species resulting in negative modification of habitat; and predation by nonnative fishes (bass, sunfish, carp, catfish, tilapia) (USFWS 2017b). Ongoing drought conditions in the Santa Ana basin are exacerbating these threats. In addition, habitat degradation through the spread of the invasive nonnative algae

Compsopogon coeruleus is a recent threat because it forms dense mats, reducing foraging opportunities for the fish (Palenscar 2014). Re-appropriation of treated water that currently provides much of the available water supply for the species is a future threat (USFWS 2011).

Habitat availability has been greatly reduced in the Santa Ana River over the last 200 years because of ongoing (1) channelization, urban runoff, and other undocumented non-point source discharges negatively affecting water quality; and (2) water abstraction for human use reducing or eliminating in-stream flows (USFWS 2011). Habitat suitability in the Santa Ana River within currently occupied reaches is declining because of modified hydrologic processes that may have reduced coarse sediment transport to downstream occupied areas (Moyle 2002). Suitable habitat upstream of Seven Oaks Dam in the upper Santa Ana River, Plunge Creek, and City Creek are being assessed as potential reintroduction sites.

Other Relevant Information

In the Planning Area, suckers concentrate in tributaries or in sections of river that are fed by high-quality effluent from sewage treatment plants (Moyle 2002). Discharged treated effluent makes up the majority of the water present in the mainstem of the Santa Ana River during the dry summer months (USFWS 2011). Santa Ana sucker abundance is predominantly concentrated around the Regional Tertiary Treatment RIX discharge location to approximately Riverside Avenue. Concentrations of all age classes are at times present in the Rialto Drain, although habitat conditions are degraded due to multiple variables such as high summer water temperatures and high abundance of aquatic predator species. Critical habitat in the Planning Area is designated in the Santa Ana River from the Orange-San Bernardino County line to Greenspot Road, City Creek from its confluence with the Santa Ana River to the East-West City Creek fork, and Mill Creek from its confluence with the Santa Ana River to Valley of the Falls Drive.

Changes in flood flows below Seven Oaks Dam result in changes to sediment transport within the Santa Ana River Wash and reaches farther downstream. The operation of Seven Oaks Dam modifies the historic flow regime of the upper Santa Ana River. The reduction in peak flows has reduced both the amount and size of sediment that is transported downstream (USACE 2000), affecting the prevalence of coarse sediment as Santa Ana sucker habitat. Furthermore, the dam creates a discontinuity in sediment transport because it traps the bedload that is transported into Seven Oaks Reservoir, resulting in a reduction in sediment supply downstream.

Arroyo Chub (*Gila orcutti*)

Current Status and Distribution

The arroyo chub (*Gila orcutti*) is a California Species of Special Concern that is native to the streams and rivers of the Los Angeles basin, including the Los Angeles, San Gabriel, San Luis Rey, Santa Ana, and Santa Margarita Rivers (Moyle 2002). Distribution in the Santa Ana River is from Prado Dam upstream past Riverside Avenue, to the RIX and Rialto outflows, where surveys for Santa Ana sucker have documented incidental occurrences (Western Riverside County MSHCP 2012a). A number of tributary streams to the Santa Ana River are also occupied at times, dependent upon flow conditions and water quality, primarily in the Riverside area. This species is scarce in its native range because it does best in lower gradient streams that have largely disappeared due to the degradation of urbanized streams near the Los Angeles metropolitan area (Swift et al. 1993).

Habitat Requirements

Arroyo chub is most common in slow-flowing or backwater areas within warm to cool (50–75°F) streams with sand or mud substrates and a depth greater than 15 inches (Moyle et al. 1995, Swift et al. 1993). This species also occurs in fairly fast-moving streams with velocities over 31 inches per second or more, and in streams with coarse bottoms (CDFG 2010, Moyle 2002, Greenfield and Deckert 1973). The species can also tolerate stream flow intermittency and is adapted to survive in fluctuating streams and shift between fast-moving turbid streams in winter and clear intermittent streams in summer. Arroyo chub can also survive in hypoxic (low oxygen) conditions and in fluctuating temperatures (Western Riverside County MSHCP 2012a).

Distribution of Modeled Preferred Habitat and Documented Occurrences in the Planning Area

Distribution of arroyo chub modeled preferred habitat and documented occurrences in the Planning Area are illustrated on Figure 3-42 and quantified in Table 3-15. The known occupied habitat was mapped directly by species experts based upon habitat preference criteria, documented occurrences, and existing conditions in the Planning Area. This species was found to occupy various habitat types, including fine and coarse substrates within the Santa Ana River (Wulff et al. 2020).

Preferred habitat was modeled for arroyo chub along the same 21.1-mile-long study reach using similar methodology as described for Santa Ana sucker (Appendix E), with the exceptions of water velocity and coarse substrate. Modeled preferred habitat for arroyo chub employed one variable: water depth (greater than 15 inches). The sum of modeled preferred habitat meeting this criterion is 3.7 acres. Although additional portions of the stream are anticipated to be used by this species at any time, the focus of this analysis was on those habitats that meet the water depth criterion for preferred habitat during the dry season low flow conditions.

Taxonomy and Genetics

Arroyo chub readily hybridize with California roach and Mojave tui chubs (Moyle 2002). This species is closely related to other Gila chub from the Southwest, including those found in the Colorado River (Simons and Mayden 1998). Arroyo chub shares the subgenus Temeculina with *Gila purpurea* from Mexico and southeastern Arizona (Western Riverside County MSHCP 2012a).

Reproduction

Females can reproduce at 1 year of age. Most spawning occurs in pools or in quiet edge water at temperatures of 57–72°F (Moyle et al. 1995). Spawning takes place in pools and edge habitat from February to August, with a peak in June and July (Moyle 2002). Eggs are adhesive and are preferentially deposited on available submerged vegetation (Western Riverside County MSHCP 2003). Eggs typically hatch in 4 days, and the fry stay on the substrate for a few days before rising to the surface to stay among plants or other cover for approximately 3 to 4 months (Moyle et al. 1995, Moyle 2002).

Dispersal, Territoriality, and Home Range

Dispersal of arroyo chub is typically up- or down-river and depends on habitat availability and connectivity. The species will disperse to downstream habitat from upstream or tributary spawning areas as it becomes available. On a broad scale, dispersal in the Santa Ana River is limited by Prado

Dam and La Cadena drop structure. On a fine scale, upstream dispersal can often be limited by natural and human-made barriers and drop structures (Western Riverside County MSHCP 2003). There is no documented information on this species' territorial behaviors or on home range size.

Daily and Seasonal Activity

Daily activity patterns are not documented widely for arroyo chub. Some behavior patterns have been documented in the Riverside-Corona Resource Conservation District captive population. Seasonally, spawning occurs from February through August (Table 3-24).

Table 3-24. Seasonal Activity of Arroyo Chub

Life Stage/Activity Period	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Spawning												

Source: Moyle 2002

Diet and Foraging

Arroyo chub feed on plants such as algae and water fern (*Azolla* spp.), and on invertebrates including insects and mollusks, depending on the availability (Moyle 2002). Arroyo chub are typically benthic feeders; however, individuals may also forage on drifting invertebrates when they are prevalent in the water column (Krug et al. 2012).

Threats and Special Management Considerations

Arroyo chub are threatened by habitat degradation from channelization, hardbank stabilization, and flood control projects that alter hydrologic conditions (i.e., decrease flow rate or remove backwater areas). These activities may also block movement by introducing impassable barriers to upstream movement. The species is threatened by habitat degradation through the spread of invasive plant species including giant reed and tamarisk (*Tamarix* spp.) (Moyle 2002, Western Riverside County MSHCP 2003). Arroyo chub are also negatively affected by nonnative predators; for example, they can be displaced through competition with introduced nonnative species such as red shiners (*Cyprinella lutrensis*) (Moyle 2002). Water quality degradation from urban runoff and in-stream discharges also negatively affects habitat quality (Western Riverside County MSHCP 2003).

Conservation management should include maintenance of connectivity through intermediate creek stretches to facilitate exchange between populations. Population exchange and subsequent gene flow is important for long-term persistence of the species. Perennial stream refugia should be protected from nonnative invasive plant and animal species known to negatively impact chub populations. Drop structures or other barriers isolating populations from each other should be identified and assessed for possible removal. The species responds favorably to captive headstarting, and can easily be re-introduced to create new populations. Because of this, unoccupied habitat that is suitable for the species, especially above impassable drop structures, but currently unoccupied should be considered for reintroduction opportunities (Moyle 2002, Western Riverside County MSHCP 2012a).

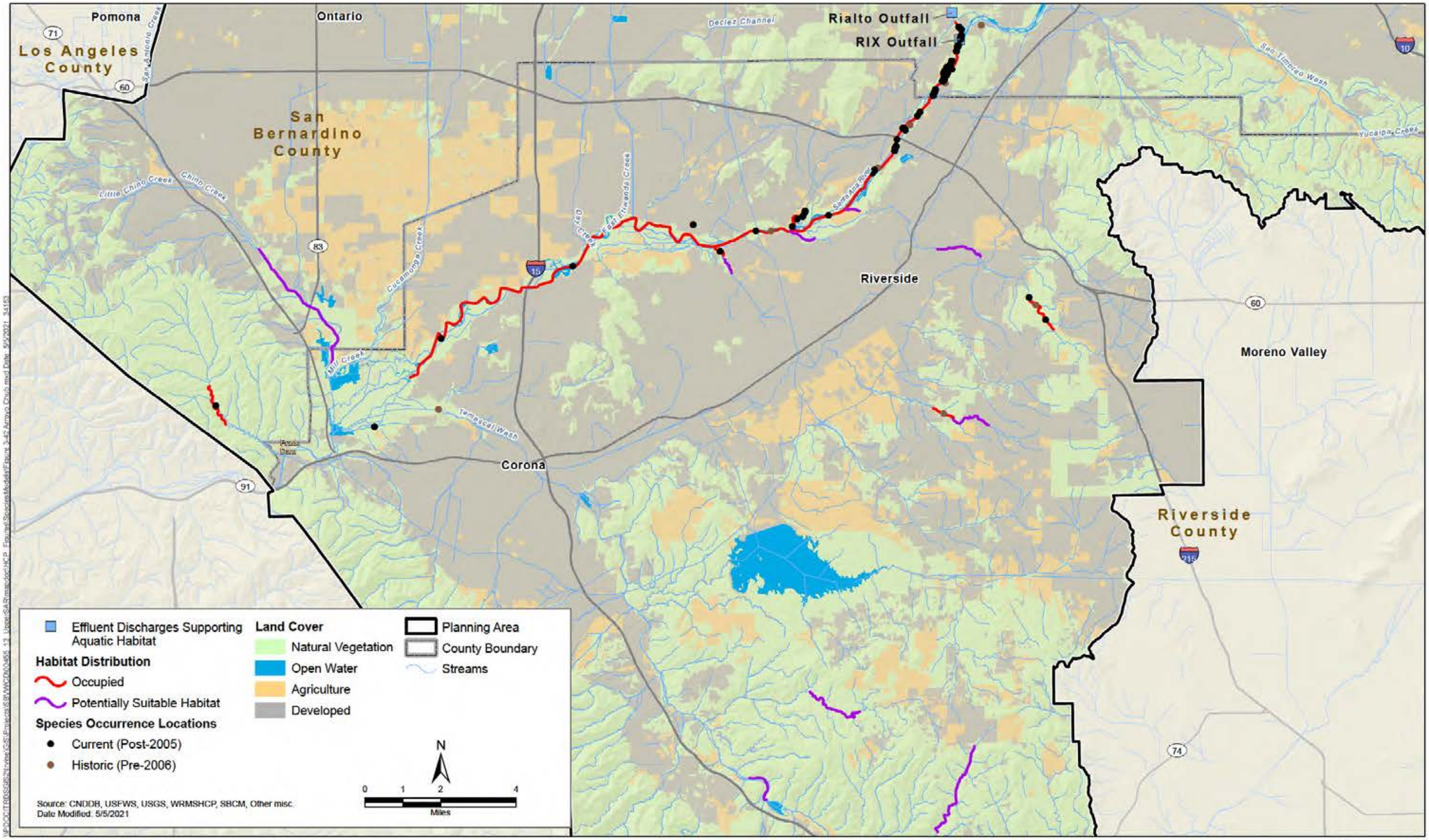


Figure 3-42
Arroyo chub, *Gila orcuttii*
Potential Habitat Distribution and Known Occurrence Records

Santa Ana Speckled Dace (*Rhinichthys osculus*)

Current Status and Distribution

Santa Ana speckled dace (*Rhinichthys osculus*) is a California Species of Special Concern and historically occurred throughout the basin, foothill, and higher elevation portions of the Los Angeles, Santa Ana, and San Gabriel River systems, but currently only occurs in the headwaters of the Santa Ana and San Gabriel Rivers (Moyle et al. 1995). In the Planning Area this species is considered present in Lytle Creek, Cajon Creek, City Creek, and Plunge Creek (Pisces 2014). There are also occurrence records for Mill Creek and Strawberry Creek; however, Santa Ana speckled dace is now assumed to be extirpated from these streams (ICF International 2014, Pisces 2014). After significant winter flows, this species has been found in the mainstem Santa Ana River at the confluence of Warm Springs Creek and below the drop structure at La Cadena Drive; however, these sites do not represent suitable habitat for the species due to higher water temperatures (ICF International 2014, Russell pers. comm).

Habitat Requirements

Santa Ana speckled dace is found primarily in small perennial streams fed by cool springs that maintain summer water temperature below 68°F (Moyle 2002). This species can thrive in shallow (less than 24 inches), rocky riffles and runs with gravel and cobble substrates, which is optimal foraging habitat (Moyle 2002, Moyle et al. 1995). Numbers of dace may actually increase in streams that have been channelized or reduced in flow, providing more preferred riffle habitat (Moyle 2002). Overhanging vegetation is important for cover (Moyle et al. 1995). This species is often most abundant in streams where nonnative sculpins are absent, which compete for habitat and prey (Moyle 2002).

Distribution of Modeled Habitat and Documented Occurrences in the Planning Area

The distribution of the Santa Ana speckled dace in the Planning Area is defined via miles of occupied reaches, and documented occurrences (Figure 3-43). The known occupied habitat and modeled suitable habitat was mapped directly by species experts based upon habitat preference criteria, documented occurrences, and existing conditions in the Planning Area. This species is expected to be present in Fredabla Creek, downstream of the Plunge Creek confluence, Hemlock Creek, Lytle Creek, and Waterman Creek. Potential habitat exists in Strawberry Creek, East Twin Creek, and possibly Horsethief Creek (Pisces 2014, Russell pers. comm.).

Predicted Wetted Area as a Measure of Aquatic Habitat

Wetted area as a measure of aquatic habitat was estimated for Santa Ana speckled dace using the methodology described in Section 3.6.4. Less than 1 acre (0.01 acre) of modeled suitable habitat was found to co-occur with predicted wetted area acreage downstream of Covered Activities.

Taxonomy and Genetics

The genus *Rhinicthys* is distributed throughout North America and has eight recognized species. Species are highly variable and may encompass complexes of unrecognized species or subspecies. This species has not been formally described as a subspecies, but studies indicate that it is genetically distinct (Moyle 2002).

Reproduction

Santa Ana speckled dace spawn throughout the summer with peaks in activity in June and July, likely induced by rising water temperatures. Reproduction rates have not been measured, but are probably high due to the species' ability to recolonize or repopulate areas over a few seasons, when suitable habitat exists (Moyle 2002).

Dispersal, Territoriality, and Home Range

Santa Ana speckled dace has the ability to recolonize or repopulate areas if conditions become too extreme and local populations are greatly depressed by floods, droughts, or winter freezing. Dispersal in the Planning Area is limited by available suitable habitat and by barriers to movement. Santa Ana speckled dace typically occurs in small groups while foraging and are seldom found singly; however, they avoid forming conspicuous shoals except during the breeding season (Moyle 2002).

Daily and Seasonal Activity

Santa Ana speckled dace may be active during the day or night, and activity may depend on vulnerability to avian predators. The species can be active year-round if the temperatures do not drop below 39°F, and spawning occurs March through July (Moyle 2002) (Table 3-25).

Table 3-25. Seasonal Activity of Santa Ana Speckled Dace

Life Stage/Activity Period	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Spawning												

Source: Moyle 2002

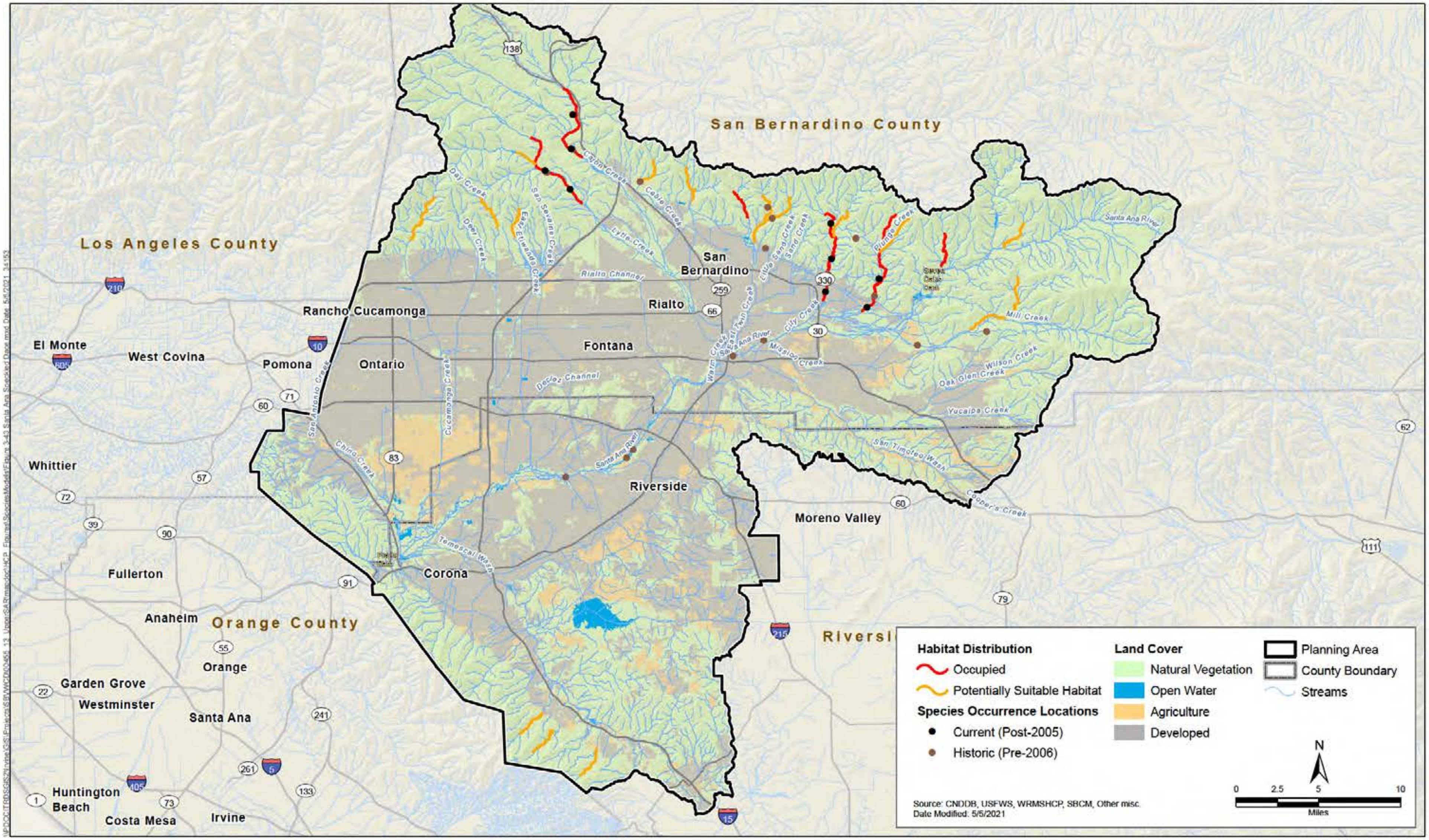
Diet and Foraging

In general, Santa Ana speckled dace forage as bottom-browsers on small invertebrates, especially those taxa found in riffles, such as insect larvae or nymphs (Moyle 2002, Pisces 2014). This species will also feed on filamentous algae (Pisces 2014). The species' diet varies with season and associated prey availability (Moyle 2002).

Threats and Special Management Considerations

Predominant threats to Santa Ana speckled dace include water diversion, urbanization of watersheds, introduction of nonnative species, habitat loss from wildfire, and habitat fragmentation. Where small populations do exist, this species is separated by dry washes most of the year and/or barriers that isolate them and make repopulation impossible. Other threats include recreational use that alters habitat or disturbs behavior, water quality degradation, and drought (Moyle et al. 1995).

Conservation management should include maintenance of connectivity through intermediate creek stretches to facilitate exchange between populations. Population exchange and subsequent gene flow is important for long-term persistence of the species. Perennial stream refugia should be protected from nonnative invasive plant and animal species known to negatively impact dace populations. Drop structures and other barriers isolating populations from each other should be identified and assessed for possible removal. The species responds favorably to captive headstarting and can easily be re-introduced to create new populations. Because of this, unoccupied habitat that is suitable for the species, especially above impassable drop structures, but currently unoccupied



Upper Santa Ana River Habitat Conservation Plan

Figure 3-43
Santa Ana speckleld dace, *Rhinichthys osculus ssp.*
Potential Habitat Distribution and Known Occurrence Records

should be considered for reintroduction opportunities. Surveys are needed to better understand population abundance and trends in the Santa Ana River watershed in the Planning Area. Water diversions that reduce in-stream flows and barriers to movement remain pervasive threats that isolate populations and threaten the species' existence (Moyle et al. 1995).

Arroyo Toad (*Anaxyrus californicus*)

Current Status and Distribution

The arroyo toad (*Anaxyrus* [*Bufo*] *californicus*) is Federally listed as endangered and is a California Species of Special Concern. The known range for the arroyo toad in the Planning Area is limited to San Bernardino County, where it occurs in the Upper Santa Ana River and Cajon Wash basins. It is also known to occur from the mouth of Cucamonga Canyon within and south of the San Bernardino National Forest (USFWS 2009b).

Habitat Requirements

Arroyo toad habitat includes shallow, slow-moving stream and riparian habitats that are naturally disturbed on a regular basis, primarily by flooding, including streams and washes with sandy banks free of dense vegetation with mature willow (*Salix* spp.) stands, cottonwoods (*Populus* spp.), western sycamore (*Platanus racemosa*), riparian habitats of semi-arid areas, and small cobble streambeds (USFWS 2009b). Areas of sandy or friable (readily crumbled) soils are the most important upland habitat for the species, and these soils can be interspersed with gravel or cobble deposits (USFWS 2005). USFWS description of critical habitat physical and biological features (PBFs) includes primary hydrologic regimes that supply water for space, food, and cover to maintain eggs, tadpoles, juveniles, and breeding adults, including low-gradient stream segments and alluvial streamside terraces. Groundwater conditions must support intermittent flows and persisting shallow pools into mid-summer; areas of open, sandy, and dynamic stream channels; and adjacent upland habitat (USFWS 2005, Rohde et al. 2019).

Distribution of Modeled Habitat and Documented Occurrences in the Planning Area

The distribution of arroyo toad modeled suitable habitat, documented occurrences, and designated critical habitat in the Planning Area are illustrated on Figure 3-44 and quantified in Table 3-15. The following modeled habitat types are used to represent the species' habitat distribution in the Planning Area; this includes a listing of the data and/or parameters used to create each modeled habitat type.

Suitable Breeding Habitat

- An average width of 20 feet around specific selected streams mapped as breeding areas or within final critical habitat; **AND**
- **Land Cover**: Water – Intermittent (except within existing groundwater recharge basins); Water – Permanent (except within existing groundwater recharge basins); Water – Seasonal (except within existing groundwater recharge basins); Western North American Freshwater Aquatic Vegetation; Western North American Montane-Subalpine-Boreal Marsh, Wet Meadow, and Shrubland; Western North American Disturbed Marsh, Wet Meadow, and Shrubland; Western North American Temperate and Boreal Freshwater Marsh, Wet Meadow, and Shrubland; Great

Basin-Intermountain Xeric-Riparian Scrub; North American Warm-Desert Xeric-Riparian Scrub; Warm Desert Lowland Freshwater Marsh, Wet Meadow, and Shrubland; and Warm Southwest Riparian Forest.

Non-Breeding Upland Habitat

- Upland areas within a half-mile of Suitable Breeding Habitat (excluding developed, agriculture, disturbed).

Permeable Movement Area (Developed, Agriculture, Disturbed)

- Developed, agriculture, disturbed within a half-mile of Suitable Breeding Habitat.

Arroyo Toad Designated Critical Habitat

There are 1,777 acres of designated critical habitat for arroyo toad in the Planning Area (76 *Federal Register* 7245). The species has largely been extirpated as a result of urban development within the Planning Area and in other parts of the species range. Designated critical habitat within the Planning Area occurs within Cajon Creek, which supports a population of arroyo toad.

Taxonomy and Genetics

Arroyo toad was originally identified as part of the southwestern toad complex (*Bufo microscaphus*), and was considered a subspecies at original listing (*B. m. californicus*) (USFWS 1994). Recent genetic studies now place it in the genus *Anaxyrus* (Frost et al. 2008).

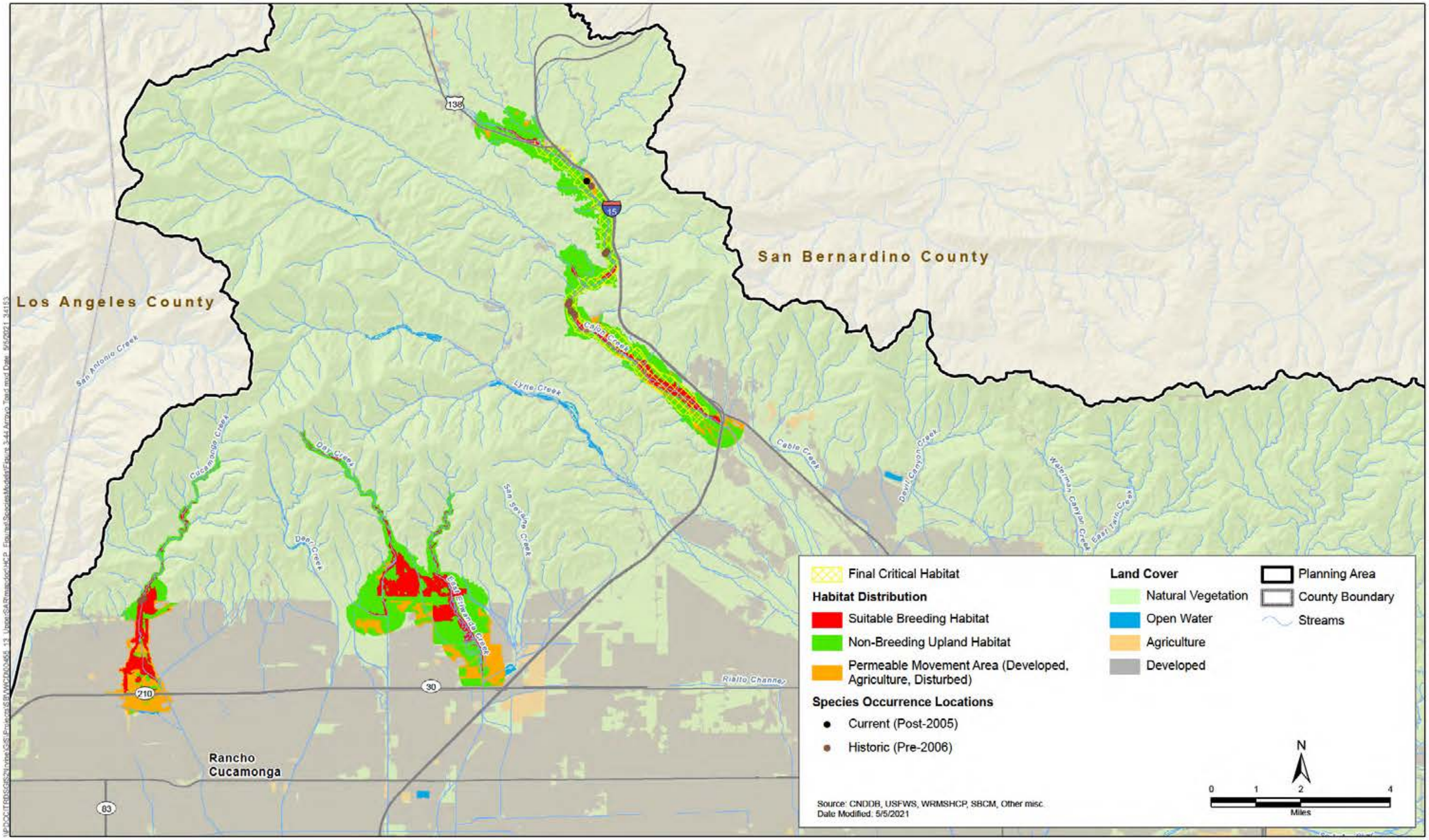
Reproduction

Arroyo toad breeding occurs from late January or February to early July, although it can be extended in some years depending on weather conditions (USFWS 1999). Breeding in mountainous habitats characteristic of the Planning Area populations may commence later (May–June) and last longer (to August) than in the coastal portion of the range. Breeding sites are typically adjacent to sandy terraces (USFWS 1994); at or near the edge of shallow pools, low-flow stream channels, and ox-bows; and along in-stream sand bars with minimal current (0–2 kilometers [1.24 miles] per hour) and have little or no emergent vegetation.

Dispersal, Territoriality, and Home Range

The arroyo toad is capable of moving 0.3 to 1.3 miles into suitable adjacent habitats and may not be constrained by topography (USFWS 1999). In a study using pitfall traps, this species was captured in upland habitats averaging more than 980 to 1,640 feet from two coastal streams; one was captured 3,940 feet beyond the edge of the riparian habitat bordering the stream (Holland and Sisk 2001). Four separate studies of inland populations (Ramirez 2002a, 2002b, 2002c, 2003) showed that this species burrowed no farther than 1,062 feet from the edge of a stream, with an overall average of 52 feet between burrow locations and the edge of the stream. These larger movements may be associated with dispersal, as additional work has shown arroyo toads to have high site fidelity, moving less than 300 feet during the breeding season (Mitrovich et al. 2011).

Home range is influenced by rainfall amounts, availability of surface water, width of streamside terraces and floodplains, vegetative cover, and topography (Griffin et al. 1999, Ramirez 2000a). Females have been documented to use riparian and upland habitats an average maximum distance of 443 feet with a maximum of more than 984 feet perpendicular to streams, while males move an



ICF Upper Santa Ana River Habitat Conservation Plan

Figure 3-44
Arroyo toad, *Anaxyrus californicus*
Potential Habitat Distribution and Known Occurrence Records

average maximum distance of 240 feet from streams. Within-stream movement was documented up to 492 feet. Juvenile dispersal is shown to be 0.5 to 0.6 mile (Sweet 1993).

Daily and Seasonal Activity

Arroyo toad is primarily nocturnal, though activity of tadpoles often extends throughout the day. Adult activity begins after the onset of fall rains and continues through the typical breeding period (January–August) (Table 3-26). The species enters aestivation during the non-breeding season (August–January) (USFWS 1999).

Table 3-26. Seasonal Activity of Arroyo Toad

Life Stage/ Activity Period	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Breeding												

Source: USFWS 1999

Diet and Foraging

Tadpoles are highly specialized feeders on loose organic material such as detritus, interstitial algae, bacteria, and diatoms (Sweet 1992). Subadults and adults are opportunistic feeders, foraging on immediately available prey throughout both their breeding and upland habitats. Adults feed on a variety of invertebrates, including snails, Jerusalem crickets, beetles, ants, caterpillars, and moths.

Threats and Special Management Considerations

Historically, because habitats are favored sites for dams and reservoirs, roads, mining, agriculture, livestock grazing, urbanization, and recreational facilities (such as campgrounds and off-highway vehicle parks), many arroyo toad populations were reduced in size or extirpated due to extensive habitat loss that occurred from about 1920 to 1980 (USFWS 1999).

Introduced plants and predators (bullfrog, African clawed frog, crayfish, and green sunfish) have had substantial impacts on existing populations, and may have contributed to regional extirpation. Nonnative invasive plant species (e.g., tamarisk, giant reed, iceplant, pampas grass) degrade habitat by contributing to altered hydrology, eliminating sandbars and breeding pools, and restricting the quality and access to upland habitats. Active management of weeds may benefit arroyo toad populations by reducing weed cover of sandy soils that are essential refugia habitat for the species. Arroyo toads are highly vulnerable to habitat degradation resulting from changes in groundwater levels because they are so dependent on riparian vegetation for foraging and on perennial still pools for development and metamorphosis (i.e., the time it takes for this species to transform from a tadpole to frog) that span a minimum of two summer months (Rohde et al. 2019). Because native ants are a major food source for juveniles during the rapid growth stage in the weeks following metamorphosis, the spread of the nonnative Argentine ant into arroyo toad habitat may displace native ants and other macro invertebrates and thus negatively affect arroyo toad (Mitrovich et al. 2010, Stephenson and Calcarone 1999).

Other Relevant Information

The Upper Santa Ana River Basin/Cajon Wash Critical Habitat Unit (Unit 20) is the only critical habitat unit in the Planning Area, and supports a population that may represent some of the last vestiges of a much greater population that historically existed along the upper Santa Ana River Basin. Improved conservation of this location is important to maintain the current geographic extent of the species. Unit 20 contains the PBFs that are essential to the conservation of the species, including aquatic habitat for breeding and non-breeding activities (PBFs 1, 2, and 3) and upland habitat for foraging and dispersal activities (PBF 4). This habitat has been disturbed and fragmented over time; therefore, the PBFs essential to the conservation of the species in this unit may require special management considerations or protection to address threats from recreational activities (USFWS 2005).

Mountain Yellow-Legged Frog (*Rana muscosa*)

Current Status and Distribution

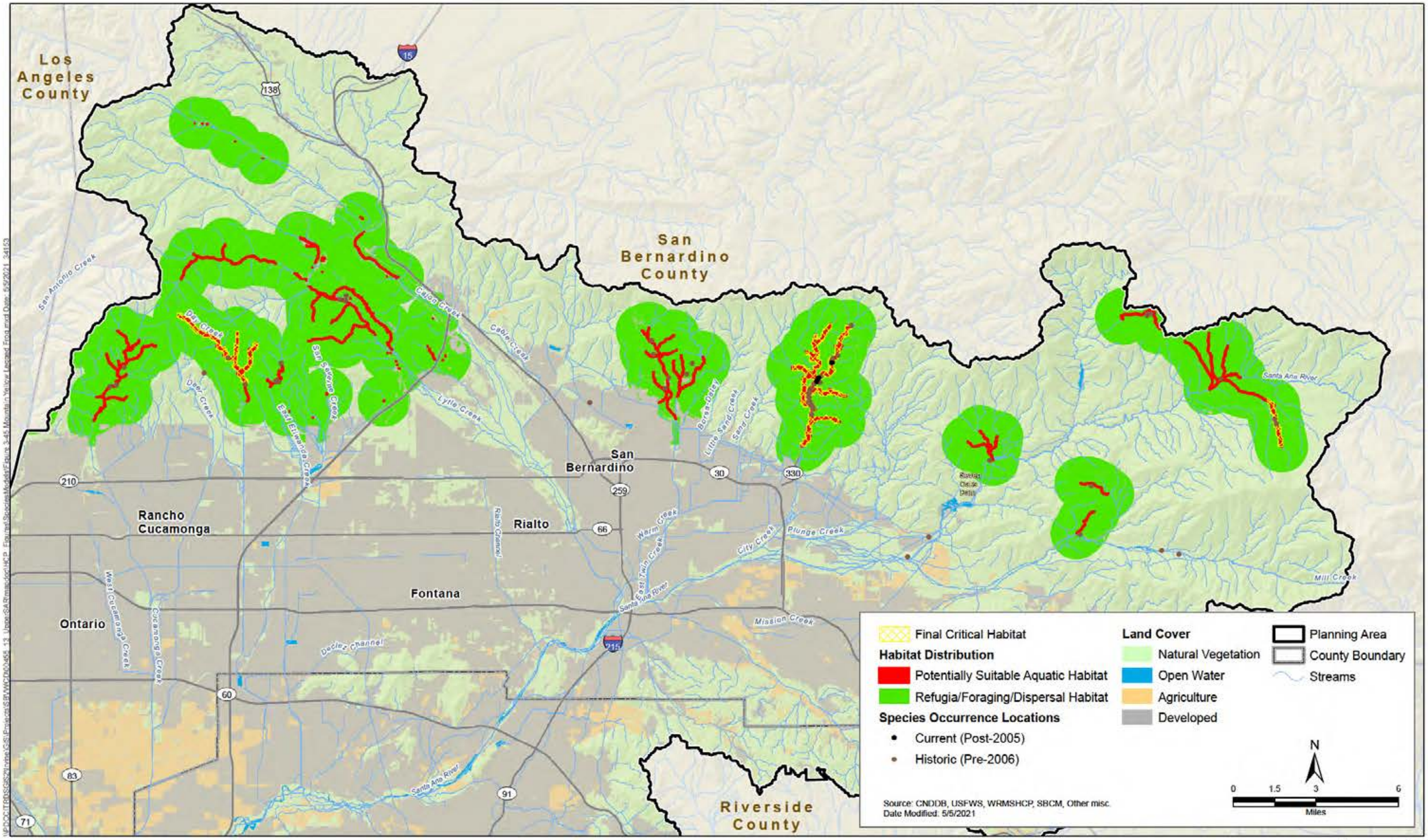
The mountain yellow-legged frog (*Rana muscosa*) is Federally and State listed as endangered and occurs in the San Gabriel, San Bernardino, and San Jacinto Mountain Ranges, in Los Angeles, Riverside, and San Bernardino Counties. In the San Gabriel Mountain Range, known populations occur in Devil's Canyon, Little Rock Creek, South Fork Big Rock Creek, Vincent Gulch, and Bear Gulch. In the San Jacinto Range, known populations occur in Fuller Mill Creek, Dark Canyon, and Tahquitz-Willow Creek (ICF 2014). The status of individuals that were previously salvaged, maintained in captivity, and then released in Indian Creek and Hall Canyon are unknown as of 2012. In the San Bernardino Mountain Range, the only known extant population occurs in East Fork City Creek. Populations occur from 370 to 2,290 meters (1,200 to 7,500 feet) in elevation (USFWS 2012).

Habitat Requirements

In Southern California, habitat typically consists of rocky and shaded streams with boulders or vegetation growing along the water's edge (USFWS 2012, Jennings and Hayes 1994) 3 feet away from water (Stebbins 2003). This species is found in creeks and streams with at least some portion with permanent water. Perennial flows are needed for reproduction, larval growth and survival, and hydration of juveniles and adults. The species is absent from the smallest creeks because these habitats lack the depth for aquatic refuge and overwintering (USFWS 2012, Jennings and Hayes 1994). Occupied habitat at City Creek consists of pools, rapids, and small waterfalls, with some structure that could function as refugia (cover from predators) such as bank overhangs, rocks, and downed logs, although aquatic vegetation is minimal (USFWS 2012). The USFWS description of critical habitat PBFs includes aquatic habitat with characteristics suitable for breeding, rearing, and non-breeding (over-wintering) as well adjacent upland areas providing feeding and movement habitat (USFWS 2006).

Distribution of Modeled Habitat and Documented Occurrences in the Planning Area

The distribution of mountain yellow-legged frog modeled suitable habitat, documented occurrences, and designated critical habitat in the Planning Area are illustrated on Figure 3-45, and quantified in Table 3-15. The following modeled habitat types are used to represent the species' habitat distribution in the Planning Area; this includes a listing of the data and/or parameters used to create each modeled habitat type.



ICF

Upper Santa Ana River Habitat Conservation Plan

Figure 3-45
Mountain yellow-legged frog, *Rana muscosa*
Potential Habitat Distribution and Known Occurrence Records

Potentially Suitable Aquatic Habitat

- Within 100 feet of: National Hydrography Dataset perennial streams/waterbodies or National Wetlands Inventory (NWI) permanently flooded ponds or all streams within final critical habitat or all streams with documented or possibly extirpated occurrences – removed open water to retain perimeter of larger water bodies.

Refugia/Foraging/Dispersal Habitat

- **Landcover:** All landcover except Developed and Agriculture within 4,920 feet of Potentially Suitable Aquatic Habitat.

Mountain Yellow-Legged Frog Designated Critical Habitat

There are 2,216 acres of designated critical habitat for mountain yellow-legged frog in the Planning Area (81 *Federal Register* 59045). The species is extirpated across a majority of its range, including within the Planning Area. Critical habitat is located in Day Canyon in the San Gabriel Mountains, and the East and West Forks of City Creek.

Predicted Wetted Area as a Measure of Aquatic Habitat

Wetted area as a measure of aquatic habitat was also estimated for mountain yellow-legged frog using the methodology described in Section 3.6.4. Less than 1 acre (0.2 acre) of modeled suitable habitat was found to co-occur with predicted wetted area acreage downstream of Covered Activities (Table 3-16).

Taxonomy and Genetics

Mountain yellow-legged frogs were once considered one species, *Rana muscosa* throughout its range. Vrendenburg et al. (2007) clarified the taxonomy of mountain yellow-legged frog by analyzing the mitochondrial DNA, acoustic data, and morphological characteristics. His study showed two distinct species of mountain yellow-legged frogs: *R. sierra* in the northern and central Sierra Nevada and *R. muscosa* in the southern Sierra Nevada and Southern California. Within *R. muscosa*, three clades were identified (two in the southern Sierra Nevada and one in Southern California). The Southern California clade is disjunct from the clades in the Sierra Nevada and occurs in Los Angeles, Riverside, and San Bernardino Counties (USFWS 2012).

Reproduction

In Southern California, breeding occurs from March through August. Breeding commences as soon as aquatic habitat is free of snow and ice and when high waters subside (Stebbins 2003). Oviposition occurs in shallow water and egg masses are often clustered and are generally unattached in ponds and lakes, but may be attached to underwater structures in streams (Jennings and Hayes 1994). Metamorphosis is variable and dependent upon temperature (USFWS 2012), and can occur as quickly as one season at low elevations and up to three seasons at high elevation (Jennings and Hayes 1994). For southern populations, metamorphosis likely occurs at the end of the second summer when second year tadpoles are 1.5 years old. Hibernation and aestivation occur between November and January and between July and September, respectively (USFWS 2012). Breeding typically occurs between March and August (Jennings and Hayes 1994).

Dispersal, Territoriality, and Home Range

Dispersal often takes place along available aquatic habitat, but may occur through upland habitats as well. Dispersing individuals can travel long distances (up to 1,500 meters) in search of new territories or for breeding purposes (USFWS 2012). Longer dispersals generally occur soon after emerging from hibernation in the spring or before returning to hibernacula in the winter. Longer movements may occur due to drying of habitat (Matthews 2003).

Daily and Seasonal Activity

Larvae select warmer microclimates to keep relatively high body temperatures and often congregate in shallow waters during the day to increase body temperature. Adults are generally diurnal, and hibernate during winter months beneath ice-covered streams, lakes, and ponds. Adults emerge from hibernation immediately following snowmelt. During the active season, adults maximize their body temperatures at all times of the day by basking in the sun by moving between the warmer shallows along the shoreline and rocks on the shoreline (Jennings and Hayes 1994). Adults in Southern California will aestivate during the drier periods of late summer (Matthews 2003) (Table 3-27).

Table 3-27. Seasonal Activity of Mountain Yellow-Legged Frog

Life Stage/Activity Period	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hibernation	■	■									■	■
Aestivation (in dry conditions)							■	■	■			
Breeding			■	■	■	■	■	■				

Sources: USFWS 2012, Jennings and Hayes 1994

Diet and Foraging

Adults feed opportunistically on other amphibians, beetles, flies, ants, bees, wasps, and true bugs (Jennings and Hayes 1994). Larvae feed on algae and diatoms located along the rocky bottoms of streams (Matthews 2003).

Threats and Special Management Considerations

The decline of mountain yellow-legged frog in Southern California is severe, with loss at approximately 99% of historical sites thought to be due to chytrid fungus, predation by introduced trout, habitat degradation due to mining, public dumping, and off-road vehicles, stream channelization, fire and post-fire debris flows, and pollution (CaliforniaHerps 2014, Morey 1988). Additionally, physical isolation has caused inbreeding, resulting in genetic isolation. Catastrophic natural events such as fires or flooding increase the likelihood of extirpation of small, isolated populations (USFWS 2012). Drought can also result in large mortality events if larval habitat evaporates. Mountain yellow-legged frogs depend on perennial water sources that do not fully freeze in winter. Changes in groundwater levels that reduce the necessary depth for overwintering tadpoles or increase oxygen depletion for overwintering adults may negatively affect this species (Rohde et al. 2019).

Translocation is often discussed as a possible management tool to reestablish threatened and endangered animals to areas where they have been extirpated. However, in the case of mountain yellow-legged frogs, one study found that because they are highly philopatric, translocated adult frogs can return to their capture site following short distance translocations and possibly from longer distance translocations. Additionally, translocating adult frogs can cause stress on the animals resulting in the loss of body mass. Matthews (2003) suggests that translocation of egg masses or tadpoles may have greater success and less stress as the homing would presumably not be as developed. More information on the viability of re-introducing the species via egg masses or tadpoles is needed to assess this as a potential management tool (USFWS 2012). Trout removal in the headwaters of some systems appears to be a potential tool for expanding available habitat for the species. Additional information regarding potentially suitable reintroduction sites is needed, including the presence and distribution of perennial waters, chytrid fungus, and nonnative invasive fish species at any proposed sites (CDFG 2011).

The Southern California population is critically endangered. To increase this population, San Diego Zoo Global has a southern mountain yellow-legged frog recovery project that began approximately 13 years ago. The Los Angeles Zoo, Henry Doorly Zoo, CDFW, USFWS, USGS, and the U.S. Forest Service are also part of this collaborative effort to re-introduce captive-bred frogs in Southern California. This program has released froglets and tadpoles into the frog's historic range in Southern California. In June of 2018, San Diego Zoo Global released 250 froglets in the San Bernardino National Forest (U.S. Forest Service 2018).

Western Spadefoot (*Spea hammondii*)

Current Status and Distribution

The western spadefoot (*Spea hammondii*) is a California Species of Special Concern and is endemic to California and northern Baja California (Jennings and Hayes 1994). This species occurs in the Central Valley, Coast Ranges, and Southern California south of the Transverse Range and west of Peninsular Mountains from near sea level to around 4,500 feet above sea level (CaliforniaHerps 2014). Western spadefoot has been extirpated from much of Southern California but persists in coastal Orange, western Riverside, southwest San Bernardino, and inland San Diego Counties (Stebbins 2003). This species occurs in the central and southern portions of the Planning Area, along I-15 south of Corona, just east of I-215 near March Air Force Base, and in the Santa Ana River basin just downstream from and at scattered locations along the base of the San Bernardino Mountains (ICF 2014, Braden pers. comm).

Habitat Requirements

Western spadefoot occurs primarily in lowland areas including river floodplains, alluvial plains, playas, and alkali flats (Stebbins 2003). This species prefers habitats with sandy or gravely soils and requires slow-moving edges of rivers and streams or temporary rain pools with temperatures >48°F to <86°F in which to breed. Pools need to last at least 3 weeks to allow successful metamorphosis (CaliforniaHerps 2014, Jennings and Hayes 1994). Breeding habitat includes vernal pools and artificial impoundments such as stock ponds and pools that form at the bases of road and railroad grades, and pooled areas of ephemeral streams (Jennings and Hayes 1994). Suitable breeding habitat must be free of bullfrogs, crayfish, or fish (AmphibiaWeb 2014, CaliforniaHerps 2014). Upland habitats include grasslands, oak woodlands, coastal sage scrub, and chaparral in the vicinity of breeding pools, and the species prefers open areas with short grasses (AmphibiaWeb 2014, Stebbins 2003).

Distribution of Modeled Habitat and Documented Occurrences in the Planning Area

Distribution of western spadefoot modeled habitat and documented occurrences in the Planning Area are illustrated on Figure 3-46, and quantified in Table 3-15. The following modeled habitat types are used to represent the species' habitat distribution in the Planning Area; this includes a listing of the data and/or parameters used to create each modeled habitat type.

Potentially Suitable Habitat

- **Land Cover**: Californian Annual and Perennial Grassland, Warm Southwest Riparian Forest, North American Warm-Desert Xeric-Riparian Scrub, Californian Chaparral, and Californian Coastal Scrub; Barren; **AND**
- **NWI and SoCal Wetlands hydrology attribute modifier**: Seasonally Flooded, Temporarily Flooded, Artificially Flooded; Upper Santa Ana River Wash Plan recharge basin; NWI freshwater pond; and SoCal Wetlands pond, detention basin; **AND**
- **Soil Texture**: sand, sandy loam, coarse sand, coarse sandy loam, fine sand, fine sandy loam, loamy sand, loamy coarse sand, loamy fine sand, river wash, very fine sandy loam, clay, and loam; **AND**
- **Landform**: alluvial flats; alluvial fans; alluvial plains; channels; floodplains, foothills, terraces, and uplands; also drainageways regardless of land cover type; **AND**
- **Elevation**: 0–2,953 feet; **AND**
- **Slope**: 0–3%; **AND**
- Must be a 536-acre block of natural contiguous open space grouped using a maximum separation distance of 25 feet.
- **Post-processing:** Removed fragmented and isolated patches surrounded by development.

Predicted Wetted Area as a Measure of Aquatic Habitat

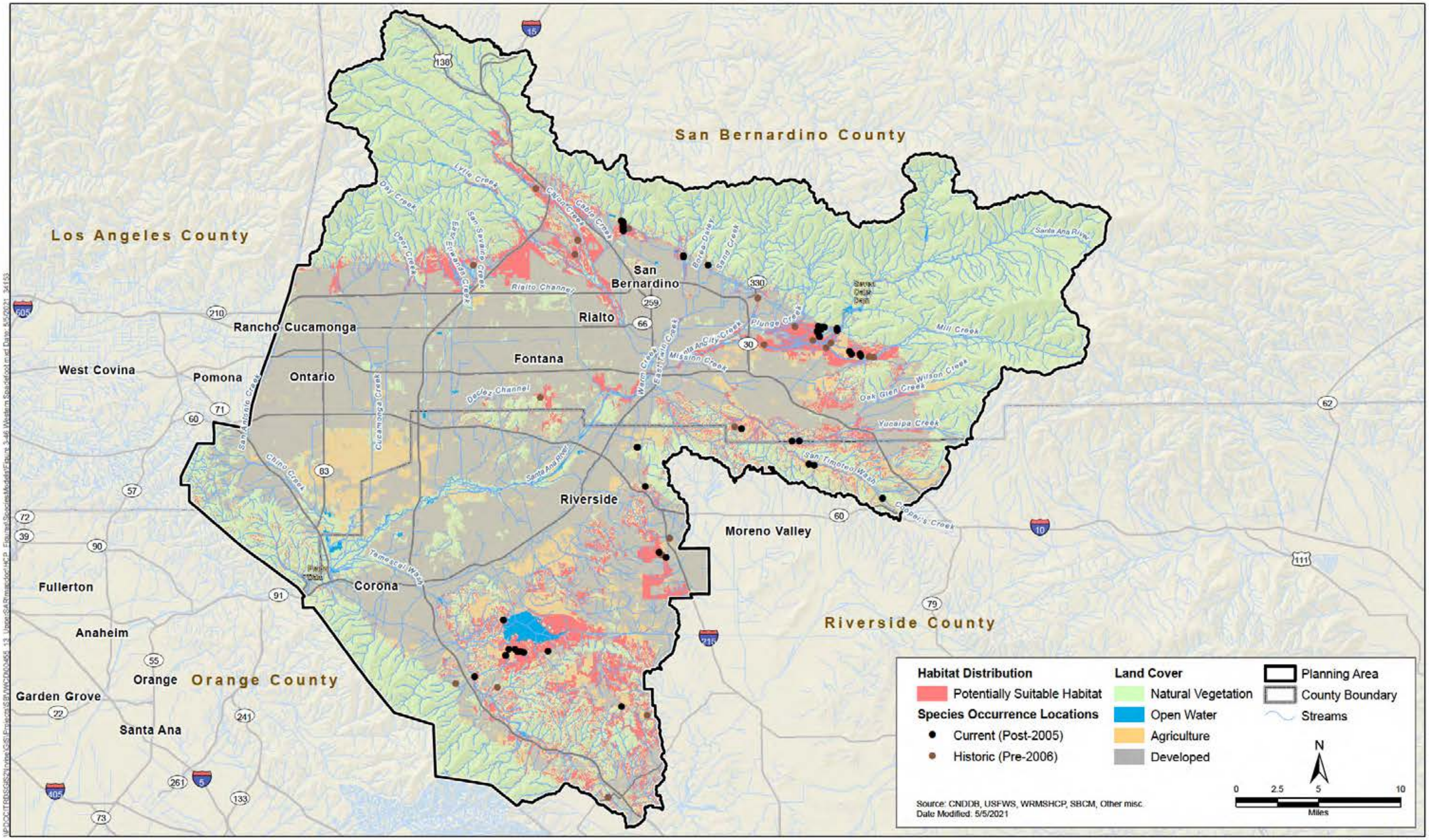
Wetted area as a measure of aquatic habitat was also estimated for western spadefoot using the methodology described in Section 3.6.4. Approximately 199 acres of modeled suitable habitat was found to co-occur with predicted wetted area acreage downstream of Covered Activities (Table 3-16).

Taxonomy and Genetics

Western spadefoot was once considered widespread through the southwestern U.S. and northern Mexico with the population in California being a subspecies, *S. hammondii hammondii* (CaliforniaHerps 2014). Past studies have proposed that populations east of California be recognized as Mexican spadefoot (*Spea multiplicata*) citing morphological differences and differences in mating calls and ecology. Since this work, *S. hammondii* has been applied to western spadefoot populations in California exclusively (Jennings and Hayes 1994, AmphibiaWeb 2014)

Reproduction

Breeding for western spadefoot is dependent on temperature and rainfall. Mating and egg laying generally occurs from late February to late May (Jennings and Hayes 1994). Females lay 300–500



Upper Santa Ana River
Habitat Conservation Plan

Figure 3-46
Western spadefoot, *Spea hammondii*
Potential Habitat Distribution and Known Occurrence Records

eggs in small clusters of 10–42 eggs (CaliforniaHerps 2014). Egg masses are attached to submerged plant material or detritus (Jennings and Hayes 1994, CaliforniaHerps 2014). Eggs usually hatch in 3–4 days, and larval development lasts approximately 58 days, although development of larvae is flexible and positively correlated to pool duration. Larvae will delay metamorphosis in long-lasting pools with large food supply. Breeding may not occur during dry years because breeding pools may not fill (CaliforniaHerps 2014).

Dispersal, Territoriality, and Home Range

Little is known about how far individuals move to reach breeding sites (AmphibiaWeb 2014), but adults are known to travel a few meters on rainy nights. Following metamorphosis, juveniles migrate from the breeding pools. Little is known about how far the species disperses (Morey 1988). They are not territorial during most of the year; however, males keep individual space during chorusing (AmphibiaWeb 2014). Calling males do exhibit aggressive behaviors at breeding sites, suggesting some territoriality (Morey 1988).

Daily and Seasonal Activity

Western spadefoot is predominantly terrestrial, only enters the water to breed, and is rarely seen on the surface; it remains dormant for most of the year in subterranean refugia that it constructs or in mud cracks, under boards or other surface cover objects (Morey 1988). Spadefoots can dig their own burrows using the hardened spades on their hind feet. The species emerges from underground aestivation during periods of relatively warm rains from fall to early spring months, migrates to breeding pools, and emigrates from pools following breeding (Jennings and Hayes 1994, CaliforniaHerps 2014) (Table 3-28). Emergence and migration is generally synchronous (CaliforniaHerps 2014).

Table 3-28. Seasonal Activity of Western Spadefoot

Life Stage/Activity Period	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Emergence and Migration	■	■	■	■					■	■	■	■
Breeding		■	■	■	■							

Sources: Jennings and Hayes 1994, CaliforniaHerps 2014

Diet and Foraging

Larvae primarily consume plankton and algae, but may also be carnivorous and feed on other tadpoles. Adults feed on invertebrates including worms and insects (Morey 1988). Adults require annual foraging opportunities to acquire enough food to survive through seasonal dormancy (Jennings and Hayes 1994).

Threats and Special Management Considerations

The primary threat to the western spadefoot is loss of habitat. In Southern California, more than 80% of habitat once known to sustain the species has been lost due to development or incompatible conversion (Jennings and Hayes 1994, CaliforniaHerps 2014, Stebbins 2003). Introduction of bullfrogs into breeding pools has had a negative impact on some populations, as has the introduction of mosquito fish (Jennings and Hayes 1994, CaliforniaHerps 2014).

Efforts should be undertaken to protect areas with temporary rain pools and surrounding habitat. The species will readily use human-made water sources to breed, and could be subsidized through the maintenance of temporary water sources in areas where adults are known to occur. Weed management, including removal or grazing control of nonnative invasive grasses, may also provide some benefit to the species (Marty 2005). In addition to conservation of existing habitat, creation of new vernal pool habitat and subsequent translocation of western spadefoot egg masses and larvae has shown success as a conservation mitigation strategy in Orange County, California, where persistence of the species and successful reproduction was observed at mitigation sites 10 years after establishment (Baumberger et al. 2020).

California Glossy Snake (*Arizona elegans occidentalis*)

Current Status and Distribution

California glossy snake (*Arizona elegans occidentalis*) is a California Species of Special Concern and is found from California's central San Joaquin Valley south to the U.S. Mexico border and east into the Mojave and Sonoran Desert region. The Planning Area encompasses the area of intergrade between the unrecognized California and desert subspecies (Stebbins 2003, Thompson et al. 2016). Occurrences are known around the Santa Ana River from the San Bernardino Airport east toward the Seven Oaks reservoir and to the north associated with Cajon Wash and Lytle Creek.

Habitat Requirements

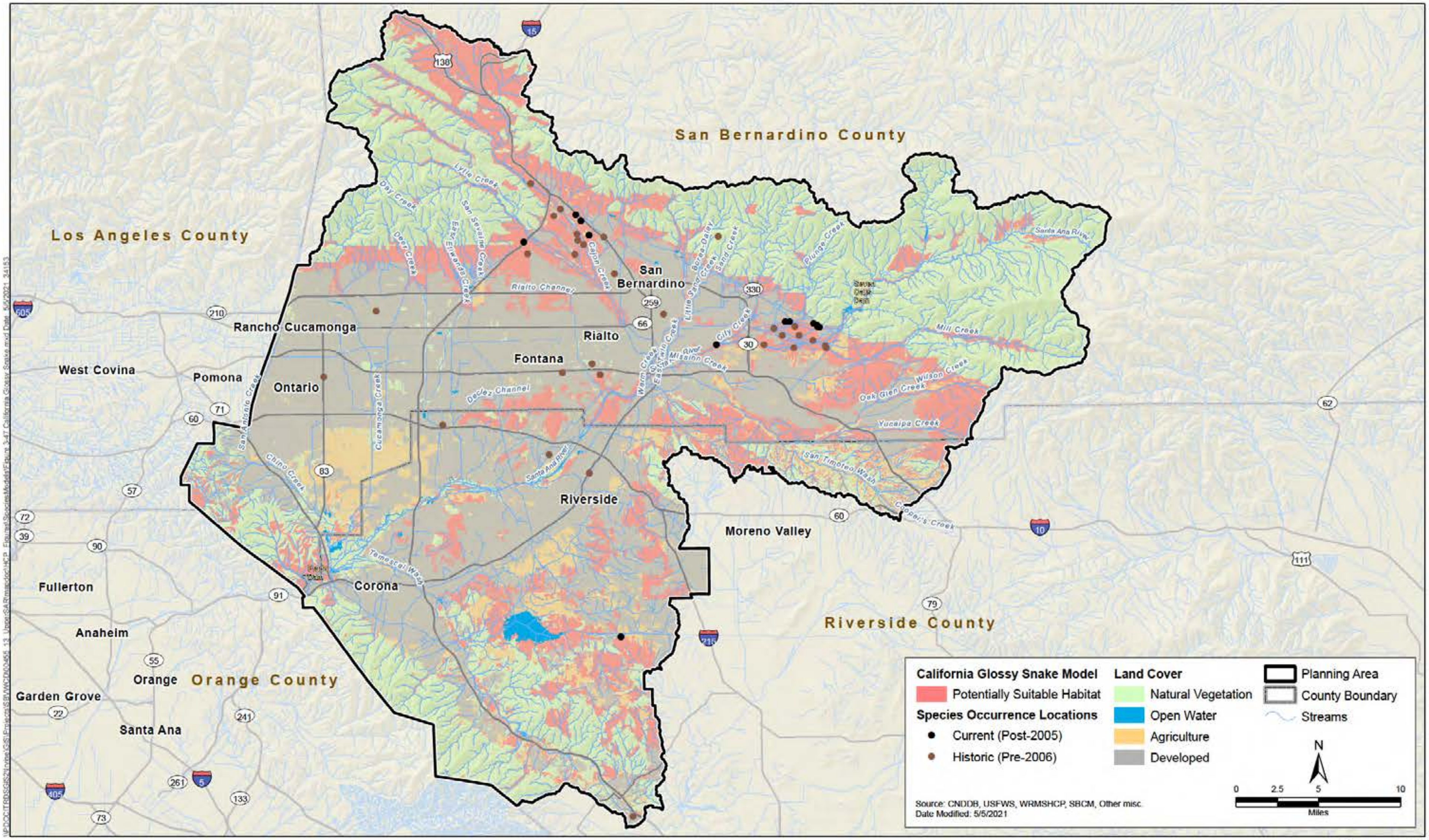
California glossy snake prefers open areas in a variety of habitats including light shrubby to barren desert, grassland, chaparral, and coastal sage scrub (Stebbins 2003, Thompson et al. 2016).

Distribution of Modeled Habitat and Documented Occurrences in the Planning Area

Distribution of California glossy snake modeled habitat and documented occurrences in the Planning Area are illustrated on Figure 3-47, and quantified in Table 3-15. The following modeled habitat types are used to represent the species' habitat distribution in the Planning Area; this includes a listing of the data and/or parameters used to create each modeled habitat type.

Potentially Suitable Habitat

- **Land Cover**: Californian Annual and Perennial Grassland; California Chaparral; Cool Interior Chaparral; Warm Interior Chaparral; Californian Coastal Scrub; Californian Forest and Woodland; Great Basin-Intermountain Xeric-Riparian Scrub; Intermountain Singleleaf Pinyon-Utah Juniper-Western Juniper Woodland; North American Warm-Desert Xeric-Riparian Scrub; North American Warm Semi-Desert Cliff, Scree, and Rock Vegetation; Western North American Cliff, Scree, and Rock Vegetation; **AND**
- **Soil Texture**: sand, sandy loam, coarse sand, coarse sandy loam, fine sand, fine sandy loam, loam sand, loamy coarse sand, loamy fine sand, river wash, and very fine sandy loam; **AND**
- **Landform**: alluvial fans, alluvial flats, alluvial plains, channels, floodplains, foothills, terraces, uplands, and also drainageways regardless of land cover type; **AND**
- **Elevation**: 0–6,000 feet.



Upper Santa Ana River Habitat Conservation Plan

Figure 3-47
California glossy snake, *Arizona elegans occidentalis*
Potential Habitat Distribution and Known Occurrence Records

- **Post-processing**: Excludes very small isolated habitat fragments that would not be considered viable habitat and agricultural lands near the Prado Basin, Chino, and Ontario because the disturbance regime in these areas would not be compatible with this species occurrence.

Taxonomy and Genetics

Nine subspecies have been described within this monotypic genus (Aldridge 2001). The subspecies *occidentalis* was proposed as a western subspecies but this taxonomy has not been accepted (Hammerson et al. 2007).

Reproduction

California glossy snake is oviparous; mating season is restricted to the spring (Aldridge 2001); ovulation begins in June and eggs are laid in July with clutch size of 3–23 with an average of 8.5 (Stebbins 2003, Thompson et al. 2016). Neonates emerge in September (Thompson et al. 2016).

Dispersal, Territoriality, and Home Range

The sexual and seasonal distribution observed based on a mortality study found that the mating system is consistent with Prolonged Mate Searching Polygyny (Aldridge 2001). In this mating system, males search competitively for widely distributed, spatially unpredictable females. Data on territoriality and home range behavior are not currently available.

Daily and Seasonal Activity

California glossy snake is active primarily at night and remains underground during the day (Stebbins 2003). Seasonal activity is depicted in Table 3-29.

Table 3-29. Seasonal Activity of California Glossy Snake

Life Stage/Activity Period	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Egg Laying						■	■					
Neonate Emergence								■	■	■		

Source: CaliforniaHerps 2014

Diet and Foraging

California glossy snake feeds primarily on diurnal lizards, which it captures while they sleep, and nocturnal mammals, such as kangaroo rats, which it ambushes (Klauber 1946, Rodriguez-Robles et al. 1999). Larger specimens are also known to take small birds and other snakes (Rodriguez-Robles et al. 1999, Stebbins 2003, Thomson et al. 2016).

Threats and Special Management Considerations

Major threats to California glossy snake include primarily anthropogenic threats caused by direct mortality from development (agricultural, commercial, and residential) and road kill, as well as pressure from collectors (NatureServe 2014). Additional threats may include light pollution and increasing frequency and intensity of fires (Thomson et al. 2016).

Relatively little is known about the ecology of this species, which makes management difficult. California glossy snakes are thought to have relatively small range sizes and a moderate degree of ecological specialization and endemism. Population declines have been documented across the species' range, caused largely by ongoing development. Habitat management is the primary management priority. Two research priorities will help inform habitat management objectives for this poorly studied species: (1) ecological studies to enhance the understanding of life history and existing population sizes, and (2) a species-wide phylogenetic study to determine whether there is intraspecific variation and to identify appropriate conservation needs (Thomson et al. 2016).

Other Relevant Information

The distribution of the California glossy snake has been reduced by 90% with only a handful of extant occurrences thought to remain in southwest San Bernardino County (Braden pers. comm.).

South Coast Garter Snake (*Thamnophis sirtalis* ssp.)

Current Status and Distribution

The south coast garter snake (*Thamnophis sirtalis* ssp.) is a Priority 1 California Species of Special Concern (Thomson et al. 2016) that is wide-ranging throughout the United States and Canada from the Pacific to the Atlantic (Stebbins 2003). Along the Southern California coast, this species has a restricted distribution from the Santa Clara River Valley (Ventura County) south coastally to the vicinity of San Pasqual (San Diego County). South coast garter snake occurs from near sea level to 2,730 feet and has been observed in the Lake Prado Basin in the Planning Area (Jennings and Hayes 1994, ICF 2014, Thomson et al. 2016).

Habitat Requirements

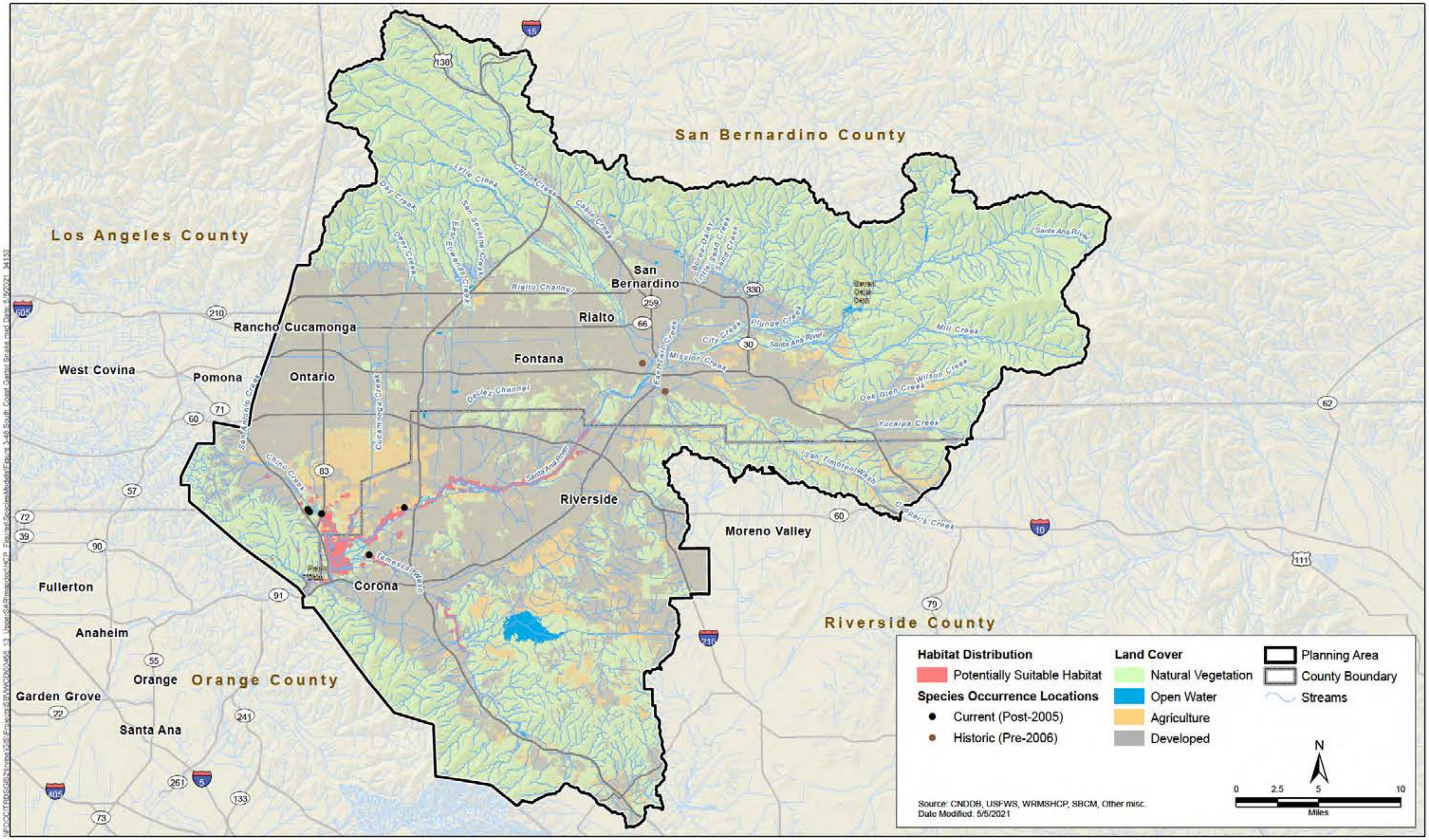
Essential habitat factors for south coast garter snake includes a permanent water source, low gradient topography, and dense multi-storied riparian vegetation (Ervin 2011). South coast garter snake is restricted to shallow freshwater aquatic habitats such as wetlands and marshes and upland riparian habitat near permanent waters (Jennings and Hayes 1994). This species is highly aquatic and needs open water for foraging; however, it generally avoids fast-flowing water (Morey 1988b, Rohde et al. 2019).

Distribution of Modeled Habitat and Documented Occurrences in the Planning Area

Distribution of south coast garter snake modeled habitat and documented occurrences in the Planning Area are illustrated on Figure 3-48, and quantified in Table 3-15. The following modeled habitat types are used to represent the species' habitat distribution in the Planning Area; this includes a listing of the data and/or parameters used to create each modeled habitat type.

Potentially Suitable Habitat

- **Land Cover:** Western North American Freshwater Aquatic Vegetation; Warm Southwest Riparian Forest; Western North American Temperate and Boreal Freshwater Marsh, Wet Meadow, and Shrubland; **AND**
- Elevation: 0–833 feet; **AND**
- Slope: 0–3%; **AND**



Upper Santa Ana River Habitat Conservation Plan

Figure 3-48
South coast garter snake, *Thamnophis sirtalis ssp.*
Potential Habitat Distribution and Known Occurrence Records

- Within 500 feet of selected land cover, elevation, and slope *except for* Developed and Agriculture.

Predicted Wetted Area as a Measure of Aquatic Habitat

Wetted area as a measure of aquatic habitat was also estimated for south coast garter snake using the methodology described in Section 3.6.4. Approximately 189 acres of modeled suitable habitat was found to co-occur with predicted wetted area acreage downstream of Covered Activities (Table 3-16).

Taxonomy and Genetics

Although south coast populations of *Thamnophis sirtalis* have not been formally described as a distinct taxon (Thomson et al. 2016), consistent with earlier findings (Jennings and Hayes 1994) garter snakes in this part of the range are considered Species of Special Concern (Thomson et al. 2016). Populations from Southern California were first described as California red-sided garter snake (*Thamnophis sirtalis infernalis*) by Henri Marie Ducrotay de Blainville in 1835 (CaliforniaHerps 2014). Barry (1998) and Stebbins (2003) support description of snakes from Southern California as *Thamnophis sirtalis infernalis*, while others (Boundy and Rossman 1995, Janzen at al. 2002) refer to them as red-spotted garter snakes (*Thamnophis sirtalis concinnus*). Morphological and genetic studies that will help to clarify the status of this taxon (*Thamnophis sirtalis* ssp.) are still pending (Thomson et al. 2016).

Reproduction

South coast garter snakes mate in the spring. Several males may often attempt to mate with a single female (Morey 1988b). This species is a live-bearing snake and generally gives birth to 12 to 18 young (Stebbins 2003). Young are generally born in August but gestation can extend into late summer and early fall (Jennings and Hayes 1994).

Dispersal, Territoriality, and Home Range

Data on movement ecology for this species are limited and the nature of its home range is not well known (Jennings and Hayes 1994, Morey 1988b). Individual home ranges probably overlap with others during the summer months. Individuals can be found close together in areas of favorable habitat. Many populations of common garter snakes aggregate in large numbers during the winter, especially in cold northern climates, though it is unknown if south coast garter snakes exhibit this behavior (Morey 1988b).

Daily and Seasonal Activity

South coast garter snake is an excellent swimmer and is often found near water (Jennings and Hayes 1994, Morey 1988a). The species is most active during the daytime, mainly during the morning and late afternoon most summer days and mainly during the afternoon in spring and fall. It may retreat to hibernacula during the winter months but may emerge to bask during warmer winter days (Morey 1988a). Seasonal activity is depicted in Table 3-30.

Table 3-30. Seasonal Activity of South Coast Garter Snake

Life Stage/Activity Period	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hibernation												
Breeding												

Sources: Morey 1988, Stebbins 2003, Jennings and Hayes 1994

Diet and Foraging

South coast garter snake is known to primarily feed on amphibians; however, fish and invertebrates are also targeted as prey (Jennings and Hayes 1994). This species is also known to prey on adult Pacific newts (*Taricha* sp.) without suffering the effects of poison secreted from the newt's body (Stebbins 2003).

Threats and Special Management Considerations

Loss of habitat is the principal threat to south coast garter snake. Urbanization and flood control projects have greatly affected suitable habitat. Of the 24 known historic localities, 18 sites (75%) no longer support the species. The introduction of nonnative aquatic predators also threatens existing populations. Destruction of suitable aquatic habitat is the biggest threat to populations, and the species is vulnerable to habitat degradation caused by reduced water levels and quality, which affects the availability of suitable vegetation and burrows (Jennings and Hayes 1994, Rohde et al. 2019). Wetland drying in the summer months and decreased hydrology due to water transfers or drought can also reduce suitable habitat. Substitution of groundwater for surface water can degrade habitat because groundwater has lower temperatures and may contain higher concentrations of contaminants (Rohde et al. 2019). Wide-spread surveys need to be undertaken in Southern California to determine where the species still exists and to evaluate the quality of the habitat where it does exist. Studies are also necessary to identify the importance of prey resources on recruitment and reproduction. Because seasonal movement patterns and recolonization abilities are not well understood, studies to identify these attributes should also be undertaken (Jennings and Hayes 1994).

Southwestern Pond Turtle (*Emys pallida*)

Current Status and Distribution

The southwestern pond turtle (*Emys pallida*) is a California Species of Special Concern and is currently under review for listing under the Federal Endangered Species Act (FESA) by USFWS. This species was formerly considered a subspecies of the western pond turtle (*Actinemys marmorota*); however, based on recent analyses the species has been split into two distinct, geographically non-overlapping species: *E. pallida* and *E. marmorota* (Spinks et al. 2014, 2016). The range for the southwestern pond turtle includes the southern and coastal portions of the overall range from northwestern Baja California del Sur to approximately San Francisco Bay. In the Planning Area, this species is known from Chino Hills State Park in Aliso Creek from Banie Canyon to the confluence with the Santa Ana River and in Soquel Canyon; Arnold Reservoir in Tonner Canyon; in a detention basin at the southern end of Walker Canyon north of Lake Elsinore, and within a section of the Santa Ana River in the Riverside area (Wulff et al. 2020).

Habitat Requirements

The southwestern pond turtle is an aquatic turtle that occurs in ponds, lakes, marshes, rivers, streams, and irrigation ditches. This species prefers habitats with emergent basking sites such as logs, rocks, and shorelines, and with underwater refugia (Stebbins 2003, Bury and Germano 2008). Southwestern pond turtle is most abundant in slow-moving portions of streams and rivers such as plunge pools because they lack swift currents and are deep enough to allow the turtle to retreat when threatened. Densities of this species in standing or slow-moving waters are often several times higher than in swifter-moving sections of streams and rivers. Southwestern pond turtle also utilizes upland habitats near aquatic habitat to reproduce, aestivate, and overwinter (Bury and Germano 2008). Hatchlings require shallow aquatic habitat with submerged vegetation on which to feed (Jennings and Hayes 1994).

Distribution of Modeled Habitat and Documented Occurrences in the Planning Area

Distribution of southwestern pond turtle modeled habitat and documented occurrences in the Planning Area are illustrated on Figure 3-49, and quantified in Table 3-15. The following modeled habitat types are used to represent the species' habitat distribution in the Planning Area; this includes a listing of the data and/or parameters used to create each modeled habitat type.

Modeled Suitable Habitat:

Aquatic Habitat

- **Land Cover**: Water-Permanent (except within existing groundwater recharge basins) and Western North American Freshwater Aquatic Vegetation; **AND**
- **Elevation**: 0–1,800 feet.

Potentially Suitable Upland Habitat

- Areas that are within 1,640 feet of Aquatic Habitat (Reese and Welsh 1997); **AND**
- **Elevation:** 0–1,800 feet; **AND**
- Contiguous with Aquatic Habitat *except for* Developed; Agriculture; California Chaparral; and Cool Interior Chaparral, Western North American Cliff, Scree, and Rock Vegetation.
- **Post-processing**: Removed fragmented and isolated patches surrounded by development and upstream of RIX Discharge.

Predicted Wetted Area as a Measure of Aquatic Habitat

Wetted area as a measure of aquatic habitat was also estimated for southwestern pond turtle using the methodology described in Section 3.6.4. Approximately 192 acres of modeled suitable habitat was found to co-occur with predicted wetted area acreage downstream of Covered Activities (Table 3-16).

Taxonomy and Genetics

Since 2011, CDFW has identified one species throughout its range (*Actinemys marmorata*) (CDFG 2011). However, four distinct mitochondrial clades have been identified: Northern, San Joaquin

Valley, Santa Barbara, and Southern California (Spinks and Shaffer 2005, Spinks et al. 2010). Additionally, some studies recommend, based on genetic differences, that populations north of San Francisco and in the Central valley be identified as *E. marmorata,* and populations in the central Coast Range south of San Francisco be identified as *E. pallida* (Spinks et al. 2014). This implies that the Tehachapi Mountains/Transverse Range are major barriers to movement in Southern California northward (Spinks et al. 2010). The pond turtle species found within the Planning Area is *Emys pallida*.

Reproduction

Southwestern pond turtle nest in terrestrial habitat in sites that can be as far as 1,312 feet from aquatic habitat; however, most are within 656 feet of aquatic habitat (Reese and Welsh 1997, Jennings and Hayes 1994). Mating typically occurs in April and May. Females emigrate from the water to upland nest sites and deposit 3–14 eggs from April through August, with timing dependent on location (Stebbins 2003). Females are highly terrestrial while they are gravid and make multiple trips onto land and burrow themselves beneath leaf litter (Reese and Welsh 1997). Incubation time ranges from 94 to 122 or more days (Bury and Germano 2008). Hatchlings in the northern portion of the species' range generally overwinter in the nest and emerge in the spring (Reese and Welsh 1997). In Southern California, hatchlings may emerge from the nest in the fall (Jennings and Hayes 1994).

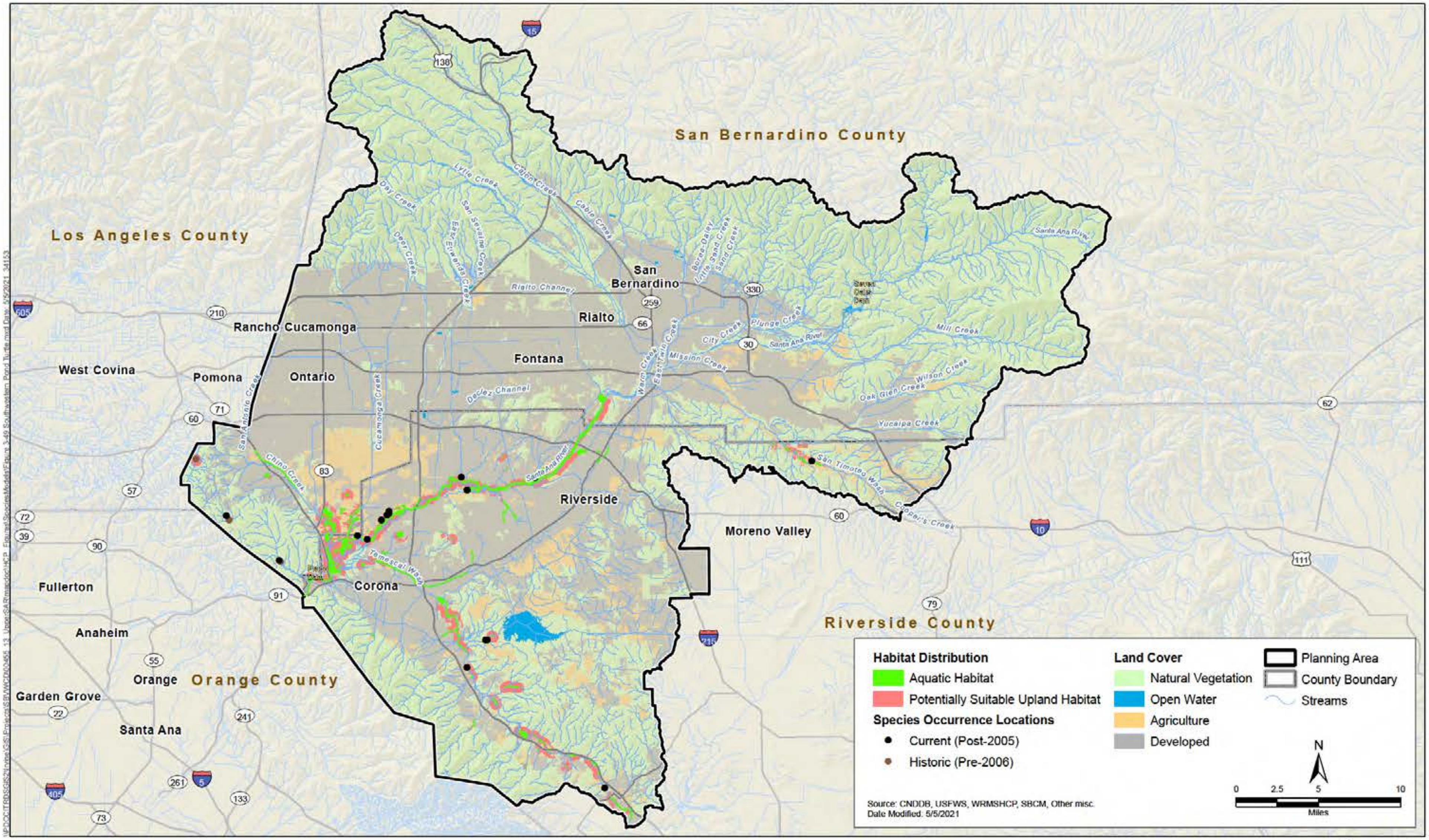
Dispersal, Territoriality, and Home Range

Home range size and dispersal distances are highly variable among individuals. Some individuals may only travel a few feet from aquatic habitat to nest, aestivate, or overwinter, while others may travel considerably farther. Southwestern pond turtle has been known to disperse farther than 1.2 miles if local aquatic habitat disappears or becomes inhospitable, and adults can tolerate at least 7 days without water. The dispersal habits of juveniles are unknown (Jennings and Hayes 1994).

Males have average home ranges of 2.4 acres, while females have average home ranges of 0.6 acre. Populations can reach densities of 215 per hectare in undisturbed stream habitats and even higher in undisturbed ponds (Buskirk 2002). As water levels drop in the summer months and during droughts, the species tends to aggregate in higher densities (Bury and Germano 2008). Basking pond turtles will engage in aggressive behaviors such as biting and ramming to ensure adequate spacing for basking (DOI 1999).

Daily and Seasonal Activity

The level of activity is greatly affected by temperature, especially when surface water temperature is above 59°F (Bury and Germano 2008). Along the southern coastal areas of California, southwestern pond turtles may be active year-round. At higher elevations and higher latitudes, pond turtles will overwinter in upland areas or in the water (Jennings and Hayes 1994). Overwintering turtles may travel up to 1,640 feet from aquatic habitat to terrestrial refuges. Some have been known to occur in terrestrial habitats up to 7 months out of the year (Reese and Welsh 1997). Seasonal activity is depicted in Table 3-31.



Upper Santa Ana River Habitat Conservation Plan

Figure 3-49
Southwestern pond turtle, *Emys pallida*
Potential Habitat Distribution and Known Occurrence Records

Table 3-31. Seasonal Activity of Southwestern Pond Turtle

Life Stage/Activity Period	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hibernation												
Breeding												
Hatchling Emergence												

Sources: Stebbins 2003, Jennings and Hayes 1994

Diet and Foraging

Southwestern pond turtles are omnivorous and dietary generalists (Bury and Germano 2008). Hatchlings and young juveniles feed primarily on zooplankton (Jennings and Hayes 1994). Adults feed on insect larvae, other aquatic invertebrates, fish, amphibian eggs and tadpoles, small fish, carrion, and aquatic plants (Stebbins 2003; DOI 1999).

Threats and Special Management Considerations

Overexploitation for food in the nineteenth and early twentieth centuries caused initial population declines throughout much of the southwestern pond turtle's range. Habitat destruction and alteration are now the primary threats (Bury and Germano 2008, Nicholson et al. 2020). Raccoons (*Procyon lotor*) and other native and introduced mammals may destroy nests and consume eggs and hatchlings. The introduction of largemouth bass (*Micropterus salmoides*) and bullfrogs (*Lithobates catesbeiana*) into aquatic habitats has been damaging to population recruitment (both species have been documented to eat hatchlings and juveniles) (Buskirk 2002, Nicholson et al. 2020), as has the introduction of red-eared sliders, which outcompete southwestern pond turtle for resources. Water diversions/reductions are also a threat to this species, reducing or completely drying suitable aquatic habitat.

Population declines may also be a result of female-biased mortality on roads, caused when gravid females leave aquatic habitats to nest in upland habitats (Nicholson et al. 2020). A recent study showed a strong correlational relationship between road proximity and density and increasing male population bias in this species (Nicholson et al. 2020).

Tricolored Blackbird (*Agelaius tricolor*)

Current Status and Distribution

Tricolored blackbird (*Agelaius tricolor*) is State listed as threatened. It is nearly endemic to California, with 95% of historic breeding range within the state (Western Riverside County MSHCP 2012a). Recent data shows breeding colonies occur sporadically within the Planning Area at the following locations (the most recent date and breeding colony size are given in parentheses)—San Bernardino County: pond adjacent to the Santa Ana River in Colton (2009; 100) (Feenstra 2009), wheat field near Euclid and Eucalyptus Avenues in Chino (2014; 100) (UC Davis 2014), a created wetland south of the Chino Airport (2014; 500) (UC Davis 2014), and the recently created Mill Creek Wetlands (2014; 1,000) (Pike pers. comm, eBird 2014). Breeding colonies have also been detected outside of the Planning Area within and adjacent to the San Jacinto Wildlife Area and along Salt Creek in western Riverside County.

Habitat Requirements

Habitat requirements for a tricolored blackbird breeding colony include open water; appropriate nesting substrate with cattails, bulrushes, willows, and forbs; and nearby foraging habitat (Beedy and Hamilton 1999). Foraging areas include grasslands, open fields, irrigated pasture, and agricultural areas (Beedy and Hamilton 1997, Shuford and Gardali 2008, Rohde et al. 2019). Alfalfa fields are the primary foraging area for the Mill Creek Wetlands colony (Pike pers. comm.) and is reported as the primary forage for several colonies in Riverside County (Western Riverside MSHCP 2012b). Sunflower is the only other crop known to support good foraging opportunities for this species (Meese pers. comm.). In addition to cattail/bulrush habitat, nest sites in the Planning Area have been documented in weedy areas, dominated by species such as bull thistle, mustard, nettle, and cheeseweed mallow (Western Riverside MSHCP 2012b).

Distribution of Modeled Habitat and Documented Occurrences in the Planning Area

Distribution of tricolored blackbird modeled habitat and documented occurrences in the Planning Area are illustrated on Figure 3-50, and quantified in Table 3-15. Statewide mapping and monitoring of tricolored blackbird colony locations is coordinated through the UC Davis Tricolored Blackbird Portal. Colony locations are attributed with the habitat where the colony is located. Colonies were classified into categories based on the surrounding habitat.

- **Typical colony**: Colony located in naturally occurring emergent wetland habitats.
- **Atypical colony**: Colony located in nonnative or atypical natural habitats including: thistle or nettle colony, willow colony, agriculture colony, and urban park colony.

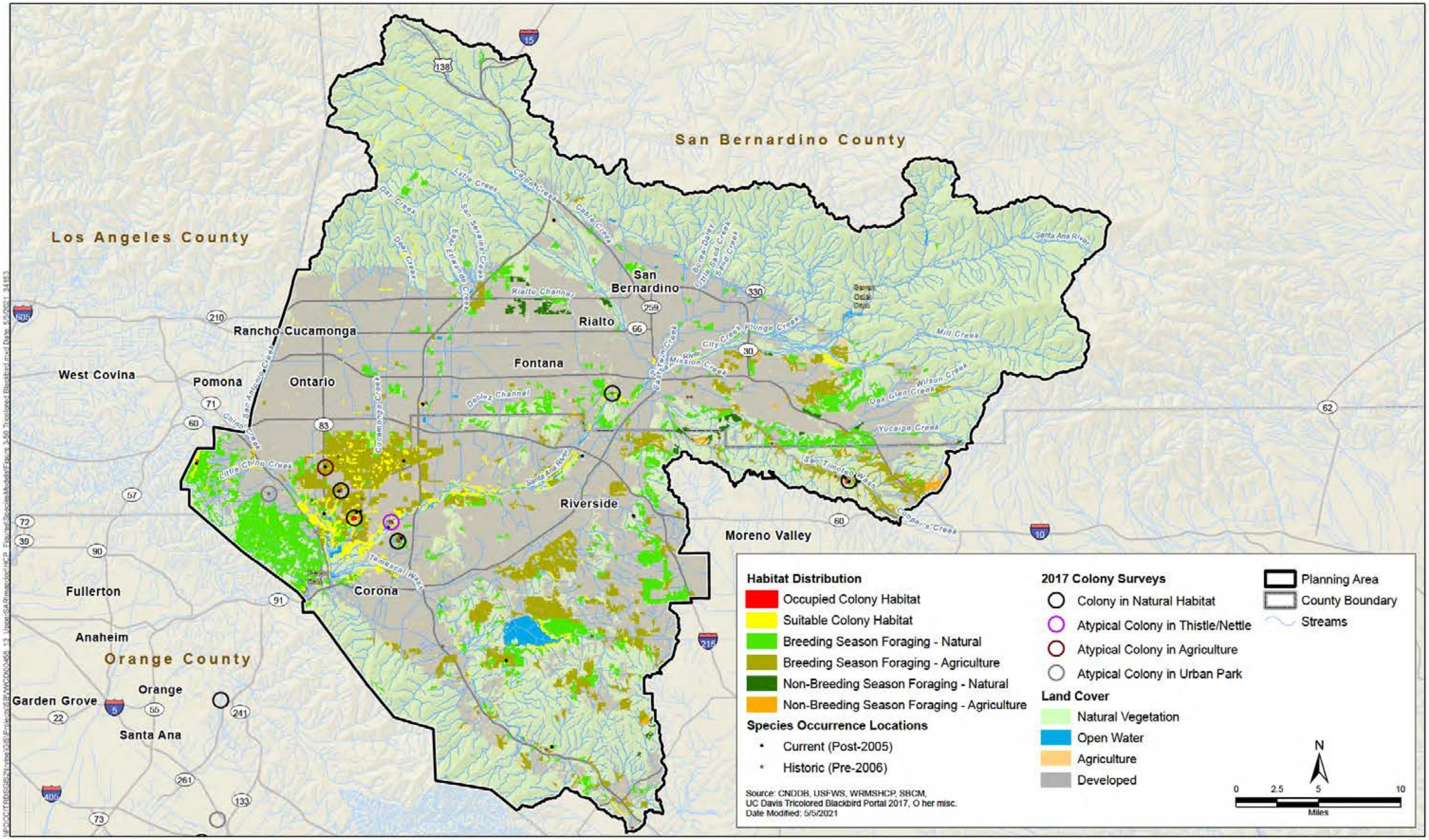
The following modeled habitat types are used to represent the species' habitat distribution in the Planning Area, and include a listing of the data and/or parameters used to create each modeled habitat type.

Occupied Colony Habitat (suitable breeding habitat that allows colony establishment around known colony locations)

- Typical Colony Locations; **AND**
- **Land Cover:** Wetlands; **OR**
- Other natural habitats within 500 feet of atypical thistle, nettle, or willow colony locations (natural is defined as all landcover types except, agriculture, open water, and developed); **OR**
- Agricultural habitats within 500 feet of atypical agriculture colony locations (agriculture colonies are in a limited number of crop types, but all agriculture types are selected because crops are regularly rotated); **OR**
- Urban park colonies represented by the colony occurrence data alone.

Suitable Colony Habitat

- Wetlands within 500 feet of Occupied Colony Habitat.



Upper Santa Ana River Habitat Conservation Plan

Figure 3-50
Tricolored blackbird, *Agelaius tricolor*
Potential Habitat Distribution and Known Occurrence Records

Breeding Season Foraging – Natural

- Grasslands within 5 kilometers of Occupied Colony Habitat or Suitable Colony Habitat with a minimum patch size of 20 acres.

Breeding Season Foraging – Agriculture

- Agriculture within 5 kilometers of Occupied Colony Habitat or Suitable Colony Habitat with a minimum patch size of 20 acres.

Non-Breeding Season Foraging – Natural

- Grasslands with a minimum patch size of 20 acres.

Non-Breeding Season Foraging – Agriculture

- Agriculture with a minimum patch size of 20 acres.

Taxonomy and Genetics

There are two populations of tricolored blackbird within California: (1) Southern California population and (2) Central Valley population. Banding studies have not shown evidence of individuals mixing between the two populations (UC Davis 2014, Shuford and Gardali 2008).

Reproduction

Tricolored blackbirds are synchronized, colonial nesters (Beedy and Hamilton 1997). Reproduction starts in mid-March (UC Davis 2014, Hamilton 1998) and concludes in early August (Beedy and Hamilton 1997, Shuford and Gardali 2008). Females build deep cup nests composed of leaves and grasses in which they lay 3–4 eggs. Eggs are incubated solely by the female for 12–14 days, and chicks typically fledge 10–14 days after hatching (UC Davis 2014). Young within the colony fledge no more than a few days from each other (Western Riverside County MSHCP 2012b). Both male and female feed the young (Beedy and Hamilton 1997). Once the young have fledged, they will remain with the colony (either inside or along the perimeter of the colony) for a few days while still being fed by both parents (UC Davis 2014).

Dispersal, Territoriality, and Home Range

Tricolored blackbirds are regionally philopatric, so this species tends to remain within the region where it hatched, but studies show no strong evidence of site fidelity. Populations in California may move regionally in both winter and breeding months (Shuford and Gardali 2008, Hamilton 1998), but they do not migrate. Young will disperse from the breeding colony, sometimes being led away by the parents carrying food items (UC Davis 2014).

During the breeding season, territories are relatively small, averaging 2–6 meters between nesting sites (UC Davis 2014, Beedy and Hamilton 1999). Foraging areas generally occur up to 5 kilometers from the nest site (Beedy and Hamilton 1999) but have been documented up to 13 kilometers from the nest site (Beedy and Hamilton 1997). Itinerant breeders, capable of breeding twice a year in different locations within the same region (UC Davis 2014, Hamilton 1998).

Daily and Seasonal Activity

In the non-breeding season, tricolored blackbirds form large flocks, often with other species, such as red-winged blackbirds, for foraging and roosting (Shuford and Gardali 2008). Seasonal activity is depicted in Table 3-32.

Table 3-32. Seasonal Activity of Tricolored Blackbird

Life Stage/ Activity Period	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wintering												
Breeding												

Sources: University of California-Davis 2014, Shuford and Gardali 2008

Diet and Foraging

Tricolored blackbirds are opportunistic feeders. This species is mainly granivorous, but will consume invertebrates, such as grasshoppers, beetles, and insect larvae, during the breeding season (UC Davis 2014, Shuford and Gardali 2008, Beedy and Hamilton 1997). Young are fed exclusive insect prey (Western Riverside County MSHCP 2012b).

Threats and Special Management Considerations

Loss of habitat and fragmentation of this species' habitat is largely attributed to human development, and land alteration is considered the most significant threat (Beedy and Hamilton 1999). These anthropogenic factors include water diversion and draining of wetlands, land conversion to agricultural uses, and development of land (UC Davis 2014). Timing of agricultural harvesting can also pose a significant threat to local colonies if harvesting occurs in nesting areas prior to fledging. Conversion of productive foraging habitat to perennial, woody crops including nut trees and vines also threaten this species (Rohde et al. 2019). Severe weather conditions, such as drought, can also contribute to population decline, as it can reduce insect prey populations and cause abandonment of colonies, low reproductive success, and failure to reproduce (Beedy and Hamilton 1999, Rohde et al. 2019).

Nesting habitat within the Planning Area for tricolored blackbird consists primarily of wetland- and marsh-type habitats, but also includes weedy habitats that may be found within or adjacent to crops such as wheat. The Mill Creek Wetlands Recreation and Restoration Demonstration Project provides a management example and shows how quickly this species can occupy newly created suitable nesting habitat (with adjacent suitable foraging habitat), as construction was initiated in early 2013 and occupied in spring 2014 (UC Davis 2014). Activities that alter potential nesting habitat, including vegetation removal and changes in water flow, will be important to consider for conservation of this species in the Planning Area. The conservation and management of suitable foraging habitat within 3 miles of a breeding colony may be an equally important consideration; in the Planning Area, the primary forage appears to be alfalfa fields. There are few areas within the Planning Area that have suitable nesting and foraging habitat and are being used by breeding tricolored blackbirds, and recently occupied sites and surroundings should be the primary consideration.

Other Relevant Information

The Planning Area is within the current range of this species, and, therefore, it is dependent on patchy and somewhat unpredictable breeding and foraging habitat. As a result, it is possible that additional tricolored blackbird colonies will be documented within the Planning Area in the future.

Burrowing Owl (*Athene cunicularia*)

Current Status and Distribution

Burrowing owl (*Athene cunicularia*) is a California Species of Special Concern that is widely distributed throughout California. Riverside and San Bernardino Counties have the largest remaining numbers in the Central and South Coast region (Gervais et al. 2008). Burrowing owl have generally been documented in the lower elevations and flat portions of the Planning Area. This species is known to occur in the Santa Ana River Basin at the San Bernardino International Airport, along City Creek, along the perimeter of several flood control basins, and scattered throughout suitable habitat north and northeast of the Prado Basin. Burrowing owls are also known to occur east of the Jurupa Mountains, at Lake Mathews, at Ayala Park in Chino, scattered throughout the dairy farms in east Chino and southern Ontario, and in the business parks along I-15 and I-10 (ICF 2014).

Habitat Requirements

Burrowing owl occurs primarily in grassland habitats with few shrubs on level to gently sloping topography and well-drained soils (Poulin et al. 2011). While low vegetation is favored, burrowing owl can be found among taller shrubs where the shrubs are rather sparse. This species can also be found in habitats that are highly altered by human activity, such as agricultural fields, golf courses, parks, airports, and vacant urban lots (Gervais et al. 2008, Klute et al. 2003). The most important habitat component is the presence of small mammal burrows for roosting and nesting, and relatively short vegetation (Gervais et al. 2008, Klute et al. 2003, Poulin et al. 2011). Fossorial species whose burrows are often used by burrowing owls include: California ground squirrels (*Spermophilus beecheyi*), American badger (*Taxidea taxus*), coyote (*Canis latrans*), and kit fox (*Vulpes macrotis*). The owl will also utilize non-natural burrows such as pipes and culverts as well as rock outcrops that offer suitable holes (Gervais et al. 2008).

Distribution of Modeled Habitat and Documented Occurrences in the Planning Area

Distribution of burrowing owl modeled habitat and documented occurrences in the Planning Area are illustrated on Figure 3-51, and quantified in Table 3-15. The following modeled habitat types are used to represent the species' habitat distribution in the Planning Area; this includes a listing of the data and/or parameters used to create each modeled habitat type.

Potentially Suitable Habitat

- **Land Cover**: Herbaceous Agricultural Vegetation; Californian Coastal Scrub; Californian Annual and Perennial Grassland; Californian Disturbed Grassland, Meadow, and Scrub; North American Warm-Desert Xeric-Riparian Scrub; and Great Basin-Intermountain Xeric-Riparian Scrub; **AND**
- **Elevation**: 0–2,000 feet; **AND**

- **Slope**: 0–20%.
- **Post-processing**: Removed patch sizes less than 100 acres.

Taxonomy and Genetics

In North America, burrowing owl is divided into two recognized subspecies; *Athene cunicularia hypugaea* in the west and *A. c. floridana* in Florida and the Bahamas (Poulin et al. 2011).

Reproduction

The breeding season for burrowing owl in California is generally March to August, but can begin in February and extend into December (Gervais et al. 2008), The peak of the breeding season occurs between April 15 and July 15, which is when most burrowing owls have active nests (eggs or young). Incubation lasts approximately 29 days, with young fledging approximately 44 days after hatching. Burrowing owl may change burrows several times during the breeding season, starting when the nestlings are about 3 weeks old (CDFG 2012). This species may attempt to re-nest if the first nest is destroyed early in the nesting season (Klute et al. 2003).

Dispersal, Territoriality, and Home Range

Dispersal distances for both juveniles (post fledging) and adults (post nesting) may be considerable, between 33 and 93 miles (Gervais et al. 2008). One study found that populations in California were indistinguishable, suggesting a high degree of dispersal and interconnectivity of populations (Klute et al. 2003).

Home range size is linked to the availability of food. Burrowing owl generally forage near a nest burrow during breeding, but have been recorded foraging up to 1.7 miles away from a burrow during the breeding season. In California, burrowing owl had a nest-site fidelity from year to year of 32–50% in areas with large expanses of grasslands and 57% in agricultural areas (Gervais et al. 2008). Wintering owls, unlike breeding owls, are not as dedicated to single burrows or a group of burrows. However, there is roost fidelity within and between winter seasons (Poulin et al. 2011).

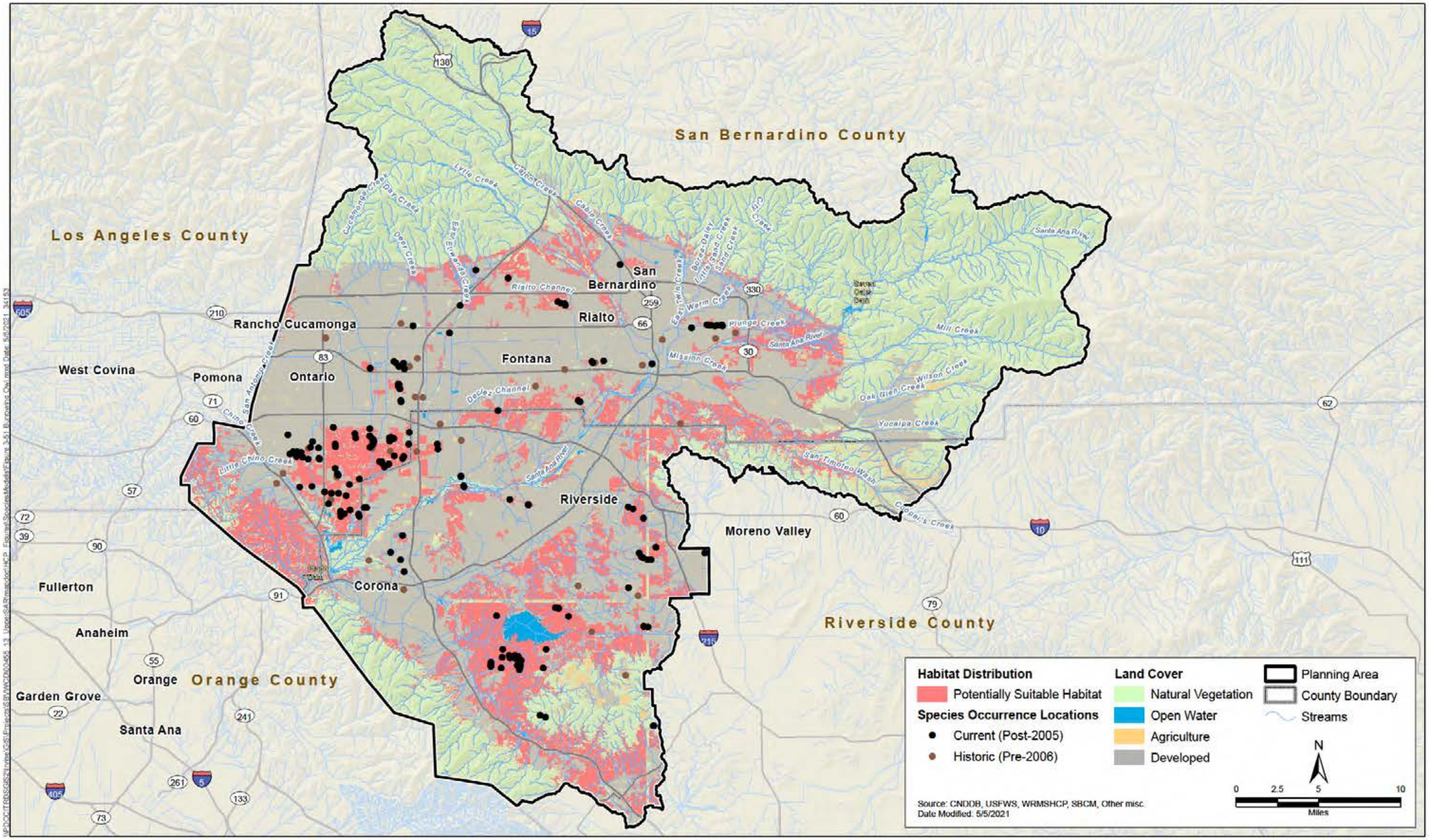
Daily and Seasonal Activity

Many burrowing owls in California are year-round residents, often retreating from higher elevations in the winter. Migrants from other states may augment lowland populations in the winter throughout the state (Gervais et al. 2008). The species is primarily diurnal, with the greatest period of activity occurring during crepuscular hours. Seasonal activity is depicted in Table 3-33.

Table 3-33. Seasonal Activity of Burrowing Owl

Life Stage/ Activity Period	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wintering	■	■									■	■
Breeding		■	■	■	■	■	■	■				
Migration		■	■	■	■			■	■	■	■	
Molt		■	■	■	■	■	■	■	■	■	■	

Source: Poulin et al. 2011



Upper Santa Ana River Habitat Conservation Plan

Figure 3-51
Burrowing owl, *Athene cunicularia*
Potential Habitat Distribution and Known Occurrence Records

Diet and Foraging

Burrowing owls are opportunistic foragers that will feed on a wide variety of prey depending on availability. This species readily preys upon insects such as crickets, beetles, and dragonflies. Other prey include small rodents such as voles, deer mice, harvest mice, pocket mice, and kangaroo mice. Less frequently, this species is known to consume birds such as horned larks (*Eremophila alpestris*), western meadowlarks (*Sturnella neglecta*), and shorebirds, as well as bat species (Hoetker and Gobalet 1999). Burrowing owl are generally crepuscular hunters and hunt either on the wing or by walking or hopping on the ground, and will often use elevated perches to spot prey (Poulin et al. 2011).

Threats and Special Management Considerations

Loss of habitat, degradation and fragmentation of remaining habitat, ongoing urbanization, and continuing eradication of ground squirrels are the main threats to burrowing owl in California (Gervais et al. 2008). The elimination of burrowing rodents through the use of rodenticides and other means has contributed to the decline of populations nationwide (Klute et al. 2003). The control of ground squirrels in California may affect local burrowing owl populations by reducing or eliminating ground squirrel burrows. Road and ditch maintenance and discing to control weeds in fallow fields may destroy burrows. Exposure to pesticides may also cause mortality to individuals (CDFG 2012).

Declines in Southern California have continued to occur. One study determined that the number of burrowing owl pairs in the inland portion of Southern California declined by 34% between 1993 and 2007 (Wilkerson and Siegel 2010). Retaining colonies of burrowing mammals is of upmost importance, as burrowing owls require their burrows for nesting and roosting. While burrowing owls appear to adapt fairly well to human disturbances in some cases (i.e., airport runways and other human modified open spaces), the continued presence of active mammal-created burrows is essential to its survival. Rodent eradication programs may reduce the consistent availability of high and moderate function habitat. Additionally, suitable foraging habitat near burrows is required to sustain viable populations (Gervais et al. 2008, Klute et al. 2003, Poulin et al. 2011, CDFG 2012). Because of high nest site fidelity, the disturbance of nest sites could have a dramatic impact on populations. Before artificial burrows are constructed and burrowing owls are relocated, it is important to consider the characteristics of the burrow sites previously used for nesting and mimic them as closely as possible (Botelho and Arrowood 1998). Additionally, because of high nest site fidelity, relocated nests should be installed close to the original nest burrow, ideally within 100 meters (Smith and Belthoff 2001).

Cactus Wren (*Campylorhynchus brunneicapillus*)

Current Status and Distribution

The cactus wren (*Campylorhynchus brunneicapillus*) is a California Species of Special Concern. It is found in California east to Texas, extending south through Baja California and mainland Mexico (Hamilton et al. 2011).

In the Planning Area, it occurs in southwestern San Bernardino County in washes and lower slopes flanking the urbanized area from Fontana east to Yucaipa, including the Santa Ana River, Lytle Creek, Cajon Creek, and Mill Creek. In western Riverside County occurrences are concentrated near Lake Mathews and the Santa Ana River, with small populations scattered in washes and lower hills south to the Temecula area; a disjunct population also persists in the Wilson Valley/Aguanga area (ICF 2014).

Habitat Requirements

Cactus wren typically occupies native scrub with cholla (*Cylindropuntia*) or prickly-pear (*Opuntia*) (Hamilton et al. 2011). Suitable nest sites in and near the Planning Area also include California buckwheat (*Eriogonum fasciculatum*) and California sagebrush (*Artemisia californica*), yucca (*Yucca* spp.), chamise (*Adenostoma fasciculatum*), mountain mahogany (*Cercocarpus* spp.), and juniper (*Juniperus* spp.) (Hamilton et al. 2011, San Bernardino County Museum 2014).

Distribution of Modeled Habitat and Documented Occurrences in the Planning Area

Distribution of cactus wren modeled habitat and documented occurrences in the Planning Area are illustrated on Figure 3-52, and quantified in Table 3-15. The following modeled habitat types are used to represent cactus wren habitat distribution in the Planning Area; this includes a listing of the data and/or parameters used to create each modeled habitat type.

Known Suitable Nesting

- **Existing data**: Historical breeding habitat dataset from Cactus Wren Working Group, as well as cactus mapping conducted as part of the Wash Plan HCP buffered by 213 feet (approximate coastal average nesting territory size); **AND**
- **Land Cover** (only within Known Suitable Nesting buffer): Californian Coastal Scrub; Californian Annual and Perennial Grassland; Californian Disturbed Grassland, Meadow, and Scrub; North American Warm-Desert Xeric-Riparian Scrub; Great Basin-Intermountain Xeric-Riparian Scrub; Californian Coastal Scrub (prickly pear).

Potential Nesting and Foraging Habitat:

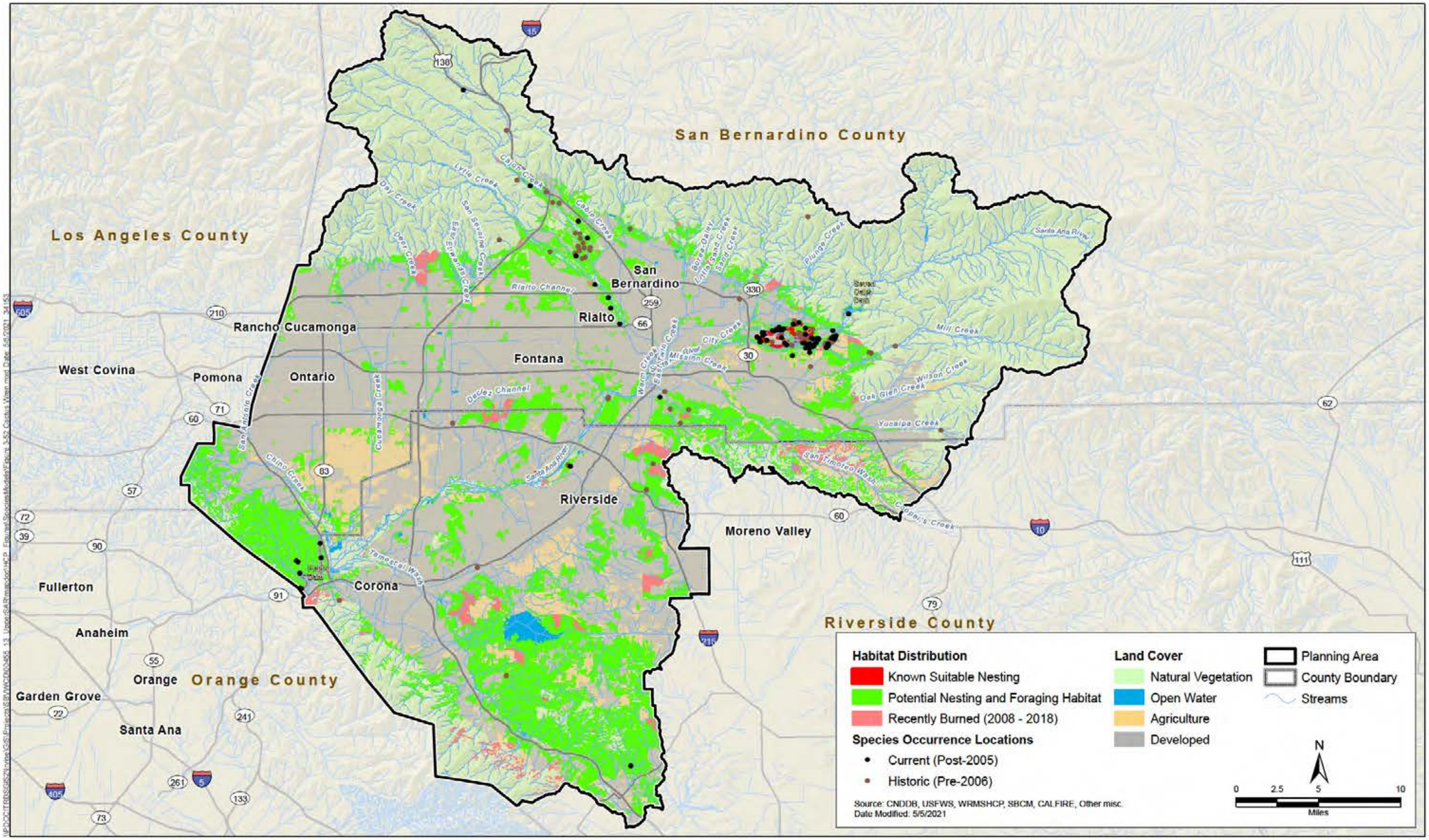
- **Land Cover**: Californian Coastal Scrub; Californian Annual and Perennial Grassland; Californian Disturbed Grassland, Meadow, and Scrub; North American Warm-Desert Xeric-Riparian Scrub; Great Basin-Intermountain Xeric-Riparian Scrub; Californian Coastal Scrub (prickly pear); **AND**
- **Elevation**: 0–2,500 feet; **AND**
- **Slope**: 0–40%.

Recently Burned (2008–2018):

- All Known Suitable Nesting and Potential Nesting and Foraging Habitat that has been burned within the last 10 years (CALFIRE 2018).

Taxonomy and Genetics

Of the eight subspecies of *Campylorhynchus brunneicapillus* (Hamilton et al. 2011), two occur within Southern California. *C. b. sandiegensis* is found in San Diego County and southern Orange County, whereas populations elsewhere on the coastal slope, which includes those within the Planning Area, are classified as *C. b. anthonyi* (Solek and Sziji 2004). Current molecular evidence does not support historical separation of gene lineages between *C. b. sandiegensis* and *C. b. anthonyi* populations



Upper Santa Ana River Habitat Conservation Plan

Figure 3-52
Cactus wren, *Campylorhynchus brunneicapillus*
Potential Habitat Distribution and Known Occurrence Records

(Teutimez 2012), but does indicate recent genetic differentiation of subpopulations, presumably due to habitat fragmentation (Barr et al. 2013).

Reproduction

Cactus wrens nest almost entirely in prickly pear or cholla between 3 and 6 feet tall (Hamilton et al. 2011), and averaging 4 to 5 feet tall within Southern California (Solek and Sziji 2004). Both male and female build the nest (Hamilton et al. 2011, ebird 2014). The female lays 3–5 eggs per clutch (Solek and Sziji 2004). Only the female incubates, which lasts for 16–17 days, and eggs hatch asynchronously (Hamilton et al. 2011, Solek and Sziji 2004). Nestlings fledge 17–23 days after hatching (Hamilton et al. 2011).

Dispersal, Territoriality, and Home Range

Adults show site fidelity to breeding areas, returning to the same area each year (Solek and Sziji 2004). Adults will lead juveniles to old breeding nests for use as roost nests, and eventually stop responding to begging calls to break dependency (Hamilton et al. 2011). Juveniles may disperse to nearby areas, within an average distance of approximately 1 mile of the natal site, but the majority will stay within the site where they were hatched and establish territories (Preston and Kamada 2012). Juveniles typically complete only short-distance dispersal that can be negatively affected by fragmented habitat and non-cactus supporting lands (Teutimez 2012).

Adults may disperse short distances to foraging areas during the non-breeding season. Adults have been documented moving between 0.19 and 0.31 mile from breeding areas (Hamilton et al. 2011). Within Southern California, territories typically range from 1.2 to 4.9 acres (Solek and Sziji 2004). Larger territories have been recorded in drought conditions, when prey populations are depressed (Hamilton et al. 2011). Territories have been recorded as large as 16.6 acres (Hamilton et al. 2011).

Daily and Seasonal Activity

Cactus wren is a year-round, non-migratory resident of the Planning Area. Individuals typically do not make long distance seasonal movements (Hamilton et al. 2011, Solek and Sziji 2004). The breeding period is February to September (Table 3-34) (Hamilton et al. 2011, Simons and Martin 1990). However, adults build nests throughout the year for roosting (Solek and Sziji 2004).

Table 3-34. Seasonal Activity of Cactus Wren

Life Stage/ Activity Period	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Breeding												
Molt												

Sources: Hamilton et al. 2011, Solek and Sziji 2004

Diet and Foraging

Cactus wren forage on the ground or in low shrubs (Hamilton et al. 2011, Solek and Sziji 2004). Their diet consists mainly of insects, such as grasshoppers, ants, beetles, and wasps (Hamilton et al. 2011). As summarized in Solek and Sziji (2004), a stomach contents analysis concluded that vegetation may be important in the diet during months when insect prey is low.

Threats and Special Management Considerations

Habitat loss and fragmentation of habitat seem to have the largest impact on cactus wren (Solek and Sziji 2004, Preston and Kamada 2012). Development has removed large tracts of cactus and has fragmented what is left, which limits dispersal between patches of suitable habitat, creating isolated populations. Decreased gene flow could weaken a population's ability to adapt to changing environmental conditions and potentially lead to localized extinction (Hamilton et al. 2011, Preston and Kamada 2012). The species appears to be affected by edge-related habitat degradation, rather than aversion to the edge per se, which suggests that restoration of cactus scrub habitat along urban edges could be beneficial (Hamilton et al. 2011). Long recovery times for cactus after fire limit the species' ability to recolonize suitable habitat for long periods after fire; use of nest boxes may speed the process (Hamilton et al. 2011). Anthropogenic increase in cover of nonnative grasses and forbs in scrub understory may decrease foraging efficiency (Hamilton et al. 2011).

Habitat throughout the Planning Area consists as a patchy distribution of sage scrub habitat with extensive stands of cactus. Vegetation removal activities will reduce the amount of suitable habitat for this resident species, and it will be important to consider avoidance/restoration of cactus patches for conservation of this species in the Planning Area.

Yellow-Breasted Chat (*Icteria virens*)

Current Status and Distribution

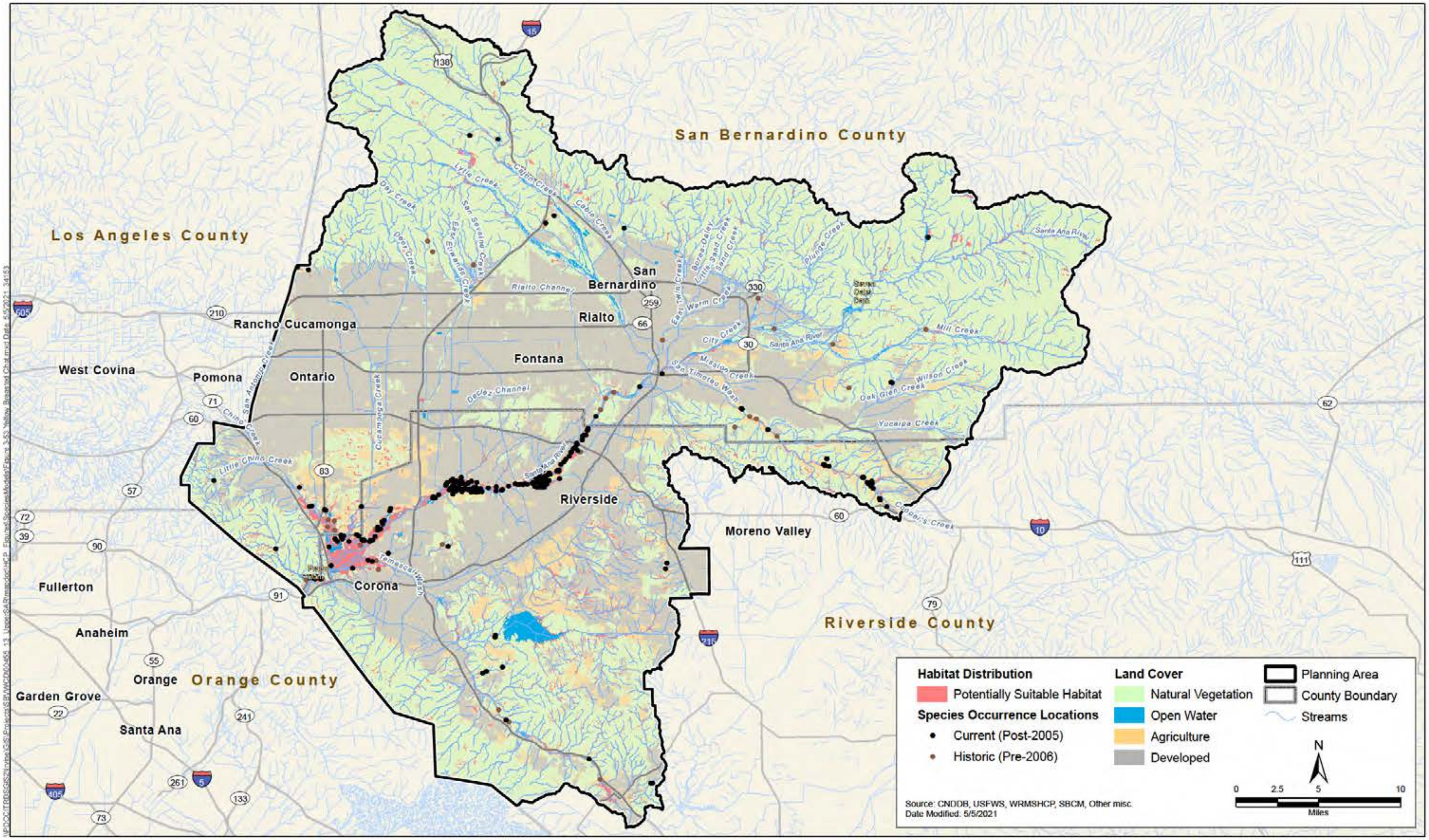
Yellow-breasted chat (*Icteria virens*) is a California Species of Special Concern. It breeds in western North America (from the Great Plains and western Texas toward the west) (Shuford and Gardali 2008, ICF International 2014) and winters in Baja California and southern Texas south through western Mexico to Guatemala (Eckerle and Thompson 2001). In Southern California, the species is known to occur during migration and summer months from the coast east to the Colorado River (Shuford and Gardali 2008). Within the Planning Area, the species occurs sporadically within Riverside and San Bernardino Counties where suitable riparian habitat is present. The largest population is present in the Santa Ana River riparian corridor.

Habitat Requirements

Yellow-breasted chat is found in early successional riparian habitats that have developed shrub layers and an open canopy (Shuford and Gardali 2008). These habitats include riparian woodland and forest, and scrub dominated by cottonwoods, mulefat, and willows (Myers n.d.). Dense thickets are required for nest placement. These often consist of shrubby willows, wild grape (Myers n.d.), and blackberry, tamarisk, and other species that form dense thickets (Shuford and Gardali 2008). Nests are usually built near waterways (Zeiner et al. 1990) along the borders of rivers, streams, and creeks (Shuford and Gardali 2008).

Distribution of Modeled Habitat and Documented Occurrences in the Planning Area

Distribution of yellow-breasted chat modeled habitat and documented occurrences in the Planning Area are illustrated on Figure 3-53, and quantified in Table 3-15. The following modeled habitat types are used to represent the species' habitat distribution in the Planning Area; this includes a listing of the data and/or parameters used to create each modeled habitat type.



Upper Santa Ana River Habitat Conservation Plan

Figure 3-53
Yellow-breasted chat, *Icteria virens*
Potential Habitat Distribution and Known Occurrence Records

Potentially Suitable Habitat

- **Land Cover**: Western North American Disturbed Marsh, Wet Meadow, and Shrubland; Warm Southwest Riparian Forest; Warm Southwest Riparian Forest (Arroyo Willow); Warm Southwest Riparian Forest (Black Willow); Warm Southwest Riparian Forest (Elderberry); Warm Southwest Riparian Forest (Fremont Cottonwood); Warm Southwest Riparian Forest (Red Willow); Warm Southwest Riparian Forest (Sandbar Willow); Warm Southwest Riparian Forest (Shining Willow); Warm Southwest Riparian Forest (Sycamore); Warm Southwest Riparian Forest (White Alder); and Western North American Temperate and Boreal Freshwater Marsh, Wet Meadow, and Shrubland; **AND**
- **NWI and SoCal Wetlands hydrology attribute modifier**: Semi-permanently flooded (regardless of Land Cover type).

Taxonomy and Genetics

Two subspecies exists for *Icteria virens: I. v. virens* in eastern North America and *I. v. auricollis* in western North America.

Reproduction

Adults begin building nests in early to mid-May and chicks usually fledge by early August (Eckerle and Thompson 2001, Dudek and Associates 2003a). Females construct a cup nest between 3 and 6 feet from the ground (Myers n.d.). Females incubate a single clutch of 3–6 eggs (Myers n.d.) for 11–15 days (Zeiner et al. 1990). Young are altricial, hatching without down feathers and unable to nourish themselves, and are fed by both parents until they fledge at 8–11 days (Zeiner et al. 1990, McKibbin and Bishop 2012a).

Dispersal, Territoriality, and Home Range

Literature on juvenile dispersal, territoriality, and home range is limited. As summarized in Eckerle and Thompson. (2001), studies indicate a lack of strong fidelity to return to hatch site to breed. A study found that approximately half of banded nestlings returned to their natal site to breed (McKibbin and Bishop 2012a). For those that did not return to natal site, dispersal ranged from 2.5–15.6 kilometers for males and 2.3–2.6 kilometers for females (McKibbin and Bishop 2012a). The dispersal distance for adult males that did not return to their previous territory ranged from 6.4–42.9 kilometers (McKibbin and Bishop 2012a).

Territorial responses appear to decrease as pairs tend to congregate in an area as population densities increase (Eckerle and Thompson 2001). Studies in the eastern U.S., including Indiana, report the average territory size to be 0.3–3.1 acres (Eckerle and Thompson 2001). In British Columbia, breeding territories were on average 1.5 acres based on singing male locations, but averaged 2.9 acres based on radio telemetry (McKibbin and Bishop 2012b).

Daily and Seasonal Activity

During spring migration, yellow-breasted chat arrives in Southern California early to mid-April and departs for fall migration back to wintering areas in late August into early September (Eckerle and Thompson 2001). Table 3-35 summarizes seasonal activity.

Table 3-35. Seasonal Activity of Yellow-Breasted Chat

Life Stage/ Activity Period	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wintering	■	■	■							■	■	■
Breeding					■	■	■	■				
Migration				■				■	■			
Molt							■	■	■			

Source: Eckerle and Thompson 2001.

Diet and Foraging

Yellow-breasted chat forages by gleaning (Zeiner et al. 1990), taking invertebrates from the surface of foliage or the ground. Diet consists primarily of insects and spiders. Fruits and berries, such as elderberries, blackberries, and wild grape, may also be eaten (Shuford and Gardali 2008, Eckerle and Thompson 2001, Myers n.d.). Invertebrate prey includes beetles, ants, weevils, bees, wasps, mayflies, and caterpillars (Eckerle and Thompson 2001, Myers n.d.). Young are fed soft-bodied invertebrates, including adult and larval insects (Eckerle and Thompson 2001, Myers n.d.).

Threats and Special Management Considerations

Habitat loss and habitat degradation are the primary threats to the species. Removal of vegetation for development, agriculture, or flood control maintenance are the driving forces behind habitat removal (Myers n.d.). Nest parasitism by brown-headed cowbirds is also a contributing factor to the decline of the species (Myers n.d., Zeiner et al. 1990).

Suitable habitat for the species is found throughout the Planning Area within riparian vegetation in and along rivers, creeks, and flood control basins. The most important limiting factor of populations appears to be habitat. Consequently, the maintenance of early successional shrub-scrub habitat is essential. Mature forests with a closed canopy preclude breeding by this species due to the lack of understory. It requires thick vegetation for nesting, and this should be considered when performing activities that alter habitat. Human activity in the vicinity of a nest can cause abandonment of the egg and nestlings by the adults.

Western Yellow-Billed Cuckoo (*Coccyzus americanus*)

Current Status and Distribution

Western yellow-billed cuckoo (*Coccyzus americanus*) is Federally listed as threatened and State-listed as endangered. In California, only three core areas support breeding yellow-billed cuckoo: the Sacramento River between Colusa and Red Bluff, the South Fork of the Kern River, and the lower Colorado River (McNeil and Tracy 2013). The most recent breeding record from the Planning Area was documented in Prado Basin in 1989 (ICF 2014). There are historical occurrences documented within the Santa Ana River (1930 and 1977) and San Timoteo Creek, with sporadic migrants recorded in San Bernardino and Riverside County (USFWS 2014, ICF 2014, Dudek & Associates. 2003a). In August 2014, USFWS proposed designating critical habitat within the Prado Flood Control Basin (Unit 6) in the Planning Area and revised this designation in 2020 (85 *Federal Register* 11458).

Habitat Requirements

Breeding habitat, especially along the Lower Colorado River, has been documented to include structurally complex mature riparian habitats with tall trees and a dense woody vegetative understory, typically near waterways dominated by willows and cottonwoods (Laymon 1998, Hughes 1999). However, recent habitat restoration projects at the Palos Verde Ecological Reserve, which is located on the Lower Colorado River, documented cuckoos favoring young, 2- to 3-year-old cottonwood-willow habitat (McNeil et al. 2011). Furthermore, other studies have documented a range of habitat preferences including monotypic salt cedar with no differentiated understory, linear strips of open and mixed native and nonnative habitat, small isolated patches of mature cottonwood/willow riparian, and very open habitat without understory and small clusters of mature cottonwoods. Canopy height typically ranges from 15 to 100 feet, and the understory ranges from 3 to 20 feet (Dudek & Associates 2003). USFWS description of critical habitat PBFs includes riparian woodlands, prey base consisting of large insect fauna and tree frogs, and dynamic riverine processes that encourage sediment movement and deposits to facilitate plant growth (USFWS 2014).

Distribution of Habitat and Occurrences in the Planning Area

Distribution of western yellow-billed cuckoo modeled habitat and documented occurrences in the Planning Area are illustrated on Figure 3-54, and quantified in Table 3-15. The following modeled habitat types are used to represent the species' habitat distribution in the Planning Area; this includes a listing of the data and/or parameters used to create each modeled habitat type.

High Value Breeding Habitat

- **Land Cover**: Interior Warm and Cool Desert Riparian Forest; **AND**
- Patches of the above selected vegetation must be at least 328 feet in width and *at least* 200 acres in size.

Other Potentially Suitable Breeding Habitat

- **Land Cover**: Interior Warm and Cool Desert Riparian Forest; **AND**
- Patches of the above selected vegetation must be at least 328 feet in width and *less than* 200 acres in size.

Taxonomy and Genetics

Recent research on yellow-billed cuckoo genetics did not indicate sufficient genetic differences between eastern and western yellow-billed cuckoos to support two separate subspecies (USFWS 2014). However, existing DNA studies show sufficient divergence to determine that cuckoos that nest in the western North America are a biologically distinct population segment (USFWS 2014).

Reproduction

Western yellow-billed cuckoo breeding occurs from June through August but may begin as early as May. Both male and female adults construct a flat, loose platform stick nest (Hughes 1999). Nests are built on horizontal branches. Nest height varies from 2–88 feet (Hughes 1999, Dudek & Associates 2003), and on the Santa Ana River varies from 4–30 feet (14-foot average) (Laymon 1998). Incubation is shared by both adults, which lasts 9–12 days. Nestlings are fed by both parents and fledge 5–9 days after hatching (Laymon 1998, Hughes 1999). Cuckoos are an occasional nest parasite, and there is documentation of their laying eggs in other *C. americanus* nests (Hughes 1999).

Dispersal, Territoriality, and Home Range

Cuckoo adults show high breeding site fidelity and have been documented returning to the same site to breed for at least three consecutive seasons (McNeil et al. 2011, USFWS 2014). Two females dispersed 21 and 24 miles to other sites along the same reach of the Colorado River (USFWS 2014).

Home ranges are large, variable in size depending on seasonal food abundance, and overlap between neighboring pairs (McNeil and Tracy 2013). Recent radio telemetry has documented home ranges between 95 and 204 acres (McNeil and Tracy 2013).

Daily and Seasonal Activity

Western yellow-billed cuckoo migrates in the spring and arrives in California as early as mid to late May (Hughes 1999), but typically arrives in June (Laymon 1998). The species' non-breeding range is believed to be the western side of the Andes in South America (Hughes 1999). Departure for fall migration begins in August, but peaks in September (Laymon 1998). Seasonal activity is depicted in Table 3-36.

Table 3-36. Seasonal Activity of Western Yellow-Billed Cuckoo

Life Stage/ Activity Period	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wintering	■	■	■									■
Breeding						■	■	■				
Migration					■	■		■	■	■	■	
Molt	■	■	■						■	■	■	■

Source: Hughes 1999

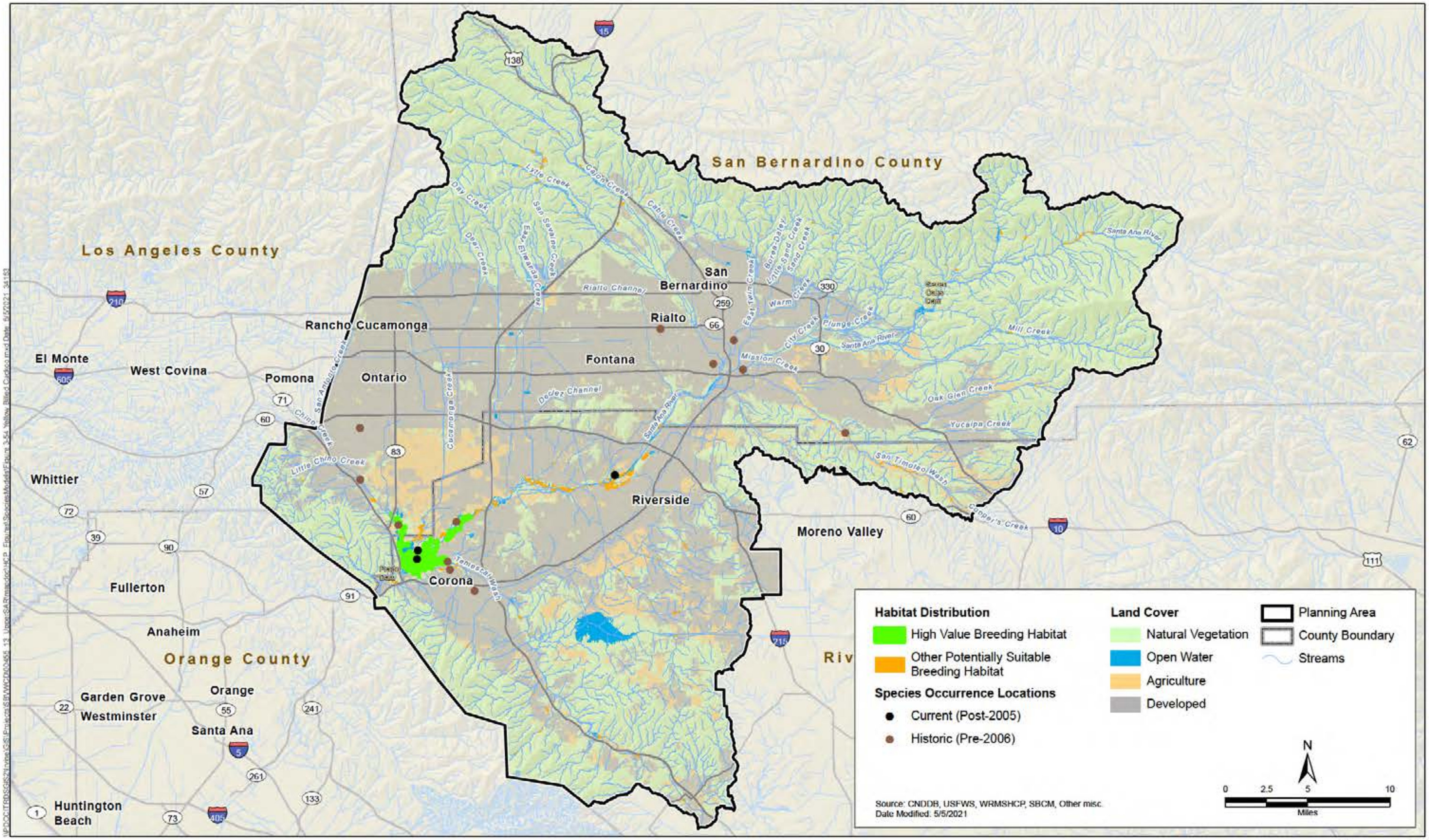
Diet and Foraging

Cuckoos are insectivorous and forage by gleaning, usually while perched (Dudek & Associates 2003, Laymon 1998), taking invertebrates from the surface of foliage. Their diet consists primarily of cicadas, katydids, grasshoppers, crickets, and caterpillars (Hughes 1999, Laymon 1998). Adults feed nestlings whole prey items, which consist primarily of caterpillars (Hughes 1999).

Threats and Special Management Considerations

Habitat loss and fragmentation due to flooding behind dams, clearing, water table lowering, and invasion by nonnative invasive vegetation are the primary threats to the species (Laymon 1998). Groundwater depletion that results in reduction of groundwater-dependent riparian vegetation (e.g., cottonwood, willow, and valley oak) can further fragment and reduce this species' available suitable habitat (Rohde et al. 2019).

Suitable nesting habitat with the appropriate acreage is limited within the Planning Area. Large-scale restoration activities have been shown to be an effective management technique for this species elsewhere within their range, with use documented within 2 years. Areas with the most



Upper Santa Ana River Habitat Conservation Plan

Figure 3-54
Yellow-billed cuckoo, *Coccyzus americanus*
Potential Habitat Distribution and Known Occurrence Records

recent documentation of occurrences, such as Prado Basin, could be considered for such restoration efforts.

Other Relevant Information

Little is known about the migration route of the western yellow-billed cuckoo. Conservation of riparian corridors within the Planning Area may be considered for this species as migration between summer and wintering areas. The most recent statewide survey (1999 to 2000) indicates a population decline with a contraction of the range to the core areas of occurrence along the Sacramento, Kern, and Colorado Rivers (McNeil and Tracy 2013). When compared to earlier statewide surveys (1977 and 1987), there was an absence of yellow-billed cuckoos at isolated sites in the Prado Flood Control Basin, the Mojave and Armargosa Rivers, and the Owens Valley in Inyo County where it had previously bred (McNeil and Tracy 2013). The lower Eel River in Humboldt County may prove to be a newly documented breeding site.

Southwestern Willow Flycatcher (*Empidonax traillii extimus*)

Current Status and Distribution

The southwestern willow flycatcher (*Empidonax traillii extimus*) is Federally and State listed as endangered and has a breeding range that includes Southern California; southern Nevada; southern Utah, Arizona, and New Mexico; and southwestern Colorado (Sogge et la. 2010). Occurrences recorded in the Planning Area since 2004 are in Cajon Wash, Waterman Creek, Day Canyon, Santa Ana River (north of Crafton Hills), San Timoteo Canyon, Santa Ana River (within Prado Basin), English Creek, Little Sand Canyon, and southwest of McKinley Mountain (northeast of San Bernardino) (ICF 2014, USFWS 2013).

Habitat Requirements

In Southern California, the southwestern willow flycatcher is restricted to riparian habitat along rivers, streams, or other wetlands where an adequate prey base is present (USFWS 1995). Suitable habitat typically consists of dense tree or shrub cover (≥ 10 feet) with dense twig structure and foliage, and may include interspersed patches of open habitat (USFWS 1995, Sogge et al. 2010). Vegetative composition can range from all native species to a mix of native and nonnative species or monotypic stands of nonnative species, but almost always includes willow (*Salix* spp.) and/or tamarisk (Sogge et al. 2010, USFWS 2013). Nests are located near surface water or saturated soils; water availability at a site may range from inundated to dry from year to year or within the breeding season (Sogge et al. 2010). Riparian habitats lacking suitable conditions located adjacent to territories may function as secondary habitat used for foraging.

Distribution of Modeled Habitat and Documented Occurrences in the Planning Area

The distribution of southwestern willow flycatcher modeled habitat, documented occurrences, and designated critical habitat in the Planning Area are illustrated on Figure 3-55, and quantified in Table 3-15. The habitat distribution model combines an existing regional model developed by USGS (Hatten 2016) that identifies and ranks core habitat and adds other areas of potentially suitable habitat based on wildlife habitat relationships.[3] The Hatten (2016) model was limited to the extent of potentially suitable land cover types as identified below.

Potentially Suitable Habitat

Land Cover: Western North American Disturbed Marsh, Wet Meadow, and Shrubland; Warm Southwest Riparian Forest; Warm Southwest Riparian Forest (Arroyo Willow); Warm Southwest Riparian Forest (Black Willow); Warm Southwest Riparian Forest (Elderberry); Warm Southwest Riparian Forest (Fremont Cottonwood); Warm Southwest Riparian Forest (Red Willow); Warm Southwest Riparian Forest (Sandbar Willow); Warm Southwest Riparian Forest (Shining Willow); Warm Southwest Riparian Forest (Sycamore); Warm Southwest Riparian Forest (White Alder); Western North American Temperate and Boreal Freshwater Marsh, Wet Meadow, and Shrubland.

The Hatten model output is displayed within the riparian habitat as defined above.

The potentially suitable habitat was then classified into the following habitat suitability categories by ranking highest value to lowest value based on the Hatten (2016) model scores and critical habitat delineations:

- **Core Southwestern Willow Flycatcher Habitat**: Potentially suitable habitat within southwestern willow flycatcher final critical habitat
- **Very High Value Habitat**: Hatten model highest score
- **High Value Habitat**: Hatten model next highest score
- **Moderate Value Habitat**: Hatten model next highest score
- **Other Potentially Suitable Habitat**: Potentially suitable habitat not mapped in the very high, high, and moderate value habitat classes of the Hatten model.

Southwestern Willow Flycatcher Designated Critical Habitat

There are 4,431 acres of designated critical habitat for southwestern willow flycatcher in the Planning Area (78 *Federal Register* 343). Designated critical habitat is located within Bear, Mill, Oak Glen, San Timoteo, and Waterman Creeks, and the East, Middle, and West Forks of the Santa Ana River.

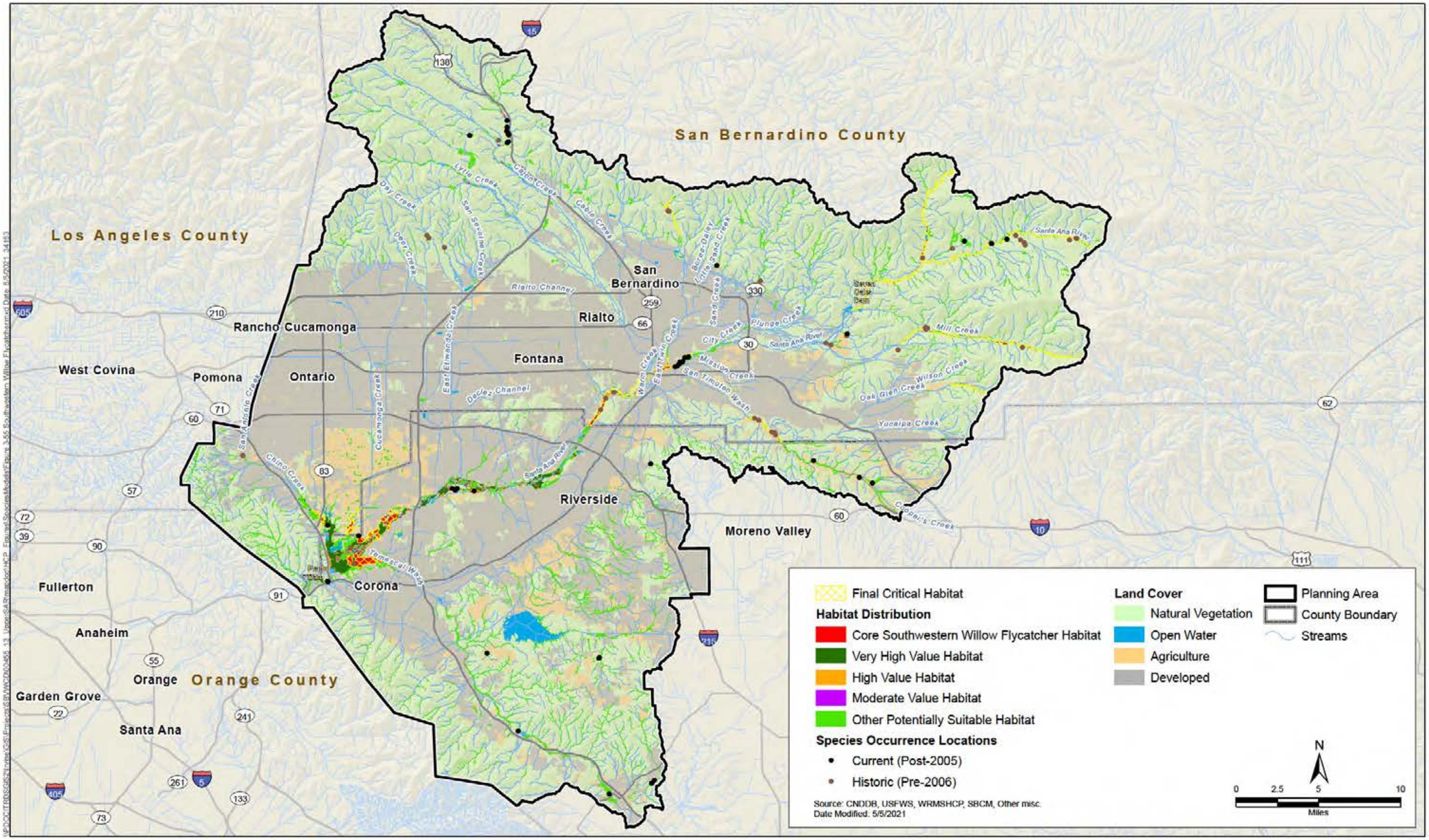
Taxonomy and Genetics

The southwestern willow flycatcher is one of four currently accepted subspecies of the willow flycatcher (*Extimus traillii*) in North America (USFWS 2002). Genetic research has determined that southwestern willow flycatcher (*E. t. extimus*) is a distinct subspecies (Paxton 2000).

Reproduction

The southwestern willow flycatcher is predominantly monogamous, although some populations have high rates of polygyny (Paxton et al. 2007). Breeding typically begins in early June (few in early

[3] The Hatten (2016) Southwestern Willow Flycatcher Model is a statistical model that integrates GIS, Landsat TM data, and logistic regression. Input variables include floodplain size, vegetation density, and variation in vegetation density and amount of dense vegetation. Output of the Hatten model is categorized and ranked into classes of habitat value. See Hatten (2016) for further information.



Upper Santa Ana River
Habitat Conservation Plan

Figure 3-55
Southwestern willow flycatcher, *Empidonax traillii extimus*
Potential Habitat Distribution and Known Occurrence Records

May). The female builds the nest with little to no assistance from the male. Up to two clutches are produced each season; re-nesting rates are higher for pairs following an unsuccessful breeding attempt (Ellis et al. 2008). Clutch size is typically 3–4 eggs and decreases with each re-nesting attempt (Sogge et al. 2010, Ellis et al. 2008). The female incubates eggs for 12–13 days after the last egg is laid. Chicks leave the nest within 12–15 days of hatching. Initially the female provides the majority of care for the young; the male's role increases with the age of the nestlings. Both parents will feed fledglings for about 2 weeks (Sogge et al. 2010).

Dispersal, Territoriality, and Home Range

Most adult flycatchers return to the same drainage from one year to the next, often near their previous breeding site; however, movement to different breeding sites from year to year is not uncommon. Dispersal can range from 0.1–450 kilometers. First year birds tend to disperse farther distances than adults, on average 11 kilometers farther (Sogge et al. 2010, Paxton et al. 2007).

Males establish and defend territories aggressively. Females usually arrive 1 or 2 weeks after males and settle on established territories; the territory is likely chosen based on the characteristics of the site rather than those of the male (Sogge et al. 2010). Territories tend to be larger early in the season and become smaller after pairing occurs (Sogge et al. 2010, Finch and Stoleson 2000). Territory sizes vary depending on the habitat quality, food availability, population density, and pairing/nesting stage. Typically, territories range from 0.2 to 5.7 acres (Sogge et al. 2010).

Daily and Seasonal Activity

Individuals typically arrive on breeding grounds by early May (very few in late April); males typically arrive a few weeks before females (USFWS 2002, Sogge et al. 2010). Pairs with fledglings may stay as late as late-August to early-September. Unpaired males may leave the breeding grounds as early as mid-July (USFWS 2002). Seasonal activity is depicted in Table 3-37.

Table 3-37. Seasonal Activity of Southwestern Willow Flycatcher

Life Stage/ Activity Period	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wintering	■	■	■						■	■	■	■
Breeding					■	■	■	■				
Migration				■	■			■	■			
Molt			■	■				■	■	■	■	

Source: USFWS 2002

Diet and Foraging

The southwestern willow flycatcher is an insectivore generalist and forages on external edges or internal canopy openings of its territory (sometime in neighboring territories), above the canopy or over open water (Finch and Stoleson 2000). Adult diets consist mainly of arthropods: bees, wasps, flies, leaf hoppers, and beetles (Durst et al. 2008), which it catches in the air, gleans from vegetation, or picks from the ground. Variations in diet can occur based on the quality of its territory or weather conditions (Durst 2004).

Threats and Special Management Considerations

The primary threat to southwestern willow flycatcher is the loss, modification, and fragmentation of suitable riparian habitat, caused primarily by dams and reservoirs, water diversion and ground water pumping, channelization, flood control, agriculture, recreation, and urbanization (Durst et al. 2008). Changes in groundwater levels can result in overall reduction in water availability during breeding and nesting seasons, which can particularly affect this species (Rohde et al. 2019). Tamarisk, which has invaded riparian habitats in part due to anthropogenic disturbances, is highly flammable and poses a threat to riparian habitat. The reduction of flow of water through riparian habitat, due to the dams and flood control, allows for the buildup of fuel in the understory, which increases the risk of fire (USFWS 2002) and reduces the natural processes of recruitment and fluvial disturbance.

Major stressors on the species, such as destruction of riparian habitat, manipulation of groundwater and surface water, livestock and other agricultural practices, and floodplain and watershed alterations, must be managed and/or minimized in areas of suitable habitat (USFWS 2002). Monitoring and surveying efforts in the Planning Area should continue in order to maintain current information regarding the population size, breeding status, and distribution of this species. Important considerations when managing and creating riparian habitat are inundation timing, plant species composition, and plant genetic variety, which can influence the arthropod prey base.

Other Relevant Information

Brown-headed cowbirds, which are obligate brood parasites, also contribute to overall nest failure for southwestern willow flycatcher; however, they are not considered a primary threat (Durst et al. 2008). Nonetheless, short-term cowbird control practices, such as trapping, as well as long-term management practices, with an emphasis on reducing conditions known to attract cowbirds, including horse stables, agricultural fields, and golf courses, should be implemented (USFWS 2002, Finch and Stoleson 2000).

Coastal California Gnatcatcher (*Polioptila californica californica*)

Current Status and Distribution

The coastal California gnatcatcher (*Polioptila californica californica*) is Federally listed as threatened and is a California Species of Special Concern. This species occurs in the following locations within the Planning Area: (1) San Bernardino County: Etiwanda Fan, Lytle Creek Wash, Cajon Wash, Cable Creek Wash, Santa Ana River Wash, Mill Creek, Reche Canyon (Jurupa Hills, Blue Mountain), and Chino Hills; and (2) Riverside County: Reche Canyon, Lake Mathews, Gavilan Hills, Norco Hills, Arroyo Del Torro-Temescal Wash (Lake Elsinore, Wasson Canyon), Alberhill/Lake Elsinore (Walker Canyon, Lake Elsinore Clay Mines), and Temescal Valley (ICF 2014, USFWS 2014, eBird 2012).

Habitat Requirements

Coastal California gnatcatcher occurs in Venturan, Riversidian, and Diegan coastal sage scrub (Atwood 1993). Suitable coastal sage scrub typically includes *Artemisia californica*, *Eriogonum fasciculatum*, *Encelia californica*, *E. farinosa*, and various species of *Salvia* (Beyers and Wirtz 1997). Nest success, fledgling survival, and adult survival are positively correlated with robust vertical and horizontal perennial structure, and suitable nest patches can be significantly different among pairs (Braden 1999). USFWS description of critical habitat PBFs includes dynamic and successional sage scrub habitats and nearby non-sage scrub habitats such as chaparral, grassland, and riparian areas to provide space for dispersal, foraging, and nesting (USFWS 2007).

Distribution of Modeled Habitat and Documented Occurrences in the Planning Area

The distribution of coastal California gnatcatcher modeled habitat, documented occurrences, and designated critical habitat in the Planning Area are illustrated on Figure 3-56, and quantified in Table 3-15. As part of the San Diego Multi-Species Management Plan (SDMMP) to conduct long-term coordinated monitoring of the gnatcatcher across the species' range, a statistical habitat distribution model was developed (Preston and Kus 2015). The results of the SDMMP model were applied to areas mapped as Californian Coastal Scrub and North American Warm-Desert Xeric-Riparian Scrub land cover types within the Planning Area, and habitat value was categorized based on the scores of the SDMMP model as follows:

- Very High Value Habitat = 0.75–1.00
- High Value Habitat = 0.50–0.74
- Moderate Value Habitat = 0.25–0.49
- Low Value Habitat = 0–0.24
- **Other Suitable Habitat**: Includes the above vegetation types within the species range but *not* captured by the SDMMP model.
- **Post-processing**: Areas mapped as developed or agriculture in the Upper SAR HCP land cover data were removed from the model results.

Coastal California Gnatcatcher Designated Critical Habitat

There are 13,589 acres of designated critical habitat for coastal California gnatcatcher in the Planning Area (72 *Federal Register* 72009). Designated critical habitat occurs within the central, western, and southwestern portions of the Planning Area.

Taxonomy and Genetics

One of three subspecies of California gnatcatcher, the coastal California gnatcatcher (*P. c. californica*) is the northernmost subspecies of California gnatcatcher. Other subspecies (*P. c. pontilis* and *P. c. margaritae*) are located in Baja California (Atwood 1993).

Reproduction

The coastal California gnatcatcher is monogamous. The breeding season occurs from mid-February to August. Both males and females nest build, incubate, and care for altricial young. Egg laying is highest April through May. Incubation is 14–15 days, clutch size ranges from 2–5 eggs, and chicks fledge 16 days after hatching (USFWS 2010d). Reproductive success is dependent on habitat condition, predator populations, and food availability.

Dispersal, Territoriality, and Home Range

The coastal California gnatcatcher is a permanent resident and does not migrate. This species tends to remain in the same home range from year to year and disperses only as far as necessary to find unoccupied areas within suitable habitat patches (Atwood 1993, Braden 1999). This species' natal dispersal is largely connected with corridors of native vegetation. Juveniles generally disperse approximately 1.4 miles from their natal site depending on habitat availability and condition (Bailey and Mock 1998). The pair of gnatcatchers defends their home range. Density of shrub cover, composition of plants, habitat quality, surrounding disturbances, and adjacent gnatcatcher territories dictate the size of a territory (Kucera 1997). The size of a territory ranges between 2 and 14 acres (USFWS 2010d), typically on lower elevations along coast ranges or on gentle slopes.

Daily and Seasonal Activity

The coastal California gnatcatcher is diurnal and is active yearlong. The species' highest activity is in the morning. Daily activity is dependent on the condition of occupied coastal sage scrub. Poor quality coastal sage scrub results in an expansive home range. Foraging can occur in adjacent vegetation communities (e.g., riparian and chaparral), especially in the non-breeding season. During the breeding season, home range becomes smaller (Atwood 1993). Seasonal activity is depicted in Table 3-38.

Table 3-38. Seasonal Activity of Coastal California Gnatcatcher

Life Stage/ Activity Period	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Breeding		■	■	■	■	■	■	■				
Dispersal					■	■	■	■	■	■		
Molt	■	■	■				■	■	■			

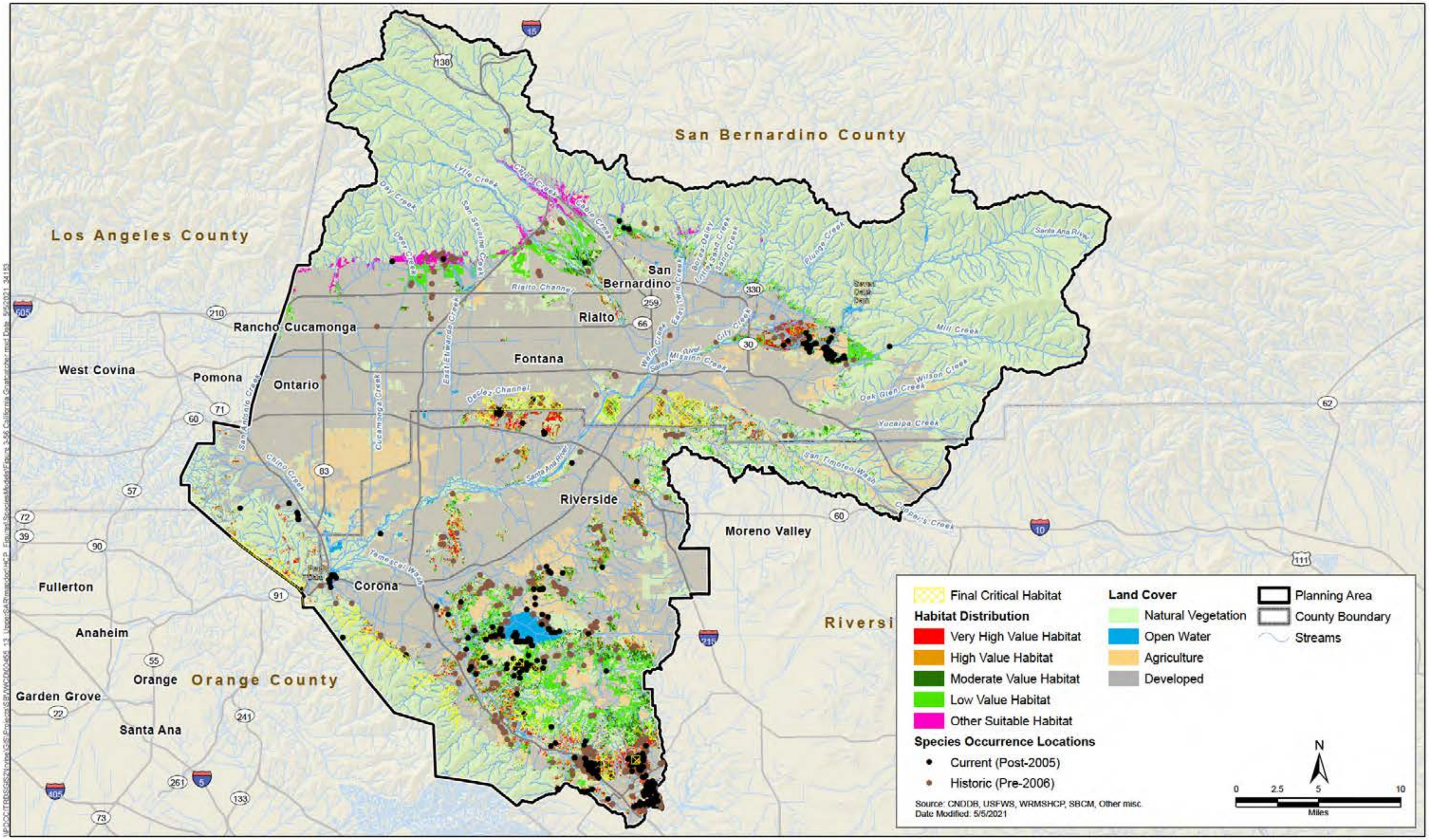
Sources: Atwood 1993, Atwood and Bontrager 2001

Diet and Foraging

Coastal California gnatcatcher typically gleans insects from vegetation, primarily *Artemisia* and *Eriogonum* (Atwood 1993) and may also eat some seeds (Kucera 1997). The species' foraging range is dependent on condition of coastal sage scrub (variation of plant species and shrub cover), food availability, and time of year (breeding season vs. non-breeding season) (Atwood 1993).

Threats and Special Management Considerations

The primary threat to coastal California gnatcatcher is loss of habitat due to urban and agricultural development. Wildfires, nest predators, and brood parasitism by brown-headed cowbirds have potential to debilitate population viability (Atwood 1993). Successful conservation of the species is dependent on restoring or enhancing areas of fragmented coastal sage scrub throughout the Planning Area so that increased shrub cover and improved habitat quality supports dispersing individuals. Expansion of corridors connecting good quality coastal sage scrub allows for a greater exchange of genetic material. Expanding/connecting areas of coastal sage scrub between Lytle Creek and the Etiwanda Fan, Lake Mathews, and other areas that are currently fragmented would promote the overall viability of the species within the Planning Area. Coastal sage scrub restoration areas should include higher density of *Artemisia californica* and *Eriogonum fasciculatum*, as there seems to be a strong correlation between these species and occupied habitat (likeliness to use as nest substrate and greater food supply). Additionally, wildfires are fueled by drought-tolerant coastal sage scrub. Fire management along the foothills of the San Bernardino and San Gabriel Mountains and areas of critical habitat throughout the Planning Area should be carefully considered.



Upper Santa Ana River Habitat Conservation Plan

Figure 3-56
Coastal California gnatcatcher, *Polioptila californica californica*
Potential Habitat Distribution and Known Occurrence Records

Other Relevant Information

The highest densities of coastal California gnatcatcher are known to occur in the upper Santa Ana River, Lake Mathews Watershed, the foothills of the San Bernardino mountains (Etiwanda Fan, Lytle Creek, Cable Creek), and Temescal Wash. Riversidian coastal sage scrub with greater than 50% shrub cover has the highest potential to support successful nesting and high quality foraging grounds. Home ranges or territory sizes are dependent on density of shrub cover, composition of plants, habitat quality, surrounding disturbances, and adjacent gnatcatcher territories. Poor quality coastal sage scrub increases dispersal and overall home range size.

Least Bell's Vireo (*Vireo bellii pusillus*)

Current Status and Distribution

Least Bell's vireo (*Vireo bellii pusillus*) is listed as Federally and State endangered. The species is found throughout Southern California during the breeding season, from Santa Barbara County southward, with the largest populations in San Diego and Riverside Counties (USFWS 2006). The species is distributed throughout the Planning Area where suitable riparian habitat is present, with the largest core population in the Prado Basin portion of the Santa Ana River (ICF 2014).

Habitat Requirements

Suitable habitat is largely associated with early successional (5- to 10-year-old) riparian scrub and woodlands that have developed canopy layer and dense shrubs at 3–6 feet (Franzreb 1989). Habitat is typically dominated by species such as mulefat, willows, cottonwood, and Mexican elderberry (Kus 2002). Nesting habitat in California is characterized by a dense shrub layer 2–10 feet aboveground, and the species can use any age riparian habitat if such an understory is present (Franzreb 1989, Kus 2002). Breeding birds are also found in isolated riparian patches (>0.20 acre) with no discernable over-story canopy and limited understory structure (Braden 2015). USFWS description of critical habitat PBFs includes riparian woodland vegetation that generally contains both canopy and shrub layers, and some associated upland habitats (USFWS 1994).

Distribution of Modeled Habitat and Documented Occurrences in the Planning Area

The distribution of least Bell's vireo modeled habitat, documented occurrences, and designated critical habitat in the Planning Area are illustrated on Figure 3-57, and quantified in Table 3-15. The following modeled habitat types are used to represent the species' habitat distribution in the Planning Area; this includes a listing of the data and/or parameters used to create each modeled habitat type.

Core Breeding Habitat

- **Land Cover**: Western North American Disturbed Marsh, Wet Meadow, and Shrubland; Warm Southwest Riparian Forest; Warm Southwest Riparian Forest (Arroyo Willow); Warm Southwest Riparian Forest (Black Willow); Warm Southwest Riparian Forest (Elderberry); Warm Southwest Riparian Forest (Fremont Cottonwood); Warm Southwest Riparian Forest (Red Willow); Warm Southwest Riparian Forest (Sandbar Willow); Warm Southwest Riparian Forest (Shining Willow); Warm Southwest Riparian Forest (Sycamore); Warm Southwest

Riparian Forest (White Alder); Western North American Temperate and Boreal Freshwater Marsh, Wet Meadow, and Shrubland; **AND**

- **NWI and SoCal Wetlands hydrology attribute modifier:** Semi-permanently flooded (regardless of Land Cover type); **AND**
- Within final critical habitat.

Other Breeding Habitat

- **Land Cover**: Western North American Disturbed Marsh, Wet Meadow, and Shrubland; Warm Southwest Riparian Forest; Warm Southwest Riparian Forest (Arroyo Willow); Warm Southwest Riparian Forest (Black Willow); Warm Southwest Riparian Forest (Elderberry); Warm Southwest Riparian Forest (Fremont Cottonwood); Warm Southwest Riparian Forest (Red Willow); Warm Southwest Riparian Forest (Sandbar Willow); Warm Southwest Riparian Forest (Shining Willow); Warm Southwest Riparian Forest (Sycamore); Warm Southwest Riparian Forest (White Alder); Western North American Temperate and Boreal Freshwater Marsh, Wet Meadow, and Shrubland; **AND**
- **NWI and SoCal Wetlands hydrology attribute modifier**: Semi-permanently flooded (regardless of Land Cover type).

Least Bell's Vireo Designated Critical Habitat

There are 9,900 acres of designated critical habitat for least Bell's vireo in the Planning Area (*Federal Register*, February 2, 1994). Designated critical habitat occurs within Prado Basin and along the Santa Ana River in the Planning Area.

Taxonomy and Genetics

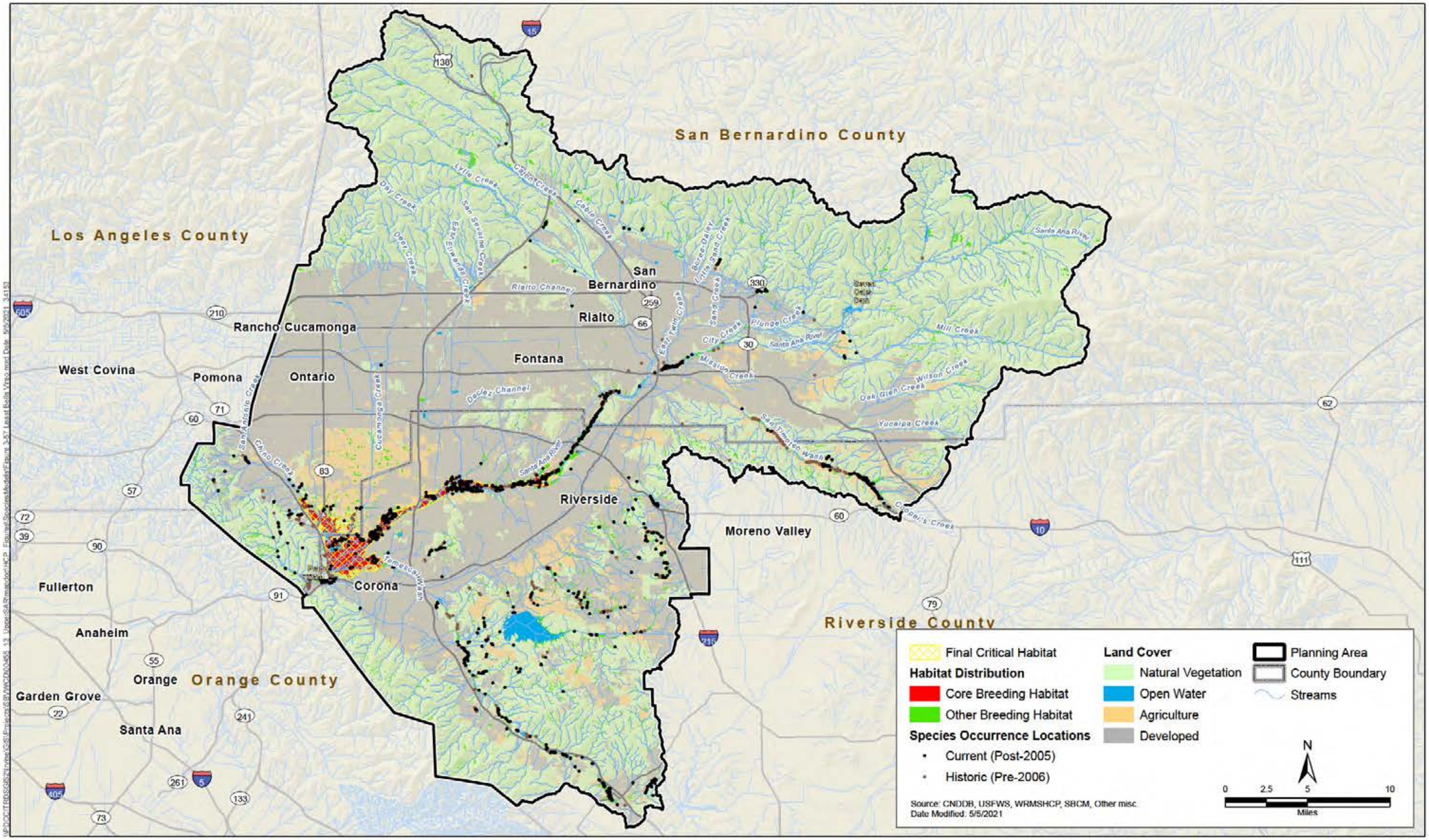
Least Bell's vireo is one of four subspecies of Bell's vireo (*Vireo belli*). All subspecies breed in different areas of the U.S. and winter in Mexico (Franzreb 1989).

Reproduction

Least Bell's vireo breeds monogamously. Males arrive mid-March to establish and defend breeding territories. Nests are built in dense shrubs along the edge of riparian habitat (USFWS 1998). Nests are typically placed below approximately 6.5 feet from the ground. In the Planning Area, nests were most common in willow species (48%) and mulefat (29%) (SAWA 2019). Courtship, pair-bonds, and nesting occurs while the male actively defends the breeding territory. Both adults incubate for 14 days and feed chicks. Clutch size is 3–5 eggs, and pairs often produce two broods (Franzreb 1989). Young fledge in 10–12 days, but are tended by adults for up to 40 days. Fledglings disperse gradually from the natal site.

Dispersal, Territoriality, and Home Range

Birds have a high breeding site fidelity in that an individual will return to breed in the same area from year to year (Franzreb 1989). Juveniles disperse from their natal site gradually: 10–100 meters between the first 14 days after fledging and approximately 1.6 kilometer from the natal site by the time of the second brood (Kus et al. 2010). Individuals are capable of long-distance dispersal, perhaps over 350 kilometers (217 miles) (Howell et al. 2010).



Upper Santa Ana River
Habitat Conservation Plan

Figure 3-57
Least Bell's vireo, *Vireo bellii pusillus*
Potential Habitat Distribution and Known Occurrence Records

Males aggressively defend breeding territories through all reproductive stages. Breeding territories expand and contract based on the nest cycle stage, with wider territories while a male is unpaired and as fledglings begin to forage. Territories contract when a male is mated and the pair is incubating (Kus et al. 2010). Breeding territories vary from 0.37 to 4.1 acres depending on location (Franzreb 1989). Along the Santa Ana River, breeding territories range from 0.75–3.2 acres (Kus et al. 2010).

Daily and Seasonal Activity

Least Bell's vireo are mostly active during the day. Daily activity includes foraging by hopping amongst vegetation between branches while foraging (Kus 2002). Seasonal activity includes defense of breeding territory by males during the nesting season. Migration occurs in April–May and August–November from Southern California to overwintering areas in southern Baja California (Table 3-39) (Franzreb 1989, Kus et al. 2010).

Table 3-39. Seasonal Activity of Least Bell's Vireo

Life Stage/ Activity Period	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wintering	X	X										X
Breeding			X	X	X	X	X					
Migration			X	X	X			X	X	X	X	
Molt						X	X	X	X			

Source: Kus et al. 2020

Diet and Foraging

Least Bell's vireo is an insectivore. Foraging behavior includes gleaning, hovering, and hawking (fly-catching behavior) insects from all riparian vegetation levels, up to 20 meters (65 feet) above the ground, with activity concentrated in lower to mid-canopies during breeding (Kus 2002). During the nesting season, foraging is typically restricted to the breeding territory. Non-riparian habitat adjacent to the breeding territory is utilized as foraging habitat toward the end of the nesting season (Franzreb 1989).

Threats and Special Management Considerations

Predominant threats to the species include loss of riparian habitat, degradation of riparian habitat, and brood parasitism by brown-headed cowbird (Franzreb 1989). Changes in groundwater levels can result in overall reduction in water availability during breeding and nesting seasons, which can particularly affect this species (Rohde et al. 2019). Successful conservation of the species is dependent on restoring or enhancing areas of fragmented and degraded riparian habitat so that successional habitat can support dispersing and returning individuals. In the Planning Area, areas such as the Prado Basin and Santa Ana River should continue annual brown-headed cowbird trapping to decrease brood parasitism. Establishment and recruitment of riparian habitat is dependent on natural hydrological processes, and changes to those processes can alter the distribution and species composition of riparian habitat, which in turn could affect breeding suitability and reproductive output.

Los Angeles Pocket Mouse (*Perognathus longimembris brevinasus*)

Current Status and Distribution

Los Angeles pocket mouse (*Perognathus longimembris brevinasus*) is a California Species of Special Concern. Its distribution is restricted to Southern California. Historically, it was found from San Fernando east through San Bernardino and Riverside to Cabazon, south through Temecula to Aguanga (Williams 1986, Bolster 1998). It has been documented in the northern portion of the Planning Area, almost entirely within San Bernardino County, with some occurrences in Riverside County (ICF 2014).

Habitat Requirements

Generally, habitat consists of alluvial, aeolian, or well-drained upland deposits of sandy soil in sparsely vegetated habitats (Dudek & Associates 2003). These habitats are generally lower elevation sparse grassland, alluvial sage scrub, and coastal sage scrub (Bolster 1998). Foraging occurs under shrub cover or near rock crevices (Dudek & Associates 2003). In Riverside County, trapping data suggests that habitat dominated by bare ground is more frequently occupied than habitat dominated by litter and grass thatch (WRMSHCP 2011).

Distribution of Modeled Habitat and Documented Occurrences in the Planning Area

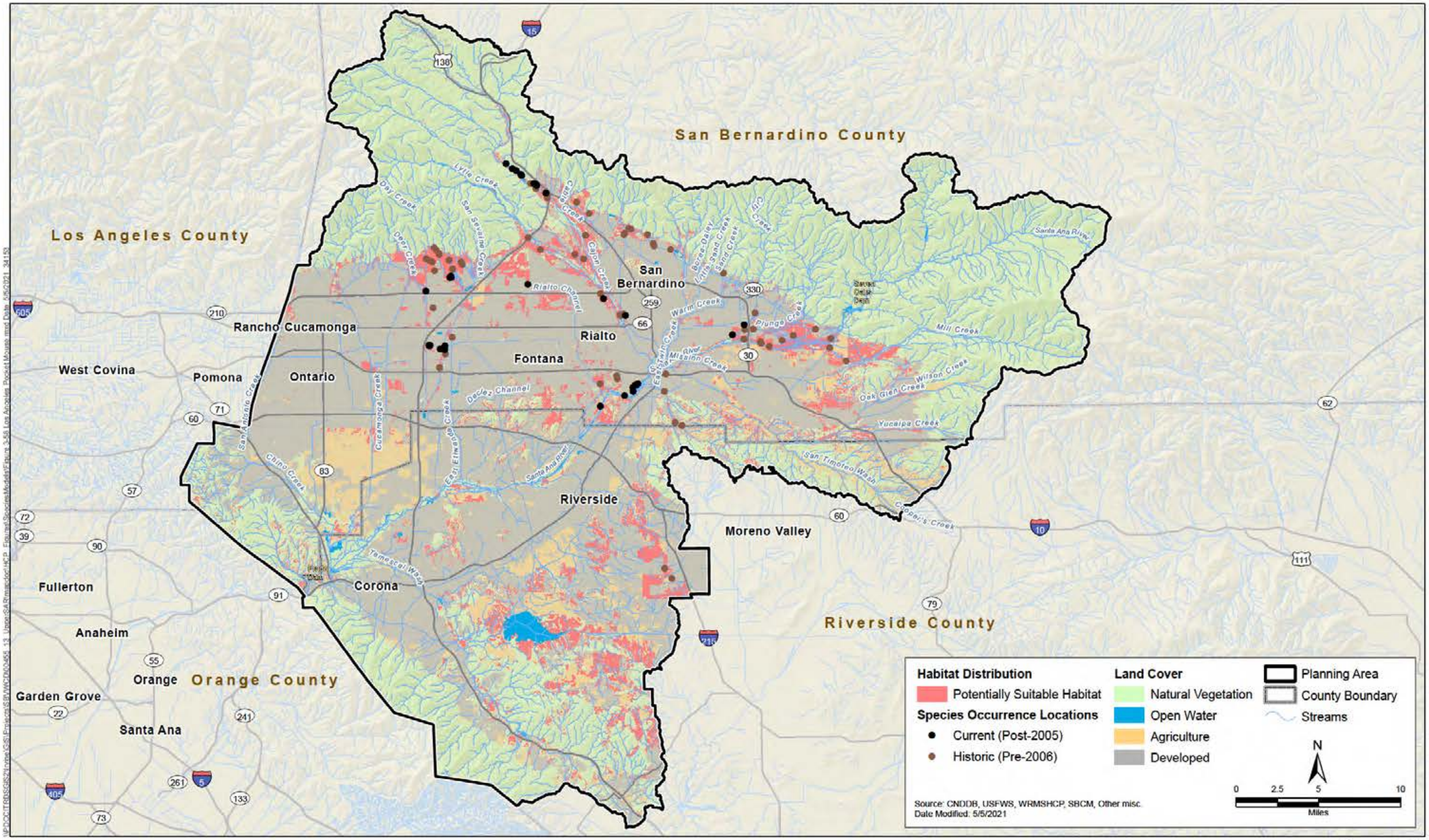
Distribution of Los Angeles pocket mouse modeled habitat and documented occurrences in the Planning Area are illustrated on Figure 3-58, and quantified in Table 3-15. The following modeled habitat types are used to represent the species' habitat distribution in the Planning Area; this includes a listing of the data and/or parameters used to create each modeled habitat type.

Potentially Suitable Habitat

- **Land Cover**: Californian Coastal Scrub; Californian Annual and Perennial Grassland; Californian Disturbed Grassland, Meadow, and Scrub; North American Warm-Desert Xeric-Riparian Scrub; Great Basin-Intermountain Xeric-Riparian Scrub; **AND**
- **Soil Texture**: Sand; sandy loam; coarse sand; coarse sandy loam; fine sand; fine sandy loam; loamy sand; loamy coarse sand; loamy fine sand; river wash; very fine sandy loam; **AND**
- **Landform**: alluvial fans; alluvial flats; floodplains; foothills, terraces, and uplands; also drainageways regardless of land cover type; **AND**
- **Elevation**: 0–3,000 feet; **AND**
- **Slope**: 0–10%.

Taxonomy and Genetics

Los Angeles pocket mouse is one of eight subspecies of *P. longimembris* found in California. Subspecies *P. l. pacificus,* is Federally endangered. *P. l. brevinasus* is physically distinguished from other *P. longimembris* subspecies by a short rostrum (Bolster 1998).



Upper Santa Ana River Habitat Conservation Plan

Figure 3-58
Los Angeles pocket mouse, *Perognathus longimembris brevinasus*
Potential Habitat Distribution and Known Occurrence Records

Reproduction

Individuals breed once, typically April–June, but can extend breeding season and have more litters. Reproduction appears correlated with rainfall and seed availability, which can result in substantial population fluctuations (USFWS 2010e). Reproductive males and females have been observed as early as February and continue through September, with the peak of breeding occurring May–June (Dudek & Associates 2003). Litters consist of 3 to 4 pups.

Dispersal, Territoriality, and Home Range

The data on Los Angeles pocket mouse is limited. Studies done on *P. longimembris* show high site fidelity, with individuals trapped from year to year as close as 50 feet from previous detections. Studies from similar subspecies, *P. l. pacificus,* showed first year individuals dispersing a mean distance of 62 feet (Dudek & Associates 2003).

Individuals are solitary, with home ranges typically overlapping during the breeding season. A study of *P. longimembris* demonstrated that home ranges averaged 0.25–1.2 acres, with an average of 0.74 acre. Average home ranges are 1.2–7.6 acres for females and 0.7–4.7 acres for males (Dudek & Associates 2003).

Though dispersal and home ranges are relatively small (generally no more than 8 acres per individual), corridors for dispersal between populations are important for the health and survival of the species. Disconnection between populations limits gene flow, which may prevent populations from adapting to changing environmental conditions.

Daily and Seasonal Activity

Los Angles pocket mouse is primarily nocturnal, being active and emerging at night (Dudek & Associates 2003, WRMSHCP 2011). The species uses torpor to decrease body temperature and metabolic rate to conserve energy. It remains underground in burrows from September to March (USFWS 2010e). However, timing and duration of activity cycles can vary across seasons and appear to be a function of soil temperature, food availability, and ambient air temperature; aestivation (dormancy) has been recorded in June (USFWS 2010e). May and June are peak months for surface activity (WRMSHCP 2011). Seasonal activity is depicted in Table 3-40.

Table 3-40. Seasonal Activity of Los Angeles Pocket Mouse

Life Stage/Activity Period[1]	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hibernation	■	■	■						■	■	■	■
Peak Surface Activity					■	■	■					
Breeding				■	■	■						

Sources: Dudek & Associates 2003, WRMSHCP 2011, USFWS 2010e
[1]Timing and duration of seasonal activity can vary depending upon site conditions (e.g., soil temperature, food availability, ambient air temperature)

Diet and Foraging

Los Angeles pocket mouse is primarily a granivore (seed eater), and may prefer to feed on grass and forb seeds (Dudek & Associates 2003). Although a strong seed specialist, it may seasonally eat forbs and rarely insect larva and arthropods (Bolster 1998). Los Angeles pocket mouse forages on the ground under the low canopy of shrubs and trees, using fur–lined cheek pouches to gather food. It stores seeds in underground caches (Dudek & Associates 2003).

Threats and Special Management Considerations

The main threat to the species is habitat loss due to urban and suburban development, agriculture, sand and gravel mining, and flood control projects (Bolster 1998, Dudek & Associates 2003, WRMSHCP 2011). Fragmentation of habitat caused by habitat loss creates isolated populations that limit dispersal, causing a decrease in gene flow that could lead to localized extirpation (Dudek & Associates 2003). Plant species that are food sources for Los Angeles pocket mouse may be adversely affected by changes in groundwater management regimes. Changes in groundwater levels may also affect soil substrates, which would affect the availability of forage (Rohde et al. 2019).

Suitable habitat for this species is found throughout the Planning Area. Based on occurrence information, habitat suitability appears linked to the presence of sandy terraces associated with rivers and creeks. These areas experience infrequent flood events that remove excess vegetation, grass thatch, and litter to maintain the open sandy soils preferred by this species. Any activities that might change the flood event frequency could have a negative effect on the species. The allocation and conservation of large areas of habitat should be considered to prevent continued decline in distribution and abundance. This species responds well to management activities, such as fire (WRMSHCP 2011) and presumably mechanical removal that takes out excess shrub vegetation and groundcover to expose open sandy substrates. This species has limited periods when it is active at the surface, which must be considered for any monitoring program that is established.

San Bernardino Kangaroo Rat (*Dipodomys merriami parvus*)

Current Status and Distribution

San Bernardino kangaroo rat (*Dipodomys merriami parvus*) is Federally listed as endangered and is a candidate for listing as endangered under the California Endangered Species Act (CESA). Prior to emergency listing under the CESA, the San Bernardino County Museum estimated the historic range at 28,000 acres. At the time of the final listing, USFWS determined that only about 9,797 acres appeared to be suitable in three primary locations: (1) Santa Ana River (3,861 acres), (2) Lytle Creek and Cajon Creek (5,161 acres), and (3) San Jacinto River (775 acres), with smaller amounts of habitat at City Creek, Reche Canyon, Etiwanda alluvial fan, and South Bloomington (USFWS 2009c). During the 2009, 5-year review, USFWS determined that San Bernardino kangaroo rat (SBKR) populations persisted only within the three main locations; however, these habitats were highly fragmented and included a mosaic with varying qualities of habitat that were isolated from other high-quality habitats occupied by the species (USFWS 2009c). As of 2018, it was estimated that over 85% of remaining functional SBKR occupied habitat was associated with Lytle Creek and Cajon Wash and the Santa Ana River, with the other important occupied habitat occurring along the San Jacinto River (USFWS 2009c). This species is likely extirpated from the Etiwanda Fan and Bautista Creek (USFWS 2018).

Current (post-2005) occurrences of this species are known from the northern portion of the Planning Area in San Bernardino County, Day Canyon Wash, Etiwanda Canyon, Lytle Creek, Cajon Canyon, Devil Canyon, and City Creek, and habitat along the Upper Santa Ana River from southwest of the San Bernardino International Airport east to the Crafton Hills. There is also critical habitat designated in the Planning Area.

Habitat Requirements

Primary habitat for San Bernardino kangaroo rat is Riversidian alluvial fan sage scrub (RAFSS) within alluvial floodplains (USFWS 2009c). Each successional stage of this habitat (pioneer, intermediate, and mature) is used, but highest densities are often found in pioneer-intermediate RAFSS. Mature habitat occurs within the greatest elevation from the low flow channel and provides the most protection from inundation during storm events (USFWS 2002). Sandy substrate is the best predictor of species abundance (Shier et al. 2019), while a high density of nonnative grass is most strongly correlated with negative occupancy (USFWS 2009c). USFWS description of critical habitat PBFs includes alluvial fans, washes and associated floodplains with sandy soils suitable for burrowing, and adjacent upland areas, including alluvial fan sage scrub and associated vegetation with a moderately open canopy (USFWS 2002).

Distribution of Modeled Habitat and Documented Occurrences in the Planning Area

The distribution of SBKR modeled habitat, documented occurrences, designated critical habitat, refugia, and areas assumed to be occupied in the Planning Area are illustrated on Figure 3-59, Figure 3-60, and 3-61 and quantified in Table 3-15. The following modeled habitat type is used to represent the species' habitat distribution in the Planning Area; this includes a listing of the data and/or parameters used to create the modeled habitat type.

The distribution of SBKR habitat in the Planning Area is based on a habitat suitability model developed by ICF with review and input from SBKR researchers at the San Diego Zoo Institute for Conservation Research.

Suitable Habitat

- **Land Cover**: Californian Coastal Scrub, California Coastal Scrub (California buckwheat), North American Warm-Desert Xeric-Riparian Scrub, Great Basin-Intermountain Xeric-Riparian Scrub, and Water – Seasonal; **AND**
- **Soil Type:** The above land cover types were then clipped to fluvent soils as identified in the U.S. Department of Agriculture (USDA) National Resource Conservation Service (NRCS) Soil Survey Geographic Database. SBKR researchers at the San Diego Zoo Institute for Conservation Research have found that SBKR often have a high association with fluvent soils (alluvial soils where repeated deposition of sediments from periodic flooding prevents the development of more mature soil characteristics) (Shier pers. comm.). The fluvent soils data were used to select model results in the GIS layer, which were retained in the final results. Areas with non-fluvent soils were removed.
- **Post-Processing**: Areas that were highly fragmented resulting in small (e.g., less than 10 acres) and isolated (e.g., greater than 1,000 feet) patches of habitat were removed from the model results. Areas that were small, fragmented, highly disturbed, and isolated by development were identified using aerial photos and removed from the model output or downgraded in habitat assessment classification, where appropriate.

  Other areas were included in the final model results if they were surrounded by modeled suitable habitat and were known to be suitable from field observations, even when the GIS model did not include them (e.g., due to fine-scale differences in the regional vegetation or soils mapping data).

- **Potential Refugia Habitat:** Areas outside of the 100-year floodplain boundary were identified as Potential Refugia Habitat (see Figure 3-60) important to temporarily support SBKR during major flood events.

San Bernardino Kangaroo Rat Assumed Occupied Habitat

- **Assumed Occupied Habitat:** Assumed Occupied is not a modeled dataset; it is a separate data layer that was estimated to indicate all areas where SBKR may be present (Figure 3-61). All areas outside of this data layer have extremely limited potential for SBKR to occur. The layer was generated from review of available trapping data (positive and negative), known extant occurrences, and estimates of likely occupied areas where data were absent. It provides a conservative estimate of all areas where SBKR has the potential to be found. Note: because some areas known to support SBKR did not have occurrence data available in GIS format not all areas of assumed occupied habitat will have occurrences shown in Figure 3-61.

San Bernardino Kangaroo Rat Designated Critical Habitat

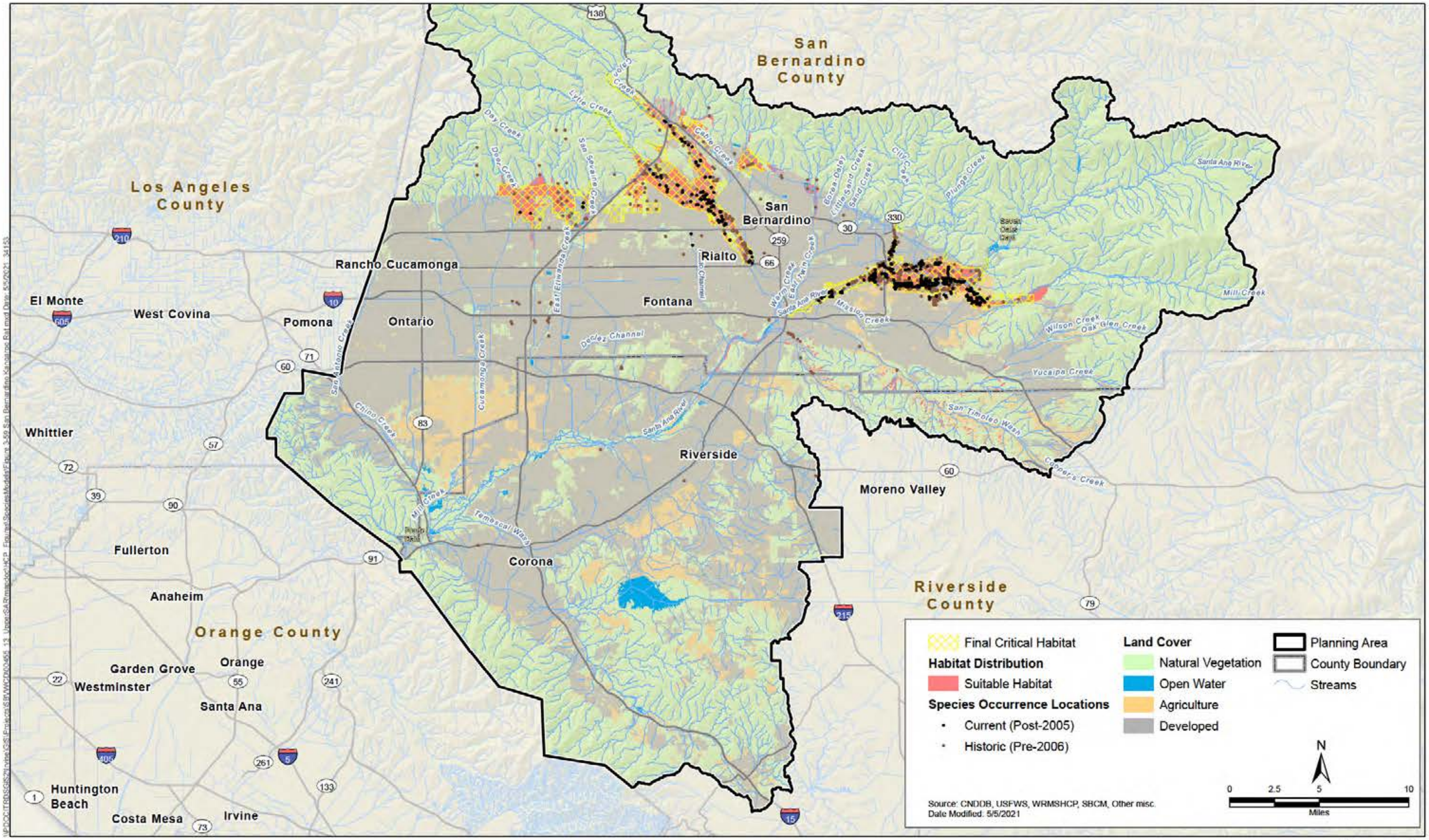
There are 27,745 acres of designated critical habitat for SBKR in the Planning Area (72 *Federal Register* 33807). Designated critical habitat occurs within the Etiwanda Fan, Lytle, and Cajon Creeks (including Cable and Devil Canyon Creeks) and the Santa Ana River Wash (including portions of Mill, Plunge, and City Creeks).

Taxonomy and Genetics

The subspecies is one of three Merriam's kangaroo rat (*Dipodomys merriami*) in California (USFWS 2009c). The species is the most highly differentiated subspecies of *Dipodomys merriami* morphologically (Lidicker 1960). A range-wide genetic study found that the three primary remaining populations (Santa Ana, Lytle-Cajon, and San Jacinto) are genetically distinct from one another with further sub-structuring among sites within the populations and little to no gene flow between sites (Hendricks et al. 2020). Sub-structuring indicates isolation or limited gene flow is occurring among sites within populations. All three remaining populations exhibit a low level of genetic diversity with low effective population sizes (Hendricks et al. 2020). Diversity within the three populations is similar to other species with fragmented distributions. Genetic evidence suggests that these three populations have been recently separated, likely within the last 100 years, which also corresponds with reduction in habitat since the 1930s (Hendricks et al. 2020). This indicates a lack of ability to adapt to environmental change, which in turn makes the populations more vulnerable to extinction as a result of stochastic (random) environmental events, such as wildfire or flooding.

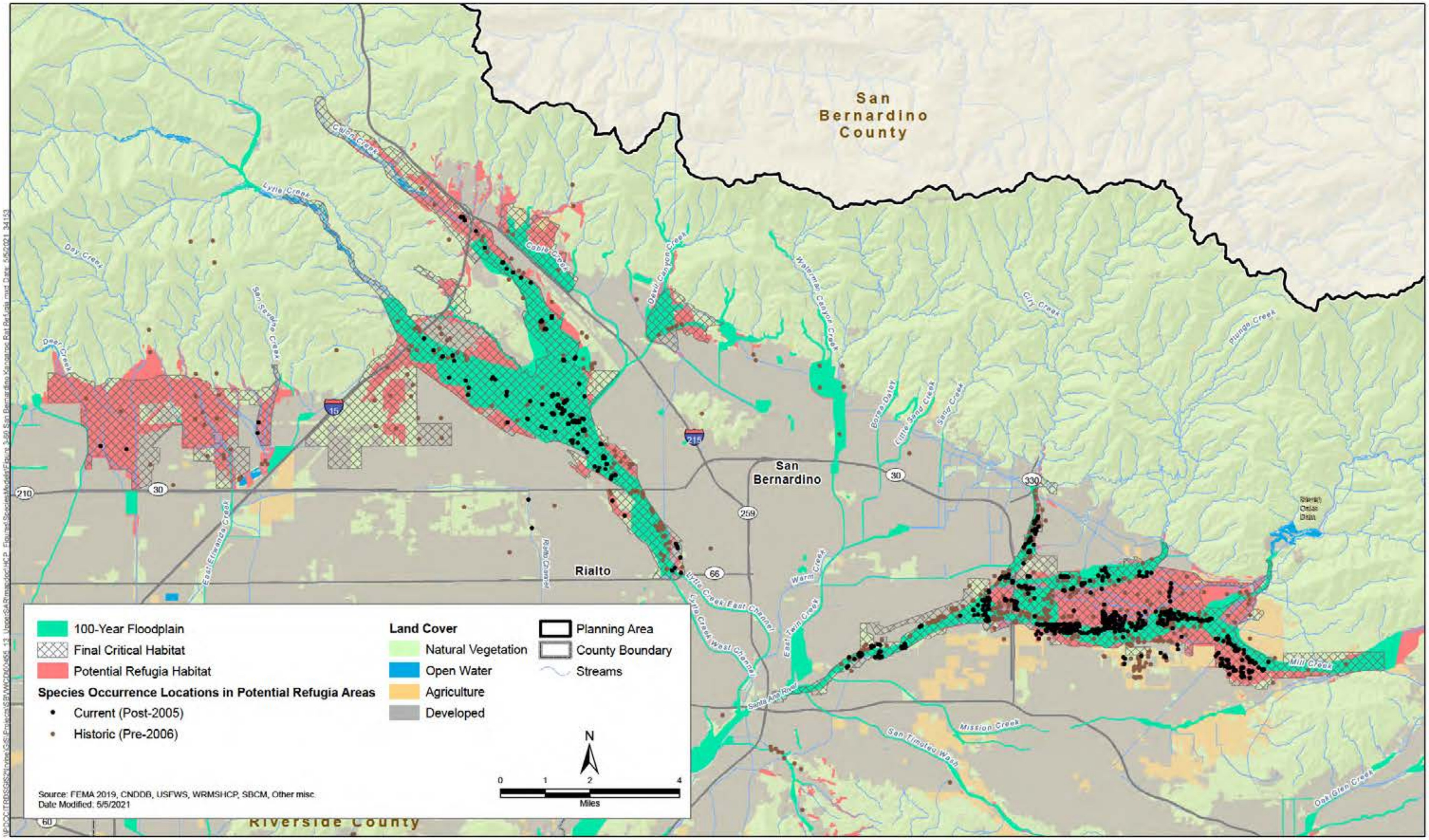
Reproduction

Reproductive activities peak in June and July (USFWS 2009c), but pregnant or lactating females can be present January–November (USFWS 1998) (Table 3-41). Females are capable of more than one litter per year and typical size is 2–3 individuals (Jones 1993). Breeding varies in relation to ecological conditions, with individuals not breeding when plant productivity is poor (Heske et al. 1993).



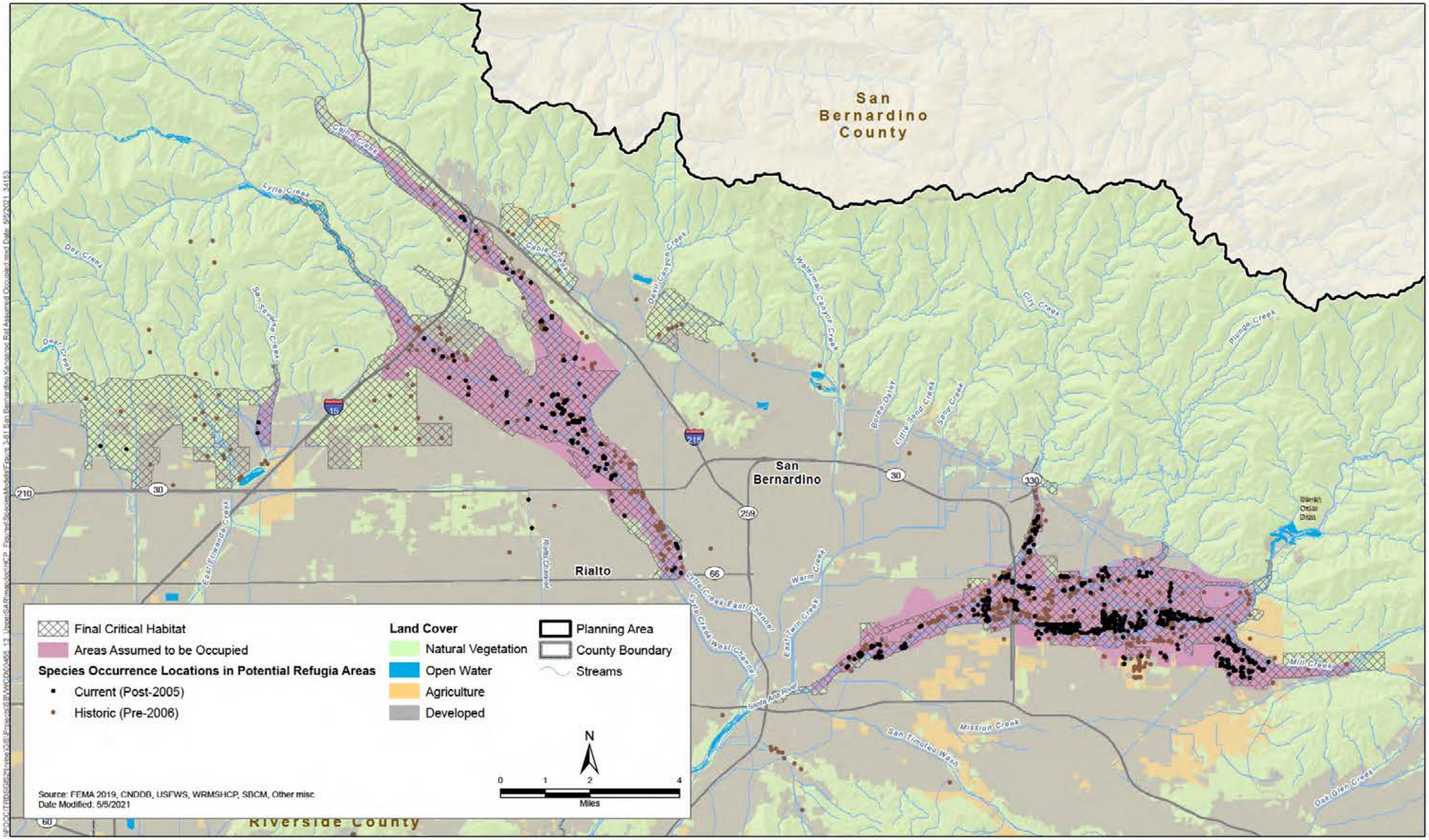
Upper Santa Ana River Habitat Conservation Plan

Figure 3-59
San Bernardino kangaroo rat, *Dipodomys merriami parvus*
Potential Habitat Distribution and Known Occurrence Records



Upper Santa Ana River Habitat Conservation Plan

Figure 3-60
Refugia Habitat and Occurrence Records for San Bernardino kangaroo rat



Upper Santa Ana River
Habitat Conservation Plan

Figure 3-61
Areas Assumed to be Occupied and Occurrence Records for San Bernardino kangaroo rat

Dispersal, Territoriality, and Home Range

The species is philopatric so tends to establish home ranges close to their natal range (French 1993). Movements of 40–60 meters are common (USFWS 1998), and long-distance events can be over 240 meters (Zeng and Brown 1987) and documented up to 1.2 kilometers (Braden 2015). However, more than 85% of individuals disperse less than 125 meters (Jones 1989). Dispersal is slightly male-biased (Jones 1989). Reproductive males travel farther than females or males with regressed testes (Behrends et al. 1986).

Individuals are primarily solitary but have overlapping home ranges (Randall 1993). They tend to tolerate familiar neighbors more than strangers and may have long-term associations with the same individuals (Randall 1993). Kangaroo rats actively defend small core areas near burrows (Jones 1993). Sand baths may be important to establish familiarity between individuals (Randall 1991). Average male home ranges may be slightly larger than those of females (0.74 versus 0.26 hectare) (Jones 1989).

Daily and Seasonal Activity

The San Bernardino kangaroo rat is unable to enter a state of torpor (Brown and Harney 1993), and therefore can be active at the surface year-round. They are nocturnal, emerging from their burrows at dusk to forage and returning before dawn, and occupying their burrows during daylight hours for shelter and to avoid high temperatures. Surface activity is reduced during full moon periods (Daly et al. 1992a).

Table 3-41. Seasonal Activity of San Bernardino Kangaroo Rat

Life Stage/ Activity Period	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Breeding	■	■	■	■	■	■	■	■	■	■	■	

Sources: USFWS 1998, USFWS 2009c

Diet and Foraging

San Bernardino kangaroo rats are primarily granivores (seed eaters), but consume herbaceous material and insects when available (Reichman and Price 1993). They collect seeds in cheek pouches and store them in subsurface caches (Daly et al. 1992b). Water requirements are satisfied by seeds and herbaceous material consumed (French 1993).

Threats and Special Management Considerations

Major threats to the San Bernardino kangaroo rat include loss of habitat, including upland refugia habitat (Figure 3-60), habitat fragmentation due to development, and the alteration of waterways. Flood control, dams, and water conservation projects that change the hydrology of a system are indirect long-term threats to fluvial processes required for habitat.

Because existing flood control structures, roads, and dams have altered fluvial processes, long-term maintenance of high-quality habitat through vegetation management and fluvial processes will be important for conservation in the Planning Area. Pioneer- and intermediate-stage alluvial fan sage scrub, which tends to occur on the terraces above the low flow channel, provides the highest quality habitat because it is sandy and fairly open, and has low vegetation cover. The density of vegetation is particularly important as it affects the species' burrowing, locomotion, and foraging ability.