UPPER SAR HCP

MAY 2021

PUBLIC REVIEW DRAFT

UPPER SANTA ANA RIVER HABITAT CONSERVATION PLAN

Prepared for:
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Upper Santa Ana River
• HABITAT CONSERVATION PLAN •

Public Review Draft

Upper Santa Ana River Habitat Conservation Plan

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Permittee Agencies:

East Valley Water District
Inland Empire Utilities Agency
Metropolitan Water District of Southern California
Orange County Water District
Rialto Utility Authority
Riverside Public Utilities
San Bernardino Municipal Water Department
San Bernardino Valley Water Conservation District
West Valley Water District
Western Municipal Water District of Riverside County

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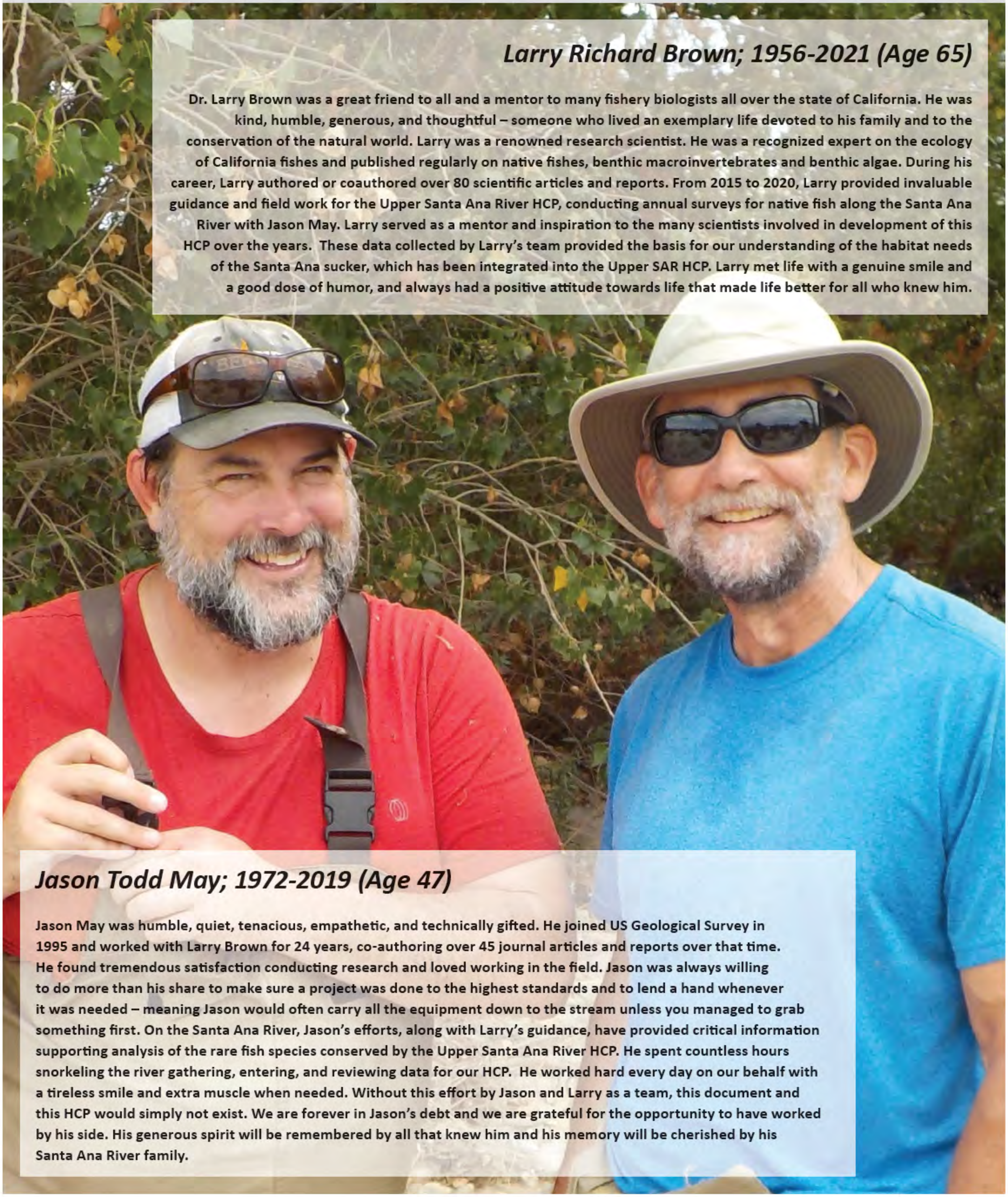
The Upper Santa Ana River Habitat Conservation Plan is dedicated to the memory of our friends and colleagues, Larry Brown and Jason May.



Larry Richard Brown; 1956-2021 (Age 65)

Dr. Larry Brown was a great friend to all and a mentor to many fishery biologists all over the state of California. He was kind, humble, generous, and thoughtful – someone who lived an exemplary life devoted to his family and to the conservation of the natural world. Larry was a renowned research scientist. He was a recognized expert on the ecology of California fishes and published regularly on native fishes, benthic macroinvertebrates and benthic algae. During his career, Larry authored or coauthored over 80 scientific articles and reports. From 2015 to 2020, Larry provided invaluable guidance and field work for the Upper Santa Ana River HCP, conducting annual surveys for native fish along the Santa Ana River with Jason May. Larry served as a mentor and inspiration to the many scientists involved in development of this HCP over the years. These data collected by Larry's team provided the basis for our understanding of the habitat needs of the Santa Ana sucker, which has been integrated into the Upper SAR HCP. Larry met life with a genuine smile and a good dose of humor, and always had a positive attitude towards life that made life better for all who knew him.

Jason Todd May; 1972-2019 (Age 47)

Jason May was humble, quiet, tenacious, empathetic, and technically gifted. He joined US Geological Survey in 1995 and worked with Larry Brown for 24 years, co-authoring over 45 journal articles and reports over that time. He found tremendous satisfaction conducting research and loved working in the field. Jason was always willing to do more than his share to make sure a project was done to the highest standards and to lend a hand whenever it was needed – meaning Jason would often carry all the equipment down to the stream unless you managed to grab something first. On the Santa Ana River, Jason's efforts, along with Larry's guidance, have provided critical information supporting analysis of the rare fish species conserved by the Upper Santa Ana River HCP. He spent countless hours snorkeling the river gathering, entering, and reviewing data for our HCP. He worked hard every day on our behalf with a tireless smile and extra muscle when needed. Without this effort by Jason and Larry as a team, this document and this HCP would simply not exist. We are forever in Jason's debt and we are grateful for the opportunity to have worked by his side. His generous spirit will be remembered by all that knew him and his memory will be cherished by his Santa Ana River family.

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Acronyms and Abbreviations

Acronym	Definition
°F	degrees Fahrenheit
AF	acre-feet
afy	acre-feet per year
Alliance	Upper Santa Ana River Sustainable Resource Alliance
AMMs	avoidance and minimization measures
AMs	avoidance measures
APNs	Assessor Parcel Numbers
AVM	acoustic velocity meter
BIOS	Biogeographic Information and Observation System
BLS	Bureau of Labor Statistics
BMPs	Best Management Practices
CAL FIRE	California Department of Forestry and Fire Protection
Cal-IPC	California Invasive Plant Council
CAMMP	Comprehensive Adaptive Management and Monitoring Program
CBWCD	Chino Basin Water Conservation District
CDFW	California Department of Fish and Wildlife
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
CFR	Code of Federal Regulations
cfs	cubic feet per second
CNDDB	California Natural Diversity Database
CNPS	California Native Plant Society
COI	Certificate of Inclusion
Consortium	Louis Rubidoux Nature Center Consortium
CPAD	California Protected Areas Database
CWA	Clean Water Act
DPS	Distinct Population Segment
East Valley	East Valley Water District
eDNA	Environmental DNA
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act

Acronym	Definition
ESA	Environmentally Sensitive Area
FEIR	Final Environmental Impact Report
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FESA	Federal Endangered Species Act
FR	Federal Register
GDE	a groundwater-dependent ecosystem
Geoscience	Geoscience Support Services, Inc.
GHG	greenhouse gas
GIS	geographic information system
GSAs	Groundwater Sustainability Agencies
HCP	Habitat Conservation Plan
HCP Handbook	2016 Habitat Conservation Planning Handbook
HdV	Huerta del Valle
HMMP	Habitat Management and Monitoring Plan
HSPF	Hydrologic Simulation Program Fortran
HTAC	Hydrology Technical Advisory Committee
I-	Interstate
ICCP	Implementation Compliance and Concurrence Procedure
IEMM	Institute for Ecological Monitoring and Management
IERCD	Inland Empire Resource Conservation District
IEUA	Inland Empire Utilities Agency
IFIM	Instream Flow Incremental Methodology
IFSAR	interferometric synthetic aperture radar
Integrated Model	Integrated Santa Ana River Model
IP	Individual Permit
ITP	Incidental Take Permit
JPA	Joint Powers Authority
JPA Governing Board	Permittee Agencies and will be governed by a board of directors
Lake Mathews MSHCP	Lake Mathews Multiple Species HCP
LiDAR	Light detection and ranging
LRNC	Louis Rubidoux Nature Center
LSAA	Lake and Streambed Alteration Agreement
MBTA	Migratory Bird Treaty Act of 1918

Acronym	Definition
MCV	Manual of California Vegetation
Metropolitan	Metropolitan Water District of Southern California
mgd	million gallons per day
MW	megawatts
NCCP	Natural Community Conservation Plan
NEPA	National Environmental Policy Act
NERC	North American Electric Reliability Corporation
NHPA	National Historic Preservation Act
NPDES	National Pollutant Discharge Elimination System
NPV	net present value
NRCS	National Resource Conservation Service
NWI	National Wetlands Inventory
O&M	operations and maintenance
OCWD	Orange County Water District
or Basin Plans	Regional Water Quality Plans
PBFs	physical and biological features
PCW	Prado Constructed Wetlands
PFA	Participation and Financing Agreement
PHABSIM	Physical Habitat Simulation System
PMSP	Prolonged Mate Searching Polygyny
Porter-Cologne	Porter-Cologne Water Quality Control Act
PUPs	Preserve Unit Plans
RAFSS	Riversidian alluvial fan sage scrub
RCHCA	Riverside County Habitat Conservation Agency
RCIS	Regional Conservation Investment Strategy
RCRCD	Riverside-Corona Resource Conservation District
Rialto	Rialto Utility Authority
RIX	Rapid Infiltration and Extraction
ROW	right-of-way
RPU	Riverside Public Utilities
RPU.5	Riverside North Aquifer Storage and Recovery Project
RWIPP	Right-of-Way and Infrastructure Protection Program
RWQCB	Regional Water Quality Control Board
RWQCP	Regional Water Quality Control Plant

Acronym	Definition
RWRPs	regional water recycling plants
SAR	Santa Ana River
SAR 3	Santa Ana River No. 3
SARCCUP	Santa Ana River Conservation and Conjunctive Use Program
SARMP	Santa Ana River Mainstem Project
SAS	anta Ana sucker
SAS	Santa Ana sucker
SBCFCD	San Bernardino County Flood Control District
SBKR	San Bernardino kangaroo rat
SCADA	supervisory control and data acquisition
SCE	Southern California Edison
SCS	Soil Conservation Service
SDMMP	San Diego Multi-Species Management Plan
SGMA	Sustainable Groundwater Management Act
SKR	Stephens' kangaroo rat
SKR HCP	Stephens' Kangaroo Rat Habitat Conservation Plan
SNRC	Sterling Natural Resource Center
SSC	CDFW Species of Special Concern
State Water Board	State Water Resources Control Board
SWAMP	Surface Water Ambient Monitoring Program
SWP	State Water Project
SWPPP	stormwater pollution prevention plan
SWRCB	State Water Resources Control Board
TDS	total dissolved solids
the Wildlife Agencies	USFWS and CDFW
TIN	total inorganic nitrogen
Tributary Restoration Projects	Santa Ana River and its tributaries
USACE	U.S. Army Corps of Engineers
USC	United States Code
USDA	U.S. Department of Agriculture
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey

Acronym	Definition
Valley District	San Bernardino Valley Municipal Water District
Wash Plan	Upper Santa Ana River Wash HCP
Water Department	San Bernardino Municipal Water Department
WDRs	Waste Discharge Requirements
WDRs	waste discharge requirements
West Valley	West Valley Water District
Western	Western Municipal Water District of Riverside County
WFF	Water Filtration Facility
Wildermuth	Wildermuth Environmental, Inc.
WLAM	Wasteload Allocation Model
WRC MSHCP	Western Riverside County Multiple Species HCP
WRCRWA	Western Riverside County Regional Wastewater Authority
WRDA	Water Resources Development Act
WSEs	water surface elevations
WWRF	Western Water Recycling Facility
WWTP	wastewater treatment plant

Executive Summary

ES.1 Overview of the Habitat Conservation Plan

The Upper Santa Ana River (SAR) watershed is home to dozens of water districts, flood control districts, and other local water management agencies (collectively and generally referred to as *water agencies*) with an interest in the responsible management of water supply resources (e.g., storage, conveyance, treatment, flood protection, and recreation) and sustainable stewardship (e.g., water quality and biological resource protection) of the watershed. The challenges facing water districts and other local agencies in the Upper SAR include the effects of population growth that increase water demand and decrease natural hydrological processes and groundwater recharge, the reduction of imported water availability, and the effects of climate change. As a result of these pressures of urbanization, many of the species in the Upper SAR watershed are listed as threatened or endangered under the California and federal Endangered Species Acts (CESA and FESA, respectively). Therefore, many water agency activities potentially impacting these species, such as the Santa Ana sucker and San Bernardino kangaroo rat (see Section ES.3, *Covered Species*, below), may require permits from the United States Fish and Wildlife Service (USFWS) and California Department of Fish and Wildlife (CDFW) (collectively referred to as the *Wildlife Agencies*).

The Upper SAR Habitat Conservation Plan (HCP) has been developed to address the potential effects of water agency activities on the sensitive species and habitats in the watershed in order to receive Incidental Take Permits (ITPs) under Section 10 of FESA.

ES.1.1 Purpose of the Habitat Conservation Plan

The Upper SAR HCP is a regional, comprehensive program that would provide a framework to protect, enhance, and restore the habitat for Covered Species (Chapter 3, *Planning Area and Existing Environment*), while streamlining permitting for Covered Activities (Chapter 2). Within this framework, the Upper SAR HCP would achieve conservation goals and objectives and comply with FESA while streamlining planning and permitting for anticipated water resource management projects needed to serve the water resource needs of the public. The HCP will achieve the conservation goals and objectives through the establishment of the HCP Preserve System and implementation of the conservation actions as described in Chapter 5, *Conservation Strategy,* of this HCP.

ES.1.2 Cost and Benefit of the Habitat Conservation Plan

The HCP is estimated to cost approximately $185.3 million, paid incrementally over the 50-year permit term and excluding inflation, and shared among the water agencies receiving ITPs under this HCP (see Section ES.2, *Incidental Take Permits*, below).

Over 50 years, the $187.5 million in HCP costs will allow Permittee Agencies to develop over 4 million acre-feet of water for local use, or approximately 87,000 acre-feet per year (afy) by year 15 of HCP implementation. These water resources will reduce reliance on costly imports from other parts of the State, increasing the area's resilience to drought and regulatory restrictions that hamper water deliveries from the State Water Project, while also keeping more of the project spending in the local economy.

While there is a high initial investment cost, the economic benefits of the plan to water users and the local economy as a whole are substantially greater than the costs. Without the HCP in place, Permittee Agencies would need to acquire this additional 87,000 afy of water supply from more costly alternative sources. Even if it was possible to purchase that volume of water either from wholesalers or elsewhere in the market, the HCP is projected to save the region approximately $952 million over the life of the HCP on a net present value basis, and create secondary benefits from investment in the local economy.[1] This represents a benefit-cost ratio of over 7.3,[2] which illustrates the enormity and importance of this effort. See Chapter 7, *Funding*, for additional information.

ES.1.3 Evolution of the Habitat Conservation Plan

The current set of Covered Activities in the Upper SAR HCP was determined through the partnership and the collaborative efforts with the Permittee Agencies, Wildlife Agencies, and involved stakeholders. The complete HCP conservation strategy for all Covered Species was also developed through this collaborative partnership, and includes a comprehensive strategy for long-term protection, restoration, and conservation to manage the natural resources and species of the Upper SAR watershed in a way that ensures long-term ecological value to the region and species recovery. Through this collaborative partnership, many modifications were made to the HCP to further reduce impacts on the Santa Ana River and increase conservation values to species in a way that protects and enhances the ecological function of the system.

Previous HCP iterations included Covered Activities that resulted in greater impacts on species and the riverine system than were acceptable or likely to be permittable under FESA and CESA. Preliminary impact analyses, including substantial hydrology modeling, led to modifications of the Covered Activities to substantially reduce, and avoid where possible, the potential biological and hydrological impacts resulting from the implementation of those Covered Activities. Similarly, many iterations and additions to the conservation strategy led to substantial improvements in measures that provided additional avoidance and/or minimization of potential impacts on Covered Species with implementation of the HCP. These modifications resulted in reduced impacts on water supply to the Santa Ana River and increased conservation values to species in a way that further protects and enhances ecological functions of the River system.

ES.2 Incidental Take Permits

ES.2.1 Permittee Agencies

The HCP was collaboratively developed for 11 water agencies with planned water supply or other infrastructure projects needing incidental take permit coverage for endangered and threatened species in the Santa Ana River watershed. The Permittees under the Upper Santa Ana River HCP include the 11 water agencies, the Upper Santa Ana River Sustainable Resources Alliance (Alliance), and the San Bernardino Valley Conservation Trust or other appropriately qualified entity (referred

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[1] Refer to Section 7.6, *HCP Benefits*, for a detailed accounting of this estimate. Net present value (NPV) calculations are made using an interest rate of 4.61% based on the rate used by the State Water Project in calculating water prices. A general inflation rate is assumed to be 2%. The net discount rate is 2.61%.

[2] The benefit-cost ratio is the net present value of the benefits divided by the net present value of the costs. In this case, the benefits are the avoided future costs of more expensive water sources. A ratio above 1.0 indicates net positive benefits over the life or a project or program.

to generally as the *Permittee Agencies*). Each Permittee Agency will receive incidental take authority to undertake their respective Covered Activities as described in Chapter 2. The 11 water agencies, the Alliance, and the Conservation Trust will operate under a single Joint ITP. A second ITP will be issued to Southern California Edison (SCE), to provide incidental take coverage for any Santa Ana suckers that may be translocated to waters upstream of SCE's hydroelectric facilities, including those that are covered by SCE's licenses from the Federal Energy Regulatory Commission (FERC).The water agencies are listed in alphabetical order below.

- East Valley Water District
- Inland Empire Utilities Agency
- Metropolitan Water District of Southern California
- Orange County Water District
- Rialto Utility Authority
- Riverside Public Utilities
- San Bernardino Municipal Water Department
- San Bernardino Valley Municipal Water District
- San Bernardino Valley Water Conservation District
- West Valley Water District
- Western Municipal Water District of Riverside County

Southern California Edison Incidental Take Permit

For any mountain tributary streams with SCE infrastructure the translocation of Santa Ana sucker into those streams presents an opportunity for incidental take to occur. A second ITP will be issued to SCE to provide incidental take coverage for Santa Ana sucker to waters upstream of their hydroelectric facilities, including those covered by licenses from the Federal Energy Regulatory Commission (FERC), and where translocation is proposed.

ES.2.2 Habitat Conservation Plan Planning Area and Permit Area

The Planning Area encompasses approximately 862,966 acres and was developed to ensure that the natural resources that might be affected by Covered Activities can be adequately assessed at a regional scale and that sufficient mitigation opportunities are available. The Permit Area is the geographic area where the impacts of the Covered Activities are expected to occur and is depicted as the ownership, easements, and areas of operation and maintenance where all Covered Activities are located within natural habitats. The Permit Area also includes the HCP Preserve System so that the ITPs cover the potential take associated with habitat mitigation, management, and monitoring. The Planning Area and Permit Area are shown on Figures 1-2 and 1-3 in Chapter 1, *Introduction and Background*.

ES.2.3 Permit Term

The Permittee Agencies are seeking a 50-year ITP, which would accommodate the expected schedule for construction of projects in the Permit Area and ongoing associated operations and maintenance. The permit term for the ITP for SCE will be independent of that of the Permittee Agencies' ITP.

ES.3 Covered Species

There are 20 species covered by the HCP, including 9 listed and 11 non-listed species. There are also two additional Fully Avoided species that are listed but are not Covered Species and will be fully avoided during Covered Activities (Table ES-1). The avoidance and minimization measures included in Chapter 5 are expected to reduce any adverse effects on these species so that they would not result in incidental take.

The incidental take authorization under Section 10 of FESA will apply to the wildlife species. Impacts on listed plant species are not prohibited under FESA or authorized under a Section 10(a)(1)(B) permit. However, the two plant species conserved by this HCP are listed in the 10(a)(1)(B) permit in recognition of the conservation measures and benefits provided for them under the HCP such that the Permittee Agencies will receive assurances pursuant to the USFWS "No Surprises" rule. Both plants are federally listed species. Similarly, non-listed sensitive wildlife species covered in the HCP will also receive assurances under the "No Surprises" rule should they become listed in the future. Federal authorization for incidental take of other species may be sought through the amendment process and in accordance with FESA Sections 10(a) and 7 (Table ES-1).

As noted above, this HCP establishes conservation strategies for a number of State-listed species. Although CDFW will not approve the HCP, the conservation strategies established for the HCP are intended to also support the issuance of State ITPs.

Table ES-1. Species Addressed in the Upper SAR HCP

		Status	
Common Name	**Scientific Name**	**Federal**	**State**
Covered Species			
Slender-horned spineflower	*Dodecahema leptoceras*	Endangered	Endangered
Santa Ana River woolly-star	*Eriastrum densifolium* ssp. *sanctorum*	Endangered	Endangered
Santa Ana sucker	*Catostomus santaanae*	Threatened	None
Arroyo chub	*Gila orcuttii*	None	SSC
Santa Ana speckled dace	*Rhinichthys osculus* ssp.	None	SSC
Mountain yellow-legged frog (Southern California DPS)	*Rana muscosa*	Endangered	Endangered
Western spadefoot	*Spea hammondii*	None	SSC
California glossy snake	*Arizona elegans occidentalis*	None	SSC
South coast garter snake	*Thamnophis sirtalis* sp.	None	SSC
Southwestern pond turtle	*Emys pallida*	None	SSC
Tricolored blackbird	*Agelaius tricolor*	None	Threatened
Burrowing owl	*Athene cunicularia*	None	SSC

Common Name	Scientific Name	Status	
		Federal	State
Cactus wren	*Campylorhynchus brunneicapillus*	None	SSC
Yellow-breasted chat	*Icteria virens*	None	SSC
Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	Threatened	Endangered
Southwestern willow flycatcher	*Empidonax traillii extimus*	Endangered	Endangered
Coastal California gnatcatcher	*Polioptila californica*	Threatened	SSC
Least Bell's vireo	*Vireo bellii pusillus*	Endangered	Endangered
Los Angeles pocket mouse	*Perognathus longimembris brevinasus*	None	SSC
San Bernardino kangaroo rat	*Dipodomys merriami parvus*	Endangered	Candidate
Fully Avoided Species[1]			
Delhi Sands flower-loving fly	*Rhaphiomidas terminatus abdominalis*	Endangered	None
Arroyo toad	*Anaxyrus californicus*	Endangered	None

[1] Implementation of avoidance measures as described in Chapter 5 of this HCP would avoid impacts on these species.
DPS = Distinct Population Segment; SSC = CDFW Species of Special Concern.

ES.4 Covered Activities

The Upper SAR HCP must identify the activities that could result in impacts on Covered Species within the Planning Area. The types of activities covered by the HCP (Covered Activities) should include all actions that the Permittee Agencies want to have covered by FESA Section 10 and CESA 2081(b) permits. Covered Activities include both specific projects and ongoing activities (e.g., operations and maintenance).

- *Projects* are well-defined actions that occur **once** in a discrete location (e.g., construction of new facilities, infrastructure development, capital improvement projects).
- *Operations and maintenance activities* are actions that occur **repeatedly** in one area or over a wide area (e.g., bank stabilization, storm-damage repair, maintenance of facilities).

Covered Activity types are listed in Table ES-2, and include construction, infrastructure development, and operations and maintenance of water conservation, water infrastructure development, flood control, habitat restoration, and solar energy facility activities. The Covered Activities are described in detail in Chapter 2, *Covered Activities*, including the size of the impacted area, frequency of activity, and the type and intensity of impact. The potential effects of the Covered Activities on Covered Species are analyzed in Chapter 4, *Incidental Take Assessment and Impact Analysis*.

Table ES-2. Covered Activity Types Included in the Upper SAR HCP

Activity Type	Description
Water Reuse Projects (Figure 2-1)	Activities related to projects associated with water reuse, including construction of new water treatment plants and associated facilities, and operations and maintenance of existing and new water treatment plants and associated facilities.
Groundwater Recharge (Figure 2-4)	Activities related to construction of new structures associated with diversions, operations and maintenance of existing and new diversion structures for groundwater recharge, activities related to construction of new recharge basins, and operations and maintenance of existing and new recharge basins.
Wells and Water Conveyance Infrastructure (Figure 2-14)	Activities related to the creation of new wells and associated development (e.g., pipelines, access roads, reservoirs, bridges) and the operations and maintenance of this infrastructure and associated development.
Solar Energy Development (Figure 20-21)	Activities related to the construction and the operations and maintenance of new solar facilities.
Routine Operations and Maintenance (See other figures)	Activities that occur repeatedly in one location and/or in many locations over a wide area and include minor construction, earth-moving, or vegetation clearing activities to infrastructure.
Habitat Improvement, Management, and Monitoring (Figure 20-21)	Activities that support the restoration and/or rehabilitation, and management of habitat values in the Planning Area, including species surveys, monitoring, research, and adaptive management activities.

Covered Activities are also anticipated to occur in different phases during implementation of the HCP. These HCP phases are as follows:

- **Up-Front**—This initial phase of the HCP was started prior to the completion of the HCP and permit issuance to begin implementation of the Conservation Strategy so that conservation will stay ahead of Covered Activity impacts by a minimum of 10% according to the Stay-ahead provision.
- **Phase 1**—0 to 5 years from permit issuance
- **Phase 2**—6 to 10 years from permit issuance
- **Phase 3**—11 to 15 years from permit issuance
- **Phase 4**—16 years from permit issuance to end of permit term

Activities not covered by the HCP and the incidental take authorizations are described in Chapter 2, Section 2.3, *Projects and Activities Not Covered by the HCP*.

ES.5 Take Assessment and Impact Analysis

The Covered Activities will have effects on Covered Species through the alteration of hydrology in the Santa Ana River and its tributaries, which in turn may affect depth to groundwater for some groundwater-dependent ecosystems. Alteration of hydrology may also affect sediment transport, a natural ecological process that shapes the ecology of the alluvial fan sage scrub community and the aquatic and riparian communities. Other Covered Activities will affect Covered Species by directly removing habitat (vegetation) or harming individuals through ground-disturbing impacts. Chapter 3 describes the current distribution of species and habitats in the Planning Area, and uses hydrology modeling to describe the sediment transport processes in the watershed. The hydrology model is integrated with a groundwater model to describe the existing surface water and groundwater conditions as they relate to aquatic habitats and groundwater-dependent ecosystems. These models are used in Chapter 4 to estimate the effects that Covered Activities have on sediment transport, surface water flows, and groundwater so that an estimate of potential incidental take of Covered Species can be made. The Covered Activities are also evaluated to determine the amount of Covered Species habitat directly lost due to ground-disturbing impacts.

These incidental take estimates are as accurate as possible using the methods described in Chapter 4 and given the available details of the Covered Activities at the time of HCP preparation. These estimates represent a maximum potential incidental take estimate for each species. With the implementation of avoidance and minimization measures and more precise project-specific design, the take is expected to be lower than estimated in most cases. In no case will the incidental take of any species be allowed to exceed the allotted estimate established by this HCP. Furthermore, these methods to estimate incidental take are based on habitat suitability models and the potential impacts on modeled habitat, not occupied habitat. The area of potentially suitable habitat predicted by the models is much larger than the area of occupied habitat at any given moment in time, such that the actual impacts on occupied habitat will be substantially less. Actual impacts will be further minimized through the implementation of general and species-specific avoidance and minimization measures.

ES.5.1 Summary of Effects on Species

Mitigation (offset to proposed impacts) provided by the proposed conservation actions (Chapter 5) will provide significant net benefits to Covered Species through the addition of permanent protections, restoration and enhancement, monitoring, and management. The potential impacts from Covered Activities should be considered in the context of the net benefit to species resulting from the implementation of the conservation strategy.

Table ES-3. Summary of Estimated Impacts and Expected Outcome of Actual Incidental Take

Common Name	Estimated Total Impacts in Acres on Modeled Habitat[1]	Mitigation* (acres of Modeled Habitat in the HCP Preserve System)	Expected Outcome of Actual Incidental Take of Species
Covered Species			
Slender-horned spineflower	425[2] (31)	**532**	Pre-project surveys, refinements to project siting, and strict avoidance and minimization measures will ensure impacts on individual plants will be near zero. Modeled suitable habitat will be monitored and adaptively managed to enhance habitat conditions for this species and will be protected in perpetuity.
Santa Ana River woolly-star	464 (32)	**433***	Pre-project surveys, refinements to project siting, and strict avoidance and minimization measures will ensure impacts on individual plants will be near zero. Modeled suitable habitat will be monitored and adaptively managed to enhance habitat conditions and achieve success criteria for this species and will be protected in perpetuity.
Santa Ana sucker	1.25 [preferred] [75 acres of designated critical habitat]	**5.1** [1.5 acres will be enhanced in mainstem Santa Ana River and 3.6 acres of tributary restoration within 3.9 miles of restored aquatic stream habitat] [161 acres of designated critical habitat] Santa Ana sucker will also be translocated to a minimum of three montane streams and actively managed	Pre-project surveys and the implementation of avoidance and minimization measures will reduce potential for incidental take. A majority of Santa Ana River recovery actions in the U.S. Fish and Wildlife Service (USFWS) Recovery Plan for this species will be initiated within the HCP Preserve System through implementation of the HCP Conservation Strategy. Habitat restoration will increase the amount and quality of foraging, refugia, and spawning habitat in tributaries to the mainstem Santa Ana River. Tributary restoration sites will be supplied with a dedicated, permanent water supply. Prior to any base flow reductions at least two mainstem tributary restoration projects would need to be functional or 1 acre of mainstem river enhancement would need to occur. A minimum of two translocations of Santa Ana sucker into portions of its historic range within the Santa Ana River watershed will occur prior to reduction in discharge to the Santa Ana River associated with WD.1. Santa Ana sucker distribution will be expanded via successive translocations to mountain tributaries, and the HCP will successfully maintain Santa

Common Name	Estimated Total Impacts in Acres on Modeled Habitat[1]	Mitigation* (acres of Modeled Habitat in the HCP Preserve System)	Expected Outcome of Actual Incidental Take of Species
			Ana sucker populations in at least three mountain tributaries. Suitable habitat will be monitored and adaptively managed to enhance habitat conditions and achieve success criteria for this species and will be protected in perpetuity. Though suitable habitat in the mainstem of the Santa Ana River will be reduced as a result of implementation of Covered Activities, restoration of tributaries coupled with translocation of fish to upper watershed streams within the HCP Preserve System, and long-term adaptive management of these areas to achieve success criteria, will go beyond offsetting impacts, and will achieve major contributions to the recovery of the Santa Ana Sucker.
Arroyo chub	2.4	**5.1** [1.5 acres will be enhanced in mainstem Santa Ana River and 3.6 acres of tributary restoration within 3.9 miles of restored aquatic stream habitat]	Pre-project surveys and the implementation of avoidance and minimization measures will reduce potential for incidental take. Habitat restoration will increase the amount and quality of available habitat in tributaries to the mainstem Santa Ana River. Tributary restoration will commence prior to implementation of Covered Activities, and the tributaries will be supplied with a dedicated, permanent water supply. Suitable habitat in all occupied reaches of the Santa Ana River and tributaries will be monitored and adaptively managed to enhance habitat conditions and achieve success criteria for this species. Tributary restoration sites within the HCP Preserve System will be adaptively managed and protected in perpetuity.
Santa Ana speckled dace	0.01	**0.0**	Pre-project surveys and strict avoidance and minimization measures will ensure impacts on this species will be near zero. Active habitat management (e.g., nonnative species management) within occupied reaches where they co-occur with Santa Ana sucker translocation streams will benefit this species.
Mountain yellow-legged frog	195 (157) [including 6 acres of aquatic habitat]	**264**	3% of the impacted habitat is aquatic habitat. The remaining 189 acres are refugia, foraging, and dispersal upland habitats. Pre-project surveys and strict avoidance

Common Name	Estimated Total Impacts in Acres on Modeled Habitat[1]	Mitigation* (acres of Modeled Habitat in the HCP Preserve System)	Expected Outcome of Actual Incidental Take of Species
	[0 acre of designated critical habitat]		and minimization measures will ensure impacts on this species will be near zero. The HCP will provide financial and logistical support to ongoing research and population re-establishment efforts within the Planning Area to further conservation actions for the species. Active habitat management (e.g., nonnative species management) within occupied reaches where they co-occur with Santa Ana sucker translocation streams will benefit this species.
Western spadefoot	816 (304)	**588**	Pre-project surveys and avoidance and minimization measures will ensure impacts on this species will be substantially lower than the estimated impact on modeled habitat. Suitable habitat within the HCP Preserve System will be monitored and adaptively managed to enhance habitat conditions for this species and will be protected in perpetuity.
California glossy snake	975 (145)	**807**	Pre-project surveys and avoidance and minimization measures will ensure impacts on this species will be substantially lower than the estimated impact on modeled habitat. Suitable habitat within the HCP Preserve System will be monitored and managed to enhance habitat conditions for this species and will be protected in perpetuity.
South coast garter snake	58	**169**	Pre-project surveys and avoidance and minimization measures will ensure impacts on this species will be substantially lower than the estimated impact on modeled habitat. Suitable habitat within the HCP Preserve System will be monitored and adaptively managed to enhance habitat conditions for this species and will be protected in perpetuity.
Southwestern pond turtle	78 [including 6 acres of aquatic habitat]	**309**	Pre-project surveys and avoidance and minimization measures will ensure impacts on this species is substantially lower than the estimated impact on modeled habitat. Suitable habitat within the HCP Preserve System will be monitored and adaptively managed to enhance

Common Name	Estimated Total Impacts in Acres on Modeled Habitat[1]	Mitigation* (acres of Modeled Habitat in the HCP Preserve System)	Expected Outcome of Actual Incidental Take of Species
			habitat conditions for this species and will be protected in perpetuity.
Tricolored blackbird	437 (58) [including 66 acres of unoccupied but suitable colony habitat and 371 acres of foraging habitat]	**122** [39 acres of wetland habitat and 208 acres of riparian habitat will be restored to benefit the species]	Pre-project surveys and avoidance and minimization measures will ensure no occupied colonies are disturbed. Approximately 39 acres of wetland habitat and 208 acres of riparian habitat will be restored to benefit the species. Suitable habitat within the HCP Preserve System will be monitored and managed to enhance habitat conditions for this species and will be protected in perpetuity.
Burrowing owl	979 (182)	**595**	Pre-project surveys and avoidance and minimization measures will reduce the potential for occupied burrows to be disturbed. Suitable habitat within the HCP Preserve System will be monitored and managed to enhance habitat conditions for this species and will be protected in perpetuity.
Cactus wren	885 (186)	**681**	Pre-project surveys and avoidance and minimization measures will ensure active nests are not disturbed. Suitable habitat within the HCP Preserve System will be monitored and adaptively managed to enhance habitat conditions for this species and will be protected in perpetuity.
Yellow-breasted chat	171 (69)	**242**	Pre-project surveys and avoidance and minimization measures will ensure active nests are not disturbed. Suitable habitat within the HCP Preserve System will be monitored and adaptively managed to enhance habitat conditions for this species and will be protected in perpetuity.
Western yellow-billed cuckoo	18	**118**	Pre-project surveys and avoidance and minimization measures will ensure active nests and occupied habitat are not disturbed. Suitable habitat within the HCP Preserve System will be monitored and adaptively managed to enhance habitat conditions for this species and will be protected in perpetuity.

Common Name	Estimated Total Impacts in Acres on Modeled Habitat[1]	Mitigation* (acres of Modeled Habitat in the HCP Preserve System)	Expected Outcome of Actual Incidental Take of Species
Southwestern willow flycatcher	171 (69) [109 acres of designated critical habitat]	**242** [9 acres of designated critical habitat]	Pre-project surveys and avoidance and minimization measures will ensure active nests and occupied habitat are not disturbed. Suitable habitat within the HCP Preserve System will be monitored and adaptively managed to enhance habitat conditions for this species and will be protected in perpetuity.
Coastal California gnatcatcher	516 (137) [6 acres of designated critical habitat]	**498** [0 acre of designated critical habitat] [509 acres of alluvial fan sage scrub will be enhanced and restored]	Pre-project surveys and avoidance and minimization measures will ensure active nests are not disturbed. Suitable habitat within the HCP Preserve System will be monitored and adaptively managed to enhance habitat conditions for this species and will be protected in perpetuity. A total of 509 acres of sage scrub habitat will be enhanced and restored.
Least Bell's vireo	171 (69) [58 acres of designated critical habitat]	**242** [128 acres of designated critical habitat]	Pre-project surveys and avoidance and minimization measures will ensure active nests are not disturbed. Suitable habitat within the HCP Preserve System will be monitored and adaptively managed to enhance habitat conditions for this species and will be protected in perpetuity.
Los Angeles pocket mouse	801 (182)	**625** [509 acres of alluvial fan sage scrub will be enhanced and restored]	Pre-project surveys, refinements to project siting, and avoidance and minimization measures will ensure impacts are reduced to the maximum extent practicable. Suitable habitat within the HCP Preserve System will be monitored and adaptively managed to enhance habitat conditions for this species and will be protected in perpetuity. A total of 509 acres of alluvial fan sage scrub habitat will be enhanced and restored.
San Bernardino kangaroo rat	754 (377) [196 acres of refugia habitat (119)] [3] [776 acres of areas assumed to be occupied by SBKR (58)] [4]	**586*** [509 acres of alluvial fan sage scrub will be enhanced and restored] [305 acres of refugia habitat] [3] [458 acres of areas assumed to be occupied by SBKR] [4]	Pre-project surveys, refinements to project siting, and avoidance and minimization measures will be implemented to ensure that impacts on individuals and occupied habitat is reduced to the greatest extent practicable. These measures include habitat assessments, exclusionary fencing, trapping surveys, relocation, topsoil sequestration, and timing and night-lighting limitations. Suitable habitat within the HCP Preserve System will be monitored and

Common Name	Estimated Total Impacts in Acres on Modeled Habitat[1]	Mitigation* (acres of Modeled Habitat in the HCP Preserve System)	Expected Outcome of Actual Incidental Take of Species
	[766 acres of designated critical habitat (109)]	[685 acres of designated critical habitat]	adaptively managed to enhance habitat conditions and achieve success criteria for this species and will be protected in perpetuity. A total of 509 acres of alluvial fan sage scrub habitat will be enhanced and restored to be suitable for this species. A minimum of 67 acres of SBKR occupied habitat restoration and/or rehabilitation, and preservation will occur ahead of any impacts on occupied habitat.
Fully Avoided Species [1]			
Delhi Sands flower-loving fly	103[2] (84) [no impact on occupied habitat]		Strict avoidance measures will ensure full avoidance of this species.
Arroyo toad	125[2] (110) [3 acres of designated critical habitat] [no impact on occupied habitat]		Strict avoidance measures will ensure full avoidance of this species.

*Mitigation acreages represent the *minimum* that will be incorporated into the HCP Preserve System, and consists of lands already acquired, or those owned by Permittees determined to have high potential for inclusion in the HCP. Additional mitigation lands will need to be acquired for Santa Ana River woolly-star and San Bernardino kangaroo rat (refer to individual species accounts later in this chapter).

1 Impact acreages in parentheses are on existing water recharge/flood control basins subject to regular O&M activities and are a subset of total impacts. For example, for San Bernardino kangaroo rat, of the 754 acres of total impacts on modeled habitat, 377 acres occur within existing basins. Consequently, impacts outside of existing basins are: 754 – 377 = 377 acres.

2 Implementation of avoidance measures as described in Chapter 5 would prevent impacts on these species.

3 San Bernardino kangaroo rat refugia habitat is composed of modeled habitat that occurs outside of the 100-year floodplain.

4 "Assumed Occupied" is not a modeled dataset; it is a separate data layer that was estimated to indicate all areas that are assumed to be currently occupied by San Bernardino kangaroo rat (SBKR). 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.

Habitat Conservation Plan Conservation Strategy

The Upper SAR HCP conservation strategy (Chapter 5) is designed to avoid, minimize, and mitigate impacts of the taking of the Covered Species to the maximum extent practicable. The strategy meets the regulatory requirements of FESA and CESA.

Implementation of the Conservation Strategy is the responsibility of the Alliance, which will be established as a Joint Powers Authority (JPA) of the HCP. The Alliance will be responsible for implementing the HCP and all conservation actions described in the Conservation Strategy and assisting the other Permittee Agencies in complying with the conditions of the HCP Incidental Take Permit in connection with their Covered Activities.

ES.5.2 Elements of the Conservation Strategy

The conservation strategy includes all conservation actions as mitigation to offset the impacts of take of Covered Species. The conservation actions are based on the biological needs of the Covered Species and, when fully implemented, will meet the biological goals and objectives of the HCP. The elements of the conservation strategy are listed below and are described in more detail in the sections that follow. The phasing of the implementation of these conservation actions in relationship to the implementation of Covered Activities is also described below.

Elements of the Upper Santa River HCP Conservation Strategy:

- *Biological Goals and Objectives*
- *HCP Preserve System*
- *Hydrologic Manipulation and Substrate Management*
- *Captive Headstarting and Translocation*
- *Species and Habitat Research*
- *Conservation Bank Credits*
- *Species-Specific Conservation Strategies*
- *Fully Avoided Species*
- *Measures to Avoid and Minimize Effects*
- *Comprehensive Adaptive Management and Monitoring Program*

ES.5.3 Habitat Conservation Plan Goals and Objectives

The Upper SAR HCP has four overarching goals and six HCP Objectives as listed below.

The HCP Goals will be accomplished within the HCP Preserve System and are as follows:

HCP Goal 1: Conserve Covered Species and manage their habitats to contribute to the recovery of listed species or those that may become listed under the Federal Endangered Species Act.

HCP Goal 2: Maintain or simulate natural ecological processes necessary to maintain the functionality of the natural communities and habitats upon which the Covered Species depend within the HCP Preserve System and to the greatest extent possible outside the HCP Preserve System.

HCP Goal 3: Maintain or increase habitat connectivity in the HCP Preserve System and to adjacent protected habitat areas to reduce isolation between metapopulations of Covered Species.

HCP Goal 4: Actively manage lands within the HCP Preserve System for the benefit of Covered Species to maintain or increase the health of populations.

The following HCP Objectives will support the HCP Goals:

HCP Objective 1: Conserve, restore/rehabilitate, and manage a minimum of 1,348.8 acres of native habitat for Covered Species in the HCP Preserve System over the duration of the life of the permit.

HCP Objective 2: Reduce anthropogenic and environmental threats to Covered Species and their habitats within the HCP Preserve System.

HCP Objective 3: Maintain and successfully enhance existing and new Santa Ana sucker habitats.

HCP Objective 4: Maintain and successfully enhance existing San Bernardino kangaroo rat habitats.

HCP Objective 5: Implement successful conservation measures to promote the recovery of Covered Species.

HCP Objective 6: Conduct scientific research in order to improve our knowledge and fill existing and future data gaps.

Species-specific objectives and species-specific conservation actions are presented for each Covered Species in Section 5.9, *Species-Specific Conservation Strategies,* to achieve the HCP goals and objectives.

ES.5.4 Habitat Conservation Plan Preserve System

The Alliance—as the HCP Implementing Entity—will provide for the permanent conservation of a minimum of approximately 1,349 acres within the HCP Preserve System. The HCP Preserve System will be assembled through a combination of property acquisitions, and/or establishment of conservation easements. The HCP Preserve System will be managed and monitored through the Comprehensive Adaptive Management and Monitoring Program (CAMMP) that will be implemented by the Alliance. The HCP Preserve System is divided into five Preserve Units (Figure 5-1).

HCP conservation action implementation has been separated into four phases that align with the phases of Covered Activity implementation (Table ES-4) plus an Up-Front phase to begin implementation of the conservation actions ahead of the implementation of Covered Activity impacts. Table ES-5 shows the approximate phasing of Covered Activity implementation.

Conservation actions and associated mitigation will be provided before, and stay ahead of, the cumulative total impacts of Covered Activities as they are implemented (Table ES-6). The phasing is based on best estimates for approximate timing. The actual implementation of conservation and Covered Activities may vary. Regardless, the conservation actions as mitigation established by the HCP will stay ahead of the impacts by a minimum of 10%. The Alliance will ensure that HCP implementation is in compliance with this Stay Ahead Provision by monitoring and tracking the establishment of the HCP Preserve System and conservation actions along with tracking of impacts using the impact and mitigation tracking of the Mitigation Reserve Program described below.

Table ES-4. Approximate Phasing of Conservation of Vegetation Communities in the HCP Preserve System (acres)

Conserved Vegetation Types	Up-Front[1]	Phase 1 (Years 0–5)	Phase 2 (Years 6–10)	Phase 3 (Years 11–15)	Phase 4 (Years >15)	HCP Preserve System Total
Riparian	11.1	103.4	93.8	--	--	208.3
Wetlands	1.2	12.5	25.4	--	--	39.1
Permanent Water	1.7	18.7	17.4	--	--	37.8
Water in Existing Basins	--	--	--	--	--	--
Alluvial Fan Sage Scrub	16.8	487.1	5.5	--	--	509.4
Dry Channel/Shrubland	0.1	7.5	43.8	--	--	51.4
Other Shrublands	0.8	81.3	232.1	--	--	314.3
Woodlands		21.0	--	--	--	21.0
Grasslands	49.2	79.5	23.9	--	--	152.5
Rock Outcrops	--	15.0	0.2	--	--	15.2
Total by Phase	**80.9**	**825.9**	**442.1**	**--**	**--**	**1,348.8**

[1] The Up-Front provision will ensure that progress towards assembly and management of the HCP Preserve System has been initiated prior to HCP implementation (i.e., prior to initiation of any Covered Activities).

Table ES-5. Approximate Phasing of Covered Activities and Associated Impacts in the Permit Area[1,2]

Vegetation Types	Phase 1 (Years 0–5)	Phase 2 (Years 6–10)	Phase 3 (Years 11–15)	Phase 4 (Years >15)	Total Impacts
Riparian	55.9 (3.6)	22.7	11.8	0.6	91.0 (3.6)
Wetlands	44.2 (28.0)	45.7 (43.7)	2.9	--	92.8 (71.7)
Permanent Water	47.5 (22.6)	28.2	--	0.3	76.1 (27.2)
Water in Existing Basins	335.5 (335.4)	280.3 (280.3)	--	2.9 (2.7)	618.7 (618.4)
Alluvial Fan Sage Scrub	145.7 (62.8)	164.4 (133.4)	110.9	102.3	523.2 (196.2)
Dry Channel/Shrubland	76.2 (22.8)	19.2	5.7	1.4	102.5 (22.8)
Other Shrublands	139.4 (17.7)	96.0 (23.0)	61.1	33.7 (0.3)	330.4 (40.9)
Woodlands	5.6 (2.3)	1.7	--	--	7.3 (2.3)
Grasslands	210.9 (23.1)	127.1 (15.8)	4.9	10.7	353.6 (38.9)
Rock Outcrops	7.2 (3.1)	13.1 (4.0)	0.6	0.2	21.1 (7.1)
Agriculture	113.9 (14.0)	110.3	0.6	--	224.7
Total by Phase	**1,182.0 (535.3)**	**908.7 (504.8)**	**198.6**	**152.2 (3.0)**	**2,441.5 (1,043.1)**

[1] Acres of ground disturbance.

[2] Impact acreages in parentheses are to existing water recharge/flood control basins subject to regular operations and maintenance activities.

Table ES-6. Up-Front and Stay- Ahead Provision Tracking by HCP Phase

	Implementation Period (years)					
	Up-Front	Phase 1 (0–5)	Phase 2 (6–10)	Phase 3 (11–15)	Phase 4 (>15)	Total
Conservation HCP Preserve System	6%	61%	33%	--	--	100%
Covered Activity Impacts		46%	35%	10%	9%	100%

[1] Tracking is based on the acreage of conservation lands already acquired by the HCP, or owned by HCP Permittees with high potential for incorporation into the HCP Preserve System. Additional lands will be acquired for incorporation into the HCP Preserve System as they become available.

Mitigation Reserve Program (Mitigation Accounting)

The Alliance will establish a Mitigation Reserve Program to account for and track the development of conservation values (e.g., species, waters, or habitat values) as well as account for the use of these values to offset future permit requirements for HCP Covered Activities. The purpose of the Mitigation Reserve Program is to establish a common understanding and legal framework for the conservation values created by HCP conservation actions, and to establish a transparent mechanism for tracking those values (creation and use) over time. In this way the Mitigation Reserve Program will be used to inform and track regulatory compliance of the HCP Covered Activities, including species and aquatic resource mitigation.

ES.5.5 Comprehensive Adaptive Management and Monitoring Program Framework

The HCP includes an adaptive management and monitoring framework for the HCP, including guidelines, and specific recommendations that will help the Alliance develop the Upper Santa Ana River HCP CAMMP. The purposes of this CAMMP framework—and one of the primary purposes of the CAMMP itself—are to ensure compliance with the HCP, to assess the status of Covered Species within the HCP Preserve System, and to evaluate the effects of management actions such that the conservation strategy, including the biological goals and objectives of the HCP, are achieved. Adaptive management and monitoring are integrated processes in the CAMMP, and monitoring will inform and change management actions to continually improve outcomes for Covered Species.

ES.6 Funding Implementation of the Habitat Conservation Plan

Chapter 7 provides planning-level estimates of the costs to implement the HCP, identifies funding sources to pay for implementation, and describes the rationale for funding assurances. The HCP is estimated to cost approximately $185.3 million in 2020 dollars, including costs over 50 years without discounting and inflation. Tables ES-7 through ES-9 summarize the total, capital, and operational costs estimated to be necessary to carry out the HCP.

The cost analysis is based on a number of assumptions regarding the timing of implementation of various components of the HCP and the estimated unit costs of land, labor, and materials. Unit cost estimates were based on the best available information and represent average unit costs. The costs of individual items will fluctuate above and below these averages. The total cost presented herein should therefore be regarded as a planning-level estimate to aid in the determination of the approximate amount of funding needed to implement the HCP. Specific costs will be refined as they are ascertained during the first years of HCP implementation, and any adjustments to the overall costs, cost-sharing agreements among Permittee Agencies, and endowment requirements will be made as needed.

Table ES-7. Summary of Upper SAR HCP Total Implementation Costs (1,000s 2020 dollars)

	Implementation Period (Years)					
	Initial	Phase 1	Phase 2	Phase 3	Phase 4	
Total Costs[1]	**0[2]**	**1–5**	**6–10**	**11–15**	**16–50**	**Total Costs[3]**
Land Acquisition & Easements	$60	$18,520	$11,132	$0	$0	$29,712
Habitat Improvement	$24,350	$6,003	$4,647	$973	$1,561	$37,534
Fish Translocation	$255	$381	$122	$72	$504	$1,334
Management and Maintenance	$0	$1,422	$2,515	$2,137	$13,515	$19,589
Monitoring and Reporting	$722	$722	$722	$722	$4,798	$7,686
Staffing and Program Administration	$0	$6,549	$6,549	$6,413	$44,891	$64,402
Endowment Fund	$0	$1,378	$1,378	$1,378	$9,646	$13,780
Changed Circumstance Reserve	$0	$6,725	$2,115	$402	$2,017	$11,259
Total	$25,393	$41,700	$29,180	$12,097	$76,932	$185,302
Total Per Year		$8,340	$5,836	$2,419	$2,198	$3,706

[1] All costs rounded to the nearest $1,000.
[2] Year 0 costs are costs that will have been incurred prior to the start of the HCP.
[3] Total Costs sum across all years with no discounting

TableES-8. Summary of Upper SAR HCP Capital Costs (1,000s 2020 dollars)

	Implementation Period (Years)					
	Initial	Phase 1	Phase 2	Phase 3	Phase 4	
Capital Costs[1]	**0[2]**	**1–5**	**6–10**	**11–15**	**16–50**	**Total Costs[3]**
Land Acquisition & Easements	$60	$18,520	$11,132	$0	$0	$29,712
Habitat Improvement	$24,350	$3,711	$800	$750	$0	$29,611
Fish Translocation	$255	$0	$0	$0	$0	$255
Management and Maintenance	$0	$0	$751	$206	$0	$957
Monitoring and Reporting	$0	$0	$0	$0	$0	$0
Staffing and Program Administration	$0	$0	$0	$0	$0	$0
Endowment Fund	$0	$0	$0	$0	$0	$0

Capital Costs[1]	Implementation Period (Years)					Total Costs[3]
	Initial	Phase 1	Phase 2	Phase 3	Phase 4	
	0[2]	1–5	6–10	11–15	16–50	
Changed Circumstance Reserve	$0	$6,069	$1,233	$113	$0	$7,415
Total	$24,671	$28,300	$13,916	$1,069	$0	$67,956
Total Per Year		$5,660	$2,783	$214	$0	$1,359

[1] All costs rounded to the nearest $1,000.
[2] Year 0 costs are costs that will have been incurred prior to the start of the HCP.
[3] Total Costs sum across all years with no discounting.

Table ES-9. Summary of Upper SAR HCP Operating Costs (1,000s 2020 dollars)

Operating Costs[1]	Implementation Period (Years)					Total Costs[3]
	Initial	Phase 1	Phase 2	Phase 3	Phase 4	
	0[2]	1–5	6–10	11–15	16–50	
Land Acquisition & Easements	$0	$0	$0	$0	$0	$0
Habitat Improvement	$0	$3,298	$4,854	$949	$6,646	$15,747
Fish Translocation	$0	$1,135	$876	$565	$3,958	$6,535
Management and Maintenance	$0	$2,693	$3,035	$3,513	$24,589	$33,830
Monitoring and Reporting	$0	$1,797	$1,797	$2,026	$13,930	$19,551
Staffing and Program Administration	$0	$2,442	$2,442	$2,307	$16,148	$23,339
Endowment Fund	$0	$1,378	$1,378	$1,378	$9,645	$13,779
Changed Circumstance Reserve	$0	$656	$881	$289	$2,018	$3,845
Total	$0	$13,399	$15,263	$11,028	$76,934	$116,626
Total Per Year		**$2,680**	**$3,053**	**$2,206**	**$2,198**	**$2,333**

[1] All costs rounded to the nearest $1,000.
[2] Year 0 costs are costs that will have been incurred prior to the start of the HCP.
[3] Total Costs sum across all years with no discounting.

ES.6.1 Funding Sources and Assurances

The single joint ITP permit structure was determined to be the best arrangement to facilitate ongoing coordination among the Permittee Agencies. In particular, this structure will allow the Permittee Agencies to enter into enforceable arrangements to allocate operational and funding responsibilities and rectify any occurrence of non-compliance by a Permittee Agency. The costs of the HCP will be borne by the Permittee Agencies in accordance with the Joint Powers Authority Agreement, and a separate "Participation and Financing Agreement" (PFA) that fully accounts for and assigns financial responsibility of the Alliance among the Permittee Agencies. The PFA will describe the financial responsibilities of each of the Permittee Agencies with respect to the HCP and the Alliance. The cost of plan implementation will be shared among the Permittee Agencies, based on a cost-sharing mechanism developed and approved by all agencies. The cost-sharing mechanism will account for impacts of the individual Covered Activity as well as both the financial and in-kind contributions by the Permittee Agencies.

Each of the Permittee Agencies will be fully responsible for any Covered Activity undertaken by that agency under the HCP and will be required to coordinate with the Alliance staff in order to ensure consistency of the Covered Activity with the Plan. Any cost resulting from non-compliance with the terms of the ITP by any Permittee Agency will be the responsibility of the non-complying Agency.

ES.6.2 Cost-Effectiveness of the Habitat Conservation Plan

Over the 50-year life of the HCP, the $185.3 million investment will allow Permittee Agencies to develop over 4 million acre-feet of water cumulatively for local use, or approximately 87,000 afy by year 15. These water resources will reduce reliance on imported water from other parts of the State, increasing the area's resilience to drought and the increasing uncertainty and volatility that hamper water deliveries from the State Water Project and Colorado River Aqueduct.

The net benefits of this investment to water users and the local economy amount to an estimated $955 million as a whole. This total net benefit illustrates the enormity and importance of this effort and represents a benefit-cost ratio over 1.4:1.[3]

Without the Covered Activities enabled by the HCP and associated incidental take permits, the Permittee Agencies would not be able to optimize the use of local water resources. Instead, their best options for obtaining such a large volume of water at the same level of reliability are to purchase additional imported water or develop new supplies through desalination. It is true that in some years, particularly wet hydrologic years, a fraction of the 87,000 acre-feet of water may be available for Permittee Agencies to purchase through San Bernardino Valley Municipal Water District's (Valley District's) State Water Project allotment. However, this water would not be available in other drier years, so it would not be reliable or predictable. This reliability benefit is part of the reason that Permittee Agencies are pursuing the HCP.

Based on the planned mix of Covered Activity water supply projects, Permittee Agencies will be able to develop the same amount of water at a net present value (NPV)[4] cost of approximately $2.2 billion. To estimate this cost, for conventional and groundwater supply Covered Activity projects, a value of $829 per acre-foot is used, based on average costs for managed aquifer recharge projects in California State grant applications (Perrone and Rhode 2016). For recycled water and indirect potable reuse projects, an average cost of $1,269 per acre-foot was used, based on the cost of the Water Replenishment District of Southern California's Groundwater Reliability Improvement Program Advanced Water Treatment Facility (Metropolitan 2016), Orange County Water District's Groundwater Replenishment System (Metropolitan 2016), and cost estimates developed by the Pacific Institute for Indirect Potable Reuse (Cooley and Phurisamban 2016).

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[3] The benefit-cost ratio is the net present value of the benefits divided by the net present value of the costs. In this case, the benefits are the avoided future costs of more expensive water sources. A ratio above 1:1 indicates net positive benefits over the life or a project or program.

[4] NPV calculations are made using an interest rate of 4.61% based on the rate used by the State Water Project in calculating water prices. The general inflation rate is assumed to be 2%. The net discount rate is 2.61%.

The net present value (NPV) of water supply costs without the HCP is $3.2 billion, compared to an NPV of $2.2 billion in water supply costs with the HCP. This is an estimated savings of $1.08 billion from water supply projects alone.

This potential savings puts the HCP total cost in perspective. The $185.3 million undiscounted total HCP cost translates to an NPV of $126.5 million. Based on the savings estimated from water supply projects and the cost of the HCP, pursuing the HCP over alternative water supply options could result in net savings of $955 million or more in net present value. This cost saving will be passed on to commercial and residential water customers throughout the HCP area (Table ES-10).

Table ES-10. HCP Net Savings Estimate in Net Present Value ($1,000s)

	Water Supply Cost	HCP Cost	Net Savings (cost)
Without HCP	$3,243	$0	
With HCP	$2,162	$126.5[1]	
Total savings (cost)	**$1,081**	**-$126.5**	**$955**

[1] Note that this total HCP cost is presented in net present value (NPV). It is equivalent to the $185.3 million undiscounted total cost presented elsewhere in this chapter, but shown in NPV so that it can be compared to alternative scenarios on a comparable basis.

ES.7 From Conflict to Collaboration

Remarkably, this HCP was born from the depths of conflict and legal battles over the listing of the Santa Ana sucker as a federally threatened species and the subsequent designation of Critical Habitat. The growing human population of the Upper SAR watershed was in need of a reliable source of water, resilient to the extended droughts, effects of climate change, reduced State Water Project supplies, and increasing costs. The listings of the Santa Ana sucker and the other Federal and State listed species were standing in the way, pitting people against fish, water agencies against regulatory agencies, and human needs against the needs of the environment. It was a fight with no winners, and it became increasingly clear that the only path forward was a path of collaboration. Failure was not an option.

Through the acceptance that people need water and so do fish and what's good for the River is good for people too, a spirit of interagency collaboration emerged. The water agencies, regulatory agencies, and other stakeholders each took a seat at the table with a firm commitment to work together, understanding each other's needs and interests, finding common ground to craft a solution that was good for everyone—the people, the wildlife and plant species, the water.

The preparation of this HCP is *the* viable solution to balancing the competing demands on the limited availability of water. This HCP exists through the partnership and the collaborative efforts of the Permittee Agencies, Wildlife Agencies, and involved stakeholders. Through this collaboration, this regional, comprehensive program will provide the necessary framework to protect, enhance, and restore the habitat for Covered Species, while streamlining permitting of Covered Activities, providing a reliable source of water for people. This HCP will enable the water agencies to continue to provide and maintain a secure source of water for the residents and businesses in the watershed, and to conserve and maintain natural habitats that provide a home for the diversity of unique and rare species in the watershed.

Chapter 1
Introduction and Background

1.1 Overview

1.1.1 Background and Integrated Habitat Conservation Plan Approach

The Santa Ana River (SAR) watershed is the largest coastal stream system in Southern California, and has been the subject of many important water use and water rights agreements, judicial orders, judgments, and accords dating back to the early twentieth century.

The Upper SAR is home to dozens of water districts, flood control districts, and other local water management agencies (collectively and generally referred to as *water agencies*) with an interest in the responsible management of water supply resources (storage, conveyance, treatment, flood protection, and recreation) and sustainable stewardship (water quality and biological resource protection) of the watershed. Many of these entities have participated in integrated regional watershed management coordination efforts in the Upper SAR since the 1960s. Recent cooperative planning initiatives among the water districts and stakeholders have resulted in a comprehensive vision for sustainable stewardship and watershed management (e.g., One Water, One Watershed 2.0 Plan finalized in 2014). However, several considerable challenges remain in the Upper SAR watershed, including ongoing modification of the Santa Ana River hydrogeomorphology, reduction of river flow, alteration of natural habitats, and the long-term effects of these changes on the functional ecology and native species of the watershed. The challenges facing water districts and other local agencies in the Upper SAR include the effects of population growth that increase water demand and decrease natural hydrological processes and groundwater recharge, the reduction of imported water availability, and the effects of climate change.

Many of the species in the Upper SAR watershed are listed as threatened or endangered under the State and/or Federal Endangered Species Acts (CESA and FESA, respectively). Therefore, many water agency activities potentially impacting these species may require permits from the United States Fish and Wildlife Service (USFWS) and California Department of Fish and Wildlife (CDFW). In 2013, several water agencies, led by the San Bernardino Valley Municipal Water District (Valley District), made a decision to prepare the Upper SAR Habitat Conservation Plan (HCP) to address the potential effects of water agency activities on the sensitive species and habitats in the watershed in order to receive Incidental Take Permits (ITPs) under Section 10 of FESA. The conservation measures contained in this HCP may also serve as the basis for the issuance of incidental take permits under CESA for State-listed species. Development of an HCP is a comprehensive planning process with careful consideration taken to address the FESA compliance needs of project proponents. The regional location of the Upper SAR HCP is provided in Figure 1-1.

Upper Santa Ana River HCP Team

The Upper SAR HCP development process was intended and designed from the beginning to be a collaborative and transparent process. The challenges that the HCP is addressing are complex and multifaceted, and therefore need input, support, and commitment from a variety of agencies, organizations, and the public. The stakeholders involved in this process (the HCP Team) included, the following participants, among others:

- All 11 participating water agencies seeking ITPs through the HCP (Permittee Agencies)
- Southern California Edison
- U.S. Fish and Wildlife Service
- California Department of Fish and Wildlife
- U.S. Forest Service
- U.S. Army Corps of Engineers
- U.S. Geological Survey
- Santa Ana Regional Water Quality Control Board
- Riverside-Corona Resource Conservation District
- Santa Ana Watershed Project Authority
- Southern California Coastal Water Research Project
- Endangered Habitats League
- Center for Biological Diversity
- Other interested members of the public

The HCP Team met on a regular (bi-monthly) schedule for the first few years of HCP development, and then as needed during the final year of plan preparation. HCP Team members were kept up to date through emails, board meetings of the participating entities, and the HCP public outreach and public participation program. Information and access to the HCP preparers and the lead agency were provided through the HCP website throughout the HCP development process (www.uppersarhcp.com).

During certain periods of HCP development, subsets of the HCP Team members met as the **Biological Technical Advisory Committee** and the **Hydrologic Technical Advisory Committee**. The Biological Technical Advisory Committee convened periodically throughout 2016 and 2017, providing input on development of the list of species covered by the HCP (Covered Species) and Covered Species profiles, and the use of the best available scientific data. The committee also provided input toward the creation of conceptual models for each Covered Species that identified anthropogenic threats, natural drivers, and conservation targets for each Covered Species. These conceptual models were used to develop preliminary biological goals and objectives for the Covered Species.

The Hydrologic Technical Advisory Committee met approximately bi-monthly from 2015 to 2018 and provided input into the hydrologic modeling conducted for the HCP, including development of the methodological approach to modeling of the whole Upper Santa Ana River and tributaries system affected by Covered Activities. The Hydrologic Technical Advisory Committee provided critical review and input to the establishment of the hydrological base period, and key assumptions driving the 2D hydraulic model that were to estimate the effects on aquatic habitats in terms of low

Figure 1-1
Regional Location Map
Upper Santa Ana River Habitat Conservation Plan

flow habitat suitability and high flow sediment transport. This modeling created the foundation for quantifying existing hydrologic conditions and future conditions with implementation of the Covered Activities on the Upper Santa Ana River and its tributaries.

Upper Santa Ana River Sustainable Resources Alliance as HCP Implementing Entity

The Upper SAR HCP will be implemented by the Upper Santa Ana River Sustainable Resources Alliance (established as a Joint Powers Authority [JPA] and the HCP Implementing Entity). While the Upper Santa Ana River Sustainable Resources Alliance (Alliance) will be the HCP Implementing Entity, the Alliance will also oversee and support other components of Covered Activity regulatory compliance, conservation of water and species habitat, and water supply. The ultimate goal of the Alliance is to maintain a sustainable watershed for water resources and species resources, of which the HCP is a substantial part. The HCP and other watershed sustainability components overseen by the Alliance will bring together a variety of organizations, agencies, and the public to create a forum for collaborative problem-solving to meet diverse needs and missions that include the protection of endangered species and timely approval and reliability of water supply projects.

The main components of the Upper Santa Ana River Sustainable Resources Alliance are presented below.

- **Habitat Conservation Plan**
    - HCP Implementing Entity.
    - Endangered Species Act compliance.
    - Conservation for species impacts.
    - Long-term monitoring and management of species and habitats.
- **Stream, Riparian, and Alluvial Fan Habitat Improvement**
    - Restoration/Rehabilitation for Santa Ana sucker and other aquatic and riparian species covered by the HCP.
    - Restoration/Rehabilitation for San Bernardino kangaroo rat and other alluvial fan scrub species covered by the HCP.
    - Mitigation for aquatic resource impacts.
    - Mitigation units for inclusion in a waters and species mitigation strategy (e.g., mitigation bank, in-lieu fee program).
- **Mitigation Accounting**
    - Documentation of mitigation accounting unit value from restoration/rehabilitation sites.
    - Common currency for aquatic resources and species mitigation accounting units.
    - Monetization and mechanism for the application of use of mitigation accounting units as needed.
- **Translocation**

  - o Conservation for Santa Ana sucker.
  - o Improved population stability and security with multiple subpopulations.
  - o Substantial increase in baseline condition of population and offset of potential impacts from water projects.

- **Programmatic Permitting**
  - o Streamlining of the aquatic resources permitting process (Clean Water Act [CWA] Sections 401 and 404, California Fish and Game Code Section 1600 et seq.).
  - o Mechanism to link aquatic resource impacts to mitigation bank credits.
  - o Coordination with Endangered Species Act permitting.

To support these components the Alliance will serve a broad variety of roles, including the following:

- Overall plan administration and management, such as HCP budgeting and finance, monitoring, and enforcement.
- HCP implementation of the conservation strategy, ensuring HCP compliance, project consistency review, and allocation of incidental take and mitigation credit.
- Implementation of the Adaptive Management and Monitoring Program and updates, maintenance, and management of the HCP geographic information system (GIS) database and implementation and tracking tools.
- Liaison between the Permittee Agencies and USFWS relative to HCP implementation and compliance, including annual reporting.
- Implementation and management of the Upper SAR HCP mitigation strategy.
- Land acquisition, and HCP Preserve management and monitoring, all in coordination with the San Bernardino Valley Conservation Trust (or other appropriately qualified entity), as described below.
- Public outreach and education (including establishment and management of the technical advisory and stakeholder committees).
- Other administration functions, including GIS and other technical support to Permittee Agencies, grant administration, and third-party contracting (including contracts between the JPA and Permittee Agencies or other parties for activities related to plan implementation).
- Other agency permitting implementation and compliance oversight:
  - o Implementation and compliance for Section 2081 Multi-Project ITP, or other ITPs as approved by CDFW, for impacts under CESA.
  - o Implementation and compliance oversight of all waters permits (e.g., 404, 401, 1600), including assistance to Permittee Agencies in securing any necessary sub-permits for their respective Covered Activities.

The roles and responsibilities of the Alliance are described in more detail in Chapter 6, *Plan Implementation*.

1.1.2 Purpose

The Upper SAR HCP is a regional, comprehensive program that would provide a framework to protect, enhance, and restore the habitat for the Covered Species, while streamlining permitting for Covered Activities. Within this framework, the Upper SAR HCP would achieve conservation goals and objectives and comply with FESA while streamlining planning and permitting for anticipated water resource management projects needed to serve the water resource needs of the public. The HCP will achieve the conservation goals and objectives through the establishment of the HCP Preserve System and implementation of the conservation actions as described in the Conservation Strategy of the HCP (Chapter 5).

By providing FESA compliance, the Upper SAR HCP and associated ITPs will facilitate the ability of the Permittee Agencies to construct and operate identified projects (Covered Activities) that would impact FESA-listed species covered by the HCP (Covered Species). The Covered Activities are public infrastructure projects that have tremendous public value because they will increase regional water supply reliability. The Permittee Agencies will provide long-term commitments to native resources by agreeing to conserve, monitor, and manage Covered Species and their habitats in perpetuity. In exchange, the Permittee Agencies will receive assurances that USFWS will not require additional land, water, or other natural resources beyond the level agreed upon in the HCP as long as the Permittee Agencies are honoring the terms and conditions of the permit.

The Upper SAR HCP will also provide incidental take authority for any activity occurring downstream of areas where Santa Ana sucker do not currently exist within the upper Santa Ana River watershed, to the extent that these activities may affect new populations of translocated Santa Ana sucker. Examples of activities where incidental take of translocated Santa Ana sucker may occur include where translocated fish are washed downstream into existing Southern California Edison hydroelectric facilities, areas actively managed for flood control or water recharge, recreational use areas, and areas where CDFW stocks fish for public recreational use.

The HCP as a conservation tool provides many valuable benefits to the region by providing a mechanism that allows the Permittee Agencies, USFWS and CDFW (the Wildlife Agencies), and other stakeholders to collaboratively address endangered species issues on a regional scale and with long-term funding assurances. Operating through stakeholder and other committees to be established and coordinated by the Alliance as the HCP Implementing Entity, this multi-stakeholder group can anticipate, prevent, and resolve potential conflicts over current and future resource needs through the HCP planning and implementation process. This includes development of strategies to meet minimum in-stream flow requirements to protect native aquatic species and riparian communities in the Santa Ana River and tributaries. The breadth of the Permittee Agencies' jurisdiction also allows creative solutions to be implemented for tributary restoration and long-term water supply for these habitats, even in the face of climate change and statewide water conservation efforts. Finally, through the partnership and the collaborative efforts with the Wildlife Agencies, a comprehensive strategy for long-term protection, restoration, and conservation is being developed that will manage the natural resources and species of the Upper SAR watershed in a way that ensures long-term ecological value to the region.

This HCP supports the permit application submitted by the San Bernardino Valley Municipal Water District to USFWS on behalf of all of the Permittee Agencies. That application requests authorization from USFWS for the incidental take of the seven Federally listed species shown below. The Permittee Agencies are seeking State authorization through a separate process for take of Covered Species that are also State listed species from CDFW under Section 2081 subdivision (b) of the California Fish and Game Code.

- Santa Ana sucker (*Catostomus santaanae*)
- Mountain yellow-legged frog (*Rana muscosa*)
- Coastal California gnatcatcher (*Polioptila californica californica*)
- Least Bell's vireo (*Vireo bellii pusillus*)
- Southwestern willow flycatcher (*Empidonax traillii extimus*)
- Western yellow-billed cuckoo (*Coccyzus americanus*)
- San Bernardino kangaroo rat (*Dipodomys merriami parvus*)

Although FESA does not prohibit the incidental take of listed plants in most instances, in consideration of the conservation benefits provided by the HCP, USFWS is being asked to include coverage for two listed plant species:

- Santa Ana River woolly-star (*Eriastrum densifolium* ssp. *sanctorum*)
- Slender-horned spineflower (*Dodecahema leptoceras*)

In consideration of the conservation benefits provided by the HCP, USFWS is also being asked to include coverage for 11 wildlife species that are not currently listed but which, if they are listed in the future, will be exempt from incidental take prohibitions under the permit to be issued by USFWS:

- Arroyo chub (*Gila orcutti*)
- Santa Ana speckled dace (*Rhinichthys osculus subspecies*)
- California glossy snake (*Arizona elegans occidentalis*)
- South coast garter snake (*Thamnophis sirtalis* sp.)
- Southwestern pond turtle (*Emys pallida*)
- Western spadefoot (*Spea hammondii*)
- Burrowing owl (*Athene cunicularia*)
- Cactus wren (*Campylorhynchus brunneicapillus*)
- Tricolored blackbird (*Agelaius tricolor*)
- Yellow-breasted chat (*Icteria virens*)
- Los Angeles pocket mouse (*Perognathus longimembris brevinasus*)

Two other listed wildlife species are included in the HCP so that implementation of Covered Activities will include appropriate full avoidance measures because take authorization is not being requested (i.e., full avoidance or no-take species):

- Arroyo toad (*Anaxyrus californicus*)
- Delhi Sands flower-loving fly (*Rhaphiomidas terminatus abdominalis*)

The completion and implementation of this HCP will accomplish the following:

1. Provide for the conservation of populations of the 20 Covered Species (defined in Section 1.2.5, *Covered Species,* below) and their habitat within the Planning Area (see Section 1.2.2, *Planning Area,* below) as mitigation for the effects of incidental take (animals) and other adverse impacts (plants) from water supply management activities, and avoid all impacts on two additional species not covered by the HCP.
2. Fulfill the requirements for an ITP as specified in Section 10(a)(1)(B) of FESA, implementing regulations (50 Code of Federal Regulations [CFR] 17.22[b][2][i] and 17.32[b][2][i]), and the 2016 *Habitat Conservation Planning Handbook* (HCP Handbook).
3. Support the Permittee Agencies' request to CDFW for CESA ITPs under Section 2081 subdivision (b) of the California Fish and Game Code.
4. Support the Permittee Agencies' application to CDFW for a Master Lake and Streambed Alteration Agreement under Section 1602 of the California Fish and Game Code.
5. Serve as a "watershed plan" to support (i) the issuance by the Santa Ana Regional Water Quality Control Board of authorizations required under Section 401 of the CWA, or the Porter-Cologne Water Quality Control Act (Porter-Cologne), for activities resulting in the discharge of dredged or fill material into waters of the State and (ii) the issuance of permits by the U.S. Army Corps of Engineers (USACE) under Section 404 of the CWA for the discharge of dredged or fill material into the navigable waters.
6. Standardize avoidance, minimization, and mitigation requirements of FESA, CESA, the California Environmental Quality Act (CEQA), the National Environmental Policy Act (NEPA), and other applicable laws and regulations relating to biological and natural resources in the Planning Area (Section 1.2.2), so that water agency actions will be governed consistently, thus reducing delays, expenses, and regulatory duplication.
7. Support the development and coordinated implementation of the Upper SAR HCP Programmatic Aquatic Resource permits under Sections 404 and 401 of the CWA, Porter-Cologne, and Section 1602 of the California Fish and Game Code.

1.1.3 Program-Level and HCP Goals

The program-level goal of the HCP is to streamline permitting for Covered Activities through the act of protecting and restoring the habitats needed for Covered Species to offset the deleterious effects of water supply management activities in the Planning Area (Section 1.2.2). To meet this goal, the Upper SAR HCP includes HCP Goals and Objectives in the Conservation Strategy (Chapter 5) that will conserve and protect the long-term ecological health and resilience of Covered Species and other non-listed native species within the HCP Preserve System.

The HCP Goals will be accomplished within the HCP Preserve System and are as follows:

HCP Goal 1: Conserve Covered Species and manage their habitats to contribute to the recovery of listed species or those that may become listed under the Federal Endangered Species Act.

HCP Goal 2: Maintain or simulate natural ecological processes necessary to maintain the functionality of the natural communities and habitats upon which the Covered Species depend within the HCP Preserve System and to the greatest extent possible outside the HCP Preserve System.

HCP Goal 3: Maintain or increase habitat connectivity in the HCP Preserve System and to adjacent protected habitat areas to reduce isolation between metapopulations of Covered Species.

HCP Goal 4: Actively manage lands within the HCP Preserve System for the benefit of Covered Species to maintain or increase the health of populations.

The following HCP Objectives will support the HCP Goals:

HCP Objective 1: Conserve, restore/rehabilitate, and manage a minimum of 1,348.8 acres of native habitat for Covered Species in the HCP Preserve System over the duration of the life of the permit.

HCP Objective 2: Reduce anthropogenic and environmental threats to Covered Species and their habitats within the HCP Preserve System.

HCP Objective 3: Maintain and successfully enhance existing and new Santa Ana sucker habitats.

HCP Objective 4: Maintain and successfully enhance existing San Bernardino kangaroo rat habitats.

HCP Objective 5: Implement successful conservation measures to promote the recovery of Covered Species.

HCP Objective 6: Conduct scientific research in order to improve our knowledge and fill existing and future data gaps.

Species-specific objectives and species-specific conservation actions are presented for each Covered Species in Section 5.9, *Species-Specific Conservation Strategies,* to achieve the HCP goals and objectives.

1.2 Scope of the Habitat Conservation Plan

This section identifies the Incidental Take Permittee Agencies, Planning Area, Permit Area, Covered Species, Covered Activities, and the term of the ITPs.

1.2.1 Permittee Agencies

The Permittees under the Upper Santa Ana River HCP include the 11 water agencies, the Upper Santa Ana River Sustainable Resources Alliance, and the San Bernardino Valley Conservation Trust or other appropriately qualified entity (referred to generally as the *Permittee Agencies*). Each Permittee Agency will receive incidental take authority to undertake their respective Covered Activities as described in Chapter 2. The 11 water agencies, the Alliance, and the Conservation Trust will operate under a single Joint ITP. A second ITP will be issued to Southern California Edison

(SCE), to provide incidental take coverage for any Santa Ana suckers that may be translocated to waters upstream of SCE's hydroelectric facilities, including those that are covered by SCE's licenses from the Federal Energy Regulatory Commission (FERC).When public agencies jointly prepare and implement a programmatic HCP, they typically use a co-permittee structure. In this approach, all Permittee Agencies are named on one permit issued to all of them jointly. Following this approach, the 11 water agencies, the Alliance, and the Conservation Trust, will be issued a single joint ITP. This approach provides the greatest flexibility in implementation and ensures that all Permittee Agencies share equally in the obligations and risks associated with the HCP. The HCP delineates the responsibilities of each of the water agencies for HCP implementation (see Chapter 6, *Plan Implementation*) and funding (see Chapter 7, *Funding*).

Habitat Conservation Plan Permittee Agencies

The Permittee Agencies are listed below, and the following sections provide a short description of those agencies. The service area boundaries of each Permittee Agency within the Planning Area are shown in Figure 1-2.

- Rialto Utility Authority
- East Valley Water District
- Inland Empire Utilities Agency
- Metropolitan Water District of Southern California
- Orange County Water District
- Riverside Public Utilities
- San Bernardino Municipal Water Department
- San Bernardino Valley Municipal Water District
- San Bernardino Valley Water Conservation District
- West Valley Water District
- Western Municipal Water District of Riverside County
- Upper Santa Ana River Sustainable Resources Alliance
- San Bernardino Valley Conservation Trust (or other appropriately qualified entity)

Rialto Utility Authority

The Rialto Utility Authority (Rialto) coordinates and provides direct services related to engineering, capital improvement projects, infrastructure, parks, streets, waste management, utilities, tree trimming, graffiti removal, and traffic and transportation, which includes, but is not limited to, traffic signals and signing and striping throughout the city. As noted in Chapter 3, *Planning Area and Existing Environment*, Table 3-2, *Counties and Cities/Jurisdictions in the Planning Area*, Rialto services approximately 103,000 people in San Bernardino County.

East Valley Water District

The East Valley Water District (East Valley) is a California Special District that provides water and wastewater services to approximately 101,700 residents within the City of Highland and portions of both the City and County of San Bernardino. East Valley was originally formed to provide domestic water service to the unincorporated and agricultural-based communities of Highland and East Highlands. Later, as the population increased, the need for a modern sewer system to replace existing septic tanks became apparent. East Valley's previously agriculturally dominated service area is now urbanized. Before September 2000, East Valley's service area was approximately 14,750 acres (28.5 square miles). An annexation in September 2000 increased the service area by 3,228 acres and included the Greenspot Ranch Area.

Inland Empire Utilities Agency

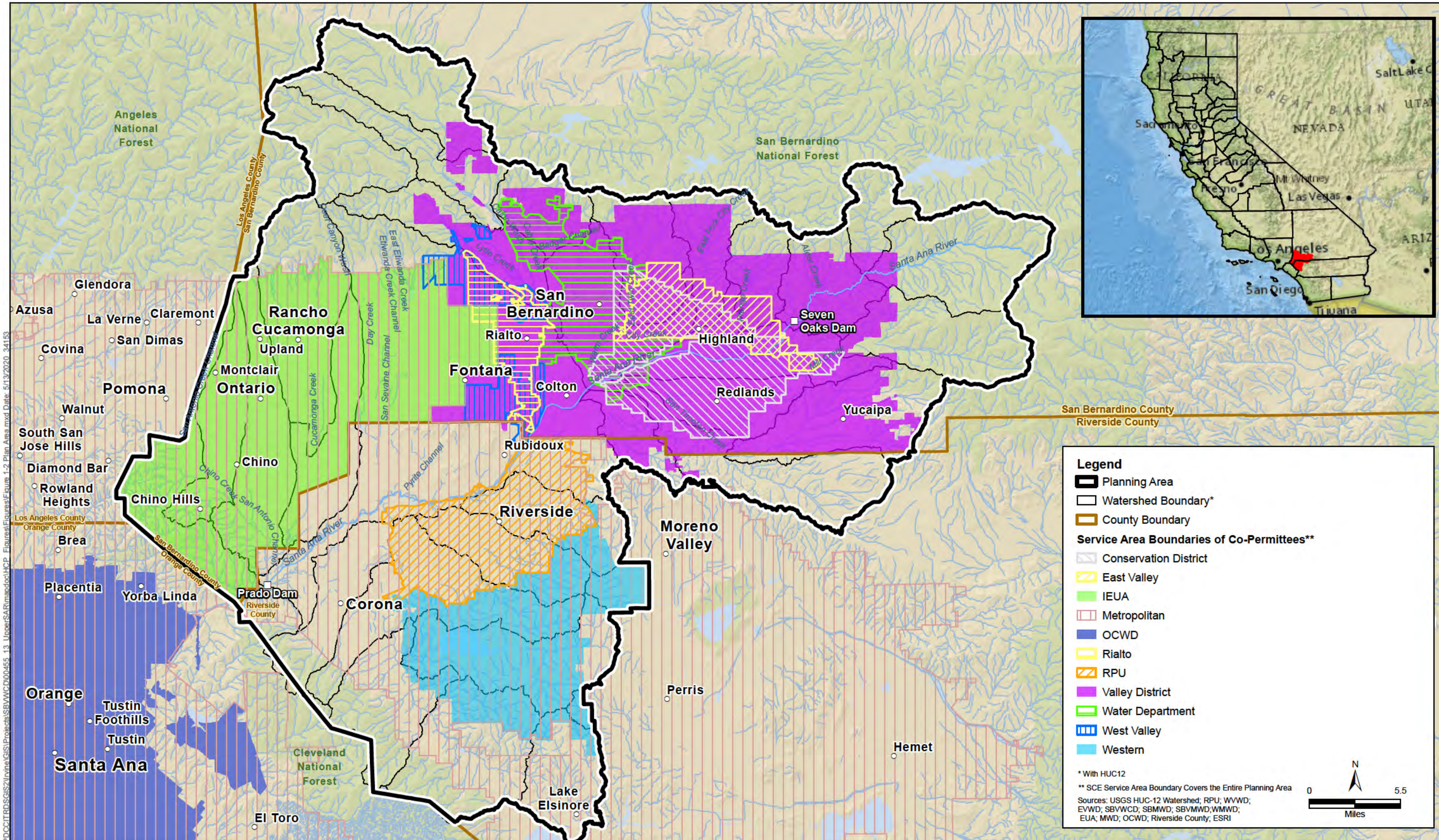
The Inland Empire Utilities Agency (IEUA) is a regional wastewater treatment agency and wholesale distributor of imported water. IEUA is responsible for serving approximately 875,000 people over 242 square miles in western San Bernardino County. The agency is focused on providing three key services: (1) treating wastewater and developing recycled water, local water resources, and water conservation programs to reduce the region's dependence on imported water supplies and drought-proof the service area; (2) converting biosolids and waste products into a high-quality compost made from recycled materials; and (3) generating electrical energy from renewable sources. As a regional wastewater treatment agency, IEUA provides sewage utility services to seven contracting agencies under the Chino Basin Regional Sewage Service Contract: the Cities of Chino, Chino Hills, Fontana, Montclair, Ontario, and Upland; and the Cucamonga Valley Water District in the City of Rancho Cucamonga. In addition to the contracting agencies, IEUA provides wholesale imported water from the Metropolitan Water District of Southern California (see below) to seven retail agencies: the Cities of Chino, Chino Hills, Ontario, and Upland; the Cucamonga Valley Water District in the City of Rancho Cucamonga; the Fontana Water Company in the City of Fontana, and the Monte Vista Water District in the City of Montclair.

Metropolitan Water District of Southern California

The Metropolitan Water District of Southern California (Metropolitan) is a regional wholesaler that delivers water to 26 member public agencies—14 cities, 11 municipal water districts, and 1 county water authority—which in turn provide water to more than 19 million people in Los Angeles, Orange, Riverside, San Bernardino, San Diego, and Ventura Counties. Metropolitan is the largest distributor of treated drinking water in the United States. To supply the more than 300 cities and unincorporated areas in Southern California with reliable and safe water, Metropolitan owns and operates an extensive water system, including the Colorado River Aqueduct, 16 hydroelectric facilities, 9 reservoirs, 819 miles of large-scale pipes, and 5 water treatment plants. Metropolitan currently delivers an average of 1.5 billion gallons of water per day to a 5,200-square-mile service area. In the Planning Area, Metropolitan provides water to IEUA (see above) and the Western Municipal Water District of Riverside County (see below).

Orange County Water District

The Orange County Water District (OCWD) provides water for 2.4 million people in Orange County. Since 1933, OCWD has been entrusted to guard the region's groundwater basin. OCWD manages and



Upper Santa Ana River
Habitat Conservation Plan

Figure 1-2
Planning Area

replenishes the basin, ensures water reliability and quality, prevents seawater intrusion, and protects Orange County's rights to Santa Ana River water.

Riverside Public Utilities

Established in 1895, the Riverside Public Utilities (RPU) is a consumer-owned water and electric utility governed by a board of nine community volunteers and the City Council of Riverside. RPU services more than 106,000 electric customers and over 64,000 water customers (serving a population of more than 300,000) in and around the City of Riverside.

San Bernardino Municipal Water Department

The San Bernardino Municipal Water Department (Water Department) provides customer service in drinking water, wastewater collection and treatment, and geothermal water services to the City of San Bernardino and nearby unincorporated San Bernardino County areas. It produces all of its own water using 51 wells located in 45 square miles of water service area and delivers to more than 40,000 service connections through 750 miles of water mains. The Water Department also operates two waste water treatment plants along the Santa Ana River.

San Bernardino Valley Municipal Water District

Valley District was formed in 1954 as a regional wholesale agency to ensure long-term water supply for the San Bernardino Valley. Valley District imports water into its service area through participation in the State Water Project and manages groundwater storage within its basin boundaries. Valley District has authority to provide water and wastewater services along with stormwater disposal, recreation, and fire protection services. Valley District covers about 353 square miles in southwestern San Bernardino County and serves a population of about 660,000 people through delivery of water to the retail water agencies within its service area. It spans the eastern two-thirds of the San Bernardino Valley, the Crafton Hills, and a portion of the Yucaipa Valley and includes the cities and communities of San Bernardino, Colton, Loma Linda, Redlands, Rialto, Bloomington, Highland, East Highland, Mentone, Grand Terrace, and Yucaipa.

San Bernardino Valley Water Conservation District

The San Bernardino Valley Water Conservation District (Conservation District) was created in 1932 to recharge the groundwater basin with local water supply in order to conserve that water for future use. At that time, the water was primarily used for agriculture; however, today this water is used for agricultural, municipal, and industrial purposes. The Conservation District's mission is to ensure recharge of the Bunker Hill Groundwater Basin in an environmentally and economically responsible way, using local native surface water to the maximum extent practicable. The Conservation District serves an area totaling 50,000 acres. It owns or has water recharge easements over 3,600 acres in the Santa Ana River and Mill Creek alluvial washes.

West Valley Water District

The West Valley Water District (West Valley) serves approximately 80,000 customers in the communities of Bloomington, Colton, Fontana, and Rialto; parts of unincorporated areas in San Bernardino; and Jurupa Valley in Riverside County. West Valley's water comes from groundwater wells, surface water, and direct delivery from Valley District. Groundwater wells pump from the

Lytle, Rialto, Bunkerhill, and North Riverside Basins. Treated surface water comes from Lytle Creek and Lake Silverwood.

Western Municipal Water District of Riverside County

The Western Municipal Water District of Riverside County (Western) provides water and wastewater services to retail customers and wholesale agencies from Corona to Temecula, a service area stretching 527 square miles in Riverside County. This regional area includes the cities of Corona, Norco, and Riverside, and the water agencies serving Box Springs, Eagle Valley, Lake Elsinore, Lee Lake, and Temecula. Western is a member agency of Metropolitan.

Upper Santa Ana River Sustainable Resources Alliance

The Upper SAR HCP will be implemented by the Upper Santa Ana River Sustainable Resources Alliance (established as a Joint Powers Authority). In addition to being the HCP Implementing Entity, the Upper Santa Ana River Sustainable Resources Alliance will oversee and support Covered Activity regulatory compliance, and implementation, management, and monitoring of the HCP Conservation Strategy.

San Bernardino Valley Conservation Trust

The San Bernardino Valley Conservation Trust (Conservation Trust; a 501(c)(3) charitable corporation) is proposed to hold fee title to, or conservation easements covering, land secured as mitigation for Covered Activities. The Conservation Trust is qualified to hold conservation easements, endowments, and other forms of security in accordance with Section 815 et seq. of the California Government Code. The Conservation Trust may be required to perform land management activities on lands secured as part of the HCP Conservation Strategy. Note: should another entity be selected as Grantee of any conservation easement and/or endowments or other forms of security, they will be similarly qualified per California Government Code.

Southern California Edison Incidental Take Permit

A second ITP will be issued to SCE to provide incidental take coverage for any Santa Ana suckers that may be translocated to waters covered by their licenses from the FERC.

SCE is the primary electricity supply company for much of Southern California. It provides 15 million people with electricity (hydro generated) across a service territory of approximately 50,000 square miles. SCE has several water intakes and powerhouses located in the Planning Area on Mill Creek, Bear Creek, Lytle Creek, and the Santa Ana River, as well as water intakes and powerhouses located just outside of the Planning Area on San Antonio Creek, tributary to Chino Creek, and thence the Santa Ana River.

1.2.2 Planning Area

The Planning Area is located in San Bernardino and Riverside Counties, California (Figure 1-1), and encompasses approximately 862,966 acres. It was developed to ensure that the natural resources that might be affected by Covered Activities can be adequately assessed at a regional scale and that sufficient mitigation opportunities are available.

The Planning Area is based on sub-watershed boundaries within the Santa Ana River watershed, except in areas where the water resource agency boundaries extend beyond the Santa Ana River watershed or where the Planning Area is constrained by the Los Angeles County (with one exception noted below) and Orange County lines. The Santa Ana River watershed below Prado Dam is not included in the Planning Area as the proposed Covered Activities, impact areas, and HCP Preserve System are not anticipated to occur there. The Planning Area also includes San Antonio Creek, in Los Angeles County, immediately west of the San Bernardino County line.

1.2.3 Permit Area

The area covered by the ITP, which falls within the Planning Area, is referred to as the Permit Area. The Upper SAR HCP Permit Area is the geographic area where the impacts of the Covered Activities are expected to occur and is depicted as the ownership, easements, and areas of operation and maintenance where all Covered Activities are located within natural habitats. The Permit Area includes SCE's hydroelectric facilities within San Antonio Creek, which lies immediately west of the San Bernardino County line in Los Angeles County. These facilities were proposed for inclusion in the HCP late in the planning process. The Permit Area also includes the HCP Preserve System so that the ITPs cover the potential take associated with habitat mitigation, management, and monitoring activities. While a number of mitigation areas are already known (e.g., tributary restoration sites) others will be identified during HCP implementation. If the HCP Preserve System is expanded in the future, the Permit Area will also include any new areas. Figure 1-3 depicts the Permit Area based on mapping of the Covered Activities and the currently proposed HCP Preserve System.

1.2.4 Species Addressed in this HCP

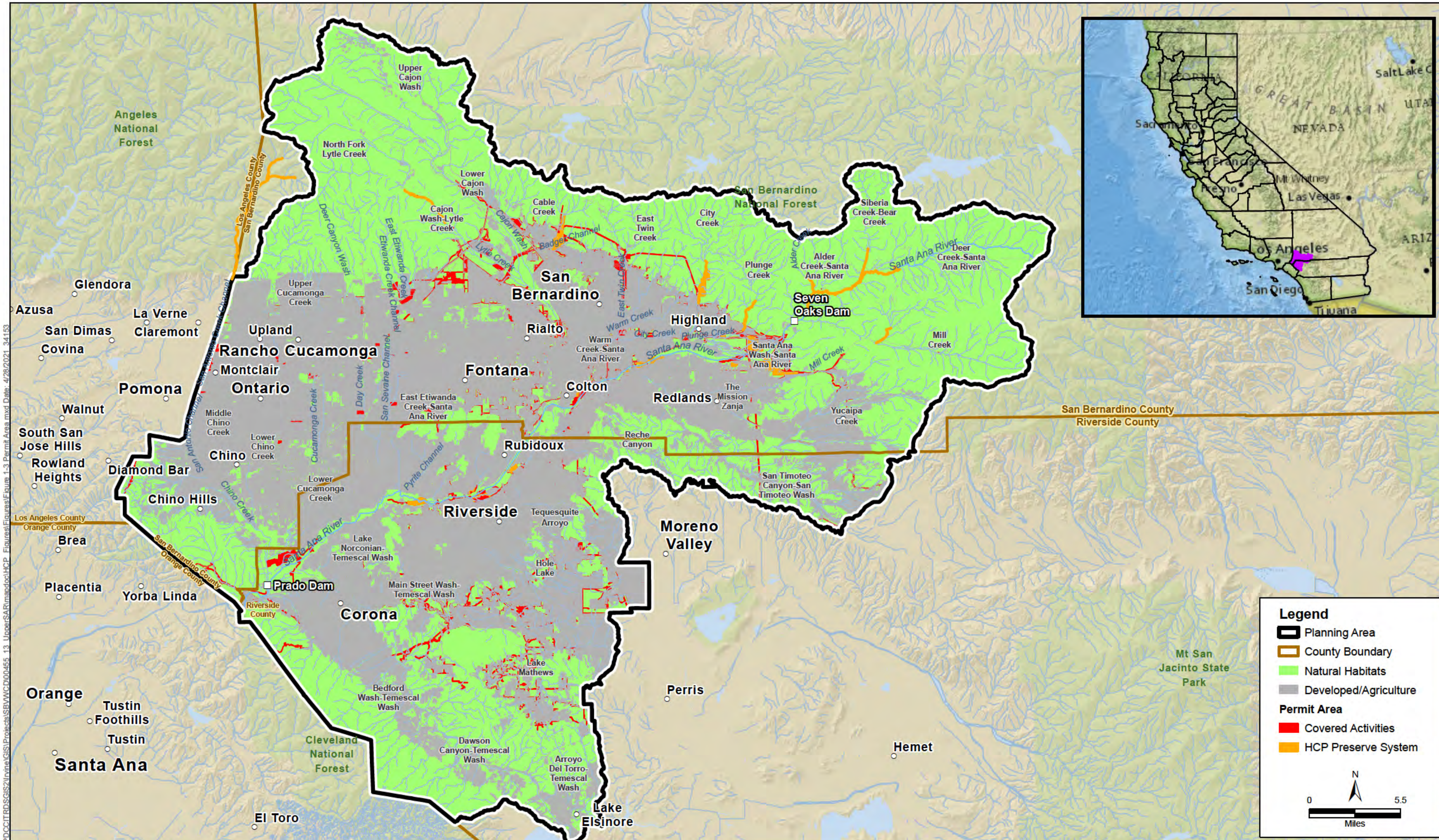
The ITP issued by USFWS must name specific species for which take resulting from Covered Activities is authorized. These species, called *Covered Species*, are either currently listed as threatened or endangered under the FESA or may become listed during the permit term. Although the primary intent of this HCP is to describe and offset the deleterious effects from proposed Covered Activities on Covered Species and their habitats, it is anticipated to also contribute to the protection of non-listed native species, and their habitats and communities; and provide landscape-scale protections of ecosystem processes and services within the HCP Preserve System. This broad scope would conserve a wide range of natural resources, including native species that are common as well as those that are rare.

There are 20 species covered by the HCP, including 9 listed and 11 non-listed species. There are also 2 additional Fully Avoided species that are listed but are not Covered Species and will be fully avoided during Covered Activities (Table 1-1). The incidental take authorization under Section 10 of FESA will apply to the wildlife species. Impacts on listed plant species is not prohibited under FESA or authorized under a Section 10(a)(1)(B) permit. However, the two plant species conserved by this HCP are listed in the 10(a)(1)(B) permit in recognition of the conservation measures and benefits provided for them under the HCP such that the Permittee Agencies will receive assurances pursuant to the USFWS "No Surprises" rule. Similarly, the unlisted Covered Species will also receive assurances under the "No Surprises" rule should they become listed in the future. Federal authorization for incidental take of other species, not included here as a Covered Species, may be sought through the amendment process and in accordance with FESA Sections 10(a) and 7 (Table 1-1).

In addition to Covered Species for which incidental take is requested, two species addressed in this HCP are Fully Avoided species: Delhi Sands flower-loving fly and arroyo toad. The avoidance and minimization measures included in Chapter 5, *Conservation Strategy*, are expected to reduce any adverse effects on these species so that any adverse effects would not rise to the level of take (see *Federal and State Definitions of Incidental Take* below). As noted above, this HCP establishes conservation strategies for a number of State-listed species. The conservation strategies established for the HCP are intended to support the issuance of State ITPs. Covered Species for which incidental take authorization will be requested under CESA are indicated as State-listed species in Table 1-1.

Table 1-1. Species Addressed in the Upper SAR HCP

		Listing Status	
Common Name	**Scientific Name**	**Federal**	**State**
Covered Species			
Slender-horned spineflower	*Dodecahema leptoceras*	Endangered	Endangered
Santa Ana River woolly-star	*Eriastrum densifolium* ssp. *sanctorum*	Endangered	Endangered
Santa Ana sucker	*Catostomus santaanae*	Threatened	None
Arroyo chub	*Gila orcuttii*	None	SSC
Santa Ana speckled dace	*Rhinichthys osculus* ssp.	None	SSC
Mountain yellow-legged frog (Southern California DPS)	*Rana muscosa*	Endangered	Endangered
Western spadefoot	*Spea hammondii*	None	SSC
California glossy snake	*Arizona elegans occidentalis*	None	SSC
South coast garter snake	*Thamnophis sirtalis* sp.	None	SSC
Southwestern pond turtle	*Emys pallida*	None	SSC
Tricolored blackbird	*Agelaius tricolor*	None	Threatened
Burrowing owl	*Athene cunicularia*	None	SSC
Cactus wren	*Campylorhynchus brunneicapillus*	None	SSC
Yellow-breasted chat	*Icteria virens*	None	SSC
Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	Threatened	Endangered
Southwestern willow flycatcher	*Empidonax traillii extimus*	Endangered	Endangered
Coastal California gnatcatcher	*Polioptila californica*	Threatened	SSC
Least Bell's vireo	*Vireo bellii pusillus*	Endangered	Endangered
Los Angeles pocket mouse	*Perognathus longimembris brevinasus*	None	SSC
San Bernardino kangaroo rat	*Dipodomys merriami parvus*	Endangered	Candidate
Fully Avoided Species[1]			
Delhi Sands flower-loving fly	*Rhaphiomidas terminatus abdominalis*	Endangered	None
Arroyo toad	*Anaxyrus californicus*	Endangered	None



Upper Santa Ana River Habitat Conservation Plan

Figure 1-3
Permit Area

[1] Implementation of avoidance measures as described in Chapter 5 of this HCP would prevent the take of these species.
DPS = Distinct Population Segment; SSC = CDFW Species of Special Concern.

Federal and State Definitions of Take

Under FESA, the term *take* (sometimes referred to as *taking*) is defined as to "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." *Harm* is defined as "an act which actually kills or injures wildlife [and] may include significant habitat modification." Note that, under the Supreme Court's decision in *Babbit v Sweet Home Chapter Communities for a Great Oregon*, not every action that modifies habitat results in a take under FESA.

The definition of take under CESA is narrower than the Federal definition (Section 86 of the California Fish and Game Code defines take as "hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill"). In considering issuance of an ITP under Section 2081 of CESA, however, CDFW must consider all of the impacts on State-listed species that are caused by the action to be permitted, even if not all of those impacts arise to the level of take under CESA.

Incidental Take Authorizations for Non-Listed Covered Species

Non-listed Covered Species must be treated as if they were already listed. All conservation measures described in the HCP for non-listed species must satisfy the permit issuance criteria under Section 10(a)(2)(B) of FESA that would otherwise apply if the non-listed Covered Species were actually listed (50 CFR 17.3). The Federal ITPs will identify all Covered Species regardless of Federal listing status. If implementation of Covered Activities is compliant with the terms of the Federal ITP, the incidental taking of listed Covered Species can occur after their issuance. The Federal ITPs will become effective for a non-listed Covered Species upon the listing of such species. Any reference in this HCP to incidental take of Covered Species refers to potential impacts on all Covered Species, regardless of current Federal listing status.

1.2.5 Covered Activities

The Upper SAR HCP must identify the activities that could result in the incidental take of Covered Species within the Planning Area. The types of activities covered by the HCP (Covered Activities) should include all actions that the Permittee Agencies want to have covered by FESA Section 10 and CESA 2081(b) permits. Covered Activities include both specific projects and ongoing activities (e.g., operations and maintenance).

- *Projects* are well-defined actions that occur **once** in a discrete location (e.g., construction of new facilities, infrastructure development, or capital improvement projects).
- *Operations and maintenance activities* are actions that occur **repeatedly** in one area or over a wide area (e.g., bank stabilization, storm-damage repair, or maintenance of facilities).

Covered Activity types are listed in Table 1-2 and include construction, development, and operations and maintenance of water conservation, and water infrastructure facilities; habitat restoration and/or rehabilitation; solar energy facility activities; and activities related to SCE's operations and maintenance of diversion structures associated with hydroelectric facilities where native fishes may be translocated, as part of the HCP's Conservation Strategy. The Covered Activities are described in detail in Chapter 2, including the size of the impacted area, frequency of activity, and the type and intensity of impact.

Table 1-2. Covered Activity Types Included in the Upper SAR HCP

Activity Type	Description
Water Reuse Projects	Activities related to projects associated with water reuse, including construction of new water treatment plants and associated facilities, and operations and maintenance of existing and new water treatment plants and associated facilities.
Groundwater Recharge	Activities related to construction of new structures associated with diversions, operations and maintenance of existing and new diversion structures for groundwater recharge, activities related to construction of new recharge basins, and operations and maintenance of existing and new recharge basins.
Wells and Water Conveyance Infrastructure	Activities related to the creation of new wells and associated development (pipelines, access roads, reservoirs, bridges) and the operations and maintenance of this infrastructure and associated development.
Solar Energy Development	Activities related to the construction and maintenance of new solar facilities.
Routine Operations and Maintenance	Activities that occur repeatedly in one location and/or in many locations over a wide area periodically and include minor construction, earth-moving, or vegetation management activities to infrastructure.
Habitat Improvement, Management, and Monitoring	Activities that support the improvement and management of habitat values in the Planning Area, including species surveys, monitoring, research, and adaptive management activities.

Activities not covered by the HCP and the incidental take authorizations are described in Chapter 2, Section 2.3, *Projects and Activities Not Covered by the HCP.*

1.2.6 Permit Term

The Permittee Agencies are seeking a 50-year ITP, which would accommodate the expected schedule for construction of projects in the Permit Area and ongoing associated operations and maintenance.

Covered Activities involving infrastructure for water supply reliability (i.e., groundwater replenishment, direct reuse, conservation) and associated operations and maintenance are expected to extend beyond the 50-year period. Prior to expiration of the take permits, each Permittee may apply to USFWS and CDFW to renew them. The permit may be renewed in accordance with applicable Federal and State laws and regulations in effect at the time of application for renewal. The Permittee Agencies will initiate the permit renewal process prior to the expiration of the permit term with ample time to allow for the review and processing of the renewal application.

The permit term for the ITP for SCE will be independent of that of the Permittee Agencies ITP. SCE operates and maintains hydroelectric facilities in accordance with three, 30-year licenses issued by the FERC in 2003, and the SCE ITP permit term may be established to coincide with the FERC relicensing cycles.

1.3 Regulatory Framework

The Upper SAR HCP is designed to comply with FESA and CESA. Implementation of the HCP will occur in compliance with the other State and Federal wildlife and related laws and regulations, each of which is referenced below and described in greater detail in subsequent sections, including the following:

- California Fish and Game Code Sections 3511, 4700, 5050, and 5515 (Fully Protected Species)
- California Fish and Game Code Section 3503 (Bird Nests)
- California Fish and Game Code Section 3503.5 (Birds of Prey)
- Migratory Bird Treaty Act
- Bald and Golden Eagle Protection Act
- California Environmental Quality Act of 1970
- National Environmental Policy Act of 1969
- Clean Water Act Sections 401, 402, and 404
- Porter-Cologne Water Quality Control Act
- Fish and Game Code Section 1600 et seq. (Lake or Streambed Alteration Agreement)
- National Historic Preservation Act

For a complete list of State and Federal permits that may be required for activities covered by the HCP, refer to Appendix A, *Covered Activities Permit Matrix*.

1.3.1 Federal Endangered Species Act (U.S. Code, Title 16, Section 153 et seq.)

Section 9

Section 9 of FESA and Federal regulation pursuant to Section 4(d) of FESA prohibit the take of endangered and threatened wildlife species, respectively, without special exemption. For a definition of take see *Federal and State Definitions of Take* above.

Pursuant to Section 11(a) and (b) of FESA, any person who knowingly violates Section 9 of FESA or any permit, certificate, or regulation related to Section 9 may be subject to civil penalties of up to $25,000 for each violation, or criminal penalties up to $100,000 for individuals or $200,000 for corporations and/or imprisonment of up to 1 year.

Section 10

Individuals and State and local agencies proposing an action that is expected to result in the incidental take of Federally listed species are encouraged to apply for an ITP under Section 10(a)(1)(B) of FESA. Such permits are issued by USFWS when take is not the intention of and is incidental to an otherwise legal activity. An application for an ITP must be accompanied by an

HCP that meets the requirements outlined in Section 10(a)(2)(A). Section 10(a)(2)(B) of FESA identifies the criteria that must be met for USFWS to issue an ITP.

Section 10(a)(1)(B) Process – Habitat Conservation Plan Requirements and Guidelines

The Section 10(a)(1)(B) process for obtaining an ITP has three primary stages: (1) the HCP development stage, (2) the formal permit processing stage, and (3) the post-issuance stage.

During the HCP development stage, the project applicant prepares a plan that integrates the proposed project or activity with the protection of listed species. An HCP submitted in support of an ITP application must include the following information:

- Impacts likely to result from the proposed incidental taking of the species for which permit coverage is requested. Measures implemented to avoid, minimize, mitigate, and monitor take and its effects,; funding that will be made available to undertake such measures; and procedures to deal with unforeseen circumstances.
- Alternative actions that further minimize and/or avoid the incidental taking considered by the applicant.
- Additional measures USFWS may require as necessary or appropriate for purposes of the plan.

The HCP development stage concludes and the permit processing stage begins when a complete application package is submitted to the appropriate permit-issuing office. A complete application package consists of (1) an HCP, (2) an Implementation Agreement, as appropriate, (3) a permit application, and (4) a $100 fee from the applicant. A NEPA document is prepared by USFWS, which can include an Environmental Action Statement, Environmental Assessment, or Environmental Impact Statement. USFWS then prepares and publishes a Notice of Availability of the HCP package, which includes NEPA, in the *Federal Register* to allow for a 30-, 60-, or 90-day public comment period.

After the public comment period has ended, USFWS prepares an Intra-Service Section 7 Biological Opinion taking into consideration any public comments received. Next a Set of Findings is prepared by USFWS, which evaluates the Section 10(a)(1)(B) permit application as in the context of permit issuance criteria. Statutory criteria for issuance of the permit specify the following:

1. The taking will be incidental to the intent of the proposed action.
2. The impacts of incidental take will be minimized and mitigated to the maximum extent practicable.
3. Adequate funding for the HCP and procedures to handle unforeseen circumstances will be provided.
4. The taking will not reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild.
5. The applicant will provide additional measures that USFWS requires as being necessary or appropriate.
6. USFWS has received assurances, as may be required, that the HCP will be implemented.

7. During the post-issuance stage, the Permittees and other responsible entities implement the HCP, and USFWS monitors the Permittees' compliance with the HCP as well as the long-term progress and success of the HCP. The public is notified of permit issuance by means of the *Federal Register*.
8. The required key elements to be included in the HCP document include the following:
   a) Area, time-frame, species, and activities covered by the plan and permit
   b) An estimate of the incidental take and associated impacts
9. A conservation plan is provided (with all of the items below):
   a) Biological goals and objectives
   b) Measures to avoid, minimize, mitigate, and monitor take and its effects
   c) Implementation and effectiveness monitoring
   d) Adaptive management provisions
   e) Measures for changed and unforeseen circumstances
   f) Provisions for amending the plan and permit
   g) Funding provisions and assurances
   h) Implementation assurances
   i) Alternatives to the taking of listed species and the reasons why not selected

A Section 10(a)(1)(B) ITP is granted upon a determination by USFWS that all requirements for permit issuance have been met. The Upper SAR HCP has been developed to address and include all of these key elements.

Section 7

Section 7 of FESA requires Federal agencies to ensure that their actions, including issuing permits, do not jeopardize the continued existence of listed species or destroy or adversely modify listed species' critical habitat. "Jeopardize the continued existence of…" pursuant to 50 CFR 402.02, means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species.

Issuance of an ITP under Section 10(a)(1)(B) of FESA by USFWS is a Federal action subject to Section 7 of the Act. As a Federal agency issuing a discretionary permit, USFWS is required to consult with itself (i.e., conduct an internal consultation). Delivery of the HCP and a Section 10(a)(1)(B) permit application initiates the Section 7 consultation process within USFWS.

The requirements of Section 7 and Section 10 overlap in some respects. Elements unique to Section 7 include analyses of impacts on designated critical habitat, analyses of impacts on listed plant species, if any, and analyses of indirect and cumulative impacts on listed species. Cumulative effects are effects of future State, tribal, local, or private actions that are reasonably certain to occur in the action area, pursuant to Section 7(a)(2) of the Act. The action area is defined by the influence of direct and indirect impacts of Covered Activities. The action area may or may not be solely contained within the HCP boundary. These additional analyses are included in this HCP to meet the requirements of Section 7 and to assist USFWS with its internal consultation.

USFWS will conduct an internal Section 7 consultation and prepare a biological opinion on its action, the issuance of the ITP for the Upper SAR HCP.

1.3.2 California Endangered Species Act

CESA is part of the California Fish and Game Code (Section 2050 et seq.) and is administered by CDFW as the trustee for fish and wildlife resources in California. CESA authorizes the California Fish and Game Commission to establish a list of endangered and threatened species.

Section 2081

Section 2081(b) of CESA authorizes CDFW to allow, by permit, the take of an endangered, threatened, or candidate species. Such a "Section 2081 permit" may be issued only if the following permit issuance criteria are met:

1. The take is incidental to an otherwise lawful activity.
2. The impacts of the authorized take shall be minimized and fully mitigated. The measures required to meet this obligation shall be roughly proportional in extent to the impact of the authorized taking on the species. Where various measures are available to meet this obligation, the measures required shall maintain the applicant's objectives to the greatest extent practicable. All required measures shall be capable of successful implementation. For purposes of this section only, impacts of taking include all impacts on the species that result from an act that would cause the proposed taking.
3. The permit is consistent with regulations adopted pursuant to Sections 2112 and 2114.
4. The applicant shall ensure adequate funding to implement the measures required by paragraph (2), and for monitoring compliance with, and effectiveness of, those measures. (CESA Section 2081[b])

CESA further requires that no permit may be issued if issuance of the permit would jeopardize the continued existence of the species, a determination that CDFW must make based on the best scientific and other information that is reasonably available. This must include consideration of the species' capability to survive and reproduce in light of known population trends, known threats to the species, and reasonably foreseeable impacts on the species from other related projects and activities. The conditions and measures in the Upper SAR HCP were designed to meet the issuance criteria for 2081 permits for all Covered Species; therefore, separate 2081 permits are expected to be obtained from CDFW largely based on the HCP.

1.3.3 Other Federal and State Wildlife Laws and Regulations

Federal Migratory Bird Treaty Act

The Migratory Bird Treaty Act of 1918 (MBTA), as amended, implements various treaties and conventions between the United States and Canada, Japan, Mexico, and the former Soviet Union for the protection of migratory birds. Under the MBTA, taking, killing, or possessing migratory birds is unlawful, as is taking of any parts, nests, or eggs of such birds (16 United States Code [USC] 703).

The conservation measures for covered birds under this HCP are intended to be consistent with the MBTA.

Bald and Golden Eagle Protection Act

The Bald and Golden Eagle Protection Act prohibits the taking or possession of and commerce in bald and golden eagles, with limited exceptions. USFWS provides guidance regarding the incidental take of bald and golden eagles (Chapters 3 and 7 in the *HCP Handbook;* USFWS and NOAA Fisheries 2016). Under the Act, it is a violation to "…take, possess, sell, purchase, barter, offer to sell, transport, export or import, at any time or in any manner, any bald eagle commonly known as the American eagle, or golden eagle, alive or dead, or any part, nest, or egg, thereof." Here, take is defined as to include pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest, and disturb. *Disturb* is further defined in 50 CFR 22.3 as follows:

> To agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available (1) injury to an eagle, (2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or (3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior.

Recent revisions to regulations implementing the Bald and Golden Eagle Protection Act authorize take of bald eagles and golden eagles under the following conditions: where the take (1) is compatible with the preservation of the bald eagle and golden eagle, (2) is necessary to protect an interest in a particular locality, and (3) is associated with, but not the purpose of, the activity and the applicant has applied all appropriate and practicable avoidance and minimization measures and appropriate and practicable compensatory mitigation measures, as required (50 CFR 22.26).

Neither the bald eagle nor the golden eagle is a Covered Species under the HCP. The HCP does not seek a permit under the Bald and Golden Eagle Protection Act because disturbance, injury, or death of eagles or eggs, or disturbance of nests, are not anticipated in association with Covered Activities or overall HCP implementation.

California Fully Protected Species

In the 1960s, before CESA was enacted, the California Legislature identified species for specific protection under the California Fish and Game Code. These fully protected species may not be taken or possessed at any time, and no licenses or permits may be issued for their take except for collecting these species for necessary scientific research and relocation of the bird species for the protection of livestock.[1] Fully protected species are described in Sections 3511 (birds), 4700 (mammals), 5050 (reptiles and amphibians), and 5515 (fish) of the California Fish and Game Code. These protections state that "…no provision of this code or any other law shall be construed to authorize the issuance of permits or licenses to take any fully protected [bird], [mammal], [reptile or amphibian], [fish]." No fully protected species are covered by the HCP, and CDFW cannot issue a 2081 permit for fully protected species. Fully protected species expected to occur in the Planning Area include, but are not restricted to, those listed below.

- White-tailed kite (*Elanus leucurus*)

[1] CDFW can issue permits authorizing the incidental take of fully protected species under CESA, so long as any take authorization is issued in conjunction with the approval of a Natural Community Conservation Plan (NCCP). The Permittees are not seeking an NCCP Permit.

- Golden eagle (*Aquila chrysaetos*)
- Bald eagle (*Haliaeetus leucocephalus*)

Fully protected species are not Covered Species under the HCP. The HCP does not seek a permit for fully protected species because take is not anticipated in association with Covered Activities or overall HCP implementation.

California Fish and Game Code 3503 (Bird Nests)

Section 3503 of the Fish and Game Code makes it "unlawful to take, possess or needlessly destroy the nests or eggs of any bird, except as otherwise provided by this code or any regulation made pursuant thereto." Therefore, CDFW may issue permits authorizing take pursuant to CESA**.** The HCP contains conservation measures to avoid such take to the maximum extent practicable in order to comply with Section 3503. However, some take of covered birds still may occur; the 2081 permit will serve as the State authorization for take of nests or eggs of State-listed covered birds pursuant to Section 3503.

California Fish and Game Code 3503.5 (Birds of Prey)

Section 3503.5 of the Fish and Game Code prohibits the take, possession, or destruction of any birds of prey or their nests or eggs "except as otherwise provided by this code or any regulation adopted pursuant thereto." CDFW may issue permits authorizing take pursuant to CESA. The burrowing owl is the only bird of prey covered by the HCP, and the HCP contains conservation measures to avoid such take in order to comply with Section 3503.5.

California Fish and Game Code 1900–1913 (Native Plant Protection Act)

The Native Plant Protection Act prohibits taking of endangered and rare plants from the wild and requires that CDFW be notified at least 10 days in advance of certain specified changes in land use that would adversely impact listed plants. There are two rare and endangered plants that occur in the Planning Area and that are protected by the Native Plant Protection Act. Both plants are Covered Species (Santa Ana River woolly-star and slender-horned spineflower); therefore, incidental take of these species will be covered by the 2081 permits.

1.3.4 National Environmental Policy Act

The purpose of NEPA is twofold: to ensure that Federal agencies examine environmental impacts of their actions (in this case deciding whether to issue an ITP) and to provide a mechanism for public participation. NEPA serves as an analytical tool on direct, indirect, and cumulative impacts of the proposed project alternatives to help USFWS decide whether to issue an ITP. NEPA analysis must be done by USFWS as the lead agency for each HCP as part of the ITP application process.

1.3.5 California Environmental Quality Act

CEQA is similar to but more extensive than NEPA in that it requires significant environmental impacts of proposed projects to be reduced to a less-than-significant level through adoption of feasible avoidance, minimization, or mitigation measures unless overriding considerations are identified and documented. CDFW's action on a 2081 permit is subject to CEQA and will be addressed by the NEPA/CEQA environmental review process for the HCP.

1.3.6 Federal and State Wetland Laws and Regulations

Note that the HCP has been developed to support permitting under FESA and CESA. Compliance with Federal and State Wetland Laws and Regulations must be achieved through the permit processes established by the aquatic resources regulatory agencies. To this end, the Upper SAR HCP Programmatic Aquatic Resource permits will be developed to assist the Permittee Agencies with streamlined regulatory compliance for these Federal and State wetland laws and regulations.

The CWA is the primary Federal law that protects the physical, chemical, and biological integrity of the nation's waters, including lakes, rivers, wetlands, and coastal waters. Programs conducted under the CWA are directed at both point-source pollution (e.g., waste discharged from outfalls and filling of waters) and nonpoint-source pollution (e.g., runoff from roads, freeways, and bridges). Under Sections 401, 402, and 404 of the CWA, the U.S. Environmental Protection Agency (EPA), Federal agencies, and State agencies set effluent limitations and issue permits. These permits are the primary regulatory tools of the CWA. EPA oversees all CWA permits.

Definition of Jurisdictional Wetlands and Waters

The term *jurisdictional waters* is used to refer to State and Federally regulated wetlands and other waterbodies that cannot be filled without permits from the USACE under CWA Section 404 or from the State Water Resources Control Board (SWRCB) or the Regional Water Quality Control Boards (RWQCBs) under either CWA Section 401 or Porter-Cologne.

Federally regulated wetlands and other waters are defined under the CWA as "waters of the United States" (WoUS). WoUS include traditionally navigable waters such as rivers, lakes, and the territorial seas, and other wetlands and waters that may not be navigable, such as tributaries of navigable waters and wetlands adjacent to navigable waters. WoUS are more specifically defined by USACE regulations as interpreted by the courts. USACE relies on several published technical manuals for determining the scope of Federally jurisdictional wetlands.

The SWRCB and RWQCBs regulate the discharge of dredged or fill material to waters of the State of California, which includes any surface or groundwater within the state. The permit process for discharges to waters of the State were established by the SWRCB in 2019 with the adoption of a statewide wetlands definition and "procedures" for the discharge of dredged or fill material.

Mitigation is typically required for activities permitted under CWA Sections 401 and 404, and Porter-Cologne.

Clean Water Act Section 404

Pursuant to CWA Section 404, USACE regulates the discharge of dredged or fill material into WoUS, including wetlands. A discharge of fill material includes activities such as grading, placing riprap for erosion control, pouring concrete, laying sod, and stockpiling excavated material into WoUS. Activities that generally do not involve a regulated discharge (if performed specifically in a manner to avoid discharges) include driving pilings, performing certain drainage channel maintenance activities, constructing temporary mining and farm/forest roads, and excavating without stockpiling.

USACE issues two types of permits under Section 404: general permits (either nationwide permits or regional permits) and standard permits (referred to as individual permits). General permits are issued by USACE to streamline the Section 404 process for nationwide, statewide, or regional activities that have minimal direct or cumulative environmental impacts on the aquatic environment. Individual permits are issued for activities that do not qualify for a general permit (i.e., that may have more than a minimal adverse environmental impact). The Los Angeles District of USACE will review and consider issuing permits for projects in the Planning Area that propose to fill WoUS.

The HCP will not provide permits under CWA Section 404 for impacts on wetlands or other waters from Covered Activities. However, the Section 404 permitting process is expected to be streamlined as a result of the HCP. Issuance of a Section 404 permit often requires USACE to consult with USFWS to comply with FESA Section 7. This consultation would address the Federally listed species covered by the HCP. Accordingly, provided that Covered Activities requiring Section 404 permits are implemented consistently with the HCP, it is expected that there will not be mitigation or other offsetting measures for effects on Covered Species beyond those already required by the HCP. The Section 7 biological opinion issued for the HCP also can serve as the basis for any future biological opinions in the Planning Area for Covered Activities.

Clean Water Act Section 401 and the Porter-Cologne Water Quality Control Act

Under CWA Section 401, states are required to certify that Federal permits for discharges to waters in the state comply with State water quality standards. In California, these standards are established under Porter-Cologne. A Federal permit cannot be issued if the State denies certification. In California, the SWRCB and the RWQCBs are responsible for the issuance of CWA Section 401 certifications. The Planning Area is within the Santa Ana RWQCB.

Porter-Cologne is the primary State law concerning water quality. It authorizes the SWRCB and RWQCBs to prepare management plans such as Regional Water Quality Plans (Basin Plans) to address the quality of groundwater and surface water. Porter-Cologne also authorizes the RWQCBs to issue Waste Discharge Requirements (WDRs) defining limitations on allowable discharge to waters of the State, including wetlands. In addition to issuing CWA Section 401 certifications on CWA Section 404 applications to fill waters, the RWQCBs may issue WDRs for such activities.

The HCP does not include certifications under Section 401 or WDRs under Porter-Cologne. However, the HCP should provide some streamlining benefits for Covered Activities requiring a certification or WDRs. Under SWRCB regulations, the alternatives analysis and mitigation required for a proposed discharge to waters of the State are required to be evaluated in a watershed context. In particular, if a watershed plan has been adopted for an area that includes a proposed discharge, the permit for that discharge will be evaluated in light of the watershed plan. This HCP is intended to serve as such a watershed plan within the meaning of SWRCB regulations.

Clean Water Act Section 402, National Pollutant Discharge Elimination System

CWA Section 402 controls direct discharges into navigable waters. Direct discharges or “point–source” discharges are from sources such as pipes and sewers. National Pollutant Discharge Elimination System (NPDES) permits are issued by the State with oversight by EPA. A facility that intends to discharge into the nation's waters must obtain a permit before initiating a discharge. A permit applicant must provide quantitative analytical data identifying the types of pollutants present in the facility's effluent. The Section 402 permit then will set forth the conditions and effluent limitations under which a facility may make a discharge. The HCP does not include certifications under Section 402 or NPDES permits under the CWA. These authorizations, if required, must be obtained separately.

California Water Code and Wastewater Change Petitions

If a water re-use project will change the point of discharge, place of use, or purpose of use of the treated wastewater a wastewater change petition needs to be submitted to the SWRCB, Division of Water Rights. To approve a wastewater change petition, the SWRCB must be able to find that the proposed change will not injure other legal users of water, will not unreasonably harm instream uses, and is not contrary to the public interest. A petition is not needed for changes in the discharge or use of treated wastewater that do not result in decreasing the flow in any portion of a watercourse. Also, reductions in discharge associated with reduced plant influent due to water conservation measures are not subject to the petition requirement. Wastewater change petitions are sent to SWRCB. Specifically, as stated in Water Code Section 1211 "(a) Prior to making any change in the point of discharge, place of use, or purpose of use of treated wastewater, the owner of any wastewater treatment plant shall obtain approval of the board for that change." This approval is typically referred to as a "Change of Use 1211 Permit." CEQA applies to non-exempt wastewater change petitions, and the SWRCB must either undertake CEQA review as a lead agency, or review CEQA documents as a responsible agency before taking a discretionary action.

Several recent wastewater change petitions with proposed flow reductions to the Santa Ana River within the Planning Area have been filed and/or approved by the SWRCB, Division of Water Rights. A brief summary of these petitions is provided below.[2]

Wastewater Change Petition WW0095

Wastewater Change Petition WW0095 was filed by Valley District (in partnership with East Valley) for the reduction of 6 million gallons per day (mgd) of tertiary treated wastewater from the Water Department's Rapid Infiltration and Extraction Facility (RIX) to the Santa Ana River associated with the construction and operation of the Sterling Natural Resources Center project (SNRC). The SWRCB authorized WW0095, and the associated Order authorized the change in point of discharge to include City Creek (as well as from RIX to the Santa Ana River) and a reduction in discharge from RIX to the Santa Ana River by an average monthly rate of up to 5 mgd, for a total reduction of 6.725 acre-feet per year (afy), from January 1 to December 31 of each year.

Wastewater Change Petition WW0067

Wastewater Change Petition WW0067 was filed by the Western Riverside County Regional Wastewater Authority (WRCRWA) for a 100% reduction of tertiary treated wastewater discharge (approximately 7,240 afy) from their wastewater treatment plant (WWTP) to OCWD's diversion canal (tributary to Prado Basin). The SWRCB authorized WW0067 and the associated Order provided for the requested 100% reduction.

Wastewater Change Petition WW0059

Wastewater Change Petition WW0059 was filed by the Water Department, seeking authorization for a reduction of up to 17.9 mgd in discharge from the RIX to the Santa Ana River, associated with the

[2] Copies of public notices of Wastewater Change Petitions and Wastewater Petition Orders are available on the State Water Resources Control Board website.

Water Department's Clean Water Factory Project. Due to environmental concerns and Settlement Agreements with the City of Riverside and the Center for Biological Diversity, the Water Department subsequently agreed to maintain a minimum discharge of 18.5 mgd (28.6 cubic feet per second) from the RIX to the Santa Ana River from June 1 to October 15 each year. This stipulation, amongst others, was incorporated into the SWRCB's approved Order.

Wastewater Change Petition WW0079

Wastewater Change Petition WW0079 was filed by the City of Rialto, seeking authorization to reduce discharge to Rialto Channel (tributary to Santa Ana River) from Rialto's WWTP. WW0079 is still pending before the SWRCB, Division of Water Rights.

Lake or Streambed Alteration Agreement

CDFW has jurisdictional authority over rivers, streams and lakes under California Fish and Game Code Section 1600 *et seq*. CDFW has the authority to regulate work that will "substantially divert or obstruct the natural flow of, or substantially change or use any material from the bed, channel, or bank of, any river, stream, or lake, or deposit or dispose of debris, waste, or other material containing crumbled, flaked, or ground pavement where it may pass into any river, stream, or lake."

Activities of any person, State or local governmental agency, or public utility are regulated by CDFW under Section 1602 of the California Fish and Game Code. CDFW enters into a streambed or lakebed alteration agreement with the project proponent and is authorized to impose "reasonable" conditions on the agreement to protect fish and wildlife resources.

The lake or streambed alteration agreement is not a permit, but rather a mutual agreement between CDFW and the project proponent. To secure such an agreement, a project proponent must submit a notification of proposed streambed alteration to CDFW before construction. CDFW will review the notification and, within 60 days following such notice having been deemed complete, will issue a draft agreement to the project proponent. The Fish and Game Code establishes a dispute resolution process to address any disagreements between CDFW and the proponent over CDFW's proposed conditions to the activity. CDFW can enter into streambed alteration agreements that cover recurring operation and maintenance activities and can enter into long-term agreements to cover development and other activities described in regional plans.

National Historic Preservation Act

Section 106 of the National Historic Preservation Act of 1966 (NHPA), as amended (16 USC 470 et seq.), requires Federal agencies to take into account the effects of their proposed actions on properties eligible for inclusion in the National Register of Historic Places. *Properties* are defined as cultural resources, which include prehistoric and historic sites, buildings, and structures that are listed on or eligible for listing on the National Register of Historic Places. An *undertaking* is defined as a project, activity, or program funded in whole or in part under the direct or indirect jurisdiction of a Federal agency, including those carried out by or on behalf of a Federal agency; those carried out with Federal financial assistance; those requiring a Federal permit, license, or approval; and those subject to State or local regulation administered pursuant to a delegation or approval by a Federal agency.

The issuance of an ITP is an undertaking subject to Section 106 of the NHPA. USFWS has determined that the area of potential effects for the present undertaking is that area where on-the-ground Covered Activities will result in take of species.

1.4 Relationship to Other Conservation Plans in the Planning Area

The Upper SAR HCP overlaps with four other HCPs and one Natural Community Conservation Plan (NCCP)/HCP that are approved and active (i.e., within the permit duration). A brief description of these overlapping HCPs and NCCPs is provided below. There are an additional four NCCP/HCPs and one HCP that are near the Planning Area: (1) Coachella Valley Multiple Species NCCP/HCP, (2) Orange County Central/Coastal Subregion NCCP/HCP, (3) Orange County Southern Subregion HCP, (4) Apple Valley Multi-Species Conservation Plan NCCP/HCP, and (5) Orange County Transportation Authority NCCP/HCP (Figure 1-4).

1.4.1 Upper Santa Ana River Wash HCP

The Upper Santa Ana River Wash HCP (Wash Plan) planning area (4,892 acres) is entirely within the Upper SAR HCP Planning Area and includes the area from approximately 1 mile downstream of the Seven Oaks Dam to approximately 6 miles westward from Greenspot Road in the City of Highland to Alabama Street in the City of Redlands. The primary goal of the Wash Plan is to balance the ground-disturbing activities of water conservation, aggregate mining, recreation activities, and other public services with the conservation of natural communities and populations of Santa Ana River woolly-star, slender-horned spineflower, coastal California gnatcatcher, cactus wren, and San Bernardino kangaroo rat (all of which are also covered by the Upper SAR HCP). The Wash Plan was permitted in July 2020. The City of Redlands, City of Highland, Valley District, East Valley, Cemex, Inc., and Robertson's Ready-Mix will participate in the implementation of the HCP through a Certificate of Inclusion to receive coverage for their planned projects in the Wash Plan planning area.

Given the overlap of some participating water agencies and the similar name and geographic location, the Wash Plan may be confused with the Upper SAR HCP. The Covered Activities and associated ITPs of the Wash Plan are independent of the Covered Activities and ITPs of the Upper SAR HCP.

1.4.2 Western Riverside County Multiple Species NCCP/HCP

The Western Riverside County Multiple Species NCCP and HCP (WRC MSHCP), a comprehensive regional NCCP/HCP, was adopted in June 2003. The WRC MSHCP provides impact mitigation for future County projects, particularly transportation and development projects in the covered area of western Riverside County. The southern portion of the Upper SAR HCP occurs within the boundaries of the WRC MSHCP planning area (Figure 1-4). There are 146 listed and non-listed Covered Species in the WRC MSHCP, including the following species also included in the Upper SAR HCP: Santa Ana River woolly-star, slender-horned spineflower, Delhi Sands flower-loving fly, Santa Ana sucker, arroyo chub, arroyo toad, mountain yellow-legged frog, western spadefoot, burrowing owl, coastal California gnatcatcher, cactus wren, least Bell's vireo, southwestern willow flycatcher, tricolored blackbird, western yellow-billed cuckoo, yellow-breasted chat, San Bernardino kangaroo rat, and Los Angeles pocket mouse.

The Covered Activities in the Upper SAR HCP were not explicitly covered in the WRC MSHCP; therefore, all Upper SAR HCP Covered Activities will be mitigated through this HCP and all WRC MSHCP covered activities must be mitigated through that plan and are not allowed to be mitigated through this HCP.

1.4.3 West Valley HCP

The City of Colton obtained an ITP from USFWS for the Delhi Sands flower-loving fly within the West Valley HCP planning area. The purpose of the West Valley HCP is to fulfill the permit requirements for proposed activities under the plan in areas containing occupied and suitable habitat for Delhi Sands flower-loving fly in order to maximize economic development in the City of Colton while also conserving the fly. The West Valley HCP focuses on preserving populations of the species north of Interstate 10. The goals of the plan include preserving large blocks of habitat north of Interstate 10, protecting populations of Delhi Sands flower-loving fly, providing connections between local populations, and providing long-term conservation management of populations (RBF 2014).

The West Valley HCP occurs entirely within the Upper SAR HCP Planning Area (Figure 1-4). The West Valley HCP planning area consists of 416 acres, of which approximately 149 acres is potentially suitable habitat for Delhi Sands flower-loving fly. There are five conservation areas organized into four distinct management units within the planning area, which are managed and monitored by the Riverside Land Conservancy. The Delhi Sands flower-loving fly is also covered by the Upper SAR HCP.

1.4.4 Lake Mathews Multiple Species HCP

The Lake Mathews Multiple Species HCP (Lake Mathews MSHCP) is a joint conservation effort initiated by Metropolitan and the Riverside County Habitat Conservation Agency (RCHCA) in cooperation with USFWS. There are 65 listed and non-listed species covered under the Lake Mathews MSHCP (MWD/RCHCA 1995); 31 of the species covered under the Lake Mathews MSHCP are also covered under the Upper SAR HCP.

The Lake Mathews MSHCP occurs entirely within the Upper SAR HCP Planning Area, in northwestern Riverside County (Figure 1-4). It consists of approximately 5,110 acres of open land surrounding Lake Mathews, 2,565 acres of which is a State Ecological Reserve. La Sierra Avenue runs north/south along the Lake Mathews shore near the western boundary, Cajalco Road runs east/west near the southern shore and boundary, and El Sobrante Road runs east/west along the northern shore and boundary of the Lake Mathews MSHCP.

1.4.5 Stephens' Kangaroo Rat HCP

The RCHCA obtained ITPs from USFWS and CDFW for Stephens' kangaroo rat (*Dipodomys stephensi*; SKR) within the Stephens' Kangaroo Rat Habitat Conservation Plan (SKR HCP) area. Conservation goals included the acquisition and conservation of Stephens' kangaroo rat habitat within a regional reserve system and establishes conservation of 15,000 acres in seven core reserves within the plan's boundary for SKR. The Upper SAR HCP Planning Area encompasses three SKR HCP core reserve areas: Lake Mathews/Estelle Core Reserve, Steele Peak Core Reserve, and Sycamore Canyon Core Reserve (RCHCA 1996) (Figure 1-4); however, none of the Upper SAR HCP Covered Activities considered in the HCP are anticipated to impact SKR. Therefore, SKR is not a Covered Species under the Upper SAR HCP. Should Covered Activities (listed in Table 2-1) occurring within the SKR HCP fee

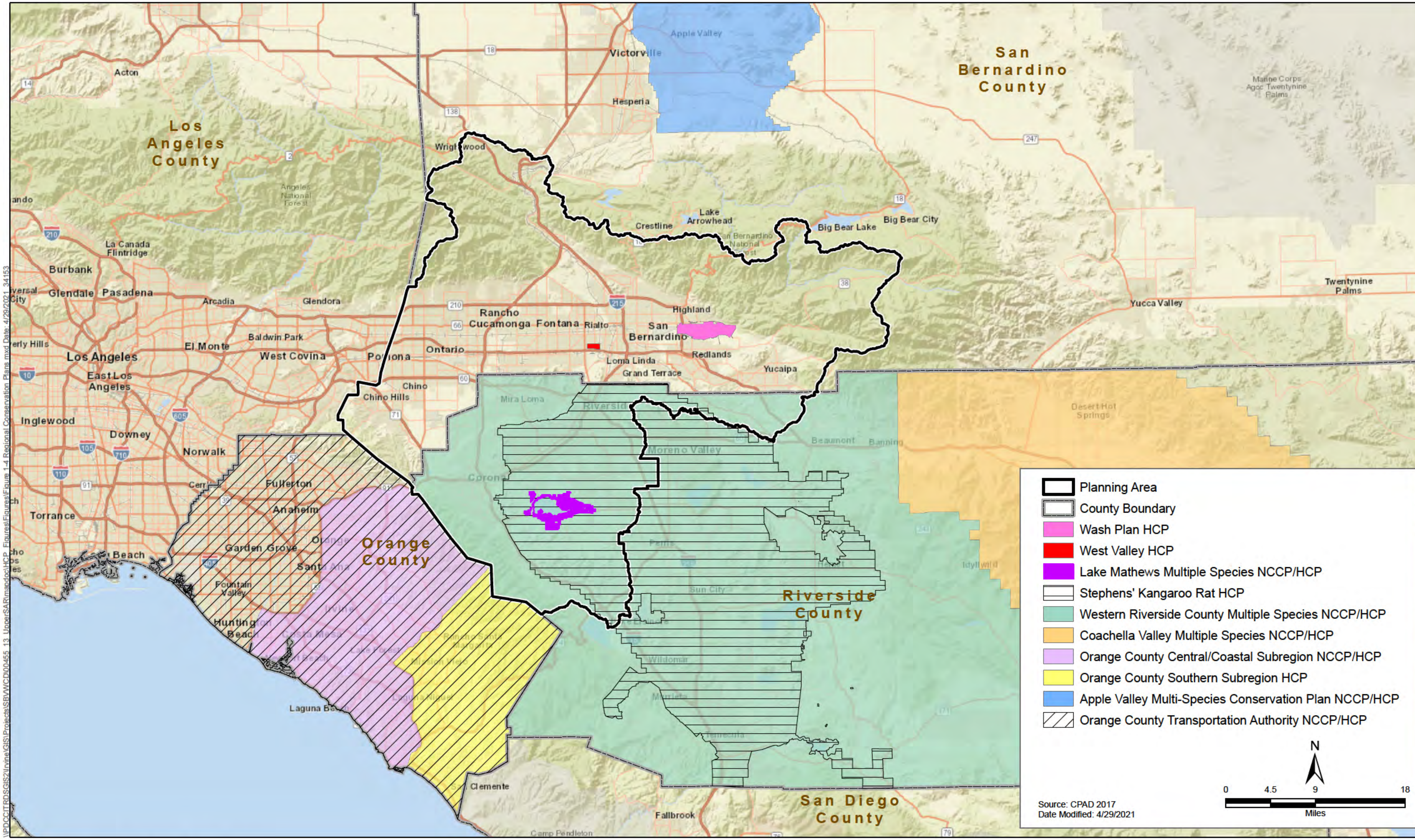


Figure 1-4
Regional Habitat Conservation Plans in the vicinity of the Planning Area

area need take authorization for SKR, they would obtain that through a certificate of inclusion in the SKR HCP.

1.5 Relationship to Water Rights Judgments and Agreements within the Planning Area

Multiple Agreements and Judgments pertaining to water rights are in effect within the Planning Area. There are two primary water rights that dictate minimum base flows at Prado Basin: the 1969 Orange County Water District Judgment (1969 OCWD Judgment), and the 1969 Western Municipal Water District Judgment (1969 Western Judgment).

The 1969 OCWD Judgment resulted in an adjudication of water rights against substantially all water users in the area tributary to Prado Dam in the Santa Ana River Watershed, and decreed that the lower Santa Ana River Watershed (area below Prado Dam) had rights to receive 42,000 afy of base flow at Prado. The Judgment identified that Valley District was responsible for an average annual adjusted base flow of 15,250 afy at Riverside Narrows (with a minimum of not less than 13,420 afy base flow plus one-third of any cumulative debit), and Chino Basin Municipal Water District and Western were responsible for an average annual adjusted base flow of 42,000 afy at Prado (with a minimum of not less than 37,000 afy of base flow plus one-third of any cumulative debit). The Judgment also required formation of a Watermaster to administer and enforce the provisions of the Judgement.

The 1969 Western Judgment further implemented the 1969 OCWD Judgment and quantified extractions, rights, and replenishment requirements for the San Bernardino Basin Area, including the Bunker Hill Dike, Colton Basin Area, Riverside Basin Area with San Bernardino County, and Riverside Basin Area within Riverside County (area tributary to Riverside Narrows). The Judgement identified that a Watermaster would be responsible for administering and enforcing the Judgement and instructions.

The Upper SAR HCP is consistent with all of the water rights Judgments and Agreements in effect within the Planning Area.

Chapter 2
Covered Activities

2.1 Description of Covered Activities

The Upper Santa Ana River (SAR) Habitat Conservation Plan (HCP) covers two types of activities: (1) new or expanded facilities planned in the Planning Area, and (2) activities related to the operations and maintenance (O&M) of existing facilities or associated with new facilities constructed as a Covered Activity.

All Covered Activities have been subdivided into the following categories:

1. **Water Reuse Projects**—Activities related to projects associated with water reuse, including construction of new water treatment plants and associated facilities, and operations and maintenance of existing and new water treatment plants and associated facilities.
2. **Groundwater Recharge**— Activities related to construction of new structures associated with diversions, operations and maintenance of existing and new diversion structures for groundwater recharge, activities related to construction of new recharge basins, and operations and maintenance of existing and new recharge basins.
3. **Wells and Water Conveyance Infrastructure**—Activities related to the creation of new wells and associated development (pipelines, access roads, reservoirs, bridges) and the operations and maintenance of this infrastructure and associated development.
4. **Solar Energy Development**—Activities related to the construction and maintenance of new solar facilities.
5. **Routine Operations and Maintenance**—Activities that occur repeatedly in one location and/or in many locations over a wide area periodically and include minor construction, earth moving, or vegetation management activities to infrastructure.
6. **Habitat Improvement, Management, and Monitoring**—Activities that support the restoration, rehabilitation, and maintenance of habitat values in the Planning Area, including species surveys, monitoring, research, and adaptive management activities.

The impacts of all Covered Activities are analyzed and described in Chapter 4, *Incidental Take Assessment and Impact Analysis*. All Covered Activities will be implemented with appropriate avoidance and minimization measures. These avoidance and minimization measures are described in Chapter 5, Section 5.11, *Measures to Avoid and Minimize Effects*.

In certain instances, a covered project may include multiple components (e.g., conveyance infrastructure and recharge basins). In these cases, the project is categorized in the component anticipated to result in the greatest effects.

Covered Activities are also anticipated to occur in different phases during implementation of the HCP. These HCP phases are as follows:

- **Phase 1**—0 to 5 years from permit issuance
- **Phase 2**—6 to 10 years from permit issuance

- **Phase 3**—11 to 15 years from permit issuance
- **Phase 4**—16 years from permit issuance to end of permit term

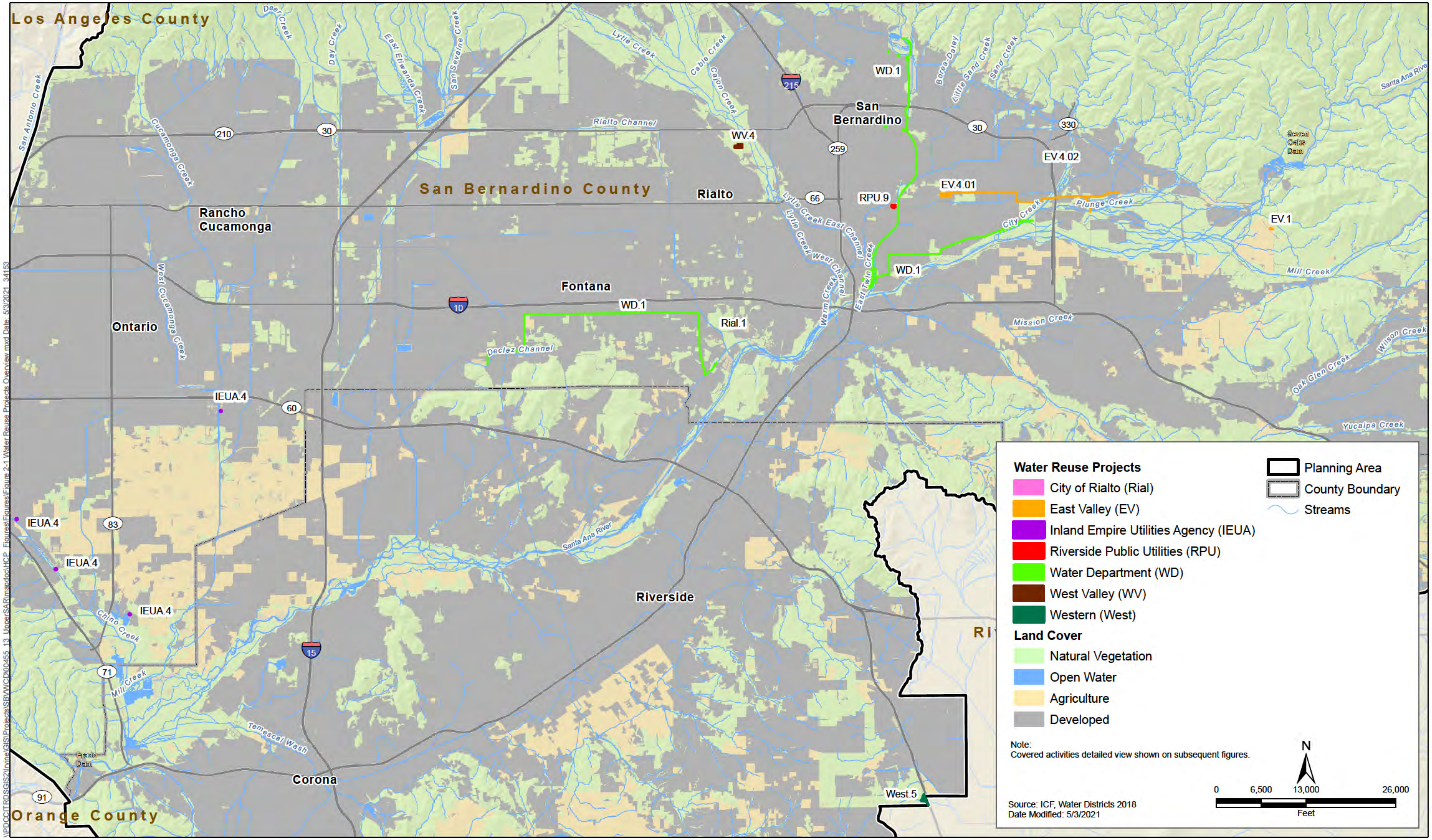
Covered Activities result in permanent and/or temporary ground disturbance from construction or maintenance activities and/or changes to hydrology that affect Covered Species or their habitat. Projects covered under the HCP are in various stages of planning, and, therefore, project descriptions may vary in detail according to how far along in planning a project is. For example, a project occurring in Phase 1 may have very detailed descriptions (specific location, site layout, etc.) while activities in earlier planning stages may have more general descriptions (general location and/or development envelope).

To account for some uncertainty as to the extent and location of Covered Activities, this HCP assumes disturbance footprints conservatively to ensure that the potential effects on Covered Species are adequately assessed. Figures 2-1 through 2-26 illustrate the areas where this HCP assumes Covered Activities will occur for the purposes of estimating effects. All activities described in this chapter have been analyzed in Chapter 4, unless specifically identified as not covered. Acreages of ground disturbance associated with construction, operations, or maintenance are reported in Chapter 4.

Geotechnical drilling (e.g., cone penetration testing) to understand subsurface conditions may be necessary prior to construction of water infrastructure (e.g., recharge basin, pipeline, well, or storage tank). This activity is assumed to occur within the Covered Activity ground disturbance footprint analyzed in Chapter 4. Holes drilled for geotechnical studies will be backfilled with native material or other material following the conditions of Clean Water Act Section 404 Nationwide Permit 6 and approved by the Regional Water Quality Control Board (RWQCB).

The Covered Activities described in Sections 2.1.1 through 2.1.5 describe new projects and are organized by the activity types covered by the HCP. Section 2.1.6 describes routine operations and maintenance activities to be covered that generally apply to all water agencies. All ground-disturbing and hydrology-changing activities covered by the Incidental Take Permit (ITP) for the HCP are described in this section and mapped in a Geographical Information System (GIS) database. Operations and maintenance activities covered by the ITP are described generally in Section 2.1.6, and also mapped in the GIS database. Additionally, Section 2.2 describes specific activities not covered by the ITP.

In order to track Covered Activities in tabular impact calculations and locate projects in the figures in this document, the Covered Activities have been assigned a unique identification code. Table 2-1 lists the code associated with each Covered Activity. Table 2-2 summarizes all Covered Activities that propose aquatic effects.



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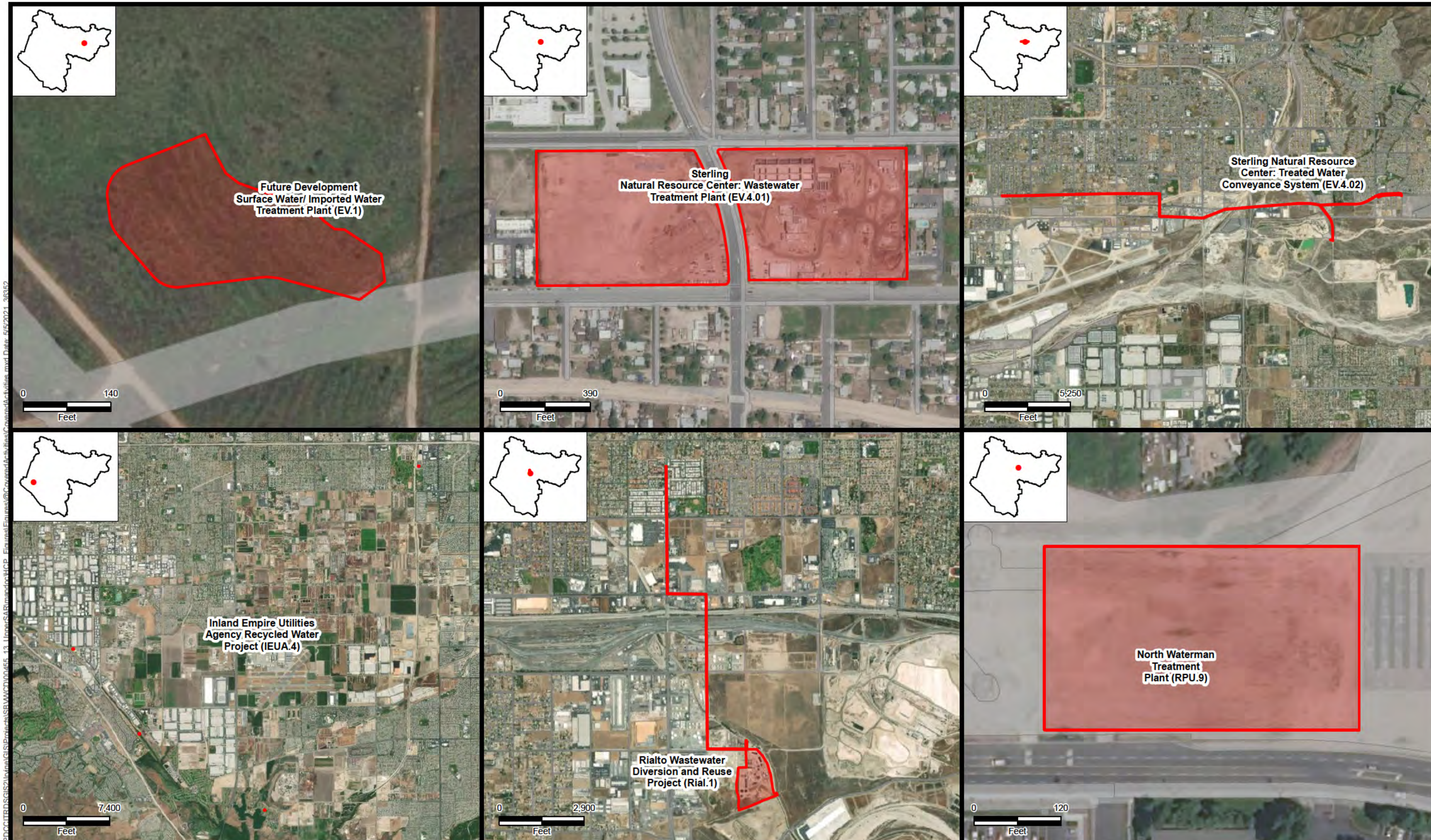
Upper Santa Ana River Habitat Conservation Plan

Figure 2-1
Covered Activities: Water Reuse Projects

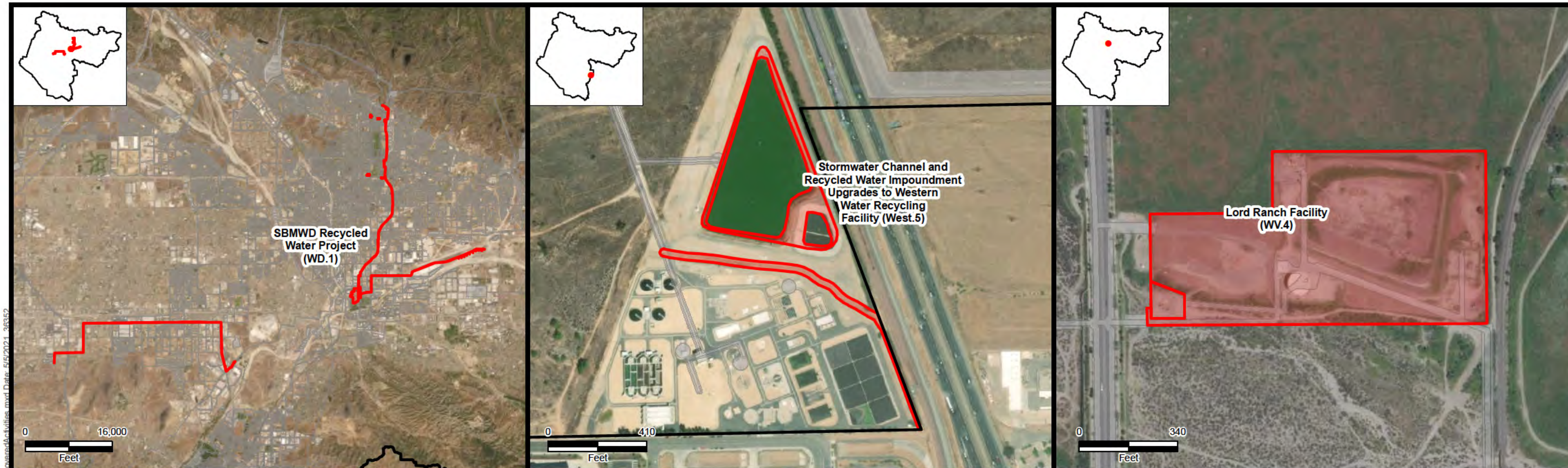


Upper Santa Ana River
Habitat Conservation Plan

N

Covered Activity
Adjacent Covered Activities
Planning Area

Figure 2-2
Covered Activities:
Water Reuse Projects



Upper Santa Ana River Habitat Conservation Plan

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Covered Activity
Adjacent Covered Activities
Planning Area

Figure 2-3
Covered Activities:
Water Reuse Projects (continued)

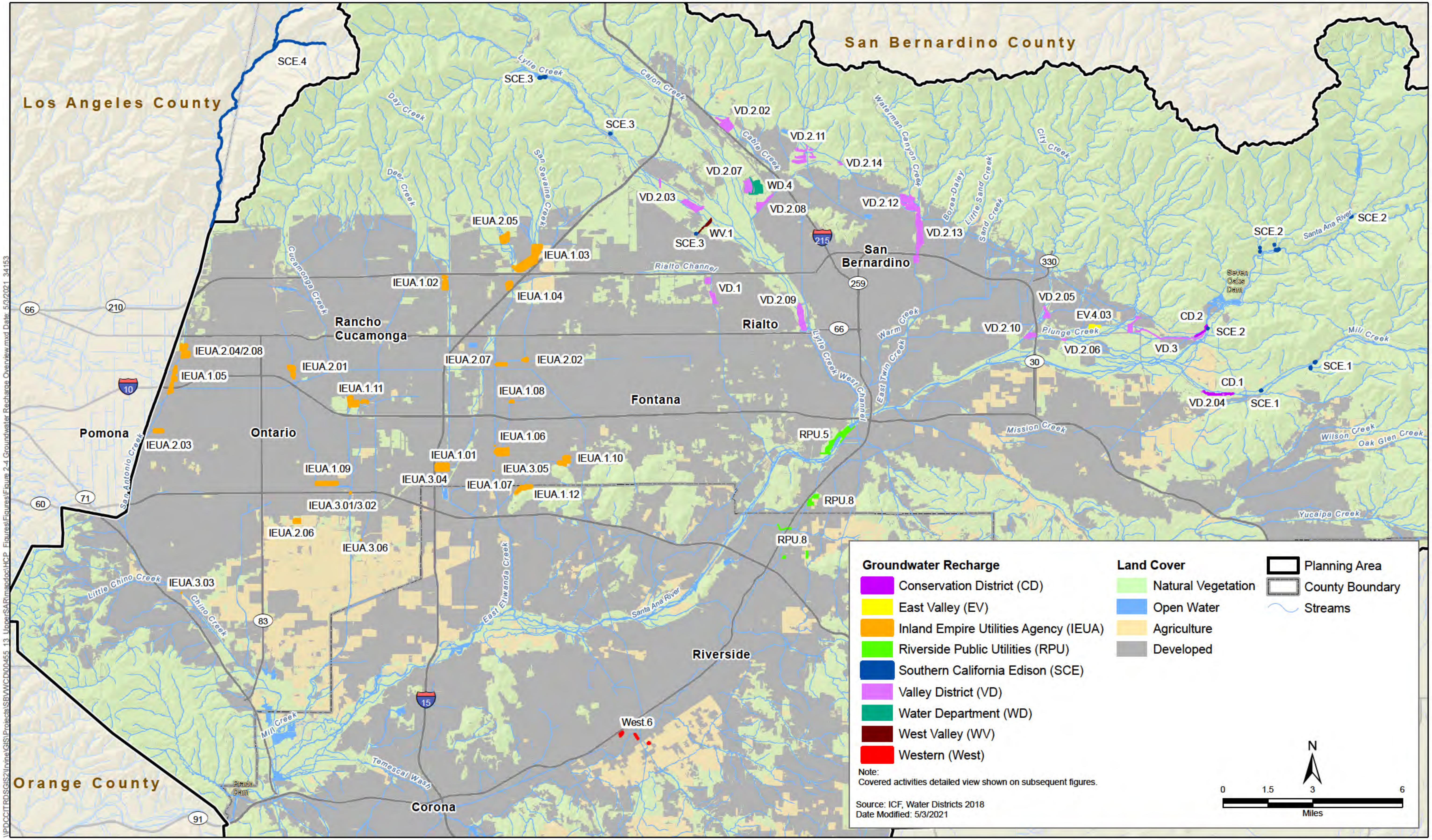
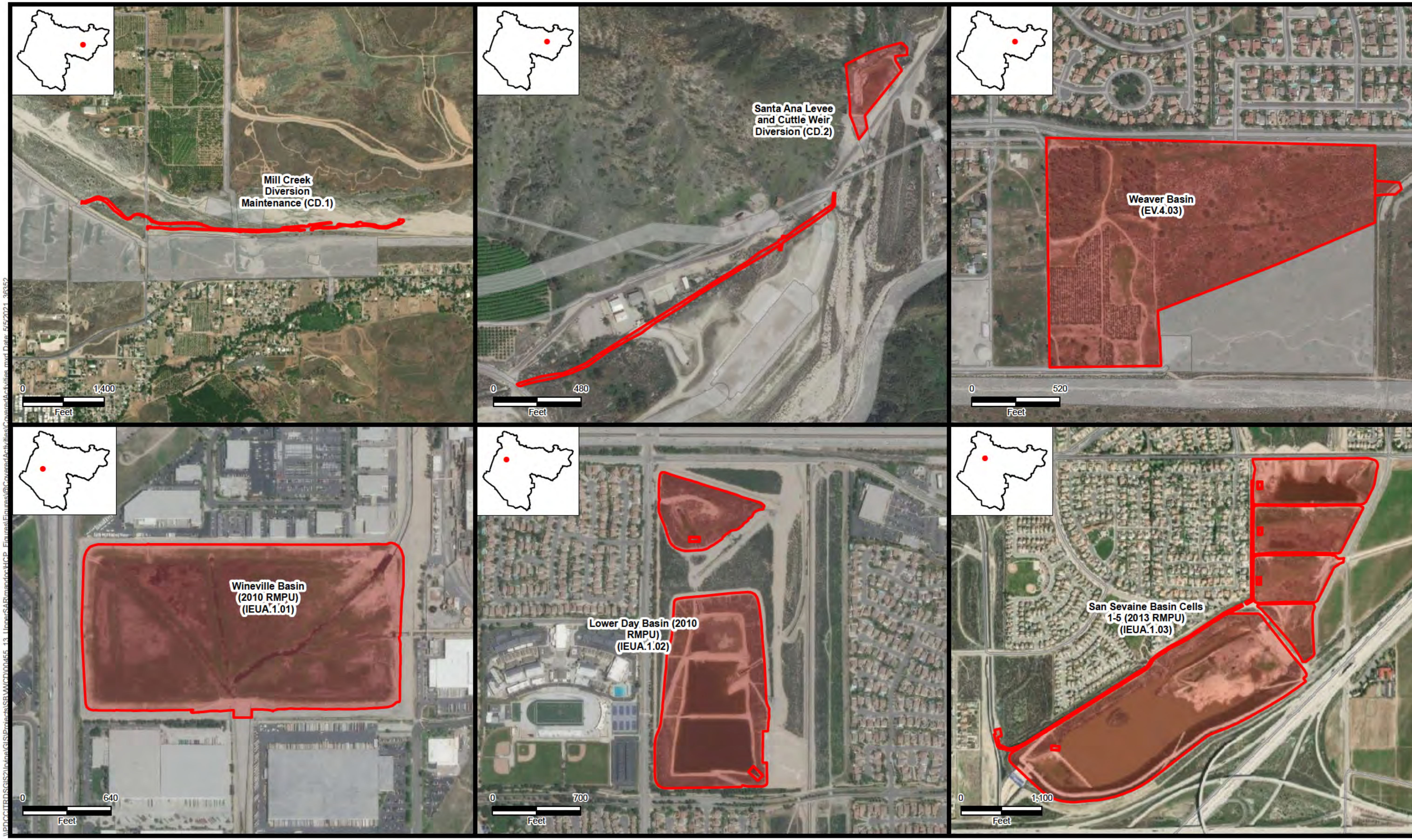


Figure 2-4
Covered Activities:
Groundwater Recharge

Upper Santa Ana River
Habitat Conservation Plan



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Upper Santa Ana River Habitat Conservation Plan

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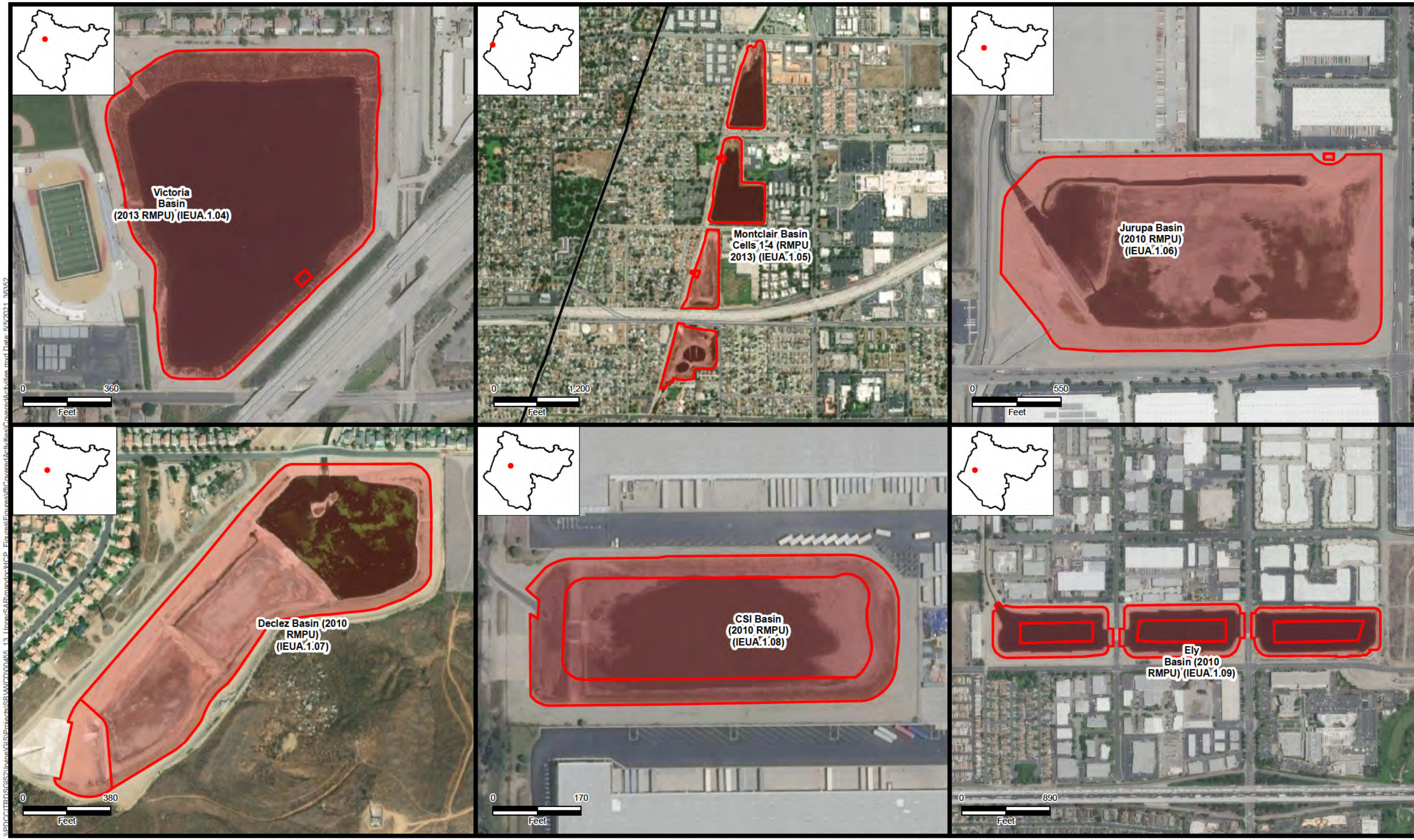
Covered Activity
Adjacent Covered Activities
Planning Area

Figure 2-5
Covered Activities: Groundwater Recharge



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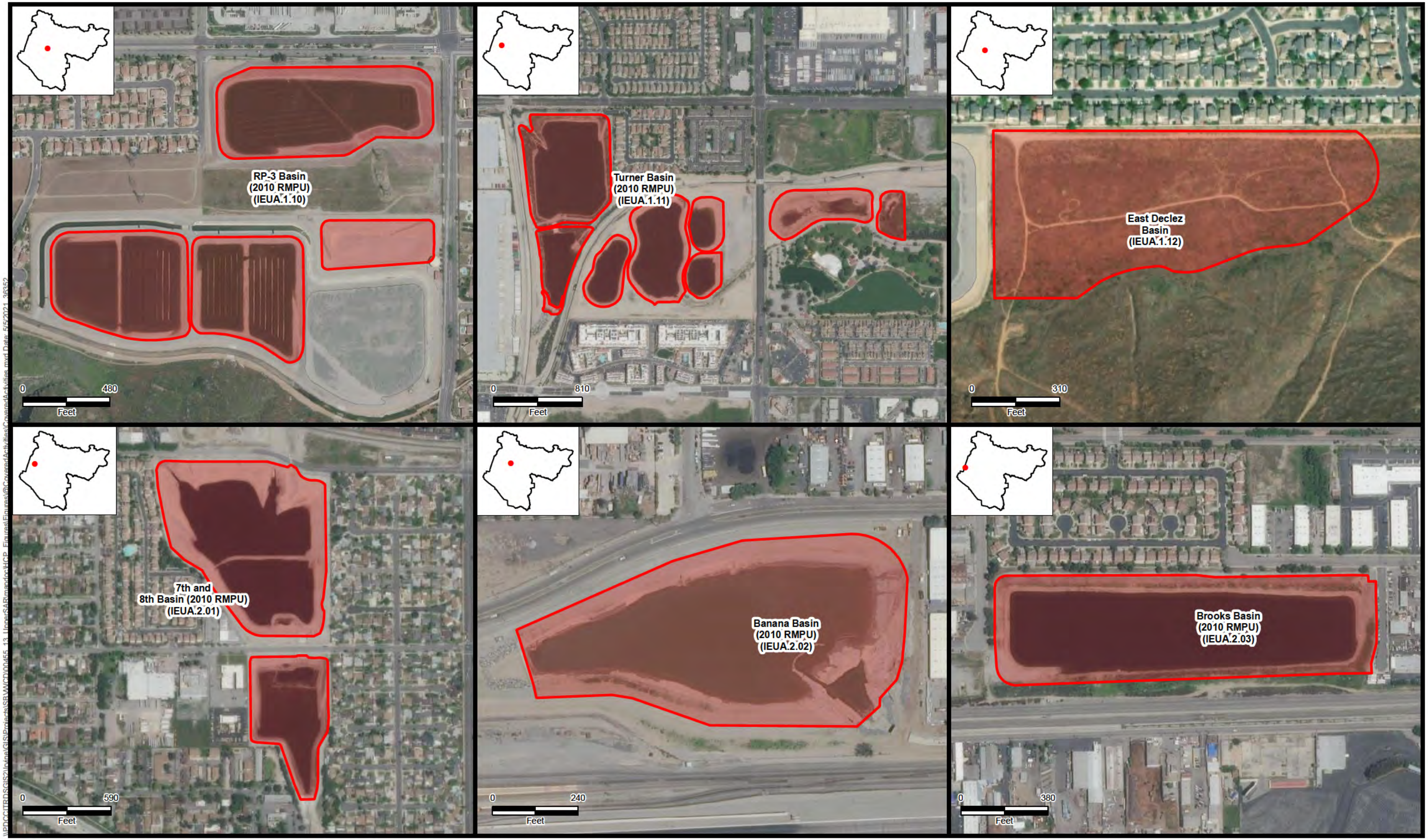
Upper Santa Ana River Habitat Conservation Plan

Figure 2-6
Covered Activities: Groundwater Recharge (continued)



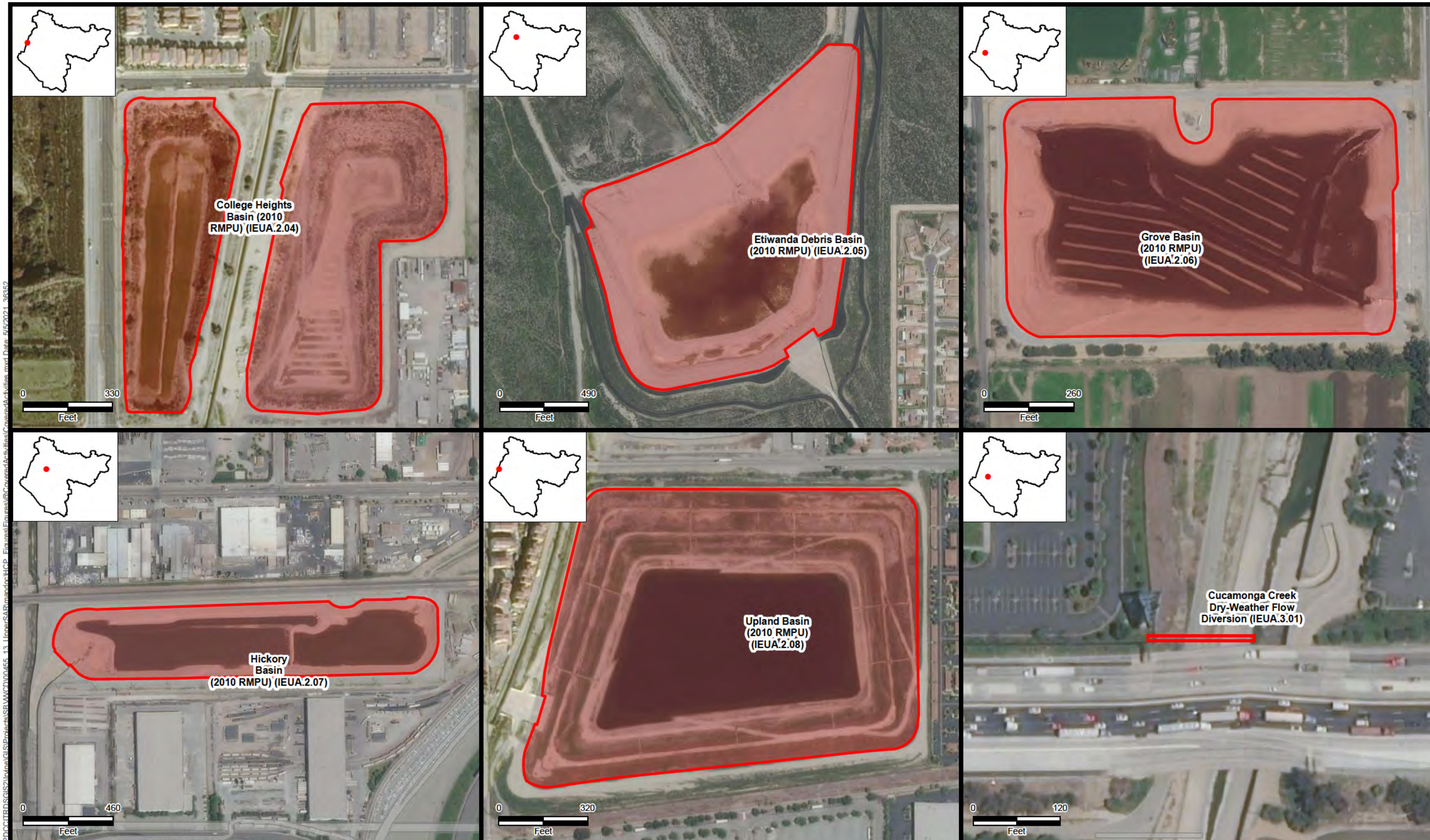
Covered Activity

Adjacent Covered Activities

Planning Area

Upper Santa Ana River Habitat Conservation Plan

Figure 2-7
Covered Activities:
Groundwater Recharge (continued)



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Upper Santa Ana River Habitat Conservation Plan

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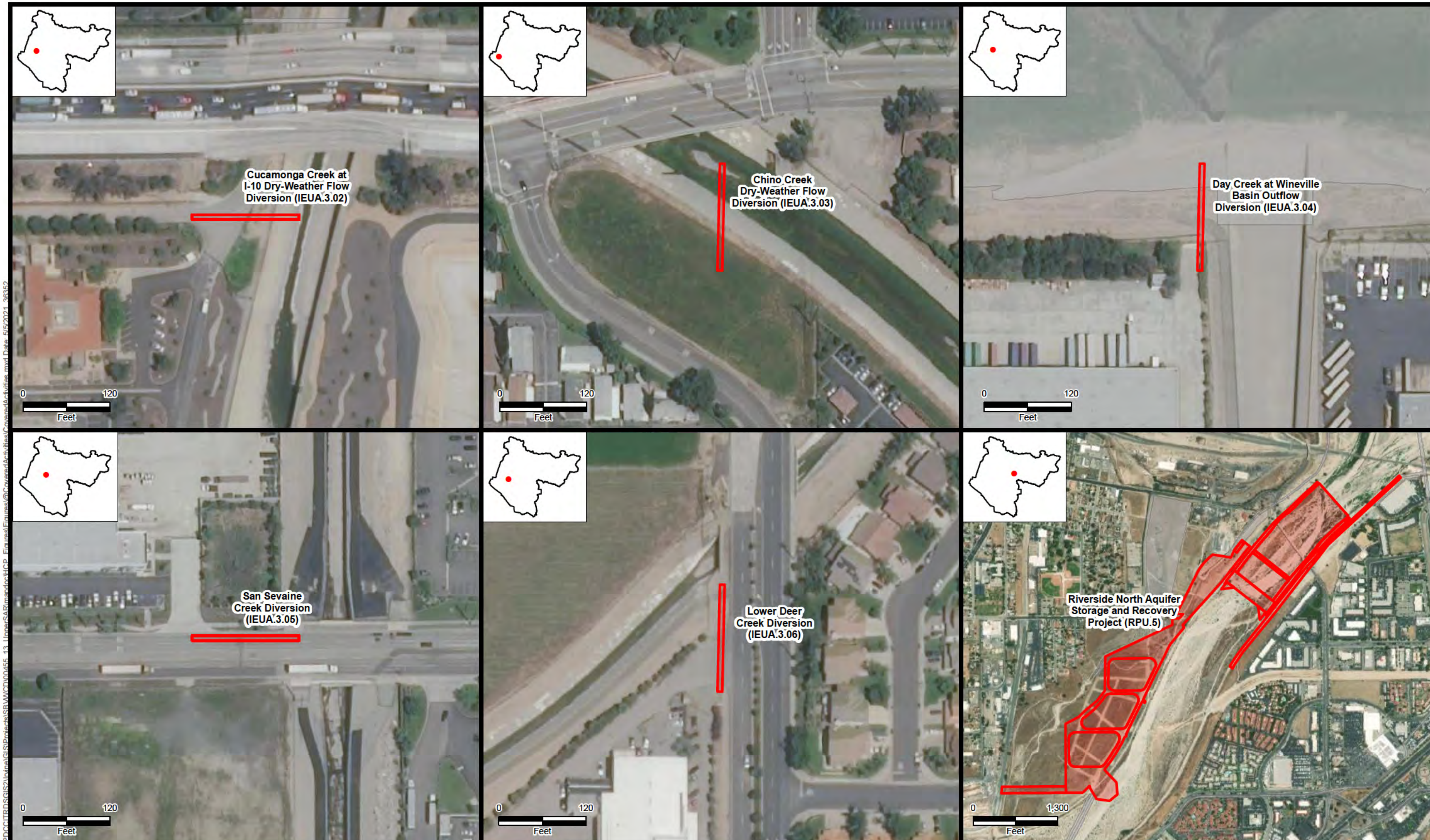
Covered Activity
Adjacent Covered Activities
Planning Area

Figure 2-8
Covered Activities: Groundwater Recharge (continued)



Upper Santa Ana River Habitat Conservation Plan

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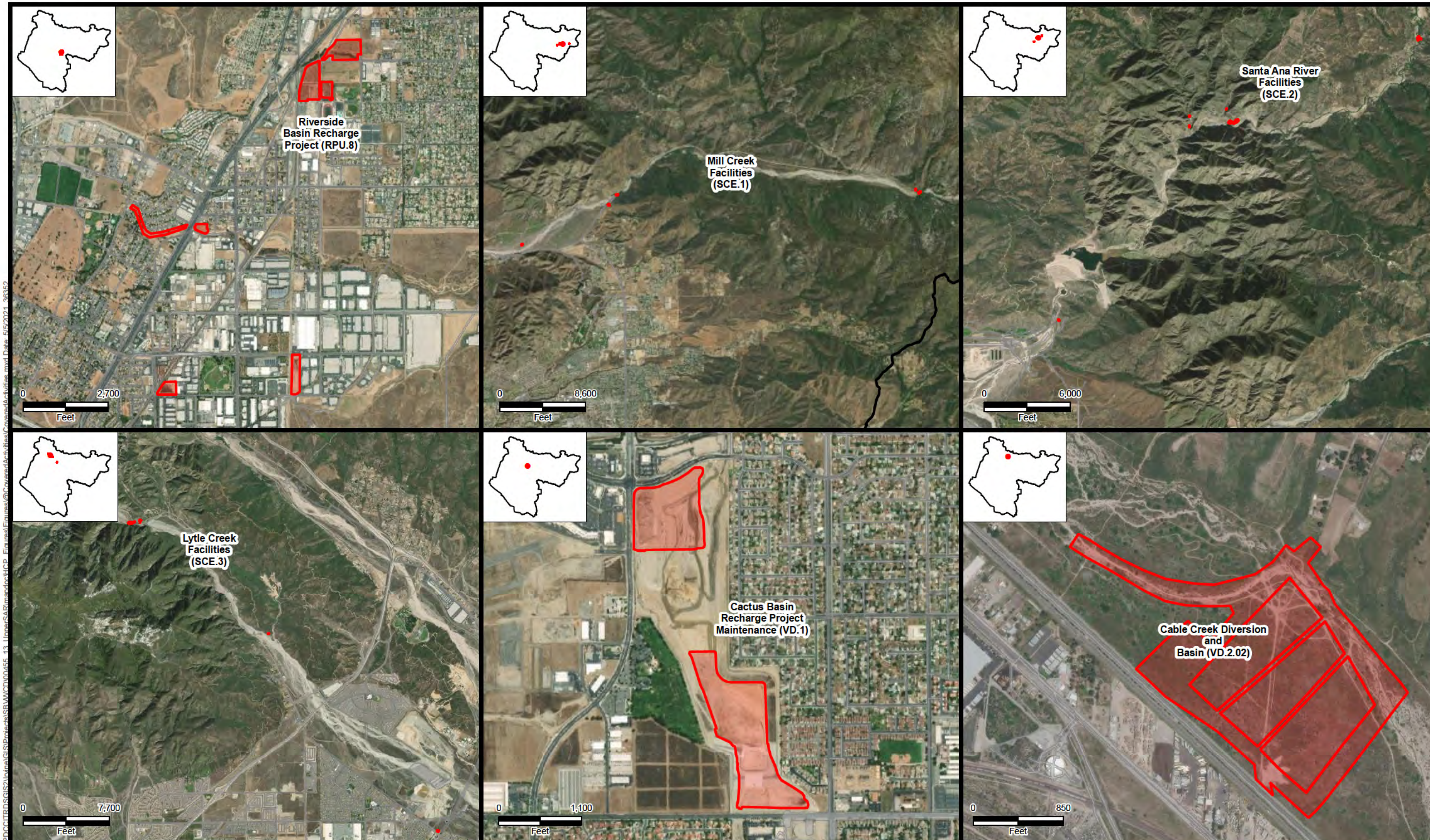
Covered Activity
Adjacent Covered Activities
Planning Area

Figure 2-9
Covered Activities: Groundwater Recharge (continued)



Upper Santa Ana River Habitat Conservation Plan

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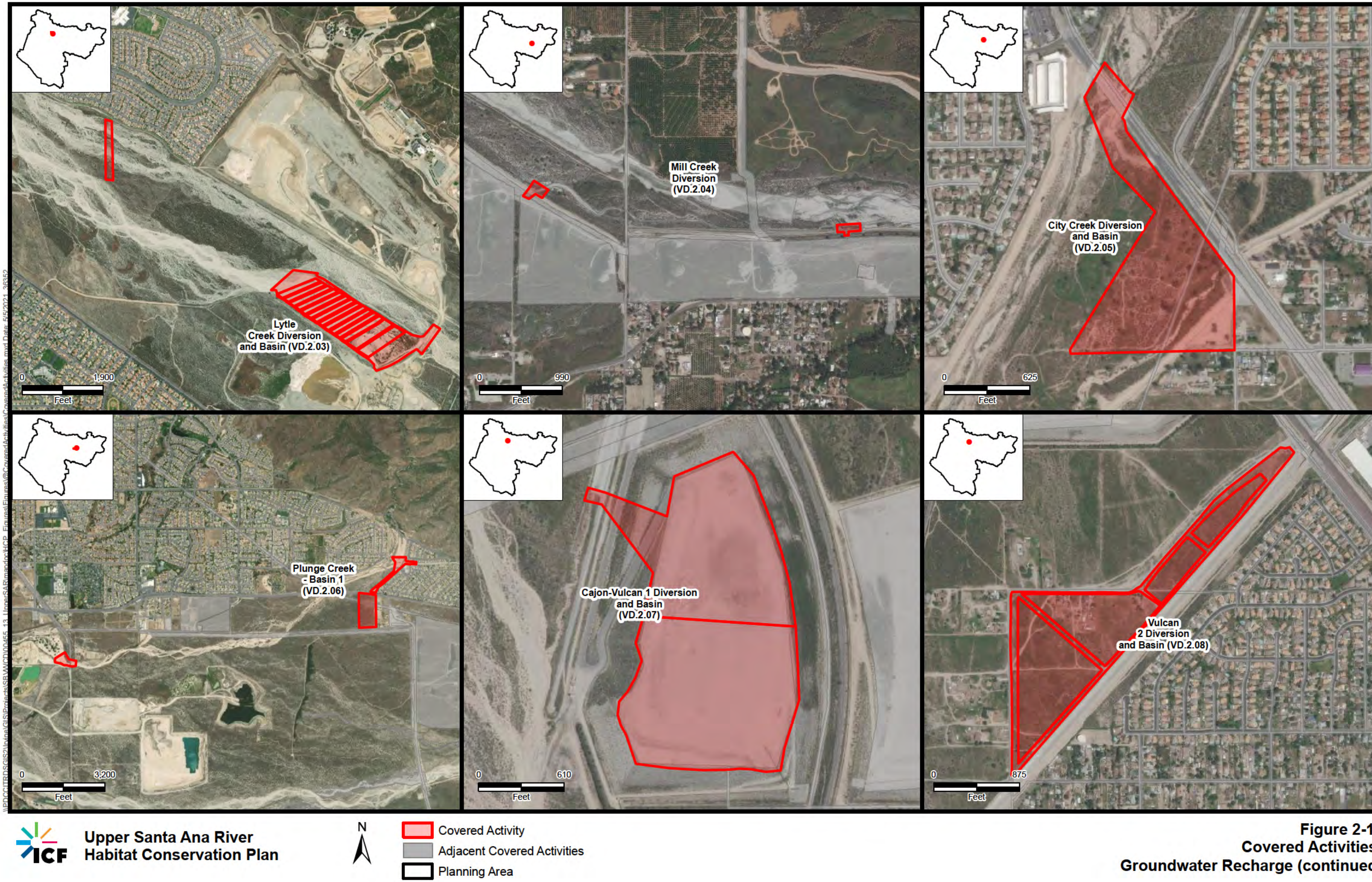
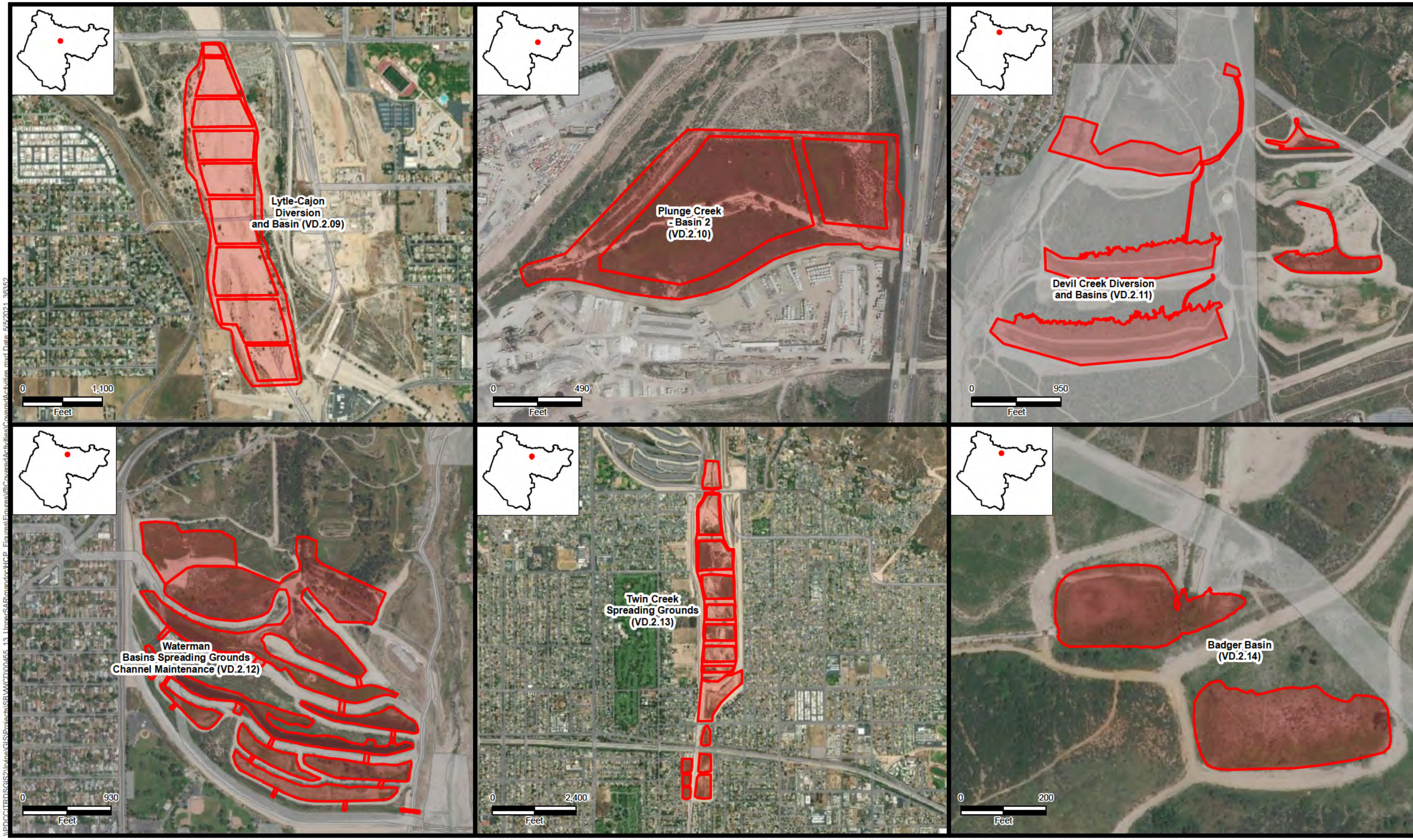
Covered Activity
Adjacent Covered Activities
Planning Area

Figure 2-10
Covered Activities:
Groundwater Recharge (continued)



Upper Santa Ana River Habitat Conservation Plan

Figure 2-11
Covered Activities: Groundwater Recharge (continued)



Upper Santa Ana River Habitat Conservation Plan

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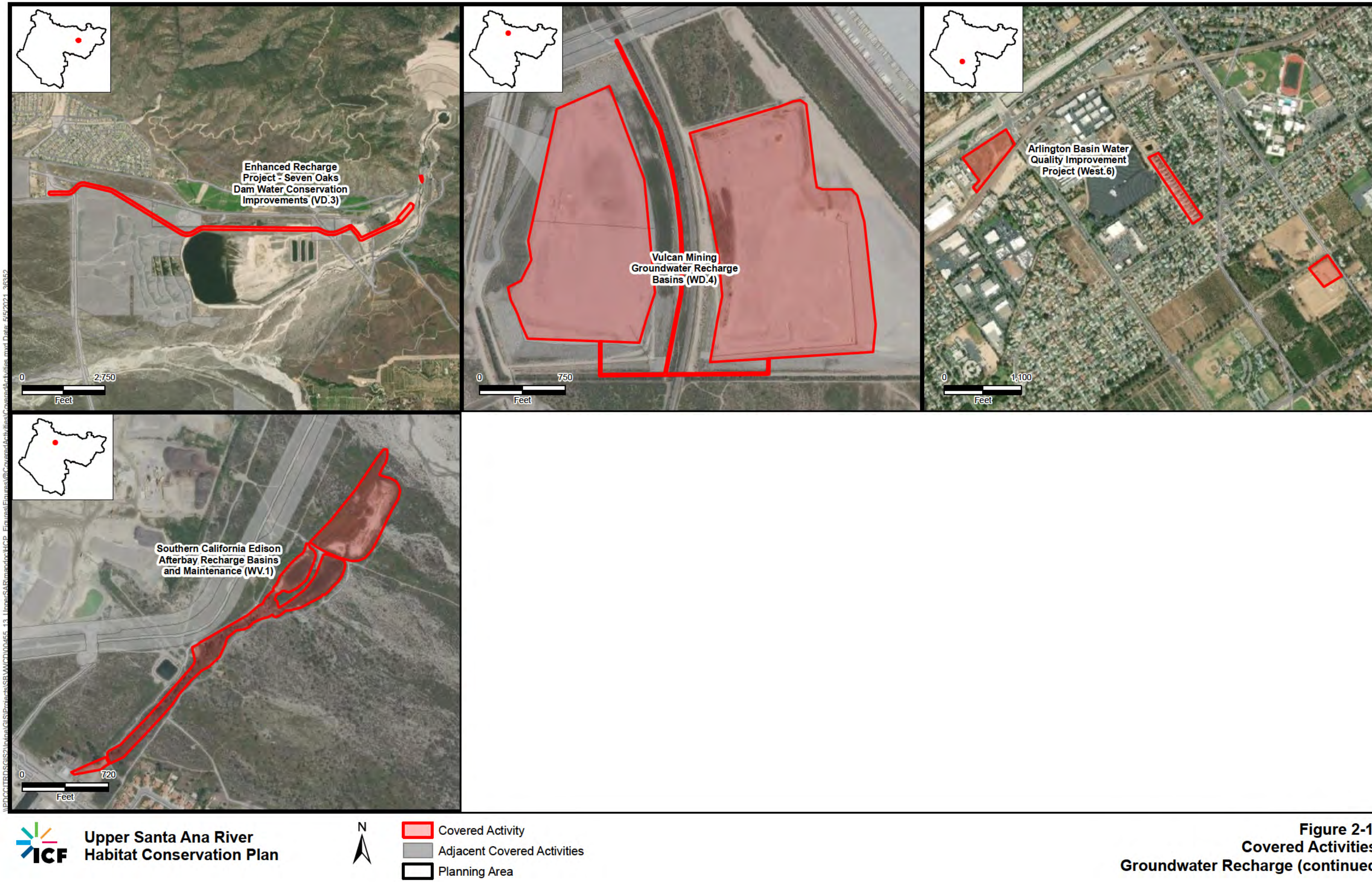
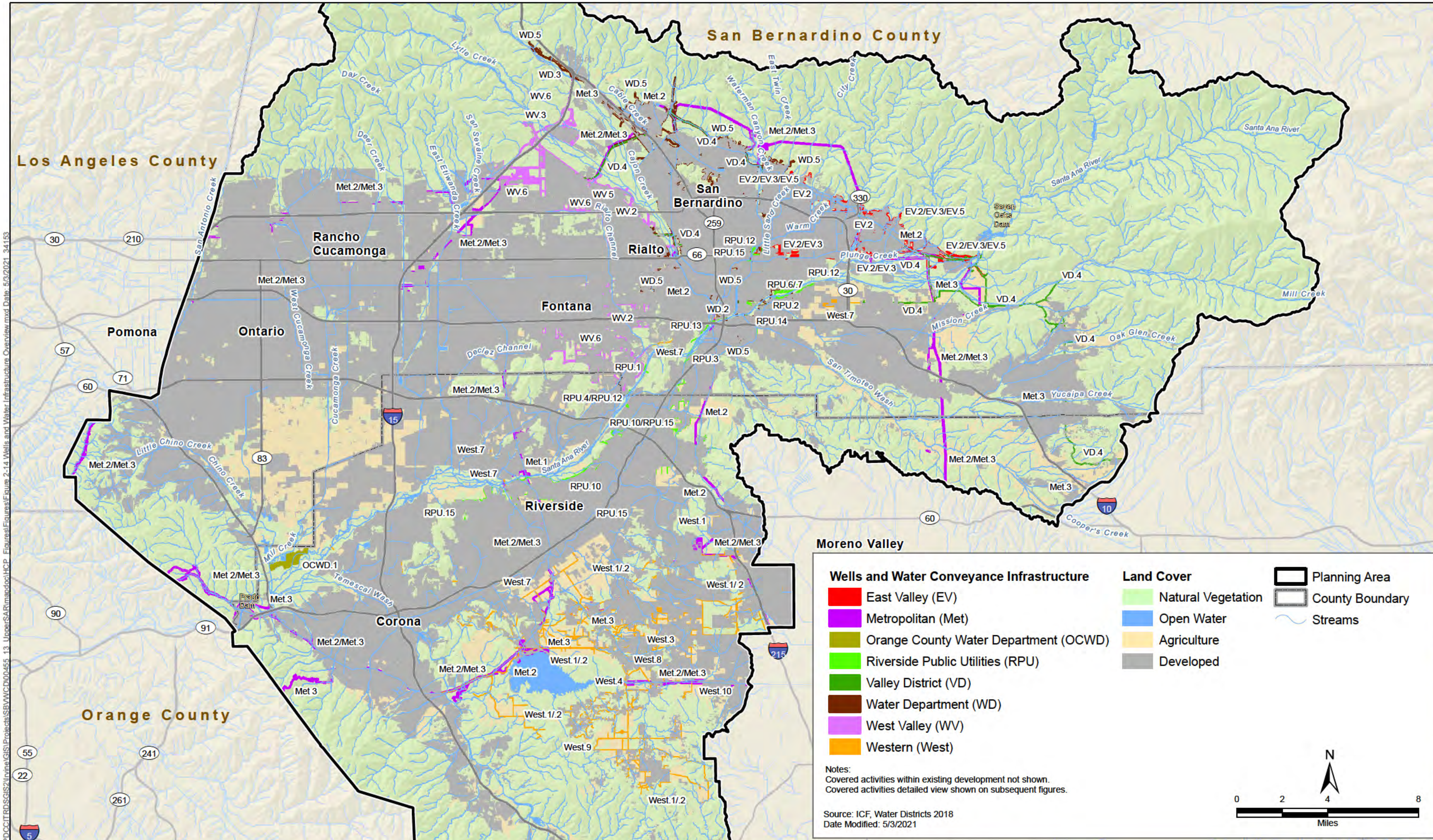
Covered Activity
Adjacent Covered Activities
Planning Area

Figure 2-12
Covered Activities: Groundwater Recharge (continued)



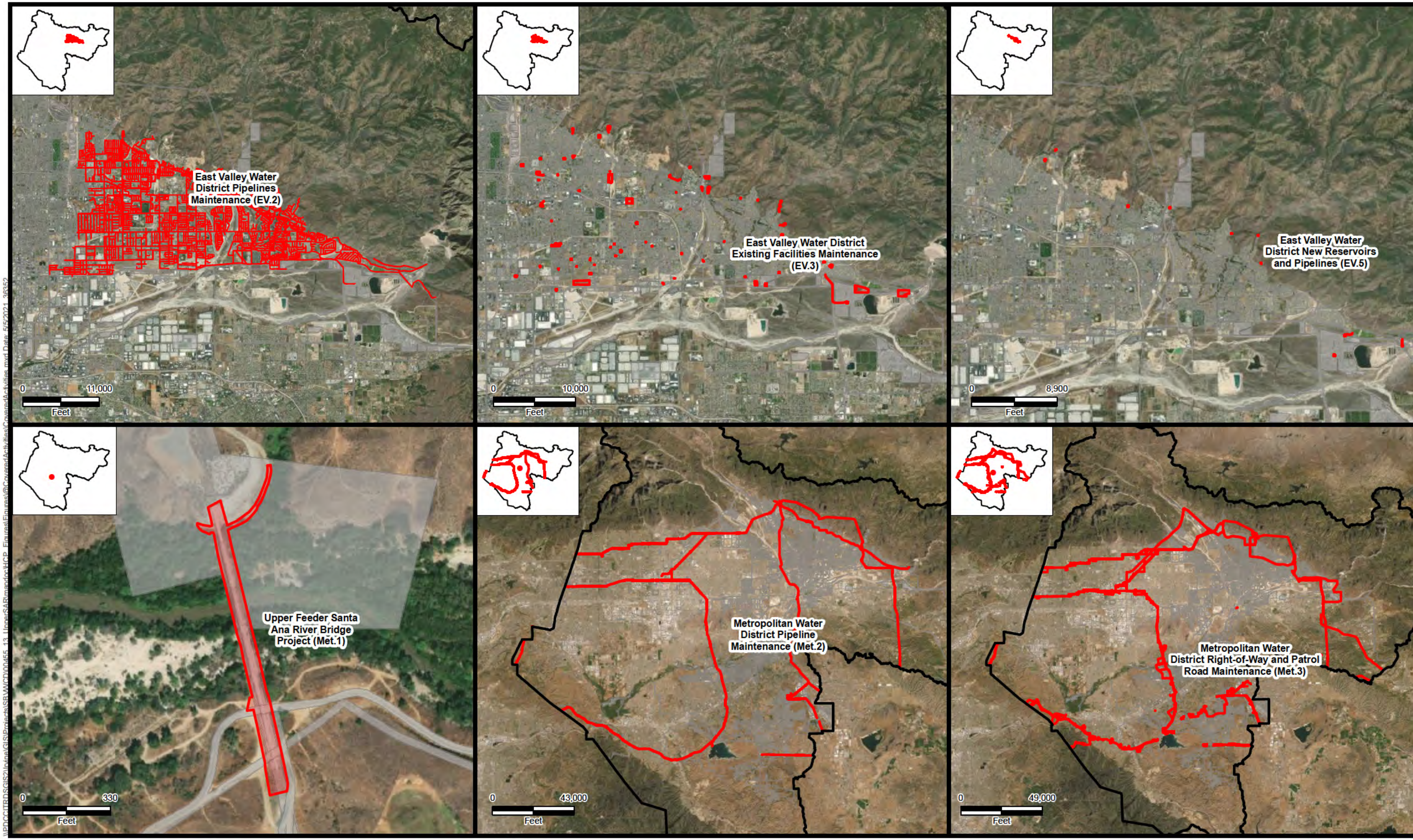
Upper Santa Ana River Habitat Conservation Plan

Figure 2-13
Covered Activities:
Groundwater Recharge (continued)



Upper Santa Ana River Habitat Conservation Plan

Figure 2-14
Covered Activities:
Wells and Water Conveyance Infrastructure



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Upper Santa Ana River Habitat Conservation Plan

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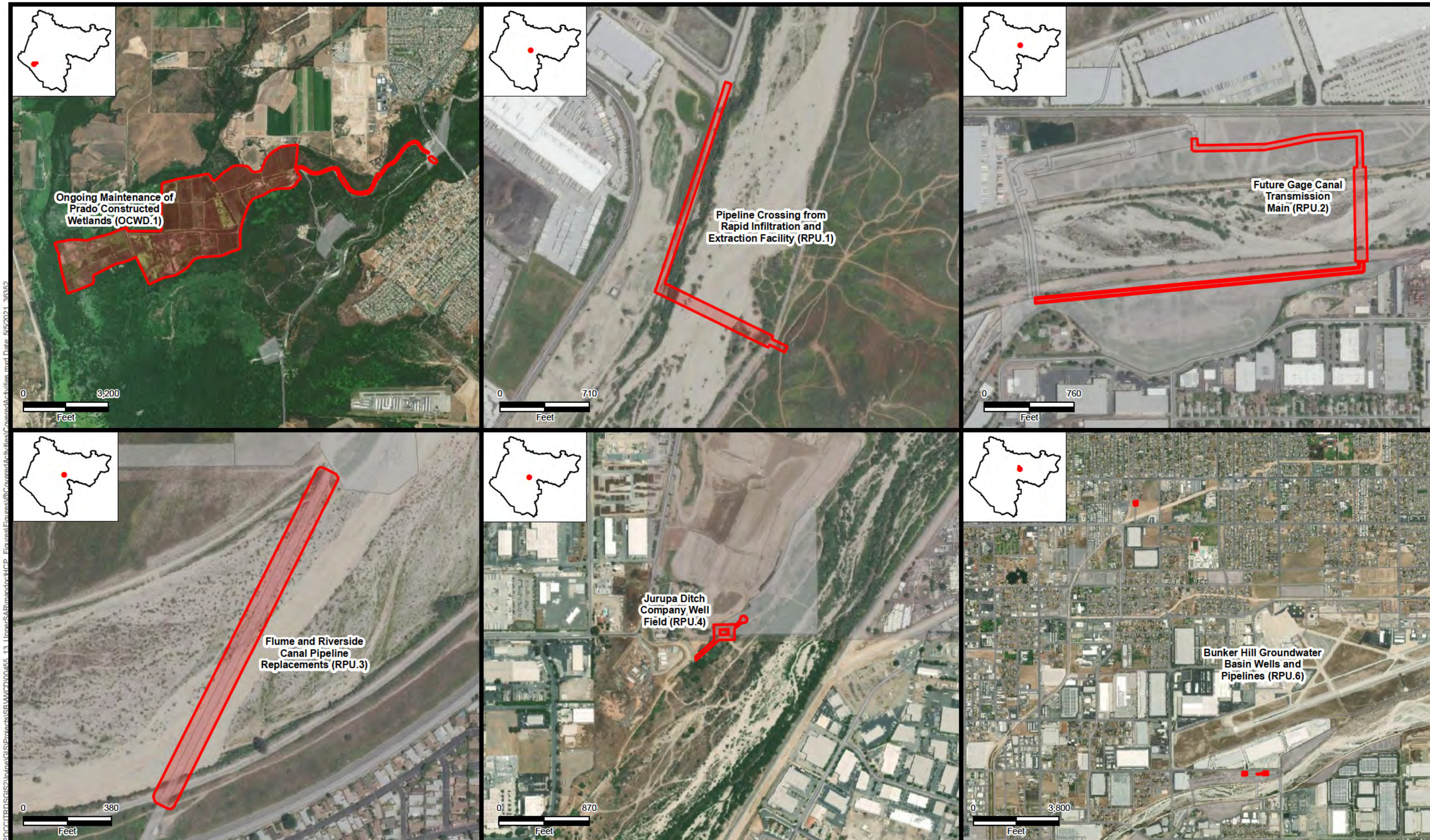
Covered Activity
Adjacent Covered Activities
Planning Area

Figure 2-15
Covered Activities:
Wells and Water Conveyance Infrastructure



Upper Santa Ana River Habitat Conservation Plan

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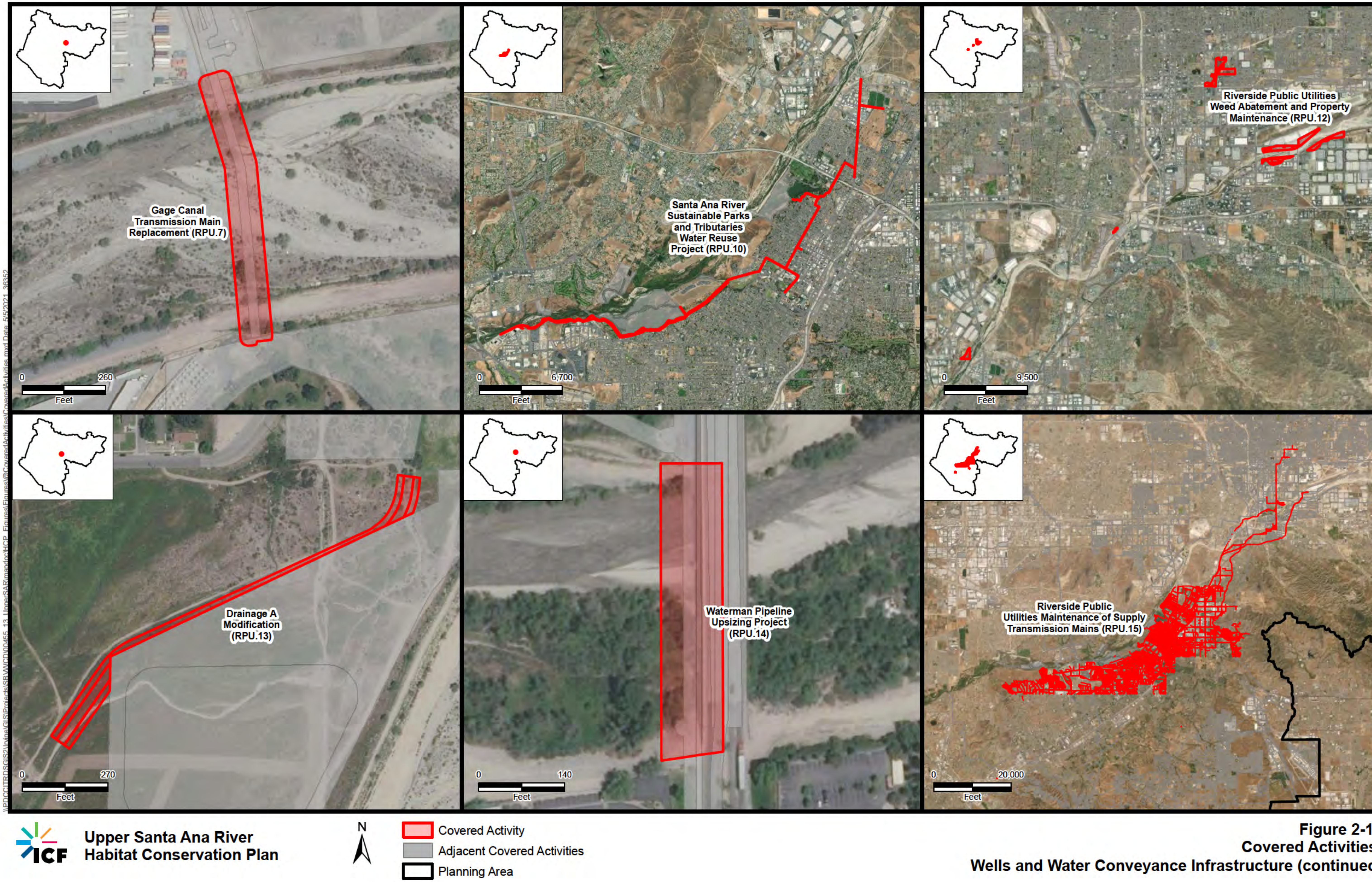
- Covered Activity
- Adjacent Covered Activities
- Planning Area

Figure 2-16
Covered Activities:
Wells and Water Conveyance Infrastructure (continued)



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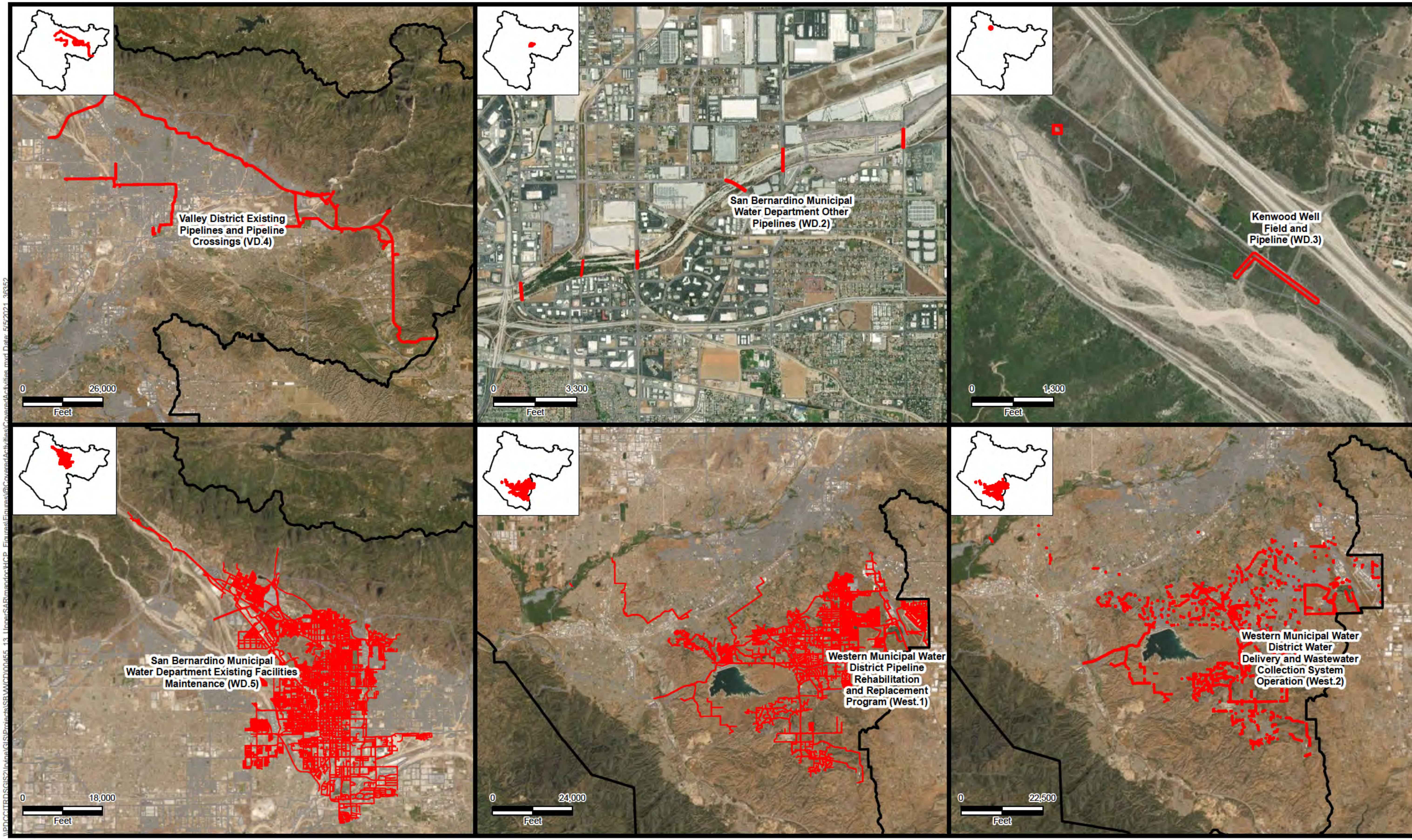
Upper Santa Ana River Habitat Conservation Plan

Figure 2-17
Covered Activities:
Wells and Water Conveyance Infrastructure (continued)



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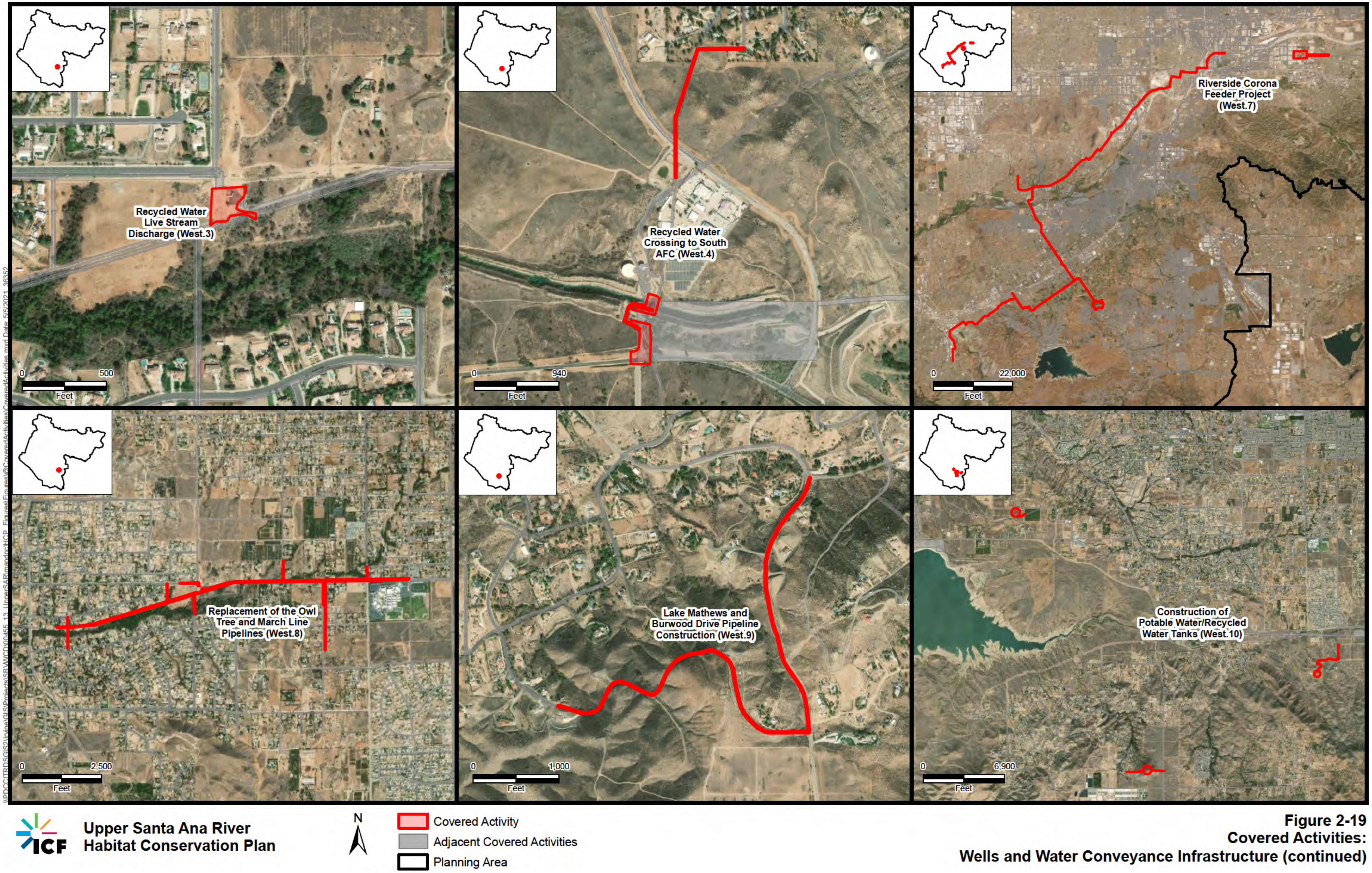
Covered Activity
Adjacent Covered Activities
Planning Area

ICF

Upper Santa Ana River Habitat Conservation Plan

Figure 2-18
Covered Activities:
Wells and Water Conveyance Infrastructure (continued)



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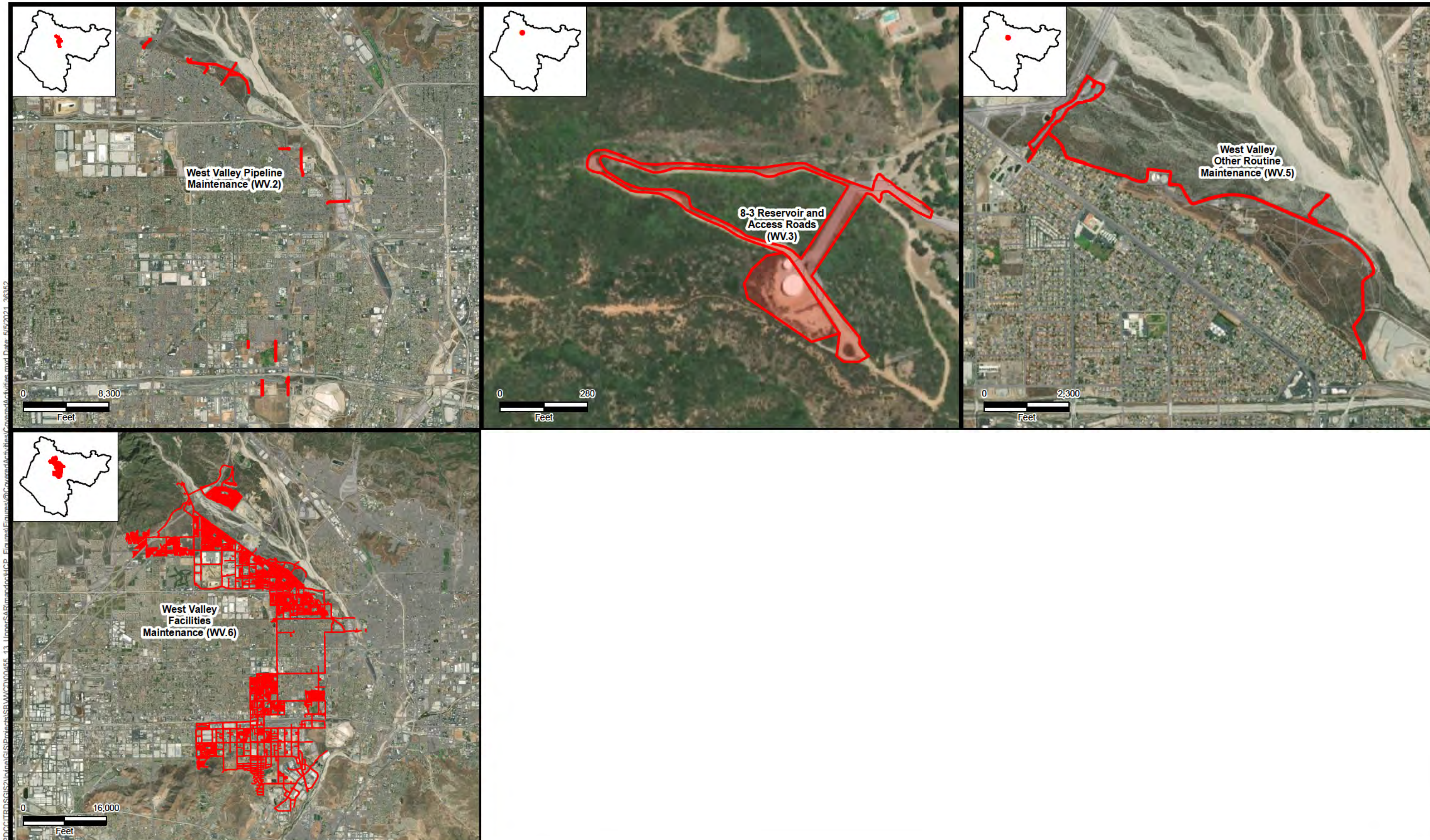
Upper Santa Ana River Habitat Conservation Plan

Figure 2-19
Covered Activities:
Wells and Water Conveyance Infrastructure (continued)



Upper Santa Ana River Habitat Conservation Plan

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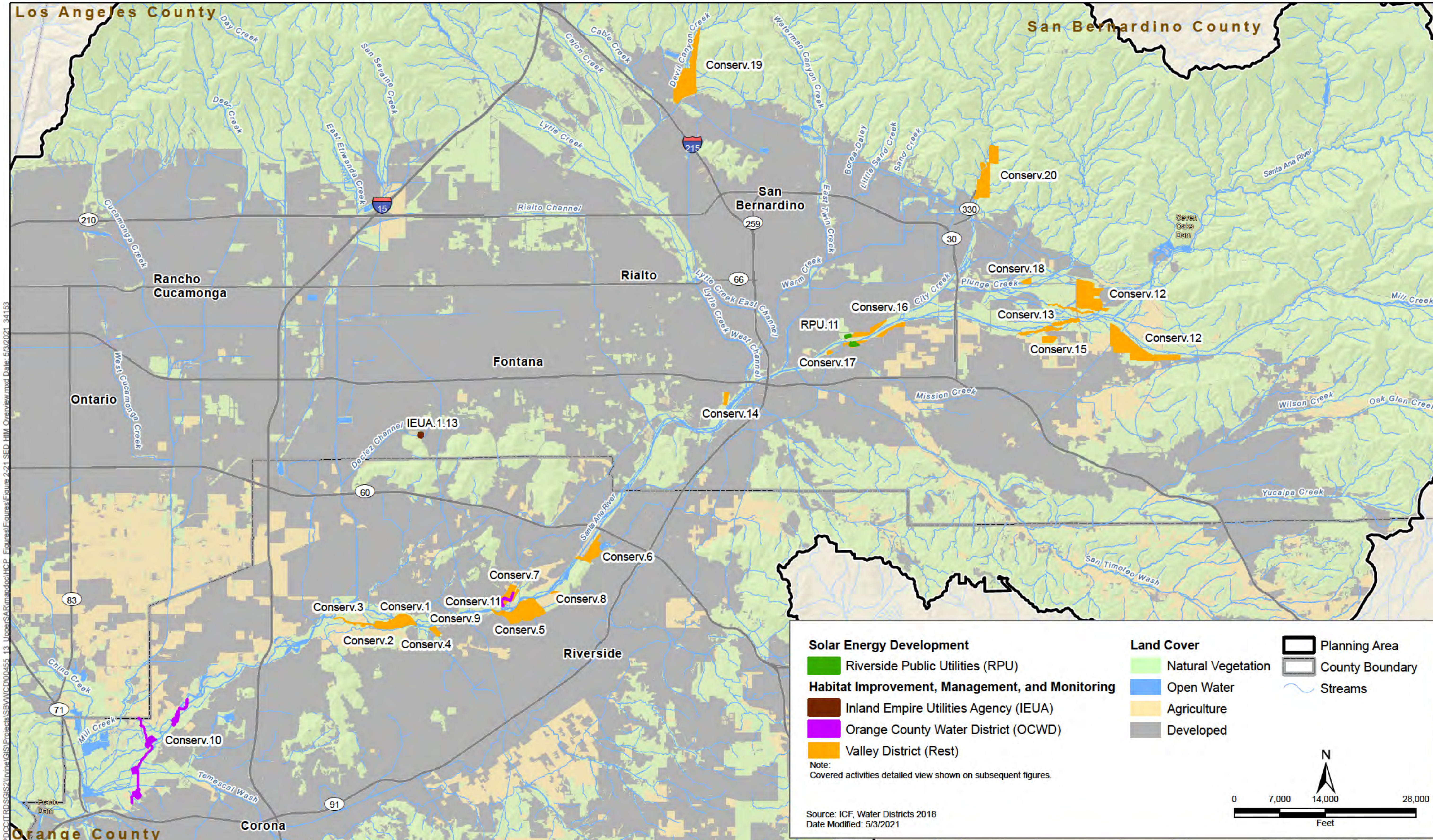
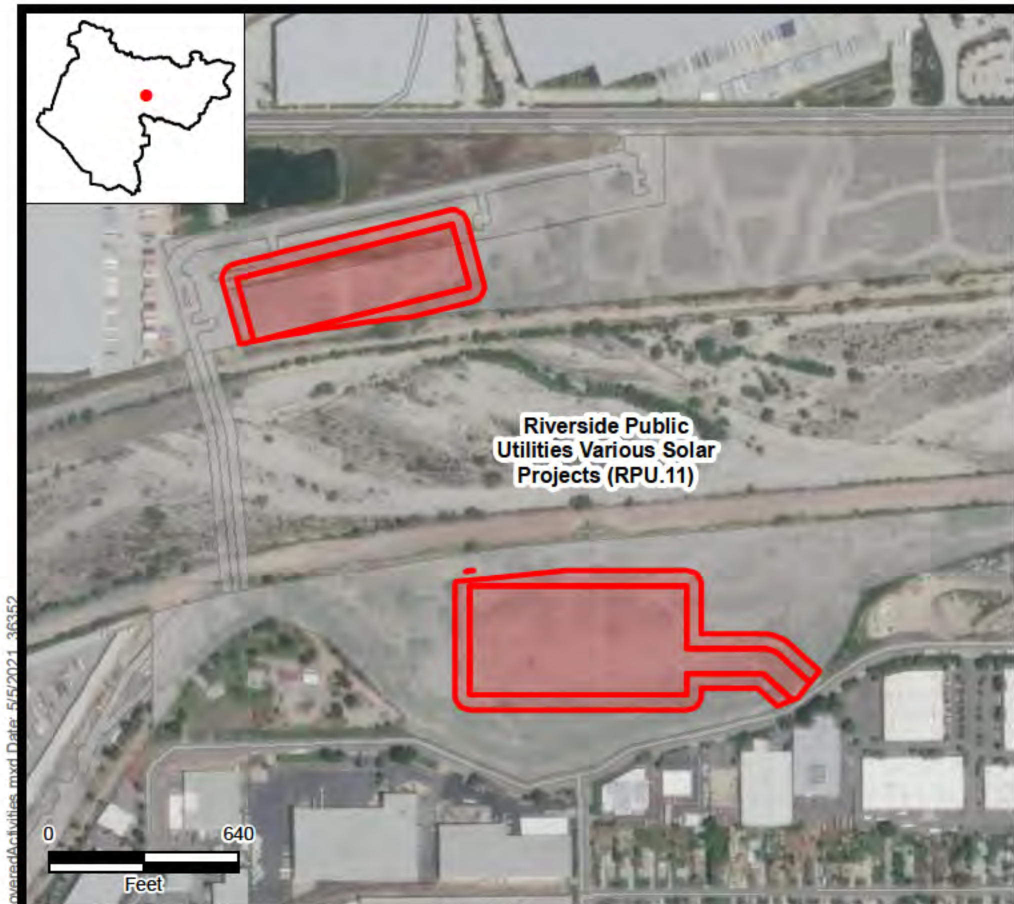
Covered Activity
Adjacent Covered Activities
Planning Area

Figure 2-20
Covered Activities:
Wells and Water Conveyance Infrastructure (continued)



Upper Santa Ana River
Habitat Conservation Plan

Figure 2-21
Covered Activities:
Solar Energy Development and Habitat Improvement, Management, and Monitoring

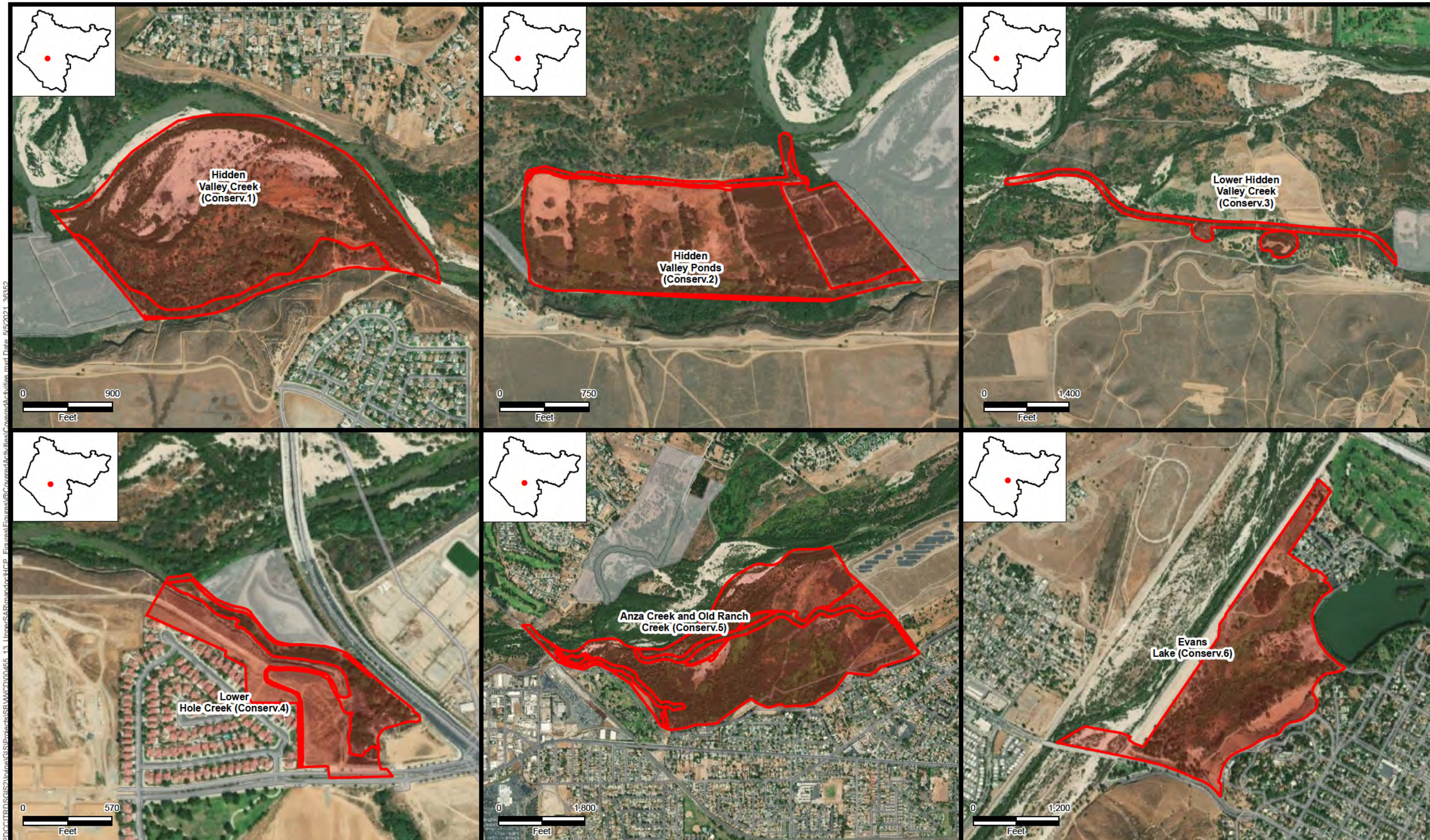


Upper Santa Ana River Habitat Conservation Plan

N

Covered Activity
Adjacent Covered Activities
Planning Area

Figure 2-22
Covered Activities:
Solar Energy Development



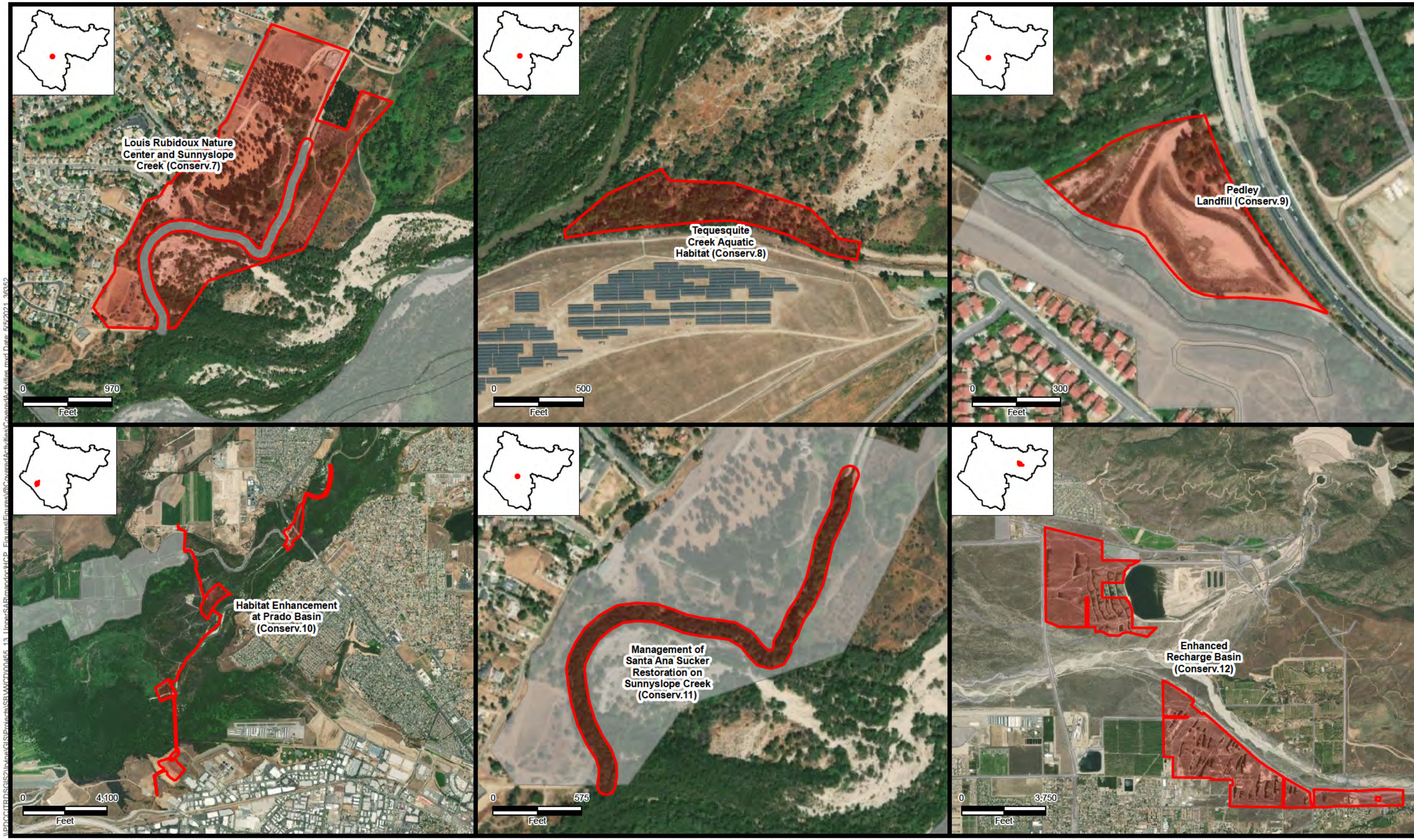
ICF

Upper Santa Ana River Habitat Conservation Plan

N

- Covered Activity
- Adjacent Covered Activities
- Planning Area

Figure 2-23
Covered Activities:
Habitat Improvement, Management, and Monitoring

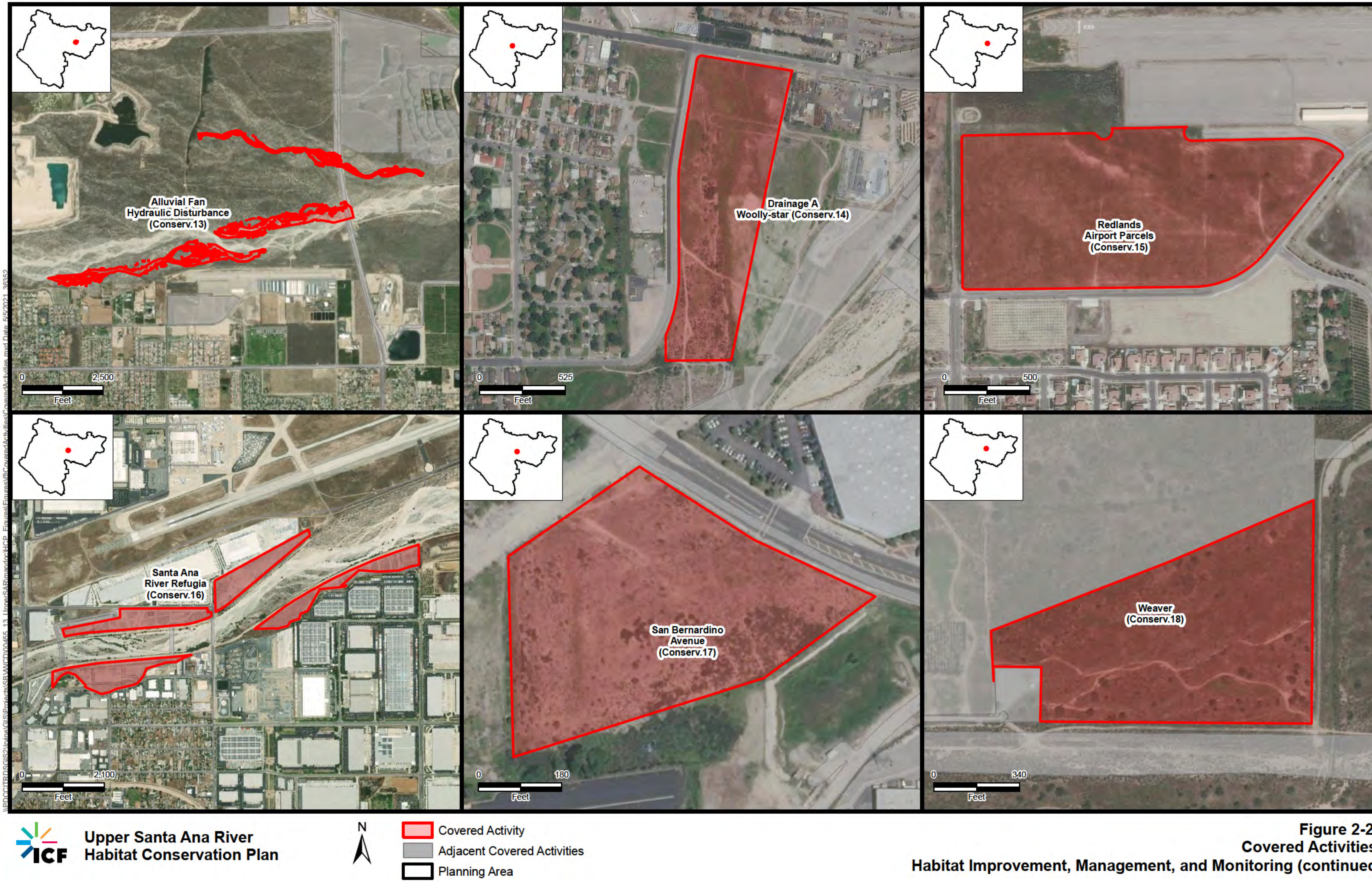


Upper Santa Ana River Habitat Conservation Plan

N

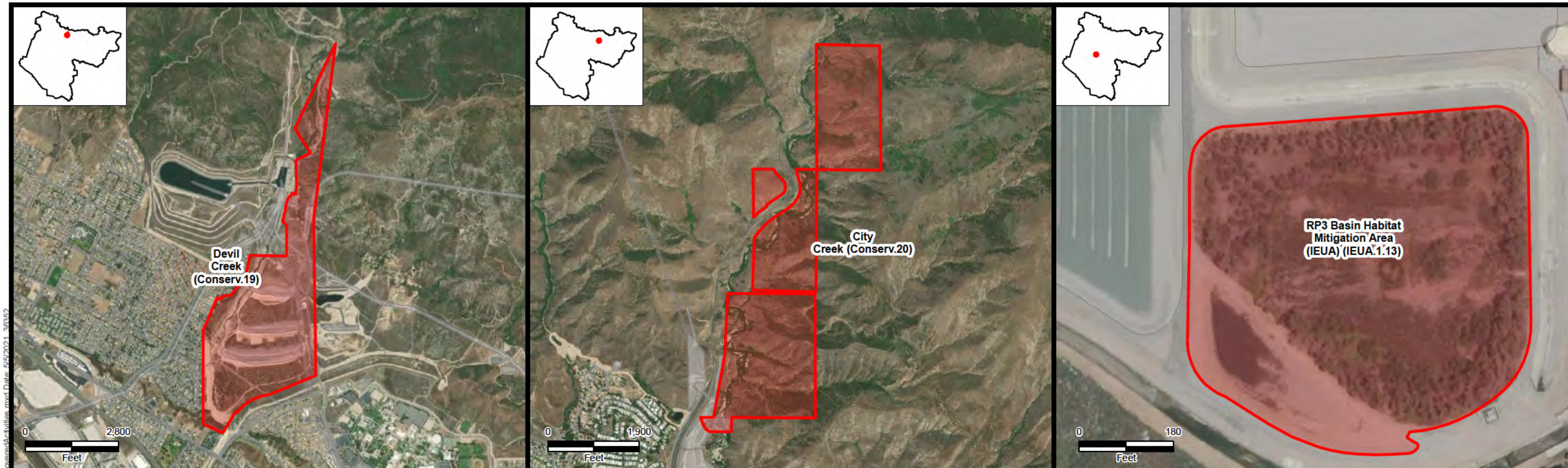
- Covered Activity
- Adjacent Covered Activities
- Planning Area

Figure 2-24
Covered Activities:
Habitat Improvement, Management, and Monitoring (continued)



Upper Santa Ana River Habitat Conservation Plan

Figure 2-25
Covered Activities:
Habitat Improvement, Management, and Monitoring (continued)



Upper Santa Ana River
Habitat Conservation Plan

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Covered Activity
Adjacent Covered Activities
Planning Area

Figure 2-26
Covered Activities:
Habitat Improvement, Management, and Monitoring (continued)

Table 2-1. Summary of Covered Activities

ID (Phase)	Owner	Project/Activity Name	Activity Type
CD.1 (1)	Conservation District	Mill Creek Diversion Maintenance	Groundwater Recharge
CD.2 (1)	Conservation District	Santa Ana Levee and Cuttle Weir Diversion	Groundwater Recharge
EV.1 (1)	East Valley	Future Development Surface Water/ Imported Water Treatment Plant	Water Reuse Projects
EV.2 (1)	East Valley	East Valley Water District Pipelines Maintenance	Wells and Water Conveyance Infrastructure
EV.3 (1)	East Valley	East Valley Water District Existing Facilities Maintenance	Wells and Water Conveyance Infrastructure
EV.4.01–4.02 (1)	East Valley	Sterling Natural Resource Center	Water Reuse Projects
EV.4.03 (1)	East Valley	Sterling Natural Resource Center	Groundwater Recharge
EV.5 (3)	East Valley	East Valley Water District New Reservoirs and Pipelines	Wells and Water Conveyance Infrastructure
IEUA.1.01–1.03 (2)	IEUA	Groundwater Recharge Basins with New Construction and Maintenance	Groundwater Recharge
IEUA.1.04–1.12 (1)	IEUA	Groundwater Recharge Basins with New Construction and Maintenance	Groundwater Recharge
IEUA.1.13 (1)	IEUA	RP3 Basin Habitat Mitigation Area (IEUA)	Habitat Improvement, Management, and Monitoring
IEUA.2.01–2.08 (1,2)	IEUA	Existing Basins and Maintenance Areas	Groundwater Recharge
IEUA.3.01–3.06 (1)	IEUA	Creek Diversion Projects	Groundwater Recharge
IEUA.4 (1)	IEUA	IEUA Recycled Water Project	Water Reuse Projects
Met.1 (1)	Metropolitan	Upper Feeder Santa Ana River Bridge Project	Wells and Water Conveyance Infrastructure
Met.2 (1)[1]	Metropolitan	Metropolitan Water District Pipeline Maintenance	Wells and Water Conveyance Infrastructure
Met.3 (1)[1]	Metropolitan	Metropolitan Water District Right-of-Way and Patrol Road Maintenance	Wells and Water Conveyance Infrastructure
OCWD.1 (1)	OCWD	Ongoing Maintenance of Prado Constructed Wetlands	Wells and Water Conveyance Infrastructure

ID (Phase)	Owner	Project/Activity Name	Activity Type
Rial.1 (2)	Rialto	Rialto Wastewater Diversion and Reuse Project	Water Reuse Projects
RPU.1 (1)	RPU	Pipeline Crossing from Rapid Infiltration and Extraction Facility	Wells and Water Conveyance Infrastructure
RPU.2 (1)	RPU	Future Gage Canal Transmission Main	Wells and Water Conveyance Infrastructure
RPU.3 (1)	RPU	Flume and Riverside Canal Pipeline Replacements	Wells and Water Conveyance Infrastructure
RPU.4 (1)	RPU	Jurupa Ditch Company Well Field	Wells and Water Conveyance Infrastructure
RPU.5 (2)	RPU/Valley District/ Western	Riverside North Aquifer Storage and Recovery Project	Groundwater Recharge
RPU.6 (1)	RPU	Bunker Hill Basin Proposed Wells and Pipelines	Wells and Water Conveyance Infrastructure
RPU.7 (1)	RPU	Gage Canal Transmission Main Replacement	Wells and Water Conveyance Infrastructure
RPU.8 (2)[1]	RPU	Riverside Basin Recharge Project	Groundwater Recharge
RPU.9 (1)	RPU	North Waterman Treatment Plant	Water Reuse Projects
RPU.10 (1)[1]	RPU/Valley District/ Upper SAR HCP	Santa Ana River Sustainable Parks and Tributaries Water Reuse Project	Wells and Water Conveyance Infrastructure
RPU.11 (1)	RPU	Riverside Public Utilities Various Solar Projects	Solar Energy Development
RPU.12 (1)	RPU	Riverside Public Utilities Weed Abatement and Property Maintenance	Wells and Water Conveyance Infrastructure
RPU.13 (2)	RPU	Drainage A Modification	Wells and Water Conveyance Infrastructure
RPU.14 (1)	RPU	Waterman Pipeline Upsizing Project	Wells and Water Conveyance Infrastructure
RPU.15 (1)[1]	RPU	Riverside Public Utilities Maintenance of Supply Transmission Mains	Wells and Water Conveyance Infrastructure
Conserv.1 (1, 2)[1]	Valley District	Hidden Valley Creek	Habitat Improvement, Management, and Monitoring
Conserv.2 (1, 2)	Valley District	Hidden Valley Ponds	Habitat Improvement, Management, and Monitoring
Conserv.3 (F)	Valley District	Lower Hidden Valley Creek	Habitat Improvement, Management, and Monitoring

ID (Phase)	Owner	Project/Activity Name	Activity Type
Conserv.4 (1, F)[1]	Valley District	Lower Hole Creek	Habitat Improvement, Management, and Monitoring
Conserv.5 (1, F)[1]	Valley District	Anza Creek and Old Ranch Creek	Habitat Improvement, Management, and Monitoring
Conserv.6 (1)	Valley District	Evans Lake	Habitat Improvement, Management, and Monitoring
Conserv.7 (F)	Valley District	Louis Rubidoux Nature Center and Sunnyslope Creek	Habitat Improvement, Management, and Monitoring
Conserv.8[1]	Valley District	Tequesquite Creek Aquatic Habitat	Habitat Improvement, Management, and Monitoring
Conserv.9 (F)[1]	Valley District	Pedley Landfill	Habitat Improvement, Management, and Monitoring
Conserv.10 (1)	OCWD	Habitat Enhancement at Prado Basin	Habitat Improvement, Management, and Monitoring
Conserv.11 (1)	OCWD	Management of Santa Ana Sucker Restoration on Sunnyslope Creek	Habitat Improvement, Management, and Monitoring
Conserv.12 (1)	Valley District	Enhanced Recharge Basin	Habitat Improvement, Management, and Monitoring
Conserv.13 (F)	Valley District	Alluvial Fan Hydraulic Disturbance	Habitat Improvement, Management, and Monitoring
Conserv.14 (2)	Valley District	Drainage A Woolly-Star	Habitat Improvement, Management, and Monitoring
Conserv.15 (1)	Valley District	Redlands Airport Parcels	Habitat Improvement, Management, and Monitoring
Conserv.16 (1)	Valley District	Santa Ana River Refugia	Habitat Improvement, Management, and Monitoring
Conserv.17 (1)	Valley District	San Bernardino Avenue	Habitat Improvement, Management, and Monitoring
Conserv.18 (1)	Valley District	Weaver	Habitat Improvement, Management, and Monitoring
Conserv.19 (1)	Valley District	Devil Creek	Habitat Improvement, Management, and Monitoring

ID (Phase)	Owner	Project/Activity Name	Activity Type
Conserv.20 (2)	Valley District	City Creek	Habitat Improvement, Management, and Monitoring
Conserv.21 (1)	Valley District	Santa Ana Sucker Translocation	Habitat Improvement, Management, and Monitoring
SCE.1 (1)	SCE	Mill Creek Facilities	Groundwater Recharge
SCE.2 (1)	SCE	Santa Ana River Facilities	Groundwater Recharge
SCE.3 (1)	SCE	Lytle Creek Facilities	Groundwater Recharge
SCE.4 (1)	SCE	San Antonio Creek Facilities	Groundwater Recharge
VD.1 (1)	Valley District	Cactus Basin Recharge Project Maintenance	Groundwater Recharge
VD.2.02 (3)	Valley District/RPU/ Western/ Conservation District	Active Recharge Project – Cable Creek Diversion and Basin	Groundwater Recharge
VD.2.03 (4)	Valley District/RPU/ Western/Conservation District	Active Recharge Project – Lytle Creek Diversion and Basin	Groundwater Recharge
VD.2.04 (4)	Valley District/RPU/ Western/Conservation District	Active Recharge Project – Mill Creek Diversion	Groundwater Recharge
VD.2.05 (4)	Valley District/RPU/ Western/ Conservation District	Active Recharge Project – City Creek Diversion and Basin	Groundwater Recharge
VD.2.06 (2)	Valley District/RPU/ Western/Conservation District	Active Recharge Project – Plunge Creek – Basin 1	Groundwater Recharge
VD.2.07 (4)	Valley District/RPU/ Western/Conservation District	Active Recharge Project – Cajon-Vulcan 1 Diversion and Basin	Groundwater Recharge
VD.2.08 (4)	Valley District/RPU/ Western/Conservation District	Active Recharge Project – Vulcan 2 Diversion and Basin	Groundwater Recharge
VD.2.09 (3)	Valley District/RPU/ Western/Conservation District	Active Recharge Project – Lytle-Cajon Diversion and Basin	Groundwater Recharge
VD.2.10 (3)	Valley District/RPU/ Western/Conservation District	Active Recharge Project – Plunge Creek – Basin 2	Groundwater Recharge
VD.2.11 (2)	Valley District/RPU/ Western/Conservation District	Active Recharge Project – Devil Creek Diversion and Basins	Groundwater Recharge
VD.2.12 (1)	Valley District/RPU/ Western/Conservation District	Active Recharge Project – Waterman Basin Spreading Grounds Channel Maintenance	Groundwater Recharge

ID (Phase)	Owner	Project/Activity Name	Activity Type
VD.2.13 (2)	Valley District/RPU/ Western/Conservation District	Active Recharge Project – Twin Creek Spreading Grounds	Groundwater Recharge
VD.2.14 (4)	Valley District/RPU/ Western/Conservation District	Active Recharge Project – Badger Basin spreading Grounds Channel Maintenance	Groundwater Recharge
VD.3 (1)	Valley District/ Western/RPU	Enhanced Recharge Project – Seven Oaks Dam Water Conservation Improvements	Groundwater Recharge
VD.4 (1)	Valley District	Valley District Existing Pipelines and Pipeline Crossings	Wells and Water Conveyance Infrastructure
WD.1 (1, 3, 4)	Water Department	SBMWD Recycled Water Project	Water Reuse Projects
WD.2 (1)	Water Department	San Bernardino Municipal Water Department Other Pipelines	Wells and Water Conveyance Infrastructure
WD.3 (1)	Water Department	Kenwood Well Field and Pipeline	Wells and Water Conveyance Infrastructure
WD.4 (4)	Water Department	Vulcan Mining Groundwater Recharge Basins	Groundwater Recharge
WD.5 (1)	Water Department	San Bernardino Municipal Water Department Existing Facilities Maintenance	Wells and Water Conveyance Infrastructure
West.1 (2)[1]	Western	Western Municipal Water District Pipeline Rehabilitation and Replacement Program	Wells and Water Conveyance Infrastructure
West.2 (1)[1]	Western	Western Municipal Water District Water Delivery and Wastewater Collection System Operation	Wells and Water Conveyance Infrastructure
West.3 (1)[1]	Western	Recycled Water Live Stream Discharge	Wells and Water Conveyance Infrastructure
West.4 (1)[1]	Western	Recycled Water Crossing to South Added Facilities Charge	Wells and Water Conveyance Infrastructure
West.5 (1)[1]	Western	Stormwater Channel and Recycled Water Impoundment Upgrades to Western Water Recycling Facility	Water Reuse Projects
West.6 (1)[1]	Western	Arlington Basin Water Quality Improvement Project	Groundwater Recharge
West.7 (1)[1]	Western	Riverside Corona Feeder Project	Wells and Water Conveyance Infrastructure
West.8 (1)[1]	Western	Replacement of the Owl Tree and March Line Pipelines	Wells and Water Conveyance Infrastructure

ID (Phase)	Owner	Project/Activity Name	Activity Type
West.9 (1)[1]	Western	Lake Mathews and Burwood Drive Pipeline Construction	Wells and Water Conveyance Infrastructure
West.10 (2)	Western	Construction of Potable Water/Recycled Water Tanks	Wells and Water Conveyance Infrastructure
WV.1 (1)	West Valley	Southern California Edison Afterbay Recharge Basins and Maintenance	Groundwater Recharge
WV.2 (1)	West Valley	West Valley Pipeline Maintenance	Wells and Water Conveyance Infrastructure
WV.3 (1)	West Valley	8-3 Reservoir and Access Roads	Wells and Water Conveyance Infrastructure
WV.4 (1)	West Valley	Lord Ranch Facility	Water Reuse Projects
WV.5 (1)	West Valley	West Valley Other Routine Maintenance	Wells and Water Conveyance Infrastructure
WV.6 (1)	West Valley	West Valley Facilities Maintenance	Wells and Water Conveyance Infrastructure

[1] Covered activity occurs within the Stephens' Kangaroo Rat HCP. This Covered Activity will need to be evaluated for potential effects on the Stephens' kangaroo rat (*Dipodomys stephensi*) and if take is anticipated to occur, it will need to be obtained through that HCP.
Conservation District (CD) = San Bernardino Valley Water Conservation District, East Valley (EV) = East Valley Water District; IEUA = Inland Empire Utilities Agency; Metropolitan (Met) = Metropolitan Water District of Southern California; OCWD = Orange County Water District; Rialto (Rial) = Rialto Utility Authority; RPU = Riverside Public Utilities; SBMWD = San Bernardino Municipal Water Department; SCE = Southern California Edison; Valley District (VD) = San Bernardino Valley Municipal Water District; Water Department (WD) = San Bernardino Municipal Water Department; West Valley (WV) = West Valley Water District; Western (West.) = Western Municipal Water District of Riverside County.
F = Potential future phase.

Table 2-2. Summary of Covered Activities with Aquatic Effects

ID (Phase)	Proposed Covered Activity	Type of Modification	Average Annual Amount[1]
EV.4.01–4.03 (1)	Sterling Natural Resource Center: Wastewater Treatment Plant	Effluent Discharge Reduction and Groundwater Recharge	6,733 afy/9.3 cfs/6.0 mgd reduction in flow to SAR
IEUA.1.01 (2)	Wineville Basin (2010 RMPU)	Groundwater Recharge	Increase capture by 2,968 afy/4.1 cfs/2.7 mgd (combined with IEUA.1.06 and IEUA.1.10)
IEUA.1.02 (2)	Lower Day Basin (2010 RMPU)	Groundwater Recharge	Increase capture by 1,014 afy/1.4 cfs/0.9 mgd
IEUA.1.03 (2)	San Sevaine Basin Cells 1–5 (2013 RMPU)	Groundwater Recharge	Increase capture by 652 afy/0.9 cfs/0.6 mgd
IEUA.1.04 (1)	Victoria Basin (2013 RMPU)	Groundwater Recharge	Increase capture by 72 afy/0.1 cfs/0.06 mgd
IEUA.1.05 (1)	Montclair Basin Cells 1–4 (2013 RMPU)	Groundwater Recharge	Increase capture by 72 afy/0.1 cfs/0.06 mgd
IEUA.1.06 (1)	Jurupa Basin (2010 RMPU)	Groundwater Recharge	Increase capture by 2,968 afy/4.1 cfs/2.7 mgd (combined with IEUA.1.01 and IEUA.1.10)
IEUA.1.07 (1)	Declez Basin (2010 RMPU)	Groundwater Recharge	Increase capture by 507 afy/0.7 cfs/0.5 mgd
IEUA.1.08 (1)	CSI Basin (2010 RMPU)	Groundwater Recharge	Increase capture by 72 afy/0.1 cfs/0.06 mgd
IEUA.1.09 (1)	Ely Basin (2010 RMPU)	Groundwater Recharge	Increase capture by 217 afy/0.3 cfs/0.2 mgd
IEUA.1.10 (1)	RP3 Basin (2010 RMPU)	Groundwater Recharge	Increase capture by 2,968 afy/4.1 cfs/2.7 mgd (combined with IEUA.1.01 and IEUA.1.06)
IEUA.1.11 (1)	Turner Basin (2010 RMPU)	Groundwater Recharge	Increase capture by 22 afy/0.03 cfs/0.02 mgd
IEUA.1.12 (1)	East Declez Basin	Groundwater Recharge	Increase capture by 434 afy/0.6 cfs/0.4 mgd
IEUA.3.01 (1)	Cucamonga Creek Dry-Weather Flow Diversion	Groundwater Recharge	Increase capture by 652 afy/0.9 cfs/0.6 mgd (combined with IEUA.3.02 and IEUA.3.06)
IEUA.3.02 (1)	Cucamonga Creek at Interstate 10 Dry-Weather Flow Diversion	Groundwater Recharge	Increase capture by 652 afy/0.9 cfs/0.6 mgd (combined with IEUA.3.01 and IEUA.3.06)
IEUA.3.03 (1)	Chino Creek at Chino Hills Parkway Dry-Weather Flow Diversion	Groundwater Recharge	Increase capture by 145 afy/0.2 cfs/0.1 mgd

ID (Phase)	Proposed Covered Activity	Type of Modification	Average Annual Amount[1]
IEUA.3.04 (1)	Day Creek at Wineville Basin Outflow Diversion	Groundwater Recharge	Increase capture by 362 afy/0.5 cfs/0.3 mgd
IEUA.3.05 (1)	San Sevaine Creek Diversion	Groundwater Recharge	Increase capture by 652 afy/0.9 cfs/0.6 mgd
IEUA.3.06 (1)	Lower Deer Creek Diversion	Groundwater Recharge	Increase capture by 579 afy/0.8 cfs/0.5 mgd (combined with IEUA.3.01 and IEUA.3.02)
IEUA.4 (1)	IEUA Regional Wastewater Treatment Expansion	Water Reuse Projects	Increase capture by 9,991 afy/13.8 cfs/8.9 mgd
Rial.1 (2)	Rialto Wastewater Diversion and Reuse Project	Discharge Reduction	Phase 1 – 1,665 afy/ 2.3 cfs/1.5 mgd Phase 2 – 1,448/2.0 cfs/ 1.3 mgd
RPU.5 (2)	Riverside North Aquifer Storage and Recovery Project	In-Stream and Off-Stream Recharge	Increase capture by 9,845 afy/13.6 cfs/8.8 mgd
RPU.8 (2)	Riverside Basin Recharge Project	Groundwater Recharge[2]	Columbia – 362 afy/ 0.5 cfs/0.3 mgd Marlborough – 290 afy/ 0.4 cfs/0.2 mgd Spring Brook – 290 afy/ 0.4 cfs/0.2 mgd Van Buren – 579 afy/ 0.8 cfs/0.5 mgd
RPU.10 (1)	Santa Ana River Sustainable Parks and Tributaries Water Reuse Project	Effluent Reduction/ Redistribution	4,995 afy/6.9 cfs/4.5 mgd
VD.2.02 (3)	Cable Creek Diversion and Basin	Groundwater Recharge	Increase capture by 2,389 afy/3.3 cfs/2.1 mgd
VD.2.03 (4)	Lytle Creek Diversion and Basin	Groundwater Recharge	Increase capture by 3,620 afy/5.0 cfs/3.2 mgd
VD.2.04 (4)	Mill Creek Diversion	Groundwater Recharge	Increase capture by 7,963 afy/11.0 cfs/7.1 mgd
VD.2.05 (4)	City Creek Diversion and Basin	Groundwater Recharge	Increase capture by 4,633 afy/6.4 cfs/4.1 mgd
VD.2.06 (2)	Plunge Creek – Basin 1	Groundwater Recharge	Increase capture by 3,113 afy/4.3 cfs/2.8 mgd
VD.2.07 (4)	Cajon-Vulcan 1 Diversion and Basin	Groundwater Recharge	Increase capture by 579 afy/0.8 cfs/0.5 mgd
VD.2.08 (4)	Vulcan 2 Diversion and Basin	Groundwater Recharge	Increase capture by 796 afy/1.1 cfs/0.7 mgd
VD.2.09 (3)	Lytle-Cajon Diversion and Basin	In-channel recharge basin	Increase capture by 1,086 afy/1.5 cfs/1.0 mgd

ID (Phase)	Proposed Covered Activity	Type of Modification	Average Annual Amount[1]
VD.2.10 (3)	Plunge Creek – Basin 2	Groundwater Recharge	Accounted for in VD.2.06
VD.2.11 (2)	Devil Creek Diversion and Basins	Groundwater Recharge	Increase capture by 2,027 afy /2.8 cfs/1.8 mgd
VD.2.12 (1)	Waterman Basin Spreading Grounds Channel Maintenance	Groundwater Recharge	Increase capture by 1,448 afy/2.0 cfs/1.3 mgd
VD.2.13 (2)	Twin Creek Spreading Grounds	Groundwater Recharge	Increase capture by 1,955 afy/2.7 cfs/1.8 mgd
VD.3 (1)	Enhanced Recharge Project – Seven Oaks Dam Water Conservation Improvements	Groundwater Recharge	Phase 1b – Increase capture by 3,692 afy/5.1 cfs/3.3 mgd
WD.1 (1, 3) [3, 4]	SBMWD Recycled Water Project	Effluent Discharge Reduction	HCP Phase 1 – 9,556 afy/13.2 cfs/8.5mgd reduction in flow from RIX to River HCP Phase 3 – 3,620 afy/5 cfs/ 3.2 mgd reduction (minimum 16,651 afy/23 cfs/14.9 mgd discharge)
West.3 (1)	Recycled Water Live Stream Discharge	Groundwater Recharge*	6,733 afy/9.3 cfs/6.0 mgd capacity
West.6 (1)	Arlington Basin Water Quality Improvement Project	Groundwater Recharge*	1,810 – 2,534 afy/ 2.5–3.5 cfs/16–2.3 mgd

[1] Average annual amount is the volume of water estimated to be diverted, captured, discharged over a year in (i.e., acre-feet per year).
[2] The source of the water captured by new recharge basins is urban runoff that currently flows to Lake Evans, where it percolates and evaporates. As such, increasing capture of this water would not directly affect surface hydrology of the mainstem of Santa Ana River.
[3] The Phase 1 reduction includes both the Sterling Natural Resources Center (SNRC) and San Bernardino Municipal Water Department (SBMWD) reductions identified in State Water Resources Control Board (SWRCB), Division of Water Rights wastewater petition Orders WW0095 and WW0059 (available on the SWRCB website at https://www.waterboards.ca.gov/). The SNRC reduction totals approximately 5 mgd of the Phase 1 reduction, with the remainder associated with the SBMWD reduction.
[4] Wastewater petition order WW0059 and SBMWD's Settlement Agreements with the City of Riverside and the Center for Biological Diversity (available on the SWRCB website at https://www.waterboards.ca.gov/) stipulate a minimum discharge of 28.6 cfs (18.5 mgd) between June 1 and October 15 of each year.
afy = acre-feet per year; cfs= cubic feet per second; mgd = million gallons per day; RIX = Rapid Infiltration and Extraction facility; RMPU = Recharge Master Plan Update; RWQCP = Riverside Regional Water Quality Control Plant; SBMWD = San Bernardino Municipal Water Department.

2.1.1 Water Reuse Projects

This section describes projects related to construction of new water treatment plants and associated facilities and activities for operating and maintaining existing and new water treatment plants and associated facilities. The location of these activities is shown on Figure 2-1.

East Valley Water District Activities

Future Development Surface Water/Imported Water Treatment Plant (EV.1) – Phase 1

The Future Development Surface Water/Imported Water Treatment Plant is a new facility for which a final location has not yet been determined, as it is currently in the planning stage; however, a preliminary location has been identified: on a combination of previously disturbed lands and inactive citrus groves. New construction would include construction of the plant and conveyance pipelines within a public right-of-way (ROW) (Figure 2-2). There will be no new reduction of streamflow associated with operations for this plant.

New Construction

The water treatment plant would be located on land that was previously used as a source of impervious material for the construction of Seven Oaks Dam and on inactive citrus groves. It is possible that the plant will provide water to a development being proposed that is not covered by this HCP. The development's water supply infrastructure would be built by the developer within the project site boundaries but would then be turned over to East Valley Water District (East Valley) for long-term management.

East Valley is including the construction of pipelines needed to deliver water to the new water treatment plant. Once raw water is processed at the treatment plant, underground water pipelines will convey potable water throughout the new development and surrounding communities. The conveyance pipelines will be constructed within the public ROW. Because this project is currently pursuing its independent planning and permitting, a timeframe and expected duration for construction have not yet been determined.

Operations

These diversions under consideration are pre-existing and are thus part of the baseline conditions because the water rights and diversions have been occurring for many decades. There will be no new reduction of streamflow as part of this Covered Activity.

East Valley will supply domestic (potable) water to the future development area within the eastern limits of the East Valley service area. There are no existing East Valley facilities adjacent to the future development project, which will have an expected average water demand of approximately 3.2 cubic feet per second (cfs) (2.1 million gallons per day [mgd]) for domestic water and 1.82 cfs (1.2 mgd) for irrigation water, for a total of 5.0 cfs (3.2 mgd). Potable water will be supplied to the development by combination of sources that include (1) an extension of existing East Valley facilities located in Greenspot Road; (2) optional treatment of imported (State Water Project [SWP]) raw water from the San Bernardino Valley Municipal Water District (Valley District); and (3) treatment of raw water from the North Fork Pipeline based on existing water rights and diversions. Onsite water supply, system hydraulics, and facility planning are based on a conceptual plan. There are existing East Valley water facilities capable of providing service to the future development approximately 3 miles west at the Intersection of Greenspot Road and Santa Paula Street. According to East Valley infrastructure standards based on the size of development, the future development is projected to require 4.5 million gallons of storage, 4,900 gallons per minute pumping capacity, and transmission water mains ranging in size from 8 to 24 inches.

Maintenance

The general O&M activities common to most of the Permittee Agencies are described in Section 2.1.6.

Sterling Natural Resource Center (EV.4)

The proposed Sterling Natural Resource Center (SNRC) would include a new wastewater treatment facility, treated water conveyance system, and construction of new recharge basins. The SNRC would treat wastewater generated within the East Valley service area, which is entirely within the Valley District wholesale water agency service area. Currently, East Valley conveys its waste to the City of San Bernardino for secondary treatment at the San Bernardino Water Reclamation Plant and for tertiary treatment at the Rapid Infiltration and Extraction (RIX) facility. Following construction of SNRC, treated wastewater would be conveyed to newly constructed basins (Weaver Basins) located east of Merris Street, west of Weaver Channel, south of Greenspot Road, and north of Plunge Creek within the City of Highland. Water discharged into the Weaver Basins would recharge the local groundwater basin.

Construction and operational impacts of this project have been covered through Section 7 in a Biological Opinion signed by the U.S. Fish and Wildlife Service (USFWS) on March 9, 2017.[1] Conservation Measures included in the Biological Opinion are intended to be implemented, monitored, and managed by the HCP and therefore have been included herein, however, take coverage for long-term monitoring and management of the conservation measures has been covered in the Biological Opinion should the HCP not be completed prior to the SNRC project being completed. This HCP will only cover operations and maintenance associated with the pipelines and the new recharge basins, as described below.

Sterling Natural Resource Center: Wastewater Treatment Plant (EV.4.01) – Phase 1

The plant is located within two municipalities: City of Highland and City of San Bernardino (Figure 2-2). The SNRC would produce tertiary-treated water for reuse. A conveyance system including a pumping station and pipeline would be constructed to convey treated water from the SNRC to the Weaver Basins , and potentially to Plunge Creek – Basin 1 (VD.2.06) in the future.

The SNRC would provide tertiary treatment of wastewater generated within the East Valley service area. The SNRC would have a maximum capacity of 10–12 mgd and produce tertiary-treated water in compliance with California Code of Regulations Title 22 recycled water quality requirements for unrestricted use. Refer to Table 2-2 for the average annual hydrological changes anticipated from this Covered Activity.

Sterling Natural Resource Center: Treated Water Conveyance System (EV.4.02) – Phase 1

A treated water conveyance system is required to convey tertiary effluent from the SNRC wastewater treatment plant to the Weaver Basins and Plunge Creek Basins for groundwater recharge (Figure 2-2). The system requires up to 18,000 linear feet of up to a 30-inch-diameter pipeline. A 30-inch-diameter conveyance pipeline would be installed within the existing ROW of East 6th Street (or a parallel street) from the SNRC property for approximately 2 miles to Central Avenue. The pipeline would run south on Central Avenue from East 6th Street to 3rd Street, and then

[1] Biological Opinion_16BO0182-17F0387_BO_Sterling Natural Resource Center

east on 3rd Street to West 5th Street before crossing City Creek within an existing conduit attached to the West 5th Street/Greenspot Road Bridge. No trenching within sensitive habitat will be necessary when crossing City Creek. The pipeline would then continue east within the Greenspot Road ROW for approximately 2 miles where a discharge structure would be constructed at the Weaver Basins, located south of Greenspot Road, east of Merris Street, and west of Weaver Channel. An additional conveyance pipeline would be constructed along Orange Street, from its intersection with Greenspot Road to just south of Plunge Creek to connect to the Plunge Creek Basins.

Various collection system improvements are required within the service area in order to convey flows to the SNRC. The new facilities may include at least two sewer lift stations and associated force mains as well as several sewer trunk improvements within city streets.

Sterling Natural Resource Center: Weaver Recharge Basin (EV.4.03) – Phase 1

Note that Weaver Recharge Basin (EV.4.03) is a component of the overall Sterling Natural Resource Center, which is a Water Reuse Covered Activity. However, the Weaver Recharge Basin (EV.4.03) portion of the project is a Ground Water Recharge Covered Activity. The proposed conveyance pipeline described above (EV.4.02) will convey flows to the Weaver Recharge Basins (Figure 2-5). A new discharge structure may be constructed to discharge flows to Weaver Channel, located immediately east of the project site. A pipeline manifold may be installed in the basin with multiple valves at a predetermined spacing that can be opened or closed at different times based on the incoming flow. Construction and operation of the Sterling Natural Resource Center is covered by a Section 7 permit (USFWS 2017), and therefore Weaver Recharge Basin (EV.4.03) is considered an existing basin.

Maintenance

Future maintenance work will occur annually and will include the plant, pipelines, basins, pumps, and associated infrastructure. See Section 2.1.6 for a discussion of general O&M activities at East Valley's existing or planned facilities.

Inland Empire Utilities Agency Activities

Inland Empire Utilities Agency Recycled Water Project (IEUA.4) – Phase 1

This project will be implemented to increase the reuse of local recycled water within the Inland Empire Utilities Agency's (IEUA's) service area (Figure 2-2). This project involves maximizing the reuse of 9,991 acre-feet per year (afy)/13.8 cfs/8.9 mgd of effluent flow discharges from IEUA's regional water recycling plants (RWRPs), which would be diverted from the current effluent discharge and directed to groundwater recharge. Since 1972, IEUA has operated RWRPs to produce recycled water that meets Title 22 standards for indirect reuse, groundwater recharge, and local discharge.

New Construction

There is no construction associated with this project that will be covered by this HCP.

Operations

Effluent flow discharges from the RWRPs would be reduced at four discharge points during the cooler fall and winter months (November to March). Discharge reduction would take place at Prado

Lake near the Prado Park Equestrian Center, on Cucamonga Creek at Highway 60, and at two locations on Chino Creek near Fairfield Ranch Park and near the crossing of Chino Hills Parkway. This reduction of up to a maximum of 13.8 cfs (8.9 mgd) would be allocated to groundwater recharge. Summer flows would remain at current levels.

Maintenance

There is no maintenance associated with this project.

Rialto Utility Authority

Rialto Wastewater Diversion and Reuse Project (Rial.1) – Phase 2

The Rialto Utility Authority (Rialto) plans to reduce the amount of treated effluent that is discharged from the Rialto Wastewater Treatment Plant into the Rialto Channel, which is a tributary to the Santa Ana River (Figure 2-2). Any reduction of flow would first require approval from the SWRCB, Division of Water Rights. Flow reductions (pending approval from SWRCB, Division of Water Rights), would occur in phases as infrastructure is constructed, demand for recycled water increases, and certain habitat modifications are implemented within the Rialto Channel. The City of Rialto would recycle/reuse the wastewater by transporting treated wastewater through a pipeline system to recycled water consumers for direct application and reuse.

New Construction

Capital improvements may be required depending on demand for recycled water. Improvements would include construction of the pipeline infrastructure necessary to transport the recycled water from the facility to the customers. Pipelines would be constructed within existing public roadway ROW.

Operations

The average discharge of the Rialto Wastewater Treatment Plant to Rialto Channel is approximately 6,733 afy/9.3 cfs/6.0 mgd, with a maximum capacity of 12,742 afy/17.6 cfs/11.4 mgd. Seasonal changes to the amount of water discharged are due to periodic rain events adding to the flow in the channel. The planned reuse of the effluent is meant to help Rialto comply with potential mandates for recycled water and to implement the City of Rialto's Recycled Water Master Plan and provide supplies to other agencies.

For the purposes of HCP analyses, discharge reductions were quantified in two steps: Part 1 Reduction, and Potential Future Reduction. Part 1 of the project would reduce the current wastewater discharge by about 25%, or an annual average of 1,665 afy/2.3 cfs/1.5 mgd. Potential future phasing could reduce flow by an additional 1,448 afy/2 cfs/1.3 mgd (Table 2-2) (for a total reduction of 3,113 afy/4.3 cfs/2.8 mgd). However, any future reduction would be dependent upon the development of implementable design/construction elements downstream of the Rialto Wastewater Treatment Plant discharge to ensure the protection of key habitat criteria for Santa Ana sucker, such as depth, velocity, temperature, and suitable substrate and other criteria developed in the future that are determined important for aquatic species. In order for Rialto to reduce discharge from 6,733 afy/9.3 cfs/6.0 mgd to 3,620 afy/5 cfs/3.2 mgd or to 54% of the baseline flow, Rialto and the HCP would cooperatively develop a project with measurable benefits to Santa Ana sucker. One potential example includes the constriction of effluent baseflow within Rialto Channel to a confined, narrower, meandering inset channel to increase velocity and substrate availability for sucker and eliminate habitat suitability for nonnative predators. Future phased reductions would be contingent upon USFWS and California Department of Fish and Wildlife (CDFW) (the Wildlife Agencies) approval of appropriate and implementable design modifications benefitting native fishes and protecting riparian vegetation and covered avian species within the vicinity of Rialto's discharge location.

Maintenance

The general O&M activities common to most of the Permittee Agencies are described in Section 2.1.6.

Riverside Public Utilities Activities

North Waterman Treatment Plant (RPU.9) – Phase 1

The North Waterman Treatment Plant is a 2.5-acre water treatment plant to potentially be constructed at Riverside Public Utilities' (RPU's) Cooley property, which encompasses multiple parcels that are generally located south of 6th Street, north of 3rd Street, east of Waterman Street, and west of Warm Creek channel in the City of San Bernardino (Figure 2-2). In addition to construction, there would also be ongoing maintenance of access roads, vegetation and vector control, and preventative maintenance and repair.

New Construction

The project proposes to construct a 2.5-acre water treatment plant at either RPU's Cooley property (18 acres) or Garner property (25 acres, located south of 6th Street, north of 5th Street, west of Pedley Road, and east of Warm Creek channel in the City of San Bernardino). For the purposes of analyzing the project in the HCP, the project is assumed to be located on the Cooley site. Both sites are cleared regularly for weed abatement as described in RPU.12; therefore, construction of the treatment plant at either site would have roughly the same residual impact. The treatment plant will consist of clearing and grubbing the site, grading and compacting the soil, and installing above and below ground equipment. Construction is anticipated to last up to 6 months. Some releases of water may occur during startup O&M, with water releases on site or potentially to the adjacent concrete-lined Twin Creek Channel.

Maintenance

Ongoing activities for this plant will entail maintenance of access roads, releases of water (confined to the site) for inspections and preventative maintenance, and excavations for preventative maintenance and repair. Maintenance activities may include vegetation and vector control. See Section 2.1.6 for general O&M activities conducted by the RPU for their existing or planned facilities.

The general O&M activities common to most of the Permittee Agencies are described in Section 2.1.6.

San Bernardino Municipal Water Department Activities

SBMWD Recycled Water Project (WD.1) – Phase 1, Phase 3, Phase 4

The City of San Bernardino Municipal Water Department (Water Department) plans to develop a recycled water project that would permanently reduce the amount of treated effluent discharged from the Water Department's RIX facility into the Santa Ana River (Figure 2-3). This project would include construction of pipeline infrastructure. The proposed effluent discharge reduction is proposed to occur in two parts corresponding to Phases 1 and 3 of the HCP implementation (Table 2-2). In Phase 1 the Water Department will reduce flows from the RIX facility to the Santa Ana River from the baseline of 41.2 cfs (26.6 mgd) to 28 cfs (18.1 mgd)[2]. In Phase 3, effluent reduction could occur if the HCP demonstrates that the success criteria for mitigation actions in this HCP for Santa Ana sucker are being met or exceeded. Success criteria for Santa Ana sucker will be developed as part of the Comprehensive Adaptive Management and Monitoring Program (CAMMP) where thresholds for success will be dependent upon population trends and distribution of this species. If, however, the success criteria are not met then implementation would be delayed until Phase 4 of the HCP, but would still be contingent on achievement of success criteria. In this phase the RIX effluent discharge could be reduced to a minimum of 16,651 afy/23 cfs/14.9 mgd[3] (Table 2-2).

New Construction

Capital improvements may be required for this project depending on demand for recycled water. Improvements would include construction of the pipeline infrastructure necessary to transport the recycled water from the facility to customers. Pipelines may be constructed within existing public roadway ROW.

Operations

The Phase 1 portion of the Water Department's recycled water project will reduce discharge into the Santa Ana River by approximately 9,556 afy/13.2 cfs/8.5 mgd, from 29,828 afy/41.2 cfs/26.6 mgd to 20,271 afy/28 cfs/18.1 mgd. A commitment will be made by the Water Department to provide 20,271 afy/28 cfs/18.1 mgd of discharge to the river for habitat and downstream benefits on behalf of the HCP.[4] As mentioned above, a future part of the project (in Phase 3 or 4 of the HCP) could take place (pending approval from the SWRCB, Division of Water Rights) that would reduce discharge into the river by an additional 3,620 afy/5 cfs/3.2 mgd, to 16,651 afy/23 cfs/14.9 mgd; however, this reduction is dependent upon the Upper SAR HCP meeting or exceeding USFWS-approved success criteria for adult Santa Ana sucker suitable habitat availability.

[2] The Phase 1 reduction includes both the SNRC and SBMWD reductions identified in SWRCB, Division of Water Rights wastewater change Orders WW0095 and WW0059 (available on the SWRCB website at https://www.waterboards.ca.gov/). The SNRC reduction totals approximately 5 mgd of the Phase 1 reduction, with the remainder associated with the SBMWD reduction.

[3] Additional reductions beyond those stipulated in WW0059 and the associated Settlement Agreements would first need to be approved by the SWRCB, Division of Water Rights.

[4] SBMWD is required to adhere to Order WW0059 and the associated Settlement Agreements, which stipulate a minimum discharge requirement of 28.6 cfs (18.5 mgd) between June 1 and October 15 of each year.

Maintenance

The general O&M activities common to most of the Permittee Agencies are described in Section 2.1.6.

Western Municipal Water District of Riverside County Activities

Stormwater Channel and Recycled Water Impoundment Upgrades to Western Water Recycling Facility (West.5) – Phase 1

Western Municipal Water District of Riverside County (Western) proposes upgrades for the Western Water Recycling Facility, including bank stabilization with rip-rap to improve drainage, and improvements to the existing impoundment (Figure 2-3). Pipelines, pumps, and valves would provide recycled water to the impoundment during operations, and regular maintenance would include periodic cleaning to remove accumulated sediment, bank repair, and vegetation and vector control. Removed sediment may be used on site for repair activities, or hauled off site for disposal (note: this facility is located some distance from any of the proposed habitat improvement, management, and monitoring sites; consequently, reuse of sediment for habitat restoration purposes is not proposed).

New Construction

This project will consist of upgrades to the existing stormwater channel that crosses the Western Water Recycling Facility (WWRF) site to minimize erosion and sediment transport and ensure spills at the treatment plant do not enter the drainage. Upgrades to the existing recycled water impoundment may include bank stabilization with non-grouted rip-rap and improved drainage throughout the property. The proposed location is the WWRF site at 22751 Nandina Avenue, Riverside, California 92518.

Construction of the upgrades would be scheduled in the late spring through fall to avoid wet weather delays. Construction activities are expected be completed within weeks or a month. Once constructed, the upgrades would not increase any discharges from the WWRF.

Operations

Operation of the project would consist of the use of pipelines, pumps, and valves to provide recycled water to the impoundment.

Maintenance

Maintenance activities will consist of periodic cleaning to remove accumulated sediment, bank repair, and vegetation and vector control. Excavations may also be required for preventative maintenance and repair. Non-emergency maintenance activities will likely be scheduled during dry seasons to minimize impacts. See Section 2.1.6 for general operations and maintenance activities conducted by the Western for their existing or planned facilities as well as general O&M activities common to most of the Permittee Agencies.

West Valley Water District Activities

Lord Ranch Facility (WV.4) – Phase 1

The Lord Ranch facility is on the east side of Pepper Avenue, north of Winchester Avenue and north of Frisbee Wash, west of the railroad line, and south of Interstate (I-) 210 in the City of Rialto (Figure 2-3). The site contains two separate parcels. West Valley Water District (West Valley) is planning to expand facilities at this site and is pursuing permitting for this construction separately to this HCP. The expansion project includes the construction of a new booster pump station, a 1.0-million-gallon aeration reservoir, an arsenic treatment plant, new site fencing and pipeline installation, grading, and paving. The proposed arsenic treatment plant will treat water pumped from three existing wells on the site through existing and new pipelines before entering the reservoir. The expansion project also includes raising the existing well #36 at the site by construction of a retaining wall to raise the current grade, or abandoning the existing well and drilling a replacement well at the existing site (new fencing may also be installed).

New Construction

New construction is anticipated to occur prior to HCP approval, and coverage under this HCP is being sought only for maintenance activities.

Maintenance

West Valley is seeking routine O&M activity coverage of the Lord Ranch facility, which will include the above-mentioned expansion elements once constructed. Maintenance of facilities will include three groundwater wells, a 1.0-million-gallon aeration tank, a booster pump station, and pipelines connecting the facilities. Pipelines leaving the facility connect to West Valley's distribution system. Existing facilities will continue to be maintained by West Valley.

An existing earthen basin, on the northeast corner of the property that has been at this location for over 50 years, is also subject to routine maintenance activities including weed abatement, vegetation removal from slopes, berm repair, rodent control (limited to management of ground squirrel burrows [e.g., filling with native sediment], where burrows pose a structural threat to the berm slope), and bottom scarification. Maintenance activities will occur approximately twice a year in the summer and fall.

The general O&M activities common to most of the Permittee Agencies are described in Section 2.1.6.

2.1.2 Groundwater Recharge

This section describes projects related to construction of new structures that divert stream or channel flow, activities to operate and maintain existing and new diversion structures, and activities related to construction of new recharge basins and O&M of existing and new recharge basins. The locations of these activities are illustrated on Figure 2-5.

San Bernardino Valley Water Conservation District

Mill Creek Diversion Maintenance (CD.1) – Phase 1

Mill Creek is approximately 3.0 miles south of Seven Oaks Dam and confluences with the Santa Ana River approximately 2 miles southwest of the dam. The existing Mill Creek diversion system is located along the south bank of Mill Creek and immediately north of the existing U.S. Army Corps of Engineers (USACE) levee, upstream and downstream of the Garnet Street crossing of Mill Creek in the community of Mentone. The existing facility consists of three locations that include the main diversion structure, two intake structures, and canals that connect all three locations. These locations are points where storm flow or imported water flow is routed from within the natural Mill Creek channel to downstream facilities outside of Mill Creek (Figure 2-5). This project does not involve a change in the quantity of water diverted from Mill Creek.

Starting at the upstream end of the system, storm flow within Mill Creek is directed to the diversion structure using a series of earthen berms. These berms are referred to as *soft plugs,* and they are constructed to direct low flows into the diversion system while not impacting peak storm conditions.

Flow is conveyed by way of a channel to the diversion structure that diverts flow from Mill Creek into a concrete diversion canal. The diversion structure consists of four gates: one to direct water toward the intake structure, and three to return water back to Mill Creek's natural river channel. When the three return gates are open and the intake gate is closed the structure directs water back to Mill Creek's natural river channel. When the three return gates are closed and the intake gate is open, water is directed towards the additional downstream intake structures and basins.

Downstream of the diversion structure is a secondary structure: the main intake. The main intake structure consists of three gates, a weir for flow measurement, and a catwalk structure. This structure is approximately 200 feet downstream of the main diversion structure and functions to direct water (1) to the upper basins through the south canal, (2) into the lower basins through the North Canal, or (3) to return flows back to the Mill Creek natural channel. The third gate structure location, referred to as the North Canal intake, is downstream of the main intake structure within Mill Creek. This structure is approximately 3,800 feet downstream of the diversion structure and 1,100 feet downstream of Garnet Street. When open, it allows water to pass underneath the Mill Creek levee system and into the lower basins, when closed flows return to the Mill Creek natural river channel. These three locations of gated structures provide operational flexibility to maximize infiltration of the diverted water into a system of basins used for groundwater recharge. Separate authorizations, outside of this HCP, are being sought to improve the diversion structure (and initial point of diversion), which will allow for the protection of the structure from washout due to debris-laden flows.

Maintenance activities are proposed for coverage under this HCP.

Maintenance

In addition to general O&M activities common to most of the Permittee Agencies (described in Section 2.1.6), maintenance activities specific to the Mill Creek Diversion are described below:

Mill Creek Soft Plugs

The Conservation District maintains four low (24-inch maximum) sand and gravel earthen berms (soft plugs)—three to direct flow from Mill Creek to the diversion structure and one to direct flow to the North Canal intake structure. The soft plugs direct flows to an earthen channel that leads to the diversion structure (described above) that functions to divert water into the District's recharge basins or back into Mill Creek's natural channel. The soft plugs are composed of native material designed to naturally erode at higher flows. As flows increase, the soft plugs begin to deteriorate and break apart at approximately 400 cfs (259 mgd), a function that helps to reduce debris damage at the diversion structure following inundation and damage from high flow rates. Once the soft plugs are completely disintegrated, all flow remains within the Mill Creek natural channel.

To rebuild and maintain these soft plugs, bulldozers access the diversion channel and proceed upstream of the diversion structure as frequently as annually but more commonly every 3 to 5 years, dependent on Mill Creek flow conditions. These repairs primarily occur immediately following storm flow events. The entrance of the main access road to the soft plug maintenance area is to the east of Garnet Street. Activities may also include rebuilding and maintaining the soft plugs, which could include disturbance to gather the sand and gravel materials that are needed. Soft plug maintenance includes patch repair of erosional features and would result in up to two re-creations per soft plug per year. Existing roads and reestablished roads would be used to the extent possible.

Mill Creek Diversion and Intake Structures

The Mill Creek diversion and intake structure maintenance area includes areas upstream and downstream of the diversion and intake structures. Maintenance of the diversion and intake structure includes the upkeep of the structures and gates, levee replacement, large debris and vegetation removal within the existing channel, removal of sediment from the concrete apron at the gates, and grading to reestablish access roads after storm events.

The diversion and intake structures typically consist of concrete or cement block with wooden gates and associated structures and hardware. Maintenance includes cleaning and greasing the gates on an annual basis or more frequent basis depending on storms.

The North Canal intake is maintained less frequently than the intake or main diversion structure. Maintenance activities are similar to those described above and are assumed to occur every 5 years on average.

The diversion structure is typically maintained frequently. Levees may need to be replaced occasionally when they are washed out, which is assumed to happen on average every 2.5 years. Other routine maintenance occurs annually.

Mill Creek Diversion Channels

The diversion channels that connect the three described structures are inspected throughout the year, and maintenance is conducted on an as-needed basis, or as often as annually. Ongoing maintenance activities include clearing encroaching vegetation, debris, and/or sediment removal, as well as structural repairs. Repair of the conveyance channel between the soft plugs and the diversion structure and the channel between the main intake structure and the North Canal intake structure may be necessary due to erosion or washout of the channel side slopes. Repair is typically accomplished by filling in the eroded area with native material. Grouted rock is only used in those areas that already had grouted rock or concrete prior to the damage occurring. The conveyance channel can also be used to provide access for heavy equipment (i.e., bulldozer) for channel repair and vegetation/debris management.

Vegetation control occurs annually, removal of sediment occurs every 2 years, and all other activities occur infrequently, or as necessary. Most portions of the conveyance channel can be accessed from existing unpaved access roads, but some walking and equipment movement through unmaintained areas may be required.

Mill Creek Diversion Access Road

The existing access road is graded dirt, and runs between Garnet Street and the main diversion structure. The access road is near the flood wall slope protection and is outside of the wetted area of typical storm flows. It is utilized to access the main intake and diversion structure for maintenance activities. The access road is infrequently maintained, but may require occasional new grading as well as vegetation control as needed (e.g., after storm events).

Santa Ana Levee and Cuttle Weir Diversion (CD.2) – Phase 1

The Santa Ana levee and cuttle weir diversion structure is just downstream of the Seven Oaks Dam. The Cuttle Weir is located where Santa Ana Canyon Road crosses the Santa Ana River, and the Greenspot Road Canal extends from just south of the Cuttle Weir, on the south side of Santa Ana Canyon Road, west to the intersection of the canal with Greenspot Road (Figure 2-5). Maintenance activities for the Cuttle Weir diversion structure and Greenspot Road canal are proposed under this HCP.

Maintenance

In addition to the general O&M activities common to most of the Permittee Agencies (described in Section 2.1.6), maintenance activities specific to this Covered Activity are described below.

Cuttle Weir and Diversion Structure

Maintenance of the Cuttle Weir and diversion structure includes regular mechanical maintenance of the diversion structure and gates, vegetation management, streambed recontouring, and levee maintenance. Streambed recontouring requires removal of vegetation, large boulders, and rock and debris that reduce flow. Nonnative invasive species such as salt cedar (*Tamarix ramosissima*), castor bean (*Ricinus communis*), and giant reed (*Arundo donax*) will be removed and treated to prevent re-establishment. These plants are cut down to a stump, and an herbicide[5] designed for aquatic environments is applied to the stump. If necessary, native vegetation may be cut and removed to protect the diversion structure, although this will be minimized. Vegetation is removed using hand tools and hauled from the site via truck. Vegetation management typically occurs annually in order to maximize the removal of accumulated debris from the preceding storm season.

[5] Activities associated with the application of herbicide that may result in incidental take of a Covered Species (e.g., the operation of an all-terrain vehicle in San Bernardino kangaroo rat (SBKR) habitat resulting in the collapse of a burrow) are proposed for coverage by this HCP. However, this HCP does not cover incidental take from pesticides (herbicides) that have been applied. Applicators must be certified to apply pesticide and use pesticides according to label specifications. This includes locations of use and per acre limits to cumulative product use in order to avoid non-intended impacts on wildlife.

Levee maintenance and recontouring would occur approximately every 3 years. It requires the use of mechanical equipment within the riverbed, with access occurring from existing paved and non-paved roads. Maintenance on diversion structures would take place on an as-needed basis outside of the breeding bird nesting season (September 16 to February 14).

The Conservation District is seeking coverage for routine maintenance associated with ensuring that debris and vegetation do not obstruct the flow path of the water. See Section 2.1.6 for general O&M activities conducted by the Conservation District for their existing or planned facilities. Planned improvements that increase capacity to divert up to 500 cfs (323 mgd) at the Cuttle Weir (from current capacity of 300 cfs [194 mgd]) is described in the Valley District's Covered Activities for this HCP.

Cuttle-Weir – Greenspot Road Canal

The Conservation District canal that extends between the Cuttle Weir and Greenspot Road is a natural earth and rock surface. The canal fills with sediment that periodically requires removal. Maintenance would include removing sediment and possibly some portion of vegetation.

East Valley Water District Activities

Sterling Natural Resource Center: Weaver Recharge Basin (EV.4.03) – Phase 1

The proposed conveyance pipeline described under Water Reuse Projects above (EV.4.02) will convey flows to the Weaver Recharge Basins (Figure 2-2). A new discharge structure may be constructed to discharge flows to Weaver Channel, located immediately east of the project site. A pipeline manifold may be installed in the basin with multiple valves at a predetermined spacing that can be opened or closed at different times based on the incoming flow. Construction and operation of the Sterling Natural Resource Center is covered by a Section 7 permit (USFWS 2017), and therefore Weaver Recharge Basin (EV.4.03) is considered an existing basin.

Inland Empire Utilities Agency Activities

Wineville Basin (2010 RMPU) (IEUA.1.01) – Phase 2

Wineville Basin is an existing facility subject to ongoing routine operations and maintenance. This proposed construction project will convert the existing Wineville Basin to also function as a groundwater recharge basin (in addition to its current use as a flood control basin). The Wineville Basin is owned by the San Bernardino County Flood Control District (SBCFCD) and is located east of I-15 and south of Jurupa Street in the City of Ontario (Figure 2-5).

New Construction

This project will occur within the existing maintained basin. The basin bottom will be cleared of any existing vegetation, and a soil layer may be cleared in order to enhance infiltration. Basin bottom soils may also be configured to create earthen berms in order to compartmentalize activities such as infiltration or maintenance. Vegetation on the existing basin slopes would be removed and slopes may be reinforced.

Additional improvements to this basin include constructing a dam with a pneumatic gate on the low-level outlet and raising the existing maximum storage elevation of the basin by approximately 9 feet (from 869 feet to 878 feet). A small permanent footprint for construction of the dam and pneumatic gate will be required. Staging areas and access roads will be strategically planned to utilize disturbed areas of the basin where no habitat values currently exist for Delhi Sands flower loving fly or other species. Construction of the dam and pneumatic gate is not yet scheduled, as this project is still being conceptually developed.

Operations

Stormwater recharge would increase by an annual average of 2,968 afy/4.1 cfs/2.7 mgd (Table 2-2) from the current incidental value of 296 afy to a total of 3,257 afy/4.5 cfs/2.9 mgd. The yield of the Wineville Basin is combined with the yields of Jurupa Basin (IEUA.1.06) and the RP3 Basin Habitat Mitigation Area (IEUA.1.13). The Wineville Basin is in line with Day Creek and the Santa Ana River. Stormwater will be captured in the basin up to 3,257 afy/4.5 cfs/2.9 mgd, and excess will flow in Day Creek. The final design would be expected to capture 100% of storm flows during low and average storm events. In a large storm event the first flushing flow would be allowed to pass in order to minimize debris captured in the basin and minimize maintenance needs. Stormwater recharge at this facility would be dependent on when storm events occur, which can vary from year to year. However, the majority of stormwater recharge would occur between October and April.

Maintenance

Maintenance of Wineville Basin specific to water recharge would be conducted by IEUA on an annual basis in the fall, and would consist of vegetation and sediment management on the bottom and sides of the basin. See Section 2.1.6 for general O&M activities for basins conducted by IEUA for their existing or planned facilities.

Lower Day Basin (2010 RMPU) (IEUA.1.02) – Phase 2

Lower Day Basin is an existing water recharge and flood control facility subject to ongoing routine operations and maintenance. Lower Day Basin is owned by SBCFCD and is located south of I-210, north of Victoria Park Lane, and east of Rochester Avenue in the City of Rancho Cucamonga. Day Creek flows into the basin from the north. The terminus of this drainage is Santa Ana River at the Goose Creek Golf Club (Figure 2-5).

New Construction

In order to enhance the basin's recharge capacity a secondary diversion structure will be constructed downstream of the current rubber dam diversion to capture water that over flows the rubber dam (currently occurs at greater than 18,099 afy/25 cfs/16.1 mgd).

Additionally, the current rubber dam will be improved so it may remain inflated during high storm events (72,397 afy/>100 cfs/64.6 mgd). Current capacity is limited to less than 72,397 afy/<100 cfs/64.6 mgd flows to maintain structural integrity. The eastern embankment will be reconstructed with earthen materials, and the mid-level outlet at the southeast corner of the basin will be eliminated so that the capacity of the basin for water recharge would be increased as it will be able to hold a greater volume of water.

The project would raise the existing maximum storage elevation of the basin by 16 feet (from a 1,382-foot contour elevation to a 1,398-foot elevation) with an additional storage volume of 163 acre-feet.

Operations

It is estimated that stormwater recharge would increase by an annual average of 1,013 afy/1.4 cfs/0.9 mgd (Table 2-2) from the current baseline value (434 afy/0.6 cfs/0.4 mgd) to a total of 1,376 afy/1.9 cfs/1.2 mgd. Stormwater recharge at this facility would be dependent on when storm events occur, which can be variable from year to year. However, the majority of stormwater recharge would occur from October to April. State water could be used in the future at this recharge facility as it is made available.

Maintenance

Currently, SBCFCD and IEUA are responsible for maintenance of Lower Day Basin for flood protection and water recharge, respectively. Maintenance specific to water recharge would be conducted by IEUA annually, in the fall, and would consist of vegetation and sediment management on the basin bottom and sides. See Section 2.1.6 for general O&M activities for recharge basins conducted by IEUA for their existing or planned facilities as well as the general O&M activities common to most of the Permittee Agencies.

San Sevaine Basin Cells 1–5 (2013 RMPU) (IEUA.1.03) – Phase 2

San Sevaine Basins 1–5 are existing water recharge and flood control facilities, subject to ongoing routine operations and maintenance, owned by SBCFCD and operated for recharge by IEUA. This project proposes the construction of a conveyance pipeline, inlet structure, and an internal berm. The San Sevaine Basins are located north of I-210 and east of I-15 and Cherry Avenue. San Sevaine Creek and Etiwanda Channel flow into the basin from the north, and its downstream tributary is San Sevaine Creek (Figure 2-5).

New Construction

A temporary construction footprint will be necessary to construct the conveyance pipeline from basin 5 to the upstream basins. A portion of this temporary construction area is located within existing disturbed maintenance areas, and the remainder falls outside of the currently permitted maintenance area. Basins 1–3 will include construction of an inlet structure. An internal berm will also be constructed in Basin 5.

Basin 3 has very high percolation rates, while Basin 5 is much slower. To maximize the recharge capabilities a pump station will be constructed to pump excess water from Basin 5 back up to Basins 1, 2, or 3 for percolation. A permanent construction footprint for the pump station would be required. Staging areas and access roads will be strategically planned to utilize existing disturbed areas of the basin.

For Basin Cells 1–5, the basin bottom will be cleared of vegetation and a soil layer may be cleared in order to enhance infiltration. Basin bottom soils may also be configured to create earthen berms in order to compartmentalize activities such as infiltration or maintenance. Vegetation on the existing basin slopes would be removed, and some reinforcement of the slopes may be required to meet flood protection requirements.

Operations

It is estimated that stormwater recharge would increase by an annual average of 652 afy/0.9 cfs/0.6 mgd (Table 2-2) from the current baseline value (3,982 afy/5.5 cfs/3.6 mgd) to a total of

4,634 afy/6.4 cfs/4.1 mgd. The San Sevaine Basin Cells 1–5 are in line with San Sevaine Creek. Stormwater will be captured in the basin at 4,634 afy/6.4 cfs/4.1 mgd, and excess will flow in the San Sevaine Creek.

Stormwater recharge at this facility would be dependent on when storm events occur, which can be variable from year to year. However, the majority of stormwater recharge would occur from October through April. State water could be used in the future at this recharge facility as it is made available.

Maintenance

Maintenance specific to water recharge of the basin would occur by IEUA annually, in the fall, and would consist of vegetation and sediment management on the basin bottom and sides. See Section 2.1.6 for general O&M activities for recharge basins conducted by IEUA for their existing or planned facilities

Victoria Basin (2013 RMPU) (IEUA.1.04) – Phase 1

Victoria Basin is an existing water recharge and flood control facility subject to ongoing routine operations and maintenance. Victoria Basin is owned by SBCFCD and operated by IEUA for recharge, and is located northwest of I-15 and north of Victoria Street in the City of Rancho Cucamonga. Etiwanda Creek Channel and the San Sevaine Channel flow into the basin from the north. The terminus of this drainage is the San Sevaine Channel (Figure 2-6).

New Construction

The proposed project will improve the recharge and flood control capabilities of the existing Victoria Basin by abandoning the mid-level outlet that allows flows to the San Sevaine Channel. By blocking the outlet and extending the existing lysimeter stations, the capacity of the basin for water recharge would be increased as it will be able to hold a greater volume of water.

Additional construction activities would include blocking the mid-level outlet that will occur within the already disturbed, currently permitted maintenance area. The existing lysimeter stations would also need to be extended. Staging areas and access roads will be strategically planned to utilize existing disturbed areas of the basin.

The basin bottom will be cleared of vegetation, and a soil layer may be cleared in order to enhance infiltration. Basin bottom soils may also be configured to create earthen berms in order to compartmentalize activities such as infiltration or maintenance. Vegetation on the existing basin slopes would be removed and some reinforcement of the slopes may be required.

Operations

It is estimated that stormwater recharge would increase by an annual average of 72 afy/0.1 cfs/ 0.06 mgd (Table 2-2) from the current baseline value (434 afy/0.6 cfs/0.4 mgd) to a total of 507 afy/0.7 cfs/0.5 mgd. The new recharge capacity is expected to only be realized in high flow storms/years. This design is expected to capture 100% of storm flows during low and average storm events. Stormwater recharge at this facility would be dependent on when storm events occur, which can be variable from year to year. However, the majority of stormwater recharge would occur from October to April. State water could be used at this recharge facility in the future as it is made available.

Maintenance

Maintenance specific to water recharge would be conducted by IUEA annually, in the fall, and would consist of vegetation and sediment management on the basin bottom and sides. See Section 2.1.6 for general O&M activities for recharge basins conducted by IEUA for their existing or planned facilities as well as the general O&M activities common to most of the Permittee Agencies.

Montclair Basin Cells 1–4 (2013 RMPU) (IEUA.1.05) – Phase 1

This project includes modifying the existing Montclair Basin Cells 1–4 to enhance their groundwater recharge capacity. The Montclair Basins are existing water recharge facilities subject to ongoing routine operations and maintenance, owned by the Chino Basin Water Conservation District (CBWCD), which IEUA operates as recharge basins. The Montclair Basins are located north and south of I-10, west of Monte Vista Avenue, in the City of Montclair (Figure 2-6). San Antonio Creek flows into Montclair basins from the north, where flow is regulated by USACE operation of the San Antonio Dam. This drainage is a tributary to Chino Creek, with a terminus at the Santa Ana River near Prado Dam.

New Construction

Construction activities for the Montclair Basin Cells 1–4 would enhance the basin's recharge capacity. Low level drains will be constructed from Basins 1 to 2 and from Basins 2 to 3. Basin 4 may be deepened. New drop inlet structures to Basins 2 and 3 will be constructed, and an automated inlet will be constructed to Basin 1. Temporary staging areas would be needed for these new structures. These improvements will allow for a more efficient transfer of water between recharge basins, which would be especially important when imported water is available for recharge.

Operations

It is estimated that stormwater recharge would increase by an annual average of 72 afy/0.1 cfs/ 0.06 mgd (Table 2-2) from the current baseline value (1,187 afy/1.64 cfs/1.1 mgd) to a total of 1,231 afy/1.7 cfs/1.1 mgd. Stormwater recharge at this facility would be dependent on storm events, which can be variable from year to year, as well as on the release schedule from San Antonio Dam. However, the majority of stormwater recharge would occur from October through April. State water would be used at this recharge facility as it is made available.

Maintenance

Currently, IEUA is responsible for maintenance of the Montclair Basins for water recharge. Maintenance specific to water recharge would by conducted by IEUA annually, in the fall, and would consist of vegetation and sediment management on the basin bottom and sides. See Section 2.1.6 for general O&M activities for recharge basins conducted by IEUA for their existing or planned facilities as well as general O&M activities common to most of the Permittee Agencies.

Jurupa Basin (2010 RMPU) (IEUA.1.06) – Phase 1

The Jurupa Basin is an existing flood control facility, subject to ongoing routine operations and maintenance. This project proposes to expand the existing basin to also function as a recharge basin. Jurupa Basin is south of I-10, north of Jurupa Avenue, and east of Etiwanda Avenue in the City of Fontana (Figure 2-6). San Sevaine Channel can be diverted into the basin from the north, and its downstream tributary is San Sevaine Channel.

New Construction

The Jurupa Basin improvements involve expanding the capacities of an existing diversion from San Sevaine Creek and an existing pump station that is used to convey stormwater from the Jurupa Basin to the RP3 Basins from 14,479 afy/20 cfs/12.9 mgd to 28,958 afy/40 cfs/25.9 mgd. All new construction will occur within the existing pump station and on the concrete wall. Refer to Table 2-2 for the average annual hydrological change associated with this Covered Activity.

Operations

The yield of the Jurupa Basin is combined with the yields of Wineville Basin (IEUA.1.01) and the RP3 Basin Habitat Mitigation Area (IEUA.1.13). Stormwater recharge at this facility would be dependent on when storm events occur, which can vary from year to year. However, the majority of stormwater recharge would occur from October through April. State water could be used in the future at this recharge facility as it is made available.

Maintenance

Currently, SBCFCD and IEUA are responsible for maintenance for flood protection and water recharge, respectively. Maintenance specific to water recharge would be conducted by IEUA annually, in the fall, and would consist of vegetation and sediment management on the basin bottom and sides. See Section 2.1.6 for general O&M activities for recharge basins conducted by IEUA for their existing or planned facilities as well as general O&M activities common to most of the Permittee Agencies.

Declez Basin (2010 RMPU) (IEUA.1.07) – Phase 1

Declez Basin is an existing water recharge and flood control facility subject to ongoing routine operations and maintenance. Declez Basin is operated for recharge by IEUA, and is located north of I-60, north of the Jurupa Mountains, and east of Country Village Road in the City of Fontana (Figure 2-6).

New Construction

The Declez Basin project improvements include replacing the existing western embankment with a dam and installing a gate on the low-level outlet. Design plans are currently preliminary, but the project may include the addition of riprap along the western embankment of the two most southerly cells, and reconstruction of the existing spillway and the existing low level outlet (raising both to accommodate a greater capacity in the basin to increase recharge potential).

Operations

Stormwater recharge at this facility would be dependent on when storm events occur, which can vary from year to year. However, the majority of stormwater recharge would occur from October through April. Improvements to Declez Basin will increase the useable storage of the basin to 541 acre-feet and will increase the stormwater recharge by an annual average of 507 afy/0.7 cfs/0.5 mgd (Table 2-2). State water could be used in the future at this recharge facility as it is made available.

Maintenance

Currently, SBCFCD and IEUA are responsible for maintenance for flood protection and water recharge, respectively. Maintenance specific to water recharge would be conducted by IEUA annually, in the fall, and would consist of vegetation and sediment management on the basin bottom and sides. See Section 2.1.6 for general O&M activities for recharge basins conducted by IEUA for their existing or planned facilities as well as general O&M activities common to most of the Permittee Agencies.

CSI Basin (2010 RMPU) (IEUA.1.08) – Phase 1

The CSI Basin is an existing water recharge facility subject to ongoing routine operations and maintenance. CSI Basin is operated for recharge by IEUA and is located north of I-10 and east of I-15, north of the Jurupa Hills, and south of the Auto Club Speedway (Figure 2-6).

New Construction

The CSI Basin project involves deepening the existing basin by 10 feet while maintaining the existing diversion, outlet, and spillway. The excavation will take place within the existing basin floor. Activities include deepening the existing basin and maintaining the existing diversion, outlet, and spillway. The stormwater recharge in this project comes from a drainage area north of the CSI Basin, east of the San Sevaine Channel, south of the Auto Club Speedway, and west of Cherry Avenue. If not recharged in the CSI Basin, the stormwater would flow through various human-made channels and eventually discharge into San Sevaine Creek.

Operations

Stormwater recharge at this facility would be dependent on when storm events occur, which can be variable from year to year. However, the majority of stormwater recharge would occur from October through April and increase the useable storage of the basin to 47 acre-feet and increase stormwater recharge by an annual average of 72 afy/0.1 cfs/0.1 mgd (Table 2-2). State water could be used in the future at this recharge facility as it is made available.

Maintenance

CSI Basin is not currently operated or maintained by IEUA. Maintenance specific to water recharge would be conducted by IEUA annually, in the fall, and would consist of vegetation and sediment management on the basin bottom and sides. See Section 2.1.6 for general O&M activities for recharge basins conducted by IEUA for their existing or planned facilities as well as general O&M activities common to most of the Permittee Agencies.

Ely Basin (2010 RMPU) (IEUA.1.09) – Phase 1

Ely Basin is an existing water recharge and flood control facility subject to ongoing routine operations and maintenance. Ely Basin is owned by SBCFCD and CBWCD and operated for recharge by IEUA. Ely Basin is north of I-60, west of Vineyard Avenue, and east of Archibald Avenue in the City of Ontario (Figure 2-6). West Cucamonga Creek flows into the basin from the north. The terminus of this drainage is Santa Ana River.

New Construction

The Ely Basin improvements include excavating the basin and increasing its drainage area. Frequency of basin maintenance will also be increased to ensure optimal recharge.

Operations

Stormwater recharge at this facility would be dependent on when storm events occur, which can vary from year to year. However, the majority of stormwater recharge would occur from October through April. Proposed improvements to the basin will increase the useable storage to 672 acre-feet and provide an annual average of 217 afy/0.3 cfs/0.2 mgd (Table 2-2) of stormwater to the Chino Basin. State water could be used in the future at this recharge facility as it is made available.

Maintenance

Currently, SBCFCD and IEUA are responsible for maintenance for flood protection and water recharge, respectively. Maintenance specific to water recharge would be conducted by IEUA annually, in the fall, and would consist of vegetation and sediment management on the basin bottom and sides. See Section 2.1.6 for general O&M activities for recharge basins conducted by IEUA for their existing or planned facilities as well as general O&M activities common to most of the Permittee Agencies.

RP3 Basin (2010 RMPU) (IEUA.1.10) – Phase 1

RP3 Basin is an existing water recharge and flood control facility subject to ongoing routine operations and maintenance. RP3 Basin is owned by and operated for recharge by IEUA. The site consists of four existing basins, three of which are recharge sites, and the most southeasterly cell is a habitat mitigation site. RP3 Basin is south of I-10, north of the Jurupa Mountains, and west of Beech Avenue in the City of Fontana (Figure 2-7). Declez Channel flows into the basin from the south. The terminus of this drainage is the Declez Channel.

New Construction

The RP3 Basin improvements include enhancing the inlet structures, increasing the conservation storage, and constructing a fifth new basin on the site. New construction will occur in areas outside of the existing facility but in previously disturbed areas. Activities would include improving existing inlet structures and increasing conservation storage as well as constructing the new basin.

Operations

The yield of the RP3 Basin is combined with the yields of Wineville Basin (IEUA.1.01) and Jurupa Basin (IEUA.1.06): combined, stormflow capture would be increased by 2,968 afy/4.1 cfs/2.7 mgd (Table 2-2). Stormwater recharge at this facility would be dependent on when storm events occur, which can be variable from year to year. However, the majority of stormwater recharge would occur from October through April. State water could be used in the future at this recharge facility as it is made available. Table 2-2

Maintenance

Currently, SBCFCD and IEUA are responsible for maintenance for flood protection and water recharge, respectively. Maintenance specific to water recharge would be conducted by IEUA annually, in the fall, and would consist of vegetation and sediment management on the basin bottom and sides. See Section 2.1.6 for general O&M activities for recharge basins conducted by IEUA for their existing or planned facilities.

Additional maintenance activities include habitat mitigation site maintenance, limited to trash removal and weed control of invasive plant species. Trash removal occurs by using nets on long poles and/or wader outfits to comb through the wetlands to remove litter/debris that has come to the site via the incoming water flow or wind. Weed removal services involve hand weeding low growing annual weeds and removal of nonnative trees, such as eucalyptus. All weeds and tree material are removed from the site or shredded for use as weed-control ground mulch.

Turner Basins (2010 RMPU) (IEUA.1.11) – Phase 1

Turner Basins are existing water recharge and flood control facilities subject to ongoing routine operations and maintenance. Turner Basins are owned by SBCFCD and operated for recharge by IEUA. Turner Basins are north of I-10, west of Archibald Avenue, and east of Vineyard Avenue in the City of Ontario (Figure 2-7). Cucamonga and Deer Creeks flow into the basin from the north and east. The terminus of this drainage is Cucamonga Creek.

New Construction

The Turner Basins improvements include raising the spillway in Turner Basin 2. Stormwater is diverted into Turner Basins 2, 3, and 4.

Operations

Stormwater recharge at these facilities would be dependent on when storm events occur, which can vary from year to year. However, the majority of stormwater recharge would occur from October through April. Proposed improvements will increase stormwater recharge by an average of 22 afy/0.03 cfs/0.02 mgd (Table 2-2). State water could be used in the future at these recharge facilities as it is made available.

Maintenance

SBCFCD and IEUA have a pending permit filed with CDFW for maintenance for flood protection and water recharge at these basins. Maintenance specific to water recharge would be conducted by IEUA annually, in the fall, and would consist of vegetation and sediment management on the basin bottom and sides. See Section 2.1.6 for general O&M activities for recharge basins conducted by IEUA for their existing or planned facilities as well as general O&M activities common to most of the Permittee Agencies.

East Declez Basin (IEUA.1.12) – Phase 1

This project would include the construction of a new recharge basin. East Declez Basin will be north of I-60, north of the Jurupa Mountains, and east of Country Village Road in the City of Fontana (Figure 2-7). San Sevaine Channel and Declez Creek will flow into the basin, and its downstream tributary will be Declez Creek.

New Construction

The East Declez Basin project involves constructing a new basin in land east of and adjacent to the existing Declez Basin and about 6,000 feet southwest and downstream of the RP3 recharge facility.

Water will be diverted from two sources to the East Declez Basin. Stormwater in Declez Channel will be diverted in a new East Declez Basin Diversion from Declez Channel to the East Declez Basin through a pipeline. This will be done by constructing a drop inlet in the Declez Channel near the southerly crossing with Cherry Avenue to divert up to 108,595 afy/150 cfs/97.0 mgd of stormwater to the East Declez Basin. Stormwater will be conveyed in a 54-inch pipe that will be constructed in the channel, parallel to the existing channel alignment, and then due east along the north side of Declez Basin. The stormwater will then discharge to the East Declez Basin parallel to the existing channel alignment and continue due east along the north side of Declez Basin before discharging to the East Declez Basin. An overflow spillway will permit East Declez Basin to overflow into Declez Basin.

Stormwater will also be diverted from San Sevaine Creek Channel into Jurupa Basin, then will be pumped to the Declez Channel through a new 43,438 afy/60 cfs/38.8 mgd (Table 2-2) pump station (the existing pump station at Jurupa Basin will be expanded) and an existing pipeline and will subsequently be diverted through the new East Declez Basin Diversion from Declez Channel to the East Declez Basin through a pipeline. The diversion will be accomplished by constructing a rubber dam in San Sevaine Channel to increase the amount of stormwater that can be diverted into Jurupa Basin, and expanding the Jurupa Basin pump station from 28,958 to 72,397 afy/40 to 100 cfs/25.9 to 64.6 mgd. An existing pipeline is proposed to be utilized to convey water from the Jurupa Basin to East Declez Basin; however, a new pipeline may need to be constructed. If needed, the new pipeline will convey up to 43,438 afy/60 cfs/38.8 mgd to a 72-inch storm drain that subsequently discharges to the Declez Channel upstream of the new East Declez Basin Diversion. The inlet expansion from San Sevaine Channel to the Jurupa Basin included in the recommended 2013 RMPU Project ID 23a is required for this alternative.

Operations

Stormwater recharge at this facility would be dependent on when storm events occur, which can vary from year to year. However, the majority of stormwater recharge would occur from October through April. The new East Declez Basin storage will be 300 acre-feet, and the project will increase stormwater recharge by an average of 434 afy/0.6 cfs/0.4 mgd (Table 2-2). State water could be used in the future at this recharge facility as it is made available.

Maintenance

Maintenance specific to water recharge would be conducted by IEUA annually, in the fall, consisting of vegetation and sediment management on the basin bottom and sides. See Section 2.1.6 for general O&M activities for recharge basins conducted by IEUA for their existing or planned facilities.

Existing Basins and Maintenance Areas (IEUA.2)

The following basins are operated for groundwater recharge by IEUA and would require periodic maintenance to be covered under this HCP. These basins are existing facilities, currently permitted and subject to ongoing routine operations and maintenance, and will have no change in O&M activities. Stormwater recharge at these would be dependent on when storm events occur, which can vary from year to year. However, the majority of stormwater recharge would occur from October through April. State water could be used in the future at these recharge facilities as it is made available. Maintenance specific to water recharge would be conducted by IEUA annually, in the fall, consisting of vegetation and sediment management on the basin bottom and sides. The general

O&M activities common to most of the Permittee Agencies, including groundwater recharge basin maintenance, are described in Section 2.1.6.

7th and 8th Street Basin (2010 RMPU) (IEUA.2.01) – Phase 1

The 7th & 8th Street Basin is used as a water recharge and flood control facility owned by SBCFCD and operated for recharge by IEUA. The basin is located north of I-10, east of North Campus Avenue, in the City of Upland (Figure 2-7). West Cucamonga Creek flows into the basin from the north, and its downstream tributary is the West Cucamonga Creek.

Banana Basin (2010 RMPU) (IEUA.2.02) – Phase 1

Banana Basin is used as a water recharge and flood control facility owned by SBCFCD and operated for recharge by IEUA. Banana Basin is located south of Foothill Boulevard and south of Whittram Avenue, west of Cherry Avenue, and north of the Auto Club Speedway, in the City of Fontana (Figure 2-7). Its upstream tributary is West Fontana Channel and its downstream tributary is San Sevaine Channel.

Brooks Basin (2010 RMPU) (IEUA.2.03) – Phase 1

Brooks Basin is used as a water recharge and flood control facility owned by SBCFCD and operated for recharge by IEUA. Brooks Basin is located south of Holt Boulevard, west of Ramona Avenue, and north of State Street, in the City of Chino (Figure 2-7). San Antonio Channel flows into the basin from the west; the terminus of this drainage is San Antonio Creek.

College Heights Basin (2010 RMPU) (IEUA.2.04) – Phase 1

College Heights Basin is used as a water recharge and flood control facility owned by SBCFCD and operated for recharge by IEUA. College Heights Basin is located north of I-10, north of Arrow Highway, and east of Central Avenue in the City of Upland (Figure 2-8). San Antonio Creek flows into the basin from the north; the downstream tributary of this drainage is San Antonio Creek.

Etiwanda Debris Basin (2010 RMPU) (IEUA.2.05) – Phase 2

Etiwanda Debris Basin is used as a water recharge and flood control facility owned by SBCFCD and operated for recharge by IEUA. Etiwanda Debris Basin is located north of Wilson Avenue, east of Etiwanda Avenue, and west of Wardman Bullock Road in the City of Rancho Cucamonga (Figure 2-8). East Etiwanda Creek flows into the basin from the north. The terminus of this drainage is Etiwanda Creek.

Grove Basin (2010 RMPU) (IEUA.2.06) – Phase 1

Grove Basin is used as a water recharge and flood control facility owned by SBCFCD and operated for recharge by IEUA. Grove Basin is located south of I-60 and south of East Riverside Drive, north of Chino Avenue, west of Grove Avenue, and east of South Cucamonga Avenue, in the City of Ontario (Figure 2-8). Local storm drains flow into the basin from the north. The terminus of this drainage is Grove Avenue.

Hickory Basin (2010 RMPU) (IEUA.2.07) – Phase 1

Hickory Basin is used as a water recharge and flood control facility owned by SBCFCD and operated for recharge by IEUA. Hickory Basin is located northwest of the Auto Club Speedway, north of Napa

Street, and south of Whittram Avenue, in the City of Fontana (Figure 2-8). Hickory Basin is connected to Banana Basin, which is upstream. Hickory Basin's downstream tributary is San Sevaine Creek.

Upland Basin (2010 RMPU) (IEUA.2.08) – Phase 1

Upland Basin is used as a water recharge and flood control facility owned by SBCFCD and operated for recharge by IEUA. Upland Basin is located southwest of the intersection of West Arrow Route and Monte Vista Avenue, north of Richton Street, and west of Central Avenue in the City of Upland. San Antonio Creek flows into the basin from the north, and the terminus of this drainage is San Antonio Creek (Figure 2-8).

Cucamonga Creek Dry-Weather Flow Diversion (IEUA.3.01) – Phase 1

This project involves the diversion of an average of 0.8 cfs (0.5 mgd) of dry-weather flow (i.e., urban runoff) from Cucamonga Creek south of I-10 and conveyance of that flow to IEUA's RP1 Water Recycling Facility. The dry-weather flow will then be treated to Title 22 Groundwater Replenishment – Surface Application standards. Once treated, the water will go into IEUA's recycled water system for subsequent direct non-potable reuse or groundwater replenishment (Figure 2-8).

New Construction

The diversion project will involve connecting the existing stream channel with the existing regional sewage pipeline. The project would require construction in public ROW near Cucamonga Creek and Philadelphia to convey dry-weather flows from the Cucamonga Creek to the regional sewage pipeline.

Operations

Dry-weather diversions to this facility would occur from April to October at a maximum flow of 2,172 afy/3 cfs/1.9 mgd. Diversions from IEAU.3.01 would combine with Cucamonga Creek at Interstate 10 Dry-Weather Flow Diversion (IEUA.3.02) and Lower Deer Creek Diversion (IEUA.3.06), amounting to an approximate annual average of 652 afy/0.9 cfs/0.6 mgd (Table 2-2) of flow diverted to the RP1 Water Recycling Facility. State water could be used in the future at this recharge facility as it is made available.

Maintenance

IEUA is responsible for maintenance for flood protection and water recharge. Maintenance specific to water recharge would occur on an annual basis in the fall. IEUA conducts many of the maintenance activities described in Section 2.1.6 for general O&M activities for their basins and creek conveyance as well as general O&M activities common to most of the Permittee Agencies.

Cucamonga Creek at Interstate 10 Dry-Weather Flow Diversion (IEUA.3.02) – Phase 1

This project involves the diversion of dry-weather flow (i.e., urban runoff) of 652 afy/0.9 cfs/0.6 mgd from Cucamonga Creek north of I-10 and conveyance of that flow to IEUA's RP1 Water Recycling Facility. The dry-weather flow will then be treated to Title 22 Groundwater Replenishment – Surface Application standards. Once treated, the water will go into IEUA's recycled water system for subsequent direct non-potable reuse or groundwater replenishment (Figure 2-9).

New Construction

The diversion project will involve connecting the existing stream channel with the existing regional sewage pipeline. The project would require construction in public ROWs near Cucamonga Creek and Philadelphia Street to convey dry-weather flows from the Cucamonga Creek to the regional sewage pipeline.

Operations

Dry-weather diversions to this facility would occur from April to October at a maximum rate of 3 cfs (1.6 mgd) amounting to an approximate annual average of 652 afy/0.9 cfs/0.6 mgd (Table 2-2) combined with the Cucamonga Creek Dry-Weather Flow Diversion (IEUA.3.01) and the Lower Deer Creek Diversion (IEUA.3.06).

Maintenance

IEUA is responsible for maintenance for flood protection and water recharge. Maintenance specific to water recharge would occur on an annual basis in the fall.

The general O&M activities common to most of the Permittee Agencies are described in Section 2.1.6.

Chino Creek at Chino Hills Parkway Dry-Weather Flow Diversion (IEUA.3.03) – Phase 1

This project involves the diversion of an average of 145 afy/0.2 cfs/0.1 mgd (Table 2-2) of dry-weather flow from Chino Creek and conveyance of the diverted water to IEUA's Carbon Canyon Water Recycling Facility. The dry-weather flow will then be treated to Title 22 Groundwater Replenishment – Surface Application standards. Once treated, the water will go into IEUA's recycled water system for subsequent direct non-potable reuse or groundwater replenishment (Figure 2-9).

New Construction

The diversion project will involve connecting the existing stream channel with the existing regional sewage pipeline. The project would require construction in public ROWs near Chino Creek and Chino Hills Parkway to convey dry-weather flows from the Chino Creek to the regional sewage pipeline.

Operations

Dry-weather diversions to this facility would typically occur from April to October at a maximum rate of 2,172 afy/3 cfs/1.9 mgd, amounting to an approximate annual average rate of 145 afy/0.2 cfs/0.1 mgd (Table 2-2).

Maintenance

Currently, SBCFCD and IEUA are responsible for maintenance for flood protection and water recharge. Maintenance specific to water recharge would occur on an annual basis in the fall.

The general O&M activities common to most of the Permittee Agencies are described in Section 2.1.6.

Day Creek at Wineville Basin Outflow Diversion (IEUA.3.04) – Phase 1

This project involves the diversion of dry-weather flow of an annual average of 362 afy/0.5 cfs/ 0.3 mgd (Table 2-2) at the outflow of Wineville Basin to Day Creek and conveyance of the diverted water to IEUA's RP1 Water Recycling Facility. The dry-weather flow will then be treated to Title 22 Groundwater Replenishment – Surface Application standards. Once treated, the water will go into IEUA's recycled water system for subsequent direct non-potable reuse or groundwater replenishment (Figure 2-9).

New Construction

The diversion project will involve connecting the existing stream channel with the existing regional sewage pipeline. The project would require construction in the concrete-lined outflow channel immediately south of Wineville Basin. Dry-weather flows would be conveyed to the regional sewage pipeline.

Operations

Dry-weather diversions to this facility would typically occur from April to October at a maximum rate of 3 cfs (1.9 mgd), amounting to an approximate annual average of 362 afy/0.5 cfs/0.3 mgd (Table 2-2).

Maintenance

Maintenance specific to water recharge would be conducted by IEUA an annual basis in the fall. The general O&M activities common to most of the Permittee Agencies are described in Section 2.1.6.

San Sevaine Creek Diversion (IEUA.3.05) – Phase 1

This project involves the diversion of an annual average dry-weather flow of 652 afy/0.9 cfs/ 0.6 mgd from San Sevaine Creek below Jurupa Basin and conveyance of the diverted water to IEUA's RP1 Water Recycling Facility. The dry-weather flow will then be treated to Title 22 Groundwater Replenishment – Surface Application standards. Dry-weather flows are currently limited at this location, but the project could assist in capturing basin drainage for maintenance purposes (Figure 2-9).

New Construction

The diversion project will involve connecting the existing stream channel with the existing regional sewage pipeline. The project would require construction within the concrete-lined outlet channel at the southwest corner of Jurupa Basin to convey dry-weather flows from the San Sevaine Creek to the regional sewage pipeline.

Operations

Dry-weather diversions to this facility would typically occur from April to October at a maximum rate of 2,172 afy/3 cfs/1.9 mgd, amounting to an approximate annual average of 652 afy/0.9 cfs/ 0.5 mgd (Table 2-2).

Maintenance

Currently, SBCFCD and IEUA are responsible for maintenance for flood protection and water recharge, respectively. Maintenance specific to water recharge would be conducted by IEUA on an annual basis in the fall. The general O&M activities common to most of the Permittee Agencies are described in Section 2.1.6.

Lower Deer Creek Diversion (IEUA.3.06) – Phase 1

This project involves the diversion of an annual average dry-weather flow of 579 afy/0.8 cfs/0.5 mgd from Lower Deer Creek above Chris Basin at Archibald Avenue and conveyance of the diverted water to IEUA's RP5 Water Recycling Facility. The dry-weather flow will then be treated to Title 22 Groundwater Replenishment – Surface Application standards.

New Construction

The diversion project will involve connecting the existing stream channel with the existing regional sewage pipeline. The project would require construction within the concrete-lined Lower Deer Creek channel near the Archibald Road overcrossing to convey dry-weather flows from the Lower Deer Creek to the regional sewage pipeline (Figure 2-9).

Operation

Dry-weather diversions to this facility would occur from April to October at a maximum rate of 2,172 afy/3 cfs/1.9 mgd, amounting to an approximate annual average of 579 afy/0.8 cfs/0.5 mgd (Table 2-2) combined with the Cucamonga Creek Dry-Weather Flow Diversion (IEUA.3.01) and the Cucamonga Creek at Interstate 10 Dry-Weather Flow Diversion (IEUA.3.06).

Maintenance

Currently, SBCFCD and IEUA are responsible for maintenance for flood protection and water recharge, respectively. Maintenance specific to water recharge would be conducted by IEUA on an annual basis in the fall. See Section 2.1.6 for general O&M activities for basins and creek conveyance conducted by IEUA for their existing or planned facilities as well as general O&M activities common to most of the Permittee Agencies.

Riverside Public Utilities Activities

Riverside North Aquifer Storage and Recovery Project (RPU.5) (shared equally with Western and Valley District) – Phase 2

The proposed Riverside North Aquifer Storage and Recovery Project is located in the southern portion of the City of Colton and north of the City of Grand Terrace. The project consists of proposed in-channel and off-channel recharge. The proposed off-channel recharge facility location is along the west side of the Santa Ana River. The in-channel recharge basin dam (i.e., rubber dam) alignment is proposed at a location on the Santa Ana River channel about 1 mile south of the I-215/I-10 interchange and the confluence of the Santa Ana River and Warm Creek (Figure 2-9). RPU.5 proposes the construction of a dam, SWP pipeline, levee modifications, diversion structure, and in- and off-stream recharge basins. Construction is anticipated to last approximately 24 to 36 months. This project will require facilities associated with a recharge site, such as fencing, lighting, aboveground utilities, parking, and/or other supporting infrastructure.

New infrastructure that will be required is described below.

New Construction

In-Stream Recharge Component

In-stream recharge activities would include the construction of an inflatable dam across the Santa Ana River channel, which can be raised and lowered depending on the amount of water flowing in the river. The proposed dam would span approximately 810 feet across the Santa Ana River and would inflate to a height of about 6 feet. The dam would consist of two to four sections across the channel, and the sections would be attached to one to three newly constructed abutment piers. The area behind the inflatable dam (upstream) would encompass approximately 24 acres and is anticipated to have an initial infiltration rate of 3 feet per day.

Additional activities include potential removal/reconstruction of approximately 100 linear feet of new levees downstream of the proposed dam location and potential modification of approximately 2,400 linear feet of USACE levees upstream of the proposed dam location. The in-stream recharge project would also include construction of a water diversion outlet structure through the west levee north of the proposed inflatable dam. Miscellaneous rip-rap/energy dissipater devices downstream of the proposed dam location would be installed to reduce the potential for erosion at the base of the dam structure.

Off-Stream Recharge Component

The project proposes the construction of up to five individual recharge basins immediately west and north of the Santa Ana River, and east of La Cadena Drive, in the City of Colton. It is anticipated that the depths of these basins will range from 6 to 11 feet and be connected in a series with pipes and gate structures. An initial infiltration rate of 5 feet per day is expected. The off-stream basins may be constructed to allow for drainage back to the river using gravity. Implementation of this component will require the construction of a diversion structure located within the levee wall. The diversion of headworks will include a sillwall and trash rack.

Other Project Components

Other project components would include the placement of a 42-inch-diameter steel casing across the Santa Ana River, located adjacent to the inflatable dam. This casing will contain multiple conduits allowing a utility crossing under the Santa Ana River. The diversion headworks will also be tied into the existing Riverside Canal and diversions to the canal would follow the off-stream basin diversions. A temporary access road would be needed during construction.

Operations

Raising and lowering of the dam would be automated based on flow volume. When flows in the river are greater than 4,000 cfs/2,585 mgd the inflatable dam would be lowered. When flows are at or less than this amount, the dam would inflate and begin impounding water. The specific discharge value used to lower and raise the dam will ultimately be based on the design of the project, which is currently in progress. Once the basins are full, diversions to the Riverside Canal would begin. The initial infiltration rates will diminish with time due to sediment deposition within the basin. Any flows greater than the infiltration rates and/or diversion structure capacity would flow over the dam and continue downstream.

The project is designed to divert a maximum annual average of 16,578 afy/22.9 cfs/14.8 mgd. Ultimately, the project yield will depend on the design and maintenance of the project facilities and how effective the facilities are at recharging the available flows. Current estimates indicate that the likely project yield will be up to 9,845 afy/13.6 cfs/8.8 mgd.

Maintenance

Maintenance will be required for access roads, the rubber dam, pipelines, basins (in-stream and off-stream), culverts, canals, the diversion structure, and outlet structure; and will be conducted annually or as needed. Typical in-stream maintenance actions will be conducted when storm flow is not present in the river and will consist of activities to enhance and maximize groundwater recharge—e.g., sediment removal and contouring and vegetation management, and mechanized land clearing for sediment and vegetation removal. Where feasible, removed sediment will be sorted and retained for application in habitat enhancement projects (e.g., gravel/cobble can be used for native fish habitat enhancement) or placed downstream of the diversion structure within the active channel of the Santa Ana River. Occasionally, in-stream maintenance may be necessary during the storm season when flows are present in the river channel. Typically, the routine maintenance activities can be completed within 90 days per year.

Off-stream maintenance activities would include about three basin cleanings during the storm season and one basin cleaning during the non-storm season. A material stockpile/laydown area will be used to assist with basin cleanings. See Section 2.1.6 for general O&M activities conducted by the RPU for their existing or planned facilities as well as general O&M activities common to most of the Permittee Agencies.

Riverside Basin Recharge Project (RPU.8) – Phase 2

New Construction

RPU plans to construct new recharge basins and/or repurpose existing retention basins within the northern part of the Riverside Basin (Figure 2-10). These basins will be used to recharge the Riverside Groundwater Basin and therefore increase the operating yield from the basin. The source of the water will be onsite stormwater, imported water, and/or water from the Riverside North Aquifer Storage and Recovery Project (RPU.5) via the existing Riverside Canal and associated delivery systems, if necessary.

Construction activities are proposed at four locations and include the modification of Columbia Basin and Marlborough Basin, and construction of the Spring Brook facilities, followed by construction of the Highgrove facilities at Van Buren. Columbia Basin is located south of Columbia Avenue and west of Northgate Street in the community of Highgrove. Marlborough Basin is located at the corner of Marlborough Avenue and Chicago Avenue in the City of Riverside, and the Spring Brook facilities are proposed to be constructed along Spring Brook Channel, between West La Cadena Drive and Orange Street. The Highgrove facilities at Van Buren are proposed to be constructed off Taylor Street and south of Van Buren Street (in the community of Highgrove). Construction at each site is anticipated to take anywhere from 6 to 18 months. Geotechnical drilling and cone penetrating testing will occur prior to construction at each site and should take about 2 weeks to conduct.

Operations

Typical recharge operations would include recharging onsite stormwater, imported water, and water diverted from the Riverside North Aquifer Storage and Recovery Project (RPU.5) via the Riverside Canal and associated delivery systems. Additional recharge of recycled water may occur in the future; however, it was not considered for this HCP analysis. The recharge basins would be operated to meet all California Department of Drinking Water standards and all RWQCB standards, should they apply. A few of the basins utilize existing flood control facilities and would be operated for groundwater recharge.

RPU conducted a preliminary analysis that assessed each site's runoff capture area and analyzed historical rainfall data to evaluate how much stormwater runoff each site could have potentially captured assuming a 1-foot per day infiltration rate. Columbia Basin and Marlborough Basin were found to yield an annual average of 362 and 290 afy/0.5 and 0.4 cfs/0.3 and 0.2 mgd (Table 2-2), respectively, for a total of 652 afy/0.9 cfs/0.6 mgd captured. The source of the water is urban runoff that is currently captured in basins and sent downstream. Under the project conditions the water would percolate rather than flow to Lake Evans. The Spring Brook and Van Buren facilities were found to yield approximately 290 and 579 afy/0.4 and 0.8 cfs/0.3 and 0.5 mgd, respectively for a total of 941 afy/1.3 cfs/0.8 mgd captured.

Maintenance

Routine maintenance will be conducted annually at the new recharge basins during summer months when storm flow is not present. Typically, the routine maintenance activities can be completed within 60 days per year. Maintenance activities will include maintenance of diversion structures, use of pesticides[6] to control nonnative invasive plant species and nonnative rodents, vegetation removal, and mechanized land clearing for sediment removal. Sediment removal maintenance will also occur as needed during storm seasons, to maintain basin infiltration performance. See Section 2.1.6 for general O&M activities conducted by the RPU for their existing or planned facilities as well as general O&M activities common to most of the Permittee Agencies.

Southern California Edison Activities

Southern California Edison (SCE) operates hydropower facilities and associated diversions within the Planning Area, and in a tributary to streams within the Planning Area. SCE's Eastern Hydropower geography overlaps with the Planning Area and includes 3 Federal Energy Regulatory Commission (FERC) licenses, 9 powerhouses, 17 generating units, and an electric capacity of 14.86 megawatts (MW). In addition, SCE's hydroelectric facilities Sierra, and Ontario Nos. 1 and 2 operate in San Antonio Creek, tributary to Chino Creek, which flows through the Planning Area to the Santa Ana River at Prado Basin.

Three SCE Hydroelectric Projects in the Planning Area are operated according to their respective FERC licenses: Santa Ana River Nos. 1 and 3 (FERC No. 1933), Mill Creek (FERC No. 1934), and Lytle Creek (FERC No. 1934). The FERC licenses provide the parameters under which these facilities are operated and maintained. These parameters include a Federal ROW; water diversion allowances;

[6] Activities associated with the application of pesticides that may result in the incidental take of a Covered Species (e.g., the operation of an all-terrain vehicle in SBKR habitat resulting in the collapse of a burrow) are covered by the HCP. However, incidental take resulting from the pesticide itself would not be covered. Applicators must use pesticides according to the label. This includes limits on applications to avoid impacts on wildlife.

instream and bypass flow requirements; and resource protection management plans for water quality, threatened and endangered species and other special status species, and fish. The licenses have incorporated Federal Power Act Section 4(e) conditions from the U.S. Forest Service that provide additional parameters and restrictions on maintenance and operations. The FERC licenses are periodically renewed, and the parameters provided by the FERC licenses, including, but not limited to, the management plans may be revised.

SCE has non-consumptive water rights that allow power generation. The water diverted through SCE's system is delivered to the consumptive water rights holders downstream of the SCE facilities, many of whom have contractual agreements with SCE for water delivery. Water delivery obligations to downstream users and License required flows restrict on SCE's ability to manipulate and change flows through its facilities.

Most of SCE's Eastern hydroelectric facilities have similar operational designs at each stream diversion. The diversion structure, which is typically a concrete dam, diverts the stream flow into a "river pick-up" unit or intake. The intake directs the flow into a spillway or canal and then into an existing pipe system to a power plant. A soft-plug (or earthen berm) is a natural extension of the diversion structure and extends the effective length of the dam. The soft plug acts as a "sacrificial" structure that is intended to give way during heavy flows that occur during storms and protect the dam from damage. The soft plug is made up of existing native material including sand, cobble, and boulders.

At all facilities and diversions, routine operations and maintenance activities include:

- **Material Removal:** On an as-needed basis, storm-borne sediment deposits and other debris are removed from the intake, the upstream wall of the dam, and areas that obstruct water diversions and hydroelectric generation. Equipment used may include, but is not limited to, bulldozers, backhoes, front loaders, pickup truck, and hand tools.
- **Sediment Management:** Sediment deposits regularly accumulate behind diversions and other structures, and these deposits require routine removal or control.
- **Vegetation Control**: SCE controls vegetation growth at and adjacent to its facilities to prevent overgrowth interfering with the flow of water or with measurement of flow through the gauging stations. Methods of vegetation control may include, but are not limited to, selective thinning, selective vegetation removal, and mowing.
- **Facilities Repair:** Throughout the year, SCE undertakes repairs to structures and facilities (including gates and valves) and conducts maintenance to retain the functional and structural integrity of facilities.
- **Measuring Stations and Flumes**: SCE uses measuring stations and flumes to measure water flow in waterways. Maintenance work related to measuring stations and flumes includes the mowing of vegetation to provide access along channel banks and the removal of sediment deposits and other debris around measuring stations to allow for unobstructed water flow and accurate reading of water flow in waterways.
- **Intake and Diversion Structures**: SCE uses intake and diversion structures to divert water from a stream, canal, or intermittent human-made waterway into a canal or intermittent human-made waterway. Sediment deposits and other debris are removed above or below intake structures.

- **Access Roads**: Many diversions are accessed via existing dirt and rock access roads, which are repaired following flooding using heavy (and other) equipment.
- **Reconstruction**: The soft plug must be rebuilt following heavy storm events. The reconstruction uses either the storm-borne sediment removed from the intake, or native material, if not enough storm-borne material is available.
- **Dam Protection**: SCE protects the toe of the dam from undercutting by moving either storm-borne sediment removed from the intake or native sediment to the toe of the dam. These activities are performed at diversions that sustained damage from heavy storms and occur on an as-needed basis.

This HCP covers the potential impacts of SCE's O&M of its diversion structures on potential future Covered Species fish populations established through translocation as part of the HCP Conservation Strategy. The following sections describe diversions associated with O&M of SCE's hydropower facilities that could affect or result in the incidental take of fish populations translocated to these stream reaches.

Mill Creek Facilities (SCE.1) – Phase 1

The Mill Creek facilities are located on Mill Creek in San Bernardino County, California. These facilities are approximately 15 miles east of the City of Redlands on the lower coastal slopes of the San Bernardino Mountains. Elevations in the project area range from approximately 2,950 feet at the Mill Creek 1 Diversion to 5,000 feet at the Mill Creek 3 Diversion (Figure 2-10).

Mill Creek No. 1 Diversion

The Mill Creek No. 1 Diversion is located approximately 0.2 mile upstream of the Valley of the Falls Drive crossing of Mill Creek in the community of Forest Falls, San Bernardino County, and consists of a concrete diversion dam with a soft plug that directs flows into the intake. The Mill Creek No. 1 Diversion has a maximum daily flow rate of approximately 28.0 cfs. This facility's O&M activities include occasional repairs to the access road, concrete dam, and dam drain gate; removal of debris and sediment at the sandbox and intake/impoundment; and repairs to the soft plug following storm events. Removed material may be placed at the toe and heel of the dam. An excavator, backhoe, bulldozer and/or other equipment is used to repair the access road and dam, remove material from the intake and repair the soft plug, and realign the stream to ensure that it flows into the diversion. Prior to maintenance activities, water is diverted, using a small dike or sand bags, and is then directed either through a diversion dam drain gate or around and over the diversion dam to provide a dry working area.

Mill Creek No. 3 Diversion

The Mill Creek No. 3 Diversion is located at the Mill Creek Road/State Route 38 crossing of Mill Creek in unincorporated San Bernardino County, and includes a rubble concrete diversion dam, an intake structure with a steel debris grid and fish wheel, and a concrete sandbox. The dam is approximately 13 feet tall and the downstream side is approximately 26 feet wide and constructed of native materials. The soft plug is approximately 100 feet long, 14 feet tall, and ranges in width from approximately 30 feet at the concrete dam to 10 feet at the end. The Mill Creek No. 3 Diversion has a maximum daily flow rate of approximately 25.0 cfs. This facility's O&M activities include removal of debris in the intake, repairs and replacement (as-needed) to the soft plug, realignment of the stream where needed, and replacement of material at the toe and heel of the dam. Maintenance activities use a backhoe and bulldozer on tracks and other equipment as appropriate. Prior to maintenance activities, water is diverted, using a small dike or sand bags, and is then directed either through a diversion dam drain gate or around and over the diversion dam to provide a dry work area. When repairing the entire soft plug, native material is needed from the surrounding area. The use of the access road to the diversion typically prevents any mature vegetation from becoming established.

Santa Ana River Facilities (SCE.2) – Phase 1

The Santa Ana River facilities are located on the Santa Ana River in San Bernardino County. They are approximately 70 miles east of Los Angeles, near the City of Redlands, on the lower coastal slopes of the San Bernardino Mountains. Elevations in the area range from 2,720 feet at the Santa Ana River No. 3 Diversion to 3,470 feet at the Bear Creek confluence.

Bear Creek Diversion

The Bear Creek Diversion is located downstream of the Santa Ana Road/7 Pines Road crossing of Bear Creek in unincorporated San Bernardino County, and consists of a concrete diversion dam, soft plug, and intake with a fixed trash rack. The soft plug is approximately 600 feet long, 20 feet wide and 10 feet high. The Bear Creek Diversion has a maximum daily flow rate of approximately 28.6 cfs. This facility's O&M activities include the removal of debris in the intake, repairs to the soft plug, realignment of the stream, and replacement of the material at the toe and heel of the dam. Prior to construction, water is diverted upstream of the diversion so that it bypasses the diversion (Figure 2-10). Depending on the location of the repair work, a portion of the soft plug is removed for access. In addition to soft plug repairs, native material is placed on the downstream side of the diversion dam. Other activities at Bear Creek include work to reestablish the connection to an existing road that crosses Bear Creek, which allows access to the Santa Ana River No. 1 Diversion.

Santa Ana River No. 1 Diversion

The Santa Ana River No. 1 Diversion is a concrete diversion dam and intake with a fixed trash rack on the Santa Ana River, located downstream of the Santa Ana Road/7 Pines Road crossing of Bear Creek in unincorporated San Bernardino County. No soft plug is present. The Santa Ana River No. 1 Diversion has a maximum daily flow rate of approximately 67.7 cfs. This facility's O&M activities include removal of sediment and debris. At this facility, water cannot be diverted prior to activities. Up to 10 cubic yards of native material may be needed to protect the toe and heel of the dam. The use of the access road to the diversion typically prevents any mature vegetation from becoming established.

Santa Ana River No. 3 Diversion

The Santa Ana River No. 3 (SAR 3) Diversion is located approximately 3.5 miles upstream of Seven Oaks Dam in unincorporated San Bernardino County and consists of a concrete dam and soft plug adjacent to the Santa Ana River No. 1 powerhouse and a circular concrete sandbox. The soft plug is approximately 100 feet long, 12 feet wide (at the base) and 10 feet high. In 2008, four fish screens were added to the river pickup (RPU). The SAR 3 Diversion has a maximum daily flow rate of approximately 107 cfs. This facility's O&M activities include removal of debris, repairs to the diversion structures, and realignment of the stream. Repairs to the soft plug may use native material and require an adequate area in the streambed to conduct repairs. The soft plug is rebuilt using a bulldozer and other equipment. Access to this site is via an existing dirt and rock access road, which is re-established following flooding events. The Santa Ana River has historically been diverted into the SAR 3 Diversion by way of a small earth, rock, and boulder berm (of native materials) that directs flow into a natural, low-flow stream channel leading toward the diversion. This small berm is located about 450 feet upstream of the diversion. The stream flow is diverted around the SAR 3 diversion work site by diverting flow upstream of the diversion into a channel that bypasses the diversion. The existing stream diversion berm at this location is removed during activities, allowing water to flow into another low-flow channel bypassing the diversion, to facilitate work in a dry riverbed. Following completion of maintenance activities, the stream diversion berm is replaced.

Access to this stream diversion berm location is via an unimproved access path over sediment, rocks, and boulders scattered over this high-energy portion of the river channel canyon bottom. A bulldozer is used to re-establish access on top of the material. The SAR 3 Diversion site is primarily sand and gravel; vegetation consists of scattered, immature willows. Maintenance of the soft plug and adjacent impoundment occurs frequently enough to prevent growth of mature riparian species, assuming the flooding frequency does not naturally keep this vegetation down in the active stream channel.

Alder Creek Diversion

The Alder Creek Diversion consists of a small rubble concrete diversion dam, soft plug, and fish screen, located approximately 0.6 mile west of the Santa Ana River No. 1 powerhouse, in unincorporated San Bernardino County. The dam has a broad-crested weir that creates a minimum water depth of about 2 feet at the diversion. Below the intake structure is a low-level outlet to lower the water level to below the spillway elevation when necessary. The maximum daily flow rate is approximately 5.3 cfs (3.4 mgd). The Alder Creek Diversion has a soft plug that is approximately 60 feet long, 12 feet wide, and 5 feet tall. This facility's O&M activities include removal of debris in the intake and repairs to the soft plug; material may also be placed at the toe and heel of the dam. This material and other native materials are used to re-establish the soft plug. Repair of the entire soft plug requires native material. Access to and work within the creek are needed to repair the soft plug. This work requires the use of a bulldozer or backhoe and other equipment. Due to space constraints, Alder Creek cannot be diverted upstream of the diversion, and this work is conducted in a wetted stream channel. Maintenance activities typically prevent mature riparian species from becoming established, assuming the flooding frequency does not naturally keep this vegetation down in the active stream channel. Use of the access road to the diversion typically prevents any mature vegetation from becoming established.

Alder Creek Fish Barrier

In 2007/2008, as required by the FERC license, SCE installed a fish barrier (or gabions) at the existing access road crossing of Alder Creek. The purpose of the fish barrier is to prevent nonnative fish from swimming upstream into Alder Creek from water impounded behind Seven Oaks Dam. Following storm events, SCE re-covers the gabions with native rock material and removes any debris that has collected. This work requires the use of a backhoe and other equipment.

The Alder Creek channel at this location is approximately 10 feet wide. Alder Creek is diverted around the work site. Streamflow is diverted from half of the channel, via a diversion dam constructed of native material, while work on the other half is completed. Then the flow is diverted to the other side to complete the work.

Alder Creek Bridge

SCE brings tracked equipment (backhoes, tractors) up to its Santa Ana River facilities. To get the equipment up stream, SCE uses an access road around the Alder Creek Bridge, so that the equipment does not damage it. The access road is approximately 10 feet wide and 50 feet long, and is regularly blocked by rock boulders to prevent other traffic from driving around the bridge. The tracked equipment moves the rocks to cross Alder Creek and replaces the rocks after the work is complete. Water is not diverted; if water is present in the stream when access is needed, the equipment drives through the stream channel. Any effects on Alder Creek's bed, channel, and bank are limited to the crossing of one or two pieces of construction equipment. Boulders are moved around on the bank to allow for access. Because the route is used regularly and the area is regularly scoured, the vegetation remains immature.

Keller Creek Diversion

The Keller Creek Diversion consists of a concrete dam and soft plug. The soft plug is approximately 20 feet long, 15 feet wide, and 15 feet high. The Keller Creek Diversion has a maximum daily flow rate of approximately 3.2 cfs. This facility's O&M activities include removal of debris in the intake and repairs to the soft plug; material may also be placed at the toe and heel of the dam. Repair of the entire soft plug requires native material and is typically accomplished using a backhoe and other equipment. Prior to completing the repairs, water is diverted upstream so that it bypasses the diversion dam.

The use of the access road to the diversion typically prevents any mature vegetation from becoming established. Maintenance of the soft plug and adjacent impoundment occurs frequently enough to prevent growth of mature riparian species. Naturally occurring flood and scour events also keep this vegetation down in the active stream channel.

Lytle Creek Facilities (SCE.3) – Phase 1

Lytle Creek is a tributary of the Santa Ana River. It originates in the San Gabriel Mountains, drains the western portion of the San Bernardino National Forest through Lytle Creek Canyon, and meets the Santa Ana River near Colton, California. All facilities listed in this section, except Fontana, operate under FERC No. 1934.

Lytle Creek Diversion

The Lytle Creek Diversion, located approximately 0.4 mile west of the U.S. Forest Service Lytle Creek Ranger Station, consists of a rubble masonry gravity dam and two adjacent soft plugs, a concrete intake structure with trash racks and a revolving fish screen, and a concrete-lined sandbox (Figure 2-10). The primary soft plug is approximately 150 feet long, 20 feet wide, and 15 feet high. The secondary soft plug on the downstream side of the dam collects water that leaks from the dam, and this feature is approximately 75 feet long, 10 feet wide, and 8 feet tall. Additionally, there is a berm that runs perpendicular to the concrete dam; this feature is approximately 100 feet long, 50 feet wide, and 10 feet tall. The Lytle Creek Diversion has a maximum daily flow rate of approximately 21.0 cfs. This facility's O&M activities include removal of debris from the intake, repairs to the two soft plugs, and maintenance of the berm. Material is placed at the toe and heel of the dam on an as-needed basis. Repair activities use a bulldozer excavator and other equipment. Water is diverted upstream during repairs so that it bypasses the diversion dam. In addition to repairs following flooding damage, the secondary soft plug often requires repairs. Repair of the entire soft plug requires native material. Maintenance of the soft plugs and adjacent impoundment typically prevents mature riparian species from becoming established. Naturally occurring flood and scour events also keep this vegetation down in the active stream channel.

Lytle Creek Channelization

Article 404, Appendix A, Condition 6 of the License required SCE to adopt the Stream Channel Modification and Maintenance Plan. This plan requires SCE to re-establish a hydrological connection between (a) a future, flood-damaged channel near the entrance of the middle of the broad floodplain of Lytle Creek Canyon, located downstream of the Project dam; and (b) the low-flow channel on the western edge of that floodplain. Article 405, Appendix A, Condition 6 required SCE to adopt the Streamflow and Channel Effectiveness Monitoring Plan. This plan is intended to monitor the effectiveness of any future modification to the channel in the broad flood plain of Lytle Creek Canyon (known as Turk's Basin). This plan is activated following the implementation of the Stream Channel Modification and Maintenance Plan and the actual modification of the channel.

Fontana

The Fontana facility consists of a powerhouse, penstock, and intake. Water for the Fontana powerhouse originates in Lytle Creek. Once water passes out of the Lytle Creek powerhouse tailrace it flows downstream and enters the Fontana Union Water Company facilities in Lytle Creek and the intake for SCE's Fontana powerhouse. The water flows through a penstock to the Fontana powerhouse. This facility's O&M activities consist of monthly site visits to collect data and validate the operation of the acoustic velocity meter (AVM) as a function of water temperature, quarterly independent AVM check measurements with a portable AVM on the penstock, bi-annual U.S. Geological Survey (USGS) site inspections, and annual transducer service. SCE also performs penstock repair work. Forebay and tailrace maintenance is performed by the Fontana Union Water Company.

San Antonio Creek Facilities – Ontario No. 1 Diversion, Ontario No. 2 Diversion, and Ontario No. 2 Berm (SCE.4) – Phase 1

The Ontario No. 1 Diversion, Ontario No. 2 Diversion, and Ontario No. 2 Berm facilities are located along San Antonio Creek within the rough mountain and canyon terrain of the southern San Gabriel Mountains in Los Angeles County. San Antonio Creek is a tributary of Chino Creek, and thence the Santa Ana River. The San Antonio Creek Facilities are located just outside of the HCP Planning Area and were proposed for inclusion in the HCP very late in the HCP planning process. They are being included here for coverage from potential impacts of SCE's O&M activities of its diversion structures on potential future Covered Species fish populations established through translocation as part of the HCP Conservation Strategy (see Figure 2-4). A description of SCE's O&M at their San Antonio Creek hydropower facilities that could affect or result in incidental take of fish populations translocated to this stream reach is provided below.

Ontario No. 1 Diversion

The Ontario No. 1 Diversion consists of a concrete diversion dam and a soft plug made of existing native materials. The dam is approximately 15 feet long, 2 feet wide, and 5 feet tall. The soft plug is approximately 30 feet long, 10 feet wide, and 5 feet tall. The Ontario No. 1 Diversion has a maximum daily flow rate of approximately 23.0 cfs. This facility's O&M activities include removal of debris in the intake, repairs to the soft plug, and the placement of material at the toe and heel of the dam. Maintenance activities require the use of a backhoe and other equipment. Repair of the entire soft plug requires native material.

Other activities include road maintenance (of the asphalt road that leads to the Sierra Powerhouse off of Mount Baldy Road, and an existing unpaved road that is used to access the soft plug). Prior to maintenance activities, water is diverted using a small dike or sand bags. The water is directed through a diversion dam drain gate or around and over the diversion dam. Maintenance activities can then be completed in a dry work area. Maintenance of the soft plug and adjacent impoundment typically prevents growth of mature riparian species. Naturally occurring flood and scour events also keep this vegetation down in the active stream channel. The use of the access road to the diversion typically prevents mature vegetation from becoming established.

Ontario No. 2 Primary Diversion

The Ontario No. 2 Diversion consists of a concrete dam, intake, and soft plug. The dam is about 30 feet long and 12 feet tall, and the soft plug is approximately 20 feet long, 10 feet wide, and 8 feet tall. The Ontario No. 2 Primary Diversion has a maximum daily flow rate of approximately 30.0 cfs. This facility's O&M activities include removal of debris in the intake, repairs to the soft plug, and the placement of material at the toe and heel of the dam. Repair of the entire soft plug is accomplished with native material and work in the creek bed. This feature is accessed via an existing access path and is typically rebuilt using a backhoe and other equipment. Prior to completing the repairs, water is diverted upstream so that it bypasses the diversion dam.

Maintenance of the soft plug and adjacent impoundment at the Ontario No. 2 Primary Diversion dam typically prevents growth of mature riparian species, assuming the flooding frequency does not naturally keep this vegetation down in the active stream channel. The use of the access road to the diversion is regularly used, preventing mature vegetation from becoming established.

Ontario No. 2 Secondary Diversion

The Ontario No. 2 Secondary Diversion consists of a concrete dam approximately 15 feet wide and 4 feet high. There is no soft plug present at this facility. Water collected feeds into a 10-inch pipe that connects to the Ontario No. 2 Primary Diversion. It has a maximum daily flow rate of approximately 3.0 cfs. This facility's O&M activities at this facility consist of clearing sediment and debris from the upstream impoundment. After major floods, a rubber-tired backhoe is used. Access to the Ontario No. 2 Secondary Diversion is via an existing path from the primary channel.

Maintenance of the Ontario No. 2 Secondary Diversion dam is accomplished with backhoes and other equipment.

Ontario No. 2 Berm

The Ontario No. 2 Berm is located approximately 200 feet upstream from the Ontario No. 2 Diversion. The Ontario No. 2 Berm ensures that water flow in San Antonio Creek remains in the historic low-flow channel and enters the Ontario No. 2 Diversion. The berm has a base of approximately 20 feet by 20 feet and is 12 feet high. The berm is rebuilt following certain storm events.

Repair work occurs in the creek, and native material is required. The repair work requires a tracked excavator or a rubber-tired or tracked loader and other equipment. The equipment is "walked" up the canyon from existing access at the diversion vicinity, over adjacent upland and the dewatered historic low-flow channel. Alternatively, the equipment is "walked" down to the berm from an upstream access point via a dirt access road on private property, depending on the condition of the road at the time repairs are needed to the small berm.

San Bernardino Valley Municipal Water District Activities

Cactus Basin Recharge Project Maintenance (VD.1) – Phase 1

Valley District is working to recharge SWP supplemental water in the Cactus Basins (Figure 2-10). Recharge of SWP water will initially occur in the existing Basins 3 and 3A, and occasionally Basin 5. The Cactus Basins are located south of West Renaissance Parkway, east of North Ayala Drive, west of North Cactus Avenue, and north of West Etiwanda Avenue in the City of Rialto.

Prior improvements to Basins 3, 3A, 4, and 5 were permitted and completed in 2017 and included installation of a bypass pipeline along the perimeter of the basins and construction of water conservation berms within the basins. It is anticipated that imported water may also be discharged into one or more of these basins in the future, depending on conditions. Expansion of Basins 4 and 5 is not proposed by Valley District; however, maintenance of Basins 3, 3A, and 5 for the purposes of groundwater recharge is proposed for coverage under the HCP and included below. The bottoms of the basins along with the lower portions of the side slopes that may be inundated with SWP water will be kept permanently clear of vegetation to facilitate effective recharge.

Diversion

SWP water will be conveyed to the Cactus Basins from the Devil Canyon – Azusa Pipeline to the Cactus Basins for groundwater recharge through a series of new pipeline and existing stormwater drainage facilities owned by the City of Rialto and SBCFCD, respectively. Water will be directed to a specific basin or a combination of basins, depending on operational needs, through the bypass pipeline. The recharge of imported water may occur year-round. This project does not include the diversion of existing surface flows.

Operations

Operations for water conservation purposes will be managed by Valley District (Basins 3, 3A, and 5) in cooperation with SBCFCD. The Cactus Basins are hydrologically connected to Rialto Channel, which enters the Santa Ana River just upstream of the RIX facility. The recharge of imported water from the SWP is planned to occur year-round. There will be no diversion of existing surface flow.

Maintenance

Routine maintenance activities include maintenance of levees and access roads; bank repair; concrete structure repair; and removal of debris, sediment, and vegetation from the basins and culverts. Routine maintenance will begin from a post-construction baseline condition; therefore, no existing vegetation will be removed as a result of this project. The bottoms of each basin and inundated side slopes would be kept clear of emergent vegetation, algae, and debris using heavy equipment. Ongoing maintenance activities are proposed for coverage under the HCP.

The general O&M activities common to most of the Permittee Agencies are described in Section 2.1.6.

Active Recharge Project (VD.2) (Partnered with Western, RPU, and Conservation District)

The Active Recharge Project will divert a portion of stormflow from tributaries of the Santa Ana River for use in recharging groundwater supply. Eleven creeks have been identified as potential areas for new recharge basins, and three existing basins have been identified for modification to increase the current recharge capabilities. These two components collectively make up the Active Recharge Project. Water will be diverted from storm flows in the tributaries and directed into new and existing basins to recharge the San Bernardino Basin Area. The Active Recharge Project projects will be constructed in phases over approximately 15 to 20 years, based on funding availability, permitting schedules, and mitigation opportunities.

Ongoing maintenance activities are proposed for coverage under the HCP. See Section 2.1.6 for general O&M activities conducted by the Valley District for their existing or planned facilities.

Cable Creek Diversion and Basin (VD.2.02) – Phase 3

This project is located upstream of where Cable Creek is a maintained trapezoidal channel: east of Frontage Road and the I-215, adjacent to Washington Avenue, and southwest of West Meyers Road, in unincorporated San Bernardino County. The proposed improvements at Cable Creek for the Active Recharge Project will construct a 245-foot-long by 6-foot-diameter inflatable rubber dam diversion, three recharge basins covering a total wetted area of 37.9 acres, a 361,983 afy/500 cfs/323.1 mgd capacity basin inlet structure and piping, two surface transfer structures, and six basin drain tubes (Figure 2-10). The diversion, recharge basins, and drain tubes have been developed to utilize a gravity conveyance system and to maximize usage of the available area on the site. The northeast edge of the new basins will act as a levee to isolate uncontrolled high flows from the basin system. An inflatable rubber dam was selected for this site due to the frequent and high flow rates predicted to occur at the diversion site.

In general, the perimeter basin berms will be approximately 10 feet in height. The divider berms between the basins will also be approximately 10 feet high with slightly increased heights on the downstream slopes to terrace the basins to match the slope of the site. The maximum operating level within the basin will be approximately 8–10 feet deep for a storage volume of 281 acre-feet.

The area above the rubber dam diversion will act as the forebay for the diversion structure. While the dam is inflated the forebay area will pool water and increase the wetted area, thereby increasing the groundwater recharge yield in Cable Creek. The wetted area above the rubber dam (while the dam is inflated) has a volume capacity of approximately 8.6 acre-feet.

A series of model iterations were performed to help determine a target design flow rate of 361,983 afy/500 cfs/323.1 mgd for the diversion capacity. Based on the model results it was determined that the project benefit of an annual average flow of approximately 2,389 afy/3.3 cfs/ 2.1 mgd would be realized by constructing the Cable Creek Basin Project (Table 2-2).

Lytle Creek Diversion and Basin (VD.2.03) – Phase 4

This project is proposed within CEMEX's facility along Lytle Creek. Design plans are only conceptual, and the project has a relatively low probability of being implemented. Further, this project could only occur if mitigation lands within the Lytle Creek/Cajon Creek area were acquired and preserved prior to Phase 4 of HCP Implementation (see Chapter 5, *Conservation Strategy*). If implemented, the project would occur in Phase 4 of HCP implementation (after year 15), and area-specific conservation actions would be implemented in this portion of Lytle Creek in conjunction with the project. Area-specific conservation actions would focus on restoration and rehabilitation of San Bernardino kangaroo rat (SBKR) habitat in the vicinity of the project and connectivity of habitat around the project site. A large residential project is proposed adjacent to the conceptual location of VD.2.03. Consequently, if VD.2.03 is pursued, project-level design plans would need to account for the proposed adjacent development and any mitigation areas that may have been established for the development project.

The project would include proposed diversion(s) within Lytle Creek and a basin system for groundwater recharge. The exact location of the diversion and basins has not been determined, but for the purposes of this HCP a "worst-case" scenario project was analyzed, which is generally depicted on Figure 2-11, and includes the construction of a sand diversion berm, in-channel recharge berms, and a basin inlet structure and piping with a series of cells within the larger CEMEX basin area. The upstream end of the in-channel recharge area would require the construction and regular rebuilding of a sand diversion berm. The sand diversion berm would help to direct flows to the southern side of the existing island. The berm would be self-leveling during high flows to maintain the full flood control capacity of the creek. The basin inlet would be cooperatively designed and constructed with CEMEX's isolation berm planned for the basin area. A series of inner berms would be constructed within the basin area to terrace the site, create storage volume, and maximize the wetted area of the cells. The maximum operating level within the basin will be approximately 12–14 feet deep for a storage volume of 460 acre-feet.

The area above the CEMEX isolation berm will act as the forebay for the diversion structure. The forebay area will pool water and increase the wetted area, thereby increasing the groundwater recharge yield in Lytle Creek. The wetted area above the isolation berm has a volume capacity of approximately 223 acre-feet.

A series of model iterations were performed to help determine a target design flow rate of 500 cfs (323.2 mgd) for the diversion capacity. Based on these model iterations it was determined that a design diversion capacity of 500 cfs (323.2 mgd) would yield an annual average of approximately 3,620 afy/5.0 cfs/3.2 mgd (Table 2-2).

Mill Creek Diversion (VD.2.04) – Phase 4

This project is proposed at two discrete locations within the existing USACE flood control levee along Mill Creek. One location occurs approximately 1,300 feet downstream of the Garnet Street Bridge crossing of Mill Creek; the second occurs approximately 2,700 feet upstream of the Garnet Street Bridge crossing of Mill Creek in the community of Mentone. The Mill Creek Diversion is an upgrade to existing Conservation District facilities that turns out flow from Mill Creek adjacent to a USACE flood control wall, into a series of spreading basins that lay outside of the natural stream course. The spreading basins include approximately 59 small (each less than 3 acres) recharge basins with a total maximum wetted are of 66.7 acres and total storage volume of approximately 160 acre-feet. The diversion structure diverts flow using two separate discharge points. The upstream diversion outlet discharges directly into spreading grounds. The second outlet discharges into the spreading grounds by way of a channel named the North Canal. Restrictions in the diversion and canal inlet structures result in an underutilization of the full wetted area and storage volume of the existing Mill Creek Basins.

This project proposes the removal of the existing north inlet structure, construction of a new North Canal inlet with a capacity of 210 cfs, construction a new South Canal inlet gate, construction of a new bypass outlet structure with sediment transport features, and improvements to increase the capacity of the conveyance under the USACE flood control wall. Construction of these improvements would first demolish the existing inlet and reconstruct the canal inlet structure while at the same time increasing the diversion flow capacity of the North Canal Inlet. Additionally, the bypass outlet of the structure will be redesigned and reconstructed to increase the sediment bypass function of the structure (Figure 2-11). This project entails increasing the size or number of the outlet pipes and gates and does not have any additional permanent impacts within the active stream. The Mill Creek Diversion Active Recharge Project improvements will result in reduction in flow in Mill Creek of up to 7,9635 afy/11.0 cfs/7.1 mgd.

City Creek Diversion and Basin (VD.2.05) – Phase 4

The proposed project will be located east of City Creek, south of Boulder Avenue, and west of the western extent of Eucalyptus Avenue and Bledsoe Creek, in the City of Highland. The project will require a diversion structure to direct flows from within the main flow path of City Creek and Bledsoe Creek and into the proposed recharge basins. The basin(s) will be situated generally in upland areas between the main flow paths of City Creek and Bledsoe Creek. The diversion structures will be constructed within the active channels (Figure 2-11).

The proposed diversion structures within City Creek and in Bledsoe Creek will be designed to divert only a small portion of the stormwater peak flows and most or all of the stormwater low flows. Design plans are currently preliminary. One diversion option is an inflatable rubber dam with a series of basins in and around Baseline Avenue and Boulder Avenue bridge crossings. The basin layout will utilize a gravity conveyance system and will maximize the onsite recharge area while maintaining the required flood control capacity in City Creek Channel and Bledsoe Creek. The northwest and south sides of the new basins will be designed to isolate high flows from the basin system. The proposed diversion(s) will be installed at the upstream end of the basins system to maximize stormwater distribution into the percolation basins. Improvements may also include reconstruction of an existing levee along Bledsoe Creek.

In general, the perimeter basin berms will be less than 6 high feet higher than the adjacent ground. The berms dividing the basins will be approximately 5 feet high, with berm height increasing slightly downstream to match the slope of the site.

The area above the rubber dam (or similar structure) will act as the forebay for the diversion structure. When the dam is inflated, the forebay area will pool water and increase the groundwater recharge yield in City Creek. The wetted area above the rubber dam (while the dam is inflated) will encompass approximately 0.06 acre, with a volume capacity of approximately 0.23 acre-feet. Based on modeling results, the project is targeting a design flow rate of 361,983 afy/500 cfs/323.2 mgd for the diversion capacity and is expected to yield an annual average benefit of 4,662 afy/6.44 cfs/4.1 mgd (Table 2-2).

This project could only proceed if SBKR mitigation lands within City Creek/Santa Ana River are acquired and preserved ahead of project implementation (see Chapter 5). Project design plans will incorporate avoidance and minimization measures for SBKR, such as connectivity for SBKR upstream and downstream of the project alignment.

Plunge Creek – Basin 1 (VD.2.06) – Phase 2

The proposed project occurs in the watershed of Plunge Creek: within the immediate vicinity of the Orange Street crossing of Plunge Creek; in the concrete-lined portion of Oak Creek, just upstream of its confluence with Plunge Creek; and south of Greenspot Road, approximately 3 miles east of the I-210/5th Street Avenue crossing of City Creek in the City of Highland (Figure 2-11). The proposed project includes the construction of multiple diverter structures within Plunge Creek and its tributary Oak Creek. The diversion structure at Oak Creek will be constructed within an existing concrete channel structure and may include improvements to the outlet structure within Oak Creek near the confluence with Plunge Creek to mitigate potential scour. The Oak Creek diversion will divert flows from Oak Creek to a series of recharge basins proposed for construction south of Greenspot Road and immediately west of the intersection of Greenspot Road and Calle Del Rio Street in the City of Highland. The diversion within Plunge Creek will be located near the Orange Street bridge crossing and will divert water into basins located south of Plunge Creek, in areas covered for aggregate mining under the Wash Plan HCP. The project impact area within Plunge Creek depicted on Figure 2-11 depicts a maximal impact area where diversion structures may be located.

Project improvements will be designed to maintain the current floodplain and levels of flood protection. The basins will be constructed outside of the 100-year floodplain, where possible. The basins will be between 40 feet below and 25 feet above adjacent ground, with their ponding height a maximum of 6 feet above adjacent ground levels. The project will also include a structure to return flow back into Plunge Creek if the recharge capacity is less than the system inflow.

Based on modeling results, the project is targeting a design flow rate of 180,992 afy/250 cfs/161.6 mgd for the diversion capacity and is expected to yield an annual average benefit of approximately 3,113 afy/4.3 cfs/2.8 mgd (Table 2-2).

This project could only proceed if SBKR mitigation lands within the Santa Ana River Wash area are acquired and preserved ahead of project implementation (see Chapter 5). Project design plans will incorporate avoidance and minimization measures for SBKR, such as connectivity for SBKR upstream and downstream of the project alignment.

Cajon-Vulcan 1 Diversion and Basin (VD.2.07) – Phase 4

The Cajon-Vulcan 1 site, located southwest of the I-215/Palm Avenue crossing in the City of San Bernardino, was proposed to occur adjacent to Cajon Creek along the site's western edge, with project components within Cajon Creek just upstream of Institution Road (Figure 2-11). However, after completion of analyses associated with all Covered Activities (including this project), it was decided that this project would no longer be pursued and consequently would not be constructed. Because the decision to exclude the project did not occur until late in HCP development, the associated hydrologic and sediment analyses were not recalculated to subtract this project. Consequently, the impacts of this project, including the design flow rate and annual yield (the project was calculated to target a design flow rate of 361,983 afy/<500 cfs/323.2 mgd [during low flow conditions] and an annual benefit of approximately 579 afy/0.8 cfs/0.5 mgd), are still identified as impacts in the HCP. Therefore, there will be more water and sediment remaining in the system than is presented in the analyses.

Vulcan 2 Diversion and Basin (VD.2.08) – Phase 4

The Vulcan 2 site is located adjacent to the Devil Creek Diversion Channel, which borders the southeast edge of the proposed Vulcan 2 Basin. The proposed diversion would be located within the Devil Creek Diversion Channel immediately downstream of the Cajon Boulevard/Devil Creek Diversion Channel crossing, east of Cajon Wash, and adjacent to Gray Street (on the north side of the Devil Creek Channel), in unincorporated San Bernardino County. The basin site is southwest of Cajon Boulevard and approximately 7,500 feet south of the I-215/Palm Avenue crossing in the City of San Bernardino (Figure 2-11).

The Devil Creek Diversion Channel is a concrete-lined trapezoidal channel that delivers flow from the Devil Creek and Cable Creek drainage areas into Cajon Creek. The Vulcan 2 Basin site is currently an open space area/unimproved site planned for future aggregate mining. Overall the Vulcan 2 Basin site has an elevation differential of approximately 35 feet from the diversion location to the southwest end of the basin site (0.88% grade).

The proposed improvements at Vulcan 2 Basin for the Active Recharge Project will construct an inflatable rubber dam diversion across Devil Creek Diversion Channel and a series of basins from Cajon Boulevard extending southwest 4,000 feet (approximately four basins total). The basin layout has been developed to utilize a gravity conveyance system and to maximize usage of the available area on the site. The basin invert will be slightly lower than the Devil Creek Diversion Channel invert near the diversion point and slightly higher than the channel invert at the downstream most end of the basins.

An inflatable rubber dam (selected because the channel is trapezoidal in shape and concrete lined) will be constructed in the channel diversion. A diversion structure and inlet piping will be constructed from the channel to the first basin. A series of surface transfer structures and basin drains will be constructed between each basin as well as from each basin directly back into the channel.

In general, the perimeter of the basin will be constructed at existing grade with low perimeter berms. The average basin depth will range between 12 and 15 feet, with the maximum operating level within the basins at approximately 10–13 feet deep. The total wetted area of the basins will have a storage volume of 383 acre-feet.

The area above the rubber dam diversion will act as the forebay for the diversion structure. While the dam is inflated the forebay area will pool water above the dam; however, because the channel is concrete lined there will be no increase to groundwater recharge yield in the forebay.

A series of model iterations were performed to help determine a target design flow rate of 750 cfs (484.7 mgd) for the diversion capacity. Based on the model results it was determined that the project benefit would be approximately 796 afy/1.1 cfs/0.7mgd.

Lytle-Cajon Diversion and Basin (VD.2.09) – Phase 3

If this project is implemented it would occur in Phase 3 of HCP implementation (after year 10), and area-specific conservation actions would be implemented adjacent to Lytle-Cajon Basin in conjunction with the project. Area-specific conservation actions would focus on enhancement of SBKR habitat in the vicinity of the project and connectivity of habitat from one side of the creek to the other. The project could only occur if SBKR mitigation lands are acquired and preserved within or adjacent to Lytle Creek prior to Phase 3 of HCP implementation (see Chapter 5).

The Lytle-Cajon Basin site is located within the flow path of Lytle Creek Wash immediately downstream of West Baseline Road/Lytle Creek Wash crossing and upstream of the West 5th Street crossing of Lytle Creek. The basin site is approximately 1.9 miles southwest of the I-215/I-210 Interchange in the City of San Bernardino (Figure 2-12).

The proposed improvements at the Lytle-Cajon Basin site for the Active Recharge Project include constructing a series of in-channel recharge basins, totaling approximately 43 acres. The basins would increase the wetted area of Lytle Creek Wash and provide storage volume for stormwater capture and recharge. There would be eight basins constructed in series and operated as flow-through basins. The basin berms would be approximately 8–10 feet high, and the basins would be constructed of native creek bed materials. Sections of the basin berms perpendicular to the flow would self-level during high flow events to preserve the flood control capacity of Lytle Creek Wash. Each in-channel recharge basin would have an overflow surface transfer structure and a low-level drain tube.

The average operating level within the proposed basins will be approximately 6 feet, for a total wetted area of 43 acres and a storage volume of 244 acre-feet. There will be no groundwater recharge operations in the zones directly adjacent to the Radial Gate or USACE levees.

The proposed project would be placed in an existing flow-through system, and therefore there is no diversion or inlet restriction associated with this project. There were no model iterations needed to determine an optimum diversion flow rate. Based on the model results it was determined that the project benefit would be approximately 1,086 afy/1.5 cfs/1.0 mgd.

The proposed physical improvements for the Active Recharge Project at the Lytle-Cajon Basin Project include the construction of eight in-channel recharge basins, and eight new surface transfer structures and low-level outlets/drains. Each of the basins should include the construction of remote level sensing and inflow/outflow metering.

Plunge Creek – Basin 2 (VD.2.10) – Phase 3

The Plunge Creek – Basin 2 site is approximately 350 feet west of the I-210/Plunge Creek crossing, east of Palm Avenue, and south of West 5th Street in the City of Highland. The proposed diversion and basin would be situated within the existing flow path of Plunge Creek. The site is located in a wide area of the Plunge Creek Channel (Figure 2-12) and is currently bisected by the low flow channel of Plunge Creek. The proposed project would reroute the creek's flow path along the southern edge of the site. This project could only proceed if SBKR mitigation lands are acquired and preserved within/adjacent to Plunge Creek/Santa Ana River prior to Phase 3 of HCP implementation (see Chapter 5). Project design plans will incorporate avoidance and minimization measures for SBKR, such as connectivity for SBKR upstream and downstream of the project alignment.

Water flows through the site from east to west under I-210 and then continues west for approximately 2,000 feet before draining into City Creek. The southwest tip of the site is at the confluence of Plunge and City Creeks.

The proposed improvements for the Active Recharge Project at the Plunge Basin 2 site include the construction of 10.7 acres of basin, a 125-foot-long by 8-foot-tall inflatable rubber dam, a 253,388 afy/350 cfs/226.2 mgd diversion/inlet structure, a basin overflow structure, and a 36-inch-diameter basin drain. The site should also be improved by adding a flow measuring station in Plunge Creek at the diversion and flow meters in the diversion conduits to help facilitate operations.

The rubber dam diversion will be intentionally placed near the creek constriction to help encourage sediment transport past the dam and diversion structure. A rubber dam was selected for this site due to the frequent and high flow rates predicted to occur at the diversion site.

The perimeter berms of the basin along the east, south, and west sides will be approximately 10 feet high. The divider berm between the basins will also be approximately 10 feet high. The maximum operating level within the basin will be approximately 8 feet deep, for a storage volume of 66 acre-feet. To avoid jurisdiction from the State of California, Department of Water Resources, Division of Safety of Dams, the basin will be split into two smaller basins. The upstream basin will have a volume of 16 acre-feet. The downstream basin will encompass approximately 8.4 acres and have a volume of 50 acre-feet.

The area above the rubber dam diversion will act as the forebay for the diversion structure. When the dam is inflated this area will pool water and increase the wetted area, thereby increasing the groundwater recharge yield in Plunge Creek. The wetted area above the rubber dam (while the dam is inflated) has a volume capacity of approximately 1.5 acre-feet.

Stormwater capture of this project is accounted for in the annual average of approximately 3,113 afy/4.3 cfs/2.8 mgd attributed to the Plunge Creek – Basin 1 project (VD.2.06) (Table 2-2).

Devil Creek Diversion and Basins (VD.2.11) – Phase 2

The proposed improvements at Devil Creek Basins for the Active Recharge Project are located within the existing Devil Creek Infiltration Basin site at the intersection of Devil's Canyon Road and Ben Canyon Road. The project will construct an inflatable armored dam (Obermeyer Spillway Gate) diversion across Devil Creek to increase the diversion flow rate capacity and divert low flows that would otherwise pass by the basins. Two new recharge cells will be constructed below the existing Basin 1 and above the USACE levee. Additionally, the existing inter-basin surface transfer structures and low-level outlets/drains will be refurbished and/or replaced as a part of the project (Figure 2-12).

A new operational plan would need to be developed with SBCFCD in order to realize the project benefit at Devil Creek Basins. In general, higher flows would be diverted into the basins more frequently, and the basins would be operated at higher water surface elevations (WSEs) for longer durations to allow captured stormwater to be infiltrated into the basins. The existing basins will be cleaned to remove deposits of silt and clay. The average operating level within the basins will range from 7–10 feet, for a total storage volume of 242 acre-feet.

Based on field observations and preliminary hydraulic analysis it is estimated that the existing diversion capacity could be as high as 361,983 afy/500 cfs/323.2 mgd with the proper hydraulic conditions. In order to create adequate hydraulic head to convey that amount into the basins a new armored spillway gate will be needed. Approximately 2,027 afy/2.8 cfs/1.8 mgd would be realized by constructing the proposed improvements and re-operating the Devil Creek Basins.

The proposed physical improvements for the Active Recharge Project at the Devil Creek Basins include the construction of a 250-foot-long by 8-foot-tall spillway gate, and refurbishment of three inter-basin surface transfer structures and five low-level outlets/drains. Each of the basins should include the construction of remote level sensing and inflow/outflow metering. The site should also be improved by adding a flow measuring station in Devil Creek at the diversion site and flow meters in the diversion structure to help facilitate operations. The project may also include a connection (via pipeline or concrete channel) to the Foothill Feeder Pipeline to enable recharge of SWP water within the basins. The connection would be constructed in upland habitat north of the most northwest basin (Figure 2-12).

Waterman Basin Spreading Grounds Channel Maintenance (VD.2.12) – Phase 1

The Waterman Basin Spreading Grounds site is located along the west branch of Waterman Creek and is bordered by North Waterman Avenue to the west and East 40th Street to the south (Figure 2-12). The Waterman Basins have an elevation differential of approximately 90 feet over the 2,800-foot site (3.2% grade). The basins are an existing SBCFCD facility (System # 2-403-4 A-D) located approximately 3.2 miles northeast of the I-210 /I-215 interchange in the City of San Bernardino. The existing basins attenuate storm flows from Waterman Creek. The hydrologic changes (i.e., flow captured by the basins) are proposed to be covered under this HCP. The proposed improvements are intended to increase the diversion capacity from the current maximum of 180 cfs to 1,000 cfs.

The proposed physical improvements for the Active Recharge Project at the Waterman Basins include the construction of two approximately 17-foot-long by 8-foot-tall spillway gates, refurbishment of 2 radial gate systems, and refurbishment of all inner-basin surface transfer structures and low-level outlets/drains. Installation of remote level sensing and inflow/outflow metering is planned for each basin. In addition, a flow measuring station will be added in Waterman Creek at the diversion site along with flow meters in the diversion structure to facilitate operations. Other improvements include restoring two upper basins that have lowered function due to limited maintenance over time. These improvements may include total or partial reconstruction of the diversion gates. Maintenance of the basins is covered under a separate permit.

Operations

Water flows into the Waterman Basins from the north and is routed through the basins by a radial gate diversion and two sluice gates. High flows or flows that bypass the basins enter Twin Creek north of 40th Street. Flows leaving the basins are discharged at the southeast corner of the site and also flow into Twin Creek. The west and south perimeter berms of the site are a USACE and Federal Emergency Management Agency (FEMA) Certified levee.

There are four primary basin groups within the Waterman Basins site that provide an opportunity to increase stormwater capture and groundwater recharge in the basins. The basins are interconnected by a series of surface transfer structures and low-level drain tubes. Together, these basins allow for stormwater capture of approximately 180 acre-feet.

A new operational plan would be prepared in order to implement increased stormwater capture and recharge at the Waterman Basins. In general, higher flows would be diverted into the basins more frequently and the basins would be operated at higher WSEs for longer durations to allow captured stormwater to be infiltrated into the basins.

Based on field observations and preliminary hydraulic analysis it is estimated that the existing diversion capacity could be up to 723,967afy/1,000 cfs/646.3 mgd with the proper hydraulic conditions. A new armored spillway gate will be added to create adequate hydraulic head to convey the diverted water into the basin. Based on the recharge rate modeling conducted to identify the optimal diversion flow rate, the project benefit would be an annual average of approximately 1,448 afy/2.0 cfs/1.3 mgd (Table 2-2).

Maintenance

The existing basins were cleaned to remove algae, emergent vegetation, and deposits of silt and clay in September 2017 under a separate permitting process with stand-alone mitigation. This resulted in a current baseline condition of clean sand surface on the floor of the basins. The basin floors will be maintained in that state permanently in order to ensure effective recharge of water. Channel maintenance activities are covered under this HCP, and described in Section 2.1.6.

Twin Creek Spreading Grounds (VD.2.13) – Phase 2

This project includes two elements: improvements at the Twin Creek Spreading Grounds and operations and maintenance of the Twin Creek, 29th Street, and Lynwood Basins. The Twin Creek Basins are located north of I-210, north and south of 40th Street, west of Harrison Street, and east of Valencia Avenue. The 29th Street and Lynwood Basins are located immediately south of the Twin Creek Basins, south of I-210, north of E. 27th Street, west of Cedar Street, and east of North San Gabriel Street. All basins occur within the City of San Bernardino. Because all of the aforementioned basins are interconnected along Twin Creek, for ease of reference they are collectively referred to as Twin Creek Spreading Grounds in this HCP. Project activities within the basins located north of East Lynwood Drive include reconstructing and armoring the berms between each basin and adding low level outlets/drains to each basin. Additionally, portions of the basins will need to be regraded to restore infiltration rates and achieve positive drainage (Figure 2-12). Other improvements include maintenance of basins located south of East Lynwood Drive, and improving the inlet and outlet structures.

New Construction

The proposed physical improvements for the Active Recharge Project at the Twin Creek Spreading Grounds Basins, located north of East Lynwood Drive, include the reconstruction and armoring of seven existing berms, construction of one new water conservation berm above E. 40th Street, construction of eight new low-level outlets/drains, and basin regrading. Each of the basins may also include the construction of remote level sensing and inflow/outflow metering. These basins are subject to regular O&M by SBCFCD for flood protection purposes. Construction proposed under this project will occur within areas subject to regular maintenance.

Operations

In general, the basin drain tubes will remain closed and the basins will be operated at higher WSEs for longer durations to allow captured stormwater to be recharged through the basins. During very high flow events the basins will be operated to achieve flood control functions, which may include draining water out of the basins.

There are no diversion or inlet restrictions associated with this project. Modeled recharged rates indicate that the project benefit would be approximately 2.66 cfs/1,926 afy/1.7 mgd. The average operating level within the basins will range between 4 and 8 feet, for a storage volume of 372 acre-feet. The construction of the new water conservation berm will prevent groundwater recharge operations in the zones directly adjacent to the USACE levees.

Maintenance

All of the aforementioned basins will be maintained for water recharge purposes, including sediment removal (removal of silt and clay). The general O&M activities common to most of the Permittee Agencies are described in Section 2.1.6.

Badger Basins (VD.2.14) – Phase 4

The Badger Basins are located north of Campus Circle and east of the intersection of Badger Canyon Road and West Frontline Road in the City of San Bernardino (Figure 2-12). The facility is owned by SBCFCD.

Note: Project activities are no longer proposed at this location; however, because of the late timing associated with removal of this project (the decision was made very late in the HCP process), impacts associated with this project are still included in the HCP. This project had no hydrologic impacts, but ground-disturbing impacts were identified, and remain in the HCP impact assessment.

Enhanced Recharge Project – Seven Oaks Dam Water Conservation Improvements (VD.3) – Phase 1

The Enhanced Recharge Project – Seven Oaks Dam Water Conservation Improvements is located in the wash area of the mainstem of the Santa Ana River downstream of Seven Oaks Dam. It is divided into three parts. Parts 1a and 2 are covered under separate permits or the Wash Plan HCP and include modification of existing facilities for improved sediment management and structure protection (Parts 1a and 1b) and extension of the existing Water Conservation District canal, and construction of new spreading basins for groundwater recharge (Part 2). Part 3 is proposed as a Covered Activity under this HCP and described below (Figure 2-13). Refer to Table 2-2 for the average annual hydrological change for this Covered Activity.

Change in Operations of Water Diversion Structure

Valley District would change operations at the Cuttle Weir water diversion structure from the existing diversion of 141,174 afy/195 cfs/126 mgd so that up to 361,983 afy/500 cfs/323.2 mgd of Santa Ana River water can be diverted into the Conservation District's canal, the sedimentation basin, and the enhanced spreading basins for groundwater recharge into the San Bernardino Basin Area. The water may also be delivered for direct use through the first part of the Plunge Pool Pipeline. Valley District has the rights to 1,250 cfs, but this HCP only address the recharge of 500 cfs. The Cuttle Weir is an existing concrete structure located downstream of Seven Oaks Dam, where Santa Ana Canyon Road crosses the Santa Ana River.

Plunge Pool Pipeline

When conditions warrant (e.g., groundwater mounding, liquefaction), all or a portion of the 500 cfs would be sent to the inland feeder pipeline for groundwater recharge via the Plunge Pool Pipeline. The Plunge Pool Pipeline would connect approximately 2 miles of 98-inch-diameter pipe to the existing Inland Feeder pipeline owned and operated by the Metropolitan Water District of Southern California (Metropolitan).

Maintenance

Ongoing maintenance activities are proposed for coverage under the HCP. See Section 2.1.6 for general O&M activities conducted by the Valley District for their existing or planned facilities.

San Bernardino Municipal Water Department Activities

Vulcan Mining Groundwater Recharge Basins (WD.4) – Phase 4

New Construction

The Vulcan Mining Groundwater Recharge Basins are located east of Cajon Wash, northerly of Devil Creek Channel, and westerly of Cajon Boulevard within existing aggregate mining pits owned by Vulcan Materials Company (Figure 2-13). The Water Department proposes to develop groundwater recharge facilities within the basins in conjunction with Vulcan Materials Company for recharge of water supplied through the SWP, which would include construction of an SWP turnout, a metering facility, and the placement of a pipeline. The project will not include water supply from surface water diversions.

Maintenance

It is estimated that the pipeline is likely to be repaired or replaced once during the life of the permit. An approximately 25- by 100-foot temporary construction area would be required. General maintenance activities are expected. The general O&M activities common to most of the Permittees are discussed later in this section.

Western Municipal Water District of Riverside County Activities

Arlington Basin Water Quality Improvement Project (West.6) – Phase 1

New Construction

Western is planning to construct new artificial recharge basins at three different stormwater channels within the Arlington groundwater basin to provide additional water supply to the cities of Norco and Corona. The selected sites, located in the immediate vicinity of the Arlington Desalter in the City of Riverside, are commonly referred to as the Victoria site and other potential sites (Figure 2-13). These locations are generally located south of SR-91, west of Jackson Street, east of Myers Street, and north of Cleveland Avenue. Stormwater from Mockingbird Reservoir would be captured during stormwater events within the Victoria basin (located immediately south of the intersection of Jackson Street and Victoria Avenue), and when water is available in the channel and capacity remains at the basins. The Victoria site is located in previously disturbed, non-operational farmlands. Common to the Victoria site and other potential sites, construction will include clearing and grubbing, earth work/removal, grading, inlet works, berms, and outlet works (spillway and interconnecting pipelines). These basins would be designed to capture and recharge stormwater, as well as any other recycled water that may be available in the future.

By enabling an increase of Arlington Desalter product water by up to 1,810 afy/2.5 cfs/1.6 mgd, this project effectively integrates various water resource management goals, including improved runoff management, groundwater recharge and water quality management, and provides a cost effective solution for preserving lower-cost local groundwater supplies for those areas receiving Arlington Desalter product water including the City of Norco and the City of Corona.

The construction would be scheduled in the late spring through fall to avoid wet weather delays. Construction activities are expected be completed within several months at any specific location.

Operations

Operation of the project would consist of operation of spillways and pipelines to provide water to the basins for recharge. It is estimated that between 1,810 and 2,534 afy/2.5 and 3.5 cfs/1.6 and 2.3 mgd of stormwater and non-potable water may be recharged by these facilities.

Maintenance

Maintenance activities for these recharge basins will consist of annual cleaning to remove accumulated sediment, bank repair, and vegetation and vector control. Access road maintenance may also be required. Maintenance is expected to occur during the fall prior to the wet season. See Section 2.1.6 for general O&M activities conducted by Western for their existing or planned facilities.

West Valley Water District Activities

Southern California Edison Afterbay Recharge Basins and Maintenance (WV.1) – Phase 1

West Valley is requesting coverage for maintenance of SCE's afterbay recharge basins and canal under the HCP. The SCE afterbay recharge basins are used to recharge water originally diverted at the existing SCE hydroelectric facility located on Riverside Avenue in the City of Rialto (Figure 2-13). This water originates from Lytle Creek and is used for power production by SCE before going to West Valley or the Fontana Water Company. If West Valley takes the water it goes to the Oliver P. Roemer Water Filtration Facility (WFF) for drinking water treatment.

However, Lytle Creek surface water flows fluctuate seasonally, and highly turbid water known as *china clay* is periodically encountered during heavy rain events in the upper portion of Lytle Creek. During these events the WFF is unable to take the water due to high turbidity, and the water is diverted to the SCE Afterbay Recharge Basin through an open canal for groundwater percolation. The frequency and quantity of water turned out to the SCE afterbay recharge basins during these heavy rain events varies and is dependent on the severity of the storm. There is a potential that the location and configuration of this project could change in the future. However, the impacts identified and assessed in this HCP represent the maximum potential impacts, regardless of a potential future change in location and configuration.

Maintenance of the existing basins and open canal is anticipated to be needed up to twice per year, and may include weed abatement, berm repair, sediment removal, and bottom scarification using heavy equipment such as dozers, dump truck, and excavator. Sediment material may be rearranged on site, retained for use in habitat improvement, management, and monitoring sites (if composition is appropriate) or removed to offsite disposal. See Section 2.1.6 for general O&M activities conducted by West Valley for their existing or planned facilities.

2.1.3 Wells and Water Conveyance Infrastructure

Wells and water conveyance infrastructure activities are related to the creation or improvement of wells, storage facilities, pipelines, channels, and ancillary facilities (e.g., access roads) and the O&M of existing infrastructure and associated development. The location of these activities is illustrated on Figure 2-14.

East Valley Water District

East Valley Water District Pipelines Maintenance (EV.2) – Phase 1

The subsections below describe activities associated with East Valley's water pipeline maintenance (Figure 2-15). There are 12 locations where EV.2 pipelines intersect with sensitive biological resource areas: seven are located within the environs of the Santa Ana River Wash, and five are located within the environs of City Creek. The seven within the Santa Ana River Wash environs are:

- Crossing of Santa Ana River: above ground, immediately downstream of the Cuttle Weir.
- Crossing of Santa Ana River: below ground, immediately downstream of the Greenspot Road crossing.
- Buried pipeline below Cone Camp Road, traversing south from Greenspot Road (along Cone Camp Road) and then east to East Valley's Well 125.
- Crossing of Plunge Creek: above ground, northeast of the intersection of Frontera Del Norte and Vista Rio in the City of Highland.
- Culvert at Plunge Creek: north of the Greenspot Road crossing of Plunge, west of water reservoirs located at terminus of Calle Del Rio Street in the City of Highland.
- Crossings of Plunge Creek (both below ground): immediately upstream and immediately downstream of the Greenspot Road crossing of Plunge Creek.
- Crossing of Elder Creek at Abbey Way in the City of Highland.

The five within City Creek environs are:

- Crossing of City Creek: 5th Street/Greenspot Road Bridge, attached to bridge deck.
- Bledsoe Creek and environs: immediately west of the western terminus of Eucalyptus Avenue in the City of Highland.
- Crossing of City Creek: Baseline Road Bridge, attached to bridge deck.
- Crossing of City Creek: Highland Avenue Bridge, attached to bridge deck.
- Crossing of City Creek: adjacent to the water treatment facility located north of Highland Avenue Bridge, buried.

New Services (New Construction)

Any time a customer signs up for a new service to a property that does not have an existing service East Valley will install a new service for them. This requires exposing the water main where the new service is to be installed and welding or tapping a new line into the existing main, installing a new lateral and meter. The same equipment used to repair leaks is generally used when installing new services.

Maintenance

Ongoing maintenance activities are proposed for coverage under the HCP. See Section 2.1.6 for general O&M activities conducted by East Valley. Temporary impact areas will be restored to pre-project conditions following completion of maintenance activities.

Activities specific to East Valley will include:

Flushing

Depending on the pipeline design, low points and dead ends require regularly scheduled flushing to remove sediment or stagnant water. A "blow off" or hydrant can be flushed for anywhere from 2 to 10 minutes at a flow rate of about 1,200 gallons per minute. The flow is directed to an existing storm drain, the street or curb, or gutter. Sodium thiosulfate is used to neutralize any chlorine residual.

Repairs

Leaks may occur in all water systems. Over time the vibration of traffic, earthquakes, and water hammer can cause damage to infrastructure and cause leaks. This can happen at various points in the infrastructure including meters, air/vacuum valves, blow-offs, hydrants, fittings, and/or joints. Repairs to the damaged area would likely require a backhoe, excavator, or hand digging to expose and uncover the leak in the pipeline. Depending on the size of the leak a repair band could be used to repair it, but in cases where the leaks are large, pipe sections might need to be replaced entirely.

East Valley owns pipelines placed in bridges that cross creeks or rivers, and on occasion, these pipelines can leak. To make repairs, equipment needs to be placed underneath the pipeline, which requires backhoes or excavators be placed in the creek or river. As described above, East Valley owns pipelines attached to bridges that cross City Creek at three locations: 5th Street/Greenspot Road, Baseline Road, and Highland Avenue, all in the City of Highland. Existing ramps off levees would be used to access each of these locations if maintenance was needed. The project site would be restored to pre-project conditions.

Replacement

When water lines begin to develop many leaks in the same area East Valley replaces the main instead of continuing to make repairs. This could mean replacing certain sections (hundreds of feet) or longer runs (thousands of feet).

Cleaning Appurtenances

Over time, any facilities that are exposed to the elements fade and become dirty. This includes hydrants, air/vacs, and blow-offs. Once a year East Valley staff cleans and repaints such facilities.

North Fork Pipeline

East Valley is the majority shareholder in the North Fork Water Company. As majority shareholder East Valley oversees the delivery of water shares to other shareholders as well as maintenance. The North Fork pipeline consists of 7.5 miles of 24- to 58-inch pipeline, 12 weirs, 2 sand separator boxes, 2 siphons, manholes, and blow-offs. The North Fork pipeline begins at the SCE afterbay that is located near the Seven Oaks Dam and ends near the intersection of Highland and Palm Avenues. The pipeline is mostly located in an easement that was acquired when it was constructed. On occasion the weirs and sandboxes fill up with dirt and debris and require cleaning. East Valley staff uses a tractor truck to clean out all the debris. On occasion the pipeline also develops leaks. East Valley staff repairs these in a similar fashion as distribution pipelines.

East Valley Water District Existing Facilities Maintenance (EV.3) – Phase 1

Facilities and Reservoirs

East Valley currently has 27.6 million gallons of storage in its system in both concrete and steel reservoirs. East Valley properties require periodic maintenance and activities associated with property maintenance that include the following (Figure 2-15).

- Vegetation Control
  - Vegetation control consists of cutting plants as close to the ground as is practical. All but desired plants shall be completely removed at East Valley Plants 24, 27, 28, 33, 40, 108, 120, 134, 142, 146 and 149, on regularly scheduled dates. In addition, nonnative plants shall be removed at the following locations: Plant 150 Parcel 0279-211-34 (4.56 acres) near 5th Street and County Road; future Plant 152 Parcel 0155-151-25 (2.87 acres) near Mountain Avenue and Citrus Street; three Patton Parcels 1191-251-02, 1191-251-05, 1191-251-06 (9 acres) near Highland Avenue and Central Avenue; and New District Offices Parcels 1192-241-01, 1196-231-01 (22 acres) near Sterling Avenue and between 5th and 3rd Street, as well as the Parcel 1192-421-12 behind the Highland Post Office.
  - Where practical, vegetation control at all East Valley Plants shall be performed at the site perimeters consisting of a 3-foot strip exterior to the compound fences.
  - Vegetation control at East Valley Plant 33 shall be performed in the area between the east side of the driveway and the flood control fence.
- Litter
  - Remove all nuisance litter and trimmings from the premises at each regularly scheduled maintenance visit.
- Inspection and Notification
  - Perform the site inspections at each regularly scheduled maintenance visit.
- Plant Replacement
  - Promptly remove any dead or dying trees, shrubs, groundcover and any other plants that are dedicated to the planned landscape design.

Access Roads and Ditches

East Valley currently maintains 9 miles of dirt access roads and 3 miles of paved access roads within their service area and will continue to maintain these roads as needed (monthly, quarterly, and bi-annually). East Valley also annually repairs and maintains open ditches within the service area through bank repair.

The general O&M activities common to most of the Permittee Agencies are described in Section 2.1.6.

East Valley Water District New Reservoirs and Pipelines (EV.5) – Phase 3

In the recently updated Water System Master Plan, an analysis determined that East Valley would need an additional 32 million gallons of storage for the system build out in 2035 (MWH Global 2014) (Figure 2-15). The water master plan has identified the following (zone, size, number) reservoirs are needed:

- Mountain Zone – 1 and 2 million gallons
- Canal Zone – 2.5 and 2 million gallons
- Foothill Zone – 2 and 4 million gallons
- Upper Zone – 1 and 3 million gallons
- Intermediate Zone – 5 million gallons
- Lower Zone – 2 and 3.5 million gallons

A preliminary investigation has determined some potential sites but an additional study would be needed to determine the best locations for the additional storage. As indicated in the water master plan, East Valley will require additional reservoirs ranging in size from 1 to 5 million gallons. For the construction and maintenance of storage reservoirs the following activities would be required:

- Clearing, grubbing, and grading
- Trenching and construction of new pipelines leading into and out of the new reservoir
- New or upgraded boosters to pump into or out of the new reservoir
- Drain lines for overflow or emptying the reservoir for maintenance
- Electrical panels, conduits, and transformer
- Buildings to house water conveyance and water reuse projects

Maintenance

The general O&M activities common to most of the Permittee Agencies are described in Section 2.1.6.

Metropolitan Water District of Southern California Activities

Upper Feeder Santa Ana River Bridge Project (Met.1) – Phase 1

The Upper Feeder aboveground concrete bridge crossing of the Santa Ana River is located north of the northern extent of Wilderness Avenue in the City of Riverside (Figure 2-15). Maintenance work on this section of the pipe, bridge, and existing access roads (located north and south of the Santa Ana River at the ends of the bridge) would include ongoing vegetation management beneath and adjacent to the Santa Ana River Bridge Crossing and the north access road maintenance program. Metropolitan proposes to routinely maintain vegetation along the dirt access road on the north side of the river and along the length of the bridge outside of areas of flowing water within the riverbed (see *Vegetation Management* under Section 2.1.6).

Vegetation would be trimmed back to the edge of the access road using mechanical mowers (tractor mounted or hand-held). The access road would then be bladed and any ruts filled in with existing soil. Grading of the road would include provisions to control flow of stormwater down the road (e.g., use of water bars and energy dissipation devices/design features). If required, clean soil could be imported to the site during access road maintenance. BMPs would be implemented in areas where clean soil is needed to protect adjacent riparian and aquatic habitat. It is anticipated that one to two truckloads of clean soil could be required in each year maintenance occurs. The finished road width would be maintained at approximately 15 feet, windrow to windrow. Vegetation would also be removed within up to approximately 26 feet from the centerline of the bridge, encompassing a total area of approximately 0.4 acre. Vegetation clearance within the riverbed would only occur outside of areas with flowing water within the riverbed. Worker access to the area around the bridge would be on foot. Vegetation clearance would be by hand; no heavy equipment would be used within the riverbed. Vegetation would be cut flush to the ground. The cut material would be placed in a chipper and collected for disposal off site. BMPs would be implemented

All vegetation maintenance and access road grading activities would be conducted between mid-September and mid-March, outside of the avian breeding season, in order to avoid direct impacts on nesting birds. Work would not be performed in the rain to ensure workers are able to safely access the work area on foot. Vegetation maintenance and access road grading would be performed annually, or more frequently as needed.

A long-term routine maintenance Streambed Alteration Agreement (Notification No. 1600-2013-0077-R6 Revision 2) has been issued for this maintenance work, which will expire on March 26, 2027. See Section 2.1.6 for general O&M activities conducted by Metropolitan for their existing or planned facilities.

Metropolitan Water District Pipeline Maintenance (Met.2) – Phase 1

Metropolitan's O&M activities are conducted on a regular basis and are intended to maintain existing pipelines and appurtenant pipelines structures throughout San Bernardino and Riverside counties (Figure 2-15). See Section 2.1.6 for a discussion of the general O&M activities common to most of the Permittee Agencies.

A majority of the pipelines traverse developed lands, but there are a number of pipeline sections that cross undeveloped lands, including streambeds. These sections include:

- From Lake Mathews west to the I-15 corridor. This segment crosses Temescal Wash approximately 0.5 mile north of the Cajalco Road Bridge crossing of Temescal Wash.
- Within the southern portion of Chino Hills State Park, east of the Orange/San Bernardino County line. This segment crosses the Santa Ana River at the Green River Golf Course west of the western extent of Crestridge Drive in the City of Corona.
- An approximately 0.4-mile segment of pipeline crossing San Sevaine Creek, north of Summit Avenue in the City of Rancho Cucamonga.
- An approximately 2.9-mile section of pipeline crossing Lytle and Cajon Creeks, from immediately south of the CEMEX facility at Lytle Creek, traversing northeast to just south of the Sheriff's facility, and then east across Cajon Creek, just south of Institution Road. This section of pipeline occurs within the City of Rialto, unincorporated San Bernardino County, and the City of San Bernardino, and shares the same alignment as a portion of pipeline described in VD.4.
- An approximately 0.4-mile segment within Lytle Creek, immediately north of the Foothill Boulevard crossing of Lytle Creek in the City of San Bernardino.

- An approximately 0.1-mile segment within the Santa Ana River, immediately downstream of the I-10 and immediately upstream of the Union Pacific Railroad crossings of the Santa Ana River in the City of Colton.
- A north-south section of pipeline from the Badlands in Riverside County north into San Bernardino County, including crossings of San Timoteo and Yucaipa Creeks.
- An approximately 1.8-mile section of pipeline extending from the northern extent of Opal Avenue (City of Redlands) to the southern extent of Cone Camp Road (City of Highland), including a crossing of the Santa Ana River.
- An approximately 2.1-mile section of pipeline within the Wash Plan HCP, extending from southern terminus of Cone Camp Road west to Boulder Avenue in the City of Highland.
- Crossing of Plunge Creek immediately north of the Greenspot Road crossing of Plunge Creek.
- An approximately 1.5-mile section of pipeline along the east bank/levee of City Creek extending from Boulder Avenue north to approximately 0.2 mile south of the Highland Avenue Bridge crossing of City Creek, and then crossing City Creek to north of the eastern extent of Atlantic Avenue in the City of Highland.
- A section of pipeline extending along the foothills of the San Bernardino Mountains, primarily within the San Bernardino National Forest, from the Devil's Canyon facility southeast to City Creek. The alignment traverses primarily undeveloped lands with crossings of Waterman, Twin, Daley, Little Sand, Sand, and Small Canyon Creeks.

Temporary impact areas will be restored to pre-project conditions following completion of maintenance activities. If project activities occur within an existing stream channel, the stream course will be restored to pre-project conditions in coordination with the resource agencies or as established in this HCP. All access roads will be returned to their pre-project conditions.

Metropolitan Water District Right-of-Way and Patrol Road Maintenance (Met.3) – Phase 1

Metropolitan's O&M activities are conducted on a regular basis and are intended to maintain existing facilities including existing patrol roads, power plants, and telecommunications sites throughout San Bernardino and Riverside Counties (Figure 2-15). Metropolitan has existing, long-term encumbrances on Metropolitan lands (i.e., telecommunication sites, road and utility crossings, and trails). Any new or renewed leases, easements, permits, and licenses Metropolitan issues will be required to operate under the terms of the HCP.

Metropolitan's maintenance activities are actions that occur repeatedly in one location and/or in many locations over a wide area (e.g., bank stabilization, storm-damage repair, facility maintenance). The majority of maintenance locations associated with Met.3 overlap and/or co-occur with Met.2 locations, and the majority of sites are located in developed areas. Existing dirt maintenance roads parallel many of the pipeline sections that occur within undeveloped lands, as described in Met.2 above. There are two general geographic locations where existing dirt roads, subject to periodic maintenance by Metropolitan, do not co-occur with existing pipelines: the Skyline Trail/Road, which occurs west of the western extent of Skyline Drive in the City of Corona, and extends west to the Orange County line near the crest of the Santa Ana Mountains within the Cleveland National Forest; and three segments of dirt roadway/trail within the southwest portion of Chino Hills State Park (Aliso Canyon Road, Lower Aliso Canyon Trail, and Wire Springs Trail). These existing dirt roads/trails are maintained on an as-needed basis to facilitate access to Metropolitan's existing facilities. Note, however, that these dirt roads/trails are shared by other users, and maintenance may be completed by these entities—for example, Chino Hills State Park, Cleveland National Forest, and other entities with telecommunications facilities along the crest of the Santa Ana Mountains. HCP coverage for maintenance of these existing dirt roads/trails is being requested by Metropolitan only.

Maintenance activities are generally performed periodically and include actions such as minor construction, earth-moving, or vegetation management activities that can affect listed species. Below is a list of typical Metropolitan maintenance activities. These activities also include O&M projects and activities that are being implemented under Metropolitan's Right-of-Way and Infrastructure Protection Program (RWIPP).

- Site inspections and repairs
- Stockpiling
- Access road maintenance
- Bank repair
- Structure repair
- Maintenance of culverts, canals, and diversion structures
- Dike repair
- Vegetation management, including fuel modification, and vegetation removal for maintaining water conveyance and facility infrastructure access
- Vector control

See Section 2.1.6 for descriptions of these activities, which includes the general O&M activities common to most of the Permittee Agencies.

Temporary impact areas will be restored to pre-project conditions following completion of maintenance activities. If project activities occur within an existing stream channel, the stream course will be restored to pre-project conditions in coordination with the resource agencies or as established in this HCP. All access roads will be returned to their pre-project conditions.

Orange County Water District Activities

Ongoing Maintenance of Prado Constructed Wetlands (OCWD.1) – Phase 1

The Prado Constructed Wetlands (PCW) consists of 46 individual artificial ponds, 45 weir boxes, conveyance channels, and a series of intervening dikes and maintenance (Figure 2-16). Proposed maintenance activities will occur within the wetland ponds, the diversion berm, the diversion/conveyance channels, and on access roads and water conveyance structures as described below.

Wetland Ponds

Once a year, one-third of the wetland ponds will be drained, and silt, sand, and vegetation will be removed to maintain their productivity. As a result, two-thirds of the ponds will be in operation at all times. The material will be removed from the wetland ponds with earth movers, bulldozers, front-end loaders, or similar equipment. The excavated material will be stored on site and used to rebuild pond levees and access roads when needed. The volume of material removed from the ponds typically will not exceed 10,000 cubic yards of material per year.

Diversion Berm

The diversion berm diverts up to half of the river's low flow into the PCW. The berm is approximately 45 feet in width, 200 feet in length, and 6 to 10 feet in height. Because the berm is washed away during high flows, it generally requires reconstruction up to six times per year. The materials used to repair and/or reconstruct the diversion berm are obtained only from the Santa Ana River at the diversion berm site. It will be necessary to excavate approximately 30,000 cubic yards of sediment from the Santa Ana River, at the diversion berm, annually to repair and/or reconstruct the diversion berm.

Diversion/Conveyance Channels

The PCW contains a series of diversion and conveyance channels that convey surface water flows to the wetland ponds. Periodically the levees along the diversion channels wash out or erode. Existing sediment from the Santa Ana River will be excavated to rebuild the diversion channel levees. An average of 10,000 cubic yards of material will be excavated annually to maintain the diversion channels. In addition, ongoing removal activities of nonnative invasive species such as the giant reed occur in the channels to maintain adequate surface water flows through the channels. Diversion channels will require rebuilding and/or maintenance up to six times per year.

Additionally, up to 10,000 cubic yards of sediment would be removed from the Cattail Channel at the convergence of the Southern Conveyance Channel near Wetland Pond E-6, and along the Southern Conveyance Channel near Wetland Pond S-1.

Up to 20,000 cubic yards of sediment would be removed from the diversion channel from the 60/40 reach. The excavated material would be deposited along the existing levees on each side of the channel.

Approximately once every 10 years, a large flood impacts the diversion and conveyance channels, and the diversion and conveyance channels would be reconstructed. As part of this reconstruction, sediment is excavated and moved on the site but there is no removal of sediment from the site.

Access Roads

A network of access roads at the PCW is needed to maintain the wetlands and facilitate habitat and wildlife management. The roads are constructed on the perimeter of the site and on sand levees along channels and around ponds. Periodically the access roads wash out and require reconstruction. In addition, nonnative invasive plant growth encroaching onto roads must be periodically removed. Sediment from the river will be excavated to rebuild the access roads. Up to six times a year, access roads will require rebuilding and/or maintenance. An average of 10,000 cubic yards of material will be excavated to maintain the access roads. Approximately once every 10 years, a large flood impacts the roads in the wetlands and sediment deposited by the flood is removed to rebuild the access roads. As part of this reconstruction of access roads, sediment is excavated and moved on the site but there is no removal of sediment from the site.

Water Conveyance Structures

Periodic vegetation removal activities, typically less than 10,000 square feet, are required at the outlets and inlets of water conveyance structures. Additionally, structures such as weir boxes and culverts, may be replaced. Approximately once every 10 years, a large flood impacts the water conveyance structures and sediment is excavated to rebuild the water conveyance structures. There is no removal of sediment from the site when the water conveyance structures are rebuilt.

Maintenance

Maintenance activities for the wetland ponds, the diversion berm, the diversion/conveyance channels, Pheasant Field Levees, and access roads and water conveyance structures will routinely occur as specified previously. The general O&M activities common to most of the Permittee Agencies are described in Section 2.1.6.

Riverside Public Utilities Activities

Pipeline Crossing from Rapid Infiltration and Extraction Facility (RPU.1) – Phase 1

New Construction

Project RPU.1 proposes to install a 36-inch-diameter pipeline under the Santa Ana River to transport water from the RIX facility (west bank of Santa Ana River) to the City of Riverside environs (east bank of Santa Ana River) (Figure 2-16). The recycled water would be purchased from the City of San Bernardino. In addition to being used by RPU, the pipeline could also benefit the conservation strategy of the HCP should additional recycled water supplies become available and desired at a downstream location to benefit the Santa Ana sucker and other riverine habitat needs. The project would be located east of Riverside Avenue and south of Agua Mansa Road in the City of Colton.

The new pipeline would be constructed at a depth of at least 20 feet below the existing elevation of the Santa Ana River bottom, for a stretch of about 1,000 linear feet. The total new pipeline length for the project would be approximately 3,000 linear feet. A steel conductor casing may be installed around the pipeline. Open-cut trench construction and jack and bore methods are being evaluated for construction of the pipeline. Construction is estimated to take approximately 12 months. A 50-foot construction easement would be required. A temporary 100-foot construction area may be necessary within the riverbed. Access to the riverbed will occur via an existing ramp located adjacent to the proposed project location, on the west river bank. After project completion the existing stream course and all temporary impact areas will be restored in coordination with the resource agencies or as established in this HCP. All access roads will be returned to their pre-project conditions.

Operations

The estimated reduction in discharge from the wastewater treatment plant could be up to 13.8 cfs (8.9 mgd). This amount is accounted for in the total discharge reduction as proposed by the Water Department in their Recycled Water Project (WD.1).

Maintenance

Visual inspection of the pipeline from the levee following large storm events, in addition to routine valve exercising would be conducted when necessary.

The general O&M activities common to most of the Permittee Agencies are described in Section 2.1.6.

Future Gage Canal Transmission Main (RPU.2) – Phase 1

New Construction

The project would install a 24-inch-diameter water transmission main crossing under the Santa Ana River and connect with existing pipeline facilities. The project is located east of the Tippecanoe Avenue overcrossing and west of Mountain View Avenue overcrossing of the Santa Ana River and south of East Central Avenue in the City of San Bernardino (Figure 2-16). The project proposes a new pipeline be constructed within property owned by RPU (south of the Santa Ana River) and connected with an existing pipeline north of the river. The pipeline would then cross under the riverbed and connect with an existing pipeline to the west. The river crossing would occur upstream and parallel to the existing Gage Canal Transmission Main at a depth of at least 20 feet below the existing elevation of the river bottom. The total pipeline length is 5,425 linear feet. Open-cut trenching construction and jack and bore methods are being evaluated for construction of the Future Gage Canal Transmission Main. The construction period will last approximately 12 months. RPU would require a 50-foot construction easement for the project. Access to the riverbed will occur via existing ramps in the Santa Ana River levees, where available. After completion of project activities, the existing stream course will be restored in coordination with the resource agencies or as established in this HCP. All access roads will be returned to their pre-project conditions.

Maintenance

Visual inspection of the pipeline from the levee following large storm events, in addition to routine valve exercising would be conducted when necessary. The general O&M activities common to most of the Permittee Agencies are described in Section 2.1.6, and pipeline maintenance may include the activities described therein under *Pipelines and Associated Facilities*.

Flume and Riverside Canal Pipeline Replacements (RPU.3) – Phase 1

New Construction

The Flume and Riverside Canal Pipeline Replacement project would replace two existing 42-inch-diameter pipelines that cross under the Santa Ana River east of the Union Pacific Railroad crossing of the Santa Ana River and north of Washington Street in the City of Colton (Figure 2-16).

The project proposes that the two replacement pipelines be constructed parallel to the existing Flume and Riverside Canal pipelines for a length of 1,580 linear feet at a depth of at least 20 feet below the existing elevation of the river bottom. A steel conductor casing may be installed around the pipeline. Open-cut trenching and jack and bore methods are being evaluated for construction of the pipelines. A 100-foot construction easement is anticipated for these replacements. The time period of construction is estimated to be 12 months. Access to the riverbed will occur via an existing ramp located adjacent to the proposed project location, on the west river bank. Following project completion, the existing stream course and all temporary impact areas will be restored in coordination with the resource agencies or as established in this HCP. All access roads will be returned to their pre-project conditions.

Maintenance

Visual inspection of the pipeline from the levee following large storm events, in addition to routine valve exercising would be conducted when necessary.

The general O&M activities common to most of the Permittee Agencies are described in Section 2.1.6.

Jurupa Ditch Company Well Field (RPU.4) – Phase 1

New Construction

RPU operates the Jurupa 7 well to provide non-potable water to the Jurupa Ditch Company. This project is located on the west bank of the Santa Ana River, downstream of the Riverside Avenue crossing of the Santa Ana River, at the very eastern extent of Wilson Street in the City of Riverside. This project will include the abandonment/removal of two wells and replacement with one new well to facilitate water delivery to the Jurupa Ditch Company (Figure 2-16). No hydrological changes are anticipated as a result of this project.

Maintenance

Maintenance will consist of rehabilitating the existing Jurupa 7 well until it is replaced with a new well. Rehabilitation will occur when necessary, which is estimated to be every 20 years. Rehabilitation of the well would consist of bringing in a pump rig to: remove and reinstall the well pump, brush and bail the well, and airlift and swab the well. Redevelopment of the well would include equipping the well with a temporary pump and pumping the well to waste, which would likely consist of discharging to a baker tank. Maintenance would include repair of existing or temporary construction of new access routes for vehicular ingress and egress. Additional maintenance at Jurupa 7 or a replacement well will also consist of monitoring and repair of an aboveground section of pipeline onsite and typical facility maintenance such as mechanical or electrical equipment replacement, or securing the site. All temporary impact areas will be restored to pre-project conditions following completion of maintenance activities.

The general O&M activities common to most of the Permittee Agencies are described in Section 2.1.6.

Bunker Hill Basin Proposed Wells and Pipelines (RPU.6) – Phase 1

New Construction

RPU plans to construct three new wells within the southern portion of the Bunker Hill Groundwater Basin (Figure 2-16). Each well will be implemented individually, and each well is expected to take up to 1 year to construct. This project will require new pipelines to connect with existing transmission mains, most of which will be within improved roadways and previously disturbed areas. The project will require fencing, lighting, and a pump house at each well site. At this time, RPU cannot determine the exact location for each well; however, for the purposes of this HCP, three representative sites were submitted for analysis (two locations were tentatively identified on the Gage Canal Property, located south of Central Avenue, between Tippecanoe Avenue and Mountain View Avenue in San Bernardino; and a third location was tentatively identified on vacant land located at the southern end of Barton Street, south of Baseline Street, also in San Bernardino).

Operations

New wells and their associated facilities will extract water from the underlying groundwater basin for municipal use. Generally, wells operate year-round.

Maintenance

Routine maintenance at each well site will consist of facility maintenance such as mechanical or electrical equipment replacement, or securing the site. Routine maintenance is not anticipated to have any environmental impacts. Rehabilitation at each well will occur approximately every 10 years and will consist of bringing in a pump rig to: remove and reinstall the well pump, brush and bail the well, and airlift and swab the well. Redevelopment of the well would include equipping the well with a temporary pump and pumping the well to waste utilizing onsite facilities or a baker tank. All impacts would be temporary in nature and would essentially consist of vehicular ingress and egress.

The general O&M activities common to most of the Permittee Agencies are described in Section 2.1.6.

Gage Canal Transmission Main Replacement (RPU.7) – Phase 1

New Construction

The project objective is to replace an existing 30-inch-diameter concrete cylinder water transmission main crossing under the Santa Ana River in the City San Bernardino, located east of Tippecanoe Avenue and south of Central Avenue (Figure 2-17). The project proposes that a new pipeline be constructed parallel to the existing main at a depth of at least 20 feet below the existing elevation of the river bottom. To accommodate the flow rate of future wells, it is also proposed that the new transmission main be upsized to a 42-inch-diameter steel cement mortar-lined and coated pipe. Open-cut trenching construction and jack and bore methods are being evaluated for the construction of the Gage Canal Transmission Main. The time period of construction is estimated to be 12 months. The project proposes an upsize replacement of the current transmission main to a 42-inch-diameter pipe for a length of 1,185 linear feet. Access to the riverbed will occur via the nearest existing ramp within the Santa Ana River levee, where available. Following project completion, the existing stream course and all temporary impact areas will be restored in coordination with the resource agencies or as established in this HCP. All access roads will be returned to their pre-project conditions.

Maintenance

Routine maintenance of pipelines is described in Riverside Public Utilities Maintenance of Supply Transmission Mains (RPU.15), below. Visual inspection from the levee following large storm events, in addition to routine valve exercising, would be conducted.

The general O&M activities common to most of the Permittee Agencies are described in Section 2.1.6.

Santa Ana River Sustainable Parks and Tributaries Water Reuse Project (RPU.10) – Phase 1

The proposed project is a joint project between RPU and Valley District to install approximately 52,000 feet of pipeline to deliver tertiary treated recycled water from the Riverside Regional Water Quality Control Plant (RWQCP) to Tributary Restoration Sites that are part of the conservation strategy of the HCP (Figure 2-17). The project is currently in the planning and design stage.

New Construction

New construction for the project includes the installation of approximately 52,000 feet of pipeline and additional facilities. Additional facilities include a storage tank, pump station, and dechlorination stations. The pipeline would also provide recycled water irrigation to several of Riverside's high-priority parks. Construction is expected to take 24 to 36 months. Following pipeline installation, temporary impact areas will be restored to pre-project conditions.

Operations

The City of Riverside is required to discharge a minimum of 25,000 afy/34.5 cfs/ 22.3 mgd to the Santa Ana River. Currently all discharge occurs at the City of Riverside's RWQCP, located immediately upstream of the Van Buren Boulevard crossing of the Santa Ana River. RPU (in partnership with Valley District/Upper SAR HCP) is proposing to change the point of discharge for a portion of this water, and RPU is also proposing to reduce the total volume discharged to the river for irrigation use.

Two sections of pipeline are proposed to be installed: West Purple Pipe and East Purple Pipe. The West Purple Pipe will run downstream from the RWQCP to provide a permanent source of water to the Tributary Restoration sites Hidden Valley Creek, Hidden Valley Wetlands, and Hole Creek. The East Purple Pipe will run upstream of the RWQCP to provide water to the Tributary Restoration sites Anza Drain, Old Ranch Creek, Tequesquite Creek, and Evans Lake. The East Purple Pipe will also convey water for landscape irrigation use. The City of Riverside proposes a reduction of approximately 4,674 afy/ 6.5 cfs/ 4.2 mgd of discharge to the Santa Ana River to be used for landscape irrigation. Approximately 4,272 afy/ 5.9 cfs/ 3.8 mgd is proposed to be conveyed via the West Purple Pipe for discharge to Hidden Valley Creek, Hidden Valley Wetlands, and Hole Creek, and approximately 5,076 afy/ 7.0 cfs/ 4.5 mgd is proposed to be conveyed through the East Purple Pipe for discharge to Anza Drain, Old Ranch Creek, Tequesquite Creek, and Evans Lake. Total volume proposed to be conveyed to the Tributary Restoration sites is 9,348 afy/ 12.9 cfs/ 8.3 mgd. Sites considered for delivery of recycled water discharge under this HCP include the following Tributary Restoration Sites via new pipeline constructed as part of the project:

East Purple Pipe

- **Anza Drain:** 728 afy/1.0 cfs/0.4 mgd. In addition to new pipeline for recycled water discharge, the construction of a dechlorination facility may be required. If needed, the facility would be constructed in previously disturbed, vacant areas. This facility would be utilized by both Anza Drain and the Old Ranch Road Channel.
- **Old Ranch Creek:** 1,448 afy/2.0 cfs/1.3 mgd.

- **Tequesquite Arroyo**: 728 afy/1.0 cfs/0.4 mgd. In addition to the new pipeline for recycled water discharge, a dechlorination facility may be constructed. If needed, construction would occur in areas that are already disturbed.
- **Evans Lake**: 2,172 afy/3.0 cfs/2.0 mgd. In addition to the new pipeline for recycled water discharge, there would also be construction of channel improvements and a dechlorination facility, which would occur in the already disturbed parking area located in Fairmount Park.

West Purple Pipe

- **Hidden Valley Creek**: 2,317 afy/3.09 cfs/2.0 mgd.
- **Hidden Valley Ponds**: 507 afy/0.7cfs/0.5 mgd.
- **Lower Hole Creek**: Up to 1,448 afy/2.0 cfs/1.3 mgd.

Maintenance

The proposed recycled water customers would begin receiving recycled water for use as landscape irrigation. This project will meet all Department of Drinking Water and RWQCB requirements. Given this project is still in the conceptual stage, maintenance at the Tributary Restoration sites are not well understood at this time.

The general O&M activities common to most of the Permittee Agencies are described in Section 2.1.6.

Riverside Public Utilities Weed Abatement and Property Maintenance (RPU.12) – Phase 1

RPU owns numerous vacant parcels (identified below), which require site inspections and maintenance that typically consists of weed abatement, trash removal, non-organic material cleanup, and/or removal of trespassers (Figure 2-17). Weed abatement activities are generally conducted on a quarterly basis as required by the local fire agency in order to comply with fire and public safety code requirements, and consist of fence line clearing, mowing fire breaks, and cross-cut fire breaks. Weed abatement activities are assumed to be a permanent impact because they occur quarterly.

- Cooley Ranch Parcels (six parcels: San Bernardino County Assessor Parcel Numbers [APNs] 0279-042-10, 0279-041-02, 0279-042-11, 0279-031-39, 0279-031-38, and 0279-021-38). These parcels are generally located south of 6th Street, north of 3rd Street, east of Waterman Street, and west of Warm Creek channel in the City of San Bernardino.
- Flume Tract Parcels (six parcels: San Bernardino County APNs 0163-362-08, 0163-362-09, 0276-123-11, 0163-141-15, 0163-381-07, and 0163-381-06), located south of East Congress Street, east of South La Cadena Drive, and north of the Santa Ana River.
- Headgates North Parcels/Gage (three parcels: San Bernardino County APNs 0280-251-25, 0280-251-18, and 0280-251-06), located east of South Tippecanoe Avenue, south of East Central Avenue, west of South Mountain View Avenue, north of Riverview Drive, and north and south of the Santa Ana River in the City of San Bernardino.
- Jurupa 7 (one parcel: San Bernardino County APN 0277-021-17), located east of Holly Street, west of South Riverside Avenue, on the west bank and partially within the Santa Ana River in the City of Colton.

- Scheuer Parcel (four parcels: San Bernardino County APNs 0278-161-30, 0278-181-12, 0278-181-19, and 0278-161-29). These parcels are located south of East 9th Street, north of 6th Street, and immediately east and west of Warm Creek channel in the City of San Bernardino.
- Amazon Parcel (two parcels: San Bernardino County APNs 0292-011-32 and 0292-011-40). These parcels are located northeast of the intersection of East Central Avenue and Mountain View Avenue, north of the Santa Ana River, and south of the San Bernardino International Airport.
- California Redlands Parcels (five parcels: San Bernardino County APNs 0167-672-03, 0292-011-43, 0167-701-04, 0167-701-04, and 0167-721-03). These parcels are located east of Mountain View Avenue, west of California Street, north of Palmetto Avenue, and south of the Santa Ana River in the City of San Bernardino.
- Garner Parcels (two parcels: San Bernardino County APNs 0279-041-14 and 0279-041-15). These parcels are located south of 6th Street, north of 5th Street, west of Pedley Road, and east of Warm Creek channel in the City of San Bernardino.
- Tippecanoe (one parcel: San Bernardino County APN 0280-251-53). This parcel is located east of South Tippecanoe Avenue, west of Mountain View Avenue, north of Riverview Drive, and south of the Santa Ana River in the City of San Bernardino.

The general O&M activities common to most of the Permittee Agencies are described in Section 2.1.6.

Drainage A Modification (RPU.13) – Phase 2

New Construction

Drainage A is an ephemeral channel that begins in the vicinity of I-10 and flows south, adjacent to Fogg Street and East Congress Street in the City of Colton, and then meanders across vacant land before discharging into the Santa Ana River just west of a railroad crossing (Figure 2-17). Some of the vacant land through which Drainage A flows is owned by RPU and is the area planned for the Riverside North Aquifer Storage and Recovery Project (RPU.5) off-stream recharge basins. Lytle Creek Channel historically flowed through the Colton area and comingled with the Santa Ana River in this vicinity. Lytle Creek ceased flowing through this area once SBCFCD redirected and improved the channel. Drainage A occurs within part of the historical Lytle Creek Channel. The Drainage A project site currently supports Santa Ana River woolly-star, Los Angeles pocket mouse, and Riversidean alluvial fan sage scrub habitat.

The project proposes to relocate part of Drainage A to the north, along the perimeter of RPU's property. The relocation would allow RPU to utilize its property for constructing the northern off-stream basin and provide for a material laydown area for the Riverside North Aquifer Storage and Recovery Project (RPU.5). Drainage A would continue to support the aforementioned species and habitat, and continue to drain to the Santa Ana River. A culvert may also be necessary to improve the flow of the drainage channel through an access road that is currently impacted by storm flows each winter. Improvements to Drainage A have yet to be studied or designed. The relocation of Drainage A could potentially be part of an overall management plan for this area and be modified in such a way that it would provide an improved benefit to the Santa Ana River woolly-star, Los Angeles pocket mouse, and Riversidean alluvial fan sage scrub habitat.

Operations

RPU is planning to complete a study to fully assess the hydraulics of Drainage A and its role in supporting onsite habitat. A biological expert will be retained to assist designing the Drainage A improvements and assure that the onsite habitat that Drainage A supports would remain the same or be improved.

Maintenance

This project would be constructed such that little to no maintenance would be necessary and the drainage channel would continue to support wildlife species. Site inspections would occur annually.

The general O&M activities common to most of the Permittee Agencies are described in Section 2.1.6.

Waterman Pipeline Upsizing Project (RPU.14) – Phase 1

New Construction

The project objective is to replace a segment of a 36-inch-diameter concrete cylinder water transmission main crossing under the Santa Ana River in the City of San Bernardino at Waterman Avenue (Figure 2-17). The Waterman Pipeline extends from the Bunker Hill Subbasin in the City of San Bernardino to the Linden and Evans Reservoir in the City of Riverside, and is used to convey groundwater to the City of Riverside. The project is located along Waterman Avenue at the Santa Ana River crossing in San Bernardino generally between Vanderbilt Way and Park Center Circle. The project proposes that a new pipeline be constructed to replace the existing main at a depth of at least 20 feet below the existing elevation of the river bottom. To accommodate the flow rate, it is also proposed that the new transmission main be upsized to a 54-inch-diameter steel cement mortar-lined and coated pipe. Open-cut trenching construction and jack and bore methods are being evaluated for construction of the Waterman Pipeline. The time period of construction is estimated to be 12 months, and the project proposes an upsize replacement of the current transmission main to a 54-inch-diameter pipe for a length of approximately 500 linear feet within the riverbed area. Access to the riverbed will occur via existing access ramps located at the northern and southern river bank at the proposed project site. Following project completion, the existing stream course and all temporary impact areas will be restored in coordination with the resource agencies or as established in this HCP. All access roads will be returned to their pre-project conditions.

Maintenance

Visual inspection from the levee following large storm events, in addition to routine valve exercising, would be conducted. Given this project is relatively new, minor to no maintenance would be anticipated.

The general O&M activities common to most of the Permittee Agencies are described in Section 2.1.6.

Riverside Public Utilities Maintenance of Supply Transmission Mains (RPU.15) – Phase 1

The project objective is to conduct general maintenance activities for RPU's supply transmission mains (Figure 2-17). See Section 2.1.6 for general O&M activities common to most of the Permittee

Agencies. Over 95% of the transmission mains occur in developed areas; however, there are three Santa Ana River crossings that could potentially have environmental impacts should they become exposed following a large storm event and require repairs or replacement.

- 1,000 feet upstream of Tippecanoe Avenue (described in RPU.7)
- At the Waterman Avenue bridge crossing (described in RPU.14)
- One-half mile upstream of La Cadena Drive (described in RPU.3)

Other pipelines that would be added to this list following construction include RPU.1 and RPU.2.

In addition to the aforementioned locations, facilities are also located within:

- An approximately 0.8-mile section of aboveground transmission line, and an approximate 0.85-mile section of buried pipeline located within a portion of the southern Santa Ana River floodplain located west of the Tequesquite Landfill, north of Jurupa Avenues, south of the Santa Ana River, and east of Martha McLean Park in the City of Riverside.
- An approximately 0.02-mile section of buried pipeline crossing under Springbrook Wash, north of Palmyrita Avenue, east of California Street, west of Murphy Avenue, and south of the southern terminus of Swayzee Court in the community of Highgrove.

The supply transmission mains would be maintained on an ongoing basis with repairs made as needed. Non-emergency repairs in the river will be conducted when the Santa Ana River is dry. Following project completion, the existing stream course and all temporary impact areas will be restored in coordination with the resource agencies or as established in this HCP. All access roads will be returned to their pre-project conditions.

San Bernardino Valley Municipal Water District Activities

Valley District Existing Pipelines and Pipeline Crossings (VD.4) – Phase 1

Maintenance

Pipeline Maintenance and Repair

Maintenance or repair of existing pipelines and pipeline crossings may be necessary for Valley District pipelines. The majority of Valley District's pipelines occur in developed areas, but sections of existing pipeline do traverse undeveloped lands, including streambeds (Figure 2-18):

Lytle/Cajon

- An approximately 0.5-mile section of buried pipeline crossing under Lytle Creek, immediately north of the Baseline Road in the City of San Bernardino (this segment of pipeline is the same as that identified in WD.5 and WV.6; the pipeline is proportionally shared by these agencies).
- An approximately 2.9-mile section of buried pipeline crossing Lytle and Cajon Creeks, from immediately south of the CEMEX facility at Lytle Creek, traversing northeast to just south of the Sheriff's facility, and then east across Cajon Creek, just south of Institution Road. This section of pipeline occurs within the City of Rialto, unincorporated San Bernardino County, and the City of San Bernardino and shares the same alignment as a portion of pipeline described in Met.2.

City Creek

- An approximately 0.7-mile section of buried pipeline under City Creek, located approximately 0.2-mile south of the Highland Avenue Bridge crossing of City Creek in the City of Highland. This section of pipeline co-occurs with a section of Met.2 pipeline,

Santa Ana River

- An approximately 1.8-mile section of buried pipeline extending from the northern extent of Opal Avenue in the City of Redlands to the northern extent of Cone Camp Road in the City of Highland, including a crossing of the Santa Ana River. This section of pipeline co-occurs with a section of Met.2 pipeline. A portion of this pipeline is also identified as a Covered Activity under the Wash Plan HCP.
- An approximately 0.6-mile section of buried pipeline extending across an eastern portion of the Wash Plan HCP and the Santa Ana River in a northwest-southeast direction from approximately 0.3 mile west of the intersection of Greenspot Road and Santa Ana Canyon Road, to the Greenspot Pumping Station location at 31000 Greenspot Road in the City of Highland. This section of pipeline is also identified as a Covered Activity under the Wash Plan HCP.

Mill Creek

- An approximately 0.1-mile section of buried pipeline under Mill Creek from the southern extent of Emerald Avenue to the Santa Ana River Trail on southern levee of Mill Creek (approximately 0.3-mile upstream of Garnet Street Bridge crossing of Mill Creek) in the City of Redlands.
- An approximately 0.1-mile section of pipeline crossing Mill Creek just south (downstream) of the SR-38 Bridge over Mill Creek in unincorporated San Bernardino County.

Oak Glen and Yucaipa Creeks

- An approximately 0.1-mile section of buried pipeline under Oak Glen Creek at Bryant Street in the City of Yucaipa.
- An approximately 0.1-mile section of buried pipeline under Yucaipa Creek equidistant between the California and Bryant Street crossings of Yucaipa Creek in the City of Yucaipa.

Valley District visual inspection patrols will occur monthly and after periods of heavy or prolonged storm activity. Patrols will consist of one or two maintenance personnel walking the pipeline alignment in the active channel area to verify the condition of the channel and pipeline. Only existing footpaths will be used for these patrols.

Maintenance or repair is expected to occur after larger storm events that cause erosion that removes the existing earthen cover and threatens to expose or does expose Valley District structures and pipelines within active channel areas. It is expected that these conditions may occur every 5 to 10 years. The repairs may take a minimum of 5 days and up to 3 months to complete.

Repair can involve fixing or replacing sections of cement mortar lined and coated, welded, steel pipelines; replacing or repairing pipeline concrete encasement; and or restoring the channel bottom to pre-storm surface elevations along the pipeline. Valley District anticipates utilizing end or side loading dump trucks, flatbed tractor trailer trucks, small backhoe loaders, large loaders, large bulldozers, and or larger excavators as required to repair the channel or pipeline. Approximately 20-foot-wide access roads would be established to and from the nearest street or access point into the channel. It is anticipated a minimum of 50- to 100-foot-wide area upstream and downstream of the centerline of the pipeline in the channel area may be cleared in order to do all required repairs. It is anticipated that between 2 and 20 construction workers would be required depending on the size and complexity of the repairs.

Pipeline repairs can include replacing damaged or broken sections of pipeline utilizing standard practices for installation of large diameter welded steel pipeline. This work will involve heavy construction equipment such as graders, dump trucks, and excavators. Types of work involved are trenching, lifting and setting of pipes, welding of pipes, backfilling, and site restoration. Staging and stockpile areas will be located in previously disturbed areas, if possible.

Concrete Pipeline Encasement Repair

Concrete pipeline encasement repair can include removing damaged portions of encasement and replacing, or installing, new concrete steel reinforcement and pouring new concrete to replace the damaged areas. This work will involve large construction equipment normally associated with construction of concrete placement. Types of work involved are trenching, forming of encasement, steel reinforcement placement, pouring concrete, backfilling, and site restoration.

Channel Bottom Grade Repair

Existing channel bottom grade repair where erosion of soil is threatening to expose the pipeline or encasement can include the restoration of the channel bottoms utilizing native sand, rock, and boulder material. The channel bottom will be graded to the pre-storm existing elevation conditions if possible after all pipeline repairs are done. Valley District will avoid creating any abrupt changes in channel elevations. All existing rock armoring in the channel that was removed for the repairs will be replaced in-kind. After completion of the repairs all temporary impact areas will be restored to pre-project conditions. For projects within existing stream courses, restoration of temporary impact areas will occur in coordination with the resource agencies or as established in this HCP. All access roads will be returned to their pre-project conditions.

It is possible that these pipelines, or portions of these pipelines may need to be replaced during the course of the permit term. Replacement would also be covered under this HCP. The general O&M activities common to most of the Permittee Agencies are described in Section 2.1.6.

San Bernardino Municipal Water Department Activities

San Bernardino Municipal Water Department Other Pipelines (WD.2) – Phase 1

The project objective is to conduct general maintenance activities for Water Department pipelines. See Section 2.1.6 for general O&M activities common to most of the Permittee Agencies. The Water Department maintains six pipeline stream crossings along the Santa Ana River (Figure 2-18).

- Pipeline Crossing at Tippecanoe Avenue
- Pipeline Crossing at Mountain View Avenue
- Pipeline Crossing at E Street
- Pipeline Crossing at Waterman Avenue
- Pipeline Crossing at Orange Show Road

- Geothermal Pipeline Crossing upstream of the Twin Creek Channel confluence with the Santa Ana River (described below)

The pipeline crossings at Tippecanoe Avenue, Mountain View Avenue, E Street, Orange Show Road, and Waterman Avenue hang in existing bridges. Maintenance would include visual inspection and repair of leaks or other issues once identified. Replacement and/or repair would likely involve temporary impacts on the Santa Ana River channel so that equipment could access the pipeline located in the bridge structure. An approximately 25- by 100-foot temporary construction area would be required. It is estimated that each pipeline is likely to be repaired or replaced once during the life of the permit. Non-emergency repairs such as this will be conducted when the Santa Ana River is dry. Access to the repair/maintenance locations will utilize existing access ramps within the Santa Ana River, where available. Following project completion, the existing stream course and all temporary impact areas will be restored in coordination with the resource agencies or as established in this HCP. All access roads will be returned to their pre-project conditions.

Geothermal Pipeline

The Water Department's Geothermal Facility is located upstream of the I-215 crossing of the Santa Ana River, and upstream of the Twin Creek Channel confluence with the Santa Ana River (crossing the Santa Ana River directly north of the northern extent of South Commerce Center Drive West in the City of San Bernardino). The geothermal pipeline consists of two geothermal production wells that produce up to 2.88 million gallons per day of geothermal water from within the San Jacinto Fault system. Geothermal water is extracted and delivered through insulated pipes to heat various municipal buildings in the downtown area of the City of San Bernardino. After heat exchange, waste geothermal water is then discharged into either the sanitary sewer line or to one or more of 10 outfalls. Seven outfalls feed into storm channels that drain to tributary creeks of the Santa Ana River. These creeks include Lytle Creek, Warm Creek, City Creek, and East Twin Creek.

Routine maintenance requested under the HCP includes the 12-inch geothermal pipeline where it crosses underneath the Santa Ana River downstream of the confluence with City Creek. Geothermal pipeline facilities may also be used for future distribution of recycled water from the proposed SBMWD Recycled Water Project (WD.1) to direct use sites south of the Santa Ana River.

For example, within the portion that crosses the Santa Ana River, if a leak has been identified that would require repair, work would be performed by excavation above and around the pipeline using a backhoe or other equipment. Non-emergency repairs such as this will be conducted when the Santa Ana River is dry. Access to the repair/maintenance locations will utilize existing access ramps within the Santa Ana River, where available. Following project completion, the existing stream course and all temporary impact areas will be restored in coordination with the resource agencies or as established in this HCP. All access roads will be returned to their pre-project conditions.

Maintenance/Operations

Routine maintenance of the geothermal pipeline includes visual inspections as needed. When leaks or other issues that need repair are identified, activities could include temporary flow diversions, pipeline excavation with heavy equipment, temporary stockpiles, leak repairs, and replacement of spoils. Pipeline maintenance may include the activities described in Section 2.1.6 under *Pipelines and Associated Facilities,* which also includes the general O&M activities common to most of the Permittee Agencies. Temporary impact areas will be restored to pre-project conditions.

Kenwood Well Field and Pipeline (WD.3) – Phase 1

The Kenwood well field is located in and adjacent to Cajon Creek Wash near the I-215/I-15 interchange (Figure 2-18). The well field is connected to other Water Department infrastructure by an existing pipeline.

New Construction

The Water Department is proposing to add one new well and associated pipeline to the existing facility, as well as a new main pipeline from the well field to an existing 20-inch pipeline in Cajon Boulevard approximately 650 feet northwest of the Cajon Boulevard and Kenwood Avenue intersection.

Kenwood Well No. 3 will be located just north of existing Kenwood Well No. 1, approximately 4,400 feet northwest of the Cajon Boulevard and Kenwood Avenue intersection. The future groundwater well pump will be accessed through existing unimproved roads off of Cajon Boulevard and will be similar to existing Kenwood Well No. 2 in capacity and construction. Construction will consist of well drilling/development, pump and motor installation, 12-inch-diameter discharge piping, a block-type pump house measuring approximately 25 by 25 feet, and perimeter fencing measuring approximately 50 by 50 feet.

Operations

The new well is expected to produce approximately 4.50 cfs (2.9 mgd) at a total dynamic head of 140 feet, and will serve as additional supply to meet demands within the Water Department's service area.

Maintenance

Maintenance activities would cover four existing wells at the Kenwood well field site (Cajon Canyon Well, Vincent Well, Kenwood Well No. 1, and Kenwood Well No.2), and the new proposed well (Kenwood Well No. 3), for a total of five wells. Maintenance of the road within Cajon Wash would be completed at most annually, but more commonly every second year. Pipeline maintenance will be conducted as needed for the Kenwood pipeline between the well field and the Devore reservoir. All temporary impact areas will be restored to pre-project conditions.

The general O&M activities common to most of the Permittee Agencies are described in Section 2.1.6.

San Bernardino Municipal Water Department Existing Facilities Maintenance (WD.5) – Phase 1

The project objective is to conduct general maintenance activities for the Water Department's existing or planned facilities to maintain existing access roads, groundwater wells, sewer and water pipelines, reservoirs and pump stations, and associated sewer and water infrastructure (Figure 2-18). Over 95% of the facilities occur in developed areas but sections of existing pipeline do traverse undeveloped lands, including streambeds (Figure 2-18):

- Within Cajon Wash (i.e., existing WD.3 facilities), upstream (north) of the I-215/I-15 interchange.

- An approximately 0.8-mile segment of buried pipeline within Cajon Wash, just downstream (south) of Institution Road in the City of San Bernardino. This section of pipeline shares the same alignment as existing pipeline described in Met.2 and VD.4.
- An approximately 0.5-mile section of buried pipeline crossing under Lytle Creek, immediately north of the Baseline Road crossing of Lytle Creek in the City of San Bernardino. This segment of pipeline is the same as that identified in VD.4 and WV.6 (the pipeline is proportionally shared by these agencies).
- The pipeline crossings of the Santa Ana River, described in WD.2, are also presented on Figure 2-18. These include: pipeline crossings at Tippecanoe Avenue, Mountain View Avenue, E Street, Waterman Avenue, and Orange Show Road, as well as the geothermal pipeline crossing upstream of the Twin Creek Channel confluence with the Santa Ana River, all located in the City of San Bernardino.

The Water Department's existing facilities would be maintained on an ongoing basis with repairs made as needed. Access to the repair/maintenance locations will utilize existing access ramps within levees of the Santa Ana River, where available. Following project completion, the existing stream course and all temporary impact areas will be restored in coordination with the resource agencies or as established in this HCP. All access roads will be returned to their pre-project conditions. See Section 2.1.6 for general O&M activities conducted by the Water Department.

Western Municipal Water District of Riverside County Activities

Western Municipal Water District Pipeline Rehabilitation and Replacement Program (West.1) – Phase 2

The Pipeline Rehabilitation and Replacement Program will be an evaluation and replacement of aging pipeline within Western's retail service area of southeastern Riverside County (Figure 2-18). Over 75% of the aging pipeline occurs in existing roadways or other developed areas, but sections of existing pipeline do traverse undeveloped lands, including streambeds (Figure 2-18):

- An approximately 0.3-mile section of pipeline attached to the River Road Bridge crossing of the Santa Ana River in the City of Eastvale.
- From Lake Mathews west to the I-15 corridor. This segment crosses Temescal Wash approximately 0.5 mile north of the Cajalco Road Bridge crossing of Temescal Wash. This section of pipeline follows the same alignment as pipeline described under Met.2.
- Two north-south pipeline crossings of Mockingbird Creek, one extending between Stallion Crest Road and Shady Side Lane, and the other north of Pinecone Lane in the City of Riverside.
- Two east-west crossings of Alessandro Arroyo, one at the Berry Lane crossing of Alessandro Arroyo, and the other just south of Berry Lane.

Most pipe is between 8 and 24 inches in diameter but can be up to 8 feet. The project will begin with inspecting the condition of the existing pipelines by either videotaping inside the pipe or reading data from cathodic protection test stations to determine whether pipeline rehabilitation (relining), spot repair, or replacement can address any identified issues. The pipe condition assessment does not have a physical disturbance except along potential access roads that occur in natural areas, as well as small excavations (estimated to be less than 500 square feet of impact area along the pipeline for access at test station locations with an estimated three to four per mile of pipeline). A multi-year pipeline rehabilitation and replacement project will be developed based on the condition assessment.

The rehabilitation and replacement may require pipe lining or full replacement of pipelines with associated construction activities, including excavation, access road grading, staging and work area creation, and attendant noise and light. For lining and replacement, an open-cut trench is used and installation would require about a 20- by 100-foot footprint for each standard 40-foot pipe length. Typical construction equipment would include backhoes, excavators, and other heavy equipment. These activities will largely result in a temporary impact, although a permanent 12-foot width is assumed to accommodate the access road. For dewatering a section of pipeline in preparation for lining or replacement, a temporary aboveground pipeline may need to be constructed to divert the water.

Construction activities may occur year-round, but construction scheduling is expected to be concentrated in the late spring through fall to avoid wet weather delays. Construction activities would generally be completed within 2 to 3 months for a specific project area. Several project areas could be completed in any specific year. Temporary impact areas will be restored to pre-project conditions. Repairs proposed within existing stream courses will be restored in coordination with the resource agencies or as established in this HCP. All access roads will be returned to their pre-project conditions.

Operations

Operational activities for rehabilitated or replaced pipelines will be covered under the Water Delivery and Wastewater Collection System Operation (West.2) project (see below).

Maintenance

Maintenance activities for rehabilitated or replaced pipelines will be covered under the Water Delivery and Wastewater Collection System Operation (West.2) project.

The general O&M activities common to most of the Permittee Agencies are described in Section 2.1.6.

Western Municipal Water District Water Delivery and Wastewater Collection System Operation (West.2) – Phase 1

Western is requesting coverage for maintenance of existing facilities within its water delivery and wastewater collection system. Facilities include pipelines, tanks, pumping stations, valves, hydrants, air release valves, blow-offs, and other appurtenances required to operate these systems (Figure 2-18). Approximately 95% of this pipeline system occurs in developed areas, primarily following existing road (including both paved and unpaved) alignments, and a majority of the system co-occurs with pipelines identified in West.1. West.2 facilities that cross streambeds include (all co-occur with existing West.1 facilities):

- An approximately 0.3-mile section of pipeline attached to the River Road Bridge crossing of the Santa Ana River in the City of Eastvale.
- From Lake Mathews west to the I-15 corridor. This segment crosses Temescal Wash approximately 0.5 mile north of the Cajalco Road Bridge crossing of Temescal Wash. This section of pipeline follows the same alignment as pipeline described under Met.2.

- Two east-west crossings of Alessandro Arroyo, one at the Berry Lane crossing of Alessandro Arroyo, and the other just south of Berry Lane.

These facilities provide critical services to Western customers for potable water and wastewater collection. The systems continue to expand with new development, but new pipelines are almost entirely within existing ROW on public roads. Maintenance and repair of these facilities is continually required to ensure proper operation. Temporary impact areas will be restored to pre-project conditions. Repairs proposed within existing stream courses will be restored in coordination with the resource agencies or as established in this HCP. All access roads will be returned to their pre-project conditions.

Maintenance and repair activities for these facilities occur year-round, and would generally be completed within hours or days for a specific issue/area.

Operations

Operation of the potable and recycled water pipelines is generally performed remotely using a supervisory control and data acquisition (SCADA) system. However, operations will require personnel to routinely visit facilities for inspections, sampling, and equipment operation and monitoring.

Maintenance

Maintenance and repair activities for these facilities occur year-round, and would generally be completed within hours or days for a specific issue/area. In addition to the general O&M activities common to most of the Permittee Agencies (described in Section 2.1.6), Western also performs routine maintenance as follows:

Access roads: Approximately 7 miles of unpaved access roads are maintained with grading, removal of debris, and other associated activities to keep them smooth and drivable. Such activity occurs not more than annually.

Releases of potable or recycled water for inspections and preventative maintenance: Approximately 250,000 gallons of water would be released and permitted and reported in accordance with SWRCB/RWQCB potable water discharge permits. Between 4 and 5 million gallons of unchlorinated or dechlorinated potable water would be released in order to do major maintenance approximately once every 10–15 years. Water would likely be released into nearby fields and infiltrate into the ground.

Tank maintenance: Tank maintenance may include recoating of the interior, replacement of cathodic protection, and repainting of the exterior.

Collection system maintenance: Collection systems require frequent maintenance, including cleaning and video inspections.

Recycled Water Live Stream Discharge (West.3) – Phase 1

New Construction

Currently, Western's Water Recycling Facility has no live stream discharge point. Should excess recycled water be available during wet months, the recycled water is routed through the recycled distribution system to a discharge point on the Western Riverside County Regional Wastewater

Authority (WRCRWA) treatment plant's collection system. The recycled water is then taken through the WRCRWA plant and retreated for release to the Prado Basin. Rather than continue this inefficient process, Western proposes to either discharge to Victoria Recharge Basin (located immediately south of the intersection of Jackson Street and Victoria Avenue in the City of Riverside) or construct an emergency discharge point for recycled water to be released into Mockingbird Creek, just southeast of the intersection of Roosevelt Street and Markham Street in the City of Riverside. Discharge to Mockingbird Creek would include an in-stream energy diffuser, dechlorination station, and a new valve system to redirect the water (Figure 2-19). If Mockingbird Creek is chosen as a release site, construction would likely include vegetation management, minimal site grading, installation of a culvert outlet/pipe infrastructure outlet, and installation of riprap or other energy diffusing materials to minimize the potential for erosion. Mockingbird Creek is an ephemeral drainage that drains into Mockingbird Reservoir, a human-made reservoir that is not hydrologically connected to the Santa Ana River.

A test event would occur the first year of operations. The construction of the discharge point would be scheduled early in the project to avoid wet weather delays. Construction activities are expected be completed within weeks or a month. Operation of the discharge point would occur during wet weather only when storage is full and there is insufficient usage. Releases would be adaptively monitored and managed to ensure existing riparian habitat conditions are not degraded.

Operations

Operation of the facility (either Victoria Basin or Mockingbird Creek) will require periodic opening of a valve or other control equipment to allow recycled water to drain through to the discharge point. A test event is also expected to occur near the completion of construction. The dechlorination station will also require operational support when discharging. If discharge to Mockingbird Creek is pursued, the discharge will increase flows within Mockingbird Creek when excess recycled water is available during wet months, typically November 1 to June 1.[7] Excess recycled water would generally only be released during long periods of wet weather because recycled water during short rain periods is stored for future use. Generally, releases of an annual average of up to approximately 6,733 afy/9.3 cfs/6.0 mgd would occur. Releases are not anticipated to be continuous during these months but could occur over several weeks (Table 2-2).

Maintenance

Maintenance of the facility may require periodic cleaning of the basin or creek outlet structure, which is likely to occur in the fall prior to the wet season (typically November 1 to June 1). Maintenance may also be required of any associated piping and appurtenances and access roads to maintain connection of the discharge point to the recycled water distribution system. In addition, maintenance may be required on a dechlorination station that will be required for discharges. Excavations with a backhoe may be required for preventative maintenance and repair.

Temporary impact areas at the Mockingbird Creek site will be restored to pre-project conditions. Repairs proposed within Mockingbird Creek will be restored in coordination with the resource agencies or as established in this HCP. All access roads will be returned to their pre-project conditions.

[7] This is the time period in which demand for recycled water is low to nil due to low temperatures and precipitation. During this time sewage continues to be converted to recycled water and, without demand that equals or exceeds the sewer flow, the recycled water that exceeds demand is discharged as effluent.

The general O&M activities common to most of the Permittee Agencies are described in Section 2.1.6.

Recycled Water Crossing to South Added Facilities Charge (West.4) – Phase 1

The Recycled Water Crossing to South Added Facilities Charge will consist of construction of a crossing of the Colorado River Aqueduct with a 12-inch recycled water pipeline (Figure 2-19). The proposed location is Western's Operations Center at 16451 El Sobrante Road in the City of Riverside. Construction or repair of access roads may be required on the south side of the Colorado River Aqueduct, which is included in the maximum design consideration area for this project.

The construction of the crossing would be scheduled in the late spring through fall to avoid wet weather delays. Construction activities are expected be completed in 2 to 4 weeks. Once constructed, the crossing would operate continuously.

Operations

Operation of the facility will require periodic checks of the leak detection system and any required repairs to piping or the leak detection system.

Maintenance

Maintenance of the facility may require periodic maintenance of the piping and associated leak detection system. In addition, maintenance may be required of any associated access roads to maintain the piping. Excavations may also be required for preventative maintenance and repair.

The general O&M activities common to most of the Permittee Agencies are described in Section 2.1.6.

Riverside Corona Feeder Project (West.7) – Phase 1

New Construction

The Riverside Corona Feeder Project is a conjunctive use project consisting of up to 20 new and existing wells and 28 miles of new pipeline that will capture, store, and deliver water in wet years in order to increase the reliability of water supplies, reduce water costs, and improve water quality (Figure 2-19). Wellhead treatment will remediate perchlorate and other contaminants. This water will come from local runoff, including releases from Seven Oaks Dam and the SWP. Projects designed to capture this water are described elsewhere. This project does not include the construction of new water recharge facilities. Up to 40,000 acre-feet of water will be stored in San Bernardino Valley and Chino groundwater basins to be available for use in dry years. This water will be transported by pipeline through the Riverside area to the ultimate use locations. All water recharge and capture has been accounted for.

The construction of wells, treatment systems, and pipelines likely will take multiple years to complete and be conducted generally year-round. All construction is proposed within disturbed areas, including existing road ROW, except for an approximate 0.25-mile section of pipeline proposed to cross the Santa Ana River located just upstream of the Van Buren Boulevard Bridge crossing of the Santa Ana River. Open-cut trenching and jack and bore methods will be evaluated for construction of the pipelines. Temporary impact areas will be restored to pre-project conditions following completion of maintenance activities. If project activities occur within the Santa Ana River, the project area will be restored to pre-project conditions in coordination with the resource agencies or as established in this HCP. All access roads will be returned to their pre-project conditions.

Operations

Operation of these facilities requires personnel to routinely visit facilities for inspections, sampling, and equipment operation and monitoring. Releases of raw water will occur at well sites during startup activities. Additionally, periodically wells will require rehabilitation that will include mobilization of heavy equipment, with associated noise and water releases. If well head treatment is implemented, routine monitoring, sampling, and inspections will be required of the treatment systems.

Maintenance

Maintenance activities for these facilities will require routine maintenance of access roads, releases of raw and potable water for inspections and preventative maintenance, and excavations for preventative maintenance and repair.

The general O&M activities common to most of the Permittee Agencies are described in Section 2.1.6.

Replacement of the Owl Tree and March Line Pipelines (West.8) – Phase 1

The Owl Tree and March Line potable and recycled water pipelines, respectively, follow roughly the same alignment buried within an approximate 6-foot depth, extending from just east of the Washington Street Bridge crossing of Mockingbird Creek east to near the intersection of Markham Street and Roosevelt Street, then extending farther east along Markham Street to the intersection of Parsons Road and Markham Street (Figure 2-19). Two sections of pipeline cross Mockingbird Creek, following the same alignment as pipeline described in West.1: one extending between Stallion Crest Road and Shady Side Lane, and the other north of Pinecone Lane.

This project includes replacement of both of these sections of aging infrastructure with an open-cut trench. Typical construction equipment would include backhoes, excavators, and other heavy equipment. The project includes replacement of 11,100 feet of 30-inch-diameter potable water pipeline and 8,800 feet of aging 24-inch-diameter recycled water pipeline. Replacement of the pipelines will require construction through areas under the influence of surface water drainages, such as dry washes. The expected footprint width is 25 feet, which would accommodate deep excavation as required. Preliminary staging areas will be identified for the stockpiling of materials and equipment storage. Staging areas would include existing disturbed or developed areas where possible. Temporary impact areas will be restored to pre-project conditions following completion of project activities. If project activities occur within an existing stream channel, the stream course will be restored to pre-project conditions in coordination with the resource agencies or as established in this HCP. All access roads will be returned to their pre-project conditions.

Maintenance activities for these facilities routinely requires maintenance of access roads, releases of potable or recycled water for inspections and preventative maintenance, and excavations for preventative maintenance and repair.

Construction scheduling is expected to be concentrated in the late spring through fall to avoid wet weather delays. Construction activities would generally be completed within a year. No significant changes in stream flows are anticipated, and any impact would be short term on the order of hours or days. Some releases of water may occur during startup O&M but are expected to be temporary.

The general O&M activities common to most of the Permittee Agencies are described in Section 2.1.6.

Lake Mathews and Burwood Drive Pipeline Construction (West.9) – Phase 1

This project will construct approximately 7,100 feet of pipeline in Lake Mathews Drive and Burwood Drive, in unincorporated Riverside County (Figure 2-19). This is a master plan pipeline that will provide higher pressure in the southwest of Western's retail area. Modeling results indicate that this pipeline facility would address low fire flow capability. Modeling indicates that under current conditions, flows in the system to respond to a fire would result in low and potentially negative pressure at some services. Though replacement of the pipeline will occur within existing paved (Lake Mathews Drive) and unpaved (Burwood Drive) roadway, construction will occur where the roadway crosses several unnamed ephemeral streams. Deep excavation may be necessary along portions of the pipeline alignment. The expected footprint width is 25 feet, which would accommodate deep excavation as required.

Maintenance activities for these facilities routinely requires maintenance of access roads, releases of potable or recycled water for inspections and preventative maintenance, and excavations for preventative maintenance and repair.

Construction scheduling is expected to be concentrated in the late spring through fall to avoid wet weather delays. Minor temporary stream impacts may occur but would be mitigated. No significant changes in stream flows are anticipated, and any impact would be short term, on the order of hours or days. Some releases of water may occur during startup O&M but are expected to be temporary. Temporary impact areas will be restored to pre-project conditions. Repairs proposed within existing stream courses will be restored in coordination with the resource agencies or as established in this HCP. All access roads will be returned to their pre-project conditions.

The general O&M activities common to most of the Permittee Agencies are described in Section 2.1.6.

Construction of Potable Water/Recycled Water Tanks (West.10) – Phase 2

This project will construct water tanks within Western's service area and may include both potable and recycled water tanks (Figure 2-19). Tanks are proposed at three locations in unincorporated Riverside County: north of Idaleona Road, west of Rolling Meadows Drive, and east of Via Lago; south of Cajalco Road, west of Barnes Avenue, east of Granite Avenue, and northeast of the northern extent of Juniper Road; and north of El Sobrante Road, and west of the intersection of Vista Del Lago Drive and Blackburn Road. These tanks are needed so that there is sufficient capacity to meet system demand during a Metropolitan outage of the Mills Treatment Plant. Current contractual requirements with Metropolitan require Western to be able to meet system demand requirements for 7 days of outage. Currently, Western has only been able to meet demand for a 6-day outage by importing water from Riverside at levels that exceeded the design capacity of the interconnection facility. It is estimated that an additional 6 million gallons of storage is needed. The initial tanks will replace the lost storage that will occur with the decommissioning of aging tanks. Subsequent tanks will be constructed according to the facilities master plan. Tank construction sites must be on elevated areas where a gravity feed can be used. Erosion during releases is typically avoided by engineering tank releases to flow into existing stream courses or channels, which can be accomplished with concrete ditches.

Each tank will require preparation of a large pad, installation of the tank and connecting pipelines, and construction of an access road. Such activities would generally be scheduled in the late spring through fall to avoid wet weather delays with phasing of all tank construction over several years. No significant changes in stream flows are anticipated, and any impact would be short term, on the order of hours or days. Some releases of water may occur during startup O&M but will be temporary.

Operations

Operation of the tank filling and draining operation is generally performed remotely using a SCADA system. Should SCADA not be operable, tank operations can be performed at the site. Staff routinely inspect the tanks and perform sampling activities at the tank locations. Operational activities for new tanks will be covered under the Water Delivery and Wastewater Collection System Operation (West.2) project.

Maintenance

Maintenance activities for these tanks routinely requires maintenance of access roads, releases of potable or recycled water for inspections and preventative maintenance, and excavations for preventative maintenance and repair of connecting piping. Tank maintenance may include recoating of the interior, replacement of cathodic protection, and repainting of the exterior. Maintenance activities for new tanks will be covered under the Water Delivery and Wastewater Collection System Operation (West.2) project.

The general O&M activities common to most of the Permittee Agencies are described in Section 2.1.6.

West Valley Water District Activities

West Valley Pipeline Maintenance (WV.2) – Phase 1

West Valley maintains several pipelines that are not constructed within street ROW and are located in different areas of West Valley's service area and serve various facilities (Figure 2-20). West Valley is seeking coverage for ongoing maintenance of these pipelines. Maintenance may include the activities described in Section 2.1.6 under *Pipelines and Associated Facilities*.

Pipeline maintenance would include pipeline section and/or valve replacement, as needed. Maintenance would include visual inspection of the pipelines, and repair of leaks or other issues once identified, including pipeline section replacement and/or valve replacement. Repair activities may include temporary flow diversions, pipeline excavation and trenching with heavy equipment to reach buried components, temporary stockpiles, leak repairs, and replacement of spoils. An approximately 30- by 200-foot temporary maintenance work area would be used by heavy equipment and service trucks in order to complete the repairs. Maintenance would be expected to occur approximately once every 10 years per pipeline. Non-emergency repairs would be conducted when surface flows were absent. All maintenance activities proposed to occur in areas supporting SBKR will adhere to strict avoidance and minimization measures (see Chapter 5). Temporary impact areas will be restored to pre-project conditions. Repairs proposed within existing stream courses will be restored in coordination with the resource agencies or as established in this HCP. All access roads will be returned to their pre-project conditions.

West Valley's pipelines include the following.

Lytle Creek Wash Pipelines

Two cement lined and mortar coated steel pipelines cross the Lytle Creek Wash from West Valley's Zone 3A pump station (just west of 9th Street) in San Bernardino westerly to Terrace Road. One pipeline is 24 inches in diameter and serves pressure zone 3, and the other one is 30 inches in diameter and serves pressure zone 3A. Both pipelines carry water from production wells on the east side of the wash to the west side.

In order to complete repairs the pipeline may need to be drained such that water would flow into Lytle Creek. An existing connection on the east side of the wash would be used to drain the line prior to maintenance activities. It is estimated that approximately 0.16 acre-feet of water would be drained during this occurrence.

Lytle Creek Turnout Pipelines

Two cement lined and mortar coated steel pipelines travel from Riverside Avenue to the Lytle Creek Turnout, located approximately 1,000 feet east of the intersection of North Linden Avenue and Riverside Avenue in the City of Rialto. These pipelines bring SWP from the San Gabriel Feeder pipeline to the Oliver P. Roemer Water Filtration Facility. The pipeline diameters are 24 and 36 inches. In order to complete repairs the pipeline may need to be drained such that water would be redirected into the Water Filtration Facility.

Eucalyptus Pipeline

An existing 16-inch steel pipeline that was installed in 1963 travels south from the intersection of San Bernardino Avenue and Eucalyptus Avenue to Valley Boulevard in the City of Colton. Approximately 600 feet of this pipeline north of Valley Boulevard is located in the existing paved street ROW. The remaining 1,960 feet of pipeline is located in an open space area. This pipeline is located east of the Colton Golf Club. In order to complete repairs, the pipeline may need to be drained such that water would be redirected into local storm drains.

Well 42 Pipeline

An existing 16-inch cement lined and mortar coated steel pipeline travels north from West Valley's Well 42 and connects to a 16-inch pipeline in San Bernardino Avenue in the City of Colton. This pipeline is located just west of Wildrose Avenue. In order to complete repairs the pipeline may need to be drained such that water would be redirected into local storm drains.

West Pepper Pipeline

An existing 24-inch cement lined and mortar coated steel pipeline travels north from Slover Avenue just west of Pepper Avenue in the City of Colton to the Southern Pacific Railway. A future 24-inch pipeline will connect the existing 24-inch pipeline west of Pepper Avenue to a newly constructed 24-inch pipeline in the new Pepper Avenue Bridge over I-10. Construction of this new pipeline would include boring under the Southern California Pacific Railway. To install this pipeline under the railway, a boring pit and a receiving pit will be constructed on either side of the railway. During construction activities, additional space adjacent to the railway will be required for vehicles and material staging.

Lord Ranch Pipeline

An existing 24-inch pipeline travels north from Base Line to West Valley's Lord Ranch Facility, immediately west of the railroad line. The pipeline crosses Frisbie Wash immediately west of the railroad line and east of North Pepper Avenue. This pipeline conveys Base Line Feeder water from the Meridian Turnout to the facility, and it can transport water from the facility south into the pressure zone 3 distribution system. In order to complete repairs, the pipeline may need to be drained such that water would flow into Frisbie Wash/Lytle Creek.

Acacia Pipeline

An existing 16-inch steel pipeline installed in 1963 travels north from Slover Avenue to the Southern Pacific Railway along Acacia Avenue in the City of Colton. This pipeline conveys water from Well 18A and reservoir R2-1 south under I-10 and the Southern Pacific Railway to West Valley customers in pressure zone 2.

Walnut Pipeline

An existing 20-inch steel pipeline travels from the east end of Walnut Avenue in the City of Rialto to West Valley's Lord Ranch facility, crossing Frisbie Wash and crossing under North Pepper Avenue. This pipeline conveys water from wells at the facility to West Valley customers in pressure zone 4. The pipeline is within a casing as it crosses under Pepper Avenue. In order to complete repairs, the pipeline may need to be drained such that water would flow into Frisbie Wash.

Golf Course Pipelines

West Valley has six wells on the outskirts of the former El Rancho Verde Golf Course; five of the wells are located within the former golf course itself, and one is located to the east of the golf course and the existing levee on the southern bank of Lytle Creek. Transmission lines ranging in diameter from 10 to 24 inches traverse the former golf course and land between Lytle Creek and the golf course (for the sixth well), supplying water to R4-3 reservoir and to West Valley customers in pressure zone 4. There are approximately 14,000 feet of pipeline within a 6.44-acre area. In order to complete repairs, the pipeline may need to be drained into Lytle Creek.

8-3 Reservoir and Access Roads (WV.3) – Phase 1

The new 8-3 Reservoir project is located west of Lytle Creek Road, adjacent to two existing reservoirs situated on the hillside west of Lytle Creek, approximately 0.4 mile north of the intersection of Lytle Creek Road and Glen Helen Parkway, in unincorporated San Bernardino County (Figure 2-20). The project involves the construction of a 2.0-million-gallon aboveground reservoir (tank) that would be located adjacent to two existing reservoirs: 8-1 and 8-2. Extensive grading is anticipated with approximately 15,690 cubic feet of dirt being removed from the site. There are two existing dirt access roads that access the site, but due to safety concerns one of the dirt roads will be decommissioned. West Valley will utilize the northern most dirt access road during project construction to access the current reservoir site and for day-to-day operations. West Valley will also maintain the access road to the reservoir site in addition to weed abatement and any waterline repairs. Activities associated with the access road or pipeline alignment are assumed to occur on an annual basis. This project is currently mapped as a maximum design consideration area, but the actual project when designed would impact a fraction of this area.

See Section 2.1.6 for general O&M activities conducted by West Valley for their existing or planned facilities.

West Valley Other Routine Maintenance (WV.5) – Phase 1

West Valley currently maintains existing dirt access roads, totaling approximately 17,800 feet (3.4 miles), within their service area, and will continue to maintain these roads annually, and as necessary (Figure 2-20). Regular use of the access roads keeps maintenance requirements minimal. If needed, West Valley would perform weed abatement or grading activities to keep the roadway clear of vegetation and erosion holes, and gullies.

The general O&M activities common to most of the Permittee Agencies are described in 2.1.6.

West Valley Facilities Maintenance (WV.6) – Phase 1

Ongoing maintenance activities for existing pipelines and facilities are proposed for coverage under the HCP (Figure 2-20). The majority of pipeline occurs in existing roadways or other developed areas but sections of existing pipeline do traverse streambeds (Figure 2-20):

- Lytle Creek Wash Pipeline (WV.2): an approximately 0.3-mile section of pipeline crossing Lytle Creek 0.6 mile upstream (north) of the Foothill Boulevard crossing of Lytle Creek.
- A buried segment of pipeline under Lytle Creek immediately upstream of West Baseline Street Bridge in the City of San Bernardino (this same segment of pipeline is identified in VD.4 and WD.5; the pipeline is proportionally shared by these agencies).
- Three crossings of Frisbie Wash, two described in WV.2: Walnut Pipeline and Lord Ranch Pipeline, and a section crossing Frisbie Wash at North Pepper Avenue.
- The crossing of Lytle Creek at Glen Helen Parkway (buried in road ROW).

Pipeline maintenance would include pipeline section and/or valve replacement, as needed. An approximately 30- by 200-foot temporary maintenance work area would be used by heavy equipment and service trucks in order to complete the repairs. Repair activities may include temporary flow diversions, pipeline excavation with heavy equipment, temporary stockpiles, leak repairs, and replacement of spoils. Access to repair/maintenance locations within stream channels will utilize existing access ramps/roads, where available. Temporary impact areas will be restored to pre-project conditions. Repairs proposed within existing stream courses will be restored in coordination with the resource agencies or as established in this HCP. All access roads will be returned to their pre-project conditions. The general O&M activities common to most of the Permittee Agencies are described in Section 2.1.6.

2.1.4 Solar Energy Development

This section describes projects related to construction and maintenance of new solar energy facilities to supply electricity to existing wells. The location of these activities is illustrated on Figure 2-21 and Figure 2-22.

Riverside Public Utilities Activities

Riverside Public Utilities Various Solar Projects (RPU.11) – Phase 1

New Construction

The City of Riverside is contemplating the construction of solar projects on land it owns in San Bernardino County. Sites have not yet been confirmed, but they may include portions of the Tippecanoe and Headgates North/Gage properties:

Tippecanoe Solar Projects

RPU proposes to construct an approximately 1 MW solar project on the Tippecanoe site (APN 0280-251-53), located south of the Santa Ana River, north of Riverview Drive, west of Mountain View Avenue, and east of South Tippecanoe Avenue in the City of San Bernardino. Construction will include select clearing and grubbing of existing vegetation, and limited grading to facilitate the installation of above- and below-ground equipment for solar panels, electrical equipment, and ingress and egress access paths. Construction will take approximately 12 to 16 weeks.

Gage Solar Projects

RPU proposes to construct an approximately 0.5 MW solar project upon the Headgates North Parcels/Gage site (APNs 0280-251-25 and 0280-251-18), located north of the Santa Ana River, south of East Central Avenue, east of South Tippecanoe Avenue, and west of Mountain View Avenue in the City of San Bernardino. Construction will include select clearing and grubbing of existing vegetation, and limited grading to facilitate the installation of above- and below-ground equipment for solar panels, electrical equipment, and ingress and egress access paths. Construction will take approximately 12 to 16 weeks.

Maintenance

Maintenance would be required periodically to clear vegetation and wash down the equipment.

The general O&M activities common to most of the Permittee Agencies are described in Section 2.1.6.

2.1.5 Habitat Improvement, Management, and Monitoring

Habitat improvement, management, and monitoring activities covered under this HCP are grouped into four categories.

1. Existing activities or projects being planned and conducted by Permittee Agencies to benefit habitats or species for mitigation outside of this HCP. These projects are described below under *Ongoing Habitat Management Projects in the Planning Area* by each Permittee that is the owner of the project.
2. Habitat Improvement Projects (includes habitat restoration and rehabilitation projects throughout the HCP Preserve System).
3. Experimental Projects being conducted to determine benefits to Covered Species and Covered Species habitat.

4. Preserve management and monitoring activities implemented in the future to restore, rehabilitate, maintain, and monitor conserved lands that may impact Covered Species or may be used to offset impacts as part of the mitigation strategy for this HCP.

These projects are described below. The locations of these activities are illustrated on Figure 2-21.

For the purposes of this HCP, rehabilitation includes activities that improve habitat conditions of a degraded site, for example through nonnative plant management. Restoration includes more intensive activities, such as site manipulation, with the goal of rebuilding/expanding habitat and re-instating ecological processes and services, where possible.

Ongoing Habitat Improvement and Management Projects in the Planning Area

These properties are currently protected under existing conservation obligations that predate the development of the HCP. No ongoing habitat improvement and management projects described in this section are proposed to provide mitigation value for impacts under the HCP; however, the ongoing management activities are included as they may require take authorization. Avoidance and minimization measures detailed in Section 5.9, *Species-Specific Conservation Strategies,* will be followed for this project to avoid or reduce impacts on Covered Species.

Inland Empire Utilities Agency Activities

RP3 Basin Habitat Mitigation Area (2010 RMPU) (IEUA.1.13) – Phase 1

The approximately 10-acre RP3 Basin Habitat Mitigation Area is located immediately west of the intersection of Beech Avenue and Chaps Lane in the City of Fontana. This existing mitigation site consists of an easement area to provide mitigation for unavoidable impacts on riparian wetlands associated with the Chino Basin Facilities Improvement Program (Figure 2-26). The conservation easement is held by the Rivers & Land Conservancy. The site supports upland scrub, riparian woodland, and wetland habitats providing wildlife habitat and water quality benefits.

New Construction

No new construction is anticipated as part of this Covered Activity.

Operations

No operations activities are anticipated as part of this Covered Activity.

Maintenance

Maintenance activities in the mitigation area are limited to trash removal and weed control of invasive plant species. Trash removal occurs by using nets on long poles and/or wader outfits to comb through the wetlands to remove litter/debris that has come to the site via the incoming water flow or wind. Weed removal services involve hand weeding low growing annual weeds and removal of nonnative trees, such as eucalyptus. Avoidance and minimization measures common to all rehabilitation projects are described in Section 5.11,1, *General Avoidance and Minimization Measures*.

Habitat Improvement Projects

Habitat improvement projects, consisting of restoration and/or rehabilitation, have been identified in four of the five HCP Preserve Units: Santa Ana River Preserve Unit, Alluvial Fan Preserve Unit A, Alluvial Fan Preserve Unit B, and Santa Ana Sucker Translocation Preserve Unit A. Though conservation lands have not yet been identified in Santa Ana Sucker Translocation Preserve Unit B, habitat acquisition, restoration, and/or rehabilitation opportunities continue to be actively pursued in all Preserve Units. Habitat restoration and/or rehabilitation activities would generally be temporary and disruptive only in the short term. Habitat rehabilitation activities could involve soil disturbance, removal of undesirable plants, and planting of native species. Habitat restoration would involve all of the aforementioned activities, as well as limited grading. All habitat improvement activities are expected to result in a net long-term benefit for Covered Species and vegetation communities. All habitat rehabilitation and restoration activities conducted within the Planning Area that are consistent with HCP requirements will be covered by the HCP.

Each of the currently identified habitat restoration and rehabilitation projects are described below, grouped by the Preserve Unit within which they are located.

Santa Ana River Preserve Unit

The Tributary Stream and Riparian Floodplain Restoration/Rehabilitation projects are proposed to occur over multiple phases of HCP implementation, Tributary Stream Restoration/Rehabilitation will primary occur in Phase 1, with some of the adjacent Riparian Floodplain Restoration/Rehabilitation proposed in Phase 2. Several projects are also proposed for general consideration in the HCP, but the timing of phasing is currently unknown. This HCP considers habitat restoration and rehabilitation activities in the following areas as components of the Conservation Strategy that would result in beneficial effects for the Covered Species.

- Hidden Valley Creek (Conserv.1)
- Hidden Valley Ponds (Conserv.2)
- Lower Hidden Valley Creek (Conserv.3)
- Lower Hole Creek (Conserv.4)
- Anza Creek and Old Ranch Creek (Conserv.5)
- Evans Lake (Conserv.6)
- Louis Rubidoux Nature Center and Sunnyslope Creek (Conserv.7)
- Tequesquite Creek Aquatic Habitat (Conserv.8)
- Pedley Landfill (Conserv.9)
- Management of Santa Ana Sucker Restoration on Sunnyslope Creek (Conserv.11)

The following sections provide a brief description of each of these restoration/rehabilitation projects. Refer to Chapter 5 for details about the restoration and habitat rehabilitation activities planned at these sites. Avoidance and minimization measures common to all restoration and rehabilitation projects are described in Section 5.11.1.

Hidden Valley Creek (Conserv.1) – Phase 1, Phase 2

Phase 1

The Hidden Valley Creek site is located at the Hidden Valley Wildlife Area, on the inside of a meander bend on the south side of the Santa Ana River on approximately 112 acres (Figure 2-23). It is about 0.75 mile downstream of the Van Buren Boulevard Bridge and the City of Riverside's RWQCP (Figure 2-6). The Santa Ana River historically occupied a position farther to the northwest than it presently does, but the land that was not being farmed was active floodplain, similar to how it is today. The alignment and shape of the Santa Ana River changes regularly at the Hidden Valley Creek site in response to flood events, as scour and fill processes lead to the creation of new channels with sand and gravel bars and the filling of previous channels. Riparian vegetation colonizes new river bars and becomes more established in areas that have sufficient time for plants to grow in between flood scouring events.

The Hidden Valley Creek site and the downstream wetlands are part of the 1,500-acre Hidden Valley Wildlife Area along the Santa Ana River. Approximately 1,250 acres of the Hidden Valley Wildlife Area are owned by CDFW, but the entire property is managed by Riverside County Parks and Open Space District. Currently, the Hidden Valley Creek site does not have a perennial source of water. Water at the site is limited to storm runoff generated from the surrounding hillslopes during rain events and, infrequently, the Santa Ana River during high flood events. Until infrastructure was damaged by a large flood event in 2010, the site contained a canal with flowing water and wetlands supported by wastewater that flowed from Riverside's RWQCP upstream. The canal still exists but has no reliable water source.

The restoration activities for the Hidden Valley Creek site proposed under Phase 1 include establishment of a new channel and rehabilitation of the existing channel (including native riparian buffer), new floodplain establishment, installation of fish habitat features, culvert installation and replacement, nonnative vegetation removal, enhancement of riparian vegetation, groundwater well and pump installation, and long-term habitat maintenance, and monitoring. Additionally, human disturbance will be limited and recreation and public education opportunities provided to the public.

Phase 2

Riparian and floodplain restoration and rehabilitation opportunities at the Hidden Valley Creek site include establishing an oxbow feature and further controlling nonnative invasive species. Rehabilitation opportunities at the site are largely associated with enhancing habitat by removing nonnative plant species and planting native species. These activities would improve habitat conditions for multiple species, including those that are threatened and endangered. The site is in an active part of the Santa Ana River floodplain that has experienced substantial erosion and deposition from flood flows. Groundwater and surface flows currently support one large perennial pond feature in the downstream portion of the site, likely a remnant of a previous river course. This feature provides a unique habitat for wildlife, as it represents a perennial, low-velocity water source with adjacent riparian habitat. Creation of a similar feature in the upstream portion of the site would increase the opportunity for wildlife to utilize this unique habitat type. Adding gently sloping shoreline habitat to the created feature would increase nesting opportunity for certain bird species and also provide benefits to southwestern pond turtle and south coast garter snake. Due to the risk of future flooding associated with the active Santa Ana River, the proposed location for this feature is the southern portion of the floodplain outside of the regular channel migration zone. Collectively, the site has the potential to support approximately 15 acres of wetland habitat.

Hidden Valley Ponds (Conserv.2) – Phase 1, Phase 2

Phase 1

The Hidden Valley Ponds restoration site is located immediately west of the Hidden Valley Creek site, on the Hidden Valley Wildlife Area (Figure 2-23). The site is in the SAR floodplain and consists of a large riparian floodplain terrace south of the mainstem SAR along with several artificial (now dry) ponds. Prior to being operated by the County of Riverside Parks and Open Space Department, the site was known as the Hidden Valley Gun Club, founded in 1957 and active until 1974 when the property was purchased by the State of California. The gun club promoted duck and pheasant hunting and was responsible for much of the development of the existing pond system. The ponds were created by a series of levees that were filled with delivered water that gravity fed through the system until exiting downstream to a long channel that returned water to the river. The depth of the constructed ponds varied from 6 inches to over 5 feet. Flooding from the Santa Ana River deposited sediment and filled in some areas that used to be duck ponds (City of Riverside 1995). A flood in 2010 along the Santa Ana River lowered the riverbed by up to 8 feet and destroyed the infrastructure that delivered water to the ponds (Danelski 2014). Since that time the ponds have remained empty as they are not connected to groundwater or any other natural surface water sources. The ponds historically provided seasonal habitat for resident and migrating avian species, as well as native terrestrial and aquatic wildlife and plants. Historically, the ponds provided a variety of active and passive recreational opportunities, including hiking, hunting, fishing, bird watching, and public education. Since drying, the ponds no longer support many of these services.

Habitat restoration and management activities proposed at the site and covered under the HCP include reconfiguring the eastern ponds and restoring to aquatic/riparian, and controlling nonnative species.

Phase 2

Restoration activities conducted during Phase 1 would be expanded upon in Phase 2. Phase 2 activities will include reconfiguration of the western pond cells and restoration of the adjacent floodplain. Nonnative species management, and the provision of a permanent, dedicated water source is also planned.

Lower Hidden Valley Creek (Conserv.3) – Potential Future Phase

Note: This activity is in its early planning stage and is described below for its general consideration in the HCP. It will be re-evaluated more specifically upon completion of the Conservation Strategy to determine the potential for mitigation value.

The Lower Hidden Valley Creek restoration project includes restoring the stream channel downstream of Hidden Valley Ponds, between the ponds and the mainstem of the Santa Ana River (Figure 2-23). Restoration activities may include stabilizing the channel, enhancing habitat in the existing channel for the Santa Ana sucker, restoring the riparian corridor along the existing channel through nonnative species removal and replanting of native species, reestablishing floodplain, controlling nonnative wildlife species, reducing human disturbance, and restoring upland buffer vegetation.

Lower Hole Creek (Conserv.4) – Phase 1, Potential Future Phase

Phase 1

Lower Hole Creek is located west of Van Buren Boulevard and north of Jurupa Avenue in the City of Riverside. Hole Creek is a tributary to the Santa Ana River. The proposed Lower Hole Creek restoration area begins downstream of Jurupa Avenue where the stream passes under the road through a large, newly installed 40-foot concrete box culvert with extensive downstream protections that creates a 27-foot elevation difference between the channel upstream and downstream of the crossing (Figure 2-23). Lower Hole Creek consists of two drainage features: the main creek and a small tributary, which meets the SAR at the downstream end. Much of Lower Hole Creek is part of Hidden Valley Wildlife Area, owned by CDFW and managed by Riverside County Parks and Open Space District. The City of Riverside owns the upper 260 feet of the Lower Hole Creek Channel and floodplain, and the Riverside-Corona Resource Conservation District (RCRCD) is grantee to a conservation easement recorded over approximately 1 acre of this area. Additional privately held parcels are located in the southeastern corner of the site and elevated high above the creek.

Currently, Lower Hole Creek's water sources include treated effluent and urban runoff (RCRCD 2012), including runoff from Van Buren Boulevard that enters the site from the east downstream of Jurupa Avenue, runoff from the Greenbelt area (south of Victoria), locally rising groundwater, and occasionally flow from Riverside Canal (Herzog pers. comm.). The creek is part of the McAllister/Hole Creek drainage; the watershed is heavily urbanized, and much of the runoff is piped underground to the lower reaches of Hole Creek. The urban watershed causes rapid runoff during rain events and periodic flooding that delivers abundant trash and debris to Lower Hole Creek (RCRCD 2012). These sources provide enough water for Lower Hole Creek to be a perennial channel throughout the year, with low flows typically less than 0.5 cfs (0.3 mgd).

Restoration activities proposed for the Lower Hole Creek covered under the HCP include stabilizing the channel (recontouring incised stream banks and using natural materials to reduce erosion potential), replacing existing concrete in the upper channel with a cobble and boulder step-pool type morphology to dissipate energy, enhancing habitat in the existing channel for the Santa Ana sucker by laying back tall, steep eroding banks to create inset floodplains and adding boulder and wood to the channel to increase habitat diversity and spawning gravel beds, restoring the riparian corridor along the existing channel through nonnative species removal and replanting of native species, reestablishing floodplain, controlling nonnative wildlife species, reducing human disturbance, restoring upland buffer vegetation, and including opportunities for public recreation and education.

Potential Future Phase

Note: Additional riparian and floodplain restoration and/or rehabilitation opportunities exist at Lower Hole Creek. These activities are in an early planning stage and are described below for general consideration in the HCP. These additional opportunities will be re-evaluated more specifically upon completion of the Conservation Strategy to determine the potential for mitigation value.

Riparian and floodplain habitat improvement opportunities at the Lower Hole Creek site include rehabilitating upland vegetation and further controlling nonnative plant and wildlife species, which would enhance Covered Species habitat. In addition to restoration on site, improved condition of the adjacent upland (buffer) habitats will further reduce adverse impacts on the creek related to its proximity to an urbanized landscape. Currently, the buffer is highly accessible to the public, contains an historic landfill, and functions in a degraded state with high human use, soil disturbance, and nonnative cover. Rehabilitation of the upland areas to coastal sage scrub vegetation would protect wetland conditions and create additional opportunities for Covered Species.

Anza Creek and Old Ranch Creek (Conserv.5) – Phase 1, Potential Future Phase

Anza Creek and Old Ranch Creek are part of the same site that is approximately 321 acres and is located on the SAR's south floodplain about 2 miles downstream of Mount Rubidoux (Figure 2-23). The Anza Creek/Old Ranch Creek site is bounded to the north by the SAR, to the east by the closed Tequesquite Landfill, and to the south and west by the SAR bicycle trail and Anza Narrows Park. Anza Creek is in the western half of the site while Old Ranch Creek is located generally in the eastern half of the site.

The Anza Creek Channel is a large drainage that flows along the southern edge of the site. The upper 2,000 feet of the present-day Anza Creek Channel was the active channel of the SAR in 1931 and had a large meander bend that extended south up against the present-day bicycle trail. Portions of the middle section of the present Anza Creek are on land that appears to be a terrace feature based on historical aerial photography. A flood event that occurred prior to 1980 appears to have eroded portions of this high ground where the Anza Creek Channel is presently located near Anza Narrows Park. The confluence of the present-day Anza Creek Channel with the SAR is a dynamic area, as the exact location of the confluence changes depending on shifts in the position of the SAR in response to flood events. The RCRCD is grantee to an approximate 12.6-acre conservation easement over lower Anza Creek.

Anza Creek flows originate from a large 20-foot concrete box culvert under the SAR bike trail and a concrete box culvert that enters from the southeastern corner of Anza Narrows Park. Groundwater upwelling is an important contributor to surface flows in Anza Creek. The drainage becomes well defined approximately 0.6 mile upstream of the confluence with the SAR; at this location the banks are steep.

Old Ranch Creek has a 585-acre watershed area composed predominantly of impervious surfaces as a result of urban development. Stormwater enters the Old Ranch Creek Channel from a 10-foot concrete box culvert in the southeastern corner of the site. This drainage is also fed by runoff from the closed Tequesquite Landfill property to the east of the site via a culvert beneath the dirt path that runs along the eastern project boundary. The urban watershed causes rapid runoff during rain events and periodic flooding that delivers abundant trash and debris to Old Ranch Creek. Flowing water is rarely observed in the Old Ranch Creek Channel and only occurs during storm events.

Based on historic aerial imagery, the Old Ranch Creek Channel previously connected with the Santa Ana River, with the confluence occurring on the western boundary of the Old Ranch Creek site. However, several decades ago, the downstream half of Old Ranch Creek was eroded during a large flood event that caused the Santa Ana River to migrate south. Subsequent construction of the Tequesquite Landfill on the eastern (upstream) boundary of the site has constrained the river from migrating south into the former floodplain, thus eliminating any evidence of a direct connection with Old Ranch Creek. The remaining upstream half of Old Ranch Creek is still evident, consisting of an arcing swath of dense vegetation and ephemeral stream morphology.

Phase 1

Restoration activities of Anza Creek covered under the HCP include modifying and augmenting surface flows to support Santa Ana sucker, enhancing the existing channel to create suitable Santa Ana sucker habitat, constructing a well-defined channel in the uppermost portion of Anza Drain, creating new floodplain within Anza Drain, and stabilizing a steep, unvegetated portion of bank near the bicycle trail at Anza Narrows Park.

The restoration activities for the Old Ranch Creek site covered under the HCP include establishment of a new channel and rehabilitation of the existing channel (including native riparian buffer), new floodplain establishment, installation of fish habitat features, culvert installation and replacement, nonnative vegetation removal, groundwater well and pump installation, and maintenance and monitoring.

Potential Future Phase

Note: Additional riparian and floodplain habitat improvement opportunities exist at Anza Creek/Old Ranch Creek. These activities are in an early planning stage and are described below for general consideration in the HCP. These additional opportunities will be re-evaluated more specifically upon completion of the Conservation Strategy to determine the potential for mitigation value.

Riparian and floodplain habitat improvement opportunities at the Anza Creek/Old Ranch Creek sites include alkali marsh rehabilitation, upland rehabilitation, floodplain expansion, and further management of nonnative wildlife species. These restoration and rehabilitation opportunities would improve habitat quality for Covered Species by reducing the threat from nonnative wildlife species such as bullfrogs (*Lithobates catesbeianus*), wild boar (*Sus sp*.), mosquitofish (*Gambusia affinis*), and brown-headed cowbird (*Molothrus ater*). Control methods are as yet undetermined and may include methods such as seasonal variation in water supply or more traditional control methods such as trapping.

The site currently supports alkali meadow habitat at several locations in the outer floodplains that illustrate near-reference conditions for that vegetation community. There are also areas on site where historic alkali meadow has become degraded by past human use and an influx of nonnative species. In particular, the southeastern corner of this site provides an ideal opportunity for alkali marsh restoration, including control of nonnative species, planting of native species, and improvements to hydrology by connecting the area to the Old Ranch Creek drainage. This area is dominated by nonnative grasses, but there are still native alkali species present such as salt grass (*Distichlis spicata*) and creeping wild rye (*Elymus triticoides*). The presence of these species, the adjacent reference condition, and the topography (low depression) are all indicators that this area can be successfully restored to alkali meadow. Additional restoration opportunities exist throughout the floodplain as much of these areas supports lower densities of native alkali species.

The northeastern corner of the site, immediately downstream of the landfill, is at a higher elevation than much of the site, with extensive areas of disturbed bare ground, nonnative species, and human disturbance. The higher elevation appears to be a result of historic fill, potentially in association with past landfill practices. Removal of fill material would allow this area to reengage the active floodplain at a frequency similar to that of the riparian zone along the river. As this area is artificially armored by the presence of the landfill, there is also the opportunity to further excavate an area in the southern portion of this site to emulate a relic channel in the form of an oxbow. This would require excavation to and below groundwater levels to support a perennial water source. Any work in this area would require pre-approval from Riverside County Waste.

Evans Lake (Conserv.6) – Phase 1

The Evans Lake site covers approximately 115 acres in the City of Riverside's Fairmount Park and is bounded to the northeast by Evans Lake, to the west by the levee along the Santa Ana River, and to the east and south by the Santa Ana River bicycle trail (Figure 2-23). The land at the site is owned by the City of Riverside. Evans Lake was constructed in the early 1900s. The watershed area upstream of the lake is approximately 9 square miles with two major drainage channels, Spring Brook Wash and University Wash, providing most of the runoff to the lake (Northwest Hydraulic Consultants 2015). These channels were constructed by USACE and are maintained by Riverside County Flood Control District. Locally high groundwater elevations likely supported the lake's water historically but with the declines in groundwater levels the lake's water is now maintained by pumping from wells to support recreation (Northwest Hydraulic Consultants 2015). The Santa Ana River was a part of the site prior to construction of the Santa Ana River levee.

The low flow channel and spillway channel downstream of Evans Lake receive water either via a culvert or from water that is released or spilled from the lake at two locations. Evans Lake traps bedload sediment and prevents it from supplying the channel below. A sluice box located near the southwest corner of the lake allows water to flow under Dexter Drive and into the low flow channel that flows for 3,400 feet before going into twin reinforced concrete culverts at the Santa Ana River levee. A culvert that carries flows from Spring Brook Wash and a higher elevation spillway is located at the northwest section of Evans Lake. The 200-foot-long spillway is formed by a dip in Dexter Drive at an elevation of 792 feet. The 2,750-foot-long spillway channel flows to the southwest before joining the low flow channel about 1,500 feet upstream of the levee.

The Evans Lake habitat restoration and rehabilitation activities covered by the HCP include restoration of the low flow and spillway channels, removal of nonnative species, replanting with natives, removal of trash and debris, management of human disturbance, and long-term monitoring and management of these habitats. Portions of the channel will be enhanced to provide suitable habitat for the Santa Ana sucker and other native aquatic species. Riparian and upland areas will be rehabilitated through the removal of nonnative species, replanting with native plants and long-term management of these plantings and their surrounding habitats.

Community and recreational facilities will also be part of the project site including, but not limited to, a nature trail, amphitheater, archery/BB gun range, community garden, and camping and day use area. These facilities would be constructed outside of the most sensitive areas of the project, and many would incorporate community outreach and education about the natural resources of the site.

Louis Rubidoux Nature Center and Sunnyslope Creek (Conserv.7) – Potential Future Phase

Note: This activity is in its early planning stage and is described below for its general consideration in the HCP. It will be re-evaluated more specifically upon completion of the Conservation Strategy to determine the potential for mitigation value.

Riverside County Parks and Open Space District owns the Louis Rubidoux Nature Center (LRNC), adjacent park, and portions of Sunnyslope Creek but is leasing the property to the Louis Rubidoux Nature Center Consortium (Consortium) (Figure 2-24). Five entities—the Inland Empire Resource Conservation District (IERCD), Valley District, Orange County Water District (OCWD), Huerta del

Valle (HdV), and Sunshine Haven Animal Rescue and Wildlife Rehabilitation—are part of the Consortium.

The LRNC and Sunnyslope Creek will be revitalized and enhanced to meet the needs of the Riverside County Parks and Open Space District, community, and multiple watershed entities, through refurbishment of existing site elements and development of new opportunities. The LRNC Consortium plans to rehabilitate, restore, and re-invigorate key historical elements on the site including the Nature Center, the pecan grove, the children's garden, interpretive signage, and the trails to and along the creek. In addition to incorporating historical onsite resources new uses will be brought to the site, such as sustainable agriculture, wildlife rehabilitation, local office space, group camping, science education, and restoration and rehabilitation of the adjacent creek and riparian habitat for the benefit of dependent species and watershed health. Community engagement opportunities resulting from this work are projected to include familiar events such as the Annual Pecan Festival and professional development workshops, while updated site features will serve as the foundation to host new events such as regular farmer's markets and annual stewardship festivals.

Restoration and rehabilitation of Sunnyslope Creek and adjacent habitat is proposed to include nonnative species removal, planting with native riparian plant species, and enhancement of adjacent habitat features. These habitat improvement activities are expected to benefit native fish and reptile species including Santa Ana sucker, arroyo chub, southwestern pond turtle, south coast garter snake, as well as riparian bird species such as least Bell's vireo, and yellow-breasted chat.

Tequesquite Creek Aquatic Habitat (Conserv.8)

*[**Note to reader**: This activity is in its early planning stage and is described below for its general consideration in the HCP. Conservation Actions at this location are not a part of the HCP Conservation Strategy and not considered as mitigation for Covered Activities in this HCP.]*

The Tequesquite Creek is one of the primary creeks within the City of Riverside with upper portions of its watershed originating in the Box Springs Mountains and Sycamore Canyon Wilderness Park. The drainage spans over 40,000 acres and is a tributary to the Santa Ana River. The RCRCD is grantee to a conservation easement over approximately 7.5 acres of city and county lands centered on Tequesquite Creek, from just downstream of the Riverside County Flood Control channel to the stream's confluence with the Santa Ana River (Figure 2-24). This site is located west of the western extent of Tequesquite Avenue, close to the junction of Tequesquite Avenue and the Santa Ana River Trail, in the City of Riverside. Ryan Bonaminio Park is located just to the east, and Mt Rubidoux to the north.

The RCRCD commenced habitat improvement activities at this site in 2013. Habitat improvement activities included removal of trash, and clearing of nonnative plant species (e.g., palm, ash, fig, catalpa, eucalyptus) to improve spawning habitat and riparian vegetation for listed fish species, including Santa Ana sucker and arroyo chub.

Future habitat restoration and rehabilitation activities at the site may include continued nonnative plant removal and control, homeless camp debris removal, streambank stabilization via native plantings, substrate enhancements, and supplemental water input, as well as activities to monitor native fish in the creek.

Pedley Landfill Restoration (Conserv.9) – Potential Future Phase

*[**Note to reader**: This activity is in its early planning stage and is described below for its general consideration in the HCP. Conservation Actions at this location are not a part of the HCP Conservation Strategy and not considered as mitigation for Covered Activities in this HCP.]*

The Pedley Landfill is located on a 13.5-acre parcel, which is owned by CDFW (Figure 2-24). Previously, in 1932 the County of Riverside had a burn operation at the site, and in 1957 through 1958 used the site as a cut and fill operation before selling it to CDFW in February 1974. The parcel is at the immediate confluence of the Santa Ana River mainstem and Hole Creek, just west of Van Buren Boulevard. During an evaluation of restoration opportunities for Hole Creek, Pedley Landfill was identified as one of the largest constraints to meaningful restoration in the creek. In addition to constraining the physical movement of Hole Creek the landfill has become increasingly unstable as the mainstem Santa Ana River has moved south, resulting in damage and likely contamination issues. At least three recent site failures have occurred: in December 2010, half an acre was washed away, followed by erosion of the north slope during a spring storm in March 2014, and then again in November 2015. The repairs are costly and pose a risk to the river system downstream. In addition, the physical constraints of the landfill—which flanks the lowermost 1,200 feet of Hole Creek's east bank—limit the ecological conditions of the creek, including a lack of floodplain, riparian habitat, suitable buffer, and channel migration. As a result of the risk for continued erosion into the landfill, a project was initiated to excavate approximately 1.3 acres of the landfill and install interlocking concrete mat on the northern edge of the landfill. However, additional erosion has occurred since this repair. CDFW, Riverside County Waste, and Valley District have discussed opportunities for complete removal or substantially reducing the size of the landfill to protect downstream water resources and facilitate additional restoration opportunities for Hole Creek.

Management of Santa Ana Sucker Restoration on Sunnyslope Creek (Conserv.11) – Phase 1

Habitat restoration and rehabilitation activities within Sunnyslope Creek (Figure 2-24) for the benefit of Santa Ana sucker are proposed to occur, at minimum, annually. Activities may include: clearing discrete areas of the channel where flow is obstructed; removal of nonnative aquatic predators; reducing the depth of deep pools to minimize habitat suitable for nonnative fish species; and manipulation of the channel using equipment to concentrate the creek flow in a single channel to maximize velocity and facilitate silt scour, and enhance hydrologic connectivity between Sunnyslope Creek and the Santa Ana River. Substrate, including rock, gravel, and smaller boulders may be imported to improve substrate conditions in the creek for the Santa Ana sucker. The addition of up to 10 cubic yards is proposed. These materials are proposed to be surface gleaned from the adjacent alluvium and deposited in deeper holes in the creek to significantly reduce the depth of the pool complexes with the potential to harbor large nonnative predatory fishes. Nonnative fishes and amphibious predator removal are proposed using electro-shocking, trapping, seining, fishing, and dip-netting. Trash and debris will be removed by hand, and longer-term solutions for trash prevention are being explored (for example, the installation and operation of a trash boom). The possibility of augmenting creek flow with well water will also be explored to alleviate drought-associated impacts on dry-weather creek flow.

Maintenance

Maintenance activities at Sunnyslope Creek will routinely occur monthly. Repair and maintenance activities would generally be completed within a day or two for the project area. Maintenance activities may require work in streambed areas.

The general O&M activities common to most of the Permittee Agencies are described in Section 2.1.6. Avoidance and minimization measures common to all habitat improvement, management, and monitoring projects are described in Section 5.11.1.

Alluvial Fan Preserve Unit A

Habitat rehabilitation and restoration has been identified for seven sites within Alluvial Fan Preserve Unit A. Projects within this Preserve Unit will focus on the rehabilitation and restoration of alluvial fan scrub and SBKR refugia habitat. Projects currently identified within Alluvial Fan Preserve Unit A include:

- Enhanced Recharge Basin (Conserv.12)
- Alluvial Fan Hydraulic Disturbance (Conserv.13)
- Drainage A Woolly-Star (Conserv.14)
- Redlands Airport Parcels (Conserv.15)
- Santa Ana River Refugia (Conserv.16)
- San Bernardino Avenue (Conserv.17)
- Weaver (Conserv.18)

Enhanced Recharge Basin (Conserv.12) – Phase 1

The Enhanced Recharge Basin alluvial fan scrub restoration and rehabilitation would be conducted during Phase 1 of HCP implementation. The project will encompass 295 acres within a portion of one of two larger areas (or a combination of the two) (Figure 2-24). Both areas are owned by the Conservation District. The first area is within the Wash Plan HCP area, immediately west of the Borrow Pit and east of Cone Camp Road, and the second location occurs south of Mill Creek and the USACE levee, around existing recharge basins. These larger areas include existing facilities (e.g., roads, recharge basins, etc.). Restoration and rehabilitation will occur outside of these areas, primarily within the interstitial spaces between existing facilities, or around the periphery. Habitat improvement activities at either site (or both) would involve enhancing alluvial fan scrub habitat for the benefit of SBKR and Santa Ana River woolly-star. There are multiple recent documented occurrences of SBKR throughout the Conservation District lands south of Mill Creek (Romich 2018), but the species is currently generally limited to the periphery of the area located west of the borrow pit within the Wash Plan HCP area (Romich 2019).

Habitat improvement activities will rely on the best available data based on recent research on microhabitat suitability for SBKR conducted by the San Diego Zoo Institute for Conservation Research (Shier et al. 2019) and the evaluation of various methods of mechanical manipulation to simulate the effects of fluvial disturbance (ICF 2019). If habitat improvement activities are proposed to occur within lands west of the borrow pit the effort would be considered experimental, until it could be demonstrated that SBKR were using the restored and/or rehabilitated habitat (more detail available in Chapter 5). However, because SBKR currently occupy areas immediately adjacent to habitat proposed for restoration and/or rehabilitation (Romich 2019), it is expected that habitat improvement activities will create favorable conditions for SBKR. Success criteria will be developed and presence or an increase of SBKR will need to be demonstrated before acreage can be used to offset Covered Activity impacts on SBKR (see Chapter 5). Success criteria will also be developed for

Santa Ana River woolly-star, with presence of the species required prior to use of this acreage to offset impacts from Covered Activity implementation.

Alluvial Fan Hydraulic Disturbance (Conserv.13)

Note: This activity is in its early planning stage and is described below for its general consideration in the HCP. Conservation Actions at this location are not a part of the HCP Conservation Strategy and not considered as mitigation for Covered Activities in this HCP.

The Alluvial Fan Hydraulic Disturbance project may be completed during a future phase of HCP implementation. This restoration project may include the use of structures made from natural materials (boulder and large cobble) that will be placed within the active channel of the Santa Ana River at several locations below the confluence with Mill Creek to manipulate water movement into inactive areas of the channel (Figure 2-25). Three potential locations within the main channel are under consideration to conduct fluvial disturbance to refresh habitat, with anticipated benefits for SBKR and other alluvial habitat species. Success criteria will be developed and presence or an increase of SBKR will need to be demonstrated before acreage can be used to offset Covered Activity impacts to SBKR. Installation of a much larger structure within the main channel is also under consideration to divert flows from major storms into the 1969 breakout channel to create additional fluvial disturbance. The total acreage of new habitat from these manipulations is expected to encompass approximately 14.4 acres.

Drainage A Woolly-Star (Conserv.14) – Phase 2

This mitigation site is located south of East M Street, east of South Fogg Street, and west of the Santa Ana River in the City of Colton. The Drainage A Woolly-Star alluvial fan scrub habitat improvement project is contingent upon successful land acquisition/conservation easement recordation, and, consequently, the project is not proposed until Phase 2 of HCP implementation. The Drainage A parcel (Figure 2-25) is a portion of the diversion structure for the Riverside North Aquifer Storage and Recovery Project (RPU.5). The parcel is occupied by a large population of Santa Ana River woolly-star (several thousand individual plants), and a large population of Los Angeles pocket mouse, despite the degraded habitat quality of the site. The Drainage A Woolly-Star project will rehabilitate approximately 20 acres of degraded habitat by removing nonnative species, trash, and debris, and by improving the overall protection, management, and monitoring of the site. Opportunities to widen the alluvial floodplain of the drainage will also be explored. The project will benefit Santa Ana River woolly-star, Los Angeles pocket mouse, and the Riversidean alluvial fan sage scrub habitat on the site.

Redlands Airport Parcels (Conserv.15) – Phase 1

The Redlands Airport Parcels comprise approximately 40 acres and are located east of Judson Street, north of East Pioneer Avenue, west of Sessums Drive, and south of Riverview Drive/Aviation Drive and the Redlands Airport in the City of Redlands (Figure 2-25). The site is situated outside of the current floodplain of the Santa Ana River. In recent decades the site likely supported citrus groves but was cleared for development sometime prior to 1995 (based on review of aerial photography). Since 1995 the site has been regularly maintained via mowing, and has potentially been scraped with heavy equipment.

SBKR habitat rehabilitation is proposed at this site with rehabilitation activities scheduled to commence prior to Phase 1 of HCP implementation. Portions of the site are occupied by SBKR, and because the property is located outside of the Santa Ana River floodplain it provides refugia habitat for the species. Habitat rehabilitation will enhance conditions for the species over the entire 40 acres of the site. This acreage will be used to mitigate impacts on SBKR from HCP Covered Activities. Best available science on SBKR habitat preferences (Shier et al. 2019) will be used to inform habitat rehabilitation activities. Success criteria will be developed and presence or an increase of SBKR will need to be demonstrated before acreage can be used to offset Covered Activity impacts to SBKR. The site was purchased in late 2020 by Valley District on behalf of the HCP with the purpose of managing, protecting, and preserving the site for the benefit of SBKR in perpetuity.

Santa Ana River Refugia (Conserv.16) – Phase 1

Four locations, totaling approximately 123 acres comprise the Santa Ana River Refugia sites. Portions of all four locations support existing populations of SBKR. These sites include:

- Amazon: The Amazon mitigation site totals approximately 29 acres and is located northeast of the intersection of East Central Avenue and Mountain View Avenue, north of the Santa Ana River, and south of the San Bernardino International Airport (Figure 2-25).
- California Redlands: The California Redlands mitigation site totals approximately 32 acres and is located east of Mountain View Avenue, west of California Street, north of Palmetto Avenue, and south of the Santa Ana River in the City of San Bernardino (Figure 2-25).
- Tippecanoe: The Tippecanoe mitigation site totals approximately 32 acres and is located south of the Santa Ana River, north of Riverview Drive, west of Mountain View Avenue, and east of South Tippecanoe Avenue in the City of San Bernardino (Figure 2-25).
- The RPU Headgates mitigation site totals approximately 31 acres and is located east of South Tippecanoe Avenue, south of East Central Avenue, west of South Mountain View Avenue, north of Riverview Drive, and north and south of the Santa Ana River in the City of San Bernardino (Figure 2-25).

The sites are currently owned by the City of Riverside/RPU, but are proposed for acquisition (via purchase and/or conservation easement recordation) by the HCP. SBKR habitat rehabilitation is proposed at all four locations with activities scheduled to commence prior to and during Phase 1 of HCP implementation. All four properties are located outside of the Santa Ana River floodplain; consequently, they provide refugia habitat for the species.

Habitat rehabilitation will enhance habitat conditions for the species over the entire 123 acres of all four sites. This acreage will be used to mitigate impacts on SBKR from HCP Covered Activities. Best available science on SBKR habitat preferences (Shier et al. 2019) will be used to inform habitat management activities. Success criteria will be developed and presence or an increase of SBKR will need to be demonstrated before acreage can be used to offset Covered Activity impacts to SBKR. All four sites will be protected and preserved in perpetuity.

San Bernardino Avenue (Conserv.17) – Phase 1

The San Bernardino Avenue mitigation site totals approximately 7 acres and is located north of East Cooley Avenue, south of East Orange Show Road, and immediately east of the Santa Ana River in the City of San Bernardino (Figure 2-25). The site was purchased by Valley District for future use by the HCP.

SBKR habitat restoration/rehabilitation is proposed at this site with activities scheduled to commence prior to and during Phase 1 of HCP implementation. Portions of the site are occupied by SBKR, and because the property is located outside of the Santa Ana River floodplain it provides refugia habitat for the species. Habitat restoration/rehabilitation will enhance habitat conditions for the species over the entire 7 acres of the site. This acreage will be used to mitigate impacts on SBKR from HCP Covered Activities. Best available science on SBKR habitat preferences (Shier et al. 2019) will be used to inform habitat management activities. Success criteria will be developed and presence or an increase of SBKR will need to be demonstrated before acreage can be used to offset Covered Activity impacts to SBKR The site will be protected and preserved in perpetuity.

Weaver (Conserv.18) – Phase 1

The Weaver mitigation site totals approximately 20 acres and is located south of Greenspot Road, west of Weaver Channel, and east of Merris Street in the City of Highland (Figure 2-25).

SBKR habitat restoration/rehabilitation is proposed at this site with activities scheduled to commence prior to and during Phase 1 of HCP implementation. Portions of the site are currently occupied by SBKR. Habitat restoration/rehabilitation will enhance habitat conditions for the species over the entire 20 acres of the site. Best available science on SBKR habitat preferences (Shier et al. 2019) will be used to inform habitat management activities. Success criteria will be developed and presence or an increase of SBKR will need to be demonstrated before acreage can be used to offset Covered Activity impacts to SBKR The site will be protected and preserved in perpetuity.

Alluvial Fan Preserve Unit B

Habitat rehabilitation and restoration has been identified for one site within Alluvial Fan Preserve Unit B.

Devil Creek (Conserv.19) – Phase 1

The Devil Creek rehabilitation and restoration project would be conducted during Phase 1 of HCP implementation. The site is located north of I-215, and east of the Devils Canyon Hydroelectric facility, along Devils Canyon Road in the City of San Bernardino. The project will encompass approximately 391 acres, within a portion of the total area identified on Figure 2-26. The larger area includes existing facilities (e.g., roads, recharge basins). Habitat rehabilitation/restoration will occur outside of these areas, primarily within the interstitial spaces between existing facilities, or around the periphery. Habitat rehabilitation/restoration activities are currently conceptual, but would involve enhancing alluvial fan scrub and adjacent habitat for the benefit of Covered Species.

Santa Ana Sucker Translocation Unit A and Unit B

Habitat rehabilitation and restoration has been identified for one site within Santa Ana Sucker Translocation Unit A. Santa Ana sucker translocation will occur to upper watershed streams with suitable habitat conditions within either of (and potentially both) Santa Ana Sucker Translocation Units A and B:

City Creek (Conserv.20) – Phase 2

The City Creek rehabilitation/restoration project would be conducted during Phase 2 of HCP implementation. The site is located north of Highland Avenue and east and west of City Creek Drive/SR-330 in the City of San Bernardino and unincorporated San Bernardino County. The project will encompass approximately 264 acres, within a portion of the total area identified on Figure 2-26. Proposed habitat rehabilitation/restoration activities are conceptual, but will likely include enhancing riparian and aquatic and adjacent upland habitat for the benefit of Covered Species.

Santa Ana Sucker Translocation (Conserv.21) – Phase 1

Translocation and long-term maintenance and monitoring of Santa Ana sucker will occur at a minimum of three mountain tributary streams within the upper Santa Ana River watershed (Figure 3-29). Some of the potential translocation streams are located upstream of Seven Oaks Dam and include Plunge, Hemlock, Alder, City, and Bear Creeks. Other potential streams include Mill, Lytle, San Antonio, and Mountain Home Creeks. Translocation will follow methodology outlined in the Santa Ana Sucker Translocation Plan and the CAMMP. Translocated populations will be maintained and monitored for, at minimum, the duration of the permit (up to 50 years with the option to renew).

Translocation actions of the Upper Santa Ana River Sustainable Resources Alliance (Alliance) may result in impacts on individual Santa Ana sucker downstream of the aforementioned translocation areas (or other mountain tributary streams with suitable habitat conditions), outside of areas where the species currently exists within the Planning Area (i.e., upstream of the La Cadena drop structure). Impacts may also occur within translocated areas by entities other than the named Permittees. These impacts may be caused by recreational use and CDFW fish planting, or where fish may be lost to downstream areas (e.g., washed into existing SCE hydroelectric facilities, and existing channels or basins with migration barriers). Impacts from these or other unnamed activities or where translocated fish are lost to ephemeral portions of the river (due to drying of the stream) outside of areas where the species does not currently exist would not result in incidental take. This is described further below.

The assumption exists that if/when translocated Santa Ana sucker are lost downstream of a barrier to upstream migration, outside of the intended translocation stream, these fish are impacted so as to be "taken" (mortally wounded to cause death). To clarify, but for human intervention, these fish would not provide a viable population or have any chance to re-populate the intended translocation areas. Further impacts on these fish downstream of translocation areas would not constitute "incidental take" because the taking occurred when the fish moved downstream into stream reaches that were not biologically connected. Minimization of impacts, so as to reduce the loss of these fish, will be provided by the Alliance, whereby Santa Ana sucker will be salvaged and relocated back upstream to their translocation stream of origin. Once relocated upstream into the appropriate translocation area(s), these fish are again managed and monitored as other translocation fish and incidental take prohibitions are reinstated.

If impacts occur on Santa Ana sucker within translocation areas, existing or future otherwise lawful activities that may impact fish are covered by incidental take exemptions provided by the Alliance. These activities include typical actions whereby the public may induce impacts on translocated Santa Ana sucker in the form of harm or death but are incidental to the intent of the action. Examples include, but are not limited to, the stocking of game fishes by CDFW, fishing, stream crossing by off road vehicles (only if approved by the U.S. Forest Service, or on private lands), stream diversion (if lawful), in-stream use (if lawful) including foot traffic, operation and maintenance of existing facilities, and vegetation management. New (translocation) populations of Santa Ana sucker will be managed and monitored to provide occupied habitats outside of the existing, extant range of the species. Loss of individual fish will be accounted for by the Alliance through habitat improvement and ongoing adaptive management. If a population fails repeatedly due to known threats caused by the public, a new translocation stream may need to be populated with fish to account for this loss.

Experimental Projects

One project is currently classified as experimental. The project is a Conservation Action and is anticipated to result in beneficial conditions for native fish species in areas upstream of the Conservation Action areas. *This project is not a part of the HCP Conservation Strategy and is not considered as mitigation for Covered Activities in this HCP.*

Habitat Enhancement at Prado Basin (Conserv.10) – Phase 1

The Habitat Enhancement at Prado Basin project involves periodic sediment removal at three locations in response to sediment deposition that has occurred and continues to occur in the Prado Basin, as well as long-term management of in-stream native fish habitat structures within the Santa Ana River (Figure 2-24). Sediment has also deposited and continues to deposit upstream from the Basin along an unknown distance within the Santa Ana River, flattening the stream gradient in some sections of the river. The majority of sediment that is removed from the river will be used for various projects unrelated to this Plan. Sorted larger sediment will be returned to the river to provide habitat enhancement benefits, further described below.

Impacts expected during construction and maintenance of the Habitat Enhancement at Prado Basin project (Conserv.10) are proposed as self-mitigating within lands controlled and managed by OCWD. Impacts on riparian habitats will be mitigated at Pheasant Field and/or riparian restoration in areas of giant reed that burned in recent wildfires in the Prado Basin. In-stream benefits within the mainstem of the Santa Ana River are anticipated for Santa Ana sucker and arroyo chub, and are described in detail below.

Site 1 – River Road

The River Road project work area for sand removal will encompass most of the river’s unvegetated banks and stream (open water) area from just below River Road Bridge to approximately 1,000 feet upstream and cover approximately 18 acres plus an access road, similar to the area used for sand removal in the early 2000s. Up to 150,000 cubic yards of sediment will be removed per year.

Site 2 – Sand Trap

A second location, an in-stream sand trap, is also proposed for sand removal and is located approximately 2 miles downstream of River Road Bridge in Prado Basin. This location is the site of a recently completed sediment demonstration project. The sand trap site encompasses approximately 14.3 acres and is designed to capture the majority of the sediment that bypasses the River Road basins (located upstream) during baseflow conditions. The site is currently accessible by an approximate 0.5-mile-long access road, used to convey sediment extracted from the site to an existing sediment stockpile area (approximately 15 acres in size) located in a weedy field west and south of the terminus of Butterfield Drive and the Corona Airport in Prado Basin. The sand trap is currently permitted as a temporary feature to test the amount and rate of sediment capture through OCWD’s Prado Basin Sediment Management Demonstration Project (Permit Number SPL-2011-00961-JEM). A second permitting process has been completed that provides coverage for temporary impacts to remove an additional 120,000 cubic yards of sediment from this site, which is projected to occur twice over the next 50 years (for a total of 240,000 additional cubic yards of sediment). More frequent sediment extraction may be needed to provide the desired upstream aquatic habitat benefits; therefore, this is considered a permanent impact under the HCP to provide the added flexibility for sediment removal. Data collected during the currently permitted temporary project (1 year) will be used to refine features associated with the permanent HCP project. Final design of this project will be dependent on the approach that best avoids and minimizes impacts on threatened and endangered species occupied habitats.

Site 3 – Pheasant Field

A third site for sand removal is proposed at Pheasant Field (approximately 24 acres in size), which is approximately 0.75 mile north and east of the sand trap and south of the OCWD diversion channel. This area contains nonnative annual plants and open sand. If additional sediment removal is needed to achieve upstream habitat benefits, a one-time removal of surplus sand (2–4 feet) will occur on this site. Up to 150,000 cubic yards of sediment would be removed. The sediment removal will then be followed by planting of native riparian plant species. Management and monitoring of this habitat area will be integrated into the HCP long-term habitat management and monitoring strategy.

Gabions

There are ten existing gabions that occur approximately 0.75 mile upstream of River Road Bridge that will be maintained as a part of this Covered Activity. Gabion construction activities took place in the fall of 2016 but subsequent gabions may be built in the future. Each gabion is a rock filled cage, approximately 12 feet long by 3 feet wide. These structures are intended to create localized areas of scour that expose coarse substrate (e.g., gravel) found below the surface layer of sand. Gabion maintenance will include placement of rock found during sand removal at Prado Basin. If the existing gabions are not operable, new gabions may be built, or the rock found during the sand removal will be utilized for Santa Ana sucker habitat enhancement at ten locations near the existing gabions or at a new location(s) agreed to by USFWS.

Construction scheduling is expected to be concentrated in the late summer through fall to avoid wet weather delays and nesting birds. Construction activities are generally anticipated to be completed within 4 months.

Anticipated Benefits

Monitoring will be conducted along the stream to track the change in streambed elevation and grain size. It is anticipated that a coarsening of the streambed will occur upstream of the sand removal areas due to an increase in the rate of sediment transport into the sediment basins. The *Santa Ana River Sediment Monitoring Program Phase 1* (Scheevel Engineering 2019) provides proof of concept and an example of the type of monitoring proposed. This experimental project shows that a small sediment trap (7,000 cubic yards, approximately 4 acres) downstream of River Road created a deepening of the streambed (incision) that extended more than 1.75 miles upstream. At 1.75 miles upstream of the basin the deepening was measured at 6 inches (near Dearborn Street). The average rate of sediment transported into Prado Basin during baseflow was estimated at 60 to 80 tons per day at baseflow conditions. The sediment trap was estimated to enhance sediment transport at baseflow by transporting sediment at up to 115 tons per day and causing up to 3 feet of incision of streambed at the top of the trap. Beneficial results (streambed incision) were observed when the sediment trap was functional (2 months) and diminished once the sediment trap had filled.

Maintenance

Typical maintenance of River Road basins (Site 1 described above) includes the opening and closing of basin stream apertures to allow sediment clean out. The frequency of clean out will be dependent on the rate of sediment removed from the streambed and size and dimensions of each basin. Basin berms are typically reconstructed after large flood events approximately three times per year.

The Sand Trap site (Site 2) will be cleaned out using either bulldozers, as in the River Road basins, or with a suction dredge that deposits sediment at the proposed stockpile area. Each activity will have its own maintenance schedule, but work within the sand trap area will be minimized to reduce impacts on surrounding resources.

No maintenance is anticipated within Pheasant Field (Site 3). Post construction, this site will become riparian habitat.

The maintenance of the gabions will include the occasional addition of rock derived from sorted rock removed from the stream and/or from an alternative source, probably not more than twice annually, as the gabions sink into the riverbed over time.

The general O&M activities common to most of the Permittee Agencies are described in Section 2.1.8.

Preserve Management and Monitoring

The conservation and mitigation strategy (Chapter 5) is designed to mitigate impacts of Covered Activities on the Covered Species within the Planning Area and to manage and monitor those species in the future. However, implementation of some conservation and mitigation actions may result in low levels of take (for wildlife) or adverse impacts (for plants) and, therefore, are being addressed in this HCP as Covered Activities. Preserve management and monitoring may include but is not limited to the following types of activities.

- Easement monitoring to assess the condition of site facilities (e.g., pumps, fencing, gates, signage, roads) and determine management needs.
- Habitat rehabilitation, restoration, and creation.
- Operational changes to enhance in-stream habitat.
- Control of invasive species, including vegetation (e.g., grazing, mowing, hand clearing, targeted herbicide application[8]) and wildlife (e.g., aquatic predator control).
- Covered species captive headstarting and translocation.
- Covered species relocation from impact sites (relocating species to adjacent suitable habitat outside of where impacts are unavoidable).
- Species monitoring activities in the Planning Area and mitigation areas such as tagging, population surveys, and genetic sampling.
- Species surveys and research.

[8] Activities associated with the application of herbicide that may result in take of a Covered Species (e.g., the operation of an all-terrain vehicle in SBKR habitat resulting in the collapse of a burrow) are covered by the HCP, However, take resulting from the herbicide itself would not be covered. Applicators must use pesticides according to the label. This includes limits on applications to avoid wildlife.

- Seed collection.
- Assessment of habitat condition utilizing appropriate methodologies (e.g., point surveys).
- Monitoring and mapping of nonnative invasive plant and wildlife species to inform adaptive management actions.
- Vegetation management using grazing, and/or mechanical or hand clearing methods, as appropriate.
- Fire management such as prescribed burning (as conducted by the Forest Service on Forest Service Lands), mowing, hand-thinning of vegetation, and establishment of fuel breaks.
- Trash and debris removal, and offsite disposal.
- Removal of encampment sites, including garbage and structure (e.g., trailers, vehicles, solar panels, electronic devices, fencing materials) and hazardous material (e.g., fuel) removal.
- Installation and maintenance of access control features (e.g., gates, barriers, and fences).
- Preserve patrols in coordination with local law enforcement (where needed) to identify and enforce conservation easements or approved long-term management plans. Specific details of the level of effort of preserve patrols will be determined between the Upper Santa Ana River Sustainable Resources Alliance and local law enforcement.

2.1.6 Routine Operations and Maintenance

Routine maintenance activities are actions that occur repeatedly in one location and/or in many locations over a wide area (e.g., bank stabilization, storm-damage repair, maintenance of facilities). Maintenance activities are generally performed periodically and include actions such as minor construction, earth-moving, or vegetation management activities that can affect listed species. Below is a list of typical water agency routine maintenance activities. Routine maintenance activities that involve repair and replacement are assumed to typically be conducted in-kind (i.e., not result in an expanded footprint or replace earthen material with grouted material). Repair or replacement activities that result in an enlarged footprint to accommodate new facilities or infrastructure, or an existing earthen embankment proposed to be replaced with a concrete or grouted embankment will be considered new projects.

All routine O&M activities will use existing access routes, where available. If activities need to occur in undeveloped areas, including streambeds, the least impactful route will be determined and used based on the recommendations of an appropriately qualified biologist. All temporary impacts, including temporary access routes/roads, will be restored to preexisting or superior conditions. Repairs proposed within existing stream courses will be restored in coordination with the resource agencies or as established in this HCP.

Pipelines and Associated Facilities

Areas that may be affected by pipeline maintenance activities include those around existing water conveyance systems such as pipelines, pump stations, blow-offs, turnouts, and vaults. The following activities may be conducted as part of routine pipeline maintenance.

- Leak repair, which may require blow-off (dewatering of pipes that typically includes a point source of high velocity flow) to local uplands or streams and/or excavation to access pipelines.

- Internal inspection, which also may require blow-off or planned discharge to local uplands or streams to access the internal portion of the pipeline.
- Unscheduled releases of water, which may be due to a pressure surge in a pipeline that could damage the pipeline. Under such conditions, an automatic turnout valve will open and release the water to prevent the pipe from bursting. Flows from the pipeline may be reduced following such an event. This is a relatively self-contained process, with the valves opening for less than 1 minute and shutting as soon as system pressure drops.
- Rehabilitation and/or replacement of pipeline components, which may include, but is not limited to, air release valves, piping sections or connections, joints, and appurtenances. Activities may include excavation and trenching to access buried pipelines.
- Bank stabilization and erosion control within a creek, which may be related to pipeline maintenance and includes discharges that either come out of pipes within a stream bank and flow down the bank into the channel, or are pumped down or across a stream bank. Bank protection work, which may require some excavation, would occur prior to a planned discharge in areas where banks within 50 feet of the discharge point show signs of erosion or instability.
- Replacement/repair of buried service valves, which may include valves within creek embankments that may require excavation and minor bank stabilization activities.
- Pipeline turnout maintenance, which may include access to pipelines.
- Replacement/repair of appurtenances, fittings, manholes, and meters.
- Vault maintenance: vaults occur along segments of pipeline; pipeline components are located within vaults. There are different types of vaults and all are considered confined spaces. Structures other than the pipeline contained within vaults include valves, electrical stations, turnout piping, etc. Telemetry pull boxes, corrosion monitoring stations, and some air release valves are not located within vaults. Vaults are typically made of concrete and may be located immediately below grade (below ground level) or partially or fully above grade.
- Telemetry cable/system inspections and repairs: telemetry systems allow communication of data from the pipeline to the pipeline operator so that the operator can track the operations of the pipeline. Telemetry cables are often cited in the center of roads. May require excavation to access system components.
- Meter inspections and repairs: flow meters measure the rate of flow through a pipeline. Some meters are located in vaults while others are not.
- Maintenance of pump stations, operation yards, utility yards, and corporation yards.

Wells and Associated Facilities

Maintenance of wells and associated facilities includes rehabilitation, redevelopment (limited to within the existing footprint), testing, and/or replacement. Typical activities associated with rehabilitation and redevelopment may include, but are not limited to, the following.

- Temporary removal of above/below ground equipment
- Brushing and bailing, chemical treatment (oxidizers, cleaning agents [surfactant and/or dispersant], and/or acid treatments)
- Redevelopment, and reinstallation of above-/below-ground equipment

Typical activities associated with aquifer pump testing may include, but are not limited to, the following.

- Step drawdown testing
- Constant rate pumping test
- Spinner surveys
- Downhole video survey
- Casing sidewall sampling
- Biological activity reaction test, and/or packer testing for isolated zone sampling

Pump testing requires a small hole be constructed to accept test discharge. A pump test and associated discharge will occur once when a new well initially comes online, and then each well, existing or new, will be tested once every 15 years.

The equipment that may be used for well rehabilitation, redevelopment, testing, and/or replacement includes the following.

- Cable-tool rig, drill rig, or pump hoist equipment
- Nylon, polypropylene, or steel brushes
- Dual-swab assembly
- Air compressor
- Test pumping equipment
- Discharge measuring device(s)
- Water level measuring device(s)

Site Inspections and Repairs

Most routine maintenance activities described in this section are initiated based on regular site inspections of facilities. Site inspections are made both by vehicle and on foot. Access, particularly in areas that are frequently maintained, is provided by paved and dirt maintenance roads. Small-scale repairs (e.g., fences and gate repairs, signage replacement and repair, graffiti removal, trash and small debris removal) may be made as part of regular site inspections, while other maintenance needs are documented and included in annual maintenance planning efforts (e.g., a site that is experiencing erosion may be noted for future bank stabilization work).

Operation of water reuse projects requires personnel to routinely be at the facilities for inspections and equipment operation and monitoring. Operations may require night lighting and generate noise.

Stockpiling

Maintenance of stockpile locations includes placement of material (i.e., debris and sediment from facilities) at specific locations for use in repairs and temporary storage. Stockpiles are often treated to avoid the spread of nonnative invasive plants.

Mechanized Land Clearing/Excavation

Mechanized land clearing and excavation activities include, but are not limited to, the following.

- Grading basin bottoms, which is undertaken to properly convey flows downstream and debris removal, water quality control, and groundwater recharge. Debris removal includes removal of sediment, dead vegetation such as fallen boughs and leaves, and illegally dumped trash. Material is removed to maintain conveyance capacity of each facility as necessary. Substrate suitable for use in restoration/enhancement sites will be retained and applied at mitigation sites, where feasible, and sediment removed from active recharge facilities will be deposited in locations for re-entrainment during subsequent flow events (see *Basin Sediment Management Plan*). Sand and gravel operations may occur. Basin bottom silt and clays are removed and soil is typically broken up and kept free of vegetation to enhance groundwater recharge.
- Mechanical vegetation management, which includes the removal of vegetation with equipment such as dozers and graders to facilitate recharge and convey flows, to remove large areas of growth from regulated facilities that are certified/inspected by the U.S. Federal Emergency Management Agency, USACE, and California Department of Water Resources Division of Safety of Dams. Mechanical vegetation management may also be required for fuel modification purposes per State and local fire codes.

Removed sediment, vegetation, and other debris is stockpiled on- or off site prior to final disposal. Clean sediment may be used in bank repairs. If sand or gravel suitable for use in habitat restoration activities (e.g., substrate for Santa Ana sucker or SBKR) is removed, these materials may be saved for use in conservation/mitigation actions.

Mechanized land clearing/excavation can have a significant impact on habitat, hydrology, and sediment transport. Therefore, all mechanized land clearing/excavation activities must be coordinated closely with the HCP Implementation Entity to ensure that such clearing activities fully implement avoidance and minimization measures, and do not exceed the allotted "take" allowed under the incidental take permits of the HCP.

Access Roads

Maintenance of access roads includes road grading, surface repair of potholes and wash-outs, and fencing and gate repairs. Activities may also include excavations of various sizes that may be needed to fill potholes, conduct drainage and erosion control, conduct shoulder and slope repair, or re-gravel existing access roads. Access road excavations could be very small (e.g., to repair a pothole or shoulder slump) or involve larger, linear excavations (e.g., to replace culverts or drainage ditches, or repair slope failures for elevated access road fills).

Bank Repair

Bank repairs include filling and compaction of slumped or eroded stream, ditch, and levee banks. This may also include the removal of excess sediment that has slumped into the channel bed (invert) or basin. Sometimes, repair or replacement of rip-rap rock or gabions may be required for banks that experience frequent erosion resulting in high frequency of maintenance. Rip-rap repair includes repositioning and in-kind replacement to stabilize the slopes. It also includes the in-kind repair of grouted and ungrouted sections of rock. Bank repair can also include the repair or replacement of steel revetment. Placement of rip-rap or grouted or un-grouted sections of rock or steel revetment in areas not currently stabilized with such features would not be considered routine O&M and would be treated as a new project. Bank repair along ditches may also include using a backhoe or other heavy equipment to rough grade or stabilize banks and then hydroseeding. Hydroseeding requires the use of special machinery that is towed by a pickup truck. The machinery mixes the seeds and mulch and sprays the mixture onto the bare slope. A maintenance worker may need to spread or move hydroseed around with shovels and rakes. Hydroseeding is usually done once a year prior to rainy season.

Basins

Maintenance activities for basins consists of periodic sediment and vegetation removal within the basin bottoms to enhance groundwater recharge, bank repair, adding sand to existing permanently disturbed areas, and clearing of encroaching vegetation to restore to as-built design specifications. Removed sediment is typically used for dike, canal, and access road maintenance or is exported off site. Routine maintenance may also include vector control (see *Vector and Pest Control* below).

Structure Repair

Existing structure repair or replacement includes, but is not limited to, maintenance and in-kind repair/replacement of concrete walls, and appurtenant structures such as diversion gates, inlets, outlets, spillways, down-drains and/or under-drains, bottom controls, and channel invert improvements.

Culverts, Canals, and Channels

Routine maintenance activities of existing facilities may include clearing encroaching vegetation and debris or sediment, filling ruts and potholes, grading, resurfacing (with gravel or compacted soil), and repairing washouts or erosion. Washout and erosion repair is typically accomplished by filling in the eroded area with native material and sometimes in-kind replacement of grouted rock. It also includes periodic vegetation control. Channels may also be used for heavy equipment access for channel repair activities and vegetation/debris management.

Dikes

Routine maintenance activities may entail occasional excavation and compaction of the dike material at the source of leaks, similar work to replace broken overflow culverts, and repair of washouts. Such repairs occur infrequently.

Vegetation Management

Fuel Modification

Fuel modification can be in the form of manual, mechanical, or chemical vegetation control for the purposes of wildfire management. Methods may include thinning, trimming up, and removing vegetation within buffer zones. Such activities could occur periodically throughout the year in the Planning Area.

Conveyance Maintenance

Mechanical and manual vegetation management activities—including mowing and manual pruning—remove vegetation within facilities or on or in the vicinity of water conveyance structures (e.g., weeds growing up through gabions) that prevent the proper conveyance of storm flows downstream. Equipment used includes, but is not limited to, herbicide[9] applicators, tractor mowers, tractor and disc trailer, and boom mowers. Manual removal includes using power trimmers, weed eaters, and tools such as pruning loppers, saws, and clippers to trim and thin vegetation so it does not clog downstream facilities or reduce water quality.

Facility/Infrastructure Access

Mechanical and manual vegetation management activities are also necessary to maintain access to exposed pipelines, fence lines, and access roads. Equipment used is the same as above, and removal is intended to provide access for inspection of facilities and infrastructure integrity and to prevent damage from vegetation.

RPU may also conduct vegetation management around powerlines. Vegetation management around powerlines requires maintaining a specific clearance distance from the line to ensure that vegetation does not grow back into the electric lines before the next maintenance cycle. If the vegetation is located adjacent to the line, limbs can be pruned along one side of a tree (i.e., side pruning). Vegetation growing under the lines is often topped (i.e., its height is reduced) at the required height below the conductors. Vegetation management is only implemented for those trees and shrubs that will interfere with the electric line when at a mature height or when North American Electric Reliability Corporation (NERC) requirements specify different prescriptions. With few exceptions, such as in the case of pole clearing, any low-growing species are left untouched because they will never pose a risk to the safety or reliability of the electric line. NERC requires clearing at subject poles to remove any vegetation that could propagate a fire. Avoidance and minimization measures for this activity, including avoidance of breeding periods for birds, are addressed in Chapter 5.

Vector and Pest Control

Vector control primarily involves mosquito control to reduce the spread of disease, including West Nile virus. Vector control is conducted by the Riverside and San Bernardino County Environmental Health Department – Mosquito/Vector Control offices, and includes biopesticides and the introduction of mosquito-larvae eating fish.

Pest control includes controlling species that impair habitat quality for Covered Species or degrade water management infrastructure (e.g., ground squirrels burrowing in earthen berms). Pest control measures include the following.

- Hunting or trapping of wild pigs (pursuant to all relevant regulatory authorizations) to manage and protect native species and their habitats.

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[9] Activities associated with the application of herbicide that may result in take of a Covered Species (e.g., the operation of an all-terrain vehicle in SBKR habitat resulting in the collapse of a burrow) are covered by the HCP. Applicators must use pesticides according to the label. This includes limits on applications to avoid impacts on wildlife. Appendix B of the HCP Handbook (USFWS and NMFS 2016) provides special considerations for including use of pesticides in HCPs. This HCP does not cover take from herbicide or pesticide use.

- Controlling ground squirrels on earthen berms to prevent burrowing and maintain berm integrity. Control will be limited to management of ground squirrel burrows (via filling with native sediment), where burrows pose a structural threat to the berm.[10]
- Brown-headed cowbird control may occur on preserve lands. Least Bell's vireo and southwestern willow flycatcher, two Covered Species in this HCP, are negatively affected by nest parasitism by brown-headed cowbirds.

2.2 Projects and Activities Not Covered by the HCP

During development of the HCP, other activities were considered but rejected for inclusion as Covered Activities; these activities are not covered by this HCP. If incidental take authorization is needed for any activities not covered by the HCP, it would have to be obtained independently from the Wildlife Agencies by the appropriate party.

Activities not covered by the HCP and the incidental take authorizations include the following:

- Any activity conducted by a non-Permittee or entity not holding a Certificate of Inclusion (COI) is not covered under the HCP, for example:
  - Utility construction and maintenance, such as electric transmission lines, gas pipelines, petroleum pipelines, telecommunications lines, or cellular telephone stations and associated access roads, if not specifically required as part of a Covered Activity and included as part of the Covered Activity's design.
  - The San Bernardino County Flood Control District owns facilities within the HCP Planning Area upon which some Covered Activities will occur (implemented by HCP Permittee Agencies); however, SBCFCD is not a Permittee and SBCFCD's own projects, operations, and maintenance activities are not covered under this HCP.
- Any activity conducted by the San Bernardino County Flood Control District are not covered by this HCP.
- Channel centerflow activities. Channel centerflow is the establishment and maintenance of a smaller center channel within a channel to convey low volume flows within the center of an earthen channel to keep flows away from the slopes, and is used for guiding first-storm flows. A centerflow channel is established by clearing sediment and vegetation within the center of the channel.
- Disking as a means of vegetation control or maintenance of fire breaks. Mowing is covered as needed for these purposes; disking is not covered.
- This HCP does not cover IEUA's pipeline maintenance activities.
- The Conservation District owns and operates water spreading facilities located outside of the southern edge of Mill Creek, on the dry side of the existing Mill Creek floodwall and

[10] Activities associated with the application of herbicide that may result in take of a Covered Species (e.g., the operation of an all-terrain vehicle in habitat resulting in the collapse of a burrow) are covered by the HCP. Applicators must use pesticides according to the label. This includes limits on applications to avoid impacts on wildlife. Appendix B of the HCP Handbook (USFWS and NMFS 2016) provides special considerations for including use of pesticides in HCPs. This HCP does not cover take from herbicide or pesticide use.

approximately 3.5 miles south of Seven Oaks Dam. The Conservation District's Mill Creek Diversion and Debris Management Improvement Project and maintenance of the spreading facilities south of the Mill Creek flood wall will be permitted outside of this HCP, and therefore are not Covered Activities.

- Routine freeway O&M activities that occur within the Planning Area.
- Development projects such as commercial, industrial, residential development, or other urban transportation infrastructure (e.g., roadways, railways, bicycle paths) are not covered unless specifically listed as a Covered Activity.
- The Western Riverside County Regional Wastewater Treatment Plant Enhancement and Expansion Project was included in the HCP Hydrology Model to account for its effects on in-stream flow from a cumulative effects perspective. However, this project is not covered by the HCP. The discharge from this facility is governed by the California Regional Water Quality Control Board, Santa Ana Region's Order No. R8-2008-0005 (National Pollutant Discharge Elimination System Permit No. CA8000316). Its present design capacity is 8.0 mgd with a proposed ultimate capacity of approximately 16 mgd.

  The Final Environmental Impact Report (FEIR) for the Western Riverside County Regional Wastewater Treatment Plant Enhancement and Enlargement Project, State Clearinghouse No. 2009091040 (K.S. Dunbar & Associates 2010) was certified by the Western Riverside County Regional Wastewater Authority (WRCRWA) Board of Directors' Resolution No. 10-116 on August 24, 2010. The goals and objectives of the project are as follows.

  - Remain in compliance with Order No. R8-2008-0005 adopted by the California Regional Water Quality Control Board, Santa Ana Region on July 18, 2008 and any amendments thereto.
  - Decrease the amount of recycled water that must be discharged to the Santa Ana River.
  - Increase the use of recycled water within economic distance of the Western Riverside County Regional Wastewater Treatment Plant for non-potable uses.
  - Decrease the dependence on imported water supplies within the service areas of the WRCRWA members.

  The FEIR analyzed diversion of up to approximately 24.9 cfs (16.1 mgd; which would be achieved at full build out of the facility) and found that the proposed reduction in recycled water discharge would have no significant impacts on riparian habitat within the Santa Ana River environs nor would it have significant impacts on special-status species that occupy the subject riparian habitat. This determination was based on the fact that the proposed reduction in discharge of 24.8 cfs (16.0 mgd) accounts for only about 2.3% of the total recycled water discharged to the Prado wetlands.

  In December 2012, WRCWRA filed a request with the SWRCB seeking authorization to reduce its current discharge to zero for a reduction of 12.4 cfs (8.0 mgd) to the Santa Ana River Diversion Channel or Canal pursuant to California Water Code Section 1211, Wastewater Change Petition WW0067. The entirety of the water remaining in the Canal, following WRCRWA's discharge reduction, would be from the OCWD diversion at the Santa Ana River.

  Following its request to the SWRCB for Wastewater Change Petition WW0067, in coordination with USFWS and CDFW, WRCRWA developed an Adaptive Management and Monitoring

Program that addresses potential impacts on riparian habitat and associated special-status species within and along the Canal.

- Large-scale maintenance activities not listed as a stand-alone Covered Activity or included under the covered routine maintenance activities (Section 2.1.6). Covered routine maintenance activities are actions that occur repeatedly in one location and/or in many locations over a wide area (e.g., bank stabilization, storm-damage repair, maintenance of facilities). These maintenance activities are generally performed periodically and include actions such as minor construction, earth-moving, or vegetation management activities that can affect listed species.
- Collection and handling of the Covered Species unless specifically required as a component of the biological monitoring and adaptive management. Separate authorization from USFWS and CDFW as appropriate is required for unrelated collection and handling of any listed species.
- Take of a Covered Species, species proposed for Federal listing, State-listed species, or State candidate species as a result of the use of herbicides or other pesticides, or other chemical agents.[11]

[11] Activities associated with the application of herbicide that may result in take of a Covered Species (e.g., the operation of an all-terrain vehicle in SBKR habitat resulting in the collapse of a burrow) are covered by the HCP. Applicators must use pesticides according to the label. This includes limits on applications to avoid impacts on wildlife. Appendix B of the HCP Handbook (USFWS and NMFS 2016) provides special considerations for including use of pesticides in HCPs. This HCP does not cover take from herbicide or pesticide use.

Chapter 3
Planning Area and Existing Environment

This chapter describes existing conditions in the Planning Area. The Planning Area comprises all areas that will be used for any of the activities associated with the Upper Santa Ana River (SAR) Habitat Conservation Plan (HCP), including Covered Activities (Chapter 2) and the conservation strategy (Chapter 5). It includes all lands necessary for the HCP to be fully implemented. A Planning Area for any HCP must, at a minimum, include the permit area, but it may be larger, as is the case for this HCP.

This chapter describes the physical conditions in the Planning Area, including geographic location, topography, geology, soils, climate, hydrology, and geomorphology. It also describes the existing biological environment with an explanation of the methodology and approach used to describe the physical conditions for each Covered Species and their habitats. This description provides the foundation for estimating the potential impacts and potential for take that is presented in Chapter 4, *Incidental Take Assessment and Impact Analysis*, as well as for the conservation strategy described in Chapter 5.

3.1 Geography, Location and Topography

The Planning Area (covering approximately 862,987 acres) is in San Bernardino and Riverside Counties and includes the majority of the upper Santa Ana River watershed. The Planning Area extends from Prado Dam along the San Bernardino County and Los Angeles County line to the north, and then along the Santa Ana River watershed boundary west to east in the San Gabriel and San Bernardino Mountains, reaching elevations of approximately 2,000 to 8,000 feet in the Planning Area. The Planning Area then continues south into Riverside County to the Box Spring Mountains (elevation up to approximately 2,500 feet in the Planning Area), and then southwest through the Moreno Valley to eastern slopes of the Santa Ana Mountains (elevation up to approximately 3,500 feet in the Planning Area) where it runs north again along the border with Orange County. Elevation in the valleys ranges from approximately 500 feet at Prado Basin to approximately 2,000 feet at the eastern end of San Bernardino Valley. Most of the proposed Covered Activities would occur on the mainstem of the Santa Ana River or its tributaries within the Planning Area (see Chapter 2).

3.2 Land Use, Ownership, and Jurisdictions

Existing land uses in the Planning Area include urban areas, farmland, grazing land, national forest, water conservation/water storage facilities, flood control, habitat conservation, open space, aggregate mining/mineral extraction, agriculture/orchards and vineyards, roadways, and airport operations (Table 3-1). National Forest and urban areas comprise the greatest acreage in the Planning Area. See Figure 3-1 for a map of land use types within the Planning Area. Figure 3-2 provides an overview of land ownership boundaries within the Planning Area. For a description of the jurisdictional and physical factors used to define the Planning Area, see Chapter 1, *Introduction and Background*.

Table 3-1. Generalized Land Use in the Planning Area

Existing Land Use	Area (acres)
Residential	163,920
Commercial/Office	21,085
Industrial	35,623
Mixed Uses	1,336
Rural Residential	13,312
Military Installations	7,528
Public Facilities	14,478
Transportation/Communications/Utilities	35,525
Under Construction	11,969
Agriculture	40,869
Water	3,973
Open Space and Recreation	19,612
Existing Land Use Total (does not include Vacant/Undeveloped Land)	**369,230**
Vacant Lands	**Area (acres)**
U.S. Forest Service	233,514
Private	221,929
State Parks	9,011
Owned by Counties	8,686
Owned by Cities	6,911
U.S. Bureau of Land Management	5,073
Special District	4,384
Non-Governmental Organization	2,185
Other Federal	1,213
California Department of Fish and Wildlife	681
Other State	172
Vacant Lands Total	**493,759**
Grand Total	**862,989**

Source: Southern California Association of Governments 2005

3.2.1 Cities and Counties

The majority (65%) of the Planning Area is within San Bernardino County, with the remaining portion (35%) in Riverside County. A number of local land use agencies have approved general plans and specific plans in the Planning Area. These local land use-planning agencies play a major role in zoning and land use decisions in the region. Cities in the Planning Area are listed in Table 3-2 and the larger cities are shown on Figure 3-1.

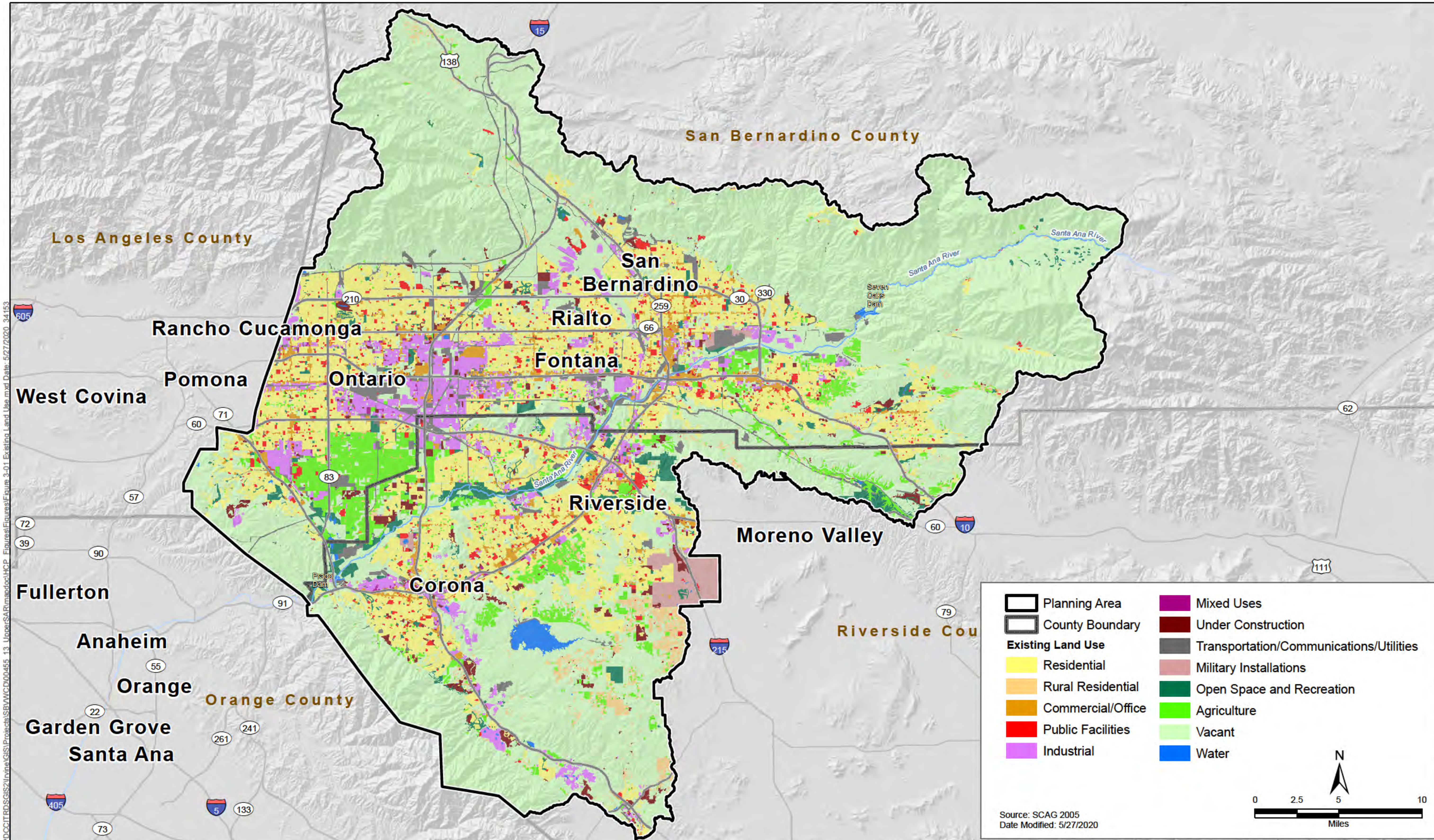


Figure 3-1
Existing Land Use in the Planning Area

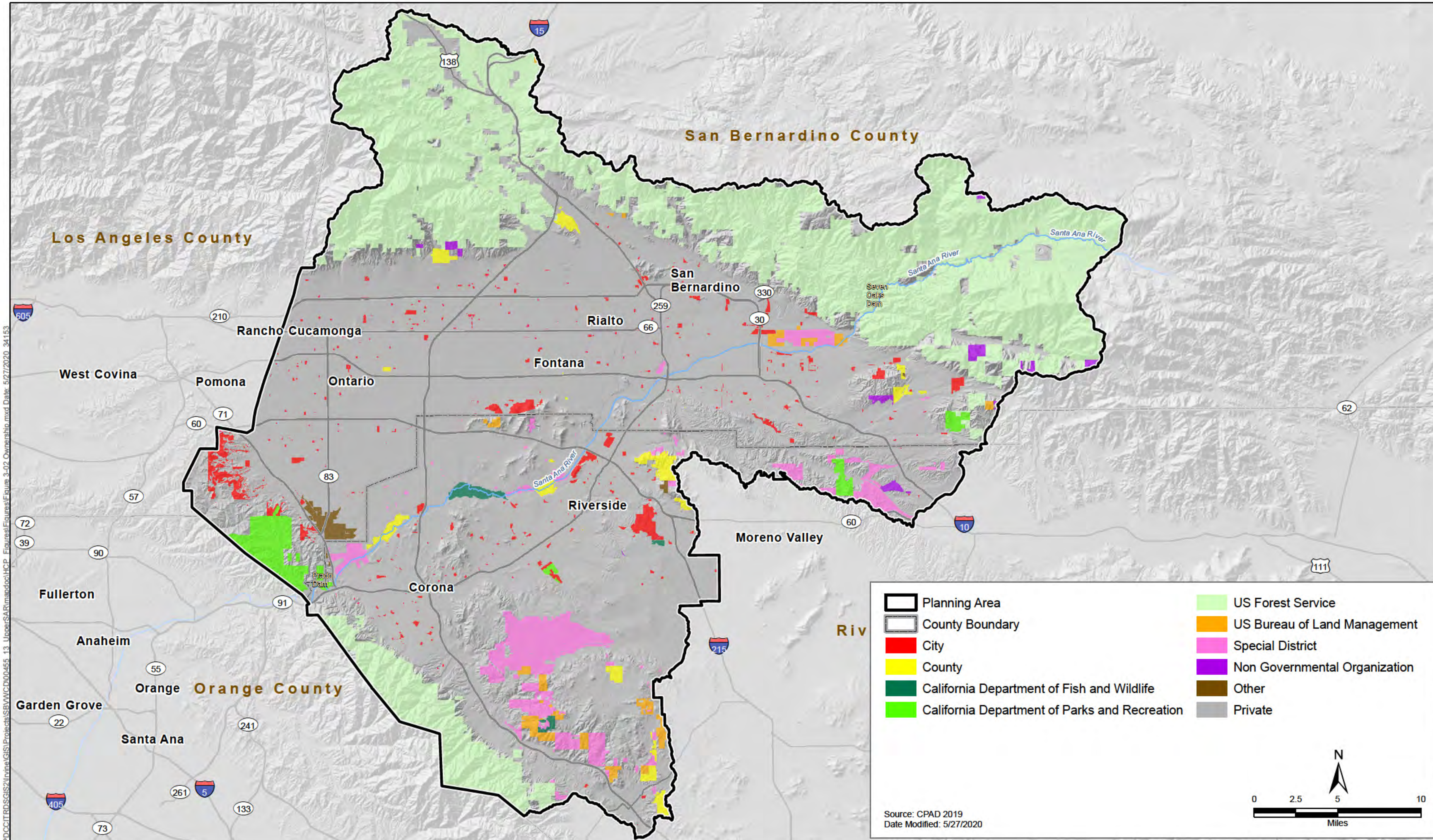


Figure 3-2
Generalized Land Ownership in the Planning Area

Upper Santa Ana River Habitat Conservation Plan

Table 3-2. Counties and Cities/Jurisdictions in the Planning Area

Jurisdiction	Population[5]	Area (acres)[4]
San Bernardino County		**560,440**
Chino[1]	85,595	19,042
Chino Hills[1]	78,309	28,676
Colton[1]	52,154	10,318
Fontana[1]	207,460	27,587
Grand Terrace[1]	12,040	2,245
Highland[1]	54,854	11,959
Loma Linda[1]	23,261	4,805
Montclair[1]	38,690	3,537
Ontario[1]	171,214	31,968
Rancho Cucamonga[1]	175,236	25,672
Redlands[1]	71,035	23,151
Rialto[1]	103,132	14,270
San Bernardino[1]	216,108	39,961
Upland[1]	76,443	10,025
Yucaipa[1]	53,328	18,037
Unincorporated San Bernardino County[2]	309,759	289,187
Riverside County		**302,498**
Beaumont[1]	36,877	1,536
Calimesa[1]	7,879	9,501
Corona[1]	164,226	25,135
Eastvale[2]	63,211	8,403
Jurupa Valley[2]	106,028	27,939
Lake Elsinore[1]	51,821	12,306
Moreno Valley[1]	193,365	2,069
Norco[1]	27,063	8,948
Riverside[1]	322,424	52,190
Unincorporated Riverside County[3]	364,413	154,471

[1] USCB 2010
[2] U.S. Census Bureau 2017
[3] SCAG 2017a, 2017b
[4] California State Board of Equalization 2015
[5] Population numbers are for the entire city or jurisdiction and not just the portion that occurs in the Planning Area.

3.2.2 Existing Protected Areas

A variety of local, State, Federal, and private open space land exists in the Planning Area, including United States Department of Agriculture Forest Service land, and county and city parks (Table 3-3 and Figure 3-3). Roughly 60% (approximately 289,154 acres) of the natural habitat in the Planning Area is currently in some form of public or private habitat protection or otherwise designated open space. The California Protected Areas Database (CPAD) is maintained by GreenInfo Network (www.calands.org) to create a regional database mapping of the distribution of existing protected lands.

Table 3-3. Protected Lands in the Planning Area

Ownership	Acres
California Department of Fish and Wildlife	1,779
California Department of Parks and Recreation	9,798
City	12,029
County	7,002
Non-Governmental Organization	2,355
Other Federal	2,213
Other State	179
Special District	25,168
U.S. Bureau of Land Management	5,290
U.S. Forest Service	236,504
Total	**302,319**

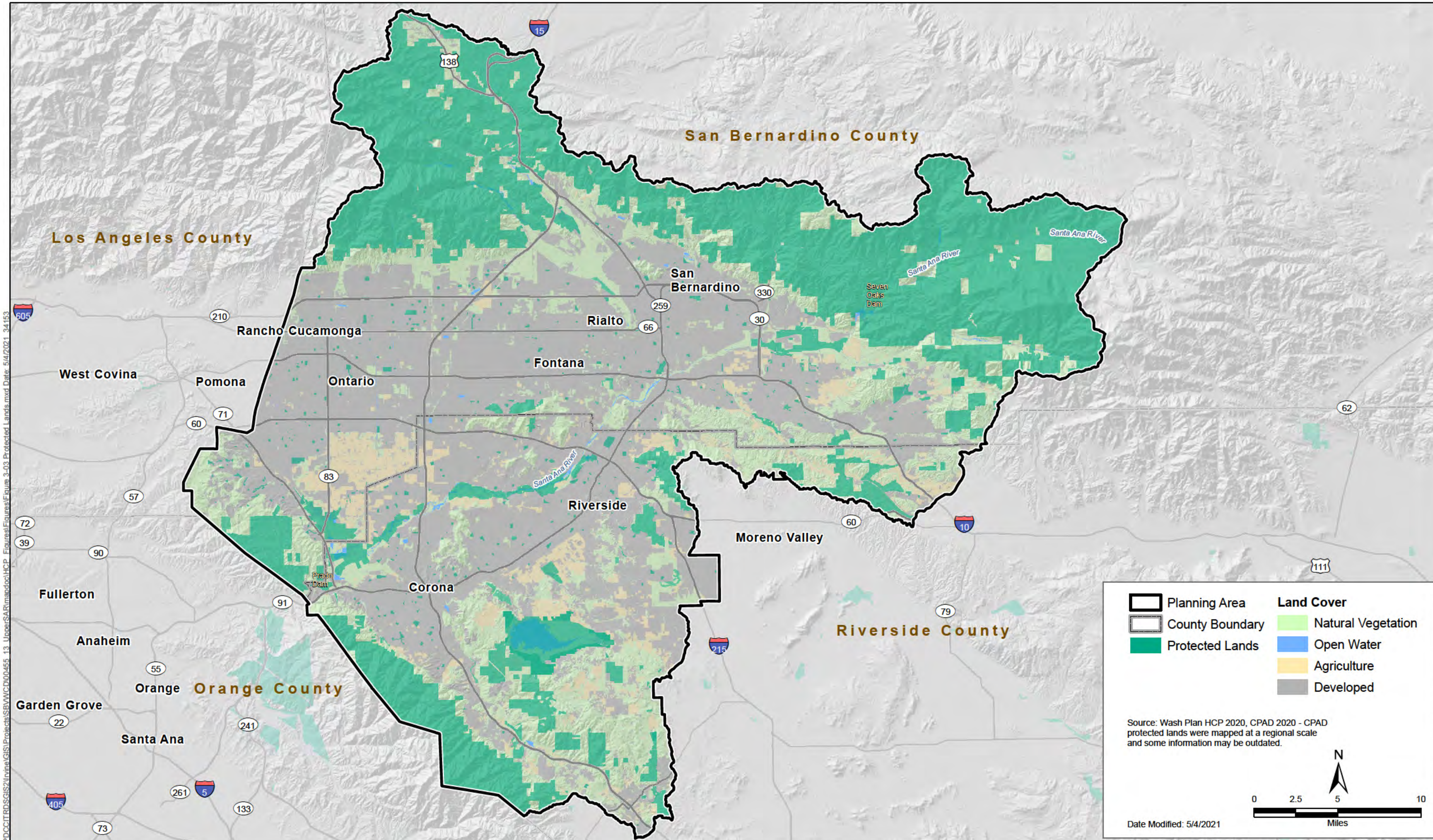
Source: CPAD 2019

3.3 Geology and Fault Zones

The geology and fault zones of the Planning Area have an important influence on the distribution of landforms and soil types, which in turn influence vegetation and plant species distribution and abundance. In some cases, geology and soils also greatly influence wildlife species distribution. For example, many invertebrates are closely associated with particular plant species or vegetation types that are restricted to particular soil types and geologic substrates. On a regional scale, geologic activity has also greatly influenced the pattern of stream formation and the structure and function of local watersheds.

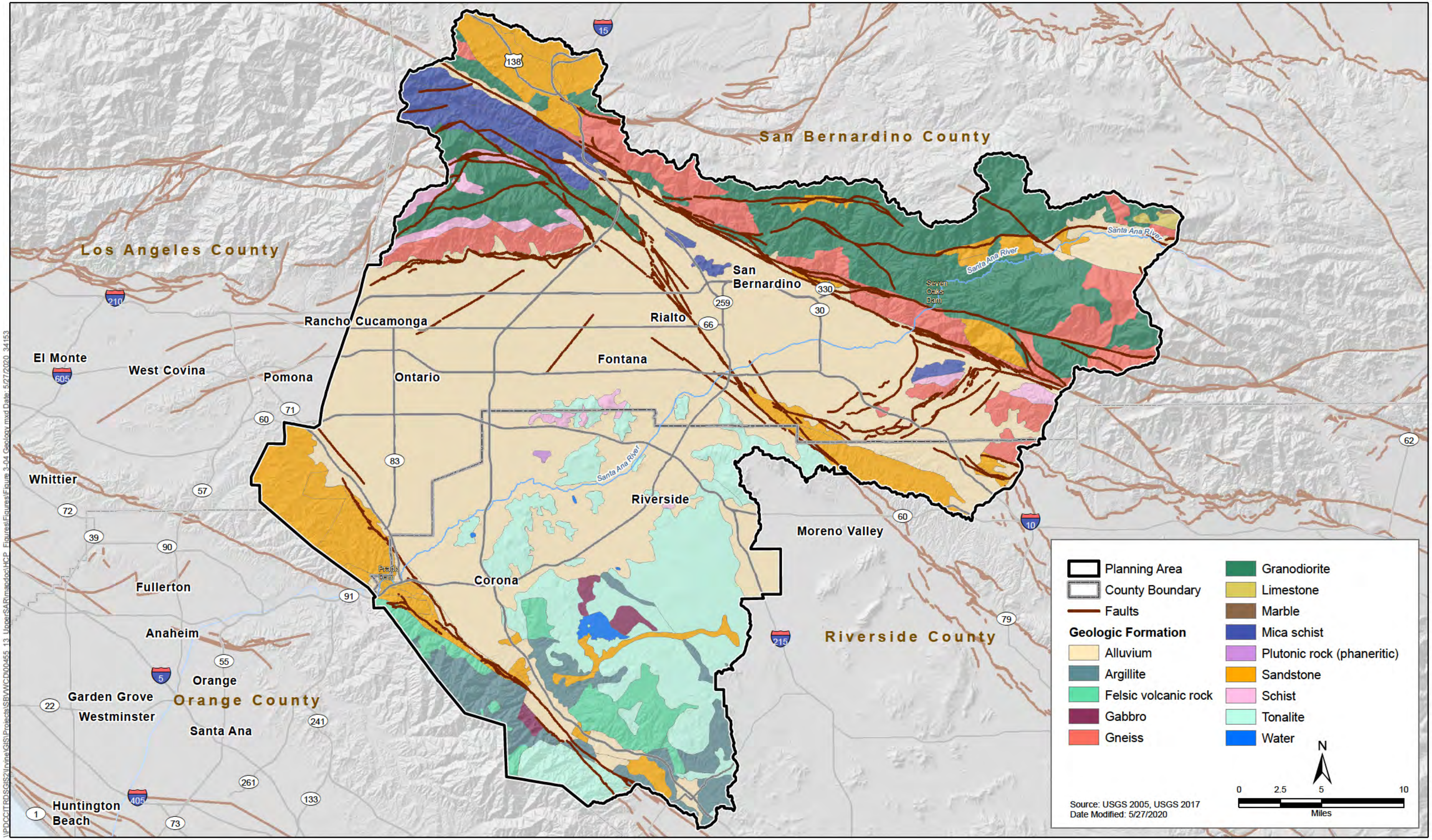
Southern California is a geologically active area. Major earthquake faults in the region include the San Andreas Fault and its large branch, the San Jacinto Fault; the Elsinore-Whittier Fault; and the Newport-Inglewood Fault. The San Andreas Fault divides the San Gabriel Mountains from the San Bernardino Mountains. The San Jacinto Fault, which splits off from the San Andreas Fault near San Bernardino, affects groundwater flows associated with both the Santa Ana and San Jacinto Rivers. The Elsinore-Whittier Fault passes under Prado Dam as it trends, like the others, from the southeast toward the northwest. The Newport-Inglewood Fault enters the region from the Los Angeles basin and passes offshore at Newport Beach. In addition to these major faults, there are many branching, connecting, and parallel faults in the region (Santa Ana RWQCB 2008).

Major rock types in the Planning Area include sandstone, alluvium, granodiorite, gneiss, mica schist, schist, limestone, tonalite, argillite, gabbro, and felsic volcanic rock (USGS 2007). As depicted on Figure 3-4, the majority of the Planning Area consists of alluvium. Alluvium is a general term for clay, silt, sand, gravel, or similar unconsolidated detrital material deposited during comparatively recent geologic time by streams, rivers, and major flooding events. Alluvium is deposited as a sorted or semi-sorted sediment in the bed of the stream or river, or on its floodplain or delta, or as a cone or fan at the base of a mountain slope.



Upper Santa Ana River Habitat Conservation Plan

Figure 3-3
Protected Lands in the Planning Area



Upper Santa Ana River Habitat Conservation Plan

Figure 3-4
Geology and Fault Zones of the Planning Area

3.4 Soils

Soils are the result of complex interactions between geologic parent material, climate, topography, organisms, and time. Soils are classified by the degree of development into distinct layers, or horizons, and their prevailing physical and chemical properties. Similar soil types are grouped into soil orders based on defining characteristics, such as organic matter and clay content, amount of mineral weathering, water and temperature regimes, depth, drainage, slope, particle size, or base saturation that give soil its unique properties.

Soil resources provide the foundation for vegetation and biological communities. Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. The kind and abundance of wildlife depend largely on the amount and distribution of food, water, and cover. Soil orders in the Planning Area include entisols, inceptisols, alfisols, mollisols, and vertisols (NRCS 2017). Entisols, alfisols, and mollisols comprise the majority of the Planning Area (Figure 3-5).

Entisols exhibit little to no soil development other than the presence of an identifiable topsoil horizon. These soils occur in areas of recently deposited sediments, often in places where deposition is faster than the rate of soil development (e.g., active floodplains) (Soil Science Society of America 2017).

Alfisols are moderately leached soils that have relatively high native fertility. They have mainly formed under forest and have a subsurface horizon in which clays have accumulated. Alfisols are primarily found in temperate humid and sub-humid regions of the world (University of Idaho 2017).

Mollisols are prairie or grassland soils that have a dark-colored surface horizon. They are highly fertile and rich in chemical "bases" such as calcium and magnesium. The dark surface horizon comes from the yearly addition of organic matter to the soil from the deep roots of prairie plants. Mollisols are often found in climates with pronounced dry seasons (Soil Science Society of America 2017).

Of particular interest in the Planning Area are the suborder of soils known as fluvents. Fluvents are alluvial soils that undergo repeated sediment deposition from relatively frequent periodic flooding. The repeated deposition prevents substantial development of soil horizons. Fluvent soils are most typical in the valley floor, alluvial fans, and active floodplains. Several Covered Species have a high affinity for fluvents in the Planning Area, including San Bernardino kangaroo rat, Los Angeles pocket mouse, slender-horned spineflower, and Santa Ana River woolly-star.

3.5 Climate

The Planning Area is characterized by a climate of long dry summers and short wet winters, commonly referred to as a Mediterranean climate. Average daily temperatures in the winter (December through March) are about 56 degrees Fahrenheit (°F), and in the summer (June through September) are about 76°F for the Planning Area, with the highest average temperature (95°F) occurring in August and the lowest average temperature (41°F) occurring in December (U.S. Climate Data 2017a: San Bernardino, California Station 1961–1990 climate data, 2017b: Riverside Citrus Exp. 1991–2010 climate data). Annual average daily temperatures for the Planning Area range from a low of about 51°F to an average high of about 80°F (US Climate Data 2017a, 2017b). Average annual precipitation ranges from 12 inches in the coastal plain, 10 to 24 inches in the inland alluvial valleys, and 24 to 48 inches in the San Bernardino Mountains (USGS 2016, 2009). The average total annual precipitation recorded in the City of San Bernardino from water years 1893 through 2014 is

16.0 inches; however, the average total annual precipitation will vary depending on location in the watershed. Most of the precipitation occurs between November and April, and rainless periods are common in the summer.

3.6 Hydrology and Geomorphology

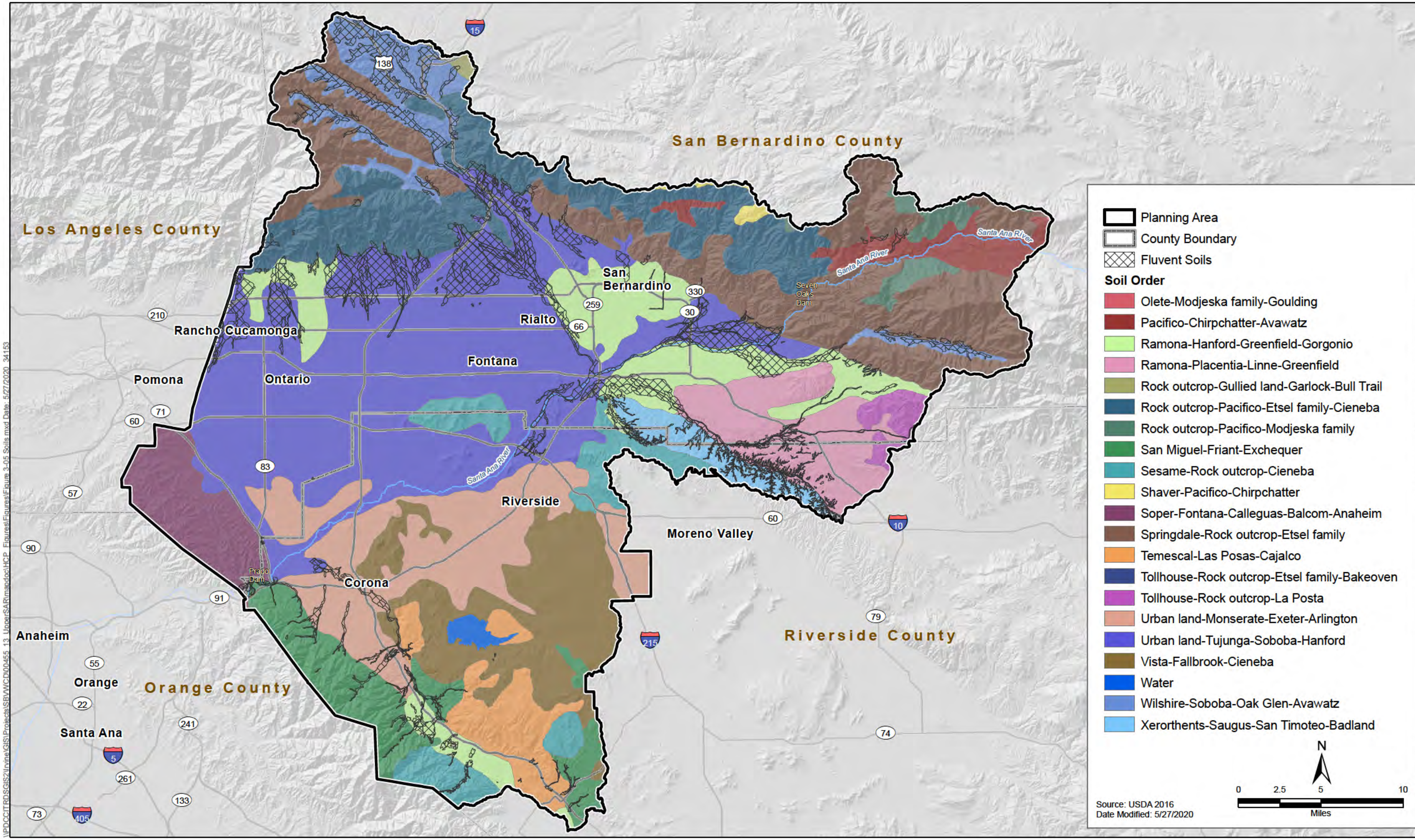
The Santa Ana River Watershed is the largest watershed in coastal Southern California, covering an area of approximately 2,800 square miles composed of mountains, foothills, and valleys. The watershed contains many sub-watersheds with approximately 50 mapped tributaries and contains parts of Orange, San Bernardino, Riverside, and Los Angeles Counties (note the Planning Area does not include any of the watershed occurring in Orange and Los Angeles Counties). The flow of the Santa Ana River begins high in the San Bernardino Mountains and flows over 100 miles southwestward where it discharges into the Pacific Ocean at the City of Huntington Beach (USGS 2016). Figure 3-6 shows the main reaches of the Santa Ana River and the sub-watersheds in the Planning Area. The hydrology and geomorphologic features of the mainstem of the Santa Ana River and tributaries are described below.

3.6.1 Hydrology

Streamflow in the Santa Ana River Watershed is highly variable from year to year in response to precipitation patterns, with large floods and long periods of extremely low flow or dry channels. As reported by the Santa Ana River Watermaster (2018), the total flow discharged from Prado Dam was 202,808 acre-feet/year averaged over the 1972–2017 water years. The total surface flow over the same period at the Riverside Narrows was 94,910 acre-feet/year. Average annual discharges determined from hydrology models for select locations along the Santa Ana River and its major tributaries are listed in Table 3-4. Generally, the largest monthly discharges occur in February and March, and the lowest flows occur in August through October. Because the climate in the region is characterized by hot, dry summers and cool winters with intermittent precipitation, the Santa Ana River and most of its tributaries are intermittent with little or no flow in the summer months (USGS 2016, WRCC n.d.). All reaches of the river and tributaries have seasonal flows, including large flood flows in most winters and spring, as well as perennial flows in some stream reaches from groundwater upwelling in most years.

Table 3-4. Mean Annual Flow for the Upper Santa Ana River and Major Tributaries

Location	Mean Annual Flow (acre-feet/year)[1,2]
Santa Ana River Mainstem	
Seven Oaks Dam Inflow (Reach 6)	33,032
SAR at Mt Vernon Avenue (Reach 5)	56,815
SAR at Mission Boulevard (Reach 4)	84,961
SAR at Prado Dam[3]	291,663
Major Tributaries	
Mill Creek	14,362
City Creek (includes 3,694 acre-feet/year from Plunge Creek tributary)	9,423
Plunge Creek	3,694
Mission Creek	3,029



Upper Santa Ana River
Habitat Conservation Plan

Figure 3-5
Soil Orders in the Planning Area

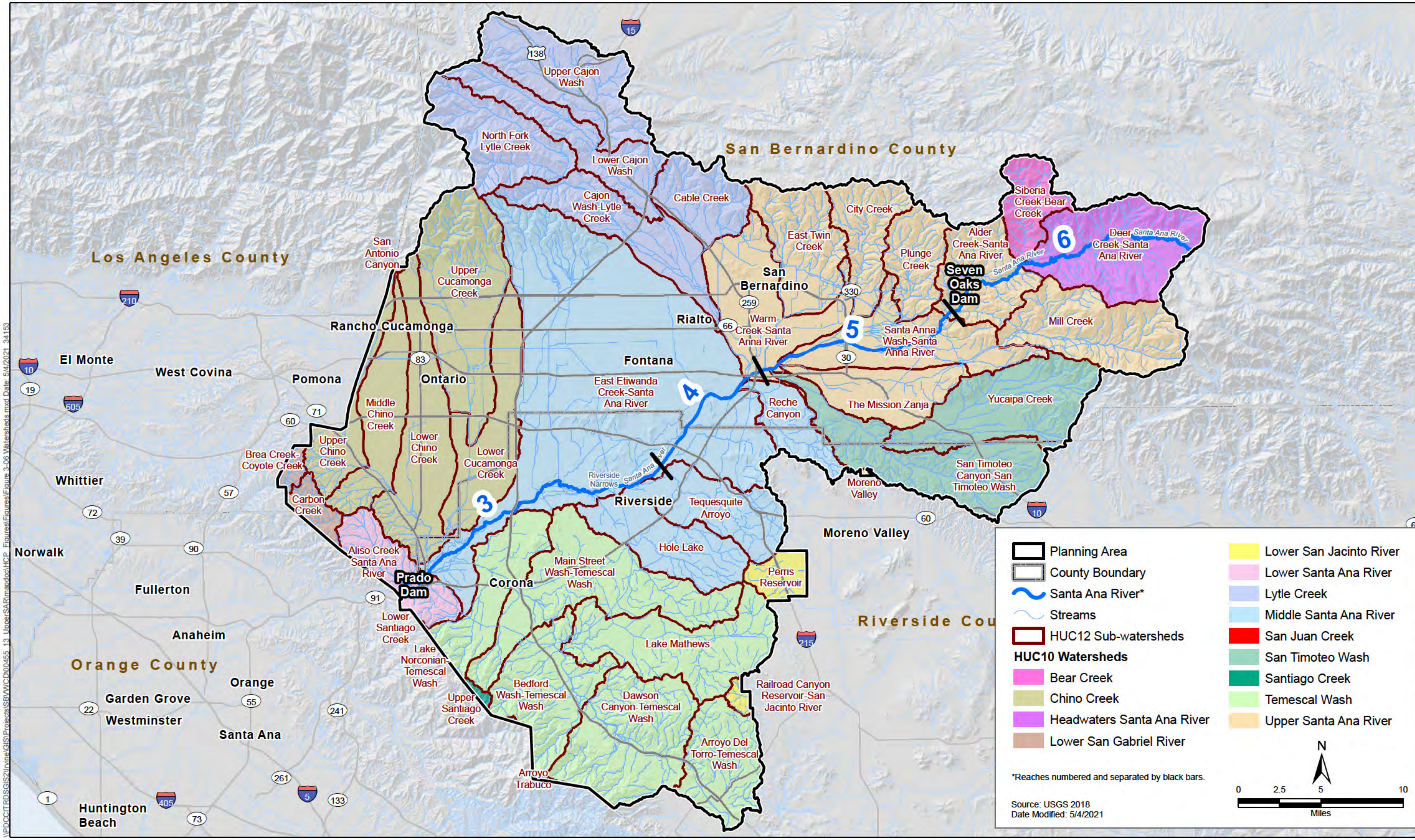


Figure 3-6
Watersheds and Sub-watersheds in the Planning Area

Location	Mean Annual Flow (acre-feet/year)[1,2]
San Timoteo Wash	3,419
East Twin Creek	6,195
Lytle Creek	9,471
Cajon Wash	1,711
Rialto Channel	12,822
San Sevaine Creek	17,934
Day Creek	13,473
Chino Creek	96,318
Temescal Wash	30,068

[1] Discharge values are from modeled hydrology described under Section 3.6.3, *Hydrologic Modeling as the Foundation for Hydrologic Analysis*.
[2] Hydrology values include flow regulation by Seven Oaks Dam.
[3] Discharge from wastewater treatment plants and groundwater upwelling contribute to the total Santa Ana River mainstem flow at Prado Dam.

Due to urbanization, flood control, inter-basin water transfers, and other water-supply projects throughout the Santa Ana River basin, the natural hydrology of watershed runoff and the streamflow for most streams have been substantially altered. By 1969, water diversions and groundwater pumping had severely diminished natural flow in the Santa Ana River (Kratzer et al. 2011) such that groundwater levels experienced large declines since the 1800s, eliminating perennial flows in much of the river (ESA 2015).

Existing alterations to natural hydrologic conditions, including diversions, constructed drainages, channels, and other impervious surfaces, are especially prevalent in the San Bernardino Mountains foothills and the Santa Ana River Valley, causing decreased groundwater infiltration and increased runoff from urban areas (SBVMWD 2004). Modification of natural flow patterns also stems from water storage and controlled releases from reservoirs, groundwater withdrawal, hydraulic structures, diversion into groundwater recharge basins, vegetation management, and irrigation runoff and wastewater effluent that create perennial flow in some streams that would otherwise be dry. Stormwater and flood management is an ongoing concern in the region. Flood control facilities, such as detention basins, have provided control of flood flows. The region's groundwater managers are working with flood control agencies to optimize the use of flood control facilities to increase the recharge of stormwater into the groundwater basin (RMC 2015).

Santa Ana River Mainstem

Several major dams are located on the Santa Ana River, including Big Bear Dam, Seven Oaks Dam, and Prado Dam. The surface water of Bear Creek (a tributary to the Santa Ana River) is impounded high in the mountains by Big Bear Dam beyond the northeast boundary of the Planning Area, which was constructed in 1884 as a reservoir to supply water for surrounding communities. Seven Oaks Dam and Prado Dam, shown on Figure 3-6, were constructed for flood control purposes, as described below.

A flash flood in 1938 resulted in the flooding of large areas of coastal San Bernardino, Riverside, and Orange Counties (68,400 acres flooded). The recurrence of large floods such as this was the driver behind construction of the Prado Dam in 1941 at the downstream end of the Planning Area. Approximately 80% of the Santa Ana River's total watershed area (2,780 square miles) is upstream of Prado Dam (2,260 square miles). Another major flood in 1969 caused damage along several tributaries of the Santa Ana River, including San Timoteo and Santiago Creeks, prompting additional flood control improvements. The U.S. Army Corps of Engineers (USACE) conducted an initial study for the Santa Ana River Mainstem Project (SARMP) in 1970, and in 1986 the SARMP was authorized by Congress in the Water Resources Development Act (WRDA) to improve flood control. Construction of the SARMP began in 1989 and is ongoing. Construction elements associated with SARMP include several bank and bridge protection features and associated mitigation actions along the Santa Ana River, generally between Seven Oaks Dam (6 miles east of the City of Highland) and the Pacific Ocean. Flood risk management features associated with the SARMP also occur at San Timoteo Creek (Riverside and San Bernardino Counties) and are planned for Santiago Creek (Orange County). Prado Dam, located in the City of Corona, was improved (raising the height of the dam) in the mid-2000s (USACE 2015).

Seven Oaks Dam was completed in 2000 as part of the SARMP. Seven Oaks Dam provides flood control protection by temporarily retaining Santa Ana River storm flows and snowmelt from the San Bernardino Mountains. The dam impounds water in Seven Oaks Reservoir, thereby reducing flow magnitudes downstream. Floodwaters are retained behind the dam during winter and early spring rain events, and released once the rain event is passed, typically in early spring, and depending on local conditions, including inputs to Prado and Seven Oaks reservoirs. Peak flows from the dam following flood events are typically less than 500 cubic feet per second (cfs), but can be as much as 7,000 cfs, as instructed by the USACE water control manual for Seven Oaks Dam. This results in reduced magnitude and variability of flows in comparison with the pre-dam condition, as well as a significant reduction in new sediment supply and transport.

Seven Oaks Dam acts as a barrier to downstream transport of sediments, trapping sediment that would otherwise be transported to downstream reaches of the Santa Ana River. Sediment trapping has resulted in a coarsening of the active streambed through the process of erosion of finer sand and gravel sediments (winnowing) between the dam and the confluence with Mill Creek (Wright and Minear 2019). In comparison with the pre-dam condition, reduced sediment supply, sediment winnowing, and reduced peak flows have resulted in a relatively stable bed and bank below Seven Oaks Dam.

In addition to altering flows and sediment supply/transport in the channel, the dam affects flood magnitude and erosional/depositional characteristics in overbank floodplain areas. Reduced flood magnitude results in restricted inundation limits and prevents overbank flooding. Operation of the dam under current conditions means that large portions of the floodplain immediately downstream of the dam and outside the main course of the Santa Ana River will not experience flood disturbance during the dam's operational lifetime.

The dam is also operated to meet historic water rights held by the East Valley Water District, the San Bernardino Valley Water Conservation District, and others to ensure pre-dam water supply obligations continue to be met. Southern California Edison diverts water several miles upstream of the dam for power generation and then returns flow to the river to meet downstream water rights. Just downstream of Seven Oaks Dam is the Cuttle Weir. The Cuttle Weir is operated in tandem with flow releases from Seven Oaks Dam with a capacity to divert up to 195 cfs of the Santa Ana River flow into the Santa Ana River Spreading Grounds for groundwater recharge. Typical flow diversions are around 150 cfs.

Flow in the Santa Ana River generally increases in a downstream direction due to inflows from tributaries, rising groundwater, and inflow from wastewater treatment plants (WWTPs) (Geoscience 2014). There are 14 publicly owned WWTPs in the Upper Santa Ana River watershed, 9 of which contribute to surface flow (SBVMWD 2004). Discharge from wastewater treatment facilities provides base flow in many parts of the drainage network (USGS 2016).

The following description of the six main reaches of the Santa Ana River is adapted from the Santa Ana River Basin Water Quality Control Plan (California Regional Water Quality Control Board 1995); therefore, the reach numbers used below are consistent with the numbering in the Water Quality Control Plan. The mainstem of the Santa Ana River is divided into six reaches, described below starting from upstream of the Seven Oaks Dam down to the tidal zone flowing into the ocean. Reaches 3 through 6 are within the Planning Area; reaches 1 and 2 are downstream of the Planning Area. Additional information on the various reaches found within the Planning Area is provided below, starting with the top of the watershed (Reach 6).

Reach 6 includes the river upstream of Seven Oaks Dam. Flows consist largely of snowmelt and storm runoff. Other than Big Bear Reservoir, hydrologic conditions are relatively natural (unaltered) compared to downstream reaches.

Reach 5 extends from Seven Oaks Dam to the City of San Bernardino at the San Jacinto Fault (Bunker Hill Dike), which marks the downstream edge of the Bunker Hill groundwater basin. Most of this reach tends to be dry, except as a result of storm flows. The extreme lower end of this reach historically includes rising groundwater and flows from major Santa Ana River tributaries such as Mill Creek, Lytle Creek, and San Timoteo Creek, which flows intermittently and includes effluent from the City of Beaumont and Yucaipa Valley Water District WWTPs.

Reach 4 includes the river from the Bunker Hill Dike down to Mission Boulevard Bridge in the City of Riverside. That bridge marks the upstream limit of rising water induced by the flow constriction in the Riverside Narrows downstream in Reach 3. Until about 1985, most water in the reach percolated to the local groundwater, leaving the lower part of the reach dry. However, flows in the lower end of this reach are perennial and may now intermittently contain rising groundwater. Flow is supplemented with tertiary treated effluent discharged from two WWTPs: Rialto WWTP and San Bernardino/Colton Rapid Infiltration and Extraction (RIX) Facility.

Reach 3 includes the river from Mission Bridge to Prado Dam at the downstream end of the Planning Area. The major tributaries of Reach 3 of the Santa Ana River include San Sevaine Creek, Day Creek, Cucamonga Creek, San Antonio Creek/Chino Creek, and Temescal Wash. Flow within Reach 3 is supplemented with wastewater discharge from the City of Riverside Regional Water Quality Control Plant and Western Riverside County Regional Wastewater Authority's WWTP. In the Riverside Narrows, rising water feeds several small tributaries (Tequesquite Arroyo, Anza Park Drain, Sunnyslope Channel, and Hole Creek) which historically were breeding and nursery areas for native fishes. Many of the tributaries in this reach are channelized (concrete-lined), flood control facilities that have little resemblance to natural streams.

Santa Ana River Tributaries

The Santa Ana River includes over 20 significant tributaries, 11 of which occur within the Planning Area. These tributaries and their mean annual flow are listed above in Table 3-4 and are described further below.

Mill Creek is a 17.8-mile long stream that originates in the San Bernardino Mountains and has a confluence with the Santa Ana River just downstream of the mouth of the upper Santa Ana Canyon. This creek is in relatively better condition than lower portions of the Santa Ana watershed because its drainage area is less urbanized. This creek is the site of two hydroelectric plants owned by Southern California Edison.

City Creek is a 7.5-mile stream that originates in the San Bernardino National Forest and rises in two forks of similar length and size: the West Fork City Creek and East Fork City Creek. The two forks combine in a steep ravine under a bridge of California State Route 330 (City Creek Road) and flow through a deep gorge between McKinley and Harrison Mountains before dropping into the plains near the City of Highland.

Plunge Creek is a 13-mile long stream that originates in the San Bernardino Mountains as a high gradient single-thread stream and continues southwest to the Santa Ana River just east of the San Bernardino International Airport. The stream widens into braided channels for approximately 6 miles of its length from the San Andreas Rift Zone southwest of Greenspot Road to the airport. Portions of the stream are scheduled for restoration within the Wash Plan HCP Planning Area.

Mission Zanja Creek is an approximately 5-mile stream that has a confluence with Mill Creek before it continues to the west where it meets the Santa Ana River. It is located just north of the Crafton Hills in a relatively low topography area within the Planning Area east of the town of Mentone. The entirety of this creek is channelized.

San Timoteo Wash is formed by the confluence of Little San Antonio Creek and Noble Creek west of the City of Beaumont in Riverside County. This wash flows northwest through San Timoteo Canyon, north of the Badlands in the southern hills of the City of Redlands. It joins the Santa Ana River near the Interstate (I-) 10 and I-215 interchange. The creek flowed intermittently in the past; however, today it flows nearly year-round due to agricultural runoff and secondary treatment discharge from the Yucaipa Valley Water District WWTP.

East Twin Creek originates southwest of Strawberry Creek and is joined by West Twin Creek, which is tributary to Warm Creek, which is, in turn, tributary to the Santa Ana River.

Lytle Creek is approximately 18 miles long and originates in the San Gabriel Mountains in southwestern San Bernardino County near the City of San Bernardino. It is a tributary of Warm Creek, which feeds into the Santa Ana River 1 mile after Warm Creek joins the Santa Ana River. Southern California Edison operates a hydroelectric plant on Lytle Creek at Miller Narrows.

Cajon Wash is an approximately 20-mile-long tributary to Lytle Creek. It is a braided channel that originates in the northwestern portion of the Planning Area within Cajon Canyon and extends south to Lytle Creek at West Foothill Boulevard.

Rialto Channel is a concrete conveyance channel that flows south for approximately 9 miles before meeting the Santa Ana River. The perennial flow in this channel is tertiary treated discharge from the City of Rialto's WWTP.

San Sevaine Creek is a concrete conveyance channel that runs south for approximately 11 miles through San Bernardino County, which is joined by Day Creek and ultimately connects with the Santa Ana River.

Day Creek or Day Canyon Wash originates in the San Gabriel Mountains as a high gradient single-thread stream and becomes a concrete conveyance channel as it continues south to its confluence with the Santa Ana River.

Chino Creek is approximately 12.7 miles long and originates in the San Gabriel Mountains from an underground stormwater channel and flows south from the southern extent of the City of Pomona, in eastern Los Angeles County. The channelized stream enters southwestern San Bernardino County and runs southeast across the Chino Valley between the Chino Hills to the south and the City of Chino to the northeast. From here, the creek flows parallel to State Route 71 through industrial and agricultural areas of Chino and joins the Santa Ana River north of Prado Dam.

Temescal Wash is approximately 29 miles long and is the largest tributary of the Santa Ana River. Temescal Wash originates in the Elsinore Spillway Channel, an overflow channel that is confined to Lake Elsinore and passes northwest into the Warm Springs Valley. The wash flows through the rain shadow zone of the Santa Ana Mountains, and where it emerges from Temescal Canyon, north of El Cerrito, it enters a second reservoir from which point it is channelized before entering into the Prado Flood Control Basin, which consists of a series of wetlands where Temescal Wash merges with the Santa Ana River. Temescal Wash is diverted heavily for human use and, as a result, is ephemeral for most of its length, except in areas where runoff from housing and agricultural development return flows

3.6.2 Geomorphology

The geomorphology of the Upper Santa Ana River and tributaries is a product of the interaction of the underlying geology with past and current hydrologic patterns in the watershed. As described above in Section 3.3, *Geology and Fault Zones*, the majority of the Santa Ana River watershed in the Planning Area consists of unconsolidated alluvium. Winter rains result in high streamflow events that produce a variety of geomorphic processes, including moving sediment downstream in tributaries into the mainstem of the Santa Ana River and scouring and renewing vegetation. Ecologically, the native plant and animal communities evolved to exist within the context of these geomorphic processes; however, they have been altered by human development. An understanding of the geomorphologic conditions in the Planning Area is necessary to assess the existing ecological conditions.

Light detection and ranging (LiDAR), air photo analysis, and geomorphic assessment techniques were used to perform a broad assessment of different geomorphic attributes of streams in the Planning Area. The channel classification specific to the HCP Planning Area was developed based on three variables: (1) channel pattern, (2) channel slope, and (3) width to depth ratio. Channel classification was performed for 431 miles of channels within the Planning Area, as described below.

Classification of Stream Channels in the Planning Area

Stream reach classification is a process of categorizing natural variation in measured characteristics among a group of streams and rivers to delineate channel types that are similar in terms of hydrologic, geomorphic, and other environmental features. Categorization of the river and streams in the Planning Area is important to be able to describe the range of channel types and to understand and analyze the potential changes in each channel type as a response to the different Covered Activities evaluated by the HCP.

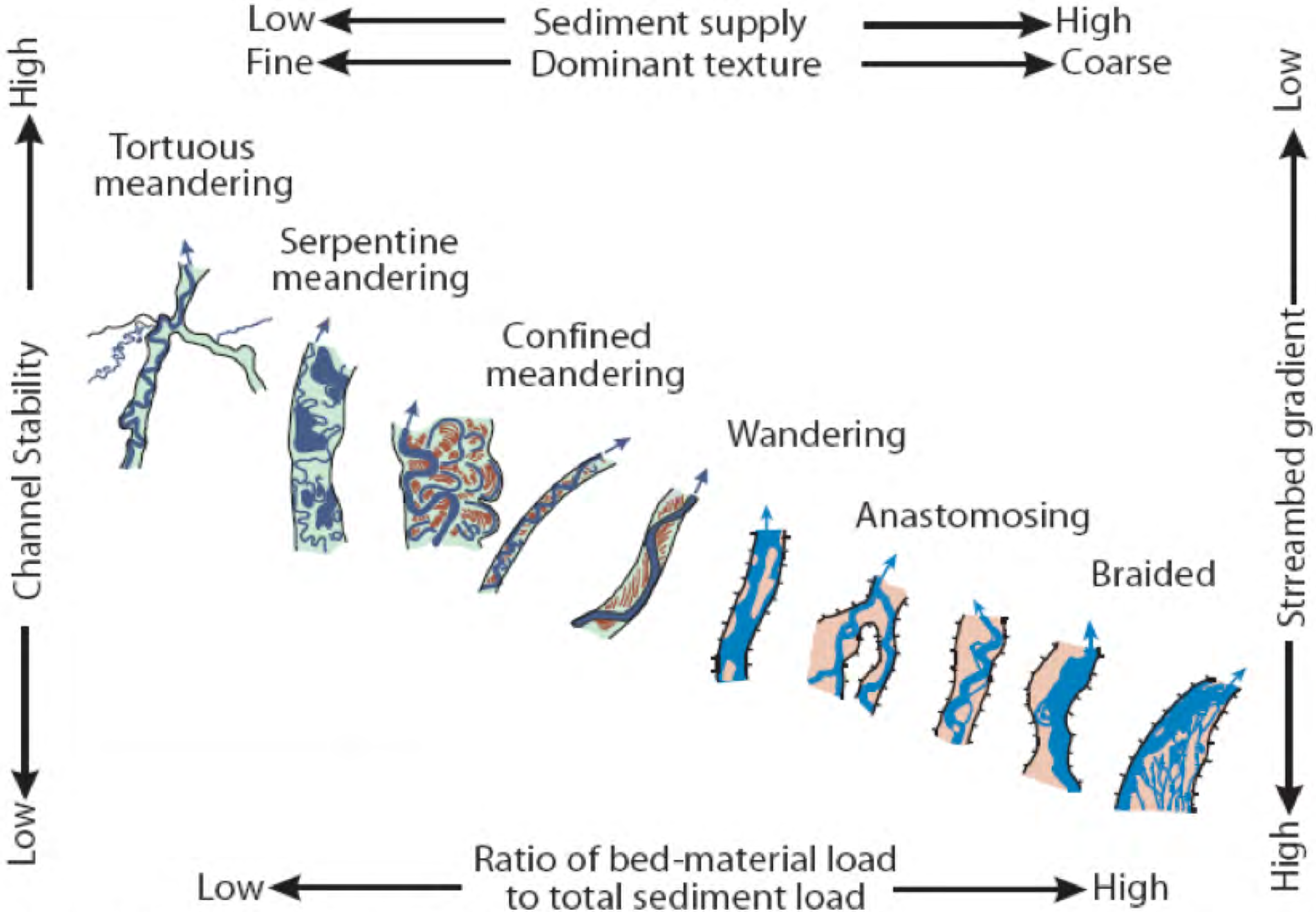
By assigning stream channels or segments to a particular channel type category, relationships between ecological metrics and potential flow alteration from Covered Activities can be developed for each channel type based on data obtained from a representative set of channels of each type within the Planning Area (Arthington et al. 2006, Poff et al. 2006). For each channel type there is a range of natural hydrologic variation that regulates characteristic ecological processes and habitat characteristics (Lytle & Poff 2004, Arthington et al. 2006).

Channel Pattern

Channel pattern is commonly used to characterize the geomorphic state of streams in the watershed. A channel's pattern is often related to other important geomorphic variables, such as channel stability, the texture and volume of sediment supply, slope (stream gradient), and mode of sediment transport (bedload vs. suspended load) (Figure 3-7). Channels with different patterns will typically respond differently to changes in sediment supply, discharge, riparian vegetation removal, and other alterations, making channel pattern an effective approach to characterizing the geomorphic conditions of the watershed (Mollard 1973). Nine channel patterns were identified to capture the range of variability in the Planning Area, as described below. The distribution of these channel patterns is illustrated on Figure 3-8, and their prevalence in the Planning Area is summarized in Table 3-5.

There are nine categories of channel patterns in the Planning Area:

- **Concrete conveyance channels** are streams with concrete bed and banks that function as flood control channels designed to quickly route water off the landscape. These highly altered channels account for the largest percentage of the channel pattern, comprising 40% (171 miles) of the total channel length evaluated in the Planning Area.
- **Straight channelized reaches** comprise 4% of the total channel length in the Planning Area and are similar to concrete conveyance channels except they do not have concrete beds and thus have more ecological value than just pure flood conveyance channels. Examples in the Planning Area include reaches on Chino Creek and City Creek Channel.
- **High-gradient, single-thread channels** are channels with slopes greater than 2%. They make up 18% of the total channel length, and in the Planning Area they are typically unaltered channels located in the foothills and mountainous areas upstream of diversions or other alterations. High-gradient, single-thread channels typically have coarse bed substrate (gravel, cobble, boulder) and are often confined to valleys with little developed floodplain.
- **High-gradient, single-thread channelized** occur on 1% of the total channel length, and are similar to high-gradient, single-thread channels except that they have been channelized for flood control purposes.
- **Low-gradient, meandering channels**, defined as having slopes less than 2%, account for 17% of the total channel length in the Planning Area. Most of the low-gradient, meandering channels are located on the downstream portion of the Santa Ana River and San Timoteo Wash. They are differentiated from braided channels in the Planning Area (see below) by their lower channel slopes, increased channel stability with channel paths typically separated by vegetated bars or islands, and floodplain creation (at least in areas where the floodplain has not been developed or the stream leveed).



Source: William H. Langer, USGS Open-File Report, 2002, modified from Mollard, 1973.

Figure 3-7
Geomorphic Behavior of Different Channel Patterns
Upper Santa Ana River Habitat Conservation Plan

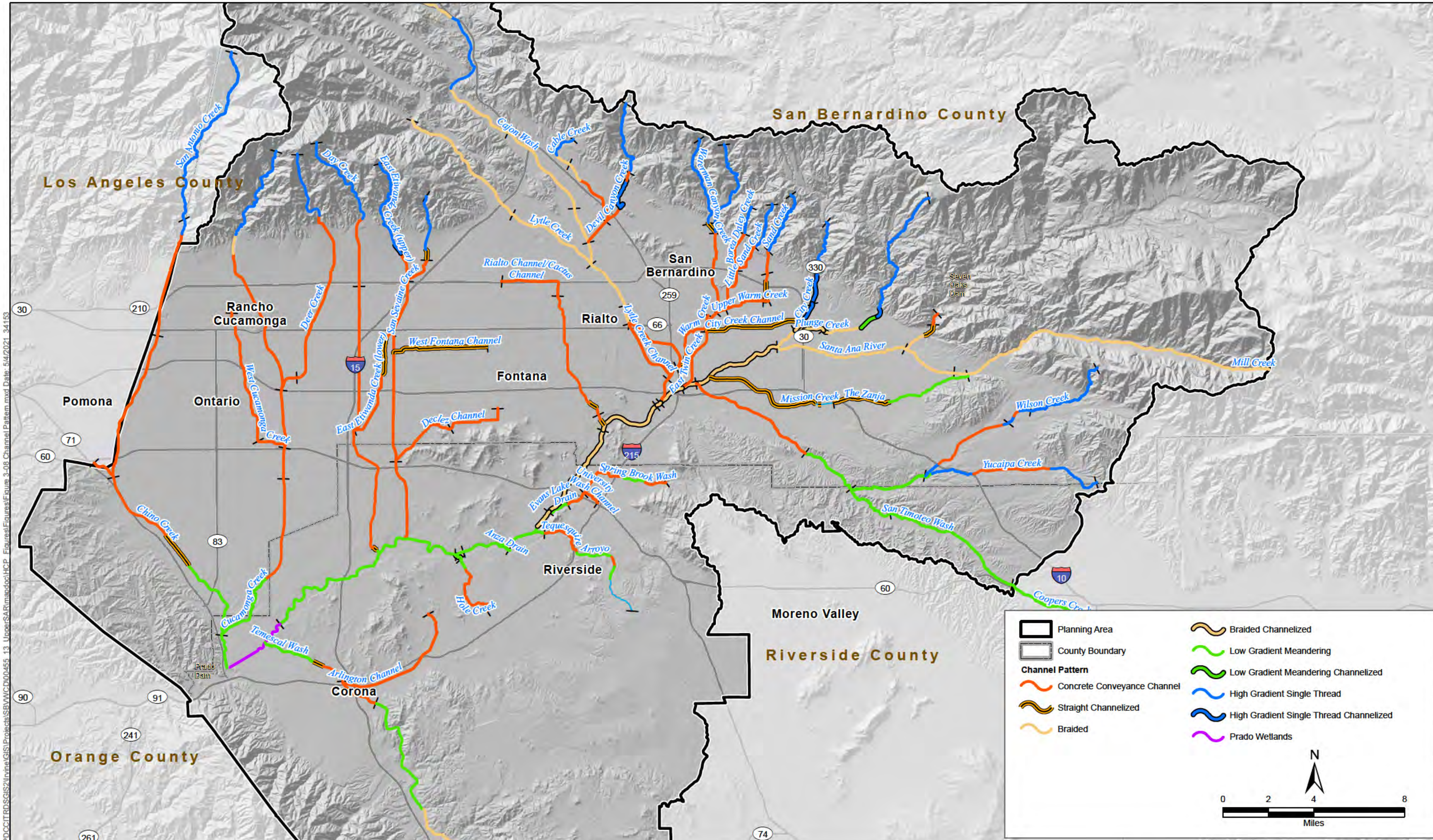


Figure 3-8
Channel Patterns in the Planning Area

- **Low-gradient, meandering channelized** occur on less than 1% of the total channel length, and are similar to low-gradient, meandering channels except that they have been channelized for flood control purposes.
- **Braided channels** comprise 15% of the total channel length in the Planning Area, largely located on the upper reaches of the Santa Ana River and on Lytle Creek, Cajon Wash, and Mill Creek. The braided channels are located on alluvial washes at the transition from the mountainous regions to the lower alluvial plain reaches below. They are characterized by high sediment loads, also often with high slopes, and erodible banks in which the channel has multiple braids that routinely shift in response to flood events.
- **Braided channelized reaches** cover 4% of the total channel length, and are similar to the braided reaches, but are laterally confined by levees and often have been straightened for flood control purposes.
- **Prado Wetlands** classifies the channel pattern of the Santa Ana River as it flows through the wetlands in Prado Reservoir.

Table 3-5. Categorization of Streams by Channel Pattern in the Planning Area

Channel Pattern	Miles of Channel	Percent of Total Channel Miles
Concrete Conveyance	171	40
Straight Channelized	17	4
High-Gradient, Single-Thread	77	18
High-Gradient, Single-Thread Channelized	4	1
Low-Gradient, Meandering	74	17
Low-Gradient, Meandering Channelized	1	0
Braided	66	15
Braided Channelized	17	4
Prado Wetlands	3	1
Total	**431**	**100**

Channel Slope

Channel slope or gradient is a primary determinant of the rate at which water and sediment flow through the system and the texture of sediment that forms the channel and is carried downstream. The slopes of the major streams in the Planning Area are derived from Montgomery & Buffington (1997). These investigators correlated channel slope with channel morphology. LiDAR was used to determine the slope of channels. Channel slopes within the Planning Area were correlated and categorized with the channel morphologies developed by Montgomery and Buffington (1997). The results of that analysis were tabulated within slope categories (Table 3-6). The channels with slopes between 0.6 and 1.6% (Pool-Riffle) were the most prevalent in the Planning Area, while channels with slopes less than 3.3 represented 71% of the reaches. It is worth noting that the mapped channels in the Planning Area did not always have the specified channel morphology described by Montgomery and Buffington (1997) (e.g., as stated above, highly altered concrete conveyance channels account for 40% of the total channel length). To this end, the channel morphology classification they derived did not include braided channels, which are prevalent in the Planning

Area. Braided channels can fall within several different slope ranges depending on flow and sediment supply. Braided channels are addressed in *Channel Type Classification*, below.

Table 3-6. Channel Slope of Streams in the Planning Area

Slope (%)	Miles	Percent of Total	Channel Morphology
0.0–0.5	78	18	Low-Gradient
0.6–1.6	146	34	Pool-Riffle
1.7–3.3	84	19	Plane Bed
3.4–6.8	64	15	Step-Pool
6.9–14	36	8	Cascade
14.1–73.5	24	6	Headwaters

Width Depth Ratio

Channel width-to-depth ratio is a measurement of the ratio of a channel's wetted width to flow depth for a given flood stage. Channels with different width-to-depth ratios typically exhibit different morphologic form and behave differently in terms of how they route water and sediment, and the degree to which they are connected to floodplains and riparian areas. Because width-to-depth ratio is a dimensionless ratio, it is a useful variable in a channel classification scheme as different channel reaches may be at different positions in the watershed with different flow regimes, yet have similar form and process because of similarities in width to depth. Relative elevation mapping based on LiDAR analysis and hydraulic calculations was used to determine the width-to-depth ratio of reaches in the Planning Area. A majority (56%) of the stream channels were generally very wide and shallow channels with a width-to-depth ratio greater than 175 (Figure 3-9 and Table 3-7).

Table 3-7. Width Depth Ratios of Natural Stream Channels in the Planning Area[1]

Width-to-Depth Ratio	Miles	Percent of Total
< 50	14.9	18.7
50–175	20.0	25.1
> 175	44.9	56.2

[1] 87 miles of concrete conveyance channel was not included in this table.

Channel Type Classification

The results from the analysis of channel pattern, channel slope, and channel width-to-depth ratio were combined to create a channel type classification for the Planning Area. The reaches in the Planning Area located downstream of Covered Activities with hydrology effects were assigned to one of 12 channel type bins. Frequency distributions (miles of channel) were created for the channel classification variables from which breakpoints were created to define the channel type bins. The resultant channel type classification developed for the Planning Area is mapped on Figure 3-10. Summary statistics are listed in Table 3-8. Note that the statistics do not account for concrete conveyance channels because width-to-depth calculations were not performed for this channel type. Concrete conveyance channels comprise 87 miles (50% of total) of channel length in the Planning Area downstream of Covered Activities with hydrology effects.

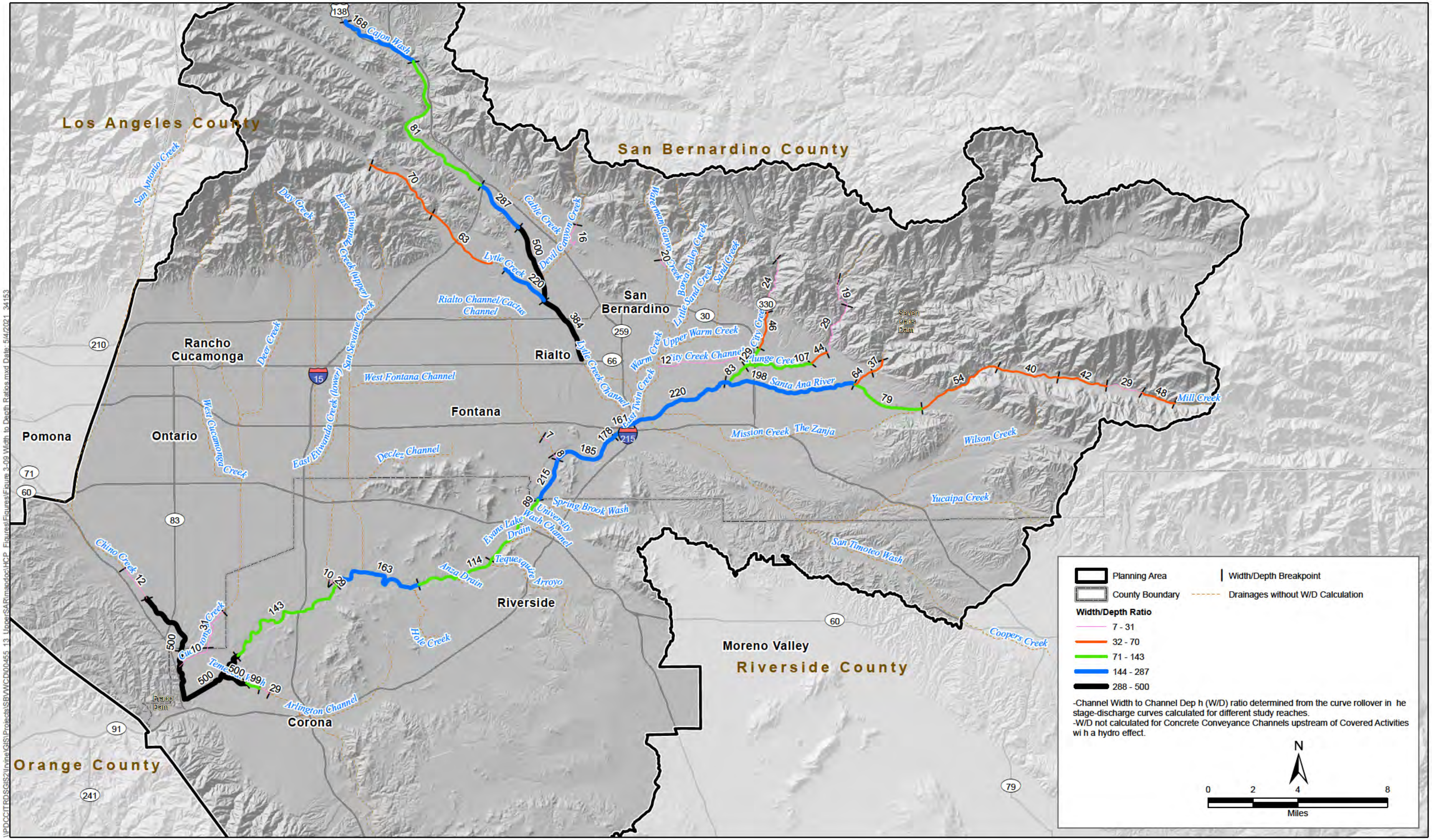


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Figure 3-9
Width to Depth Ratios of Stream Channels in the Planning Area

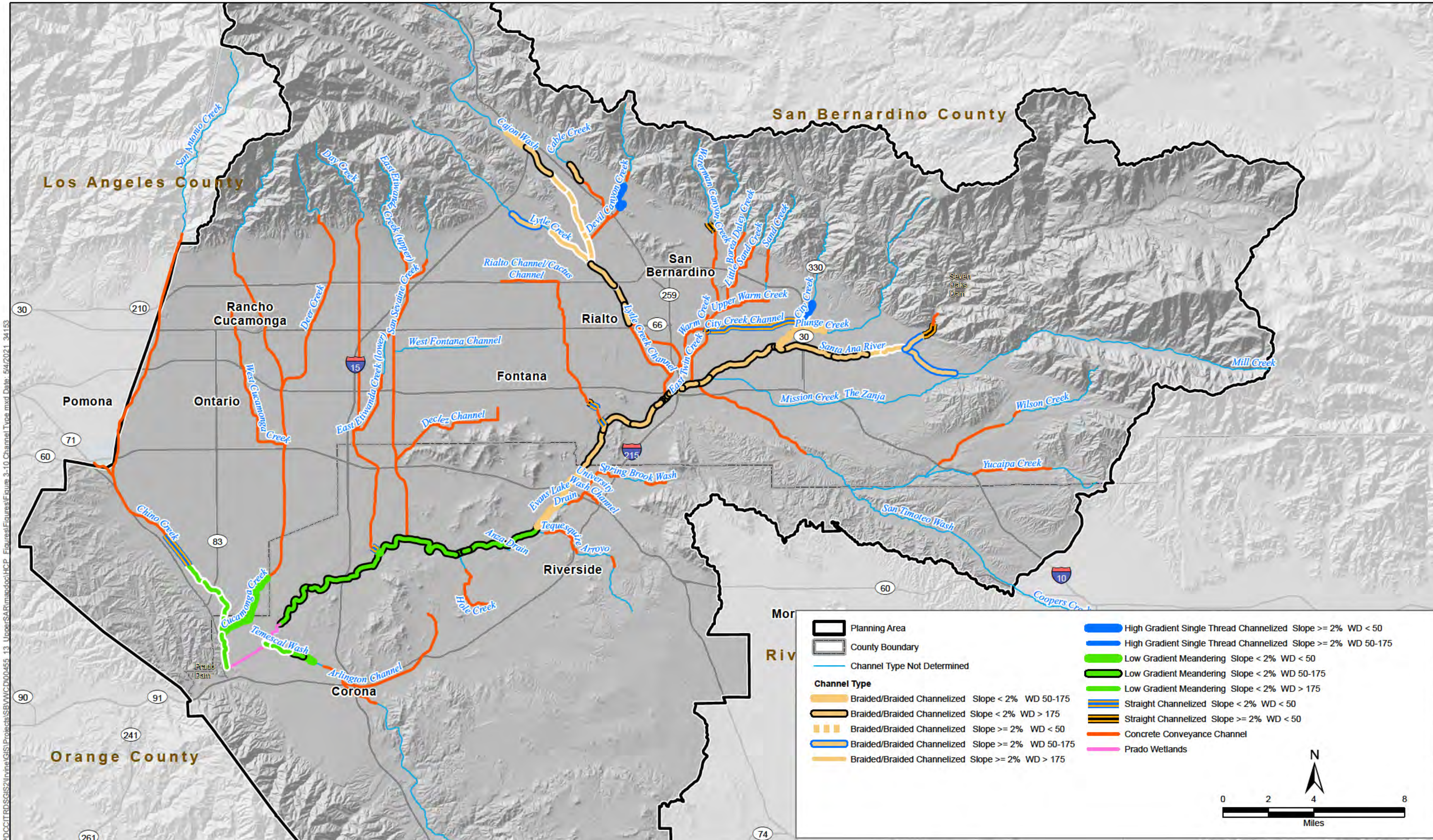

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Figure 3-10
Channel Types in the Planning Area

Table 3-8. Channel Type Classification of Streams in the Planning Area in Reaches Downstream of Covered Activities

Channel Pattern	Braided/Braided Channelized	Braided/Braided Channelized	Braided/Braided Channelized	Braided/Braided Channelized	Braided/Braided Channelized	Low-Gradient Meandering	Low-Gradient Meandering	Low-Gradient Meandering	High-Gradient Single-Thread Channel	High-Gradient Single-Thread Channel	Straight Channelized	Straight Channelized
Slope	<2%	<2%	≥2%	≥2%	≥2%	<2%	<2%	<2%	≥2%	≥2%	<2%	≥2%
W/D Ratio	50–175	>175	<50	50–175	>175	<50	50–175	>175	<50	50–175	<50	<50
# of Reaches	16	26	1	5	13	5	8	9	4	1	15	12
Miles	8	20	0.5	4.9	8.7	4.5	6.8	16.2	1.7	0.3	6.9	1.3

Note: Concrete Conveyance Channels account for 87 miles (50% of total) of channel length in the Planning Area downstream of Covered Activities with hydrology effects. Concrete channels were excluded from this table.
W/D = width-to-depth

3.6.3 Hydrologic Modeling as the Foundation for Hydrologic Analysis

The development of a hydrologic database that describes flow regimes in terms linked to ecological outcomes is a key feature in establishing the hydrologic foundation for analysis of hydrologic effects of Covered Activities in the HCP. The hydrologic database is based on empirical data from stream gages throughout the Planning Area in combination with hydrologic modeling. The hydrologic model is calibrated with flows measured at stream gage stations and is able to predict the flows throughout the Planning Area where stream gage data is not available. By using the hydrologic model it is possible to characterize existing hydrologic conditions at key points where Covered Activities could change the stream flow and then predict the effects of these changes downstream (see Chapter 4).

The hydrologic model includes two primary conditions for stream flow (described as daily, weekly, monthly, or seasonal average flow as needed for analysis): (1) existing conditions (described in this chapter), and (2) future conditions as would be expected with all Covered Activities in place (described in Chapter 4). The future conditions reflect the altered flow regimes resulting from implementation of the Covered Activities. Other than land use changes directly associated with Covered Activities, the watershed land use conditions are kept the same in both the existing and future condition (i.e., With Covered Activities) models to isolate the effect of implementing the Covered Activity.

The following sections summarize the hydrologic data and modeling conducted to establish existing hydrologic conditions analyzed in the HCP.

Stream Gage Data

Numerous U.S. Geological Survey (USGS) and San Bernardino County Flood Control stream gages are located in the Planning Area. The stream flows are typically reported at 15-minute intervals from these gages and are generally the most accurate and precise source of existing stream flow information because they are based on direct measurements and not modeling. However, many limitations prevent the exclusive use of stream gages to describe the existing hydrologic conditions:

1. Many of the gages (especially USGS gages) are located higher in the watershed, upstream of many of the Covered Activities that need to be assessed.
2. Several stream gages are no longer active, and have not been for decades.
3. The periods of record of the gages vary widely, making comparison between locations difficult.
4. Numerous streams do not have any gages.

Hydrology Modeling[1]

Instead of using empirical gage data, the development of the existing hydrologic condition used for the HCP is primarily based on modeling of mean daily flows with the stream gage data used to calibrate the hydrology model to ensure the most accurate model predictions. The model developed for the HCP is a composite model that integrates two separate models, one for the Planning Area upstream of Rialto Channel (known as the *Geoscience Hydrology Model*), and another for the Planning Area downstream of Rialto Channel (known as the *Wildermuth Hydrology Model*). The composite model is identified as the *HCP Hydrology Model.* Each of these models is described below. The HCP Hydrology Model predicts mean daily flow values under existing conditions at 122 model nodes on the SAR and major tributaries located between the Seven Oaks Dam and Prado Basin (Figure 3-11). The nodes are generally at locations where flows change, such as wastewater treatment plant outfalls or channel confluences. The HCP Hydrology Model also identifies 115 reaches between the nodes, with reaches defined by the nodes at each end of each reach.

The HCP Hydrology Model is used to predict the direct effects of the Covered Activities on the surface hydrology of the river and tributaries, which are then used to estimate potential direct and indirect effects on habitat and species based on those model-predicted changes to surface flow. All hydrology modeling developed for the HCP followed best modeling practices for hydrology models built for specific purposes (Reilly and Harbaugh 2004, Zheng et al. 2012)

Geoscience Hydrology Model

Geoscience Support Services, Inc. (Geoscience) has developed several watershed hydrology models of the upper Santa Ana River basin, including models to assess the Active Recharge Project, the Enhanced Recharge Project, and the Riverside North Aquifer Storage Recharge Project. The

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[1] The HCP Hydrology Model was developed using 2015 as the baseline year, which represents the approximate year of the lowest recycled baseflow discharge from the WWTPs that discharge to the upper Santa Ana River, and the mid-point of an extended drought. The HCP Hydrology Model and associated analyses were developed prior to the State Water Resources Control Board (SWRCB) Division of Water Rights' authorization of the City of San Bernardino's Wastewater Change Petition WW0059, which occurred on June 10, 2019. WW0059 requires a minimum discharge of 28.6 cfs (18.5 million gallons per day) between June 1 and October 15 annually (also stipulated in the City of San Bernardino's settlement agreements with the City of Riverside and the Center for Biological Diversity) (available on the SWRCB's website at https://www.waterboards.ca.gov/).

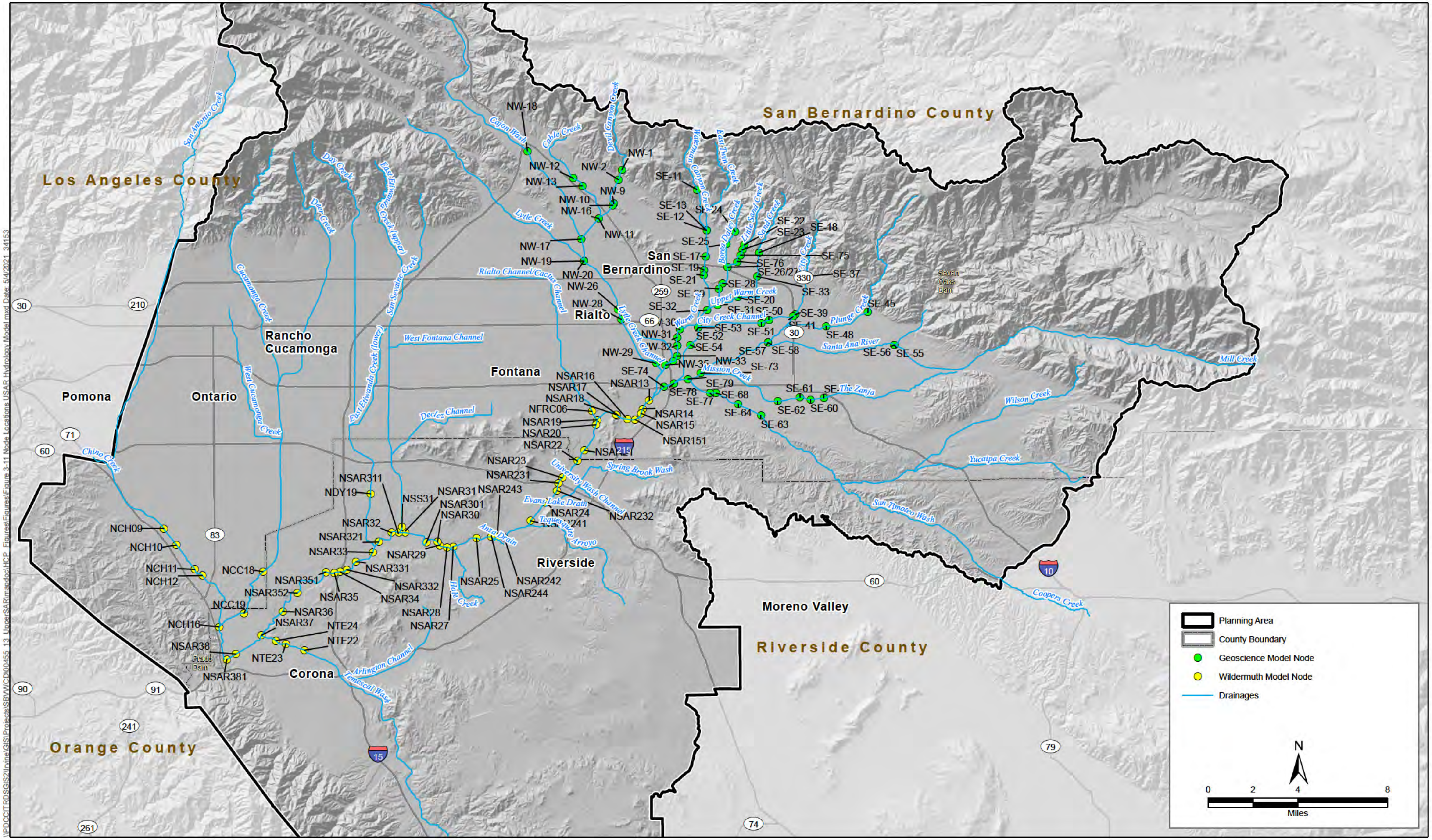

Figure 3-11
Node Locations of Upper Santa Ana River HCP Hydrology Models

modeling is performed in Hydrologic Simulation Program Fortran (HSPF) software and includes calibration with USGS gage data. The Geoscience model includes the current operation parameters for Seven Oaks Dam and the operations of the groundwater recharge basins in the upper watershed. Existing conditions are based on 2012 land use and precipitation records from 1934–2008. The Geoscience model includes mean daily flows for stream nodes in the watershed area upstream of the proposed Riverside North Aquifer Storage and Recovery Project (RPU.5) (see Geoscience 2012, 2013, and 2014 for full descriptions of the Geoscience models, including calibration results with measured data). While additional development has occurred within the Planning Area since 2012, it is not expected to create an appreciable difference at the watershed level that would result in different model results for the purposes of this HCP. The Geoscience model represents use of the best available data for this type of HSPF model.

Wildermuth Hydrology Model

Wildermuth Environmental, Inc. (Wildermuth) also has developed several watershed hydrology models of the Santa Ana River watershed. Wildermuth developed the Wasteload Allocation Model (WLAM) that simulates discharge, streambed recharge, and the fate and transport processes for total dissolved solids (TDS) and total inorganic nitrogen (TIN) as part of the work of the Basin Monitoring Program Task Force to assess water quality objectives specified in the Santa Ana River Watershed Basin Plan. For the HCP, Wildermuth combined its WLAM Scenario 8 model with recent improved resolution modeling of the Chino Basin to assess the 2013 Recharge Master Plan Update. Wildermuth's model includes effluent discharges from the wastewater treatment plants and operations of groundwater recharge basins. Existing conditions are based on 2005 land use and precipitation records from 1950–2011. Wildermuth's Fortran ROUTER model uses Soil Conservation Service (SCS) curve number methods for 2001 land use conditions to estimate runoff and its ROUTER module to route the runoff through the drainage system. Wildermuth's model includes calibration with USGS gage data. The Wildermuth model includes mean daily flows for stream nodes in the watershed area upstream of Prado Dam (see Wildermuth 2009, 2015, and 2017 for full descriptions of the Wildermuth models, including calibration results with measured data).

HCP Hydrology Model

The Geoscience model and Wildermuth model were combined into one model for the HCP by taking the outflow from the Geoscience model at its most downstream location (a node on the Santa Ana River just downstream of the proposed RPU.5) and using it as the inflow into the Wildermuth model. The streambed infiltration rates used in the Wildermuth model in both the Rialto Channel and in the Santa Ana River reach downstream of RIX were modified to provide a better fit between modeled losses and the measured USGS infiltration losses in the same reach. Finally, the existing effluent discharges at RIX and Rialto were modified to better fit recent reported measured effluent discharges at these two locations.

Groundwater Flow Model

A groundwater flow model was created for the Upper Santa Ana River (SAR) Groundwater Basin (known as the Integrated SAR Model or Integrated Model) by integrating existing groundwater and surface water models (Geoscience 2018). The Integrated SAR Model gives a more detailed understanding of the surface hydrology/groundwater interaction by taking into consideration variables such as infiltration rate, groundwater upwelling, and riparian vegetation evapotranspiration. The Integrated SAR Model is able to depict the current depth to groundwater in riparian areas used by Covered Species (see Figure 3-12). The model is used to predict the changes in groundwater associated with Covered Activities (see Section 4.3.4, *Methods for Effects of Groundwater Change on Riparian and Wetland Habitats*) and will be used as an important component of the long-term monitoring and adaptive management program.

3.6.4 HCP Existing Condition Hydrologic Period

As previously noted, both the Wildermuth and Geoscience models use precipitation records for different time periods in their rainfall-runoff calculations. The historic precipitation records dating back to 1934 include a mixture of years that were drier and wetter than the long-term average. It is important to note that the models are not predicting historic runoff and streamflow. Instead they calculate the amount of runoff and streamflow that would occur by applying historic precipitation patterns to 2005 (Geoscience 2012) and 2001 (Wildermuth 2009) land use conditions. A statistical analysis of precipitation records dating back to 1892 was performed to determine a base hydrologic period to use in the HCP Hydrology Model. The purpose of the base period is to select a period of precipitation years that is representative of the long-term average and that fits within the hydrologic periods used in both the Geoscience and Wildermuth models. The process to select the base period was conducted by the HCP Hydrology Technical Advisory Committee (HTAC), which included an interdisciplinary team of water managers, hydrologic modeling experts, biologists, and representatives of the U.S. Fish and Wildlife Service (USFWS and California Department of Fish and Wildlife (CDFW), among other regulatory agencies involved in development of the HCP. The hydrologic period for the HCP Hydrology Model was selected as a 25-year base period that begins in 1966 and ends in 1990. This period includes a dry and wet period that is representative of the long-term conditions. Selection of this hydrologic period was based on an analysis of precipitation frequency distribution curves that clearly depicted historic dry, intermediate, and wet water year types classifications. Based on historical records, dry years have less than 11 inches of annual precipitation, intermediate years have 11–19 inches, and wet years have more than 19 inches of annual precipitation.[2]

Table 3-9 compares water year type statistics for the following periods: 1892–2014 (full record), 1995–2014 (previous 20 years), and 1966–1990 (selected existing condition hydrologic period). The results show strong similarity in the percentage of years designated in each of the three water year types between the long-term period of 1892–2014 and the selected existing condition hydrologic period of 1966–1990. See Appendix B, *Selection of Baseline Period for Hydrology Analysis,* for additional details on the analysis performed to select the existing condition hydrologic period for the HCP.

[2] The City of San Bernardino gage was used to depict the pattern of variability over time (1892–2014) in precipitation in the Planning Area. This gage provides the longest continuous precipitation record in the region and is centrally located without any notable montane rain shadow effects.

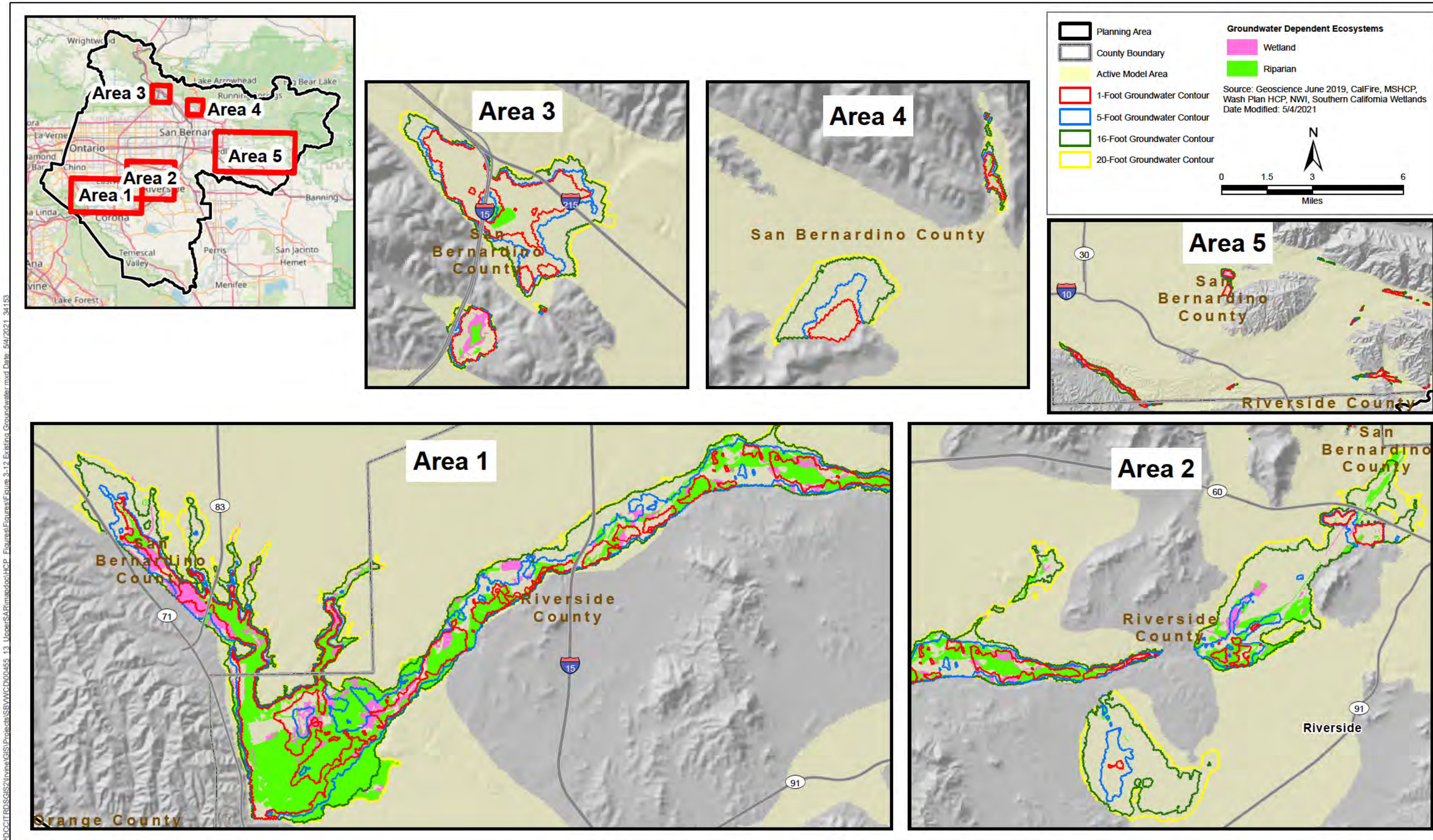

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Figure 3-12
Depth to Groundwater (Existing Conditions)

Table 3-9. Comparison of Water Year Type Characteristics among the 1892–2014, 1995–2014, and 1966–1990 Periods

Period	Water Year Type	Rainfall (inches)	Number of Years	Percent of Years	Average Rainfall (inches)
1892–2014	Dry	<11	30	24	8.7
	Intermediate	11–19	62	50	14.7
	Wet	>19	31	25	25.4
	Annual Average	--	123	--	16.0
1995–2014	Dry	<11	9	45	7.7
	Intermediate	11–19	7	35	14.4
	Wet	>19	4	20	27.6
	Annual Average	--	20	--	14.0
1966–1990	Dry	<11	6	24	9.8
	Intermediate	11–19	14	56	14.7
	Wet	>19	5	20	29.3
	Annual Average	--	25	--	16.4

Mean Daily Streamflow

Mean daily stream flow is often represented as a statistical probability of flow, known as an *exceedance flow*. An exceedance flow analysis shows the probability that a certain magnitude flow is equaled or exceeded on a given day within a given period. For example, a 0.05 probability of exceedance means the flow magnitude is equaled or exceeded only 5% of the time in a given year. As stream flows are rarely greater than the 5% exceedance, it is typically an indicator of high flows that infrequently occur. Conversely, the 0.95 probability of exceedance means the flow magnitude is equaled or exceeded 95% of the time, and thus is an indicator of low flow conditions. The 0.5 probability of exceedance is the median flow in which half the time the flow is greater and half the time it is less.

Mean daily stream flow was calculated at each model node for existing conditions under the HCP hydrologic period. Appendix C, *Monthly and Annual Flows for Exceedance Probabilities at Existing Conditions and with Covered Activities,* lists the 0.95, 0.75, 0.5, 0.25, and 0.05 exceedance probabilities on a monthly and annual basis for all model nodes shown on Figure 3-11. It also lists the mean monthly and annual flows. To spatially summarize the existing hydrology for the drainages in the Planning Area, Figures 3-13 and 3-14, show the mean September and March flows, respectively (representing the driest and wettest months of the year, on average).

Dry Weather Flows

In September, streamflow in the upper parts of the tributaries in the upper watersheds (e.g., Lytle, City, Plunge, San Timoteo) is less than 1.0 cfs (Figure 3-13). Some of the upper watershed tributaries have September flows in the 1.1–10.0 cfs range that exhibit influences of effluent flows, irrigation runoff, or groundwater upwelling. The mean September flow in the Santa Ana River is typically in the 1.1–10.0 cfs range from downstream of Seven Oaks Dam until the confluence with Lytle Creek, at which point the additional tributary inputs have increased the flow into the 10.1–50.0 cfs range. Significant effluent inputs at the Rialto and RIX WWTPs increase the Santa Ana River flow downstream of the Rialto Channel into the 50.1–100.0 cfs range. However, streambed infiltration downstream of the WWTPs decrease the surface flow to the 10.1–50.0 cfs range until approximately the Van Buren Boulevard bridge in Riverside. Due to surface water contributions from groundwater upwelling at the Riverside Narrows and discharge from the City of Riverside Regional Water Quality Control Plant, just upstream of Van Buren Boulevard and Hole Creek, the flow increases again up to the 100.1–200.0 cfs range. After additional streambed infiltration losses, the Santa Ana River in the reach downstream of San Sevaine Creek has September flows in the 50.1–100.0 cfs range until it reaches the Orange County Water District diversion channel to the Prado Wetlands (Node NSAR36). As derived from the HCP Hydrology Model, approximately 30 cfs is lost to infiltration in the Santa Ana River between the City of Riverside Regional Water Quality Control Plant and the diversion to the Orange County Water District Prado Wetlands. Mean September streamflow in tributaries in the Chino Basin (e.g., Chino Creek, Cucamonga Creek, Day Creek, San Sevaine Creek) are typically in the 1.1–10.0 cfs range, with some increases due to WWTP effluent.

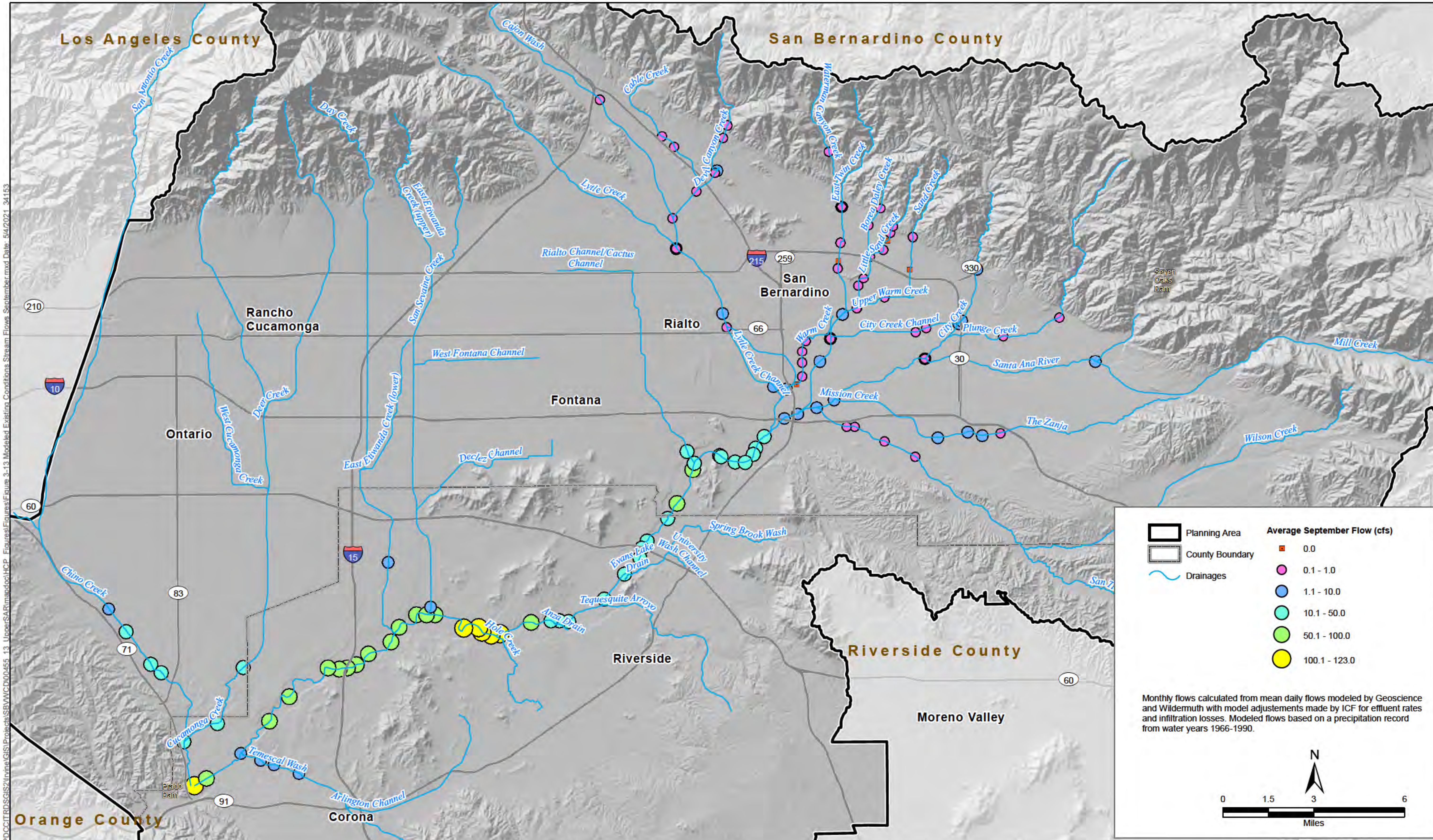
Wet Weather Flows

Historic data show that stream flow is typically greatest in March in the Planning Area. Mean March streamflow is mapped on Figure 3-14. Several of the tributaries in the upper portion of the watershed have mean March streamflow in the 1.1–10.0 cfs range (e.g., San Timoteo, Mission Creek, Sand Creek) or 10.1–50.0 cfs range (e.g., Lytle Creek, Mill Creek, Plunge Creek). The Santa Ana River downstream of Seven Oaks Dam also has flows in the 10.1–50.0 cfs range until losses to streambed infiltration reduce flows down to 1.1–10.0 cfs upon reaching the confluence with Mission Creek. Downstream of the confluence with Lytle Creek, the flow contributions from all the tributaries upstream increase the Santa Ana River's mean March flow to 100.1–200.0 cfs. Streamflow in the Santa Ana River is increased again up to the 200.1–400.0 cfs range from effluent supplied to the river by the RIX and Rialto WWTPs. Mean March flows in the Santa Ana River reach remain 200.1–400.0 cfs from the Rialto Channel down to the Prado Wetlands diversion (Node NSAR36). The tributary inputs from the Chino Basin are in the 100.1–200.0 cfs range.

Hydrologic Sediment Transport

High flows in the wet season and during major storm events are responsible for most of the fluvial processes that create and maintain stream channels. Channel maintenance flows are described here as instream flows necessary to maintain the physical character of the stream channel (Schmidt and Potyondy 2004). Maintenance of the physical habitat is in turn essential for healthy aquatic and terrestrial habitat and reducing flood risk. Schmidt and Potyondy (2004) describe the following benefits of channel maintenance flows:

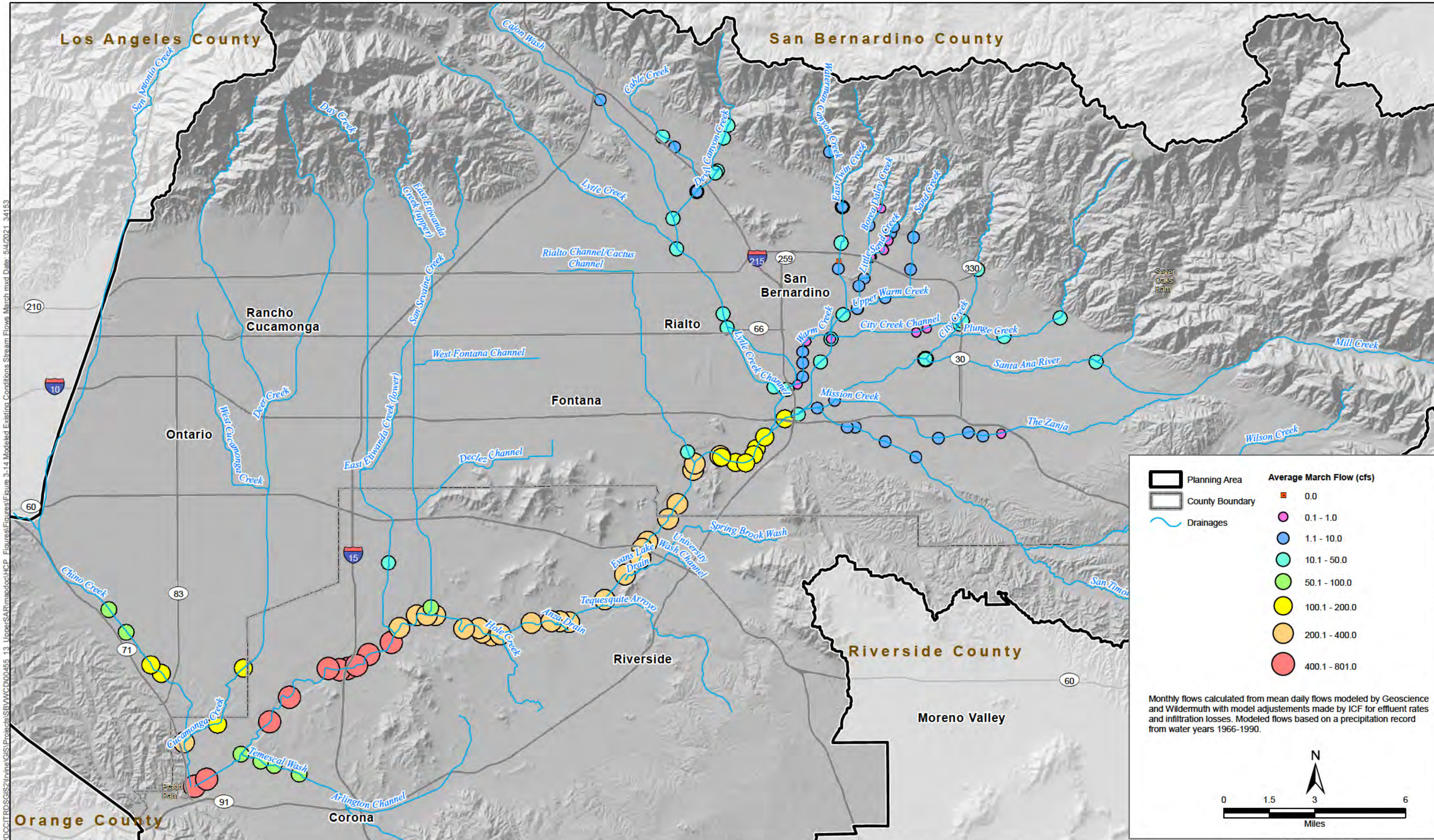
- Convey water and sediment from tributary areas through the stream system without aggradation (net raising) or degradation (net lowering) of the channel bed.
- Maintain the relationship between the channel and the floodplain by temporarily storing flood flows on the floodplain.
- Maintain the ability of the stream to dissipate energy on the floodplain.
- Maintain essential channel capacity to avoid increasing flood risk to adjacent and downstream facilities.
- Maintain pools, riffles, meanders, and other physical habitats necessary to sustain aquatic ecosystems.



ICF

Upper Santa Ana River Habitat Conservation Plan

Figure 3-13
September Monthly Average Daily Flow for Existing Conditions (modeled)



Upper Santa Ana River
Habitat Conservation Plan

Figure 3-14
March Monthly Average Daily Flow for Existing Conditions (modeled)

Channel maintenance flows are also essential for maintaining healthy riparian vegetation and the numerous benefits it provides, including habitat, root cohesion to protect against excessive erosion, shading to regulate stream temperatures, and nutrient filtering. Channel maintenance flows sustain riparian vegetation by:

- Providing a source of abundant moisture.
- Transporting seed and propagules.
- Depositing sediment and scouring areas of the floodplain to create and maintain regeneration sites.
- Suppressing vegetation growth and encroachment of the main channel by several mechanisms including scour and inundation. (Schmidt and Potyondy 2004)

Loss of riparian vegetation can lead to increased erosion of sediments, forming channel banks and floodplains. Rapid transport and eventual deposition of this sediment downstream can cause flooding problems and degrade aquatic habitats. Furthermore, riparian vegetation stores flood water, at least temporarily, and slows the pace of the flood wave as it moves down the watershed, thereby reducing flooding levels downstream (Anderson 2006).

The magnitude, frequency, and duration of flood flows necessary for performing channel maintenance can vary depending on the characteristics of the channel morphology. The recurrence interval, also known as the return period, is the average interval of time in years for which the discharge magnitude of a given flood will be equaled or exceeded. Surian et al. (2014) presents a conceptual framework that relates recurrence interval flows with channel maintenance fluvial processes in braided rivers, similar to much of the Santa Ana River in the Planning Area (Figure 3-15). Braided channel processes of sediment transport in channels and on low bars, in-channel bank erosion, sudden channel shifts into new channel braids, and vegetation erosion can all occur at frequently occurring flood events with recurrence intervals of less than a 1-year return period. It can require larger recurrence interval events of up to 2.5 years for the process of sediment transport on high bars. The framework model (Figure 3-15) illustrates that fluvial processes occur under a range of discharges, not a single discharge, and relatively infrequent floods (recurrence intervals in the 1- to 3-year range) are important drivers of braided channel morphology (Surian et al. 2014, Bertoldi et al. 2010). Flow regulations that affect frequent, low magnitude floods with recurrence intervals in the 1- to 3-year range can significantly change braided river vegetation dynamics and the transport of coarse sediment (Surian et al. 2014). The recurrence interval of 1.25 years was selected as one measure to characterize the existing high flow conditions of the Santa Ana River in the Planning Area as this recurrence interval includes all of the primary channel maintenance processes except sediment transport to high bars. As discussed below, characterization of bedload transport over the entire hydrograph, which includes less frequent and higher magnitude flood events than the 1.25-year flood, was also performed as another measure of high flow characterization.

Three different analyses were performed to characterize existing conditions:

1. Characterization of the Flow Magnitude for the 1.25-year Flood Event
2. Characterization of Sediment Transport for the 1.25-year Flood Event
3. Characterization of Sediment Transport Over the Entire Hydrograph

Details on this analysis are included in Appendix D, *Santa Ana River High Flow Effects Analysis*.

Characterization of Flow Magnitude for the 1.25-year Flood Event

Determination of the flow magnitude that corresponds to different recurrence intervals, including the 1.25-year flood event, is usually based on peak instantaneous flows that can be queried from USGS gage records (e.g., flow levels reported on a 15-minute interval) to find the largest value that occurred in the year. While several USGS gages exist in the Planning Area, there are too few to comprehensively characterize the 1.25-year flood event for all reaches of the upper Santa Ana River and its tributaries. Therefore, a procedure to correlate the available peak flow recurrence interval with mean daily discharge was used. For the first step, flood recurrence intervals (based on the approach in England et al. 2018) were calculated on the available gage records. Then a flow duration curve was created from the mean daily flow records at the USGS gages, and the exceedance probability corresponding to the 1.25-year flood was determined. Finally, the same exceedance probability determined for the USGS gage was used to determine the modeled mean daily flow that corresponds to the 1.25-year flood event (see Appendix D for a more thorough description of this approach and graphs of the flow duration curves).

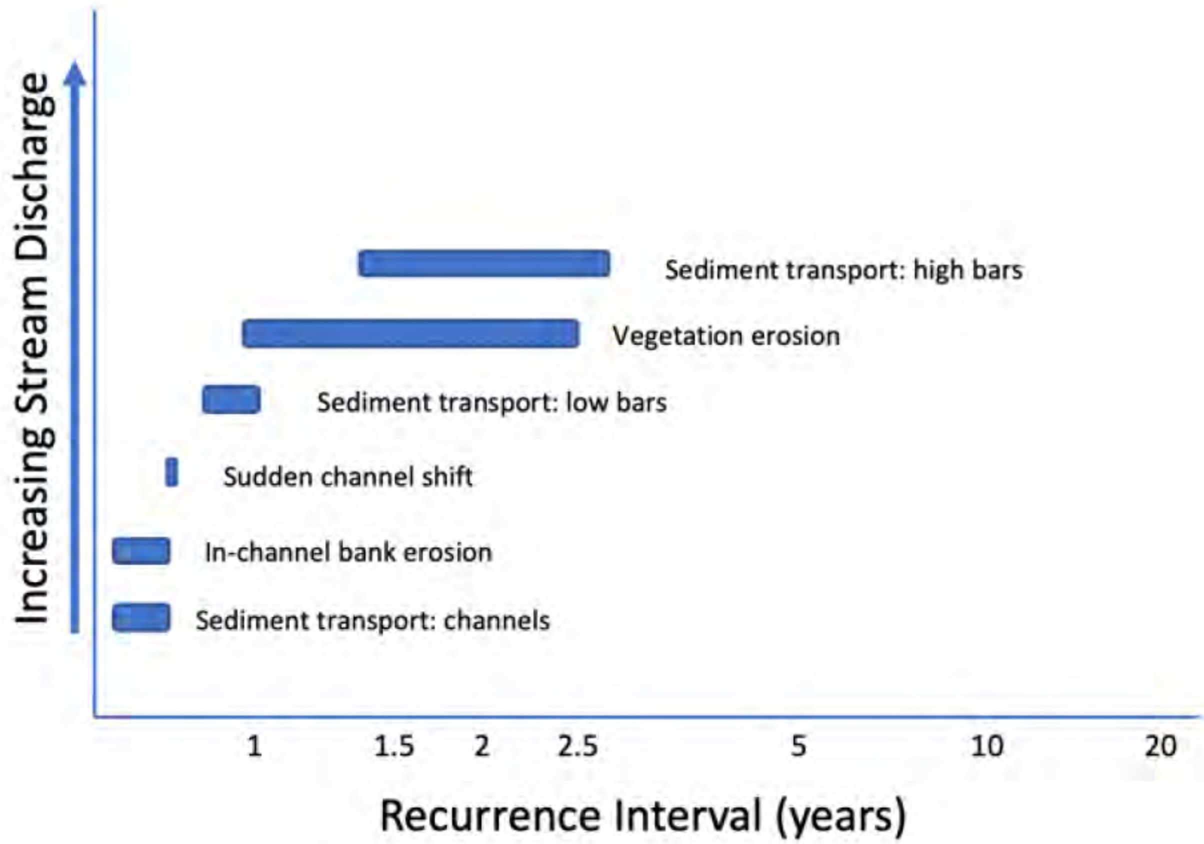
While this approach does not produce an exact correlation of peak flow with mean daily flow (e.g., when the peak instantaneous flow duration is less than a day) it does provide a good approximation and results in a comprehensive characterization of the existing conditions for comparison with potential effects of the Covered Activities. As the results in Appendix D show, the peak instantaneous and modeled mean daily existing flows have similar magnitudes for most gages. The flow magnitude at the 1.25-year flood event is shown in the second column of Table 3-10.

Characterization of Sediment Transport for the 1.25-year Flood

Particle size analysis of the channel bed sediment samples shows that most of the assessment reaches are composed of fine grained, poorly sorted, sandy sediment (Appendix D). The exceptions are steeper reaches in the upper watershed on the Santa Ana River at Greenspot Road and Mill Creek (dominant, small cobble size), the Rialto Channel (dominant, coarse gravel), and Santa Ana River (ESA Middle Reach) downstream of Highway 60 (dominant, fine gravel size). Results for the modeled sediment transport for the 11 assessment reaches are listed in Table 3-10. The table lists total sediment transport and change in fractional sediment transport. Mill Creek has the largest sediment transport rate (15,781 tons/day) and is nearly three times greater than the second largest tributary site of Lytle Creek upstream of Cajon Wash (5,295 tons/day). Mill Creek's steep bed slope (4.1%) is the highest of all reaches assessed and a primary factor for why this tributary is the largest sediment source. In terms of the fractional size components of the total sediment load, Mill Creek is the largest supplier of gravel and cobble at the 1.25-year flood under the existing hydrologic condition (Table 3-10).

Table 3-10. Sediment Transport Rate Under Existing Conditions that Corresponds to the 1.25-Year Flood Recurrence Interval

2D Hydraulic Model Assessment Reach	Stream Flow (cfs)	Total Bedload Transport (t/d)	Fractional Bedload Transport under Existing Conditions			
			Sand (t/d)	Gravel (t/d)	Cobble (t/d)	Boulder (t/d)
Mill Creek Upstream of SAR	84	15,781	6,407	8,557	815	2
Lower City Creek	176	1,100	904	196	0	0
Lytle Creek Upstream of Cajon Wash	100	5,295	4,224	1,063	8	0



After Surian et al. 2014

Figure 3-15
Relationship of recurrence interval and high flow channel maintenance processes
Upper Santa Ana River Habitat Conservation Plan

2D Hydraulic Model Assessment Reach	Stream Flow (cfs)	Total Bedload Transport (t/d)	Fractional Bedload Transport under Existing Conditions			
			Sand (t/d)	Gravel (t/d)	Cobble (t/d)	Boulder (t/d)
Lytle Creek Downstream of Cajon Wash	159	1,737	1,497	240	0	0
Cajon Wash	100	2,167	1,847	319	0	0
SAR – Greenspot Rd	259	8,201	1,949	3,747	2,365	140
SAR – Downstream of Mill Creek	401	5,660	1,482	2,660	1,462	56
SAR – Upstream of East Twin Creek	473	959	877	81	0	0
SAR – USGS Reach 9 Downstream of RIX	3,178	7,626	6,862	764	0	0
SAR – ESA Middle Reach	2,971	2,490	1,641	849	0	0
SAR – Site 3A Downstream of I-15	5,948	2,157	1,179	978	0	0

t/d = tons per day

Characterization of Bedload Transport Over the Entire Hydrograph

Results of the sediment transport analysis over the entire hydrograph are presented in Table 3-11. These locations were selected for analysis because they are the tributaries that deliver the most sediment to the mainstem of the Santa Ana River that also are the site of Covered Activities. The other three tributaries on the Santa Ana River were selected to include different locations distributed throughout the Planning Area. Appendix D includes the sediment transport rating curves that were used to determine the values in Table 3-11. It also illustrates with graphical bar charts the fractional transport rates listed in Table 3-11. Mill Creek by far has the largest total sediment load under existing conditions of all sites at 1,184,365 tons/year, and is also the largest supplier of combined gravel and cobble to the Santa Ana River. The Santa Ana River at Greenspot Road is the location with the second largest existing condition total sediment load at 280,296 tons/year. The third largest location under existing conditions for total sediment load is the Santa Ana River USGS Reach 9 downstream of RIX at 177,376 tons/year. In terms of the fractional size components of the total sediment load, Mill Creek is the largest supplier of gravel and cobble under existing conditions (Table 3-11). The Santa Ana River at Greenspot Road is the second largest supplier of gravel and cobble.

Table 3-11. Sediment Transport Effects from Changes in Hydrology Calculated for Every Mean Daily Discharge over the 25-Year 1966–1990 Base Hydro Period

Hydraulic Model Assessment Reach	Stream Flow (afy)	Total Bedload Transport (t/yr)	Fractional Bedload Transport			
			Sand (t/yr)	Gravel (t/yr)	Cobble (t/yr)	Boulder (t/yr)
Mill Creek Upstream of SAR	14,362	1,184,365	466,051	641,526	75,564	967
Lower City Creek	8,275	22,964	18,838	4,126	0	0
Lytle Creek Downstream of Cajon Wash	9,471	48,938	41,864	7,052	23	0
SAR at Greenspot Rd	15,650	280,296	63,450	125,237	84,766	6,340
SAR – Upstream of East Twin Creek	36,313	39,531	35,847	3,668	15	0

Hydraulic Model Assessment Reach	Stream Flow (afy)	Total Bedload Transport (t/yr)	Fractional Bedload Transport			
			Sand (t/yr)	Gravel (t/yr)	Cobble (t/yr)	Boulder (t/yr)
SAR – USGS Reach 9 Downstream of RIX	99,675	177,376	161,323	16,053	0	0

afy = acre-feet per year; t/y = tons per year

Wetted Area as a Measure of Aquatic Habitat

Geomorphic processes influence the channel pattern and channel type (as described in the sections above), and these in turn influence the corresponding riparian and aquatic habitats and biotic communities. Riparian habitats develop along the margins of stream channels, with the riparian vegetation structure (e.g., shrubs, woodlands, forest), composition, and width of riparian zone dependent on channel pattern, slope, and type (Figure 3-16).

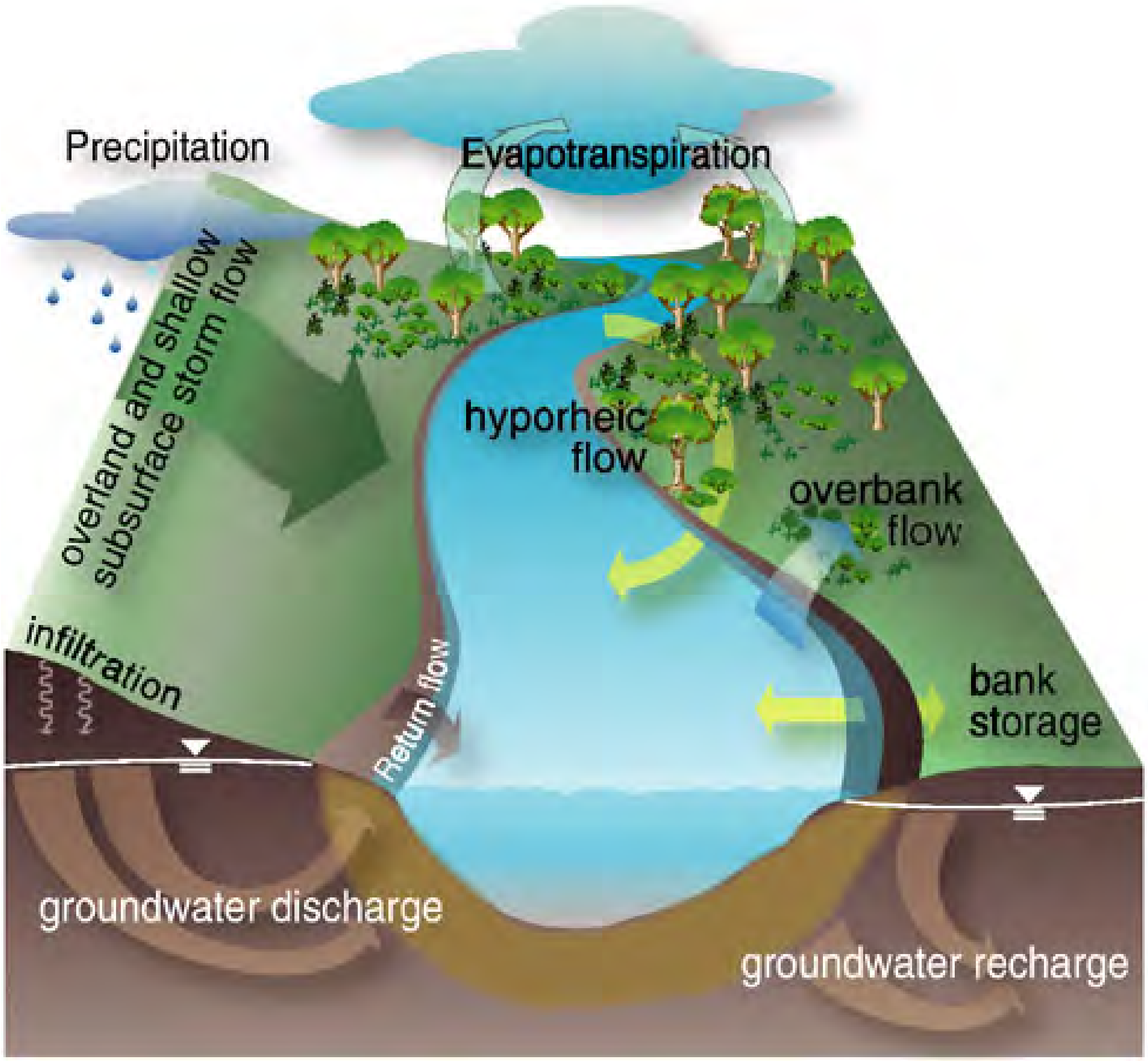
For the purposes of this HCP, aquatic or in-channel habitat represents that portion of the stream channel that is wetted during any given period. Throughout most of the year this "wetted area" is defined by the low-flow channel that is sustained by upstream sources and connection to groundwater. The low-flow channel varies in width and depth throughout the year. During storm events, the "wetted area" can expand dramatically as the main channel expands onto the floodplain. The low-flow state of the stream is important to sustain aquatic species throughout the year, while the high-flow (storm) state is important to periodically reset the in-channel habitat through sediment transport and other fluvial processes that scour channel banks and associated vegetation. During high-flow events and the corresponding periods of higher stage flows, important periods of enhanced habitat connectivity may occur, providing the opportunity for movement of aquatic species between otherwise disconnected areas of suitable habitat. High-flow events also mobilize gravel, cobbles, and boulders in the bed, flushing away sand and changing the sediment distribution and availability of coarse substrates, which may support algal growth and habitat for native fish foraging and spawning.

Geomorphology also influences the degree to which groundwater is sustained near the surface, regulating the extent to which streams lose surface water to groundwater or gain surface water from groundwater. The interchange of water between surface flows in the stream channel and adjacent groundwater plays a major role in supporting riparian and aquatic communities during the dry season as well as during periods of extended drought.

Calculation of the Wetted Area of the Channel

The Upper Santa Ana River and its tributaries are divided into 85 different reaches occurring between nodes in the HCP Hydrology Model (see Section 3.6.3 and Figure 3-11). Each reach was classified into one of 12 different channel types (see Table 3-8). A set of 21 assessment reaches were identified throughout the watershed that represent the different channel types (Figure 3-17). Bathymetry was created from LiDAR data and supplemented with field-based bathymetry surveys in assessment reaches where perennial flow prevented the LiDAR sensors from detecting the topography of the bottom of the channel.

A 2D hydrology model was created for each of the assessment reaches using the bathymetry data, and a range of flows were run through the model to facilitate the calculation of wetted area acreage estimates for each of the flow volume simulations (from low to high flows). The estimates of wetted



Source: National Research Council. 2002.

Figure 3-16
Water Movement Pathways through Riparian Areas
Upper Santa Ana River Habitat Conservation Plan

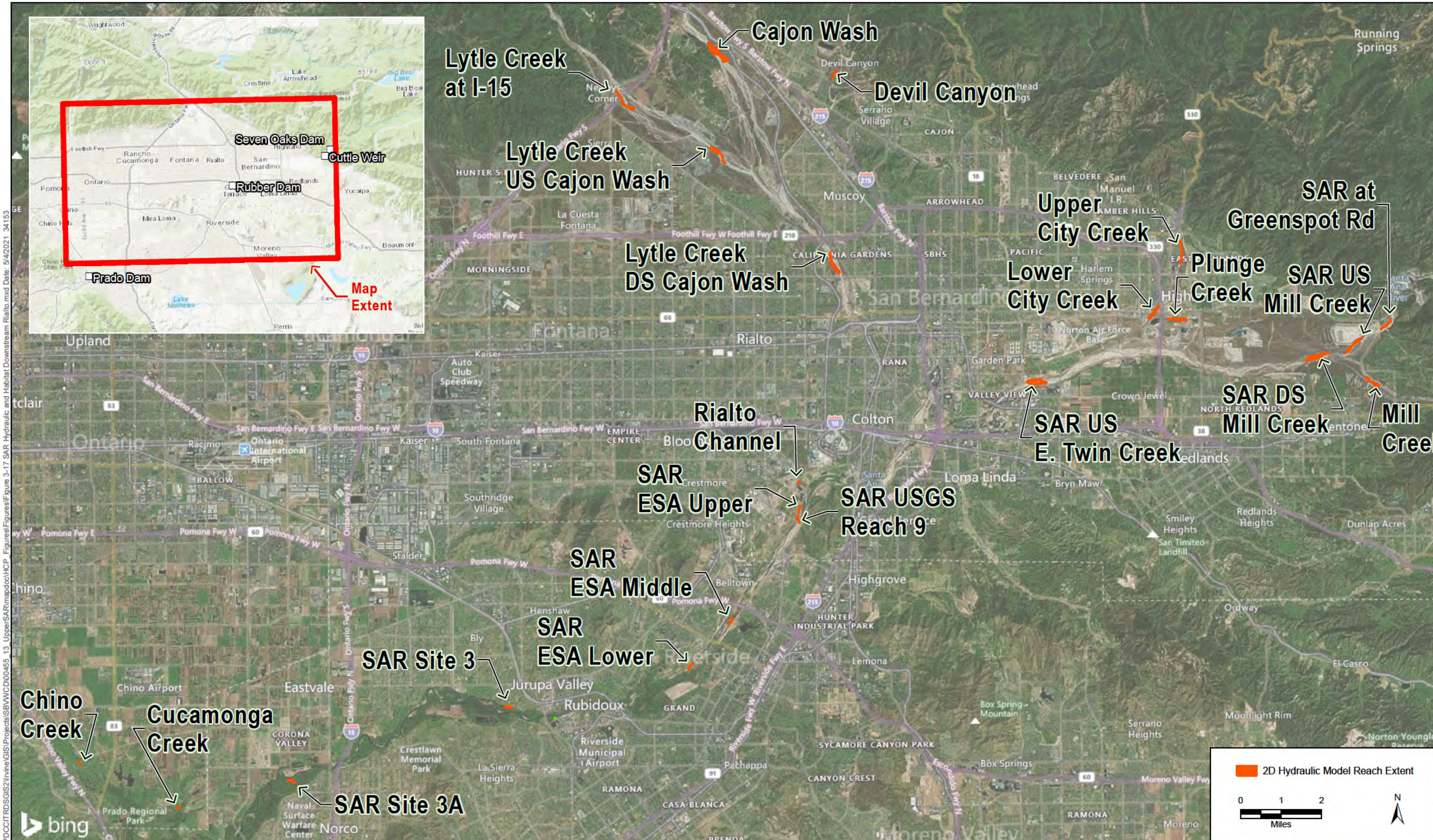


Figure 3-17
Santa Ana River - Locations of 2D Hydraulic Model Assessment Reaches

area acreage were next plotted on a graph and fitted with a curve, allowing for interpolation of wetted area for any flow between the lowest and highest simulated flows (Figure 3-18 provides an example of one of these graphs with five simulated flow volumes, ranging from 10–100 cfs, plotted along with the corresponding curve).

The wetted area acreage for each assessment reach was interpolated from each graph for the dry season simulated flow volume at the August–October 95% exceedance interval (left vertical line on Figure 3-18). The August–October 95% exceedance interval was chosen as this period represents the dry season when flow volumes are at their lowest, and aquatic species are likely at their most vulnerable to reduced wetted area availability (see *Mean Daily Streamflow,* above). For the other 64 reaches not modeled as assessment reaches, dry season wetted area acreages were extrapolated from the wetted area curve generated for the assessment reach(es) within the same reach classification category.

To estimate the acreage of wetted area during the dry season for each Covered Species that uses aquatic habitat for all or part of their life histories (except Santa Ana sucker and arroyo chub, see Section 3.8.3, *Covered Species Accounts*), each species' suitable habitat model was overlaid on the reaches, and the area of overlap (i.e., where wetted area coincided with modeled suitable habitat) was calculated. The same process was repeated to determine the effect of Covered Activities on wetted area for each species by using the dry season flows estimated in the HCP Hydrology Model with all Covered Activities in place (see right vertical line in Figure 3-18).

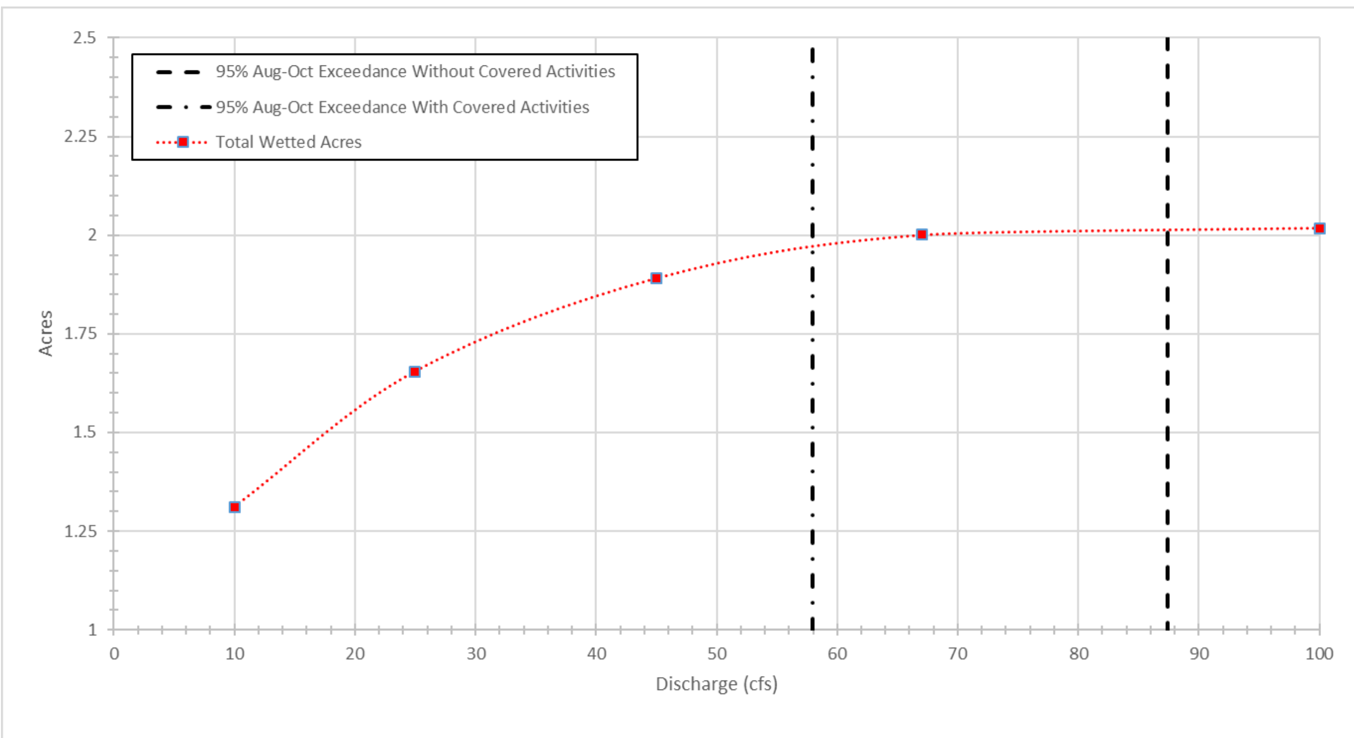
3.7 Vegetation and Land Cover

The vegetation communities and other land cover types were compiled using the most current land cover data available from a variety of sources to create a single land cover layer encompassing the entire Planning Area. The majority of the landcover aerial coverage was derived from the California Department of Forestry and Fire Protection (CAL FIRE) land cover dataset (CAL FIRE). This layer was supplemented with more current and/or detailed data from (1) agricultural and developed lands from the Farmland Mapping and Monitoring Program (California Department of Conservation 2014), (2) USFWS National Wetlands Inventory (USFWS 2017a), (3) Southern California Wetlands Inventory (State of California 2007), (4) Western Riverside County vegetation data, and (5) Upper Santa Ana River Wash Plan HCP land cover data (see Table 3-12 for a complete list of land cover data sources). All data were reclassified to the U.S. National Vegetation Classification Standard level 5 (macrogroup) (USNVC 2016) to match the CAL FIRE base layer. Table 3-13 lists the vegetation community macrogroup types occurring in the Planning Area. See Figures 3-19 through 3-25, for a geographic overview of where these land cover types occur within the Planning Area.

Table 3-12. Land Cover Data Sources

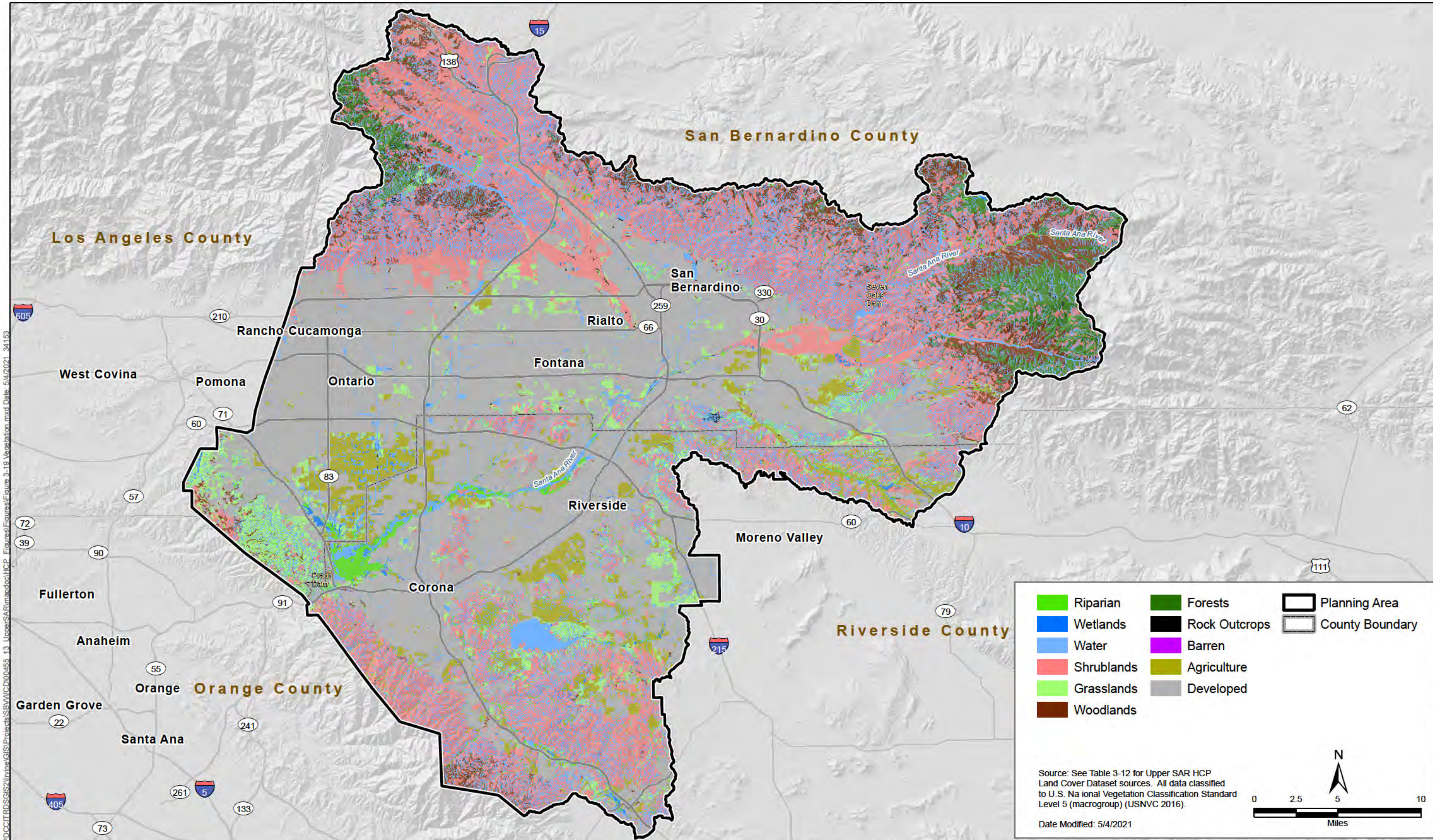
Data Layer	Data Description
CAL FIRE	This vegetation dataset was compiled from three different vegetation classifications (U.S. Forest Service [USFS] CALVEG, *Mojave Manual of California Vegetation* [MCV], and *West Riverside MCV*) that have been crosswalked for the Santa Ana River Watershed planning project. CALVEG and the California Wildlife Habitat Relationships System were crosswalked to National Vegetation Classification System. Sources: CAL FIRE, California Native Plant Society (CNPS) MCV at http://vegetation.cnps.org/.

Data Layer	Data Description
California Farmland Mapping and Monitoring Program	A land cover map that focuses on farmland of California. Source: California State, Department of Conservation, Division of Land Resource Protection at http://redirect.conservation.ca.gov/DLRP/fmmp/county_info_results.asp.
CALVEG, USFS	This layer provides vegetation databases in Zone 7: South Coast, which includes San Bernardino County, that meets regional and national vegetation mapping standards. Source: http://www.fs.usda.gov/detail/r5/landmanagement/resourcemanagement/?cid=stelprdb5347188.
CDFW Western Riverside County Vegetation Mapping	An alliance-level vegetation classification and map of Western Riverside County, 2010. Source: CDFW at http://www.dfg.ca.gov/biogeodata/gis/veg.asp.
Desert Renewable Energy Conservation Plan Vegetation Map	A fine-scale vegetation map of portions of the Mojave and Colorado Deserts in California prepared for the CDFW Renewable Energy Program and the California Energy Commission. Source: https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=62826.
Southern California Wetlands Mapping Project	Updated mapping of wetland and associated riparian habitat maps in Southern California coastal watersheds. Source: https://www.sfei.org/projects/southern-california-wetland-mapping-project
USFWS National Wetlands Inventory	Reconnaissance level information on the location, type, and size of wetlands and deepwater habitats, which are identified based on vegetation, visible hydrology, and geography. The maps are prepared from the analysis of high altitude imagery. Source: http://www.fws.gov/wetlands/data/Data-Download.html.
Upper Santa Ana River Wash Plan HCP	A land cover map produced for the Wash Plan HCP. Source: https://www.sbvwcd.org/our-projects/wash-plan.html
Soils	
USDA NRCS Soil Survey Geographic Database	Soil texture and landform data produced by the National Cooperative Soil Survey. Source: U.S. Department of Agriculture National Resource Conservation Service at http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx.
Elevation	
National Elevation Dataset	A seamless raster product primarily derived from USGS 10- and 30-meter Digital Elevation Models, and, increasingly, from higher resolution data sources such as LiDAR, interferometric synthetic aperture radar (IFSAR), and high-resolution imagery. Source: USGS at http://nationalmap.gov/elevation.html#data.



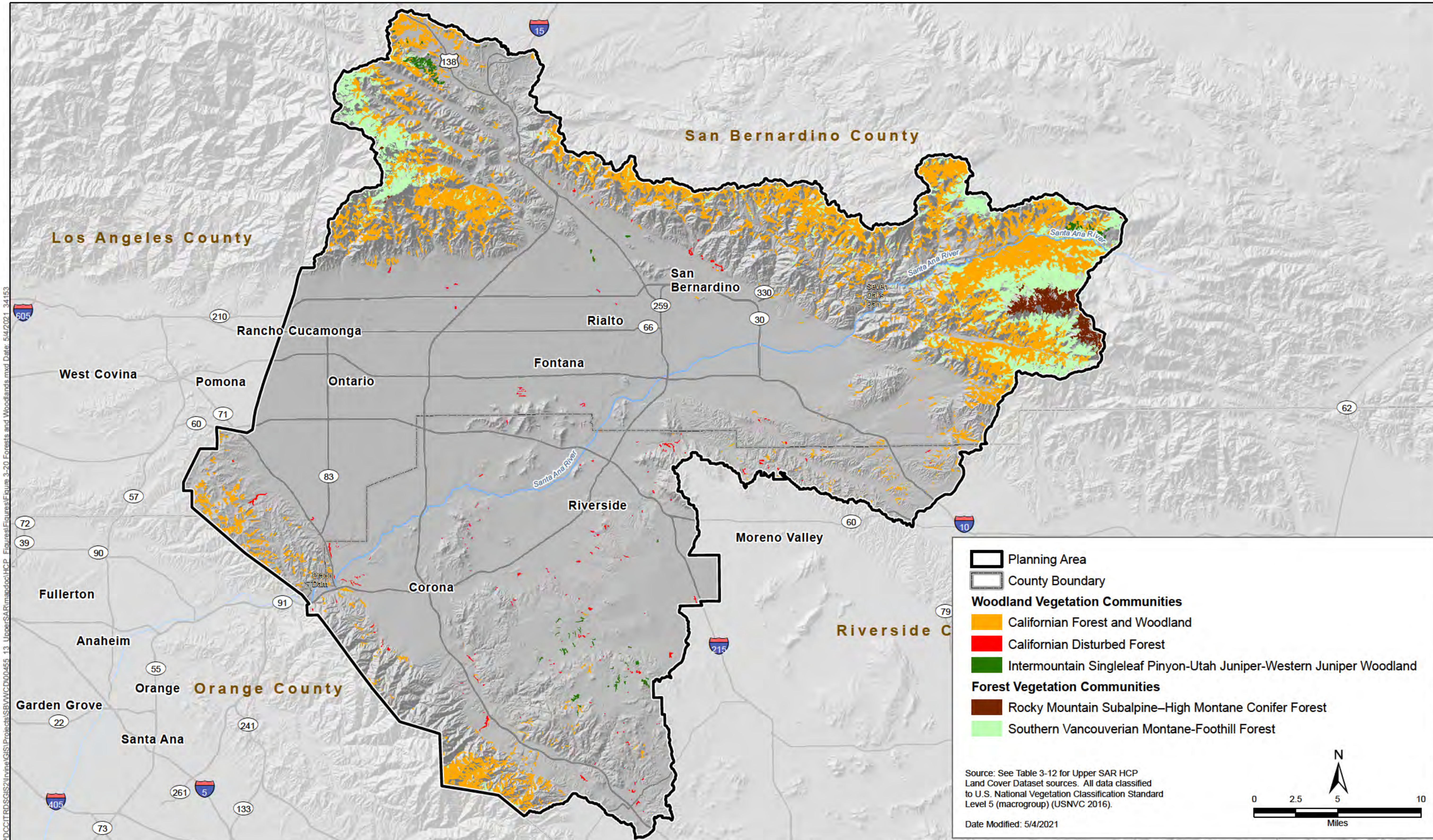
Change in Wetted Channel Area with Discharge: Santa Ana River downstream of Van Buren Blvd
(Site 3, 2D Modeling Reach)

Figure 3-18
Example: Wetted Area Estimation Curve
Upper Santa Ana River Habitat Conservation Plan



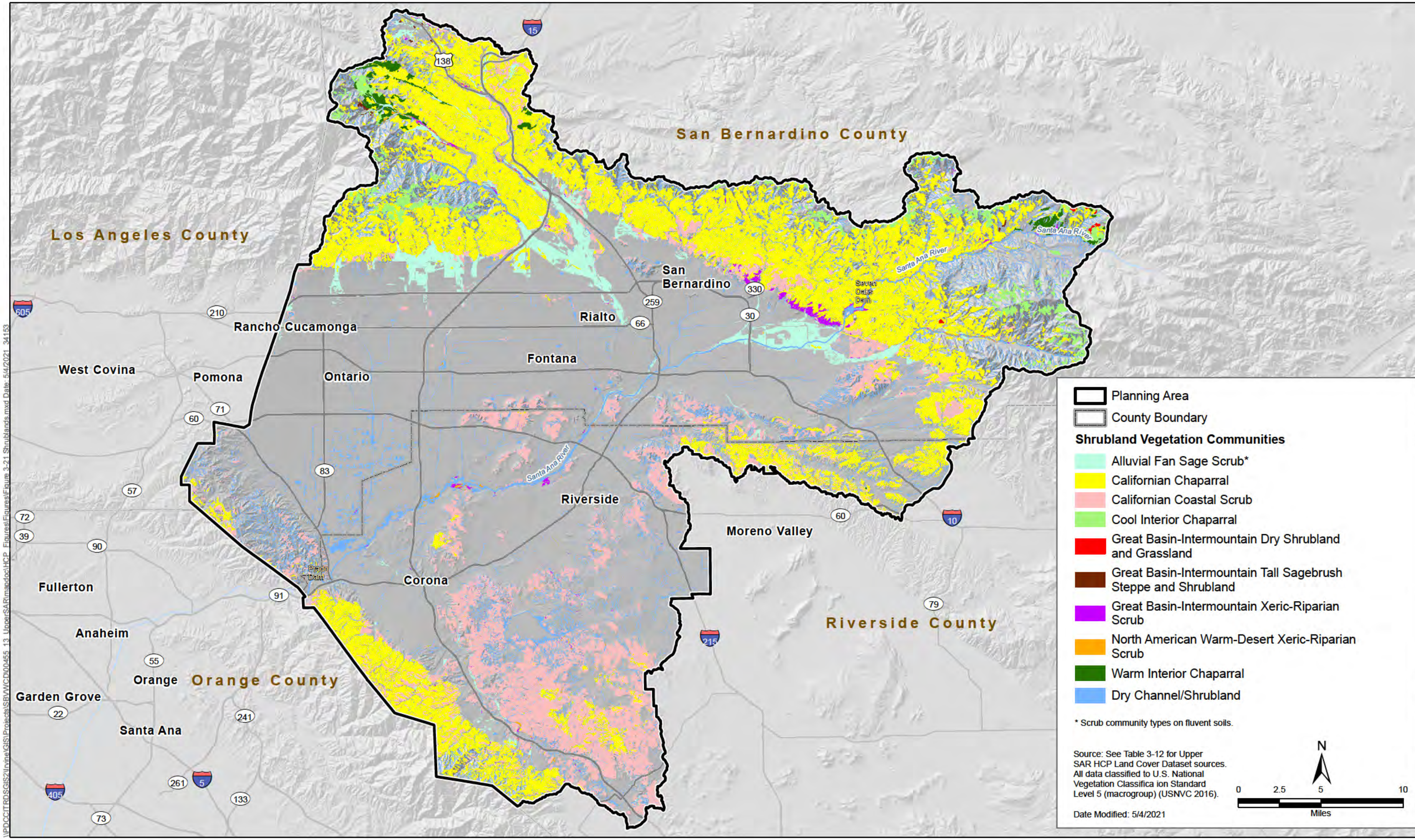
Upper Santa Ana River Habitat Conservation Plan

Figure 3-19
General Vegetation Communities and Land Cover Types in the Planning Area



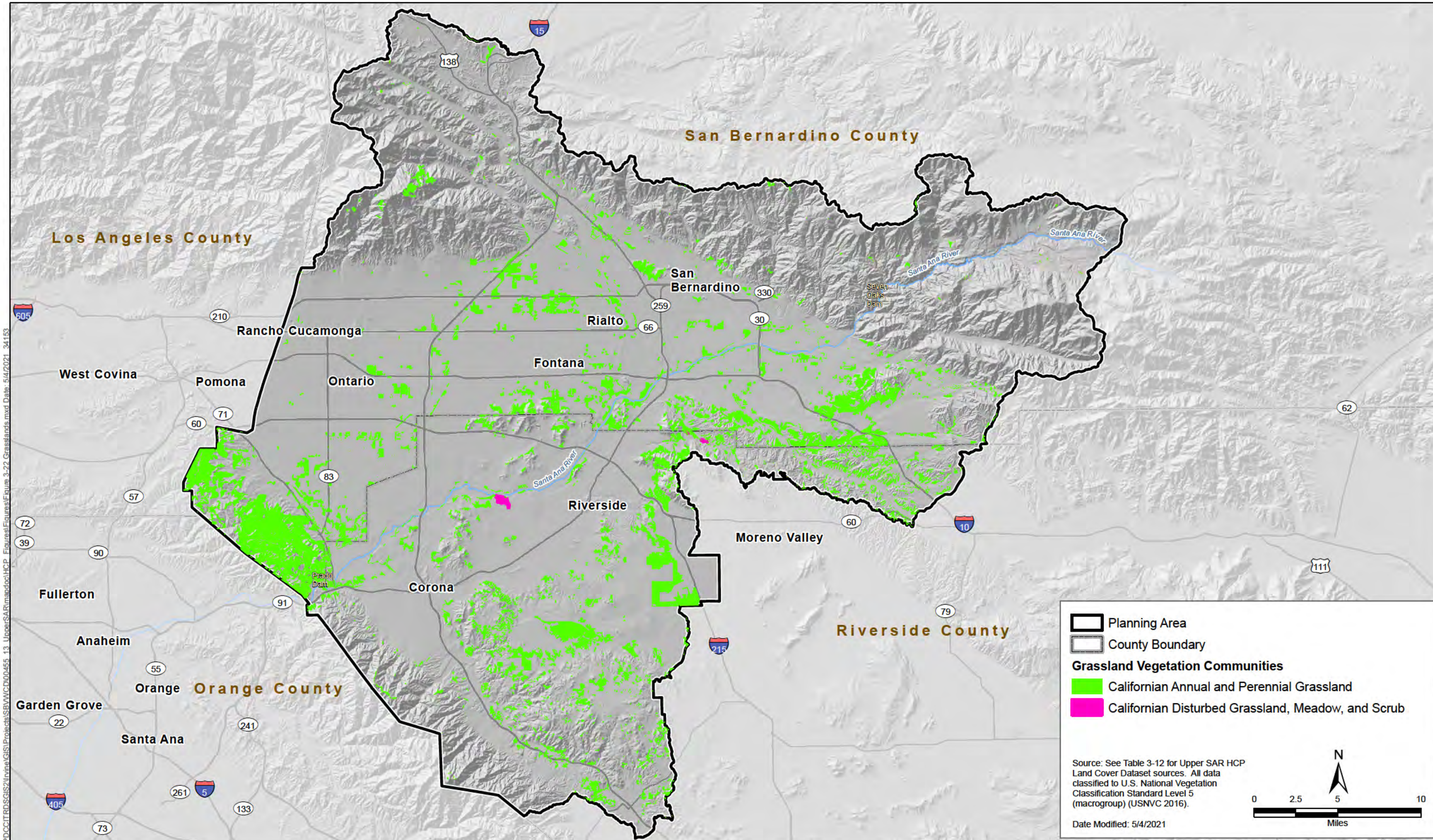
Upper Santa Ana River
Habitat Conservation Plan

Figure 3-20
Forest and Woodland Communities in the Planning Area



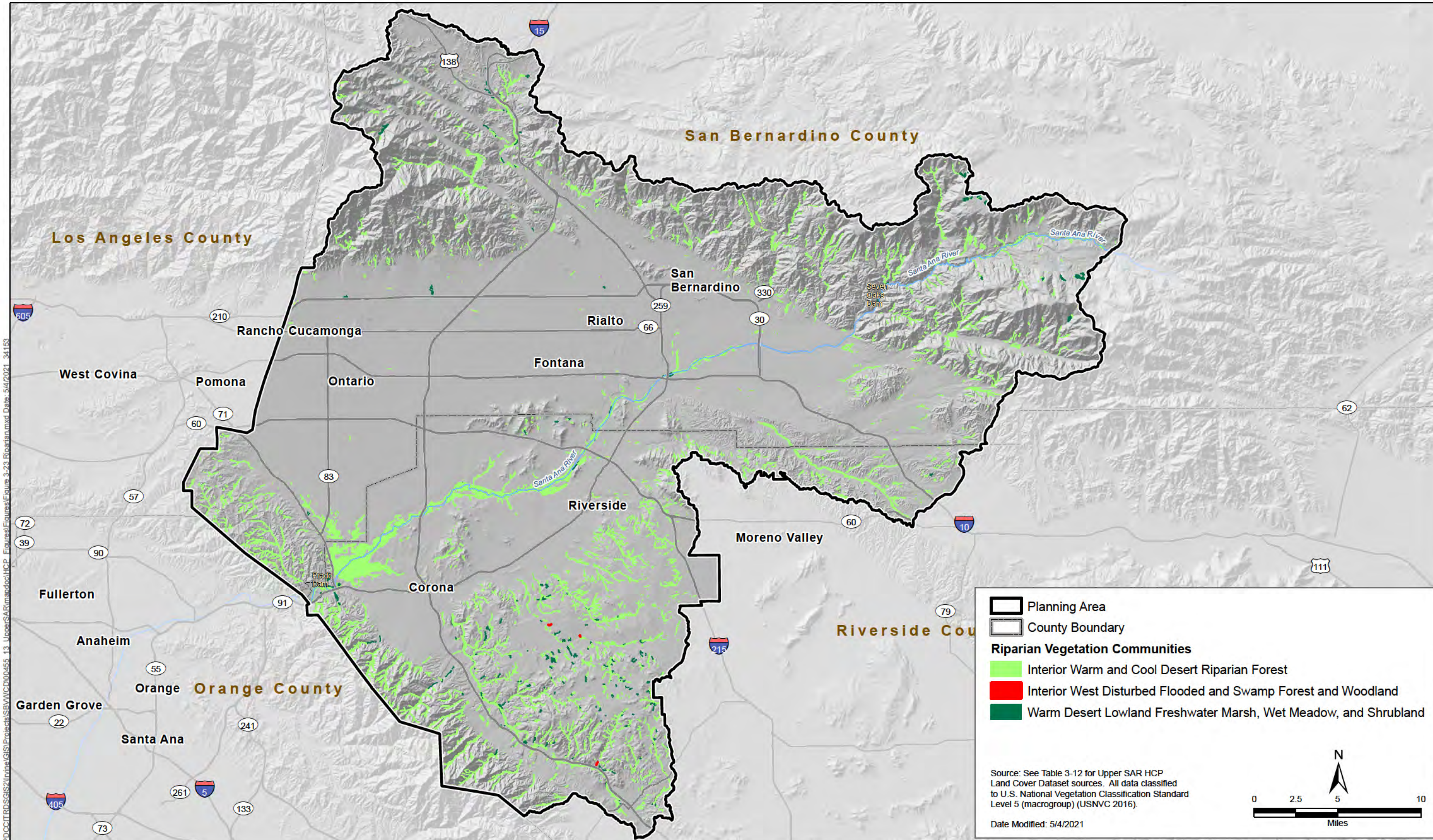
Upper Santa Ana River
Habitat Conservation Plan

Figure 3-21
Shrubland Vegetation Communities in the Planning Area



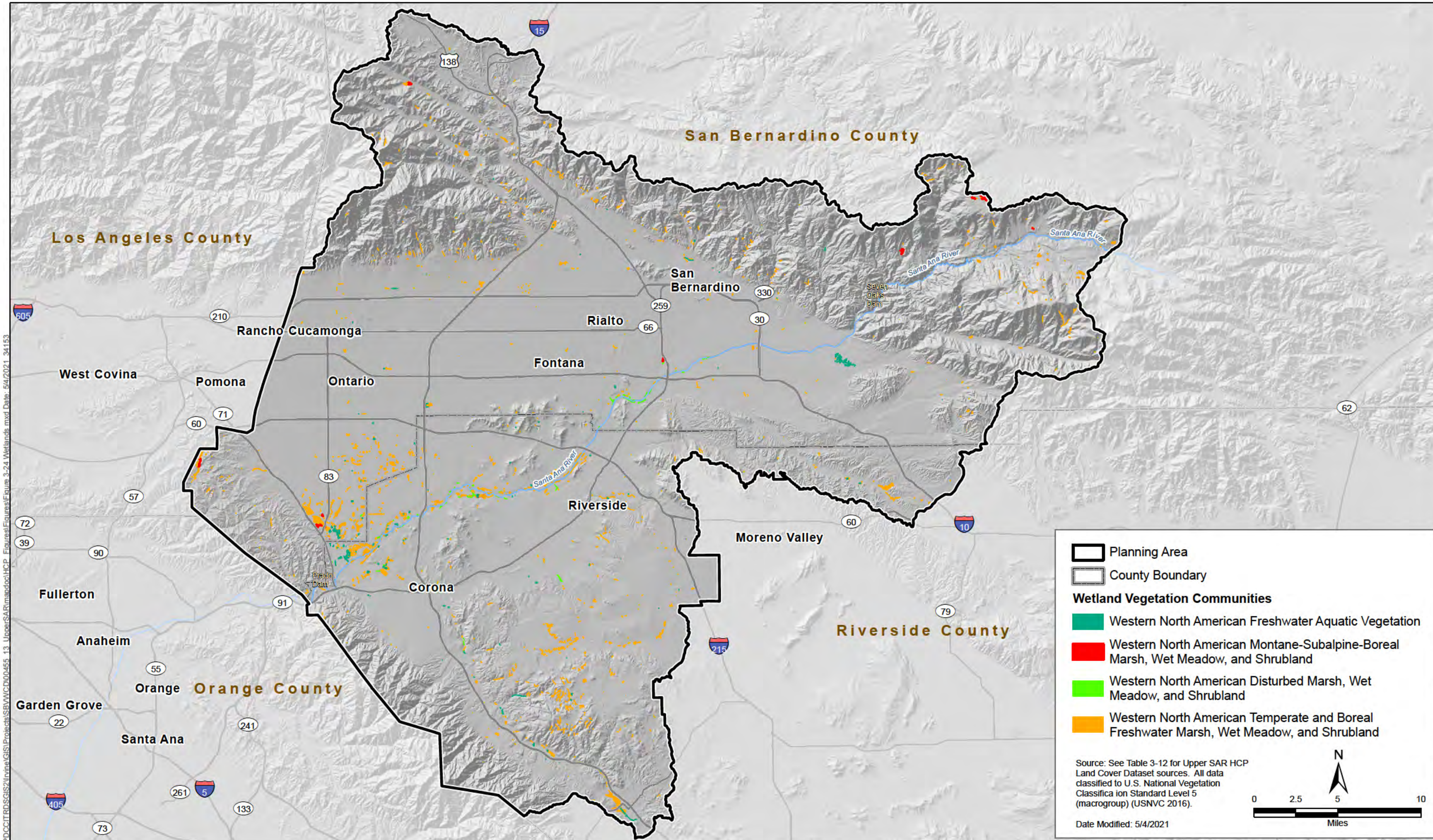
Upper Santa Ana River
Habitat Conservation Plan

Figure 3-22
Grassland Vegetation Communities in the Planning Area



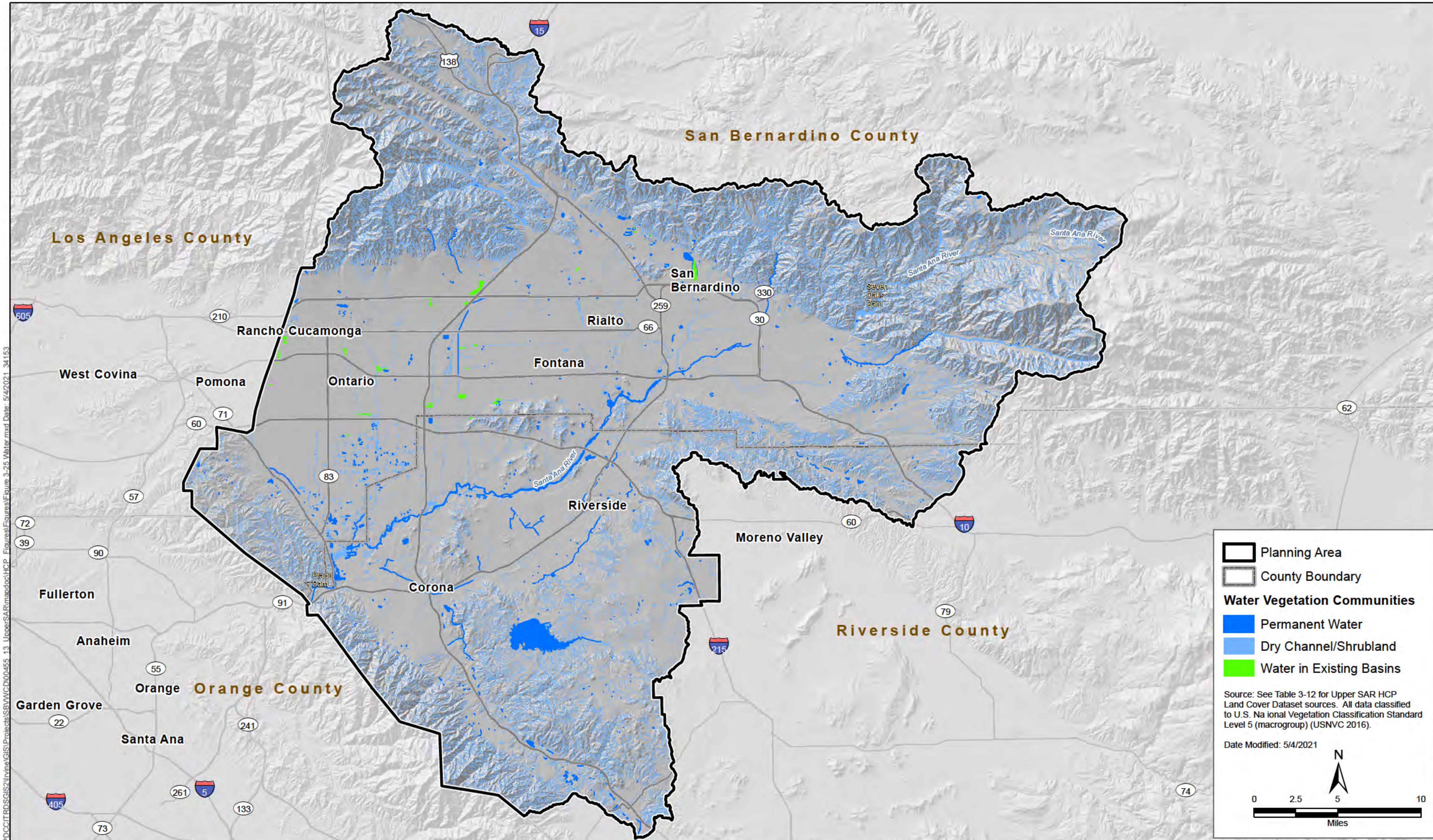
Upper Santa Ana River
Habitat Conservation Plan

Figure 3-23
Riparian Vegetation Communities in the Planning Area



Upper Santa Ana River
Habitat Conservation Plan

Figure 3-24
Wetland Vegetation Communities in the Planning Area



Upper Santa Ana River
Habitat Conservation Plan

Figure 3-25
Water Vegetation Communities in the Planning Area

Table 3-13. Vegetation Community and Land Cover Types in the Planning Area

Vegetation Community/Land Cover Type	Description
Riparian	**Subtotal = 14,752 acres (2% of Planning Area)**
Interior Warm and Cool Desert Riparian Forest *14,062 acres* *2% of Planning Area*	Warm and cold climate riparian and wetland forested vegetation of the southwestern deserts and western interior U.S., including the Tamaulipan area of southern Texas. Some of the dominant trees species of this highly diverse macrogroup include sweet acacia (*Acacia suaveolens*), sugar hackberry (*Celtis laevigata*), Texas ebony (*Ebenopsis ebano*), Arizona walnut (*Juglans major*), California sycamore (*Platanus racemose*), Arizona sycamore (*Platanus wrightii*), Rio Grande cottonwood (*Populus deltoides* ssp. *wislizeni*), eastern cottonwood (*Populus deltoides* ssp. *monilifera*), Fremont's cottonwood (*Populus fremontii*), honey mesquite (*Prosopis glandulosa*), red willow (*Salix laevigata*), and Goodding's black willow (*Salix gooddingii*). This macrogroup also includes oases dominated by evergreen palms such as California fan palm (*Washingtonia filifera*) or Rio Grande palmetto (*Sabal Mexicana*).
Interior West Disturbed Flooded and Swamp Forest and Woodland *4 acres* *<1% of Planning Area*	Low-elevation riparian and lacustrine areas throughout the southwestern U.S. and into Mexico that are dominated by nonnative invasive woody species such as tamarisk (*Tamarix* spp.), Russian olive (*Elaeagnus angustifolia*), or date palm (*Phoenix dactylifera*).
Warm Desert Lowland Freshwater Marsh, Wet Meadow, and Shrubland *687 acres* *<1% of Planning Area*	Includes desert freshwater wetlands, such as low-statured honey mesquite (*Prosopis glandulosa*) and velvet mesquite (*Prosopis velutina*) stands and shrubby areas of Emory's baccharis (*Baccharis salicina*), mulefat (*Baccharis salicifolia*), arrowweed (*Pluchea sericea*), arroyo willow (*Salix lasiolepis*), silver buffaloberry (*Shepherdia argentea*), and desert willow (*Salix exigua*), along perennial and intermittent streams, lake or playa edges, and alkaline seeps and springs, at low elevations (>1,100 meters) in the warm desert regions of the southwestern U.S.
Wetland	**Subtotal = 2,733 acres (<1% of Planning Area)**
Western North American Disturbed Marsh, Wet Meadow, and Shrubland *79 acres* *<1% of Planning Area*	This macrogroup includes disturbed natural wetland habitats of temperate western North America that are now strongly dominated by nonnative and sometimes weedy or generalist native species. This macrogroup occupies approximately 79 acres (<1%) of the Planning Area.
Western North American Freshwater Aquatic Vegetation *205 acres* *<1% of Planning Area*	Consists of rooted and floating freshwater aquatic herbaceous vegetation dominated by western U.S. aquatic species such as Pacific mosquitofern (*Azolla filiculoides*), Mexican mosquitofern (*Azolla mexicana*), Rocky Mountain pond-lily (*Nuphar polysepala*), pygmy water-lily (*Nymphaea tetragona*), broadleaf pondweed (*Stuckenia striata*), and several other cosmopolitan species, found throughout the temperate regions of western North America.

Vegetation Community/Land Cover Type	Description
Western North American Montane-Subalpine-Boreal Marsh, Wet Meadow, and Shrubland *22 acres* *<1% of Planning Area*	Contains montane to subalpine and alpine wet meadows, marshes, and wet shrublands throughout the Rocky Mountains of the U.S. and Canada, the Sierra Nevada, and Intermountain cordillera. Dominant species include graminoids such as bluejoint reedgrass (*Calamagrostis canadensis*), mountain sedge (*Carex scopulorum*), Northwest Territory sedge (*Carex utriculata*), fowl mannagrass (*Glyceria striata*); forbs such as white marsh-marigold (*Caltha leptosepala*), Sierra shootingstar (*Primula subalpina*), creeping-glow-wort (*Sibbaldia procumbens*); and shrub species such as, but not limited to, gray alder (*Alnus incana*), water birch (*Betula occidentalis*), resin birch (*Betula glandulosa*), and many willow (*Salix*) species.
Western North American Temperate and Boreal Freshwater Marsh, Wet Meadow, and Shrubland *2,427 acres* *<1% of Planning Area*	Contains marshes, wet meadows, and shrublands, singly and in mosaics, along riparian corridors, around vernal pools, depressions, seeps, and springs on mineral soils or shallow organic layers over mineral substrates in temperate (and possibly southern boreal) latitudes of western North America.
Water	**Subtotal = 23,156 acres (3% of Planning Area)**
Permanent Water *4,575 acres* *<1% of Planning Area*	Contains open water areas of intermittent, permanent, and seasonal nature.
Water in Existing Basins *618 acres* *<1% of Planning Area*	Contains open water areas of intermittent, permanent, and seasonal nature.
Dry Channel/Shrubland *17,963 acres* *2% of Planning Area*	Contains open water areas of intermittent, permanent, and seasonal nature.
Shrubland	**Subtotal = 288,537 acres (33% of Planning Area)**
Alluvial Fan Sage Scrub *24,521 acres* *8.5% of Planning Area*	Riversidean alluvial fan sage scrub is a shrubland type that occurs in washes and on gently sloping alluvial fans. Alluvial scrub is made up predominantly of drought-deciduous soft-leaved shrubs, but with significant cover of larger perennial species typically found in chaparral (Kirkpatrick and Hutchinson 1977). Scalebroom generally is regarded as an indicator of Riversidean alluvial scrub (Smith 1980, Hanes et al. 1989).

Vegetation Community/Land Cover Type	Description
Californian Chaparral *170,526 acres* *20% of Planning Area*	Consists of evergreen sclerophyllous shrublands found throughout California, extreme southern Oregon, and northern Baja California, closely associated with Mediterranean climates, from fog-belt coastal settings to extremely xeric interior stands that are dominated by a wide variety of endemic shrubs, including chamise species (*Adenostoma* spp.), manzanitas species (*Arctostaphylos* spp.), ceanothus species (*Ceanothus* spp.), birch-leaf mountain-mahogany (*Cercocarpus beltuloides*), Eastern Mojave buckwheat (*Eriogonum fasciculatum*), two-petal ash (*Fraxinus dipetala*), toyon (*Heteromeles arbutifolia*), scrub oak (*Quercus berberidifolia*), and many others.
Californian Coastal Scrub *78,304 acres* *9% of Planning Area*	Consists of a diverse mix of drought-deciduous shrubs and characteristic obligate-seeding or resprouting evergreen shrubs occurring in coastal and foothill communities of southwestern Oregon, along the California coast and inner foothills, and south into Baja Norte, Mexico.
Cool Interior Chaparral *7,989 acres* *1% of Planning Area*	Chaparral shrublands occur between low-elevation desert landscapes and higher subalpine woodlands of the Cascades, Sierra Nevada, and interior mountain ranges of the western U.S., generally among montane forests above 4,550 feet elevation.
Great Basin-Intermountain Dry Shrubland and Grassland *168 acres* *<1% of Planning Area*	Found throughout the Intermountain West, including mid-elevation sites in eastern and central Mojave Desert, the Great Basin, Colorado Plateau, Columbia Plateau, and lower elevation sites in the central Rocky Mountains extending east across Wyoming Basins into the western Great Plains. It can occur as open shrubland, dwarf-shrub, shrub herbaceous, or grassland communities. Characteristic species include shrubs such as yellow rabbitbrush (*Chrysothamnus viscidiflorus*), blackbrush (*Coleogyne ramosissima*), ephedra species (*Ephedra* spp.), rubber rabbitbrush (*Gutierrezia sarothrae*), and winterfat (*Krascheninnikovia lanata*), and dry grasses such as Indian ricegrass (*Achnatherum hymenoides*), Letterman's needlegrass (*Achnatherum lettermanii*), purple three-awn (*Aristida purpurea*), blue grama (*Bouteloua gracilis*), needle and thread (*Hesperostipa comata*), wildrye (*Elymus* spp.), sandhill muhly (*Muhlenbergia pungens*), James' galleta (*Pleuraphis jamesii*), mutton grass (*Poa fendleriana*), big bluegrass (*Poa secunda*), bluebunch wheatgrass (*Pseudoroegneria spicata*), sand dropseed (*Sporobolus cryptandrus*), and alkali sacaton (*Sporobolus airoides*).
Great Basin-Intermountain Tall Sagebrush Steppe and Shrubland *254 acres* *<1% of Planning Area*	Includes the big sagebrush shrubland and shrub-steppe that is a matrix and large-patch type throughout much of the intermountain western U.S. and that is dominated by big sagebrush (*Artemisia tridentata*), bitterbrush (*Purshia tridentata*), and several local dominants such as silver sagebrush (*Artemisia cana*) and threetip sagebrush (*Artemisia tripartita* ssp. *tripartita*).
Great Basin-Intermountain Xeric-Riparian Scrub *2,690 acres* *<1% of Planning Area*	Shrublands along dry washes and valley floors dominated by *Atriplex canescens*, *Ericameria nauseosa*, *Artemisia tridentata* ssp. *tridentata*, and other species within the cool temperate desert of western North America.

Vegetation Community/Land Cover Type	Description
North American Warm-Desert Xeric-Riparian Scrub *1,553 acres* *<1% of Planning Area*	Shrublands and grasslands along intermittent streams and washes dominated by shrubs such as catclaw acacia (*Senegalia greggii*), desertbroom (*Baccharis sarothroides*), sweetbush (*Bebbia juncea*), splitleaf brickelbush (*Brickellia laciniata*), desert willow (*Chilopsis linearis*), California Mormon tea (*Ephedra californica*), Mojave rabbitbrush (*Ericameria paniculata*), Apache plume (*Fallugia paradoxa*), burrowbrush (*Ambrosia salsola*), singlewhorl burrobrush (*Ambrosia monogyra*), desert lavender (*Hyptis emoryi*), desert ironwood (*Olneya tesota*), blue palo verde (*Parkinsonia florida*), Mexican bladdersage (*Salazaria mexicana*), and/or netvein goldeneye (*Viguiera reticulata*) and herbs such as bulb panicgrass (*Panicum bulbosum* var. *bulbosum*), shortawn foxtail (*Alopecurus aequalis*), or wolfstail (*Lycurus Kunth*) that are found within the warm temperate deserts of western North America.
Warm Interior Chaparral *2,530 acres* *<1% of Planning Area*	Includes all the interior chaparral in the southwestern U.S. and northern Mexico and is composed of a very diverse list of diagnostic, mostly evergreen shrubs such as Mexican manzanita (*Arctostaphylos pungens*), desert ceanothus (*Ceanothus greggii*), Wright's silktassel (*Garrya wrightii*), and turbinella oak (*Quercus turbinella*), which dominate large areas on foothills, xeric mountain slopes, and canyons.
Grassland	**Subtotal = 55,475 acres (6% of Planning Area)**
Californian Annual and Perennial Grassland[1] *55,359 acres* *6% of Planning Area*	Consists of native perennial and annual forb- and grass-dominated meadows and grasslands of California from the coast to the upper foothills of the Sierra Nevada, dominated or characterized by native perennial bunchgrass tussockgrass species (*Nassella* spp. [= *Stipa* spp.]), and/or perennial forbs such as brodiaea (*Brodiaea*), mariposa lily (*Calochortus*), snakelily (*Dichelostemma*), sanicle (*Sanicula*), and triteleia (*Triteleia)* species; and annual species such as fiddlenecks (*Amsinckia* spp.), poppy (*Eschscholzia* spp.), American bird's-foot trefoil (*Acmispon americanus*), lupines (*Lupinus* spp.), rusty popcornflower (*Plagiobothrys nothofulvus*), whitetip clover (*Trifolium variegatum*), and small fescue (*Vulpia microstachys*). Occurrences often have high native species richness though they may have significant abundance of nonnative species.
Californian Disturbed Grassland, Meadow, and Scrub *115 acres* *<1% of Planning Area*	Encompasses nonnative-dominated annual grassland, forbland, and scrub found in the "Mediterranean" region of California, especially in disturbed areas. Dominant introduced species include the herbs slender oat (*Avena barbata*), wild oat (*Avena fatua*), black mustard (*Brassica nigra*), ripgut brome (*Bromus diandrus*), soft brome (*Bromus hordeaceus*), red brome (*Bromus rubens*), knapweeds (*Centaurea* spp.), finarees (*Erodium* spp.), perennial rye grass (*Lolium perenne* L.), and cultivated radish (*Raphanus sativus*). Species in nonnative shrublands include common gorse (*Ulex europaeus*), Scotch broom (*Cytisus scoparius*), and species of broom (*Genista* spp. and *Spartium* spp.), among others.

Vegetation Community/Land Cover Type	Description
Woodland	**Subtotal = 56,019 acres (6% of Planning Area)**
Californian Disturbed Forest *703 acres* *<1% of Planning Area*	Includes groves of escaped or naturalized cultivars of tree-of-heaven (*Ailanthus altissima*), acacias (*Acacia* spp.), several species of eucalyptus (*Eucalyptus* spp.), common fig (*Ficus carica*), ngaio tree (*Myoporum laetum*), Aleppo pine (*Pinus halepensis*), black locust (*Robinia pseudoacacia*), peppertree (*Schinus molle*), and Brazilian peppertree (*Schinus terebinthifolius*), or native species that have become invasive, such as Monterey cypress (*Callitropsis macrocarpa*) or Monterey pine (*Pinus radiata*), found scattered throughout California and south into Baja California, Mexico.
Californian Forest and Woodland *54,185 acres* *6% of Planning Area*	Mesic to dry upland savannas, woodlands, and forests dominated by warm-temperate endemic oak and conifer species at low elevations throughout California, on the mainland and islands of Baja California, and in the foothills of the Cascade Range of Oregon.
Intermountain Singleleaf Pinyon–Utah Juniper–Western Juniper Woodland *1,130 acres* *1<% of Planning Area*	Occurs in dry foothills in the interior western U.S. and is characterized by an open to closed tree canopy composed of western juniper (*Juniperus occidentalis*), Utah juniper (*Juniperus osteosperma*), twoneedle pinyon (*Pinus edulis*), singleleaf pinyon (*Pinus monophylla*), and/or curl-leaf mountain-mahogany *Cercocarpus ledifolius*.
Forests	**Subtotal = 33,343 acres (4% of Planning Area)**
Rocky Mountain Subalpine–High Montane Conifer Forest *4,027 acres* *<1% of Planning Area*	Occurs in dry foothills in the interior western U.S. and is characterized by an open to closed tree canopy composed of western juniper (*Juniperus occidentalis*), Utah juniper (*Juniperus osteosperma*), twoneedle pinyon (*Pinus edulis*), singleleaf pinyon (*Pinus monophylla*), and/or curl-leaf mountain-mahogany *Cercocarpus ledifolius*.
Southern Vancouverian Montane–Foothill Forest *29,316 acres* *3% of Planning Area*	Includes Jeffrey pine–ponderosa pine woodlands; mixed conifer woodlands with balsam fir (*Abies concolor*), incense cedar (*Calocedrus decurrens*), Jeffrey pine (*Pinus jeffreyi*), sugar pine (*Pinus lambertiana*), ponderosa pine (*Pinus ponderosa* [= var. *pacifica*, = var. *benthamiana*]), Washoe pine (*Pinus washoensis* [= *Pinus ponderosa* var. *washoensis*)]), Douglas fir (*Pseudotsuga menziesii* var. *menziesii*), or giant sequoia (*Sequoiadendron giganteum*); and western white pine (*Pinus monticola*) and white fir (*Abies concolor* var. *concolor*) forests that occur in dry habitats found in the foothills and montane elevations of the southern Cascade Range, Klamath Mountains, Modoc Plateau, Sierra Nevada, and Peninsula and Transverse ranges. Additionally, some stands of bristlecone fir (*Abies bracteata*), sugar pine, and ponderosa pine occur close to the coast, such as in the Santa Lucia Range of the Central Coast, which is the highest coastal range in the U.S.

Vegetation Community/Land Cover Type	Description
Rock Outcrop	**Subtotal = 2,857 acres (<1% of Planning Area)**
North American Warm Semi-Desert Cliff, Scree, and Rock Vegetation *82 acres* *<1% of Planning Area*	Consists of a variety of near barren and sparsely vegetated substrates in the southwestern U.S. and northern Mexico (including Baja California), including coastal areas, saline plains, desert pavement, rocky slopes, cliffs, and outcrops in foothills, canyons, and desert mountain ranges.
Western North American Cliff, Scree, and Rock Vegetation *2,775 acres* *<1% of Planning Area*	This cliff, scree, and rock vegetation is scattered across California's Coast, Transverse, and Peninsular ranges, Klamath Mountains, southern Sierra Nevada, and the northern coast of Baja California.
Barren	**Subtotal = 2 acres (<1% of Planning Area)**
Barren	In general, barren lands include deserts, dry salt flats, sand dunes, exposed strip mines, quarries, and gravel pits.
Agriculture	**Subtotal = 50,387 acres (6% of Planning Area)**
Herbaceous Agricultural Vegetation *48,097 acres* *6% of Planning Area*	Agricultural land is used primarily for the production of food and fiber. Agricultural land uses include forest landscapes such as orchards as well as non-forested land uses such as vineyards and field crops.
Woody Agricultural Vegetation *2,290 acres* *<1% of Planning Area*	Agricultural land is used primarily for the production of food and fiber. Agricultural land uses include forest landscapes such as orchards as well as non-forested land uses such as vineyards and field crops.
Developed	**Subtotal = 335,704 acres (39% of Planning Area)**
Developed and Urban *335,704 acres* *39% of Planning Area*	Developed and urban areas in the Planning Area include the cities of Chino, Montclair, Rancho Cucamonga, Fontana, San Bernardino, Redlands, Yucaipa, Riverside, and Corona.
Total	**862,966 acres**

[1]While this habitat type is defined by a high native species richness, this habitat is predominantly nonnative grassland species within the Planning Area.

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

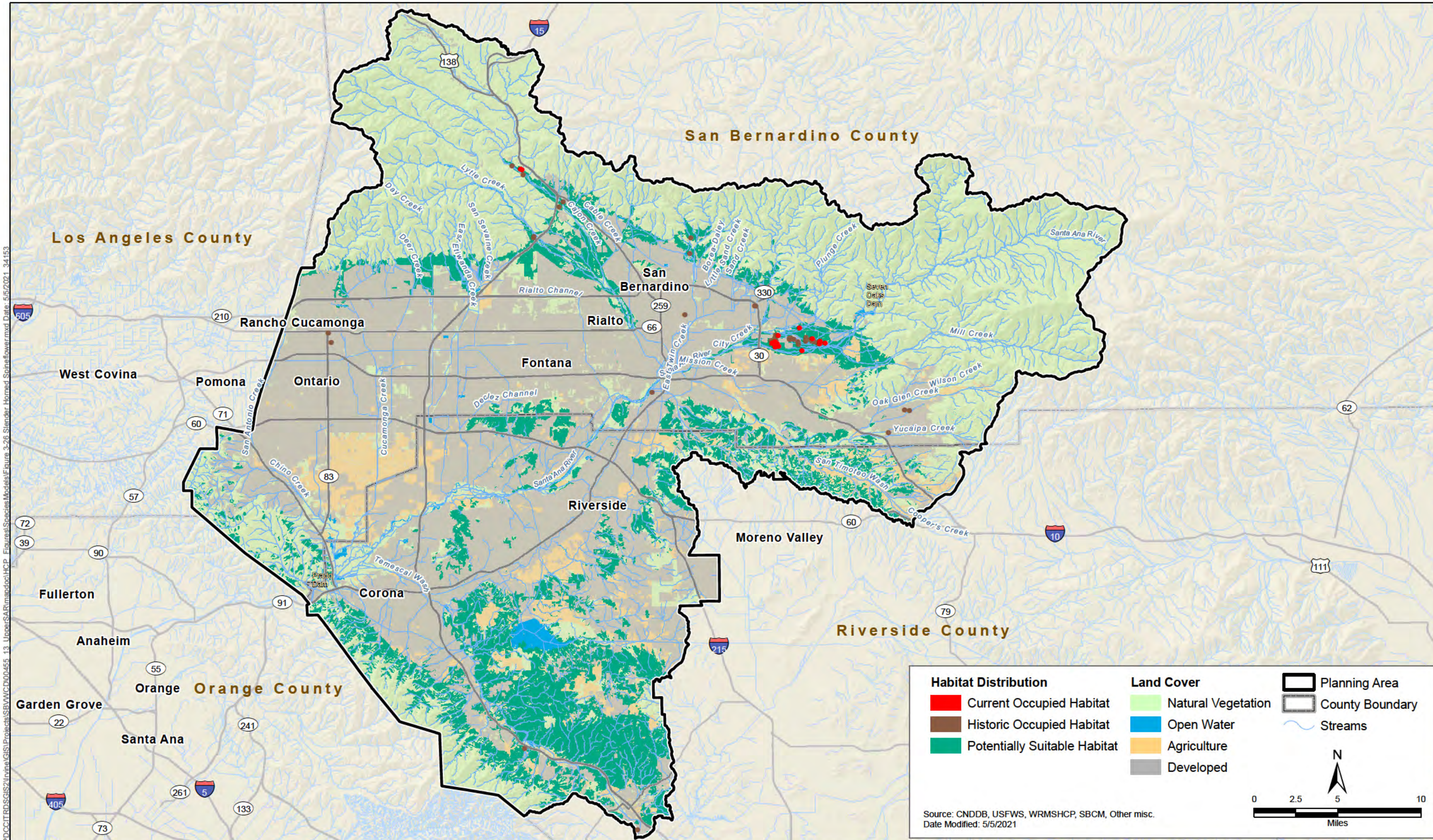
Slender-horned spineflower occurs on stable older alluvium away from active channels in areas with little flooding disturbance and infrequent surface flows between 656 and 2,493 feet in elevation (CNPS 2020). This species occurs in slightly acidic silt soil with low salinity, little organic matter, and 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

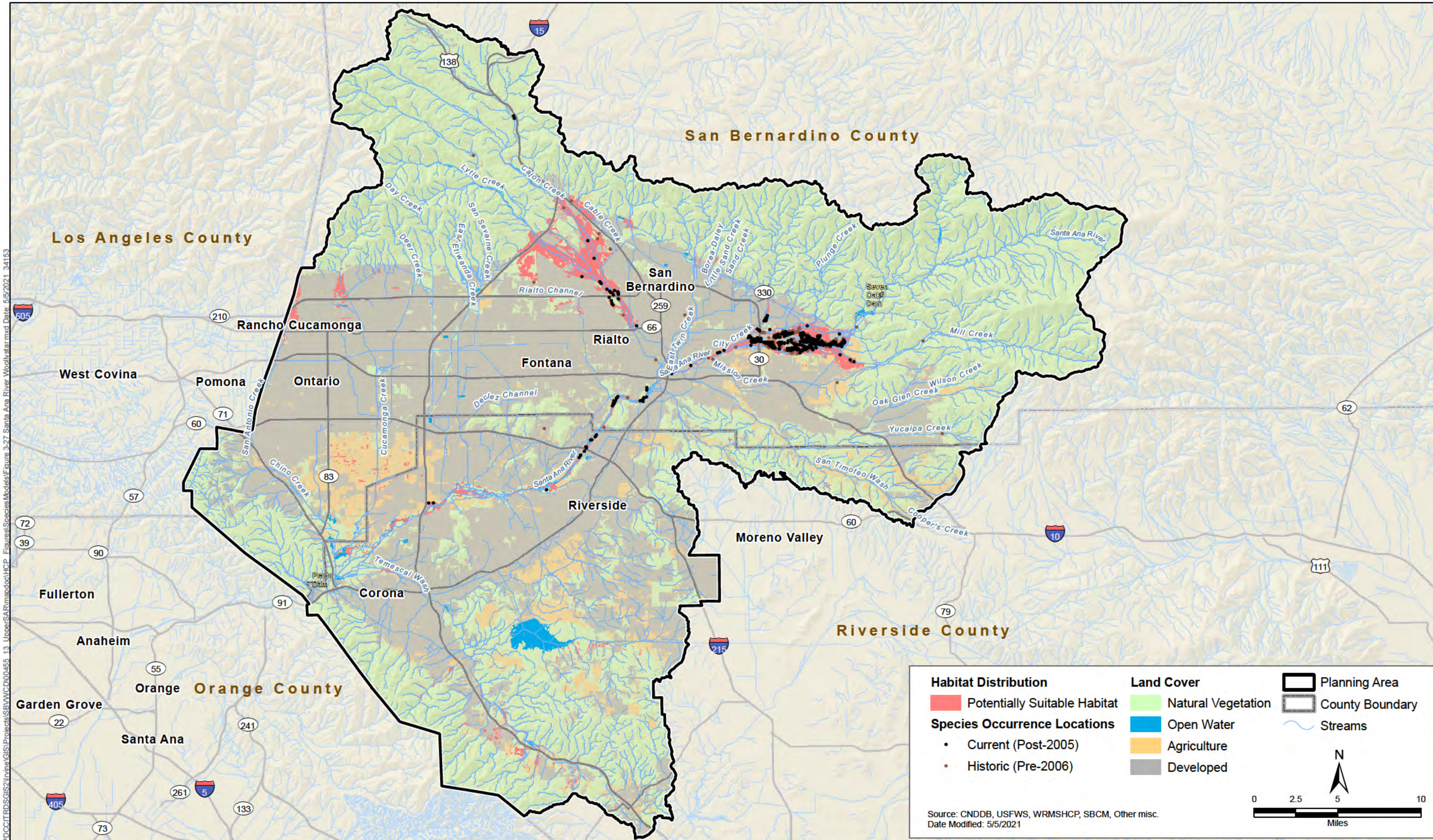
The Delhi Sands flower-loving fly (*Rhaphiomidas terminatus abdominalis*) is Federally listed as endangered. It is a subspecies endemic to the Colton Dunes Ecosystem of Southern California and is only known to occur in Riverside and San Bernardino Counties, with most of the occupied habitat located within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

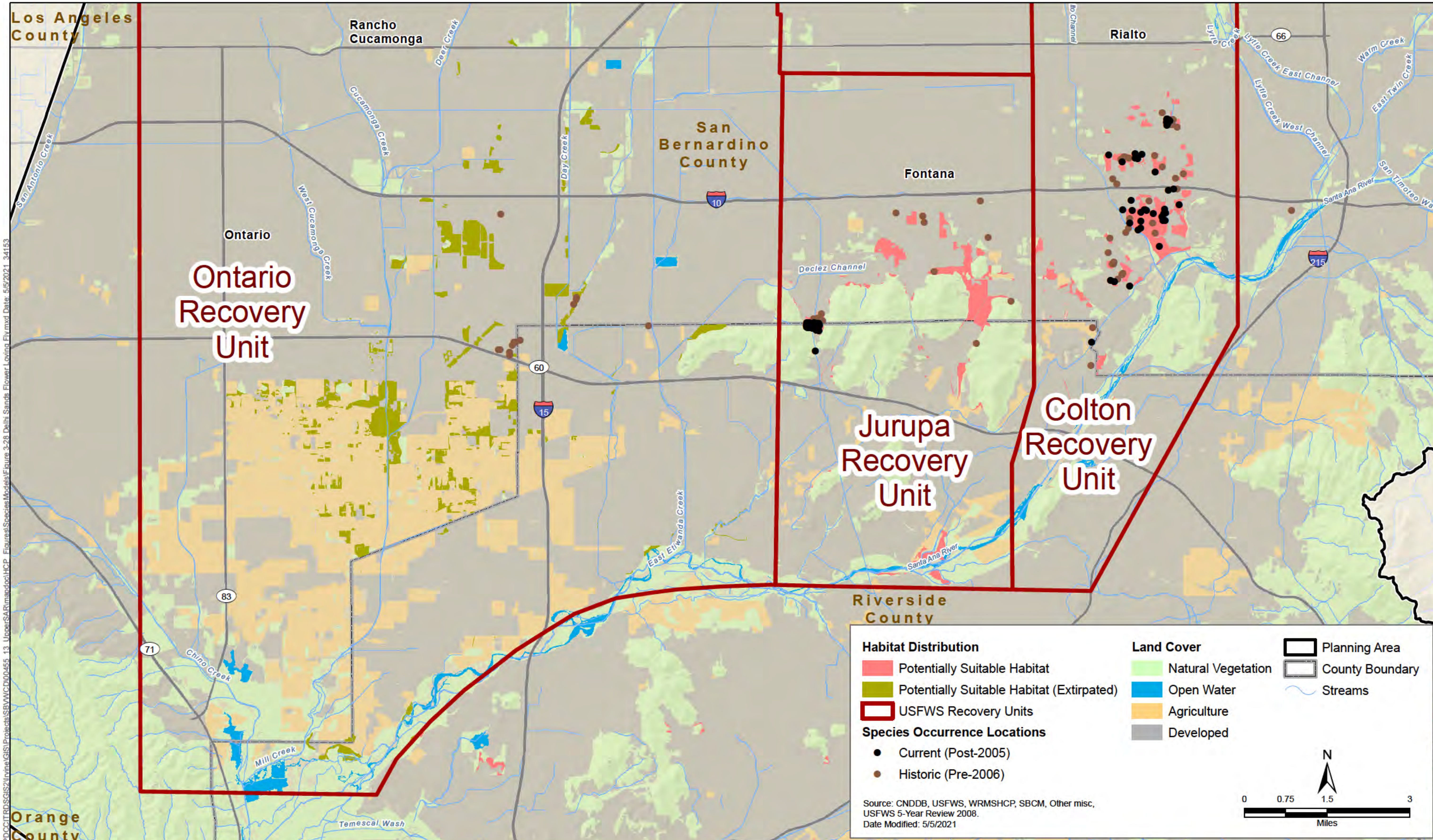
Distribution of Modeled Habitat and Documented Occurrences in the Planning Area

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)												

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

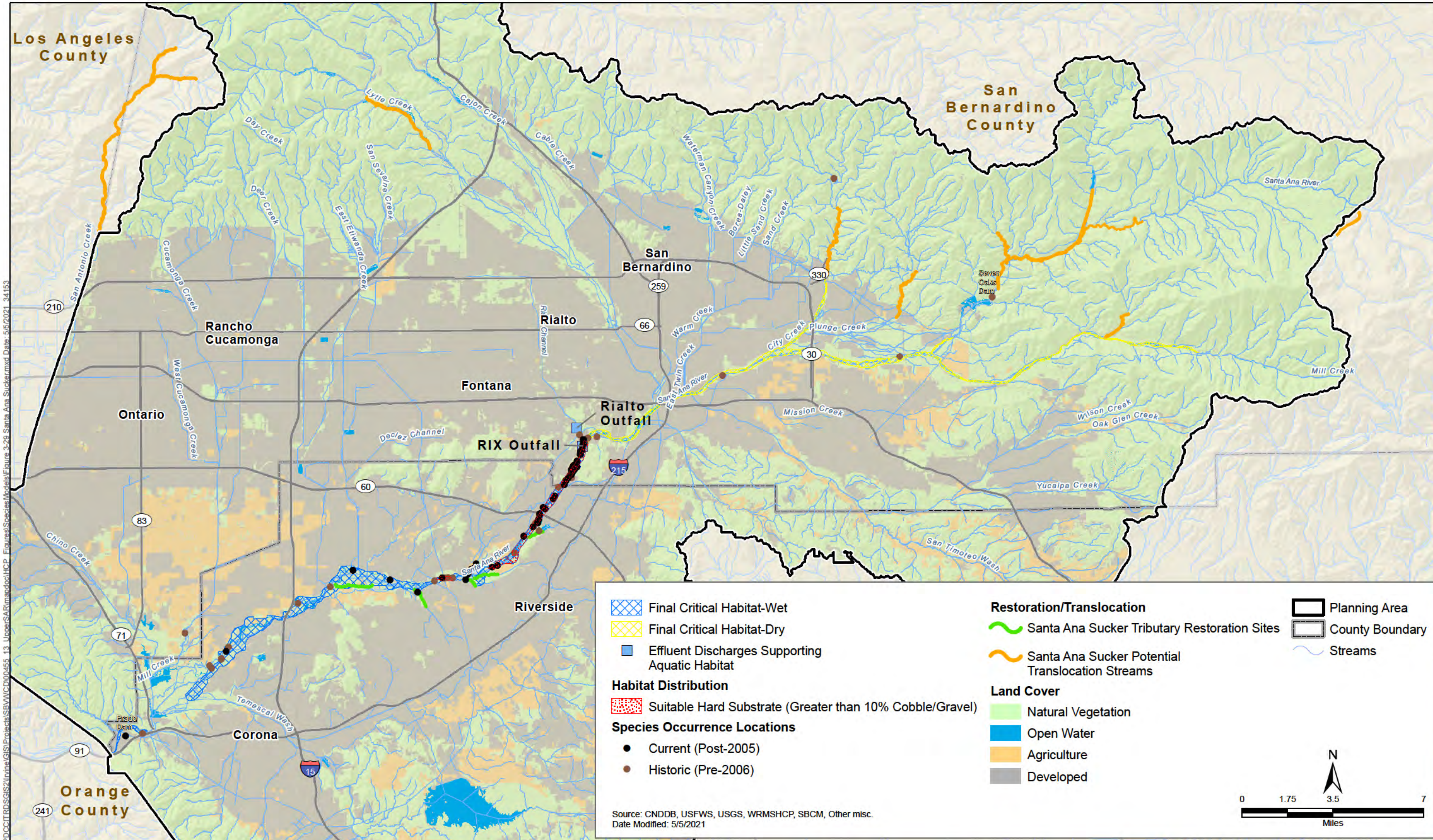
The primary threat to the Delhi Sands flower-loving fly is loss of habitat, habitat degradation, and habitat fragmentation (USFWS 2008). Activities that result in habitat degradation include grading, plowing, disking, and off-highway vehicle use. Occupied sites have become increasingly isolated by surrounding 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

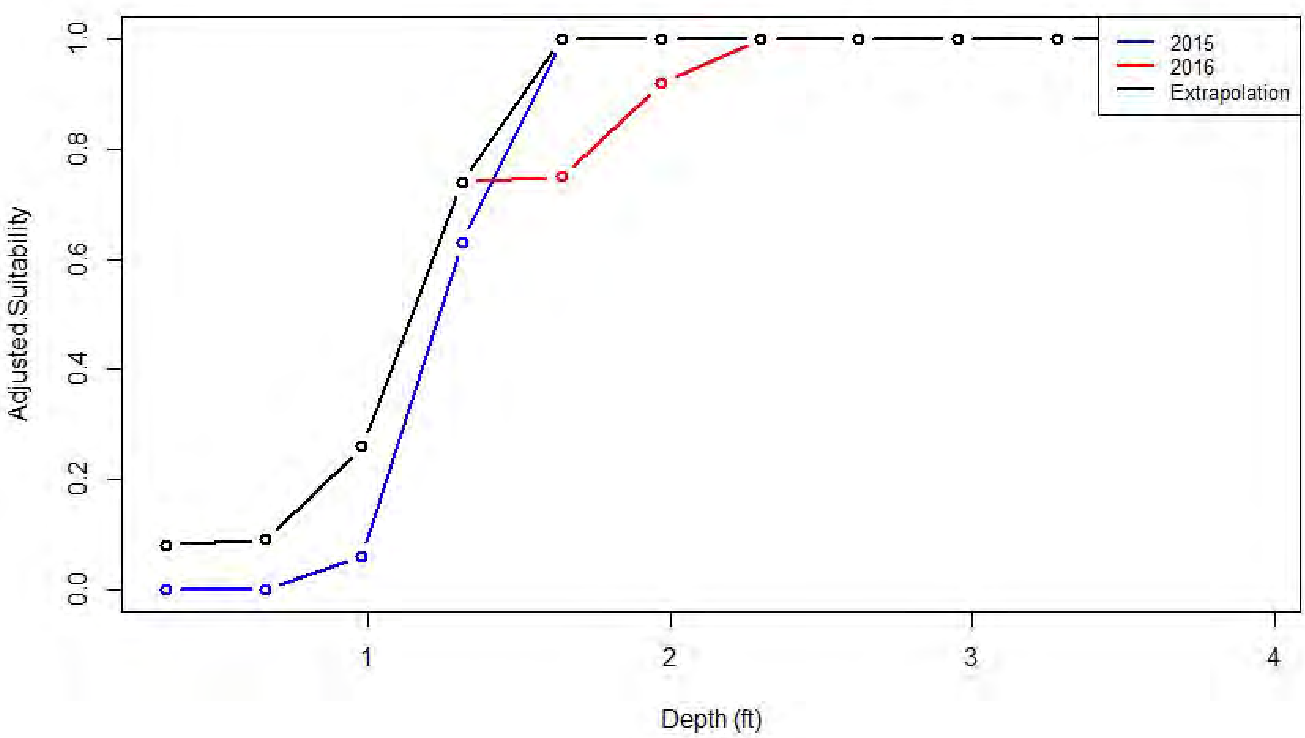


Figure 3-30
Sucker Habitat Flow Depth Suitability Curve
Upper Santa Ana River Habitat Conservation Plan

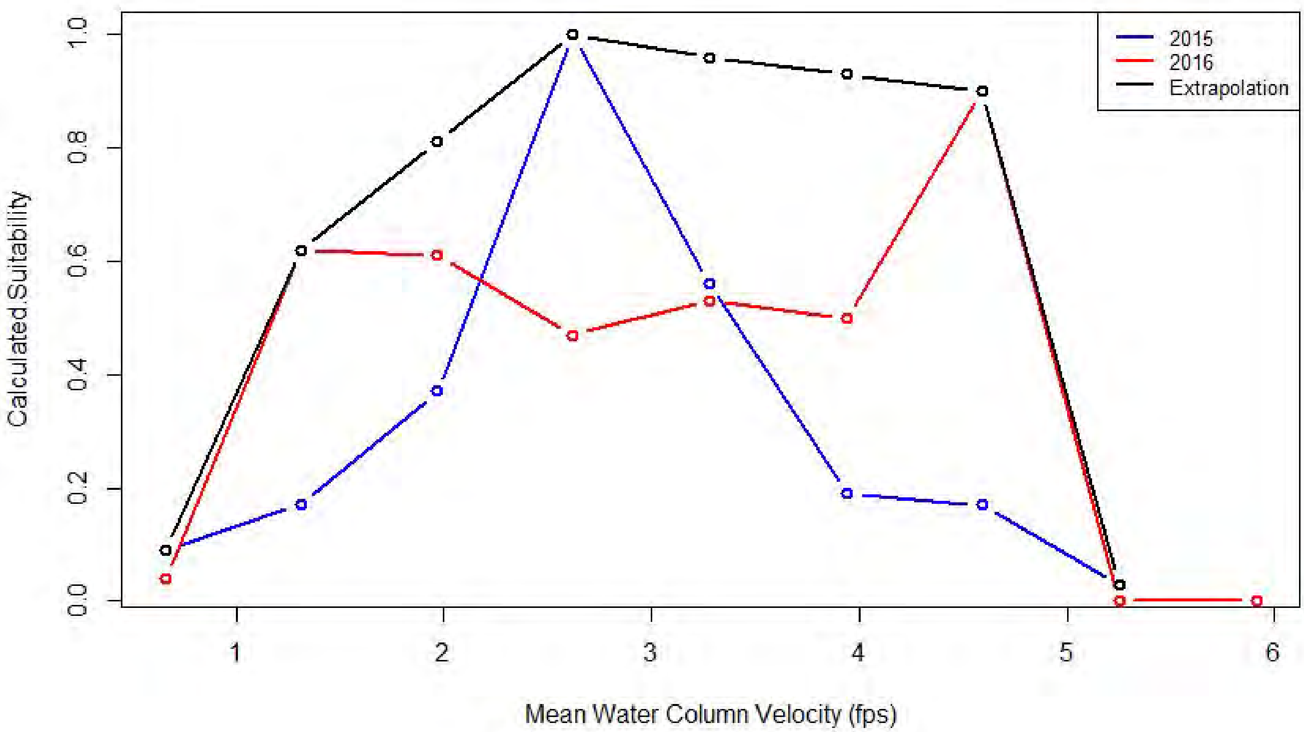


Figure 3-31
Sucker Habitat Flow Velocity Suitability Curve
Upper Santa Ana River Habitat Conservation Plan

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.

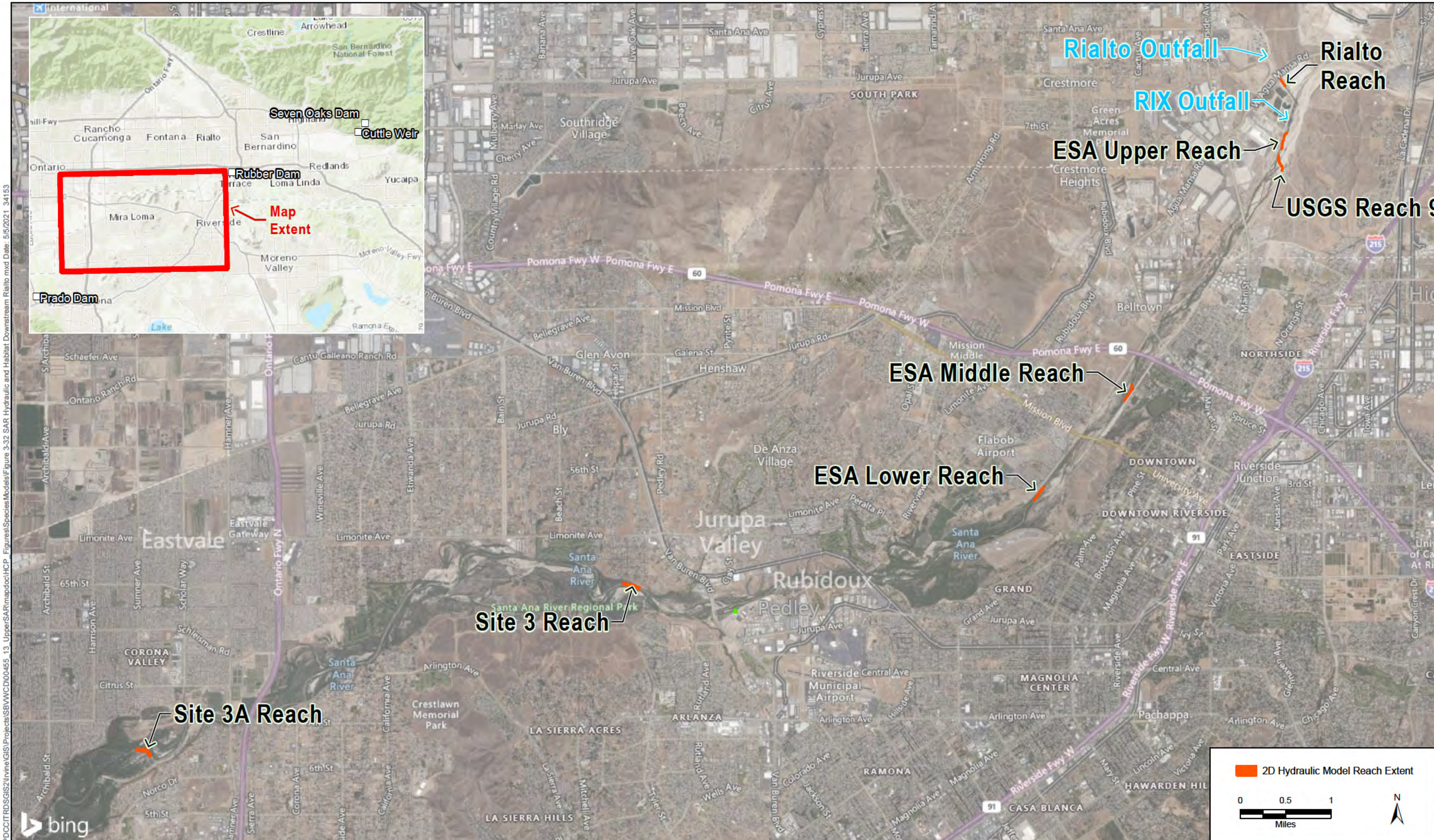
Table 3-21. Summary of Hydrologic Model Characteristics by Santa Ana Sucker Habitat Modeling Site (Upstream to Downstream)

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

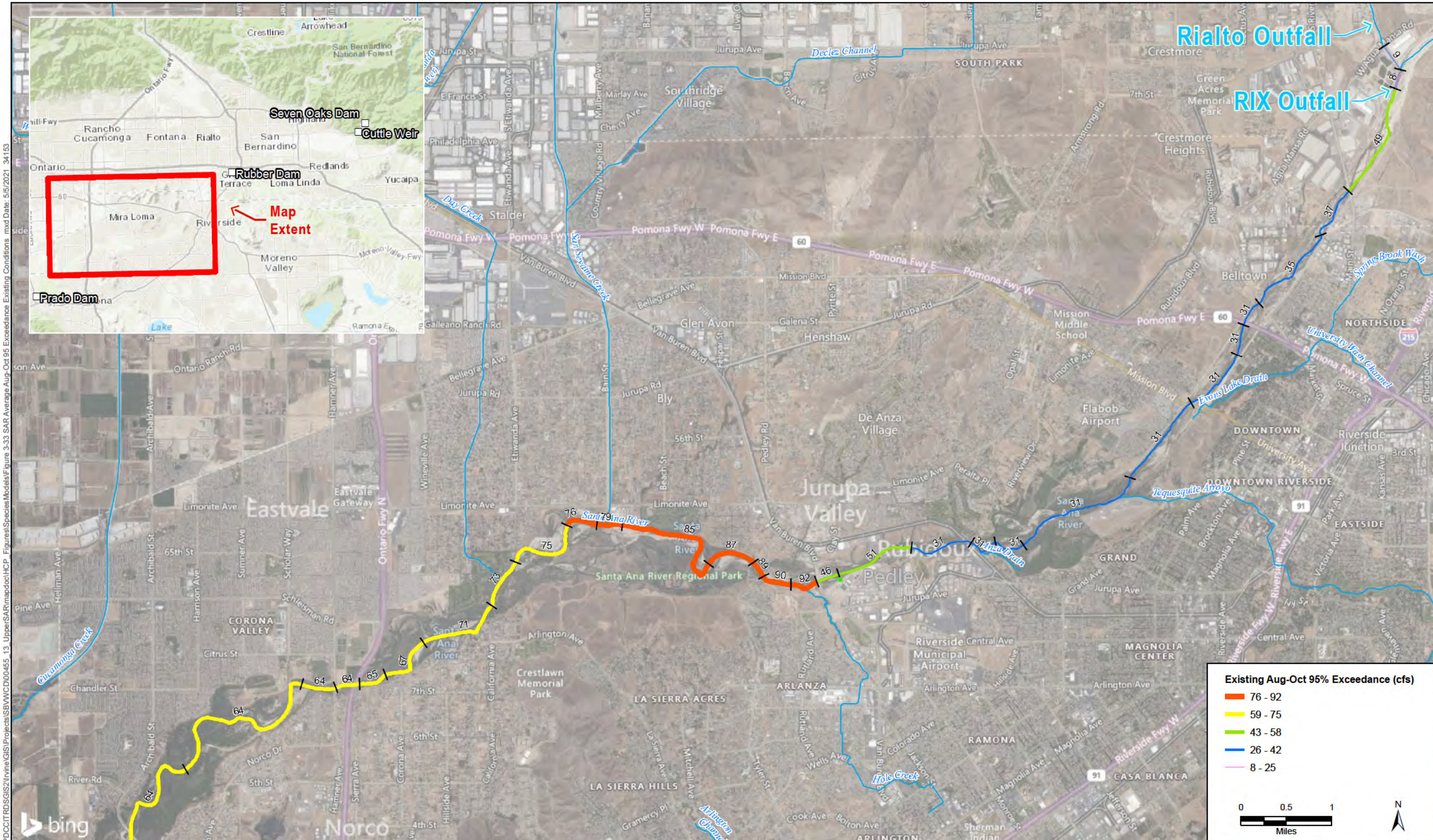
The process for using the results from the individual assessment sites to interpolate suitability for the entire 21.1-mile long study reach (starting at the Rialto Outfall and extending down the Rialto Channel and then down the Santa Ana River to Prado) is described in Appendix E. The acreage of habitat 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



\\PDCCITRDSGIS2\Irvine\GIS\Projects\SBVWCD\00455_13_UpperSAR\mapdoc\HCP_Figures\SpeciesModels\Figure 3-33 SAR Average Aug-Oct 95 Exceedance Existing Conditions.mxd Date: 5/5/2021 34153

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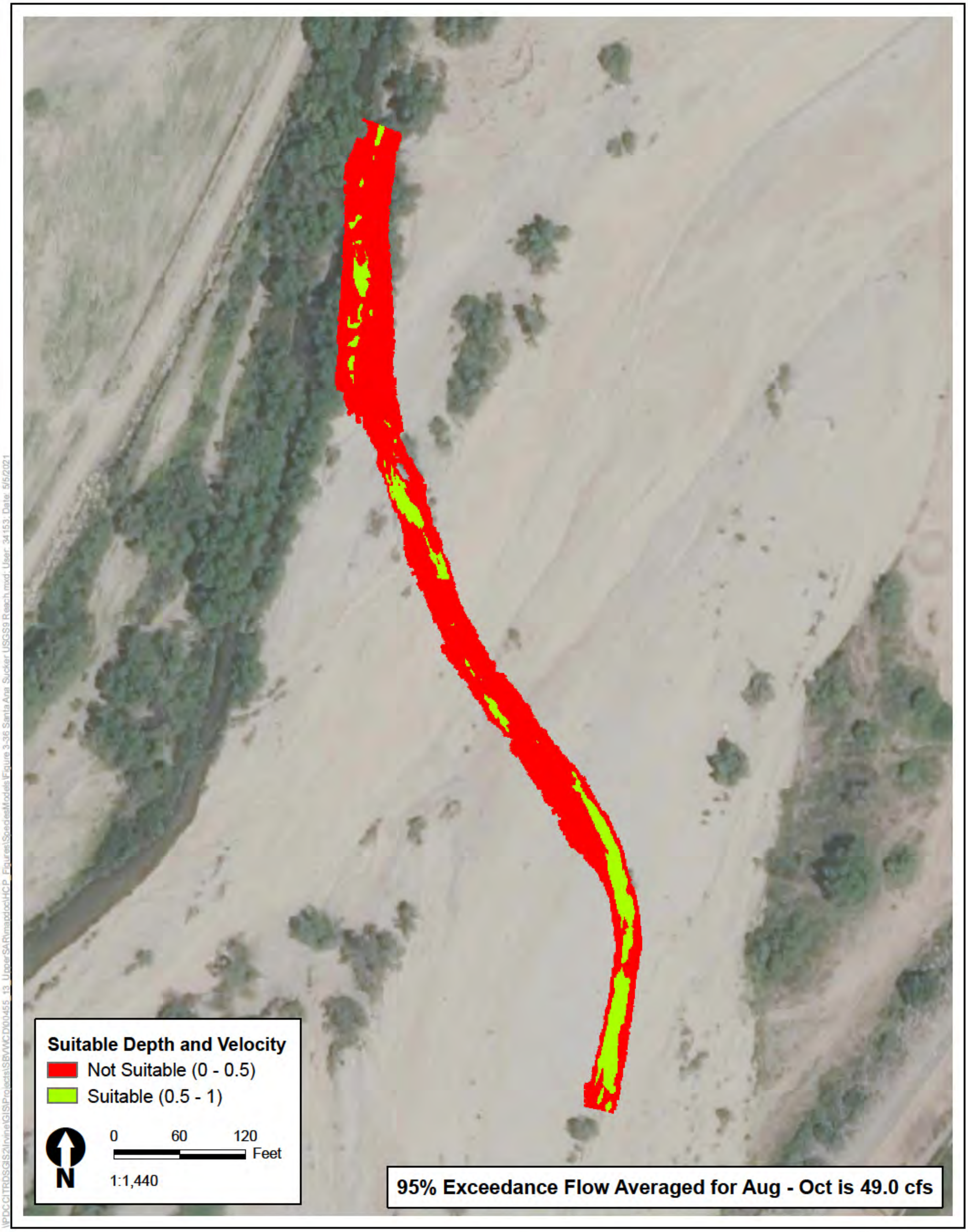
Upper Santa Ana River Habitat Conservation Plan

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



\\PDCCITRDSGIS2\Irvine\GIS\Projects\SBVMWD\00455_13_UpperSAR\mapdoc\HCP_Figures\SpeciesModels\Figure 3-36 Santa Ana Sucker USGS9 Reach.mxd; User: 34153; Date: 5/5/2021

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

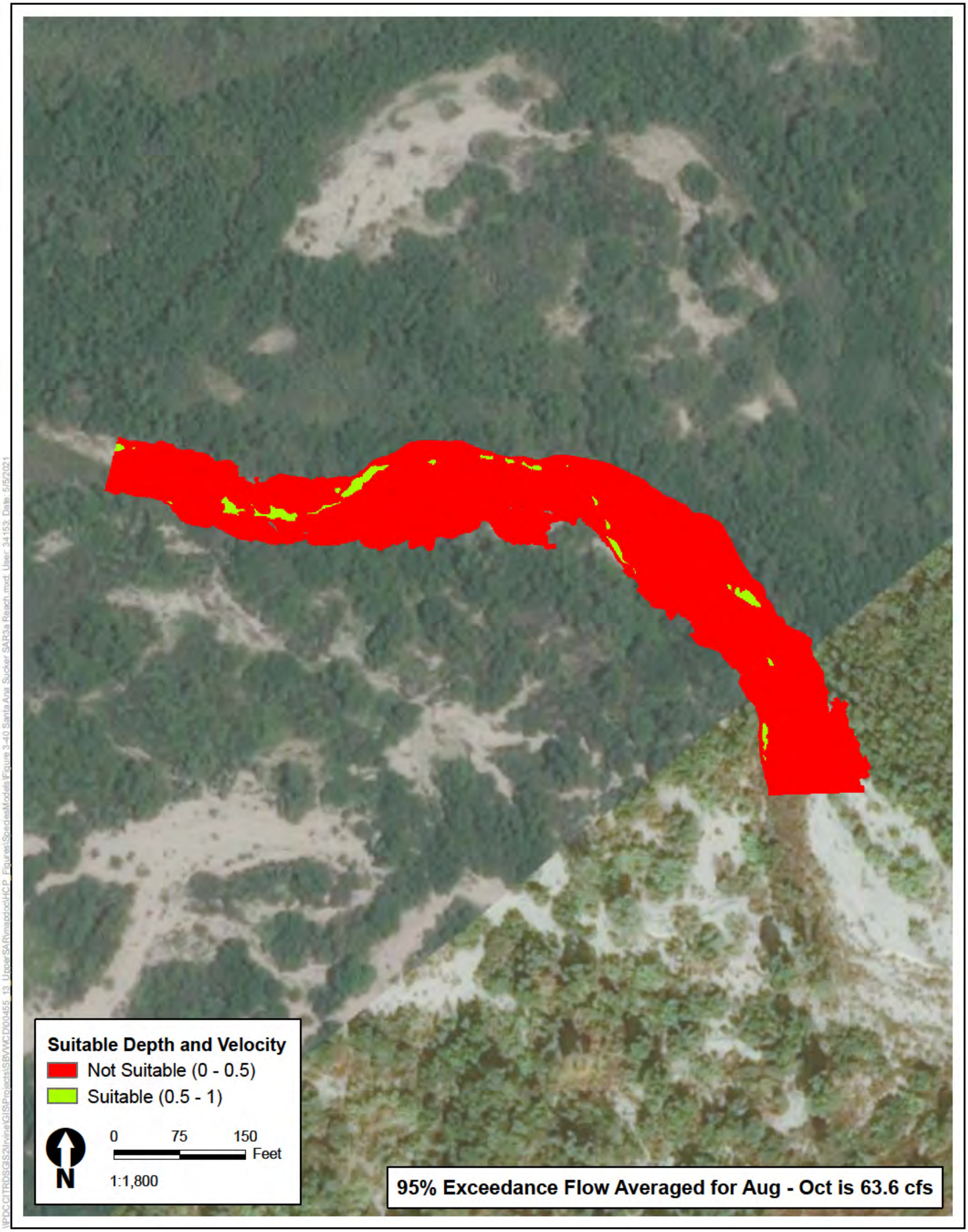


Figure 3-40
Santa Ana Sucker Suitable Depth and Velocity
Site 3a Reach - Downstream of RIX - Modeled Flow of 67.0 cfs
Upper Santa Ana River Habitat Conservation Plan

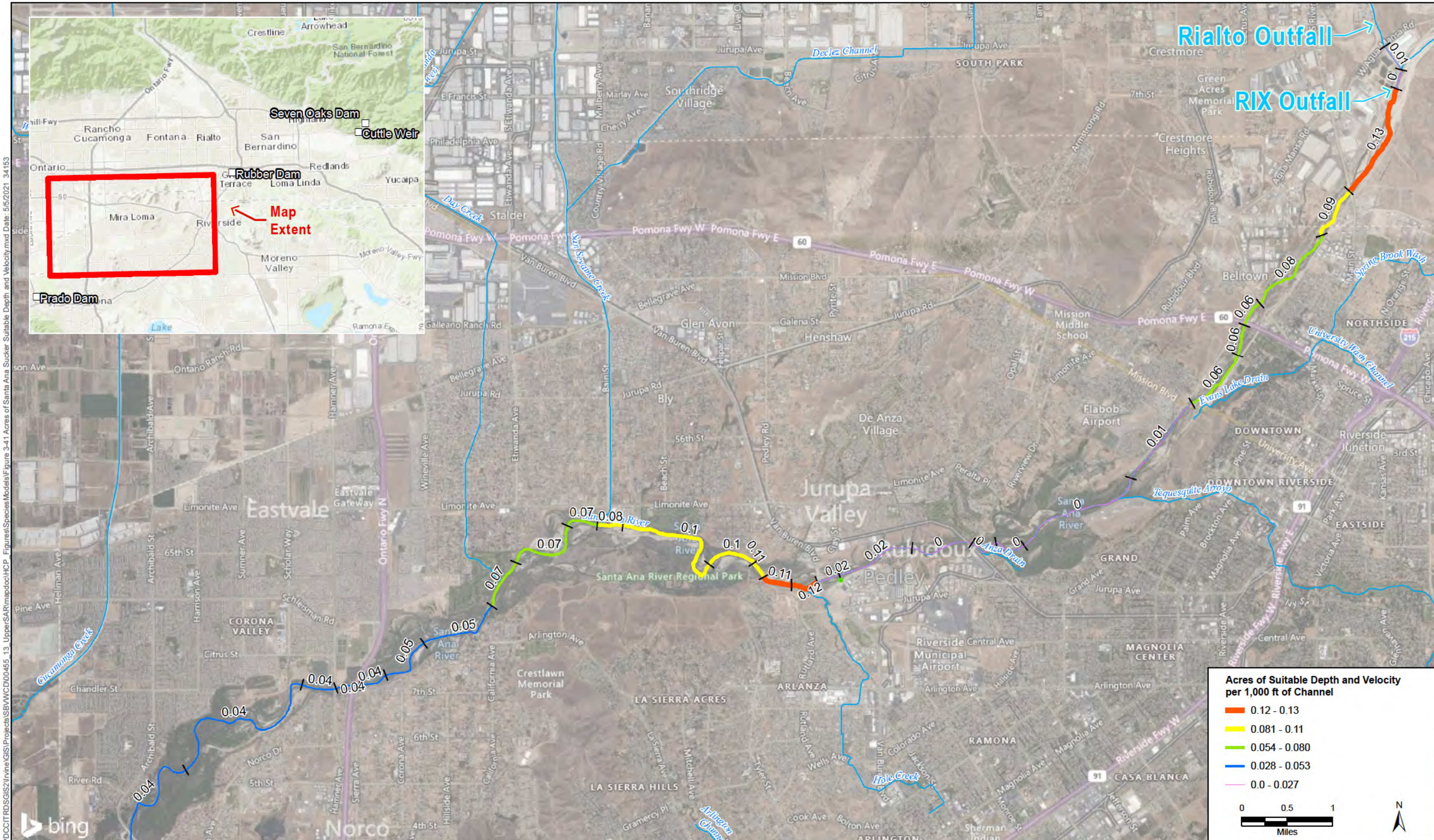


Figure 3-41
Acres of Santa Ana Sucker Suitable Depth and Velocity per 1,000 ft of Channel Length under Existing Condition Average Aug-Oct 95% Exceedance Flow

Upper Santa Ana River Habitat Conservation Plan

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

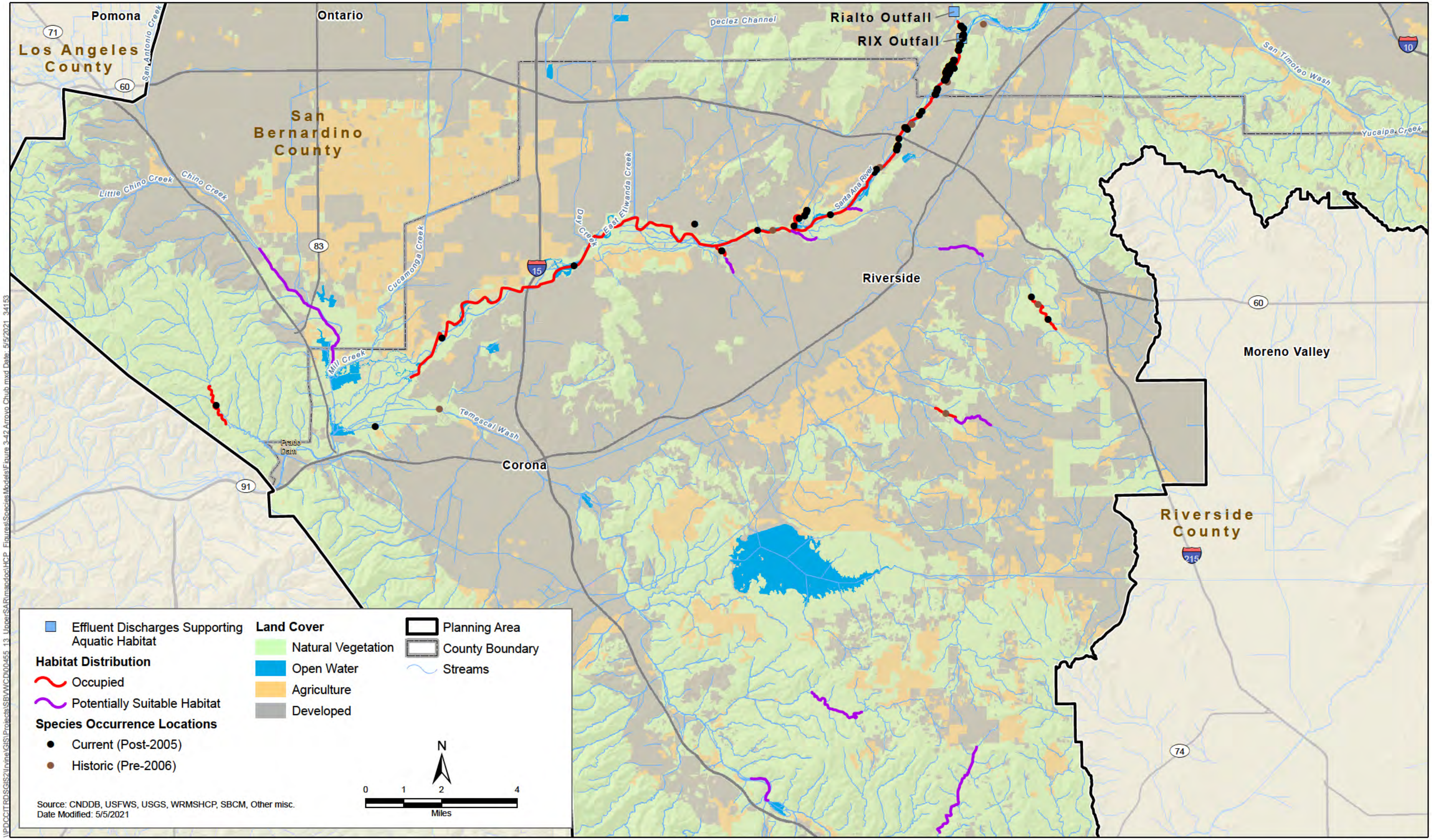
Diet and Foraging

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).



Upper Santa Ana River Habitat Conservation Plan

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

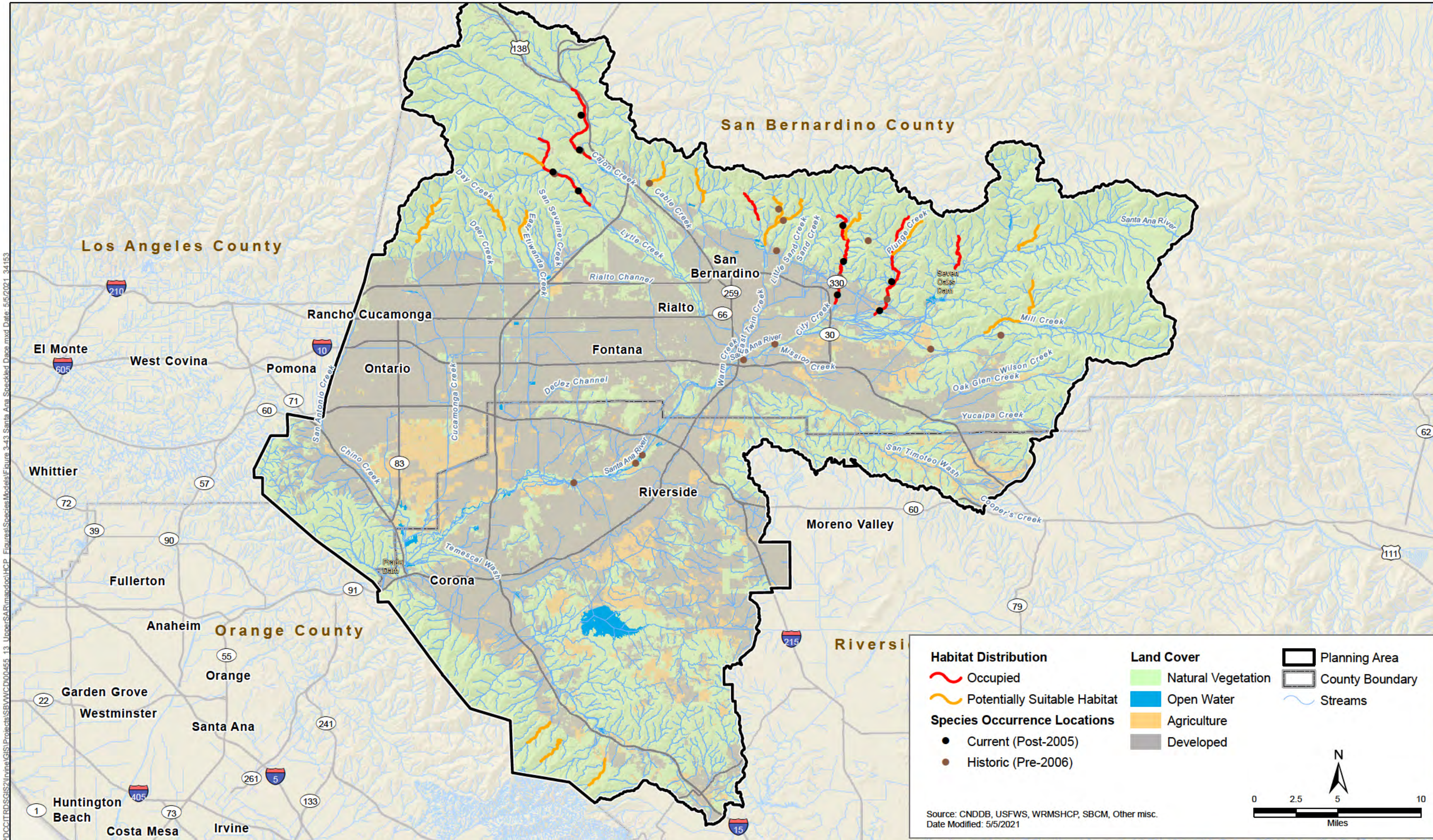


Figure 3-43
Santa Ana speckleld dace, *Rhinichthys osculus ssp.*
Potential Habitat Distribution and Known Occurrence Records

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Upper Santa Ana River Habitat Conservation Plan

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

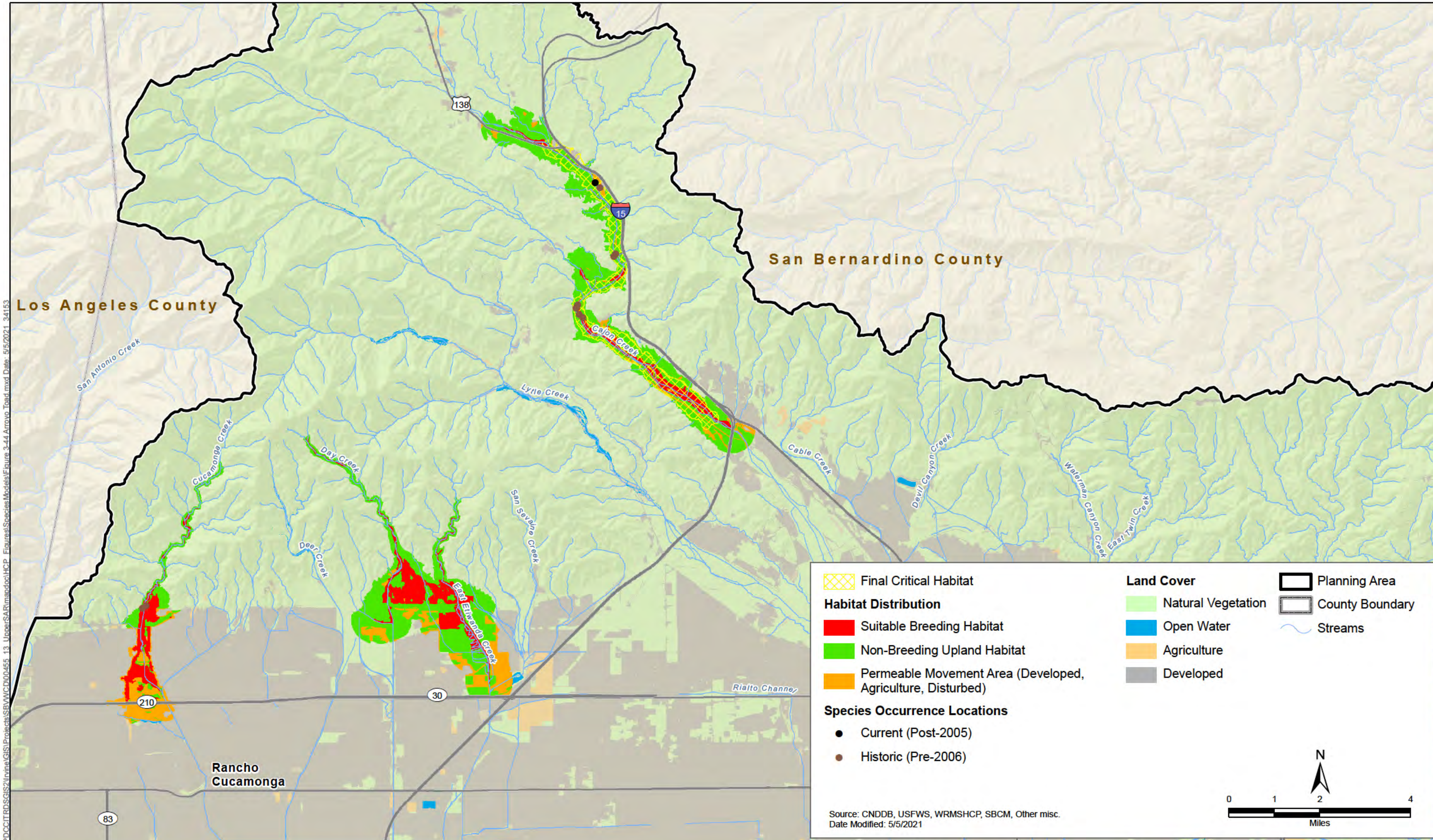

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Figure 3-44
Arroyo toad, *Anaxyrus californicus*
Potential Habitat Distribution and Known Occurrence Records

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

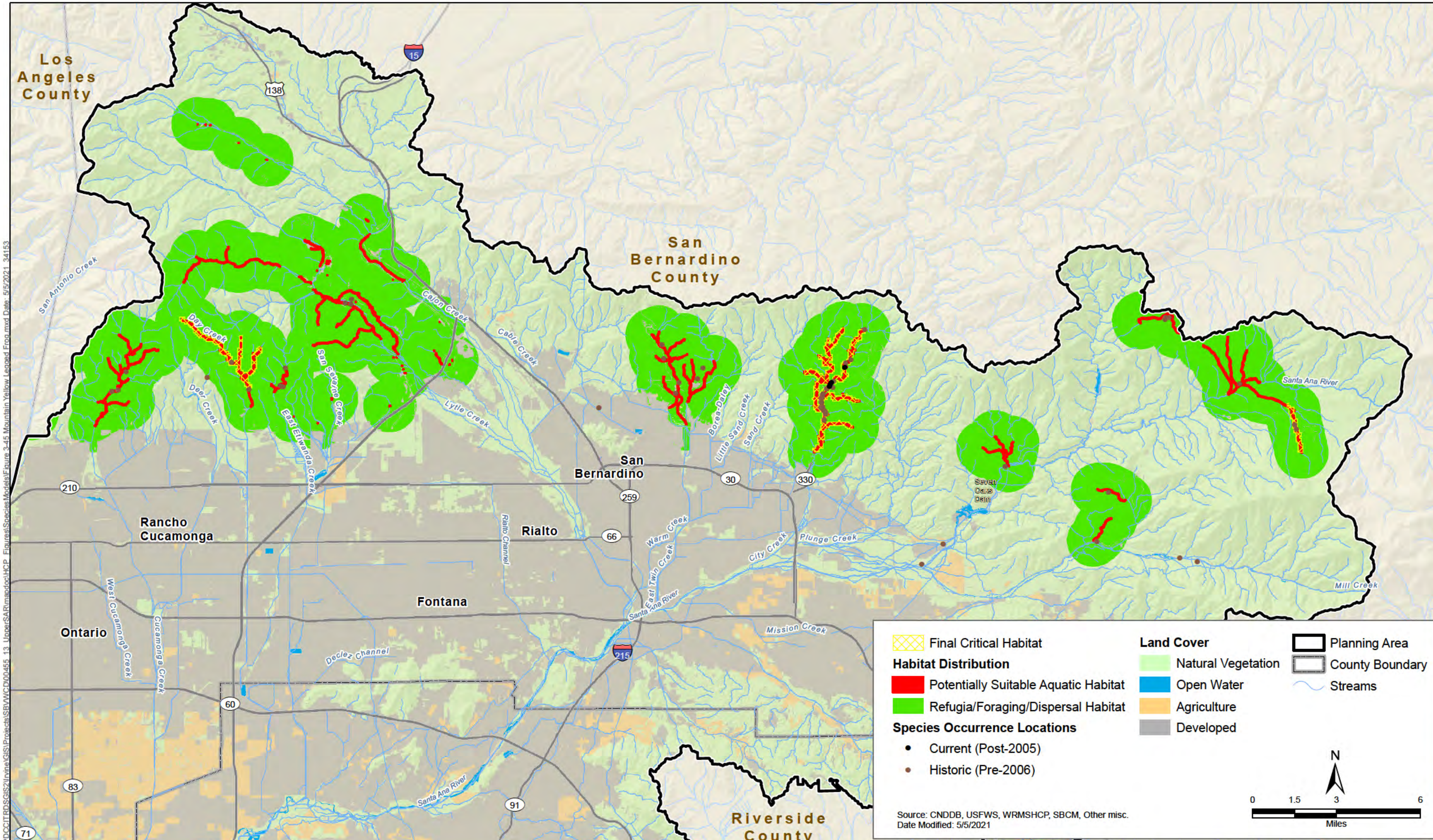
The mountain yellow-legged frog (*Rana muscosa*) is Federally and State listed as endangered and occurs in the San Gabriel, San Bernardino, and San Jacinto Mountain Ranges, in Los Angeles, Riverside, and San Bernardino Counties. In the San Gabriel Mountain Range, known populations occur in Devil's Canyon, 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.



\\PDCCITRDSGIS2\Irvine\GIS\Projects\SBVWCD\00455_13_UpperSARmapdoc\HCP_Figures\SpeciesModels\Figure 3-45 Mountain Yellow Legged Frog.mxd Date: 5/5/2021 34153

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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	X	X									X	X
Aestivation (in dry conditions)							X	X	X			
Breeding			X	X	X	X	X	X				

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

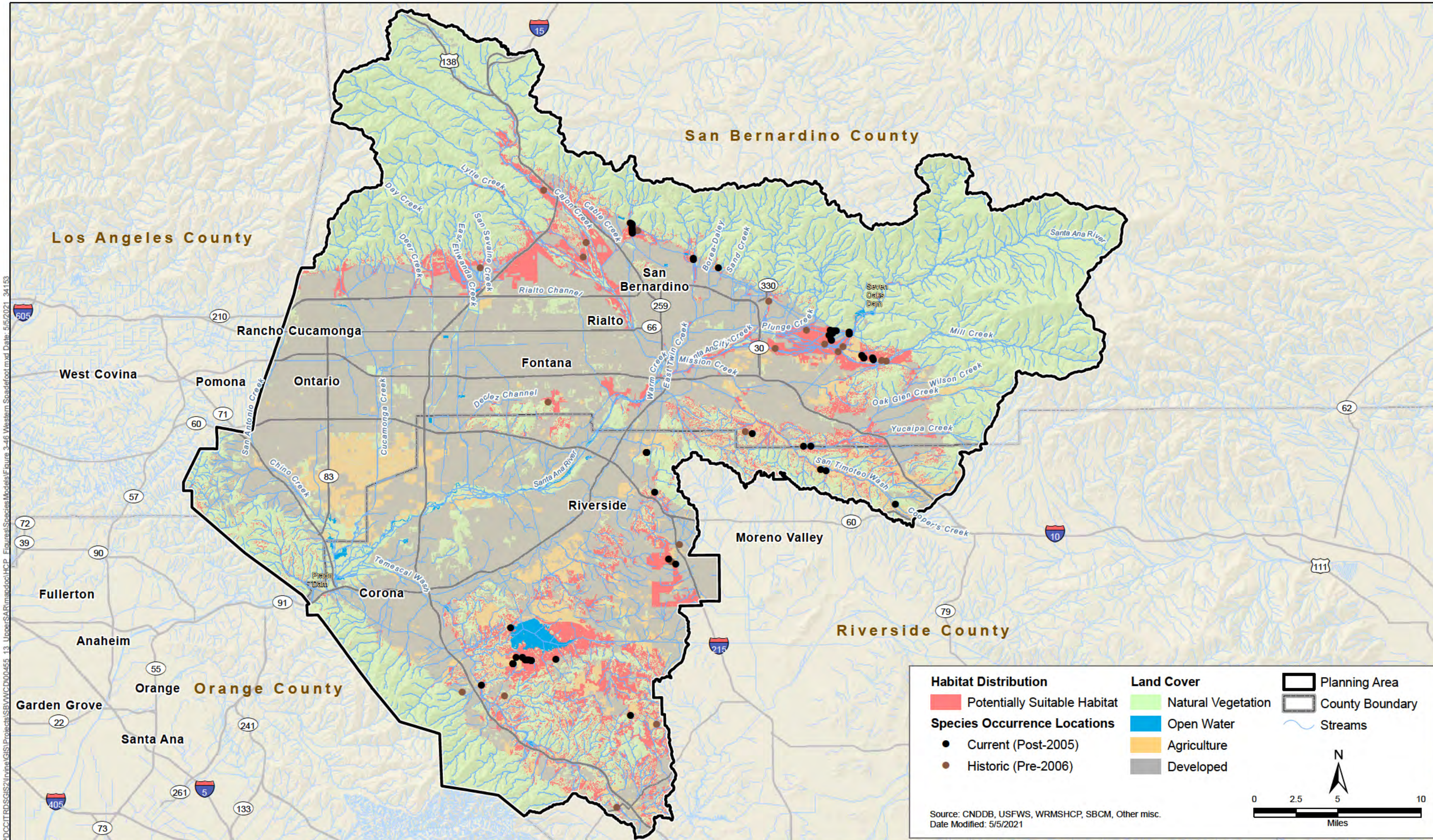
Wetted area as a measure of aquatic habitat was also estimated for western spadefoot using the methodology described in Section 3.6.4. Approximately 199 acres of modeled suitable habitat was found to co-occur with predicted wetted area acreage downstream of Covered Activities (Table 3-16).

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

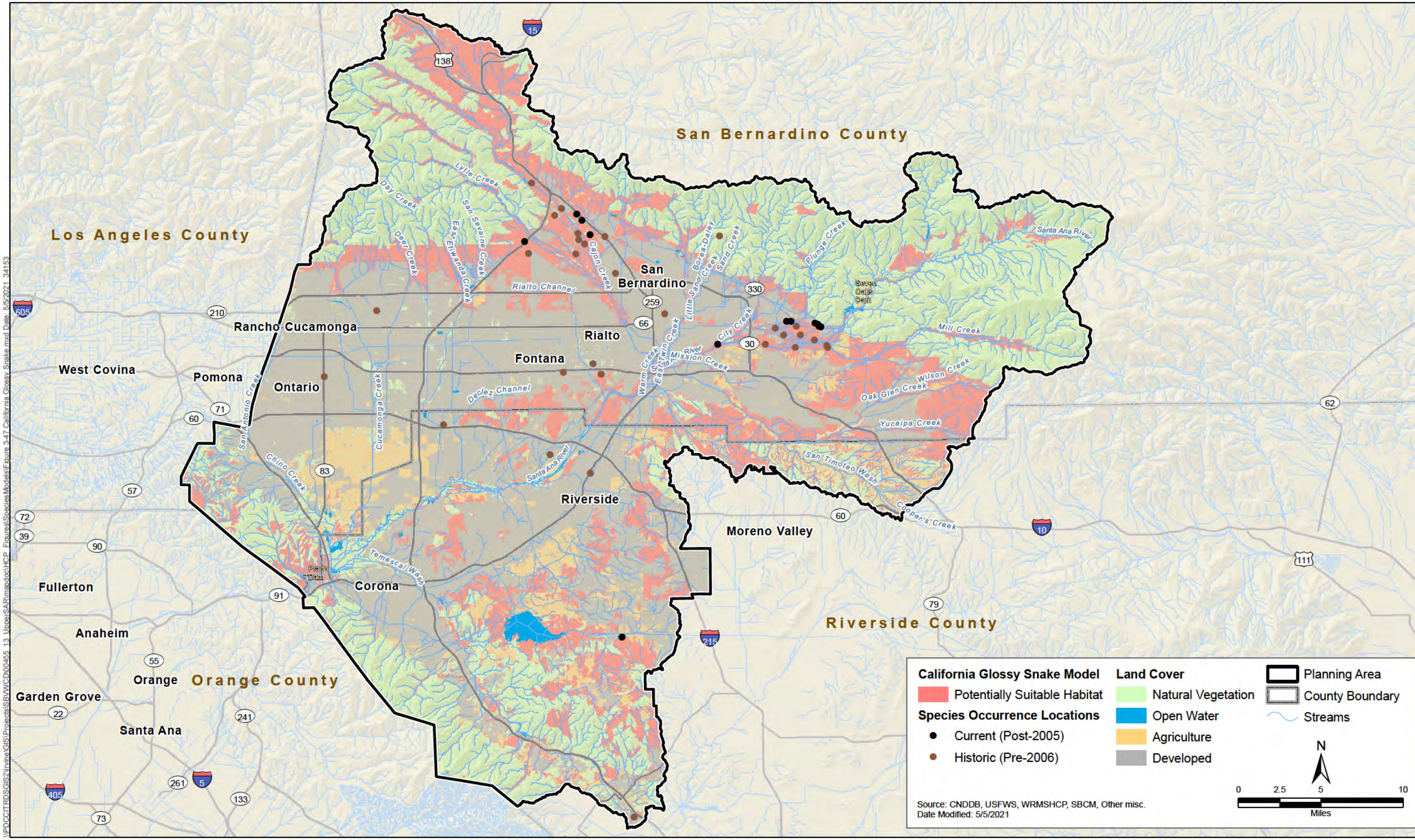
California glossy snake prefers open areas in a variety of habitats including light shrubby to barren desert, grassland, chaparral, and coastal sage scrub (Stebbins 2003, Thompson et al. 2016).

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

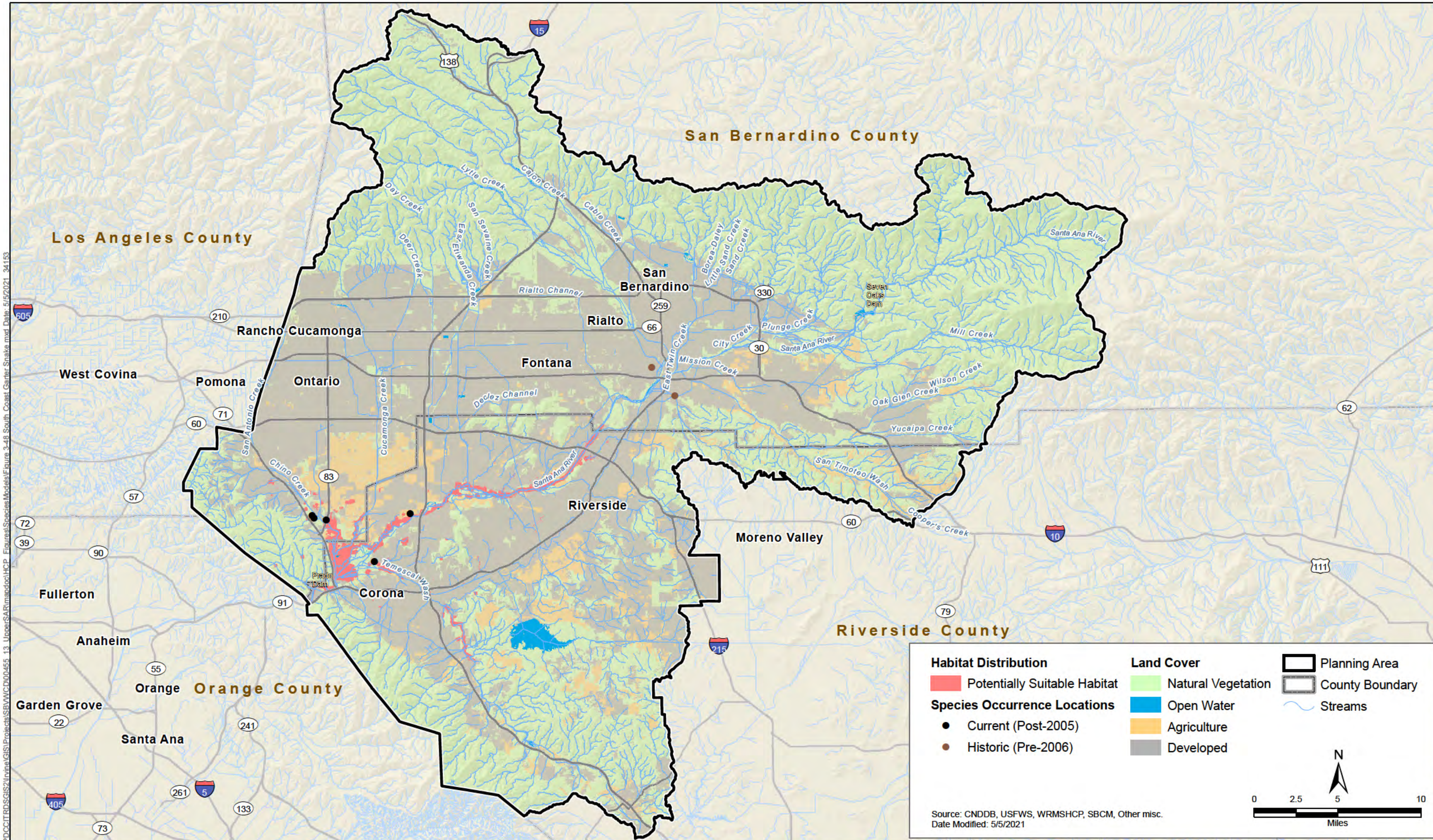
Essential habitat factors for south coast garter snake includes a permanent water source, low gradient topography, and dense multi-storied riparian vegetation (Ervin 2011). South coast garter snake is restricted to shallow freshwater aquatic habitats such as wetlands and marshes and upland riparian habitat 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
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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	X	X										X
Breeding				X	X	X	X	X	X	X	X	

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).

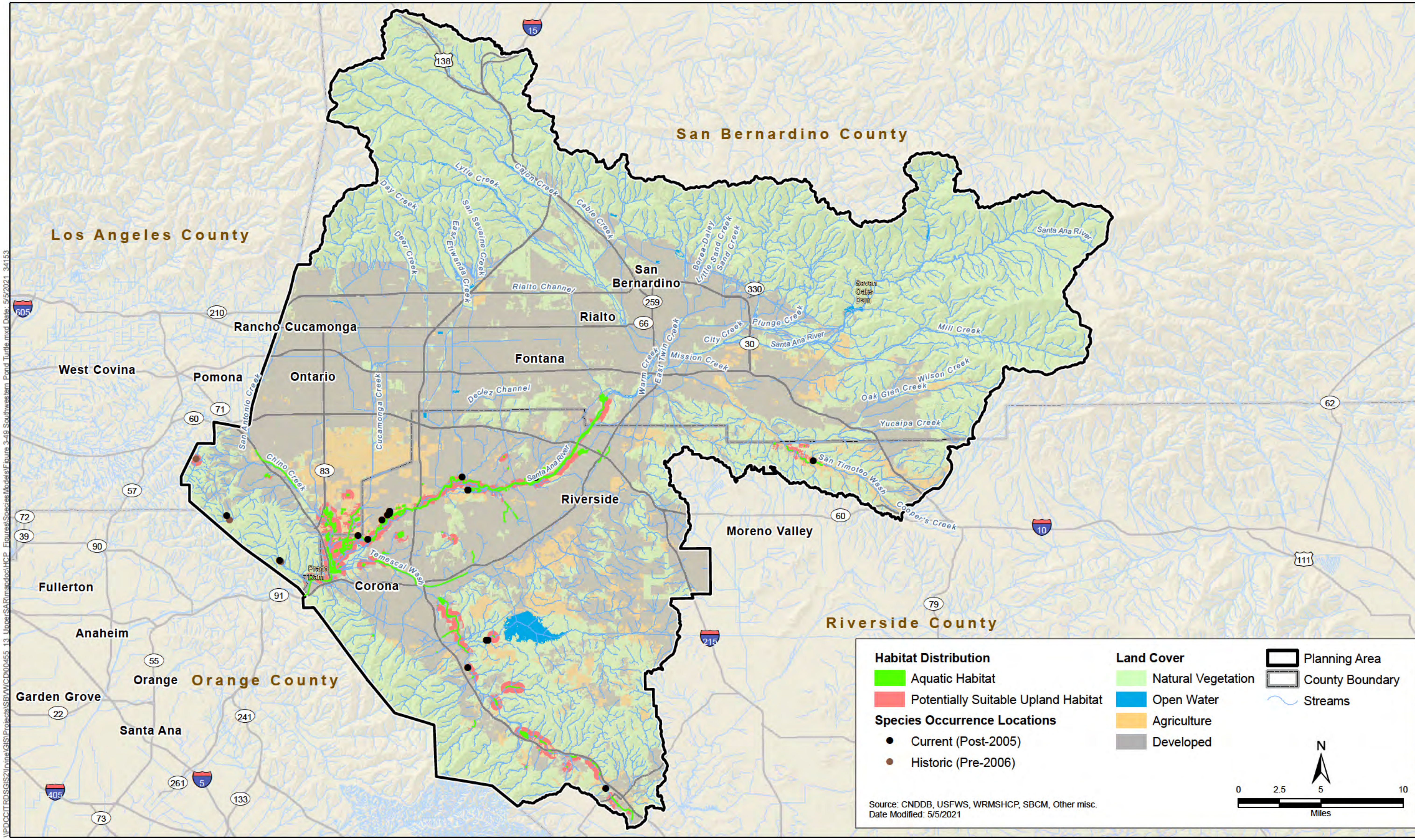
Dispersal, Territoriality, and Home Range

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.

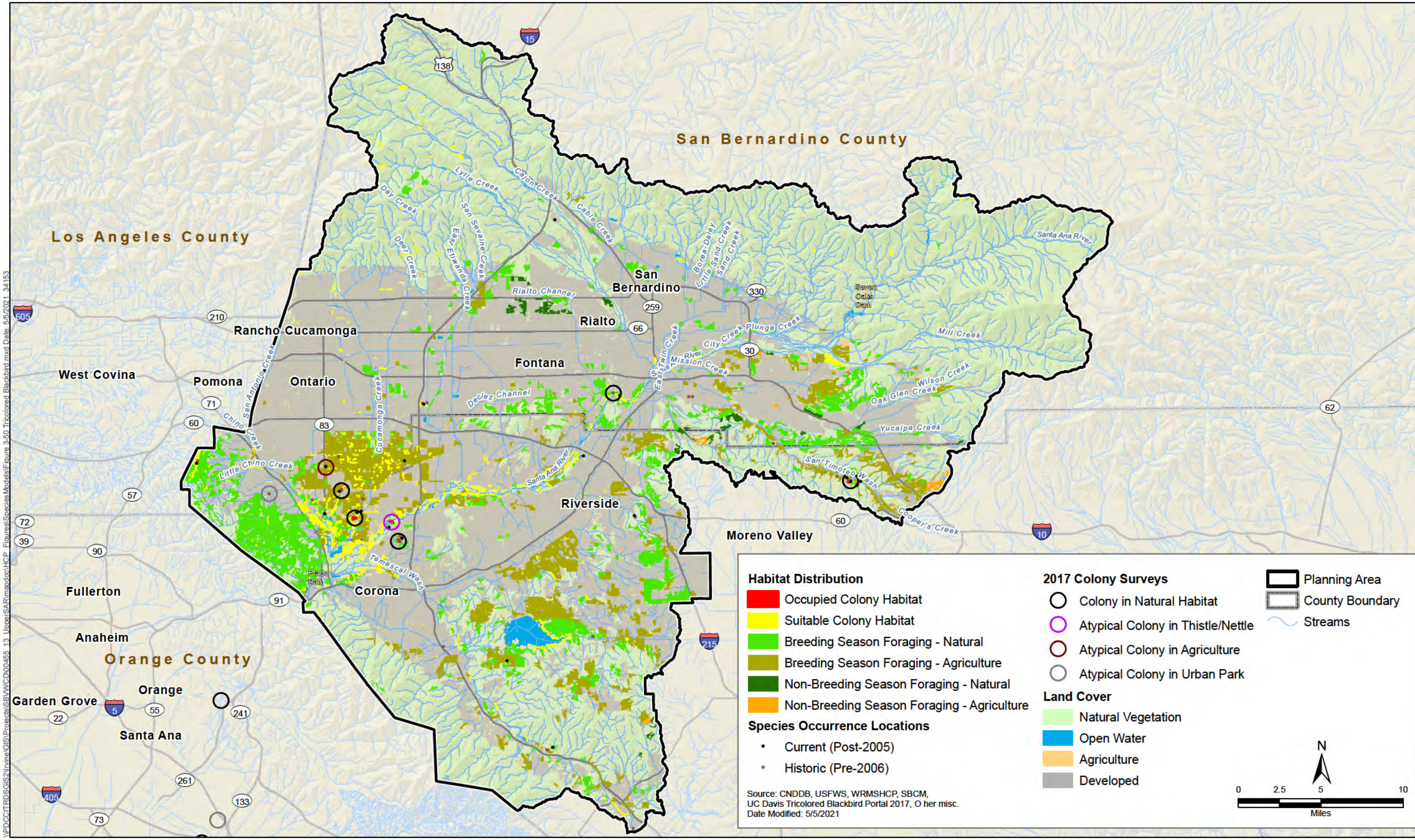
The following modeled habitat types are used to represent the species' habitat distribution in the Planning Area, and include a listing of the data and/or parameters used to create each modeled habitat type.

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).

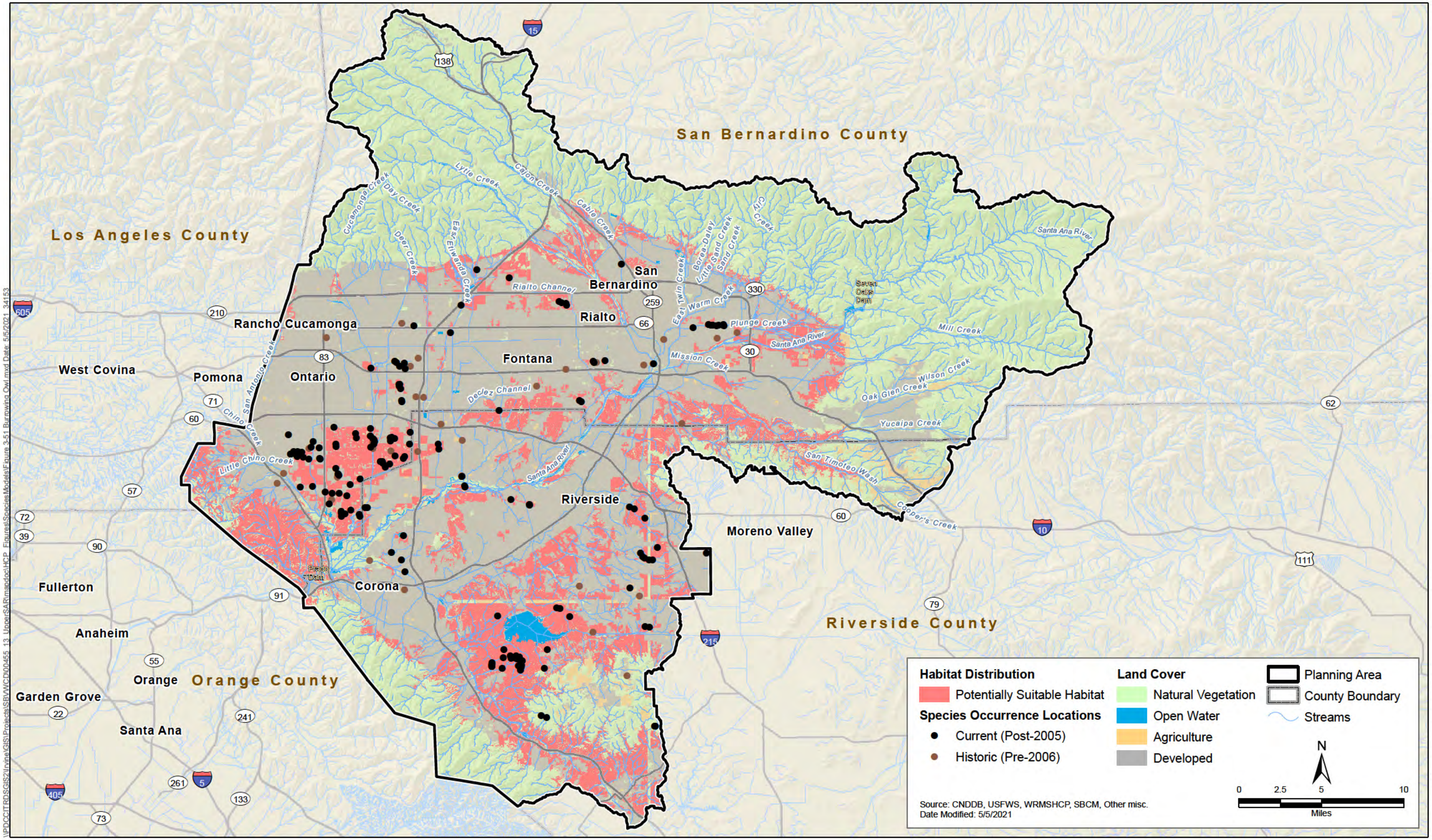
Daily and Seasonal Activity

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:

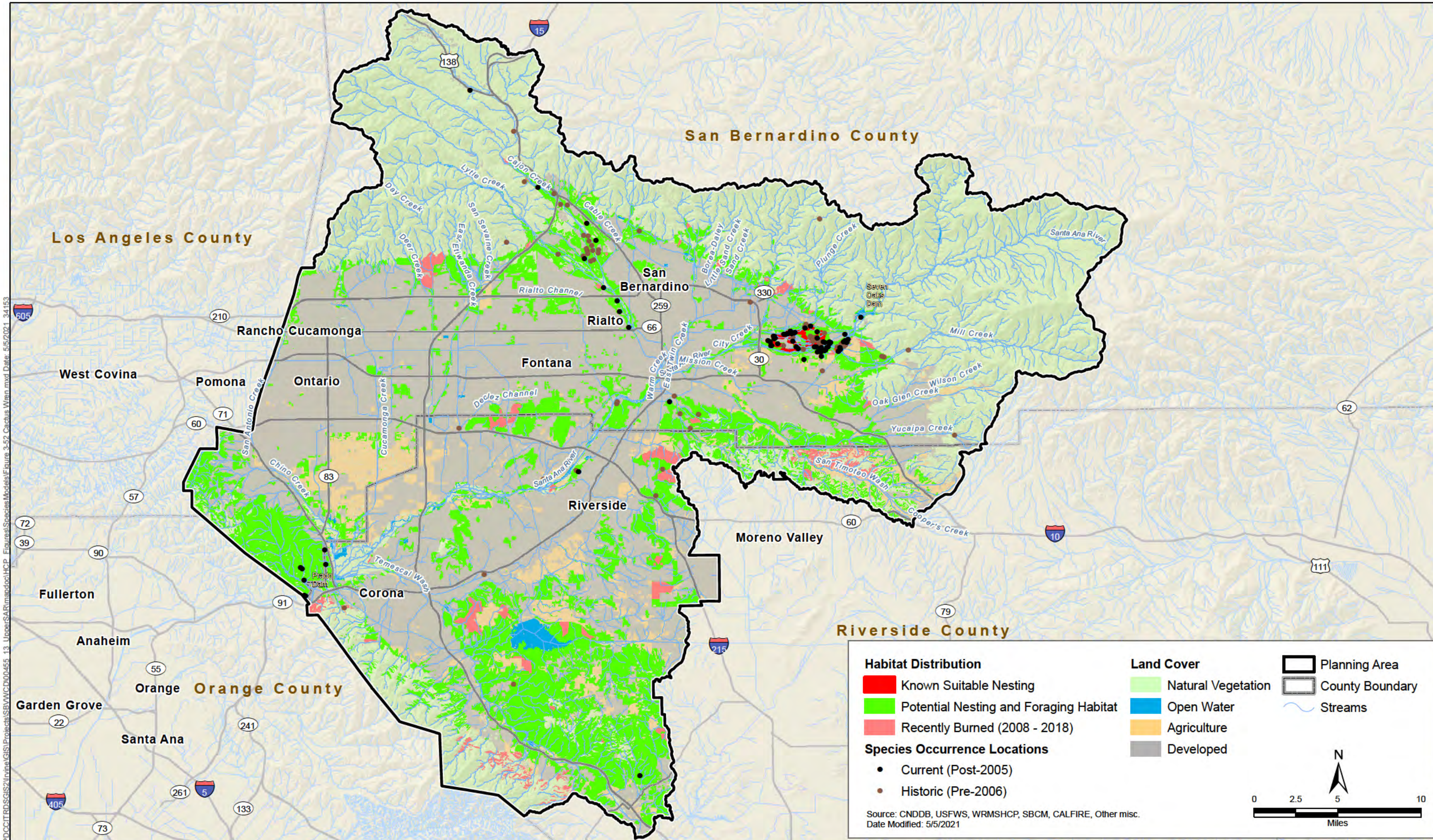
- **Land Cover**: Californian Coastal Scrub; Californian Annual and Perennial Grassland; Californian Disturbed Grassland, Meadow, and Scrub; North American Warm-Desert Xeric-Riparian Scrub; Great Basin-Intermountain Xeric-Riparian Scrub; Californian Coastal Scrub (prickly pear); **AND**
- **Elevation**: 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

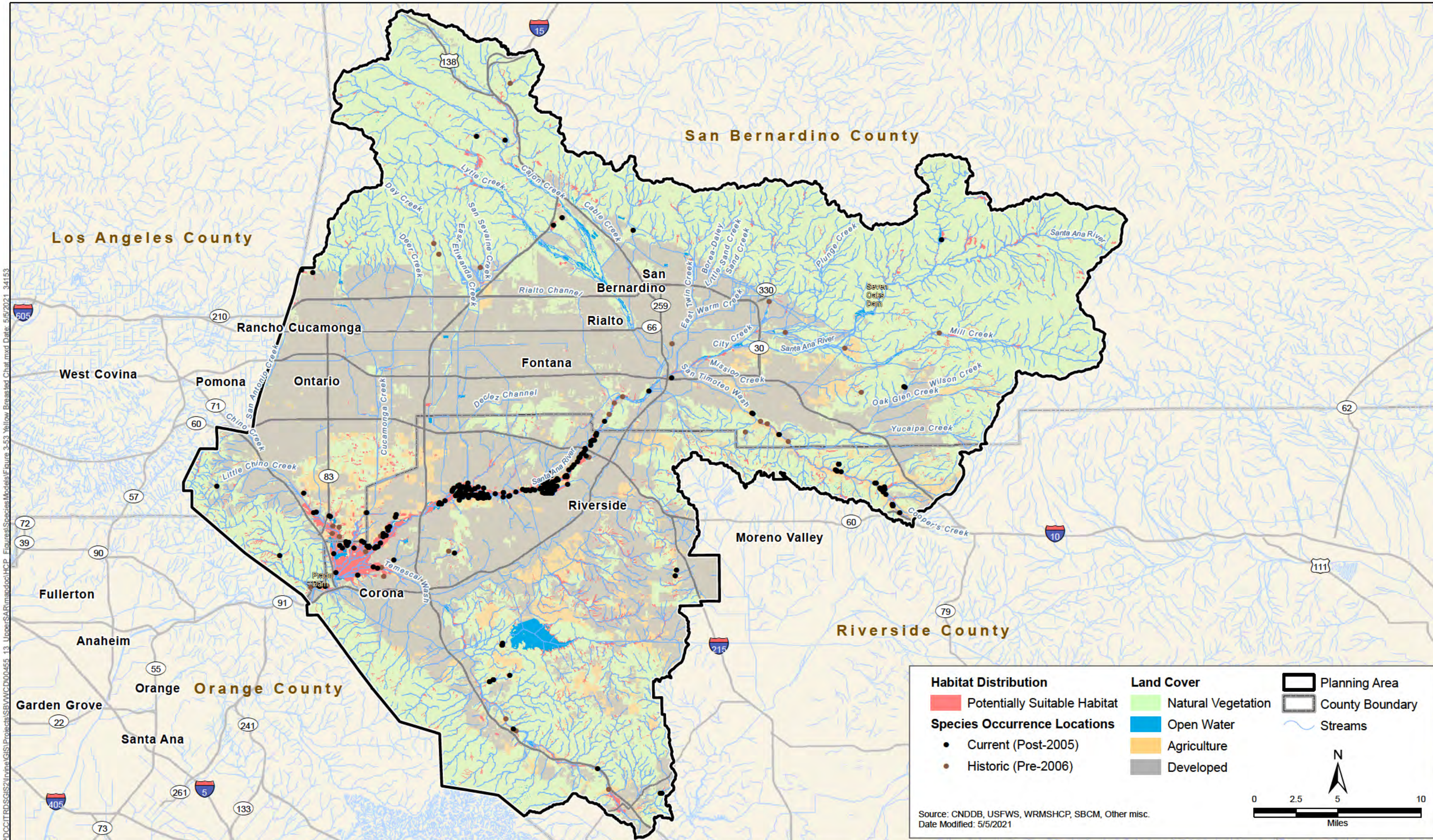
Yellow-breasted chat (*Icteria virens*) is a California Species of Special Concern. It breeds in western North America (from the Great Plains and western Texas toward the west) (Shuford and Gardali 2008, ICF International 2014) and winters in Baja California and southern Texas south through western Mexico 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

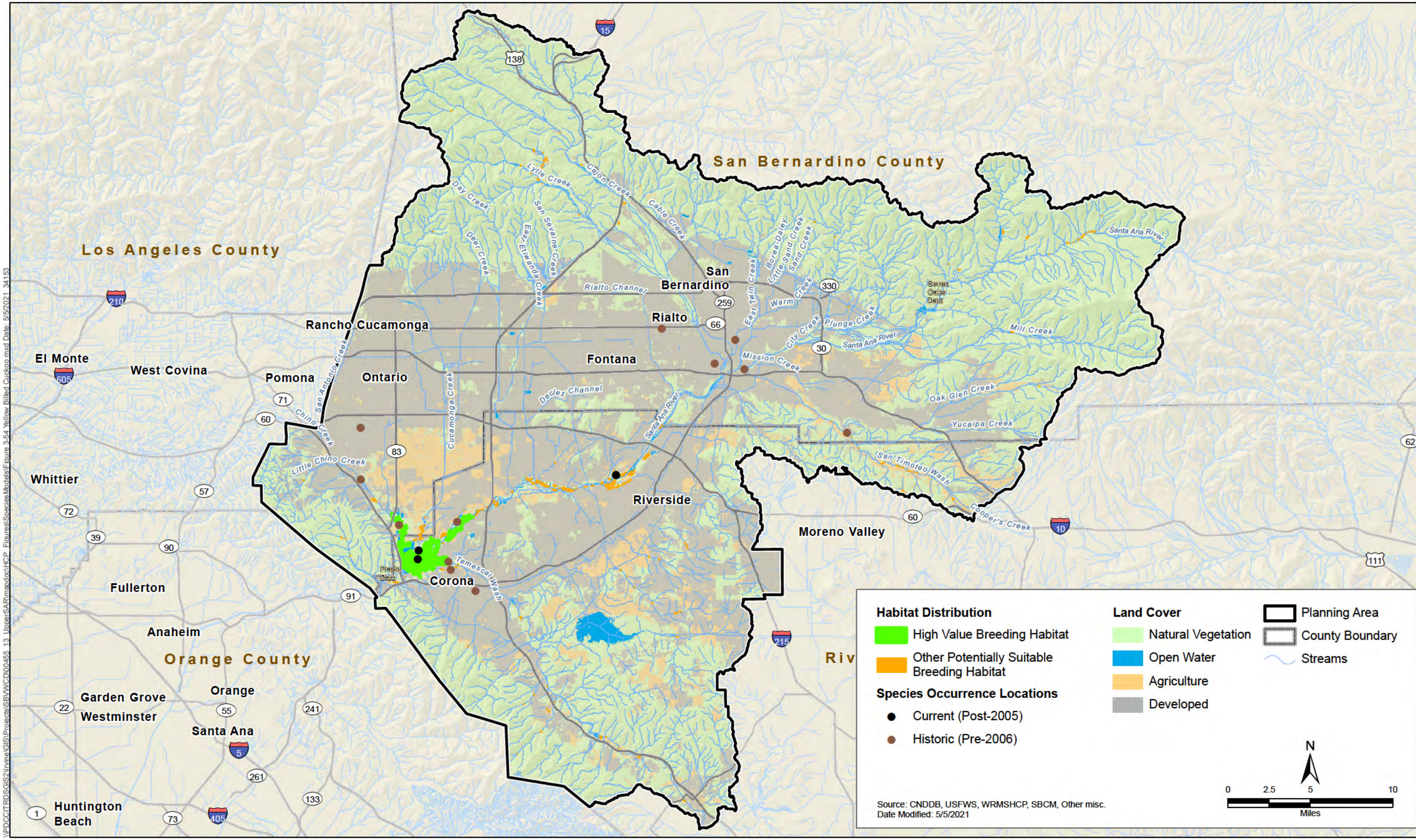
Diet and Foraging

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.

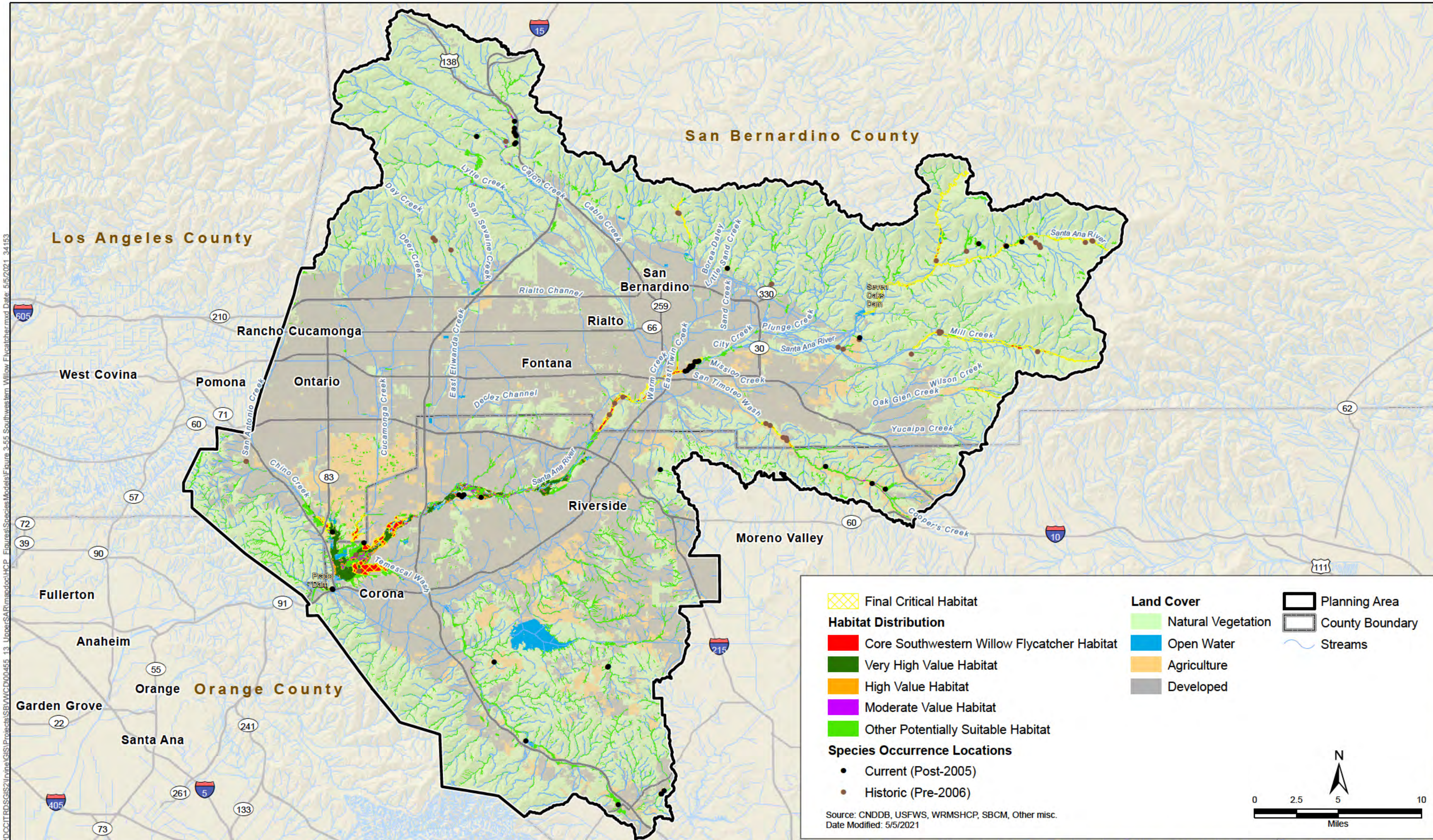
Taxonomy and Genetics

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	■	■	■				■	■	■			

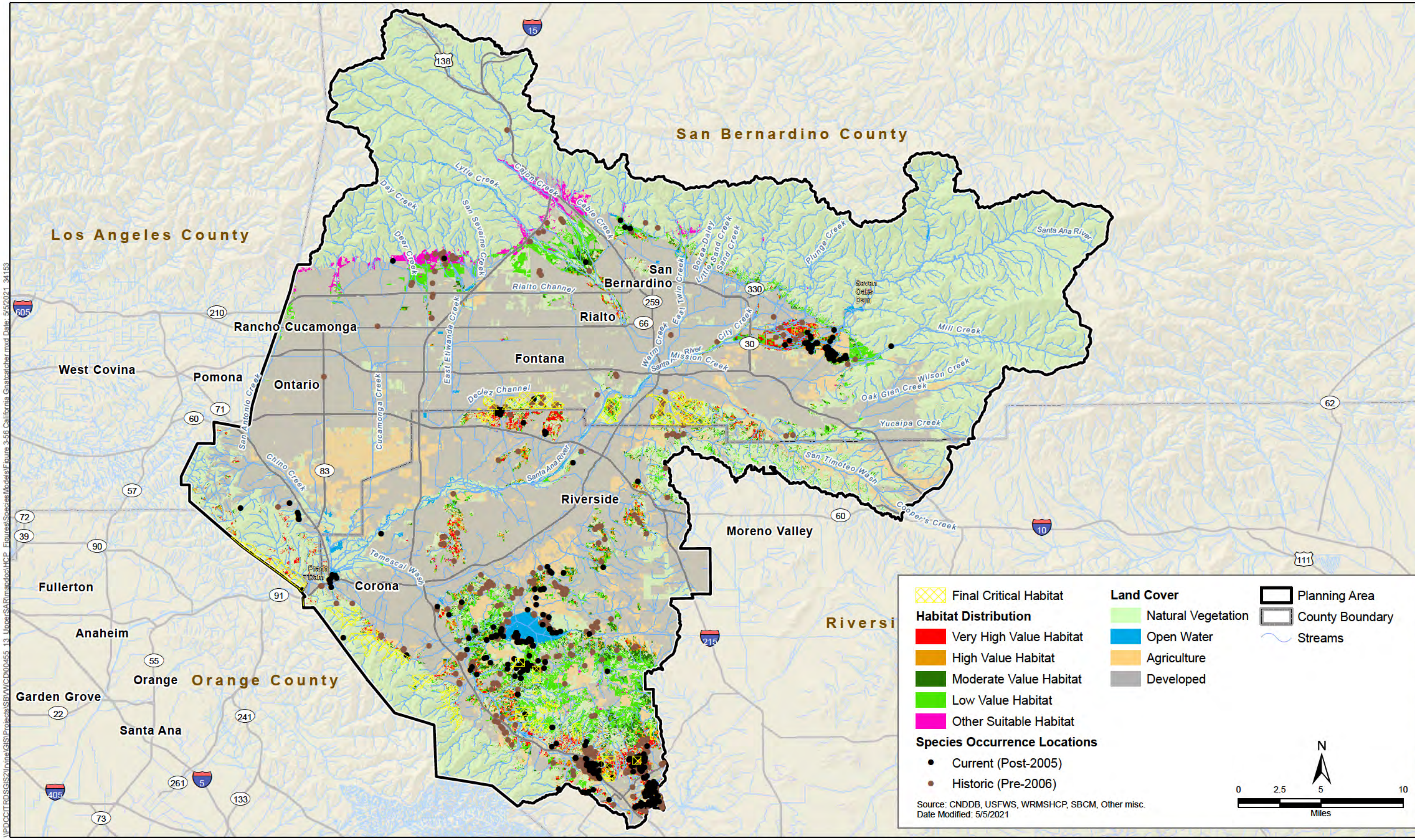
Sources: Atwood 1993, Atwood and Bontrager 2001

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

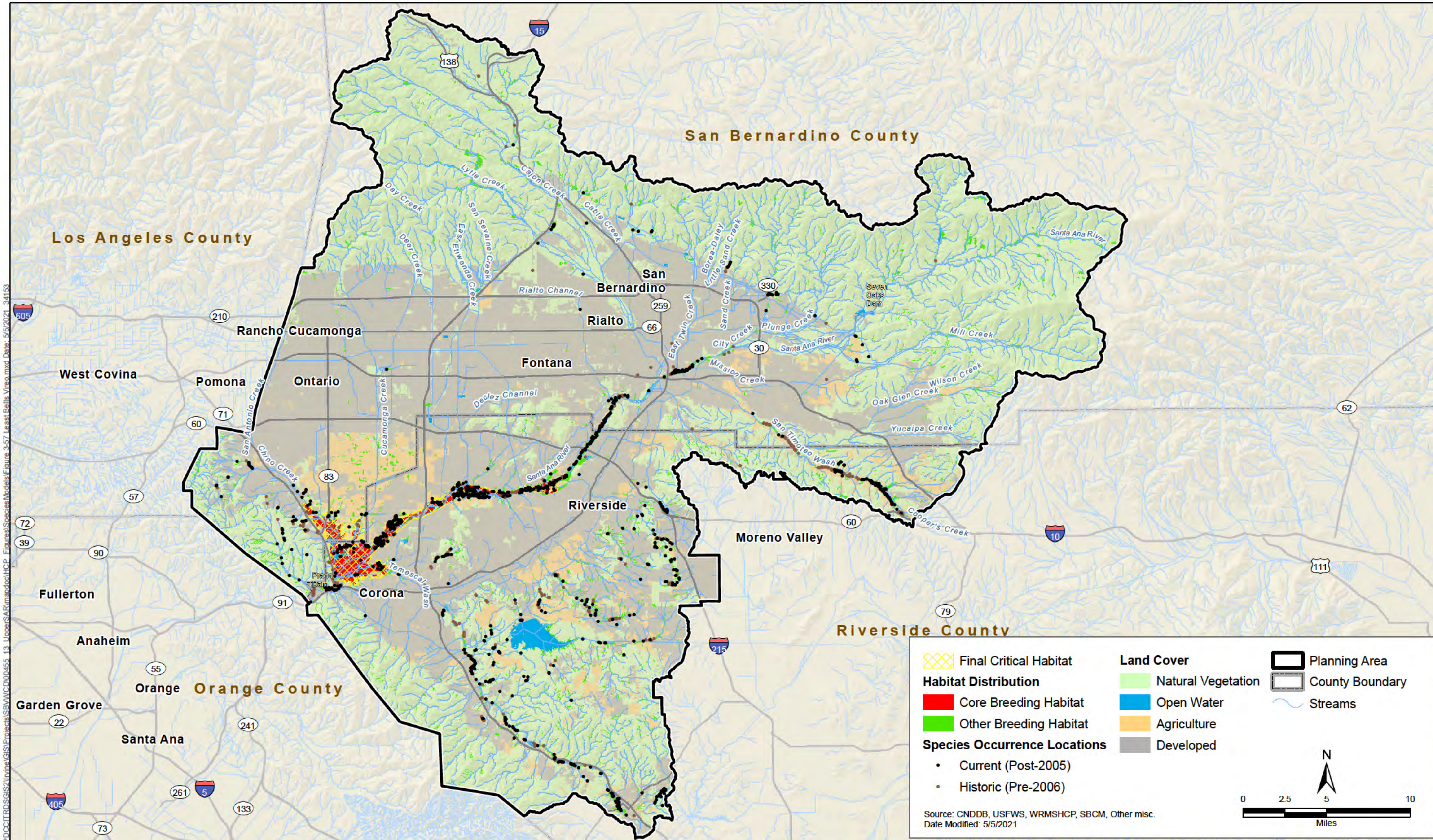
Least Bell's vireo is one of four subspecies of Bell's vireo (*Vireo belli*). All subspecies breed in different areas of the U.S. and winter in Mexico (Franzreb 1989).

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

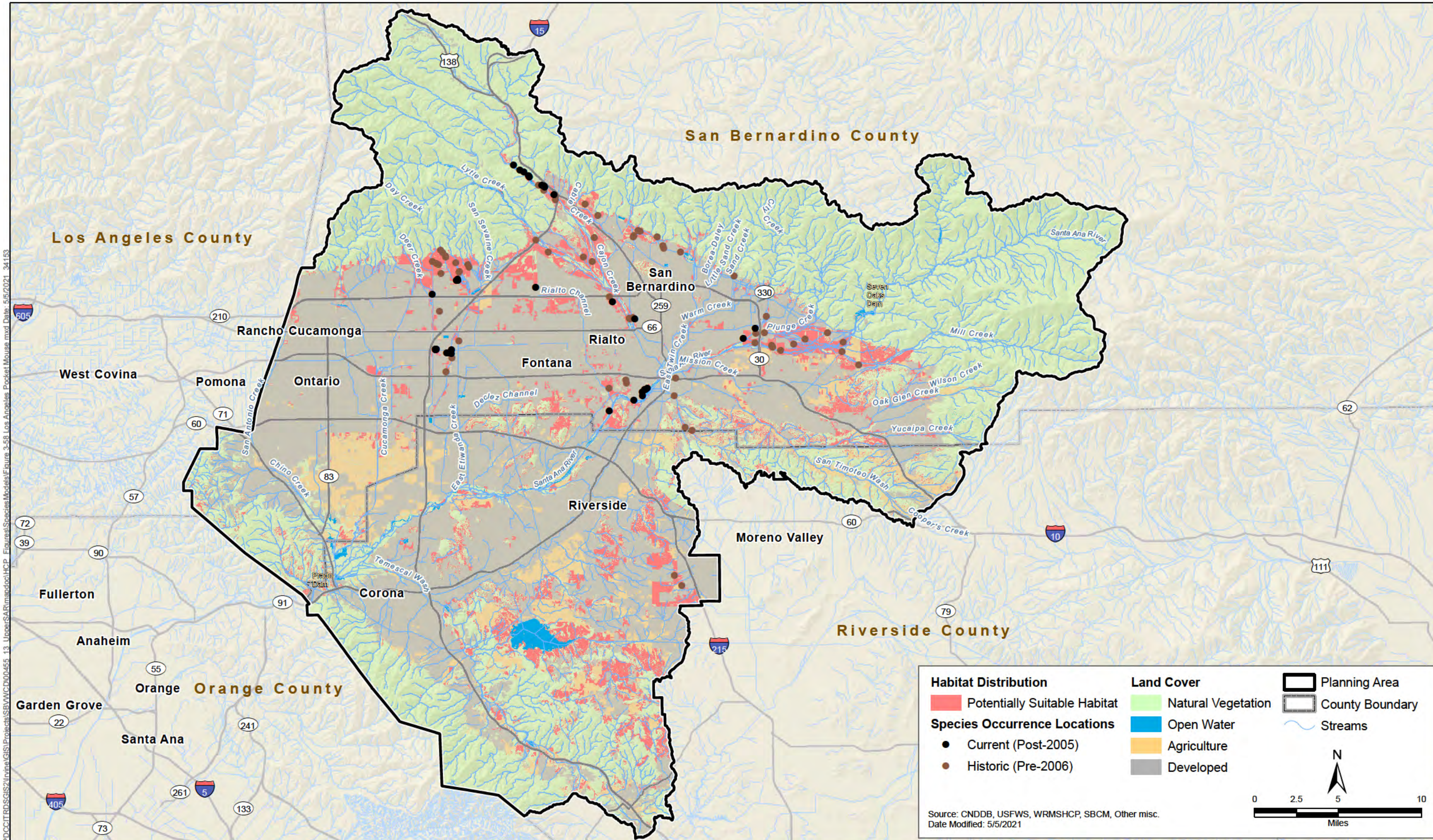
Distribution of Los Angeles pocket mouse modeled habitat and documented occurrences in the Planning Area are illustrated on Figure 3-58, and quantified in Table 3-15. The following modeled habitat types are used to represent the species' habitat distribution in the Planning Area; this includes a listing 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	X	X	X						X	X	X	X
Peak Surface Activity					X	X	X					
Breeding				X	X	X						

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

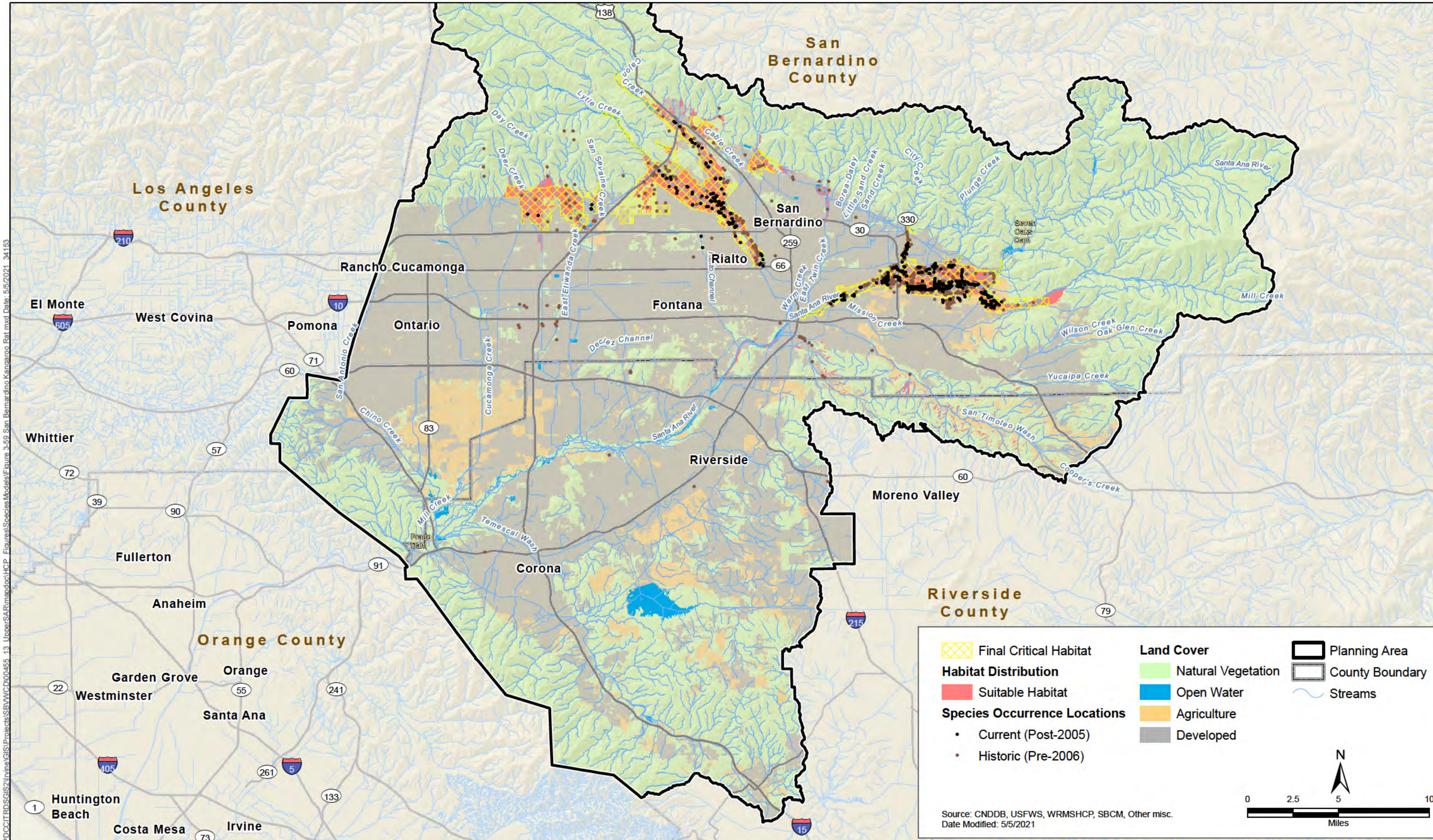
There are 27,745 acres of designated critical habitat for SBKR in the Planning Area (72 *Federal Register* 33807). Designated critical habitat occurs within the Etiwanda Fan, Lytle, and Cajon Creeks (including Cable and Devil Canyon Creeks) and the Santa Ana River Wash (including portions of Mill, Plunge,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

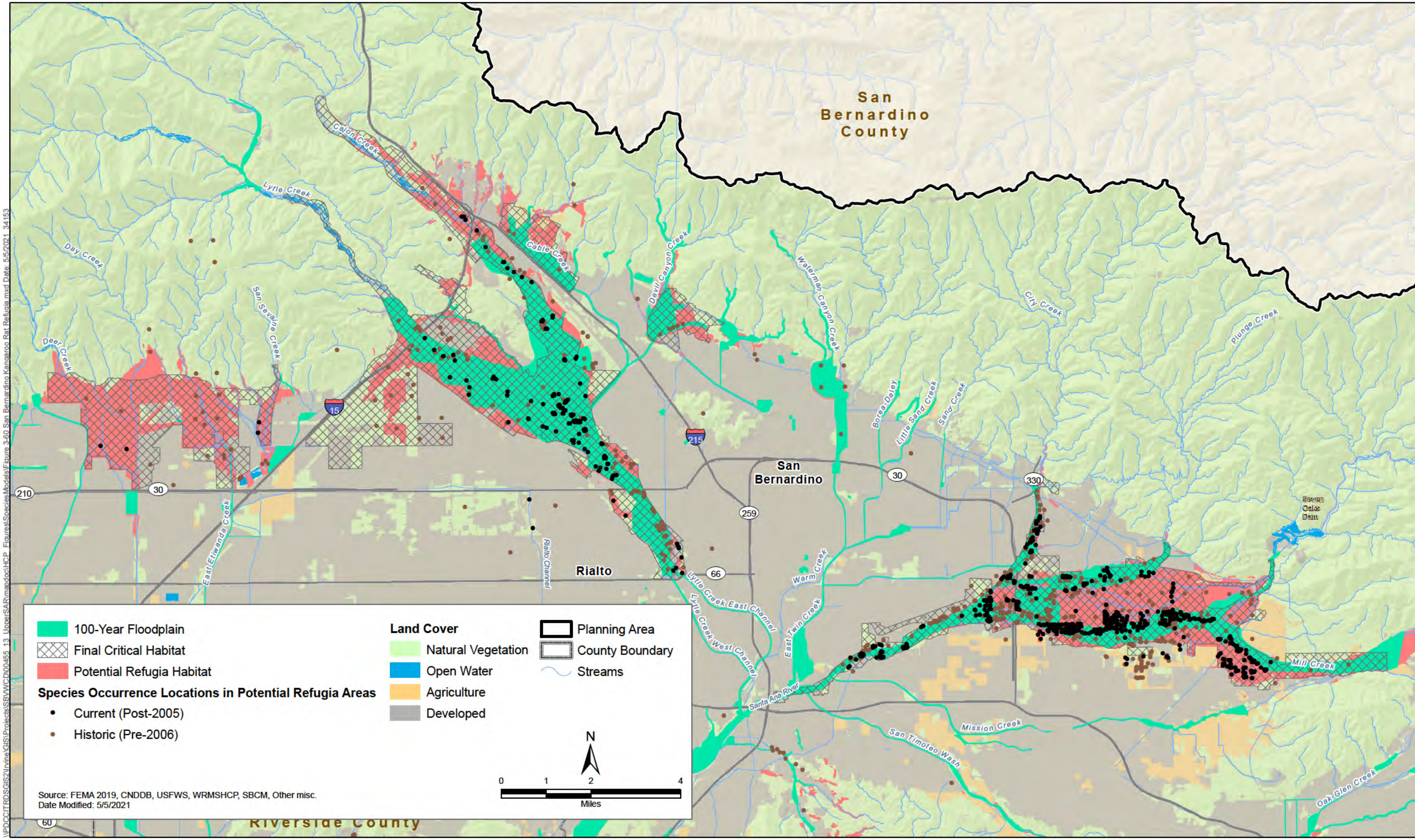
Reproduction

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).



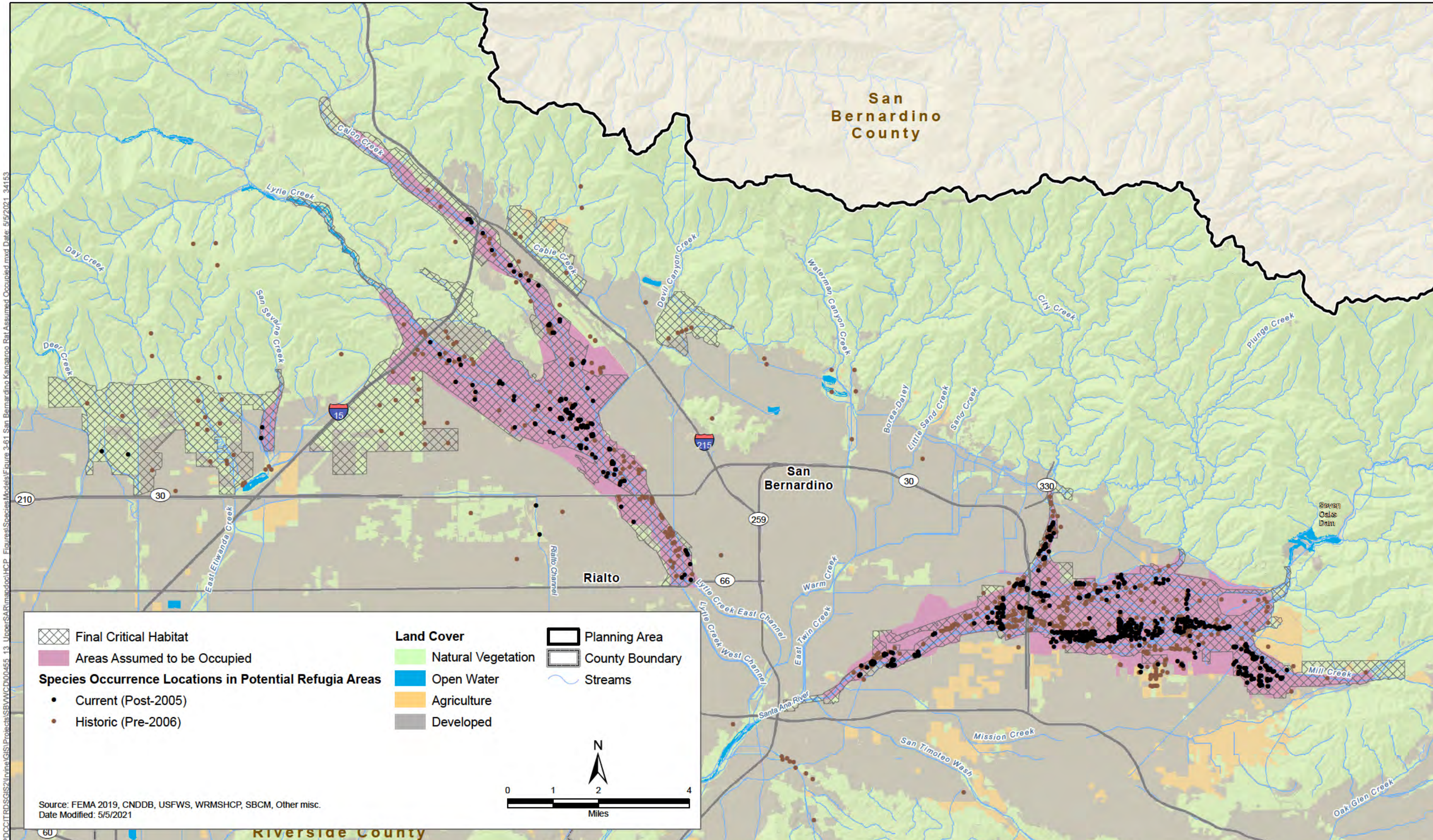
Upper Santa Ana River Habitat Conservation Plan

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	X	X	X	X	X	X	X	X	X	X	X	

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.

Experimental thinning of vegetation in the Santa Ana River resulted in an increase in use of the more open habitat (Price 1978). Mature-stage alluvial fan sage scrub is less suitable as primary habitat because of the typical dense vegetation cover, but is important as refugia in high flow events. Consequently, natural fluvial processes (or other mechanisms that mimic these processes), whereby cycles of flooding and dry periods result in dynamic fluctuations of terraces and habitat, are crucial.

Reduction in overall genetic diversity and lack of gene flow between populations make this species more vulnerable to stochastic events. While fluctuations in population numbers are natural for this species due to local extirpation and recolonization following flood events, increasing precipitation volatility in the form of extreme drought years followed by extreme precipitation years and flooding may have more serious consequences for this species (Hendricks et al 2020). Natural recolonization following extreme events may be impossible due to loss of adjacent refugia and habitat fragmentation as evidenced by no gene flow between sub-populations in the Planning Area aside from translocation (Hendricks et al. 2020). Successful translocation may help offset effects of habitat fragmentation, restore some level of geneflow between sub-populations, and increase genetic diversity within sub-populations (Hendricks et al. 2020).

Edge effects are also threats to remaining San Bernardino kangaroo rat populations. These effects include increased nighttime illumination, habitat degradation due to nonnative invasive plant cover (particularly nonnative grasses), disturbances from off-highway vehicles, and effects associated with trash dumping. The effects of nighttime lighting are of particular concern for nocturnal animals, including this species, because rodents alter foraging behaviors in response to the full moon, and artificial lights can result in the same responses (Wang and Shier 2017). Increased nighttime lighting can also result in increased predation (Beier 2006).

Other Relevant Information

The Planning Area supports the majority of the current known range of this species. The most stable populations remaining are present in Lytle Creek, Cajon Wash, and the Santa Ana River. Plunge Creek and City Creek also support moderate populations, although the long-term viability of these areas is likely dependent on the connectedness of suitable habitat to the more robust Santa Ana River populations. Currently, the suitable habitat connection between City Creek and the Santa Ana River is constrained at Alabama Street with a very narrow swath of habitat. Further constraints to movement may occur between 5th Street and I-210, where currently no terraced habitat is available and vegetation is lacking due to frequent scouring events. The suitable habitat connection between City Creek and Plunge Creek is constrained at I-210 and Plunge Creek where only a very narrow swath of habitat is present. The suitable habitat connection between Plunge Creek and the Santa Ana River is likely only slightly constrained by maturing vegetation characteristics and the presence of nonnative grasses.

Chapter 4
Incidental Take Assessment and Impact Analysis

4.1 Introduction and Approach

This chapter addresses the effects of the Covered Activities described in Chapter 2, *Covered Activities,* on Covered Species and examines the potential for the Covered Activities to result in incidental take of Covered Species and loss or degradation of their habitat. To meet regulatory requirements and properly offset (mitigate) effects, the amount of impacts that may result in the incidental take during implementation of an otherwise lawful activity must be discussed and quantified to the extent possible. Under the Federal Endangered Species Act (FESA), *take* is defined as to "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." *Harm* is defined as "an act which actually kills or injures wildlife [and] may include significant habitat modification."

This chapter estimates direct impacts on Covered Species quantitatively and assesses indirect impacts qualitatively. Impacts on critical habitat are also analyzed. Impacts are analyzed in terms of hydrologic effects on aquatic habitat, groundwater, and riparian habitat, and ground-disturbing effects on all habitat types in the Planning Area. Each species will vary regarding if or how each impact type may affect it and have the potential for take. For example, the primary effects on Santa Ana sucker and other aquatic and riparian species are changes to hydrologic conditions that reduce the amount and quality of the aquatic habitats or affect access to groundwater (e.g., changes in flow velocity, water depth, overall reduction in wetted area, or access to groundwater), while the primary effects anticipated on other terrestrial species would result from the direct removal of habitat due to ground-disturbing activities.

The approach to analyzing impacts is programmatic due to the geographic scope, range of Covered Activities, and duration of the permit term. Therefore, the acres of impacts presented in this chapter represent the maximum impact that will be allowable under the Plan and associated incidental take permit. All impact estimates are conservative and will function as a maximum amount of incidental take not to be exceeded by Covered Activities without a Habitat Conservation Plan (HCP) amendment. Actual impacts will be monitored, tracked, and reported throughout HCP implementation to ensure that impacts do not exceed the maximum established by this analysis and in the incidental take permits. As further described in Chapter 6, *Plan Implementation*, incidental take is calculated as a sum total, by species, for all the HCP Covered Activities but may be re-allocated among participating entities provided all incidental take remains within the stated limits.

The approach to the incidental take assessment and impact analysis for Covered Species is to (1) quantify the amount of suitable habitat (based on species distribution modeling) for each species in the Planning Area (Chapter 3, *Planning Area and Existing Environment*), (2) determine the reduction in quantity and/or quality of that modeled suitable habitat to result from Covered Activities (i.e., impact analysis), and then (3) assess the potential effect of that impact analysis on the species. This analysis forms the basis for determining appropriate conservation actions needed to offset these impacts. The net effect of the estimated impacts and conservation actions to offset the impacts on Covered Species are described in Chapter 5, *Conservation Strategy*.

The locations of the Covered Activities relative to the natural habitats where Covered Species are expected to occur are shown in Chapter 2, Figures 2-1, 2-4, 2-14, and 2-21. The potential distribution of modeled suitable habitat for each of the Covered Species is shown in Chapter 3, Figures 3-26 through 3-61.

The methods and results for estimating the impacts from Covered Activities and the potential associated incidental take of Covered Species to be permitted under the HCP are included in the sections that follow. These estimates are as accurate as possible using the methods described below and given the available details of the Covered Activities at the time of HCP preparation. The impact and associated incidental take analyses represent maximum potential estimates for each species. Further, calculations of permanent impacts include modeled habitat that occurs within existing groundwater recharge basins and flood control basins that are subject to regular operations and maintenance (O&M) activities. Though modeled habitat occurs in these facilities, because of the frequency of O&M activities, the habitat value and use of these locations by Covered Species is likely limited. Given the low biological value of these existing facilities, excluding impacts from within existing groundwater recharge basins and flood control basins provides for a more biologically meaningful understanding of Covered Activity impacts on Covered Species modeled habitat. Tables that present impacts on vegetation communities and Covered Species modeled habitat in this chapter identify the total calculated impacts, as well as the portion of those impacts that occur within existing basins (presented in parentheses).

With the implementation of avoidance and minimization measures and more precise project-specific design, impacts on Covered Species are expected to be lower than estimated in most cases. In no case will the amount of accrued impacts, in the form of incidental take, of any species be allowed to exceed the amount of allocated incidental take estimate established by this HCP for that species. Furthermore, these methods to estimate incidental take are based on habitat suitability models and the potential impacts on *modeled habitat*, not occupied habitat. For most species, the area of suitable habitat predicted by the models is much larger than the area of occupied habitat at any given moment in time, such that the actual impacts on occupied habitat (I.e., impacts that could result in incidental take) will be substantially less. For Santa Ana sucker and arroyo chub only known-occupied habitats were considered in their habitat suitability models. Depth and/or flow velocity were used to constrain the models so that only the preferred habitats were represented. For all Covered Species modeled habitat, suitable or preferred, is used as a surrogate for incidental take estimates. Actual (realized) impacts on individuals or to habitats will be further minimized through the implementation of general and species-specific avoidance and minimization measures (Section 5.11, *Measures to Avoid and Minimize Effects*).

4.2 Summary of Effects on Species

Estimated impacts on Covered Species modeled habitat are summarized in Table 4-1. The actual impacts on Covered Species and their habitats are expected to be substantially less than the estimates provided in this effects analysis for the reasons stated above. The mitigation provided by the conservation actions (Chapter 5) will provide significant net benefits to Covered Species through the addition of permanent protections, habitat restoration, monitoring, and management. The mitigation acreage identified in Table 4-1 represents the minimum acreage that will be incorporated into the HCP Preserve System and is composed of lands already acquired, or those owned by Permittees, determined to have high potential for inclusion in the HCP. The focus of this chapter is to document the potential impacts of Covered Activities on Covered Species. Potential impacts should be considered in the context of the net benefit to species resulting from implementation of the conservation strategy. Therefore, the effects analysis will cross-reference those net benefits described in detail in Chapter 5 regularly throughout the analysis.

Table 4-1. Summary of Estimated Impacts and Expected Outcome of Actual Incidental Take

Common Name	Estimated Total Impacts in Acres on Modeled Habitat[1]	Mitigation* (acres of Modeled Habitat in the HCP Preserve System)	Expected Outcome of Actual Incidental Take of Species
Covered Species			
Slender-horned spineflower	425[2] (31)	**532**	Pre-project surveys, refinements to project siting, and strict avoidance and minimization measures will ensure impacts on individual plants will be near zero. Modeled suitable habitat will be monitored and adaptively managed to enhance habitat conditions for this species and will be protected in perpetuity.
Santa Ana River woolly-star	464 (32)	**433***	Pre-project surveys, refinements to project siting, and strict avoidance and minimization measures will ensure impacts on individual plants will be near zero. Modeled suitable habitat will be monitored and adaptively managed to enhance habitat conditions and achieve success criteria for this species and will be protected in perpetuity.
Santa Ana sucker	1.25 [preferred] [75 acres of designated critical habitat]	**5.1** [1.5 acres will be enhanced in mainstem Santa Ana River and 3.6 acres of tributary restoration within 3.9 miles of restored aquatic stream habitat] [161 acres of designated critical habitat] Santa Ana sucker will also be translocated to a minimum of three montane streams and actively managed	Pre-project surveys and the implementation of avoidance and minimization measures will reduce potential for incidental take. A majority of Santa Ana River recovery actions in the U.S. Fish and Wildlife Service (USFWS) Recovery Plan for this species will be initiated within the HCP Preserve System through implementation of the HCP Conservation Strategy. Habitat restoration will increase the amount and quality of foraging, refugia, and spawning habitat in tributaries to the mainstem Santa Ana River. Tributary restoration sites will be supplied with a dedicated, permanent water supply. Prior to any base flow reductions at least two mainstem tributary restoration projects would need to be functional or 1 acre of mainstem river enhancement would need to occur. A minimum of two translocations of Santa Ana sucker into portions of its historic range within the Santa Ana River watershed will occur prior to reduction in discharge to the Santa Ana River associated with WD.1. Santa Ana sucker

Common Name	Estimated Total Impacts in Acres on Modeled Habitat[1]	Mitigation* (acres of Modeled Habitat in the HCP Preserve System)	Expected Outcome of Actual Incidental Take of Species
			distribution will be expanded via successive translocations to mountain tributaries, and the HCP will successfully maintain Santa Ana sucker populations in at least three mountain tributaries. Suitable habitat will be monitored and adaptively managed to enhance habitat conditions and achieve success criteria for this species and will be protected in perpetuity. Though suitable habitat in the mainstem of the Santa Ana River will be reduced as a result of implementation of Covered Activities, restoration of tributaries coupled with translocation of fish to upper watershed streams within the HCP Preserve System, and long-term adaptive management of these areas to achieve success criteria, will go beyond offsetting impacts, and will achieve major contributions to the recovery of the Santa Ana Sucker.
Arroyo chub	2.4	**5.1** [1.5 acres will be enhanced in mainstem Santa Ana River and 3.6 acres of tributary restoration within 3.9 miles of restored aquatic stream habitat]	Pre-project surveys and the implementation of avoidance and minimization measures will reduce potential for incidental take. Habitat restoration will increase the amount and quality of available habitat in tributaries to the mainstem Santa Ana River. Tributary restoration will commence prior to implementation of Covered Activities, and the tributaries will be supplied with a dedicated, permanent water supply. Suitable habitat in all occupied reaches of the Santa Ana River and tributaries will be monitored and adaptively managed to enhance habitat conditions and achieve success criteria for this species. Tributary restoration sites within the HCP Preserve System will be adaptively managed and protected in perpetuity.
Santa Ana speckled dace	0.01	**0.0**	Pre-project surveys and strict avoidance and minimization measures will ensure impacts on this species will be near zero. Active habitat management (e.g., nonnative species management) within occupied

Common Name	Estimated Total Impacts in Acres on Modeled Habitat[1]	Mitigation* (acres of Modeled Habitat in the HCP Preserve System)	Expected Outcome of Actual Incidental Take of Species
			reaches where they co-occur with Santa Ana sucker translocation streams will benefit this species.
Mountain yellow-legged frog	195 (157) [including 6 acres of aquatic habitat] [0 acre of designated critical habitat]	**264**	3% of the impacted habitat is aquatic habitat. The remaining 189 acres are refugia, foraging, and dispersal upland habitats. Pre-project surveys and strict avoidance and minimization measures will ensure impacts on this species will be near zero. The HCP will provide financial and logistical support to ongoing research and population re-establishment efforts within the Planning Area to further conservation actions for the species. Active habitat management (e.g., nonnative species management) within occupied reaches where they co-occur with Santa Ana sucker translocation streams will benefit this species.
Western spadefoot	816 (304)	**588**	Pre-project surveys and avoidance and minimization measures will ensure impacts on this species will be substantially lower than the estimated impact on modeled habitat. Suitable habitat within the HCP Preserve System will be monitored and adaptively managed to enhance habitat conditions for this species and will be protected in perpetuity.
California glossy snake	975 (145)	**807**	Pre-project surveys and avoidance and minimization measures will ensure impacts on this species will be substantially lower than the estimated impact on modeled habitat. Suitable habitat within the HCP Preserve System will be monitored and managed to enhance habitat conditions for this species and will be protected in perpetuity.
South coast garter snake	58	**169**	Pre-project surveys and avoidance and minimization measures will ensure impacts on this species will be substantially lower than the estimated impact on modeled habitat. Suitable habitat within the HCP Preserve System will be monitored and adaptively managed to enhance habitat conditions for this species and will be protected in perpetuity.

Common Name	Estimated Total Impacts in Acres on Modeled Habitat[1]	Mitigation* (acres of Modeled Habitat in the HCP Preserve System)	Expected Outcome of Actual Incidental Take of Species
Southwestern pond turtle	78 [including 6 acres of aquatic habitat]	**309**	Pre-project surveys and avoidance and minimization measures will ensure impacts on this species is substantially lower than the estimated impact on modeled habitat. Suitable habitat within the HCP Preserve System will be monitored and adaptively managed to enhance habitat conditions for this species and will be protected in perpetuity.
Tricolored blackbird	437 (58) [including 66 acres of unoccupied but suitable colony habitat and 371 acres of foraging habitat]	**122** [39 acres of wetland habitat and 208 acres of riparian habitat will be restored to benefit the species]	Pre-project surveys and avoidance and minimization measures will ensure no occupied colonies are disturbed. Approximately 39 acres of wetland habitat and 208 acres of riparian habitat will be restored to benefit the species. Suitable habitat within the HCP Preserve System will be monitored and managed to enhance habitat conditions for this species and will be protected in perpetuity.
Burrowing owl	979 (182)	**595**	Pre-project surveys and avoidance and minimization measures will reduce the potential for occupied burrows to be disturbed. Suitable habitat within the HCP Preserve System will be monitored and managed to enhance habitat conditions for this species and will be protected in perpetuity.
Cactus wren	885 (186)	**681**	Pre-project surveys and avoidance and minimization measures will ensure active nests are not disturbed. Suitable habitat within the HCP Preserve System will be monitored and adaptively managed to enhance habitat conditions for this species and will be protected in perpetuity.
Yellow-breasted chat	171 (69)	**242**	Pre-project surveys and avoidance and minimization measures will ensure active nests are not disturbed. Suitable habitat within the HCP Preserve System will be monitored and adaptively managed to enhance habitat conditions for this species and will be protected in perpetuity.

Common Name	Estimated Total Impacts in Acres on Modeled Habitat[1]	Mitigation* (acres of Modeled Habitat in the HCP Preserve System)	Expected Outcome of Actual Incidental Take of Species
Western yellow-billed cuckoo	18	**118**	Pre-project surveys and avoidance and minimization measures will ensure active nests and occupied habitat are not disturbed. Suitable habitat within the HCP Preserve System will be monitored and adaptively managed to enhance habitat conditions for this species and will be protected in perpetuity.
Southwestern willow flycatcher	171 (69) [109 acres of designated critical habitat]	**242** [9 acres of designated critical habitat]	Pre-project surveys and avoidance and minimization measures will ensure active nests and occupied habitat are not disturbed. Suitable habitat within the HCP Preserve System will be monitored and adaptively managed to enhance habitat conditions for this species and will be protected in perpetuity.
Coastal California gnatcatcher	516 (137) [6 acres of designated critical habitat]	**498** [0 acre of designated critical habitat] [509 acres of alluvial fan sage scrub will be enhanced and restored]	Pre-project surveys and avoidance and minimization measures will ensure active nests are not disturbed. Suitable habitat within the HCP Preserve System will be monitored and adaptively managed to enhance habitat conditions for this species and will be protected in perpetuity. A total of 509 acres of sage scrub habitat will be enhanced and restored.
Least Bell's vireo	171 (69) [58 acres of designated critical habitat]	**242** [128 acres of designated critical habitat]	Pre-project surveys and avoidance and minimization measures will ensure active nests are not disturbed. Suitable habitat within the HCP Preserve System will be monitored and adaptively managed to enhance habitat conditions for this species and will be protected in perpetuity.
Los Angeles pocket mouse	801 (182)	**625** [509 acres of alluvial fan sage scrub will be enhanced and restored]	Pre-project surveys, refinements to project siting, and avoidance and minimization measures will ensure impacts are reduced to the maximum extent practicable. Suitable habitat within the HCP Preserve System will be monitored and adaptively managed to enhance habitat conditions for this species and will be protected in perpetuity. A total of 509 acres of alluvial fan sage scrub habitat will be enhanced and restored.

Common Name	Estimated Total Impacts in Acres on Modeled Habitat[1]	Mitigation* (acres of Modeled Habitat in the HCP Preserve System)	Expected Outcome of Actual Incidental Take of Species
San Bernardino kangaroo rat	754 (377) [196 acres of refugia habitat (119)] [3] [776 acres of areas assumed to be occupied by SBKR (58)] [4] [766 acres of designated critical habitat (109)]	**586*** [509 acres of alluvial fan sage scrub will be enhanced and restored] [305 acres of refugia habitat] [3] [458 acres of areas assumed to be occupied by SBKR] [4] [685 acres of designated critical habitat]	Pre-project surveys, refinements to project siting, and avoidance and minimization measures will be implemented to ensure that impacts on individuals and occupied habitat is reduced to the greatest extent practicable. These measures include habitat assessments, exclusionary fencing, trapping surveys, relocation, topsoil sequestration, and timing and night-lighting limitations. Suitable habitat within the HCP Preserve System will be monitored and adaptively managed to enhance habitat conditions and achieve success criteria for this species and will be protected in perpetuity. A total of 509 acres of alluvial fan sage scrub habitat will be enhanced and restored to be suitable for this species. A minimum of 67 acres of SBKR occupied habitat restoration and/or rehabilitation, and preservation will occur ahead of any impacts on occupied habitat.
Fully Avoided Species [1]			
Delhi Sands flower-loving fly	103[2] (84) [no impact on occupied habitat]		Strict avoidance measures will ensure full avoidance of this species.
Arroyo toad	125[2] (110) [3 acres of designated critical habitat] [no impact on occupied habitat]		Strict avoidance measures will ensure full avoidance of this species.

*Mitigation acreages represent the *minimum* that will be incorporated into the HCP Preserve System, and consists of lands already acquired, or those owned by Permittees determined to have high potential for inclusion in the HCP. Additional mitigation lands will need to be acquired for Santa Ana River woolly-star and San Bernardino kangaroo rat (refer to individual species accounts later in this chapter).

[1] Impact acreages in parentheses are on existing water recharge/flood control basins subject to regular O&M activities and are a subset of total impacts. For example, for San Bernardino kangaroo rat, of the 754 acres of total impacts on modeled habitat, 377 acres occur within existing basins. Consequently, impacts outside of existing basins are: 754 – 377 = 377 acres.

[2] Implementation of avoidance measures as described in Chapter 5 would prevent impacts on these species.
[3] San Bernardino kangaroo rat refugia habitat is composed of modeled habitat that occurs outside of the 100-year floodplain.
[4] "Assumed Occupied" is not a modeled dataset; it is a separate data layer that was estimated to indicate all areas that are assumed to be currently occupied by San Bernardino kangaroo rat (SBKR). 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.

4.3 Effects Analysis Methods

Several methods were used to estimate the effects on species and their habitats from Covered Activities. Effects from ground-disturbing actions of Covered Activities were evaluated in terms of impacts on species habitat based on species habitat suitability models (including temporary and permanent impacts). Potential hydrologic effects from Covered Activities were estimated from the HCP Hydrology Model.[1] Potential hydrologic modifications with Covered Activities in place were estimated in terms of the potential effect on daily instream flow during wet and dry seasons, the ability to transport sediment, the amount of aquatic habitat (measured as wetted area), and the depth to groundwater that could potentially affect the ability of an area to continue to support wetland and riparian vegetation.

Effects on the aquatic habitat for Santa Ana sucker were evaluated in terms of reduction of suitable habitat, based on a detailed hydrologic model that integrated water depth, velocity, and effects of reduced flow on the availability of suitable riverbed substrate needed for foraging and breeding. Effects on aquatic habitat for arroyo chub were also evaluated in terms of reduction of suitable habitat, based on the hydrologic model and water depth. Effects on other aquatic species were evaluated in terms of the potential total amount of aquatic habitat as measured by wetted surface area. The hydrologic effects were evaluated for all Covered Activities together, which represents the maximum potential effect if and when all Covered Activities with hydrologic changes are implemented. Each of these methods is described below.

4.3.1 Methods for Effects on Mean Daily Streamflow Hydrology

As described in Section 3.6.4, *HCP Existing Condition Hydrologic Period*, mean daily stream flow was calculated as a statistical probability of flow known as an exceedance flow. The mean daily stream flow was calculated at each model node by modeling the modified hydrologic effect of all Covered Activities together. The HCP hydrology model used the same hydrologic period as was used for the existing conditions hydrology model results in order to quantify the potential net hydrologic effect of the Covered Activities. Appendix C, *Monthly and Annual Flows for Exceedance Probabilities at Existing Conditions and with Covered Activities,* lists the 0.95 (i.e., low flow conditions), 0.75, 0.5, 0.25, and 0.05 (i.e., high flow conditions) exceedance probabilities on a monthly and annual basis for all model nodes shown on Figure 3-11 in Chapter 3. It also lists the mean monthly and annual flows. To spatially summarize the existing hydrology for the drainages in the Planning Area, Figures 3-13 and 3-14 show the mean September and March flows, respectively (representing the driest and wettest months of the year, on average).

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[1] The HCP Hydrology Model was developed using 2015 as the baseline year, which represents the approximate year of the lowest recycled baseflow discharge from the wastewater treatment plants (WWTPs) that discharge to the upper Santa Ana River, and the mid-point of an extended drought. The HCP Hydrology Model and associated effects analyses were developed prior to the State Water Resources Control Board (SWRCB) Division of Water Rights' authorization of the City of San Bernardino's Wastewater Change Petition WW0059 on June 10, 2019. WW0059 requires a minimum discharge requirement of 28.6 cfs (18.5 million gallons per day [mgd]) between June 1 and October 15 annually (also stipulated in the City of San Bernardino's settlement agreements with the City of Riverside and the Center for Biological Diversity), and the associated Wastewater Petition Order WW0059 (Wastewater Petition Orders are available on the SWRCB website).

Potential effects on mean daily streamflow with Covered Activities in place are based on predictive modeling, and consequently represent our best estimate of potential effects. Actual effects on streamflow hydrology will be monitored and adaptively managed to ensure the potential effects estimated in the HCP Effects Analysis are not exceeded (see Section 5.12, *Comprehensive Adaptive Management and Monitoring Program*).

Results of the mean daily streamflow effects analysis are provided in Section 4.4.1, *Potential Effects on Monthly Average Daily Streamflow Hydrology,* below.

4.3.2 Methods for Effects on Hydrologic Sediment Transport

The focus of the hydrologic sediment transport effects analysis was on the mainstem Santa Ana River, extending from near Seven Oaks Dam downstream to near Prado Wetlands, and major tributaries from Lytle Creek and farther upstream. Sediment transport analysis was not performed on tributaries downstream of the Lytle Creek confluence with the Santa Ana River because they are (1) not significant sources of sediment compared to the upper tributaries, (2) mostly concrete conveyance channels devoid of natural geomorphic processes, and (3) not designated as Santa Ana sucker critical habitat for sediment sources (Wright and Minear 2019). Sediment transport analysis in the lower watershed downstream of Lytle Creek is focused on evaluation of the sediment transport capacity of the Santa Ana River, which includes potential changes in its ability to transport sediment supplied by the lower tributaries.

Bedload transport analysis was performed at 11 stream reaches on the Santa Ana River and tributaries using 2D hydraulic modeling and field-measured bed sediment particle size analysis. The average 2D model reach over which sediment transport was evaluated is 2,280 feet in stream length and several acres in flow area. Sediment transport capacity was calculated using a sediment transport capacity equation (see Appendix D, *Santa Ana River High Flow Effects Analysis,* for more details). It is important to note that the sediment transport analysis conducted for the HCP is based on transport capacity, which is the maximum rate that a stream can move sediment based on the energy available for a given flow. The two key inputs in the transport capacity analysis are: (1) the modeled shear stress available at the bed to mobilize sediment and (2) the bed sediment particle sizes based on actual field measurements.

A fractional, or size class, sediment transport analysis was performed in which the individual transport capacity rates of different sediment size classes (e.g., sand, gravel, cobble) are calculated and then summed to obtain the total transport capacity. The transport equation will only predict movement of a size class if the size class is represented in the field sediment sample used in the analysis. For example, the modeled shear stress may be great enough to transport cobble size sediment, but if there is no cobble in the sediment sample, then the equation will not predict transport of cobble material. Because it is a transport capacity analysis, the equation inherently assumes that the supply of sediment coming into the assessment reach is in equilibrium with the calculated rate of movement. The transport capacity analysis does not predict how the bed elevations may change if the transport capacity is greater than the sediment supply (*erosion*) or less than the sediment supply (*deposition*). Likewise, the capacity analysis does not predict changes in bed sediment texture, such as potential winnowing of fine-grained sediment that can lead to armoring of the substrate if the transport capacity is greater than the sediment supply.

The Covered Activities have the potential to decrease the magnitude, frequency, and duration of high-flow flood events in the Santa Ana River and several tributaries, primarily through diversion of a portion of the storm flow into groundwater recharge basins, which can affect hydrologic sediment transport, dependent upon operation of the diversion. Changes in over-bank flooding and sediment transport were characterized to assess the potential for Covered Activities to alter high flows and channel maintenance processes. As described in Section 3.6.4, three different analyses were performed to characterize existing conditions as a point of comparison with the effects of Covered Activities. Each of these analyses were run with the hydrologic changes due to Covered Activities to determine the net effect on the following metrics:

1. **Flow Magnitude for the 1.25-Year Flood Event.** The change in the flow magnitude between the existing conditions and with Covered Activities conditions corresponding to the 1.25-year recurrence was evaluated. As described in Chapter 3, the 1.25-year flood is in the range of events that have been shown to be a key driver of geomorphic processes and vegetation dynamics in braided channel systems. Characterizing the existing conditions and understanding how the Covered Activities would alter the 1.25-year flood event provides insight into the extent to which channel maintenance processes may be altered.
2. **Sediment Transport for the 1.25-Year Flood Event.** Based on the change in the flow magnitude of the 1.25-year flood, sediment transport calculations were performed to assess if the Covered Activity condition would alter existing flow events that translate into altered sediment transport, which is a primary channel maintenance function.
3. **Sediment Transport Over the Entire Hydrograph.** Because fluvial processes occur under a range of discharges, not just the 1.25-year flood, analysis was performed at select locations to understand how changes between existing conditions and Covered Activity hydrologic conditions could cumulatively affect sediment transport for all flows in the hydrograph. Sediment transport rating curves were developed to analyze any potential changes in sediment transport to downstream reaches for every flow under existing conditions and Covered Activity conditions—from the lowest to highest flow over the 25-year hydroperiod.

The sediment transport effects with Covered Activities in place are based on predictive modeling, and consequently represent our best estimate of potential effects. Actual effects on sediment transport will be monitored and adaptively managed to ensure the potential effects estimated in the HCP Effects Analysis are not exceeded (see Section 5.12).

Details on this analysis are included in Appendix D. Results of the hydrologic sediment transport effects analysis are provided in Section 4.4.2, *Potential Effects on Hydrologic Sediment Transport*.

4.3.3 Methods for Effects on Aquatic Species Habitat

Santa Ana Sucker Effects Methods

The effects analysis for Santa Ana sucker focused on quantifying the amount of available preferred habitat during the driest time of year when in-stream habitat is most limited due to increased infiltration and evapotranspiration. As described in Section 3.8.3, *Covered Species Accounts*, the preferred habitat model for Santa Ana sucker identifies the areas where modeled suitable water depth and velocity co-occur with modeled suitable coarse substrates (gravel, cobble, or boulder). These areas have been found to provide habitat where Santa Ana sucker is most often found to occur in the Santa Ana River (Brown and May 2016). The effects of the Covered Activities were quantified with this model by taking the hydrology output from the HCP Hydrology Model run with all Covered Activities in place and modeling the water depth and velocity under this condition. The amount of modeled preferred habitat where the velocity, depth, and substrate are suitable can then be compared with the amount of preferred habitat modeled under existing conditions to estimate the cumulative effect of the Covered Activities associated with water reuse. This is a conservative approach to quantifying the amount of preferred habitat that will be lost with implementation of Covered Activities. Sub-optimal habitats, containing sandy substrates, will continue to be present in much greater abundance than those considered “preferred” in terms of use by adult fish.

Effects on Santa Ana sucker habitat with Covered Activities in place are based on predictive modeling, and consequently represent our best estimate of potential effects. Actual effects on Santa Ana sucker habitat will be monitored and adaptively managed to ensure the potential effects estimated in the HCP Effects Analysis are not exceeded (Section 5.12).

The methods for quantifying preferred habitat and estimating potential effects are described in detail in the Santa Ana sucker species account in Chapter 3 and in Appendix E, *Santa Ana Sucker Habitat Suitability Analysis*, and the results and effects of the Covered Activities are quantified in Section 4.6, *Effects on Covered Species*.

Arroyo Chub Effects Methods

The effects analysis for arroyo chub followed similar methodology to Santa Ana sucker, and focused on quantifying the amount of available preferred habitat during the driest time of year when in-stream habitat is most limited. As described in Section 3.8.3, the modeled preferred habitat for arroyo chub employed one variable: water depth greater than 15 inches. The effects of the Covered Activities were quantified for this model by taking the hydrology output from the HCP Hydrology Model run with all Covered Activities in place and modeling water depth under this condition. The amount of modeled preferred habitat with appropriate depth can then be compared with the amount of preferred habitat modeled under existing conditions to estimate the cumulative effect of the Covered Activities associated with changes in in-stream hydrology. This is a conservative approach to quantifying the amount of preferred habitat that will be lost with implementation of Covered Activities. Additional portions of the stream with depths less than 15 inches will continue to be available and used by arroyo chub, but the focus of this analysis was on those habitats that met the water depth criterion for preferred habitat.

Effects on arroyo chub habitat with Covered Activities in place are based on predictive modeling, and consequently represent our best estimate of potential effects. Actual effects on arroyo chub habitat will be monitored and adaptively managed to ensure the potential effects estimated in the HCP Effects Analysis are not exceeded (Section 5.12).

Other Aquatic Species Effects Methods

In addition to the Santa Ana sucker and arroyo chub there are five other Covered Species (one fish species, two amphibians, and two reptiles, listed below) that use aquatic habitats for all, or a portion of their habitat needs.

Fish: Santa Ana speckled dace

Amphibians: western spadefoot, mountain yellow-legged frog

Reptiles: southwestern pond turtle, south coast garter snake

Potential effects of Covered Activities on wetted area of the stream channel as a measure of aquatic habitat was estimated for each aquatic species, as described in Section 3.6.4. Similar to Santa Ana sucker and arroyo chub, the wetted area effects analysis was focused on the driest time of the year (August through October) when in-stream habitat is most limited. This dry season represents the period when a decrease in wetted surface area has the greatest potential to affect Covered Species that rely on aquatic habitats, and therefore provides the most conservative evaluation of potential effects on aquatic habitat with Covered Activities in place for these species.

As described in Section 3.6.4, the HCP Hydrology Model was used to estimate the water surface area (the wetted area, downstream of Covered Activities in the Santa Ana River and tributaries) under existing conditions and with all Covered Activities in place. The wetted area generated from the HCP Hydrology Model was then overlaid with each aquatic species' modeled suitable habitat to identify stream reaches where the species is expected to occur based on its habitat suitability model. The wetted area was then totaled in these reaches both with and without Covered Activities in place. The net change in wetted area was then calculated to quantify the potential effect of Covered Activities on these aquatic species. As stated above, the wetted area was considered habitat for each species only where it co-occurred (i.e., overlapped) with modeled suitable habitat for that species. Wetted area is only quantified downstream of Covered Activities because the HCP Hydrology Model only applies to streams downstream of Covered Activities. Santa Ana speckled dace is a purely aquatic species; therefore, wetted area is the only modeled habitat used to assess the effects from Covered Activities on speckled dace. The other four species also have habitat in the riparian or adjacent upland habitat areas based on the habitat relationships in their species distribution models (described in Chapter 3), and with which the effects of Covered Activities could also be estimated.

Potential effects on aquatic species wetted area from Covered Activities are based on predictive modeling, and consequently they represent our best estimate of potential effects. Actual effects on aquatic species habitat will be monitored and adaptively managed to ensure the potential effects estimated in the HCP Effects Analysis are not exceeded (Section 5.12).

The methods for determining wetted area from the HCP Hydrology Model are described under *Wetted Area as a Measure of Aquatic Habitat* and *Calculation of the Wetted Area of the Channel* in Section 3.6.4*.* Results of the aquatic species habitat effects analysis are provided in Section 4.4.3, *Potential Effects on Aquatic Species Habitat*.

4.3.4 Methods for Effects of Groundwater Change on Riparian and Wetland Habitats

The methods to assess potential effects on riparian and wetland habitat from changes in groundwater level due to Covered Activities in the areas supporting riparian and wetland habitats are based on modeled data, and are described below. These methods are based on the assumption that once the wetland and riparian plant species are no longer able to access groundwater, they will no longer be able to persist. The point at which an increasing depth to groundwater becomes too deep for a groundwater-dependent ecosystem (GDE) to reliably access the groundwater is called the *extinction depth.* More precisely, extinction depth is the elevation relative to the surface where evapotranspiration ceases. For this analysis, extinction depth is used to determine the depth to groundwater threshold where GDEs can no longer persist, i.e., plants no longer transpire. GDEs are defined for the purpose of this assessment as wetland and riparian land covers mapped within the groundwater basin underlying the Santa Ana River. Additionally, wetland and riparian habitats are discussed as mutually exclusive habitats in this analysis even though the wetlands being discussed are within the overall riparian area. This is done to distinguish aquatic and non-aquatic habitat types and to clarify the potential effect of shifting groundwater on GDE habitat types. Landcover types included in the wetland and riparian habitats are defined in Table 3-13.

The extinction depth was estimated for wetland and riparian habitats in the Planning Area (Aspen 2017) based on evapotranspiration flux curves identified for similar plant functional groups (Maddock et al. 2012). Figure 4-1 indicates the depths to groundwater of evapotranspiration flux curves for wetlands and riparian (shallow-rooted and deep-rooted) GDEs and the associated GDE extinction depths. The extinction depths for wetlands and riparian habitats are shown in Table 4-2. Note that the herbaceous and scrub vegetation of the riparian understory is more shallow-rooted than the deep-rooted larger shrubs and trees of the riparian overstory and therefore has a shallower corresponding extinction depth.

Table 4-2. Expected Groundwater-Dependent Ecosystem Extinction Depths for Wetland and Riparian Habitats in the Planning Area

GDE Plant Functional Group	Extinction Depths (feet) Lower	Extinction Depths (feet) Upper
Wetland	-0.7	2.6[1]
Riparian Understory (shallow-rooted)	-4.92	0[1]
Riparian Overstory (deep-rooted)	-16.4	0[1]

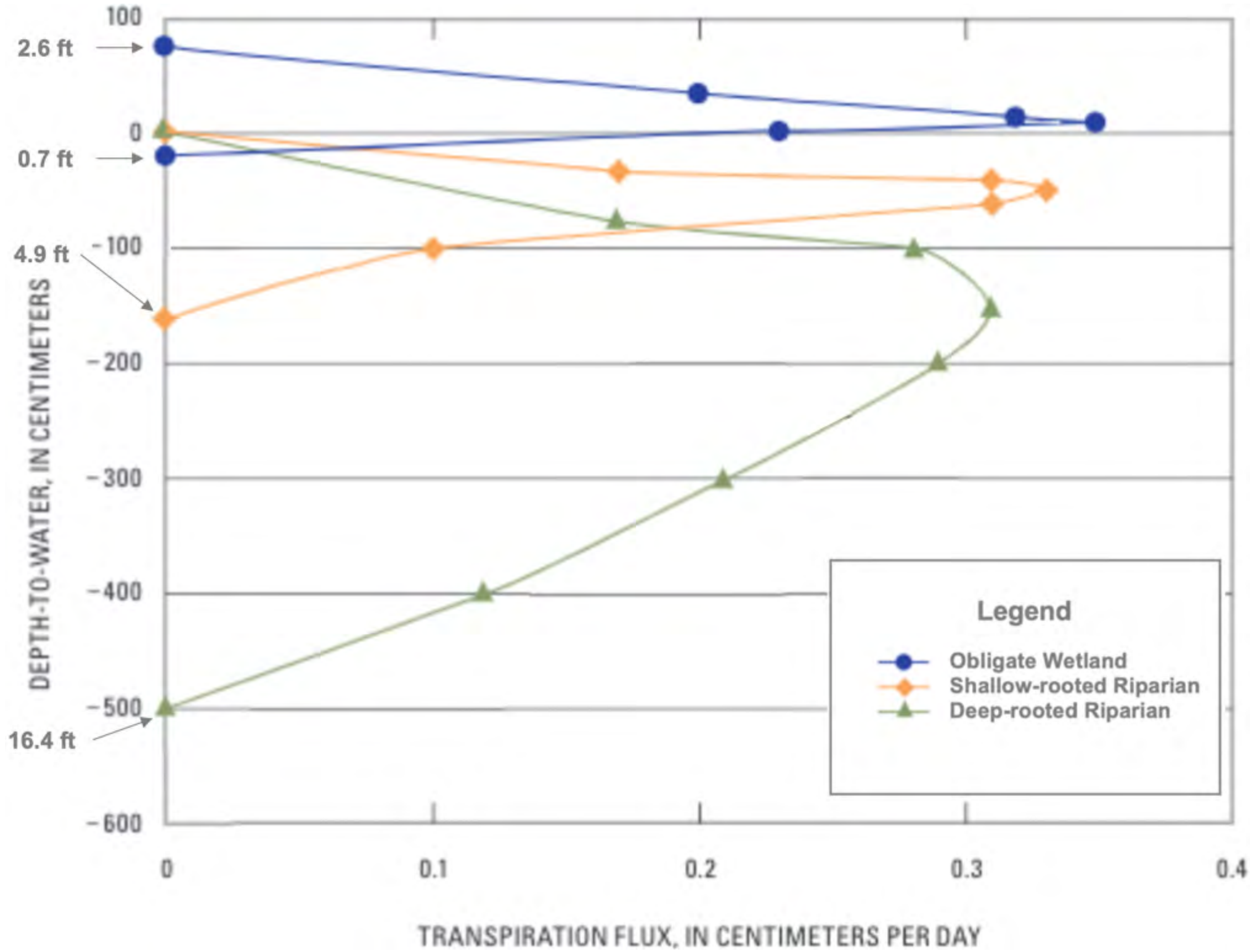
Source: Maddock et al. 2012

[1] surface water

Based on these extinction depths, groundwater contours were created for the existing conditions and the future conditions with Covered Activities for the groundwater depths of 1, 5, and 16 feet (rounded to the nearest 1-foot interval from GDE extinction depths). The groundwater contours were created by Geoscience Support Services, Inc. (Geoscience) using the groundwater flow model created for the Upper Santa Ana River Groundwater Basin (known as the Integrated SAR Model; Geoscience 2019; see Section 3.6.3, *Hydrologic Modeling as the Foundation for Hydrologic Analysis*). The Integrated Santa Ana River Model (Integrated Model) integrates existing groundwater and surface water models and is used to predict the potential effects from proposed Covered Activities on streamflow and groundwater levels across the basin. The model assessed the potential hydrologic response of the Upper Santa Ana River Groundwater Basin to the Covered Activities with hydrologic effects, including streamflow diversions, recharge basins (new basins and modifications), effluent reductions, and new discharge locations to determine the effects on wetland and riparian habitat, groundwater levels, and streamflow.

The potential acres of wetland and riparian habitats were estimated in each groundwater depth range (between each extinction depth, i.e., 0–1, 1–5, 5–16, and >16 feet) for existing conditions and with Covered Activities, and then number of acres was determined that crossed from each groundwater depth range for each GDE community type. Potential impacts from Covered Activities on GDE communities are assumed when the groundwater depth shifts into a groundwater depth range that is below the extinction depth for a given GDE community.

The potential effects on GDE presented from these analyses relies on modeled data. Consequently, the results of these analyses represent our best estimate of potential effects. Actual effects on GDE community types will be monitored and adaptively managed to ensure the potential effects estimated in the HCP Effects Analysis are not exceeded. Ongoing monitoring will include the installation of new shallow and deep groundwater wells around the Prado Basin and along the Santa



Modified from Maddock et al., 2012

Figure 4-1
GDE Extinction Thresholds as Determined by Evapotranspiration Flux
Upper Santa Ana River Habitat Conservation Plan

Ana River, and the application of data collected from these new wells (amongst others) to verify the accuracy of the Integrated Model (see Section 3.6.3). If inaccuracies are detected in the Integrated Model around the Prado Basin, a new sub-basin model will be created and incorporated into the Integrated Model to increase model accuracy for this area (Section 5.12). Additional monitoring and ways to ameliorate potential effects are discussed in Section 4.4.4 *Potential Effects on Groundwater-Dependent Ecosystems* and in Chapter 5.

4.3.5 Methods for Effects of Ground-Disturbing Activities

Many of the Covered Activities will result in the direct removal of habitat through ground-disturbing activities (e.g., project construction). The method to calculate ground-disturbing impacts is through an overlay of the project footprint on a map of the biological resources (vegetation map and individual species distribution model maps) so that the acreages of impacts can be calculated for each project and summarized for all Covered Activities. Calculations of impacts from specific projects are included in Appendix F, *Covered Activity Impacts*.

As noted previously, these methods to estimate incidental take for all Covered Species save Santa Ana sucker and arroyo chub are based on habitat suitability models and the potential impacts on *modeled habitat*, not occupied habitat. The distribution of suitable habitat predicted by the models is much larger than the distribution of occupied habitat at any given moment in time, such that the actual impacts on occupied habitat will be substantially less. Actual impacts will be further minimized through refinements to project siting and the implementation of general and species-specific avoidance and minimization measures (Section 5.11).

This impact analysis quantifies both permanent and temporary impacts on species and habitats.

Permanent impacts are impacts that occur when existing habitat is permanently replaced by the construction or implementation of a Covered Activity. Permanent impacts can result from installation of a new facility, new road or pipeline, or O&M activities in areas occurring frequently enough so that habitat is not allowed to reestablish (assumed to be occurring at least annually).

Calculations of permanent impacts include modeled habitat that occurs within existing groundwater recharge basins and flood control basins that have been subject to regular O&M activities. Though modeled habitat may occur in these facilities, because of the frequency of O&M activities, the habitat value and use by Covered Species is likely limited. The acreage of permanent impacts on modeled habitat within existing groundwater recharge basins and flood control basins is identified in each Covered Species' ground-disturbing impact table. Though included in the permanent impact calculations, excluding the impacts within existing groundwater recharge basins and flood control basins provides for a more biologically meaningful understanding of Covered Activity impacts on Covered Species modeled habitat.

Temporary impacts occur when habitat is removed but then allowed to regrow and recover habitat value for Covered Species. Temporary impacts may be one-time impacts, such as impacts associated with a construction staging area, or may be recurring impacts, such as those associated with periodic or infrequent O&M activities like vegetation management for facility maintenance (e.g., access road or basin maintenance). Permanent and temporary impacts are generally estimated by determining the area of overlap between the footprint for these activities and Covered Species habitat (i.e., the estimated area where activities would occur that would disturb soil or vegetation or otherwise affect environmental conditions, destroying or degrading Covered Species habitat).

Additional assumptions are used to estimate the amount and duration (permanent or temporary) of habitat loss based on the project footprint and the type of Covered Activity. Table 4-3 summarizes these assumptions. For example, construction of a new water treatment facility is assumed to result in habitat loss over the entire project footprint (i.e., footprint multiplier of 1.0). For O&M activities multipliers are used to estimate the amount of impacts on occur relative to the entire activity footprint. For example, the impact from access road maintenance is assumed to induce permanent habitat loss at a 0.1 multiplier of the entire road footprint, assuming that habitat would only be impacted on the outer margins of the road where vegetation would be trimmed back, and that road maintenance would occur at least annually so that impacted habitat would not be allowed to recover. Though all existing basins are currently subject to routine O&M activities, for the purposes of impact calculations for this HCP, impacts from recharge basin maintenance are assumed to result across the entire footprint of the basin (footprint multiplier of 1.0) and in permanent loss of habitat because basins would continue to be maintained frequently enough to prevent habitat recovery. Existing pipeline maintenance, with avoidance and minimization measures fully implemented (see Section 5.11), would result in temporary impacts, with the amount of impact assumed to be a 25-foot-wide area for maintenance activities by 10% of the entire pipeline length (or 0.1% of the entire pipeline length per year over the 50-year permit duration).

Table 4-3 summarizes the methods for estimating ground-disturbing temporary and permanent impacts for each type of Covered Activity.

Table 4-3. Ground-Disturbing Impact Estimation Methods and Key Assumptions

Covered Activity Type	New or O&M	Impact Type	Footprint Multiplier
Construction of new facilities, roads, or basins	New	Permanent	1.0
Construction of new pipelines	New	Temporary	1.0
Maintenance of existing pipelines	O&M	Temporary	0.1
Maintenance of existing recharge basins[1]	O&M	Permanent	1.0
Maintenance of existing access roads	O&M	Permanent	0.1
Property and facility maintenance	O&M	Permanent	0.1
Habitat restoration and monitoring[2]	O&M	N/A	N/A

[1] The existing basins are currently subject to regular O&M activities and are maintained on schedules that prevent the reestablishment of natural habitat.

[2] Certain habitat restoration activities covered under the HCP may result in temporary ground disturbance, but the disturbance footprint from these activities is not estimated because it would typically be relatively small in area, temporary in duration, and ultimately result in improved habitat conditions for Covered Species (i.e., self-mitigating).

4.4 Potential Effects on Hydrology and Sediment Transport[2]

The effects of Covered Activities were analyzed in terms of average daily streamflow and hydrologic sediment transport. The average daily streamflows are summarized as monthly averages for the

[2] As noted in Section 4.3, the HCP Hydrology Model was developed using 2015 as the baseline year, which represents the approximate year of the lowest recycled baseflow discharge from the WWTPs that discharge to the

driest (September) and wettest (March) months. Sediment transport was analyzed in terms of movement of sand, gravel, cobble, and boulder for the 1.25-year flood event and over the entire hydrograph. Wet season (March) high flows are primarily responsible for sediment transport of the coarse substrates (gravel, cobble, and boulder), especially during peak flows. Availability of coarse substrate is important because it provides important breeding and foraging habitat for the Santa Ana sucker. Non-peak flows during the wet season continue to move fine sediments to maintain exposure of these coarse sediments. Wet season flows can also provide important aquatic habitat connectivity to facilitate movement and dispersal of covered aquatic species among areas that are otherwise isolated when ephemeral reaches are dry. Dry season (September) flows represent the period when aquatic habitat is most limited and when further reductions in flow can have the strongest effects on aquatic species.

4.4.1 Potential Effects on Monthly Average Daily Streamflow Hydrology

Monthly average daily stream flow was calculated at each model node for the Covered Activities based on the results of the modeled hydrology. Figures 4-2 and 4-3 show the average September and March flows, respectively (representing the driest and wettest months of the year, on average) to spatially summarize the Covered Activities effects on hydrology for the drainages in the Planning Area. Appendix C lists the 95% (i.e. low flow conditions), 75%, 50%, 25%, and 5% (i.e. storm flow conditions) exceedance probabilities on a monthly and annual basis listed for all model nodes under the Covered Activities modeled hydrology and also lists the average monthly and annual flows. The dry weather (September) and wet weather (March) flows with the effects of the Covered Activities are described below as they are shown on Figures 4-2 and 4-3. Figures 4-4 and 4-5 show the net difference (Existing Conditions flows minus Covered Activities flows) for the September dry weather and March wet weather flows, respectively.

The primary predicted potential effects on covered aquatic species are the reduced total area of aquatic habitat, the potential reduced connectivity of aquatic habitat patches during the dry weather months, and the potential reduced sediment transport and connectivity of habitat during wet weather months. The effects of the reduced average daily stream flows on Covered Species are described in Section 4.6. Connectivity within the native fish occupied mainstem of the Santa Ana River and its existing ecologically functional lowland tributary streams will be maintained, enhanced, or established during the dry season upon implementation of Covered Activities.

Dry Weather Flows

Changes in dry weather flows (average September flow) with Covered Activities are shown on Figure 4-4. Upper tributaries show decreases of 3.4 cubic feet per second (cfs) on Mill Creek, 1.1 cfs on City Creek, and 1.1 cfs on Lytle Creek. Modeled decreases of less than 1.0 cfs are predicted on other upper watershed tributaries with Covered Activities, including Plunge Creek, East Twin Creek, Waterman Canyon Creek, Devil Canyon Creek, Cable Creek, and Cajon Wash. The Santa Ana River

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upper Santa Ana River, and the mid-point of an extended drought. The HCP Hydrology Model and associated effects analyses were developed prior to the SWRCB Division of Water Rights' authorization of the City of San Bernardino's Wastewater Change Petition WW0059 on June 10, 2019. WW0059 requires a minimum discharge requirement of 28.6 cfs (18.5 mgd) between June 1 and October 15 annually (also stipulated in the City of San Bernardino's settlement agreements with the City of Riverside and the Center for Biological Diversity) (Wastewater Petition Orders are available on the SWRCB website).

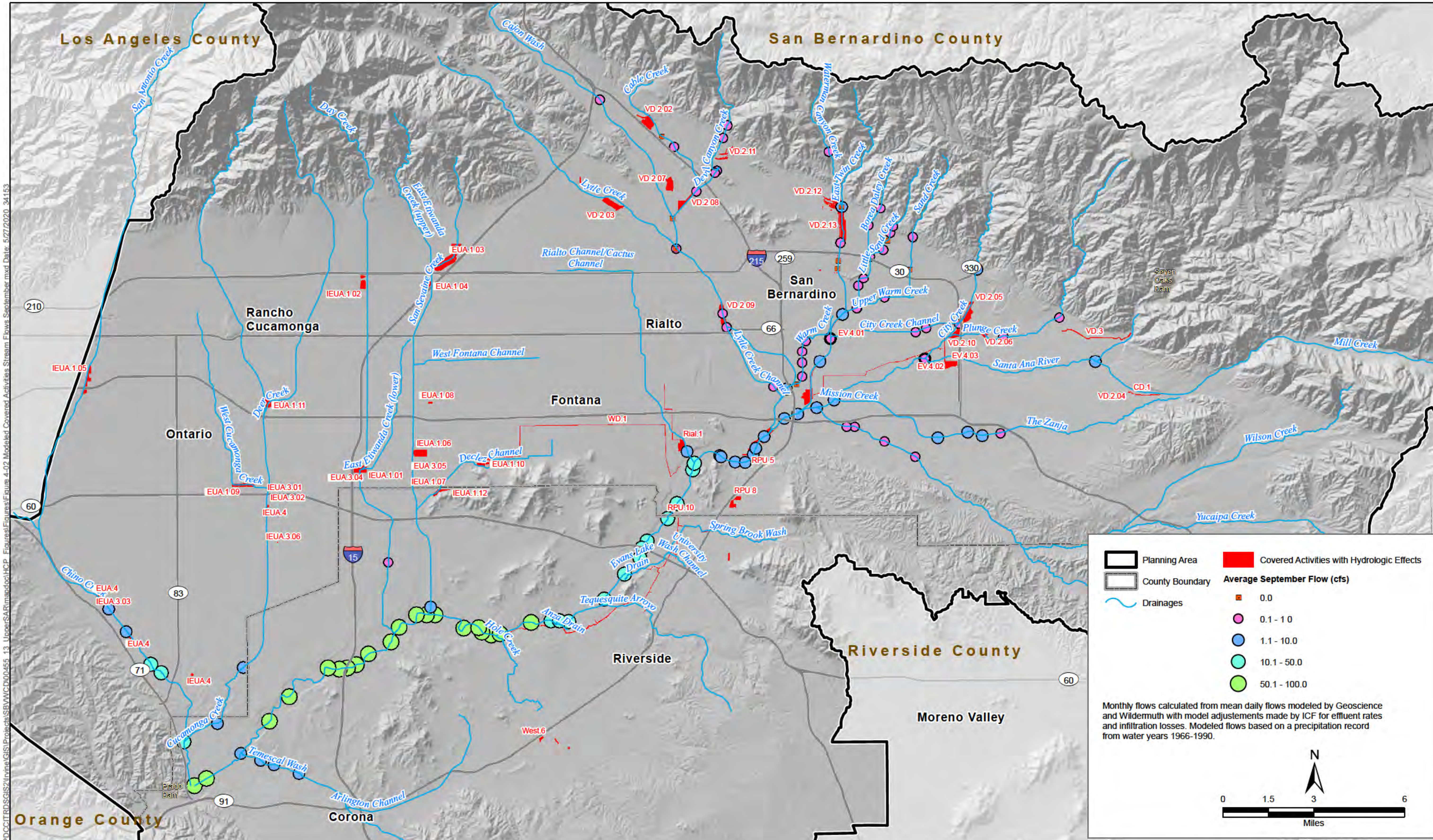
just upstream of the Riverside North Aquifer Storage and Recovery Project (RPU.5) would have a flow reduction of 9% (decreasing from 12.6 cfs down to 11.5 cfs). Downstream of the Riverside North Aquifer Storage and Recovery Project the average September flow in the Santa Ana River would decrease by 63% (from 12.6 cfs down to 4.7 cfs).

Reductions in Rialto Utility Authority's (Rialto) outflow will cause the flow in the Rialto Channel to decrease by 20%, from 10.9 cfs down to 8.7 cfs. When the Rialto outfall reduction is added with the San Bernardino/Colton Rapid Infiltration and Extraction Facility (RIX) outfall reduction, the flow in the Santa Ana River downstream of RIX is reduced by 34%, from 62.1 cfs down to 41.1 cfs. Santa Ana River average September flows are consistently reduced by over 20 cfs from RIX to downstream of the Interstate (I-) 15 crossing. At the Riverside Water Quality Control Plant upstream of Van Buren Boulevard, Covered Activity reductions in effluent from the plant outfall, when combined with the other reductions upstream, contribute to a total reduction in Santa Ana River flow of 36% (from 106.5 cfs down to 68.6 cfs). However, as part of the Santa Ana River Sustainable Parks and Tributaries Water Reuse Project, much of the flow reduction at the plant would be redirected to benefit species and habitat at Santa Ana River tributary restoration sites upstream (Lake Evans, Old Ranch Creek, Anza Creek) and downstream (Hole Creek, Hidden Valley Creek). Inland Empire Utilities Agency (IEUA) Covered Activities reduce San Sevaine Creek's flow by 2.8 cfs and Day Creek by 1.3 cfs, which contributes to a 1.4 cfs flow reduction in the Santa Ana River at the confluence with East Etiwanda Creek. The Santa Ana River downstream of the confluence with Temescal Wash in the Prado Basin has a dry weather flow reduction of 38%, decreasing from 86.7 cfs down to 53.9 cfs. Other IEUA Covered Activities result in dry weather flow reductions of 52% on Cucamonga Creek (from 15.3 cfs down to 7.4 cfs), and 24% on Chino Creek upstream of Cucamonga Creek (from 13.5 cfs down to 10.3 cfs). Where Chino Creek enters the Prado Basin, the Covered Activities result in a 37% flow reduction (from 31.4 cfs down to 19.7 cfs).

Wet Weather Flows

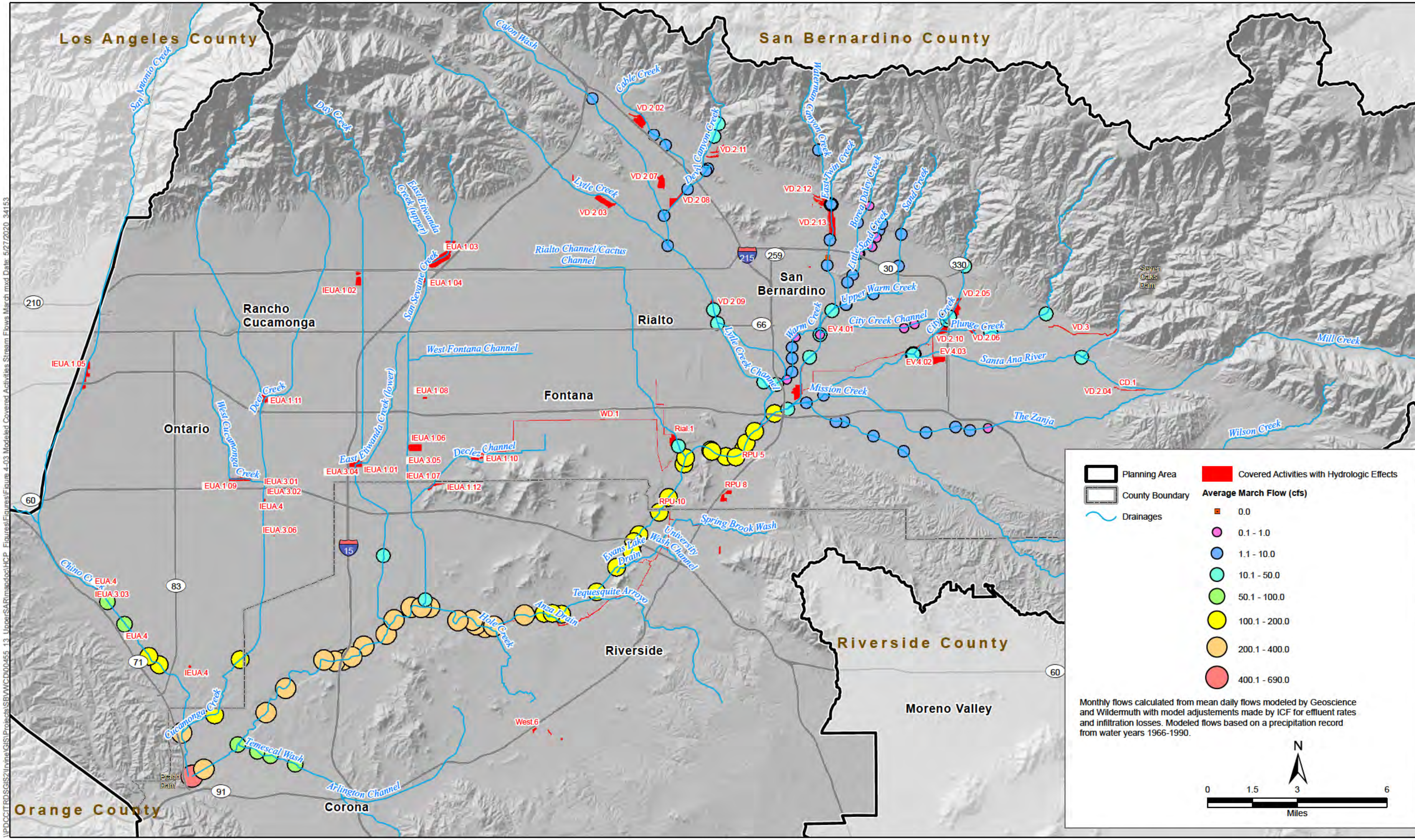
In March, streamflows are typically the highest on average in the Planning Area. Figure 4-5 shows the net decrease in March monthly average daily flows, due to the effects of Covered Activities. All of the following decreases in flow in the upper watershed are the result of stormwater capture projects that divert a portion of the stormflow (usually beginning or end of a storm event) into groundwater recharge basins. An example of how the recharge basins would typically operate is illustrated in the Upper Cable Creek (VD.2.02) hydrograph example shown on Figure 4-6. The example shows the modeled mean daily flows for the baseline condition and with Covered Activity condition for three consecutive years that span intermediate, wet, and dry water-year types. For Intermediate and Dry water year types, Cable Creek flows are low and little flow diversion into the recharge basin is occurring. Nearly all of the flow diversion is occurring in wet water years in which the diversion into the groundwater recharge basin reduces Cable Creek's peak flow. The magnitude of the diversion is related to the basin's storage capacity, its percolation rate, and the amount of time that has transpired between peak flows.

The Enhanced Recharge Project (VD.3) would decrease average March Santa Ana River flow upstream of Mill Creek by 43% (from an average daily mean of 41.2 cfs down to 23.5 cfs). Upper tributaries show decreases of 6.1 cfs on Mill Creek, 16.5 cfs on City Creek, and 16.2 cfs on Lytle Creek. Modeled decreases on other upper watershed tributaries with Covered Activities, include 6.8 cfs on East Twin Creek, 4.6 cfs on Waterman Canyon Creek, 5.9 cfs on Devil Canyon Creek, 10 cfs on Cable Creek, and 6.3 cfs on Cajon Wash. Downstream of the Riverside North Aquifer Storage and Recovery Project the average March flow in the Santa Ana River would decrease by 45% (from 192.4



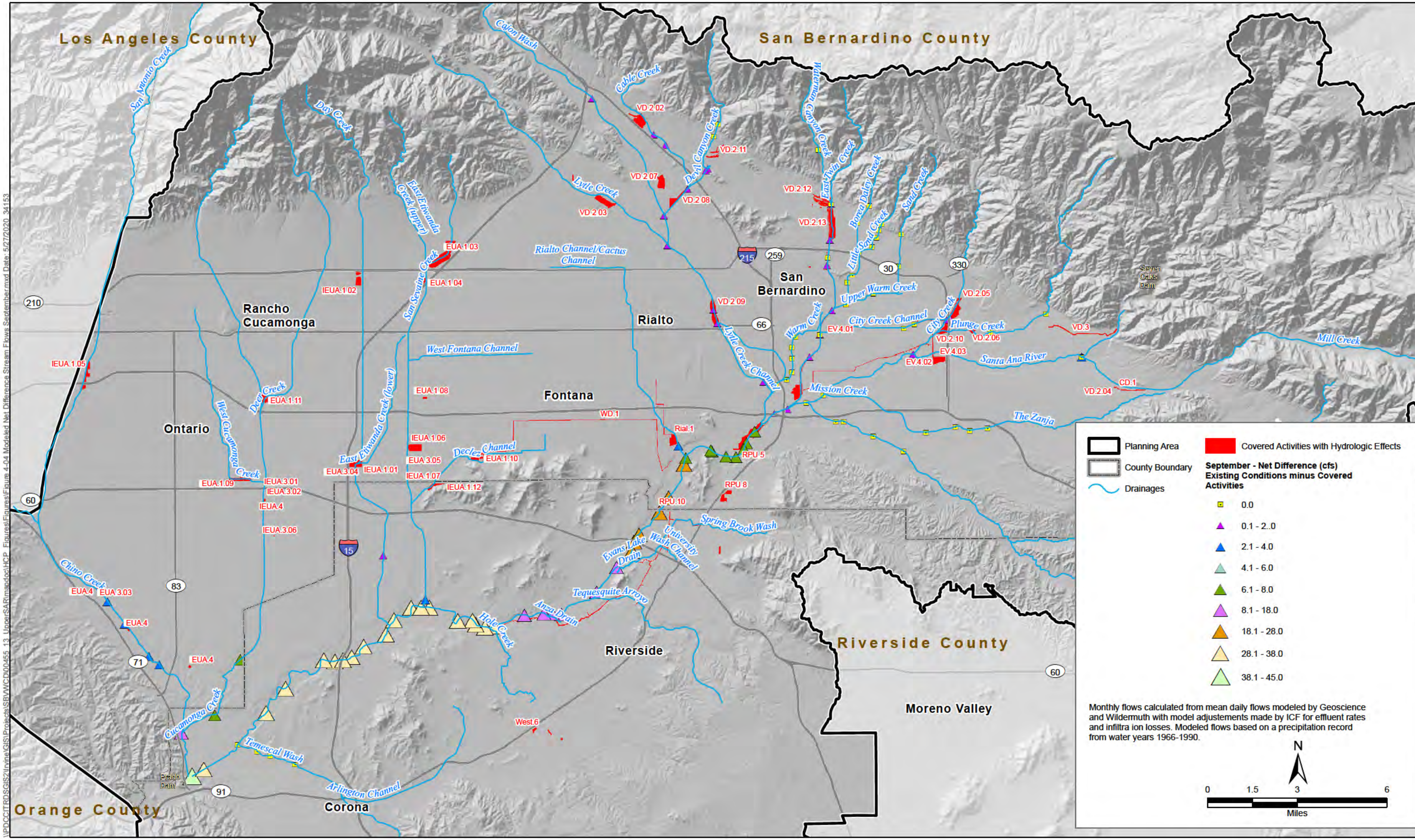
Upper Santa Ana River Habitat Conservation Plan

Figure 4-2
September Monthly Average Daily Flow with Covered Activities (modeled)



Upper Santa Ana River
Habitat Conservation Plan

Figure 4-3
March Monthly Average Daily Flow with Covered Activities (modeled)



Upper Santa Ana River Habitat Conservation Plan

Figure 4-4
Net Difference in Reduction of September Monthly Average Daily Flow with Covered Activities (modeled)

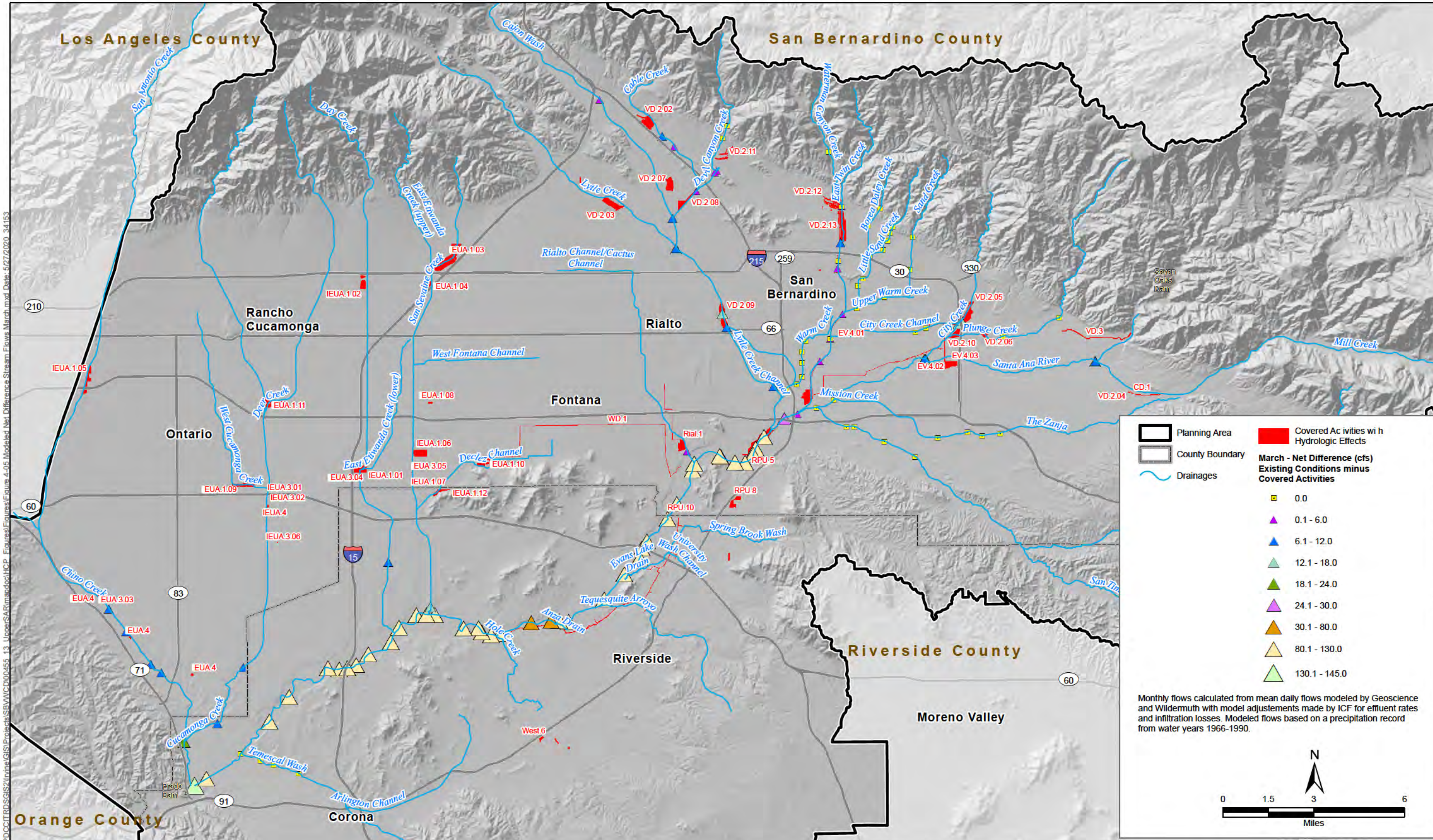


Figure 4-5
Net Difference in Reduction of March Monthly Average Daily Flow with Covered Activities (modeled)

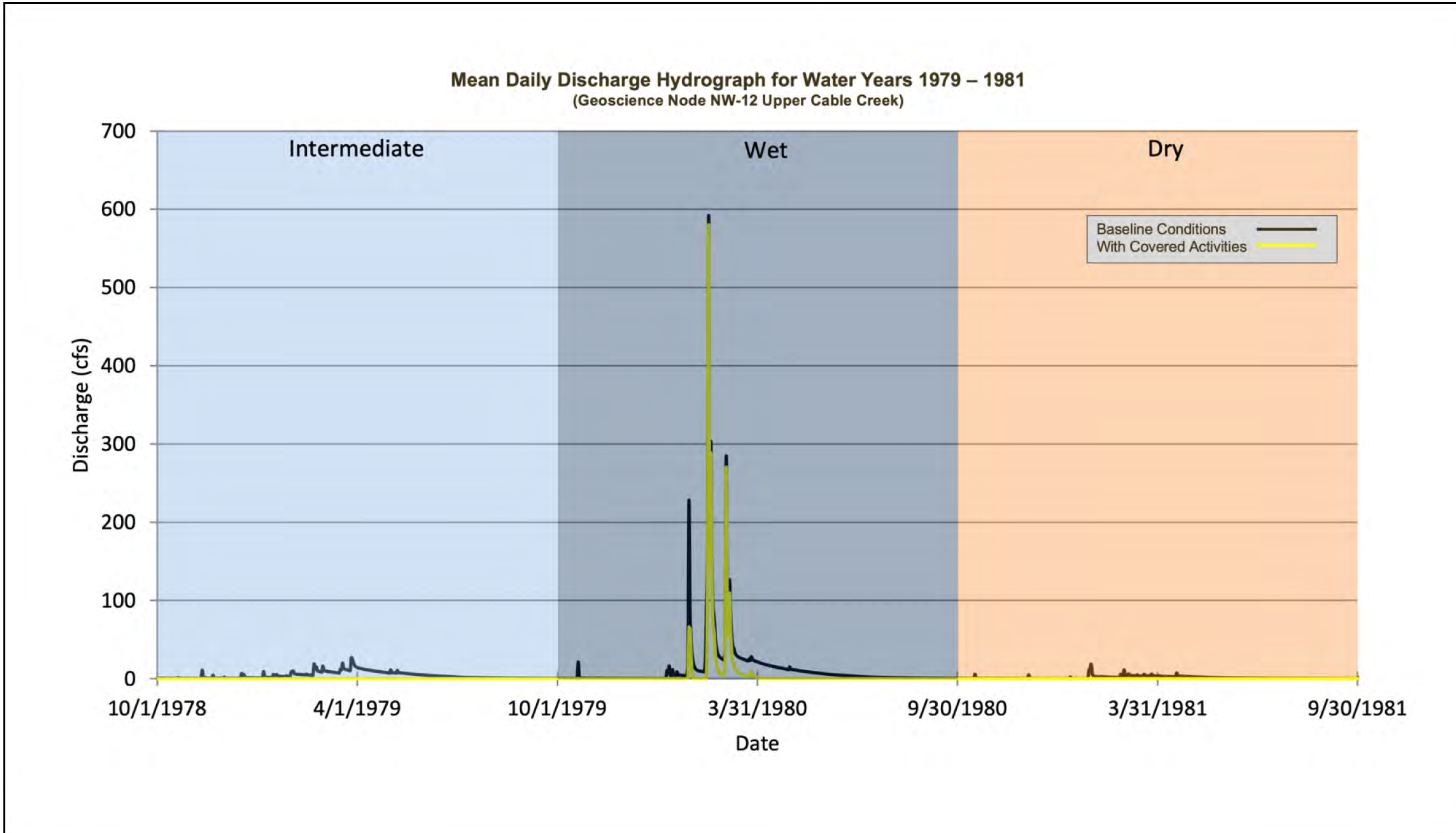


Figure 4-6

Consecutive Intermediate, Wet & Dry Water Year Hydrographs (Example: Upper Cable Creek) cfs down to 105.0 cfs), although due to operations of the facility the peak flow of storm events would likely be allowed to flow past the structure and continue downstream in order to protect infrastructure.

Covered Activity reductions in Rialto and RIX effluent from the plant outfall, when combined with the other reductions upstream, contribute to a total reduction in Santa Ana River flow of 36% (from 266.3 cfs down to 169.6 cfs). IEUA Covered Activities reduce San Sevaine Creek's average March flow by 17.5 cfs and on Day Creek by 6.2 cfs, which, when combined with other Covered Activities upstream on the Santa Ana River and its tributaries, results in a 28% flow reduction in the Santa Ana River at the confluence with East Etiwanda Creek (from 413.6 cfs down to 296.5 cfs). The Santa Ana River downstream of the confluence with Temescal Wash in the Prado Basin has a wet weather flow reduction of 23%, decreasing from 500.7 cfs to 385.0 cfs. Other IEUA Covered Activities result in wet weather flow reductions of 7% on Cucamonga Creek (from 138.3 cfs down to 129.0 cfs), and 8% reduction on Chino Creek upstream of Cucamonga Creek (from 119.3 cfs down to 110.1 cfs). Where Chino Creek enters the Prado Basin, the Covered Activities result in 7% flow reduction (from 265.9 cfs down to 247.1 cfs).

Potential Effects on Covered Species from Changes in Hydrology

The effects of these hydrologic changes on aquatic Covered Species and their modeled suitable habitat are estimated based on change in wetted area representing the aquatic habitat (and using the depth and flow velocity under base flow condition preferred habitat model for Santa Ana sucker, and the depth under base flow condition preferred habitat model for arroyo chub). These effects are quantified in Section 4.6. Because these estimated effects are based on predictive modeling, actual effects on streamflow hydrology will be monitored and adaptively managed to ensure the potential effects on Covered Species estimated in the HCP Effects Analysis are not exceeded (see Section 5.12).

4.4.2 Potential Effects on Hydrologic Sediment Transport

The effects discussion related to potential changes in sediment transport is focused on how altered transport rates may affect channel maintenance processes and how the supply of coarse sediment to the reaches occupied by native fish in the Santa Ana River downstream of the Rialto Channel may change. The changes in flushing of fine sediment (sand and silt) to expose the coarser gravel and cobble substrate needed for native fishes are discussed in the Santa Ana sucker effects analysis in Section 4.6.

Change in the Flow Magnitude of the 1.25-Year Flood

The 1.25-year flood has been shown to be a key driver of geomorphic processes and vegetation dynamics in braided channel systems (Bertoldi et al. 2010; see Appendix D for more discussion). Evaluating how the Covered Activities would alter the 1.25-year flood event provides insight into the extent to which channel maintenance processes may be altered, including the effect on sediment transport. The Covered Activities would decrease the mean daily discharge exceedance flow that corresponds to the 1.25-year flood for all locations (Table 4-4). The decrease is the smallest on Mill Creek (4%) and largest on Lytle Creek upstream of Cajon Wash (77%)[3]. For the Santa Ana River

[3] Note: the project responsible for the greatest decease in mean daily discharge exceedance flow is VD.2.03 Lytle Creek Diversion and Basin. As described in Chapter 2, this project is not proposed for construction until Phase 4 of

locations, the magnitude of the reductions progressively decreases downstream: 34% at Greenspot Road, 18% downstream of Mill Creek, and reaching a low of 7% at the E Street gage location (Node SE-74 upstream of Lytle Creek). Downstream of Lytle Creek, the Santa Ana River 1.25-year flood reductions increase to 19%. This is attributed to the substantial flow reductions created by Covered Activities on the Lytle Creek and Cajon Wash tributaries that affect Santa Ana River flows. At the most downstream Santa Ana River location evaluated (Site 3A, downstream of I-15), the reduction is 15%. Lower City Creek (just upstream of the confluence with Plunge Creek) has a 42% decrease in the 1.25-year flood reduction.

These estimated potential changes in the 1.25-year flood event do not equate to similar proportional changes in suitable habitat. The effects on species habitat are quantified in Section 4.6. Overall, a decrease in flow magnitude for the 1.25-year flood event means that the channel maintenance processes may occur over a smaller area and could result in possible narrowing of the channel and riparian zone. Because these potential effects are estimated from predictive models, channel characteristics and distribution of riparian habitat will be monitored over time as Covered Activities are implemented and adaptively managed to ensure that any effects on Covered Species are within the limits identified in the HCP and incidental take permit (see Section 5.12).

Table 4-4. Predicted Flow Magnitudes with Covered Activities for Model Assessment Reaches for the 1.25-Year Flood Event

2D Hydraulic Model Assessment Reach	Existing Conditions (cfs)	With Covered Activities (cfs)	Relative Decrease in Flow Magnitude (cfs)	Percent Change
Mill Creek Upstream of SAR	84	81	3	4%
Lower City Creek	176	102	74	42%
Lytle Creek Upstream of Cajon Wash	100	23	77	77%
Lytle Creek Downstream of Cajon Wash	159	72	87	55%
Cajon Wash	100	54	46	46%
SAR – Greenspot Road	259	170	89	34%
SAR – Downstream of Mill Creek	401	328	73	18%
SAR – Upstream of East Twin Creek	473	429	44	9%
SAR – USGS Reach 9 Downstream of RIX	3,178	2,580	599	19%
SAR – ESA Middle Reach	2,971	2,421	550	19%
SAR – Site 3A Downstream of I-15	5,948	5,053	896	15%

ESA = Environmental Science Associates; USGS = U.S. Geological Survey

Note: Realized reductions in flow magnitude will not be as great as analyzed at Lytle Creek Upstream of Cajon Wash, Lytle Creek Downstream of Cajon Wash, and Cajon Wash. As described in Chapter 2, VD.2.03 (located in Lytle Creek Upstream of Cajon Wash) has a low probability of being constructed, and VD.2.07 Cajon-Vulcan 1 Diversion and Basin, located in Cajon Wash, will no longer be constructed. Consequently, there will be more water and sediment remaining in the system than is presented in the analyses.

HCP implementation, and has a very low probability of being constructed. The project analyzed assumed the most impactful conceptual design.

Change in Sediment Transport for the 1.25-Year Flood

Results for the modeled sediment transport for the 11 assessment reaches are given in Table 4-5 (refer to Figure 3-32 for the location of each assessment reach). The table lists the change between the existing conditions and with Covered Activities for streamflow of the 1.25-year flood, change in total sediment transport, and change in sediment transport size classes. Graphs showing comparisons for transport of all the sediment size classes analyzed are presented in Appendix D.

Under the existing conditions, Mill Creek has the largest sediment transport capacity rate (15,781 tons/day) and is nearly three times greater than the second-largest tributary site of Lytle Creek, upstream of Cajon Wash (5,295 tons/day). Mill Creek's steep bed slope (4.1%) is the highest of all reaches assessed and a primary factor for why this tributary is the largest sediment source. A 4% reduction in Mill Creek's 1.25-year flood under the Covered Activities condition also results in a 4% reduction in sediment transport capacity. Lytle Creek upstream of Cajon Wash has a 75% reduction in the 1.25-year flood that results in a 72% reduction in a sediment transport capacity[4]. This is the largest reduction of all sites assessed. Other tributary reductions in sediment transport capacity include 59% at Lytle Creek downstream of Cajon Wash, 48% at Cajon Wash[5], and 49% at lower City Creek. For the Santa Ana River assessment sites, the location at Greenspot Road has the largest reduction (41%). Note however, because the Covered Activities responsible for most of the effects on sediment transport are storm flow diversions and recharge basins, and only a portion of the total duration of these flows will be diverted (typically just following the peak flow or the tail of a storm event), sediment transport will still occur to downstream areas. Further, operational procedures for the basins will ensure that sediment is made available for re-entrainment during future storm flow events (i.e., sediment will be actively removed from the basins and placed back into the main channel as described further below). The other Santa Ana River locations have reductions ranging from 12% (Environmental Science Associates [ESA] Middle Reach and upstream of East Twin Creek) up to 24% (SAR U.S. Geological Survey [USGS] Reach 9 Downstream of RIX). The fractional sediment transport changes for sand, gravel, cobble, and boulder are also shown in Table 4-5.

These estimated potential changes in sediment transport for the 1.25-year flood event do not equate to similar proportional changes in suitable habitat. The effects on species habitat are quantified in Section 4.6. Overall, reductions in sediment transport and associated channel maintenance processes are expected based on the analysis of the 1.25-year flood because flow diversions are reducing the amount of flow in the channel, and thus reducing the potential to transport sediment. However, as noted above, the effect on Covered Species can be minimized by the operation procedures implemented at the recharge basins as described in the *Basin Sediment Management Plan*. Sediment that deposits in basins will be excavated and placed back in the channel and made available as sediment supply to be transported downstream during the next flood event. This is described further below under *Net Effect on Channel Morphology and Sediment Composition*. In addition, because the amount of water that can be diverted into the recharge basins is limited, the differences in peak flows between the baseline and under the Covered Activities condition decreases

[4] As described above, the project responsible for the greatest reduction in sediment transport capacity is VD.2.03 Lytle Creek Diversion and Basin, and this project has a very low probability of being constructed.

[5] Realized reductions in sediment transport capacity will not be as great as analyzed at Lytle Creek downstream of Cajon Wash and at Cajon Wash. As described in Chapter 2, VD.2.03 (located in Lytle Creek upstream of Cajon Wash) has a low probability of being constructed, and VD.2.07 Cajon-Vulcan 1 Diversion and Basin, located in Cajon Wash upstream of Lytle Creek, will no longer be constructed, Therefore, there will be more water and sediment remaining in the system than is presented in the analysis.

with increasing flow magnitude. At the 25-year event, for example, the amount of water diverted is a small percentage of the total flow volume, and thus the reductions in sediment transport will be substantially less than compared to the 1.25-year event. Sediment that may no longer be transported at relatively frequent flood events (e.g., 1.25-year flood) will still be available for transport and supporting habitat at less frequent flood events.

Table 4-5. Predicted Sediment Transport Rate Effects of Covered Activities that Correspond to the 1.25-Year Flood Recurrence Interval (tons per day)

2D Hydraulic Model Assessment Reach	Existing Conditions	With Covered Activities	Relative Change in Sediment Transport Rate	Percent Change
Total Bedload Transport				
Mill Creek Upstream of SAR	15,781	15,139	-643	-4%
Lower City Creek	1,100	556	-544	-49%
Lytle Creek Upstream of Cajon Wash	5,295	1,472	-3,823	-72%
Lytle Creek Downstream of Cajon Wash	1,737	721	-1,017	-59%
Cajon Wash	2,167	1,117	-1,049	-48%
SAR – Greenspot Road	8,201	4,872	-3,328	-41%
SAR – Downstream of Mill Creek	5,660	4,136	-1,524	-27%
SAR – Upstream of East Twin Creek	959	846	-113	-12%
SAR – USGS Reach 9 Downstream of RIX	7,626	5,790	-1,836	-24%
SAR – ESA Middle Reach	2,490	2,197	-293	-12%
SAR – Site 3A Downstream of I-15	2,157	1,806	-352	-16%
Sand				
Mill Creek Upstream of SAR	6,407	6,171	-236	-4%
Lower City Creek	904	465	-439	-49%
Lytle Creek Upstream of Cajon Wash	4,224	1,201	-3,023	-72%
Lytle Creek Downstream of Cajon Wash	1,497	633	-864	-58%
Cajon Wash	1,847	966	-881	-48%
SAR – Greenspot Road	1,949	1,196	-753	-39%
SAR – Downstream of Mill Creek	1,482	1,120	-362	-24%
SAR – Upstream of East Twin Creek	877	776	-102	-12%
SAR – USGS Reach 9 Downstream of RIX	6,862	5,226	-1,636	-24%
SAR – ESA Middle Reach	1,641	1,443	-199	-12%
SAR – Site 3A Downstream of I-15	1,179	990	-190	-16%
Gravel				
Mill Creek Upstream of SAR	8,557	8,199	-358	-4%
Lower City Creek	196	92	-105	-53%
Lytle Creek Upstream of Cajon Wash	1,063	269	-794	-75%
Lytle Creek Downstream of Cajon Wash	240	88	-152	-63%
Cajon Wash	319	151	-168	-53%
SAR – Greenspot Road	3,747	2,240	-1,508	-40%
SAR – Downstream of Mill Creek	2,660	1,958	-702	-26%

2D Hydraulic Model Assessment Reach	Existing Conditions	With Covered Activities	Relative Change in Sediment Transport Rate	Percent Change
SAR – Upstream of East Twin Creek	81	70	-11	-14%
SAR – USGS Reach 9 Downstream of RIX	764	564	-200	-26%
SAR – ESA Middle Reach	849	754	-94	-11%
SAR – Site 3A Downstream of I-15	978	816	-162	-17%
Cobble				
Mill Creek Upstream of SAR	815	766	-49	-6.0%
Lower City Creek	0.0	0.0	0.0	0.0%
Lytle Creek Upstream of Cajon Wash	8.1	1.7	-6.4	-79.0%
Lytle Creek Downstream of Cajon Wash	0.4	0.1	0.2	-65.6%
Cajon Wash	0.3	0.1	0.1	-52.2%
SAR – Greenspot Road	2,365	1,361	-1,004	-42.5%
SAR – Downstream of Mill Creek	1,462	1,026	-436	-29.8%
SAR – Upstream of East Twin Creek	0.0	0.0	0.0	0.0%
SAR – USGS Reach 9 Downstream of RIX	0.0	0.0	0.0	0.0%
SAR – ESA Middle Reach	0.0	0.0	0.0	0.0%
SAR – Site 3A Downstream of I-15	0.0	0.0	0.0	0.0%
Boulder				
Mill Creek Upstream of SAR	2.5	2.4	-0.1	-4.1%
Lower City Creek	0.0	0.0	0.0	0.0%
Lytle Creek Upstream of Cajon Wash	0.0	0.0	0.0	0.0%
Lytle Creek Downstream of Cajon Wash	0.0	0.0	0.0	0.0%
Cajon Wash	0.0	0.0	0.0	0.0%
SAR – Greenspot Road	140	76	-64	-45.6%
SAR – Downstream of Mill Creek	56	32	-24	-42.5%
SAR – Upstream of East Twin Creek	0.0	0.0	0.0	0.0%
SAR – USGS Reach 9 Downstream of RIX	0.0	0.0	0.0	0.0%
SAR – ESA Middle Reach	0.0	0.0	0.0	0.0%
SAR – Site 3A Downstream of I-15	0.0	0.0	0.0	0.0%

Note: Realized reductions in sediment transport rate will not be as great as analyzed at Lytle Creek Upstream of Cajon Wash, Lytle Creek Downstream of Cajon Wash, and Cajon Wash. As described in Chapter 2, VD.2.03 (located in Lytle Creek Upstream of Cajon Wash) has a low probability of being constructed, and VD.2.07 Cajon-Vulcan 1 Diversion and Basin, located in Cajon Wash, will no longer be constructed.

Change in the Sediment Transport Over the Entire Hydrograph

The predicted changes in hydrology over the entire 25-year hydrograph (1966–1990 base hydro period) are shown in Table 4-6 as an annual average of the mean daily discharges in terms of acre-feet per year.

Results of the sediment transport analysis over the entire hydrograph are listed in Table 4-7 (refer to Figure 3-17 for the location of each assessment reach identified in Table 4-7). The sediment transport rating curves that were used to determine the values in Table 4-7 are presented in Appendix D.

Mill Creek has the largest total sediment transport capacity of all sites under existing conditions, at 1,184,365 tons/year, and is also the largest supplier of combined gravel and cobble to the Santa Ana River. With Covered Activities, Mill Creek's streamflow would be reduced by 3,105 acre-feet/year (22%), resulting in a sediment transport capacity reduction of 215,357 tons/year (18%). The Santa Ana River at Greenspot Road is the location with the second-largest existing conditions total sediment transport capacity at 280,296 tons/year. With Covered Activities, this location's streamflow would be reduced by 3,357 acre-feet/year (21%), resulting in a sediment transport capacity reduction of 57,404 tons/year (20%).

The distinction that the sediment transport analysis is based on sediment transport capacity (as defined above) is particularly important for the Santa Ana River upstream of Mill Creek. Seven Oaks Dam has effectively cut off sediment supply to the Santa Ana River upstream of Mill Creek, which includes the Greenspot Road location. Over time, the channel bed will coarsen as more of the relatively mobile finer-grained sediment in the channel bed is transported downstream (i.e., sand and gravel size classes) and not replenished with sediment from upstream. This winnowing of the finer-grained sediment will create an increasingly immobile substrate composed of greater percentages of cobble and boulder sediment. Therefore, it is expected that the Santa Ana River sediment transport capacity will continue to decrease beyond the 20% reduction reported herein.

The third-largest existing condition total sediment transport capacity is the SAR USGS Reach 9 Downstream of RIX at 177,376 tons/year. With Covered Activities, this location's streamflow would be reduced by 34,698 acre-feet/year (35%), resulting in a total sediment transport capacity reduction of 63,486 tons/year (36%). Total sediment transport capacity would be reduced by 45% at lower City Creek, 49% at Lytle Creek downstream of Cajon Wash (which is the largest percent reduction of all sites)[6], and 18% at the Santa Ana River upstream of East Twin Creek.

In terms of the fractional size-class components of the total sediment transport capacity, Mill Creek has the largest potential to transport gravel and cobble under existing conditions (Table 4-6). With Covered Activities, gravel transport capacity would be reduced by 17% and cobble by 10%. The Santa Ana River at Greenspot Road has the second largest transport capacity of gravel and cobble, and it would experience reductions of gravel transport capacity by 26% and cobble by 18%. On a percentage basis, Lytle Creek downstream of Cajon Wash would have the largest reduction in gravel transport capacity (48%)[7] and cobble transport capacity (35%).

These estimated potential changes in sediment transport over the entire hydrograph do not equate to similar proportional changes in suitable habitat. The effects on species habitat are quantified in Section 4.6.

[6] As previously described, this reduction is unlikely to be realized as VD.2.03 is unlikely to be constructed, and VD.2.07 will not be constructed.

[7] As previously described, this reduction is unlikely to be realized as VD.2.03 is unlikely to be constructed, and VD.2.07 will not be constructed.

Table 4-6. Predicted Changes in Hydrology Calculated as an Annual Average AFY of Every Mean Daily Discharge over the 25-year 1966–1990 Base Hydro Period

2D Hydraulic Model Assessment Reach	Existing Conditions (AFY)	With Covered Activities (AFY)	Relative Change in Annual Average (AFY)	Percent Change
Mill Creek Upstream of SAR	14,362	11,257	-3,105	-22%
Lower City Creek	8,275	3,585	-4,689	-57%
Lytle Creek Downstream of Cajon Wash	9,471	4,989	-4,482	-47%
SAR – Greenspot Road	15,650	12,292	-3,357	-21%
SAR – Upstream of East Twin Creek	36,313	29,072	-7,241	-20%
SAR – USGS Reach 9 Downstream of RIX	99,675	64,977	-34,698	-35%

Note: Realized changes in hydrology will not be as great as analyzed at Lytle Creek Downstream of Cajon Wash. As described in Chapter 2, VD.2.03 (located in Lytle Creek Upstream of Cajon Wash) has a low probability of being constructed, and VD.2.07 Cajon-Vulcan 1 Diversion and Basin, located in Cajon Wash, will no longer be constructed. Therefore, there will be more water and sediment remaining in the system than is presented in the analyses.

Table 4-7. Predicted Sediment Transport Rate Effects from Changes in Hydrology Calculated for every Mean Daily Discharge over the 25-year 1966–1990 Base Hydro Period (tons/year)

2D Hydraulic Model Assessment Reach	Existing Conditions	With Covered Activities	Relative Change in Sediment Transport Rate	Percent Change
Total Bedload Transport				
Mill Creek Upstream of SAR	1,184,365	968,978	-215,387	-18%
Lower City Creek	22,964	12,683	-10,280	-45%
Lytle Creek Downstream of Cajon Wash	48,938	24,846	-24,092	-49%
SAR – Greenspot Road	280,296	222,892	-57,404	-20%
SAR – Upstream of East Twin Creek	39,531	32,267	-7,264	-18%
SAR – USGS Reach 9 Downstream of RIX	177,376	113,891	-63,486	-36%
Sand				
Mill Creek Upstream of SAR	466,051	370,450	-95,601	-21%
Lower City Creek	18,838	10,124	-8,713	-46%
Lytle Creek Downstream of Cajon Wash	41,864	21,154	-20,711	-49%
SAR – Greenspot Road	63,450	44,720	-18,729	-30%
SAR – Upstream of East Twin Creek	35,847	29,020	-6,827	-19%
SAR – USGS Reach 9 Downstream of RIX	161,323	103,717	-57,606	-36%
Gravel				
Mill Creek Upstream of SAR	641,526	529,443	-112,083	-17%
Lower City Creek	4,126	2,559	-1,567	-38%
Lytle Creek Downstream of Cajon Wash	7,052	3,678	-3,374	-48%
SAR – Greenspot Road	125,237	93,156	-32,081	-26%
SAR – Upstream of East Twin Creek	3,668	3,131	-537	-15%

2D Hydraulic Model Assessment Reach	Existing Conditions	With Covered Activities	Relative Change in Sediment Transport Rate	Percent Change
SAR – USGS Reach 9 Downstream of RIX	16,053	10,174	-5,879	-37%
Cobble				
Mill Creek Upstream of SAR	75,564	67,955	-7,609	-10%
Lower City Creek	0.0	0.0	0.0	0.0%
Lytle Creek Downstream of Cajon Wash	23	15	-8	-35%
SAR – Greenspot Road	84,766	69,372	-15,394	-18%
SAR – Upstream of East Twin Creek	15	16	1	7%
SAR – USGS Reach 9 Downstream of RIX	0.0	0.0	0.0	0.0%
Boulder				
Mill Creek Upstream of SAR	967	912	-55	-6%
Lower City Creek	0.0	0.0	0.0	0.0%
Lytle Creek Downstream of Cajon Wash	0.0	0.0	0.0	0.0%
SAR – Greenspot Road	6,340	5,153	-1,187	-19%
SAR – Upstream of East Twin Creek	0.0	0.0	0.0	0.0%
SAR – USGS Reach 9 Downstream of RIX	0.0	0.0	0.0	0.0%

Note: Realized changes in sediment transport rate will not be as great as analyzed at Lytle Creek Downstream of Cajon Wash. As described in Chapter 2, VD.2.03 (located in Lytle Creek Upstream of Cajon Wash) has a low probability of being constructed, and VD.2.07 Cajon-Vulcan 1 Diversion and Basin, located in Cajon Wash, will no longer be constructed. Therefore, there will be more water and sediment remaining in the system than is presented in the analyses.

Potential Net Effect on Channel Morphology and Sediment Composition

The sediment transport analysis above shows Mill Creek and the Santa Ana River at Greenspot Road have the largest transport capacity for total sediment and coarse sediment to the upper Santa Ana River; however, without the continual supply of total and coarse sediment that is now blocked by Seven Oaks Dam, the available sediment and sediment transport capacity of this reach of the Santa Ana River will diminish over time. Coarse sediment is defined here as gravel (2 to 64 millimeters) and cobble (64 to 256 millimeters). This conclusion is consistent with analysis reported by Wright and Minear (2019) in their work to assess the effects of Seven Oaks Dam on sediment transport, and as reported in a recent study of the effects of Seven Oaks Dam on geomorphic process downstream of the dam (ICF 2019a, 2019b). Mill Creek will continue to have the largest sediment transport capacity with the Covered Activities but at a reduced rate.

Appreciable reductions ranging from 18 to 49% in total sediment transport capacity are predicted from the major sediment source tributaries. This will likely result in reduced channel maintenance processes compared to the existing conditions as less sediment scour and deposition will result in less vegetation uprooting, less sediment bar burial of vegetation from bar migration, and less bank undercutting. The width of the active channel belt will likely narrow compared to existing conditions. A similar response has occurred in the Santa Ana River downstream of Seven Oaks Dam, in which the zone of sparse to unvegetated bars has narrowed, and formerly active areas of the channel belt have become inactive or abandoned with increased vegetation density (ICF 2019a, 2019b). However, unlike the reach of the Santa Ana River immediately downstream of Seven Oaks Dam, the Covered Activities are not expected to trap all sediment and therefore will not result in clear water (sediment-free water) flows downstream. As mentioned, the Covered Activities responsible for most of the effects on sediment transport are storm flow diversions and recharge basins. A portion of the flow during a flood event (typically just following the peak flow or the tail of a storm event) would be diverted into recharge basins. The peak flow with the highest shear stress capable of transporting sediment would still continue downstream past the diversion due to operational parameters of the facilities. Furthermore, the basins would not permanently trap sediment because sediment will be actively removed from the basins and placed back into the main channel as described below.

To mitigate for reductions in sediment transport potential and the temporary capture of sediment in basins, the basins will be managed as a part of a *Basin Sediment Management Plan*, which will require that when sediment is periodically excavated from basins to maintain basin capacity it will be deposited downstream of each basin to allow continued transport along the tributary and into the Santa Ana River. The sediment will be transported downstream by the rising curve and peaks of storm events that would be allowed to pass by the groundwater recharge basins and facilities in order to protect the infrastructure.

A large portion of the Santa Ana sucker's designated critical habitat is in areas that have intermittent water and are not occupied habitat. Critical habitat in these areas was designated because the reaches are a source of coarse sediment to be supplied to downstream-occupied reaches, where the fish depend on coarse substrate for feeding and spawning. Wright and Minear (2019) concluded that Seven Oaks Dam decreases coarse sediment supply and deposition rates in the occupied reach downstream of the Rialto Channel. The Covered Activities will reduce the rate of transport and slow the replenishment of coarse substrate within occupied reaches. Regardless, the availability of coarse substrate in the occupied reaches of the Santa Ana River will be monitored and adaptively managed to maintain sufficient availability to support the sucker population in this area.

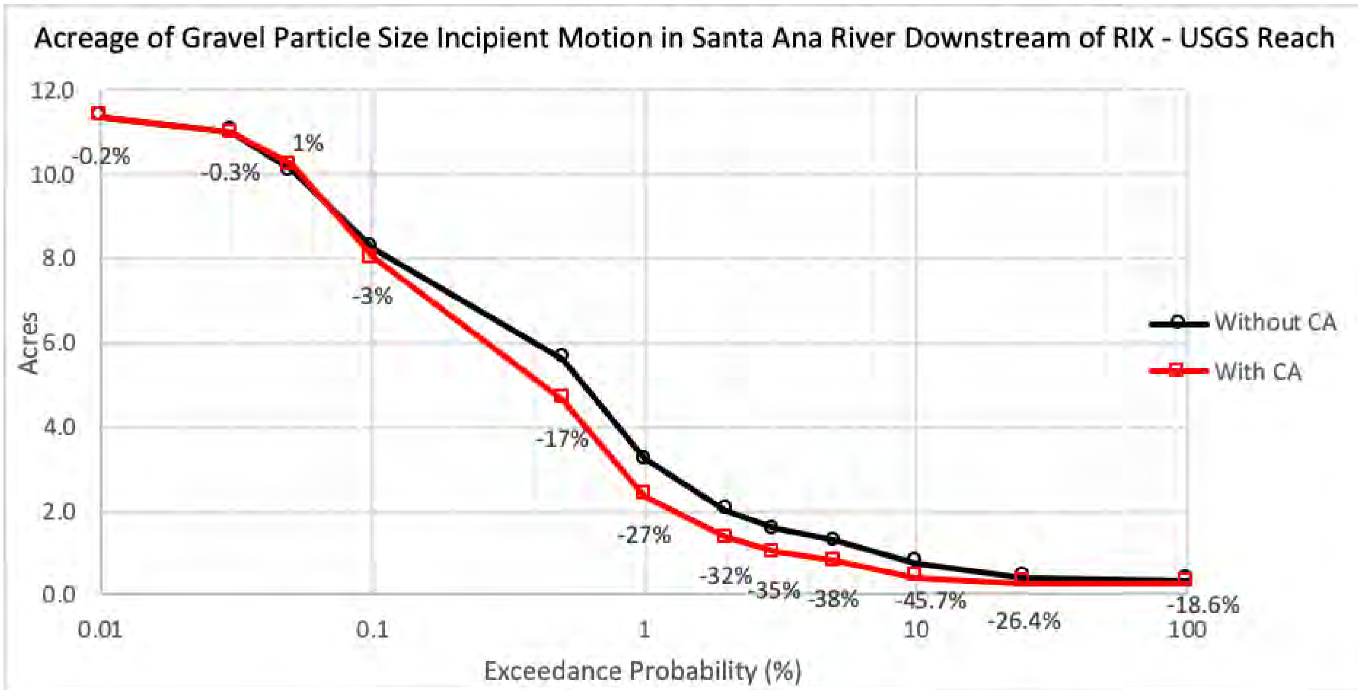
The Covered Activities are predicted to reduce coarse sediment transport capacity from Mill Creek by 17%, from the Santa Ana River upstream of Mill Creek by 23%, and from Lytle Creek by 48% (Table 4-7).[8] The slope of the Santa Ana River becomes more gradual below the confluence with Mill Creek, notably near the San Bernardino Airport and the confluence with East Twin Creek. This gentler slope results in reduced shear stress levels for a given flow and a reduction in the stream's potential to transport sediment, particularly coarse sediment, as is evident by the increasing proportion of fine sediment textures in the channel bed from upstream to downstream. The slope reduction effect applies for both the baseline condition and the Covered Activities condition. Coarse gravel and cobble sediment delivered from mountain tributary streams tends to deposit in the Santa Ana River alluvial fan upstream of the confluence with East Twin Creek (Wright and Minear 2019). This process is evident in the sediment transport results presented here for the Santa Ana River upstream of the East Twin Creek confluence where the predicted 15% reduction in transport capacity of coarse sediment due to the Covered Activities is considerably lower than for reaches farther upstream with higher slopes (i.e., the reach is depositional for both the existing conditions and with Covered Activities conditions). Only during large-magnitude, infrequently occurring events does the river have enough energy to transport appreciable volumes of coarse sediment farther downstream into reaches occupied by Santa Ana sucker. The SAR USGS Reach 9 Downstream of RIX location (Table 4-7), at the upper end of the occupied reach, is a good site for evaluating how the

[8] See previous comments noting that the sediment transport capacity change will not be as great as analyzed: VD.2.03 (located in Lytle Creek Upstream of Cajon Wash) has a low probability of being constructed, and VD.2.07 Cajon-Vulcan 1 Diversion and Basin, located in Cajon Wash, will no longer be constructed

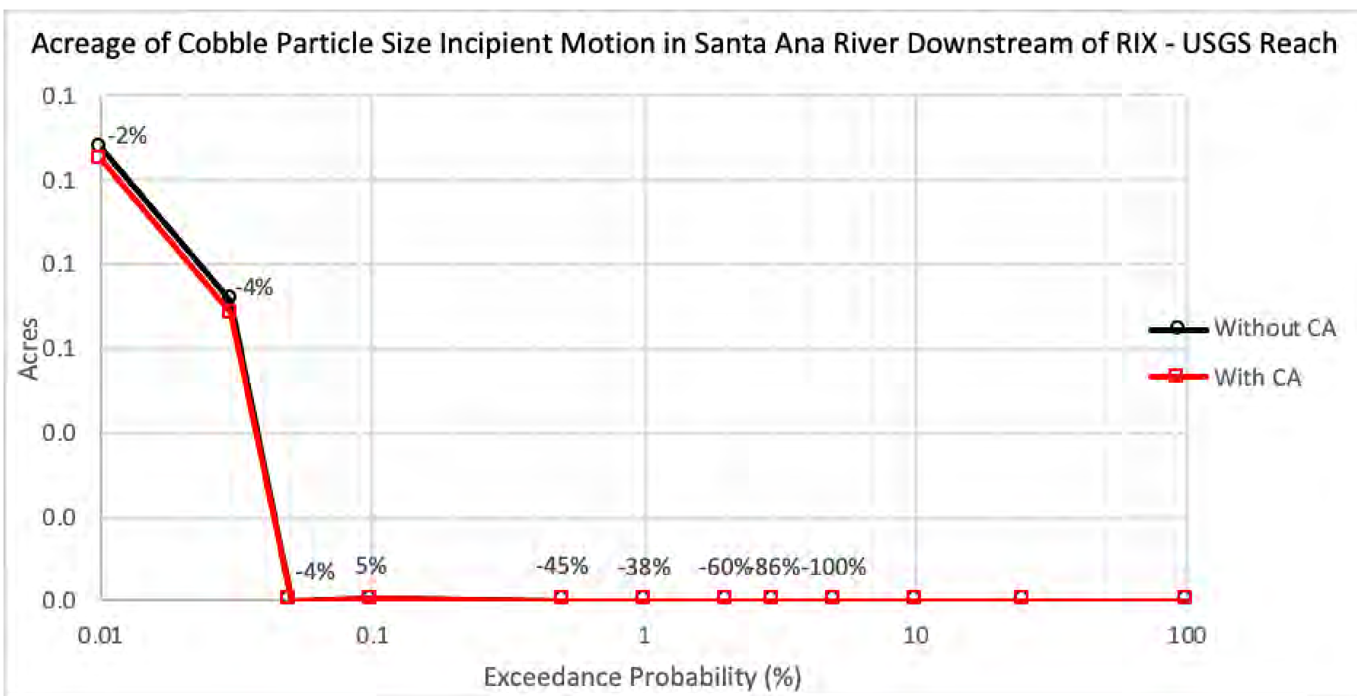
Covered Activities would affect sediment conditions in a reach of the river occupied with Santa Ana sucker. The sediment transport calculation applied for this sediment transport analysis uses the field-measured bed-sediment particle size gradation. In this reach, the Santa Ana River is a sand bed channel, with only 15% gravel and no cobble in the field sample used for the sediment transport calculations (Appendix D, Table 2). If no material is available on the bed, then the transport equation will not predict transport of these particle sizes. Thus, gravel transport is only 9% of the total sediment transport of all particle sizes for both the existing conditions and with Covered Activities conditions, and no cobble transport is predicted because the field sample shows no cobble is available to transport (Table 4-7). The Covered Activities are predicted to reduce gravel transport by 37% and cobble transport by <1%. This does not account for HCP conservation measures that would replace coarse sediments to the active floodplain that were removed during implementation of Covered Activities, and/or place new sediment to the floodplain needed to counteract reduced hydrologic processes caused by the implementation of Covered Activities. Because these potential effects are based on predictive models. the actual amount of available suitable substrate in the occupied reaches will continue to be monitored and adaptively managed to maintain habitat suitability (Section 5.12).

Small patches of coarse sediment are present in SAR USGS Reach 9, which is the primary reason native fish occupy this reach. But the patches, particularly coarse sediment (gravel and cobble), compose a small portion of the exposed active channel and are only exposed where the flow shear stresses are high enough to flush away sand that otherwise buries the gravel and cobble. There is concern that, with a reduction in coarse sediment supply to the native fish reach, eventually the coarse material currently in the reach will be transported downstream and not replenished. Because of the previously discussed sensitivity of the transport equation to the field-measured particle sizes, an additional analysis was performed to examine how the shear stresses levels would change in SAR USGS Reach 9 with the Covered Activities. This assessment examines the extent to which coarse sediment could be transported if it were available. At the 0.4% mean daily discharge exceedance probability, which corresponds to the 1.25-year recurrence interval flood, reduction in flow from 3,178 to 2,580 cfs reduces shear stress levels capable of transporting gravel by 17%. At higher flows, the differences between the baseline and under the Covered Activities becomes less. Shear stresses high enough to transport cobble are not obtained in appreciable quantities until an exceedance flow of approximately 0.03% (22,551 cfs baseline and 22,129 cfs with Covered Activities), and the area over which cobble transport would occur is a small fraction of the total wetted channel area (Figure 4-7).

In summary, this analysis further demonstrates that the reach of the Santa Ana River occupied by Santa Ana sucker (SAR USGS Reach 9) is largely depositional with respect to coarse gravel and cobble sediment. Large floods are required to transport coarse gravel and cobble sediment into and out of this reach. Because the Covered Activities do not substantially reduce the flow magnitude of these large flood events, the coarse sediment already in the upstream reaches will eventually be transported downstream. If new supplies of coarse sediment are substantially reduced from upstream reaches, then the rate of removal within occupied reaches may surpass the rate of replacement. If this occurs it would result in decreased availability of coarse substrate for fish in the occupied stream reach and could lead to a gradual flattening of the river gradient. However, because the sections of the Santa Ana River within and upstream of the occupied reach are both depositional under existing conditions, reductions in coarse sediment transport predicted in several of the tributaries and the Santa Ana River upstream of Mill Creek will not translate directly into imminent reductions in availability of coarse sediment in the occupied reach. Over the long-term it is possible



CA = Covered Activities



CA = Covered Activities

Figure 4-7
Coarse Substrate Incipient Motion in Santa Ana River
Upper Santa Ana River Habitat Conservation Plan

that the reduction of transport upstream will result in less coarse sediment in the occupied reach. The timeframe for this largely depends on the frequency of large flood events that occur in the future with the potential to transport coarse sediment. Long-term monitoring of sediment conditions in the Santa Ana River will be implemented as a part of this HCP to assess if the availability of coarse sediment in the occupied reach is diminishing, and, if so, management tools such as sediment replenishment may be necessary at the upper end of SAR USGS Reach 9. Adaptive management and monitoring in coordination with the implementation of the *Basin Sediment Management Plan* will work together to provide suitable substrate and a means to make it available in the occupied reaches of the river (Section 5.12).

4.4.3 Potential Effects on Aquatic Species Habitat

The potential effects of Covered Activities on aquatic species habitat was determined for those Covered Species that use aquatic habitats for all, or a portion of, their habitat needs. These species include Santa Ana speckled dace, western spadefoot, mountain yellow-legged frog, southwestern pond turtle, and south coast garter snake (effects on Santa Ana sucker and arroyo chub are presented in Section 4.6.3, *Wildlife Species*). As described in Section 3.6.4, the analysis was based on output from the HCP Hydrology Model, which estimated water surface area ("wetted area") downstream of Covered Activities in the Santa Ana River and tributaries under existing conditions and with all Covered Activities in place. Potential effects on aquatic species habitat were then estimated by calculating the net change in wetted area where it co-occurred with modeled species habitat under existing conditions and with all Covered Activities in place.

Potential effects on aquatic species habitat using the wetted area analysis focused on the driest part of the year (August through October) where a decrease in wetted surface area has the greatest potential to affect Covered Species that rely on aquatic habitats. This period was chosen as it provides the most conservative evaluation of potential effects on aquatic species wetted area. Table 4-8 shows the estimated potential acres of wetted area impacts on aquatic species habitat. Because these effects are based on a predictive model they represent our best estimate of the potential reduction in wetted area downstream of Covered Activities. Wetted area will be monitored and adaptively managed through the Comprehensive Adaptive Management and Monitoring Program (CAMMP) (Section 5.12). Monitoring will likely include collecting stream flow data and data from existing and newly installed shallow and deep wells, and tracking the perimeter of aquatic habitat over time. One option for reducing impacts on aquatic species habitat that will be explored in more detail in the CAMMP would be to provide supplemental seasonal flow to discrete portions of the Planning Area through the Santa Ana River Conservation and Conjunctive Use Program (SARCCUP), other conjunctive use program, or by securing additional discharge of treated wastewater from the Rialto/RIX/Riverside Wastewater Treatment Plants (WWTPs). SARCCUP stores storm flow and State Water Project water within the Bunker Hill Groundwater Basin (San Bernardino Basin) during high periods of precipitation. This water is utilized to supply regional needs. The Upper Santa Ana River Sustainable Resources Alliance (Alliance) would create an account within SARCCUP, or other conjunctive use program, to purchase water that would be used to supply environmental flow. Alternatively, additional discharge from the aforementioned WWTPs could be purchased by the Alliance to provide supplemental flow.

Table 4-8. Potential Impacts on Modeled Wetted Area within Aquatic Species Modeled Habitat

Covered Species	Potential Reduction in Wetted Area (acres)
Santa Ana Speckled Dace	
Reduction in Wetted Area	0.1
Mountain Yellow-Legged Frog	
Reduction in Wetted Area	0.2
Western Spadefoot	
Reduction in Wetted Area	6.5
South Coast Garter Snake	
Reduction in Wetted Area	19.5
Southwestern Pond Turtle	
Reduction in Wetted Area	17.8

4.4.4 Potential Effects on Groundwater-Dependent Ecosystems

The potential effects of Covered Activities on GDEs are divided into three categories: decreasing groundwater level effects, increasing groundwater level effects, and no expected effect from changes in depth to groundwater. As described in Section 4.3.4, *Methods for Effects of Groundwater Change on Riparian and Wetland Habitats*, areas with decreasing groundwater levels have the potential for conversion of GDE community types to drier, non-GDE communities when the groundwater decreases below the lower extinction depth (i.e., depth below the reach of plants in the community above). Similarly, with increasing groundwater levels there is the potential for changes in community type when the groundwater increases above the upper extinction depth (e.g., conversion of a riparian area to a wetland). Areas of decreasing and increasing groundwater levels predicted to occur as a result of the effects of the Covered Activities are shown on Figure 4-8. Table 4-3 identifies the projects that are estimated to result in an appreciable effect on groundwater.

The two main areas of decreasing groundwater levels on the Santa Ana River occur in the reach from the Riverside Avenue crossing to the railroad crossing at the confluence with Sunnyslope Channel, and the reach from I-15 downstream to Prado Dam. The main area of increasing groundwater on the Santa Ana River occurs between the railroad crossing and I-15. Other areas of increasing groundwater are in the vicinity of the lower tributaries of Chino and Cucamonga Creeks and the upper tributaries of Cajon, Cable, Devil Canyon, Waterman, and San Timoteo Creeks.

Table 4-9 shows the acres of wetlands, riparian understory, and riparian overstory that are predicted to have groundwater decrease past their respective extinction depths. Extinction depths are based on estimates in Maddock et al. (2012) for wetlands and riparian habitats of the arid west.

Falling groundwater depths from Covered Activity implementation could result in conversion of wetland and riparian habitats to drier (more xeric) habitat types, and could also affect the habitat for wetland and riparian-dependent Covered Species (i.e., mountain yellow-legged frog, western spadefoot, south coast garter snake, southwestern pond turtle, tricolored blackbird, yellow-breasted chat, western yellow-billed cuckoo, southwestern willow flycatcher, and least Bell's vireo). Potential species effects are also discussed in Section 4.6. It is important to note that conversion of habitat from one type to another is not necessarily indicative of reduced function of habitat, rather a likely transition of habitat for one cohort of species to another cohort more suited for the new vegetative

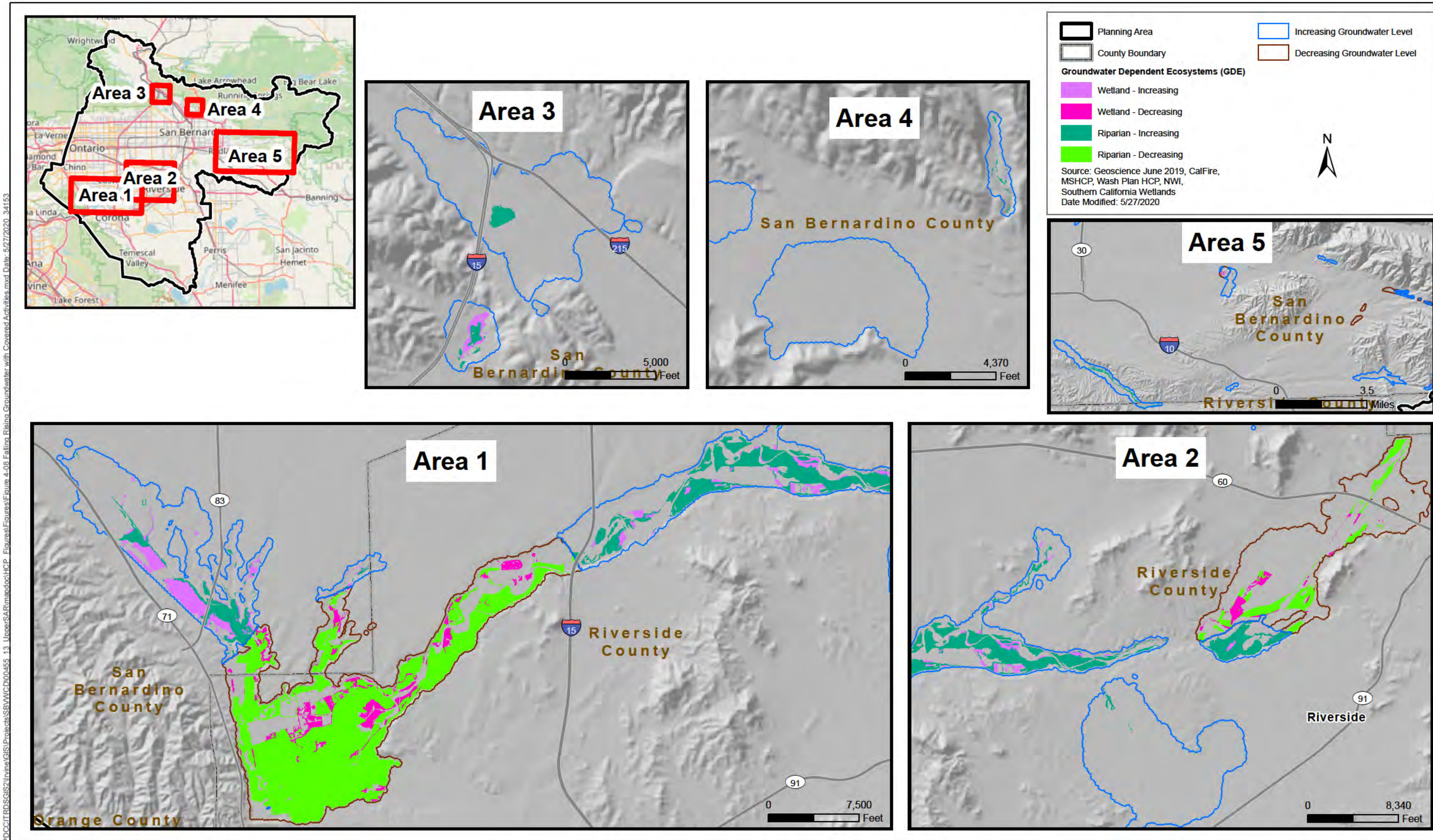


Figure 4-8
Modeled Areas of Rising or Falling Groundwater with Covered Activities

conditions, assuming these habitats are managed for native vegetation. If no areas were also receiving additional surface flow or increases in groundwater elevation, the total area occupied by obligate wetland species would be reduced. Some locations where obligate wetland species will gain area within the Planning Area will be discussed later.

The acreages in this analysis are based on an overlay of predicted (modeled) groundwater depths on the existing vegetation maps. Therefore, the inference of potential biological responses to groundwater changes based on this large-scale hydrologic modeling and vegetation mapping is speculative. As such, it will be important to conduct regular groundwater monitoring in conjunction with wetland and riparian habitat condition monitoring to adaptively manage the effects of Covered Activities on groundwater and GDEs. Ongoing monitoring of groundwater and wetland and riparian vegetation is proposed as a component of HCP implementation. Data from existing and new shallow and deep groundwater wells around the Prado Basin and along the Santa Ana River will be used to verify the accuracy of the modeled groundwater depths. If inaccuracies are detected around the Prado Basin, a new sub-basin model will be created and incorporated into the model to increase model accuracy for this area (see Chapter 5 for more information). Riparian and wetland vegetation extent will also be mapped and tracked over time, as discussed in Chapter 5. Figure 4-8 shows the areas of groundwater increase and decrease for riparian and wetland areas, and Figures 4-9 and 4-10 show areas of riparian and wetland habitat transition, respectively. As discussed in Section 4.4.3, options to reduce impacts on wetland and riparian plant communities would include the provision of supplemental flow via SARCCUP or another conjunctive use program, or additional discharge from WWTPs along the upper Santa Ana River.

Table 4-9. Predicted Acreage of Wetland and Riparian Habitats with Modeled Falling Groundwater Depths

Falling Groundwater Depth Transition (feet)		Acres of Groundwater-Dependent Community Type (Lower Extinction Depth[1])		
From Existing Depth[1]	To Covered Activities Depth[1]	Wetlands (-1 foot)	Riparian Understory (-5 feet)	Riparian Overstory (-16 feet)
<1	1–5	29.5	--	--
<1	5–16	4.9	--	--
1–5	5–16	--	211.2	--
5–16	>16	--	--	106.6

[1] Extinction depths from Maddock et al. 2012, rounded to nearest foot for modeling analysis. The extinction depths defined in Maddock et al. 2012 are -0.7 feet for wetlands, -4.92 feet for riparian understory, and -16.4 feet for riparian overstory habitats. Acreages are not indicated for habitats in areas where the existing groundwater depth is either above or below the identified extinction depths.

Table 4-10 shows the acres of wetland and riparian habitats with predicted rising groundwater. It is less clear what effect rising groundwater could have on wetland and riparian communities. Rising groundwater could benefit these communities by creating more persistent availability of groundwater, which will particularly benefit any areas that have experienced previous groundwater drawdown as well as provide some level of protection against drought. Increased groundwater could also result in conversion to a wetter community type (e.g., from riparian to wetland habitat, or from a non-GDE to riparian or wetland habitat, or wetland or riparian to open water) if the groundwater depth rises above the upper extinction depth shown on Figure 4-1. Riparian habitats can tolerate higher groundwater levels, but reach the point of converting to a wetland once the soil is fully saturated or surface water is present (i.e., groundwater at or above the surface elevation). Wetlands may lose their emergent wetland vegetation at surface water depths in excess of 2.6 feet (Figure 4-1), causing conversion to open water. Because this groundwater analysis does not include surface water levels, there is not a clear indication if the upper extinction depth would be reached for riparian communities (0 foot) or wetland communities (>2.6 feet). The acreages identified in Table 4-10 are based on predictive modeling, and consequently represent an estimate of potential effects on wetland and riparian habitats. Actual depths to groundwater and the condition of wetland and riparian habitats will be monitored and adaptively managed as a part of HCP implementation. Adaptive management will include the ability of the HCP to provide additional water supply to Prado Basin and/or riparian vegetation along the Santa Ana River if habitat is adversely affected by the implementation of Covered Activities (see Chapter 5).

Table 4-10. Predicted Acreage of Wetland and Riparian Habitats with Modeled Rising Groundwater Depths

Rising Groundwater Depth Transition		Acres of Groundwater-Dependent Community Type (Upper Extinction Depth[1])	
From Existing Depth[1] (feet)	**To Covered Activities Depth[1] (feet)**	**Riparian Understory (0 feet)**	**Riparian Overstory (0 feet)**
1–5	<1	33.8	33.8
5–16	<1	0.0	0.0
5–16	1–5	16.3	16.3
>16	5–16	2.9	2.9

[1] Extinction depths from Maddock et al. 2012, rounded to nearest foot for modeling analysis. Upper extinction depth for wetlands is +2.6 feet; however, wetlands are not included in this table because surface water contours were not included in this analysis.

Finally, the locations of wetland and riparian habitat indicated in Table 4-11 are not expected to be affected from changes in depth to groundwater. Any groundwater depth changes at these locations are expected to remain within the range of extinction depths for the given habitat type; hence, no type conversion or degradation to plant health is expected to occur with implementation of all proposed Covered Activities.

Table 4-11. Predicted Acreage of Wetland and Riparian Habitats with No Expected Meaningful Change in Modeled Groundwater Depth

Falling Groundwater Depth Transition		Acres of Groundwater-Dependent Community Type		
From Existing Depth (feet)	**To Covered Activities Depth (feet)**	**Wetlands**	**Riparian Understory**	**Riparian Overstory**
<1	<1	263.9	1,773.5	1,773.5
1–5	1–5	--	1,113.4	1,113.4
5–16	5–16	--	--	1,101.0

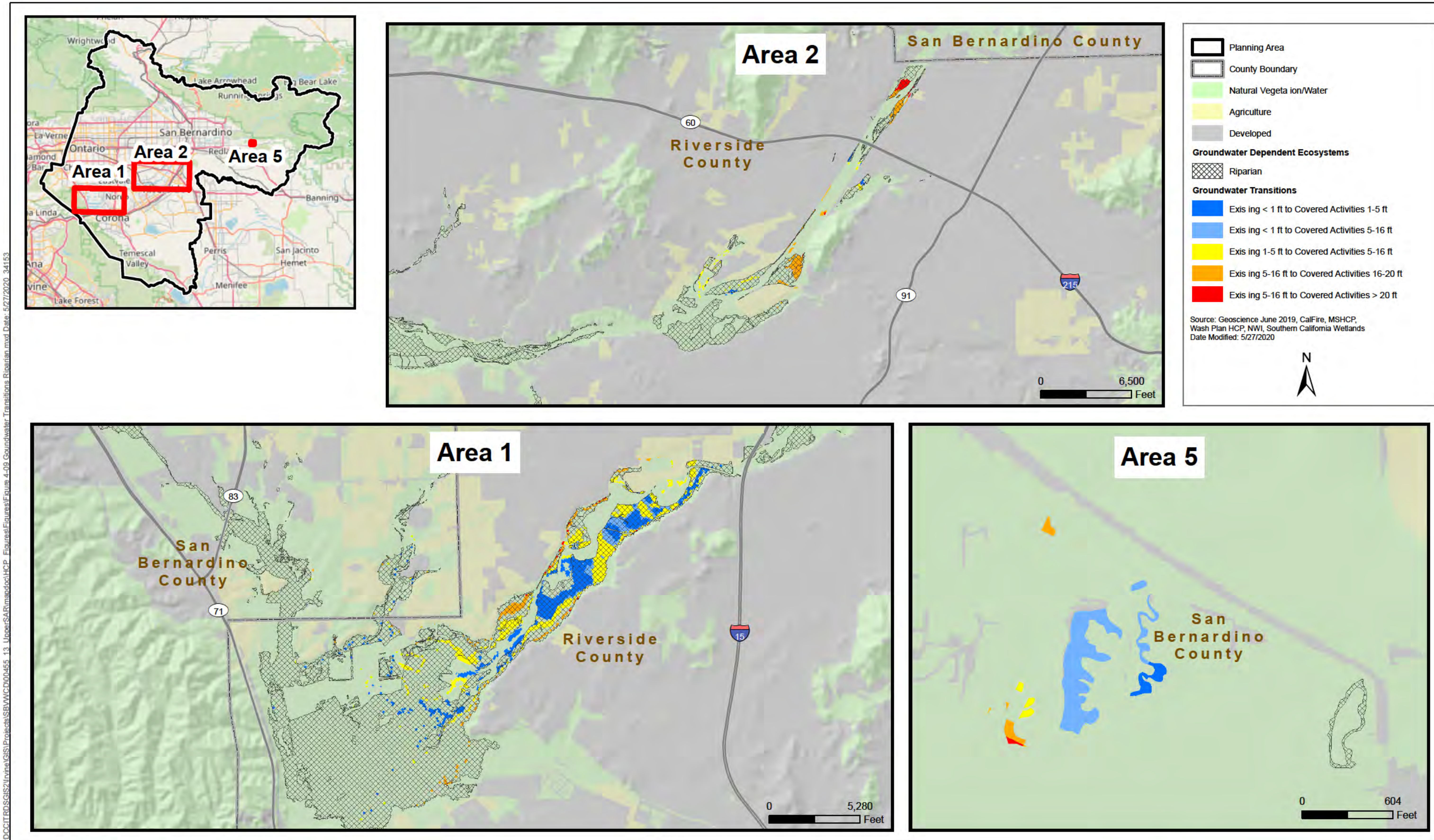


Figure 4-9
Groundwater Transitions in Riparian

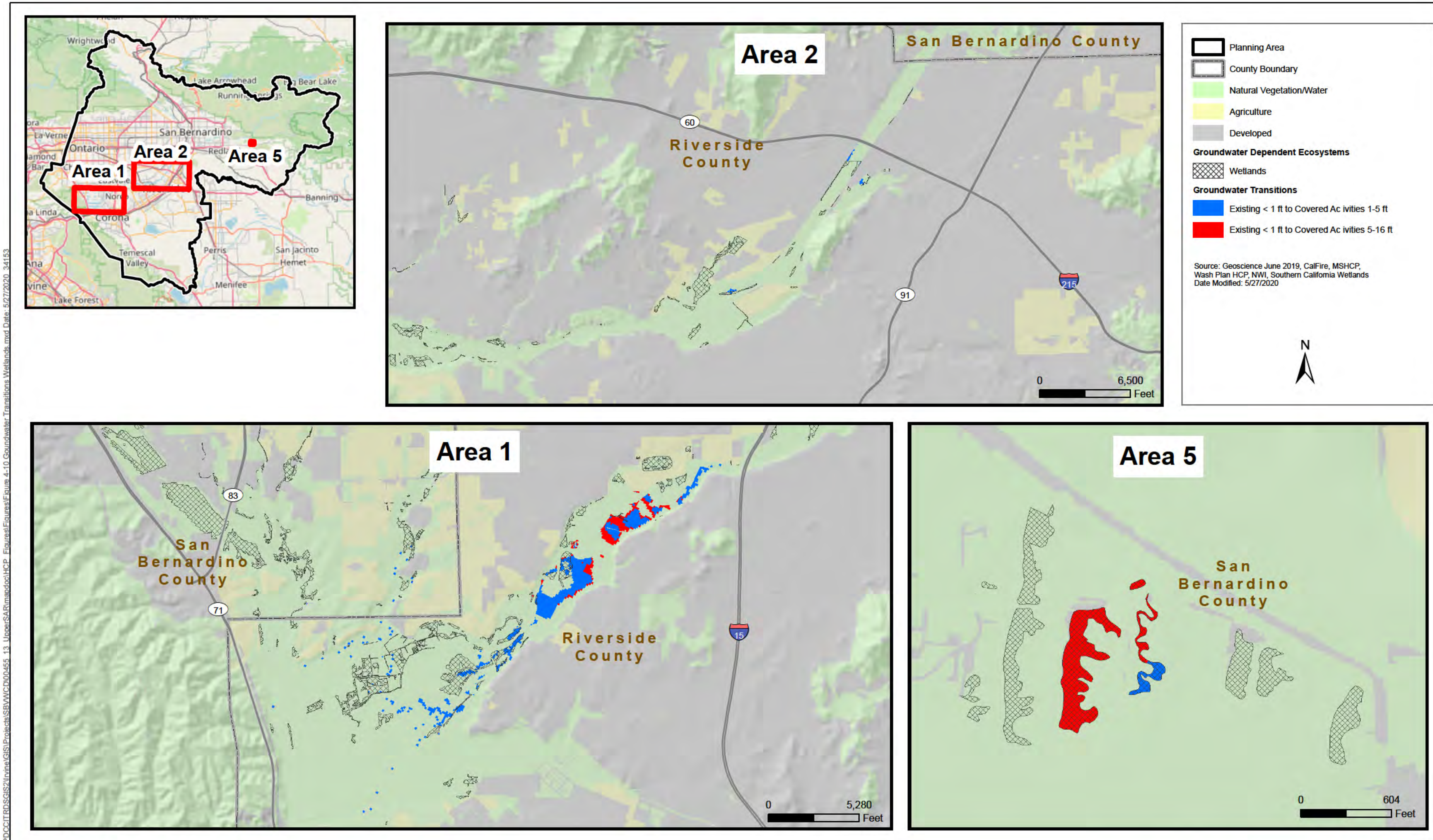


Figure 4-10
Groundwater Transitions in Wetlands

4.5 Ground-Disturbance Effects on Vegetation Communities

Although impacts on vegetation communities in the Planning Area do not directly determine the incidental take estimate for Covered Species, this information serves as a point of reference for the overall ground-disturbing impacts on habitat in the Planning Area from the Covered Activities. Table 4-12 summarizes the amount of temporary and permanent ground disturbance estimated for each water resource agency by the type of Covered Activity. Permanent and temporary impacts from Covered Activities attributed to each natural vegetation community are summarized in Table 4-13, Table 4-14, and Table 4-15.

Table 4-12. Temporary and Permanent Ground Disturbance by Water Resource Agency (Permittees) and Covered Activity Type

	Acres of Impact by Covered Activity Type – Permanent (Temporary)					
Water Agency	**Water Reuse Projects**	**Groundwater Recharge**	**Wells and Water Conveyance Infrastructure**	**Solar Energy Development**	**Habitat Improvement, Management, and Monitoring**	**Total**
Rialto	14.8 (0.2)	-- (--)	-- (--)	-- (--)	-- (--)	14.8 (0.2)
Conservation District	-- (--)	0.6 (--)	-- (--)	-- (--)	-- (--)	0.6 (--)
East Valley	18.5 (1.7)	38.2[1] (--)	8.5 (4.0)	-- (--)	-- (--)	65.3 (5.7)
IEUA	-- (--)	719.0[2] (0.4)	-- (--)	-- (--)	-- (--)	719.0 (0.4)
Metropolitan	-- (--)	-- (--)	96.3 (38.3)	-- (--)	-- (--)	96.3 (38.3)
OCWD	-- (--)	-- (--)	-- (44.0)	-- (--)	-- (--)	-- (44.0)
RPU	2.5 (<0.1)	124.5 (--)	166.4 (36.8)	15.7 (--)	-- (--)	309.1 (36.8)
Valley District	-- (--)	678.1[3] (15.2)	-- (32.3)	-- (--)	-- (--)	678.1 (47.5)
Water Department	2.0 (7.4)	<0.1 (0.8)	0.5 (12.5)	-- (--)	-- (--)	2.5 (20.7)
West Valley	0.6 (--)	15.4[4] (--)	0.5 (10.9)	-- (--)	-- (--)	16.5 (10.9)
Western	1.7 (--)	3.3 (--)	96.4 (233.2)	-- (--)	-- (--)	101.3 (233.2)
Total	**40.2 (9.4)**	**1,579.1[5] (16.5)**	**368.7 (411.9)**	**15.7 (0)**	**0 (0)**	**2,003.6[5] (437.8)**

[1] All impacts (38.2 acres) are ono existing water recharge/flood control basins subject to regular O&M activities.
[2] Impacts on 686.6 acres are on existing water recharge/flood control basins subject to regular O&M activities.
[3] Impacts on 302.9 acres are on existing water recharge/flood control basins subject to regular O&M activities.
[4] All impacts (15.4 acres) are on existing water recharge/flood control basins subject to regular O&M activities.
[5] Impacts on 1,043.1 acres are on existing water recharge/flood control basins subject to regular O&M activities.

The land cover and vegetation communities with the greatest impacts are water, shrubland, and grassland communities (Table 4-13). Groundwater recharge activities confer the greatest permanent impacts within these vegetation communities (Table 4-14). The water land cover type would experience the most permanent impacts (755 acres); however, 82% of this area is already in existing groundwater recharge basins that would be expanded such that the actual land cover type would not change in these areas. The land cover with the second largest permanent impacts is the shrubland community (706 acres), followed by the grassland community (282 acres). Temporary impacts would be highest in the shrubland communities (147 acres), followed by agricultural and grassland communities (119 acres and 71 acres, respectively). Woodland communities would experience the least amount of impacts of any type (Table 4-15).

Table 4-13. Proposed Impacts of Ground-Disturbing Covered Activities on Natural Vegetation Communities and Land Cover Types

	Acres of Impact		
Vegetation Community and Land Cover Type	**Permanent[1]**	**Temporary**	**Total**
Riparian			
Interior Warm and Cool Desert Riparian Forest	50.1 (3.6)	36.1	86.2
Warm Desert Lowland Freshwater Marsh, Wet Meadow, and Shrubland	1.0	3.8	4.8
Riparian Subtotal	*51.1 (3.6)*	*39.9*	*91.0*
Wetlands			
Western North American Freshwater Aquatic Vegetation	6.7 (6.7)	1.9	8.6
Western North American Montane-Subalpine-Boreal Marsh, Wet Meadow, and Shrubland	0.2	0.1	0.3
Western North American Disturbed Marsh, Wet Meadow, and Shrubland	2.9	0.3	3.2
Western North American Temperate and Boreal Freshwater Marsh, Wet Meadow, and Shrubland	71.8 (65.0)	9.0	80.8
Wetlands Subtotal	*81.6 (71.7)*	*11.2*	*92.8*
Water			
Permanent Water	68.3 (27.2)	7.8	76.1
Water in Existing Basins	618.4 (618.4)	0.3	618.7
Dry Channel/Shrubland	67.9 (22.8)	34.5	102.4
Water Subtotal	*754.7 (668.4)*	*42.5*	*797.2*
Shrublands			
Alluvial Fan Sage Scrub	465.3 (196.2)	57.9	523.2
Californian Chaparral	25.1	12.7	37.8
Californian Coastal Scrub	210.5 (39.5)	73.0	283.5
Great Basin and Intermountain Xeric-Riparian Scrub	2.3 (0.1)	2.3	4.6
North American Warm-Desert Xeric-Riparian Scrub	3.1 (1.4)	1.3	4.4
Shrublands Subtotal	*706.3 (237.1)*	*147.3*	*853.6*
Grasslands			
Californian Annual and Perennial Grassland	282.3 (38.9)	71.2	353.5
Californian Disturbed Grassland, Meadow, and Scrub	0.0	0.1	0.1
Grasslands Subtotal	*282.3 (38.9)*	*71.3*	*353.6*
Woodlands			
Californian Forest and Woodland	1.4	0.9	2.3
Californian Disturbed Forest	2.8 (2.3)	1.6	4.4
Intermountain Singleleaf Pinyon-Utah Juniper-Western Juniper Woodland	0.1	0.5	0.6

Vegetation Community and Land Cover Type	Acres of Impact		
	Permanent[1]	**Temporary**	**Total**
Woodlands Subtotal	*4.3 (2.3)*	*3.0*	*7.3*
Rock Outcrops			
Rock Outcrops Subtotal	17.5 (7.1)	3.7	21.2
Agriculture			
Herbaceous Agricultural Vegetation	103.7 (14.0)	116.5	220.2
Woody Agricultural Vegetation	2.2	2.4	4.6
Agriculture Subtotal	*105.9 (14.0)*	*118.9*	*224.8*
TOTAL	**2,003.6 (1,043.1)**	**437.8**	**2,441.4**

[1] Impact acreages in parentheses are on existing water recharge/flood control basins subject to regular O&M activities and are a subset of total acreage. For example, for Woodlands Subtotal, of the 4.3 acres of permanent impacts, 2.3 acres occur within existing basins; consequently, impacts outside of existing basins are 4.3 - 2.3 = 2.0 acres. The acreages in parentheses are a subset of the amount of permanent impact acreage, e.g., for Wetlands Subtotal 71.7 acres of permanent impacts out of a total of 81.6 occur within existing basins, and 9.9 acres of permanent impacts occur outside of existing basins.

Table 4-14. Proposed Permanent Impacts on Vegetation Communities by Ground-Disturbing Covered Activity Type

	Acres of Impact by Covered Activity Type – Permanent				
Vegetation Community	**Water Reuse**	**Groundwater Recharge**[1]	**Wells & Water Infrastructure**	**Solar Energy**	**Habitat Improvement**
Riparian					
Interior Warm and Cool Desert Riparian Forest	1.2	21.5 (3.6)	27.4	<0.1	0.0
Warm Desert Freshwater Shrubland, Meadow and Marsh	0.0	0.0	1.0	0.0	0.0
Riparian Subtotal	*1.2*	*21.5 (3.6)*	*28.4*	*0.0*	*0.0*
Wetlands					
Western North American Freshwater Aquatic Vegetation	0.0	6.7 (6.7)	<0.1	0.0	0.0
Western North American Montane-Subalpine-Boreal Marsh, Wet Meadow, and Shrubland	0.0	0.0	0.2	0.0	0.0
Western North American Disturbed Marsh, Wet Meadow, and Shrubland	0.0	<0.1	2.9	0.0	0.0
Western North American Temperate and Boreal Freshwater Marsh, Wet Meadow, and Shrubland	0.9	70.5 (65.0)	0.5	0.0	0.0
Wetlands Subtotal	*0.9*	*77.3 (71.7)*	*3.5*	*0.0*	*0.0*
Water					
Permanent Water	3.1	60.0 (27.2)	5.3	0.0	0.0
Water in Existing Basins	0.0	618.4 (618.4)	<0.1	0.0	0.0
Dry Channel/Shrubland	5.4	56.3 (22.8)	6.2	0.0	0.0
Water Subtotal	*8.5*	*734.7 (668.4)*	*11.5*	*0.0*	*0.0*
Shrublands					
Alluvial Fan Sage Scrub	0.3	438.2 (196.2)	23.7	3.0	0.0
Californian Chaparral	0.0	9.8	15.3	0.0	0.0
Californian Coastal Scrub	0.1	134.5 (39.5)	73.3	2.5	0.0
Great Basin and Intermountain Xero-Riparian Scrub	<0.1	0.4 (0.1)	1.9	0.0	0.0
North American Warm-Desert Xero-Riparian Scrub	0.0	2.9 (1.4)	0.2	0.0	0.0
Shrublands Subtotal	*0.5*	*585.9 (237.1)*	*114.5*	*5.5*	*0.0*

Vegetation Community	Water Reuse	Groundwater Recharge[1]	Wells & Water Infrastructure	Solar Energy	Habitat Improvement
	Acres of Impact by Covered Activity Type – Permanent				
Grasslands					
Californian Annual and Perennial Grassland	27.5	119.8 (38.9)	124.8	10.2	0.0
Californian Disturbed Grassland, Meadow, and Scrub	0.0	0.0	0.0	0.0	0.0
Grasslands Subtotal	*27.5*	*119.8 (38.9)*	*124.8*	*10.2*	*0.0*
Woodlands					
Californian Forest and Woodland	0.0	0.0	1.4	0.0	0.0
Californian Disturbed Forest	0.2	2.3 (2.3)	0.4	0.0	0.0
Intermountain Singleleaf Pinyon-Utah Juniper-Western Juniper Woodland	0.0	0.0	0.1	0.0	0.0
Woodlands Subtotal	*0.2*	*2.3 (2.3)*	*1.8*	*0.0*	*0.0*
Rock Outcrops					
Western North American Cliff, Scree, and Rock Vegetation	<0.1	16.9 (7.1)	0.6	0.0	0.0
Rock Outcrops Subtotal	*0.0*	*16.9 (7.1)*	*0.6*	*0.0*	*0.0*
Agriculture					
Herbaceous Agricultural Vegetation	0.0	20.8 (14.0)	82.8	0.0	0.0
Woody Agricultural Vegetation	1.4	0.0	0.8	0.0	0.0
Agriculture Subtotal	*1.4*	*20.8 (14.0)*	*83.6*	*0.0*	*0.0*
Total	**40.2**	**1,579.1 (1,043.1)**	**368.7**	**15.7**	**0.0**

[1] Impact acres in parentheses are to existing water recharge/flood control basins subject to regular O&M activities and are a subset of the total acres. For example, of the 1,579.1 acres of permanent impacts for Groundwater Recharge, 1,043.1 acres occur within existing basins. Consequently, impacts outside of existing basins are 1,579.1 - 1,043.1 = 536 acres.

Table 4-15. Proposed Temporary Impacts on Vegetation Communities by Ground-Disturbing Covered Activity Type

	Acres of Impact by Covered Activity Type – Temporary				
Vegetation Community	**Water Reuse**	**Groundwater Recharge**	**Wells & Water Infrastructure**	**Solar Energy**	**Habitat Improvement**
Riparian					
Interior Warm and Cool Desert Riparian Forest	0.7	0.0	35.4	0.0	0.0
Warm Desert Freshwater Shrubland, Meadow and Marsh	0.0	0.0	3.8	0.0	0.0
Riparian Subtotal	*0.7*	*0.0*	*39.2*	*0.0*	*0.0*
Wetlands					
Western North American Freshwater Aquatic Vegetation	0.0	0.0	1.9	0.0	0.0
Western North American Montane-Subalpine-Boreal Marsh, Wet Meadow, and Shrubland	0.0	0.0	0.1	0.0	0.0
Western North American Disturbed Marsh, Wet Meadow, and Shrubland	0.0	0.0	0.3	0.0	0.0
Western North American Temperate and Boreal Freshwater Marsh, Wet Meadow, and Shrubland	0.0	0.0	9.0	0.0	0.0
Wetlands Subtotal	*0.0*	*0.0*	*11.2*	*0.0*	*0.0*
Water					
Permanent Water	0.3	0.0	7.4	0.0	0.0
Water in Existing Basins	0.2	0.0	0.1	0.0	0.0
Dry Channel/Shrubland	1.4	0.0	33.1	0.0	0.0
Water Subtotal	*1.9*	*0.0*	*40.6*	*0.0*	*0.0*
Shrublands					
Alluvial Fan Sage Scrub	3.0	14.3	40.6	0.0	0.0
Californian Chaparral	0.0	0.0	12.7		
Californian Coastal Scrub	0.1	0.9	72.0	0.0	0.0
Great Basin and Intermountain Xero-Riparian Scrub	0.0	0.0	2.3	0.0	0.0
North American Warm-Desert Xero-Riparian Scrub	0.0	<0.1	1.3	0.0	0.0
Shrublands Subtotal	*3.1*	*15.9*	*128.9*	*0.0*	*0.0*
Grasslands					
Californian Annual and Perennial Grassland	2.7	0.1	68.4	0.0	0.0
Californian Disturbed Grassland, Meadow, and Scrub	0.0	0.0	0.1	0.0	0.0

	Acres of Impact by Covered Activity Type – Temporary				
Vegetation Community	**Water Reuse**	**Groundwater Recharge**	**Wells & Water Infrastructure**	**Solar Energy**	**Habitat Improvement**
Grasslands Subtotal	*2.7*	*0.1*	*68.5*	*0.0*	*0.0*
Woodlands					
Californian Forest and Woodland	0.0	0.0	0.9	0.0	0.0
Californian Disturbed Forest	0.1	0.0	1.5	0.0	0.0
Intermountain Singleleaf Pinyon-Utah Juniper-Western Juniper Woodland	0.0	0.0	0.5	0.0	0.0
Woodlands Subtotal	*0.1*	*0.0*	*3.0*	*0.0*	*0.0*
Rock Outcrops					
Western North American Cliff, Scree, and Rock Vegetation	0.1	1.0	2.6	0.0	0.0
Rock Outcrops Subtotal	*0.1*	*1.0*	*2.6*	*0.0*	*0.0*
Agriculture					
Herbaceous Agricultural Vegetation	0.8	0.0	115.7	0.0	0.0
Woody Agricultural Vegetation	0.0	0.1	2.3	0.0	0.0
Agriculture Subtotal	*0.8*	*0.1*	*118.0*	*0.0*	*0.0*
Total	**9.4**	**16.5**	**411.9**	**0.0**	**0.0**

4.6 Effects on Covered Species

Table 4-16 summarizes the overall permanent and temporary impacts expected from all the Covered Activities on Covered Species modeled suitable habitat as a surrogate for an estimate of incidental take. Potential impacts on Santa Ana sucker and arroyo chub preferred habitat are based on changes in hydrology (see Section 4.3.3, *Methods for Effects on Aquatic Species Habit*), and potential impacts on Santa Ana speckled dace are calculated in terms of changes in wetted area (see Section 4.3.3) downstream of Covered Activities.

Table 4-17 and Table 4-18 summarize the permanent and temporary impacts under each activity type for each Covered Species that is affected. The following sections address each Covered Species separately to provide additional context for the assessment of impacts on species' modeled habitat and populations, including impacts from ground-disturbing activities and from potential hydrologic effects described above in Section 4.4, *Potential Effects on Hydrology and Sediment Transport*.

The mitigation to fully offset the impacts on each species is briefly discussed in the species-specific effects analysis, below. Chapter 5 includes the complete description of all conservation actions for each species and long-term management and monitoring of the HCP Preserve System.

Note that the effects analysis for ground-disturbing effects is based on habitat suitability models and the potential impacts on *modeled habitat*, not occupied habitat. Further, calculations of permanent impacts on modeled habitat are inclusive of existing water recharge/flood control basins subject to regular O&M activities. Though included in permanent impact calculations, these areas offer limited habitat value to Covered Species because they are maintained to prevent re-establishment of vegetation. Given the limited value of existing water recharge/flood control basins to Covered Species, permanent impacts on modeled habitat within existing basins are also presented separately, in parentheses, next to each permanent impact value in the tables that follow. Because the area of suitable habitat predicted by the models is inclusive of acreage in existing water recharge/flood control basins subject to regular O&M activities, and is much larger than the area of occupied habitat at any given moment in time, actual impacts on occupied habitat will be substantially less. Actual impacts will be further minimized through the implementation of general and species-specific avoidance and minimization measures (Section 5.11). Therefore, these estimates of impact represent a maximum potential impact estimate for each species. With the implementation of avoidance and minimization measures and more precise project-specific design, the level of impact is expected to be lower than estimated in most cases. In no case will the impact of any species be allowed to exceed the level of impact estimate established by this HCP (incidental take).

Table 4-16. Estimated Impacts on Modeled Habitat and Designated Critical Habitat

	Acres of Impact	
Covered Species	**Permanent**[1]	**Temporary**
Slender-Horned Spineflower		
Current Occupied Habitat (modeled)	0.0	0.0
Historic Occupied Habitat (modeled)	<0.1	0.0
Potentially Suitable Habitat	311.2 (30.6)	114.0
Santa Ana River Woolly-Star		
Potentially Suitable Habitat	406.6 (31.9)	57.8
Santa Ana Sucker		
Preferred Habitat[3]	1.3	0
Designated Critical Habitat Wet[2]	13.5	4.8
Designated Critical Habitat Dry[2]	42.3	14.2
Arroyo Chub		
Potentially Preferred Habitat	2.4	0
Santa Ana Speckled Dace		
Potentially Suitable Habitat (Wetted Area[3,4])	<0.1	0
Mountain Yellow-Legged Frog		
Potentially Suitable Aquatic Habitat[3,4]	5.9 (5.4)	0.3
Refugia/Foraging/Dispersal Habitat	176.0 (151.3)	12.8
Designated Critical Habitat	0.0	0.0
Western Spadefoot		
Potentially Suitable Habitat	704.5 (304.1)	111.7
California Glossy Snake		
Potentially Suitable Habitat	801.3 (145.2)	173.5
South Coast Garter Snake		
Potentially Suitable Habitat	14.7	43.5
Southwestern Pond Turtle		
Aquatic Habitat[3,4]	0.9	4.8
Potentially Suitable Upland Habitat	18.5	53.9
Tricolored Blackbird		
Occupied Colony Habitat	0.0	0.0
Suitable Colony Habitat	55.2 (50.3)	10.7
Breeding Season Foraging – Natural	157.6 (7.6)	43.6
Breeding Season Foraging – Agriculture	67.0	101.0
Non-Breeding Season Foraging – Natural	0.4	0.3
Non-Breeding Season Foraging – Agriculture	0.1	0.9
Burrowing Owl		
Potentially Suitable Habitat	736.3 (181.6)	242.6
Cactus Wren		

Covered Species	Acres of Impact Permanent [1]	Acres of Impact Temporary
Known Suitable Nesting	14.6	0.3
Potential Nesting and Foraging Habitat	681.7 (186.0)	180.2
Recently Burned (2008–2018)	1.6	6.4
Yellow-Breasted Chat		
Potentially Suitable Habitat	126.7 (68.5)	44.7
Western Yellow-Billed Cuckoo		
High Value Breeding Habitat	<0.1	0.8
Other Potentially Suitable Breeding Habitat	8.7	8.2
Southwestern Willow Flycatcher		
Core Southwestern Willow Flycatcher Habitat	15.5	3.7
Very High Value Habitat	<0.1	0.4
High Value Habitat	<0.1	0.2
Moderate Value Habitat	<0.1	0.1
Other Potentially Suitable Habitat	111.2 (68.5)	40.2
Designated Critical Habitat	95.9	12.7
Coastal California Gnatcatcher		
Very High Value Habitat	40.5 (13.8)	6.0
High Value Habitat	46.3 (8.4)	17.0
Moderate Value Habitat	55.6 (18.3)	21.0
Low Value Habitat	188.9 (95.7)	65.0
Other Suitable Habitat	71.6 (1.3)	4.1
Designated Critical Habitat	2.9	2.6
Least Bell's Vireo		
Core Breeding Habitat	0.2	17.2
Other Breeding Habitat	126.5 (68.5)	27.5
Designated Critical Habitat	1.9	55.8
Los Angeles Pocket Mouse		
Potentially Suitable Habitat	657.0 (181.9)	144.2
San Bernardino Kangaroo Rat		
Suitable Habitat	681.4 (377.2)	72.7
Refugia[5]	149.9 (118.6)	46.4
Assumed Occupied[6]	681.6 (57.5)	94.4
Designated Critical Habitat	656.3 (109.4)	110.1

[1] Impact acreages in parentheses are within existing water recharge/flood control basins subject to regular O&M activities and are a subset of the total acres. For example, of the 681.4 acres of permanent impacts on San Bernardino kangaroo rat, 377.2 acres occur within existing basins. Consequently, impacts outside of basins are: 681.4 - 377.2 = 304.2 acres.

[3] Impacts from changes to hydrology, not from ground-disturbance (see Section 3.6.4).

[2] 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) as 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.

[4] The difference between wetted area impact estimates and aquatic habitat impact estimates are due to two separate analytical methods. Wetted area is calculated based on three-dimensional hydrology models, while aquatic habitat is calculated based on regional land cover mapping.
[5] San Bernardino kangaroo rat refugia habitat is composed of modeled habitat that occurs outside of the 100-year floodplain.
[6] "Assumed Occupied" is not a modeled dataset; it is a separate data layer that was estimated to indicate all areas that are assumed to be currently occupied by SBKR. 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.
Note: Predicted impacts on groundwater-dependent ecosystems and wetted area aquatic habitat are presented in Sections 4.4.4 and 4.4.3, respectively.

Table 4-17. Estimated Permanent Impacts of Ground-Disturbing Covered Activities on Covered Species Modeled Suitable Habitat by Covered Activity Type

Covered Species Modeled Habitat[1]	Acres of Permanent Impact by Covered Activity Type – Permanent				
	Water Reuse	Groundwater Recharge[2]	Wells and Water Infrastructure	Solar Energy	Habitat Improvement
Slender-Horned Spineflower					
Current Occupied Habitat (modeled)	0.0	0.0	0.0	0.0	0.0
Historic Occupied Habitat (modeled)	0.0	<0.1 (<0.1)	0.0	0.0	0.0
Potentially Suitable Habitat	0.5	207.2 (30.6)	98.0	5.5	0.0
Santa Ana River Woolly-Star					
Potentially Suitable Habitat	0.5	346.2 (31.9)	54.4	5.5	0.0
Mountain Yellow-Legged Frog					
Potentially Suitable Aquatic Habitat	0.0	5.4 (5.4)	0.5	0.0	0.0
Refugia/Foraging/Dispersal Habitat	0.7	162.0 (151.3)	13.3	0.0	0.0
Western Spadefoot					
Potentially Suitable Habitat	3.2	539.1 (304.1)	146.9	15.3	0.0
California Glossy Snake					
Potentially Suitable Habitat	20.3	554.2 (145.2)	211.2	15.7	0.0
South Coast Garter Snake					
Potentially Suitable Habitat	0.0	0.0	14.7	0.0	0.0
Southwestern Pond Turtle					
Aquatic Habitat	0.0	0.0	0.9	0.0	0.0
Potentially Suitable Upland Habitat	0.0	0.0	18.5	0.0	0.0
Tricolored Blackbird					
Occupied Colony Habitat	0.0	0.0	0.0	0.0	0.0
Suitable Colony Habitat	0.0	51.8 (50.3)	3.3	0.0	0.0
Breeding Season Foraging – Natural	24.8	66.3 (7.6)	61.0	5.6	0.0

Covered Species Modeled Habitat[1]	Acres of Permanent Impact by Covered Activity Type – Permanent				
	Water Reuse	Groundwater Recharge[2]	Wells and Water Infrastructure	Solar Energy	Habitat Improvement
Breeding Season Foraging – Agriculture	0.0	6.8	60.1	0.0	0.0
Non-Breeding Season Foraging – Natural	0.1	0.0	0.3	0.0	0.0
Non-Breeding Season Foraging – Agriculture	0.0	0.0	0.1	0.0	0.0
Burrowing Owl					
Potentially Suitable Habitat	27.8	416.9 (181.6)	275.9	15.7	0.0
Cactus Wren					
Known Suitable Nesting	0.0	14.4	0.2	0.0	0.0
Potential Nesting and Foraging Habitat	27.9	420.7 (186.0)	217.3	15.7	0.0
Recently Burned (2008–2018)	0.1	0.0	1.5	0.0	0.0
Yellow-Breasted Chat					
Potentially Suitable Habitat	2.1	92.0 (68.5)	32.6	<0.1	0.0
Western Yellow-Billed Cuckoo					
High Value Breeding Habitat	0.0	0.0	<0.1	0.0	0.0
Other Potentially Suitable Breeding Habitat	0.0	0.0	8.7	0.0	0.0
Southwestern Willow Flycatcher					
Core Southwestern Willow Flycatcher Habitat	0.0	6.0	9.5	0.0	0.0
Very High Value Habitat	0.0	0.0	<0.1	0.0	0.0
High Value Habitat	0.0	0.0	<0.1	0.0	0.0
Moderate Value Habitat	0.0	0.0	<0.1	0.0	0.0
Other Potentially Suitable Habitat	2.1	86.1 (68.5)	23.1	<0.1	0.0
Coastal California Gnatcatcher					
Very High Value Habitat	<0.1	30.3 (13.8)	9.5	0.7	0.0
High Value Habitat	0.0	34.8 (8.4)	11.5	0.0	0.0

Covered Species Modeled Habitat[1]	Acres of Permanent Impact by Covered Activity Type – Permanent				
	Water Reuse	Groundwater Recharge[2]	Wells and Water Infrastructure	Solar Energy	Habitat Improvement
Moderate Value Habitat	0.1	41.7 (18.3)	13.8	0.0	0.0
Low Value Habitat	0.4	127.8 (95.7)	55.9	4.8	0.0
Other Suitable Habitat	0.0	70.6 (1.3)	0.9	0.0	0.0
Least Bell's Vireo					
Core Breeding Habitat	0.0	0.0	0.2	0.0	0.0
Other Breeding Habitat	2.1	92.0 (68.5)	32.4	<0.1	0.0
Los Angeles Pocket Mouse					
Potentially Suitable Habitat	20.2	430.4 (181.9)	190.7	15.7	0.0
San Bernardino Kangaroo Rat					
Suitable Habitat	0.3	645.1 (377.2)	33.0	3.0	0.0
Refugia[3]	<0.1	135.3 (118.6)	14.6	0.0	0.0
Assumed Occupied[4]	1.6	515.8 (57.5)	148.2	15.9	0.0

[1] Ground-disturbing impacts are not applicable to the three fish species that only occur in aquatic habitat.

[2] Impact acreages in parentheses are within existing water recharge/flood control basins subject to regular O&M activities and are a subset of the total acres. For example, of the 645.1 acres of permanent impacts on San Bernardino kangaroo rat modeled habitat from Groundwater Recharge activities, 377.2 acres occur within existing basins. Consequently, impacts outside of existing basins are 645.1 - 377.2 = 267.9 acres.

[3] San Bernardino kangaroo rat refugia habitat is composed of modeled habitat that occurs outside of the 100-year floodplain.

[4] "Assumed Occupied" is not a modeled dataset; it is a separate data layer that was estimated to indicate all areas that are assumed to be currently occupied by SBKR. 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 4-18. Estimated Temporary Impacts of Ground-Disturbing Covered Activities on Covered Species Modeled Suitable Habitat by Covered Activity Type

Covered Species Modeled Habitat[1]	Acres of Impact by Covered Activity Type – Temporary				
	Water Reuse	Groundwater Recharge	Wells and Water Infrastructure	Solar Energy	Habitat Improvement
Slender-Horned Spineflower					
Current Occupied Habitat (modeled)	0.0	0.0	0.0	0.0	0.0
Historic Occupied Habitat (modeled)	0.0	0.0	0.0	0.0	
Potentially Suitable Habitat	1.9	11.9	100.2	0.0	
Santa Ana River Woolly-Star					
Potentially Suitable Habitat	2.9	11.9	42.9	0.0	0.0
Mountain Yellow-Legged Frog					
Potentially Suitable Aquatic Habitat	0.2	0.0	0.1	0.0	0.0
Refugia/Foraging/Dispersal Habitat	1.5	0.0	11.3	0.0	0.0
Western Spadefoot					
Potentially Suitable Habitat	2.6	12.6	96.4	0.0	0.0
California Glossy Snake					
Potentially Suitable Habitat	4.7	13.6	155.1	0.0	0.0
South Coast Garter Snake					
Potentially Suitable Habitat	0.0	0.0	43.5	0.0	0.0
Southwestern Pond Turtle					
Aquatic Habitat	0.0	0.0	4.8	0.0	0.0
Potentially Suitable Upland Habitat	0.0	0.0	53.9	0.0	0.0
Tricolored Blackbird					
Occupied Colony Habitat	0.0	0.0	0.0	0.0	0.0
Suitable Colony Habitat	0.0	0.0	10.7	0.0	0.0
Breeding Season Foraging – Natural	1.6	0.0	42.0	0.0	0.0
Breeding Season Foraging – Agriculture	0.6	0.0	100.4	0.0	0.0
Non-Breeding Season Foraging – Natural	0.0	0.0	0.3	0.0	0.0
Non-Breeding Season Foraging – Agriculture	0.0	0.0	0.9	0.0	0.0

	Acres of Impact by Covered Activity Type – Temporary				
Covered Species Modeled Habitat[1]	Water Reuse	Groundwater Recharge	Wells and Water Infrastructure	Solar Energy	Habitat Improvement
Burrowing Owl					
Potentially Suitable Habitat	4.9	12.6	225.1	0.0	0.0
Cactus Wren					
Known Suitable Nesting	0.0	0.0	0.3	0.0	0.0
Potential Nesting and Foraging Habitat	4.6	12.6	163.0	0.0	0.0
Recently Burned (2008–2018)	0.0	0.0	6.4	0.0	0.0
Yellow-Breasted Chat					
Potentially Suitable Habitat	0.7	0.0	44.0	0.0	0.0
Western Yellow-Billed Cuckoo					
High Value Breeding Habitat	0.0	0.0	0.8	0.0	0.0
Other Potentially Suitable Breeding Habitat	0.0	0.0	8.2	0.0	0.0
Southwestern Willow Flycatcher					
Core Southwestern Willow Flycatcher Habitat	0.2	0.0	3.5	0.0	0.0
Very High Value Habitat	0.0	0.0	0.4	0.0	0.0
High Value Habitat	0.0	0.0	0.2	0.0	0.0
Moderate Value Habitat	0.0	0.0	0.1	0.0	0.0
Other Potentially Suitable Habitat	0.5	0.0	39.7	0.0	0.0
Coastal California Gnatcatcher					
Very High Value Habitat	0.3	1.6	4.1	0.0	0.0
High Value Habitat	0.1	8.6	8.3	0.0	0.0
Moderate Value Habitat	0.6	1.4	19.0	0.0	0.0
Low Value Habitat	1.0	0.9	63.2	0.0	0.0
Other Suitable Habitat	0.0	0.0	4.1	0.0	0.0
Least Bell's Vireo					
Core Breeding Habitat	0.0	0.0	17.2	0.0	0.0
Other Breeding Habitat	0.0	0.0	26.8	0.0	0.0

Covered Species Modeled Habitat[1]	Acres of Impact by Covered Activity Type – Temporary				
	Water Reuse	Groundwater Recharge	Wells and Water Infrastructure	Solar Energy	Habitat Improvement
Los Angeles Pocket Mouse					
Potentially Suitable Habitat	4.6	12.3	127.3	0.0	0.0
San Bernardino Kangaroo Rat					
Suitable Habitat	4.4	23.8	44.5	0.0	0.0
Refugia[2]	0.8	23.8	21.8	0.0	0.0
Assumed Occupied[3]	14.0	26.6	53.7	0.0	0.0

[1] Ground-disturbing impacts are not applicable to the three fish species that only occur in aquatic habitat.

[2] San Bernardino kangaroo rat refugia habitat is composed of modeled habitat that occurs outside of the 100-year floodplain.

[3] "Assumed Occupied" is not a modeled dataset; it is a separate data layer that was estimated to indicate all areas that are assumed to be currently occupied by SBKR. 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.

4.6.1 Fully Avoided Species

The Delhi Sands flower-loving fly and arroyo toad were analyzed during the development of this HCP, and avoidance measures for these species eliminate the potential for adverse effects; therefore, Covered Activities are not anticipated to result in impacts on these species. The avoidance measures for these species are described in Sections 5.6.1. and 5.6.2., respectively. Because it is anticipated that Covered Activities will fully avoid these species, they are not listed in Table 4-16 or Table 4-17. The rationale for determining that these species will be fully avoided is discussed briefly below.

Delhi Sands Flower-Loving Fly

The distribution of the Delhi Sands flower-loving fly in the Planning Area is defined by modeled suitable habitat and suitable habitat (extirpated) and documented occurrences. Extirpated lands are those identified in the U.S. Fish and Wildlife Service (USFWS) 5-year review (USFWS 2008). It is only known from Riverside and San Bernardino Counties, with most occupied habitat located within a limited area of southwestern San Bernardino County, west of Colton. Modeled suitable habitat (1,362 acres) and suitable habitat (extirpated) (1,742 acres) also occur in this area on undeveloped patches within Delhi Sand soil types; the greatest density of modeled habitat occurs north and northwest of Eastvale, west of Colton, northwest of the Jurupa Hills, and east of the Ontario International Airport (Figure 3-28). Refer to the Delhi Sands flower-loving fly species account in Section 3.8.3 for a list of the parameters for this species' modeled habitat in the Planning Area.

Projects occurring in suitable habitat (extirpated) would not result in incidental take. There are an estimated 0.2 acre of permanent disturbance and 1.5 acres of temporary disturbance from Covered Activities occurring in modeled suitable habitat for the Delhi Sands flower-loving fly (Table 4-19). These activities, and any other covered projects proposed that would disturb modeled suitable Delhi Sands flower-loving fly habitat in the Planning Area, would adhere to the avoidance measures outlined in Chapter 5 to fully avoid impacts on the species.

Table 4-19. Projects with Estimated Disturbance in Modeled Suitable Delhi Sands Flower-Loving Fly Habitat that Would Implement Measures to Fully Avoid Impacts on the Species

Covered Activity ID[1]	Covered Activity Type	Potential Impacts to Be Fully Avoided: Permanent Disturbance	Potential Impacts to Be Fully Avoided: Temporary Disturbance
Met.2	Wells and Water Conveyance Infrastructure	0.0	<0.1
Met.3	Wells and Water Conveyance Infrastructure	0.2	0.0
Rial.1	Water Reuse Project	0.0	<0.1
RPU.10	Wells and Water Conveyance Infrastructure	0.0	0.1
WD.5	Wells and Water Conveyance Infrastructure	0.0	<0.1
West.7	Wells and Water Conveyance Infrastructure	0.0	<0.1
WV.2	Wells and Water Conveyance Infrastructure	0.0	0.3
WV.6	Wells and Water Conveyance Infrastructure	0.0	0.8

[1] See Table 2-1 for a summary list of these Covered Activities.

Arroyo Toad

The distribution of the arroyo toad in the Planning Area is defined by modeled suitable breeding habitat, non-breeding upland habitat, permeable movement areas, and documented occurrences. Within the Planning Area, the arroyo toad is known from Cajon Wash and the mouth of Cucamonga Canyon within and outside of San Bernardino National Forest. Modeled suitable habitat includes these two regions as well as lands within Day and Etiwanda Canyon washes (Figure 3-44). There are three modeled habitat types in the Planning Area: suitable breeding habitat (1,754 acres), non-breeding upland habitat (5,884 acres) and permeable movement area (1,659 acres). Within the Planning Area, designated critical habitat (1,777 acres) occurs in the upper regions of Cajon Wash. The only known current (post-2005) occurrence of arroyo toad also occurs in the upper reaches of Cajon Wash (Figure 3-44). Refer to the arroyo toad species account in Section 3.8.3 for a list of the parameters for this species' modeled habitat in the Planning Area.

Table 4-20 lists projects with estimated disturbance in arroyo toad modeled suitable habitat types. These activities, and any other covered projects proposed that would disturb arroyo toad modeled habitat in the Planning Area, would adhere to the avoidance measures outlined in Chapter 5 to fully avoid impacts on the species.

Table 4-20. Projects with Estimated Disturbance in Arroyo Toad Modeled Suitable Habitat that Would Implement Measures to Fully Avoid Impacts on the Species

		Potential Impacts	
Covered Activity ID[1]	**Covered Activity Type**	**Permanent Disturbance[2]**	**Temporary Disturbance**
Suitable Breeding Habitat			
IEUA.2.05[4]	Groundwater Recharge	24.9 (24.9)	0.0
Met.2	Wells and Water Conveyance Infrastructure	0.0	0.1
Met.3	Wells and Water Conveyance Infrastructure	0.3	0.0
WD.3	Wells and Water Conveyance Infrastructure	0.0	0.6
WD.5	Wells and Water Conveyance Infrastructure	0.1	0.2
Total		**25.3 (24.9)**	**0.9**
Non-Breeding Upland Habitat			
IEUA.1.03[4]	Groundwater Recharge	5.7 (5.7)	0.3
IEUA.2.05[4]	Groundwater Recharge	16.4 (16.4)	0.0
Met.2	Wells and Water Conveyance Infrastructure	0.0	1.0
Met.3	Wells and Water Conveyance Infrastructure	0.9	0.0
WD.3	Wells and Water Conveyance Infrastructure	0.4	0.9
WD.5	Wells and Water Conveyance Infrastructure	0.1	0.6
Total		**23.5 (22.1)**	**2.8**
Permeable Movement Area (developed, agriculture, disturbed)[3]			
IEUA.1.03[4]	Groundwater Recharge	61.8 (61.8)	1.9
IEUA.2.05[4]	Groundwater Recharge	1.0 (1.0)	0.0
Met.2	Wells and Water Conveyance Infrastructure	0.0	2.1
Met.3	Wells and Water Conveyance Infrastructure	3.4	0.0
WD.3	Wells and Water Conveyance Infrastructure	<0.1	1.1

Covered Activity ID[1]	Covered Activity Type	Potential Impacts Permanent Disturbance[2]	Potential Impacts Temporary Disturbance
WD.5	Wells and Water Conveyance Infrastructure	0.2	0.4
Total		**66.4 (62.8)**	**5.5**
Designated Critical Habitat		**0.7**	**2.8**

[1] See Table 2-1 for a summary list of these Covered Activities.

[2] Impact acreages in parentheses are within existing water recharge/flood control basins subject to regular O&M activities and are a subset of the total acres. For example, of the 66.4 acres of total modeled permeable movement area, 62.8 acres occur within existing basins. Consequently, impacts outside of basins are: 66.4 - 62.8 = 3.6 acres.

[3] If field inspection of a Covered Activity project area indicates it is clearly not suitable for arroyo toad movement, then avoidance is not necessary.

[4] Impacts at IEUA.1.03 (San Sevaine Basins) and IEUA 2.05 (Etiwanda Basin) are on modeled suitable habitat. These locations are not within designated critical habitat, and there have been no documented occurrences of the species at these locations.

4.6.2 Plant Species

Slender-Horned Spineflower

The distribution of slender-horned spineflower in the Planning Area is defined by current occupied habitat, historic occupied habitat, and modeled suitable habitat, and documented occurrences. Refer to the slender-horned spineflower species account in Section 3.8.3 for a list of the parameters for this species' modeled suitable habitat in the Planning Area. Most documented occurrences for the species occur east of the San Bernardino Airport in the vicinity of the mainstem of the Santa Ana River, within the Wash Plan HCP area. Modeled suitable habitat (93,006 acres) is widely distributed into the foothills of the San Bernardino and San Gabriel Mountains in the northern portion of the Planning Area and across the Gavilan Plateau and the foothills of the Santa Ana Mountains in the southern portion of the Planning Area (Figure 3-26). Documented current occupied habitat (18 acres) is present in the Santa Ana River floodplain downstream of Seven Oaks Dam within the Wash Plan HCP area, and along Cajon Creek. Documented historic occupied habitat (35 acres likely extirpated) is located along the mainstem of the Santa Ana River downstream of Seven Oaks Dam, and within Cajon Creek, Lytle Creek, and along other minor foothill creeks.

Potential Direct and Indirect Effects

No Covered Activities co-occur with recent documented occurrences of the species and preconstruction surveys, project siting, and avoidance and minimization measures will ensure that direct effects on spineflower are avoided to the maximum extent practicable. Direct effects on spineflower could result from direct removal or harm of individual plants or their existing seed bank. Grading, excavating, stockpiling, or other earth-disturbing activities associated with new construction of facilities and infrastructure (e.g., water treatment plants, water pipelines, discharge facilities, diversion structures) could directly remove spineflower plants and seeds, and the species' habitat. Compacted soil conditions caused by heavy equipment movement during construction could inhibit seed germination and root penetration in the soil surface, resulting in potential loss of spineflower habitat. The increased human presence during new construction activities and ongoing maintenance activities could also increase the potential for trampling of individual plants. Conversely, temporary surface disturbance may enhance germination in the years following disturbance if permanent structures are not constructed (USFWS 2010a).

Indirect effects on spineflower from Covered Activities could include the introduction of nonnative plant species and altered hydrology. Vegetation management, road and pipeline construction and maintenance, and new basin construction could increase the spread of nonnative species, especially in areas adjacent to surface-disturbing activities. Nonnative invasive plant species such as annual grasses could displace the spineflower and prevent seeds sprouting, especially in areas adjacent to roads or other disturbed areas. A mid- to late-successional species, the spineflower requires flood (or other ground) disturbance; consequently, activities that eliminate, degrade, or curtail natural fluvial processes such as the creation of new diversion structures or recharge basins could modify spineflower habitat and/or eliminate hydrologic processes that maintain spineflower habitat (USFWS 2010a). Most of the documented occurrences on the Santa Ana River are currently adversely affected by altered hydrology resulting from the Seven Oaks Dam; therefore, additional changes to hydrology from the Covered Activities could further exacerbate these impacts in the Planning Area. Section 4.4.2 summarizes the potential effects on sediment transport from Covered Activities.

Impact Assessment

The impact assessment of slender-horned spineflower estimates the permanent loss of 311.2 acres of modeled suitable habitat with Covered Activities within the Planning Area (Table 4-16). Of this total, 30.6 acres of impacts occur within existing basins. As shown in Table 4-17, areas of permanent modeled suitable habitat loss would result predominantly from the construction of groundwater recharge facilities (207.2 acres; 30.6 acres of which are within existing basins) in the vicinity of Cajon Wash, Dry Canyon Wash, and Mill Creek.

Temporary habitat impacts of 114.0 acres of modeled suitable habitat would occur, primarily as a result of short-term disturbance associated with wells and water conveyance infrastructure (100.2 acres of modeled suitable habitat) (Table 4-17 4-18). These activities would result in temporary reduction of habitat quality or temporary loss of habitat. Impacts from individual Covered Activities are shown in Appendix F. There are no anticipated impacts on current occupied slender-horned spineflower habitat.

No Covered Activities coincide with documented occurrences of spineflower and preconstruction surveys, and avoidance and minimization measures, including project siting will ensure that impacts are reduced to the maximum extent practicable. Covered Activities do however occur within modeled suitable habitat, and even if they do not remove plants, a project could reduce the spineflower seedbank. The spineflower has a relatively long-lasting seedbank, which helps maintain the species in dry years. Removal of an unknown seedbank within an extirpated occurrence area (no known plants) could affect (reduce) the potential for future recruitment of new spineflower plants. However, given that there are no impacts identified within documented occupied habitat, and preconstruction surveys, and avoidance and minimization measures, including project siting, will be rigorously implemented, impacts from Covered Activities on spineflower populations during construction and O&M activities are anticipated to be avoided, or at worst very small. Covered Activity impacts on modeled suitable habitat are also small when compared to the total modeled suitable habitat within the Planning Area (425 of 93,006 acres, or <1%), of which a portion is within existing basins (31 of 425 acres, or 7%), and consequently, population-level impacts would be limited.

As mentioned, avoidance and minimization measures will ensure that impacts on individual plants will be near zero and that adverse effects on modeled suitable habitat will be reduced to the greatest extent practicable. These measures include project spatial siting, pre-Covered Activity surveys, seed collecting and storage, fencing, and topsoil sequestration and are discussed in more detail in Chapter 5. Approximately 531.7 acres of modeled suitable habitat will be included in the HCP Preserve System and will be protected in perpetuity (Table 4-21). Conserved habitat will be monitored and managed to enhance habitat conditions for this species.

Table 4-21. Total Acres of Slender-Horned Spineflower Modeled Habitat Estimated to Be Impacted by Ground-Disturbing Covered Activities

	Impacts		Mitigation
Modeled Suitable Habitat By Phase	**Permanent[1]**	**Temporary**	**HCP Preserve System**
Current Occupied Habitat (modeled)			
Up-Front (Pre-Phase 1)			
Phase 1	0.0	0.0	0.1
Phase 2	0.0	0.0	--
Phase 3	0.0	0.0	--
Phase 4	0.0	0.0	--
Total	*0.0*	*0.0*	*0.1*
Historic Occupied Habitat (modeled)			
Up-Front (Pre-Phase 1)			
Phase 1	<0.1 (<0.1)	0.0	--
Phase 2	0.0	0.0	--
Phase 3	0.0	0.0	--
Phase 4	0.0	0.0	--
Total	*<0.1 (<0.1)*	*0.0*	--
Potentially Suitable Habitat			
Up-Front (Pre-Phase 1)			17.1
Phase 1	121.5 (24.9)	61.9	465.1
Phase 2	47.7 (5.7)	50.3	49.3
Phase 3	79.6	0.2	--
Phase 4	62.4	1.6	--
Total	*311.2 (30.6)*	*114.0*	*531.5*
Total Modeled Suitable Habitat	**311.2 (30.6)**	**114.0**	**531.7**
Total Modeled Habitat Outside of Existing Basins	**280.6**	**114.0**	**531.7**

[1]Impact acreages in parentheses are within existing water recharge/flood control basins subject to regular O&M activities, and are a subset of the total acres. For example, of the 311.2 acres of permanent impacts, 30.6 acres occur within existing basins. Consequently, impacts outside of basins are 311.2 – 30.6 = 280.6 acres.

Santa Ana River Woolly-Star

The distribution of the Santa Ana River woolly-star in the Planning Area is defined by modeled suitable habitat and documented occurrences. Refer to the Santa Ana River woolly-star species account in Section 3.8.3 for a list of the parameters for this species' modeled habitat in the Planning Area. The highest density of current documented occurrences in the Planning Area is associated with the Santa Ana River valley between Greenspot Road near Redlands, the I-215 north of

Riverside, and the Cajon Wash north and south of Foothill Highway (I-210). Modeled suitable habitat (16,434 acres) occurs primarily in the floodplain of the Santa Ana River (including the Prado Flood Control Basin), Mill Creek, Cajon Wash, Lytle Creek, Temescal Wash, Lake Mathews, Mill Creek, and San Timoteo Canyon (Figure 3-27).

Potential Direct and Indirect Effects

Preconstruction surveys, project siting, and avoidance and minimization measures will ensure that direct effects on Santa Ana River woolly-star are avoided to the maximum extent practicable. Direct effects on the Santa Ana River woolly-star could result from direct removal or harm of individual plants or their existing seed bank. Grading, excavating, soil stockpiling, or other earth-disturbing activities associated with construction could directly remove the Santa Ana River woolly-star and its habitat. Compacted soil conditions caused by heavy equipment movement during construction could inhibit seed germination and root penetration in the soil surface, resulting in potential loss of woolly-star habitat. The increased human presence during new construction activities and ongoing maintenance activities could also increase the potential for trampling of individual plants. Woolly-star is often found in areas with slight surface disturbance; therefore, temporary surface disturbance may benefit this species (USFWS 2010b).

Indirect effects on Santa Ana River woolly-star from Covered Activities could include the introduction of nonnative plant species and altered hydrology. Vegetation management, road and pipeline construction and maintenance, and new basin construction could increase the spread of nonnative species, especially in areas adjacent to surface-disturbing activities. Nonnative invasive plant species, such as annual grasses, could displace woolly-star and reduce recruitment, especially in areas adjacent to roads or other disturbed areas. Facilities that remove natural land cover could also displace the plant's pollinators that could result in decreased productivity. Dams, water diversion, and recharge basin activities that reduce flow volumes and sediment loads could reduce the frequency of scouring and depositional events in the floodplain and allow alluvial fan sage scrub communities on the Santa Ana River to achieve early to mid-succession, reducing seedling establishment of woolly-star. All documented occurrences of Santa Ana River woolly-star along the Santa Ana River are currently adversely affected by altered hydrology resulting from the Seven Oaks Dam; therefore, additional changes to hydrology from the Covered Activities could further exacerbate these impacts in the Planning Area. Section 4.4.2 summarizes the potential effects on sediment transport from Covered Activities.

Impact Assessment

The impact assessment of the Santa Ana River woolly-star estimates the permanent loss of 406.6 acres of modeled suitable habitat with Covered Activities within the Planning Area (Table 4-16). Of this total, 31.9 acres of impacts occur within existing basins. The majority of permanent modeled habitat loss would occur where the Permittees construct groundwater recharge facilities (346.2 acres) (Table 4-17).

Temporary impacts of 57.8 acres of modeled suitable habitat with Covered Activities (Table 4-16) would occur as a result of short-term disturbance associated primarily with the construction of wells and water conveyance infrastructure (42.9 acres) (Table 4-18). These activities would result in the temporary reduction in habitat quality.

Impacts are also broken down by Preserve Unit for the two Alluvial Fan Preserve Units (Table 4-23 and Table 4-24). Within Alluvial Fan Preserve Unit A there are 104.8 acres of permanent impacts

(19.1 acres of which occur within existing basins) and 31.0 acres of temporary impacts on modeled habitat. These impacts are offset by 334.7 acres of mitigation of modeled habitat within Alluvial Fan Preserve Unit A. For Alluvial Fan Preserve Unit B there are a 264.5 acres of permanent impacts (4.3 acres of which occur within existing basins) and 10.4 acres of temporary impacts on modeled habitat. These impacts will be offset by mitigation lands acquired within Alluvial Fan Preserve Unit B. The vast majority of ground-disturbing Covered Activity impacts within Alluvial Fan Preserve Unit B are proposed to occur starting in Phase 3 of HCP implementation (all but 17.1 acres of a total of 274.9 acres of impacts will occur in Phases 3 and 4 of HCP implementation, Table 4-24). The Covered Activities associated with these impacts can only occur if mitigation lands within the Lytle Creek/Cajon Creek area are acquired and preserved prior to Phase 3 of HCP implementation (see Chapter 5). Approximately 57.9 acres of mitigation of modeled habitat for Santa Ana River woolly-star have been identified in Alluvial Fan Preserve Unit B. These lands occur in the Devil Canyon area and are suitable as mitigation for impacts on Santa Ana River woolly-star modeled habitat. However, they cannot be used to mitigate impacts on occupied Santa Ana River woolly-star habitat. The HCP is actively pursuing additional mitigation within Alluvial Fan Preserve Unit B, and it is anticipated that lands will be secured prior to Phase 1 of HCP implementation. However, if acquisition of Santa Ana River woolly-star occupied habitat is not finalized prior to implementation of Phase 1 Covered Activity impacts on Santa Ana River woolly-star occupied habitat (note: Phase 1 Covered Activities are limited to routine operations and maintenance of existing facilities), impacts associated with Phase 1 will be offset through the purchase of mitigation/conservation bank credits within Alluvial Fan Preserve Unit B.

Impacts on Santa Ana River woolly-star within Alluvial Fan Preserve Unit B are not identified in Phase 2 of HCP implementation (Table 4-24). The majority of ground-disturbing Covered Activity impacts within Alluvial Fan Preserve Unit B are proposed to occur in Phases 3 and 4 of HCP implementation (Table 4-24). If additional acquisition of mitigation lands, including Santa Ana River woolly-star occupied lands, within Alluvial Fan Preserve Unit B has not occurred prior to Phase 3 of HCP implementation, Covered Activity impacts on Santa Ana River woolly-star occupied habitat cannot proceed (Chapter 5).

Covered Activities overlap with approximately 54 (of 1,580) documented current (post-2005) occurrences of the species in the Planning Area. Covered Activities occurring near documented occurrences and/or within Santa Ana River woolly-star modeled suitable habitat have the potential to impact this species: impacts could occur on plants not detected in pre-activity surveys or those that could not be avoided, and woolly-star reproduction could be adversely impacted by destroying seeds or displacing pollinators. Documented pollinators include 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*) (USFWS 2010b). However, given that impacts on modeled suitable habitat in the Planning Area due to Covered Activities are limited when compared to the total modeled suitable habitat (464 of 16,434 acres, or 3%), of which a portion is within existing basins (33 of 464 acres, or 7%), and rigorous avoidance and minimization measures will be implemented, population-level impacts on the species are anticipated to be small.

Avoidance and minimization measures will ensure that impacts on individual plants will be near zero and that adverse effects on modeled suitable habitat will be reduced to the greatest extent practicable. These measures include project siting, pre-Covered Activity surveys, fencing, and topsoil sequestration and are discussed in more detail in Chapter 5.

A minimum of approximately 433.0 acres of modeled habitat will be added to the HCP Preserve System and will be protected in perpetuity (Table 4-22). Conserved habitat will be monitored and managed to rehabilitate and/or restore[9] habitat conditions for this species. Of the 433.0 acres of conserved modeled suitable habitat, 334.7 acres will be located within Alluvial Fan Preserve Unit A, and a minimum of 57.9 acres will be located within Alluvial Fan Preserve Unit B (Table 4-23 and Table 4-24).

Table 4-22. Total Acres of Santa Ana River Woolly-Star Modeled Habitat Estimated to Be Impacted by Ground-Disturbing Covered Activities

	Impacts		Mitigation[2]
Modeled Habitat Type	**Permanent[1]**	**Temporary**	**HCP Preserve System**
Potentially Suitable Habitat			
Up-Front (Pre-Phase 1)			67.1
Phase 1	88.7 (25.3)	54.4	329.2
Phase 2	35.9 (6.6)	1.2	36.7
Phase 3	175.0	0.2	--
Phase 4	106.9	2.0	--
Total Modeled Habitat	406.6 (31.9)	57.8	433.0
Total Modeled Habitat Outside of Existing Basins	**374.7**	**57.8**	**433.0**

[1] Impact acreages in parentheses are within existing water recharge/flood control basins subject to regular O&M activities and are a subset of the total acres. For example, of the 406.6 acres of permanent impacts, 31.9 acres occur within existing basins. Consequently, impacts outside of basins are 406.6 – 31.9 = 374.7 acres.

[2] Mitigation acreages are the *minimum* that will be acquired. They include lands already acquired, or those owned by Permittees determined to have high potential for incorporation into the HCP Preserve System. Additional mitigation lands will be acquired for this species.

Table 4-23. Acres of Santa Ana River Woolly-Star Modeled Habitat Estimated to Be Impacted by Ground-Disturbing Covered Activities within Alluvial Fan Preserve Unit A

	Impacts		Mitigation
Modeled Habitat Type	**Permanent[1]**	**Temporary**	**Alluvial Fan Unit A**
Potentially Suitable Habitat			
Up-Front (Pre-Phase 1)			67.1
Phase 1	68.1 (19.1)	30.8	267.6
Phase 2	27.9	--	--
Phase 3	8.3	0.2	--
Phase 4	0.6	--	--
Total Modeled Habitat	104.8 (19.1)	31.0	334.7
Total Modeled Habitat Outside of Existing Basins	**85.7**	**31.0**	**334.7**

[9] For the purposes of this HCP, rehabilitation includes activities that improve habitat conditions of a degraded site, for example through nonnative plant management. Restoration includes more intensive activities, such as site manipulation, with the goal of rebuilding/expanding habitat and re-instating ecological processes and services, where possible.

[1]Impact acreages in parentheses are within existing water recharge/flood control basins subject to regular O&M activities and are a subset of the total acres. For example, of the 104.8 acres of permanent impacts, 19.1 acres occur within existing basins. Consequently, impacts outside of basins are 104.8 – 19.1 = 85.7 acres.

Table 4-24. Acres of Santa Ana River Woolly-Star Modeled Habitat Estimated to Be Impacted by Ground-Disturbing Covered Activities within Alluvial Fan Preserve Unit B

	Impacts		Mitigation[2]
Modeled Habitat Type	**Permanent[1]**	**Temporary**	**Alluvial Fan Unit B**
Potentially Suitable Habitat			
Up-Front (Pre-Phase 1)			--
Phase 1	7.6	9.5	57.9
Phase 2	-- (4.3)	--	--
Phase 3	166.7	--	--
Phase 4	86.0	0.8	--
Total Modeled Habitat	264.5 (4.3)	10.4	57.9
Total Modeled Habitat Outside of Existing Basins	**260.2**	**10.4**	**57.9**

[1] Impact acreages in parentheses are within existing water recharge/flood control basins subject to regular O&M activities and are a subset of the total acres. For example, of the 264.5 acres of permanent impacts, 4.3 acres occur within existing basins. Consequently, impacts outside of basins are 264.5 – 4.3 = 260.2 acres.
[2] Additional mitigation lands within Alluvial Fan Preserve Unit B will be required for this species, prior to Phase 3 of HCP implementation. Further, the 57.9 acres of mitigation identified in Phase 1 can only be used to offset impacts on modeled Santa Ana River woolly-star habitat. Impacts on occupied Santa Ana River woolly-star lands cannot proceed unless Santa Ana River woolly-star-occupied habitat is acquired prior to impacts.

4.6.3 Wildlife Species

Santa Ana Sucker

The distribution of the Santa Ana sucker in the Planning Area is defined via habitat suitability modeling, intensive annual surveys for sucker and other fish annually on the Santa Ana River (USGS surveys, described in Section 3.8.3), and surveys assessing the availability of suitable gravel and cobble substrate (Riverwalk surveys, described in Section 3.8.3). Refer to the Santa Ana sucker species account in Section 3.8.3 for a description of the methodology for determining the sucker's modeled preferred habitat in the Planning Area. The mainstem of the Santa Ana River from the Rialto Channel downstream to near Prado Dam was assessed for preferred habitat, totaling 21.1 miles of total assessed channel length. Over the length of this 21.1 miles, the sum of the predicted preferred habitat meeting suitable flow depth and velocity, and coarse substrate suitability criteria (>10 % coarse substrate) is 2.2 acres (Figure 3-41). In recent years the highest abundance of Santa Ana sucker has been concentrated from immediately downstream of the RIX facility discharge to approximately Riverside Avenue (Brown and May 2016).

Modeling was not conducted to estimate the potential reduction in suitable spawning or larval habitats that may occur with the implementation of Covered Activities. If the overall amount of adult preferred habitat is reduced, a proportionate amount of spawning habitat may be degraded. It is unknown if appropriate spawning substrate (fine to medium gravels) is currently a limitation for Santa Ana sucker in the Santa Ana River. A reduction in spawning substrate may or may not translate into a reduction in recruitment since other threats, like elevated summer and fall water temperature in much of the mainstem Santa Ana River, may limit fish survival. The mainstem Santa Ana River currently has ample larval and small juvenile Santa Ana sucker habitat (nursery habitat). These small size classes of fish utilize shallow and low velocity margins of the stream. Implementation of Covered Activities is not anticipated to reduce larval and young juvenile habitats. These habitats generally become limited when the channel is incised and/or when banks steepen. A steepened bank could be caused by a stable system with mature vegetation along its banks. High volume storm runoff is anticipated to continue to reshape the channel topography and alignment, therefore, a reduction in nursery habitat is not anticipated.

Potential Direct and Indirect Effects

No direct effects are anticipated to occur on individual Santa Ana sucker or on its occupied habitat with the implementation of Covered Activities. Conservation actions implemented prior to this HCP anticipated direct effects on Santa Ana sucker during the construction of habitat restoration projects, and the associated incidental take for these projects was provided under separate Section 7 consultations (currently in draft).

The primary indirect impact from Covered Activities on Santa Ana sucker is from hydrological modifications. Covered Activities that alter the depth and velocity of surface flows and reduce sediment transport conditions may alter the amount of exposed coarse substrate and reduce the amount of preferred sucker habitat at a given time. Covered Activities that result in decreasing groundwater will also negatively affect Santa Ana sucker through a reduction in available habitat and potential corresponding increases in water temperature, factors that favor nonnative aquatic predators. It should be noted that the Santa Ana River is a dynamic system, whereas the location and amount of Santa Ana sucker preferred habitat is constantly changing by storm event and by season. In general, during conditions where base flow conditions exist (late spring through fall), the majority of the preferred habitat exists toward the top end of the perennial stream where flow from tertiary treated wastewater transports fine sediment off of coarse sediment. These Covered Activities include reduced discharge from water treatment plants, and new water diversions and recharge facilities.

The primary anticipated direct impact on occupied Santa Ana sucker habitat will result from the SBMWD Recycled Water Project (WD.1), which will permanently reduce the amount of treated effluent discharged from the RIX facility into the Santa Ana River. This effluent discharge currently sustains the majority of habitat supporting Santa Ana sucker in the Planning Area, so reducing it would result in adverse effects on the population. Secondary effects from other Covered Activities include the potential long-term reduction in the rate of coarse sediment transport from upper reaches of the Santa Ana River into the occupied reaches of the river (see Section 4.4.2). Reduced supply of coarse sediment by these Covered Activities will be small as most coarse sediment is transported during large storm events. These large flow events will not be captured by the proposed Covered Activities, and as such these events will continue to transport large amounts of sediment. Further, sediment removed from recharge basins during O&M activities will be deposited for re-entrainment.

Indirect effects on Santa Ana sucker from Covered Activities could include the introduction of nonnative plant species and nonnative predators, habitat fragmentation, and chemical spills. Vegetation management for construction and maintenance could introduce nonnative plant species, such as tamarisk and giant reed, and facility maintenance could result in a spill of toxic substances (e.g., oil or gasoline). However, Best Management Practices (BMPs) and avoidance and minimization measures will be implemented to reduce the potential for spills and release/introduction of nonnative plant species into aquatic and riparian habitats. A stormwater pollution prevention plan (SWPPP) will also be implemented during project activities, further reducing potential impacts on Santa Ana sucker from ground disturbance near occupied reaches.

Impact Assessment

The impact assessment of the Santa Ana sucker estimates the permanent loss of 1.3 acres out of a total of 2.2 acres of modeled preferred habitat (suitable depth and water velocity, and coarse substrate present) within the 21.1-mile assessment area of the Santa Ana River (Table 4-25 and Table 4-26).

Given the limited amount of existing habitat within the Planning Area, this reduction in modeled preferred habitat is likely to have an adverse impact on the population of Santa Ana sucker in the mainstem of the Santa Ana River. Santa Ana sucker inhabits GDEs and has a direct reliance on the groundwater/surface flow interaction; therefore, these adverse impacts could be exacerbated by altered groundwater conditions (Rohde et al. 2019), as described in Section 3.8.3.

The upper reaches of the mainstem Santa Ana River and tributaries City Creek and Mill Creek are designated as critical habitat for the Santa Ana sucker (75 *Federal Register* [FR] 77962). These areas are essential sources of coarse sediment (gravel and cobble) that are transported to lower reaches of the Santa Ana River where Santa Ana sucker occur. There are approximately 83.3 acres of designated critical habitat that would be affected by permanent impacts, and 20.2 acres that would be affected by temporary impacts, from Covered Activities. More importantly, however, are the predicted effects of hydrologic change on sediment transport, as described below.

The potential effects of Covered Activities on sediment transport was evaluated in Section 4.4.2, which estimated that the total sediment transport would be reduced, but reductions in coarse sediment availability in the occupied reaches was not an imminent outcome of the effects of Covered Activities. However, over the long term (decades—but dependent on the frequency of large flood events capable of transporting coarse sediment) the reduced coarse sediment supply into occupied reaches may result in a net reduction in coarse sediment availability. Therefore, long-term monitoring of sediment conditions in the occupied reaches should be implemented to assess if the availability of coarse sediment is diminishing and if sediment replenishment is necessary at the upper end of the occupied reach. Over an extended time period within the occupied reach of the stream, the gradient of the river may be adversely affected (reduced or flattened) with an overall reduction in sediment supply (mostly sand and small gravel) at the top of the river (lowered elevation) and a raising of the lower end of the occupied reach from sediment deposition associated with flood control and water conservation activities in Prado Basin. The timeframe for this largely depends on the frequency of large flood events that occur in the future with the potential to transport coarse sediment. Long-term monitoring of sediment conditions in the Santa Ana River will be implemented as a part of this HCP to assess the availability of coarse sediment available for adult Santa Ana sucker. Adaptive management and monitoring in coordination with the implementation of the *Basin Sediment Management Plan* will work together to provide suitable substrate and a means to make it available in the occupied reaches of the river, for example sediment replenishment at the upper end of SAR USGS Reach 9.

Table 4-25. Potential Impacts on Santa Ana Sucker Modeled Preferred Habitat from Hydrologic Effects of Covered Activities

Reach Description[1]	Hydro Model Node[1]	Reach Length (feet)	Acres with Preferred Depth and Velocity per 1,000 Feet	Existing Acres of Preferred Habitat	Acres of Preferred Habitat with Covered Activities	Percent Reduction
Rialto Channel DS of Rialto outfall	NFRC-06	1,705	0.01	0.019	0.007	63.2%
SAR DS Rialto Channel and US RIX outfall	NSAR19	1,141	0.00	0.000	0.000	0.0%
SAR DS RIX outfall and US Riverside Ave (@ ESA Upper model site)	NSAR20	6,865	0.13	0.910	0.501	44.9%
SAR DS Riverside Ave and US node NSAR 22	NSAR21	3,242	0.09	0.279	0.112	59.9%
SAR DS node NSAR 22 and US Market St	NSAR22	5,624	0.08	0.425	0.122	71.3%
SAR DS Market St and US Hwy 60	NSAR23	1,576	0.06	0.093	0.021	77.4%
SAR DS Hwy 60 and US node NSAR 232	NSAR231	1,804	0.06	0.106	0.025	76.4%
SAR DS Hwy 60 and US Mission Blvd (@ ESA Middle model site)	NSAR232	4,000	0.06	0.236	0.055	76.7%
SAR DS Mission Blvd and US node NSAR 241 (@ ESA Lower model site)	NSAR24	5,679	0.01	0.064	0.010	84.4%
SAR DS node NSAR 241 and US node NSAR 242 (Tequesquite Arroyo reach)	NSAR241	7,883	0.00	0.016	0.000	100.0%
Total Suitable Habitat				**2.148**	**0.853**	**60.3%**

[1]Refer to Table 3-21 for a listing of all reaches within the 21.1-mile assessment reach over which Santa Ana sucker habitat was modelled. Only reaches with suitable substrate proportion (>10% gravel/cobble) are included in this table.

DS = downstream; NSAR = north Santa Ana River; US = upstream.

Avoidance and minimization measures will ensure that impacts on individual fish and modeled habitat will be reduced to the greatest extent practicable. These measures include avoiding impacts on spawning suckers through seasonal limitations, a biological monitor during construction activities, and preliminary surveys for and relocation of suckers prior to water diversion or dewatering and are discussed in more detail in Chapter 5.

Approximately 1.5 acres of the mainstem Santa Ana River and 3.6 acres in tributary restoration sites would be enhanced for the benefit of Santa Ana sucker and protected in the HCP Preserve System in perpetuity (Table 4-26). Conserved habitat will be monitored and managed to ensure the provision of long-term habitat value for this species. While the preferred habitat in the mainstem of the Santa Ana River will be reduced as a result of implementation of Covered Activities, conservation actions (habitat restoration, rehabilitation, and enhancements; translocation into historic habitats; long-term monitoring of all life stages; and management of aquatic nonnative predators) proposed to occur within the HCP Preserve System will offset these impacts and provide major contributions to the recovery of the Santa Ana sucker.

Table 4-26. Estimated Impacts on Santa Ana Sucker Modeled Preferred Habitat (acres)

	Impacts		Mitigation		
Modeled Habitat Type	**Permanent**	**Temporary**	**Preservation (Acquisitions and Easements)**	**SAR Mainstem Enhancement**	**Tributary Restoration (acres of stream habitat[1])**
Foraging Habitat					
Up-Front (Pre-Phase 1)					
Phase 1	1.3	--	--	1.5	1.7
Phase 2			--	--	1.9
Phase 3			--	--	--
Phase 4			--	--	--
Total	**1.3**		**--**	**1.5**	**3.6**
Designated Critical Habitat – Wet[2]	**13.5**	**4.8**	**147.2**		
Designated Critical Habitat – Dry[2]	**42.3**	**14.2**	**14.1**		

[1] This is the wetted area identified in the restoration design, which includes the entire area of the stream and is not equivalent to modeled suitable habitat for Santa Ana sucker, which considers depth and velocity.

[2]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.

Arroyo Chub

The distribution of the arroyo chub in the Planning Area is defined via miles of occupied reaches, documented occurrences, and preferred modeled habitat. Refer to the arroyo chub species account in Section 3.8.3 for a description of mapped habitat in the Planning Area. The species' 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 2012). 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. There is also potential habitat in several reaches in the Planning Area, including Chino Creek, Anza Creek, and below Corona Lake in Temescal Canyon, downstream of the Terramor development (Russell pers. comm.) (Figure 3-42).

Potential Direct and Indirect Effects

Arroyo chub is scarce in its native range because it does best in lower gradient streams, many of which have been channelized with urban expansion for flood water conveyance and supply purposes. Covered Activities that increase channelization or the prevalence of hardbank stabilization, or that divert flows from occupied or suitable reaches for the arroyo chub, could result in direct adverse effects on the species. Covered Activities that alter depth and velocity of surface flows, as well as decreasing groundwater, will also negatively affect this species through a reduction in available habitat as well as potential corresponding increases in water temperature, factors that favor nonnative aquatic predators.

Indirect effects on arroyo chub from Covered Activities could include the introduction of nonnative plant species and nonnative predators, habitat fragmentation, and chemical spills. Vegetation management for construction and maintenance could introduce nonnative plant species such as tamarisk and giant reed. Covered Activities that introduce impassible in-stream barriers to upstream movement could increase habitat fragmentation. Adverse effects may result from facility maintenance where operation of equipment could result in a spill of toxic substances (e.g., oil or gasoline) into arroyo chub habitat; however, BMPs would be implemented to reduce the potential for spills associated with maintenance activities. A SWPPP will also be implemented during activities, further reducing potential impacts on arroyo chub from ground disturbance near occupied reaches.

Impact Assessment

The impact assessment for the arroyo chub assumes a reduction in preferred modeled suitable habitat with a depth greater than 15 inches as a proxy for habitat where chub are most frequently found. The low flow dry season (August to October) is when this habitat is most limited; therefore, this impact assessment focuses on the effect during this period. During the dry season, these areas downstream of Covered Activities exist on the mainstem of the Santa Ana River and on Chino Creek. Existing habitat with depths greater than 15 inches along the entire 21.1-mile assessment area currently comprises approximately 3.7 acres, which would decrease to approximately 1.3 acres with the full development of all Covered Activities. Given that the species has already experienced such extensive habitat loss throughout the Planning Area and region, any additional habitat loss could be assumed to have proportional impacts on the arroyo chub population in the Planning Area.

Avoidance and minimization measures will ensure that impacts on individual arroyo chub and modeled habitat will be reduced to the greatest extent practicable. These measures include seasonal limitations, a biological monitor during construction activities, and preliminary surveys for and relocation of chubs prior to water diversion or dewatering. Approximately 3.6 acres of arroyo chub habitat will be restored in tributary restoration sites (Table 4-27). The 1.5 acres of Santa Ana River mainstem microhabitat enhancement is also anticipated to benefit arroyo chub. Conserved habitat will be monitored and managed to enhance habitat conditions for this species and will be protected in the HCP Preserve System in perpetuity.

Table 4-27. Acres of Arroyo Chub Modeled Habitat Estimated to Be Impacted

	Impacts		Mitigation		
Preferred Modeled Habitat	**Permanent**	**Temporary**	**Preservation (Acquisitions and Easements)**	**SAR Mainstem Enhancement**	**Tributary Restoration (acres of stream habitat[1])**
Habitat (depths >15 inches)			**Restored Stream Habitat**		
Up-Front (Pre-Phase 1)					
Phase 1	2.4	--	--	1.5	1.7
Phase 2	--	--	--	--	1.9
Phase 3	--	--	--	--	--
Phase 4	--	--	--	--	--
Total	**2.4**		**--**	**1.5**	**3.6**

[1] This is the wetted area identified in the restoration design, which includes the entire area of the stream and is not equivalent to modeled suitable habitat for arroyo chub, which considers depth.

Santa Ana Speckled Dace

The distribution of the Santa Ana speckled dace in the Planning Area is defined via miles of occupied reaches, documented occurrences, and wetted area (as a measure of aquatic habitat; see Section 3.6.4) in occupied reaches downstream of Covered Activities. Refer to the Santa Ana speckled dace species account in Section 3.8.3 for a description of mapped habitat in the Planning Area. This species is present in Fredabla Creek, downstream of the Plunge Creek confluence, Hemlock Creek, Lytle Creek, Cajon Creek, and Waterman Creek. Potential habitat exists in Strawberry Creek (recently extirpated), East Twin Creek, and possibly Horsethief Creek (Pisces 2014, Russell pers. comm.) (Figure 3-43).

Potential Direct and Indirect Effects

Most of the reaches occupied by Santa Ana speckled dace are upstream of where Covered Activities would occur. However, a limited amount of modeled habitat occurs downstream of Covered Activities (East Twin Creek). The lower reaches of City and Plunge Creeks are occupied by dace and are downstream of existing pipelines. Direct effects on Santa Ana speckled dace could include the potential for short-term habitat degradation during maintenance activities such as excavation and grading associated with pipeline maintenance and bank stabilization. However, pre-project surveys and avoidance and minimization measures will ensure that direct effects are reduced to the maximum extent practicable.

Indirect effects on Santa Ana speckled dace from Covered Activities could include the introduction of nonnative plant species and nonnative predators, habitat fragmentation, and chemical spills, though avoidance and minimization measures are expected to reduce these potential effects to the maximum extent practicable. BMPs will be implemented to reduce the potential for spills associated with maintenance activities, and a SWPPP will be implemented for all relevant activities to further reduce potential impacts on Santa Ana speckled dace.

Impact Assessment

The majority of occupied and modeled suitable habitat for Santa Ana speckled dace in the Planning Area occurs upstream of Covered Activities. There is 0.1 acre of modeled suitable aquatic habitat (wetted area) downstream of Covered Activities (i.e., East Twin Creek). The impact assessment for the Santa Ana speckled dace estimates that all of the wetted area downstream of Covered Activities would be lost (Table 4-28), but given that this represents 0.1 acre of wetted area, impacts on the dace population in the Planning Area would be extremely small.

Avoidance and minimization measures will ensure that impacts on individual Santa Ana speckled dace will be near zero. These measures include preliminary surveys for and relocation of individuals prior to water diversion or dewatering and are discussed in more detail in Chapter 5. Direct impacts on habitat are extremely limited. Additional conservation actions for Santa Ana speckled dace include an HCP funding contribution to the Santa Ana Speckled Dace Population Survey and Threats Analysis (Section 5.7.4), which is designed to increase the understanding of the distribution of and threats to this species.

Table 4-28. Acres of Santa Ana Speckled Dace Modeled Habitat Estimated to Be Impacted

	Impacts		
Modeled Habitat Type	**Permanent**	**Temporary**	**Mitigation**
Suitable Habitat (wetted area)			**Funding and Habitat Management**
Phase 1	--	--	There is no stream restoration specific to speckled dace habitat; however, active habitat management (e.g., nonnative species management) within occupied reaches where they co-occur with Santa Ana sucker translocation streams will benefit this species. Funding will also be contributed to the Santa Ana Speckled Dace Population Survey and Threats Analysis (Section 5.7.4). In combination, these actions will mitigate impacts on this species.
Phase 2	--	--	
Phase 3	--	--	
Phase 4	<0.1	--	
Total	**0.1**		

Mountain Yellow-Legged Frog

The distribution of the mountain yellow-legged frog in the Planning Area is defined by modeled suitable aquatic habitat and modeled refugia/foraging/dispersal habitat, and documented occurrences. Refer to the mountain yellow-legged frog species account in Section 3.8.3 for a list of the parameters for this species' modeled habitat in the Planning Area. The species historically occurred throughout the San Gabriel and San Bernardino Mountains in the northern part of the Planning Area in the mountainous portions of Cucamonga Wash, Day Canyon Wash, Lytle Creek, City

Creek, and East Fork Barton Creek (Figure 3-45) between 370 and 2,290 meters in elevation. Modeled habitat includes rocky and shaded streams as suitable aquatic habitat (2,189 acres) and adjacent riparian vegetation as refugia/foraging/dispersal habitat (91,854 acres). Within the Planning Area, 2,216 acres of designated critical habitat are in Day Canyon Wash, Lytle Creek, and East Fork Barton Creek. The only known current (post-2005) occurrences of mountain yellow-legged frog in the Planning Area are in the East Fork and mainstem of City Creek (Figure 3-45).

Potential Direct and Indirect Effects

The current extant occurrences of mountain yellow-legged frog do not co-occur with Covered Activities, and consequently potential direct and indirect effects on this species are anticipated to be minimal (on individuals or on occupied habitat). Potential disturbance may occur from habitat improvement activities proposed within a portion of City Creek, and/or from monitoring and management activities in areas where mountain yellow-legged frog may co-occur with translocated populations of Santa Ana sucker.

Indirect effects on mountain yellow-legged frog from Covered Activities are also anticipated to be minimal, and the implementation of avoidance and minimization measures, including BMPs and SWPPPs, will ensure that potential impacts are reduced to the maximum extent practicable.

Impact Assessment

The impact assessment of the mountain yellow-legged frog estimates the permanent loss of 5.9 acres of modeled suitable aquatic habitat and 176.0 acres of modeled refugia/foraging/dispersal habitat within the Planning Area (Table 4-16). However, because these areas of permanent habitat loss occur primarily where the Permittees currently conduct groundwater recharge activities (5.4 and 151.3 acres of aquatic and refugia/foraging/dispersal habitat, respectively, are within existing basins; Table 4-29), permanent impacts on modeled habitat are significantly less: a 0.5-acre impact on aquatic habitat and 24.7-acre impact on refugia/foraging/dispersal habitat. These impacts are on Waterman and East Twin Creeks, primarily from existing groundwater recharge basins, but because mountain yellow-legged frog is extirpated from these creeks, direct effects on the species from Covered Activities are not anticipated.

Temporary impacts on 0.3 acre of modeled aquatic habitat and 12.8 acres of modeled refugia/foraging/dispersal habitat (Table 4-16 4-16) have been identified as a result of Covered Activities (primarily associated with wells and water conveyance infrastructure [11.3 acres]) (Table 4-18), but these temporary impacts occur primarily in drainages where the species no longer occurs. Consequently, temporary impacts on mountain yellow-legged frogs from Covered Activities are not anticipated.

There are no anticipated impacts on known occurrences of mountain yellow-legged frog, or on mountain yellow-legged frog designated critical habitat, except for potential disturbance from habitat rehabilitation or restoration activities within a proposed Conservation Area in City Creek, and/or from monitoring and management activities in areas where mountain yellow-legged frog may co-occur with translocated populations of Santa Ana sucker. However, implementation of avoidance and minimization measures will ensure potential impacts are minimized to the greatest extent practicable.

Overall the amount of mountain yellow-legged frog modeled habitat that will be removed due to Covered Activities is a small proportion of the available modeled habitat in the Planning Area.

Specifically, the totals are 5.9 of 2,189 acres of suitable aquatic habitat, or <1%, of which a majority is within existing basins (5.4 of 5.9 acres, or 92%); and 176 of 91,854 acres of refugia/foraging/dispersal habitat, or <1%, of which a majority is within existing basins (151 of 176 acres or 86%).

The mountain yellow-legged frog inhabits GDEs and has a direct reliance on surface water that may be supported by groundwater; therefore, any adverse impacts could be exacerbated by altered groundwater conditions, as described in Section 3.8.3 (Rohde et al. 2019). No extant occurrences or designated critical habitat occurs in areas with modeled falling groundwater (Figure 4-8), but modeled suitable habitat for mountain yellow-legged frog in Cajon Wash and Waterman Creek occurs in areas of modeled rising groundwater (see Figure 4-8); however, given the species is not found in these locations this predicted change is not expected to adversely impact the species.

Mountain yellow-legged frog wetted area (as a measure of aquatic habitat downstream of Covered Activities; see Section 3.6.4) in Cajon and Waterman Creeks is predicted to be lost as a result of Covered Activities. But, because the species does not occur in these locations, and only 0.2 acre of potential impact on wetted area is estimated (Table 4-8, Section 4.4.3), this predicted loss is not expected to adversely impact the species. Therefore, it is unlikely any hydrologic change resulting from Covered Activities would impact occupied mountain yellow-legged frog habitat. For these reasons, Covered Activities are not anticipated to result in adverse effects on mountain yellow-legged frog populations or on the species' designated critical habitat within the Planning Area.

Avoidance and minimization measures will ensure that impacts on individual mountain yellow-legged frogs are minimized to the maximum extent practicable. These measures include minimization of project footprints in areas of suitable habitat, ensuring that construction activities do not extend beyond the limits of construction, and implementation of disease prevention protocols developed by USFWS. The majority of impacts on modeled habitat would occur in refugia, foraging, and dispersal habitat, with limited impacts occurring in modeled aquatic habitat. Approximately 247.9 acres of modeled refugia/foraging/dispersal habitat and 15.7 acres of modeled suitable aquatic habitat will be conserved in the HCP Preserve System in perpetuity, including 52 acres of designated critical habitat (Table 4-29). Conserved habitat will be monitored and managed to enhance habitat conditions for this species. The HCP will also provide contributions to the San Diego Zoo's Mountain Yellow-Legged Frog Captive Rearing and Translocation Program (Section 5.7.2) to assist with furthering current research to advance recovery of the species.

Table 4-29. Acres of Mountain Yellow-Legged Frog Modeled Habitat Estimated to Be Impacted by Ground-Disturbing Covered Activities

	Impacts		Mitigation
Modeled Habitat Type	**Permanent[1]**	**Temporary**	**HCP Preserve System**
Potentially Suitable Aquatic Habitat			
Up-Front (Pre-Phase 1)			
Phase 1	4.3 (3.7)	0.1	--
Phase 2	1.7 (1.7)	0.0	15.7
Phase 3	0.0	0.0	--
Phase 4	0.0	0.2	--
Total	*5.9 (5.4)*	*0.3*	*15.7*

Modeled Habitat Type	Impacts: Permanent[1]	Impacts: Temporary	Mitigation: HCP Preserve System
Refugia/Foraging/Dispersal Habitat			
Up-Front (Pre-Phase 1)			
Phase 1	83.6 (59.3)	11.3	--
Phase 2	92.1 (92.1)	0.0	247.9
Phase 3	0.3	0.0	--
Phase 4	0.0	1.5	--
Total	*176.0* (151.3)	*12.8*	*247.9*
Total Modeled Habitat	181.9 (156.7)[1]	13.1	263.6
Total Modeled Habitat Outside of Existing Basins	**25.2**	**13.1**	**263.6**
Designated Critical Habitat	**0.0**	**0.0**	**52.0**

[1]Impact acreages in parentheses are within existing water recharge/flood control basins subject to regular O&M activities and are a subset of the total acres. For example, of the 181.9 acres of permanent impacts, 156.7 acres occur within existing basins. Consequently, impacts outside of basins are 181.9 – 156.7 = 25.2 acres.

[2] Impacts on Refugia/Foraging/Dispersal Habitat are on Waterman and East Twin Creeks, primarily from existing groundwater recharge basins. Mountain yellow-legged frog have been extirpated from these creeks.

Note: Refer Table 4-8 for predicted impacts on mountain yellow-legged frog wetted area (as a measures of aquatic habitat).

Western Spadefoot

The distribution of the western spadefoot in the Planning Area is defined by modeled suitable habitat and documented occurrences. Refer to the western spadefoot species account in Section 3.8.3 for a list of the parameters for this species' modeled habitat in the Planning Area. Within the Planning Area, the western spadefoot is known from flood and playa plains and human-made basins within the drainages of Cajon Wash, Lytle Creek, Santa Ana River, Mill Creek, and Temescal Creek (Figure 3-46). While the species can breed in slow-moving waters of rivers and streams, there are no known documented occurrences in the modeled habitat on the mainstem of the Santa Ana River west of Highland Avenue. There are 38,252 acres of modeled suitable habitat in the Planning Area. However, because the spadefoot can use temporary rain pools in which to breed, predicting where its breeding habitat occurs is difficult, and subject to very site-specific and ephemeral conditions. Current (post-2005) documented occurrences of western spadefoot are scattered throughout the Planning Area along with modeled habitat; the highest densities of current documented occurrences are within the Wash Plan HCP area and adjacent areas along the Santa Ana River, and Mill Creek, north and east of Mentone (Figure 3-46).

Potential Direct and Indirect Effects

Potential direct effects on western spadefoot could include mortality due to vehicular traffic collisions and earth-moving activities during construction that disturb subterranean refugia. Direct effects on western spadefoot could also result from habitat destruction and degradation associated with construction activities. The loss of vernal pools and the alteration of existing artificial impoundments and pooled areas of ephemeral streams could also adversely affect modeled suitable breeding habitat.

Indirect effects on western spadefoot from Covered Activities could include the introduction of nonnative plant species and nonnative predators, altered surface water flows, habitat fragmentation, and chemical spills. Vegetation management for construction and maintenance could introduce nonnative plant species, such as tamarisk and giant reed, which could reduce the persistence of sandbars and breeding pools, crowd out native plants, and degrade native habitat for western spadefoot.

Changes in groundwater level could indirectly affect western spadefoots if falling groundwater reduces the amount and/or hydroperiod of aquatic habitat. Rising groundwater would not be expected to adversely affect the species.

Edge effects could lead to the introduction of predators such as bullfrogs and mosquitofish that prey on western spadefoot tadpoles. Recharge projects could result in the creation of deeper, persistent ponds, which could provide suitable habitat for these predatory species; if these ponds are created or enlarged adjacent to suitable habitat, western spadefoot could experience adverse effects. Habitat fragmentation resulting from Covered Activities could present barriers to movement and reduce connectivity between aquatic and upland areas with subterranean refugia.

Adverse effects may result from road maintenance. Equipment used to maintain vegetation along access roads and grading activities such as trucks, mowers, or other mechanical equipment could lead to spills of toxic substances (e.g., oil or gasoline) into western spadefoot habitat; however, BMPs would be implemented to reduce the potential for such effects. A SWPPP would also be implemented during vegetation and access road maintenance, further reducing potential impacts on this species.

Impact Assessment

The impact assessment of the western spadefoot estimates the permanent loss of 704.5 acres of modeled suitable habitat within the Planning Area (Table 4-16 4-16). However, because nearly half of this total occurs where Permittees currently conduct groundwater recharge activities (304.1 acres are within existing basins), permanent impacts on modeled habitat are significantly less: 400.4 acres. Areas of permanent modeled habitat loss would occur primarily where the Permittees construct permanent structures, such as groundwater recharge facilities (446.8 acres) and wells and water conveyance infrastructure (146.8 acres) (Table 4-17). Temporary habitat impacts of 111.7 acres (Table 4-16) of modeled suitable habitat would occur primarily as a result of short-term disturbance associated with the construction of water conveyance infrastructure (96.4 acres) (Table 4-18).

Western spadefoot habitat on Cajon Wash and Waterman Creek occurs in areas modeled to have rising groundwater, with Covered Activities in place (see Figure 4-8); however, this is not expected to adversely impact the species. There are very little to no predicted changes in groundwater in the occupied habitat east of Highland Avenue, adjacent to City Creek, or within the Wash Plan HCP area and adjacent habitat along the Santa Ana River and Mill Creek.

Approximately 6.5 acres of western spadefoot wetted area (as a measure of aquatic habitat downstream of Covered Activities; see Section 3.6.4) is predicted to be lost as a result of Covered Activities. But, because this potential loss represents a small proportion of the total estimated wetted area downstream of Covered Activities in the Planning Area (6.5 of 199 acres, or 3%; see Table 3-16 and Table 4-8), this predicted impact is not expected to adversely impact the species.

Western spadefoot is a widely distributed species outside the Planning Area; its range extends from the Redding area in northern California, south through the Central Valley and its foothills, through the South Coast Ranges into Southern California south of the Transverse Range and west of the

Peninsular Mountains into northwest Baja California (California Herps 2014). The amount of modeled suitable habitat that will be removed due to Covered Activities is a small proportion of the total modeled suitable habitat in the Planning Area (816 of 38,252 acres, or 2%), of which a portion is within existing basins (304 of 816 acres, or 37%). Covered Activities are estimated to coincide with 2 (out of 63) documented current (post-2005) occurrences of the species in the Planning Area. Impacts at these locations would result from wells and water conveyance infrastructure maintenance, specifically periodic maintenance such as vegetation management, road and pipeline maintenance, and facility repairs. Because these activities are temporal, the potential for population-level impacts is lower than if permanent structures were proposed. Implementation of avoidance and minimization measures to limit direct and indirect adverse effects will be important to minimize the potential for population-level adverse impacts on the species in the Planning Area.

Avoidance and minimization measures will ensure that impacts on individual western spadefoots will be substantially lower than the estimated impact on modeled suitable habitat. These measures include preconstruction surveys, implementation of disease prevention protocols developed by USFWS, reduced speeds to prevent mortality from construction traffic, limited construction or maintenance activities within or adjacent to areas of suitable breeding habitat, and implementation of construction site BMPs to minimize potential for spadefoots to enter and be harmed in construction sites. Approximately 588.4 acres of modeled habitat for this species will be conserved in the HCP Preserve System in perpetuity (Table 4-30). Conserved habitat will be monitored and managed to enhance habitat conditions for this species.

Table 4-30. Acres of Western Spadefoot Modeled Habitat Estimated to Be Impacted by Ground-Disturbing Covered Activities

	Impacts		Mitigation
Modeled Habitat Type	**Permanent[1]**	**Temporary**	**HCP Preserve System**
Potentially Suitable Habitat			
Up-Front (Pre-Phase 1)			60.6
Phase 1	243.9 (71.9)	62.5	512.9
Phase 2	315.8 (230.2)	46.4	14.9
Phase 3	74.0	0.2	--
Phase 4	70.8 (2.0)	2.6	--
Total Modeled Habitat	704.5 (304.1)	111.7	588.4
Total Modeled Habitat Outside of Existing Basins	**400.4**	**111.7**	**588.4**

[1]Impact acreages in parentheses are within existing water recharge/flood control basins subject to regular O&M activities and are a subset of the total acres. For example, of the 704.5 acres of permanent impacts, 304.1 acres occur within existing basins. Consequently, impacts outside of basins are 704.5 – 304.1 = 400.4 acres.

Note: Refer to Table 4-8 for predicted impacts on western spadefoot wetted area (as a measures of aquatic habitat).

California Glossy Snake

The distribution of California glossy snake in the Planning Area is defined by modeled suitable habitat and documented occurrences. Refer to the California glossy snake species account in Section 3.8.3 for a list of the parameters for this species' modeled habitat in the Planning Area. California glossy snake is known from grassland, chaparral, and coastal sage scrub communities in the valley floor and west slope of the San Bernardino Mountains and at scattered locations in northwest

Riverside County in the Planning Area (Figure 3-47). Approximately 146,338 acres of modeled suitable habitat was identified in the Planning Area. Current (post-2005) documented occurrences of California glossy snake are scattered throughout the Planning Area, along with modeled habitat; the highest density of current documented occurrences is within and adjacent to the Wash Plan HCP area and Cajon Wash (Figure 3-47).

Potential Direct and Indirect Effects

Direct effects on California glossy snake could include increased road mortality and loss or degradation of habitat resulting from construction of Covered Activities, especially in shrub and grassland communities where the snake is known to occur.

Indirect effects on California glossy snake from Covered Activities could include the introduction of nonnative plant species and subsequent decreases in habitat quality. An increase in nonnative annual grass cover could also lead to increased fire frequency and intensity, which may result in further negative impacts on California glossy snake habitat (Thompson et al. 2016).

Impact Assessment

The impact assessment of the California glossy snake estimates the permanent loss of 801.3 acres of modeled suitable habitat within the Planning Area (Table 4-16 4-16). However, because this total includes existing groundwater recharge facilities subject to routine O&M activities (145.2 acres are within existing basins), permanent impacts are less: 656.1 acres. Areas of permanent modeled habitat loss would primarily occur where the Permittees construct permanent structures such as groundwater recharge facilities (554.2 acres) (145.2 acres of which are within existing basins) and wells and water conveyance infrastructure (211.2 acres) (Table 4-17). Temporary impacts on 178.6 acres (Table 4-16) of modeled suitable habitat would occur primarily as a result of short-term disturbance associated with the construction of well and water conveyance infrastructure (155.1 acres) (Table 4-18).

The amount of California glossy snake modeled habitat that will be removed due to Covered Activities is a small proportion of the total modeled habitat in the Planning Area (975 of 146,338 acres, or 1%), of which a portion is within existing basins (145 of 975 acres, or 15%). Covered Activities are estimated to coincide with 2 (out of 14) documented current (post-2005) occurrences of the species in the Planning Area. Impacts on habitat near and adjacent to these documented occurrences would result from existing facilities maintenance, including periodic vegetation management, road and pipeline maintenance, and facility repairs. Because these activities are short-term, the potential for population-level impacts is anticipated to be limited.

California glossy snake is a widely distributed species outside the Planning Area; its range includes the eastern portion of the San Francisco Bay Area south through the Central Valley to northwestern Baja California and east into the Mojave and Sonoran Deserts (California Herps 2014). Implementation of avoidance and minimization measures to limit direct and indirect adverse effects will be important to minimize the potential for population-level adverse impacts on the species in the Planning Area.

Approximately 807.0 acres of modeled habitat will be conserved in the HCP Preserve System in perpetuity (Table 4-31). Modeled suitable habitat will be monitored and managed to enhance habitat conditions for the California glossy snake. Avoidance and minimization measures will ensure that impacts on individual California glossy snake will be substantially lower than the estimated impact on modeled habitat. These measures include preconstruction surveys, minimizing project footprints in areas of suitable habitat to the greatest extent practical, ensuring that construction activities do not extend beyond the limits of construction, avoiding use of pesticides and rodenticides, and implementing construction site BMPs to minimize potential for glossy snake to enter and be harmed in construction sites.

Table 4-31. Acres of California Glossy Snake Modeled Habitat Estimated to Be Impacted by Ground-Disturbing Covered Activities

	Impacts		Mitigation
Modeled Habitat Type	**Permanent**[1]	**Temporary**	**HCP Preserve System**
Potentially Suitable Habitat			
Up-Front (Pre-Phase 1)			63.0
Phase 1	285.1 (46.5)	111.3	614.0
Phase 2	251.2 (98.4)	59.5	130.0
Phase 3	159.3	0.5	--
Phase 4	105.7 (0.3)	2.1	--
Total Modeled Habitat	801.3 (145.2)	173.5	807.0
Total Modeled Habitat Outside of Existing Basins	**656.1**	**173.5**	**807.0**

[1] Impact acreages in parentheses are within existing water recharge/flood control basins subject to regular O&M activities and are a subset of the total acres. For example, of the 801.3 acres of permanent impacts, 145.2 acres occur within existing basins. Consequently, impacts outside of basins are 801.3 – 145.2 = 656.1 acres.

South Coast Garter Snake

The distribution of south coast garter snake in the Planning Area is defined by modeled suitable habitat and documented occurrences. Refer to the south coast garter snake species account in Section 3.8.3 for a list of the parameters for this species' modeled habitat in the Planning Area. South coast garter snake is known from permanent stream sections in the central and southwestern parts of the Planning Area including the Santa Ana River, Prado Reservoir, San Timoteo Creek, and Temescal Wash (Figure 3-48). Approximately 7,703 acres of modeled suitable habitat was identified in the Planning Area. Five current (post-2005) documented occurrences of south coast garter snake have been observed in the Planning Area: near the mainstem of the Santa Ana River and in the vicinity of the Prado Wetlands (Figure 3-48).

Potential Direct and Indirect Effects

Direct effects on south coast garter snake could include road mortality and habitat loss and degradation associated with construction, especially where Covered Activities are proposed to impact stream and riparian vegetation communities where the snake is known to occur.

Indirect effects on south coast garter snake from Covered Activities could include altered hydrology, the introduction of nonnative plant species and nonnative predators, habitat fragmentation, and chemical spills. Covered Activities such as the construction of diversion and recharge basins could lead to altered surface hydrology and groundwater, which could result in changes in the timing, amount, and duration of channel flows; a temporal or spatial extent reduction in wetted acres could reduce prey abundance and foraging opportunities for south coast garter snake.

Vegetation management for construction and maintenance could introduce nonnative plant species, such as tamarisk and giant reed, which could also contribute to the degradation of natural hydrology by eliminating sandbars, pools, and upland habitats. These nonnative invasive plant species can also crowd out and replace native plant species, reducing the availability of native habitat for stream and riparian species, including south coast garter snake. Nonnative plant species are often spread by development, and any construction associated with Covered Activities could lead to their establishment in south coast garter snake habitat. Nonnative aquatic species also pose a threat to this species, for example bullfrogs and African clawed frogs prey on young south coast garter snakes. Habitat fragmentation resulting from Covered Activities could further reduce habitat quality by presenting barriers to movement and reduced connectivity of existing habitat patches, potentially limiting dispersal and genetically isolating populations.

Impact Assessment

The impact assessment of south coast garter snake estimates the permanent loss of 14.7 acres of modeled suitable habitat within the Planning Area (Table 4-16), all of which would occur where wells and water conveyance infrastructure is proposed (Table 4-17). Temporary impacts on 43.5 acres of modeled habitat would also occur where well and water conveyance infrastructure is proposed (Table 4-18). None of the Covered Activities occur where documented current (post-2005) occurrences have been reported in the Planning Area. The amount of south coast garter snake modeled suitable habitat that will be removed due to Covered Activities is a small proportion of the modeled available habitat in the Planning Area (58 of 7,703 acres, or <1%).

As identified in Table 3-16, output from the HCP Hydrology Model estimated 189 acres of south coast garter snake wetted area (as a measure of aquatic habitat, see Section 3.6.4) downstream of Covered Activities within the Planning Area. Hydrologic changes resulting from Covered Activities are estimated to reduce this wetted area by approximately 19.5 acres (Table 4-8, Section 4.4.3); an approximate 10% loss of predicted wetted area for the species.

The two main areas of modeled falling groundwater with Covered Activities in place within south coast garter snake modeled habitat occur along the riparian and wetland communities of the Santa Ana River in the reach from the Riverside Avenue crossing to the railroad crossing at the confluence with Sunnyslope Channel, and the reach from I-15 downstream to Prado Dam. South coast garter snake habitat with modeled rising groundwater, with Covered Activities in place, occurs on the Santa Ana River between the railroad crossing and I-15, and in the vicinity of the lower tributaries of Chino and Cucamonga Creeks (see Figure 4-8). Rising groundwater is not expected to have a detrimental effect on south coast garter snake. However, falling groundwater can cause a reduction in the amount of wetland and riparian habitat suitable for the snake. South coast garter snake inhabits GDEs and has a direct reliance on groundwater-supported vegetation; therefore, any adverse impacts could be exacerbated by altered groundwater conditions, as described in Section 3.8.3 (Rohde et al. 2019). The majority of garter snake habitat is in areas of modeled falling groundwater, with Covered Activities in place (see Table 4-8).

Overall, impacts on the south coast garter snake population from ground-disturbing effects and hydrologic changes would be limited. However, the areas of predicted modeled falling groundwater, with Covered Activities in place, may have a more substantial effect on the population. As discussed in Section 4.4.4 the predicted groundwater depths, and changes in these depths with Covered Activities in place, are based on large-scale hydrologic modeling. As such, it will be important to conduct regular groundwater monitoring in conjunction with south coast garter snake habitat condition monitoring to adaptively manage the effects of Covered Activities on this species. Ongoing monitoring of groundwater and wetland and riparian vegetation is proposed as a component of HCP implementation. Data from existing and new shallow and deep groundwater wells around the Prado Basin and along the Santa Ana River will be used to verify the accuracy of the modeled groundwater depths. If inaccuracies are detected around the Prado Basin, a new sub-basin model will be created and incorporated into the model to increase model accuracy for this area (see Chapter 5 for more information). Riparian and wetland vegetation extent will also be mapped and tracked over time, as discussed in Chapter 5.

Approximately 169.3 acres of modeled south coast garter snake habitat (including restoration of 3.5 miles of aquatic stream habitat) will be conserved within the HCP Preserve System in perpetuity (Table 4-32). Conserved habitat will be monitored and managed to enhance habitat conditions for this species. Avoidance and minimization measures will ensure that impacts on individual south coast garter snake will be substantially lower than the estimated impact on modeled habitat. These measures include preconstruction and daily pre-project activity surveys, minimizing project footprints in areas of suitable habitat to the greatest extent practical, ensuring that construction activities do not extend beyond the limits of construction, avoiding use of pesticides and rodenticides, and implementing construction site BMPs to minimize potential for garter snakes to enter and be harmed in construction sites.

Table 4-32. Acres of South Coast Garter Snake Modeled Habitat Estimated to Be Impacted by Ground-Disturbing Covered Activities

	Impacts		Mitigation
Modeled Habitat Type	**Permanent**	**Temporary**	**HCP Preserve System**
Potentially Suitable Habitat			
Up-Front (Pre-Phase 1)			8.0
Phase 1	14.5	42.3	61.9
Phase 2	0.1	1.1	99.4
Phase 3	0.0	0.0	--
Phase 4	0.0	0.0	--
Total Modeled Habitat	**14.6**	**43.5**	**169.3**

Note: Refer to Table 4-8 for predicted impacts on south coast garter snake wetted area (as a measures of aquatic habitat).

Southwestern Pond Turtle

The distribution of southwestern pond turtle in the Planning Area is defined by modeled aquatic habitat and modeled suitable upland habitat, and documented occurrences. Refer to the southwestern pond turtle species account in Section 3.8.3 for a list of the parameters for this species' modeled habitat in the Planning Area. The southwestern pond turtle is known from pond, lake, marsh, and river habitat in the Jurupa and Chino Valley portions of the Santa Ana River, San Timoteo Creek near El Casco, Walker Creek in Warm Springs Valley, Temescal Wash in Temescal Valley, and Aliso Creek upstream from the Green River Golf Club (Figure 3-49). There are 1,245 acres of modeled aquatic habitat, 14,944 acres of modeled suitable upland habitat, and 98 known, current (post-2005) documented occurrences of southwestern pond turtle in the Planning Area (Figure 3-49).

Potential Direct and Indirect Effects

Potential direct effects on southwestern pond turtle from Covered Activities could include road mortality, and habitat loss and alteration. Covered Activities involving the construction of new facilities and the maintenance and enhancement of existing structures also have the potential to alter aquatic and riparian areas with slow moving water and adjacent upland habitat on which southwestern pond turtle depend.

Indirect effects on southwestern pond turtle from Covered Activities could include the introduction of nonnative predators, altered hydrology, barriers to movement, and chemical spills. Edge effects associated with construction activities could also result in the introduction of predators such as raccoons and other mammals that destroy turtle nests and eat eggs and hatchlings, and bullfrogs and largemouth bass that prey on hatchlings and juvenile turtles.

The construction of artificial structures in streams could lead to altered hydrology, which could result in changes in the timing, amount, and duration of channel flows. The loss of coarse sediments in channels could result in an increase in vegetation density due to the decrease or elimination of scouring flows. An increase in riparian vegetation density could reduce areas of open habitat adjacent to aquatic habitat, potentially reducing the availability of suitable nesting areas for pond turtles. Changes in hydrology that result in increased bank erosion could also make it difficult for turtles to exit aquatic habitat and to travel to nesting and aestivation sites.

The construction of new roads and ongoing maintenance of existing roads adjacent to suitable pond turtle habitat could present barriers to movement between aquatic and upland areas. Equipment used to maintain vegetation adjacent to occupied habitats and along nearby access roads could also result in turtle injury and mortality, and inadvertent spills of toxic substances (e.g., oil or gasoline) could lead to degradation of aquatic habitat. To reduce these potential effects BMPs and SWPPPs will be actively implemented at all Covered Activity construction and maintenance projects within and/adjacent to areas supporting southwestern pond turtle.

Impact Assessment

The impact assessment of southwestern pond turtle estimates the permanent loss of 0.9 acre of aquatic habitat and 18.5 acres of modeled suitable upland habitat within the Planning Area (Table 4-16). Areas of permanent modeled habitat loss would primarily occur where the Permittees construct permanent structures to implement wells and water conveyance infrastructure (18.5 acres) (Table 4-17). Temporary impacts on 4.8 acre of aquatic habitat and 53.9 acres of modeled suitable upland habitat would occur wholly as a result of the construction of wells and water conveyance infrastructure (Table 4-18). These activities would result in a reduction of habitat quality and loss of available potential habitat for southwestern pond turtle.

Covered Activities are estimated to coincide with 1(out of 98) documented current (post-2005) occurrences in the Planning Area, and the amount of southwestern pond turtle modeled habitat that will be impacted from Covered Activities represents a small proportion of the total modeled habitat in the Planning Area (5.7 of 1,245 acres of aquatic habitat, or <1%; and 72.3 of 14,944 acres of suitable upland habitat, or <1%).

As identified in Table 3-16, output from the HCP Hydrology estimated 192 acres of southwestern pond turtle wetted area (as a measure of aquatic habitat, see Section 3.6.4) downstream of Covered Activities within the Planning Area. Hydrologic changes resulting from Covered Activities are estimated to reduce this wetted area by approximately 17.8 acres (Table 4-8, Section 4.4.3); an approximate 9% loss of predicted wetted area for the species.

The two main areas of modeled falling groundwater with Covered Activities in place within southwestern pond turtle modeled habitat occur along the riparian and wetland communities of the Santa Ana River in the reach from the Riverside Avenue crossing to the railroad crossing at the confluence with Sunnyslope Channel, and the reach from I-15 downstream to Prado Dam. Southwestern pond turtle habitat with modeled rising groundwater, with Covered Activities in place, occurs on the Santa Ana River between the railroad crossing and I-15, and in the vicinity of the lower tributaries of Chino and Cucamonga Creeks (see Figure 4-8). Rising groundwater is not expected to have a detrimental effect on southwestern pond turtle. The majority of southwestern pond turtle habitat is in areas of modeled falling groundwater, with Covered Activities in place. Table 4-9 quantifies the acreages of wetland and riparian habitat potentially impacted by falling groundwater and that would indirectly impact southwestern pond turtle habitat quality. Southwestern pond turtle inhabits GDEs and has a direct reliance on groundwater; therefore, these adverse impacts could be exacerbated by altered groundwater conditions as described in Section 3.8.3 (Rohde et al. 2019).

Overall, impacts on southwestern pond turtle population from ground-disturbing effects and hydrologic changes would be limited. However, the areas of predicted modeled falling groundwater, with Covered Activities in place, may have a more substantial effect on the population. As discussed in Section 4.4.4, the predicted groundwater depths, and changes in these depths with Covered Activities in place, are based on large-scale hydrologic modeling. Consequently, it will be important to conduct regular groundwater monitoring in conjunction with southwestern pond turtle population and habitat condition monitoring to adaptively manage the effects of Covered Activities on this species. Ongoing monitoring of groundwater and wetland and riparian vegetation is proposed as a component of HCP implementation. Data from existing and new shallow and deep groundwater wells around the Prado Basin and along the Santa Ana River will be used to verify the accuracy of the modeled groundwater depths. If inaccuracies are detected around the Prado Basin, a new sub-basin model will be created and incorporated into the model to increase model accuracy for this area (see Chapter 5 for more information). Riparian and wetland vegetation extent will also be mapped and tracked over time, as discussed in Chapter 5.

Approximately 27.4 acres of modeled aquatic habitat (including restoration of 3.5 miles of aquatic stream habitat) and 281.9 acres of modeled upland habitat will be conserved within the HCP Preserve System in perpetuity (Table 4-33). Conserved habitat will be monitored and managed to enhance habitat conditions for this species. Avoidance and minimization measures will ensure that impacts on individual southwestern pond turtle is substantially lower than the estimated impact on modeled habitat. These measures include preconstruction and daily pre-project activity surveys, minimizing project footprints in areas of suitable habitat to the greatest extent practical, ensuring that construction activities do not extend beyond the limits of construction, enforcing reduced speeds within construction areas, and implementing construction site BMPs including strictly enforced trash measures to ensure that subsidized predators (such as raccoons) are not attracted to construction sites, and measures to reduce the potential for pond turtle to enter and be harmed in construction sites.

Table 4-33. Acres of Southwestern Pond Turtle Modeled Habitat Estimated to Be Impacted by Ground-Disturbing Covered Activities

	Impacts		Mitigation
Modeled Habitat Type	**Permanent**	**Temporary**	**HCP Preserve System**
Aquatic Habitat			
Up-Front (Pre-Phase 1)			1.7
Phase 1	0.9	4.8	8.2
Phase 2	<0.1	<0.1	17.5
Phase 3	0.0	0.0	--
Phase 4	0.0	0.0	--
Total	*0.9*	*4.8*	*27.4*
Potentially Suitable Upland Habitat			
Up-Front (Pre-Phase 1)			16.1
Phase 1	18.1	50.8	126.3
Phase 2	0.3	3.1	139.6
Phase 3	0.0	0.0	--
Phase 4	0.0	0.0	--
Total	*18.4*	*53.9*	*281.9*
Total Modeled Habitat	**19.3**	**58.7**	**309.3**

Note: Refer to Table 4-8 for predicted impacts on southwestern pond turtle wetted area (as a measures of aquatic habitat).

Tricolored Blackbird

The distribution of tricolored blackbird in the Planning Area is defined by modeled occupied colony habitat, suitable colony habitat, breeding season foraging—natural, breeding season foraging – agriculture, non-breeding season foraging – natural, non-breeding season foraging – agriculture, and documented occurrences. See the tricolored blackbird species account in Section 3.8.3 for a list of the parameters for this species' modeled habitat in the Planning Area. Most documented occurrences for the species occur in Chino Valley near the Chino Airport and along San Timoteo Canyon. Modeled occupied colony habitat (10 acres) occurs along San Timoteo Canyon and Chino Valley. Modeled suitable colony habitat (1,868 acres) primarily occurs at the southern end of Chino Valley, a basin near Jurupa Street in Ontario, and along the Santa Ana River (Figure 3-50).

Potential Direct and Indirect Effects

Direct effects on tricolored blackbird resulting from Covered Activities could include habitat loss and disturbance. For example, construction activities that include grading, excavating, soil stockpiling, or other earth-disturbing activities, if proposed to occur within tricolored blackbird habitat, could permanently remove foraging areas in grassland and open fields (Beedy and Hamilton 1997, 1999; Shuford and Gardali 2008). Similarly, construction activities that include water diversions and recharge basins could result in draining of wetlands or removal of wetland vegetation that support appropriate nesting substrate, including cattails, bulrushes, willows, and forbs, which would remove potential breeding and nesting habitat for tricolored blackbird (Beedy and Hamilton 1999, UC Davis 2014).

Indirect effects on tricolored blackbird from Covered Activities could include the introduction of nonnative plant species and habitat fragmentation. Vegetation management activities for road and pipeline construction and maintenance could increase the spread of nonnative species. The establishment of nonnative species has the potential to alter wetland vegetation communities and could reduce the suitability of blackbird habitat by outcompeting more suitable native plants that are used as nesting substrate. Nests that are located on the edges of vegetation clearings could be more susceptible to brood parasitism from brown-headed cowbirds as well as nest predation by herons, common ravens, and coyotes. Covered Activities, if proposed within areas of suitable habitat, could also further fragment already isolated patches of suitable breeding habitat for blackbird that have been adversely affected throughout their range by anthropogenic disturbance.

Groundwater recharge basins can be managed to support nesting habitat for tricolored blackbirds, who prefer young, dense stands of cattail and bulrush (Meese and Beedy 2015). Though no occurrences of tricolored blackbird have been documented within Covered Activity recharge basins within the past 7 years, the species has previously been observed using suitable patches of habitat within a recharge basin in the Planning Area (the species was documented at the Wineville Basin in 2014). If the species is determined to use habitat within Covered Activity recharge basins, avoidance and minimization measures, and vegetation management methods will be implemented to improve nesting habitat for tricolored blackbirds (see Section 5.11).

Impact Assessment

The impact assessment of the tricolored blackbird estimates the permanent loss 55.2 acres of modeled suitable colony habitat (50.3 acres are within existing basins), 157.6 acres of modeled breeding season foraging – natural (7.6 acres are within existing basins), 67.0 acres of modeled breeding season foraging – agricultural, 0.4 acre of modeled non-breeding season foraging – natural, and 0.1 acre of modeled non-breeding season foraging – agriculture within the Planning Area (Table 4-16). Because areas of permanent habitat loss for modeled suitable colony habitat and modeled breeding season foraging – natural habitat include areas where Permittees currently conduct groundwater recharge activities, permanent impacts are less: 4.9 acres of modeled suitable colony habitat, and 150 acres of modeled breeding season foraging – natural habitat. There are no permanent or temporary impacts on modeled occupied colony habitat. Areas of permanent modeled habitat loss would occur where the Permittees construct permanent structures such as groundwater recharge facilities, water reuse projects, and wells and water conveyance infrastructure, and where Permittees conduct regular and frequent vegetation management (Table 4-17). Temporary impacts will occur on 10.7 acres of modeled suitable colony habitat, and 43.6 acres of modeled breeding season foraging – natural, 101.1 acres of modeled breeding season foraging – agriculture, 0.3 acre of modeled non-breeding season foraging – natural, and 0.9 acre of modeled non-breeding season foraging – agriculture as a result of short-term disturbance associated primarily with wells and water conveyance infrastructure (Table 4-18). These activities would result in reduction of habitat quality and temporary loss of available modeled potential habitat for tricolored blackbird.

The amount of modeled tricolored blackbird habitat that will be removed due to Covered Activities is a small proportion of the total modeled available habitat in the Planning Area (437 of 83,418 acres, or <1%), of which a portion is within existing basins (58 of 437 acres, or 13%). The Wineville Basin project (IEUA.1.01) coincides with a previously active colony. Table 4-34 summarizes observations of tricolored blackbird colonies at this location. The last occupancy record for the site is in 2014; however, it was not occupied during the 2017 statewide survey. (The 2017 statewide survey is the most recent survey effort. The statewide survey is conducted every 3 years, but was canceled in 2020 due to the COVID-19 pandemic). This basin is called the Jurupa Street colony by the Tricolored Blackbird Portal. The tricolored blackbird is the most highly colonial of all North American passerine birds; these birds nest in large densely populated colonies with nests very close together. This nesting behavior makes the species more vulnerable if there are impacts at an active colony. Any impacts on tricolored blackbird colonies from Covered Activities could result in reduced reproductive success and contribute to population declines (CDFW 2015). However, given the lack of recent occupancy at the Jurupa Street location, it is presumed extirpated due to conversion of all nearby foraging habitat to urban and industrial uses (Meese pers. comm.) and no impact is expected from the Covered Activities. Basin maintenance will be scheduled outside of the breeding season to avoid direct impacts on the species.

Table 4-34. Jurupa Street Tricolored Blackbird Colony Location: Observation Records

Date	Number of Birds	Observation Source
April 7, 2017	0	Statewide Survey, 2017 (unpublished)
April 9, 2016	0	Personal Observation
April 26, 2014	10	Statewide Survey, 2014 (unpublished)
April 16, 2011	0	Statewide Survey, 2011 (unpublished)
June 8, 1999	50	Personal Observation
April 25, 1999	1,000	Statewide Survey, 1999 (unpublished)
April 26, 1997	300	Statewide Survey, 1997 (unpublished)
May 20 1995	500	Personal Observation

Source: UC-Davis 2019. Tricolored Blackbird Portal (https://tricolor.ice.ucdavis.edu/)

There are two areas of modeled falling groundwater, with Covered Activities in place, within tricolored blackbird modeled suitable colony habitat along the riparian and wetland communities of the Santa Ana River, in the reach from the Riverside Avenue crossing to the railroad crossing at the confluence with Sunnyslope Channel and the reach from I-15 downstream to Prado Dam. Modeled blackbird habitat with modeled rising groundwater occurs on the Santa Ana River between the railroad crossing and I-15 and in the vicinity of the lower tributaries of Chino and Cucamonga Creeks (see Figure 4-8). Rising groundwater is not expected to have a detrimental effect on blackbird colony habitat suitability, as long as the water is not so deep that it precludes the establishment of emergent vegetation such as cattails (see Table 4-10). However, falling groundwater can cause a reduction in the amount of wetland and riparian habitat suitable for tricolored blackbird colonies.

Overall, impacts on tricolored blackbird from ground-disturbing effects and hydrologic changes would be limited. However, the areas of predicted modeled falling groundwater, with Covered Activities in place, may have the potential to impact modeled suitable colony habitat, should these areas co-occur with the species in the future. As discussed in Section 4.4.4 the predicted groundwater depths, and changes in these depths with Covered Activities in place, are based on large-scale hydrologic modeling. Consequently, it will be important to conduct regular groundwater monitoring in conjunction with habitat condition monitoring. Ongoing monitoring of groundwater and wetland and riparian vegetation is proposed as a component of HCP implementation. Data from existing and new shallow and deep groundwater wells around the Prado Basin and along the Santa Ana River will be used to verify the accuracy of the modeled groundwater depths. If inaccuracies are detected around the Prado Basin, a new sub-basin model will be created and incorporated into the model to increase model accuracy for this area (see Chapter 5 for more information). Riparian and wetland vegetation extent will also be mapped and tracked over time, as discussed in Chapter 5.

Avoidance and minimization measures will ensure that impacts on individual tricolored blackbirds will be substantially lower than the estimated impact on modeled habitat, and will be near zero. Avoidance and minimization measures will also ensure that no occupied tricolored blackbird colonies are disturbed. These measures include seasonal limitations within suitable habitat where feasible, pre-Covered Activity surveys within suitable colony habitat, and disturbance buffers of occupied colony habitat. Approximately 35.4 acres of modeled suitable colony habitat and 86.1 acres of modeled natural foraging habitat will be conserved in the HCP Preserve System in perpetuity (Table 4-35). Restoration will include approximately 39 acres of wetland habitat and 208 acres of riparian habitat to benefit the species. Conserved and restored habitats will be monitored and managed to enhance habitat conditions for this species.

Table 4-35. Acres of Tricolored Blackbird Modeled Habitat Estimated to Be Impacted by Ground-Disturbing Covered Activities

	Impacts		Mitigation
Modeled Habitat Type	**Permanent[1]**	**Temporary**	**HCP Preserve System**
Suitable Colony Habitat[2]			
Up-Front (Pre-Phase 1)			1.2
Phase 1	26.8 (22.0)	10.1	12.3
Phase 2	28.3 (28.3)	0.5	22.0
Phase 3	0.0	0.0	--
Phase 4	0.0	0.0	--
Total	*55.2 (50.3)*	*10.7*	*35.4*
Breeding Season Foraging – Natural			
Up-Front (Pre-Phase 1)			38.7
Phase 1	87.9 (7.6)	18.5	34.3
Phase 2	69.2	24.6	13.1
Phase 3	0.1	0.2	--
Phase 4	0.5	0.3	--
Total	*157.6 (7.6)*	*43.6*	*86.1*
Breeding Season Foraging – Agriculture			
Up-Front (Pre-Phase 1)			
Phase 1	43.5	25.3	0.2
Phase 2	23.5	75.1	--
Phase 3	0.0	0.6	--
Phase 4	0.0	0.0	--
Total	*67.0*	*101.0*	*0.2*
Non-Breeding Season Foraging – Natural			
Up-Front (Pre-Phase 1)			
Phase 1	0.4	0.3	--
Phase 2	0.0	0.0	--
Phase 3	0.0	0.0	--

Modeled Habitat Type	Impacts		Mitigation
	Permanent[1]	Temporary	HCP Preserve System
Phase 4	0.0	0.0	--
Total	*0.4*	*0.3*	--
Non-Breeding Season Foraging – Agriculture			
Up-Front (Pre-Phase 1)			
Phase 1	0.0	0.2	--
Phase 2	0.1	0.6	--
Phase 3	0.0	0.0	--
Phase 4	0.0	0.0	--
Total	*0.1*	*0.9*	--
Total Modeled Habitat	280.3 (57.9)	156.4	121.8
Total Modeled Habitat Outside of Existing Basins	**222.4**	**156.4**	**121.8**
New Colony Habitat Created through Restoration			39.1
New Foraging Habitat Created through Restoration			208.3
Grand Total of Habitat in the HCP Preserve System			**369.2**

[1] Impact acreages in parentheses are within existing water recharge/flood control basins subject to regular O&M activities and are a subset of the total acres. For example, of the 280.3 acres of permanent impacts, 57.9 acres occur within existing basins. Consequently, impacts outside of basins are 280.3 – 57.9 = 222.4 acres.

[2] Occupied Colony Habitat is not included in this table because there are no impacts on or mitigation in Occupied Colony Habitat.

Burrowing Owl

The distribution of burrowing owl in the Planning Area is defined by modeled suitable habitat and documented occurrences. Refer to the burrowing owl species account in Section 3.8.3 for a list of the parameters for this species' modeled habitat in the Planning Area. Most documented occurrences for the species occur in the Chino Valley area scattered throughout the dairy farms in east Chino and in the business parks along I-15 and I-10. Modeled suitable habitat (141,791 acres) occurs throughout the Planning Area south of the San Bernardino Mountain foothills, clustered around areas in the Temescal Valley north and east of Lake Mathews, the Santa Ana River Basin east of the San Bernardino International Airport, along the Cajon and Lytle Creek washes, north of Los Osos High School in the City of Rancho Cucamonga, and in the low elevation area east of the community of Highgrove in the valley between the Box Spring Mountains (Figure 3-51).

Potential Direct and Indirect Effects

Potential direct effects on burrowing owl resulting from Covered Activities could include habitat loss and disturbance. Construction activities that include grading, excavating, soil stockpiling, or other earth-disturbing activities could alter burrowing owl habitat by permanently removing available burrows and grassland and shrubland habitat preferred by burrowing owl (Gervais et al. 2008, Klute et al. 2003). Burrowing owls can tolerate temporary impacted areas, as long as ground squirrels or other larger burrowing animals (e.g., badgers) continue to occupy, or re-occupy a site following disturbance, and soils are not permanently compacted. Covered Activities that result in more compacted soils would have adverse effects on burrowing owl (SDSU 2013).

Indirect effects on burrowing owls from Covered Activities could include the introduction of nonnative plant species and the eradication/management of burrowing rodents, such as California ground squirrels, that would result in loss of burrows. Use of rodenticides in ground squirrel management is of particular concern as these chemicals bioaccumulate in predators leading to mortality of non-target wildlife, including burrowing owl. Edge effects may result from nearby human activities such as noise, motion, and night lighting; the introduction of nonnative species; and increased predation. These activities could lead to increased disruption of life-history requirements, decreased reproductive success, and increased avoidance by individuals or groups of burrowing owls (Gervais et al. 2008). Vegetation management for road and pipeline construction and maintenance can increase the spread of nonnative species, including nonnative annual grasses which can alter vegetation composition and structure, leading to potential negative effects on burrowing owl prey base and foraging ability (Gervais et al. 2008).

Impact Assessment

The impact assessment of the burrowing owl estimates the permanent loss of 736.3 acres of modeled suitable habitat within the Planning Area (Table 4-16). However, because these areas of permanent habitat loss include areas where Permittees currently conduct groundwater recharge activities (181.6 acres are within existing basins), permanent impacts on modeled habitat are less: 554.7 acres (Table 4-36). Areas of permanent habitat loss would occur where Permittees implement wells and water conveyance infrastructure (275.9 acres) and where Permittees construct permanent structures such as groundwater recharge facilities (416.9 acres) (Table 4-17) (181.6 acres are within existing basins). Temporary impacts on 242.6 acres of modeled suitable habitat (Table 4-16) would occur as a result of short-term disturbance associated primarily with wells and water conveyance infrastructure (225.1 acres) (Table 4-18). These activities could result in a reduction of habitat quality and temporary loss of available modeled habitat for burrowing owl. A total of 182 documented current (post-2005) occurrences of burrowing owl have been reported in the Planning Area. Covered Activities are proposed to co-occur at one of these documented locations. The amount of modeled burrowing owl habitat that will be removed due to Covered Activities is a small proportion of the available modeled habitat in the Planning Area. Avoidance and minimization measures will be implemented to avoid destruction of occupied burrowing owl nests. Given the limited amount of modeled suitable habitat estimated to be impacted (979 of 141,791 acres, or <1%), of which a portion is within existing basins (182 of 979 acres, or 19%), and avoidance of direct mortality, impacts on the population of burrowing owls in the Planning Area would be small.

Avoidance and mitigation measures will be implemented to reduce impacts on individual burrowing owls and modeled habitat, including limiting disturbance at occupied burrows, to the greatest extent practicable and avoiding use of rodenticides during both construction and operations and maintenance of Covered Activities. These measures include seasonal limitations and pre-Covered Activity surveys. Implementation of construction site BMPs to minimize potential for burrowing owl to enter and be harmed in construction sites will also be included in the avoidance and minimization measures. Approximately 594.8 acres of modeled habitat will be conserved within the HCP Preserve System in perpetuity (Table 4-36). Conserved habitat will be monitored and managed to enhance habitat conditions for this species.

Table 4-36. Acres of Burrowing Owl Modeled Habitat Estimated to be Impacted by Ground-Disturbing Covered Activities

	Impacts		Mitigation
Modeled Habitat Type	**Permanent[1]**	**Temporary**	**HCP Preserve System**
Potentially Suitable Habitat			
Up-Front (Pre-Phase 1)			64.7
Phase 1	388.9 (81.0)	114.3	503.7
Phase 2	203.6 (100.3)	125.4	26.5
Phase 3	83.6	1.4	--
Phase 4	60.1 (0.3)	1.6	--
Total Modeled Habitat	736.3 (181.6)	242.6	594.8
Total Modeled Habitat Outside of Existing Basins	**554.7**	**242.6**	**594.8**

[1] Impact acreages in parentheses are within existing water recharge/flood control basins subject to regular O&M activities and are a subset of the total acres. For example, of the 736.3 acres of permanent impacts, 181.6 acres occur within existing basins. Consequently, impacts outside of basins are 736.3 – 181.6 = 554.7 acres.

Cactus Wren

The distribution of cactus wren in the Planning Area is defined by modeled known suitable nesting habitat, potential nesting and foraging habitat, recently burned (2008–2018) habitat, and documented occurrences. Refer to the cactus wren species account in Section 3.8.3 for a list of the parameters for this species' modeled habitat in the Planning Area. Most documented occurrences and modeled nesting and foraging habitat (127,918 acres) and recently burned (2008–2018) habitat (9,470 acres) for the species occur in washes and slopes adjacent to urban areas north of Fontana east to Yucaipa, including the Santa Ana River and Lytle, Cajon, and Mill Creeks. Modeled known suitable nesting habitat (677 acres), potential nesting and foraging habitat, and recently burned (2008–2018) habitat also occur around Lake Mathews and in scattered washes and lower hills south to the Temecula area (Figure 3-52).

Potential Direct and Indirect Effects

Potential direct effects on cactus wren from Covered Activities could include habitat loss from construction activities including grading, excavating, soil stockpiling, or other earth-disturbing activities. These activities could alter cactus wren habitat by permanently removing native scrub and suitable nesting sites in prickly pear or cholla (Hamilton et al. 2011, San Bernardino County Museum 2014). Adults show site fidelity to breeding areas, returning to the same area each year; therefore, removal of suitable cactuses used for nesting substrate could result in displacement of cactus wren in these areas (Solek and Szijj 2004).

Indirect effects on cactus wren from Covered Activities could include the introduction of nonnative plant species, increased potential for wildfire, and habitat fragmentation. Vegetation management for road and pipeline construction and maintenance can increase the spread of nonnative species. The introduction of nonnative plant species could also contribute to the degradation of suitable habitat by increasing the cover of nonnative invasive plants in scrub understory, which may decrease cactus wren foraging efficiency. The establishment of nonnative species alters scrub vegetation communities and could reduce the suitability of cactus wren habitat. Increases in nonnative annual grasses can increase fire frequency, intensity, and extent, further degrading and removing cactus wren habitat through habitat type conversion (Hamilton et al. 2011). Construction of new facilities that fragment contiguous habitat could limit dispersal between patches of suitable cactus wren habitat, creating isolated populations and resulting in reduced gene flow and weakened populations (Hamilton et al. 2011, Preston and Kamada 2012).

Impact Assessment

The impact assessment for cactus wren identified 14.6 acre of permanent loss and 0.3 acre of temporary impacts on known suitable nesting habitat within the Planning Area (Table 4-16). In addition, the permanent loss of 681.7 acres of modeled nesting and foraging habitat (186.0 acres of which occur within existing basins) and 1.6 acres of recently burned (2008–2018) habitat would result primarily from the construction of groundwater recharge facilities (420.7 acres), and wells and water conveyance infrastructure (217.3 acres) (Table 4-17). Note that the calculation of permanent loss of modeled nesting and foraging habitat includes areas where Permittees currently conduct groundwater recharge activities (186.0 acres of 681.7 acres); consequently, permanent impacts on modeled nesting and foraging habitat are less: 511.9 acres.

Temporary impacts on 180.2 acres of modeled nesting and foraging habitat and 6.4 acres of recently burned (2008–2018) habitat would result primarily from new construction and maintenance of wells and water conveyance infrastructure (163.0 acres) (Table 4-18). These activities would result in reduction of habitat quality and loss of available potential habitat for cactus wren.

The footprints of Covered Activities co-occur with 2 (of 95) documented current (post-2005) occurrences of the species in the Planning Area, indicating the potential for impacts on occupied cactus wren habitat and the importance of measures to minimize effects on breeding activity. The estimated modeled habitat loss to occur as a result of Covered Activities is a small fraction of the available modeled habitat within the Planning Area (885 of 138,065 acres, or <1%), of which a portion is within existing basins (186 of 885 acres, or 21%). Fragmentation resulting in small, isolated populations and limited dispersal is one of the major threats to cactus wren (Preston and Kamada 2012). The location of Covered Activities and their proximity to current documented occurrences is not expected to further isolate habitat or populations and would not result in substantial loss of modeled suitable nesting habitat. As such, impacts on the cactus wren population in the Planning Area would be limited.

Avoidance and mitigation measures will ensure that active cactus wren nests are not disturbed and that adverse effects on modeled habitat will be reduced to the greatest extent practicable. These measures include pre-Covered Activity surveys, application of nest buffers for active nests, and noise monitoring. Approximately 681.4 acres of modeled habitat will be conserved within the HCP Preserve System in perpetuity (Table 4-37). Conserved habitat will be monitored and managed to enhance habitat conditions for this species.

Table 4-37. Acres of Cactus Wren Modeled Habitat Estimated to Be Impacted by Ground-Disturbing Covered Activities

	Impacts		Mitigation
Modeled Habitat Type	**Permanent[1]**	**Temporary**	**HCP Preserve System**
Known Suitable Nesting			
Up-Front (Pre-Phase 1)			
Phase 1	0.1	0.3	19.5
Phase 2	14.2	0.0	--
Phase 3	0.3	0.0	--
Phase 4	0.0	0.0	--
Total	14.6	0.3	19.5
Potential Nesting and Foraging Habitat			
Up-Front (Pre-Phase 1)			64.7
Phase 1	322.8 (77.2)	96.4	524.2
Phase 2	212.1 (108.5)	81.0	70.7
Phase 3	83.5	0.9	--
Phase 4	63.3 (0.3)	2.0	--
Total	*681.7 (186.0)*	*180.2*	*659.5*
Recently Burned (2008–2018)			
Up-Front (Pre-Phase 1)			
Phase 1	1.3	2.5	2.4
Phase 2	0.4	4.0	--
Phase 3	0.0	0.0	--
Phase 4	0.0	0.0	--
Total	*1.6*	*6.4*	*2.4*
Total Modeled Habitat	697.9 (186.0)	186.9	681.4
Total Modeled Habitat Outside of Existing Basins	**511.9**	**186.9**	**681.4**

[1] Impact acreages in parentheses are within existing water recharge/flood control basins subject to regular O&M activities and are a subset of the total acres. For example, of the 697.9 acres of permanent impacts, 186.0 acres occur within existing basins. Consequently, impacts outside of basins are 697.9 – 186.0 = 511.9 acres.

Yellow-Breasted Chat

The distribution of yellow-breasted chat in the Planning Area is defined by modeled suitable habitat and documented occurrences. Refer to the yellow-breasted chat species account in Section 3.8.3 for a list of the parameters for this species' modeled habitat in the Planning Area. Most documented occurrences for the species occur in riparian habitat along the Santa Ana River. Modeled suitable habitat (15,329 acres) also occurs primarily along the Santa Ana River with a large area concentrated in the Prado Basin (Figure 3-53).

Potential Direct and Indirect Effects

Potential direct effects on yellow-breasted chat from Covered Activities could include habitat loss and disturbance. Construction activities that include grading, excavating, soil stockpiling, or other activities that remove riparian vegetation or disturb the soil could alter yellow-breasted chat habitat by permanently removing early successional riparian woodland vegetation and dense thickets that are required nest substrate for this species (Shuford and Gardali 2008, Myers n.d.).

Indirect effects on yellow-breasted chat from Covered Activities could include the introduction of nonnative plant species and hydrologic effects, including alteration of surface water flows and groundwater levels that can affect riparian habitat used by this species.

Vegetation management for road and pipeline construction and maintenance has the potential to increase the spread of nonnative species. The establishment of nonnative species can alter riparian vegetation communities leading to reduced suitability of potential yellow-breasted chat habitat, particularly where native plants used as nesting substrate are outcompeted and replaced by less desirable or unsuitable nonnative plant species. Nests that are located on the edges of vegetation clearings could be more susceptible to brood parasitism from brown-headed cowbirds as well as nest predation. Recharge projects that divert streamflow from the Santa Ana River, pump groundwater, or decrease groundwater infiltration rates could alter the distribution and species composition of riparian habitat, which, in turn, could affect breeding habitat. Refer to Section 4.4.1, for a description of the predicted effects of Covered Activities on average daily streamflows. Refer to Section 4.4.3, *Effects on Groundwater-Dependent Ecosystems*, for a description of the predicted effects of Covered Activities on GDEs, including riparian habitat.

Human activity during construction, operations, and maintenance activities that involves noise and motion could result in nest abandonment and/or nest failure when conducted near yellow-breasted chat nesting habitat if these activities occur between mid-May and early August during the nesting season (Eckerle and Thompson 2001, Dudek and Associates 2003a).

Impact Assessment

The impact assessment of yellow-breasted chat estimates the permanent loss of 126.7 acres of modeled suitable habitat within the Planning Area (Table 4-16). However, because these areas of permanent habitat loss occur primarily where the Permittees currently conduct groundwater recharge activities (68.5 acres are within existing basins), permanent impacts on modeled habitat are significantly less: 58.2 acres. Areas of permanent modeled habitat loss would result predominantly from groundwater recharge facilities (92.0 acres) and wells and water conveyance infrastructure (32.6 acres) (Table 4-17). Temporary impacts on 44.7 acres of modeled suitable habitat would result in short-term disturbance associated primarily with wells and water conveyance infrastructure (Table 4-18).

Covered Activities with ground-disturbing effects are proposed to co-occur at 4 (of 563) documented current (post-2005) occurrences of yellow-breasted chat in the Planning Area. Clearing of dense riparian thickets and brush tangles has caused a noticeable decline in the number of breeding pairs of yellow-breasted chat within the region (Dudek and Associates 2003a); however, the location and proximity of Covered Activities to current documented occurrences and modeled suitable habitat would not result in a substantial loss of the total modeled suitable habitat (171 of 15,329 acres, or <1%), of which a portion is within existing basins (69 of 171 acres, or 40%). The largest tract of intact modeled suitable habitat and many of the documented occurrences of this species within the Planning Area occurs in Prado Basin, and to the north in the Chino Valley (northwest of the City of Corona; Figure 3-53). This portion of modeled suitable habitat would not be affected or fragmented by the ground-disturbing effects of Covered Activities. Avoidance and minimization measures will be implemented to avoid impacts on the species during the nesting season. Therefore, impacts on nesting yellow-breasted chat in the Planning Area from ground-disturbing effects would be limited.

There are two areas of modeled falling groundwater due to Covered Activities within yellow-breasted chat habitat along the riparian communities of the Santa Ana River: in the reach from the Riverside Avenue crossing to the railroad crossing at the confluence with Sunnyslope Channel, and the reach from I-15 downstream to Prado Dam. Yellow-breasted chat habitat with modeled rising groundwater occurs on the Santa Ana River between the railroad crossing and I-15, and in the vicinity of the lower tributaries of Chino and Cucamonga Creeks (see Figure 4-8). Rising groundwater is not expected to have a detrimental effect on yellow-breasted chat habitat as long as it does not become permanent surface water where riparian under- and overstory species will not grow (see Table 4-10). However, falling groundwater in areas identified as riparian habitat may cause a reduction in the amount of riparian habitat suitable for yellow-breasted chat (see Table 4-8). Conversely, there is potential for falling groundwater to increase riparian habitat in areas currently identified as open water or wetlands.

Overall, impacts on the yellow-breasted chat population from ground-disturbing effects and hydrologic changes would be limited. However, the areas of predicted modeled falling groundwater, with Covered Activities in place, may have a greater effect on the population. As discussed in Section 4.4.4, the predicted groundwater depths, and changes in these depths with Covered Activities in place, are based on large-scale hydrologic modeling. Consequently, it will be important to conduct regular groundwater monitoring in conjunction with yellow-breasted chat population and habitat condition monitoring to adaptively manage the effects of Covered Activities on this species. Ongoing monitoring of groundwater and wetland and riparian vegetation is proposed as a component of HCP implementation. Data from existing and new shallow and deep groundwater wells around the Prado Basin and along the Santa Ana River will be used to verify the accuracy of the modeled groundwater depths. If inaccuracies are detected around the Prado Basin, a new sub-basin model will be created and incorporated into the model to increase model accuracy for this area (see Chapter 5 for more information). Riparian and wetland vegetation extent will also be mapped and tracked over time, as discussed in Chapter 5.

Avoidance and minimization measures will ensure that active yellow-breasted chat nests are not disturbed and that adverse effects of modeled habitat are reduced to the greatest extent practicable. These measures include pre-Covered Activity surveys, application of nest buffers for active nests, and noise monitoring. Approximately 241.7 acres of modeled habitat will be conserved within the HCP Preserve System in perpetuity (Table 4-38). Conserved habitat will be monitored and managed to enhance habitat conditions for this species.

Table 4-38. Acres of Yellow-Breasted Chat Modeled Habitat Estimated to Be Impacted by Ground-Disturbing Covered Activities

	Impacts		Mitigation
Modeled Habitat Type	**Permanent[1]**	**Temporary**	**HCP Preserve System**
Potentially Suitable Habitat			
Up-Front (Pre-Phase 1)			12.3
Phase 1	61.5 (27.6)	31.9	114.5
Phase 2	50.4 (40.9)	12.1	114.9
Phase 3	14.7	0.0	--

Modeled Habitat Type	Impacts: Permanent[1]	Impacts: Temporary	Mitigation: HCP Preserve System
Phase 4	0.0	0.6	--
Total Modeled Habitat	126.7 (68.5)	44.7	241.7
Total Modeled Habitat Outside of Existing Basins	**58.2**	**44.7**	**241.7**

[1] Impact acreages in parentheses are within existing water recharge/flood control basins subject to regular O&M activities and are a subset of the total acres. For example, of the 126.7 acres of permanent impacts, 68.5 acres occur within existing basins. Consequently, impacts outside of basins are 126.7 – 68.5 = 58.2 acres.

Western Yellow-Billed Cuckoo

The distribution of western yellow-billed cuckoo in the Planning Area is defined by modeled high value breeding habitat, other suitable breeding habitat, and documented occurrences. Refer to the western yellow-billed cuckoo species account in Section 3.8.3 for a list of the parameters for this species' modeled habitat in the Planning Area. Most documented occurrences for the species occur in riparian habitat scattered throughout the Planning Area. Modeled high value breeding habitat (2,773 acres) occurs primarily in the Prado Basin. Modeled other suitable breeding habitat (1,999 acres) occurs primarily in riparian areas and parks along the Santa Ana River (Figure 3-54).

Potential Direct and Indirect Effects

Potential direct effects on western yellow-billed cuckoo from Covered Activities could include habitat loss; however, these effects would be limited because very few Covered Activities that result in permanent impacts intersect with western yellow-billed cuckoo modeled high value breeding, or other suitable breeding habitat. Temporary ground disturbance associated with pipeline replacement could adversely affect modeled western yellow-billed cuckoo habitat where these activities occur within or adjacent to structurally complex, mature riparian habitats with tall trees and a dense woody understory near waterways dominated by willows and cottonwoods (Laymon 1998, Hughes 1999).

Indirect effects on western yellow-billed cuckoo from Covered Activities could include the introduction of nonnative plant species, hydrologic effects such as alteration of surface water flows and groundwater levels that can affect riparian habitat for the cuckoo, and habitat fragmentation. Refer to Section 4.4.1 for a description of the predicted effects of Covered Activities on average daily streamflows. Refer to Section 4.4.3 for a description of the predicted effects of Covered Activities on GDEs, including riparian habitat.

Vegetation management associated with road and pipeline construction and maintenance could increase the spread of nonnative species, potentially altering dense woody riparian vegetation communities leading to reduced suitability of western yellow-billed cuckoo breeding habitat. Nests that are located on the edges of vegetation clearings could be more susceptible to brood parasitism from brown-headed cowbirds as well as nest predation. Human activity during construction, operations, and maintenance activities that involve noise and motion could result in nest abandonment and/or nest failure when conducted near western yellow-billed cuckoo nesting habitat if these activities occur between May and August during the nesting and breeding season (Hughes 1999). Recharge projects that divert streamflow from the Santa Ana River, pump groundwater, or decrease groundwater infiltration rates could alter the distribution and species composition of riparian habitat, which, in turn, could affect breeding habitat. Covered Activities could also further fragment already isolated patches of suitable breeding habitat for western yellow-billed cuckoo, which have been adversely affected throughout the species range by gravel mining, agricultural development, and wildfire (79 FR 59992).

Impact Assessment

The impact assessment of western yellow-billed cuckoo assumes the permanent loss of 8.7 acres of modeled suitable breeding habitat, which would result from wells and water conveyance infrastructure (Table 4-16 and Table 4-17), and temporary impacts on 0.8 acre of modeled high value breeding habitat (Table 4-16), also from wells and water conveyance infrastructure projects (Table 4-18). Wells and water conveyance infrastructure would also result in 8.2 acres of temporary impacts on modeled suitable breeding habitat. Less than 0.1 acre of permanent impacts from Covered Activities would occur in modeled high value breeding habitat.

The amount of modeled western yellow-billed cuckoo habitat that will be removed due to Covered Activities is a small proportion of the total amount of modeled suitable habitat in the Planning Area (18 of 4,772 acres, or <1%). The largest tract of intact modeled high value breeding habitat is within the Prado Basin and this habitat would not be affected or fragmented by ground-disturbing effects of Covered Activities. Given the limited amount of modeled potential habitat estimated to be impacted, impacts on western yellow-billed cuckoo in the Planning Area would be small.

The USFWS' description of western yellow-billed cuckoo proposed critical habitat physical and biological features includes riparian woodlands with a prey base consisting of large insect fauna and tree frogs, and dynamic riverine processes that encourage sediment movement and deposition to facilitate plant growth (USFWS 2014); however, the revised critical habitat proposed for western yellow-billed cuckoo (USFWS 2020) does not include any mapped portions within the Planning Area. Changes in groundwater level could affect riparian habitat for the species. There are two areas of modeled falling groundwater, with Covered Activities, within modeled western yellow-billed cuckoo habitat along the riparian communities of the Santa Ana River, in the reach from the Riverside Avenue crossing to the railroad crossing at the confluence with Sunnyslope Channel and the reach from I-15 downstream to Prado Dam (the area supporting the majority of modeled western yellow-billed cuckoo habitat). Cuckoo habitat with modeled rising groundwater occurs on the Santa Ana River between the railroad crossing and I-15 and in the vicinity of the lower tributaries of Chino and Cucamonga (see Figure 4-8). Rising groundwater is not expected to have a detrimental effect on cuckoo habitat as long as it does not become permanent surface water where riparian under- and overstory species will not grow (see Table 4-10). However, falling groundwater may cause a reduction in the amount of riparian habitat suitable for western yellow-billed cuckoo, especially because this species favors interior riparian habitats with higher humidity (Laymon 1998, Hughes 1999). There is also potential for falling groundwater to increase riparian habitat in areas currently identified as open water or wetlands (see Table 4-8).

Predicted groundwater depths, and changes in these depths with Covered Activities in place, are based on large-scale hydrologic modeling (see Section 4.4.4). Consequently, it will be important to conduct regular groundwater monitoring in conjunction with western yellow-billed cuckoo habitat condition monitoring to adaptively manage the potential effects of Covered Activities. Ongoing monitoring of groundwater and wetland and riparian vegetation is proposed as a component of HCP implementation. Data from existing and new shallow and deep groundwater wells around the Prado Basin and along the Santa Ana River will be used to verify the accuracy of the modeled groundwater depths. If inaccuracies are detected around the Prado Basin, a new sub-basin model will be created and incorporated into the model to increase model accuracy for this area (see Chapter 5 for more information). Riparian and wetland vegetation extent will also be mapped and tracked over time, as discussed in Chapter 5.

Avoidance and mitigation measures will ensure that active western yellow-billed cuckoo nests are not disturbed should they occur near Covered Activities in the future and that adverse effects of modeled habitat are reduced to the greatest extent practicable. These measures include pre-Covered Activity surveys, and application of nest buffers and noise monitoring near active nests. Approximately 117.9 acres of modeled habitat will be conserved within the HCP Preserve System in perpetuity. Conserved habitat will be monitored and managed to enhance habitat conditions for this species (Table 4-39).

Table 4-39. Acres of Western Yellow-Billed Cuckoo Modeled Habitat Estimated to Be Impacted by Ground-Disturbing Activities

	Impacts		Mitigation
Modeled Habitat Type	**Permanent**	**Temporary**	**HCP Preserve System**
High Value Breeding Habitat			
Up-Front (Pre-Phase 1)			
Phase 1	0.0	0.7	--
Phase 2	<0.1	0.1	--
Phase 3	0.0	0.0	--
Phase 4	0.0	0.0	--
Total	*<0.1*	*0.8*	--
Other Potentially Suitable Breeding Habitat			
Up-Front (Pre-Phase 1)			5.2
Phase 1	8.7	6.6	72.2
Phase 2	0.1	1.7	40.5
Phase 3	0.0	0.0	--
Phase 4	0.0	0.0	--
Total	*8.7*	*8.2*	*117.9*
Total Modeled Habitat	**8.8**	**9.0**	**117.9**

Southwestern Willow Flycatcher

The distribution of southwestern willow flycatcher in the Planning Area is defined by modeled core southwestern flycatcher habitat, very high value habitat, high value habitat, moderate value habitat, other suitable habitat, and documented occurrences. Refer to the southwestern willow flycatcher species account in Section 3.8.3 for a list of the parameters for this species' modeled habitat in the Planning Area. Most documented occurrences for the species occur in riparian habitat in Chino Hills and Chino Valley, along the Santa Ana River in the La Loma Hills and east of the San Bernardino Golf Course, and in riparian areas scattered throughout the San Bernardino National Forest. Modeled core southwestern willow flycatcher habitat (1,844 acres), designated critical habitat (4,431 acres), very high value habitat (1,564 acres), high value habitat (613 acres), moderate value habitat (360 acres), and other suitable habitat (10,949 acres) are spread throughout Cajon Wash, Waterman Creek, Day Canyon, the Santa Ana River, the Prado Basin, and San Timoteo Canyon (Figure 3-55).

Potential Direct and Indirect Effects

Potential direct effects on southwestern willow flycatcher from Covered Activities could include habitat loss and disturbance from human activity. Habitat loss and modification is currently widespread throughout the southwestern willow flycatcher range, and additional loss due to Covered Activities could further modify and reduce riparian nesting habitat (USFWS 2014). Construction activities that include grading, excavating, soil stockpiling, or other earth-disturbing activities could alter southwestern willow flycatcher habitat by permanently removing riparian habitat along streams, rivers, or other wetlands with dense tree or shrub cover (USFWS 1995, Sogge et al. 2010).

Indirect effects on southwestern willow flycatcher from Covered Activities could include the introduction of nonnative plant species, increased potential for wildfire, and alteration of surface water flows and groundwater conditions that affect riparian habitat. Vegetation management associated with road and pipeline construction and maintenance could increase the spread of nonnative plant species, which could in turn alter riparian vegetation communities and reduce the suitability of southwestern willow flycatcher habitat. Although flycatchers have been documented to nest in some riparian habitats dominated by introduced nonnative species, primarily tamarisk and Russian olive (*Elaeagnus angustifolia*) (SAWA 2019), giant reed can form dense monotypic stands, reducing habitat quality for breeding flycatchers (USFWS 2014, SAWA 2019). In addition, giant reed is highly flammable, and the combination of increased establishment of dense stands of giant reed along with other flammable introduced nonnative species and ongoing drought increases the probability of fires that pose a threat to the continued persistence of southwestern willow flycatcher habitat (Sogge et al. 2010, USFWS 2014, SAWA 2019). Nests that are located on the edges of vegetation clearings could be more susceptible to brood parasitism from brown-headed cowbirds as well as nest predation.

Recharge projects that divert streamflow from the Santa Ana River, pump groundwater, or decrease groundwater infiltration rates could alter the distribution and species composition of riparian habitat, which, in turn, could affect breeding habitat. Refer to Section 4.4.1 for a description of the predicted effects of Covered Activities on average daily streamflows. Refer to Section 4.4.3 for a description of the predicted effects of Covered Activities on GDEs, including riparian habitat.

Human activity during construction, operations, and maintenance activities that involve noise and motion could result in nest abandonment and/or nest failure when conducted near southwestern willow flycatcher nesting habitat if these activities occur between May and June (Ellis et al. 2008).

Impact Assessment

The impact assessment of southwestern willow flycatcher estimates the permanent loss of 126.7 acres, composed of 15.5 acres of modeled core and 111.2 acres of modeled other suitable habitat (Table 4-16). However, because these areas of permanent habitat loss occur primarily where the Permittees currently conduct groundwater recharge activities (68.5 acres of modeled other suitable habitat occurs within existing basins) (Table 4-17), permanent impacts on modeled habitat are significantly less: 58.2 acres (Table 4-42). Permanent modeled core southwestern willow flycatcher habitat loss would result primarily from groundwater recharge facilities (6.0 acres) and wells and water conveyance infrastructure (9.5 acres), while permanent habitat loss of modeled other suitable habitat would result primarily from groundwater recharge facilities (86.1 acres) and wells and water conveyance infrastructure (23.1 acres) (Table 4-17). Temporary impacts on 3.7 acres of modeled core southwestern willow flycatcher habitat and 40.2 acres of modeled other suitable habitat would occur as a result of short-term disturbance associated with wells and water conveyance infrastructure (Table 4-18). These activities would result in reduction in habitat quality and temporary loss of modeled suitable habitat for southwestern willow flycatcher some of which is designated critical habitat. Impacts from Covered Activities are estimated to result in the permanent loss of 95.9 acres and temporary impacts on 12.7 acres of designated critical habitat.

The amount of modeled southwestern willow flycatcher habitat that will be removed due to Covered Activities is a small proportion of the total available modeled habitat in the Planning Area (171 of 15,330 acres, or <1%), of which a portion is within existing basins (69 of 171 acres, or 40%). None of the documented current (post-2005) occurrences of this species in the Planning Area co-occur in locations where Covered Activities are proposed.

Habitat loss estimated to occur as a result of ground-disturbing effects of Covered Activities is a small percentage of the modeled habitat within and in the vicinity of the Planning Area. In addition, the species breeding range in California extends much beyond the Planning Area to the west and east in riparian areas along coastal and interior Southern California, and along the lower Colorado River, which traverses the California border with Arizona (Sogge et al. 2010).

The known distribution and abundance of nesting southwestern willow flycatchers has improved since the 1980s through increased survey effort. Data collected from surveys of flycatcher distribution and abundance, genetic studies, and habitat and natural history has indicated that the flycatcher's breeding range has remained stable (USFWS 2017). Ground-disturbing effects of Covered Activities would not isolate habitat or populations or result in substantial loss of modeled core habitat areas or critical habitat, and impacts on the southwestern willow flycatcher population would be small.

There are two areas of modeled falling groundwater with Covered Activities in place within southwestern willow flycatcher habitat along the riparian communities of the Santa Ana River: in the reach from the Riverside Avenue crossing to the railroad crossing at the confluence with Sunnyslope Channel and the reach from I-15 downstream to Prado Dam. Flycatcher habitat with modeled rising groundwater occurs on the Santa Ana River between the railroad crossing and I-15 and in the vicinity of the lower tributaries of Chino and Cucamonga Creeks (see Figure 4-8). Rising groundwater is not expected to have a detrimental effect on flycatcher habitat as long as it does not become permanent surface water where riparian under- and overstory species will not grow (see Table 4-10). However, falling groundwater may cause a reduction in the amount of riparian habitat suitable for southwestern willow flycatchers (see Table 4-8).

Predicted groundwater depths, and changes in these depths with Covered Activities in place, are based on large-scale hydrologic modeling (Section 4.4.4). Consequently, it will be important to conduct regular groundwater monitoring in conjunction with habitat condition monitoring to adaptively manage the effects of Covered Activities. Ongoing monitoring of groundwater and wetland and riparian vegetation is proposed as a component of HCP implementation. Data from existing and new shallow and deep groundwater wells around the Prado Basin and along the Santa Ana River will be used to verify the accuracy of the modeled groundwater depths. If inaccuracies are detected around the Prado Basin, a new sub-basin model will be created and incorporated into the model to increase model accuracy for this area (see Chapter 5 for more information). Riparian and wetland vegetation extent will also be mapped and tracked over time, as discussed in Chapter 5.

Avoidance and mitigation measures will ensure that active southwestern willow flycatcher nests are not disturbed should they occur near Covered Activities in the future, and that adverse effects of modeled habitat and designated critical habitat is reduced to the greatest extent practicable. These measures include seasonal limitations in suitable modeled habitat, pre-Covered Activity USFWS-protocol presence/absence or nest searching surveys, and application of nest buffers and noise monitoring for active nests. Approximately 241.7 acres of modeled habitat will be conserved within the HCP Preserve System in perpetuity. Conserved habitat will be monitored and managed to enhance habitat conditions for this species. Approximately 51 acres of new habitat would be created in restoration sites; 10 acres of which are in designated critical habitat.

Table 4-40. Acres of Southwestern Willow Flycatcher Modeled Habitat Estimated to Be Impacted by Ground-Disturbing Covered Activities

	Impacts		Mitigation
Modeled Habitat Type	**Permanent** [1]	**Temporary**	**HCP Preserve System**
Core Southwestern Willow Flycatcher Habitat			
Up-Front (Pre-Phase 1)			
Phase 1	9.5	3.6	--
Phase 2	6.0	0.0	--
Phase 3	0.0	0.0	--
Phase 4	0.0	0.1	--
Total	*15.5*	*3.7*	--
Very High Value Habitat			
Up-Front (Pre-Phase 1)			4.8
Phase 1	0.0	0.4	19.0
Phase 2	<0.1	0.1	14.6
Phase 3	0.0	0.0	--
Phase 4	0.0	0.0	--
Total	<0.1	0.4	38.4
High Value Habitat			
Up-Front (Pre-Phase 1)			4.1
Phase 1	<0.1	0.2	12.5
Phase 2	<0.1	<0.1	25.5
Phase 3	0.0	0.0	--
Phase 4	0.0	0.0	--
Total	*<0.1*	*0.2*	*42.1*
Moderate Value Habitat			
Up-Front (Pre-Phase 1)			0.6
Phase 1	<0.1	0.1	3.8
Phase 2	0.0	0.0	18.5
Phase 3	0.0	0.0	--
Phase 4	0.0	0.0	--

Modeled Habitat Type	Impacts		Mitigation
	Permanent [1]	**Temporary**	**HCP Preserve System**
Total	*<0.1*	*0.1*	*22.9*
Other Potentially Suitable Habitat			
Up-Front (Pre-Phase 1)			2.7
Phase 1	52.0 (27.6)	27.6	79.2
Phase 2	44.5 (40.9)	12.1	56.4
Phase 3	14.7	0.0	--
Phase 4	0.0	0.5	--
Total	*111.2 (68.5)*	*40.2*	*138.3*
Total Modeled Habitat	126.7 (68.5)	44.7	241.7
Total Modeled Habitat Outside of Existing Basins	**58.2**	**44.7**	**241.7**
Designated Critical Habitat	**95.9**	**12.7**	**8.9**

[1] Impact acreages in parentheses are within existing water recharge/flood control basins subject to regular O&M activities and are a subset of the total acres. For example, of the 126.7 acres of permanent impacts, 68.5 acres occur within existing basins. Consequently, impacts outside of basins are 126.7 – 68.5 = 58.2 acres.

Coastal California Gnatcatcher

The distribution of coastal California gnatcatcher in the Planning Area is defined by modeled very high value habitat, high value habitat, moderate value habitat, low value habitat, other suitable habitat, and documented occurrences. Refer to the coastal California gnatcatcher species account in Section 3.8.3 for a list of the parameters for this species' modeled habitat in the Planning Area. Most documented occurrences for the species occur in the Temescal Valley around Lake Mathews and Lake Elsinore and along the Santa Ana River north of Mentone. Modeled very high value habitat (8,298 acres), high value habitat (9,918 acres), and designated critical habitat (13,589 acres) occur in the fans, washes, creeks, and canyons of the Jurupa Hills and Blue Mountain; and the hills and washes around Lake Elsinore, Wasson Canyon, Walker Canyon, and the Lake Elsinore Clay Mines (Figure 3-56). Modeled moderate value habitat (12,345 acres) and low value habitat (30,081 acres) occur predominantly along the border of the foothills of the San Gabriel Mountains, in Cajon Wash, and south and west of Lake Mathews in the Temescal Valley, and modeled other suitable habitat (5,441 acres) is located around the foothills of the San Gabriel Mountains and farther east into the Cajon Wash (Figure 3-56).

Potential Direct and Indirect Effects

Potential direct effects on gnatcatcher from Covered Activities could include habitat loss and disturbance from construction activities during implementation of Covered Activities. Habitat loss and modification is currently widespread throughout the gnatcatcher's range due to urban and agricultural development. Consequently, additional loss due to Covered Activities could further modify, reduce, and destroy existing and suitable habitat (USFWS 2010c). Construction activities that include grading, excavating, soil stockpiling, or other earth-disturbing activities could alter gnatcatcher habitat by permanently removing coastal sage scrub habitat (Atwood 1993).

Indirect effects on gnatcatcher from Covered Activities could include the introduction of nonnative plant species, destruction, and modification of existing and suitable habitat due to increased wildfire and habitat fragmentation, and genetic isolation. The establishment of nonnative grasses can be especially detrimental to gnatcatcher, resulting in reduced habitat quality, and increasing the potential for more intense and frequent fire regimes causing permanent type conversion of coastal sage scrub habitat to annual grassland (USFWS 2010c).

Human activity during construction, operations, and maintenance activities that involve noise and motion could result in nest abandonment and/or nest failure when conducted near gnatcatcher nesting habitat if these activities occur between mid-February and August (USFWS 2010c). Construction and maintenance activities could limit dispersal between patches of coastal California gnatcatcher habitat, creating isolated populations and resulting in reduced gene flow and weakened populations (Atwood 1993).

Impact Assessment

The impact assessment for the coastal California gnatcatcher estimates the permanent loss of 402.9 acres of modeled habitat, consisting of 40.5 acres of modeled very high value habitat, 46.3 acres of high value habitat, 55.6 acres of moderate value habitat, 188.9 acres of low value habitat, and 71.6 acres of other suitable habitat within the Planning Area (Table 4-16). However, because these areas of permanent habitat loss include places where Permittees currently conduct groundwater recharge activities (Table 4-17) (137.5 acres are within existing basins, Table 4-41), permanent impacts on modeled habitat are significantly less: 265.4 acres. Covered Activities may also result in the permanent loss of 2.9 acres of gnatcatcher designated critical habitat. Areas of permanent impacts would result predominantly from construction of groundwater recharge facilities and wells and water conveyance infrastructure. The amount of permanent impacts on modeled very high value habitat would result from groundwater recharge facilities (30.3 acres; 13.8 acres of which occur within existing basins) and wells and water conveyance infrastructure (9.5 acres). Temporary impacts on 113.0 acres of modeled habitat, composed of 6.0 acres of modeled very high value habitat, 17.0 acres of high value habitat, 21.0 acres of moderate value habitat, 65.0 acres of low value habitat, 4.1 acres of other suitable habitat, and 2.6 acres of designated critical habitat, would occur primarily as a result of wells and water conveyance infrastructure (Table 4-16 and Table 4-17).

The amount of coastal California gnatcatcher modeled habitat that will be removed due to Covered Activities is a small proportion of the total available modeled habitat in the Planning Area (516 of 66,083 acres, or <1%), and a portion of that is within existing basins (138 of 516 acres or 27%). Covered Activities have been identified to co-occur with 3 (of 1,194) documented current (post-2005) occurrences of gnatcatcher in the Planning Area, highlighting the potential for impacts on occupied gnatcatcher habitat and the importance of measures to minimize project-related impacts. Avoidance and minimization measures will be implemented to avoid destruction of occupied gnatcatcher nests, and reduce impacts on suitable habitat to the maximum extent practicable. Overall, the estimated loss to modeled habitat as a result of Covered Activities represents a small proportion of the total modeled habitat within and in the vicinity of the Planning Area. Given the limited amount of potential modeled habitat estimated to be impacted by Covered Activities, and the strict implementation of avoidance and minimization measures, which will include the avoidance of direct mortality, impacts on the population of gnatcatchers in the Planning Area would be small.

Avoidance and minimization measures will ensure that active coastal California gnatcatcher nests are not disturbed and that adverse effects on modeled habitat will be reduced to the greatest extent practicable. These measures include seasonal construction limitations in areas supporting suitable modeled habitat, pre-Covered Activity USFWS-protocol presence/absence or nest searching surveys, and application of nest buffers for active nests. Approximately 497.5 acres of modeled habitat will be conserved within the HCP Preserve System in perpetuity (Table 4-41). Conserved habitat will be monitored and managed to enhance habitat conditions for this species.

Table 4-41. Acres of Coastal California Gnatcatcher Modeled Habitat Estimated to Be Impacted by Ground-Disturbing Covered Activities

	Impacts		Mitigation
Modeled Habitat Type	**Permanent**[1]	**Temporary**	**HCP Preserve System**[2]
Very High Value Habitat			
Up-Front (Pre-Phase 1)			10.8
Phase 1	20.8 (10.6)	5.3	37.7
Phase 2	13.1 (3.2)	0.5	--
Phase 3	1.2	0.1	--
Phase 4	5.4	0.1	--
Total	*40.5 (13.8)*	*6.0*	*48.5*
High Value Habitat			
Up-Front (Pre-Phase 1)			4.9
Phase 1	16.4 (6.5)	13.4	89.2
Phase 2	7.1 (2.0)	3.6	0.6
Phase 3	5.0	<0.1	--
Phase 4	17.9	0.0	--
Total	*46.3 (8.4)*	*17.0*	*94.7*
Moderate Value Habitat			
Up-Front (Pre-Phase 1)			0.7
Phase 1	24.2 (1.9)	9.7	83.5
Phase 2	17.3 (8.4)	10.8	1.2
Phase 3	0.8	0.2	--
Phase 4	13.3	0.3	--
Total	*55.6 (18.3)*	*21.0*	*85.4*
Low Value Habitat			
Up-Front (Pre-Phase 1)			0.8
Phase 1	88.9 (27.4)	30.6	237.9
Phase 2	81.0 (68.1)	33.3	9.7
Phase 3	3.5	<0.1	--
Phase 4	15.5 (0.3)	1.2	--
Total	*188.9 (95.7)*	*65.0*	*248.4*
Other Suitable Habitat			
Up-Front (Pre-Phase 1)			--
Phase 1	2.1 (1.3)	2.6	19.5
Phase 2	0.1	1.5	1.1
Phase 3	68.6	0.0	--
Phase 4	0.8	0.0	--
Total	*71.6 (1.3)*	*4.1*	*20.6*

Modeled Habitat Type	Impacts		Mitigation
	Permanent[1]	Temporary	HCP Preserve System[2]
Total Modeled Habitat	402.9 (137.5)	113.0	497.5
Total Modeled Habitat Outside of Existing Basins	**265.4**	**113.0**	**497.5**
Designated Critical Habitat	**2.9**	**2.6**	**0.0**

[1] Impact acreages in parentheses are within existing water recharge/flood control basins subject to regular O&M activities and are a subset of the total acres. For example, of the 402.9 acres of permanent impacts, 137.5 acres occur within existing basins. Consequently, impacts outside of basins are 402.9 – 137.5 = 265.4 acres.

[2] Areas shown within the HCP Preserve System that are smaller than the required minimum patch size are located within or adjacent to modeled habitats of appropriate size.

Least Bell's Vireo

The distribution of least Bell's vireo in the Planning Area is defined by modeled core breeding habitat, other breeding habitat, and documented occurrences. Refer to the least Bell's vireo species account in Section 3.8.3 for a list of the parameters for this species' modeled habitat in the Planning Area. Most documented occurrences for the species occur in riparian habitat in the Prado Basin and along the Santa Ana River and Temescal Wash, and in San Timoteo, Mockingbird, and Little Sand Canyons (Figure 3-57). Modeled core breeding habitat (5,463 acres) and designated critical habitat (9,900 acres) occur in Prado Basin and along the lower Santa Ana River, while modeled other breeding habitat (9,867 acres) is dispersed throughout the canyons and washes in the Planning Area, including those mentioned above (Figure 3-57).

Potential Direct and Indirect Effects

Potential direct effects on least Bell's vireo from Covered Activities could include habitat loss and disturbance from human activity. Construction activities that include grading, excavating, soil stockpiling, or other earth-disturbing activities could alter vireo habitat by permanently removing early successional riparian scrub and woodlands with developed canopy layer and dense shrubs required for this species (Franzreb 1989, Kus 1998, USFWS 1998a). Human activity during construction, operations, and maintenance activities that involve noise and motion could result in nest abandonment and/or nest failure when conducted near vireo nesting habitat if these activities occur between mid-March and late June (USFWS 1998a, 2006).

Indirect effects on least Bell's vireo from Covered Activities could include the introduction of nonnative plant species and predators, and the alteration of surface and groundwater conditions that may affect not only riparian habitat, but also the abundance and availability of least Bell's vireo prey base, i.e., insects and other invertebrates. Vegetation management activities associated with road and pipeline construction and maintenance could increase the spread of nonnative species. Nests that are located on the edges of vegetation clearings could be more susceptible to brood parasitism from brown-headed cowbirds as well as nest predation. The establishment of nonnative plant species could alter riparian vegetation communities, and could reduce the suitability of core and other breeding habitat for the species by displacing more suitable native plants that are used as nesting substrate. The spread of giant reed in particular, as well as tamarisk and perennial pepperweed, constitute a threat to least Bell's vireo. Where Covered Activity disturbance occurs in highly urbanized areas adjacent to vireo habitat, edge effects could result in an increase in nest and adult predation due to mesopredator release and/or the addition of nonnative predators (e.g., domestic cats) (USFWS 2006). Recharge projects that divert streamflow from the Santa Ana River, pump groundwater, or decrease groundwater infiltration rates could alter the distribution and species composition of riparian habitat, and the associated insect community, both of which could, in turn, affect breeding. Refer to Section 4.4.1 for a description of the predicted effects of Covered Activities on average daily streamflows. Refer to Section 4.4.3 for a description of the predicted effects of Covered Activities on GDEs, including riparian habitat.

Impact Assessment

The impact assessment for least Bell's vireo estimates the permanent loss of 126.7 acres of modeled habitat, consisting of 0.2 acre of modeled core breeding habitat and 126.5 acres of modeled other breeding habitat within the Planning Area (Table 4-16). However, because more than half of this permanent habitat loss occurs primarily where Permittees currently conduct groundwater recharge activities (68.5 acres of modeled other breeding habitat are within existing basins), permanent impacts on modeled habitat are significantly less: 58.2 acres (Table 4-42). Areas of permanent habitat loss of modeled other breeding habitat would result predominantly from groundwater recharge facilities (92.0 acres, 68.5 acres of which are within existing basins) and wells and water conveyance infrastructure (32.4 acres) (Table 4-17). Temporary impacts on 17.2 acres of modeled core breeding habitat, and 27.5 acres of modeled other breeding habitat would occur as a result of short-term disturbance associated predominantly with wells and water conveyance infrastructure (Table 4-18). Impacts from Covered Activities are estimated to result in the permanent loss of 1.9 acres of designated critical habitat and temporary impacts on 55.8 acres of designated critical habitat. Impacts may result in the loss or alteration of physical and biological features for least Bell's vireo within designated critical habitat.

The amount of least Bell's vireo modeled habitat that will be removed due to Covered Activities is a small proportion of the total modeled available habitat in the Planning Area (171 of 15,330 acres, or <1%), and a portion of that is within existing basins (69 of 171 acres, or 40%). Covered Activities have been identified to co-occur with 7 (of 1,694) documented current (post-2005) occurrences of least Bell's vireo in the Planning Area, indicating the potential for impacts on occupied habitat. Avoidance and minimization measures will be rigorously implemented and will reduce potential adverse effects on this species.

When the least Bell's vireo was listed in 1986, there were 19 known pairs in the Prado Basin (USFWS 2006). That population has since increased to a high of 665 territorial males in 2018, and the total Santa Ana Watershed population was estimated as 1,967 territorial males in 2019 (SAWA 2019). No ground-disturbing Covered Activities are proposed in the Prado Basin, which supports a large core population of least Bell's vireo. Further, impacts from ground-disturbing activities associated with Covered Activities would not isolate habitat, territories, or populations or result in substantial loss of modeled core habitat areas, critical habitat, or modeled other potential breeding habitat in the Planning Area, and avoidance and minimization measures would be implemented to reduce impacts to the maximum extent practicable. As such, impacts from ground-disturbing activities on the least Bell's vireo population in the Planning Area would be small.

There are two areas of modeled falling groundwater with Covered Activities in place within least Bell's vireo habitat along the riparian communities of the Santa Ana River: in the reach from the Riverside Avenue crossing to the railroad crossing at the confluence with Sunnyslope Channel, and the reach from I-15 downstream to Prado Dam. Vireo habitat with modeled rising groundwater occurs on the Santa Ana River between the railroad crossing and I-15, and in the vicinity of the lower tributaries of Chino and Cucamonga Creeks (see Figure 4-8). Rising groundwater is not expected to have a detrimental effect on vireo habitat as long as it does not become permanent surface water where riparian under- and overstory species will not grow (see Table 4-10). However, falling groundwater may cause a reduction in the amount of riparian habitat suitable for least Bell's vireo (see Table 4-8).

Overall, impacts on the least Bell's vireo population within the Planning Area from ground-disturbing effects and hydrologic changes would be limited. However, the areas of predicted modeled falling groundwater, with Covered Activities in place, may have a more substantial effect on the population. As discussed in Section 4.4.4 the predicted groundwater depths, and changes in these depths with Covered Activities in place are based on large-scale hydrologic modeling. Consequently, it will be important to conduct regular groundwater monitoring in conjunction with least Bell's vireo population and habitat condition monitoring to adaptively manage the effects of Covered Activities on this species. Ongoing monitoring of groundwater and wetland and riparian vegetation is proposed as a component of HCP implementation. Data from existing and new shallow and deep groundwater wells around the Prado Basin and along the Santa Ana River will be used to verify the accuracy of the modeled groundwater depths. If inaccuracies are detected around the Prado Basin, a new sub-basin model will be created and incorporated into the model to increase model accuracy for this area (see Chapter 5 for more information). Riparian and wetland vegetation extent will also be mapped and tracked over time, as discussed in Chapter 5.

Avoidance and minimization measures will ensure that active least Bell's vireo nests are not disturbed and that adverse effects on modeled habitat and designated critical habitat are reduced to the greatest extent practicable. These measures include seasonal construction limitations in modeled suitable habitat, pre-Covered Activity USFWS-protocol presence/absence or nest searching surveys, and application of nest buffers for active territories. Approximately 241.7 acres of modeled suitable habitat will be conserved within the HCP Preserve System in perpetuity ahead of implementation of Phase 1 Covered Activities. Of this total, approximately 208.3 acres of habitat will be restored to suitable habitat within the HCP Preserve System, which includes 144.4 acres of least Bell's vireo designated critical habitat. Conserved and restored habitat will be monitored and managed to enhance habitat conditions for this species.

Once Covered Activities have been implemented, if impacts on occupied vireo habitats (riparian vegetation) are found to be greater than anticipated, several options exist to reduce impacts to within the amount assessed within Table 4-42. As stated above (Section 4.4.3), one option includes supplying seasonal flow to discrete portions of the Planning Area through the SARCCUP, or other conjunctive use program, or via additional discharge from the WWTPs along the upper Santa Ana River. If impacts on habitat cannot be reduced below the values in Table 4-42, additional mitigation will be necessary to provide additional values for least bell's vireo.

Table 4-42. Acres of Least Bell's Vireo Modeled Habitat Estimated to Be Impacted by Ground-Disturbing Covered Activities

	Impacts		Mitigation
Modeled Habitat Type	**Permanent[1]**	**Temporary**	**HCP Preserve System**
Core Breeding Habitat			
Up-Front (Pre-Phase 1)			4.3
Phase 1	0.2	17.0	18.8
Phase 2	<0.1	0.2	61.5
Phase 3	0.0	0.0	--
Phase 4	0.0	0.0	--
Total	*0.2*	*17.2*	*84.6*
Other Breeding Habitat			
Up-Front (Pre-Phase 1)			8.0
Phase 1	61.3 (27.6)	14.9	95.7
Phase 2	50.4 (40.9)	12.0	53.4
Phase 3	14.7	0.0	--
Phase 4	0.0	0.6	--
Total	*126.5 (68.5)*	*27.5*	*157.1*
Total Modeled Habitat	126.7 (68.5)	44.7	241.7
Total Modeled Habitat Outside of Existing Basins	**58.2**	**44.7**	**241.7**
New Habitat Created through Restoration			50.7
Grand Total of Habitat in the HCP Preserve System			**292.4**
Designated Critical Habitat	**1.9**	**55.8**	**127.5**

[1]Impact acreages in parentheses are within existing water recharge/flood control basins subject to regular O&M activities and are a subset of the total acres. For example, of the 126.7 acres of permanent impacts, 68.5 acres occur within existing basins. Consequently, impacts outside of basins are 126.7 – 68.5 = 58.2 acres.

Los Angeles Pocket Mouse

The distribution of Los Angeles pocket mouse in the Planning Area is defined by modeled suitable habitat and documented occurrences. Refer to the Los Angeles pocket mouse species account in Section 3.8.3 for a list of the parameters for this species' modeled habitat in the Planning Area. Most documented occurrences for the species occur in the northern portion of the Planning Area in San Bernardino County, in Day Canyon Wash, East Etiwanda Creek, Cajon Wash, and northern reaches of the Santa Ana River. Modeled suitable habitat (67,500 acres) occurs throughout the Planning Area and is dispersed throughout canyons and washes, including those mentioned above (Figure 3-58).

Potential Direct and Indirect Effects

Potential direct effects on pocket mouse from Covered Activities could include habitat loss and disturbance from human activity. Construction activities could result in the death or injury of Los Angeles pocket mouse. Further, construction activities that include grading, excavating, soil stockpiling, or other earth-disturbing activities could crush or bury pocket mice in their burrows. Construction could also alter pocket mouse habitat by permanently removing low-elevation sparse grassland, alluvial sage scrub, and coastal sage scrub habitats (Bolster 1998). Vegetation management for road and pipeline construction and regular maintenance and construction of infrastructure for new diversions and recharge basins could increase the spread of nonnative plant species. The establishment of nonnative species alters native vegetation communities and could reduce the suitability of Los Angeles pocket mouse habitat.

Indirect effects on Los Angeles pocket mouse from Covered Activities could include the introduction of nonnative plant species and habitat fragmentation and genetic isolation. Covered Activities could also further fragment already isolated patches of suitable habitat for Los Angeles pocket mouse, which have been adversely affected throughout the region by conversion of habitat to agricultural, suburban, and urban uses (Dudek and Associates 2003b).

Impact Assessment

The impact assessment of Los Angeles pocket mouse estimates the permanent loss of 657.0 acres of modeled suitable habitat (Table 4-16). However, because nearly one-third of these areas of permanent habitat loss occur where Permittees currently conduct groundwater recharge activities (181.9 acres of permanent impacts are within existing basins), permanent impacts on modeled habitat are significantly less: 475.1 acres. Permanent loss of modeled suitable habitat in the Planning Area would result predominantly from groundwater recharge facilities (430.4 acres, 181.9 acres of which are within existing basins) and wells and water conveyance infrastructure (190.7 acres) (Table 4-17). Temporary impacts on 144.2 acres of modeled suitable habitat would occur as a result of short-term disturbance associated primarily with wells and water conveyance infrastructure (127.3 acres) (Table 4-18).

The amount of Los Angeles pocket mouse habitat that will be removed from the construction of Covered Activities is a small proportion of the available modeled habitat in the Planning Area (801 of 67,500 acres, or 1%), and a portion of that is within existing basins (182 of 801 acres, or 23%). Covered Activities have been identified to co-occur with 2 (of 38) documented current (post-2005) occurrences of the species in the Planning Area, highlighting that impacts on occupied habitat will likely occur. Fragmentation of some of this species' habitat may also occur as a result of Covered Activities, which could reduce dispersal opportunities for this species and cause a decrease in gene flow. However, because permanent impacts are proposed on approximately 1% of the total modeled habitat in the Planning Area, the overall impacts on the population of Los Angeles pocket mouse in the Planning Area would be small.

Avoidance and minimization measures will ensure that impacts on individuals and modeled suitable habitat are reduced to the greatest extent practicable. These measures include pre-project habitat assessments, exclusionary fencing, trapping surveys, relocation, topsoil sequestration, and timing and night-lighting limitations. Approximately 624.9 acres of modeled habitat will be conserved within the HCP Preserve System in perpetuity (Table 4-43). Conserved habitat will be monitored and managed to enhance habitat conditions for this species.

Table 4-43. Acres of Los Angeles Pocket Mouse Modeled Habitat Estimated to Be Impacted by Ground-Disturbing Covered Activities

	Impacts		Mitigation
Modeled Habitat Type	**Permanent[1]**	**Temporary**	**HCP Preserve System**
Potentially Suitable Habitat			
Up-Front (Pre-Phase 1)			67.0
Phase 1	301.8 (73.1)	85.4	536.0
Phase 2	201.9 (108.5)	55.9	21.9
Phase 3	83.1	0.9	--
Phase 4	63.3 (0.3)	2.0	--
Total Modeled Habitat	657.0 (181.9)	144.2	624.9
Total Modeled Habitat Outside of Existing Basins	**475.1**	**144.2**	**624.9**

[1]Impact acreages in parentheses are within existing water recharge/flood control basins subject to regular O&M activities and are a subset of the total acres. For example, of the 657.0 acres of permanent impacts, 181.9 acres occur within existing basins. Consequently, impacts outside of basins are 657.0 - 181.9 = 475.1 acres.

San Bernardino Kangaroo Rat

The distribution of San Bernardino kangaroo rat habitat in the Planning Area is predicted by a habitat model, mapped critical habitat, and species' occurrence records. Refer to the San Bernardino kangaroo rat species account in Section 3.8.3 for a list of the parameters for this species' modeled habitat in the Planning Area. Most documented occurrences and modeled suitable habitat (21,120 acres) for the species occur in the northern portion of the Planning Area in San Bernardino County, in Day Canyon Wash, Etiwanda Canyon, Lytle Creek, Cajon Wash, Devil Canyon, City Creek, and habitat along the Upper Santa Ana River, from southwest of the San Bernardino International Airport east to the Crafton Hills. Modeled suitable habitat occurs predominantly in one of two areas within the Planning Area: (1) along Lytle-Cajon Wash in the area north of I-210 between I-15 and I-215, and (2) along the Santa Ana River in the area north of the town of Mentone and east of I-215. Within the Planning Area, designated critical habitat (27,745 acres in San Bernardino County) has been designated for the majority of the areas mentioned above that are modeled habitat (Figure 3-59).

Potential Direct and Indirect Effects

Potential direct effects on San Bernardino kangaroo rat from Covered Activities could include mortality caused by habitat loss. Construction activities could result in the death or injury of San Bernardino kangaroo rat. Grading, excavating, soil stockpiling, or other construction-related earth-disturbing activities could crush or bury kangaroo rats in their burrows. Habitat loss and modification is currently widespread throughout the species' range due to mining; agricultural, urban, and industrial development; and flood control activities (USFWS 2009b). Additional habitat removal resulting from Covered Activities could further exacerbate adverse effects on kangaroo rat.

Indirect effects on kangaroo rat from Covered Activities could include the introduction of nonnative plant species (especially nonnative Mediterranean grasses), alteration of surface water flows, or habitat fragmentation. The introduction of novel, nonnative plants can occur through the transport of viable seed or other plant propagules on construction equipment or on the clothing of persons that visit the site. Later establishment of these nonnative species, particularly nonnative grasses, can be especially detrimental to San Bernardino kangaroo rat. s. Once established, nonnative annual grasses alter the landscape of alluvial floodplain habitat by increasing the absolute vegetative density and reducing the permeability of movement by this species (USFWS 1998b). With decades of nitrogen deposition, derived primarily from vehicular pollution (combustion engine) within the Planning Area, nonnative grasses often are more successful than native plant species, especially during higher precipitation years, leading to decreased habitat value for kangaroo rats via loss of native food source (i.e., seeds) and decreased movement ability. The dense growth of nonnative grasses and the associated thatch that accumulates on the ground surface can impede the movement for small hopping species, such as kangaroo rats. Groundwater recharge projects that divert streamflow from the Santa Ana River could result in changes to the fluvial processes (i.e., reduction in total discharge and sediment transport) required for maintaining various aged stands of alluvial fan sage scrub. Consequently, changes to fluvial processes could alter the distribution and species composition of the alluvial fan vegetation community, which, in turn, could impact kangaroo rat populations (USFWS 2009b). Habitat fragmentation resulting from Covered Activities could present barriers to movement and reduce connectivity between existing habitat patches, which would limit dispersal and genetically isolate populations (Jones 1989). In addition, the Covered Activities may reduce sediment transport (see Section 4.4.2), which can indirectly affect kangaroo rat by potentially reducing disturbance within channels. This species depends upon pioneer vegetation, which is maintained by frequent flood disturbance; therefore, if sediment transport is reduced within the Planning Area these channels could undergo habitat succession, resulting in lower suitability for kangaroo rat (USFWS 2009b). It will be important to conduct regular monitoring of San Bernardino kangaroo rat habitat suitability to adaptively manage the effects of Covered Activities that result in reduction in sediment transport.

Impact Assessment

The impact assessment for San Bernardino kangaroo rat estimates the permanent loss of 681.4 acres of modeled suitable habitat, as well as 656.3 acres of designated critical habitat (Table 4-16). However, more than half of the impacts on modeled habitat occur in existing basins where Permittees currently conduct groundwater recharge activities (377.2 acres). Permanent impacts on modeled suitable habitat outside of existing basins are significantly less (304.2 acres) (Table 4-44). Similarly, 109.4 acres of the impacts on designated critical habitat also occur within existing basins; consequently, impacts on designated critical habitat are 546.9 acres (Table 4-44). Temporary impacts on 72.7 acres of modeled suitable and 110.1 acres of designated critical habitat are also estimated to occur. These impacts would occur as a result of short-term disturbance associated primarily with wells and water conveyance infrastructure (Table 4-18)). Ground-disturbing impacts occurring within San Bernardino kangaroo rat modeled suitable habitat, even short-term disturbance from pipeline construction or staging areas, could result in long-term or permanent impacts if they alter the soil condition to make them unsuitable for San Bernardino kangaroo rat burrows.

The proposed impacts include 149.9 acres of permanent impacts on San Bernardino kangaroo rat refugia habitat (of which, 118.6 acres are in existing basin), and 46.4 acres of temporary impacts on San Bernardino kangaroo rat refugia (includes areas outside of the 100-year floodplain boundary important to temporarily support San Bernardino kangaroo rat during major flood events).

As described in Section 3.8.3, an additional data layer was created representing all areas that are Assumed Occupied by San Bernardino kangaroo rat based on a 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 San Bernardino kangaroo rat has the potential to be found. Approximately 681.6 acres of permanent impacts (57.5 acres of which occur within existing basins) and 94.4 acres of temporary impacts were identified to areas that are Assumed Occupied by San Bernardino kangaroo rat.

Impacts are also broken down by Preserve Unit for the two Alluvial Fan Preserve Units (Table 4-45 and Table 4-46). Within Alluvial Fan Preserve Unit A there are 126.7 acres of permanent impacts (41.1 acres of which occur within existing basins) and 51.0 acres of temporary impacts on modeled habitat. These impacts are offset by 363.9 acres of mitigation of modeled habitat. For Alluvial Fan Preserve Unit B there are 240.9 acres of permanent impacts (48.4 acres of which occur within existing basins) and 11.5 acres of temporary impacts on modeled habitat. These impacts will be offset by mitigation lands acquired within Alluvial Fan Preserve Unit B. Approximately 216.9 acres of mitigation of modeled habitat within the Devil Creek area have been identified within Alluvial fan Preserve Unit B. These mitigation lands may be used to offset impacts on modeled San Bernardino kangaroo rat habitat, but they will not be used to mitigate for impacts on occupied lands. The HCP is actively pursuing San Bernardino kangaroo rat-occupied lands within Alluvial Fan Preserve Unit B (see Figure 3-61), and it is anticipated that lands will be secured prior to Phase 1 of HCP implementation. However, if acquisition of San Bernardino kangaroo rat-occupied habitat is not finalized prior to implementation of Phase 1, and impacts on San Bernardino kangaroo rat-occupied habitat have been identified (note: Phase 1 Covered Activities are limited to routine operations and maintenance of existing facilities), these impacts will be offset through the purchase of mitigation/conservation bank credits within Alluvial Fan Preserve Unit B.

Impacts on San Bernardino kangaroo rat within Alluvial Fan Preserve Unit B are not identified in Phase 2 of HCP implementation. The majority of ground-disturbing Covered Activity impacts within Alluvial Fan Preserve Unit B are proposed to occur during Phase 3 and 4 of HCP implementation (Table 4-46). If additional acquisition of mitigation lands, including San Bernardino kangaroo rat-occupied lands, within Alluvial Fan Preserve Unit B has not occurred prior to Phase 3 of HCP implementation, Covered Activity impacts on San Bernardino kangaroo rat-occupied habitat cannot proceed (Chapter 5).

The amount of San Bernardino kangaroo rat modeled suitable habitat that will be removed due to Covered Activities represents a small proportion of the total available modeled suitable habitat in the Planning Area (681 of 21,120 acres, or 3%), and a portion of that is within existing basins (377 of 681 acres, or 55%). The footprints of Covered Activities have been identified to co-occur with 64 (of 1,069) documented current (post-2005) occurrences of the species in the Planning Area, indicating the potential for impacts on occupied habitat and the importance of measures to minimize impacts on the species. Habitat connectivity, especially maintaining connectivity within and between the Santa Ana River and City Creek, and the Cajon Creek and Lytle Creek core population areas, is also an important factor when considering potential effects for Covered Activities on the species.

Critical Habitat Units 1, Santa Ana River Wash; 2, Lytle/Cajon Creek Wash; and 3, Etiwanda Fan and Wash, occur within the Planning Area. The Santa Ana River Wash unit in particular and, to a lesser extent, the Lytle/Cajon Creek Wash unit, exist within a fragmented and largely isolated environment (USFWS 2009b). Given that this species has experienced extensive habitat loss throughout its range and within the Planning Area, any additional habitat loss could have potentially significant proportional impacts on the San Bernardino kangaroo rat.

A minimum of approximately 585.8 acres of modeled suitable habitat will be conserved, monitored, and managed within the HCP Preserve System in perpetuity (Table 4-44). A total of 67.0 acres of modeled suitable and occupied habitat (confirmed via trapping) will be conserved and under active management up-front, prior to commencement of Covered Activities with impacts on San Bernardino kangaroo rat modeled suitable habitat. Of the 585.8 acres of conserved modeled suitable habitat, 363.9 acres will be located within Alluvial Fan Preserve Unit A, and a minimum of 216.9 acres will be located within Alluvial Fan Preserve Unit B (Table 4-45 and Table 4-46). A total of 304.7 acres of modeled refugia habitat and 458.1 acres of areas assumed to be occupied by San Bernardino kangaroo rat will be conserved within the HCP Preserve System. Conserved habitat will be monitored and managed to enhance habitat conditions for this species. Avoidance and minimization measures will be strictly enforced to ensure that impacts on individuals and occupied habitat are reduced to the greatest extent practicable. These measures include project siting, habitat assessments, exclusionary fencing, trapping surveys, relocation, topsoil sequestration, timing and night-lighting limitations, and implementation of construction site BMPs to avoid and/or minimize the potential for San Bernardino kangaroo rat to enter and be harmed in construction sites.

Table 4-44. Total Acres of San Bernardino Kangaroo Rat Modeled Habitat Estimated to Be Impacted by Ground-Disturbing Covered Activities

	Impacts		Mitigation[2]
Modeled Habitat Type	**Permanent[1]**	**Temporary**	**HCP Preserve System**
Suitable Habitat			
Up-Front (Pre-Phase 1)			67.0
Phase 1	118.4 (82.1)	70.3	513.8
Phase 2	327.4 (295.1)	0.1	5.0
Phase 3	132.1	0.5	--
Phase 4	103.5	1.7	--
Total Modeled Habitat	681.4 (377.2)	72.7	585.8
Total Modeled Habitat Outside of Existing Basins	**304.2**	**72.7**	**585.8**
Designated Critical Habitat	**656.3 (109.4)**	**110.1**	**685.0**
Refugia	**149.9 (118.6)**	**46.4**	**304.7**
Assumed Occupied[3]	**681.6 (57.5)**	**94.4**	**458.1**

[1] Impact acreages in parentheses are within existing water recharge/flood control basins subject to regular O&M activities and are a subset of the total acres. For example, of the 681.4 acres of permanent modeled habitat impacts, 377.2 acres occur within existing basins. Consequently, modeled habitat impacts outside of basins are 681.4 – 377.2 = 304.2 acres.
[2] Mitigation acreages are the minimum that will be acquired. They include lands already acquired, or those owned by Permittees determined to have high potential for incorporation into the HCP Preserve System. Additional mitigation lands will be acquired for this species.
[3] "Assumed Occupied" is not a modeled dataset; it is a separate data layer that was estimated to indicate all areas that are assumed to be currently occupied by SBKR. 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 4-45. Acres of San Bernardino Kangaroo Rat Modeled Habitat Estimated to Be Impacted by Ground-Disturbing Covered Activities within Alluvial Fan Preserve Unit A

	Impacts		Mitigation
Modeled Habitat Type	**Permanent[1]**	**Temporary**	**Alluvial Fan Unit A**
Suitable Habitat			
Up-Front (Pre-Phase 1)			67.0
Phase 1	64.8 (41.1)	50.5	296.9
Phase 2	30.7	0.0	--
Phase 3	29.9	0.5	--
Phase 4	1.2	0.0	--
Total Modeled Habitat	126.7 (41.1)	51.0	363.9
Total Modeled Habitat Outside of Existing Basins	**85.6**	**51.0**	**363.9**
Designated Critical Habitat	**219.2 (21.7)**	**66.2**	**445.0**
Refugia	**26.4**	**37.3**	**267.1**
Assumed Occupied[2]	**254.5 (42.0)**	**74.4**	**458.1**

[1]Impact acreages in parentheses are within existing water recharge/flood control basins subject to regular O&M activities and are a subset of the total acres. For example, of the 126.7 acres of permanent modeled habitat impacts, 41.1 acres occur within existing basins. Consequently, modeled habitat impacts outside of basins are 126.7 – 41.1 = 85.6 acres.

[2] "Assumed Occupied" is not a modeled dataset; it is a separate data layer that was estimated to indicate all areas that are assumed to be currently occupied by SBKR. 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 4-46. Acres of San Bernardino Kangaroo Rat Modeled Habitat Estimated to Be Impacted by Ground-Disturbing Covered Activities within Alluvial Fan Preserve Unit B

	Impacts		Mitigation[2]
Modeled Habitat Type	**Permanent[1]**	**Temporary**	**Alluvial Fan Unit B**
Suitable Habitat			
Up-Front (Pre-Phase 1)			--
Phase 1	23.7 (15.3)	11.1	216.9
Phase 2	-- (33.1)	0.0	--
Phase 3	102.2	0.0	--
Phase 4	82.0	0.3	--
Total Modeled Habitat	240.9 (48.4)	11.5	216.9
Total Modeled Habitat Outside of Existing Basins	**192.5**	**11.5**	**216.9**
Designated Critical Habitat	**382.1 (69.9)**	**19.8**	**240.0**
Refugia	**10.1 (2.3)**	**3.9**	**32.5**
Assumed Occupied[3]	**398.4 (15.5)**	**13.0**	**--**

[1] Impact acreages in parentheses are within existing water recharge/flood control basins subject to regular O&M activities and are a subset of the total acres. For example, of the 240.9 acres of permanent modeled impacts habitat, 48.4 acres occur within existing basins. Consequently, modeled habitat impacts outside of basins are 240.9 – 48.4 = 192.5 acres.

[2] Additional mitigation lands within Alluvial Fan Preserve Unit B will be acquired for this species. Impacts on Assumed Occupied lands cannot occur unless mitigation of Assumed Occupied lands has been secured prior to

impacts. Further, the 216.9 acres of mitigation identified in Phase 1 can only be used to offset impacts on modeled San Bernardino kangaroo rat habitat. Impacts on occupied San Bernardino kangaroo rat habitat cannot proceed unless San Bernardino kangaroo rat-occupied habitat is acquired prior to impacts.

[3] "Assumed Occupied" is not a modeled dataset; it is a separate data layer that was estimated to indicate all areas that are assumed to be currently occupied by SBKR. 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.

Chapter 5
Conservation Strategy

5.1 Introduction and Approach

The conservation strategy for the Upper Santa Ana River (SAR) Habitat Conservation Plan (HCP) is designed to avoid, minimize, and mitigate impacts on Covered Species to the maximum extent practicable. The strategy was designed to meet the regulatory requirements of both the Federal and State Endangered Species Acts and to streamline compliance with other applicable State and Federal environmental laws and regulations (Chapter 1, *Introduction*).

Implementation of the Conservation Strategy is the responsibility of the Upper Santa Ana River Sustainable Resources Alliance (Alliance), which will be established as a Joint Powers Authority (JPA) of the HCP. The Alliance will be responsible for implementing the HCP and all conservation actions described in the Conservation Strategy, and assisting the other Permittee Agencies in complying with the conditions of the HCP Incidental Take Permit in connection with their Covered Activities.

The conservation strategy, as organized in this chapter, first describes the more general elements then proceeds to more specific elements, organized by each Covered Species. All conservation actions will be implemented using an adaptive management and monitoring approach (Section 5.12, *Comprehensive Adaptive Management and Monitoring Program*).

5.2 Elements of the Conservation Strategy

The following sections summarize the elements of the conservation strategy, which include all conservation actions as mitigation to offset the impacts of Covered Activities to the maximum extent practicable. The conservation actions are based on the biological needs of the Covered Species and, when fully implemented, will meet the biological goals and objectives of the HCP. The elements of the conservation strategy are listed below and are described in more detail in the sections that follow. The phasing of the implementation of these conservation actions in relationship to the implementation of Covered Activities is also described below.

Elements of the Upper Santa River HCP Conservation Strategy:

- *Biological Goals and Objectives* (Section 5.3)
- *HCP Preserve System* (Section 5.4)
- *Hydrologic Manipulation and Substrate Management* (Section 5.5)
- *Captive Headstarting and Translocation* (Section 5.6)
- *Species and Habitat Research* (Section 5.7)
- *Conservation Bank Credits* (Section 5.8)
- *Species-Specific Conservation Strategies* (Section 5.9)
- *Fully Avoided Species* (Section 5.10)

- *Measures to Avoid and Minimize Effects* (Section 5.11)
- *Comprehensive Adaptive Management and Monitoring Program* (Section 5.12)

5.3 HCP Goals and Objectives

Biological goals and objectives are required elements of an HCP (USFWS and NMFS 2016). Biological goals are broad, guiding principles based on the conservation needs of the Covered Species. Biological objectives are expressed as conservation targets or desired future conditions and are designed to achieve the biological goals. The Upper Santa Ana River HCP has four overarching goals and six HCP Objectives as listed below.

The HCP Goals will be accomplished within the HCP Preserve System and are as follows:

HCP Goal 1: Conserve Covered Species and manage their habitats to contribute to the recovery of listed species or those that may become listed under the Federal Endangered Species Act.

HCP Goal 2: Maintain or simulate natural ecological processes necessary to maintain the functionality of the natural communities and habitats upon which the Covered Species depend within the HCP Preserve System and to the greatest extent possible outside the HCP Preserve System.

HCP Goal 3: Maintain or increase habitat connectivity in the HCP Preserve System and to adjacent protected habitat areas to reduce isolation between metapopulations of Covered Species.

HCP Goal 4: Actively manage lands within the HCP Preserve System for the benefit of Covered Species to maintain or increase the health of populations.

The following HCP Objectives will support the HCP Goals:

HCP Objective 1: Conserve, restore/rehabilitate, and manage a minimum of 1,348.8 acres of native habitat for Covered Species in the HCP Preserve System over the duration of the life of the permit.

HCP Objective 2: Reduce anthropogenic and environmental threats to Covered Species and their habitats within the HCP Preserve System.

HCP Objective 3: Maintain and successfully enhance existing and new Santa Ana sucker habitats.

HCP Objective 4: Maintain and successfully enhance existing San Bernardino kangaroo rat habitats.

HCP Objective 5: Implement successful conservation measures to promote the recovery of Covered Species.

HCP Objective 6: Conduct scientific research in order to improve our knowledge and fill existing and future data gaps.

Species-specific objectives and species-specific conservation actions are presented for each Covered Species in Section 5.9, *Species-Specific Conservation Strategies,* to achieve the HCP goals and objectives.

5.4 HCP Preserve System

The Alliance—as the HCP Implementing Entity—will provide for the permanent conservation of a minimum of approximately 1,349 acres within the HCP Preserve System. The HCP Preserve System will be assembled through a combination of property acquisitions, and/or establishment of conservation easements. The HCP Preserve System will be managed and monitored through the Comprehensive Adaptive Management and Monitoring Program (CAMMP) that will be implemented by the Alliance.

All conserved lands planned for within the HCP Preserve System are contiguous with existing open space and protected areas within the Planning Area (Figure 5-1), and will become an important component of the network of preserved lands that includes other HCPs and natural community conservation plans (NCCPs) (e.g., Upper Santa Ana River Wash HCP [Wash Plan HCP], Western Riverside County Multiple Species Habitat Conservation Plan), open space parks and wildlife areas (e.g., County parks and California Department of Fish and Wildlife [CDFW] lands), and other public lands (e.g., U.S. Forest Service [USFS] and Bureau of Land Management [BLM] lands). As can be seen in Figure 5-1, the HCP Preserve System includes Conservation Areas that are generally well-connected to other existing protected areas.

The HCP Preserve System is composed of various lands that are proposed to be acquired and/or protected via conservation easements and long-term management for the purpose of habitat conservation (restoration, rehabilitation, re-establishment, and/or enhancement) and/or species' re-establishment through translocation (Santa Ana sucker, Figure 5-1) in order to generate mitigation for the HCP (Figures 5-2 through 5-5). The HCP Preserve System will be adaptively managed for the long-term protection of the Covered Species and their habitats.

The HCP Preserve System is divided into five main preserve units, as listed below, and depicted in Figure 5-1. Preserve unit boundaries generally follow hydrologic unit code (HUC) 12 watershed boundaries, except the Santa Ana River Preserve Unit, which includes the natural habitats along the mainstem of the Santa Ana River and Prado Basin down to Prado Dam. Not all areas within preserve units are part of the HCP Preserve System. Only those lands proposed to be acquired and/or conserved with conservation easements are considered part of the HCP Preserve System. Additional lands will be identified and added to the HCP Preserve System as needed.

Santa Ana River Preserve Unit: The Santa Ana River Preserve Unit includes all the major tributary and riparian floodplain habitats along the mainstem of the Santa Ana River, proposed for acquisition and/or conservation easement establishment. The Santa Ana River Preserve Unit will protect and improve habitat values for aquatic and riparian habitats for Covered Species and aquatic resources along the Santa Ana River and tributaries, improving habitat condition and habitat connectivity.

Alluvial Fan Preserve Unit A: The Alluvial Fan Preserve Unit A includes areas already acquired and others proposed for acquisition and/or establishment of conservation easements. These lands support a mix of alluvial fan sage scrub and other upland habitat types. The Alluvial Fan Preserve Unit A includes Conservation Areas adjacent to the Woolly-Star Preserve Area, the Wash Plan HCP, and tributaries connecting to lands in the San Bernardino National Forest that provide important connectivity for both alluvial fan sage scrub, aquatic, and riparian Covered Species, habitats, and ecological processes.

Alluvial Fan Preserve Unit B: The Alluvial Fan Preserve Unit B includes areas proposed for acquisition and/or establishment of conservation easements supporting alluvial fan sage scrub, shrubland, woodland, aquatic and riparian habitats. The Alluvial Fan Preserve Unit B includes the preservation of lands that will provide important connectivity for both alluvial fan sage scrub and riparian species along these tributaries connecting to lands in the San Bernardino National Forest. The Alluvial Fan Preserve Unit B includes the Lytle Creek Conservation Bank and the Cajon Creek Conservation Bank (neither of which would be formally incorporated into the HCP Preserve System if credits were purchased as mitigation).

Santa Ana Sucker Translocation Preserve Units A and B: The Santa Ana Sucker Translocation streams are higher gradient headwater streams with the potential to support suitable habitat conditions for the establishment (via translocation) of Santa Ana sucker. These streams may include the Santa Ana River upstream of Seven Oaks Dam, and Plunge, Hemlock, Mill, Bear, Alder, Lytle, and Mountain Home Creeks. Translocation of Santa Ana sucker may also occur to San Antonio Creek, which occurs just outside of the HCP Planning Area. The Santa Ana Sucker Translocation Preserve Unit A also includes several conservation areas proposed for acquisition and/or establishment of conservation easements, which will provide important connectivity for both alluvial fan sage scrub, aquatic, and riparian species along these tributaries connecting to lands in the San Bernardino National Forest. The Santa Ana Sucker Translocation Preserve Unit B includes Lytle and Cajon Creeks.

5.4.1 Phases of HCP Preserve System Implementation

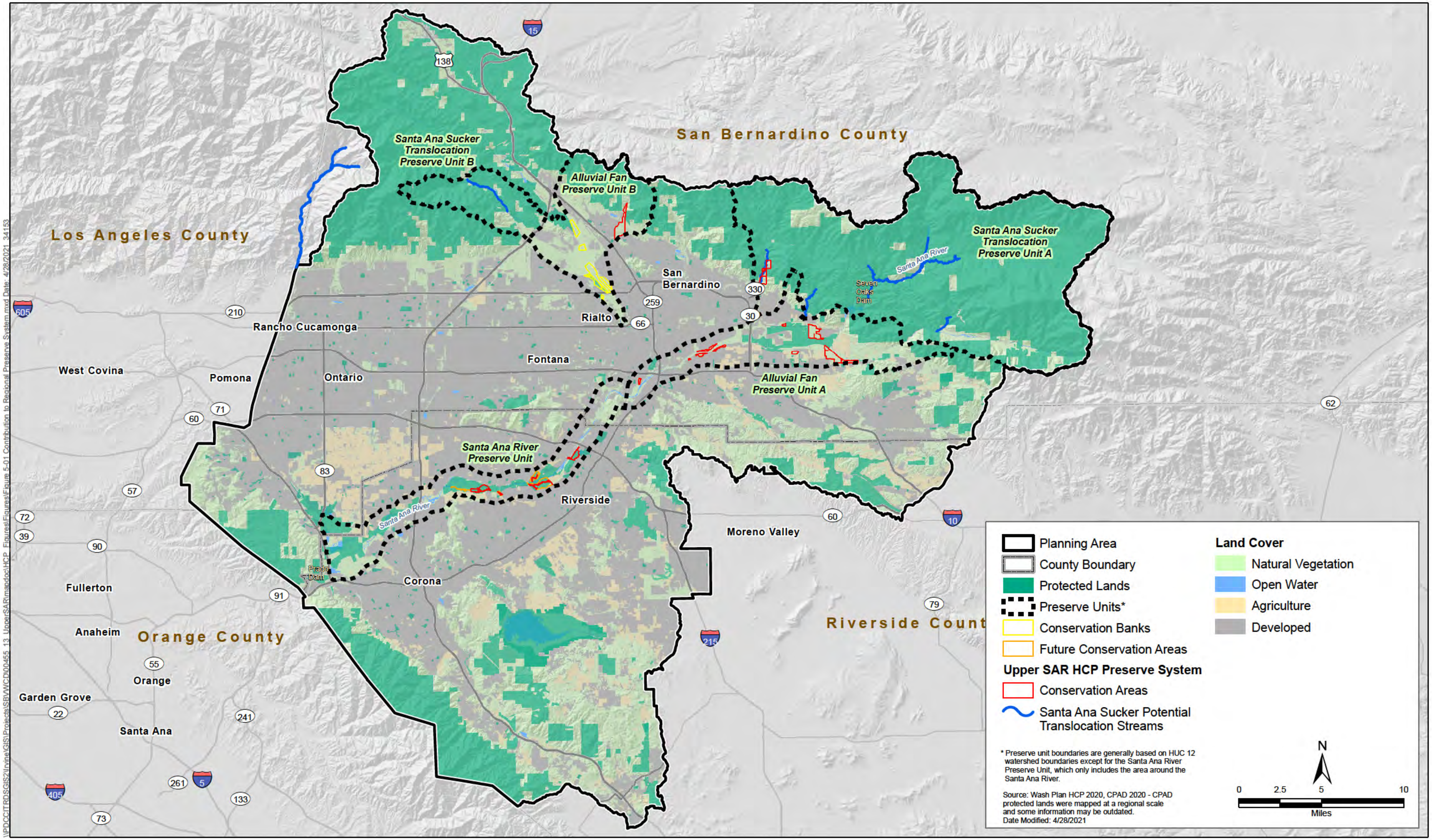
HCP implementation has been separated into phases to ensure, and to clearly describe, that the conservation actions and associated mitigation are able to occur before and stay ahead of the impacts of Covered Activities. The HCP conservation actions and mitigation as well as Covered Activity implementation are grouped into four phases: Phase 1 (years 0–5), Phase 2 (years 6–10), Phase 3 (years 11–15) and Phase 4 (years >15).

- The HCP Preserve System will include a minimum of 1,348.8[1] acres, including preservation of land via acquisitions and/or easements, and habitat restoration/rehabilitation. Table 5-1 summarizes in which phase vegetation types will be dedicated for conservation, and Table 5-2 summarizes the broad habitat categories to which these vegetation types will be improved to mitigate impacts. Approximately 80.9 acres (6%) of the HCP Preserve System will be dedicated for conservation and under active habitat management prior to HCP implementation. Approximately 825.9 acres (61%) will be dedicated in Phase 1 (years 0–5) of the permit duration and the remaining 442.1 acres (33%) will be dedicated in Phase 2 (Table 5-1 and

Table 5-2). An initial Up-Front is also included and was started prior to the completion of the HCP and permit issuance to begin implementation of the Conservation Strategy so that conservation will stay ahead of Covered Activity impacts by a minimum of 10% according to the Stay-ahead provision.

As analyzed in detail in Chapter 4, *Incidental Take Assessment and Impact Analysis*, there will be approximately 2,441.5 acres of ground-disturbing impacts from Covered Activities (Table 5-3), however 1,043.1 acres are impacts within existing groundwater recharge basins. Approximately 1,182.0 acres (535.3 acres in existing basins) will be impacted during Phase 1, 908.7 acres (504.8 acres in existing basins) during Phase 2, 198.6 acres (0 acres in existing basins) during Phase 3, and 152.2 acres (3.0 acres in existing basins) during Phase 4 of HCP implementation. Consequently, the total impact outside of existing basins is 1,398.4 acres.

[1] The preservation acreage excludes acreage associated with Covered Activities.



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Upper Santa Ana River Habitat Conservation Plan

Figure 5-1
Upper Santa Ana River HCP Preserve System

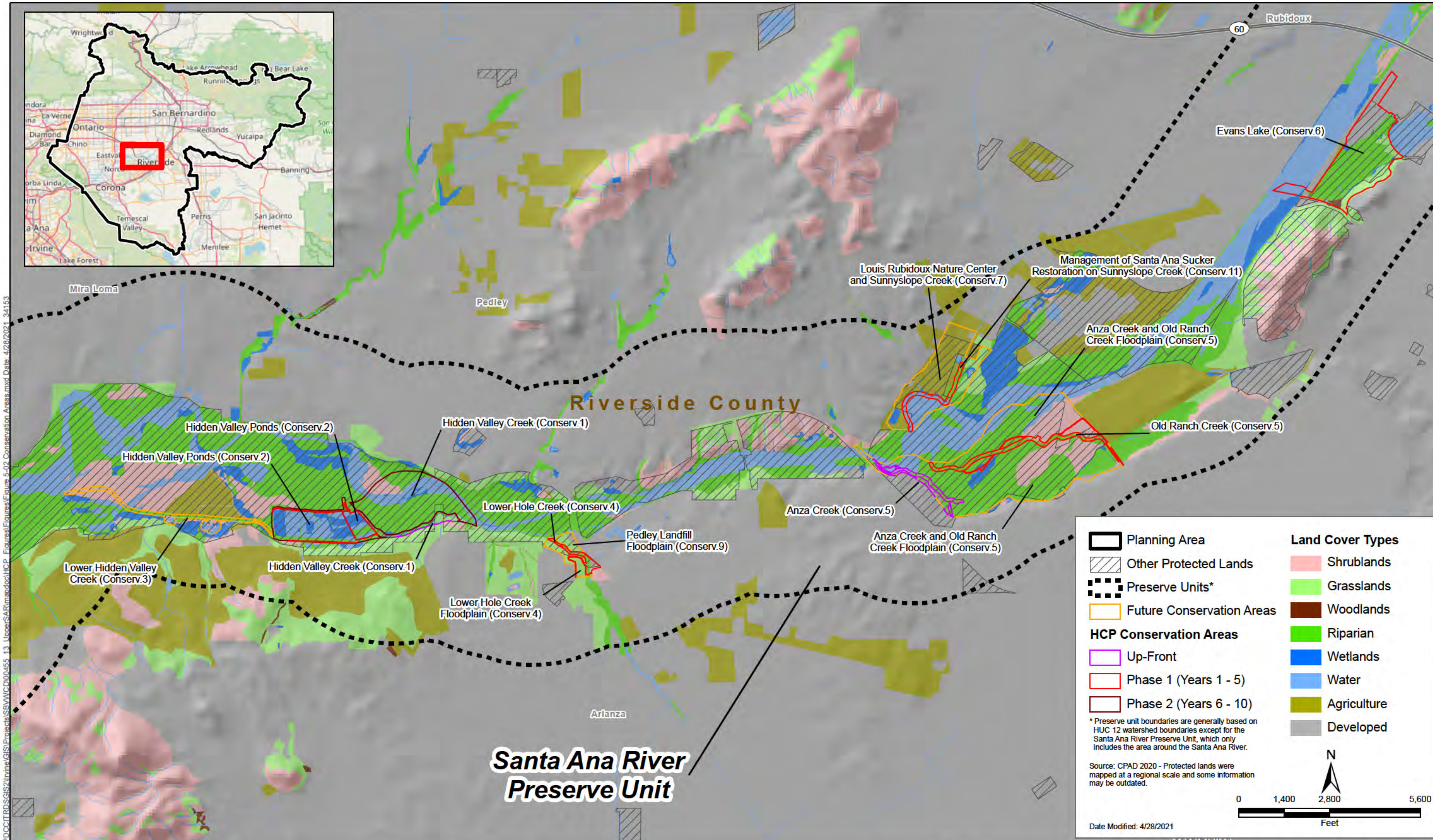
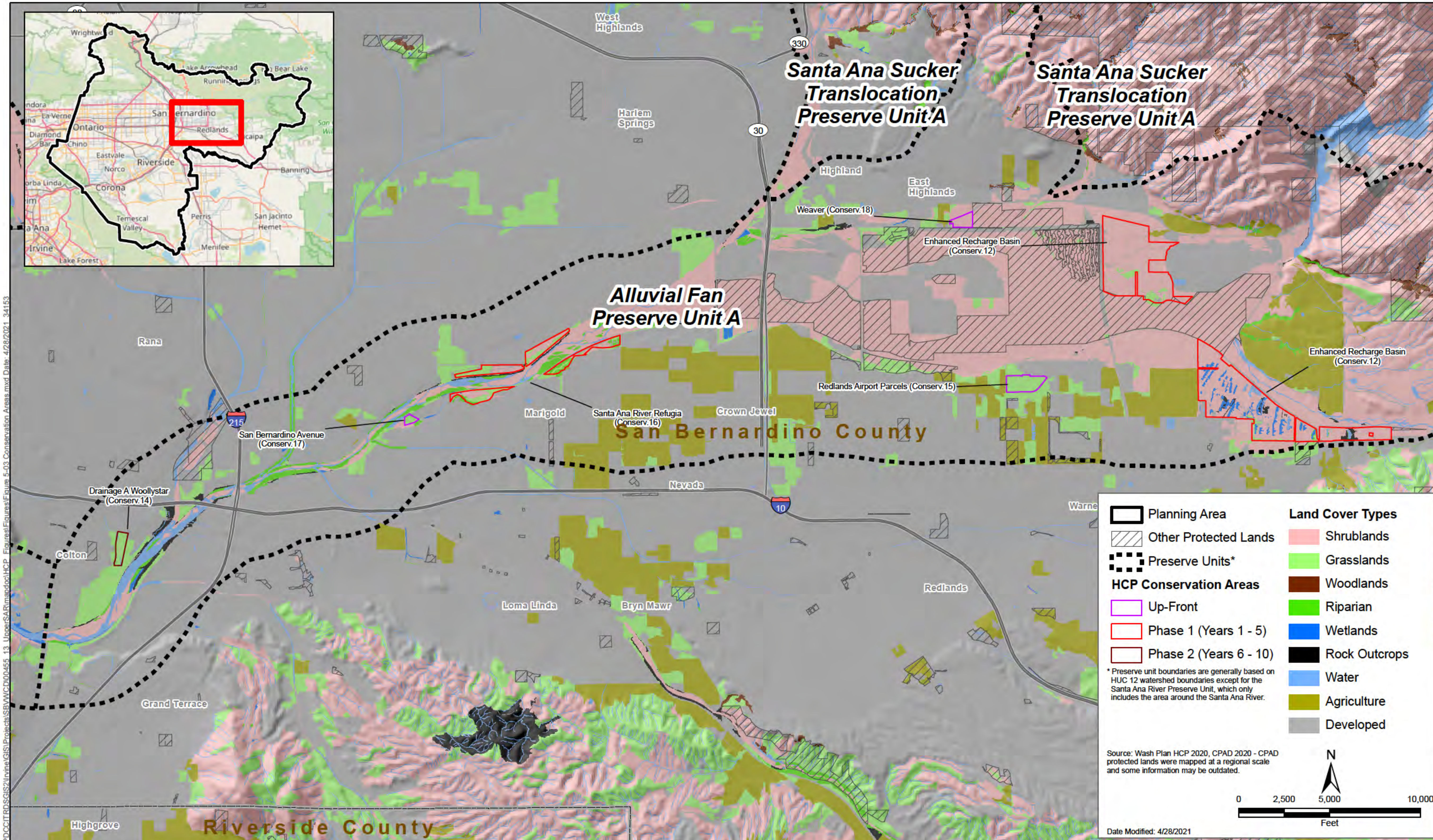
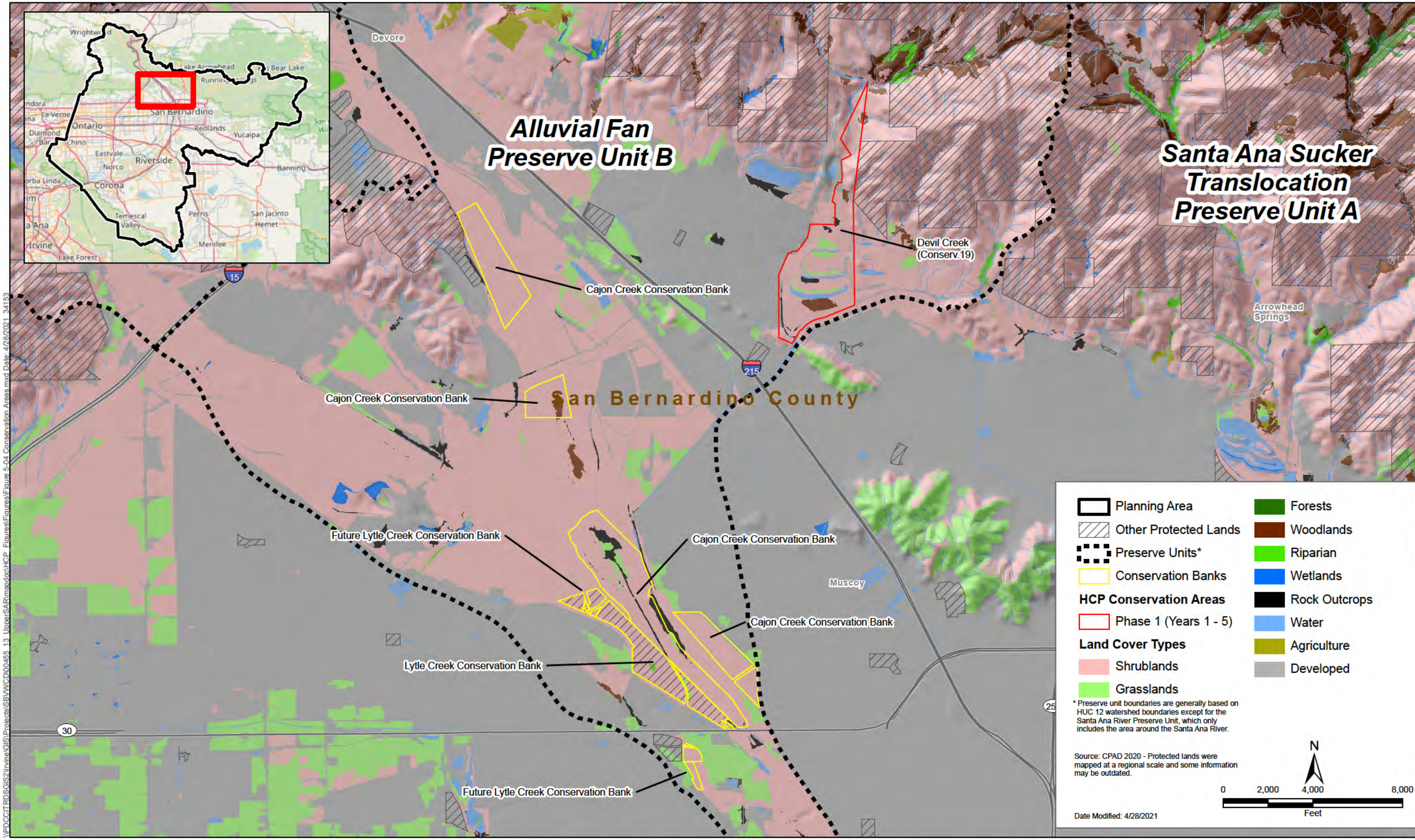


Figure 5-2
Stream and Riparian Conservation Areas (Santa Ana River Preserve Unit)



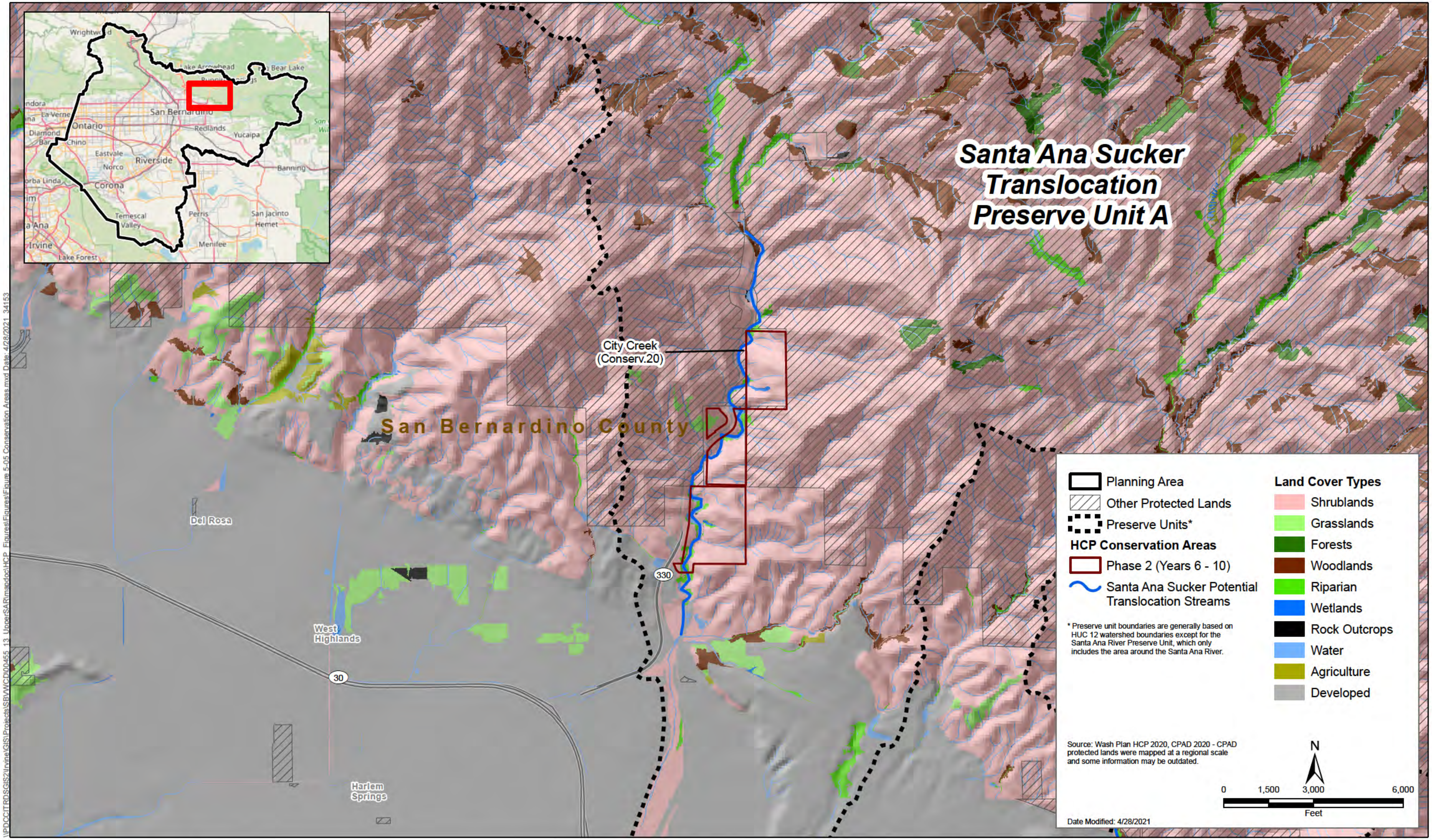
Upper Santa Ana River Habitat Conservation Plan

Figure 5-3
Alluvial Fan Conservation Areas (Alluvial Fan and Santa Ana Sucker Translocation Preserve Units)



Upper Santa Ana River Habitat Conservation Plan

Figure 5-4
Alluvial Fan and Shrublands Conservation Areas (Alluvial Fan and Santa Ana Sucker Translocation Preserve Units)



Upper Santa Ana River Habitat Conservation Plan

Figure 5-5
Santa Ana Sucker Conservation Areas (Santa Ana Sucker Translocation Preserve Units)

Table 5-1. Approximate Phasing of Conservation of Vegetation Communities in the HCP Preserve System (acres)

Conserved Vegetation Types	Up-Front[1]	Phase 1 (Years 0–5)	Phase 2 (Years 6–10)	Phase 3 (Years 11–15)	Phase 4 (Years >15)	HCP Preserve System Total
Riparian	11.1	103.4	93.8	--	--	208.3
Wetlands	1.2	12.5	25.4	--	--	39.1
Permanent Water	1.7	18.7	17.4	--	--	37.8
Water in Existing Basins	--	--	--	--	--	--
Alluvial Fan Sage Scrub	16.8	487.1	5.5	--	--	509.4
Dry Channel/Shrubland	0.1	7.5	43.8	--	--	51.4
Other Shrublands	0.8	81.3	232.1	--	--	314.3
Woodlands		21.0	--	--	--	21.0
Grasslands	49.2	79.5	23.9	--	--	152.5
Rock Outcrops	--	15.0	0.2	--	--	15.2
Total by Phase	**80.9**	**825.9**	**442.1**	**--**	**--**	**1,348.8**

[1] The Up-Front provision will ensure that progress towards assembly and management of the HCP Preserve System has been initiated prior to HCP implementation (i.e., prior to initiation of any Covered Activities).

Table 5-2. Approximate Phasing of Conservation Projects in the HCP Preserve System

Conserved Habitats	Up-Front	Phase 1 (Years 0–5)	Phase 2 (Years 6–10)	Phase 3 (Years 11–15)	Phase 4 (Years >15)	Conservation Total
Tributary Stream Channel[1] (stream miles/acres)		1.5/1.7	2.4/1.9	--	--	3.9/3.6
Santa Ana River Microhabitat (acres)		1.5	--	--	--	1.5
Riparian[2] (acres)	11.1	103.4	93.8	--	--	208.3
Wetland[3] (acres)	1.2	12.5	25.4	--	--	39.1
Alluvial Fan Sage Scrub[4] (acres)	16.8	436.9	5.5	--	--	459.2
Total by Phase (stream miles)		*1.5*	*2.4*	--	--	*3.9*
Total by Phase (acres)	**29.1**	**556.0**	**126.6**	**--**	**--**	**711.7**
Additional Area[5]	51.8	269.9	315.5	--	--	637.2
Grand Total	**80.9**	**825.9**	**442.1**	**--**	**--**	**1,348.8**

[1] Tributary stream channel restoration at Hidden Valley Creek, Anza Creek, Old Ranch Creek, Lower Hole Creek, Evans Lake Creek and installation of Santa Ana River Microhabitat Structures.
[2] Floodplain restoration/rehabilitation at Hidden Valley Creek and Ponds, Evans Lake Creek, Sunnyslope Creek.
[3] At Hidden Valley Creek and Ponds.
[4] Alluvial fan sage scrub restoration within Alluvial Fan Preserve Units A and B.
[5] Additional area within Conservation Areas that have/will be assessed to determine habitat improvement potential.

Table 5-3. Approximate Phasing of Covered Activities and Associated Impacts in the Permit Area[1,2]

Vegetation Types	Phase 1 (Years 0–5)	Phase 2 (Years 6–10)	Phase 3 (Years 11–15)	Phase 4 (Years >15)	Total Impacts
Riparian	55.9 (3.6)	22.7	11.8	0.6	91.0 (3.6)
Wetlands	44.2 (28.0)	45.7 (43.7)	2.9	--	92.8 (71.7)
Permanent Water	47.5 (22.6)	28.2	--	0.3	76.1 (27.2)
Water in Existing Basins	335.5 (335.4)	280.3 (280.3)	--	2.9 (2.7)	618.7 (618.4)
Alluvial Fan Sage Scrub	145.7 (62.8)	164.4 (133.4)	110.9	102.3	523.2 (196.2)
Dry Channel/Shrubland	76.2 (22.8)	19.2	5.7	1.4	102.5 (22.8)
Other Shrublands	139.4 (17.7)	96.0 (23.0)	61.1	33.7 (0.3)	330.4 (40.9)
Woodlands	5.6 (2.3)	1.7	--	--	7.3 (2.3)
Grasslands	210.9 (23.1)	127.1 (15.8)	4.9	10.7	353.6 (38.9)
Rock Outcrops	7.2 (3.1)	13.1 (4.0)	0.6	0.2	21.1 (7.1)
Agriculture	113.9 (14.0)	110.3	0.6	--	224.7
Total by Phase	**1,182.0 (535.3)**	**908.7 (504.8)**	**198.6**	**152.2 (3.0)**	**2,441.5 (1,043.1)**

[1] Acres of ground disturbance.
[2] Impact acreages in parentheses are to existing water recharge/flood control basins subject to regular operations and maintenance activities.

Up-Front and Stay-Ahead Provisions

The HCP's Up-Front and Stay-Ahead Provisions require that implementation of the Conservation Strategy and progress towards assembly and management of the HCP Preserve System will stay ahead of Covered Activity impacts by a minimum of 10%. The Alliance will ensure that HCP implementation complies with the Up-Front and Stay-Ahead Provisions by monitoring and tracking the establishment and management of the HCP Preserve System along with tracking of Covered Activity impacts. To ensure that mitigation is "In-Step" (Rough-Step) and ahead of impacts (i.e., similar or superior Covered Species habitat is being acquired, restored and/or rehabilitated, and managed, compared to habitat impacted by Covered Activities), the Up-Front and Stay-Ahead Provisions will track mitigation and impacts by vegetation communities (as identified in Table 5-1 and Table 5-3) and by modeled species habitat (as identified in Tables 5-7 through 5-30). Further, for San Bernardino kangaroo rat (SBKR) and Santa Ana River woolly-star, mitigation and impacts will be tracked by Alluvial Fan Preserve Unit (i.e., Unit A or B), to ensure that mitigation is being acquired, restored and/or rehabilitated, and managed within the same Alluvial Fan Preserve Unit as Covered Activity impacts. In addition to land acquisition (via fee title or easements), restoration and/or rehabilitation, and management, the Up-Front and Stay-Ahead Provisions, can be achieved by the purchase of credits from a U.S. Fish and Wildlife Service (USFWS)-approved conservation or mitigation bank operating within the same Preserve Unit as Covered Activity impacts, where credits are available for the Covered Species being impacted.

Compliance with and status of the Up-Front and Stay-Ahead Provisions will be implemented through the consistency review process for Covered Activities (see the *Project Consistency Review* in Section 6.5.2, *Implementing Entity Responsibilities*) and via the submission of annual reports. Further, an HCP Implementation Compliance and Concurrence Procedure (ICCP; see *Implementation Compliance* *and Concurrence Procedure* in Section 6.5.2) will be instituted between the Alliance and USFWS for each phase of HCP implementation. The ICCP will require the Alliance to quantify and demonstrate that the Conservation Strategy, and progress towards assembly and management of the HCP Preserve System, is ahead of Covered Activity impacts by a minimum of 10% and that mitigation is In-Step with impacts. The ICCP will involve the Alliance preparing, for submission to the USFWS, a 5-year compliance report that quantifies Covered Activity impacts and progress towards assembly and management of the HCP Preserve System. The compliance report will also quantify and demonstrate that progress towards assembly and management of the HCP Preserve System is a minimum of 10% ahead of Covered Activity impacts proposed to occur within the next phase of HCP implementation. The ICCP will include a USFWS-Alliance meet-and-confer process whereby potential compliance issues can be discussed and addressed. A parallel process will also be implemented between the Alliance and CDFW for those species that are listed under the California Endangered Species Act (CESA).

Up-Front

The Up-Front provision will ensure that progress towards assembly and management of the HCP Preserve System has been initiated prior to HCP implementation (i.e., prior to initiation of any Covered Activities). A minimum of 80.9 acres will be acquired and under active management before the first Covered Activity can occur (Table 5-4, and Tables 5-7 through 5-30).

Stay-Ahead

Under the Stay-Ahead Provision, the Alliance will ensure that progress towards assembly and management of the HCP Preserve System is well ahead of Covered Activity impacts. An accounting of impacts and conservation measures (protected lands and additional non-protected lands conservation measures) will be conducted to provide evidence that the HCP Preserve System has provided adequate offset for each Covered Species and within each HCP Preserve Unit prior to the allowance of implementation of the next phase of HCP Covered Activities.

Phase 1 of HCP implementation is proposed to be well ahead of the 10% Stay-Ahead Provision (67% of conservation achieved vs. 48% of impacts occurring); however, if at any time the conservation is less than 10% ahead of impacts by HCP implementation phase, Covered Activities within the next HCP implementation phase cannot proceed until the conservation is brought into alignment (>10%) with the provision. Figures 5-6 through 5-10 depict the Covered Activities associated with each phase of the HCP, including the Up-Front provision, alongside the conservation areas to be established in the HCP Preserve System in each phase of HCP implementation.

Table 5-4. Up-Front and Stay- Ahead Provision Tracking by HCP Phase

		Implementation Period (years)				
	Up-Front	Phase 1 (0–5)	Phase 2 (6–10)	Phase 3 (11–15)	Phase 4 (>15)	Total
Conservation HCP Preserve System	6%	61%	33%	--	--	100%
Covered Activity Impacts		46%	35%	10%	9%	100%

[1] Tracking is based on the acreage of conservation lands already acquired by the HCP, or owned by HCP Permittees with high potential for incorporation into the HCP Preserve System. Additional lands will be acquired for incorporation into the HCP Preserve System as they become available.

5.4.2 Mitigation Reserve Program (Mitigation Accounting)

The Alliance will establish a Mitigation Reserve Program to account for and track the development of conservation values (e.g., species, waters, or habitat values) as well as account for the use of these values to offset future permit requirements for HCP Covered Activities. The purpose of the Mitigation Reserve Program is to establish a common understanding and legal framework for the conservation values created by HCP conservation actions, and to establish a transparent mechanism for tracking those values (creation and use) over time. In this way the Mitigation Reserve Program will be used to inform and track regulatory compliance of the HCP Covered Activities, including species and aquatic resource mitigation.

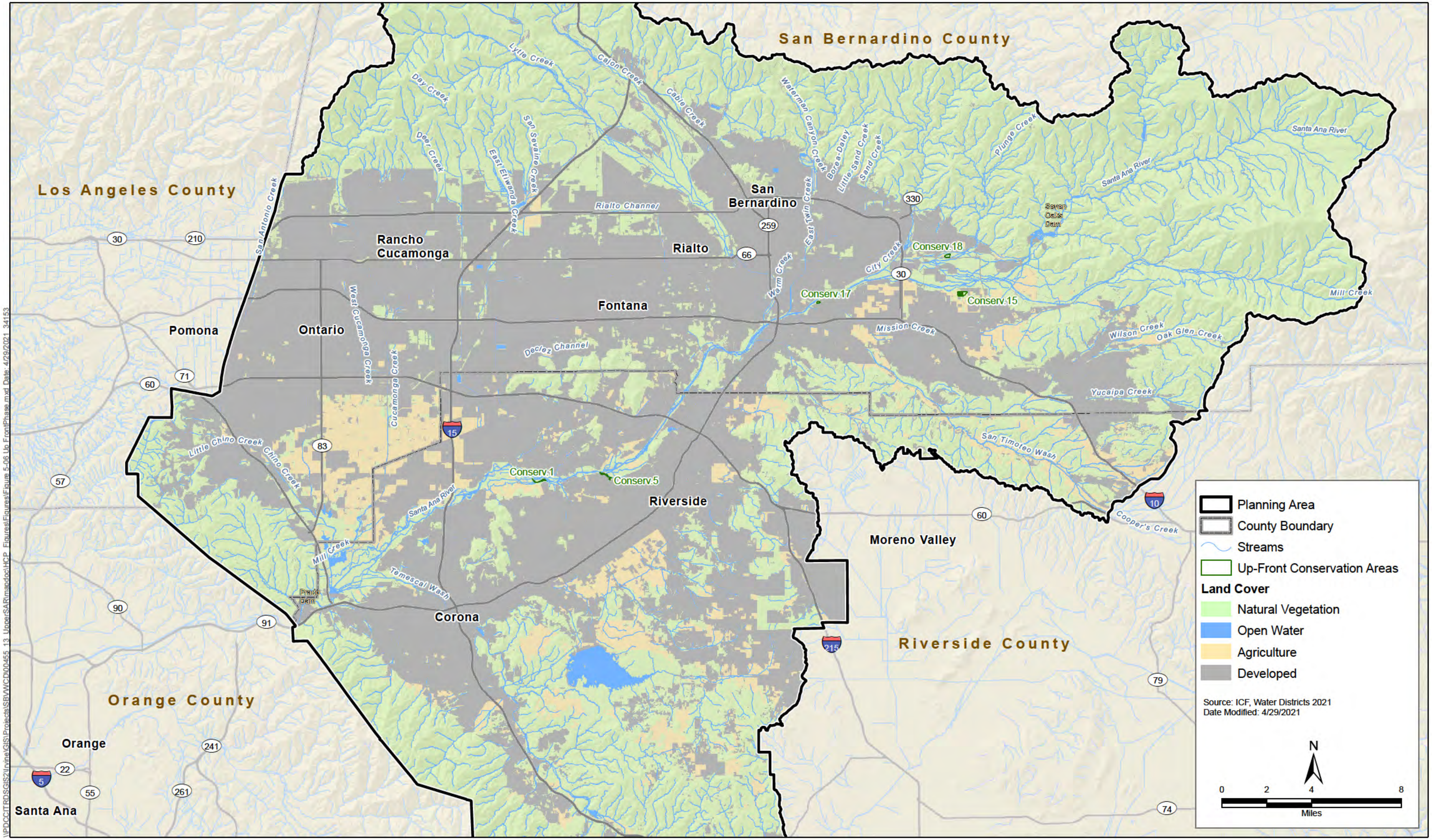
The Mitigation Reserve Program will include a spatial (geographic information system [GIS]) accounting database to establish and track all conservation value generation (e.g., through acquisitions, conservation easements, and restoration) and maintain records on the management of those resource values over time for the purposes of reporting, as required by the regulatory agencies. The GIS tracking component will provide an efficient mechanism to view and account for "stacked" conservation values for species habitat and aquatic resources in the HCP Preserve System. Stacked values occur where conservation for multiple resource types and regulations overlap such as when species values and aquatic resource values exist in the same Conservation Area. The program will provide a spatial and tabular accounting of all conservation values as they are established (i.e., reserved in advance of any specific project's impact) and used (i.e., dedicated to offset a specific project's impacts) in the Mitigation Reserve Program by the Alliance. Once created, stacked values cannot be unstacked; one value unit, or portion thereof, may only be used to provide mitigation for one project. As Covered Activities are implemented under the HCP the impacts on species and aquatic resources will be monitored, tracked, and debited from the Mitigation Reserve Program for an efficient and transparent process for using conservation values. The establishment of conservation values and the use of those values will be summarized in annual reports to the regulatory agencies.

Because much of the Santa Ana River Preserve Unit habitat restoration projects will be conducted in advance of Covered Activities, the HCP is proposing to establish a process whereby the value of these projects is formally recognized and tracked for future Covered Activity impacts. The exact process has not yet been formalized, but development of formal mitigation banks/conservation banks, in-lieu fee programs, or alternate mechanisms are being explored. The conservation values established through this process will be simultaneously established and tracked in parallel in the Mitigation Reserve Program. Similarly, when conservation values in a bank/in-lieu fee program are used, they will be simultaneously debited from the Mitigation Reserve Program.

The Mitigation Reserve Program will include development of legal agreements, where relevant, that will formalize the conservation values created by establishment of conservation areas within the HCP Preserve System as recognized by the environmental regulatory agencies (U.S. Army Corps of Engineers [USACE], CDFW, Regional Water Quality Control Board [RWQCB], and USFWS).

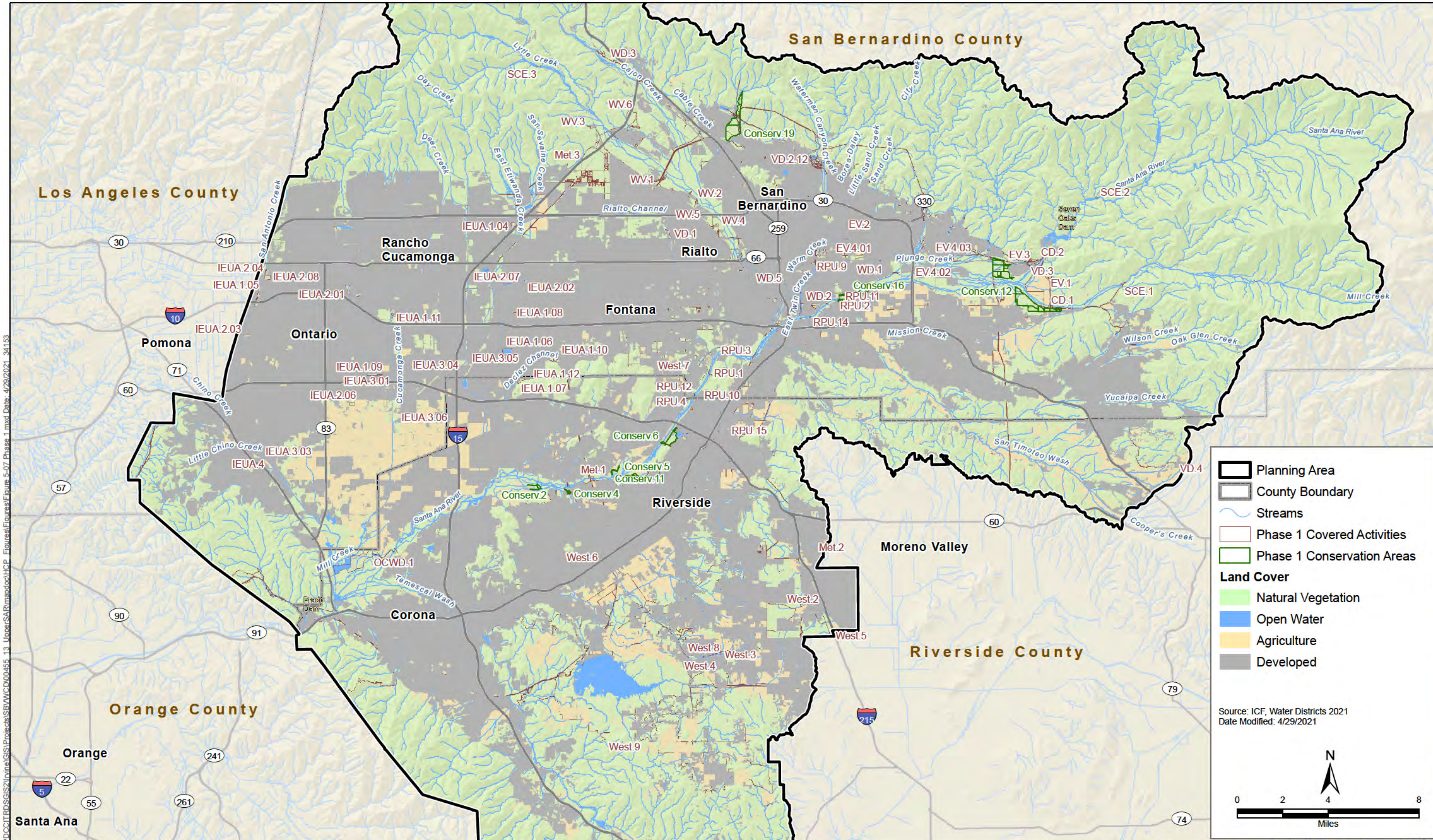
5.4.3 Conservation Areas

Conservation Areas have been identified in four of the five HCP Preserve Units: Santa Ana River Preserve Unit, Alluvial Fan Preserve Unit A, Alluvial Fan Preserve Unit B, and Santa Ana Sucker Translocation Preserve Unit A. Though Conservation Areas have not yet been identified in Santa Ana



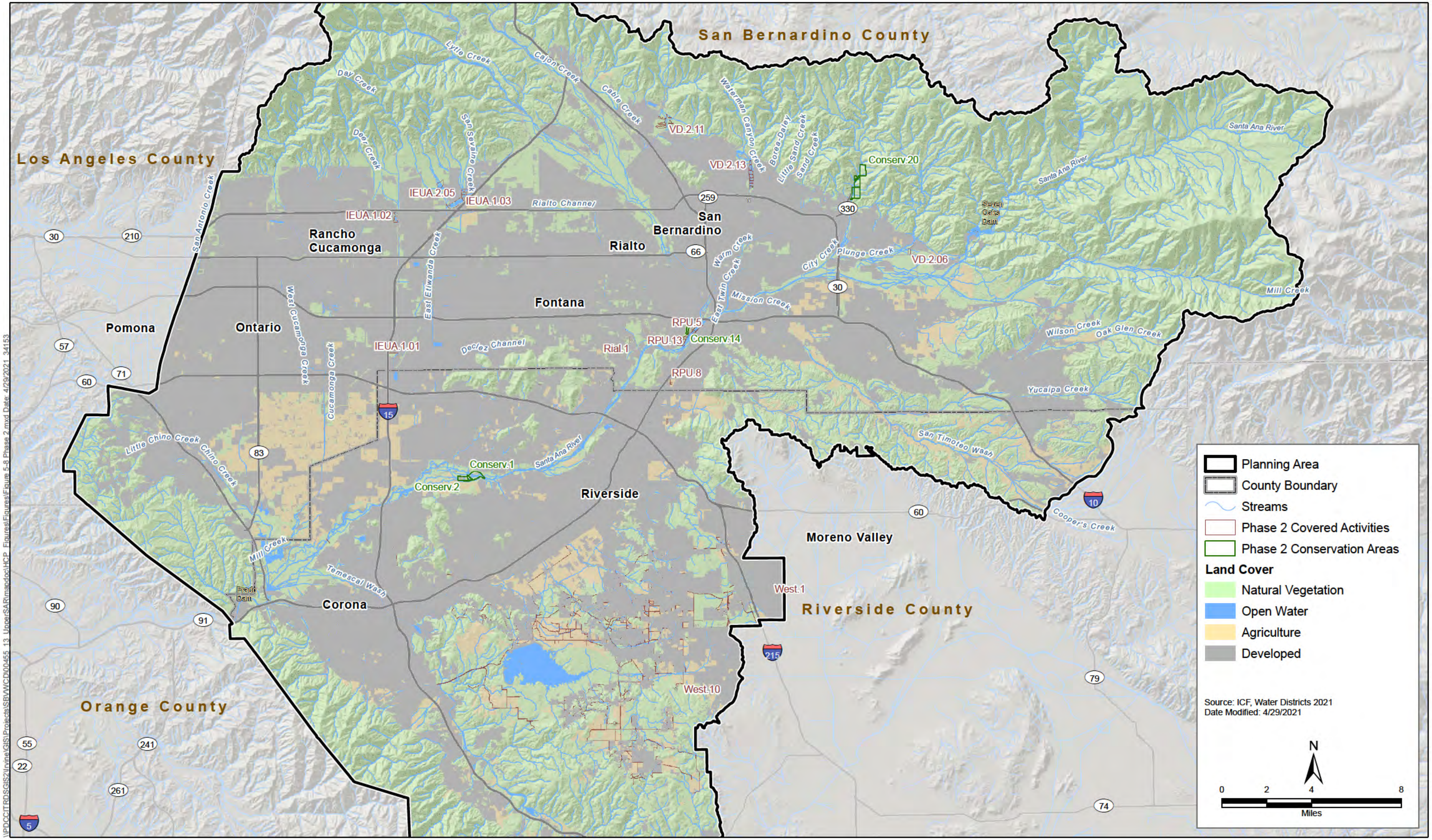
Upper Santa Ana River
Habitat Conservation Plan

Figure 5-6
Up-Front: Conservation Areas



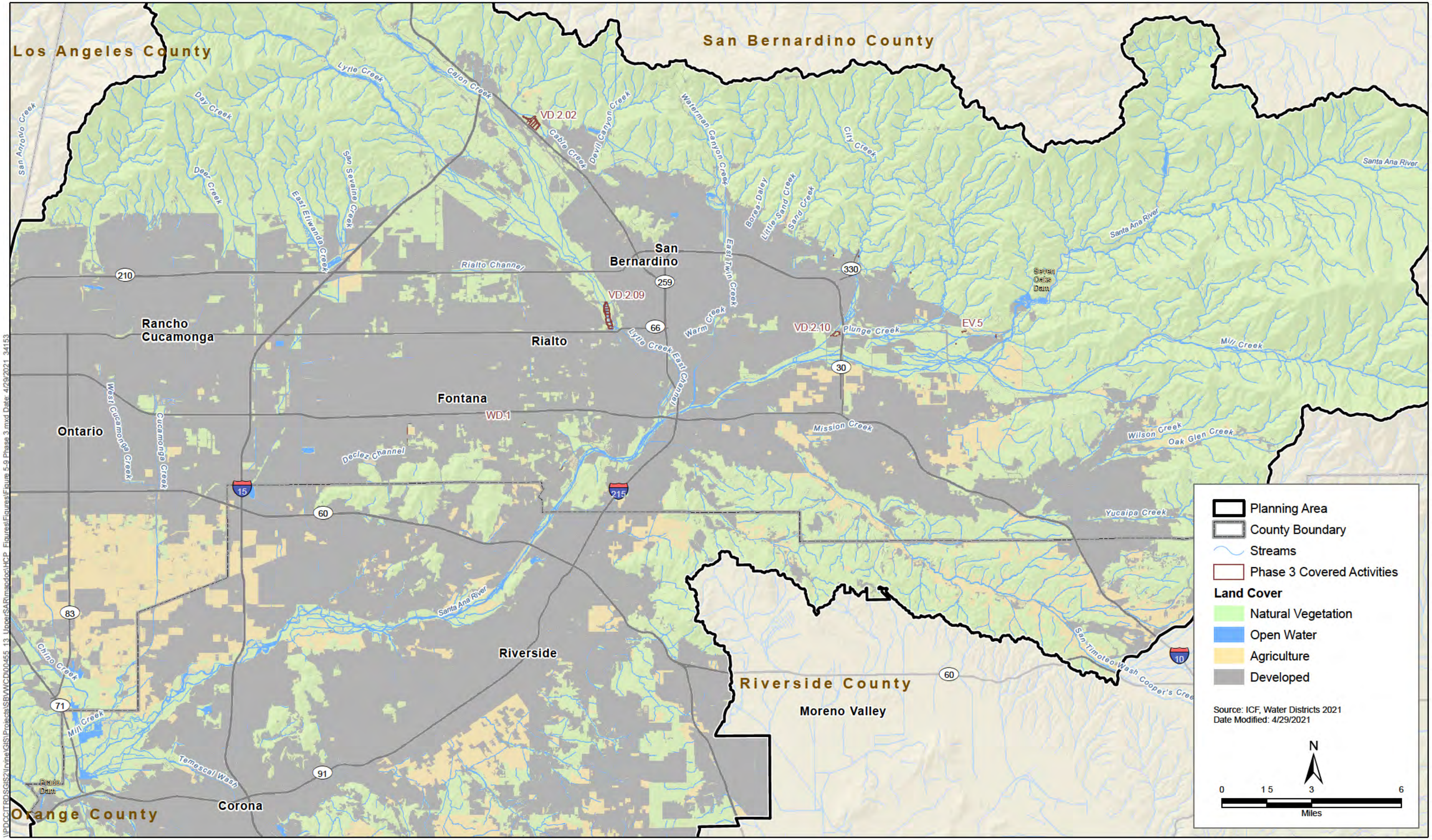
Upper Santa Ana River Habitat Conservation Plan

Figure 5-7
Phase 1: Covered Activities and HCP Preserve System



Upper Santa Ana River Habitat Conservation Plan

Figure 5-8
Phase 2: Covered Activities and HCP Preserve System



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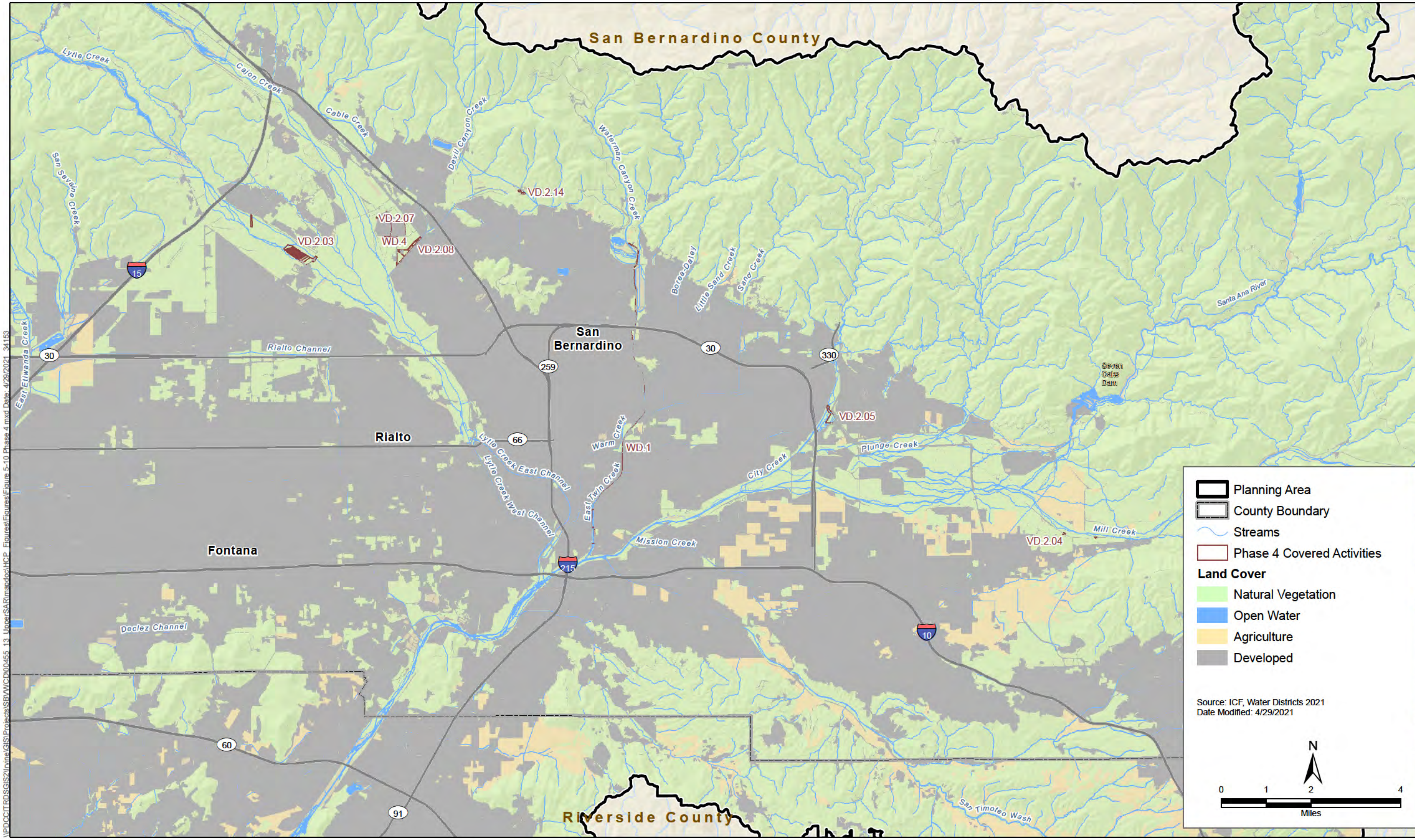
Upper Santa Ana River Habitat Conservation Plan

Figure 5-9
Phase 3: Covered Activities



Upper Santa Ana River Habitat Conservation Plan

Figure 5-10
Phase 4: Covered Activities

Sucker Translocation Preserve Unit B, acquisition opportunities continue to be actively pursued in all Preserve Units.

There are 16 Conservation Areas currently proposed within the HCP Preserve System (see Figures 5-2 to 5-5 and Table 5-5). These areas were identified because they have suitable habitat or could be restored and/or enhanced to support habitat for Covered Species. Some locations also support presumed extant occurrences of Covered Species. Additionally, these areas were selected because they were adjacent to, or in proximity to, other protected areas of habitat in the network of protected lands in the Upper Santa Ana River. Therefore, they have high potential for sustaining Covered Species on habitat to be conserved and managed under the HCP. Additional Conservation Areas are also proposed for inclusion in the HCP Preserve System; areas will be actively pursued into the future, to ensure the HCP achieves its biological goals and objectives, and remains in compliance with the Up-Front and Stay-Ahead Provisions.

Throughout the HCP the acreages of habitat contained in the Preserve System are quantified by natural vegetation community type (as in Section 5.4) and by acres of suitable habitat based on species habitat suitability models (see individual species tables in Section 5.9). However, the acres of potential restoration and/or rehabilitation described in this section are based on early designs for many of the sites, and/or based on the judgement of habitat restoration experts with respect to the restoration potential of each site. These acres represent the potential amount of suitable habitat that could be restored and/or rehabilitated on each site, and will serve as a general restoration target for each site.

Implementation of each restoration and/or rehabilitation project may result in greater or lesser acreages of individual species habitat depending on the final restoration site design and restoration site performance during the Habitat Management and Monitoring Plan (HMMP) phase of restoration (typically the first 5 years). Once the performance standards have been met for each site, the restoration/rehabilitation project will continue to be managed within the HCP Preserve System under the CAMMP. The amount of suitable habitat achieved through restoration/rehabilitation is expected to change over time due to the dynamic nature of the ecological processes of the Upper Santa Ana River and alluvial flood plain. Future restoration/rehabilitation projects will continue to be developed and implemented over time to ensure that the HCP is able to achieve and maintain its biological goals and objectives, including the Up-Front and Stay-Ahead Provisions, and maintain compliance with the HCP incidental take permits (ITPs).

The restoration/rehabilitation projects are also considered Covered Activities; therefore, they are described in more detail in Chapter 2, Section 2.1.7, *Habitat Improvement, Management, and Monitoring*. The projects are divided into the HCP Preserve Unit within which they are located, as detailed below. For the purposes of this HCP, habitat improvement may include two categories: rehabilitation and/or restoration. Rehabilitation includes activities that improve habitat conditions of a degraded site, for example through nonnative plant management. Restoration includes more intensive activities, such as site manipulation, with the goal of rebuilding/expanding habitat and re-instating ecological processes and services, where possible.

The Santa Ana River Preserve Unit includes multiple tributary stream restoration/rehabilitation projects that will be constructed predominantly prior to HCP finalization and during Phase 1 at the following tributary restoration project locations: Anza Creek and Old Ranch Creek, Lower Hole Creek, Hidden Valley Creek, Hidden Valley Ponds, Evans Lake Drain, and Sunnyslope Creek (Figure 5-2). The focus of these projects is to restore tributary streams and the adjacent riparian and/or upland buffer habitats to create and/or rehabilitate existing habitat for Santa Ana sucker and/or other aquatic and riparian Covered Species.

In addition to restoration of the tributaries and their adjacent riparian buffers the HCP Conservation Strategy also includes restoration/rehabilitation of the adjacent and associated riparian floodplain habitats. Restoration/rehabilitation of these areas are proposed to occur predominantly during Phase 2 of HCP implementation and include Hidden Valley Creek and Hidden Valley Ponds. These projects would restore/rehabilitate the broader riparian floodplain beyond the riparian buffer associated with the tributary restoration projects discussed above (also Figure 5-2).

Restoration/rehabilitation projects within Alluvial Fan Preserve Unit A will focus on the improvement of habitat for alluvial scrub species, including SBKR and the Santa Ana River woolly-star. Restoration and/or rehabilitation of the Redlands Airport, San Bernardino Avenue, and Weaver sites will commence prior to HCP finalization. The Enhanced Recharge Basins and Santa Ana Refugia sites will commence in Phase 1. The Drainage A Woolly-Star site (or alternate location of similar acreage and restoration potential) is dependent on successful acquisition (via fee title/conservation easement recordation) and is consequently planned for Phase 2 of HCP implementation (Figure 5-3).

Restoration/rehabilitation projects within Alluvial Fan Preserve Unit B will also focus on the improvement of habitat for alluvial scrub species. One project has been identified to date within this Preserve Unit, but other locations are being actively pursued. Habitat improvement of the Devil Creek site will occur during Phase 1 of HCP implementation (Figure 5-4). Though the site does not currently support SBKR, it does support western spadefoot toad (Baumberger et al. 2020) and may also support Los Angeles pocket mouse, coastal California gnatcatcher, and cactus wren. Conservation activities will include the rehabilitation of alluvial fan scrub habitat and adjacent habitat for the benefit of Covered Species.

Habitat improvement activities within Santa Ana Sucker Translocation Units A and B will focus on aquatic and riparian Covered Species. The City Creek site, within Translocation Unit A, has been identified to occur in Phase 2 of HCP implementation (Figure 5-5). The parcels along City Creek have recently been invaded by human encampments. Habitat improvement actions within the lower foothill portion of the creek will provide species benefits and reduce the propensity of wildfire ignitions. Aquatic habitat management will also occur at each Santa Ana sucker translocation stream prior to, and at a minimum throughout the life of the HCP.

Approximately 81 acres of habitat in the conservation areas have already been acquired, or will be acquired, with habitat restoration and/or rehabilitation actively underway prior to HCP finalization. An additional approximate 826 acres will be acquired during Phase 1 of the HCP. Another 442 acres are identified for Phase 2. Because the acquisition and/or establishment of easements is dependent on willing sellers it is possible that not all 16 Conservation Areas will become a part of the HCP Preserve System. Similarly, other potential Conservation Areas with suitable habitat (or with the potential to support suitable habitat via restoration/rehabilitation) for Covered Species may become available in the future and could be added to the HCP Preserve System. Any Conservation Areas currently identified for acquisition or identified in the future will require Wildlife Agencies' concurrence before becoming part of the HCP Preserve System and the conservation value(s) assigned to the HCP. All areas that become a part of the HCP Preserve System will be monitored and adaptively managed according to the CAMMP of the HCP.

Table 5-5. Acres of Habitat by Phase and Preserve Unit in HCP Conservation Areas

HCP Conservation Areas by Phase	Preserve Unit	Riparian	Wetlands	Permanent Water (miles/ acres)	Dry Channel/ Shrubland	Shrublands (Alluvial Fan Sage Scrub)	Grasslands	Woodlands	Rock Outcrops	Total Natural Habitats
Up-Front (Pre-Phase 1)										
Hidden Valley Creek	SARPU	5.2	1.2	0.8/0.2	0.1	0.1 (0)	3.9	0	0	10.8
Anza Creek	SARPU	5.8	0	0.7/1.5	0	0 (0)	0	0	0	7.4
Redlands Airport Parcels	AFPU A	0	0	0	0	0 (0)	39.6	0	0	39.6
San Bernardino Avenue	AFPU A	0	0	0	0	0.7 (0)	5.4	0	0	6.1
Weaver	AFPU A	0	0	0		16.8 (16.8)	0.2	0	0	17.0
Up-Front Totals		*11.1*	*1.2*	*1.5/1.7*	*0.1*	*17.6 (16.8)*	*49.2*	*0*	*0*	*80.9*
Santa Ana River Preserve Unit:		*11.1*	*1.2*	*1.5/1.7*	*0.1*	*0.1 (0)*	*3.9*	*0*	*0*	*18.2*
Alluvial Fan Preserve Unit A:		*0*	*0*	*0*	*0.1*	*17.5 (16.8)*	*45.2*	*0*	*0*	*62.7*
Phase 1										
Lower Hole Creek	SARPU	3.8	0.2	0	0	0.7 (0)	0.7	0	0	5.5
Evans Lake	SARPU	60.1	2.9	0.6/3.6	1.3	0 (0)	18.4	1.9	0	88.3
Management of SAS on Sunnyslope Creek	SARPU	3.0	0.7	3.6	2.4	0 (0)	0	0	0	9.7
Hidden Valley Ponds	SARPU	4.6	4.4	1.1	3.2	0 (0)	0	0	0	13.3
Old Ranch Creek	SARPU	15.4	1.0			1.7 (0)	0	0	0	18.3
Santa Ana River Mainstem	SARPU	0	0	0/0	0.2					

HCP Conservation Areas by Phase	Preserve Unit	Riparian	Wetlands	Permanent Water (miles/ acres)	Dry Channel/ Shrubland	Shrublands (Alluvial Fan Sage Scrub)	Grasslands	Woodlands	Rock Outcrops	Total Natural Habitats
Microhabitat Enhancement[1]										
Enhanced Recharge Basin	AFPU A	0.5	3.3	0.5	0	261.1 (261.1)	13.5	0	4.8	283.7[2]
Santa Ana River Refugia	AFPU A	15.9	0.1	0	0	35.5 (7.4)	36.2	0	0.1	87.7
Devil Creek	AFPU B	0	0	9.9	0.4	269.5 (218.6)	10.7	19.0	10.1	319.5
Phase 1 Totals		*103.4*	*12.5*	*0.6/18.7*	*7.5*	*568.4 (487.1)*	*79.5*	*21.0*	*15.0*	*825.9*
Santa Ana River Preserve Unit:		*87.0*	*9.1*	*0.6/8.3*	*7.2*	*2.4 (0)*	*19.1*	*1.9*	*0*	*135.0*
Alluvial Fan Preserve Unit A:		*16.4*	*3.3*	*0.5*	*0*	*296.5 (268.5)*	*49.7*	*0*	*4.9*	*371.4*
Alluvial Fan Preserve Unit B:		*0*	*0*	*9.9*	*0.4*	*269.5 (218.6)*	*10.7*	*19.0*	*10.1*	*319.5*
Phase 2										
Hidden Valley Creek	SARPU	68.7	3.5	13.0	8.2	7.4 (0)	0.9	0	0	101.6
Hidden Valley Ponds	SARPU	14.2	18.5	0.7	22.0	0 (0)	0	0	0	55.5
Drainage A Woolly-Star	AFPU A	0	0	0	0.3	0.4 (0.4)	20.3	0	0	21.0
City Creek	SASPU A	10.9	3.4	3.7	13.3	229.8 (5.1)	2.7	0	0.2	264.0
Phase 2 Totals:		*93.8*	*25.4*	*17.4*	*43.8*	*237.6 (5.5)*	*23.9*	*0*	*0.2*	*442.1*
Santa Ana River Preserve Unit:		*82.9*	*22.0*	*13.7*	*30.2*	*7.4 (0)*	*0.9*	*0*	*0*	*157.1*
Alluvial Fan Preserve Unit A:		*0*	*0*	*0*	*0.3*	*0.4 (0.4)*	*20.3*	*0*	*0*	*21.0*
Santa Ana Sucker Translocation Preserve Unit A:		*10.9*	*3.4*	*3.7*	*13.3*	*229.8 (5.1)*	*2.7*	*0*	*0.2*	*264.0*

HCP Conservation Areas by Phase	Preserve Unit	Riparian	Wetlands	Permanent Water (miles/ acres)	Dry Channel/ Shrubland	Shrublands (Alluvial Fan Sage Scrub)	Grasslands	Woodlands	Rock Outcrops	Total Natural Habitats
Phase 3										
None		--	--	--	--	--	--	--	--	--
Phase 4										
None		--	--	--	--	--	--	--	--	--
All Phases Total		**208.3**	**39.0**	**37.8**	**51.4**	**823.7 (509.4)**	**152.5**	**21.0**	**15.2**	**1,348.8**

[1] Microhabitat enhancement is proposed within the Santa Ana River mainstem for the benefit of native fish species, particularly Santa Ana sucker. The Santa Ana River is not a Conservation Area, but because microhabitat enhancement is proposed within a section of the river that occurs within the Santa Ana River Preserve Unit, the acreage of this effort is presented in this table.
[2] The conserved acres for Enhanced Recharge Basin totals 295 acres. The difference of 11.3 acres is a result of the scale of the landcover GIS and the classification of this acreage as non-natural habitat.
Note: All acres presented will be subject to habitat improvement activities.
Due to rounding, totals may not exactly match the sum of the numbers presented.
SARPU = Santa Ana River Preserve Unit; AFPU A = Alluvial Fan Preserve Unit A; AFPU B = Alluvial Fan Preserve Unit B; SASPU A = Santa Ana Sucker Translocation Preserve Unit A; SASPU B = Santa Ana Sucker Translocation Preserve Unit.

Santa Ana River Preserve Unit: Tributary Stream Restoration/Rehabilitation Project Locations

The proposed tributary stream restoration/rehabilitation projects are designed to increase the amount and quality of habitat for the Santa Ana sucker, arroyo chub, and other aquatic and riparian Covered Species at Anza Creek and Old Ranch Creek, Lower Hole Creek, Hidden Valley Creek, Evans Lake, and Sunnyslope Creek. These projects include the creation of new channels, restoring or rehabilitating existing channels, expansion or creation of adjacent riparian and floodplain habitat, controlling nonnative invasive vegetation, and limiting human disturbance. Proposed details for each tributary restoration project are described below based on information in *Site Characteristics and Preliminary Design of Santa Ana River Tributary Restoration Projects* (ICF 2015), *Opportunities and Constraints for Tributary Restoration Sites Report* (ICF 2018), and *30 Percent Design for Upper Santa Ana River Tributaries* (ICF 2019). The common elements of all restoration projects are presented below, followed by the restoration elements specific to each site.

Common Elements

The tributary stream restoration/rehabilitation projects contain the following common elements that would occur at all three sites.

Channel Restoration/Establishment/Re-establishment

Sites without an existing channel or with a poorly defined channel would require new channel construction or existing channel restoration and/or rehabilitation. In general, the rehabilitated or newly constructed channels would create conditions necessary for Santa Ana sucker sustainability, such as diversity in flow depths and velocities, diversity in substrate size without excessive fine sediment accumulation, intermittent areas of shading and cover provided by vegetation on overhanging banks, and open canopy with appropriate substrate to promote algal growth and sucker feeding. A coarse channel liner composed of a sorted mixture of cobble, gravel, and fine sediment would be constructed under the bed of the new channel in specified reaches to limit water infiltration into the sandy and silty soils at the site, thereby limiting channel flow loss and maintaining flow depths and velocities in the new channel. The new channels would include sections constructed with pool and riffle morphology to create the topographic and hydraulic diversity necessary to sustain different habitats. Gravel would be added to new riffle sections and other areas that would have sufficient flow velocities to maintain suitable coarse substrate for Santa Ana sucker habitat. Sites will be monitored and managed in perpetuity; damage from storm events, fire, or other disturbances will be repaired/restored within 6 months of damage detection (note: repairs/restoration will likely occur within 1 month or less; however, if significant damage occurs additional time will be needed to secure contracts, etc., to complete the work).

Wood and Rock Habitat Structures

All of the tributary stream restoration/rehabilitation projects include construction of wood and rock structures to add immediate habitat to the restoration sites. The objective of these structures is to create a flow obstruction that would alter hydraulics in a manner necessary to keep sand from accumulating on the gravel substrate in the vicinity of the structure. The structures would also provide deeper pools and overhang for cover for Santa Ana suckers. One instream woody material structure would be constructed for approximately every 200 feet of channel, based on channel morphology, to aid in diversifying hydraulic conditions that would create and sustain habitat complexity at each of the restoration project locations.

Riparian Buffer Floodplain Creation

Floodplain construction would occur within the riparian buffer (defined as within approximately 50 feet on each side of the stream) in channel reaches where the channel is incised and the banks are tall, steep, and unstable. Construction of these floodplains would allow flood water that is currently confined to spill out of the channel, thereby reducing the flow's energy and reducing the potential for future channel incision and bank erosion. Floodplain construction would also create the hydrologic conditions necessary to support certain native riparian species that cannot exist in upland environments. The new floodplain would be constructed by excavating the ground adjacent to the channel to lower the elevation of the top of the channel's bank and increase the frequency with which flood water would be able to spill out of the channel and overbank onto the new floodplain. The riparian buffer would be 100 feet wide (50 feet on each side of stream) on average.

Native Riparian Buffer Vegetation Restoration

The desired future condition of the tributary stream restoration/rehabilitation projects is to produce riparian areas composed of native vegetation. However, currently some of the nonnative vegetation provides beneficial shade to aquatic life in the creeks and to terrestrial species, and it may be important to preserve some nonnative plants within the riparian buffer area that are identified as important sources of existing shade and roosting habitat, or that are providing bank stability until newly planted vegetation becomes established. Future design work will include a detailed tree survey of native and nonnative trees.

Public Education

The tributary stream restoration/rehabilitation projects would include improvements for managed public education and outreach that would either expand upon existing programs or be developed in partnership with existing educational programs; for example, those managed by the City of Riverside Parks and Recreation Department and the Riverside County Parks staff at the Hidden Valley Nature Center. Community education opportunities proposed at all project sites include interpretive trails and signage promoting natural resource protection and native species conservation.

Limited Human Disturbance of Conserved Habitats

Measures would be implemented for successful management of the conserved habitats to prevent or minimize habitat degradation by controlling human visitation and disturbance in appropriate ways, including eliminating intensive riparian corridor usage by temporary human encampments, trash dumping, off-road vehicle use, and/or unauthorized recreational trails that degrade vegetation and impact wildlife. Managing human access to maintain appropriate levels and areas of visitation would require public education and collaboration with partner agencies and local stakeholders. Regular monitoring and onsite patrol presence of uniformed County Parks officers would deter unhoused individuals from building or rebuilding semi-permanent structures in the project areas once they have been removed as part of the restoration activities. The cost of patrol and maintenance of these sites will be included as a line item in the long-term endowment to ensure management of the Conservation Areas, in perpetuity.

Specific Restoration Project Elements

Each individual tributary stream restoration/rehabilitation project is described further below to include additional details not necessarily common to all sites.

Hidden Valley Creek (Conserv.1)

Components of the Hidden Valley Creek project (see Figures 2-23 and 5-2) will be conducted prior to finalization of the HCP, and during Phase 2 of HCP implementation. Project construction impacts associated with the establishment of new channel and rehabilitation of the existing channel (including native riparian buffer), new floodplain establishment, installation of fish habitat features, nonnative vegetation removal, and restoration and/or rehabilitation of riparian vegetation will be covered by formal section 7 consultation separate to and ahead of permitting this HCP. The Hidden Valley Creek site is bounded to the north and east by the Santa Ana River, to the south by a steep hillslope, and to the west by an historic wetland complex called the Hidden Valley Ponds (i.e., managed wetlands). The site currently supports a series of native riparian and floodplain vegetation communities. In addition, a large portion of the site supports nonnative annual grassland. The Hidden Valley Creek site does not currently have a perennial source of water. There is an historic channel (canal) that used to convey water diverted from the Santa Ana River down the channel, through the Hidden Valley Ponds, and back to the Santa Ana River. The restoration project proposed is anticipated to benefit Santa Ana sucker, arroyo chub, southwestern pond turtle, south coast garter snake, southwestern willow flycatcher, least Bell's vireo, yellow-breasted chat, and western yellow-billed cuckoo.

Portions of the existing canal would be graded using large earth moving equipment to enhance the geomorphic condition of the new creek bed. The alignment will start near the former canal headworks near the eastern end of the site and a new channel would be constructed, extending to the Santa Ana River near the western end of the site. Channel dimensions will conform to the anticipated perennial water supply. The total length of enhanced and created channel would be approximately 4,200 linear feet.

The riparian corridor would be rehabilitated by removing nonnative plants and replanting native vegetation where beneficial (e.g., native riparian understory). The riparian corridor extends along the length of the restored channel, and restoration/rehabilitation would target the entire area. Within floodplain areas outside of the channel margin, approximately 18.8 acres of nonnative annual grassland will be restored to riparian and/or scalebroom scrub vegetation communities. Of this, approximately 1.3 acres of new floodplain bench will be established.

The Hidden Valley Creek project site does not currently have a perennial source of water. A perennial water source would be provided from the City of Riverside's wastewater treatment plant (WWTP) by the Santa Ana River Sustainable Parks and Tributaries Water Reuse Project (RPU.10). If the Hidden Valley Creek restoration occurs prior to the completion of RPU.10, alternative water source opportunities will be explored (e.g., well water) to provide an interim source of water in the new creek channel.

Anza Creek/Old Ranch Creek (Conserv.5)

The Anza Creek project will be conducted prior to HCP finalization and will be covered by formal section 7 consultation separate to and ahead of permitting this HCP. The Old Ranch Creek project will be conducted during Phase 1 of HCP implementation. Anza Creek and Old Ranch Creek sites are bounded to the north by the Santa Ana River, to the east by the Tequesquite Landfill (closed), and to the south and west by the Santa Ana River bicycle trail and Anza Narrows Park (see Figures 2-23 and 5-2). The sites currently support a variety of native floodplain habitats, nonnative grassland, and nonnative riparian habitat. Restoration at this site is anticipated to benefit southwestern pond turtle, south coast garter snake, southwestern willow flycatcher, least Bell's vireo, yellow-breasted chat, yellow billed cuckoo, Santa Ana sucker, and arroyo chub.

Anza Creek

Anza Drain is one of several surface area concrete-lined stormwater drains within the City and County of Riverside, with the upper portion originating in the Woodcrest and El Sobrante areas (ICF 2017). The Anza Drain flows under the bicycle trail and enters the area at the far southeast portion of the site, at which point the concrete channel turns into a natural, alluvial creek (Anza Creek). Anza Drain supplies little to no surface water flow to the site in dry months; thus, the upper portions of Anza Creek are largely dry. However, in the area of proposed restoration surface water is supplied by natural springs that produce perennial flow connecting the creek to the Santa Ana River.

Approximately 1,200 linear feet of channel would be designed and constructed using heavy earth-moving equipment, and 2,120 linear feet of the existing Anza Creek channel would be rehabilitated by adding coarse substrate (cobble and gravel) to new or existing riffle sections for use by Santa Ana sucker and arroyo chub. The narrow and vegetation-blocked downstream reach near the confluence with the Santa Ana River would be restored by clearing out vegetation plugs and reconfiguring the channel topography using heavy equipment and/or in-stream habitat features (e.g., log structures and/boulder clusters). This would be done to improve flow connectivity with the Santa Ana River to support fish passage. A current deep pool, about 150 feet long and several feet deep, located at the base of an eroding bank provides habitat for nonnative predatory species. This pool would be recontoured to reduce its width and depth to reduce pool habitat suitable for nonnative fishes.

Anza Creek has several reaches where the channel is confined by steep and tall banks with little to no floodplain connectivity. Approximately 1.1 acres of new floodplain bench would be created, spread out over five different areas, by excavating the high ground adjacent to the low-flow channel. The typical width of the inset floodplain areas would be 20–40 feet, and the average excavation depth would be 2–3 feet. A 580-foot-long section of Anza Creek's left bank adjacent to the bicycle trail at Martha-McLean-Anza Narrows Park is steep, unvegetated, up to 25 feet tall, and actively eroding into Anza Drain. The bank would be excavated to reduce its steepness, and 0.8 acre would be revegetated with a mixture of riparian plants near the base and coastal scrub in the upland portion. An additional 2.1 acres of coastal scrub would be planted upstream of the eroding bank in an unvegetated and sloping area of the site between the bicycle trail and the Anza Creek channel. Approximately 4.1 acres would have selective clearing and planting.

Provide a Supplemental Permanent Perennial Water Source

The Anza Creek site has a current source of water, but the source of this flow may be reduced in the future. A source of supplemental permanent perennial water would be provided by Santa Ana River Sustainable Parks and Tributaries Water Reuse Project (RPU.10).

Old Ranch Creek

Old Ranch Creek is one of several surface area drains and stormwater systems, with the upper portion of its watershed originating in the Wood Streets neighborhood of the City of Riverside and lower portion receiving runoff from Jurupa Avenue and over to Central Avenue (also in the City of Riverside). The Old Ranch Creek drainage enters the site through a small culvert under the bicycle path at the far southeast corner of the project site. Historically, the drainage conveyed more water than at present. However, currently the drainage is dry most of the year, typically only receiving water during storm events. Thus, the Old Ranch Creek site does not have a perennial source of water and no continuous channel connecting with the Santa Ana River. The Old Ranch Creek channel no longer exists in the northwestern downstream half of the project site; this area is located in the south floodplain of the Santa Ana River and requires a rare, large flood event from the Santa Ana River to spill out into this floodplain area (ICF 2017).

Channel rehabilitation, restoration, and/or establishment at Old Ranch Creek includes approximately 3,870 linear feet of new channel construction and 3,150 linear feet of channel restoration. The upstream end of the Old Ranch Creek drainage initiates at a storm drain that discharges into the Santa Ana River floodplain. River flows are currently blocked from interacting with this area by the Tequesquite Landfill. The downstream portion of the new channel would be constructed along a southwest alignment toward an eventual confluence with the Santa Ana River, which terminates several hundred feet upstream of the Anza Creek confluence.

Approximately 0.6 acre of floodplain bench would be created adjacent in the Old Ranch Creek drainage. A new riparian corridor would be created, adjacent to which nonnative plants would be removed and new native vegetation would be planted. The riparian corridor would be approximately 100 feet wide (50 feet on either side of the channel); approximately 2.5 acres would be planted with native vegetation, and approximately 12.2 acres would have selective clearing and planting.

Provide a Permanent Perennial Water Source

The Old Ranch Creek site does not currently have a perennial source of water. A permanent perennial water source would be provided by Santa Ana River Sustainable Parks and Tributaries Water Reuse Project (RPU.10).

Lower Hole Creek (Conserv.4)

The Lower Hole Creek project (see Figures 2-23 and 5-2) will be conducted during Phase 1 of HCP implementation. The Lower Hole Creek site consists of approximately 6.2 acres, beginning downstream of Jurupa Avenue where the stream passes under the road through a large 40-foot concrete box culvert with extensive downstream protections that creates a 27-foot elevation difference between the channel upstream and downstream of the crossing. Lower Hole Creek consists of two drainage features: a small tributary and the main creek, which meets the Santa Ana River at the downstream end.

Native vegetation communities on the site include black willow thickets and California sycamore woodland along the creek channel, with upland areas consisting mostly of nonnative annual grassland. Nonnative invasive plants are present throughout the site and include palms, giant reed, ash, and tree of heaven, in addition to castor bean and tree tobacco (*Nicotiana glauca*). For more information on existing conditions at the Lower Hole Creek site, refer to the *Opportunities and Constraints for Tributary Restoration Sites* report (ICF 2018). The restoration work proposed at this site is anticipated to benefit Santa Ana sucker, arroyo chub, southwestern pond turtle, south coast garter snake, least Bell's vireo, southwestern willow flycatcher, and yellow-breasted chat.

In several long reaches downstream of Jurupa Avenue, the Lower Hole Creek channel is confined by steep, tall banks with little to no floodplain connectivity. Approximately 0.5 acre of new floodplain would be created, spread out over nine different areas, by excavating the high ground adjacent to the low-flow channel. The typical width of the inset floodplain areas would be 25–75 feet, and the average excavation depth would be 3–4 feet. The floodplain creation would provide additional areas where overbank flows can spread out into riparian zones and reduce the shear stress levels in the channel that contribute to channel downcutting and bank erosion. Approximately 3.5 acres would have selective clearing and planting.

A new riparian corridor would be created in which nonnative plants would be removed and new native vegetation would be planted. The total width of the corridor would vary from 50 to 75 feet but would extend up to 400 feet downstream of Jurupa Avenue. A total of approximately 1.7 acres of new riparian vegetation would be restored downstream of Jurupa Avenue. Approximately 440 linear feet of existing channel downstream of Jurupa Avenue would be rehabilitated.

Approximately 575 linear feet of channel bank, split into five different areas located throughout Lower Hole Creek downstream of Jurupa Avenue, exhibits excessive erosion. Many of these areas are along the toes of steep hillslopes where floodplain excavation is not feasible. Consequently, they would require separate work outside of the grading that would occur as part of the floodplain construction. Bank stabilization in these areas would incorporate bank excavation to reduce steepness and methods of placing rock and large wood along the toe to build a narrow bench that separates the active channel from the eroding bank and provides a buffer to keep erosive shear stresses away from the erodible soil that makes up the hillslopes.

Provide a Permanent Supplemental Perennial Water Source

The Lower Hole Creek site currently has a perennial source of water. A supplemental permanent perennial water source would be provided by Santa Ana River Sustainable Parks and Tributaries Water Reuse Project (RPU.10) to enhance baseflow and secure long-term flow to the creek.

Evans Lake (Conserv.6)

The Evans Lake project (see Figures 2-23 and 5-2) will be conducted during Phase 1 of HCP implementation. The largest opportunity at Evans Lake is the rehabilitation of the riparian, stream, wetland, transitional, and upland habitats. The site is currently vegetated with many different nonnative invasive species, including, but not limited to, Brazilian pepper (*Schinus terebinthifolia*), palms (*Phoenix canariensis* and *Washingtonia robusta*), tamarisk (*Tamarix* spp.), eucalyptus (*Eucalyptus* spp.), fig (*Ficus carica*), mustard (*Brassica* spp.), fennel (*Foeniculum vulgare*), and grasses. In addition, due to the presence of unhoused transients and encampments there is substantial trash, debris, and illegal trails throughout the site. Removing the nonnative invasive species, trash, and debris; reclaiming the unauthorized trails; and replanting with native species would result in rehabilitation of the entire site. The project is anticipated to benefit Santa Ana sucker, arroyo chub, southwestern pond turtle, south coast garter snake, southwestern willow flycatcher, least Bell's vireo, and yellow-breasted chat.

Provide a Permanent Supplemental Perennial Water Source

The Evans Lake site does not currently have a perennial source of water. A permanent perennial water source would be provided by Santa Ana River Sustainable Parks and Tributaries Water Reuse Project (RPU.10).

Other restoration opportunities at Evans Lake include the following:

- Laying back the channel banks in a portion of the spillway channel
- Creating a secondary/high flow channel in the spillway channel
- Creating riffles and pools and adding wood and rock structure to the low-flow channel, providing supplemental flow to the low-flow channel
- Using selective clearing and planting to rehabilitate native riparian vegetation

Santa Ana River Preserve Unit: Riparian Floodplain Habitat Restoration Areas

The Riparian Floodplain Habitat Restoration Areas include additional restoration actions to be undertaken by the Alliance to benefit Covered Species during Phase 1 and 2 of the HCP, depending on such factors as future assessments of habitat improvement needs and the availability of additional funding. These actions may occur at any of the sites identified in the tributary stream restoration/rehabilitation projects described above, or at other sites within the HCP Preserve System.

Hidden Valley Creek (Conserv.1)

The Hidden Valley Creek riparian floodplain restoration/rehabilitation project (see Figures 2-23 and 5-2) would be conducted during Phase 2 of HCP implementation. Additional opportunities at the Hidden Valley Creek site include establishing an oxbow feature and further controlling nonnative invasive species. Restoration opportunities at the site are largely associated with rehabilitating habitat by removing nonnative plant species and planting native species. These activities would improve habitat conditions for a multitude of species. The site is in an active part of the Santa Ana River floodplain that has experienced substantial erosion and deposition from flood flows. Groundwater and surface flows currently support one large perennial pond feature in the downstream portion of the site, a remnant of a previous river course. This feature provides a unique habitat for wildlife, as it represents a perennial, low-velocity water source with adjacent riparian habitat. Creation of a similar feature in the upstream portion of the site would increase the opportunity for wildlife to utilize this unique habitat type. Adding gently sloping shoreline habitat to the created feature would increase nesting opportunity for certain bird species and also provide benefits to pond turtle and garter snake. Due to the risk of future flooding associated with the active Santa Ana River, the proposed location for this feature is the southern portion of the floodplain outside of the regular channel migration zone. The restoration proposed is anticipated to benefit southwestern pond turtle, south coast garter snake, southwestern willow flycatcher, least Bell's vireo, yellow-breasted chat, and western yellow-billed cuckoo.

Hidden Valley Ponds (Conserv.2)

The Hidden Valley Ponds project (see Figures 2-23 and 5-2) will be conducted during Phase 1 and 2 of HCP implementation and will include restoring floodplains by opening levees and rehabilitating habitat, controlling nonnative species, and restoring water to seasonal waterfowl ponds. Additionally, there are rehabilitation opportunities at the site associated with removing nonnative plant species and planting native species, and focusing human use of the site through trails, interpretive signage, and controlled educational opportunities. A permanent perennial water source would be provided by Santa Ana River Sustainable Parks and Tributaries Water Reuse Project

(RPU.10). Restoring the ponds and floodplain will improve habitat for southwestern pond turtle, south coast garter snake, riparian birds, and tricolored blackbird.

Management of Santa Ana Sucker Restoration on Sunnyslope Creek (Conserv.11)

Annual management activities of the Santa Ana sucker restoration site occur within an area on Sunnyslope Creek (generally identified in Figures 2-23 and 5-2). These activities will be conducted starting in Phase 1 of HCP implementation and will include the removal of flow obstructions, deep holes, and aquatic predators; and manipulation of the channel using equipment to concentrate the creek flow in a single channel that maximizes silt scour and hydrologic connectivity with the creek. As many as 10 cubic yards per year of rock, gravel, and smaller boulders would be imported to improve substrate conditions in the creek for Santa Ana sucker. The material would be surface gleaned from the adjacent alluvium and deposited in deeper holes in the creek to significantly reduce the depth of the pool complex where otherwise such holes have harbored large nonnative predatory fishes. Available techniques would be used to reduce the abundance of nonnative predators through the use of electro-shocking, trapping, seining, fishing, and dip-netting. Trash and debris will be removed by hand and potentially by installing and operating a trash boom. The possibility of augmenting creek flow with well water will also be explored to alleviate drought-associated impacts on dry-weather creek flow. In addition to Santa Ana sucker, this management is expected to benefit arroyo chub and potentially southwestern pond turtle and south coast garter snake.

Alluvial Fan Preserve Unit A: Alluvial Fan Scrub Restoration and Rehabilitation Projects

There are six restoration and/or rehabilitation projects that will improve the quality of alluvial fan sage scrub vegetation and/or the existing surface substrate (topsoil) for the benefit of Covered Species: Enhanced Recharge Basin, Drainage A Woolly-Star, Redlands Airport Parcels, Santa Ana River Refugia, San Bernardino Avenue, and Weaver. Each is described briefly below.

Enhanced Recharge Basin (Conserv.12)

The Enhanced Recharge Basin alluvial fan scrub restoration project (see Figures 2-24 and 5-3) will be conducted during Phase 1 of HCP implementation. The project will encompass 295 acres, within a portion of one of two larger areas (or a combination of the two) (Figure 2-24). Both areas are owned by the Conservation District. The first area is within the Wash Plan HCP area, immediately west of the Borrow Pit and east of Cone Camp Road, and the second location occurs south of Mill Creek and the USACE levee, around existing recharge basins. These larger areas include existing facilities (e.g., roads, recharge basins). Habitat restoration or rehabilitation activities will occur outside of these areas, primarily within the interstitial spaces between existing facilities, or around the periphery. Habitat improvement at either site (or both) would involve enhancing alluvial fan scrub habitat for the benefit of SBKR and Santa Ana River woolly-star. There are multiple recent documented occurrences of SBKR throughout the Conservation District lands south of Mill Creek (Romich 2018), but the species is currently generally limited to the periphery of the area located west of the borrow pit (Romich 2019).

Restoration or rehabilitation actions will rely on the best available data based on the recent research on microhabitat suitability for SBKR conducted by the San Diego Zoo Institute for Conservation Research (Shier et al. 2019), and the evaluation of various methods of mechanical manipulation to simulate the effects of fluvial disturbance (ICF 2019). The project would involve the restoration or rehabilitation and management of interstitial spaces between recharge basins and habitat around the periphery of these sites for the benefit of SBKR, Los Angeles Pocket Mouse (LAPM), slender-horned spineflower, and Santa Ana River woolly-star habitats. Interstitial spaces will be approximately 200 feet wide and will be connected on both ends to habitats potentially occupied by SBKR and LAPM. In general, lands that are known to be occupied by SBKR at densities greater than a scarce presence[2] will receive less intensive restoration activities (e.g., major amendments to the substrate may not occur) as the presence of SBKR suggests the baseline condition of the habitat(s) is suitable and contains a low-level presence of stressors/threats to the species. These lands will be described as receiving “rehabilitation”, in contrast to “restoration” where more manipulative conservation actions may be needed to re-instate the physical and biological features necessary to create and maintain suitable habitat.

If restoration is proposed to occur within lands west of the borrow pit the effort would be considered experimental, until it could be demonstrated that SBKR were using the restored habitat (determined by positive trapping in areas where the species was not documented prior to commencement of habitat restoration efforts). However, because SBKR currently occupy areas immediately adjacent to habitat proposed for restoration (Romich 2020), we anticipate that these actions will create and maintain favorable conditions for SBKR. To determine success of restoration or rehabilitation activities, the site(s) will be trapped prior to commencement of habitat improvement activities to determine SBKR presence (baseline condition). Habitat restoration and/or rehabilitation activities will then commence, and the site(s) will be re-trapped at a later date (assume a minimum of approximately 24 months) to document if SBKR are present in areas where they were previously not trapped. Timing of re-trapping the site(s) will be determined based on habitat restoration and/or rehabilitation success criteria, that have yet to be developed, but will likely include a combination of low coverage of nonnative grasses and forbs (for example, <20% cover) and a moderate open shrub canopy (<40% shrub canopy cover). Success criteria will be developed and presence or an increase of SBKR will need to be demonstrated before acreage can be used to offset Covered Activity impacts to SBKR. Success criteria will also be developed for Santa Ana River woolly-star, with presence of the species required prior to use of this acreage to offset impacts from Covered Activities.

Drainage A Woolly-Star (Conserv.14)

The Drainage A Woolly-Star project (see Figures 2-25 and 5-3) is contingent on successful land acquisition/easement recordation, and, consequently, the project is not proposed until Phase 2 of HCP implementation. The Drainage A parcel is a portion of the diversion structure for the Riverside North Aquifer Storage and Recovery Project (RPU.5). The parcel is occupied by a large population of Santa Ana River woolly-star (several thousand individual plants) and LAPM, despite the degraded habitat quality of the site. Rehabilitation will enhance approximately 21 acres of degraded habitat by removing nonnative plants, trash, and debris, and by conserving and managing the site in perpetuity. Opportunities to widen the alluvial floodplain of the drainage will also be explored. The rehabilitation project will benefit Santa Ana River woolly-star and LAPM. As previously identified, mitigation actions at the Drainage A Woolly-Star site are dependent on land availability;

[2] An SBKR biologist would anticipate capturing multiple animals in one night based upon previous recent trapping surveys or field surveys.

consequently, alternate lands may need to be acquired to appropriately offset HCP impacts within this portion of the HCP Preserve System.

Redlands Airport Parcels (Conserv.15)

The Redlands Airport Parcels are situated outside of the current floodplain of the Santa Ana River, and comprise approximately 40 acres (see Figures 2-25 and 5-3). SBKR habitat rehabilitation is proposed at this site with conservation activities scheduled to commence prior to and during Phase 1 of HCP implementation. Portions of the site are occupied by SBKR, and because the property is located outside of the Santa Ana River floodplain it provides refugium habitat for the species. Rehabilitation will enhance habitat conditions for the species over the entire approximate 40-acre site. This area will be used to offset impacts on SBKR from HCP Covered Activities. Success criteria will be developed and presence or an increase of SBKR will need to be demonstrated before acreage can be used to offset Covered Activity impacts to SBKR. Best available science on SBKR habitat preferences (Shier et al. 2019) will be used to inform rehabilitation planning. The site was purchased in late 2020 for use by the HCP to provide for the recovery of SBKR and any other Covered Species that may occupy the site. The site will be conserved and managed in perpetuity.

Santa Ana River Refugia (Conserv.16)

Four locations, totaling approximately 123 acres comprise the Santa Ana River Refugia sites (see Figures 2-25 and 5-3). Portions of all four locations support existing populations of SBKR. These sites include:

- Amazon: The Amazon site totals approximately 29 acres.
- California Redlands: The California Redlands site totals approximately 32 acres.
- Tippecanoe: The Tippecanoe site totals approximately 32 acres.
- Headgates: The Headgates site totals approximately 31 acres.

The sites are currently owned by the City of Riverside/RPU, but are proposed for acquisition (fee title purchase and/or conservation easement recordation) by the HCP. SBKR habitat rehabilitation is proposed at all four locations with activities scheduled to commence prior to and during Phase 1 of HCP implementation. All four properties are located outside of the Santa Ana River floodplain; consequently, they provide refugia habitat for the species.

Rehabilitation will improve habitat conditions for SBKR, and any other Covered Species present, over the entire 123 acres of all four sites. This acreage will be used to offset impacts on SBKR from HCP Covered Activities. Success criteria will be developed and presence or an increase of SBKR will need to be demonstrated before acreage can be used to offset Covered Activity impacts to SBKR. Best available science on SBKR habitat preferences (Shier et al. 2019) will be used to inform habitat rehabilitation planning. All four sites will be conserved and managed in perpetuity.

San Bernardino Avenue (Conserv.17)

The San Bernardino Avenue project totals approximately 7 acres (see Figure 2-25 and 5-3). The majority of the site is occupied by SBKR, and because the property is located outside of the Santa Ana River floodplain it provides refugium habitat for the species. Habitat rehabilitation is proposed for the benefit of SBKR and potentially Santa Ana River woolly-star at this site with rehabilitation activities scheduled to commence prior to and during Phase 1 of HCP implementation. This acreage (approximately 7 acres) will be used to offset impacts on SBKR from HCP Covered Activities. Success criteria will be developed and presence or an increase of SBKR will need to be demonstrated before acreage can be used to offset Covered Activity impacts to SBKR. Best available science on SBKR habitat preferences (Shier et al. 2019) will be used to inform rehabilitation planning. The site will be conserved and managed in perpetuity.

Weaver (Conserv.18)

The Weaver site totals approximately 17 acres (see Figures 2-25 and 5-3). Small portions of the site are currently occupied by SBKR. Habitat restoration to benefit SBKR is proposed at this site with restoration activities scheduled to commence prior to and during Phase 1 of HCP implementation. Restoration will enhance habitat conditions for the species over the entire approximate 20 acres of the site. Success criteria will be developed and presence or an increase of SBKR will need to be demonstrated before acreage can be used to offset Covered Activity impacts to SBKR. Best available science on SBKR habitat preferences (Shier et al. 2019) will be used to inform restoration planning. The site will be conserved and managed in perpetuity.

Alluvial Fan Preserve Unit B: Alluvial Fan Scrub Restoration and Rehabilitation Projects

Habitat rehabilitation and restoration has been identified at one location within Alluvial Fan Preserve Unit B, but other locations are actively being pursued.

Devil Creek (Conserv.19)

The Devil Creek rehabilitation and restoration project is proposed to commence during Phase 1 of HCP implementation (see Figures 2-26 and 5-4). The project will encompass approximately 391 acres within a portion of the total area identified in Figure 2-26. The larger area includes existing facilities (e.g., roads, recharge basins). Restoration and/or rehabilitation will occur outside of these areas, primarily within the interstitial spaces between existing facilities, or around the periphery. These activities are currently conceptual, but would involve enhancing alluvial fan scrub and adjacent habitat for the benefit of Covered Species. Western spadefoot toad was recently documented on site (Baumberger et al. 2020), and habitat improvement may include the creation/rehabilitation of habitat to specifically benefit this species.

Santa Ana Sucker Translocation Unit A and B: Restoration and Rehabilitation Projects

Habitat restoration and/or rehabilitation has been identified for one site within Santa Ana Sucker Translocation Unit A, but other locations within both units are actively being pursued. Further, mountain tributaries within Santa Ana Sucker Translocation Units A and B proposed to support translocated Santa Ana sucker will be monitored and managed (e.g., nonnative species management)

City Creek (Conserv.20)

The City Creek project is proposed to commence during Phase 2 of HCP implementation (see Figures 2-26 and 5-5). The project will encompass approximately 264 acres, within a portion of the total area identified in Figure 2-26 Proposed habitat improvement activities are conceptual, but will likely include replanting riparian and adjacent upland habitat for the benefit of Covered Species, and removing and maintaining the stream free from human encampments. Efforts will be made to reduce the probability of future catastrophic wildfires through the thinning of overgrown vegetation (trees and shrubs) and rehabilitating landscapes to provide resistance against crown fires and habitat type conversion, and resilience of native habitat types to persist/regrow after fires pass.

Future Restoration and Rehabilitation

The following restoration projects, all currently located within the Santa Ana River Preserve Unit, are not a part of the HCP Conservation Strategy (i.e., the conservation value that these projects will create is above and beyond what is needed to offset the impacts of the Covered Activities). These projects are identified as Potential Future Phase/Future Restoration and Rehabilitation project areas, and although their construction, monitoring, and management will be coordinated by the Alliance, the conservation value will be tracked separately from the mitigation committed under the HCP. Some or all of the conservation value created by these projects in the Future Restoration and Rehabilitation project areas may be used to mitigate for impacts from projects that *are not* Covered Activities under this HCP.

Preliminary designs have been prepared for the following Future Restoration and Rehabilitation project areas. While these projects are not requirements or commitments of the HCP, they may still be implemented to create additional conservation values within or outside of the Planning Area.

Lower Hidden Valley Creek (Conserv.3)

The Lower Hidden Valley Creek Rehabilitation project includes rehabilitating the bed and banks of the historic stream channel and associated wetlands downstream of Hidden Valley ponds, between the ponds and the mainstem of the Santa Ana River. Habitat rehabilitation activities may include stabilizing the channel, enhancing habitat in the existing channel for Santa Ana sucker, restoring the riparian corridor along the existing channel through nonnative species removal and replanting of native species, re-establishing floodplain, re-establishing two wetlands, controlling nonnative invasive wildlife species, reducing human disturbance, and restoring upland buffer vegetation. The proposed project is anticipated to benefit Santa Ana sucker, arroyo chub, southwestern pond turtle, south coast garter snake, southwestern willow flycatcher, least Bell's vireo, yellow-breasted chat, tricolored blackbird, and western yellow-billed cuckoo.

Lower Hole Creek Floodplain (Conserv.4)

Additional conservation opportunities at the Lower Hole Creek site include restoring upland vegetation and further controlling nonnative invasive plant and wildlife species, which would rehabilitate habitats for Covered Species. Rehabilitation opportunities also exist upstream of the site that could further increase the size of contiguous riparian habitat. In addition, improved condition of the adjacent buffer habitat can further reduce threats to the creek. Currently, the buffer habitat is highly accessible to the public and functions in a degraded state with high human use, soil disturbance, and nonnative plant cover. Restoration of the upland areas to coastal sage scrub vegetation would protect wetland conditions and create additional opportunities for Covered Species. Restoration efforts at this site would benefit southwestern pond turtle, south coast garter snake, least Bell's vireo, southwestern willow flycatcher, and yellow-breasted chat.

Anza Creek and Old Ranch Creek Floodplain (Conserv.5)

Additional conservation opportunities at the Anza Creek/Old Ranch creek sites include alkali marsh rehabilitation, upland rehabilitation, floodplain expansion, and further management of nonnative invasive wildlife species. These opportunities would improve habitat quality for Covered Species by reducing the threat from nonnative invasive wildlife species such as bullfrogs, wild boar, mosquitofish, and brown-headed cowbird. Control methods are as yet undetermined and may include methods such as seasonal variation in water supply and trapping.

The site currently supports alkali meadow habitat at several locations in the outer floodplains that illustrate near-reference conditions for that vegetation community. There are also areas on site where historic alkali meadow has become degraded by past human use and an influx of nonnative species. In particular, the southeastern corner of this site provides an ideal opportunity for alkali marsh restoration, including control of nonnative species, planting of native species, and improvements to hydrology by connecting the area to the Old Ranch Creek drainage. This area is dominated by nonnative grasses, but there are still native alkali species present such as salt grass and creeping wild rye. The presence of these species, the adjacent reference condition, and the topography (low depression) are all indicators that this area can be successfully restored to alkali meadow.

The northeastern corner of the site, immediately downstream of the Tequesquite landfill, which borders the site to the east, is at a higher elevation than much of the site, with extensive areas of disturbed bare ground, invasive species, and human disturbance. The higher elevation appears to be a result of historic fill, potentially in association with past landfill practices. Recontouring within this area (subject to approval by Riverside County Waste) could provide for reengagement to a more active floodplain at a frequency similar to that of the riparian zone along the river. Additional opportunities within this portion of this site include emulating a relic channel in the form of an oxbow. This would require excavation to and below groundwater levels to support a perennial water source.

The conservation actions proposed is anticipated to benefit southwestern pond turtle, south coast garter snake, southwestern willow flycatcher, least Bell's vireo, yellow-breasted chat, and western yellow-billed cuckoo.

Louis Rubidoux Nature Center and Sunnyslope Creek (Conserv.7)

Additional conservation opportunities beyond those identified in Management of Santa Ana Sucker Restoration on Sunnyslope Creek (Conserv.11) may be proposed under this project. Opportunities may include expansion of habitat restoration and rehabilitation to encompass the adjacent floodplain, and the potential addition of a new parallel stream, adjacent to Sunnyslope Creek. Restoration activities are anticipated to benefit native fish and reptile species including Santa Ana sucker, arroyo chub, southwestern pond turtle, and south coast garter snake, as well as riparian bird species such as least Bell's vireo, and yellow-breasted chat.

Tequesquite Creek Aquatic Habitat (Conserv.8)

Future restoration and rehabilitation activities at this site may include continued nonnative plant removal and control, encampment debris removal, streambank stabilization via native plantings, substrate enhancements, and supplemental water input (see Section 5.5.5, *Tequesquite Creek Supplementary Flows*), as well as activities to monitor native fish in the creek.

Pedley Landfill (Conserv.9)

The Pedley Landfill is located on a 13.5-acre parcel owned by CDFW. Previously, in 1932 the County of Riverside had a burn operation at the site, and in 1957 through 1958 the County used the site as a cut and fill operation before selling it to CDFW in February 1974. The parcel is at the immediate confluence of the Santa Ana River mainstem and Hole Creek, just west of Van Buren Boulevard. During an evaluation of restoration opportunities for Hole Creek, Pedley Landfill was identified as one of the largest constraints to meaningful restoration in the creek. In addition to constraining the physical movement of Hole Creek the landfill has become increasingly unstable as the mainstem Santa Ana River has moved south, resulting in damage and likely contamination issues. At least three recent erosional site failures have occurred: December 2010, where half an acre was washed away, followed by erosion of the north slope during a spring storm in March 2014, and then again in November 2015. The repairs are costly and pose a risk to the river system downstream. In addition, the physical constraints of the landfill, which flanks the lowermost 1,200 feet of Hole Creek's east bank, limit the ecological conditions of the creek, including a lack of floodplain, riparian habitat, suitable buffer, and channel migration. CDFW, in partnership with Riverside County Waste, have discussed opportunities with Valley District for the complete removal or substantially reducing the size of the landfill to protect downstream water resources and facilitate additional restoration opportunities for Lower Hole Creek. Reclamation and revegetation of the landfill would result in the creation of approximately 4 acres of riparian habitat. The restoration proposed is anticipated to benefit southwestern pond turtle, south coast garter snake, least Bell's vireo, southwestern willow flycatcher, and yellow-breasted chat.

5.5 Hydrologic Manipulation and Substrate Management

5.5.1 Mainstem Santa Ana River Microhabitat Creation (Habitat Nodes)

The goal of this habitat management action is to create a minimum of six nodes of habitat created by installing a series of structures within the stream flow of the mainstem Santa Ana River to increase flow velocity and increase localized sediment transport of fine sediment (scour) in order to create and maintain suitable microhabitats[3] for native fishes. The expectation is that these structures (made of natural materials) will increase the total amount of suitable habitat available to Santa Ana sucker, including riffles, small scour pools, and exposed patches of coarse substrate. Strategically placing the microhabitat creation structures downstream of the San Bernardino/Colton Rapid Infiltration and Extraction Facility (RIX) discharge location between occupied reaches will create "steppingstone" nodes of habitat to connect occupied areas and the new mainstem tributary restoration sites and facilitate movement of native fishes between newly created habitat and currently occupied areas.

[3] Microhabitat enhancements using natural materials (e.g., large boulders, woody debris) to increase scour and pool formation within the Santa Ana River mainstem is a requirement of Wastewater Change Petition WW0095, and the Sterling Natural Resources Project CEQA (SCH No. 2015101058), mitigation measure SAS-1.

There are several alternatives to create these nodes of habitat. What has been experimentally tested to date within the river is the placement of coarse substrate along reaches of stream with a large component of sandy substrate (e.g., OCWD, USACE, and Santa Ana Watershed Project Authority projects). These projects have largely failed to achieve the desired habitat enhancement effect of coarsening the streambed. A significant component of the failure of these projects is the disappearance of coarse sediment grains after construction. This may occur through localized bed erosion (rocks sink into the sand), bed aggradation (rocks are covered by sand deposits), saltation (rocks rolling downstream), or a combination of these processes. The incorporation of large woody debris into the design of enhancement projects using coarse grained sediment may provide added benefit and reduce the potential for failure.

Field sampling has shown that bed elevation of the Santa Ana River can increase dramatically over hours and days, increasing by more than 12 inches (Scheevel 2017). Sand deposition within the inset perennial channel occurs during and after storm events when heavy flow transports large amounts of sediment from the upper watershed. Aggradation occurs in the inset perennial stream where sediment-heavy stormflow deposits its bed load. This deposited sediment, mostly sand, migrates downstream with the sediment-free tertiary-treated base flow. The process of high flow eroding and saltating coarse sediments, combined with aggradation during base flow makes it difficult to maintain a streambed enhancement feature that has been artificially coarsened.

A relatively simple solution to the sand aggradation problem is to cause stream bifurcation or braiding. The Santa Ana River floodplain is full of remnant channels (distributaries). If a new braid is created in an existing channel the deeper channel will generally transport the bulk of the bed load, leaving flow entering the new channel relatively sediment free. This type of diversion, which would convey only a portion of the main channel flow (and would consequently not impact the lateral extent or depth of the main channel, and will therefore not impact riparian or aquatic vegetation) is commonly done for irrigation canals. Assuming the diversion has adequate flow velocity to move sand, it will coarsen the streambed, enhancing the overall stream habitat for Santa Ana sucker. An additional benefit is that habitat enhancement features can be created prior to stream diversion, when the streambed is dry, avoiding and/or minimizing impacts on Covered Species during construction.

The process for choosing a location for this type of stream enhancement would start with an aerial imagery search for distributaries that could be re-wet. Locations where a diversion would have limited disturbance to the perennial stream and associated aquatic and riparian habitat and species would be prioritized. With a location chosen, any habitat features important to resources in that part of the stream would be constructed prior to stream diversion (e.g., placement of large woody debris, addition of coarse sediment, building of floodplain features and terraces).

The stream diversion feature would be an engineered structure to serve multiple purposes, at minimum to include water diversion and sediment exclusion, and may include a weir, boulder clusters, large woody debris, groin, etc. The intent of the structure would be to cause a bifurcation in flow, with the new minor channel braid holding a significant portion of the total flow, less than 50%, but with a minor contribution of sand. Avoidance and minimization measures would be in place to limit adverse impacts on aquatic and terrestrial species during the construction of the stream diversion feature as well as when necessary along the length of the dry channel.

Any created stream bifurcation would be a temporary feature, potentially altered or eliminated by future storm flow events. The decision to rebuild or abandon in-stream structures would be an adaptive management process, whereby survey data gathered during monitoring (between March and July) would be used to assess and determine management actions. Construction of larger projects would occur outside of spawning season for native fishes and outside of nesting season for migratory birds. Smaller projects may be appropriate to build during both spawning and nesting season if only hand work is required. The ability to build and maintain these diversions after the threat of flooding has passed and ahead of summer warming will be critical to the overall success of these projects to increase the available habitat for native fish use.

Design and implementation of the above measures to create habitat nodes will be conducted as a part of the CAMMP. Annual monitoring will include, at minimum, water quality, spring and fall visual estimates of substrate cover types, staff gauge to measure changes in bed elevation, and fish surveys. Specific variables, data collection frequency, methodology, and analysis to determine success will be developed as part of CAMMP.

5.5.2 Substrate Management Activities

Substrate augmentation (e.g., river gravel and cobble) will occur as needed to enhance perennial stream habitat function in and upstream of the microhabitat creation sites described above. Substrate augmentation will occur as a part of structure creation and maintenance when monitoring indicates that additional coarse substrate is needed.

5.5.3 Flow and Path Manipulation Activities Within Mainstem

The path of flow of the mainstem of the Santa Ana River is dynamic and regularly shifts during larger storm events. While the river is most frequently flowing through a single channel downstream of the Rialto Channel, some portions become split into multiple channels following storm events. When flow is separated into multiple channels it can reduce flow velocity and depth in each channel resulting in the deposition of fine sediments. Where appropriate, structures made of natural materials such as boulders, large cobble, and large woody debris will be used to manipulate the flow and path of the river to increase and maintain habitat suitability for Santa Ana sucker.

5.5.4 Rialto Channel Flow and Water Quality Management

The purpose of this conservation measure is to reduce water temperatures in Rialto Channel to tolerable levels (less than 85 degrees Fahrenheit [°F])[4,5] during summer months for Santa Ana sucker. In recent years the temperatures within the soft bottom (suitable native fish habitat) portions of Rialto Channel were found to be outside the tolerable range for the species (USFWS 2010) and generally greater than 80°F in summer and fall (USGS 2015). This measure will add relatively cool water (67–75°F), from groundwater wells or other water sources, in order to decrease the water temperature in Rialto Channel to tolerable levels for Santa Ana sucker.

[4] Required pursuant to Wastewater Change Petition WW0095, and the Sterling Natural Resources Project CEQA (SCH No. 2015101058), mitigation measure SAS-5.

[5] Per City of San Bernardino's settlement agreement with Center for Biological Diversity related to Wastewater Change Petition Order WW0059, the City is to coordinate with Valley District on temperature management within Rialto Channel.

5.5.5 Tequesquite Creek Supplementary Flows

Supplemental water will be provided to Tequesquite Creek from the City of Riverside's WWTP via a recycled water pipeline: Santa Ana River Sustainable Parks and Tributaries Water Reuse Project (RPU.10). The Riverside-Corona Resource Conservation District (RCRCD) is grantee to a conservation easement over approximately 7.5 acres of city and county lands centered on Tequesquite Creek, from just downstream of the Riverside County Flood Control channel to the stream's confluence with the Santa Ana River (Figure 2-24). The RCRCD commenced habitat rehabilitation activities at this site in 2013. These activities included removal of trash and nonnative plant species (e.g., palm, ash, fig, catalpa, eucalyptus), and the removal of fish barriers to improve the quality and access to spawning habitat for listed fish species including Santa Ana sucker and arroyo chub. Santa Ana sucker have been documented in the lower portions of Tequesquite Creek (within an approximate 100 meter stretch upstream from its confluence with the Santa Ana River) between 2009 and 2019, but due to low water levels the species has not been detected in the creek since 2019 (Russell pers. comm.). Flow within Tequesquite has decreased over the years, and since 2018 the mid-section of the stream has completely dried annually from July until September/October (Russell pers. comm.). The permanent provision of supplementary flows will improve the abundance and quality of available aquatic habitat for native fishes, particularly during summer months, and during periods of drought.

5.6 Captive Headstarting and Translocation

There are two conservation programs underway that are supported in part by this HCP, including for Santa Ana sucker and mountain yellow-legged frog. Both programs are described in more detail below.

5.6.1 Santa Ana Sucker Translocation

The purpose of this conservation measure is to increase the abundance, distribution, and resilience of the one existing Santa Ana sucker population in the Santa Ana River Watershed by establishing redundant populations in upper watershed tributaries. A minimum of three[6] new populations of Santa Ana sucker will be established within the highest-ranking streams that meet the suitability criteria established in the Santa Ana Sucker Translocation Plan. Streams considered for translocation sites include the Santa Ana River upstream of Seven Oaks Dam, and City, Plunge, Hemlock, Mill, Bear, and Lytle Creeks. San Antonio Creek, just outside of the Planning Area may also be considered for translocation.

Re-establishing Santa Ana sucker, through captive headstarting and/or rearing (future goal), or direct translocation, to historic habitats is a major recovery goal and objective listed in this HCP (see Section 5.9, SAS Objectives 6 and 7). The Santa Ana Sucker Translocation Plan (Dudek 2018) will guide the effort to translocate Santa Ana sucker into areas where suitable habitat is present in areas of its historic range where it has become extirpated.

The Translocation Plan is intended to serve as a framework for evaluating potential translocation sites, translocating Santa Ana sucker to those sites should they be found suitable, and monitoring the

[6] As required in the City of San Bernardino's settlement agreement with Center for Biological Diversity related to Wastewater Change Petition Order WW0059.

new population, with the ultimate goal of creating and maintaining persistent and reproducing (viable) populations that are resilient to natural disturbance and anthropogenic changes. These efforts would be conducted consistent with the *Recovery Plan for the Santa Ana Sucker* (USFWS 2017) and the *Programmatic Intra-Service Formal Section 7 Consultation on Issuance of 10(a)(1)(A) Permits for the Santa Ana Sucker* (USFWS 2015a), in coordination with the Upper SAR HCP, and with support from the RCRCD.

The Translocation Plan is intended to function as a living document. The intention is to provide a robust monitoring program within an adaptive management framework that can be modified or expanded as new knowledge becomes available to meet proposed success criteria provided in the plan. The following is a summary of the Translocation Plan components.

In order to assess the potential suitability of an identified stream for Santa Ana sucker translocation, a two-staged approach to evaluating a potential translocation site will be conducted. The first phase is to conduct a desktop assessment of the stream under consideration. The purpose of the Stage 1 Evaluation for any given stream is to: (1) identify stream reaches that have the potential to support Santa Ana sucker, and (2) conduct constraints analyses to determine if there are any fatal flaws that may preclude successful Santa Ana sucker translocation, identify physical threats to a successful Santa Ana sucker translocation, and evaluate potential conflicts (landowners, land managers, or human uses) that could adversely affect the success of a Santa Ana sucker translocation effort.

If, after completing the Stage 1 Evaluation, the stream under consideration for Santa Ana sucker introduction is initially determined to be suitable for reintroduction, the Stage 2 Habitat Suitability Evaluation is conducted. The Stage 2 Evaluation quantitatively evaluates the suitability of the stream to support Santa Ana sucker and provides valuable information for determining the general overall status or functioning of the stream. The Stage 2 Evaluation consists of two parts: (1) a comprehensive stream bioassessment following the State Water Resources Control Board's Surface Water Ambient Monitoring Program (SWAMP) Standard Operating Procedures, and (2) a targeted survey of habitat/flow conditions and Santa Ana sucker life-stage specific habitat characteristics and their relative abundance.

Sources of translocated fish include young age classes of Santa Ana sucker collected from the Santa Ana River and captively reared to larger age classes at the RCRCD's Greenbelt Facility, and direct translocation of fish captured from the Santa Ana River. The Translocation Plan describes procedures for the translocations, including age classes and number of individuals to be translocated at a chosen translocation site, release timing, and transportation and release procedures. The Alliance may consider captive rearing of Santa Ana sucker in the future; however, any such plans would be developed in close coordination with the USFWS and CDFW, and be pre-approved by both agencies prior to implementation.

The Translocation Plan includes a methodology for assessing and evaluating the success of translocation efforts. These involve regular surveys of translocated populations to determine if fish have established, are healthy, reproducing, and increasing in distribution. A self-sustaining population of Santa Ana sucker will show evidence of successful spawning and recruitment of multiple generations, have a condition index and demography similar to fish from a naturally occurring mountain population (i.e., San Gabriel River population), maintain a genetically diverse population, increase in distribution in suitable and connected habitats, and display persistence after moderate disturbance events (e.g., storm flow). Large storm flow events are anticipated to move Santa Ana sucker downstream and may potentially cause localized extirpation. This may occur in streams where upstream migration is impeded. Whenever possible, after high flow recedes following storm events, native fish (e.g., Santa Ana sucker and Santa Ana speckled dace) would be relocated upstream. When extirpation or significant depopulation is found to occur Santa Ana sucker would be re-established through successive translocation events. If one or more new populations of Santa Ana sucker are found to fail after repeated attempts of re-establishment, consultation would be sought with the USFWS and CDFW on next steps. A potential next step would be translocating Santa Ana sucker from the San Gabriel River population into Santa Ana River mountain streams. This action would have to be approved by both the USFWS and CDFW to mix these populations of fish. San Gabriel River fish currently occupy mountain streams, and they display recent genetic mixing (Richmond et al. 2017) with the Santa Ana River fish, making them an ideal candidate for translocation.

5.6.2 San Diego Zoo Mountain Yellow-Legged Frog Captive Rearing and Translocation Program

Populations of mountain yellow-legged frogs have declined considerably in Southern California over the past several decades. As stated in the mountain yellow-legged frog 5-year review (USFWS 2012), the primary way to accomplish goals for recovery of the species is through a captive breeding program and possible future translocation between existing populations. In 2011 an emergency salvage was conducted to collect any remaining individuals from East Fork City Creek because reproduction had not been detected at this locality in over 7 years, and the number of adults had been low for many years. This was the last known population in the San Bernardino Mountains and the only population in the Planning Area. The frogs salvaged from City Creek became part of the San Diego Zoo Institute for Conservation Research (renamed the San Diego Zoo Wildlife Alliance) yellow-legged frog captive rearing and reintroduction program. To date, hundreds of tadpoles have been reintroduced to City Creek and are being monitored for survival and signs of successful breeding. Surveys conducted by the U.S. Geological Survey (USGS) in 2020 detected both adult and sub-adult mountain yellow-legged frogs in City Creek, indicating that reintroduction efforts have achieved some level of success.

Currently, populations of mountain yellow-legged frogs occur in the Angeles and San Bernardino National Forests. The U.S. Geological Survey (USGS) has been monitoring the remaining populations of the southern clade of this species since the late 1990s. This work includes restoration and monitoring surveys focused on assessing population size and animal health. Valley District, on behalf of the HCP Permittee Agencies, contributed $64,382 in 2019 to continue this work and will continue to support this effort.

Information gained from USGS's 20-years of surveys will be applied to the recovery actions currently implemented by the Southern California Mountain Yellow-legged Frog Working Group. This group is composed of representatives from USFWS, USGS, Angeles National Forest, San Bernardino National Forest, CDFW, the Los Angeles Zoo, the San Diego Zoo's Institute for Conservation Research, Henry Doorly Zoo, Santa Ana Zoo, and the James San Jacinto Mountains Reserve, University of California Natural Reserve System. Surveys will allow the Working Group to monitor current population trends and die-offs.

In 2020 USGS monitored known populations of mountain yellow-legged frogs within the Santa Ana River watershed during three surveys at each of the following sites: City Creek (East Fork), Fuller Mill Creek (lower), and Dark Canyon. The focus of these surveys was on collecting data on frog demographics, distribution, and population size. Data was also collected on disease, water quality, habitat parameters, and site disturbances. In addition, USGS assisted with releases of captively produced mountain yellow-legged frogs within the Santa Ana River watershed, a process that was agreed to by the Mountain Yellow-legged Frog Working Group.

5.7 Species and Habitat Research

5.7.1 Santa Ana Sucker Population Genetics Research and Management

The focus of Santa Ana sucker translocation efforts is to re-establish or enhance the resistance and resilience to catastrophic disturbance through increased representation, redundancy, and genetic diversity of the population consistent with the species' evolution in Southern California, to the extent this is possible in a modified watershed. Successful translocation of Santa Ana sucker into different parts of the Santa Ana River watershed will require careful management and maintenance of conditions to enhance the genetic diversity of reintroduced populations. Management considerations include spatial placement of recipient sites within the watershed and the genetic diversity of source populations. USFWS, CDFW, USGS, and the Alliance will create a management plan to provide guidance that addresses these management considerations, based on available habitat and genetic data.

Genetic drift in Santa Ana sucker is occurring in the species' Santa Ana River population and may be related to genetic bottlenecks from natural boom-and-bust demographic cycles, the absence of immigration from outside sources, and human-induced mortality (Richmond et al. 2018). Since 1996, when RIX initiated discharge of wastewater into the Santa Ana River, portions of the Santa Ana River were dewatered when the facility periodically shut down discharge due to water quality or power supply issues. During periods of drought this reduction in flow led to a complete dewatering of up to 2 miles of occupied stream. RIX provides approximately 82% of the total base summer flow to the upper portions of the lowland occupied Santa Ana River with a second wastewater facility supplying the remaining surface flow.

Genetic drift and other forms of genetic loss occur primarily due to the loss of genetic variation as a consequence of a reduction in size of a reproducing population (effective population size) which can have long-term adverse effects on species' fitness. As a result, it is important to characterize the genetic health of a population and to track how genetic variability changes over time within and between isolated groups within a population. USFWS, USGS, and the Alliance are collaborating on a Santa Ana sucker genetics study which will provide updated information on the population genetics of Santa Ana sucker in the Santa Ana River using restriction site-associated DNA sequencing (RADseq). This study will assess the current status of the genetic health of the Santa Ana River population and compare this with historic collections of Santa Ana sucker to inform how the genetic health and diversity of this population has changed. The information collected will also be helpful to guide the translocation program (which may include captive rearing in the future) that will ultimately provide fish for re-establishment efforts in portions of the species' historic range within the Santa Ana River watershed.

The Alliance, on behalf of the Permittee Agencies, has contributed $20,000 (22%) of the funding to conduct the Santa Ana Sucker Translocated Populations Genetics Management program, and has committed to contributing $55,000 (60%) of the funding to conduct the Santa Ana Sucker

Population Genetics study as a part of the mitigation for potential impacts on Santa Ana sucker from Covered Activities covered by the HCP.

5.7.2 Mountain Yellow-Legged Frog Surveys

Ongoing Surveys

Mountain yellow-legged frog has declined from more than 99% of its historic range in Southern California over the past several decades. USGS has been monitoring the remaining known populations on East Fork City Creek within the Planning Area, and two sites outside the Planning Area (Lower Fuller Mill Creek and Dark Canyon Creek) since the late 1990s by conducting surveys focused on assessing population size and animal health. The focus of current efforts is to collect data on mountain yellow-legged frog demographics, distribution, and population size as well as disease, water quality, habitat parameters, and site disturbances. USGS will also be assisting with releases of captively-reared mountain yellow-legged frog within the Santa Ana River watershed.

The Alliance, on behalf of the Permittee Agencies, has contributed funds as noted in the mountain yellow-legged frog translocation discussion above to conduct these surveys as a part of the mitigation for potential impacts on mountain yellow-legged frog from Covered Activities covered by the HCP. The Alliance will continue to support ongoing surveys within the Planning Area.

Environmental DNA Survey

Surveys over the past decade have proven costly and labor-intensive because mountain yellow-legged frog is difficult to detect through traditional survey techniques. The Environmental DNA (eDNA) survey will utilize a new technique that may be less expensive while providing data needed to achieve current protocols. It involves the collection of DNA that has been introduced into the aquatic system by species from shed skin cells, feces, urine, or other means from water samples using flow-through filters and then analyzed with DNA “fingerprinting” techniques. Studies have demonstrated that recovering eDNA from stream water is possible even with low densities of amphibian populations (Goldberg et al. 2011). The technique can be applied to detect the presence of multiple species simultaneously. For example, water samples can be analyzed to identify new locations of mountain yellow-legged frog presence, evaluate threats of known predators (e.g., rainbow trout, bullfrogs, garter snakes) and/or pathogens, and to determine the effectiveness of nonnative fish removal programs. Therefore, eDNA can be used as a proxy for ecosystem health and can help identify and prioritize where management efforts are most needed.

The eDNA study will complete the following: (1) determine if eDNA from mountain yellow-legged frog and other aquatic species are detectable in Southern California streams; (2) develop protocols for eDNA collection and analysis; and (3) assess the power to detect species across a range of environmental variables. If successful, the benefits of using eDNA could include cost savings, reduction in permitting issues, and a more efficient and less invasive means of data collection.

The Alliance, on behalf of the Permittee Agencies, has contributed $70,000 (54%) of the funding to complete the eDNA survey as a part of the mitigation for potential impacts on mountain yellow-legged frog from Covered Activities covered by the HCP. Use of this technique to survey for presence of the species will be explored as part of the CAMMP.

5.7.3 Western Spadefoot Updated Population Survey

There is limited information about western spadefoot distribution within the Planning Area. USGS recently completed habitat suitability modeling for the northern range of the spadefoot and is developing a similar model for Southern California. USGS is compiling historic records for the species, identifying breeding sites, and conducting surveys to evaluate occupancy of spadefoot at these sites, and identify breeding sites. A USGS spadefoot survey was conducted in Southern California in 2020 to provide data for this model. One population of spadefoot was confirmed in the Planning Area near the proposed Devil Creek Diversion and Basins Covered Activity.

The Alliance, on behalf of the Permittee Agencies, is contributing $20,000 (66% of total funding) to conduct western spadefoot surveys and analysis by USGS as a part of the HCP conservation strategy. The Alliance will continue to support regional survey efforts in the future.

5.7.4 Santa Ana Speckled Dace Population Survey and Threats Analysis

In Southern California, including the Santa Ana River watershed, Santa Ana speckled dace have suffered dramatic declines due to habitat loss, altered hydrology, and the effects of fire/flood regimes in the upper watershed creeks of the San Bernardino National Forest. However, the status and distribution of this species is largely unknown throughout much of its former range. All known information on the status and distribution within the Santa Ana River watershed will be compiled to develop contemporary and historic distribution maps. Surveys will be completed in many localities to fill in gaps in information on presence/absence, demographics, and remaining suitable habitat. Where management actions are conducted within the HCP Preserve System on occupied streams, tissue samples will be collected for tracking the genetic health of Santa Ana speckled dace. In streams where the status of Santa Ana speckled dace is unknown, the CAMMP may develop and use eDNA to track this species, as well as to help develop a threat assessment at locations where surveys take place.

The Alliance, on behalf of the Permittee Agencies, has contributed $20,000 (93% of the funding) to conduct Santa Ana speckled dace surveys and analysis by USGS as a part of the HCP conservation strategy. The Alliance will continue to support regional survey efforts in the future.

5.7.5 Southwestern Pond Turtle Population Survey and Threats Analysis

Southwestern pond turtle is currently being evaluated for listing under the Federal Endangered Species Act. In Southern California, dramatic declines have occurred due to habitat loss, altered hydrology, and the introduction of nonnative species. However, the status and distribution of this species is largely unknown throughout much of its former range. Within the Santa Ana River watershed, surveys are needed in many localities to establish presence/absence, demographics, and remaining suitable habitat. These data are needed to establish the existing population level in the HCP Planning Area in order to demonstrate the benefits of conservation activities over time.

Few positive observations have been made in recent years along the Santa Ana River within the Planning Area. This project will conduct surveys in the wetted reaches of the Santa Ana River and its tributaries to further document the occupied areas within western Riverside and southwestern San

Bernardino Counties, as well as record demographics to assess the health of remaining populations. The surveys will include habitat suitability assessments to determine whether appropriate habitat exists at survey locations where southwestern pond turtles are not detected. Additionally, threats from invasive species will be identified, especially nonnative turtles. Nonnative turtles and any other invasive species, such as bullfrogs, will be recorded and removed from the environment, when possible.

The survey and threat analysis will include reconnaissance surveys, trapping surveys, removal of nonnative aquatic species, and compilation of survey results into a report.

The Alliance, on behalf of the Permittee Agencies, has contributed $30,000 (33% of the funding) to conduct southwestern pond turtle surveys and analysis as a part of the HCP conservation strategy. One population of southwestern pond turtle was confirmed after much of the potentially suitable habitat was surveyed by USGS in 2020. Additional surveys are planned for 2021, and the Alliance will continue to support regional survey efforts in the future.

5.8 Conservation Bank Credits

The Lytle Creek Conservation Bank and Cajon Creek Conservation Bank are in the alluvial floodplain and active channel of Lytle Creek and Cajon Creek, respectively, near the confluence of Lytle and Cajon Creeks (north of Interstate [I-] 210 and west of I-215). Both banks have habitat conservation values available to mitigate impacts on San Bernardino kangaroo rat and Santa Ana River woolly-star.

Mitigation to offset impacts on Covered Species (and their habitat) from Covered Activities within Alluvial Fan Preserve Unit B will be satisfied by land acquisition, habitat improvement (restoration and/or rehabilitation), and management of lands within this same Preserve Unit. Mitigation lands are actively being pursued for acquisition into the HCP Preserve System; however, if additional mitigation is needed above and beyond these actions then conservation/mitigation credits in the Lytle Creek or Cajon Creek Conservation Banks may be used. If the purchase of bank credits is proposed to offset Covered Activity impacts, the HCP's Up-Front and Stay-Ahead Provisions, and the ICCP (see Section 6.5.2, *Implementing Entity Responsibilities*), will afford the USFWS the opportunity to review and comment on such a proposal in advance of bank credit purchase.

5.9 Species-Specific Conservation Strategies

The species-specific conservation strategies are the heart of the HCP conservation strategy. Each strategy is described in terms of the conservation objectives and conservation actions developed specifically for that species. The strategy describes the species-specific avoidance and minimization measures (AMMs) to be implemented in addition to the general avoidance and minimization measures for the HCP (Section 5.11, *Measures to Avoid and Minimize Effects*). The species-specific conservation strategy then describes the net benefit for the species, taking into consideration the impacts from all Covered Activities, in balance with the expected mitigation resulting from implementation of the HCP Preserve System (restoration/rehabilitation projects, acquisitions and easements, monitoring and management), avoidance and minimization measures, and other supporting research. Each species-specific conservation strategy brings together all the analysis of the HCP that is relevant to the species in order to determine the net effect on the species (and critical habitat if designated) and to demonstrate that the proposed conservation measures offset impacts caused by the implementation of Covered Activities to the maximum extent practicable such that an incidental take permit may be issued for the Covered Species.

For each Expected Outcome (net benefit) a table is included that summarizes the total impact of Covered Activities in acres side-by-side with the conserved land in acres in the HCP Preserve System. The Expected Outcome is an estimate based on acres of modeled suitable habitat impacted and conserved for each species. Note that only a subset of modeled suitable habitat would be expected to be occupied; however, all modeled suitable habitat within the HCP Preserve System will be managed and monitored to benefit the Covered Species. In addition, the Expected Outcome includes an estimate of habitat to be restored for the species. A portion of this area is included in the modeled suitable habitat for the species, while other portions are not currently modeled as suitable habitat but would be restored to be suitable for the species.

While this section describes species-specific conservation strategies and avoidance and minimization measures for all Covered Species, there are two species, Delhi Sands flower-loving fly and arroyo toad, that are also addressed below. These two species will be completely avoided, and therefore will not require coverage for incidental take under this HCP. To ensure that all Covered Activities completely avoid impacts on these two species, avoidance measures (AMs) to fully avoid these species are included in Section 5.10, *Fully Avoided Species*.

Management to maintain and improve habitat and monitoring to ensure the compliance with and effectiveness of the conservation actions listed below will be conducted according to the CAMMP. A framework for the CAMMP is provided in Section 5.12. Detailed Preserve Unit Plans (PUPs) will be developed under the CAMMP for each of the five preserve units in the HCP Preserve (see Section 5.4, *HCP Preserve System*, and Section 5.12, *Comprehensive Adaptive Management and Monitoring Program*). The PUPs will be developed to focus on the specific management and monitoring needs of the species that occur in those habitats in each geographic region of the Preserve System. Unless otherwise identified, monitoring actions for Santa Ana sucker and arroyo chub within the mainstem of the Santa Ana River will be completed annually. All other species monitoring and survey activities will occur within a year of conservation lands being added to the HCP Preserve System and at intervals determined in the CAMMP (see Section 5.12).

Table 5-6 summarizes how the HCP Goals and Objectives benefit each Covered Species through the implementation of species-specific conservation actions.

Table 5-6. Summary of Conservation Actions to Accomplish the HCP Goals and Objectives by Preserve Unity and Habitat Community

HCP Conservation Goals and Objectives	Species Conservation Benefit	Associated Species Conservation Actions
HCP Goals • Conserve Covered Species and manage their habitats to contribute to the recovery of species listed or those that may become listed under the Federal Endangered Species Act. • Maintain or simulate natural ecological processes necessary to maintain the functionality of the natural communities and habitats upon which the Covered Species depend within the HCP Preserve System and to the greatest extent possible outside the HCP Preserve System. • Maintain or increase habitat connectivity in the HCP Preserve System and to adjacent protected habitat areas to reduce isolation between metapopulations of Covered Species.		

<table>
<tr><td colspan="3">• Actively manage lands within the HCP Preserve System for the benefit of Covered Species to maintain or increase the health of populations.</td></tr>
<tr><td colspan="3">HCP Objective 1: Conserve, restore/rehabilitate, and manage a minimum of 1,348.8 acres of native habitat for Covered Species in the HCP Preserve System over the duration of the life of the permit.</td></tr>
<tr><td colspan="3">Alluvial Fan Preserve Units (A and B)</td></tr>
<tr><td rowspan="9">Alluvial Fan Sage Scrub and other Shrublands: 584 acres of conserved, restored and/or rehabilitated, and managed lands.
Conserve high quality topsoil by sequestering and maintaining topsoil during ground-disturbing activities and re-applying to restoration projects where appropriate.</td><td>Burrowing owl</td><td>BUOW 1A, 1B, 1D</td></tr>
<tr><td>Cactus wren</td><td>CACW 1A, 1B, 1C, 2A, 2B, 2C</td></tr>
<tr><td>California glossy snake</td><td>CGSN 1</td></tr>
<tr><td>Coastal California gnatcatcher</td><td>CAGN 1, 2</td></tr>
<tr><td>Los Angeles pocket mouse</td><td>LAPM 1, 2A, 2B, 2C</td></tr>
<tr><td>San Bernardino kangaroo rat</td><td>SBKR 1, 2A, 2B, 2C, 2D, 2F</td></tr>
<tr><td>Santa Ana River woolly-star</td><td>SARW 1, 2A-D</td></tr>
<tr><td>Slender-horned spineflower</td><td>SHSF 1A, 1B, 2A</td></tr>
<tr><td>Western spadefoot</td><td>WESP 1, 3</td></tr>
<tr><td colspan="3">Santa Ana River Preserve Unit</td></tr>
<tr><td rowspan="11">Aquatic (stream) and Riparian habitats in and along tributaries: increase the amount and quality of available foraging and spawning habitats along 3.9 linear miles (3.6 acres of tributary stream habitat) of mainstem Santa Ana River tributary streams at Anza, Old Ranch, Lower Hole, and Hidden Valley Creek Restoration Areas through substrate augmentation. Provide supplemental surface flow (tertiary treated wastewater) to these four streams, and Tequesquite Creek, and Lake Evans.
Conserve, restore and/or rehabilitate, and manage a minimum of 232 acres of aquatic and riparian habitat in the Preserve System (wetland, riparian, and permanent water vegetation types).</td><td>Santa Ana sucker</td><td>SAS 1A, 1B, 2A-E, 3A-E,4A, 4B, 4D, 4E, 5A</td></tr>
<tr><td>Arroyo chub</td><td>ARCH 1, 2, 3A, 3B, 4</td></tr>
<tr><td>Least Bell's vireo</td><td>LBVI 1, 2A, 2B</td></tr>
<tr><td>Mountain yellow-legged frog</td><td>MYLF 1A, 1B</td></tr>
<tr><td>South coast garter snake</td><td>SCGS 1, 2A-D, 3B</td></tr>
<tr><td>Southwestern pond turtle</td><td>SWPT 1A-C, 2A, 2B, 3B</td></tr>
<tr><td>Southwestern willow flycatcher</td><td>SWFL 1, 2A, 2B</td></tr>
<tr><td>Tricolored blackbird</td><td>TRBL 1, 2A-C, 3B</td></tr>
<tr><td>Western spadefoot</td><td>WESP 1, 3</td></tr>
<tr><td>Western yellow-billed cuckoo</td><td>WYBC 1, 2A, 2B</td></tr>
<tr><td>Yellow-breasted chat</td><td>YBCH 1A, 2A, 2B</td></tr>
<tr><td colspan="3">Santa Ana Sucker Translocation Units</td></tr>
<tr><td rowspan="2">Conserve, restore and/or rehabilitate, and manage at least 264 acres of riparian, aquatic, and shrubland (wetland, riparian, permanent water, dry channel/shrubland, alluvial fan sage scrub, other</td><td>Santa Ana sucker</td><td>SAS 1A, 2A-E, 3A-E, 4A, 4B, 4D, 4E, 5A</td></tr>
<tr><td>Mountain yellow-legged frog</td><td>MYLF 1A, 1B</td></tr>
</table>

shrublands, grassland, and rock outcrop vegetation types).	Santa Ana speckled dace	SASD 2A, 2B
HCP Objective 2: Reduce anthropogenic and environmental threats to Covered Species and their habitats within the HCP Preserve System		
All Preserve Units		
Aquatic (stream) and Riparian habitats: reduce anthropogenic impacts on Santa Ana sucker and sucker habitat, for example (1) install trash racks at lowland tributaries; (2) install signs to educate the general public on the sensitivity of the Santa Ana sucker and goals of the HCP; (3) protect riparian habitat from unauthorized human access; (4) coordinate with flood control agencies to reduce the amount of riparian mowing adjacent to Santa Ana sucker habitat; and (5) reduce the impact of migrant encampments within the Preserve System.	Arroyo chub	ARCH 3A, 3B
	Burrowing owl	BUOW 1B, 1C
	Mountain yellow-legged frog	MYLF 1C, 2
	Least Bell's vireo	LBVI 3
	Los Angeles pocket mouse	LAPM 2B
	San Bernardino kangaroo rat	SBKR 2B
	Santa Ana speckled dace	SASD 2B, 2C, 2D
	Santa Ana sucker	SAS 4A-D, 4F
	Slender-horned spineflower	SHSF 1B
	South coast garter snake	SCGS 2D, 3A, 3B
	Southwestern pond turtle	SWPT 1C, 3A, 3B
	Southwestern willow flycatcher	SWFL 1B, 2B
	Tricolored blackbird	TRBL 3A, 3B
	Western yellow-billed cuckoo	WYBC 2B
	Yellow-breasted chat	YBCH 1B, 2B
HCP Objective 3: Maintain and successfully enhance existing and new Santa Ana sucker habitats		
Santa Ana River Preserve Unit		
Aquatic (stream) habitat in the mainstem of the Santa Ana River: enhance Santa Ana sucker habitat in the mainstem of the Santa Ana River with the addition of at least six habitat nodes and/or stream bifurcation structures. Removal of fine sediment in the Prado Basin to enhance habitat for native fishes with a goal of enhancing (increasing) bed coarseness by transporting fine-grained sediment off of existing coarse sediment. Aquatic (stream) habitat in the Rialto Channel: reduce water temperature in Rialto Channel to less than 86°F to provide year-round habitat for Santa Ana sucker.	Arroyo chub	ARCH 1, 2, 3A, 3B, 4
	Santa Ana sucker	SAS 1A, 2A-E, 3A-E, 4A, 4B, 4D, 4E, 5A
HCP Objective 4: Maintain and successfully enhance existing San Bernardino kangaroo rat habitats		

Alluvial Fan Preserve Units (A and B)		
Restore and/or rehabilitate a minimum of 504 acres of alluvial fan sage scrub habitat through nonnative plant management, and other methodology such as sediment enhancement and fluvial disturbances.	Santa Ana River woolly-star	SARW 1, 2B-D
	Los Angeles pocket mouse	LAPM 2A, 2B, 2C
	San Bernardino kangaroo rat	SBKR 2A, 2B, 2C, 2D, 2F
HCP Objective 5: Implement successful conservation measures to promote the recovery of Covered Species		
Alluvial Fan Preserve Units (A and B)		
Restore and provide long-term management of Los Angeles pocket mouse and San Bernardino kangaroo rat habitat to promote genetically diverse populations in appropriate areas within the Preserve System.	San Bernardino kangaroo rat	SBKR 2A-F, 3A
	Los Angeles pocket mouse	2A-C, 3A, 3B
	Slender-horned spineflower	SHSF 1B, 2B
	Santa Ana River woolly-star	SARW 2A-D
Santa Ana Sucker Translocation Preserve Units (A and B)		
Provide long-term management of Santa Ana sucker habitat in the San Bernardino National Forest to establish and support three or more new populations of Santa Ana sucker. Provide support for Santa Ana speckled dace, and mountain yellow-legged frog populations and translocation and relocation efforts.	Mountain yellow-legged frog	MYLF 1C, 4A, 4B
	Santa Ana sucker	SAS 4F, 6A, 6B, 7A, 7B
	Santa Ana speckled dace	SASD 2A, 2B, 2D
HCP Objective 6: Conduct scientific research in order to improve our knowledge and fill existing and future data gaps		
All Preserve Units		
Support or conduct studies to further the current understanding of Covered Species including: habitat requirements, population and genetics studies, threat assessments, and general species information.	Burrowing owl	BUOW 1C
	California glossy snake	CGSN 2A, 2B
	Los Angeles pocket mouse	LAPM 3A, 3B
	Mountain yellow-legged frog	MYLF 1C, 2, 3, 4A, 4B
	Southwestern pond turtle	SWPT 2A, 2B
	Western spadefoot	WESP 2A, 2B
	San Bernardino kangaroo rat	SBKR 2E, 3
	Santa Ana River woolly-star	SARW 2A-D
	Santa Ana sucker	SAS 1B, 4A, 4C, 5B, 7A, 7B

	Santa Ana speckled dace	SASD 1, 2A
	Slender-horned spineflower	SHSF 2B, 2C

5.9.1 Slender-Horned Spineflower (SHSF)

Conservation Objectives and Actions

SHSF Objective 1: Permanently conserve and manage, with conservation easements, slender-horned spineflower occupied or occupiable habitats within the HCP Preserve System.

SHSF Action 1A: If impacts from Covered Activities on slender-horned spineflower occupied habitat cannot be avoided, occupied slender-horned spineflower habitat of similar size, from within the same alluvial fan preserve unit where the impacts will occur, will be acquired, protected, and managed in advance of proposed Covered Activity impacts. Acquisition and restoration and/or rehabilitation of occupiable habitats may be necessary to fulfill this action. Success criteria for habitat improvement projects intending to establish new occupied habitat are an important consideration that will be developed through the CAMMP and fulfilled prior to any ground-disturbing impacts.

SHSF Action 1B: Rehabilitate known patches of extant and potentially extirpated slender-horned spineflower habitat in the HCP Preserve System through plant management (native and/or nonnative based upon need) or other means that will be developed using the best available science available and oversight by a qualified botanist and/or restoration ecologist. Specific success criteria and monitoring and management techniques and frequency will be developed in the CAMMP.

SHSF Objective 2. Conserve and manage slender-horned spineflower modeled suitable habitat to accommodate future changes in distribution in response to environmental conditions or management actions undertaken for the benefit of slender-horned spineflower or other Covered Species.

SHSF Action 2A: Conserve a minimum of 531.7 acres of modeled suitable habitat in the HCP Preserve System.

SHSF Action 2B: Coordinate with the Upper Santa Ana River Wash HCP (Wash Plan) Spineflower Restoration Program and other entities conducting conservation work for this species, as appropriate, to facilitate optimization of conservation benefits for the species through adoption of best available science to inform the CAMMP. For example, the Alliance will conduct/fund research on soil removal and sequestration techniques (including duration of soil retention), and the efficacy of reuse in restoration efforts. The results of such research will help guide methodology of habitat restoration efforts.

SHSF Action 2C: Determine the current extent and location of slender-horned spineflower patches in the HCP Preserve System and monitor population trends over time.

Monitoring of species conservation actions is addressed in Section 5.12.

Measures to Avoid and Minimize Effects

SHSF AMM-1: New construction projects in occupied slender-horned spineflower habitat will be avoided if feasible. For projects where the exact location of Covered Activity impacts has not been determined, the Permittee Agency must consider alternatives outside of occupied habitat. If an alternative in occupied habitat is selected, the Permittee Agency must demonstrate to the Alliance why it was not possible to locate the project in unoccupied habitat and must limit the impact to no more than 20% of the plants at that site. Further, if the Alliance has not already acquired and enhanced occupied slender-horned spineflower habitat that could be used as mitigation in advance of the impactful Covered Activity, the Permittee Agency will be solely responsible for fully funding the Alliance to locate, acquire, conserve, protect, and manage, in perpetuity, occupied[7] slender-horned spineflower habitat in advance of the proposed Covered Activity.

SHSF AMM-2: A qualified botanist will conduct pre-activity surveys in areas where impacts are proposed to occur, following *Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Sensitive Natural Communities* (CDFW 2018). The qualified botanist will also survey a known slender-horned spineflower reference site(s) to ensure plants are detectable. Note: multiple annual surveys may be necessary if surveys are conducted during periods of extended drought. If plants are detected, the qualified botanist will communicate findings in a survey report that also includes a plan for seed collection and storage. The survey report will be submitted to the Alliance and USFWS and CDFW for review prior to commencement of project activities including site preparation and equipment staging. Seeds will be collected at the appropriate time of year prior to ground disturbance.[8] Seed collection and storage will be by an entity that is qualified to process and handle the seeds of endangered plant taxa. No additional surveys are required after completion of surveys following CDFW (2018) where slender-horned spineflower are not detected. Surveys will remain valid for a period of not more than 3 years: if a Covered Activity is not initiated within 3 years of completion of surveys following CDFW 2018, new surveys will need to be conducted to verify original survey results remain unchanged.

SHSF AMM-3: Erect a temporary fence to protect known occurrences within 50 feet of Covered Activities. A qualified botanist and/or biological monitor will monitor construction activities, maintain the markers limiting construction, and maintain the fence protecting the plants to prevent accidental disturbance.

SHSF AMM-4: Surface soils, to approximately 2 inches in depth, will be removed and sequestered at the beginning of any ground-disturbing construction or operations and maintenance (O&M) activity where slender-horned spineflower is present or in the immediate vicinity. The area, depth, and amount of soil collected and location and preservation of the soil stockpiles will be determined by the qualified botanist. If cryptogamic soil crust is also present, an attempt will be made to harvest and preserve soil blocks that will be placed back on the site in areas of temporary impact. If the impacts are permanent, an alternate site in suitable habitat will be selected in consultation with a qualified botanist or restoration biologist. After the sequestered soil is returned to a site, it will be

[7] Occupiable habitat may be substituted, but only following successful demonstration of slender-horned spineflower establishment.

[8] Seed collection and storage will be by the entity that has a Memorandum of Understanding with the USFWS and CDFW to process and handle seeds of endangered plant taxa. An Incidental Take Permit will also be needed from CDFW to conduct seed collection. The Alliance or an entity contracted by the Alliance may collect spineflower seed on behalf of the entity holding the Memorandum of Understanding if they first obtain clearance from the Wildlife Agencies, and they receive supervised instruction in the collection and handling of spineflower seed.

replanted with the previously collected slender-horned spineflower seed over consecutive years following the ground disturbance. The timing and methods of planting will be determined by the Alliance in consultation with a restoration biologist and will incorporate adaptive management.

Expected Outcomes

Implementation of the Covered Activities would result in the permanent loss of 311.2 acres and the temporary loss of 114.0 acres of slender-horned spineflower modeled habitat within the Planning Area (Section 4.6.2, *Plant Species*). Of the permanent impacts a portion occurs where Permittees currently conduct groundwater recharge activities (30.6 acres are within existing basins); therefore, permanent impacts on modeled habitat are less: 280.6 acres. There are no anticipated impacts on known occurrences of slender-horned spineflower, except for disturbances from possible seed collecting activities to support restoration/rehabilitation efforts.

Approximately 531.7 acres of modeled habitat are expected to be conserved within the HCP Preserve System (note: the estimate of conserved modeled habitat excludes all developed and Covered Activity footprints).

Table 5-7 summarizes the estimated impacts and conservation of modeled habitat for slender-horned spineflower. Also detailed in Table 5-7 is the HCP's Up-Front and Stay-Ahead Provisions (Section 5.4.1,), which will ensure that mitigation for the species will stay ahead of Covered Activity impacts by a minimum of 10%.

The slender-horned spineflower avoidance and minimization measures will ensure that potential effects on the species are reduced to the greatest extent practicable, and implementation of the species' conservation actions and Up-Front and Stay-Ahead Provisions (Table 5-7) will ensure any potential impacts are offset. The conservation actions and Up-Front and Stay-Ahead Provisions for slender-horned spineflower are anticipated to result in long-term conservation benefits to the species. When considered along with the amount of modeled habitat that will be rehabilitated, restored, and conserved in the HCP Preserve System, the implementation of HCP Covered Activities would not threaten the continued existence of the species.

Table 5-7. Acres of Modeled Suitable Habitat Estimated to Be Impacted and Conserved for Slender-Horned Spineflower by HCP Implementation Phase, and the Species' Up-Front and Stay-Ahead Mitigation Strategy

	Impacts		Mitigation	
Modeled Suitable Habitat By Phase	**Permanent**[1]	**Temporary**	**HCP Preserve System**	**Stay-Ahead Provision %**
All Model Categories[2]				
Up-Front (Pre-Phase 1)			17.1	--
Phase 1	121.5 (24.9)	61.9	465.1	204%
Phase 2	47.7 (5.7)	50.3	49.3	112%
Phase 3	79.6	0.2	--	61%
Phase 4	62.4	1.6	--	35%
Total	*311.2 (30.6)*	*114.0*	*531.5*	
Current Occupied Habitat (modeled)				
Up-Front (Pre-Phase 1)				

Modeled Suitable Habitat By Phase	Impacts: Permanent[1]	Impacts: Temporary	Mitigation: HCP Preserve System	Stay-Ahead Provision %
Phase 1	0.0	0.0	0.1	
Phase 2	0.0	0.0	--	
Phase 3	0.0	0.0	--	
Phase 4	0.0	0.0	--	
Total	*0.0*	*0.0*	*0.1*	
Historic Occupied Habitat (modeled)				
Up-Front (Pre-Phase 1)				
Phase 1	<0.1 (<0.1)	0.0	--	
Phase 2	0.0	0.0	--	
Phase 3	0.0	0.0	--	
Phase 4	0.0	0.0	--	
Total	*<0.1 (<0.1)*	*0.0*	--	
Potentially Suitable Habitat				
Up-Front (Pre-Phase 1)			17.1	
Phase 1	121.5 (24.9)	61.9	465.1	
Phase 2	47.7 (5.7)	50.3	49.3	
Phase 3	79.6	0.2	--	
Phase 4	62.4	1.6	--	
Total	*311.2 (30.6)*	*114.0*	*531.5*	
Total Modeled Suitable Habitat	311.2 (30.6)	114.0	531.7	
Total Modeled Habitat Outside of Existing Basins	**280.6**	**114.0**	**531.7**	
Planned Habitat Improvement (Alluvial Fan Sage Scrub)			**509.4**	

[1] Impact acreages in parentheses are within existing water recharge/flood control basins subject to regular O&M activities, and are a subset of the total acres. For example, of the 311.2 acres of permanent impacts, 30.6 acres occur within existing basins. Consequently, impacts outside of basins are 311.2 – 30.6 = 280.6 acres.
[2] “All Model Categories” was created only for the purposes of summarizing the model categories presented in this table. Because of the number of model categories, the Stay-Ahead Provision is presented only for the All Model Categories summary.

5.9.2 Santa Ana River Woolly-Star (SARW)

Conservation Objectives and Actions

SARW Objective 1. Permanently conserve, restore and/or rehabilitate, and manage Santa Ana River woolly-star occupied habitat within the HCP Preserve System to offset the effects of impacts on Santa Ana River woolly-star resulting from Covered Activities.

SARW Action 1: Conserve with conservation easements, restore and/or rehabilitate, and manage 433.0 acres of modeled suitable habitat, primarily alluvial fan sage scrub, or adjacent habitats, where the species has been known to occur within the HCP Preserve System. This includes portions of the 295-acre Enhanced Recharge Basin Project, and the approximate 20-acre Drainage A Woolly-Star Project (an alternate location of similar acreage will be preserved if lands associated with Drainage A cannot be acquired).

SARW Objective 2: Expand the distribution of Santa Ana River woolly-star in the HCP Preserve System.

SARW Action 2A: Determine the current extent and location of Santa Ana River woolly-star in the HCP Preserve System, monitor population trends over time, and assess the effectiveness of management actions.

SARW Action 2B: Collect Santa Ana River woolly-star seeds and topsoil, through collection within the HCP Preserve System or from Covered Activity impact areas to be used at restoration sites. Conduct/fund research on soil removal and sequestration techniques (including duration of soil retention) and the efficacy of its reuse in restoration efforts. The results of such research will help guide methodology of habitat restoration efforts as part of the CAMMP.

SARW Action 2C: Plant collected Santa Ana River woolly-star seed with topsoil at restoration sites and identified areas within the HCP Preserve System that have achieved nonnative plant control objectives (as defined in the CAMMP). Planting will be scheduled and implemented by the Alliance and will follow currently accepted planting methods and timing.

SARW Action 2D: Conduct experiments/pilot projects to simulate ecological processes to benefit Santa Ana River woolly-star within the HCP Preserve System and inform the long-term adaptive management and monitoring program.

Monitoring of species conservation actions is addressed in Section 5.12.

Measures to Avoid and Minimize Effects

SARW AMM-1: New construction projects in occupied Santa Ana River woolly-star habitat will be avoided if feasible. For projects where the exact location of Covered Activity impacts has not been determined, the Permittee Agency must consider alternatives outside of occupied habitat. If an alternative in occupied habitat is selected, the Permittee Agencies must demonstrate to the Alliance why it was not possible to locate the project in unoccupied habitat. Further, if the Alliance has not already acquired and enhanced occupied Santa Ana River woolly-star habitat that could be used as mitigation in advance of the impactful Covered Activity, the Permittee Agency will be solely responsible for fully funding the Alliance to locate, acquire, conserve, protect, and manage, in perpetuity, occupied Santa Ana River woolly-star habitat in advance of the proposed Covered Activity. Mitigation lands will be acquired within the same Alluvial Fan Preserve Unit as impacts.

SARW AMM-2: A qualified botanist will conduct pre-activity surveys, during the appropriate season, in areas where permanent and temporary impacts (including O&M activities) (CDFW 2018). If plants are detected, the qualified botanist will communicate findings in a survey report that also includes a plan for seed collection and storage. The survey report will be submitted to the Alliance and USFWS and CDFW for review prior to commencement of project activities including site preparation and equipment staging. Seeds will be collected at the appropriate time of year prior to ground disturbance.[9] Seed collection and storage will be by an entity that is qualified to process and handle the seeds of endangered plant taxa. No additional surveys are required after completion of surveys following CDFW guidelines (CDFW 2018) where Santa Ana River woolly-star are not detected. Note however, this is contingent on surveys being conducted during the appropriate season, and surveys are not conducted during an extended period (> 3 years) of drought. Surveys will remain valid for a period of not more than 3 years: if a Covered Activity is not initiated within 3 years of completion of surveys, new surveys will be conducted to verify original survey results remain unchanged. Prior to ground disturbance from new construction and O&M activities in potentially suitable Santa Ana River woolly-star habitat, surveys will be conducted by a qualified botanist to determine if the species is present.

SARW AMM-3: When Covered Activities will take place within 50 feet of known occurrences of Santa Ana River woolly-star, a temporary fence will be erected to protect them. A qualified botanist and/or biological monitor will monitor construction activities, maintain the markers limiting construction, and maintain the fence protecting the Santa Ana River woolly-star, to prevent accidental disturbance.

SARW AMM-4: Surface soils will be removed and sequestered at the beginning of any ground-disturbing construction or O&M activity where Santa Ana River woolly-star is present. In areas of temporary impacts, surface soils will be returned to the site. In permanently impacted areas, sequestered soil will be relocated and distributed in non-impacted or temporarily impacted areas within the project site, where feasible, or distributed at an alternative site in consultation with the qualified botanist or restoration biologist. The timing and methods of soil sequestration and redistribution will be determined by the Alliance as part of the CAMMP in consultation with the restoration biologist and following best available science and information.

SARW AMM-5: Sites where temporary impacts occur will be replanted with the previously collected Santa Ana River woolly-star seed over consecutive years following the ground disturbance. The timing and methods of planting will be determined by the Alliance in consultation with a qualified botanist or restoration biologist with Santa Ana River woolly-star experience and will incorporate adaptive management. If the impacts are permanent, an alternate site in suitable habitat will be selected by a qualified restoration biologist or botanist.

SARW AMM-6: The replanting/soil re-distribution sites will be monitored and managed to achieve and maintain success criteria developed by the HCP Preserve System Management Committee (see Chapter 6, *Plan Implementation*).

Expected Outcomes

Implementation of Covered Activities would result in the permanent loss of 406.6 acres and the temporary loss of 57.8 acres of Santa Ana River woolly-star modeled suitable habitat in the Planning Area (Table 5-8). Of the permanent impacts, a portion occurs where Permittees currently conduct groundwater recharge activities (31.9 acres are within existing basins); therefore, permanent

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[9] Seed collection and storage will be by the entity that has a Memorandum of Understanding with USFWS and CDFW to process and handle seeds of endangered plant taxa. An Incidental Take Permit will also be needed from CDFW to conduct seed collection. The Alliance or an entity contracted by the Alliance may collect Santa Ana River woolly-star seed on behalf of the entity holding the Memorandum of Understanding if they first obtain clearance from the Wildlife Agencies, and they receive supervised instruction in the collection and handling of woolly-star seed.

impacts on modeled habitat outside of existing basins are 374.7 acres. Covered Activities have been identified to overlap with documented current occurrences of the species, indicating that impacts on Santa Ana River woolly-star may occur.

Impacts are also broken down by Preserve Unit for the two Alluvial Fan Preserve Units (Table 5-9 and Table 5-10). Within Alluvial Fan Preserve Unit A there are a total of 104.8 acres of permanent impacts (19.1 acres of which occur in existing basins) and 31.0 acres of temporary impacts on modeled habitat. Within Alluvial Fan Preserve Unit B there are a total of 264.5 acres of permanent impacts (4.3 acres of which occur in existing basins) and 10.4 acres of temporary impacts on modeled habitat.

A minimum of approximately 433 acres of modeled suitable habitat, with confirmed Santa Ana River woolly-star occupancy, or areas connected to occupied habitat are expected to be conserved, restored and/or rehabilitated, and managed in perpetuity within the HCP Preserve System. Within Alluvial Fan Preserve Unit A portions of the 295-acre Enhanced Recharge Basin Project, the Santa Ana River Refugia Project, and the Drainage A Woolly-Star Project, all of which support current occurrences of the species, are proposed for restoration and/or rehabilitation to benefit Santa Ana River woolly-star. As identified in Table 5-9, mitigation for Santa Ana River woolly-star within Alluvial Fan Preserve Unit A will meet the Stay-Ahead Provisions for all HCP implementation phases.

Within Alluvial Fan Preserve Unit B approximately 57.9 acres Santa Ana River woolly-star modeled habitat have been identified. These lands occur in the Devil Canyon Conservation Area. Habitat improvement activities will occur at this location, and the 57.9 acres of modeled habitat could be used to offset Covered Activity impacts on Santa Ana River woolly-star modeled habitat. However, because these lands are not occupied by the species they could not be used as mitigation to offset impacts on Santa Ana River woolly-star occupied habitat. Lands supporting documented occurrences of Santa Ana River woolly-star within Alluvial Fan Preserve Unit B are actively being pursued for acquisition, restoration/rehabilitation, and long-term monitoring and management. Property supporting the species within Alluvial Fan Preserve Unit B is expected to be acquired prior to initiation of Covered Activities, and the Alliance will ensure that no Covered Activities that impact the species can occur within Alluvial Fan Preserve Unit B unless lands supporting the species have been acquired and are under active management in advance of impacts. Habitat improvement activities in both Alluvial Fan Preserve Units will benefit Santa Ana River woolly-star.

Table 5-8 summarizes the estimated impacts and minimum conservation of modeled habitat for Santa Ana River woolly-star. Also detailed in Table 5-8 is the HCP's Up-Front and Stay-Ahead Provisions (Section 5.4.1), which will ensure that mitigation for the species will stay ahead of Covered Activity impacts by a minimum of 10%, and that mitigation is in Rough-Step with impacts (for Santa Ana River woolly-star this will require that mitigation occurs within the same Alluvial Fan Preserve Unit as impacts).

The Santa Ana River woolly-star avoidance and minimization measures will ensure that potential effects on the species are reduced to the maximum extent practicable, and implementation of the species' conservation actions and Up-Front and Stay-Ahead Provisions (Table 5-8) will ensure any potential impacts are offset. The conservation actions and Up-Front and Stay-Ahead Provisions for Santa Ana River woolly-star are anticipated to result in long-term conservation benefits to the species. When considered along with the amount of modeled suitable habitat that will be restored and/or rehabilitated, and conserved in the HCP Preserve System, the implementation of HCP Covered Activities would not threaten the continued existence of the species.

Table 5-8. Total Acres of Modeled Suitable Habitat Estimated to Be Impacted and Conserved for Santa Ana River Woolly-Star by HCP Implementation Phase, and the Species' Up-front and Stay Ahead Mitigation Strategy

	Impacts		Mitigation	
Modeled Habitat Type	**Permanent**[1]	**Temporary**	**HCP Preserve System**	**Stay-Ahead Provision %**
Potentially Suitable Habitat				
Up-Front (Pre-Phase 1)			67.1	--
Phase 1	88.7 (25.3)	54.4	329.2	236%
Phase 2	35.9 (6.6)	1.2	36.7	192%
Phase 3	175.0	0.2	--	34%
Phase 4	106.9	2.0	--	<1%[2]
Total Modeled Habitat	406.6 (31.9)	57.8	433.0	
Total Modeled Habitat Outside of Existing Basins	**374.7**	**57.8**	**433.0**	

[1]Impact acreages in parentheses are within existing water recharge/flood control basins subject to regular O&M activities and are a subset of the total acres. For example, of the 406.6 acres of permanent impacts, 31.9 acres occur within existing basins. Consequently, impacts outside of basins are 406.6 – 31.9 = 374.7 acres.
[2]Phase 4 Covered Activities cannot proceed until mitigation is ahead of Covered Activity impacts by a minimum of 10%.

Table 5-9. Acres of Modeled Suitable Habitat Estimated to Be Impacted and Conserved for Santa Ana River Woolly-Star by HCP Implementation Phase, and the Species' Up-front and Stay Ahead Mitigation Strategy within Alluvial Fan Preserve Unit A

	Impacts		Mitigation	
Modeled Habitat Type	**Permanent**[1]	**Temporary**	**Alluvial Fan Preserve Unit A**	**Stay-Ahead Provision %**
Potentially Suitable Habitat				
Up-Front (Pre-Phase 1)			67.1	--
Phase 1	68.1 (19.1)	30.8	267.6	320%
Phase 2	27.9	--	--	211%
Phase 3	8.3	0.2	--	188%
Phase 4	0.6	--	--	187%
Total Modeled Habitat	104.8 (19.1)	31.0	334.7	
Total Modeled Habitat Outside of Existing Basins	**85.7**	**31.0**	**334.7**	

[1]Impact acreages in parentheses are within existing water recharge/flood control basins subject to regular O&M activities and are a subset of the total acres. For example, of the 104.8 acres of permanent impacts, 19.1 acres occur within existing basins. Consequently, impacts outside of basins are 104.8 – 19.1 = 85.7 acres.

Table 5-10. Acres of Modeled Suitable Habitat Estimated to Be Impacted and Conserved for Santa Ana River Woolly-Star by HCP Implementation Phase, and the Species' Up-front and Stay Ahead Mitigation Strategy within Alluvial Fan Preserve Unit B

	Impacts		Mitigation	
Modeled Habitat Type	**Permanent**[1]	**Temporary**	**Alluvial Fan Preserve Unit B**	**Stay-Ahead Provision %**
Potentially Suitable Habitat				
Up-Front (Pre-Phase 1)			--	--
Phase 1	7.6	9.5	57.9	238%
Phase 2	-- (4.3)	--	--	238%
Phase 3	166.7	--	--	<10%[2]
Phase 4	86.0	0.8	--	<10%[2]
Total Modeled Habitat	264.5 (4.3)	10.4	57.9	
Total Modeled Habitat Outside of Existing Basins	**260.2**	**10.4**	**57.9**	

[1]Impact acreages in parentheses are within existing water recharge/flood control basins subject to regular O&M activities and are a subset of the total acres. For example, of the 264.5 acres of permanent impacts, 4.3 acres occur within existing basins. Consequently, impacts outside of basins are 264.5 – 4.3 = 260.2 acres.
[2]HCP Implementation Phase Covered Activities within Alluvial Fan Preserve Unit B cannot proceed until mitigation is ahead of Covered Activity impacts by a minimum of 10%.

5.9.3 Santa Ana Sucker (SAS)

Conservation Objectives and Actions

SAS Objective 1: Ensure that adequate surface flow is maintained to support Santa Ana sucker within the occupied portions of the mainstem of the Santa Ana River.

SAS Action 1A: Monitor flows within the mainstem of the Santa Ana River and adaptively manage flow (as identified in the CAMMP) to support a healthy Santa Ana sucker population.[10]

SAS Action 1B: Conduct research to determine the effective population size of Santa Ana sucker (e.g., number of breeding females, or reproductive adults) and use these findings to adaptively manage the health and diversity of the fish population.

SAS Objective 2: Increase the amount and quality of available foraging, refugia, and spawning habitat in the mainstem of the Santa Ana River through restoration and rehabilitation. A portion of this area is included in the modeled habitat for the species, while other portions are not currently suitable habitat but would be enhanced to be suitable habitat through habitat improvement activities (e.g., restoration and/or rehabilitation).

[10] The HCP Hydrology Model and subsequent analyses determined a minimum baseflow of 35 cubic feet per second (cfs) in the Santa Ana River, downstream of RIX to ensure maintenance of instream habitat for Santa Ana sucker. This baseflow would be fulfilled by 28 cfs minimum discharge from RIX and 7 cfs minimum discharge from the City of Rialto's WWTP. The State Water Resources Control Board (SWRCB) Division of Water Rights' authorization of the City of San Bernardino's Wastewater Change Petition WW0059 (and associated settlement agreements with the City of Riverside, and the Center for Biological Diversity) stipulates a minimum discharge of 18.5 million gallons per day (mgd; 28.6 cfs) from the RIX facility to the Santa Ana River be maintained annually from June 1 to October 15 annually.

SAS Action 2A: Enhance sucker habitat in the mainstem of the Santa Ana River with the addition of at least six habitat nodes and/or stream bifurcation structures, enhancing at least 1.5 acres of habitat (see Section 5.5.1, *Mainstem Santa Ana River Microhabitat Creation*). Successful implementation of this measure includes increasing the relative bed coarseness (increase in exposed gravel and cobble), when compared to the baseline condition or an unmanipulated control site(s), over the cumulative habitat enhancement area equivalent to or exceeding 1.5 acres. The appropriate timing for this measurement should be when surface flow is dominated by discharged wastewater during the summer and fall months, prior to the start of the rainy season (late fall). Survey methodology for this measure will be developed as part of the CAMMP.

SAS Action 2B: Where appropriate within the mainstem of the Santa Ana River, create linked microhabitat[11] areas with scour pools, exposed gravel, and a flow velocity high enough to transport sand, made of natural materials such as boulders, cobble, and large woody debris to increase and maintain habitat suitability for Santa Ana sucker (see Section 5.5.3, *Flow and Path Manipulation Activities Within Mainstem*).

SAS Action 2C: Reduce the water temperature in Rialto Channel to less than 85°F[12,13] during the warm season through the addition of relatively cool groundwater (67–70°F) in order to maintain habitats in Rialto Channel suitable for Santa Ana sucker (see Section 5.5.4, *Rialto Channel Flow and Water Quality Management*). If reduction in water temperature during the warm season is found to be not feasible, additional measures to enhance (reduce) water temperature downstream of RIX will be implemented as part of CAMMP. One option includes replacing warm season flow from Rialto Channel through increased discharge from RIX, reducing (enhancing) the overall water quality downstream of the RIX discharge location for Santa Ana sucker and other Covered Species.

SAS Action 2D: Develop and utilize a protocol for the RIX WWTP to create high volume discharge events[14] with a goal of increasing the rate of fine-grained sediment transport downstream of the RIX discharge location in order to expose high-quality sucker habitat (gravel and cobbles). Per year, there may be a need to conduct multiple high-volume discharge events in order to enhance enough habitat area for Santa Ana sucker. These measures will be developed and adaptively managed through the CAMMP by the Alliance.

SAS Action 2E: Rehabilitate riparian habitat along the upper occupied stream reaches within the HCP Preserve System by controlling nonnative plants to improve habitat cover and shade/cool surface flow during the warm season. In order to create and maintain high quality habitat for Santa Ana sucker, portions of the stream will need to be maintained with limited canopy cover in order to provide high light intensity to provide for high quality benthic periphyton (algal) growth. Providing adequate habitat (water quality and forage) for Santa Ana

[11] Microhabitat enhancements using natural materials (e.g., large boulders, woody debris) to increase scour and pool formation within the Santa Ana River mainstem is a requirement of Wastewater Change Petition WW0095, and the Sterling Natural Resources Project CEQA (SCH No. 2015101058), mitigation measure SAS-1.

[12] Required pursuant to Wastewater Change Petition WW0095, and the Sterling Natural Resources Project CEQA (SCH No. 2015101058), mitigation measure SAS-5.

[13] Per City of San Bernardino's settlement agreement with Center for Biological Diversity related to Wastewater Change Petition Order WW0059, the City is to coordinate with Valley District on temperature management within Rialto Channel.

[14] Required pursuant to Wastewater Change Petition WW0095, and the Sterling Natural Resources Project CEQA (SCH No. 2015101058), mitigation measure SAS-4.

sucker will need to be experimentally evaluated and adaptively managed through the CAMMP within portions of the occupied stream.

SAS Objective 3: Increase the amount and quality of available spawning habitat in lowland tributaries to the mainstem of the Santa Ana River.

SAS Action 3A: Create or restore 3.6 stream miles of suitable habitat, including stream restoration/rehabilitation in the Anza Creek, Old Ranch Creek, Hidden Valley Creek, Lower Hole Creek, and Evans Lake habitat improvement areas.

SAS Action 3B: Supplement or provide flow to Anza Creek, Old Ranch Creek, Hidden Valley Creek, and Lower Hole Creek Tributary habitat improvement areas via the Santa Ana River Sustainable Parks and Tributaries Water Reuse Project (RPU.10).

SAS Action 3C: Provide supplemental water to the Tequesquite Creek via the Santa Ana River Sustainable Parks and Tributaries Water Reuse Project (RPU.10) (see Section 5.5.5, *Tequesquite Creek Supplementary Flows*).

SAS Action 3D: Enhance aquatic habitat for Santa Ana sucker in Anza Creek, Old Ranch Creek, Hidden Valley Creek, and Lower Hole Creek Tributary habitat improvement areas by manipulating water movement to create suitable microhabitat areas, including the addition of natural materials such as rock (gravel, cobble, boulder) and large woody debris, and by maximizing the creation of scour pools.

SAS Action 3E: Restore and/or rehabilitate riparian habitats along tributary stream reaches at the Anza Creek, Old Ranch Creek, Hidden Valley Creek, and Lower Hole Creek Tributary habitat improvement areas to maintain channel stability and improve aquatic habitat suitability (e.g., mediate water temperature, and provide overhanging vegetation for cover).

SAS Objective 4: Reduce threats to Santa Ana sucker in the HCP Preserve System by actively managing Santa Ana sucker habitat within the occupied reaches of the mainstem river, mainstem tributary habitat improvement areas, and Translocation Sites.

SAS Action 4A: Remove nonnative aquatic predators[15] (e.g., bass, sunfish, tilapia, carp, catfish, American bullfrog, and mosquito fish) and manage nonnative plants as well as specific native plants when they become problematic (e.g., cattail) within Santa Ana sucker managed reaches on the mainstem river, mainstem tributary habitat improvement areas, and Translocation Sites. Periodic shutdowns of the RIX facility may have artificially maintained the upper river with few nonnative aquatic predators and provided a disturbance regime that benefitted Santa Ana sucker. As part of the CAMMP, experimentally test the method of controlling nonnative aquatic predators through WWTP shutdowns (dewatering a portion of the river), combined with the salvage of native fishes. This study should also monitor changes to the benthic community, including changes to the composition of the periphyton community.

SAS Action 4B: Reduce anthropogenic impacts on Santa Ana sucker and to its habitat; for example, (1) install trash racks at lowland tributaries, (2) install signs to educate the general public on the sensitivity of the Santa Ana sucker and the goals of the HCP, (3) protect riparian

[15] Development and implementation of an Aquatic Predator Control Program is a requirement of Wastewater Change Petition WW0095, and the Sterling Natural Resources Project CEQA (SCH No. 2015101058), mitigation measure SAS-2.

habitat from unauthorized recreational use, and (4) coordinate with flood control agencies to reduce the amount of riparian mowing adjacent to occupied Santa Ana sucker habitat.

SAS Action 4C: Study other potential threats to Santa Ana sucker such as (1) the sources of contaminants that reduce water quality and effects on Santa Ana sucker; (2) the effect of mosquitofish on Santa Ana sucker recruitment; (3) strategies to manage nonnative invasive beard algae (*Compsopogon caeruleus*); and (4) the effects of water temperature on Santa Ana sucker migration, spawning, and recruitment.

SAS Action 4D: If determined necessary, add cool water (to locations other than Rialto Channel) from local groundwater aquifers, or other sources, to maintain appropriate water temperature during summer and fall months.

SAS Action 4E: Remove fine sediment from the lower reaches of the river (Prado Basin) for the purposes of maintaining the river gradient, coarsening the thalweg of the stream, and providing coarse sediment back to the mainstem river.

SAS Action 4F: Support and coordinate with USFS to implement fuel reduction to limit the potential for high-intensity wildfires in new Santa Ana sucker habitat within mountain streams.

SAS Objective 5: Manage surface and groundwater supply and hydrologic processes to benefit Santa Ana sucker in the HCP Preserve System.

SAS Action 5A: Coordinate with U.S. Army Corps of Engineers and Orange County Flood Control District to schedule releases from Seven Oaks Dam as part of the CAMMP to avoid and/or minimize impacts on Santa Ana sucker.

SAS Action 5B: Include the following in a study: (1) determine what entities have water rights that may influence surface flows and Santa Ana sucker habitat in future drought years, (2) determine all wells and other sources of water that may be used to supply the mainstem and lowland tributaries, and (3) maintain and use the integrated surface-groundwater model to assess gaining and losing reaches of the watershed.

SAS Objective 6: Expand Santa Ana sucker distribution within the Santa Ana River Watershed Recovery Unit by creating new local populations of Santa Ana sucker in the HCP Preserve System.

SAS Action 6A: Conduct a minimum of three translocations[16] of Santa Ana sucker into mountain tributary streams following techniques and methodology outlined in the Santa Ana sucker Translocation Plan and CAMMP. Successfully re-introduce and maintain a minimum of three Santa Ana sucker populations over the life of the permit duration in at least three mountain streams tributary to the Santa Ana River.

SAS Action 6B: Re-establish or enhance local sucker populations that may become extirpated after threats causing extirpation have passed (winter storms) by relocating individual Santa Ana sucker that become stranded downstream of mountain tributary streams. The decision to translocate additional Santa Ana sucker will follow the techniques and methodology outlined in the Santa Ana sucker Translocation Plan and CAMMP.

[16] Identified in the City of San Bernardino's settlement agreement with Center for Biological Diversity related to Wastewater Change Petition Order WW0059. Three translocations are required; a minimum of two translocation projects will be completed and suitable progress made towards meeting success criteria prior to reduction in discharge to Santa Ana River associated with WD.1.

SAS Objective 7: Manage for genetically diverse local populations of Santa Ana sucker throughout the HCP Preserve System.

SAS Action 7A: Study and identify artificial and natural barriers to fish migration. If appropriate, install fish passage, or remove barriers to enhance connectivity and enable dispersal and gene flow.

SAS Action 7B: Use population genetic studies to determine mechanisms of genetic drift to help guide the CAMMP and translocation efforts (see Section 5.7.1, *Santa Ana Sucker Population Genetics Research and Management*).

Monitoring of species conservation actions is addressed in Section 5.12.

Measures to Avoid and Minimize Effects

In addition to the measures below, the general avoidance and minimization measures to protect water quality and to protect special-status fish and other aquatic species are applicable to this species.

SAS AMM-1: Limit work in the occupied wetted channel for restoration activities or other purposes during the Santa Ana sucker spawning season (currently determined to be February 15 to July 31).

SAS AMM-2: During work within the occupied wetted channel, a qualified Santa Ana sucker biologist will be present to monitor the activities. A qualified Santa Ana sucker biologist is defined as an individual that holds a current 10(a)(1)(A) recovery permit for Santa Ana sucker. This individual, or any other project biologist, will have the authority to stop activities at any time if impacts on native aquatic species are observed. If impacts on Santa Ana sucker occur, the Alliance and USFWS will be contacted immediately to determine if additional measures to further minimize project impacts are needed.

SAS AMM-3: Prior to diverting any water or de-watering a reach of the river, a team of biologists, which will include at least one qualified Santa Ana sucker biologist, will conduct a preliminary survey of the affected reach(es) to determine the presence of Santa Ana sucker. Where a large project is planned, any Santa Ana sucker located within the reach will be captured and relocated outside of the defined work area to a nearby suitable habitat immediately outside of the impact area. Work areas will be defined by block netting to minimize any relocated fish from reentering the work area. The affected reach(es) will be surveyed for fishes throughout the duration of the project using seining, traps, or electrofishing, as necessary. For small and or low impact projects (e.g., stream restoration/rehabilitation projects), impacts will be minimized through slow and deliberate work using hand tools.

SAS AMM-4: Relocate translocated Santa Ana sucker to upstream of diversions prior to repair and/or O&M of hydroelectric-associated facilities. For example, at the Alder Creek Diversion (SCE.2) in Alder/Hemlock Creek, the water diversion is approximately 100% of flow. Between the Alder Creek Diversion and the Santa Ana River there is a reach of stream that flows only when the diversion berm is breached; this stream is ephemeral.

SAS AMM-5: Assess the need for fish screens at all diversions or sand boxes where translocated Santa Ana sucker may come into contact with the operation of hydropower facilities. Install fish screens on diversions or sand boxes, where appropriate, to reduce the risk of entrapment or being drawn into a powerhouse. Conduct regular maintenance of fish screens in fish translocation sites for translocated fish.

Expected Outcomes

The conservation actions described above meet the conservation objectives for the Santa Ana sucker and are anticipated to avoid and minimize potential effects and offset the anticipated impacts on Santa Ana sucker resulting in long-term conservation benefits to the species. Table 5-11 summarizes the estimated impacts and conservation within modeled habitat for the Santa Ana sucker; however, it is important to note that many of the conservation actions for this species cannot be quantified in acres or miles of habitat restored. Therefore, the total benefits of conservation actions for Santa Ana sucker are expected to be substantially more than those that can be quantified here. For example, beneficial sediment removal projects occurring in the Santa Ana River mainstem do not have quantified acreage benefits though they will improve habitat and support the continued existence of the species. The long-term management of nonnative predatory aquatic species will provide additional habitats for use by Santa Ana sucker, specifically mainstem tributary streams for spawning and foraging. The installation of gabions to encourage scour and create smaller patches of viable habitat are also important to the continued existence of the species, but do not have a quantified acreage of expected habitat enhancement associated with them. Translocation will increase the viability of the species by increasing the amount of occupied habitat and by increasing the number of local populations, which will substantially reduce the risk of a catastrophic event impacting all of the occupied habitat. And finally, the proposed studies will help inform management of this species into the future.

The proposed impacts on Santa Ana sucker designated critical habitat (in seasonally dry upper channels identified as a source of coarse sediment) include approximately 83.3 acres of permanent impacts and 20.2 acres of temporary impacts. Approximately 181 acres of the HCP Preserve System are designated critical habitat in these upper channel areas. Conservation and management of these lands, combined with the proposed sorting and replacing to the active channel of coarse substrate removed from the system through water diversion, will offset the physical and biological processes (source of new coarse sediment) supplied by the upper channel areas.

The hydrologic impacts from Covered Activities will result in a loss of approximately 1.3 acres of modeled suitable habitat. The conservation actions will create approximately 3.6 acres of stream habitat in the Santa Ana River mainstem tributary restoration sites, and will enhance another 1.5 acres of habitat in the mainstem of the Santa Ana River. The HCP's Up-Front and Stay-Ahead Provisions for Santa Ana sucker (identified in Table 5-11) will ensure these aforementioned conservation actions are implemented prior to Covered Activity impacts. When considered along with the amount of habitat that will be restored or enhanced, and the additional measures proposed to ensure the long-term viability of Santa Ana sucker, the implementation of HCP Covered Activities would not threaten the continued existence of the species.

Table 5-11. Acres of Modeled Habitat Estimated to be Impacted and Conserved or Restored for Santa Ana Sucker by HCP Implementation Phase, and the Species Up-Front and Stay-Ahead Mitigation Strategy

	Impacts		Mitigation			
Modeled Habitat Type	**Permanent**	**Temporary**	**Preservation (Acquisitions and Easements)**	**SAR Mainstem Enhancement (acres)**	**Tributary Restoration (acres of wetted area)**	**Stay-Ahead Provision %**
Foraging Habitat						
Up-Front (Pre-Phase 1)						--[1]
Phase 1	1.3	--	--	1.5	1.7	146%
Phase 2	--	--	--	--	1.9	292%
Phase 3	--	--	--	--	--	Fulfilled
Phase 4	--	--	--	--	--	Fulfilled
Total	**1.3**	**--**	**--**	**1.5**	**3.6**	

[1] A minimum of two translocation projects will be completed with demonstrated progress toward success criteria prior to a reduction of discharge to the Santa Ana River related to WD.1

5.9.4 Arroyo Chub (ARCH)

Conservation Objectives and Actions

ARCH Objective 1: Increase the amount and quality of available habitat in the mainstem of the Santa Ana River through habitat improvement projects and by enhancing natural processes to create and maintain high quality aquatic habitat for arroyo chub.

ARCH Action 1: Refer to the conservation actions under *SAS Objective 2*, which will also benefit arroyo chub.

ARCH Objective 2: Increase the amount and quality of available habitat in lowland tributaries in the mainstem of the Santa Ana River. A portion of this area is included in the modeled suitable habitat for the species, while other portions are not currently suitable habitat but would be restored to be suitable for the species.

ARCH Action 2: Refer to the conservation actions under *SAS Objective 3,* which will also benefit arroyo chub.

ARCH Objective 3: Reduce threats to the arroyo chub in the HCP Preserve System by actively managing arroyo chub habitat within the occupied reaches of the mainstem and tributary habitat improvement areas.

ARCH Action 3A: Within arroyo chub-managed stream reaches remove nonnative aquatic predators (e.g., bass, sunfish, tilapia, carp, and catfish, American bullfrog, mosquito fish) and native and nonnative invasive plants (e.g., cattail and giant reed).

ARCH Action 3B: Reduce anthropogenic impacts on arroyo chub habitat though methods such as: (1) install trash racks at lowland tributaries, (2) install signs to educate the general public on the sensitivity of the arroyo chub and goals of the HCP, (3) protect riparian habitat from unauthorized recreational use, and (4) coordinate with flood control agencies to reduce the amount of riparian mowing adjacent to arroyo chub habitat.

ARCH Objective 4: Manage surface water and groundwater and hydrologic processes to benefit arroyo chub in the watershed.

ARCH Action 4: Refer to the conservation actions under the *SAS Objective 5,* which will also benefit arroyo chub.

Monitoring of species conservation actions is addressed in Section 5.12.

Measures to Avoid and Minimize Effects

The general avoidance and minimization measures to protect water quality and to protect special-status fish and other aquatic species are applicable to this species. The additional measures described for the Santa Ana sucker will further avoid and minimize impacts on arroyo chub.

Expected Outcomes

The conservation actions described above meet the conservation objectives for the species and are anticipated to avoid and minimize potential effects, and offset the anticipated impacts on arroyo chub, resulting in long-term conservation benefits to the species. Table 5-12 summarizes the estimated impacts and conservation within modeled habitat for the arroyo chub; however, it is important to note that some of the conservation actions for this species cannot be quantified in acres or miles of habitat restored. Therefore, the total benefits of conservation actions for the arroyo chub are expected to be substantially more than those that can be quantified here.

The hydrologic impacts from Covered Activities will result in a loss of approximately 2.4 acres of modeled suitable habitat. The conservation actions will create approximately 3.6 acres of stream habitat in the Santa Ana River mainstem tributary restoration sites. Though being conducted to benefit Santa Ana sucker, the enhancement of an additional 1.5 acres of habitat in the mainstem of the Santa Ana River will also likely benefit arroyo chub. Nonnative predatory species removal projects occurring in the Santa Ana River mainstem and tributary restoration sites, though not quantifiable in terms of acreage benefits, will improve habitat conditions for arroyo chub.

The HCP's Up-Front and Stay-Ahead Provisions for arroyo chub (identified in Table 5-12) will ensure the aforementioned conservation actions are implemented prior to Covered Activity impacts. When considered along with the amount of habitat that will be restored or enhanced, and the additional measures proposed to ensure the long-term viability of arroyo chub, the implementation of HCP Covered Activities would not threaten the continued existence of the species.

Table 5-12. Acres of Modeled Habitat Estimated to Be Impacted and Conserved or Restored for Arroyo Chub by HCP Implementation Phase, and the Species' Up-Front and Stay-Ahead Mitigation Strategy

	Impacts		Mitigation			
Modeled Habitat Type	Permanent	Temporary	Preservation (Acquisitions and Easements)	SAR Mainstem Enhancement (acres)	Tributary Restoration (acres of wetted area)	Stay-Ahead Provision %
Foraging Habitat						
Up-Front (Pre-Phase 1)						--
Phase 1	2.4	--	--	1.5	1.7	33%
Phase 2	--	--	--	--	1.9	113%
Phase 3	--	--	--	--	--	Fulfilled
Phase 4	--	--	--	--	--	Fulfilled
Total	**2.4**	**--**	**--**	**1.5**	**3.6**	

5.9.5 Santa Ana Speckled Dace (SASD)

Conservation Objectives and Actions

SASD Objective 1: Increase the understanding of Santa Ana speckled dace distribution and threats to improve management of the species.

SASD Action 1: Contribute $20,000 in funding and continue to support Santa Ana speckled dace population surveys and analyses in the Planning Area (see Section 5.7.4, *Santa Ana Speckled Dace Population Survey and Threats Analysis*).

SASD Objective 2: Based on the results of the Santa Ana speckled dace population survey and threats analysis in SASD Objective 1, reduce threats by actively managing habitat within occupied reaches where they co-occur with Santa Ana sucker translocation streams (e.g., City Creek, Plunge Creek).

SASD Action 2A: Conduct long-term management and monitoring of Santa Ana speckled dace local populations where they co-occur with Santa Ana sucker translocation streams.

SASD Action 2B: Evaluate instream connectivity for local populations of Santa Ana speckled dace by identifying artificial and natural barriers to fish migration and installing fishway passage and/or removing barriers where appropriate.

SASD Action 2C: Identify stream segments that have nonnative predatory aquatic species and conduct eradication in these high priority areas.

SASD Action 2D: Relocate individual dace that become stranded downstream of mountain tributary streams after flood flow recedes.

Monitoring of species conservation actions is addressed in Section 5.12.

Measures to Avoid and Minimize Effects

The general avoidance and minimization measures to protect water quality and to protect special-status fish and other aquatic species are applicable to this species. The additional measure described below will further avoid and minimize impacts on speckled dace.

SASD AMM-1: Prior to diverting any water or de-watering a reach of the river, qualified biologists will conduct a preliminary survey of the affected reach(es) to determine the presence of Santa Ana speckled dace. Any dace located within the reach will be captured and relocated to nearby suitable habitat outside of the impact area. The affected reach(es) will be surveyed for fishes throughout the duration of the project using seining, traps, or electrofishing, as necessary.

SASD AMM-2: Assess the need for fish screens at all diversions or sand boxes where Santa Ana speckled dace may come into contact with the operation of hydropower facilities. Install fish screens on diversions or sand boxes, where appropriate, to reduce the risk of entrapment or being drawn into a powerhouse.

Expected Outcomes

The majority of modeled suitable habitat (and occupied reaches) for Santa Ana speckled dace occurs upstream of Covered Activities. There is <0.1 acre of modeled suitable aquatic habitat (wetted area) downstream of Covered Activities (i.e., East Twin Creek) within the Planning Area (Section 4.6.3, Table 4-28). There are no anticipated impacts on known occurrences of Santa Ana speckled dace, except for disturbances from in-stream nonnative aquatic species management in areas where the species will co-occur with translocated Santa Ana sucker.

Though there is no proposed preservation of habitat for this species, nonnative aquatic species management and enhancement of instream connectivity (e.g., barrier removal, where appropriate) within occupied stream reaches that co-occur with Santa Ana sucker translocation sites will benefit the species (Table 5-13). The Santa Ana speckled dace avoidance and minimization measures will ensure that potential effects on the species are reduced to near zero, and implementation of the species' conservation actions and Up-Front and Stay-Ahead Provisions (Table 5-13) will ensure that any potential effects are offset. The conservation actions and Up-Front and Stay-Ahead Provisions for Santa Ana speckled dace are anticipated to result in long-term conservation benefits to the species. When the minimal impacts are considered along with the additional measures proposed to benefit habitat conditions for Santa Ana speckled dace, the implementation of HCP Covered Activities would not threaten the continued existence of the species.

Table 5-13. Acres of Modeled Suitable Habitat Estimated to be Impacted and Conserved for Santa Ana Speckled Dace by HCP Implementation Phase, and the Species' Up-Front and Stay-Ahead Mitigation Strategy

	Impacts		Mitigation	Stay Ahead
Modeled Habitat Type	**Permanent**	**Temporary**	**HCP Preserve System**	**Provision %**
Suitable Habitat (wetted area)			**Preservation (Acquisitions and Easements)**	
Up Front (Pre-Phase 1)				--[1]
Phase 1	--	--	--	n/a
Phase 2	--	--	--	
Phase 3	--	--	--	
Phase 4	0.1	--	--	
Total	**0.1**		n/a[2]	

[1] Contribution of funding and continued support of regional Santa Ana speckled dace population surveys within the Planning Area, and associated analyses is occurring ahead of HCP implementation (see Section 5.7.4, *Santa Ana Speckled Dace Population Survey and Threats Analysis*).
[2] Although there is no stream restoration/rehabilitation specific to Santa Ana speckled dace, nonnative predator control in streams where dace co-occur with translocated Santa Ana sucker will benefit this species.

5.9.6 Mountain Yellow-Legged Frog (MYLF)

Conservation Objectives and Actions

MYLF Objective 1: Permanently conserve and manage mountain yellow-legged frog modeled habitat within the HCP Preserve System in a configuration that benefits this species.

MYLF Action 1A: Conserve 247.9 acres of modeled Refugia/Foraging/Dispersal Habitat and 15.7 acres of Aquatic Habitat within the HCP Preserve System (City Creek Conservation Area).

MYLF Action 1B: Protect vegetation communities suitable for mountain yellow-legged frog habitat. Ensure aquatic habitat includes Primary Biological Features within designated critical habitat areas as well as areas where the species may be re-established in the HCP Preserve System.

MYLF Action 1C: Support and coordinate with USFS to implement fuel reduction to limit the potential for high-intensity wildfires in mountain yellow-legged frog habitat.

MYLF Objective 2: Support ongoing research to identify effective chytrid fungus treatments for mountain yellow-legged frog populations.

MYLF Action 2: Continue to provide financial support for chytrid fungus research.

MYLF Objective 3: Support ongoing environmental DNA research (eDNA) to determine if this genetic survey method can be used as a proxy to understand ecosystem health and pinpoint where management is most critical.

MYLF Action 3: Continue to provide financial support for eDNA research.

MYLF Objective 4: Expand mountain yellow-legged frog distribution within the Santa Ana River watershed by enhancing or supporting re-establishment efforts.

MYLF Action 4A: Contribute to the San Diego Zoo Mountain Yellow-legged Frog Captive Rearing and Translocation Program (Section 5.6.2) to support achieving recovery goals for the species, within the HCP Planning Area, as stated in the 5-year review (USFWS 2012).

MYLF Action 4B: Coordinate with the San Diego Zoo Mountain Yellow-legged Frog Captive Rearing and Translocation Program (Section 5.6.2) to support translocation efforts within the HCP Planning Area, and to support relocation of mountain yellow-legged frogs from streams where environmental conditions have deteriorated (e.g., fire, drought and low flow, or other threats) to suitable habitat.

Monitoring of species conservation actions is addressed in Section 5.12.

Measures to Avoid and Minimize Effects

MYLF AMM-1: All individuals working in potential mountain yellow-legged frog habitat will follow the disease prevention protocols described in the USFWS' *Declining Amphibian Population Task Force Code of Practice* (USFWS 2009).

MYLF AMM-2: An appropriately qualified biologist will conduct a pre-project assessment survey of all areas within a 50-foot buffer of modeled mountain yellow-legged frog aquatic habitat, and/or critical habitat, where a Covered Activity is proposed to occur.[17] If the biologist determines that the species has potential to occur within the Covered Activity project site, a mountain yellowed-legged frog avoidance and minimization plan will be developed and submitted to the Alliance, USFWS, and CDFW for review and comment. At a minimum the plan will include: work areas and access demarcation; a diversion plan (where necessary) that addresses maintenance of aquatic life, stranded aquatic life, flow velocities, maintenance of water quality downstream, and restoration of normal flows upon completion of work; operation and maintenance of equipment; invasive species prevention; and the implementation, monitoring, and maintenance of best management practices to prevent erosion and the discharge of sediment and pollutants.

MYLF AMM-3: Where pre-project assessment surveys determine that mountain yellow-legged frog have the potential to occur on site, an appropriately qualified biologist shall be on site daily. The biological monitor shall monitor project activities and ensure compliance with the mountain yellow-legged frog avoidance and minimization plan (see MYLF AMM-2). Presence of mountain yellow-frog within the project boundary, and/or concerns with the implementation of the avoidance and minimization plan shall be reported to the Alliance immediately.

Expected Outcomes

Implementation of the Covered Activities would result in the permanent loss of 181.9 acres and the temporary loss of 13.1 acres of modeled mountain yellow-legged frog suitable aquatic habitat and modeled refugia/foraging/dispersal habitat within the Planning Area (a majority of this modeled

[17] Covered Activities are proposed to occur in modeled mountain yellow-legged frog refugia/foraging/dispersal habitat in Lytle and Cajon Creeks, and in modeled refugia/foraging/dispersal and aquatic habitat in Waterman Canyon and Twin Creek; however, the species is extirpated from these streams. Covered Activities (pipeline maintenance) are proposed in modeled refugia/foraging/dispersal habitat in City Creek, and conservation and rehabilitation/restoration of habitat is also proposed in modeled refugia/foraging/dispersal, modeled aquatic, and designated critical habitat in City Creek.

habitat occurs within Waterman Creek and Twin Creek basins; neither location currently supports the species) (Section 4.6.3). Of the permanent impacts, the majority occurs where Permittees currently conduct groundwater recharge activities (156.7 acres are within existing basins); therefore, permanent impacts on modeled habitat are significantly less: 25.2 acres. Mountain yellow-legged frog wetted area (as a measure of aquatic habitat downstream of Covered Activities; see Section 3.6.4) in Cajon and Waterman Creeks is predicted to be lost as a result of Covered Activities. But, because the species does not occur in these locations, and only 0.2 acre of potential impact on wetted area is estimated (Table 4-29), this predicted loss is not expected to adversely impact the species. There are no anticipated impacts on known occurrences of mountain yellow-legged frog, except for potential disturbance from habitat rehabilitation or restoration activities within approximately 52 acres of designated critical habitat within City Creek that will be conserved within the HCP Preserve System.

Approximately 263.6 acres of modeled habitat (15.7 acres modeled aquatic habitat, 247.9 acres refugia/foraging/dispersal habitat) are expected to be conserved within the HCP Preserve System. Other conservation actions to be undertaken by the Alliance as part of the conservation strategy to support the conservation and recovery of the species are addressed in Section 5.6, *Captive Headstarting and Translocation,* and Section 5.7, *Species and Habitat Research,* and include funding the following:

- Contribute to the ongoing San Diego Zoo Mountain Yellow-legged Frog Captive Rearing and Translocation Program within the Santa Ana River watershed to help accomplish recovery goals for the species, as stated in the 5-year review (USFWS 2012).
- Contribute to ongoing population surveys and threats assessments to continue to increase understanding of population distribution, demographics, and health in order to inform future management, translocation, and reintroduction efforts.
- Support eDNA studies to determine how these methods can increase the cost effectiveness of mountain yellow-legged population surveys and threats assessments to inform future management of the species in the Planning Area.

The conservation actions described above meet the conservation objectives for the mountain yellow-legged frog and are anticipated to avoid and minimize potential effects of Covered Activities. Table 5-14 summarizes the estimated impacts and conservation of modeled habitat for the mountain yellow-legged frog. Also detailed in Table 5-14 is the HCP's Up-Front and Stay-Ahead Provisions (Section 5.4.1), which will ensure that mitigation for the species will stay ahead of Covered Activity impacts by a minimum of 10%.

The mountain yellow-legged frog avoidance and minimization measures will ensure that potential effects on the species are reduced to the greatest extent practicable, and implementation of the species' conservation actions and Up-Front and Stay-Ahead Provisions (Table 5-14) will ensure any potential impacts are offset. The conservation actions and Up-Front and Stay-Ahead Provisions for mountain yellow-legged frog are anticipated to result in long-term conservation benefits to the species. When considered along with the amount of modeled habitat that will be restored and/or rehabilitated and conserved in the HCP Preserve System, the implementation of HCP Covered Activities would not threaten the continued existence of the species.

Table 5-14. Acres of Modeled Suitable Habitat Estimated to Be Impacted and Conserved for Mountain Yellow-Legged Frog by HCP Implementation Phase, and the Species' Up-front and Stay-Ahead Provision

	Impacts		Mitigation	
Modeled Habitat Type	**Permanent**[1]	**Temporary**	**HCP Preserve System**	**Stay-Ahead Provision %**
All Model Categories[2]				
Up-Front (Pre-Phase 1)				--[3]
Phase 1	87.9 (63.0)	11.4	--	<10%[3]
Phase 2	93.8 (93.8)	0.0	263.6[4]	>500%
Phase 3	0.3	0.0	--	>500%
Phase 4	0.0	1.7	--	>500%
Total	*181.9 (156.7)*	*13.1*	*263.6*	
Potentially Suitable Aquatic Habitat				
Up-Front (Pre-Phase 1)				
Phase 1	4.3 (3.7)	0.1	--	
Phase 2	1.7 (1.7)	0.0	15.7	
Phase 3	0.0	0.0	--	
Phase 4	0.0	0.2	--	
Total	*5.9 (5.4)*	*0.3*	*15.7*	
Refugia/Foraging/Dispersal Habitat				
Up-Front (Pre-Phase 1)				
Phase 1	83.6 (59.3)	11.3	--	
Phase 2	92.1 (92.1)	0.0	247.9	
Phase 3	0.3	0.0	--	
Phase 4	0.0	1.5	--	
Total	*176.0* (151.3)	*12.8*	*247.9*	
Total Modeled Habitat	181.9 (156.7)[1]	13.1	263.6	
Total Modeled Habitat Outside of Existing Basins	**25.2**	**13.1**	**263.6**	
Designated Critical Habitat	**0.0**	**0.0**	**52.0**	

[1] Impact acreages in parentheses are within existing water recharge/flood control basins subject to regular O&M activities and are a subset of the total acres. For example, of the 181.9 acres of permanent impacts, 156.7 acres occur within existing basins. Consequently, impacts outside of basins are 181.9 – 156.7 = 25.2 acres. Impacts on Refugia/Foraging/Dispersal Habitat are on Waterman and East Twin Creeks, primarily from existing groundwater recharge basins. Mountain yellow-legged frog have been extirpated from these creeks. Mitigation will occur on City Creek, approximately 52 acres of which is within designated critical habitat.
[2] "All Model Categories" was created only for the purposes of summarizing the model categories presented in this table. Because of the number of model categories, the Stay-Ahead Provision is presented only for the All Model Categories summary.
[3] Contributions to the San Diego Zoo Mountain Yellow-legged Frog Captive Rearing and Translocation Program (see Section 5.6.2), and contributions to ongoing mountain yellow-legged frog surveys and environmental DNA surveys (see Section 5.7.2) is occurring ahead of HCP implementation.

[4]Although mitigation is identified as being incorporated into the HCP Preserve System in Phase 2, it is likely to be incorporated in Phase 1. No impacts on occupied habitat are anticipated for this species.

5.9.7 Western Spadefoot (WESP)

Conservation Objectives and Actions

WESP Objective 1: Permanently conserve and manage western spadefoot habitat within the HCP Preserve System in a configuration that benefits this species, and maintains or increases connectivity between occupied breeding habitat.

WESP Action 1A: Conserve 588.4 acres of modeled suitable western spadefoot habitat within the HCP Preserve System, especially temporary pools and adjacent habitat.

WESP Action 1B: Survey areas of potentially suitable habitat within the HCP Preserve System after properties are acquired and within a week of the first significant winter rain (as early as October or November) to identify and map suitable ephemeral breeding pools for subsequent monitoring and management.

WESP Action 1C: Implement habitat rehabilitation and/or restoration of suitable breeding locations and adjacent habitat, and identify opportunities for creation of new breeding habitat in adjacent locations to be included in the HCP's adaptive management and monitoring program.

WESP Objective 2: Support on-going survey efforts and research on western spadefoot with the HCP Preserve System

WESP Action 2A: Contribute to ongoing habitat surveys and modeling efforts specific to the Southern California population of western spadefoot.

WESP Action 2B: Contribute to ongoing surveys to evaluate occupancy of spadefoot at modeled and previous/current occupied sites, and identify breeding sites.

Monitoring of species conservation actions is addressed in Section 5.12.

Measures to Avoid and Minimize Effects

WESP AMM-1: A qualified biologist will conduct a pre-project assessment survey of all areas with suitable soils and areas supporting appropriate hydroperiods for western spadefoot. If the biologist determines that the species has potential to occur, timing of Covered Activity implementation will be limited to dry periods (generally May through October), where possible. If project activities must occur when water is present in suitable western spadefoot toad breeding habitat, a western spadefoot toad avoidance and minimization plan will be developed and submitted to the Alliance for review and comment. At a minimum the plan will include: work areas and access demarcation; a spadefoot rescue and tadpole collection and relocation/release strategy; operation and maintenance of equipment; and the implementation, monitoring, and maintenance of best management practices to maintain water quality and prevent erosion and the discharge of sediment and pollutants.

WESP AMM-2: Where pre-project assessment surveys determine that western spadefoot breeding habitat has the potential to occur on site, an appropriately qualified biologist shall be on site daily. The biological monitor shall monitor project activities and ensure compliance with the western spadefoot avoidance and minimization plan (see WESP AMM-1). Presence of western spadefoot within the project boundary, and/or concerns with the implementation of the avoidance and minimization plan shall be reported to the Alliance immediately.

WESP AMM-3: If spadefoot tadpoles are located in proposed project activity impact areas, they will be relocated to adjacent areas of suitable aquatic habitat, as identified in the spadefoot rescue and tadpole collection and relocation/release strategy drafted as a component of western spadefoot avoidance and minimization plan (WESP AMM-1). Disposition of relocated tadpoles will be monitored weekly until the relocation site dries, and will continue monthly (when water is present in the relocation site) for a period of not less than 24 months to determine the success of the relocation effort, and provide information on the efficacy of this strategy as an avoidance and minimization measure.

WESP AMM-4: All individuals working in potential spadefoot habitat will follow the disease prevention protocols described in the USFWS *Declining Amphibian Population Task Force Code of Practice* (USFWS 2009).

Expected Outcomes

Implementation of Covered Activities would result in the permanent loss of 704.5 acres and the temporary loss of 111.7 acres of western spadefoot modeled habitat within the Planning Area (Section 4.6.3). Of the permanent impacts, a portion occurs where Permittees currently conduct groundwater recharge activities (304.1 acres are within existing basins); therefore, permanent impacts on modeled habitat are significantly less: 400.4 acres. Covered Activities have been identified to overlap or occur adjacent to documented current occurrences of the species, indicating that direct impacts on western spadefoot may occur. The majority of Covered Activity impacts adjacent to recent documented occurrences are in existing water recharge basins that are already regularly maintained (e.g., Waterman Creek and Twin Creek Basins, Devil Canyon Basins).

Approximately 588.4 acres of modeled habitat are expected to be conserved within the HCP Preserve System. Approximately 285.7 acres of modeled habitat will be restored/rehabilitated and managed within Alluvial Fan Preserve Unit A, and 218.6 acres will be restored/rehabilitated and managed within Alluvial Fan Preserve Unit B. The Devil Creek site within Alluvial Fan Preserve Unit B supported the only documented positive occurrence of the species in the Planning Area in 2020 (Baumberger et al. 2021).

Table 5-15 summarizes the estimated impacts and conservation of modeled habitat for the western spadefoot. Also detailed in Table 5-15 is the HCP's Up-Front and Stay-Ahead Provisions (Section 5.4.1), which will ensure that mitigation for the species will stay ahead of Covered Activity impacts by a minimum of 10%.

The spadefoot avoidance and minimization measures will ensure that potential effects on the species are reduced to the maximum extent practicable, and implementation of the species' conservation measures and the Up-Front and Stay-Ahead Provisions (Table 5-15) will ensure any deleterious impacts are offset. Additional conservation actions to be supported by the Alliance as part of the conservation strategy to support the conservation and recovery of the species are addressed in Section 5.7.3, *Western Spadefoot Updated Population Survey*, and include funding the following:

- Continue potential habitat surveys and modeling efforts specific to the Southern California population of western spadefoot.

- Conduct surveys to evaluate occupancy of spadefoot at modeled and previous/current occupied sites, and identify breeding sites.

When considered along with the conservation measures, the species' Up-Front and Stay-Ahead Provisions, and the amount of modeled habitat that will be rehabilitated and/or restored and conserved in the HCP Preserve System, the implementation of HCP Covered Activities would not threaten the continued existence of the species; these actions are anticipated to result in long-term conservation benefits to the species.

Table 5-15. Acres of Modeled Habitat Estimated to Be Impacted and Conserved for Western Spadefoot by HCP Implementation Phase, and this Species' Associated Up-Front and Stay-Ahead Mitigation Strategy

	Impacts		Mitigation	
Modeled Habitat Type	**Permanent**[1]	**Temporary**	**HCP Preserve System**	**Stay Ahead Provision (%)**
Suitable Habitat				
Up-Front (Pre-Phase 1)			60.6	-- [2]
Phase 1	243.9 (71.9)	62.5	512.9	145%
Phase 2	315.8 (230.2)	46.4	14.9	61%
Phase 3	74.0	0.2	--	34%
Phase 4	70.8 (2.0)	2.6	--	15%
Total Modeled Habitat	704.5 (304.1)	111.7	588.4	
Total Modeled Habitat Outside of Existing Basins	**400.4**	**111.7**	**588.4**	

[1] Impact acreages in parentheses are within existing water recharge/flood control basins subject to regular O&M activities and are a subset of the total acres: of the 704.5 acres of permanent impacts, 304.1 acres occur within existing basins; consequently, impacts outside of basins are 704.5 – 304.1 = 400.4 acres.
[2] In addition to meeting the Stay-Ahead provisions for acres conserved in the Preserve System, the HCP is making contributions to the Western Spadefoot Updated Population Survey (see Section 5.7.3) beginning in the Up-Front phase.

5.9.8 California Glossy Snake (CGSN)

Conservation Objectives and Actions

CGSN Objective 1: Permanently conserve and manage glossy snake habitat within the HCP Preserve System in a configuration that benefits this species, and maintains or increases connectivity between occupied habitat areas.

> **CGSN Action 1:** Conserve, restore and/or rehabilitate, and manage 807.0 acres of modeled suitable glossy snake habitat within the HCP Preserve System.

CGSN Objective 2: Coordinate with USGS researchers to conduct an ecological needs and threats study for glossy snake in the HCP Preserve System to inform management and monitoring actions for the species.

CGSN Action 2A: Determine characteristics of glossy snake habitat in the HCP Preserve System.

CGSN Action 2B: Identify and delineate potentially occupied habitat in the HCP Preserve System to determine areas for management and monitoring.

Monitoring of species conservation actions is addressed in Section 5.12.

Measures to Avoid and Minimize Effects

CGS AMM-1: Prior to commencement of Covered Activities within California glossy snake modeled habitat, an appropriately qualified biologist shall conduct a preconstruction survey of all areas proposed to be impacted (including project staging and other temporary impact areas). Particular attention will be focused on areas of the project site with rocks and/or burrows. If the species is detected during the preconstruction survey it will be relocated to the closest area of suitable habitat outside of the project impact area.

CGS AMM-2: During project activities in areas of modeled suitable habitat, a qualified biologist shall be on site daily, for the duration of the work day, and shall conduct a daily inspection of areas under all equipment/materials staged on site prior to commencement of project activities to ensure the absence of glossy snake (or other species). If the species is detected and project-related activities are deemed to pose a threat, individuals will be moved out of harm's way to nearby suitable habitat outside of the impact area.

CGS AMM-3: Project activities will be limited to daylight hours where feasible. If night work is proposed the qualified biologist shall remain on site for the duration of work hours. Individual glossy snakes (or other species) detected within the project impact area will be moved to the closest area of suitable habitat outside of the project impact area.

CGS AMM-4: Erosion control materials, such as monofilament netting (erosion control netting) with fused weaves, will be prohibited from use during implementation of Covered Activities. These materials pose an entanglement risk to glossy snake, and other wildlife species. All fiber rolls and/or erosion control materials shall be made of loose-weave mesh that is not fused at the intersections of the weave, such as jute, or coconut (coir) fiber, or other products without welded weaves. Non-welded weaves reduce entanglement risks by allowing wildlife to push through the weave, which expands when spread.

CGS AMM-5: Best Management Practices (BMPs) installed/used during implementation of Covered Activities shall not pose a barrier to glossy snake (or other wildlife) movement and shall be installed to allow for the safe passage of wildlife out of the project area. Long, continuous lengths of silt-fencing or other BMP materials installed without gaps can create a barrier to wildlife movement, trapping wildlife within the project area. Areas of safe passage will be accommodated by leaving small gaps between parallel and overlapping lengths of BMPs.

Expected Outcomes

Implementation of the Covered Activities would result in the permanent loss of 801.3 acres and the temporary loss of 173.5 acres of California glossy snake modeled habitat within the Planning Area (Section 4.6.3). Of the permanent impacts, a portion occurs where Permittees currently conduct groundwater recharge activities (145.2 acres are within existing basins); therefore, permanent impacts on modeled habitat are less: 656.1 acres. Covered Activities, including the maintenance of existing pipelines and access roads, co-occur with documented recent occurrences of the species, indicating that impacts on the species from Covered Activity implementation may occur.

Approximately 807.0 acres of modeled habitat are expected to be conserved within the HCP Preserve System. Approximately 285.7 acres of modeled habitat will be restored/rehabilitated and managed within Alluvial Fan Preserve Unit A, and 218.6 acres will be restored/rehabilitated and managed within Alluvial Fan Preserve Unit B. Given that the majority of recent documented occurrences are located within these two HCP Preserve Units conservation, restoration/rehabilitation, and long-term monitoring and management of these Conservation Areas is expected to benefit California glossy snake.

Table 5-16 summarizes the estimated impacts and conservation of modeled habitat for California glossy snake. Also detailed in Table 5-16 is the HCP's Up-Front and Stay-Ahead Provisions (Section 5.4.1), which will ensure that mitigation for the species will stay ahead of Covered Activity impacts by a minimum of 10%.

The California glossy snake avoidance and minimization measures will ensure that potential effects on the species are reduced to the greatest extent practicable, and implementation of the species' conservation actions and Up-Front and Stay-Ahead Provisions (Table 5-16) will ensure any potential impacts are offset. The conservation actions and Up-Front and Stay-Ahead Provisions for California glossy snake are anticipated to result in long-term conservation benefits to the species. When considered along with the amount of modeled habitat that will be restored and/or rehabilitated, and conserved in the HCP Preserve System, the implementation of HCP Covered Activities would not threaten the continued existence of the species.

Table 5-16. Acres of Modeled Suitable Habitat Estimated to Be Impacted and Conserved for California Glossy Snake by HCP Implementation Phase, and the Species' Up-Front and Stay-Ahead Mitigation Strategy

	Impacts		Mitigation	
Modeled Habitat Type	**Permanent[1]**	**Temporary**	**HCP Preserve System**	**Stay-Ahead Provision %**
Suitable Habitat				
Up-Front (Pre-Phase 1)			63.0	--
Phase 1	285.1 (46.5)	111.3	614.0	93%
Phase 2	251.2 (98.4)	59.5	130.0	44%
Phase 3	159.3	0.5	--	12%
Phase 4	105.7 (0.3)	2.1	--	<10%[2]
Total Modeled Habitat	801.3 (145.2)	173.5	807.0	
Total Modeled Habitat Outside of Existing Basins	**656.1**	**173.5**	**807.0**	

[1] Impact acreages in parentheses are within existing water recharge/flood control basins subject to regular O&M activities and are a subset of the total acres. For example, of the 801.3 acres of permanent impacts, 145.2 acres occur within existing basins. Consequently, impacts outside of basins are 801.3 – 145.2 = 656.1 acres.
[2] Phase 4 Covered Activities cannot proceed until mitigation is ahead of Covered Activity impacts by a minimum of 10%.

5.9.9 South Coast Garter Snake (SCGS)

Conservation Objectives and Actions

SCGS Objective 1: Permanently conserve and manage south coast garter snake habitat within the HCP Preserve System in a configuration that benefits the species, and maintains or increases connectivity between areas of suitable habitat.

SCGS Action 1: Conserve, restore/rehabilitate, and manage 169.3 acres of suitable modeled aquatic habitat and adjacent upland habitat for south coast garter snake in the HCP Preserve System.

SCGS Objective 2: Increase the amount and quality of available south coast garter snake habitat in lowland tributaries to the mainstem of the Santa Ana River.

SCGS Action 2A: Identify and delineate potentially occupied/suitable habitat in the HCP Preserve System to determine areas for management and monitoring.

SCGS Action 2B: Restore 3.9 miles of aquatic habitat that is expected to benefit south coast garter snake at the Anza Creek, Old Ranch Creek, Hidden Valley Creek, Lower Hole Creek, and Evans Lake Conservation Areas. A portion of this area is included in the modeled habitat for the species, while other portions are not currently suitable habitat but would be restored to be suitable for the species.

SCGS Action 2C: Restore and/or rehabilitate 247.3 acres of riparian and wetland habitat in the HCP Preserve System. A portion of this area is modeled suitable habitat for the species, while other portions are not modeled as suitable habitat. Restoration and rehabilitation of the Hidden Valley Ponds is expected to benefit south coast garter snake.

SCGS Action 2D: Implement aquatic nonnative predator management in habitat suitable for south coast garter snake in the HCP Preserve System.

SCGS Objective 3: Reduce or prevent anthropogenic impacts on conserved and restored/rehabilitated south coast garter snake habitat within the HCP Preserve System.

SWPT Action 3A: Install signage in strategic locations adjacent to occupied or restored/rehabilitated south coast garter snake habitat within the HCP Preserve System.

SWPT Action 3B: Provide a supplemental water supply to benefit south coast garter snake in areas of modeled suitable habitat to ensure water is present at appropriate times of year during periods of drought or to offset effects of altered hydrology from HCP implementation.

Monitoring of species conservation actions is addressed in Section 5.12.

Measures to Avoid and Minimize Effects

SCGS AMM-1: Prior to commencement of Covered Activities within south coast garter snake modeled habitat, an appropriately qualified biologist shall conduct a preconstruction survey of all areas proposed to be impacted (including project staging and other temporary impact areas). If the species is detected during the preconstruction survey it will be relocated to the closest area of suitable habitat outside of the project impact area.

SCGS AMM-2: During project activities, in areas of suitable habitat, a qualified biologist shall conduct a daily inspection of areas under all equipment/materials staged on site prior to commencement of project activities to ensure the absence of south coast garter snake (or other species). If the species is detected and project-related activities are deemed to pose a threat, individuals will be moved out of harms way to nearby suitable habitat outside of the impact area.

SCGS AMM-3: Vegetation management activities in suitable south coast garter snake habitat that include the use of a tractor (or other tracked machinery) with an attached mower, shall ensure that the mower deck height is set to a minimum of 12 inches from the ground surface to minimize direct mortality or injury to south coast garter snake, and other less vagile species.

SCGS AMM-4: Where mowing is proposed in suitable south coast garter snake habitat, mowing shall be conducted at the slowest speed possible in a back and forth manner starting along a single edge of the area to be mowed. Incrementally advancing in this parallel pattern provides sufficient disturbance and time for species to escape to adjacent non-disturbed areas. Mowing shall not be conducted in a pattern that starts around the outside perimeter, and works towards to the center. This methodology often forces less vagile species to move continuously towards the center, fleeing noise and vibration and seeking un-mowed structural cover, until they are trapped.

SCGS AMM-5: Erosion control materials, such as monofilament netting (erosion control netting) with fused weaves, will be prohibited from use during implementation of Covered Activities. These materials pose an entanglement risk to south coast garter snake, and other wildlife species. All fiber rolls and/or erosion control materials shall be made of loose-weave mesh that is not fused at the intersections of the weave, such as jute, or coconut (coir) fiber, or other products without welded weaves. Non-welded weaves reduce entanglement risks by allowing wildlife to push through the weave, which expands when spread.

SCGS AMM-5: BMPs installed/used during implementation of Covered Activities shall not pose a barrier to south coast garter snake (or other wildlife) movement and shall be installed to allow for the safe passage of wildlife out of the project area. Long, continuous lengths of silt-fencing or other BMP materials installed without gaps can create a barrier to wildlife movement, trapping wildlife within the project area. Areas of safe passage will be accommodated by leaving small gaps between parallel and overlapping lengths of BMPs.

Expected Outcomes

Implementation of ground-disturbing Covered Activities would result in the permanent loss of 14.6 acres and the temporary loss of 43.5 acres of modeled suitable habitat within the Planning Area (Section 4.6.3). Of the 189 acres of predicted south coast garter snake wetted area (as a measure of aquatic habitat, see Section 3.6.4) downstream of Covered Activities, hydrologic changes resulting from Covered Activities are estimated to reduce this wetted area by approximately 19.5 acres (Table 4-8). The majority of south coast garter snake modeled suitable habitat also occurs in areas of modeled falling groundwater, with Covered Activities in place. There are no anticipated impacts from Covered Activities on known occurrences of south coast garter snake, but all of the tributary habitat improvement projects include areas of modeled suitable habitat, so temporary impacts from habitat restoration and/or rehabilitation activities could occur.

Overall, impacts on the south coast garter snake population from ground-disturbing effects and hydrologic changes would be limited. However, the areas of predicted modeled falling groundwater, with Covered Activities in place, may have a more substantial effect on the population. As discussed in Section 4.4.4, *Potential Effects on Groundwater-Dependent Ecosystems,* the predicted groundwater depths, and changes in these depths with Covered Activities in place are based on large-scale hydrologic modeling. As such, it will be important to conduct regular groundwater monitoring in conjunction with south coast garter snake habitat condition monitoring to adaptively manage the effects of Covered Activities on this species. Ongoing monitoring of groundwater and wetland and riparian vegetation is proposed as a component of HCP implementation (see Section 5.12.4, *Monitoring of the HCP Preserve System*). Data from existing and new shallow and deep groundwater wells around the Prado Basin and along the Santa Ana River will be used to verify the accuracy of the modeled groundwater depths. If inaccuracies are detected around the Prado Basin, a new sub-basin model will be created and incorporated into the model to increase model accuracy for this area.

Approximately 169.3 acres of modeled suitable habitat are expected to be conserved within the HCP Preserve System. Approximately 247.3 acres of aquatic and riparian habitat, including 3.9 linear miles of aquatic habitat, would be restored or created and managed to benefit the species within the restoration project areas, including the Hidden Valley Creeks and Ponds, Anza Creek, Old Ranch Creek, Lower Hole Creek, Evans Lake, and Management of Santa Ana Sucker Restoration on Sunnyslope Creek projects described in Section 5.4.3, *Conservation Areas*. The provision of dedicated supplemental flow to the aforementioned tributaries, as identified in SCGS Action 3B will ensure water is present at appropriate times of year during periods of drought or to offset effects of altered hydrology from HCP implementation.

Table 5-17 summarizes the estimated impacts and conservation of modeled habitat for the south coast garter snake. Also detailed in Table 5-17 is the HCP's Up-Front and Stay-Ahead Provisions, which will ensure that mitigation for the species will stay ahead of Covered Activity impacts by a minimum of 10%.

The south coast garter snake avoidance and minimization measures will ensure that potential effects on the species are reduced to the greatest extent practicable, and implementation of the species' conservation actions and Up-Front and Stay-Ahead Provisions (Table 5-17) will ensure any potential impacts are offset. The conservation actions and Up-Front and Stay-Ahead Provisions for south coast garter snake are anticipated to result in long-term conservation benefits to the species. When considered along with the amount of modeled habitat that will be restored and/or rehabilitated, and conserved in the HCP Preserve System, the implementation of HCP Covered Activities would not threaten the continued existence of the species.

Table 5-17. Acres of Modeled Suitable Habitat Estimated to Be Impacted and Conserved for South Coast Garter Snake by HCP Implementation Phase, and the Species' Up-Front and Stay-Ahead Mitigation Strategy

	Impacts		Mitigation	Stay-Ahead Provision %
Modeled Habitat Type	**Permanent**	**Temporary**	**HCP Preserve System**	
Suitable Habitat				
Up-Front (Pre-Phase 1)			8.0	--
Phase 1	14.5	42.3	61.9	23%
Phase 2	0.1	1.1	99.4	191%
Phase 3	0.0	0.0	--	Fulfilled
Phase 4	0.0	0.0	--	Fulfilled
Total Modeled Habitat	**14.6**	**43.5**	**169.3**	

5.9.10 Southwestern Pond Turtle (SWPT)

Conservation Objectives and Actions

SWPT Objective 1: Permanently conserve and manage southwestern pond turtle habitat within the HCP Preserve System to provide long-term conservation benefits to this species, including aquatic habitat with suitable adjacent upland nesting habitat.

SWPT Action 1A: Conserve 309.3 acres of modeled suitable upland and aquatic habitat in a configuration to facilitate habitat connectivity. Identify and manage known upland breeding sites within the HCP Preserve System.

SWPT Action 1B: Identify and conserve stream segments or ponds that currently provide or could provide high quality basking, breeding, and nesting habitat (vegetated banks and at least 150 feet of adjacent upland habitat) for southwestern pond turtle.

SWPT Action 1C: Implement bullfrog and other nonnative aquatic predator control in occupied southwestern pond turtle habitat in the HCP Preserve System.

SWPT Objective 2: Increase the amount of high-quality aquatic and associated upland habitat available to southwestern pond turtle in lowland tributaries to the mainstem of the Santa Ana River.

SWPT Action 2A: Restore 3.9 linear miles of aquatic habitat that is expected to benefit southwestern pond turtle at the Anza Creek, Old Ranch Creek, and Hidden Valley Creek, Lower Hole Creek, Evans Lake, and Hidden Valley Ponds Conservation Areas. A portion of this area is included in the modeled habitat for the species, while other portions are not currently suitable habitat but would be restored to be suitable for the species.

SWPT Action 2B: Install woody debris around the perimeter in open canopy/sunny locations and in submerged banks of ponds and wetlands to create basking habitat and cover for southwestern pond turtles.

SWPT Objective 3: Reduce or prevent anthropogenic impacts on conserved and restored southwestern pond turtle habitat within the HCP Preserve System.

SWPT Action 3A: Install fencing and/or signage in strategic locations adjacent to occupied or restored southwestern pond turtle habitat within the HCP Preserve System.

SWPT Action 3B: Provide a supplemental water supply to benefit southwestern pond turtle in known occupied habitats to ensure water is present at appropriate times of year during periods of drought or to offset effects of altered hydrology from HCP implementation.

SWPT Objective 4: Support ongoing survey efforts and research on southwestern pond turtle within the HCP Preserve System.

SWPT Action 2A: Contribute to ongoing surveys and assessments of habitat suitability and threats for southwestern pond turtle within the Planning Area.

SWPT Action 2B: Contribute to ongoing analyses of southwestern pond turtle demographics to assess the health of remaining populations within the Planning Area.

Monitoring of species conservation actions is addressed in Section 5.12.

Measures to Avoid and Minimize Effects

SWPT AMM-1: Prior to commencement of Covered Activities within southwestern pond turtle modeled habitat, an appropriately qualified biologist shall conduct a preconstruction survey of all areas proposed to be impacted (including project staging and other temporary impact areas). If the species is detected during the preconstruction survey it will be relocated to the closest area of suitable habitat outside of the project impact area.

SWPT AMM-2: Where project activities are proposed within or adjacent to suitable pond turtle habitat a rigorous trash prevention and removal program shall be implemented and enforced to minimize attracting subsidized predators to the area.

SWPT AMM-3: Vegetation management activities in suitable pond turtle habitat will be conducted by hand wherever possible.

SWPT AMM-4: Where mowing is proposed in suitable pond turtle habitat it will be conducted at the slowest speed possible and using the smallest and/or lightest mechanized equipment necessary. Mowing will be conducted in a back and forth manner starting along a single edge of the area to be mowed. Incrementally advancing in this parallel pattern provides sufficient disturbance and time for species to escape to adjacent non-disturbed areas. Mowing shall not be conducted in a pattern that starts around the outside perimeter, and works towards to the center. This methodology often forces less vagile species to move continuously towards the center, fleeing noise and vibration and seeking un-mowed structural cover, until they are trapped. While using mechanized equipment with an attached mower the mower deck height will be set to a minimum of 12 inches from the ground surface to minimize injury to southwestern pond turtle.

Expected Outcomes

Implementation of ground-disturbing Covered Activities would result in the permanent loss of 19.3 acres and the temporary loss of 58.7 acres of modeled habitat within the Planning Area (all but 0.9 acre of permanent and 4.8 acre of temporary impacts are on modeled suitable upland habitat) (Section 4.6.3). Of the 192 acres of predicted southwestern pond turtle wetted area (as a measure of aquatic habitat, see Section 3.6.4) downstream of Covered Activities, hydrologic changes resulting from Covered Activities are estimated to reduce this wetted area by approximately 17.8 acres (Table 4-32). The majority of southwestern pond turtle modeled suitable habitat also occurs in areas of modeled falling groundwater, with Covered Activities in place. There are no anticipated impacts from Covered Activities on known occurrences of southwestern pond turtle, but some the tributary habitat improvement projects include areas of modeled suitable habitat, so temporary impacts from habitat restoration and/or rehabilitation activities could occur.

Overall, impacts on the southwestern pond turtle population from ground-disturbing effects and hydrologic changes would be limited. However, the areas of predicted modeled falling groundwater, with Covered Activities in place, may have a more substantial effect on the population. As discussed in Section 4.4.4 the predicted groundwater depths, and changes in these depths with Covered Activities in place are based on large-scale hydrologic modeling. Consequently, long-term groundwater monitoring (Section 5.12.4), in conjunction with southwestern pond turtle population and habitat condition monitoring, will be implemented through the CAMMP to adaptively manage the effects of Covered Activities on this species.

Approximately 309.3 acres of modeled habitat are expected to be conserved within the HCP Preserve System. Approximately 39 acres of wetland and 208 acres of riparian habitat would be restored or created and managed to benefit the species within the mainstem tributary stream restoration/rehabilitation project areas including the Hidden Valley Creeks and Ponds, Anza Creek, Old Ranch Creek, Lower Hole Creek, Evans Lake, and Sunnyslope Creek described in Section 5.4.3. The provision of dedicated supplemental flow to southwestern pond turtle known occupied habitats, as identified in SWPT Action 3B will ensure water is present at appropriate times of year during periods of drought or to offset effects of altered hydrology from HCP implementation.

Table 5-18 summarizes the estimated impacts and conservation of modeled habitat for southwestern pond turtle. Also detailed in Table 5-18 is the HCP's Up-Front and Stay-Ahead Provisions, which will ensure that mitigation for the species will stay ahead of Covered Activity impacts by a minimum of 10%.

Other conservation actions to be supported by the Alliance as part of the conservation strategy to inform the management and support the conservation and recovery of the species are addressed in Section 5.7.5, *Southwestern Pond Turtle Population Survey,* and include funding the following:

- Conducting live-trapping surveys of the wetted reaches of the Santa Ana River and its tributaries to further document the occupied areas within of western Riverside and southwestern San Bernardino Counties.
- Analyzing southwestern pond turtle demographics to assess the health of remaining populations.
- Assessing habitat suitability and threats.

The southwestern pond turtle avoidance and minimization measures will ensure that potential effects on the species are reduced to the greatest extent practicable, and implementation of the species' conservation actions and Up-Front and Stay-Ahead Provisions (Table 5-18) will ensure any potential impacts are offset. The conservation actions and Up-Front and Stay-Ahead Provisions for southwestern pond turtle are anticipated to result in long-term conservation benefits to the species. When considered along with the amount of modeled habitat that will be restored and/or rehabilitated, and conserved, in the HCP Preserve System, the implementation of HCP Covered Activities would not threaten the continued existence of the species.

Table 5-18. Acres of Modeled Habitat Estimated to Be Impacted and Conserved for Southwestern Pond Turtle by HCP Implementation Phase, and the Species' Up-Front and Stay-Ahead Mitigation Strategy

Modeled Habitat Type	Impacts		Mitigation	Stay-Ahead Provision %
	Permanent	Temporary	HCP Preserve System	
All Model Categories[2]				
Up-Front (Pre-Phase 1)[1]			17.8	--[1]
Phase 1	19.0	55.6	134.4	104%
Phase 2	0.3	3.2	157.1	296%
Phase 3	0.0	0.0	--	Fulfilled
Phase 4	0.0	0.0	--	Fulfilled

Modeled Habitat Type	Impacts: Permanent	Impacts: Temporary	Mitigation: HCP Preserve System	Stay-Ahead Provision %
Total	*19.3*	*58.7*	*309.3*	
Aquatic Habitat				
Up-Front (Pre-Phase 1)			1.7	
Phase 1	0.9	4.8	8.2	
Phase 2	<0.1	<0.1	17.5	
Phase 3	0.0	0.0	--	
Phase 4	0.0	0.0	--	
Total	*0.9*	*4.8*	*27.4*	
Potentially Suitable Upland Habitat				
Up-Front (Pre-Phase 1)			16.1	
Phase 1	18.1	50.8	126.3	
Phase 2	0.3	3.1	139.6	
Phase 3	0.0	0.0	--	
Phase 4	0.0	0.0	--	
Total	*18.4*	*53.9*	*281.9*	
Total Modeled Habitat	**19.3**	**58.7**	**309.3**	

[1]Contributions to the Southwestern Pond Turtle Population Survey and Threats Analysis will occur ahead of HCP implementation (see Section 5.7.5).
[2] "All Model Categories" was created only for the purposes of summarizing the model categories presented in this table. Because of the number of model categories, the Stay-Ahead Provision is presented only for the All Model Categories summary.

5.9.11 Tricolored Blackbird (TRBL)

Conservation Objectives and Actions

TRBL Objective 1: Permanently conserve and manage tricolored blackbird habitat within the HCP Preserve System in a configuration that could support breeding and foraging for this species.

TRBL Action 1: Conserve 121.8 acres of modeled suitable habitat, including 35.4 acres of suitable colony habitat, in the HCP Preserve System to benefit the species and provide the potential for expansion of populations.

TRBL Objective 2: Restore and/or rehabilitate tricolored blackbird colony and foraging habitats within the HCP Preserve System.

TRBL Action 2A: Restore and/or rehabilitate up to 39.09 acres of wetland habitat and 208.3 acres of riparian habitat within the HCP Preserve System to benefit tricolored blackbird colony nesting and foraging.

TRBL Action 2B: Target colony habitat restoration and/or rehabilitation to occur in areas of shallow open water to create appropriate nesting substrate. Restore nesting substrate habitat in riparian floodplain areas at Hidden Valley Wetlands through planting of native vegetation, removal of nonnative species, creation of a wetland oxbow feature, and enhance floodplain processes by restoring hydrologic connectivity. Additional restoration activities for tricolored blackbird at Hidden Valley Ponds will include restoring water to seasonal ponds.

TRBL Action 2C: Maintain preferred breeding habitat (e.g., emergent vegetation/younger cattails) in the HCP Preserve System through vegetation management (e.g., cutting and removing) at appropriate intervals, as identified in the CAMMP.

TRBL Objective 3: Reduce or prevent anthropogenic impacts on conserved and restored tricolored blackbird habitat within the HCP Preserve System.

TRBL Action 3A: Install fencing and/or signage in strategic locations adjacent to occupied tricolored blackbird habitat within the HCP Preserve System.

TRBL Action 3B: Provide a dedicated water supply to Hidden Valley Ponds to ensure water is present at appropriate times of year during periods of drought or to offset effects of altered hydrology from HCP implementation.

Monitoring of species conservation actions is addressed in Section 5.12.

Measures to Avoid and Minimize Effects

TRBL AMM-1: Prior to commencement of Covered Activities within tricolored blackbird modeled habitat, an appropriately qualified biologist shall conduct a preconstruction survey of all areas proposed to be impacted (including project staging and other temporary impact areas). If the species is detected during the preconstruction survey the start of the project will be on hold until the species has moved out of the project area.

TRBL AMM-2: New construction and O&M activities conducted within suitable tricolored blackbird habitat will be avoided to the extent feasible during the breeding season (March–July).

Expected Outcomes

Implementation of ground-disturbing Covered Activities would result in a permanent loss of 280.3 acres and the temporary loss of 156.4 acres of modeled habitat within the Planning Area (Section 4.6.3). Of the permanent impacts, a portion occurs where Permittees currently conduct groundwater recharge activities (57.9 acres) are within existing basins; therefore, permanent impacts on modeled habitat are less: 222.4 acres. In addition to ground-disturbing impacts, modeled suitable habitat for tricolored blackbird within the Planning Area co-occurs in areas of predicted falling groundwater and predicted rising groundwater areas along the Santa Ana River and within and north of the Prado Basin. There are no anticipated impacts from Covered Activities on current known occurrences of tricolored blackbird. The Wineville Basin project (IEUA.1.01) coincides with a previously active colony, observed in 2014; but the species has not been detected at the site since this date.

Overall, impacts on tricolored blackbird from ground-disturbing effects and hydrologic changes would be limited. However, the areas of predicted modeled falling groundwater, with Covered Activities in place, may have a more substantial effect on the population. As discussed in Section 4.4.4 the predicted groundwater depths, and changes in these depths with Covered Activities in place, are based on large-scale hydrologic modeling. Consequently, it will be important to conduct regular groundwater monitoring in conjunction with tricolored blackbird population and habitat condition monitoring to adaptively manage the effects of Covered Activities on this species. Ongoing monitoring of groundwater and wetland and riparian vegetation is proposed as a component of HCP implementation (Section 5.12.4). Data from existing and new shallow and deep groundwater wells around the Prado Basin and along the Santa Ana River will be used to verify the accuracy of the modeled groundwater depths. If inaccuracies are detected around the Prado Basin, a new sub-basin model will be created and incorporated into the model to increase model accuracy for this area.

Approximately 121.8 acres of modeled habitat are expected to be conserved within the HCP Preserve System. Approximately 144.7 acres of tricolored blackbird suitable colony habitat would be restored, including 130.8 acres not currently modeled as colony habitat, and managed to benefit the species within the restoration project areas. An additional 13.9 acres of foraging habitat that is not currently modeled as benefiting tricolored blackbird will be restored to benefit this species. Restoration efforts proposed as part of the HCP's Conservation Strategy at Hidden Valley Ponds have the potential to benefit tricolored blackbird. Further, the provision of a permanent, dedicated water supply to Hidden Valley Ponds, as identified in TRBL Action 3B, will ensure water is present at appropriate times of year during periods of drought or to offset effects of altered hydrology from HCP implementation.

Table 5-19 summarizes the estimated impacts and conservation of modeled habitat for tricolored blackbird. Also detailed in Table 5-19 is the HCP's Up-Front and Stay-Ahead Provisions, which will ensure that mitigation for the species will stay ahead of Covered Activity impacts by a minimum of 10%.

The tricolored blackbird avoidance and minimization measures will ensure that potential effects on the species are reduced to the greatest extent practicable, and implementation of the species' conservation actions and Up-Front and Stay-Ahead Provisions (Table 5-19) will ensure any potential impacts are offset. The conservation actions and Up-Front and Stay-Ahead Provisions for tricolored blackbird are anticipated to result in long-term conservation benefits to the species. When considered along with the amount of modeled habitat that will be restored, and conserved in the HCP Preserve System, the implementation of HCP Covered Activities would not threaten the continued existence of the species.

Table 5-19. Acres of Modeled Habitat Estimated to Be Impacted and Conserved for Tricolored Blackbird by HCP Implementation Phase, and the Species' Up-Front and Stay-Ahead Mitigation Strategy

	Impacts		Mitigation	
Modeled Habitat Type	**Permanent[1]**	**Temporary**	**HCP Preserve System**	**Stay-Ahead Provision %**
All Model Categories[2]				
Up-Front (Pre-Phase 1)			39.9	
Phase 1	158.6 (29.6)	54.6	46.8	<10%[4]
Phase 2	121.1 (28.3)	100.9	35.1	<10%[4]
Phase 3	0.1	0.7	--	<10%[4]
Phase 4	0.5	0.3	--	<10%[4]
Total	*280.3 (57.9)*	*156.4*	*121.8*	
Suitable Colony Habitat[3]				
Up-Front (Pre-Phase 1)			1.2	--

Modeled Habitat Type	Impacts: Permanent[1]	Impacts: Temporary	Mitigation: HCP Preserve System	Stay-Ahead Provision %
Phase 1	26.8 (22.0)	10.1	12.3	
Phase 2	28.3 (28.3)	0.5	22.0	
Phase 3	0.0	0.0	--	
Phase 4	0.0	0.0	--	
Total	*55.2 (50.3)*	*10.7*	*35.4*	
Breeding Season Foraging – Natural				
Up-Front (Pre-Phase 1)			38.7	--
Phase 1	87.9 (7.6)	18.5	34.3	
Phase 2	69.2	24.6	13.1	
Phase 3	0.1	0.2	--	
Phase 4	0.5	0.3	--	
Total	*157.6 (7.6)*	*43.6*	*86.1*	
Breeding Season Foraging – Agriculture				
Up-Front (Pre-Phase 1)				
Phase 1	43.5	25.3	0.2	--
Phase 2	23.5	75.1	--	--
Phase 3	0.0	0.6	--	--
Phase 4	0.0	0.0	--	--
Total	*67.0*	*101.0*	*0.2*	
Non-Breeding Season Foraging – Natural				
Up-Front (Pre-Phase 1)				
Phase 1	0.4	0.3	--	--
Phase 2	0.0	0.0	--	--
Phase 3	0.0	0.0	--	--
Phase 4	0.0	0.0	--	--
Total	*0.4*	*0.3*	--	
Non-Breeding Season Foraging – Agriculture				
Up-Front (Pre-Phase 1)				
Phase 1	0.0	0.2	--	--
Phase 2	0.1	0.6	--	--
Phase 3	0.0	0.0	--	--
Phase 4	0.0	0.0	--	--
Total	*0.1*	*0.9*	--	
Total Modeled Habitat	280.3 (57.9)	156.4	121.8	
Total Modeled Habitat Outside of Existing Basins	**222.4**	**156.4**	**121.8**	
New Colony Habitat Created through Restoration			130.8	

Modeled Habitat Type	Impacts: Permanent[1]	Impacts: Temporary	Mitigation: HCP Preserve System	Stay-Ahead Provision %
New Foraging Habitat Created through Restoration			13.9	
Grand Total of Habitat in the HCP Preserve System			**266.5**	

[1] Impact acreages in parentheses are within existing water recharge/flood control basins subject to regular O&M activities and are a subset of the total acres. For example, of the 280.3 acres of permanent impacts, 57.9 acres occur within existing basins. Consequently, impacts outside of basins are 280.3 – 57.9 = 222.4 acres.
[2] "All Model Categories" was created only for the purposes of summarizing the model categories presented in this table. Because of the number of model categories, the Stay-Ahead Provision is presented only for the All Model Categories summary.
[3] Occupied Colony Habitat is not included in this table because there are no impacts on or mitigation in Occupied Colony Habitat.
[4] Covered Activities cannot proceed until mitigation is ahead of Covered Activity impacts by a minimum of 10%.

5.9.12 Burrowing Owl (BUOW)

Conservation Objectives and Actions

BUOW Objective 1: Permanently conserve and manage burrowing owl habitat within the HCP Preserve System to provide long-term conservation benefits to the species.

BUOW Action 1A: Conserve 594.8 acres of modeled burrowing owl habitat within the HCP Preserve System in a spatial distribution to maintain populations, to facilitate habitat connectivity between existing populations and breeding/foraging sites, and to provide opportunity for expansion of populations.

BUOW Action 1B: Maintain fossorial mammal (e.g., ground squirrel) populations within burrowing owl habitat identified within the HCP Preserve System to support burrow creation for roosting and breeding. Prevent rodent control efforts within the HCP Preserve System, and coordinate with adjacent landowners to limit the use of rodenticides and understand the importance of fossorial mammals for burrowing owl conservation.

BUOW Action 1C: In areas of suitable habitat within the HCP Preserve System, conduct a threat assessment to identify opportunities for habitat restoration and/or rehabilitation. Document the following: (1) observations of predators such as coyotes or raptors, (2) signs of unauthorized access such as off-road vehicle use, (3) lack of mammal burrows, (4) potential use of rodenticides, and (5) thick or tall vegetation.

BUOW Action 1D: Rehabilitate habitat for burrowing owls within areas supporting appropriate soil types in the HCP Preserve System. Through the CAMMP, identify at least one location and specific implementable actions to encourage owls to occupy areas of suitable habitat within the HCP Preserve System (e.g., translocation of ground squirrels, conspecific visual and auditory cues [white wash on rocks adjacent to burrow entrances, call playing]).

Monitoring of species conservation actions is addressed in Section 5.12.

Measures to Avoid and Minimize Effects

BUOW AMM-1: Prior to implementation of ground-disturbing project activities, including staging and site preparation, in areas that may support burrowing owls, an appropriately qualified biologist shall complete burrowing owl assessments, surveys, impact assessments, and prepare associated reports following the *Staff Report on Burrowing Owl Mitigation* (CDFG 2012). Reports shall be submitted to the Alliance, USFWS, and CDFW no more than 30 days following completion of surveys.

Expected Outcomes

Table 5-20 summarizes the estimated impacts and conservation of modeled habitat for the burrowing owl within the Planning Area. Also detailed in Table 5-20 is the HCP's Up-Front and Stay-Ahead Provisions for burrowing owl, which will ensure that mitigation for the species will stay ahead of Covered Activity impacts by a minimum of 10%.

Implementation of ground-disturbing Covered Activities would result in a permanent loss of 763.6 acres and temporary loss of 242.6 acres of modeled habitat within the Planning Area (Section 4.6.3). Of the permanent impacts, a portion occurs where Permittees currently conduct groundwater recharge activities (181.6 acres are within existing basins); therefore, permanent impacts on modeled habitat are less: 554.7 acres. Approximately 594.8 acres of modeled habitat are expected to be conserved within the HCP Preserve System. Of this total, up to 220.3 acres, within the various Conservation Areas supporting suitable soils to support fossorial mammals, will be restored and/or rehabilitated for the benefit of burrowing owl.

The burrowing owl avoidance and minimization measure will ensure that potential impacts on the species are reduced to the greatest extent practicable, and implementation of the species' conservation actions and Up-Front and Stay-Ahead Provisions (Table 5-20) will ensure any potential effects are offset. The conservation actions and Up-Front and Stay-Ahead Provisions for burrowing are anticipated to result in long-term conservation benefits for the species within the HCP Preserve System. When considered along with the amount of modeled habitat that will be restored, and conserved in the HCP Preserve System, the implementation of HCP Covered Activities would not threaten the continued existence of the species.

Table 5-20. Acres of Modeled Habitat Estimated to Be Impacted and Conserved for Burrowing Owl by HCP Implementation Phase, and the Species' Up-Front and Stay-Ahead Mitigation Strategy

	Impacts		Mitigation	
Modeled Habitat Type	**Permanent**[1]	**Temporary**	**HCP Preserve System**	**Stay-Ahead Provision %**
Potentially Suitable Habitat				
Up-Front (Pre-Phase 1)			64.7	--
Phase 1	388.9 (81.0)	114.3	503.7	35%
Phase 2	203.6 (100.3)	125.4	26.5	<10%[2]
Phase 3	83.6	1.4	--	<10%[2]
Phase 4	60.1 (0.3)	1.6	--	<10%[2]
Total Modeled Habitat	736.3 (181.6)	242.6	594.8	
Total Modeled Habitat Outside of Existing Basins	**554.7**	**242.6**	**594.8**	

[1] Impact acreages in parentheses are within existing water recharge/flood control basins subject to regular O&M activities and are a subset of the total acres. For example, of the 736.3 acres of permanent impacts, 181.6 acres occur within existing basins. Consequently, impacts outside of basins are 736.3 – 181.6 = 554.7 acres.
[2] HCP Implementation Phase Covered Activities cannot proceed until mitigation is ahead of Covered Activity impacts by a minimum of 10%.

5.9.13 Cactus Wren (CACW)

Conservation Objectives and Actions

CACW Objective 1: Permanently conserve and manage habitat within the HCP Preserve System in a configuration that provides long-term conservation benefits to the species. This will include maintaining the quality of habitat within the HCP Preserve System.

CACW Action 1A: Conserve and maintain 681.4 acres of modeled habitat within the HCP Preserve System in a spatial distribution to support populations, facilitate habitat connectivity between existing populations and breeding/foraging sites, and allow for expansion of populations.

CACW Action 1B: To minimize the threat of fire to cactus patches, control nonnative plants (grasses and other nonnative plant species) following methodology identified in the CAMMP.

CACW Objective 2: Rehabilitate cactus wren habitat within the HCP Preserve System, using best available science, as described in the CAMMP.

CACW Action 2A: Rehabilitate nesting and foraging habitat within alluvial fan restoration projects, and as appropriate in suitable habitat throughout the HCP Preserve System.

CACW Action 2B: Salvage and transplant appropriate cactus species from areas that will be permanently impacted by Covered Activities, to appropriate habitat in the HCP Preserve System.

CACW Action 2C: Inspect burned areas within 6 months after a wildfire in the HCP Preserve System for damaged or destroyed cactus patches. Collect appropriate cactus species from existing dense and locally occurring "donor" stands of cactus for transplantation into burn areas to promote recovery.

Monitoring of species conservation actions is addressed in Section 5.12.

Measures to Avoid and Minimize Effects

CACW AMM-1: New construction and O&M activities conducted within suitable cactus wren habitat will be avoided to the extent feasible during the breeding season (February to September).

CACW AMM-2: Prior to commencement of Covered Activities within cactus wren modeled habitat, an appropriately qualified biologist will conduct a preconstruction survey of all areas proposed to be impacted (including project staging and other temporary impact areas). If the species is detected during the preconstruction survey the project will be amended to avoid impacts on occupied habitat, if possible.

CACW AMM-3: If project delays cannot be accommodated appropriate buffers or noise attenuation devices will be implemented in order to minimize the deleterious effects of construction noise on nesting behaviors of cactus wren. Noise monitoring, and monitoring of wren behavior, will be conducted to provide evidence that effective noise reduction is occurring within the project area.

CACW AMM-4: During construction where there are permanent disturbance areas with native cactus, all native cactus such as cholla and beavertail will be salvaged and transplanted to HCP Preserve System sites in areas suitable for cactus. If a suitable transplant location is immediately available for replanting (preferably within 2.5 miles of occupied cactus wren habitat), plants should be salvaged and transplanted whole. When removing cacti, care should be taken to keep root systems intact, to collect adjacent soil for transplanting, and to mark orientation of the cactus at the removal site. Transplanted cactus should be placed in the same orientation as the removal site. If a transplant site is not immediately available, multi-stem cactus plants should be salvaged by breaking off sections at the joint of a minimum of two pads/segments, with larger cuttings containing multiple pads/segments being preferred. Single-stem cactus plants should be excavated whole and roots should be trimmed to within 2 to 3 inches of the base of the plant. Cacti should be stored outside and covered. If possible, cactus salvage should occur outside of late fall so plants are the least drought stressed. If salvaging prickly pear cactus, ensure that it has not hybridized with the nonnative mission fig (*Opuntia ficus-indica*).

Expected Outcomes

Table 5-21 summarizes the estimated impacts and conservation of modeled habitat for cactus wren within the Planning Area. Also detailed in Table 5-21 is the HCP's Up-Front and Stay-Ahead Provisions for cactus wren, which will ensure that mitigation for the species will stay ahead of Covered Activity impacts by a minimum of 10%.

Implementation of ground-disturbing Covered Activities would result in a permanent loss of 697.9 acres and the temporary loss of 186.9 acres of modeled habitat within the Planning Area (Section 4.6.3). Of the permanent impacts, a portion occurs where Permittees currently conduct groundwater recharge activities (186.0 acres are within existing basins); therefore, permanent impacts on modeled habitat are less: 511.9 acres. Approximately 681.4 acres of modeled habitat are expected to be conserved within the HCP Preserve System, and a portion of this habitat will be restored and/or rehabilitated and managed for the benefit of cactus wren.

The cactus wren avoidance and minimization measures will ensure that potential effects on the species are reduced to the greatest extent practicable, and implementation of the species' conservation actions and Up-Front and Stay-Ahead Provisions (Table 5-21) will ensure any potential impacts are offset. The conservation actions and Up-Front and Stay-Ahead Provisions for cactus wren are anticipated to result in long-term conservation benefits to the species. When considered along with the amount of modeled habitat that will be conserved in the HCP Preserve System, the implementation of HCP Covered Activities would not threaten the continued existence of the species.

Table 5-21. Acres of Modeled Habitat Estimated to Be Impacted and Conserved for Cactus Wren by HCP Implementation Phase, and the Species' Up-Front and Stay-Ahead Mitigation Strategy

	Impacts		Mitigation	
Modeled Habitat Type	**Permanent**[1]	**Temporary**	**HCP Preserve System**	**Stay-Ahead Provision %**
All Model Categories[2]				
Up-Front (Pre-Phase 1)			64.7	
Phase 1	324.2 (77.2)	99.1	546.0	76%
Phase 2	226.7 (108.5)	84.9	70.7	24%
Phase 3	83.9	0.9	--	<10%[3]
Phase 4	63.3 (0.3)	2.0	--	<10%[3]
Total	697.9 (186.0)	186.9	681.4	

Modeled Habitat Type	Impacts		Mitigation	
	Permanent[1]	Temporary	HCP Preserve System	Stay-Ahead Provision %
Known Suitable Nesting				
Up-Front (Pre-Phase 1)				
Phase 1	0.1	0.3	19.5	
Phase 2	14.2	0.0	--	
Phase 3	0.3	0.0	--	
Phase 4	0.0	0.0	--	
Total	14.6	0.3	19.5	
Potential Nesting and Foraging Habitat				
Up-Front (Pre-Phase 1)			64.7	--
Phase 1	322.8 (77.2)	96.4	524.2	
Phase 2	212.1 (108.5)	81.0	70.7	
Phase 3	83.5	0.9	--	
Phase 4	63.3 (0.3)	2.0	--	
Total	*681.7 (186.0)*	*180.2*	*659.5*	
Recently Burned (2008–2018)				
Up-Front (Pre-Phase 1)				
Phase 1	1.3	2.5	2.4	
Phase 2	0.4	4.0	--	
Phase 3	0.0	0.0	--	
Phase 4	0.0	0.0	--	
Total	*1.6*	*6.4*	*2.4*	
Total Modeled Habitat	697.9 (186.0)	186.9	681.4	
Total Modeled Habitat Outside of Existing Basins	**511.9**	**186.9**	**681.4**	

[1] Impact acreages in parentheses are within existing water recharge/flood control basins subject to regular O&M activities and are a subset of the total acres. For example, of the 697.9 acres of permanent impacts, 186.0 acres occur within existing basins. Consequently, impacts outside of basins are 697.9 – 186.0 = 511.9 acres.
[2] "All Model Categories" was created for the purposes of summarizing the model categories presented in this table.
[3] HCP Implementation Phase Covered Activities cannot proceed until mitigation is ahead of Covered Activity impacts by a minimum of 10%.

5.9.14 Yellow-Breasted Chat (YBCH)

Conservation Objectives and Actions

YBCH Objective 1: Permanently conserve and manage yellow-breasted chat habitat within the HCP Preserve System in a configuration that provides long-term conservation benefits for this species.

YBCH Action 1A: Conserve 241.7 acres habitat in a spatial distribution to maintain populations, facilitate habitat connectivity between existing populations and breeding/foraging sites, and allow for expansion of populations.

YBCH Action 1B: Reduce nest parasitism by cowbirds using cowbird control and removal practices when surveys indicate control measures are warranted.

YBCH Objective 2: Restore and/or rehabilitate yellow-breasted chat riparian habitat in the HCP conservation sites within the HCP Preserve System.

YBCH Action 2A: Restore and/or rehabilitate 208.3 acres of riparian habitat in the HCP Preserve System conservation sites, following methodology identified in the CAMMP. Habitat restoration and/or rehabilitation areas will include Anza Creek, Old Ranch Creek, Hidden Valley Creek, Lower Hole Creek, and Evans Lake. A portion of this area is included in the modeled habitat for the species: approximately 50.7 acres are not currently suitable habitat but would be restored to be suitable for the species.

YBCH Action 2B: Supplement or provide flow to Anza Creek, Old Ranch Creek, Hidden Valley Creek, Hidden Valley Ponds, Lower Hole Creek, and Evans Lake to support aquatic and adjacent riparian habitat via the Santa Ana River Sustainable Parks and Tributaries Water Reuse Project (RPU.10), and ensure water is present at appropriate times of year during periods of drought or to offset effects of altered hydrology from HCP implementation.

Monitoring of species conservation actions is addressed in Section 5.12.

Measures to Avoid and Minimize Effects

YBCH AMM-1: New construction and O&M activities conducted within suitable yellow-breasted chat habitat will be avoided to the extent feasible during the breeding season (May 15–September 15).

YBCH AMM-2: If Covered Activities must proceed during the breeding season within yellow-breasted chat modeled habitat, a qualified biologist shall conduct a preconstruction nesting bird survey of all areas proposed to be impacted (including project staging and other temporary impact areas), and within a minimum 100-foot buffer of the project area. If nesting yellow-breasted chat (or other species of nesting bird) are detected, the start of the project will be on hold until the species has moved out of the project area.

YBCH AMM-3: If project delays cannot be accommodated, appropriate buffers or noise attenuation devices will be implemented in order to minimize the deleterious effects of construction noise on nesting behaviors of yellow-breasted chat. Noise monitoring, and monitoring of chat behavior, will be conducted to provide evidence that effective noise reduction is occurring within the project area.

Expected Outcomes

Table 5-22 summarizes the estimated impacts and conservation of modeled habitat for the yellow-breasted chat within the Planning Area. Also detailed in Table 5-22 is the HCP's Up-Front and Stay-Ahead Provisions for yellow-breasted chat, which will ensure that mitigation for the species will stay ahead of Covered Activity impacts by a minimum of 10%.

As described in the effects analysis for yellow-breasted chat (Section 4.6.3), implementation of ground-disturbing Covered Activities would result in a permanent loss of 126.7 acres and the temporary loss of 44.7 acres of modeled habitat within the Planning Area. Of the permanent impacts, more than half occurs where Permittees currently conduct groundwater recharge activities (68.5 acres are within existing basins); therefore, permanent impacts on modeled habitat are significantly less: 58.2 acres. Modeled suitable habitat for yellow-breasted chat also occurs within areas of predicted falling groundwater, and predicted rising groundwater, along the Santa Ana River and within Prado Basin.

Overall, impacts on yellow-breasted chat from ground-disturbing effects and hydrologic changes would be limited. However, the areas of predicted modeled falling groundwater, with Covered Activities in place, may have a more substantial effect on the population. As discussed in Section 4.4.4 the predicted groundwater depths, and changes in these depths with Covered Activities in place, are based on large-scale hydrologic modeling. As such, it will be important to conduct regular groundwater monitoring, in conjunction with yellow-breasted chat population and habitat condition monitoring to adaptively manage the effects of Covered Activities on this species. Ongoing monitoring of groundwater and wetland and riparian vegetation is proposed as a component of HCP implementation (Section 5.12.4). Data from existing and new shallow and deep groundwater wells around the Prado Basin and along the Santa Ana River will be used to verify the accuracy of the modeled groundwater depths. If inaccuracies are detected around the Prado Basin, a new sub-basin model will be created and incorporated into the model to increase model accuracy for this area.

Approximately 241.7 acres of modeled habitat are expected to be conserved within the HCP Preserve System. Approximately 220.6 acres of yellow-breasted chat habitat would be restored and/or rehabilitated and managed to benefit the species within the Conservation Areas. Restoration activities will restore 50.7 acres of habitat that is not currently identified as modeled habitat for the yellow breasted chat, resulting in a net increase in habitat that will support this species. Riparian habitat restoration and/or rehabilitation that will directly benefit chat will occur at Hidden Valley Creeks and Ponds, Anza Creek, Old Ranch Creek, Lower Hole Creek, and Evans Lake. The provision of dedicated supplemental flow (via the Santa Ana Sustainable Parks and Tributaries Water Reuse Project, RPU.10) to the aforementioned tributaries, as identified in YBCH Action 2B, will ensure water is present at appropriate times of year to support riparian habitat during periods of drought or to offset effects of altered hydrology from HCP implementation.

The yellow-breasted chat avoidance and minimization measures will ensure that potential effects on the species are reduced to the greatest extent practicable, and implementation of the species' conservation actions and Up-Front and Stay-Ahead Provisions will ensure any potential impacts are offset. The conservation actions and Up-Front and Stay-Ahead Provisions for yellow-breasted chat are anticipated to result in long-term conservation benefits for the species within the HCP Preserve System. When considered along with the amount of modeled habitat that will be restored or conserved in the HCP Preserve System, the implementation of HCP Covered Activities would not threaten the continued existence of the species.

Table 5-22. Acres of Modeled Habitat Estimated to Be Impacted and Conserved for Yellow-Breasted Chat by HCP Implementation Phase, and the Species' Up-Front and Stay-Ahead Mitigation Strategy

	Impacts		Mitigation	
Modeled Habitat Type	**Permanent**[1]	**Temporary**	**HCP Preserve System**	**Stay-Ahead Provision %**
Potentially Suitable Habitat				
Up-Front (Pre-Phase 1)			12.3	--
Phase 1	61.5 (27.6)	31.9	114.5	93%
Phase 2	50.4 (40.9)	12.1	114.9	176%

Modeled Habitat Type	Impacts: Permanent[1]	Impacts: Temporary	Mitigation: HCP Preserve System	Stay-Ahead Provision %
Phase 3	14.7	0.0	--	136%
Phase 4	0.0	0.6	--	135%
Total Modeled Habitat	126.7 (68.5)	44.7	241.7	
Total Modeled Habitat Outside of Existing Basins	**58.2**	**44.7**	**241.7**	

[1] Impact acreages in parentheses are within existing water recharge/flood control basins subject to regular O&M activities and are a subset of the total acres. For example, of the 126.7 acres of permanent impacts, 68.5 acres occur within existing basins. Consequently, impacts outside of basins are 126.7 – 68.5 = 58.2 acres.

5.9.15 Western Yellow-Billed Cuckoo (WYBC)

Conservation Objectives and Actions

WYBC Objective 1: Permanently conserve and manage western yellow-billed cuckoo habitat within the HCP Preserve System in a configuration that supports the potential for breeding and foraging of this species.

WYBC Action 1: Conserve 117.9 acres of habitat in a spatial distribution to support occupancy, to facilitate habitat connectivity between breeding/foraging sites, and to allow for expansion of a population into the HCP Preserve System.

WYBC Objective 2: Restore and/or rehabilitate western yellow-billed cuckoo habitat within the HCP Preserve System.

WYBC Action 2A: Rehabilitate up to 175.3 acres of riparian habitat on the Hidden Valley Creek, Anza Creek, Old Ranch Creek, and Evans Lake conservation sites within the HCP Preserve System. Implement appropriate management techniques to restore, rehabilitate, and create suitable habitat.

WYBC Action 2B: Supplement or provide flow to Anza Creek, Old Ranch Creek, Hidden Valley Creek and Ponds, and Evans Lake to support aquatic and adjacent riparian habitat via the Santa Ana River Sustainable Parks and Tributaries Water Reuse Project (RPU.10), and ensure water is present at appropriate times of year during periods of drought or to offset effects of altered hydrology from HCP implementation.

Monitoring of species conservation actions is addressed in Section 5.12.

Measures to Avoid and Minimize Effects

WYBC AMM-1: New construction and O&M activities conducted within suitable western yellow-billed cuckoo habitat will be avoided to the extent feasible during the breeding season (May 15–September 15).

WYBC AMM-2: If Covered Activities must proceed during the breeding season within western yellow-billed cuckoo modeled habitat, a qualified biologist shall conduct a preconstruction nesting bird survey, and if possible a protocol survey, of all areas proposed to be impacted (including project staging and other temporary impact areas), and within a minimum 100-foot buffer of the project area. If nesting western yellow-billed cuckoo are detected, the start of the project will be on hold until the species has moved out of the project area.

WYBC AMM-3: If project delays cannot be accommodated appropriate buffers or noise attenuation devices will be implemented in order to minimize the deleterious effects of construction noise on nesting behaviors of western yellow-billed cuckoo. Noise monitoring, and monitoring of cuckoo behavior, will be conducted to provide evidence that effective noise reduction is occurring within the project area.

Expected Outcomes

Table 5-23 summarizes the estimated impacts and conservation of modeled habitat for the western yellow-billed cuckoo within the Planning Area. Also detailed in Table 5-23 is the HCP's Up-Front and Stay-Ahead Provisions for western yellow-billed cuckoo, which will ensure that mitigation for the species will stay ahead of Covered Activity impacts by a minimum of 10%.

As described in the effects analysis for western yellow-billed cuckoo (Section 4.6.3), implementation of ground-disturbing Covered Activities would result in a permanent loss of 8.8 acres and the temporary loss of 9.0 acres of modeled habitat within the Planning Area. USFWS has proposed, but not finalized, critical habitat for western yellow-billed cuckoo. There is no proposed critical habitat identified within the Planning Area (USFWS 2020). Modeled habitat for yellow-breasted chat also occurs within areas of predicted falling groundwater, and predicted rising groundwater, along the Santa Ana River and within Prado Basin.

Overall, impacts on western yellow-billed cuckoo from ground-disturbing effects and hydrologic changes would be limited. However, the areas of predicted modeled falling groundwater, with Covered Activities in place, may have a more substantial effect on modeled habitat and on the population (should the species be detected in the Planning Area in the future). As discussed in Section 4.4.4 the predicted groundwater depths, and changes in these depths with Covered Activities in place, are based on large-scale hydrologic modeling. As such, it will be important to conduct regular groundwater monitoring, in conjunction with western yellow-billed cuckoo population and habitat condition monitoring, to adaptively manage the effects of Covered Activities on this species. Ongoing monitoring of groundwater and wetland and riparian vegetation is proposed as a component of HCP implementation (see Section 5.12.4). Data from existing and new shallow and deep groundwater wells around the Prado Basin and along the Santa Ana River will be used to verify the accuracy of the modeled groundwater depths. If inaccuracies are detected around the Prado Basin, a new sub-basin model will be created and incorporated into the model to increase model accuracy for this area.

Approximately 117.9 acres of modeled habitat are expected to be conserved within the HCP Preserve System. Approximately 175.3 acres of western yellow-billed cuckoo habitat would be restored and managed to benefit the species within the conservation areas. Riparian habitat restoration and/or rehabilitation that may benefit western yellow-billed cuckoo will occur at Hidden Valley Creeks and Ponds, Anza Creek, Old Ranch Creek, Lower Hole Creek, and Evans Lake. The provision of dedicated supplemental flow (via the Santa Ana Sustainable Parks and Tributaries Water Reuse Project, RPU.10) to the aforementioned tributaries, as identified in WYBC Action 2B, will ensure water is present at appropriate times of year to support riparian habitat during periods of drought or to offset effects of altered hydrology from HCP implementation.

The western yellow-billed cuckoo avoidance and minimization measures will ensure that potential effects on the species are reduced to the greatest extent practicable, and implementation of the species' conservation actions and Up-Front and Stay-Ahead Provisions (Table 5-23) will ensure any potential impacts are offset. The conservation actions and Up-Front and Stay-Ahead Provisions for western yellow-billed cuckoo are anticipated to result in long-term conservation benefits for the species within the HCP Preserve System. When considered along with the amount of modeled habitat that will be restored or conserved in the HCP Preserve System, the implementation of HCP Covered Activities would not threaten the continued existence of the species.

Table 5-23. Acres of Modeled Habitat Estimated to Be Impacted and Conserved for Western Yellow-Billed Cuckoo by HCP Implementation Phase, and the Species' Up-Front and Stay-Ahead Mitigation Strategy

	Impacts		Mitigation	
Modeled Habitat Type	**Permanent**	**Temporary**	**HCP Preserve System**	**Stay-Ahead Provision %**
All Model Categories[1]				
Up-Front (Pre-Phase 1)			5.2	--
Phase 1	8.7	7.2	72.2	386%
Phase 2	0.1	1.8	40.5	>500%
Phase 3	0.0	0.0	--	Fulfilled
Phase 4	0.0	0.0	--	Fulfilled
Total	*8.8*	*0.8*	*117.9*	
High Value Breeding Habitat				
Up-Front (Pre-Phase 1)				--
Phase 1	0.0	0.7	--	[1]
Phase 2	<0.1	0.1	--	[1]
Phase 3	0.0	0.0	--	
Phase 4	0.0	0.0	--	
Total	*<0.1*	*0.8*	--	
Other Potentially Suitable Breeding Habitat				
Up-Front (Pre-Phase 1)			5.2	--
Phase 1	8.7	6.6	72.2	
Phase 2	0.1	1.7	40.5	
Phase 3	0.0	0.0	--	
Phase 4	0.0	0.0	--	
Total	*8.7*	*8.2*	*117.9*	
Total Modeled Habitat	**8.8**	**9.0**	**117.9**	
New Habitat Created Through Restoration			62.3	
Total Habitat in the HCP Preserve System			**180.2**	

[1] Though impacts on western yellow-billed cuckoo modeled high value breeding habitat are estimated in Phase 1 and 2 of HCP implementation, they are minimal. The Up-Front and Stay-Ahead Provision will be achieved through

conservation, restoration/rehabilitation, and long-term management and monitoring of modeled other potentially suitable habitat, as well as via the creation of new habitat.

5.9.16 Southwestern Willow Flycatcher (SWFL)

Conservation Objectives and Actions

SWFL Objective 1: Permanently conserve and manage southwestern willow flycatcher habitat within the HCP Preserve System in a configuration that supports the potential for breeding and foraging of this species.

SWFL Action 1A: Conserve 241.7 acres of southwestern willow flycatcher habitat in a spatial distribution to support potential occupancy, to facilitate habitat connectivity between breeding/foraging sites, and to allow for expansion of future potential populations.

SWFL Action 1B: Reduce nest parasitism by cowbirds using cowbird control and removal practices when surveys indicate control measures are warranted.

SWFL Objective 2: Restore and/or rehabilitate riparian southwestern willow flycatcher habitat on the HCP restoration sites within the HCP Preserve System.

SWFL Action 2A: Restore and/or rehabilitate 208.3[18] acres of riparian habitat where appropriate in the HCP Preserve System. A portion of this area is included in the modeled habitat for the species; however, approximately 51 acres are not currently suitable habitat but would be restored to be suitable for the species.

SWFL Action 2B: Supplement or provide flow to Anza Creek, Old Ranch Creek, Hidden Valley Creek and Ponds, and Evans Lake to support aquatic and adjacent riparian habitat via the Santa Ana River Sustainable Parks and Tributaries Water Reuse Project (RPU.10), and ensure water is present at appropriate times of year during periods of drought or to offset effects of altered hydrology from HCP implementation.

Monitoring of species conservation actions is addressed in Section 5.12.

Measures to Avoid and Minimize Effects

SWFL AMM-1: New construction and O&M activities within suitable southwestern willow flycatcher habitat containing the physical and biological features defined in the Critical Habitat designation will be avoided to the extent feasible during the breeding season (May 1–August 31).

SWFL AMM-2: If Covered Activities must proceed during the breeding season within southwestern willow flycatcher modeled habitat, a qualified biologist shall conduct a preconstruction nesting bird, and if possible a protocol, survey of all areas proposed to be impacted (including project staging and other temporary impact areas), and within a 100-foot buffer of the project area, ahead of the proposed impact(s). If nesting southwestern willow flycatcher is detected during the preconstruction survey, the start of the project will be on hold until the species has moved out of the project area.

[18] Of this total, 10 acres of riparian habitat acquisition, restoration, and long-term management and monitoring is required under the City of San Bernardino's settlement agreement with the Center for Biological Diversity related to Wastewater Change Petition WW0059.

SWFL AMM-3: If project delays cannot be accommodated appropriate buffers or noise attenuation devices will be implemented in order to minimize the deleterious effects of construction noise on nesting behaviors of western southwestern willow flycatcher. Noise monitoring, and monitoring of flycatcher behavior, will be conducted to provide evidence that effective noise reduction is occurring within the project area.

Expected Outcomes

Table 5-24Table 5-24 summarizes the estimated impacts and conservation of modeled habitat for southwestern willow flycatcher in the Planning Area. Also detailed in Table 5-24 is the HCP's Up-Front and Stay-Ahead Provisions for southwestern willow flycatcher, which will ensure that mitigation for the species will stay ahead of Covered Activity impacts by a minimum of 10%.

As described in the effects analysis for southwestern willow flycatcher (Section 4.6.3), implementation of ground-disturbing Covered Activities would result in a permanent loss of 126.7 acres and the temporary loss of 44.7 acres of modeled habitat within the Planning Area. Of the permanent impacts, more than half occurs where Permittees currently conduct groundwater recharge activities (68.5 acres are within existing basins); therefore, permanent impacts on modeled habitat are significantly less: 58.2 acres. The proposed impacts include approximately 95.9 acres of permanent impacts and 12.1 acres of temporary impacts on southwestern willow flycatcher designated critical habitat. Modeled habitat southwestern willow flycatcher also occurs within areas of predicted falling groundwater, and predicted rising groundwater, along the Santa Ana River and within Prado Basin.

Overall, impacts on southwestern willow flycatcher modeled habitat from ground-disturbing effects and hydrologic changes would be limited. However, the areas of predicted modeled falling groundwater, with Covered Activities in place, may have a more substantial effect on the population. As discussed in Section 4.4.4 the predicted groundwater depths, and changes in these depths with Covered Activities in place, are based on large-scale hydrologic modeling. As such, it will be important to conduct regular groundwater monitoring, in conjunction with southwestern willow flycatcher population and habitat condition monitoring, to adaptively manage the effects of Covered Activities on this species. Ongoing monitoring of groundwater and wetland and riparian vegetation is proposed as a component of HCP implementation (Section 5.12.4). Data from existing and new shallow and deep groundwater wells around the Prado Basin and along the Santa Ana River will be used to verify the accuracy of the modeled groundwater depths. If inaccuracies are detected around the Prado Basin, a new sub-basin model will be created and incorporated into the model to increase model accuracy for this area.

Approximately 241.7 acres of modeled habitat are expected to be conserved within the HCP Preserve System. Approximately 220.6 acres of southwestern willow flycatcher habitat would be restored and managed to benefit the species within the Conservation Areas. The restoration projects will restore 50.7 acres of habitat that is not currently identified as modeled habitat for the southwestern willow flycatcher, resulting in a net increase in habitat that could support this species. Approximately 10.1 acres of habitat restoration occurs within designated critical habitat. Though the proposed impacts on designated critical habitat are currently greater than the proposed conservation, additional avoidance and minimization measures will be taken when a project is proposed within designated critical habitat to avoid and minimize impacts. Overall, total of 307.9 acres of southwestern willow flycatcher habitat will be conserved within the HCP Preserve System.

Riparian habitat restoration and/or rehabilitation that may benefit southwestern willow flycatcher will occur at Hidden Valley Creeks and Ponds, Anza Creek, Old Ranch Creek, Lower Hole Creek, and Evans Lake, and the provision of dedicated supplemental flow (via the Santa Ana Sustainable Parks and Tributaries Water Reuse Project, RPU.10) to these streams, as identified in SWFL Action 2B, will ensure water is present at appropriate times of year to support riparian habitat during periods of drought or to offset effects of altered hydrology from HCP implementation.

The southwestern willow flycatcher avoidance and minimization measures will ensure that potential effects on the species are reduced to the greatest extent practicable, and implementation of the species' conservation actions and Up-Front and Stay-Ahead Provisions will ensure any potential impacts are offset. The conservation actions and Up-Front and Stay-Ahead Provisions for southwestern willow flycatcher are anticipated to result in long-term conservation benefits for the species within the HCP Preserve System. When considered along with the amount of modeled habitat that will be restored or rehabilitated in the HCP Preserve System, the implementation of HCP Covered Activities would not threaten the continued existence of the species.

Table 5-24. Acres of Modeled Habitat Estimated to Be Impacted and Conserved for Southwestern Willow Flycatcher by HCP Implementation Phase, and the Species' Up-Front and Stay-Ahead Mitigation Strategy

	Impacts		Mitigation	
Modeled Habitat Type	**Permanent[1]**	**Temporary**	**HCP Preserve System**	**Stay-Ahead Provision %**
All Model Categories[2]				
Up-Front (Pre-Phase 1)			12.3	
Phase 1	61.6 (27.6)	31.9	114.5	93%
Phase 2	50.4 (40.9)	12.1	114.9	176%
Phase 3	14.7	0.0	0.0	136%
Phase 4	0.0	0.6	0.0	135%
Total	*126.7 (68.5)*	*44.7*	*241.7*	
Core Southwestern Willow Flycatcher Habitat				
Up-Front (Pre-Phase 1)				
Phase 1	9.5	3.6	--	
Phase 2	6.0	0.0	--	
Phase 3	0.0	0.0	--	
Phase 4	0.0	0.1	--	
Total	*15.5*	*3.7*	--	
Very High Value Habitat				
Up-Front (Pre-Phase 1)			4.8	
Phase 1	0.0	0.4	19.0	
Phase 2	<0.1	0.1	14.6	
Phase 3	0.0	0.0	--	
Phase 4	0.0	0.0	--	
Total	*<0.1*	*0.4*	*38.4*	

Modeled Habitat Type	Impacts: Permanent[1]	Impacts: Temporary	Mitigation: HCP Preserve System	Stay-Ahead Provision %
High Value Habitat				
Up-Front (Pre-Phase 1)			4.1	
Phase 1	<0.1	0.2	12.5	
Phase 2	<0.1	<0.1	25.5	
Phase 3	0.0	0.0	--	
Phase 4	0.0	0.0	--	
Total	*<0.1*	*0.2*	*42.1*	
Moderate Value Habitat				
Up-Front (Pre-Phase 1)			0.6	
Phase 1	<0.1	0.1	3.8	
Phase 2	0.0	0.0	18.5	
Phase 3	0.0	0.0	--	
Phase 4	0.0	0.0	--	
Total	*<0.1*	*0.1*	*22.9*	
Other Potentially Suitable Habitat				
Up-Front (Pre-Phase 1)			2.7	
Phase 1	52.0 (27.6)	27.6	79.2	
Phase 2	44.5 (40.9)	12.1	56.4	
Phase 3	14.7	0.0	--	
Phase 4	0.0	0.5	--	
Total	*111.2 (68.5)*	*40.2*	*138.3*	
Total Modeled Habitat	126.7 (68.5)	44.7	241.7	
Total Modeled Habitat Outside of Existing Basins	**58.2**	**44.7**	**241.7**	
New Habitat Created Through Restoration			50.7	
Total Habitat in the HCP Preserve System			**292.4**	
Designated Critical Habitat	**95.7**	**12.7**	**8.9**	

[1] Impact acreages in parentheses are within existing water recharge/flood control basins subject to regular O&M activities and are a subset of the total acres. For example, of the 126.7 acres of permanent impacts, 68.5 acres occur within existing basins. Consequently, impacts outside of basins are 126.7 – 68.5 = 58.2 acres.
[2] "All Model Categories" was created for the purposes of summarizing the model categories presented in this table.
[3] Although the Stay-Ahead Provision for core southwestern willow flycatcher modeled habitat in Phase 1 and 2 falls to less than 10%, the Up-Front and Stay-Ahead Provision will be achieved by the total habitat that will be conserved, restored/rehabilitated, managed, and monitored in each of the other modeled habitat categories, and by the total habitat that will be conserved. The creation of new habitat will also contribute to the Stay-Ahead Provision for this species.

5.9.17 Coastal California Gnatcatcher (CAGN)

Conservation Objectives and Actions

CAGN Objective 1: Permanently conserve and manage coastal California gnatcatcher habitat within the HCP Preserve System in a configuration that provides long-term conservation benefits to the species.

CAGN Action 1: Conserve 497.5 acres of habitat in a spatial distribution to maintain populations, to facilitate habitat connectivity between existing populations and breeding/foraging sites, and to allow for expansion of populations.

CAGN Objective 2: Restore and/or rehabilitate shrubland habitat within the HCP Preserve System.

CAGN Action 2: Restore and/or rehabilitate 509.4 acres of shrublands where appropriate in the HCP Preserve System.

Monitoring of species conservation actions is addressed in Section 5.12.

Measures to Avoid and Minimize Effects

CAGN AMM-1: New construction and O&M activities within suitable coastal California gnatcatcher habitat will be avoided to the extent feasible during the breeding season (February 15–August 30).

CAGN AMM-2: Prior to commencement of Covered Activities within coastal California gnatcatcher modeled suitable habitat, a qualified biologist shall conduct a preconstruction survey, and if possible a protocol survey, of all areas proposed to be impacted (including project staging and other temporary impact areas) ahead of the proposed impact(s). If California gnatcatcher nesting is detected during the preconstruction survey the start of the project will be on hold until nesting is complete.

CAGN AMM-3: If project delays cannot be accommodated appropriate buffers or noise attenuation devices will be implemented in order to minimize the deleterious effects of construction noise to nesting behaviors of western coastal California gnatcatcher. Noise monitoring, and monitoring of gnatcatcher behavior, will be conducted to provide evidence that effective noise reduction is occurring within the project area.

Expected Outcomes

Table 5-25 summarizes the estimated impacts and conservation of modeled habitat for the coastal California gnatcatcher within the Planning Area. Also detailed in Table 5-25 is the HCP's Up-Front and Stay-Ahead Provisions for coastal California gnatcatcher, which will ensure that mitigation for the species will stay ahead of Covered Activity impacts by a minimum of 10%.

Implementation of ground-disturbing Covered Activities would result in a permanent loss of 402.9 acres and the temporary loss of 113.0 acres of modeled habitat within the Planning Area (Section 4.6.3). Of the permanent impacts, a portion occurs where Permittees currently conduct groundwater recharge activities (137.5 acres are within existing basins); therefore, permanent impacts on modeled habitat are less: 265.4 acres. The proposed impacts include approximately 2.9 acres of permanent and 3.0 acres of temporary impacts on coastal California gnatcatcher designated critical habitat; none of the Conservation Areas are within designated critical habitat. Approximately 143 acres of modeled habitat within the HCP Preserve System is high quality habitat for coastal California gnatcatcher. The proposed conservation strategy will include conservation and long-term management of higher quality habitat than the habitats proposed for impact.

Approximately 497.5 acres of modeled habitat are expected to be conserved within the HCP Preserve System. Approximately 222.4 acres of alluvial fan sage scrub habitat would be restored and/or rehabilitated, and managed to benefit the species within the conservation project areas.

The coastal California gnatcatcher avoidance and minimization measures will ensure that potential effects on the species are reduced to the greatest extent practicable, and implementation of the species' conservation actions and Up-Front and Stay-Ahead Provisions will ensure any potential effects are offset. The conservation actions and Up-Front and Stay-Ahead Provisions for coastal California gnatcatcher are anticipated to result in long-term conservation benefits to the species within the HCP Preserve System. When considered along with the amount of modeled habitat that will be restored and/or rehabilitated in the HCP Preserve System, the implementation of HCP Covered Activities would not threaten the continued existence of the species.

Table 5-25. Acres of Modeled Habitat Estimated to Be Impacted and Conserved for Coastal California Gnatcatcher by HCP Implementation Phase, and the Species' Up-Front and Stay-Ahead Mitigation Strategy

	Impacts		Mitigation	
Modeled Habitat Type	**Permanent**[1]	**Temporary**	**HCP Preserve System**	**Stay-Ahead Provision %**
All Model Categories[2]				
Up-Front (Pre-Phase 1)			17.2	--
Phase 1	152.3 (55.6)	61.5	467.8	207%
Phase 2	118.6 (81.6)	49.7	12.5	103%
Phase 3	79.1	0.2	0	53%
Phase 4	52.9 (0.3)	1.6	0	31%
Total	*402.9 (137.5)*	*113.0*	*497.5*	
Very High Value Habitat				
Up-Front (Pre-Phase 1)			10.8	
Phase 1	20.8 (10.6)	5.3	37.7	
Phase 2	13.1 (3.2)	0.5	--	
Phase 3	1.2	0.1	--	
Phase 4	5.4	0.1	--	
Total	*40.5 (13.8)*	*6.0*	*48.5*	
High Value Habitat				
Up-Front (Pre-Phase 1)			4.9	
Phase 1	16.4 (6.5)	13.4	89.2	
Phase 2	7.1 (2.0)	3.6	0.6	
Phase 3	5.0	<0.1	--	
Phase 4	17.9	0.0	--	
Total	*46.3 (8.4)*	*17.0*	*94.7*	

Modeled Habitat Type	Impacts		Mitigation	Stay-Ahead Provision %
	Permanent[1]	Temporary	HCP Preserve System	
Moderate Value Habitat				
Up-Front (Pre-Phase 1)			0.7	
Phase 1	24.2 (1.9)	9.7	83.5	
Phase 2	17.3 (8.4)	10.8	1.2	
Phase 3	0.8	0.2	--	
Phase 4	13.3	0.3	--	
Total	*55.6 (18.3)*	*21.0*	*85.4*	
Low Value Habitat				
Up-Front (Pre-Phase 1)			0.8	
Phase 1	88.9 (27.4)	30.6	237.9	
Phase 2	81.0 (68.1)	33.3	9.7	
Phase 3	3.5	<0.1	--	
Phase 4	15.5 (0.3)	1.2	--	
Total	*188.9 (95.7)*	*65.0*	*248.4*	
Other Suitable Habitat				
Up-Front (Pre-Phase 1)			--	
Phase 1	2.1 (1.3)	2.6	19.5	
Phase 2	0.1	1.5	1.1	
Phase 3	68.6	0.0	--	
Phase 4	0.8	0.0	--	
Total	*71.6 (1.3)*	*4.1*	*20.6*	
Total Modeled Habitat	402.9 (137.5)	113.0	497.5	
Total Modeled Habitat Outside of Existing Basins	**265.4**	**113.0**	**497.5**	
Designated Critical Habitat	**2.9**	**2.6**	**0.0**	

[1] Impact acreages in parentheses are within existing water recharge/flood control basins subject to regular O&M activities and are a subset of the total acres. For example, of the 402.9 acres of permanent impacts, 137.5 acres occur within existing basins. Consequently, impacts outside of basins are 402.9 – 137.5 = 265.4 acres.
[2] "All Model Categories" was created for the purposes of summarizing the model categories presented in this table.

5.9.18 Least Bell's Vireo (LBVI)

Conservation Objectives and Actions

LBVI Objective 1: Permanently conserve and manage least Bell's vireo habitat within the HCP Preserve System in a configuration that provides long-term conservation benefits to the species.

LBVI Action 1: Conserve 241.7 acres of riparian habitat, early successional riparian scrub and woodland habitat, in order to potentially expand the current distribution and amount of occupied habitat.

LBVI Objective 2: Restore and/or rehabilitate riparian habitats within the HCP Preserve System.

LBVI Action 2A: Restore and/or rehabilitate 208.3 acres[19] of riparian habitat in the HCP Preserve System, within and adjacent to Anza Creek, Old Ranch Creek, Hidden Valley Creek and Ponds, and Evans Lake. A portion of this area is included in the modeled habitat for the species; however, approximately 50.7 acres are not currently suitable habitat but would be restored and/or rehabilitated to be suitable for the species.

LBVI Action 2B: Supplement or provide flow to Anza Creek, Old Ranch Creek, Hidden Valley Creek and Ponds, and Evans Lake to support aquatic and adjacent riparian habitat via the Santa Ana River Sustainable Parks and Tributaries Water Reuse Project (RPU.10), and ensure water is present at appropriate times of year during periods of drought or to offset effects of altered hydrology from HCP implementation.

LBVI Objective 3: Enhance conditions within the HCP Preserve System to at a minimum maintain, and potentially increase, reproductive success of least Bell's vireo within the HCP Preserve System.

LBVI Action 3: Reduce nest parasitism by cowbirds using cowbird control and removal practices when surveys indicate control measures are warranted.

Monitoring of species conservation actions is addressed in Section 5.12.

Measures to Avoid and Minimize Effects

LBVI AMM-1: New construction and O&M activities will be avoided to the extent feasible during the breeding season within modeled least Bell's vireo habitat (March–July).

LBVI AMM-2: Prior to commencement of Covered Activities within least Bell's vireo modeled suitable habitat, a qualified biologist shall conduct a preconstruction survey, and if possible a protocol survey, of all areas proposed to be impacted (including project staging and other temporary impact areas) ahead of the proposed impact(s). If vireo nesting is detected during the preconstruction survey the start of the project will be on hold until nesting is complete.

LBVI AMM-3: If project delays cannot be accommodated appropriate buffers or noise attenuation devices will be implemented in order to minimize the deleterious effects of construction noise on nesting behaviors of least Bell's vireo. Noise monitoring and monitoring of vireo behavior will be conducted to provide evidence that effective noise reduction is occurring within the project area.

Expected Outcomes

Table 5-26 summarizes the estimated impacts and conservation of modeled habitat for least Bell's vireo within the Planning Area. Also detailed in Table 5-26 is the HCP's Up-Front and Stay-Ahead Provisions for least Bell's vireo, which will ensure that mitigation for the species will stay ahead of Covered Activity impacts by a minimum of 10%.

As described in the effects analysis for least Bell's vireo (Section 4.6.3), implementation of ground-disturbing Covered Activities would result in a permanent loss of 126.7 acres and the temporary loss of 44.7 acres of modeled habitat within the Planning Area. Of the permanent impacts, more than

[19] Of this total, 10 acres of riparian habitat acquisition, restoration, and long-term management and monitoring is required under the City of San Bernardino's settlement agreement with the Center for Biological Diversity related to Wastewater Change Petition WW0059.

half occurs where Permittees currently conduct groundwater recharge activities (68.5 acres are within existing basins); therefore, permanent impacts on modeled habitat are significantly less: 58.2 acres. The proposed impacts include approximately 1.9 acres of permanent impacts and 55.8 acres of temporary impacts on least Bell's vireo designated critical habitat; however, approximately 127.5 acres of the restoration sites are within critical habitat areas. Modeled suitable habitat for least Bell's vireo also occurs within areas of predicted falling groundwater, and predicted rising groundwater, along the Santa Ana River and within Prado Basin.

Overall, impacts on least Bell's vireo from ground-disturbing effects and hydrologic changes would be limited. However, the areas of predicted modeled falling groundwater, with Covered Activities in place, may have a more substantial effect on the population. As discussed in Section 4.4.4 the predicted groundwater depths, and changes in these depths with Covered Activities in place, are based on large-scale hydrologic modeling. As such, it will be important to conduct regular groundwater monitoring, in conjunction with least Bell's vireo population and habitat condition monitoring to adaptively manage the effects of Covered Activities on this species. Ongoing monitoring of groundwater and wetland and riparian vegetation is proposed as a component of HCP implementation (Section 5.12.4).

Approximately 241.7 acres of modeled habitat are expected to be conserved within the HCP Preserve System. Approximately 220.6 acres of least Bell's vireo habitat would be restored and/or rehabilitated, and managed to benefit the species within the conservation areas. Restoration activities will restore 50.7 acres of habitat that is not currently identified as modeled habitat for least Bell's vireo, resulting in a net increase in habitat that will support this species. Riparian habitat restoration and/or rehabilitation that will directly benefit least Bell's vireo will occur at Hidden Valley Creeks and Ponds, Anza Creek, Old Ranch Creek, Lower Hole Creek, and Evans Lake. The provision of dedicated supplemental flow (via the Santa Ana Sustainable Parks and Tributaries Water Reuse Project, RPU.10) to the aforementioned tributaries, as identified in LBVI Action 2B, will ensure water is present at appropriate times of year to support riparian habitat during periods of drought or to offset effects of altered hydrology from HCP implementation. A total of 307.9 acres of least Bell's vireo habitat will be conserved within the HCP Preserve System.

The least Bell's vireo avoidance and minimization measures will ensure that potential effects on the species are reduced to the greatest extent practicable, and implementation of the species' conservation actions and Up-Front and Stay-Ahead Provisions (Table 5-26) will ensure any potential impacts are offset. The conservation actions and Up-Front and Stay-Ahead Provisions will ensure any potential effects are offset. The conservation actions and Up-Front and Stay-Ahead Provisions for least Bell's vireo are anticipated to result in long-term conservation benefits to the species within the HCP Preserve System. When considered along with the amount of modeled habitat that will be restored or rehabilitated in the HCP Preserve System, the implementation of HCP Covered Activities would not threaten the continued existence of the species.

Table 5-26. Acres of Modeled Habitat Estimated to Be Impacted and Conserved for Least Bell's Vireo by HCP Implementation Phase, and the Species' Up-Front and Stay-Ahead Mitigation Strategy

	Impacts		Mitigation	
Modeled Habitat Type	**Permanent[1]**	**Temporary**	**HCP Preserve System**	**Stay-Ahead Provision %**
All Model Categories[2]				
Up-Front (Pre-Phase 1)			12.3	--
Phase 1	61.5 (27.6)	31.9	114.5	93%
Phase 2	50.4 (40.9)	12.1	114.9	176%
Phase 3	14.7	0.0	--	136%
Phase 4	0.0	0.6	--	135%
Total	*126.7 (68.5)*	*44.7*	*241.7*	
Core Breeding Habitat				
Up-Front (Pre-Phase 1)			4.3	
Phase 1	0.2	17.0	18.8	
Phase 2	<0.1	0.2	61.5	
Phase 3	0.0	0.0	--	
Phase 4	0.0	0.0	--	
Total	*0.2*	*17.2*	*84.6*	
Other Breeding Habitat				
Up-Front (Pre-Phase 1)			8.0	
Phase 1	61.3 (27.6)	14.9	95.7	
Phase 2	50.4 (40.9)	12.0	53.4	
Phase 3	14.7	0.0	--	
Phase 4	0.0	0.6	--	
Total	*126.5 (68.5)*	*27.5*	*157.1*	
Total Modeled Habitat	126.7 (68.5)	44.7	241.7	
Total Modeled Habitat Outside of Existing Basins	**58.2**	**44.7**	**241.7**	
New Habitat Created through Restoration			50.7	
Grand Total of Habitat in the HCP Preserve System			**292.4**	
Designated Critical Habitat	**1.9**	**55.8**	**127.5**	

[1] Impact acreages in parentheses are within existing water recharge/flood control basins subject to regular O&M activities and are a subset of the total acres. For example, of the 126.7 acres of permanent impacts, 68.5 acres occur within existing basins. Consequently, impacts outside of basins are 126.7 – 68.5 = 58.2 acres.
[2] "All Model Categories" was created for the purposes of summarizing the model categories presented in this table.

5.9.19 Los Angeles Pocket Mouse (LAPM)

Conservation Objectives and Actions

LAPM Objective 1: Permanently conserve and manage LAPM habitat within the HCP Preserve System in a configuration that provides long-term conservation benefits to the species.

LAPM Action 1: Conserve 624.9 acres of modeled LAPM habitat in a configuration to facilitate habitat connectivity.

LAPM Objective 2: Expand the distribution of LAPM by increasing habitat quality for LAPM through habitat restoration and/or rehabilitation within the HCP Preserve System and increasing connectivity between patches of LAPM habitat.

LAPM Action 2A: Restore and/or rehabilitate up to 509.4 acres of alluvial fan sage scrub habitat within Alluvial Fan Preserve Units A and B of the HCP Preserve System. A portion of this area is included in the modeled habitat for the species, while other portions are not currently suitable habitat but would be restored to be suitable for the species.

LAPM Action 2B: Manage nonnative grass and overall plant cover to maintain or enhance habitat for the benefit of LAPM, following methodology to be developed in the CAMMP.

LAPM Action 2C: Restore and/or rehabilitate suitable habitat in the interstitial spaces between new groundwater recharge basins to maintain connectivity across the site.

LAPM Objective 3: Contribute to studies on the genetic structure and diversity of LAPM to better understand population genetics of this species within the HCP Preserve System.

LAPM Action 3A: Coordinate with the scientific research community and Wildlife Agencies to further our understanding of population genetics for this species, and identify actions that may be needed to improve genetics for LAPM, where needed.

LAPM Action 3B: Coordinate with the Wildlife Agencies to identify areas within the HCP Preserve that would benefit from population genetics conservation actions.

Monitoring of species conservation actions is addressed in Section 5.12.

Measures to Avoid and Minimize Effects

See San Bernardino kangaroo rat AMMs, below.

Expected Outcomes

Table 5-27 summarizes the estimated impacts and conservation of modeled habitat for LAPM within the Planning Area. Also detailed in Table 5-27 is the HCP's Up-Front and Stay-Ahead Provisions for LAPM, which will ensure that mitigation for the species will stay ahead of Covered Activity impacts by a minimum of 10%.

Implementation of ground-disturbing Covered Activities would result in a permanent loss of 657.0 acres and the temporary loss of 144.2 acres of modeled habitat within the Planning Area (Section 4.6.3). Of the permanent impacts, a portion occurs where Permittees currently conduct groundwater recharge activities (181.9 acres are within existing basins); therefore, permanent impacts on modeled habitat are less: 475.1 acres. Approximately 624.9 acres of modeled habitat are expected to be conserved within the HCP Preserve System. Of this total, at least 509.4 acres of alluvial fan sage scrub habitat would be restored and/or rehabilitated, and managed for the benefit of the species.

The LAPM avoidance and minimization measures will ensure that potential effects on the species are reduced to the greatest extent practicable, and implementation of the species' conservation actions and Up-Front and Stay-Ahead Provisions (Table 5-27) will ensure any potential impacts are offset. The conservation actions and Up-Front and Stay-Ahead Provisions for LAPM are anticipated to result in long-term conservation benefits to the species. When considered along with the amount of modeled habitat that will be restored and/or rehabilitated in the HCP Preserve System, the implementation of HCP Covered Activities would not threaten the continued existence of the species.

Table 5-27. Acres of Modeled Habitat Estimated to Be Impacted and Conserved for Los Angeles Pocket Mouse by HCP Implementation Phase, and the Species' Up-Front and Stay-Ahead Mitigation Strategy

	Impacts		Mitigation	
Modeled Habitat Type	**Permanent[1]**	**Temporary**	**HCP Preserve System**	**Stay-Ahead Provision %**
Potentially Suitable Habitat				
Up-Front (Pre-Phase 1)			67.0	--
Phase 1	301.8 (73.1)	85.4	536.0	92%
Phase 2	208.9 (108.5)	55.9	21.9	33%
Phase 3	83.1	0.9	--	13%
Phase 4	63.3 (0.3)	2.0	--	<10%[2]
Total Modeled Habitat	657.0 (181.9)	144.2	624.9	
Total Modeled Habitat Outside of Existing Basins	**475.1**	**144.2**	**624.9**	

[1] Impact acreages in parentheses are within existing water recharge/flood control basins subject to regular O&M activities and are a subset of the total acres. For example, of the 657.0 acres of permanent impacts, 181.9 acres occur within existing basins. Consequently, impacts outside of basins are 657.0 - 181.9 = 475.1 acres.
[2] Phase 4 Covered Activities cannot proceed until mitigation is ahead of Covered Activity impacts by a minimum of 10%.

5.9.20 San Bernardino Kangaroo Rat (SBKR)

Conservation Objectives and Actions

SBKR Objective 1: Permanently conserve and manage SBKR habitat within the HCP Preserve System in a configuration that provides long-term conservation benefits to the species.

SBKR Action 1: Conserve a minimum of 585.8 acres of modeled habitat in a configuration to facilitate habitat connectivity to occupied SBKR habitat within the HCP Preserve System and to adjacent protected areas.

SBKR Objective 2: Expand the distribution of SBKR by increasing habitat quality for SBKR within the HCP Preserve System and increasing connectivity between areas of occupied or highly suitable SBKR habitat.

SBKR Action 2A: Restore and/or rehabilitate a minimum of 509.4 acres of SBKR habitat within Alluvial Fan Preserve Unit A and Unit B in the HCP Preserve System. A portion of this area is included in the modeled habitat for the species, while other portions are not currently suitable habitat but would be restored to be suitable for the species.

SBKR Action 2B: Manage nonnative grass and plant cover to create and maintain high quality SBKR habitat.

SBKR Action 2C: Identify areas of substantial erosion and/or streambed coarsening in SBKR habitat within the HCP Preserve System to determine where sediment replenishment would benefit SBKR habitat suitability and connectivity.

SBKR Action 2D: Provide adequate amounts of appropriate sediment to areas identified as benefiting from sediment replenishment. Sediment quality and quantity, and replenishment methods, locations, and timing will be defined by the CAMMP.

SBKR Action 2E: Contribute to range-wide surveys for SBKR within the HCP Preserve System.

SBKR Action 2F: Restore and/or rehabilitate suitable habitat in the interstitial spaces between new groundwater recharge basins as well as surrounding the basin areas to maintain connectivity throughout the site.

SBKR Objective 3: Contribute to studies on the genetic structure and genetic diversity of SBKR within the HCP Preserve System.

SBKR Action 3: Coordinate with the scientific research community and Wildlife Agencies to further the understanding of population genetics and identify actions that may be needed to improve genetics for SKBR.

Monitoring of species Conservation Actions is addressed in Section 5.12.

Measures to Avoid and Minimize Effects

SBKR AMM-1: Conduct SBKR habitat assessments of the proposed project site, including both temporary and permanent impact areas, and immediately adjacent areas, to look for signs of small mammal use and potential SBKR occupancy. This assessment will focus on determining if potentially occupied SBKR habitat would be directly and/or indirectly impacted as a result of project initiation. The habitat assessment will be conducted by a qualified biologist. If no potentially occupied SBKR habitat is identified during the habitat assessment, and the Wildlife Agencies concur with this assessment, then no further measures will be required for SBKR.

SBKR AMM-2: If a ground-disturbing activity from new construction or O&M occurs in or adjacent to potentially occupied habitat for SBKR, an appropriate exclusionary fence meeting wildlife agency standards will be placed and maintained around the perimeter of the site. Biological monitoring by a qualified SBKR biologist (holding a current 10(a)(1)(A) recovery permit) will occur during the installation of the fence and during the construction activity to ensure the fence remains intact and impacts on SBKR are minimized. The SBKR biologist will have stop-work authority to ensure potential impacts on SBKR are minimized to the maximum extent practicable.

SBKR AMM-3: If potentially occupied SBKR habitat is identified, then SBKR trapping surveys will be conducted by a qualified SBKR biologist. For short-lived projects, less than approximately 3 weeks in duration, any SBKR captured will be held in captivity and relocated back to the location of capture.

For projects that may have impacts that last longer than 3 weeks, any SBKR captured will be relocated out of areas where ground disturbance will likely impact the species. If deemed beneficial by the qualified biologist artificial burrows will be created in advance of relocation SBKR, and these animals will be maintained and monitored until they are released. The best available science, recommendations by qualified biologists, and/or consultation with the Wildlife Agencies will be used to determine the methods to minimize impacts on SBKR, which may affect the duration to hold animals during temporary impacts, release back into temporary impact areas, or translocate to new receiver locations.

SBKR AMM-4: When new construction or O&M activities with temporary ground disturbance occur, including trenching, in SBKR suitable habitat, the topsoil will be conserved and replaced as defined by the CAMMP. As an example, the top 20 inches of soil/substrate will be segregated, preserved, and placed back in the same location and approximate configuration when the trench is backfilled. The soil within the top 20 inches will remain decompacted (loose) upon final placement. If significant (over 30%) nonnative weed cover is found, the topsoil will not be replaced in the top uncompacted fill but will be used for lower compacted backfill. In all cases the top 20 inches will be uncompacted and made as suitable for SBKR burrowing as possible.

SBKR AMM-5: When new construction or O&M activities with permanent ground disturbance occurs, salvage appropriate soil for use in habitat restoration and/or rehabilitation areas.

SBKR AMM-6: Fence temporary stockpiles of soil during new construction and O&M activities in or adjacent to SBKR habitat to minimize the potential for impacts on SBKR.

SBKR AMM-7: Construction should occur during daylight hours and the use of night lighting will be avoided whenever possible. If night lighting is required, lights will be shielded to minimize lighting of habitat outside of the construction area.

Expected Outcomes

Table 5-28 summarizes the estimated impacts and conservation of modeled habitat for the SBKR. Also detailed in Table 5-28 is the HCP's Up-Front and Stay-Ahead Provisions for SBKR, which will ensure that mitigation for the species will stay ahead of Covered Activity impacts by a minimum of 10%.

As described in the effects analysis for SBKR (Section 4.6.3), implementation of ground-disturbing Covered Activities could result in the permanent loss of 681.4 acres and the temporary loss of 72.7 acres of modeled habitat within the Planning Area. However, more than half of the permanent impacts on modeled habitat occurs in existing basins where Permittees currently conduct groundwater recharge activities (377.2 acres are within existing basins). Permanent impacts on modeled habitat outside of existing basins are significantly less: 304.2 acres. The proposed impacts also include approximately 656.3 acres of permanent and 110.1 acres of temporary impacts on SBKR designated critical habitat. Permanent impacts on designated critical habitat include 109.4 acres within existing basins; consequently, impacts on designated critical habitat outside of existing basins are 546.9 acres.

Impacts on SBKR Refugia habitat were also estimated. As described in Section 4.6.3, SBKR Refugia includes modeled habitat outside of the 100-year floodplain. These areas are important to support and aid in the recovery of SBKR following major flood events. The proposed impacts include 149.9 acres of permanent impacts on SBKR Refugia habitat (of which 118.6 acres occur within existing basins), and 46.4 acres of temporary impacts on SBKR Refugia. As described in Section 3.8.3, an additional data layer was created representing all areas that are Assumed Occupied by SBKR based on a review of available trapping data (positive and negative), known extant occurrences, and estimates of likely occupied areas where data were absent. This layer provides a conservative estimate of all areas where SBKR has the potential to be found. Approximately 681.6 acres of permanent impacts (57.5 acres of which occur within existing basins) and 94.4 acres of temporary impacts were identified to areas that are Assumed Occupied by SBKR.

Impacts, mitigation, and the HCP's Up-Front and Stay-Ahead Provisions for SBKR are also broken down by Preserve Unit for the two Alluvial Fan Units (Table 5-29 and Table 5-30). Within Alluvial Fan Preserve Unit A there are a total of 126.7 acres of permanent impacts (41.1 acres of which occur within existing basins) and 51.0 acres of temporary impacts on modeled habitat. Within Alluvial Fan Preserve Unit B, a total of 240.9 acres of permanent (48.4 acres of which occur within existing basins), and 11.5 acres of temporary impacts on SBKR modeled habitat were estimated.

A minimum of approximately 585.8 acres of modeled habitat will be conserved, monitored, and managed within the HCP Preserve System (Table 5-28). Of this total, approximately 304.7 acres are modeled refugia habitat. The HCP Preserve System will also include 685 acres of designated critical habitat, and 458.1 acres of habitat areas assumed to be occupied by SBKR. When considered in total, mitigation for SBKR will meet the Stay-Ahead Provisions for all HCP implementation phases (Table 5-28).

Habitat improvement (restoration and/or rehabilitation) activities anticipated to benefit SBKR will occur at a minimum of five Conservation Areas. All five of these areas are located within Alluvial Fan Preserve Unit A and include lands already acquired, or those owned by Permittees determined to have a high potential for incorporation into the HCP Preserve System. Habitat restoration and/or rehabilitation will commence prior to finalization of the HCP at three sites that have already been acquired by the HCP: Redlands Airport Parcels, San Bernardino Avenue, and Weaver. These lands total approximately 67 acres, and portions of all three sites are currently occupied by SBKR (confirmed via trapping). Habitat improvement activities are anticipated to enhance conditions for the species across the entirety of each site. Habitat improvement activities proposed at two additional sites (Enhanced Recharge Basins, and Santa Ana River Refugia), totaling approximately 418 acres, are anticipated to commence early in Phase 1 of HCP implementation. Portions of these Conservation Areas are occupied by SBKR, but habitat improvement activities are anticipated to expand the total occupied acreage at both sites. As identified in Table 5-29, mitigation for SBKR within Alluvial Fan Preserve Unit A will meet the Stay-Ahead Provisions for all HCP implementation phases.

Approximately 216.9 acres of SBKR modeled habitat occur within the Devil Creek Conservation Area, within Alluvial Fan Preserve Unit B. Habitat improvement activities will occur at this location, and the site could be used to offset impacts on SBKR modeled habitat. But, because SBKR is extirpated from this location, and connectivity to occupied lands within Lytle Creek/Cajon Creek no longer exists, the site cannot be used to offset Covered Activity impacts on SBKR occupied habitat. The HCP is actively pursuing SBKR-occupied lands within Alluvial Fan Preserve Unit B and it is anticipated that lands will be secured prior to Phase 1 of HCP implementation. However, if acquisition of SBKR-occupied habitat is not finalized prior to implementation of Phase 1, and impacts on SBKR-occupied habitat have been identified (note: Phase 1 Covered Activities are limited to routine operations and maintenance of existing facilities), these impacts will be offset through the purchase of mitigation/conservation bank credits within Alluvial Fan Preserve Unit B. Sufficient credits would be purchased prior to Phase 1 Covered Activity impacts on SBKR-occupied habitat to ensure that the HCP meet the Stay-Ahead Provisions.

The majority of ground-disturbing Covered Activity impacts within Alluvial Fan Preserve Unit B are proposed to occur in Phases 3 and 4 of HCP implementation (Table 5-30). If additional acquisition of mitigation lands, including SBKR-occupied lands (or lands that through restoration could be occupied), within Alluvial Fan Preserve Unit B has not occurred prior to Phase 3, Covered Activity impacts on SBKR-occupied habitat cannot proceed.

The areas of known occupied habitat that are included in the HCP Preserve System area generally well-connected to areas of protected habitat (e.g., Wash Plan HCP Preserve Area), which increases the long-term viability of the species in these areas. The inclusion of SBKR Refugia habitat in multiple Conservation Areas also provides for long-term viability of the species in adjacent areas that could be inundated during larger storm flow events. The habitat improvement activities proposed by the HCP are anticipated to increase the acreage of SBKR-occupied lands. For example, SBKR is currently limited to the periphery of portions of lands west of the Borrow Pit associated with the Enhanced Recharge Basin Conservation Area. It is anticipated that through habitat restoration and/or rehabilitation, the interstitial spaces between existing water recharge basins may function as suitable habitat for SBKR and provide for connectivity across these sites. Existing groundwater recharge basins located within the Enhanced Recharge Basin Conservation Area will continue to operate, but because portions of these areas are currently occupied ongoing operations are not expected to affect the viability or occupancy of the habitat improvement areas. Further, although the basin bottoms themselves would not provide suitable burrowing habitat for SBKR, because the basins are dry most of the year they would not pose a barrier to movement, and may allow for dispersal of SBKR.

The changes in hydrology from the Covered Activities will have an effect on sediment transport, an important ecological process for the SBKR. The extent of these impacts is not quantified; however, sediment transport replenishment measures identified in the Basin Sediment Management Plan (Section 5.12.3, *Management of the HCP Preserve System*) will re-entrain the majority of the sediment diverted by Covered Activities, minimizing impacts on SBKR habitat associated with reduced sediment supply and channel incision.

The SBKR avoidance and minimization measures will ensure that potential effects on the species are reduced to the greatest extent practicable, and implementation of the species' conservation actions and Up-Front and Stay-Ahead Provisions (Table 5-28) will ensure any potential impacts are offset. Further, Covered Activities within presumed occupied areas could only commence if mitigation has been acquired prior to project commencement. Mitigation lands must also be in Rough-Step with impacts, and within the same Alluvial Fan Preserve Unit as the location of the proposed Covered Activity. The conservation actions and Up-Front and Stay-Ahead Provisions for SBKR are anticipated to result in long-term conservation benefits to the species. When considered along with the amount of modeled habitat that will be restored and/or rehabilitated or otherwise conserved in the HCP Preserve System, along with the monitoring and adaptive management to continually enhance habitat conditions and improve connectivity, the implementation of HCP Covered Activities would not threaten the continued existence of the species.

Table 5-28. Total Acres of Modeled Habitat Estimated to Be Impacted and Conserved for San Bernardino Kangaroo Rat by HCP Implementation Phase, and the Species' Up-Front and Stay-Ahead Mitigation Strategy

	Impacts		Mitigation	
Modeled Habitat Type	**Permanent**[1]	**Temporary**	**HCP Preserve System**	**Stay-Ahead Provision %**
Suitable Habitat				
Up-Front (Pre-Phase 1)			67.0	--
Phase 1	118.4 (82.1)	70.3	513.8	445%
Phase 2	327.4 (295.1)	0.1	5.0	321%
Phase 3	132.1	0.5	--	116%
Phase 4	103.5	1.7	--	55%
Total Modeled Habitat	681.4 (377.2)	72.7	585.8	
Total Modeled Habitat Outside of Existing Basins	**304.2**	**72.7**	**585.8**	
Designated Critical Habitat	**656.3 (109.4)**	**110.1**	**685.0**	
Refugia[2]	**149.9 (118.6)**	**46.4**	**304.7**	
Assumed Occupied[3]	**681.6 (57.5)**	**94.4**	**458.1**	

[1] Impact acreages in parentheses are within existing water recharge/flood control basins subject to regular O&M activities and are a subset of the total acres. For example, of the 681.4 acres of permanent modeled habitat impacts 377.2 acres occur within existing basins. Consequently, modeled habitat impacts outside of basins are 681.4 – 377.2 = 304.2 acres.
[2] San Bernardino kangaroo rat refugia habitat is composed of modeled habitat that occurs outside of the 100-year floodplain.
[3] "Assumed Occupied" is not a modeled dataset; it is a separate data layer that was estimated to indicate all areas that are assumed to be currently occupied by SBKR. 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 5-29. Acres of Modeled Habitat Estimated to Be Impacted and Conserved for San Bernardino Kangaroo Rat by HCP Implementation Phase, and the Species' Up-Front and Stay-Ahead Mitigation Strategy within Alluvial Fan Preserve Unit A

	Impacts		Mitigation	
Modeled Habitat Type	**Permanent**[1]	**Temporary**	**Alluvial Fan Preserve Unit A**	**Stay-Ahead Provision %**
Suitable Habitat				
Up-Front (Pre-Phase 1)			67.0	--
Phase 1	64.8 (41.1)	50.5	296.9	>500%
Phase 2	30.7	0.0	--	>500%
Phase 3	29.9	0.5	--	329%
Phase 4	1.2	0.0	--	323%
Total Modeled Habitat	126.7 (41.1)	51.0	363.9	
Total Modeled Habitat Outside of Existing Basins	**85.6**	**51.0**	**363.9**	

Modeled Habitat Type	Impacts		Mitigation	Stay-Ahead Provision %
	Permanent[1]	Temporary	Alluvial Fan Preserve Unit A	
Designated Critical Habitat	**219.2 (21.7)**	**66.2**	**445.0**	
Refugia[2]	**26.4**	**37.3**	**267.1**	
Assumed Occupied[3]	**254.5 (42.0)**	**74.4**	**458.1**	

[1]Impact acreages in parentheses are within existing water recharge/flood control basins subject to regular O&M activities and are a subset of the total acres. For example, of the 126.7 acres of permanent modeled habitat impacts 41.1 acres occur within existing basins. Consequently, modeled habitat impacts outside of basins are 126.7 – 41.1 = 85.6 acres.
[2]San Bernardino kangaroo rat refugia habitat is composed of modeled habitat that occurs outside of the 100-year floodplain.
[3] "Assumed Occupied" is not a modeled dataset; it is a separate data layer that was estimated to indicate all areas that are assumed to be currently occupied by SBKR. 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 5-30. Acres of Modeled Habitat Estimated to Be Impacted and Conserved for San Bernardino Kangaroo Rat by HCP Implementation Phase, and the Species' Up-Front and Stay-Ahead Mitigation Strategy within Alluvial Fan Preserve Unit B

Modeled Habitat Type	Impacts		Mitigation	Stay-Ahead Provision %
	Permanent[1]	Temporary	Alluvial Fan Preserve Unit B	
Suitable Habitat				
Up-Front (Pre-Phase 1)			--	--
Phase 1	23.7 (15.3)	11.1	216.9	>500%
Phase 2	-- (33.1)	0.0	--	>500%
Phase 3	102.2	0.0	--	78%
Phase 4	82.0	0.3	--	<10%[4]
Total Modeled Habitat	240.9 (48.4)	11.5	216.9	
Total Modeled Habitat Outside of Existing Basins	**192.5**	**11.5**	**216.9**	
Designated Critical Habitat	**382.1 (69.9)**	**19.8**	**240.0**	
Refugia[2]	**10.1 (2.3)**	**3.9**	**32.5**	
Assumed Occupied[3]	**398.4 (15.5)**	**13.0**	**--**	

[1] Impact acreages in parentheses are within existing water recharge/flood control basins subject to regular O&M activities and are a subset of the total acres. For example, of the 240.9 acres of permanent modeled impacts habitat 48.4 acres occur within existing basins. Consequently, modeled habitat impacts outside of basins are 240.9 – 48.4 = 192.5 acres.
[2] San Bernardino kangaroo rat refugia habitat is composed of modeled habitat that occurs outside of the 100-year floodplain.
[3] "Assumed Occupied" is not a modeled dataset; it is a separate data layer that was estimated to indicate all areas that are assumed to be currently occupied by SBKR. 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.
[4]Phase 4 Covered Activities cannot proceed until mitigation is ahead of Covered Activity impacts by a minimum of 10%.

5.10 Fully Avoided Species

Delhi Sands flower-loving fly and arroyo toad are included in this HCP because there are Covered Activities that overlap with known or modeled habitat areas; however, all impacts will be avoided by implementing both the general measures to avoid impacts described in Section 5.11 and the specific measures described below. This HCP does not provide incidental take coverage for either species.

5.10.1 Delhi Sands Flower-Loving Fly (DSFF)

The below measures will be employed to avoid all impacts of the Delhi Sands flower-loving fly by implementation of Covered Activities. If the proposed Covered Activity does not have the potential to directly or indirectly result in adversely affecting the Delhi Sands flower-loving fly, including temporary or permanent impacts on their habitat, no additional mitigation or avoidance measures would be required for this species.

Measures to Avoid Impacts on the Species

DSFF AM-1: If there is modeled habitat for the Delhi Sands flower-loving fly within the project site of a Covered Activity, a habitat assessment of the proposed project site will be conducted, including both temporary and permanent impact areas, and immediately adjacent areas. The initial survey effort will focus on determining if potential Delhi Sands flower-loving fly habitat is present within this Covered Activity project area, and whether potential habitat would be directly and/or indirectly impacted as a result of the project. The survey will be conducted by a qualified biologist (a biologist holding a current 10(a)(1)(A) recovery permit) familiar with the soil, preferred nectar flowers, and habitat requirements of the Delhi Sands flower-loving fly and will include mapping of the soil substrate to determine if the site includes soil characteristics suitable for Delhi sands flower-loving fly. If no potential habitat is identified during the surveys, then no further avoidance measures are required.

DSFF AM–2: If suitable soil characteristics are discovered within or adjacent to a Covered Activity project site, Delhi Sands flower-loving fly protocol surveys will be conducted by a qualified biologist, with a report written and submitted to the USFWS as described in the protocol survey guidelines. If the species is deemed absent and the USFWS concurs with this determination, no further avoidance measures are required. If the species is deemed present and Covered Activity impacts have the potential to occur, the Covered Activity cannot proceed. If the species is deemed present and Covered Activity impacts can be avoided, a 300-foot buffer will be established and maintained between the Covered Activity and the suitable soil area. The buffer will be marked with high visibility exclusionary fencing.

a. The integrity of the exclusionary fencing will be assessed by onsite personnel on a daily basis. All breaches will be immediately repaired.

b. A biological monitor will visit the proposed project site at least once a week to ensure that the fencing has not been breached and all project-related general best management practices (BMPs) are being successfully implemented.

DSFF AM-3: An environmental awareness briefing will be conducted prior to the initiation of project-related activities in order to fully inform all onsite personnel of the biologically sensitive resources associated with the proposed project. A handout will also be created and distributed that describes and illustrates the species, including contact information and course of action if detected within the proposed project site.

5.10.2 Arroyo Toad (ARTO)

The measures below will be employed to avoid all impacts on arroyo toad by implementation of Covered Activities. If the proposed Covered Activity does not have the potential to directly or indirectly result in adversely affecting arroyo toad, including temporary or permanent impacts on breeding or upland habitats, no additional mitigation or avoidance measures would be required for this species.

Measures to Avoid Impacts on the Species

ARTO AM-1: If there is modeled habitat for arroyo toad within the project site of a Covered Activity, prior to commencement of the Covered Activity an appropriately qualified biologist shall conduct an arroyo toad habitat assessment of the proposed project site, including both temporary and permanent impact areas, and immediately adjacent areas. Adjacent areas to be included in the survey include within a minimum of 300–750 feet extending laterally from the channel (depending on topography), as well as 0.5 mile upstream and downstream of the project, as accessible. The initial survey effort will focus on determining if potential arroyo toad breeding and/or upland habitats would be directly and/or indirectly impacted as a result of Covered Activity project construction or O&M activities. The survey will be conducted by a qualified biologist familiar with breeding, upland habitat utilization, activity patterns, and movement potential of the arroyo toad. If no potential breeding or upland habitat is identified during the surveys, then no further avoidance measures are required.

ARTO AM-2: If suitable arroyo toad habitat (breeding/upland/movement routes) is identified and the species has previously been documented within or adjacent to the proposed project area, either focused surveys will be conducted during the breeding season (January–July, when flows are present in the channel) to determine presence/absence, or the species will be presumed present. Depending on the outcome of surveys the following measures will be adhered to:

a. If the species is documented within or adjacent to the proposed project area or presumed present, the project will be redesigned to avoid all impacts.

b. If habitat containing the appropriate physical and biological features for arroyo toad is identified within a project that is located within designated arroyo toad critical habitat, the project will be redesigned to avoid impacts on that habitat.

c. If the species is not detected during surveys, no further avoidance measures are required.

ARTO-AM-3: Results of the initial arroyo toad habitat assessment will be submitted to the Wildlife Agencies for review and comment. Copies of the report will also be submitted to the Alliance.

ARTO AM-4: All individuals working in potential arroyo toad habitat will follow the disease prevention protocols described in the USFWS' *Declining Amphibian Population Task Force Code of Practice* (USFWS 2009).

5.11 Measures to Avoid and Minimize Effects

As required by the Endangered Species Act, section 10(a)(2)(A)(ii), the HCP includes measures with a primary focus of avoiding or minimizing impacts of the Covered Species (i.e., death or injury to species) and effects on habitat that may be affected by Covered Activities. These measures to avoid and minimize impacts are designed to achieve the following objectives:

- Provide avoidance of Covered Species during implementation of Covered Activities throughout the Planning Area.
- Prevent impacts on individuals from Covered Activities as prohibited by law.
- Minimize adverse effects on Covered Species and their habitats where conservation actions will take place.

This section describes the BMPs and AMMs that apply generally to Covered Species and Covered Activities. Species-specific AMMs, including the timing of species habitat surveys, preconstruction surveys, and construction monitoring relative to impacts, are provided in Section 5.9 for Covered Species that require additional measures. For long-term projects and projects that are phased,[20] the frequency and timing of surveys relative to impacts should also be phased such that surveys and monitoring (if required) will be conducted prior to each construction phase if the entire project area is not continuously disturbed between phases.

It is the responsibility of project proponents to design and implement their projects in compliance with these measures as well as the responsibility of the Alliance to provide adequate conservation to provide for the HCP's Up-Front and Stay-Ahead Provisions. Avoidance and minimization measures may be revised over the course of the permit duration based on results of implementation through the CAMMP and in accordance with Section 6.7, *Plan Changes and Amendments*. Even with these avoidance and minimization measures sub-lethal impacts on Covered Species may still occur.

5.11.1 General Avoidance and Minimization Measures

The AMMs listed below may apply to the initial project construction, O&M, or both. The AMMs that specifically apply to the initial project construction are further identified as BMPs. A table showing which AMMs are expected to apply to each project is included in Appendix G, *Covered Activity AMMs*.

All Covered Activities

AMM-1: Retain appropriately qualified biologists, botanists, and/or biological monitors ("Biologist") approved by the Alliance to ensure compliance with protective measures for Covered Species and migratory birds. The Biologist shall have demonstrated experience in the identification, behavior, and ecology of the Covered Species for which they are retained to survey for, or provide biological monitoring of. The Biologist will be required for monitoring of any new construction or O&M activities that may result in impacts on Covered Species or migratory birds.

AMM-2: The Biologist shall monitor project activities associated with the Covered Activity to ensure avoidance and minimization measures are being implemented and that BMPs remain in good working order (where relevant).

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[20] Phasing may include planned phasing of construction components of a project (e.g., multi-year phasing of a road or pipeline construction project), or unplanned gaps in construction activity.

AMM-3: The Biologist shall have the authority to halt project activities where Covered Activity avoidance and minimization measures are not being implemented as required. The Biologist shall immediately report lack of compliance to the Alliance, and the Wildlife Agencies, where appropriate. Project activities will not recommence until all required avoidance and minimization measures are in effect.

AMM-4: Pre-project biological surveys of Covered Activity project sites will be completed following standardized protocols (refer to Covered Species-specific AMMs), where available, at the appropriate time of year to determine the plant and wildlife species present, or with the potential to be present. Survey results will be provided to the Alliance and Wildlife Agencies, as appropriate, prior to commencement of a Covered Activity (including site preparation and staging).

AMM-5: Prior to initiation of a Covered Activity the Biologist shall conduct a project site worker environmental awareness program (WEAP) training for all persons employed or otherwise working at a Covered Activity project site. The training will include a presentation on the Covered Species and other wildlife and plant species with the potential to be on site, and the avoidance and minimization measures required to be implemented.

AMM-6 (BMP): Minimize to the extent possible all construction activity and access roads located in any drainage, stream, pool, or other feature that could be under the jurisdiction of USACE, the State Water Resources Control Board, and/or CDFW. Any unavoidable impacts on these resources must obtain any necessary State or Federal aquatic resources permits prior to construction.

AMM-7: Confine the area of Covered Activity disturbances to the smallest practical area, considering topography, placement of facilities, location of Covered Species habitat, public health and safety, and other limiting factors, and locate impacts in previously disturbed areas to the extent possible. Project design will prioritize the avoidance of Covered Species and their habitats where possible.

AMM-8 (BMP): The limits of construction for all Covered Activities, including O&M activities, and associated access routes and staging areas will be clearly demarcated prior to commencement of Covered Activity project activities. The Biologist will confirm the boundaries of the impact and avoided areas prior to project commencement and will ensure that demarcation materials remain in place and in good working condition for the duration of the Covered Activity. All persons employed or otherwise working at a Covered Activity project site will be familiar with the limits of project activities and the avoidance areas. Personnel will strictly limit their activities, vehicles, equipment, and construction materials to the designated work area. The Biologist will regularly check the project site to ensure that demarcation materials are in place and habitats outside of the limits of the project site remain protected.

AMM-9 (BMP): Confine the ingress and egress of construction equipment and personnel to designated access points and onsite roadways. Prohibit cross-country travel by vehicles and equipment.

AMM-10: Develop an integrated nonnative plant management plan to be implemented by the Permittee Agency for all Covered Activities in or adjacent to natural habitats to minimize the potential introduction of new nonnative species as a result of Covered Activities and to control the spread of nonnative plants (both terrestrial and aquatic) resulting from ground disturbance. The nonnative plant management plan will be developed by the Alliance within the CAMMP in the first year following issuance of the ITP and will be provided to each Permittee Agency as a part of the project consistency review process as a required element of project implementation.

AMM-11: All vehicles and equipment (including stationary equipment) operated within a Covered Activity project site will be in good working order and will be checked and maintained frequently to prevent leakage of materials with the potential to harm plants and wildlife, and/or contaminate soil and water (e.g., oil, gasoline, hydraulic fluid). Drip pans or other appropriate containment materials will be used under stationary equipment to prevent leakage/contamination.

AMM-12: All equipment (e.g., passenger vehicles, trucks, and heavy equipment) will be checked and cleaned, where necessary, to prevent the importation and spread of nonnative invasive plant species within and between project sites. This measure applies to both new construction and O&M.

AMM-13: Limit the use of pesticides for all Covered Activities within or adjacent to the HCP Preserve System. Where pesticides are used, limit use to those for which a "no effect" determination has been issued by the U.S. Environmental Protection Agency's (EPA) Endangered Species Protection Program. Prior to use of a pesticide the EPA's endangered species bulletin will be reviewed to ensure that the selected pesticide is not included on the bulletin.

AMM-14: Use of rodenticides will not be permitted within the HCP Preserve System or at any Covered Activity with the potential to support small mammal Covered Species.

AMM-15: Restoration of all Covered Activity temporary impact areas will be initiated within 30-days of Covered Activity project completion. Temporary impact areas will be restored to pre-project or superior condition. Only local propagules/seeds will be used for restoration.

AMM-16 (BMP): Cover, fence, or provide escape ramps with a minimum 3:1 slope for all open trenches or holes within Covered Activity project sites before leaving the site at the end of the workday. If trenches are not covered, they will be inspected for trapped wildlife by the Biologist daily, prior to commencement of project activities. Animals found will be captured and moved to the nearest safe location outside the construction area.

AMM-17 (BMP): Control dust. If water trucks are used, pooling water will be avoided to minimize the potential of attracting opportunistic predators.

AMM-18 (BMP): Conduct Covered Activities, including new project construction, during daylight hours to the extent feasible. If night work cannot be avoided, the project proponent will consult with the Alliance to determine measures to reduce impacts on Covered Species from lighting and noise.

AMM-19 (BMP): Promptly cover or mulch all exposed soil areas associated with the proposed project before the onset of precipitation if unexpected rainfall is forecast during the time grading activities are being performed. Mulch shall be free of nonnative plant materials to limit the introduction/spread of nonnative plant species.

AMM-20: Except on public paved roads with posted speed limits, limit vehicle speeds to a maximum 15 miles per hour during travel associated with the Covered Activities. If work must take place at night, the maximum speed limit is 10 miles per hour.

AMM-21: Limit noise-generating Covered Activities adjacent to occupied breeding bird habitat (see breeding seasons for HCP covered bird species) to outside of the breeding season. If Covered Activities must proceed, incorporate setbacks, berms, or walls, as appropriate, to minimize the effects of noise in excess of 60 dBA L_{eq} hourly to adjacent occupied breeding bird habitat.

AMM-22: Implement litter control measures. Trash and food items will be contained in closed containers and removed daily to reduce the attractiveness to animals in the area.

AMM-23: Avoid discarding of human-provided food in Covered Activity project sites or adjacent natural habitats.

AMM-24: Reduce the risk of wildfire ignition when conducting Covered Activities. Spark arrestors should be installed and operational on equipment used for construction. Construction or field crews should coordinate safety plans to include fire management, including actions such as parking in cleared areas to avoid ignitions and smoking bans. Crews should be aware of weather conditions and potential for fire ignition and activity for field or construction planning. Any hot work, such as welding, should not occur on high fire danger days (e.g., red flag wind warning, fire weather warning). During periods of high fire danger, crews should coordinate with local agencies for any additional measures to prevent fire ignitions.

AMM-25: Maintain adequate fire suppression capability in active construction areas. Require adequately sized fire extinguishers on all construction or field vehicles. For construction during periods of high fire danger, equipment such as a water tender or tanker should be on site. Crews should coordinate with local agencies during periods of high fire danger regarding construction plans to accommodate efficient response to any fire ignitions.

AMM-26: Erosion control materials shall not pose an entanglement risk to wildlife. Only materials with loose-weave mesh that is not fused at the intersections of the weave will be used. Loose-weave mesh expands to allow animals to push through, minimizing entanglement risk.

AMM-27: BMPs (unless specifically employed for the purpose of excluding animals) will not pose a barrier to wildlife movement. If long lengths of silt fencing are needed, for example, lengths will be shortened and installed to overlap at the edges to provide gaps for safe wildlife passage.

AMM-28: A spill containment/clean-up plan and spill control devices will be readily available at a Covered Activity project site for implementation, if needed (and where relevant).

Riparian Area and Aquatic Habitat Protection

AMM-29: Avoid and minimize all impacts on riparian and aquatic habitats to the extent practicable. Limit Covered Activities to outside of Covered Species breeding seasons, where possible.

AMM-30: Treat materials identified for restoration and rehabilitation projects, where necessary, to ensure that only clean materials are introduced into the pond, wetland, or riparian area, minimizing potential adverse effects on amphibians that may be present.

AMM-31: Implement a stormwater pollution prevention plan (SWPPP) during vegetation and access road maintenance activities, including implementing measures to control silt and sediment from reaching any tributaries to, or the mainstem of, the Santa Ana River. Install silt screens at the toe of the slope and around the perimeter of any area to be graded prior to initiating grading activities. Repair or maintain sediment and erosion controls as needed.

AMM-32: Reduce the potential for spills associated with Covered Activities by refueling vehicles outside of rivers, creeks, basins, and their banks. Equipment storage, fueling, and staging areas will be located on upland sites with limited risks of direct drainage into the HCP Preserve System or other sensitive habitat or riparian areas. Precautions will be taken to prevent the release of substances into surface waters. Project-related spills of hazardous materials will be reported to appropriate entities—including, but not limited to, the applicable jurisdictional city or county, USFWS, CDFW, and RWQCB—and will be cleaned up immediately. Contaminated soils will be removed to approved disposal areas.

AMM-33: Control pollutants affecting water quality. To reduce potential water quality impacts (e.g., from bentonite plumes), holes drilled for new wells or geotechnical studies will be refilled with native material or via another method as approved by the RWQCB.

AMM-34: Conduct in-channel work within ephemeral or intermittent channels when channels are dry to avoid flowing water whenever possible. When stream flows must be diverted, the diversions will be conducted using sandbags and other methods requiring minimal instream impacts. Silt fencing of other sediment trapping materials will be installed at the downstream end of the construction/O&M activity to minimize the transport of sediments off site. Settling ponds where sediment is collected will be cleaned out in a manner that prevents the sediment from reentering the stream. Care will be exercised when removing silt fences to prevent debris or sediment from returning to the stream. All stream diversions will have a project-specific diversion plan approved by CDFW, RWQCB, and USFWS, as applicable.

AMM-35: A Frac-Out Contingency Plan will be developed and provided to the Alliance and Wildlife Agencies for review and comment, for any Covered Activity employing horizontal directional boring/drilling or jack-and-bore methodology under a stream. The frac-out plan will detail the following elements at a minimum: equipment/materials (e.g., vac truck with sufficient hose length for the project site, straw waddles, sand bags) to be used should a frac-out occur, and where these materials will be located on the project site; the maximum allowable drilling fluid pressure, and frequency of drilling fluid pressure and fluid returns monitoring; procedures to follow should a frac-out occur; responsibilities of project site personnel during a frac-out; timing of frac-out training and daily briefings; containment materials disposal plan; notification procedures; and documentation of frac-out event,

Alluvial Fan Sage Scrub Protection:

AMM-36: When new construction or O&M activities with ground disturbance occurs, including trenching activities, within areas of alluvial fan sage scrub habitat with <30% nonnative grass and plant cover, remove and sequester surface soils at the beginning of any ground-disturbing activity. If cryptogamic soil crust is also present, it will be harvested in blocks, preserved, and placed back on the site in areas of temporary impact. If the impacts are permanent, an alternate site in suitable habitat will be selected in consultation with a qualified botanist or restoration biologist for placement of the topsoil of cryptogamic soil crust. The soil within the top 20 inches will remain decompacted (loose) upon final placement.

Special-Status Fish and Other Aquatic Species Protection:

AMM-37: Prior to any in-water work, a qualified biologist shall conduct a survey for special-status fish and other aquatic species. No work will be conducted in the flowing portion of the stream and water will be diverted around the work area in accordance with a project-specific water diversion plan (see AMM-34). Block nets or other barriers may be required if special-status fish or other aquatic species are present as determined by the preconstruction survey. A qualified Biologist will be on site to monitor installation of the diversion and to relocate special-status species from the work area. The Biologist will have the authority to stop all work if issues are noted until corrective measures have been implemented. Rescued special-status species will be relocated immediately to suitable habitat upstream or downstream of the diversion area.

Breeding Birds

AMM-38: Avoid new construction and O&M activities conducted within natural habitat areas to the extent feasible during the breeding season (February 1–September 15). If a Covered Activity resulting in surface disturbance takes place during the breeding season, a qualified biologist will conduct pre-activity nest surveys. The area to be disturbed and a 500-foot buffer will be surveyed for 5 consecutive days to determine if birds are nesting in or near the construction or O&M area. If an active nest or colony is present, a 300-foot buffer will be established and maintained between the Covered Activity and the nest area until nesting is completed.

AMM-39: Avoid human intrusion into potential nesting areas during the breeding season (February 1–September 15). A qualified biologist will conduct training of construction and/or O&M personnel on avoidance procedures, buffer zones, and protocols in the event that an active nest occurs near a construction or O&M area.

5.12 Comprehensive Adaptive Management and Monitoring Program

This section describes an adaptive management and monitoring framework for the HCP, including guidelines, and specific recommendations that will help the Alliance develop the Upper Santa Ana River HCP CAMMP. The purposes of this CAMMP framework, and one of the primary purposes of the CAMMP itself, are to ensure compliance with the HCP, to assess the status of Covered Species within the HCP Preserve System, and to evaluate the effects of management actions such that the conservation strategy, including the biological goals and objectives of the HCP, are achieved. Adaptive management and monitoring are integrated processes in the CAMMP, and monitoring will inform and change management actions to continually improve outcomes for Covered Species. The following presents an overview of the program, monitoring, and adaptive management actions, and data and reporting requirements.

5.12.1 Overview

CAMMP and Preserve Unit Plans

The CAMMP is an all-encompassing adaptive management and monitoring program for the entire HCP Preserve System. The HCP Preserve System is divided into five main Preserve Units based on their geographic location and primary habitat types (Figure 5-1). There are two Santa Ana sucker translocation preserve units in the upper headwater tributaries (Santa Ana Sucker Translocation Unit A, and Santa Ana Sucker Translocation Unit B); there are two alluvial fan sage scrub preserve units (Alluvial Fan Preserve Unit A, and Alluvial Fan Preserve Unit B) and one preserve unit on the mainstem of the Santa Ana River downstream of the wash (Santa Ana River Preserve Unit). The preserve units are described in more detail in Section 5.4, *HCP Preserve System*. In addition to the CAMMP, area-specific monitoring and management plans will be prepared for each of these preserve units. These PUPs will apply the guidance and directives of the CAMMP to the preserve unit, focusing on the specific habitat types, Covered Species, and management issues prevalent in each preserve unit. The fine-scale nature of the PUPs will enable focused application of conservation actions, monitoring methods, and prioritization of management needs. Both the CAMMP and the PUPs will require periodic updating as significant new information and tools are available; however, the PUPs will require more frequent updating to integrate the adaptive management results and reprioritize management needs. The CAMMP and PUPs will be maintained as "living" documents in the Upper Santa Ana River HCP online portal (described more under *Roles and Responsibilities*, below), greatly simplifying the update process.

Regulatory Context

An HCP must provide for the establishment of a monitoring program that generates information necessary to assess compliance and verify progress toward achieving the biological goals and objectives of the plan (50 Code of Federal Regulations [CFR] 17.22(b)(2)(A-F), 50 CFR 17.32(b)(2)(i-iii), and 50 CFR 222.307(b)(5)). Adaptive management programs are generally recommended for large, programmatic plans and those with data gaps and scientific uncertainty that could affect how species are managed and monitored in the future. The *Habitat Conservation Planning and Incidental Take Permit Processing Handbook* (USFWS and NMFS 2016) describes adaptive management as a method for addressing uncertainty in natural resource management and states that management must be linked to measurable biological goals and monitoring (see Up-Front and Stay-Ahead Provisions in Section 5.4.1). Species-specific biological goals and objectives are paired with conservation and monitoring actions to ensure evaluation of conservation measures and implementation of the biological goals and objectives (Section 5.9). Conservation measures listed in Table 5-6 can be modified in response to new information within an adaptive management framework.

The monitoring and adaptive management framework described in this chapter will fulfill the HCP requirements, which will be supported by the development of the CAMMP. This program incorporates recommendations for monitoring and adaptive management based on guidelines provided by the USGS, Biological Resources Division; CDFW; and USFWS for regional HCPs and NCCPs (Atkinson et al. 2004).

Roles and Responsibilities

The Alliance will be the HCP Implementing Entity on behalf of the Permittee Agencies and will implement conservation actions, and monitor and evaluate the effectiveness of the conservation actions and HCP Preserve System management (see Section 6.5, *HCP Implementing Entity*). Regular coordination will occur between the Alliance and Wildlife Agencies to ensure that all Covered Activities and conservation actions are consistent with commitments made within the HCP. The Alliance will be responsible for the preparation of the CAMMP and of PUPs, the HCP annual report, and the Up-Front and Stay-Ahead Compliance reports. The Wildlife Agencies will review and approve these documents and will be involved in regular HCP Preserve System oversight through annual meetings. These documents will be available to the public for review and input. In addition, coordination with other preserve managers in the Planning Area will help determine and address regional and local trends in adaptive management that may be occurring across the Planning Area.

Implementation of the CAMMP will be the responsibility of the Alliance. The Alliance will employ a Preserve System Manager, who will be responsible for ensuring that success criteria are being met within the HCP Preserve System through conservation actions that contribute to the conservation strategy of the HCP. The Alliance will be responsible for overall HCP compliance. These responsibilities include ensuring implementation of the specific mitigation requirements in the conservation strategy, as well as all biological monitoring, reporting, and adaptive management requirements as described in this chapter. The Alliance will also be responsible for ensuring compliance of the Permittee Agencies to implement Covered Activities consistent with the commitments of the HCP, which will be enforced through the Project Consistency Review (Section 6.5.2) process. To accomplish this the Alliance will also employ a Program Compliance Manager, who will be responsible for ensuring that Covered Activities are implemented in manner consistent with their description in Chapter 2 of the HCP.

Note that the implementation of the HCP and other elements of the Upper Santa Ana River Program will be coordinated, tracked, and managed through an online spatial mapping database and information portal. One of the primary objectives of this online portal will be to make HCP Preserve System management and monitoring information accessible to the regulatory agencies. While static hard copy reports would be sufficient to meet the annual reporting requirements, the expectation is that the results of monitoring and management will be available in near real-time through the Upper Santa Ana River HCP online portal, which will have the ability to generate any one of a variety of reports as needed—including to meet the annual reporting permit requirements.

Adaptive Management and Monitoring Objectives

The overarching objective of the CAMMP is to ensure that the conservation strategy described in this chapter and the biological goals and objectives are being achieved. Additional objectives of the CAMMP include the following:

1. Provide an organizational framework and decision-making process using the results of monitoring, targeted studies, and other data to adjust management actions.
2. Document the baseline condition of biological resources in the HCP Preserve System using existing data and the results of ongoing field surveys.
3. Develop conceptual models for vegetation communities and Covered Species that can be used as the basis for collecting information, verifying hypotheses, and designing and changing management practices.
4. Incorporate hypothesis testing and experimental management, including targeted studies to address key uncertainties and to improve management and monitoring efforts.
5. Develop and implement scientifically valid monitoring protocols at multiple levels to ensure that data collected will inform management and integrate with other monitoring efforts.
6. Ensure that monitoring data are collected, analyzed, stored, and organized so the data are accessible to the Permittee Agencies, regulatory agencies, scientists and, as appropriate, the public.

5.12.2 An Adaptive Approach to Management

Adaptive management is a decision-making process that promotes flexible management such that actions can be adjusted as uncertainties become better understood or as conditions change. Monitoring the outcomes of management is the foundation of an adaptive approach, and thoughtful monitoring can both advance scientific understanding and improve the effectiveness of management actions iteratively (Williams et al. 2009).

Monitoring and adaptive management of the HCP Preserve System will follow guidelines set forth in Atkinson et al. (2004) and refined in later documents (e.g., Hierl et al. 2007, Lewison and Deutschman 2014, and SDMMP and TNC 2017). This approach includes discrete steps for setup, planning, and action and should be initiated early in HCP Preserve System management and monitoring plan development (CAMMP and PUPs). The *Set-up* step identifies site-level conservation resources and potential threats and stressors. The *Planning* step defines and prioritizes monitoring and management issues. The *Action* step (1) monitors resources to assess status or trends and determine management needs, (2) implements management actions to enhance resource functions and reduce adverse effects from threats and stressors, (3) evaluates resource response to management actions, and (4) modifies monitoring and management actions, as necessary. Except for the initial site evaluation, all elements are iterative; thus, planning and action phases may overlap (Figure 5-11).

It is important to reiterate that adaptive management is used when there is uncertainty regarding management outcomes. Management issues that do not include uncertainty do not require an adaptive management approach. This topic is discussed further in Section 5.12.3, *Management of the HCP Preserve System*.

Adaptive Management Guidance

The sections below provide guidance for developing, implementing, and evaluating monitoring and management actions to protect and enhance conserved resources, minimize or avoid threats to those resources, and improve management effectiveness and efficiency through iterative learning.

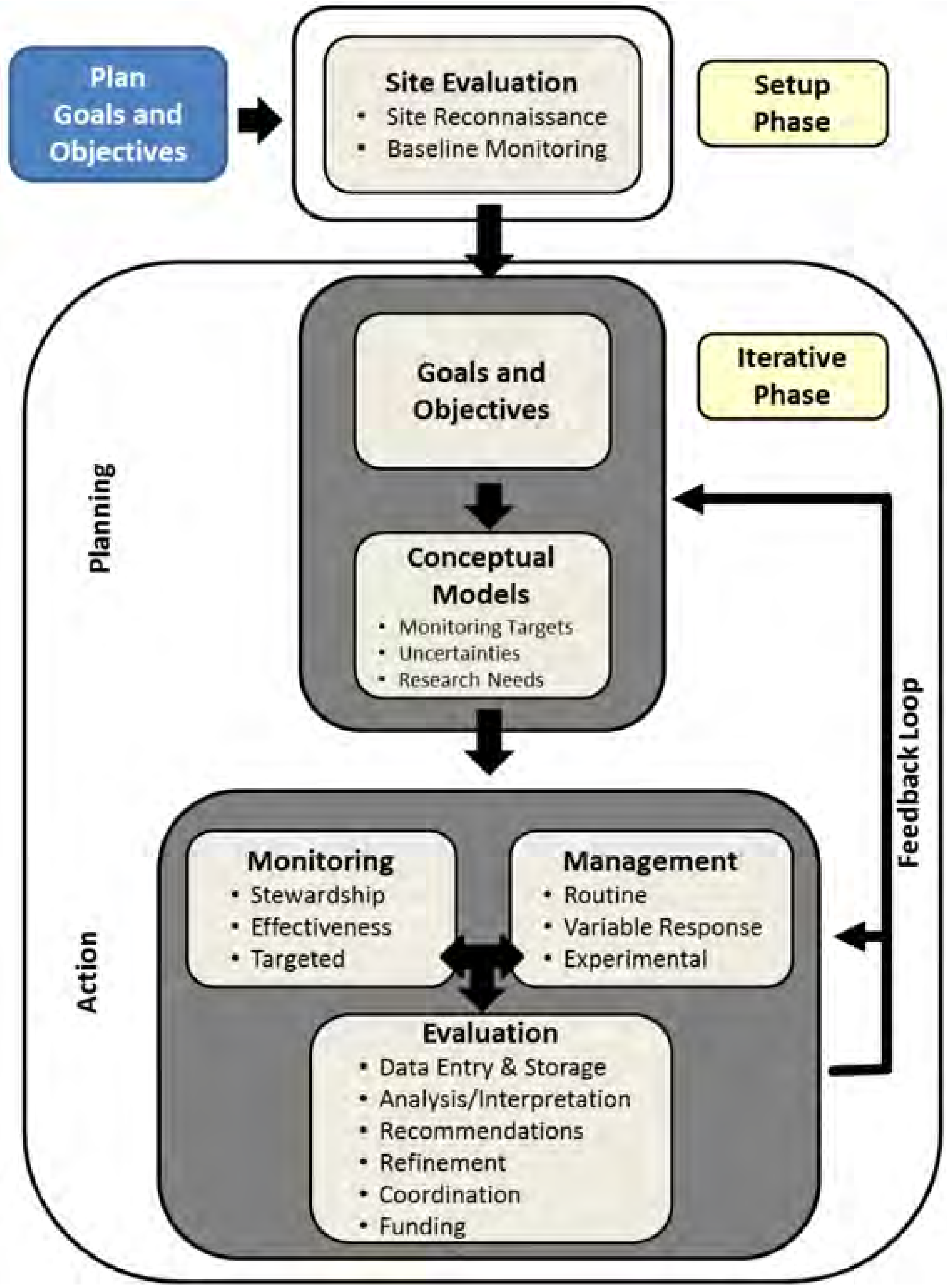
Key elements of site-level adaptive management and monitoring include:

- Site Evaluation
- Goals, Objectives, and HCP Conservation Actions
- Conceptual Models
- Management
- Monitoring
- Evaluation Process
- Uncertainties
- Research Needs

The relationship of these elements in the adaptive management and monitoring feedback loop are shown in Figure 5-11.

Site Evaluation

While many of the parcels identified for inclusion in the HCP Preserve System have already been enrolled in the Preserve through acquisition, additional parcels will continue to be added in the early phases of HCP implementation. Site evaluations will be conducted within 1 year of the issuance of the incidental take permit or within 1 year of acquisition (or establishment of conservation easement) for parcels added to the HCP Preserve System in the future. The Alliance will evaluate available data for parcels in the HCP Preserve System, conduct site reconnaissance to identify what field surveys should be prioritized and a proposed timeframe (e.g., for Covered Species), identify



Source: Lewison and Deutschman 2014.

Figure 5-11
Adaptive Management Process
Upper Santa Ana River Habitat Conservation Plan

appropriate land uses and roads or trails that should be closed, and identify immediate management and maintenance needs (e.g., fencing, runoff from adjacent properties, nonnative species, removal of structures or trash). Baseline surveys for conserved resources will be conducted subsequent to the site reconnaissance in order to obtain data necessary to assess resource status and management needs. Plan goals and objectives will focus the evaluation on key conservation resources (e.g., Covered Species, vegetation communities, ecological processes, and connectivity) and potential threats and stressors.

Existing regional and preserve-level documentation will be reviewed to identify and describe conservation resources (including types of data available), data gaps, and site history (i.e., land uses, fire, any previous management and monitoring) relevant to resource management. Potential data sources include (but are not limited to) this HCP, biological reports, regional databases (e.g., CNDDB, Biogeographic Information and Observation System [BIOS], California Invasive Plant Council [Cal-IPC] Weed Mapper), other conserved lands near the site, and expert opinion (species experts, science advisors, other Preserve Managers, Wildlife Agencies). Based on this assessment, the Alliance will prepare a site-specific list of conservation resources and data gaps, including potential threats and stressors to be included in the PUP in which the site falls.

Following land acquisition, as part of the initial site reconnaissance or subsequent baseline surveys, the Alliance will map vegetation communities (using *A Manual of California Vegetation* [Sawyer et al. 2009]) and level of disturbance, identify threats and stressors, and evaluate the potential of the property to support Covered Species and meet overall biological goals and objectives. Prior to surveys, the Alliance will identify types of data required to evaluate status and/or management needs for each resource to ensure appropriate data collection and desired outputs. The emphasis during this stage is on surveys that are broad-based (protocol or species-wide methods/procedures are preferred), comprehensive, and relatively rapid, with a focus on habitat condition and potential to support Covered Species (Lewison and Deutschman 2014).

Upon completion of site evaluation (site reconnaissance and baseline monitoring), the Alliance, in consultation with the Wildlife Agencies, will incorporate the results into the PUP in which it occurs, including the 5-year timeline of priority surveys and management needs in the PUP.

Information from the success criteria of the HMMPs for each Conservation Area will be used to develop goals and objectives for habitat improvement and evaluation procedures.

Goals, Objectives, and Conservation Actions

The HCP goals and objectives, Preserve Unit objectives, and species-specific objectives and conservation actions will be summarized and integrated as they apply to each individual PUP (e.g., Santa Ana sucker translocation goals, objectives, and actions would only apply to the Translocation Preserve Units and respective PUPs). With the additional specificity derived from the Site Evaluation (above), the objectives and conservation actions should be refined and described in further detail to specify where and how they apply to individual conservation areas in each Preserve Unit. The conceptual models, threats and stressors, and other uncertainties should be considered when adapting the objectives and conservation actions to the Preserve Unit.

Conceptual Models

Conceptual models allow for structured decision-making and should be used as a tool to test management hypotheses and identify appropriate monitoring targets, uncertainties, and research needs. Conceptual models provide a vision or concept of how a species, habitat, or ecosystem functions and how it might be influenced by management actions (Atkinson et al. 2004, Hierl et al. 2007, Williams et al. 2009, Deutschman et al. 2012, Lewison and Deutschman 2014). Further, conceptual models organize and articulate the relationship between change agents and natural drivers. For example, a conceptual model for a Covered Species will depict life history traits that influence species persistence, as well as natural and anthropogenic drivers (threats and stressors) and uncertainties that may affect those traits.

Conceptual models vary in complexity and format, and numerous sources are available to assist in model development (e.g., Atkinson et al. 2004, Hierl et al. 2007, Williams et al. 2009, Deutschman et al. 2012, Lewison and Deutschman 2014). To be scientifically defensible, model development must be based on existing data and literature- or field-based assumptions; documentation of these sources is an integral part of model development. Preliminary conceptual models have been developed for this HCP for each of the Covered Species. These conceptual models are relatively simple, identifying the natural drivers, threats, and stressors for each species, and will be further refined during the CAMMP preparation process.

The following principles and format elucidated in Hierl et al. (2007) and refined by the Institute for Ecological Monitoring and Management (IEMM) in a conceptual model workshop (Deutschman et al. 2012), Adaptive Management Framework (Lewison and Deutschman 2014), and species-specific models (Strahm 2012) are useful guidelines for model development for adaptive management:

Simpler models that represent the current state of knowledge and are supported by data are preferable to complex models with a high degree of uncertainty.

- Models should clearly identify management and monitoring goals.
- Models should include those life history traits (species variables) that influence persistence and should focus on those variables that may respond to monitoring and adaptive management (potential monitoring targets).
- Models should identify and differentiate between anthropogenic (threats and stressors) and natural drivers of the system.
- Putative or secondary relationships, if included, should be differentiated from data-based primary relationships.
- Proposed management actions should support the management goal; proposed monitoring should measure the effectiveness of management actions, followed by a modification in management, if warranted.

The Alliance will work with experts to further refine the conceptual models to guide the adaptive management process.

Management

The primary purpose of management of the HCP Preserve System is to maintain and enhance the quality of the conserved habitats within the HCP Preserve System for the benefit of Covered Species. Management of the preserve consists of the basic elements of preserve stewardship (e.g., maintaining fences, picking up trash, and controlling public access on designated trails), addressing of preserve-wide management needs (e.g., implementation of nonnative invasive species control measures), and the implementation of the species-specific management-oriented conservation actions. The HCP Preserve Management Committee and HCP Technical Advisory Committee will be consulted regularly to advise on questions related to the establishment and long-term management of the HCP Preserve System. Management of this HCP is further described in Section 5.12.3.

Monitoring

The monitoring program will provide the information necessary to assess HCP compliance and Covered Activity effects, verify progress toward achieving the biological goals and objectives, and provide the scientific data necessary to evaluate the success of the HCP's conservation strategy. The CAMMP will include three main types of monitoring: compliance monitoring, effectiveness monitoring, and targeted studies. All monitoring will be planned and conducted to support and inform the adaptive management approach of HCP implementation. The HCP Technical Advisory Committee will be consulted regularly to advise on questions related to the establishment and long-term management of the HCP Preserve System. Monitoring of this HCP is further described in Section 5.12.4.

Evaluation Process

The final step in the adaptive management process is evaluating or interpreting data to determine whether goals and objectives have been met and to guide future management and monitoring. This evaluation will be conducted yearly, and information will be used to refine goals, objectives, conceptual models, monitoring methods, and conservation and management actions.

Implementation of adaptive management is defined as successful if progress is made toward achieving management goals through a learning-based (adaptive) decision process. The PUPs will include an adaptive management component to ensure that site-specific objectives are being met and are contributing to the overarching goals and objectives of the HCP. Revisions to management components identified through adaptive management will be documented in the annual report and incorporated as a revised approach/method in the annual work plan as applicable for each Preserve Unit.

Data Entry and Storage. It is anticipated that a significant amount of data will be collected yearly in each Preserve Unit. The Alliance will maintain a GIS database of monitoring results from all Preserve Units in a format that is compatible with other state and regional monitoring databases, such as BIOS and CNDDB. The GIS database will include species, habitat, and management-relevant data, and should allow data to be input and extracted easily. Additional databases may be required to store non-digital data (e.g., data forms, photo documentation). The HCP Preserve System will be coordinated, tracked, and managed through an online spatial mapping database and information portal. Therefore, the data entry and storage structure will be developed as a key component of online system.

Data Analysis and Interpretation. Data analysis and interpretation are necessary to evaluate management effectiveness, improve understanding of the system, and reduce uncertainty. Data analysis can be simple or complex, depending on the management approach selected. Where uncertainty is absent or low, analyses may consist of graphics, summary statistics, or simple hypothesis testing. Where uncertainty is high, complex statistical analyses may be required. In the latter case, the Alliance may need to work with outside entities to ensure that data are analyzed appropriately. Data results and interpretation will be presented in the HCP Annual Report. The Alliance will include results, analyses, and recommendations from each Preserve Unit in the HCP Annual Report.

Evaluation. Evaluation completes the "feedback loop" or iterative learning process for adaptive management. Evaluation includes documentation and dissemination of results and recommendations, and refinements to goals, objectives, conceptual models, monitoring methods, and management actions, as necessary.

Decision-making. The accumulation of understanding and subsequent adaptation of a management strategy depends on feeding information obtained from monitoring results back into the decision-making process. The link between the technical and decision-making steps requires regular interaction and an exchange of information between the technical staff and decision-makers. This will be accomplished by bi-annual meetings involving the Alliance and the Wildlife Agencies where both regulatory and technical expertise can be integrated into revising goals and objectives, refining models, adjusting management and/or monitoring activities, or allocating funding. Meetings should be timed such that any new information discussed assists with the planning of upcoming seasonal work (i.e., nonnative invasive species control, vegetation management, or biological surveys). Timing some meetings to coordinate with other regional conservation planning meetings is encouraged to maximize communication and cooperation in the region.

Annual Report. The Alliance will prepare an annual report that summarizes monitoring and management activities in the HCP Preserve System including (but not limited to) baseline surveys, general stewardship monitoring, effectiveness monitoring, and targeted monitoring. The report will document monitoring results and link results to goals and objectives. The report will identify new or ongoing management issues and threats and stressors, and provide recommendations for future monitoring, management, and research. The establishment of conservation values and the use of conservation values will also be summarized in the annual report. The following information should be available with the annual report and be included in the HCP GIS database.

- A digital copy of monitoring data, including metadata (e.g., Excel spreadsheet).
- Spatial data (GIS shapefiles).
- Photo documentation.
- A comprehensive annual assessment identifying and documenting the major threats to conserved habitat and Covered Species, impacts from public use, management needs, and issues requiring focused research.

While static hard copy reports would be sufficient to meet the annual reporting requirements, the expectation is that the results of monitoring and management will be available in near real-time through the Upper Santa Ana River HCP online portal, which will have the ability to generate any one of a variety of reports as needed—including to meet the annual reporting permit requirements.

Management Actions Evaluation. The Alliance will evaluate management actions yearly (or at a frequency determined by the management action) to determine whether changes are warranted based on resource response and/or new information. This evaluation will address progress (positive and negative) toward goals and objectives. Proposed changes will be summarized in the annual report and detailed in the PUPs and associated work plans for the upcoming year.

Monitoring Program Evaluation. The Alliance will evaluate the monitoring program yearly to ensure that data are (1) collected efficiently, (2) address information needs, and (3) adequately assess resource responses to management actions. Changes in monitoring methods, protocols, or frequency will be summarized in the HCP Annual Report and detailed in the PUPs and associated work plans for the upcoming year.

Goals and Objectives Evaluation. The Alliance, in consultation with the Wildlife Agencies, will evaluate monitoring or management results that indicate that conservation actions are not meeting the HCP goals and objectives. Where the cause of poor performance is understood, prescriptive actions will be implemented, based on monitoring data or other scientifically defensible sources of information, or implementing alternative management actions.

Conceptual Models Update. Based on results from monitoring or other sources (e.g., literature reviews, species experts, science advisors, other Preserve Managers, and the Wildlife Agencies), the Alliance will update conceptual models, as appropriate, to reflect new information and guide future monitoring and management. Information that results in changes to underlying assumptions or hypotheses may warrant changes in monitoring and/or management. Revised conceptual models (including documentation of changes) will be included in the HCP Annual Report.

Coordination. The Alliance will promote coordination among Preserve Managers in the region and within Southern California to ensure that results of monitoring and management are shared and to encourage consistency in goals, objectives, monitoring methods, and monitoring priorities. Forums for coordination may be annual or bi-annual meetings or regional workshops. The Upper Santa Ana River HCP online portal is planned and expected to be a hub for science and collaboration, and will be an important tool to enhance coordination and data sharing across the region.

Funding. The support required for an adaptive approach includes not only funding for monitoring and evaluation but also an investment in inclusive and robust decision-making processes. The Alliance have included adaptive management as part of the formula for determining long-term funding requirements on the HCP (see Chapter 7. *Funding*). Identification of a long-term funding mechanism demonstrates the Alliance's commitment to adaptive management, and it strengthens the planning and implementation approach for successful adaptive management (Williams et al. 2009). Management and monitoring objectives and budgets should be formulated on a 5-year schedule, and adjusted as necessary annually.

Uncertainties

Sources of uncertainty will be identified through the site evaluation process and visualized through conceptual models. Types of uncertainty may include (1) effectiveness of management actions, (2) relationship between resource function and threats and stressors, and (3) larger ecosystem processes (e.g., annual variations in climate and climate change). Although many of these uncertainties may be addressed and reduced through HCP Preserve System-level management and monitoring, others are best addressed at regional or landscape-levels. For the latter, external sources (e.g., literature, regional monitoring programs) may be useful in understanding and reducing uncertainties.

Research Needs

Potential research needs will be identified through site evaluation, development of conceptual models, and responses to management actions. Appropriately structured monitoring programs are expected to answer some research questions, particularly those that have a direct bearing on management. The Alliance will ensure that HCP Preserve System-level data are available for analysis by other management entities or researchers focused on key management questions. The HCP conservation strategy already includes an important research component (Section 5.7, *Species and Habitat Research*). The Alliance will continue to encourage research on the HCP Preserve System lands by qualified (and funded) researchers where these efforts benefit Covered Species and protected biological resources.

5.12.3 Management of the HCP Preserve System

In order to maintain and enhance the quality of the conserved habitats within the HCP Preserve System, the Alliance will implement regular management activities with an adaptive management approach when monitoring efforts show that regular management methods are not maintaining the habitats in a condition to provide benefits to the Covered Species. The HCP Preserve Management Committee will be consulted regularly to advise on questions related to the establishment and long-term management of the HCP Preserve System. This section describes several management programs that will be developed and implemented as appropriate throughout the HCP Preserve System.

Nonnative Invasive Species Control and Management (CAMMP 1)

Nonnative invasive species control and management is typically the most labor-intensive and costly component of preserve management. Aquatic species make up a significant portion of the Covered Species and are threatened by nonnative aquatic predators. Similarly, nonnative invasive plant species are a persistent threat to the integrity of native habitats throughout the Planning Area. Lastly, cowbirds are brood parasites, reducing nesting success by leaving their eggs in the nests of other species, including the coastal California gnatcatcher and least Bell's vireo.

To address this persistent threat, the CAMMP will include a Nonnative Aquatic Predator Control Program to monitor the presence of and remove aquatic predators throughout the Santa Ana River Preserve Unit, a Nonnative Vegetation Management Program to monitor the distribution of and manage nonnative plants throughout the HCP Preserve System, and a Cowbird Management Program. The nonnative invasive species control and management provided by these programs are described briefly below.

Nonnative Aquatic Predator Control Program (CAMMP 1A)

The primary purpose of the Nonnative Aquatic Predator Control Program is to reduce the abundance of nonnative aquatic predators in areas occupied by native fish and other aquatic species to maximize the aquatic Covered Species survival and reproduction. The program will be implemented in order to offset the potential increase in nonnative aquatic predator habitat (pools or other microhabitats that provide relatively deep and slow velocity water flow) resulting from the effects of Covered Activities that reduce flow volume in the reaches occupied by aquatic Covered Species.

The nonnative predator removal program will be focused on reducing the abundance of nonnative aquatic predators immediately preceding the start of the Santa Ana sucker spawning season (approximately February 15). Species to be removed may include nonnative fish, nonnative amphibians, and nonnative reptiles such as mosquitofish, largemouth bass, black bullhead catfish, green sunfish, African clawed frog, American bullfrog, and red-eared slider. This activity will occur at minimum one time per year outside of the sucker spawning season (February 15 to August 1). The locations of where to conduct aquatic predator removal will be based on the most recent fish and/or other surveys conducted upstream of Prado Basin in the Santa Ana River as well as at the mainstem tributary habitat improvement sites. Pre-spawning predator removal will occur annually prior to February 15 in areas of highest ecological value to Santa Ana sucker reproduction. If many aquatic predators are found during the pre-spawning predator removal another predator removal effort will be conducted after August 1. While the nonnative aquatic species predator control is focused on removing threats to the Santa Ana sucker, all of the other aquatic Covered Species will also benefit from these actions. The Nonnative Aquatic Predator Control Program will be developed as a component of the overall CAMMP.

Nonnative Vegetation Management Program (CAMMP 1B)

The primary purpose of the Nonnative Vegetation Management Program is to maintain a low abundance and cover of nonnative vegetation in all Preserve Units of the HCP Preserve System (Conservation Areas). The program will focus on the removal of giant reed, tamarisk, and castor bean in riparian areas and on the removal of nonnative grasses in upland habitats areas of alluvial fan sage scrub throughout the HCP Preserve System. The Nonnative Vegetation Management Program will be developed as a component of the overall CAMMP.

Cowbird Management Program (CAMMP 1C)

Cowbird trapping and management will be conducted in and adjacent to identified habitats for the yellow-breasted chat, coastal California gnatcatcher, southwestern willow flycatcher, and least Bell's vireo when surveys indicate control measures are warranted. Trapping will be conducted by qualified biologists. The Cowbird Management Program will be developed as a component of the overall CAMMP.

Basin Sediment Management Program (CAMMP 2)

To mitigate the temporary capture of sediment in basins, the basins will be managed as a part of a Basin Sediment Management Plan, which will require sediment be periodically excavated from basins to maintain basin capacity and then be sorted with suitable substrate and deposited downstream of each basin to allow continued transport along the tributary and into the Santa Ana River. The Basin Sediment Management Plan will be developed as a component of the overall CAMMP.

Encampment Prevention and Removal (CAMMP 3)

People living in public rights-of-way or in natural open space or recreational areas are a problem for natural habitat and Covered Species as well as a public safety concern along the Upper Santa Ana River throughout the Planning Area. Encampment sites contain garbage, structures such as trailers, vehicles, solar panels, electronic devices, fencing, and other materials. Removal efforts include fuel extraction from the vehicles prior to hauling them offsite to avoid polluting water during transport as well as trash and hazardous materials removal, and other disturbances associated with physically relocating people and their belongings from the site.

The CAMMP will include an Encampment Prevention and Removal Strategy that will focus on prevention of encampment establishment rather than cleanup and removal as the most cost-effective and least environmentally damaging means to protect and maintain habitat values. Monitoring the Santa Ana River and other protected areas will attempt to prevent individuals from building semi-permanent structures and other activities that degrade habitat value. The Encampment Prevention and Removal Strategy will include procedures to coordinate with local jurisdictions and law enforcement who would work to prevent and deter people from building encampments and polluting public areas while also providing services to help them improve their circumstances. It is anticipated that implementation of the HCP will continue to require some routine cleanup and maintenance even after the initial removal of encampments.

5.12.4 Monitoring of the HCP Preserve System

Recent guidance for regional conservation planning defines monitoring as the "systematic and usually repetitive collection of information typically used to track the status of a variable or system" (Atkinson et al. 2004). The monitoring program will provide the information necessary to assess HCP compliance and Covered Activity effects, verify progress toward achieving the biological goals and objectives, and provide the scientific data necessary to evaluate the success of the HCP's conservation strategy. The Alliance will monitor resources at the landscape, community, and species levels as appropriate and directly relevant to the HCP goals and objectives. In addition to these levels, the Alliance will conduct three main types of monitoring: compliance monitoring, effectiveness monitoring, and targeted studies. All monitoring will be planned and conducted to support and inform the adaptive management approach of HCP implementation. A description of each of these types is provided below.

The monitoring guidelines presented in this section will help the Monitoring Biologist and the Alliance collect the appropriate data to ensure that the goals and objectives of the HCP and individual conservation areas are met, determine if HCP Preserve System management strategies are having the desired effect, and evaluate if underlying biological assumptions are supported by field-collected data. These guidelines include the following activities:

- Tracking the distribution and condition of natural communities and habitats throughout the HCP Preserve System.
- Periodic monitoring of Covered Species to determine presence/absence and/or relative abundance and distribution within the HCP Preserve System over time.
- Monitoring to evaluate effectiveness of specific management actions.
- Identifying and monitoring threats to habitat condition and to Covered Species, including introduction or spread of nonnative invasive species and other edge effects.
- Monitoring the effects of public use, encroachment, and other activities within and adjacent to the conservation areas.

Biological monitoring measures the effectiveness of the overall conservation approach, supports informed adaptive management decisions, assists in defining and modifying biological goals and objectives, and provides the Alliance and Wildlife Agencies with information to conduct assessments of baseline conditions and species status.

The Alliance, in consultation with the Wildlife Agencies, will identify the appropriate types of monitoring to address management questions and select monitoring methods that align with goals and objectives. In some cases, consultation with species experts or experts in monitoring or sampling design may be necessary.

Phases of Monitoring the HCP Preserve System

Table 5-31 provides a summary of monitoring tasks in each phase of HCP implementation. A more detailed description of the HCP phases is found in Section 5.4.1, *Phases of HCP Preserve System Implementation*.

Table 5-31. Expected Monitoring Task by Phase

Monitoring Type/Phase	Summary Tasks
Phase 1	**Years 0–5**
Compliance	Set up tracking databases for impacts, acquisition, and habitat restoration and/or rehabilitation. Demonstrate that Up-Front mitigation is secured, in Rough-Step, and under active management ahead of Phase 1 Covered Activity impacts.
Inventory	Initiate inventories in the HCP Preserve System.
	Develop Preserve Unit management plans with input from the Technical Advisory Committee and Wildlife Agencies within 5 years of the first acquisition for each Preserve Unit, or the issuance of the Permit, whichever is later; or as directed by the Wildlife Agencies. Each plan will contain a detailed monitoring and adaptive management plan; including the development of indicators, monitoring protocols, and success criteria for management actions.
	Prioritize conservation actions within each Preserve Unit and the Planning Area.
Targeted Studies	Develop conceptual models for Covered Species that identify critical management uncertainties.
	Prioritize and initiate pilot projects.
	Prioritize and initiate directed studies.
Long-term Monitoring	Develop experimental design for long-term management activities such as restoration and/or rehabilitation and include as part of Preserve Unit management plans.
Phase 2	**Years 6–10**
Compliance	Continue tracking impacts, acquisition, and habitat restoration and/or rehabilitation. Demonstrate that mitigation is in Rough-Step and stays ahead of Phase 2 Covered Activity impacts.
Inventory	Continue baseline inventories as sites are added to the HCP Preserve System.
Targeted Studies	Complete pilot projects.
	Continue directed studies every 5 years from initialization of study, or at other biologically appropriate intervals, as identified in the CAMMP and/or in species-specific monitoring protocols.
Long-term Monitoring	Update GIS layer (as needed) and assess trends.
	Monitor Covered Species response to management actions.
	Monitor Covered Species using methodologies developed in targeted studies phase.
	Review existing literature and scientific knowledge and make changes to monitoring and management based on new information.

Monitoring Type/Phase	Summary Tasks
Phase 3	**Years 10–15**
Compliance	Continue tracking impacts, acquisition, and habitat restoration and/or rehabilitation. Demonstrate that mitigation is in Rough-Step and stays ahead of Phase 3 Covered Activity impacts.
Inventory	Continue baseline inventories as sites are added to the HCP Preserve System.
Targeted Studies	Complete targeted studies.
Long-term Monitoring	Continue to assess status and trends of Covered Species.
	Adapt management actions based on monitoring results of species response and success criteria for restoration and other management efforts.
	Continue to monitor Covered Species and adaptively manage species in response to monitoring results.
	Evaluate efficacy of monitoring protocols using results of pilot projects.
Phase 4	**> Year 15**
Compliance	Finalize impact tracking. Maintain database of any active ongoing mitigation. Demonstrate that mitigation is in Rough-Step and stays ahead of Phase 4 Covered Activity impacts.
Inventory	Finalize baseline inventories of parcels acquired after Year 15.
Long-term Monitoring	Continue to assess status and trends of Covered Species.
	Based on 15 years of implementation, reassess monitoring protocols for target species and/or communities.
	Promote directed studies in the HCP Preserve System that benefit Covered Species.

The Alliance is not responsible for collecting additional biological monitoring data (outside of the HCP Preserve System) for regional assessments but may contribute to such efforts, as appropriate and feasible, through the collection of comparable data. Data comparability will be facilitated through regular interaction with the Wildlife Agencies and Preserve Managers in other HCP areas to support the use of similar methods, coordination of survey schedules, and other relevant efforts regarding monitoring issues. The Alliance will provide access to the HCP Preserve System for other entities to collect regional biological monitoring data, as appropriate, and will submit HCP Preserve System data to an appropriate data repository, such as BIOS, CNDDB, or other regional databases.

Compliance Monitoring

Compliance monitoring, also known as implementation monitoring, is a process used to ensure that the conservation strategy is implemented in accordance with HCP incidental take permit requirements. Compliance monitoring provides information that allows the Wildlife Agencies to track HCP implementation. Key elements of compliance monitoring will include the following.

Up-Front and Stay-Ahead. The Alliance will be responsible for demonstrating that implementation of the Conservation Strategy and progress towards assembly and management of the HCP Preserve System is consistent with the Up-Front and Stay-Ahead Provisions (Table 5-4), which identify that mitigation will be in Rough-Step and will stay ahead of Covered Activity impacts by a minimum of 10%. For SBKR and Santa Ana River woolly-star, mitigation and impacts will be tracked by Alluvial Fan Preserve Unit (i.e., Unit A or Unit B), to ensure that mitigation is being acquired, restored and/or rehabilitated, and managed within the same Alluvial Fan Unit as Covered Activity impacts.

Tracking Impacts. The Alliance will be responsible for collecting and maintaining information that tracks impacts on natural resources resulting from Covered Activities to ensure that the amount of impacts that ultimately occur under the HCP stays below the amount of impacts estimated during HCP development. The Alliance will track impacts from Covered Activities for the following areas: (1) ground-disturbing impacts on modeled habitat for Covered Species; (2) hydrology impacts on aquatic habitat conditions for covered fish species; (3) hydrology impacts on sediment transport effects on aquatic habitat substrates and alluvial fan sage scrub ecological processes; and (4) impacts on groundwater-dependent ecosystems from altered hydrology. The Alliance will use this information to make sure the HCP remains consistent with the Up-Front and Stay-Ahead Provisions (Table 5-4). The Alliance will also review each Covered Activity proposed by Permittee Agencies before implementation to ensure it is in compliance with the HCP conditions (see *Project Consistency Review* in Section 6.5.2).

Oversight of Preserve System Management and Monitoring. The Alliance will actively coordinate with local agencies and law enforcement, and direct the HCP Preserve Manager in addressing the variety of issues related to public access, enforcement, adaptive management, and funding. In addition, the Alliance will host bi-annual meetings involving the HCP Preserve System Manager, Monitoring Biologists, the HCP Administrator, and the Wildlife Agencies where implementation, policy, and technical issues of HCP Preserve System management will be addressed.

Tracking and Facilitation of Habitat Improvement (Restoration and/or Rehabilitation) Project Implementation. The Alliance will provide oversight and tracking of the habitat improvement project sites implemented under the HCP to ensure that restoration and/or rehabilitation projects meet the following criteria under the Plan:

- The restored and/or rehabilitated habitat meets final success criteria identified in final HMMPs approved by the Wildlife Agencies. The Wildlife Agencies will be responsible for the review and approval of habitat improvement projects to sign off that success criteria have been met.
- The restored and/or rehabilitated habitat is conserved through an existing real estate protection instrument or (as necessary) through a new conservation easement, deed restriction, or other mechanism pre-approved by the Wildlife Agencies. Protection instruments (e.g., conservation easement) will be recorded within 2 years of land acquisition or commencement of habitat improvement activities.
- The habitat improvement sites will be managed in accordance with activities outlined in an existing management plan or conservation easement that defines the role for managing the biological values of the project location.
- When the habitat improvement site has met its success criteria and received final sign off from the Wildlife Agencies, it will transition from management and monitoring under the HMMP into the CAMMP for long-term monitoring, management, and maintenance.

Surface Water and Groundwater Dependent Ecosystem Monitoring Program. The Alliance will develop a monitoring program to track both surface water and groundwater. Surface water monitoring may include the addition of new surface water gages at select locations along the Santa Ana River. Groundwater monitoring will assess the shift of groundwater and any subsequent shifts to wetter or dryer habitat types due to changes in the depth to groundwater. Groundwater monitoring will generally be completed with a series of shallow and deeper monitoring wells to determine the depth to groundwater along a gradient within sections of riparian habitat. The extent and health of both surface water– and groundwater-dependent ecosystems will be completed through mapping and rapid assessments (such as RipRAM) of these habitats. The results of surface water and groundwater monitoring will be incorporated into the tracking of impacts and may trigger adaptive management measures if greater than anticipated impacts on surface water– or groundwater-dependent ecosystems are observed. Adaptive management measures may include supplemental water supply from SARCCUP or other conjunctive use program, and the discharge of additional flow from the wastewater treatment plants along the upper Santa Ana River. The Surface Water and Groundwater Dependent Ecosystem Monitoring Program will be developed as a component of the overall CAMMP.

Annual Reporting. The Alliance will prepare an annual report summarizing activities over the reporting year. A public meeting on the report will be held in conjunction with the report submittal. The annual report will include descriptions and location of Covered Activities completed, summary of any minor or major amendments, summary of impact tracking, status of HCP Preserve System management and monitoring, status of restoration and/or rehabilitation projects, and summary of Plan funding. While static hard copy reports would be sufficient to meet the annual reporting requirements, the expectation is that the results of monitoring and management will be available in near real-time through the Upper Santa Ana River HCP online portal, which will have the ability generate any one of a variety of reports as needed—including to meet the annual reporting permit requirements.

Inventory Monitoring

Each property added to the HCP Preserve System will be surveyed to identify and map habitats, species occurrences, and triggers for management actions such as nonnative invasive species populations, unauthorized access, and trash. Inventory monitoring will also make note of any facilities or infrastructure on the site, their conditions, and their conservation benefits. This information, and site-specific directives specified in the PUPs, will inform the management of the site. Inventory monitoring includes the following monitoring actions:

- **Initial Reconnaissance Monitoring.** The site reconnaissance identifies survey needs, priorities, and a proposed timeframe (e.g., for Covered Species), identifies appropriate land uses and roads or trails that should be closed, and identifies immediate management and maintenance needs (e.g., fencing, runoff from adjacent properties, nonnative species, removal of structures or trash).
- **Baseline (Inventory) Monitoring.** Baseline monitoring establishes conditions at a given point in time. This monitoring requires biological expertise and will be conducted by the Monitoring Biologist. It is a one-time event that characterizes the status of conserved resources, as well as threats and stressors, for planning or future comparisons.
- **General Stewardship Monitoring.** General stewardship monitoring identifies general management issues and documents whether management actions are carried out as planned. This monitoring is used for general land management activities (e.g., trail closures, erosion control, fence repair, signage installation, routine nonnative plant inventory and control). General stewardship monitoring may commence upon HCP Preserve System acquisition and

does not generally involve an adaptive management component because uncertainty in management outcomes is low and BMPs are available to address the issue(s) of concern. The Preserve Manager will conduct general stewardship monitoring visits (monthly or as appropriate) in each Preserve Unit as part of their ongoing responsibilities and will report any issues to the Alliance within 1 week of discovery. As part of general stewardship monitoring, the status and identified threats to biological resources in the Preserve Units will be recorded.

Effectiveness Monitoring

Effectiveness monitoring assesses the biological success of the Plan. Effectiveness monitoring evaluates whether the effects of implementing the HCP conservation strategy are consistent with the assumptions and predictions made during development of the HCP (USFWS and NMFS 2016). Effectiveness monitoring is used to assess whether implementation of the conservation strategy is achieving the HCP's biological goals and objectives. Effectiveness monitoring typically measures the effects of management actions on targeted habitats (e.g., cover of invasive plants in riparian areas before and after treatment) and Covered Species (e.g., status of least Bell's vireo on the HCP Preserve System), and status and trends of stressors to the biological resources (e.g., distribution of invasive species) (Atkinson et al. 2004). To conduct effectiveness monitoring, biological expertise in the resources is necessary to develop thresholds of success for management actions and to then assess if the thresholds are being met. These may include quantitative measures such as percent cover of nonnative plant species and area of habitat suitable for Covered Species. Quantifying these conditions before and after management is the basis for judging success.

Effectiveness monitoring guidance will be developed by the Alliance to be incorporated into each PUP, including appropriate monitoring for the habitats present in that Preserve Unit: riparian (including floodplain), mainstem Santa Ana River aquatic, tributary aquatic, and alluvial fan sage scrub habitats. The effectiveness monitoring guidance will direct monitoring efforts within those habitat types in each Preserve Unit and across the HCP Preserve System, and will focus on the condition of Covered Species habitats within the HCP Preserve System and the results of management and conservation actions, almost all of which will be implemented within the HCP Preserve System. Wildlife Agencies and the HCP Technical Advisory Committee will have an opportunity to provide input on and evaluate the proposed effectiveness monitoring and its results. Effectiveness monitoring is tied closely to the HCP goals and objectives. Examples of specific monitoring measures for each habitat type are included in Table 5-32.

Table 5-32. Examples of Potential Effectiveness Monitoring Actions for Each Species and Habitat Type

Habitat	Species	Potential Monitoring Actions
Alluvial Fan Sage Scrub	General	Monitor the vegetation species diversity, nonnative plant cover, total cover, and sediment transport within alluvial scrub habitats. Monitor the effects of vegetation management on known Covered Species populations and reproductive success. Monitor the percent cover of nonnative vegetation and bare ground to determine whether control efforts are successful on an annual basis. If nonnative cover is greater than desired targets, identify management methods to achieve targeted nonnative plant species cover and increase bare ground cover,

Habitat	Species	Potential Monitoring Actions
		especially in spring (March or April depending on precipitation) when impacts from nonnative cover on small fossorial mammals (e.g., Los Angeles pocket mouse) dispersal would be greatest. Bare ground will include those areas without vegetation (dead or alive) and is exposed to direct sunlight (no native shrub component).
	Slender-horned spineflower	Establish monitoring plots and conduct baseline surveys for slender-horned spineflower in suitable habitat. Conduct regular monitoring, as determined in the CAMMP, after baseline surveys are complete. Map the size and extent of each extant patch during the baseline survey and estimate the number individuals from sample quadrats. • After baseline surveys are completed, survey for slender-horned spineflower in permanent and random sampling plots at a frequency described in the management and monitoring plan. • Compare sample plots in management treatment areas to those in untreated areas to assess the results of management actions.
	Santa Ana River woolly-star	Establish monitoring plots and conduct baseline surveys for Santa Ana River woolly-star in the HCP Preserve System. After baseline surveys are completed, survey for Santa Ana River woolly-star in permanent and random sampling plots at a frequency described in the management and monitoring plan.
	California glossy snake	Survey modeled suitable habitat areas at a frequency described in the management and monitoring plan to document species distribution in the HCP Preserve System.
	Burrowing owl	Monitor target sites for presence of ground squirrels and colonization by burrowing owl, including the number of burrows and occupancy in burrowing owl habitat.
	Cactus wren	Monitor suitable cactus patches within the HCP Preserve System to benefit cactus wren. Monitor the survivorship, growth, and structure of transplanted cacti to evaluate the efficacy of transplantation and potential benefits to cactus wren.
	Coastal California gnatcatcher	Monitor the HCP Preserve System for presence in suitable Coastal California gnatcatcher habitat. Monitor Conservation Areas expected to provide benefit for Coastal California gnatcatcher to ensure suitable vegetation structure exists.
	Los Angeles pocket mouse	Contribute to range-wide surveys for Los Angeles pocket mouse within the HCP Preserve System.

Habitat	Species	Potential Monitoring Actions
		Coordinate with the scientific research community and the Wildlife Agencies to assess genetic structure and diversity of Los Angeles pocket mouse within the HCP Preserve System.
	Western spadefoot	Monitor suitable western spadefoot habitat within the HCP Preserve System for western spadefoot occupancy and suitable vegetation coverage, including vegetation along stream channels and in adjacent uplands. Survey mammal burrows in targeted occupied/potential habitat for western spadefoot.
	San Bernardino kangaroo rat	Monitor the percent cover of nonnative vegetation and bare ground, and San Bernardino kangaroo rat occupation, to determine efficacy of control efforts on an annual basis. Monitor sediment replenishment sites to evaluate the improvement of San Bernardino kangaroo rat habitat. Contribute to range-wide surveys for San Bernardino kangaroo rat within the HCP Preserve System. Coordinate on research to assess genetic structure and diversity of San Bernardino kangaroo rat within the HCP Preserve System and collaborate on the development of strategies to enhance population genetics for the species.
Aquatic	General	Monitor groundwater levels to assess the potential for losses of surface flow to downwelling (mainstem) or increases due to upwelling.
	Santa Ana sucker	Monitor groundwater levels to assess the potential for losses of surface flow to downwelling. Monitor the Santa Ana sucker populations in the HCP Preserve System to determine if they are stable or increasing. This includes the mainstem Santa Ana River and mountain translocation streams.
	Arroyo chub	Monitor the arroyo chub populations in the mainstem of the Santa Ana River to determine if the population is stable or increasing.
	Santa Ana speckled dace	Monitor the Santa Ana speckled dace population reaches where they co-occur with Santa Ana sucker translocation streams to determine if they are stable or increasing.
	Mountain yellow-legged frog	Monitor water quality and quantity of perennial flows in Santa Ana sucker translocation streams to support mountain yellow-legged frog habitat within the HCP Preserve System.
	Western spadefoot	Monitor breeding ponds within the HCP Preserve System for pooled water throughout the western spadefoot breeding period. Monitor breeding ponds for successful breeding (through metamorphosis).
	Southwestern pond turtle	Survey all suitable habitat within the HCP Preserve System to estimate southwestern pond turtle distribution and

Habitat	Species	Potential Monitoring Actions
		demographics. Monitor occupied habitat periodically for southwestern pond turtle presence.
	South coast garter snake	Survey all suitable habitat within the HCP Preserve System to estimate south coast garter snake distribution and demographics. Monitor occupied habitat periodically for south coast garter snake presence.
Riparian	General	Conduct compliance monitoring, document the amount of habitat lost from Covered Activities, determine the amount of habitat protected in the HCP Preserve System, and field-verify suitable habitat and conduct surveys to establish a baseline and assess trends. Coordinate with existing efforts in the HCP Preserve System to monitor for presence of shothole borer. Monitor Conservation Areas targeted for riparian bird Covered Species to ensure suitable vegetation structure exists. Monitor the abundance of cowbirds in occupied least Bell's vireo, southwestern willow flycatcher, or yellow-breasted chat habitat during riparian bird surveys, and the cowbird trapping rate in cowbird control traps when surveys indicate cowbird trapping is warranted.
	Mountain yellow-legged frog	Monitor for changes to vegetation composition or habitat quality within mountain yellow-legged from habitat.
	Southwestern pond turtle	Survey all suitable habitat within the HCP Preserve System to estimate southwestern pond turtle distribution and demographics. Monitor occupied habitat periodically for southwestern pond turtle presence. Monitor and quantify the effectiveness of created basking sites. Monitor the use of nesting locations to determine factors influencing nest success in areas of known southwestern pond turtle use.
	South coast garter snake	Survey all suitable habitat within the HCP Preserve System to estimate south coast garter snake distribution and demographics. Monitor occupied habitat periodically for south coast garter snake presence.
	Tricolored blackbird	Integrate triennial monitoring data from the tricolored black bird statewide surveys to monitor occupancy of breeding sites in the HCP Preserve System and track trends in breeding colony size. Monitor habitat quality, and the structure and species composition of suitable breeding colony habitat in the HCP Preserve System.
	Yellow-breasted chat	Monitor the HCP Preserve System for presence and breeding activity in suitable yellow-breasted chat habitat.

Habitat	Species	Potential Monitoring Actions
		Monitor occupied yellow-breasted chat habitat in the HCP Preserve System to confirm that vegetation structure and species composition of habitat patches remains suitable for yellow-breasted chat breeding.
	Western yellow-billed cuckoo	Monitor the HCP Preserve System for presence in suitable western yellow-billed cuckoo habitat. Monitor Conservation Areas expected to benefit western yellow-billed cuckoo to ensure suitable vegetation structure exists.
	Southwestern willow flycatcher	Monitor the HCP Preserve System for presence in suitable southwestern willow flycatcher habitat. Monitor Conservation Areas expected to benefit southwestern willow flycatcher to ensure suitable vegetation structure exists.
	Least Bell's vireo	Monitor the abundance of cowbirds in occupied least Bell's vireo habitat during riparian bird surveys, and the cowbird trapping rate in cowbird control traps. Monitor nesting populations to determine nest success for the benefit of least Bell's vireo populations within core areas. If nest success is below a pre-determined threshold, factors adversely affecting nest success will be evaluated and appropriate management actions (such as cowbird control, habitat improvements) will be implemented.

Targeted Studies

Most targeted studies will be implemented to resolve critical uncertainties that may prevent achievement of HCP goals and objectives. Targeted studies that will be used to inform management decisions are discussed in detail in Section 5.7.

Targeted monitoring may also be used to answer specific management questions (hypotheses) and determine the effect of management actions on target resources. Targeted monitoring will be implemented by the Alliance in coordination with the HCP Technical Advisory Committee and may require additional input from outside experts with respect to sampling design, data collection, and analyses. In addition, results may be used to develop or refine BMPs. Targeted monitoring necessary to address site-specific threats to Covered Species and habitats in the HCP Preserve System will be identified and prioritized as part of the development of individual PUPs or through subsequent stewardship or effectiveness monitoring.

Selecting Appropriate Monitoring Methods

Method selection will be dependent on the monitoring target, as identified through existing protocols or conceptual models. There are many monitoring methods or protocols available to address goals, objectives, and management questions. Different methods may be required for different types of monitoring, and methods should be objective-driven. For example, if the objective is to determine whether a species occurs on the HCP Preserve System, then presence/absence monitoring will suffice. If the objective is to determine whether population size is stable, increasing, or declining over time (trend), full census/total counts, probability sampling (transects, quadrats, trapping lines, grids, visual encounter surveys), or mark-recapture surveys may be required. Further, linking change to specific threats will require some measure or assessment of those threats. For many resources, the monitoring target will be obvious (e.g., the species of concern), although targets may also be other objects of interest (e.g., burrows, nests, tracks). Finally, monitoring protocols should be consistent with other protocols in San Bernardino and Riverside Counties and/or Southern California to facilitate comparison and help inform data analysis.

It is important to point out that all species may not need the same level, frequency, or intensity of monitoring, depending on status and threats. Further, there are some species for which habitat monitoring may be sufficient to determine trends and threats. However, assumptions about species-habitat relations must be supported by data prior to relying on "surrogate" monitoring (Atkinson et al. 2004).

The Alliance, in consultation with the HCP Technical Advisory Committee, Wildlife Agencies, and other species experts, will review and select the most appropriate monitoring method(s) to address resource-specific management questions. Recommended monitoring methods will be included in the CAMMP and PUPs, although the specific methods will be adapted and revised over time based in monitoring needs, effectiveness, and best available science and technology.

5.13 Recommended Additional Species Conservation Measures

The following conservation measures are not requirements or commitments of the HCP, but are additional measures that are being contemplated and may potentially occur using other funding sources outside of the HCP funding obligations. These additional conservation measures are expected to complement the conservation actions of the HCP, but are not required for the success of the HCP conservation strategy. These include species-specific conservation measures and the implementation of restoration projects in Future Conservation Areas (described in Section 5.4.4).

Santa Ana Speckled Dace

- Study the isolated populations of speckled dace in Lytle, Cajon, Plunge, Mill, Big Tujunga, Haines, and Indian Creeks to maintain a working knowledge of the year-to-year distribution of speckled dace.
- Survey the perennial reaches of Lytle Creek, Plunge Creek, Mill Creek (the spring system at Thurman Flats), Etiwanda, Day, and Cucamonga Creeks for Santa Ana speckled dace.
- Coordinate with researchers and the Wildlife Agencies on management actions that may be needed for the species.

San Bernardino Kangaroo Rat

Coordinate with researchers and the Wildlife Agencies to investigate techniques that may be employed to restore or create opportunities for connectivity between SBKR populations isolated from one another due to the presence of infrastructure that poses a barrier to movement.

Chapter 6
Plan Implementation

6.1 Overview

The Upper Santa Ana River Habitat Conservation Plan (HCP) Joint Powers Authority (JPA), also referred to as the Upper Santa Ana River Sustainable Resources Alliance (Alliance), will serve as the Implementing Entity of the HCP. As more fully described below, in its role as Implementing Entity, the Alliance will be responsible for implementing the HCP and assisting the other Permittee Agencies in complying with the terms and conditions of the Joint Incidental Take Permit in connection with their Covered Activities.

In many regional HCPs, the Implementing Entity serves as a single Master Permittee that issues certificates of inclusion to other entities who derive their incidental take authority through the Master Permittee. The Upper Santa Ana River HCP follows a different structure in which the Implementing Entity (i.e., the Alliance) and each of other the Permittee Agencies will receive incidental take authority directly from the U.S. Fish and Wildlife Service (USFWS) under a shared, joint incidental take permit (Joint ITP). Under this structure, the Joint ITP will (i) provide coverage to the Alliance for the incidental take of species incidental to the Alliance's implementation of the conservation strategy (e.g., for restoration or other physical work) and (ii) provide coverage to each of the other Permittee Agencies for their respective Covered Activities. Although a single Joint ITP will be issued to the JPA and the other Permittee Agencies, the respective responsibilities of the various Permittees will be severable, as more fully described below.

This chapter describes the formation and structure of the JPA, as well as the overall HCP implementation structure, roles and responsibilities, annual reporting requirements, and procedures for amending the HCP. In addition, this chapter addresses how the JPA will respond to Changed and Unforeseen Circumstances that may occur during the duration of the HCP.

HCP Implementing Entity: Upper Santa Ana River Sustainable Resources Alliance

The Alliance will be responsible for a broad variety of tasks, including:

1. Overall plan administration and management, such as HCP budgeting and finance, monitoring, and enforcement.
2. Implementation of the conservation strategy, ensuring HCP compliance by the Permittee Agencies, project consistency review, and allocation of incidental take and mitigation accounting.
3. Implementation of the Adaptive Management and Monitoring Program and updates, maintenance, and management of the HCP geographical information system (GIS) database and implementation and tracking tools.
4. Acting as a liaison between the Permittee Agencies and USFWS relative to HCP implementation and compliance, including annual reporting.
5. Sponsoring the Upper Santa Ana River HCP mitigation/conservation strategy.

6. Land acquisition, and HCP Preserve management and monitoring, all in coordination with the San Bernardino Valley Conservation Trust, or other appropriately qualified entity (as described below).
7. Public outreach and education (including establishment and management of the technical advisory and stakeholder committees).
8. Other administration functions, including providing GIS and other technical support to Permittee Agencies, grant administration, and third-party contracting (e.g., contracts between the JPA and Permittee Agencies or other parties for activities related to Plan implementation).
9. Other regulatory agency permitting implementation and oversight, including:
    a. Implementation and compliance oversight of a Section 2081 Multi-Project ITP for incidental take under the California Endangered Species Act.
    b. Implementation and compliance oversight of all other programmatic permits (e.g., 404, 401, 1600), including assisting the Permittee Agencies in submitting any sub-notifications and securing authorization for project-specific sub-permits/agreements for their respective Covered Activities.

Each of these roles is described more fully in Section 6.5, *HCP Implementing Entity*.

6.2 HCP Permit Structure

6.2.1 Permittee Agencies

The Permittees under the Upper Santa Ana River HCP include the 11 water agencies, the Upper Santa Ana River Sustainable Resources Alliance, and the San Bernardino Valley Conservation Trust or other appropriately qualified entity (referred to generally as the *Permittee Agencies*). The Permittee Agencies are listed in Table 6-1. Each Permittee Agency will receive incidental take authority to undertake their respective Covered Activities as described in Chapter 2. The 11 water agencies, the Alliance, and the Conservation Trust will operate under a single Joint ITP. A second ITP will be issued to Southern California Edison (SCE), as more fully described below, to provide incidental take coverage for any Santa Ana suckers that may be translocated to waters upstream of SCE's hydroelectric facilities, including those that are covered by SCE's licenses from the Federal Energy Regulatory Commission (FERC).

Table 6-1. Permittees Agencies Under the Joint ITP

Water Agencies
Rialto Utility Authority
East Valley Water District
Inland Empire Utilities Agency
Metropolitan Water District of Southern California
Orange County Water District
City of Riverside, Riverside Public Utilities
San Bernardino Municipal Water Department
San Bernardino Valley Municipal Water District

San Bernardino Valley Water Conservation District
West Valley Water District
Western Municipal District
Other Agencies
Upper Santa Ana River Sustainable Resources Alliance
San Bernardino Valley Conservation Trust (or other appropriately qualified entity)

6.2.2 Joint ITP Permit Structure

The Joint ITP structure was selected over other permit structures based on a need to coordinate efforts on the river itself and the conflicts that might arise if each Permittee Agency were to operate under its own ITP. Because the Permittee Agencies are independent legal agencies, each of which is undertaking its own Covered Activities, a master permit structure (i.e., one master permit holder with multiple sub-permittees) was determined not to be institutionally feasible for this HCP. By contrast, a joint permit structure will facilitate ongoing coordination among the parties, which, as described below, will be managed by the Alliance in accordance with a JPA and other contractual arrangements to allocate operational and funding responsibilities, risks, and liabilities under the HCP.

To coordinate their activities under the HCP, the Permittee Agencies will establish the Alliance as a JPA in accordance with the Joint Exercise of Powers Act (California Government Code Section 6500) and will be governed by a JPA Agreement in accordance with that statute. As more fully described below, the Alliance will have primary responsibility for overall implementation of the HCP including, for example, mitigation, monitoring, and reporting, and assisting the Permittee Agencies plan and implement their respective Covered Activities. The costs of administration of the Alliance, and the HCP as a whole, will be borne by the Permittee Agencies in accordance with the JPA Agreement. A separate Participation and Financing Agreement (PFA) between the Permittee Agencies will account for and assign financial responsibility of the Alliance among the Permittee Agencies. As more fully described below, the JPA Agreement will establish the operational aspects of the HCP, while the PFA will describe the financial responsibilities of each of the Permittee Agencies with respect to the HCP and the Alliance, as well as their own individual responsibilities under the Joint ITP.

Although the Permittee Agencies will operate collectively under the Joint ITP, each will be fully responsible for any Covered Activity undertaken by that agency under the HCP and will be required to coordinate with the Alliance staff in order to ensure consistency of the Covered Activity with the Plan and the ITP. Moreover, the responsibilities of the Permittee Agencies with respect to Covered Activities will be severable so that non-compliance by one of them will not compromise the rights of the others under the ITP. For example, if one Permittee Agency conducts a Covered Activity in a manner inconsistent with the HCP, that Permittee Agency's incidental take authority may be suspended or revoked without affecting the incidental take authority issued to the other Permittee Agencies or the Alliance. Moreover, any costs incurred by the Alliance or other Permittee Agencies as a result of non-compliance by one Permittee Agency will be borne by the non-complying Permittee Agency and reimbursed to the Alliance if the Alliance has incurred any associated costs.

Similarly, if one Permittee Agency withdraws from the Alliance, that withdrawal will occur in a manner that does not affect implementation of the HCP's Conservation Strategy or the ability of the other Permittee Agencies to operate under the HCP for the remainder of its terms. In particular, a withdrawing Permittee Agency will be required to "make the HCP whole" by (i) reimbursing the Alliance any costs incurred on behalf of or attributable to the Permittee Agency prior to withdrawal; (ii) making any remaining contributions in the form of an endowment as needed to assure that any mitigation attributable to any Covered Activity already undertaken by the Permittee Agency is funded in perpetuity; and (iii) covering (in the form of an endowment or otherwise) any and all other additional costs associated with the withdrawal (e.g., Alliance administrative time, cost of amending or modifying the HCP (if necessary) or any other permit documents or agreements, increased incremental mitigation, or other costs). If a Permittee Agency withdraws from the Alliance prior to undertaking a specific Covered Activity, that Covered Activity may be removed from the proposed Covered Activities and, pending approval from the USFWS, any unused incidental take could be substituted for another Covered Activity (see Section 6.7, *Plan Changes and Amendments*). If a withdrawing Permittee Agency has already undertaken a Covered Activity, that agency will not be released from any financial responsibilities associated with that Covered Activity. The precise requirements for withdrawal from the Alliance will be fully described in the JPA Agreement and the PFA.

6.2.3 Southern California Edison ITP

As described in Chapter 2, *Covered Activities,* and further below, certain of SCE's ongoing activities on the Upper Santa Ana River or tributaries are expected to require incidental take coverage as Santa Ana sucker populations are expanded within the watershed. In particular, the HCP's conservation strategy requires the translocation of Santa Ana suckers into at least three tributaries of the Santa Ana River, some of which may be near where SCE operates and maintains hydroelectric facilities, including three that are operated in accordance with 30-year licenses issued by the FERC in 2003 (i.e., Covered Activities SCE.1, SCE.2, and SCE.3), and facilities that do not operate under a FERC license (SCE.4). The HCP provides coverage for SCE's activities under the FERC licenses to the extent those activities result in incidental take of Santa Ana suckers. SCE will be issued its own incidental take permit for those activities.

Although SCE is a Permittee under the HCP, SCE will not be responsible for the actions of the Alliance or the other Permittee Agencies, nor will it participate in the JPA. Moreover, SCE will not be responsible for implementing of avoidance or minimization measures associated with Santa Ana sucker that may be translocated into the area of SCE operations. That is, any avoidance and minimization measures associated with SCE operations will be the responsibility of the Alliance, which will undertake those measures (e.g., rescue and relocation) in coordination with SCE as and when necessary. SCE and the Alliance may enter into separate contractual arrangements by which operational or other specified costs to SCE associated with the HCP may be covered by the Alliance.

Because the FERC licenses are subject to renewal during the life of the HCP, SCE has requested some assurance that the presence of Santa Ana sucker in the area of its operations will not negatively affect SCE's long-term ability to operate in those areas. The HCP's regulatory assurances therefore explicitly apply to SCE's activities. To provide additional certainty to SCE, USFWS is expected to include in its biological opinion for the HCP all impacts of the long-term operations of SCE's hydropower facilities in these areas. The HCP biological opinion can be used in connection with the USFWS consultation on future FERC relicensing.

6.3 Other Regulatory Agency Permits

Many of the Covered Activities will require authorizations under other State or Federal laws, including Section 2081 of the California Endangered Species Act, Section 1600 et seq. of the California Fish and Game Code (lake and streambed alterations), Sections 404 and 401 of the Clean Water Act, and the Porter-Cologne Water Quality Control Act (waste discharge requirements [WDRs] and Section 401 certifications). To facilitate implementation of Covered Activities under the HCP, the Permittee Agencies and the Alliance are also seeking authorizations under these laws. These separate authorizations will establish performance standards and mitigation requirements for various classes or aspects of Covered Activities. Except for the Section 2081 Multi-Project ITP (described below), these authorizations are expected to be programmatic in nature, thus enabling the proponents of those activities to secure project-level authorizations on a predictable and expedited basis. The performance standards of the other regulatory agency permits are expected to be as consistent as possible with those of the HCP to increase the efficiency of mitigation and coordinated permit compliance and implementation.

6.3.1 Section 2081 Multi-Project ITP (California Department of Fish and Wildlife)

A California Endangered Species Act (CESA) ITP is required from California Department of Fish and Wildlife (CDFW) under Section 2081 of the California Fish and Game Code. The information, analysis, and conservation actions described in this HCP have been prepared to meet the needs of CDFW in the development and issuance of a long-term CESA ITP for all Covered Activities to be undertaken by the Permittee Agencies or the Alliance where impacts on CESA-listed Covered Species have been identified. The CESA ITP's authorization to impact the CESA-listed Covered Species, which may be issued as a whole or in a phased manner, would expire 50 years from the date it is signed by CDFW, or alternate timeframe identified by CDFW.

The CESA ITP will be a Section 2081 Multi-Project ITP, or other ITP structure as deemed appropriate by CDFW. When issued it will provide a mechanism for the incidental take of CESA-listed Covered Species needed for implementation and operation of the Covered Activities. One benefit of this structure is that it will allow the Alliance to acquire and implement mitigation projects well ahead of incidental take without the need to rely on advance mitigation legal structures that are otherwise authorized specifically only under CDFW's Natural Community Conservation Plan (NCCP), Regional Conservation Investment Strategy (RCIS), or conservation and mitigation banking programs. This will provide both temporal mitigation benefits and assurance that mitigation will be available when needed by the Permittee Agencies or Alliance.

To assure that the assumptions and findings upon which the Section 2081 Multi-Project ITP or other ITP structure are based remain valid throughout the life of the permit, the Alliance will review each permitted activity prior to its being undertaken, ideally through multiple consistency reviews performed at several stages of project planning and design. During the consistency review process, the Alliance will confirm that the permitted activity is consistent with the assumptions and impact calculations of the HCP and the Section 2081 ITP(s). The Alliance will monitor compliance with the CESA ITP(s) and submit to CDFW compliance reports prepared as a part of the annual regulatory reporting activities. The report will include at a minimum the following:

1. A list of projects completed over the reporting period, including projects that are currently in progress.
2. Acreages of impacts on CESA-listed Covered Species Habitat(s) over the reporting period, along with GIS mapping depicting impacts on CESA-listed Covered Species Habitat(s) over the last 10 years.
3. Acres of CESA-listed Covered Species Modeled Habitat that was preserved for projects during the reporting period.
4. Acres of CESA-listed Covered Species Habitat that was restored for projects during the reporting period.
5. Number of impacted CESA-listed Covered Species, if available.
6. Any new information relevant to the conservation of the CESA-listed Covered Species and/or to the Upper Santa Ana River Habitat Conservation Planning Area.
7. A comprehensive summary and assessment of compliance with the Up Front and Stay-Ahead Provision to assure that mitigation requirements of the Conservation Strategy (i.e., as incorporated into the Section 2081 ITP[s]) stay ahead of Covered Activity impacts.
8. Any additional information/reporting required by CDFW and the CESA ITP(s).

6.3.2 Clean Water Act Section 404 Permitting (U.S. Army Corps of Engineers)

The HCP will be implemented in coordination with the regulatory permit required from the U.S. Army Corps of Engineers (USACE) under Section 404 of Clean Water Act for the discharge of dredged or fill material into waters of the United States. A USACE permit may be issued for a specifically identified activity (Individual Permit or IP) or they may also be issued on a programmatic basis for a class of activities. To assist in streamlining the issuance of Section 404 clearance(s), the Permittee Agencies and the Alliance will seek from the USACE the most appropriate permits for the proposed Covered Activities. The permitting approach has yet to be determined, but regardless of permitting path selected, the HCP will be implemented in coordination with these permits.

6.3.3 Clean Water Act Section 401 Certification/Waste Discharge Requirement (Regional Water Quality Control Board)

The HCP will also be implemented in coordination with the Section 401 certification process. Section 401 of the Clean Water Act requires that, prior to or as a condition of issuance of a USACE permit, a state certify that the proposed Federally authorized discharge complies with state water quality standards. In California, Section 401 certifications are issued by the State Water Resources Control Board (SWRCB) or one of the nine regional water quality control boards (RWQCBs). In reviewing any proposed discharge for certification, the water boards apply the standards issued under California's Porter-Cologne Water Quality Control Act, California Water Code Division 7 (Porter-Cologne). Where a discharge to a water of the State does not require a USACE permit, the water boards will issue WDRs to authorize that discharge under Porter-Cologne.

In April 2019, the SWRCB adopted a statewide wetlands definition and "Procedures for the Discharge of Dredged or Fill Material into Waters of the State." The "Procedures," which became effective on May 28, 2020, establish a uniform set of application, avoidance, and mitigation requirements for activities requiring Section 401 Certification or WDRs. Under the Procedures, the SWRCB or one of the RWQCBs may issue an "Order" that can serve as both a Section 401 Certification and WDRs. Orders may be issued on either an individual basis (like a USACE IP) or as a "General Order," which is programmatic in nature. In particular, the Procedures authorize the issuance of General Orders "for specific classes of … discharge activities that are similar; involve the same or similar types of discharges and possible adverse impacts requiring the same or similar conditions or limitations in order to alleviate potential adverse impacts to water quality; and are determined … to more appropriately be regulated under a general order rather than an Individual Order."

Under the Procedures, compensatory mitigation requirements for the discharge of dredged or fill material are determined based upon a watershed approach that may be developed from a "watershed plan" that (i) has been approved for use by the RWQCBs and analyzed in an environmental document, (ii) includes monitoring provisions, and (iii) includes guidance on compensatory mitigation opportunities. A watershed plan is defined as a document, such as a habitat conservation plan, that has been developed in consultation with relevant stakeholders and a specific goal of which is aquatic resource restoration, establishment, enhancement, and preservation within a watershed. In addition to governing mitigation decisions, a watershed plan may be used to evaluate alternatives to fill under the Procedures' sequencing requirements. The Upper Santa Ana River HCP specifically has been developed to serve as a watershed plan under the Procedures.

The Permittee Agencies and the Alliance will apply to the Santa Ana and San Diego RWQCBs for a General Order under the Procedures.

The General Order will include Covered Activities proposed for authorization under any Programmatic IP or LOP issued by USACE. This Order will serve as a Section 401 certification for the Programmatic IP, as well as WDRs for any such activity that will result in a discharge to a water of the State but not a water of the United States. This Order will likely include terms and conditions, including mitigation requirements consistent with those imposed under the HCP, applicable to any activity permitted thereunder.

6.3.4 Master Streambed Alteration Agreement (California Department of Fish and Wildlife)

Similar to the above-mentioned regulatory processes, the HCP will also be implemented in coordination with implementation of a Master Streambed Alteration Agreement(s).

Any "entity" proposing to undertake an activity resulting in certain impacts (e.g., diversions, substantial alterations, certain discharges) to the bed, channel, or bank of a river, stream, or lake in California must secure an authorization from CDFW under Section 1600 et seq. of the California Fish and Game Code. This authorization takes the form of a negotiated agreement between CDFW and the entity, which agreement is referred to as a "Lake and Streambed Alteration Agreement" (LSAA).

To secure authorization, the entity proposing the activity submits a "notification" to CDFW in accordance with the application requirements identified in Section 1602 of the California Fish and Game Code. When issuing a draft agreement, CDFW includes "reasonable measures" to protect the fish and wildlife resources that may be substantially affected by the proposed activity. Most LSAAs are authorized for specifically identified activities and carry a term of up to 5 years, subject to one extension. Under Section 1605 of the California Fish and Game Code, however, CDFW may enter into an LSAA for an initial term of longer than 5 years. Because of their longer terms, these LSAAs are subject to periodic reporting and reviews by CDFW to confirm that the measures in the agreement "continue to protect" the fish and wildlife resources affected by the activity covered.

Long-term agreements are often issued for classes of activities proposed to occur over a longer time frame. The type of long-term agreement that provides for both the construction and long-term operation and maintenance of projects is a "Master LSAA." Master LSAAs provide coverage for projects proposed to be phased over time where project-level design plans are not yet available. Once project-level designs are available, a "sub-notification" is submitted to CDFW following the procedures identified in the Master LSAA, along with the specified fees. CDFW then reviews the sub-notification to ensure that it is consistent with the Master LSAA, and following a determination of completeness, issues sub-notification approval. The approval of Master LSAAs is not subject to the 60-day issuance period associated with short-term LSAAs.

The Permittees and the Alliance intend to seek a Master LSAA from CDFW to provide coverage for construction projects as well as routine operation and maintenance activities proposed for inclusion in the Programmatic IP and General Order.

6.3.5 Wastewater Change Petition

The reduction of effluent discharge is an HCP Covered Activity for several wastewater treatment plants operated by Permittee Agencies in the Planning Area. A Petition for Change is required to be submitted for approval to the SWRCB, Division of Water Rights, for any proposed changes to a water right (e.g., change in place of use, purpose of use, wastewater discharge reduction). A petitioner must evaluate the effect of the proposed changes on the water rights of other diverters as well as the effects on instream resources, including fish and wildlife (Water Commission Act, Section 1700–1707). Several Covered Activities have already received Orders from the SWRCB approving the Change of Use Petition; however, several others are in the approval process (Wastewater Petition Orders are available on the SWRCB website: https://www.waterboards.ca.gov/). The HCP is intended to quantify the impacts associated with the proposed Covered Activities seeking SWRCB approvals of Petitions for Change and demonstrate that the HCP adequately offsets those impacts on instream resources through the implementation of the Conservation Strategy.

6.4 Upper SAR Joint Powers Authority

The Upper Santa Ana River HCP will be implemented as a long-term, multi-jurisdiction, regulatory compliance program designed to coordinate environmental permitting processes such that the benefits to Permittees and regulated natural resources are maximized. The implementation of this program will improve the health of the Santa Ana River through the coordinated efforts of 11 public water agencies, State and Federal regulatory agencies, and interested stakeholders in order to provide a holistic conservation strategy that commits resources and assurances as needed for success. Although the overall purpose of the HCP to is to facilitate development and operation of the public infrastructure, it does so through a coordinated permit and conservation strategy that could involve hundreds of individual agency actions over the life of the Plan. Note that the JPA as

Implementing Entity is referred to as the Upper Santa Ana River Sustainable Resources Alliance. However, in this section discussing JPA structure, membership, and governance, it is referred to simply as the JPA.

Given the complexity of the HCP and the number of agencies and other entities involved, it was determined appropriate to identify a single local implementing entity to assume overall responsibility for plan management, administration, and implementation. Rather than allocate this responsibility to just one Permittee Agency or a committee of agencies, the Permittee Agencies have formed a “joint exercise of powers authority” (JPA) to assume these responsibilities. Through this agreement the JPA is directed to be the HCP Implementing Entity identified as the Upper Santa Ana River Sustainable Resources Alliance.

A JPA is a legally created entity that allows two or more public agencies to exercise commonly held powers. The Joint Exercise of Powers Act, California Government Code Section 6500 et seq., which governs JPAs in California, does not require the agencies participating in a JPA to be the same kind of agencies so long as the participating agencies independently possess the requisite powers. Based upon an analysis of the statutory authority of each of the Permittee Agencies, it has been determined that they have sufficient powers in common to enter into the JPA and sufficient authority for the JPA to act as the implementing agency under the HCP.

JPAs are formed by contract between two or more public agencies. The Joint Exercise of Powers Act provides for two different types of JPA arrangements: (1) two or more public agencies may contract to jointly exercise common powers or (2) two or more public agencies may contract to form a separate legal entity. Many JPAs take the form of a separate legal entity from the contracting agencies, which can be beneficial to the contracting agencies as the debts, obligations, and liabilities of a separate entity JPA remain distinct from and do not belong to the contracting parties themselves. For this reason, the JPA proposed for the Upper Santa Ana River HCP will be established as a separate legal entity.

The roles and functions of the JPA are further described below.

6.4.1 Membership and Governance

The JPA will be composed of the Permittee Agencies and will be governed by a board of directors (JPA Governing Board) consisting of representatives of the Permittee Agencies who will be appointed by each Permittee Agency to serve on the JPA, and who will vote on certain identified major decisions related to the HCP. It is anticipated that each Permittee Agency on the JPA (referred to as Permittee Agencies) generally will receive one vote on decisions made by the JPA Governing Board. However, given that Permittee Agencies are contributing different levels of resources for HCP implementation costs, it is expected that votes on certain financial decisions (e.g., annual budget approval) may be weighted based upon each agency’s contribution commitment. The details of this voting structure are outlined more fully in the JPA Agreement, the instrument creating the JPA. The relative contributions of the JPA Permittee Agencies are presented in Table 6-2.

Table 6-2. Proportional Contribution of JPA Permittee Agencies to HCP Implementation

Permittee Agency	Total Share	Estimated Annual Operating Cost of Program Implementation[1]
San Bernardino Valley Municipal Water District	40%	$ 933,200.00
East Valley Water District	7%	$ 163,310.00
Riverside Public Utilities	5%	$ 116,650.00
Inland Empire Utilities Agency	20%	$ 466,600.00
Western Municipal Water District of Riverside County	15%	$ 349,950.00
San Bernardino Municipal Water Department	5%	$ 116,650.00
Metropolitan Water District of Southern California	2%	$ 46,660.00
Rialto Utility Authority	2%	$ 46,660.00
San Bernardino Valley Water Conservation District	3%	$ 69,990.00
Orange County Water District	1%	$ 23,330.00
West Valley Water District	1%	$ 23,330.00
Total	**100%**	$ 2,333,000

[1]Total and annual operating costs of Program implementation are calculated in Table 7-3.

The JPA Agreement will establish an HCP Executive Committee composed of the general managers of each of the Permittee Agencies, or some subset thereof. The purpose of the HCP Executive Committee is to oversee the administration of the JPA by JPA staff (described below), act as a liaison between the JPA and its Permittee Agencies, assist in resolving disputes between Permittee Agencies, approve annual budgets (subject to final approval by the JPA Governing Board), and report to the JPA Governing Board on significant policy and financial developments. The HCP Executive Committee will be chaired by the General Manager of the San Bernardino Valley Municipal Water District (Valley District), as the majority contributor to HCP implementation costs.

As described above, if one Permittee Agency withdraws from the JPA, that withdrawal will occur in a manner that does not affect the ability of the other Permittee Agencies to operate under the HCP for the remainder of its permit term. In particular, a withdrawing Permittee Agency will be required to make the JPA whole by (i) reimbursing the JPA any costs incurred on behalf of or attributable to the Permittee Agency prior to withdrawal; (ii) making any remaining contributions in the form of an endowment as needed to assure that any mitigation attributable to any Covered Activity already undertaken by the Member Agencies (i.e., as a Permittee Agency) is funded in perpetuity; and (iii) covering (in the form of an endowment or otherwise) any and all other additional costs associated with the withdrawal (e.g., JPA administrative time, cost of amending or modifying the HCP [if necessary] or any other permit documents or agreements, increased incremental mitigation or other costs).

If a Permittee Agency withdraws from the HCP and the JPA prior to that agency undertaking a Covered Activity, that Covered Activity may be “released” from the ITP, and any mitigation values allocated to that activity will be available for allocation to other Covered Activities under the HCP if needed. If a withdrawing Permittee Agency has already undertaken a Covered Activity, that agency will not be released from any responsibilities under the HCP or the ITP with respect to that activity. The precise requirements for withdrawal from the HCP and the JPA will be fully described in the JPA Agreement and the PFA.

6.4.2 JPA Termination

The JPA is intended to survive for the 50-year term of the HCP. At that time all Covered Activities, and all required mitigation, are anticipated to be implemented with endowments established for permanent management, monitoring, and reporting by a third party (e.g., the Conservation Trust). Given that the advisory and permit management functions of the JPA will no longer be necessary, it may terminate at that time. All remaining funds and liabilities will be distributed or allocated as specified in the JPA Agreement. However, the Permittee agencies may decide to pursue a renewal of the ITP or maintain the Alliance for HCP Preserve management or other reasons.

6.4.3 Participation and Financing Agreement

Although the JPA may receive grant funding for certain portions of its efforts above and beyond the HCP mitigation obligations, primary responsibility for JPA operation and HCP implementation will be funded by the Permittee Agencies themselves. The annual operational expenses of the JPA will be billed directly to the Member Agencies in accordance with budgets approved by the HCP Executive Committee and the JPA Governing Board. HCP-specific expenses will be funded in accordance with a separate PFA entered into between the Permittee Agencies and the JPA.

The purpose of the PFA is to ensure that each of the Permittee Agencies is committed to participate and comply with the terms of the HCP and ITP; that each of the Permittee Agencies bears the cost of each of its Covered Activities as set forth in the PFA, including its overall fair share of contributions (as set forth in Table 6-2) to the JPA; and that there is an established dispute resolution and enforcement mechanism to assure that Permittee Agencies perform their obligations in a manner that does not undermine the HCP ITP.

6.4.4 Conservation Easements, Fee Title, and Endowments

San Bernardino Valley Conservation Trust

The Alliance does not have the ability to hold conservation easements or the proper fiduciary mandates to hold endowments or other securities. Therefore, the San Bernardino Valley Conservation Trust (Conservation Trust), as a 501(c)(3) charitable corporation, or other appropriately qualified entity, as approved by the Wildlife Agencies, will be charged with holding fee title to, or conservation easements covering, land secured as mitigation for Covered Activities. The Conservation Trust is qualified to hold conservation easements, endowments and other forms of security in accordance with Section 815 et seq. of the California Government Code. Financial management of the Conservation Trust, or other entity, will be in accordance with the prudent investor standards set forth in the California Probate Code, and the overall activities of the Conservation Trust will be governed by Senate Bill 1094, codified at Sections 65965-98 of the California Government Code. The Conservation Trust has an independent board of directors and management separate from the managers of the HCP. It is anticipated that there will be some form of Memorandums of Agreement or Memorandums of Understanding between the Conservation Trust (or other appropriately qualified entity) and the Alliance establishing a long-term relationship for the purposes of plan compliance and implementation. The Conservation Trust, or other appropriately qualified entity, will receive incidental take under the Joint ITP for any activities it may conduct under the HCP.

6.5 HCP Implementing Entity

As described in Section 6.4, *Upper SAR Joint Powers Authority*, the JPA is the HCP Implementing Entity, and as Implementing Entity it operates as the Upper Santa Ana River Sustainable Resources Alliance.

6.5.1 Staffing of the Upper Santa Ana River Sustainable Resources Alliance

The Alliance will be staffed primarily by employees of Valley District with supplemental assistance provided by contracted consultants or other entities, as needed. The day-to-day operations of the Alliance will be run by the Executive Director. Additionally, the Executive Director will serve as the Principal Scientist for the HCP with the responsibility for guiding the scientific work plan and maintaining the highest level of scientific integrity within the Plan. The primary responsibility of the Executive Director is to ensure the Alliance and Permittee Agencies remain in compliance with the ITPs associated with the HCP and other programmatic permits issued for Covered Activities. The Executive Director will be supported by a staff of professionals, including a Program Compliance Manager, who will be responsible for ensuring that Covered Activities are implemented in a manner consistent with the Joint ITP and other agency permits (404, 401, 1602, 2081); and a Preserve System Manager, who will be responsible for ensuring that success criteria are being met within the HCP Preserve System through conservation actions that contribute to the conservation strategy of the HCP, as well as the mitigation requirements of the additional permits as committed by the Alliance.

6.5.2 Implementing Entity Responsibilities

The Alliance's responsibilities are fully spelled out on the JPA Agreement and are summarized below.

Plan Implementation

The Alliance will serve as the overall implementing entity on behalf of the Permittee Agencies. Although each Permittee Agency will be responsible for any and all of its actions in connection with the Covered Activities, including compliance with the terms of the HCP and the Joint ITP, the Alliance will be responsible for implementing the overall conservation strategy. The Alliance will also be responsible for all financial aspects of the HCP, including budgeting, grant administration, and expenditures.

HCP Compliance

The Alliance will be responsible for overall HCP compliance. This includes ensuring implementation of the specific mitigation requirements in the conservation strategy, as well as meeting all biological monitoring, reporting, and adaptive management requirements as described in Chapter 5, *Conservation Strategy*. The Alliance will also be responsible for ensuring that the Permittee Agencies implement Covered Activities consistent with the HCP and ITP, which will be enforced through the Project Consistency Review process described below.

Up-Front and Stay-Ahead Provision

The HCP's Up-Front and Stay-Ahead Provisions require that implementation of the Conservation Strategy and progress towards assembly and management of the HCP Preserve System will stay ahead of Covered Activity impacts by a minimum of 10%. The Alliance will ensure that HCP implementation complies with the Up-Front and Stay-Ahead Provisions by monitoring and tracking the establishment and management of the HCP Preserve System along with tracking of Covered Activity impacts. To ensure that mitigation is in Rough-Step and ahead of impacts (i.e., similar or superior Covered Species habitat is being acquired, restored, and managed, compared to those impacted by Covered Activities), the Up-Front and Stay-Ahead Provisions will track mitigation and impacts by general habitat type (i.e., aquatic, riparian, alluvial fan) and Preserve Unit area. For example, for San Bernardino kangaroo rat, Santa Ana River woolly-star, and slender-horned spineflower, mitigation and impacts will be tracked by Alluvial Fan Preserve Unit (i.e., Unit A or B), to ensure that mitigation is being acquired, restored, and managed within the same Alluvial Fan Unit as Covered Activity impacts. In addition to land acquisition (via fee title or easements), restoration and/or rehabilitation, and management, the Up-Front and Stay-Ahead Provisions, can be achieved by the purchase of credits from a USFWS-approved conservation or mitigation bank operating within the same Preserve Unit as Covered Activity impacts, where credits are available for the Covered Species being impacted.

Implementation Compliance and Concurrence Procedure

An Implementation Compliance and Concurrence Procedure (ICCP) will be instituted between the Alliance and USFWS for each phase of HCP implementation, including pre-HCP Covered Activity implementation (i.e., Up-Front). The ICCP will require the Alliance to quantify and demonstrate that the Conservation Strategy, and progress towards assembly and management of the HCP Preserve System, is ahead of Covered Activity impacts by a minimum of 10% and that mitigation is In-Step with impacts. The ICCP will involve the Alliance preparing, for submission to the USFWS, a 5-year compliance report that quantifies Covered Activity impacts and progress towards assembly and management of the HCP Preserve System for the prior 5 years, as well as the quantification and identification of the Stay-Ahead accounting for the next 5-years of HCP Implementation. The Stay-Ahead accounting will demonstrate that progress towards assembly and management of the HCP Preserve System is a minimum of 10% ahead of Covered Activity impacts proposed to occur within the next phase of HCP implementation. The ICCP will include a USFWS-Alliance meet and confer process whereby potential compliance issues can be discussed and addressed. The ICCP will apply to all phases of HCP Implementation, including Phase 1.

Compliance with and status of the Up-Front and Stay-Ahead Provisions will also be implemented through the consistency review process for Covered Activities (see *Project Consistency Review* below) and via the submission of annual reports.

Project Consistency Review

Prior to implementing any Covered Activity, a Permittee Agency will provide to the Program Compliance Manager a description of the proposed Covered Activity, including project specifications and schedule to enable evaluation of the project's consistency with the HCP, as well as other regulatory permits and environmental compliance required for that project (e.g., California Environmental Quality Act [CEQA], aquatic resource permits, 2081 State ITP). While the project may also receive regulatory permits through the Upper SAR Aquatic Resources Programmatic Permits

(CDFW Section 1600 Multi-Project Lake and Streambed Alteration Agreement, Clean Water Act Section 404 Regional General Permit and/or Programmatic IP, and Programmatic 401 Certification and/or General Order) and/or the Section 2081 ITP(s), each individual water agency will be responsible for their own project-specific CEQA compliance when required.

The Alliance will develop a regular calendared "pre-application" meeting where Permittees can discuss preliminary and project-level proposals/design plans with the Alliance, Wildlife Agencies, and water resources regulatory agencies to ensure projects are being designed in compliance with the HCP, ITPs, and other permits/agreements. The Alliance will also develop project review forms, checklists, and a fee schedule to streamline and support the project consistency review. The project consistency review will document the specific amount of planned impact and proposed impact of Covered Species and regulated resources to document the impacts and the associated mitigation to be used by the Covered Activity (see *Allocation of Incidental Take and Mitigation Accounting*, below). Upon a determination that the Covered Activity is consistent with the HCP, the Program Compliance Manager shall issue a Project Consistency Determination to the applying Permitting Agency and a Notice to Proceed. Decisions of the Program Compliance Manager may be appealed to the HCP Executive Committee. Regardless, the final Project Consistency Determination must be in compliance with the HCP and ITP.

Allocation of Incidental Take and Mitigation Accounting

Upon issuance of a Project Consistency Determination and Notice to Proceed, the Program Compliance Manager shall enter the Covered Activity data into the GIS impact and mitigation tracking database including the amount of incidental take allocated to the project under the ITP, and the amount of mitigation allocated to the project. The GIS impact and mitigation tracking database will be linked to the mitigation accounting system in the Mitigation Reserve Program and the parallel mitigation and species conservation program to ensure full transparency of impact and mitigation tracking and reporting. The Program Compliance Manager will report quarterly to the HCP Executive Committee and JPA Governing Board the amount of incidental take and mitigation issued under the HCP. Impact and mitigation reporting will also include the extent to which mitigation has stayed up front and ahead of impacts, and will identify any foreseeable challenges for upcoming mitigation needs relative to overall phasing and schedules for Covered Activity and mitigation action implementation.

Permit Coordination

The Alliance will provide advice and guidance to Permittee Agencies to support their project planning and implementation of Covered Activities to facilitate project streamlining and HCP compliance. Permit coordination support may include advisory input on project-specific CEQA needs, preconstruction surveys, avoidance and minimization requirements associated with the implementation of any Covered Activity, and other related regulatory advice for Covered Activity implementation. The Alliance will also provide advice to Permittee Agencies for coordinating, securing, and implementing any authorizations needed for Covered Activities under the Aquatic Resources Permits issued by the USACE, the Santa Ana or San Diego RWQCB, and CDFW as described in Section 6.3, *Other Regulatory Agency Permits*.

Regulatory Agency Liaison

In addition to assisting in HCP and permit implementation, the Alliance will serve in a general liaison role between the Permittee Agencies and USFWS and other regulatory agencies, thus providing streamlined feedback to and coordination between the Permittee Agencies and Regulatory Agencies.

Land Acquisition and Mitigation/Conservation Program Management

The Alliance will be responsible for implementing the mitigation requirements of the HCP. This will include the acquisition and funding of conservation easements to be held by the Conservation Trust, or other appropriately qualified entity as approved by the Wildlife Agencies, as well as serving as sponsor of the mitigation and species conservation program described above. The Alliance will be responsible for overall management of the preserve established under the HCP, although specific responsibilities will be undertaken by the Conservation Trust or other easement- or landholders.

Adaptive Management and Monitoring Oversight

The Alliance is responsible for implementation of the Comprehensive Adaptive Management and Monitoring Program (CAMMP). The CAMMP includes adaptive management guidance that applies across all areas of the HCP Preserve System as well as guidance for detailed management actions to be developed at the Preserve Unit-level for specific management issues. The Alliance will be responsible for collecting the appropriate data to ensure that the goals and objectives of the HCP and individual preserve areas are met, determining if HCP Preserve System management strategies are having the desired effect, and evaluating if underlying biological assumptions are supported by field-collected data from the preserves. A framework and guidance for preparation of the CAMMP can be found in Section 5.12, *Comprehensive Adaptive Management and Monitoring Program*.

GIS/Database Maintenance

The Alliance will maintain the overall GIS database required for HCP implementation, including monitoring and reporting and provision of other geospatial services. The GIS database will be available to Permittee Agencies to aid HCP implementation and administration of the other regulatory permits. The GIS database will be linked to the mitigation accounting system in the Mitigation Reserve Program and the parallel mitigation and species conservation program to ensure full transparency of impact and mitigation tracking and reporting. The GIS database is also an integral part of the CAMMP implementation tool set.

Third-Party Contracting

The JPA will have the power to contract with third parties for various services required for HCP implementation. Most importantly, the JPA may enter into agreements with Permittee Agencies from time to time for specific HCP projects. For example, existing Memorandums of Understanding between Valley District and the City of Riverside, and between Valley District and the San Bernardino Municipal Water Department, relative to the Tributary Stream Restoration/Rehabilitation Projects and certain water supply issues, respectively, will be assigned to the JPA for implementation. The JPA may enter into other agreements with Permittee Agencies, or regulatory agencies, relative to specific actions required for implementation of the HCP conservation strategy or otherwise. The JPA will be party to any agreements with SCE and/or the U.S. Forest

Service relative to implementation of the Santa Ana sucker translocation into streams in SCE's hydroelectric operating areas.

Grant Administration

The Alliance will be responsible for writing and securing grants, and administering any grant funds available and needed for HCP implementation.

6.5.3 Public Input

Stakeholder Committee

To receive public input on the implementation of the HCP over its 50-year life, the JPA will form a committee of outside stakeholders that will meet periodically (at least twice per year). Ideally, the Stakeholder Committee will include participants with a range of views, including cities and counties, conservation organizations, the business community, and the public at large. The Stakeholder Committee will be provided with reports of ongoing HCP activity, upcoming decisions, significant policy issues, changes in management arising out of the HCP's adaptive management provisions, and other relevant information. The purpose is to secure a broad cross-section of community views to inform HCP decision-making.

Technical Advisory Committee

To receive technical input on the implementation of the HCP over its 50-year life, the JPA will form a Technical Advisory Committee that will meet periodically (at least once per year, or more frequently as needed). The Technical Advisory Committee will include scientists, engineers, and other professionals with expertise in biology, hydrology, and other relevant areas. Although the Technical Advisory Committee will be provided with reports of all ongoing HCP activity, its most important role will be to advise the Alliance on adaptive management questions that may arise over the life of the Plan. The Technical Advisory Committee may have some overlapping membership with the Preserve Management Committee described below.

Preserve Management Committee

The JPA, in conjunction with the Conservation Trust, or other appropriately qualified entity, will form a Preserve Management Committee to advise on questions related to the establishment and long-term management of the HCP Preserve System. This will include preparation of focused preserve management plans for each Preserve Unit (Preserve Unit Plans, or PUPs), monitoring and management of each preserve area and the overall health of the preserve, and identification and establishment of future preserve areas as needed to complete the mitigation obligations of the HCP. In addition to participation by the JPA and the Conservation Trust, this committee may also include members of the Technical Advisory Committee, Stakeholder Committee, the Wildlife Agencies, and other regulatory agencies.

The Preserve Management Committee will provide advice and input on the content of HCP Preserve System Annual Management Work Plan and 5-year update of the PUPs, along with the funding to be allocated to implement the Annual Management Work Plan and to be anticipated for each 5-year PUP.

Any potential for incidental take occurring from actions implemented under the Preserve System Annual Management Work Plan is covered by the HCP ITP, and will be documented by the Program Compliance Manager and entered into the GIS impact and mitigation tracking database.

Annual Public Meeting

The Alliance will hold a noticed public meeting to present the results in the Annual Report on HCP Implementation. The public meeting will include reports from the committees described above and a report from the wildlife agencies evaluating JPA compliance with the HCP ITP. The annual public meeting will be conducted to provide a transparent accounting of HCP implementation and to receive public input on matters of public concern or interest.

6.6 Mitigation/Conservation Program Implementation

A mitigation program will be developed to provide accounting of mitigation requirements identified in the HCP and other permits. The program will track the types of mitigation (e.g., restoration, rehabilitation, re-establishment, establishment) implemented/proposed to be implemented, and the species and habitat value of each identified mitigation unit. The HCP will determine the most appropriate mechanism to pursue for this mitigation program (e.g., mitigation and/or conservation bank, in-lieu fee program, or other system) as deemed appropriate and acceptable by the regulatory agencies.

If a mitigation and/or conservation bank is deemed the most appropriate strategy, all regulatory agencies will likely be signatory to the bank. The USACE is authorized to approve mitigation banks in accordance with detailed regulations it adopted in 2008 governing all types of mitigation (2008 Mitigation Rule). The USFWS may also approve banks for mitigation projects involving threatened or endangered species. Banks approved by USFWS are referred to as “conservation banks,” but they are often combined with USACE-approved mitigation banks through an inter-agency approval process articulated in the 2008 Mitigation Rule. CDFW may also participate in such banks for the purposes of generating credits under CESA, Section 1600 et seq. of the California Fish and Game Code, or CEQA. CDFW has adopted a comprehensive banking policy to provide guidance. Although the SWRCB has not yet adopted its own policy on banking, their 2019 *Wetland Definition and Procedures for the Discharge of Dredged or Fill Material into Waters of the State* provide certain specific regulatory benefits for banks.

6.6.1 Early Implementation of HCP Mitigation

Prior to approval of the Upper Santa Ana River HCP, some of the Permittee Agencies initiated conservation projects intended to benefit the Santa Ana sucker. In particular, Valley District entered into a cooperative arrangement with the City of Riverside to undertake certain restoration efforts in the Santa Ana River and its tributaries (Tributary Restoration Projects). The participants’ intent was to begin these efforts as early implementation of the HCP (i.e., in advance of HCP approval) given the critical state of the Santa Ana sucker population, but to have the benefit of these efforts built into and accounted for in the HCP’s Up-Front and Stay-Ahead Provisions, and to serve as mitigation for various Covered Activities under the HCP. The mitigation value generated by these early implementation restoration efforts will be integrated into mitigation/conservation program.

6.6.2 Mitigation/Conservation Program Sponsor

If a mitigation/conservation bank(s) is chosen as the appropriate mitigation strategy, the JPA will serve as the bank sponsor and will have the ability to allocate credits to various Permittee Agencies undertaking projects within the Planning Area. Unlike a typical mitigation or conservation bank, however, the primary purpose for establishing these credits is for use by the HCP Permittees to mitigate impacts from Covered Activities, over a long period of time. The JPA will use the bank ledger process established in the Mitigation Reserve Program as an accounting mechanism to track the impacts of Covered Activities to assure they are fully mitigated over the life of the HCP. However, if for any reason one or more of the Permittee Agencies decides to formally abandon a project covered by the HCP, thus leaving unused credits available in a bank, a secondary purpose of a mitigation/conservation bank is to enable the JPA to sell those unused credits to private or public third parties (i.e., who are not Permittees under the HCP) to recoup some portion of the cost of the mitigation projects. The process for credit generation, tracking, allocation and sale will, along with other aspects of the bank, be set forth in a "Bank Enabling Instrument(s)" between the JPA as bank sponsor and participating State and Federal agencies, and will be integrated into the Mitigation Reserve Program.

6.6.3 Mitigation on CDFW Lands

It should also be noted that, because restoration projects will occur on land owned by CDFW, as a matter of CDFW policy they may not be included in a bank. These restoration projects (Hidden Valley Creek, Hidden Valley Wetlands, and Lower Hole Creek) will instead be treated as "permittee responsible" mitigation projects. The mitigation value created through restoration on CDFW-owned lands will also be tracked through the Mitigation Reserve Program.

6.7 Plan Changes and Amendments

6.7.1 Withdrawal of Permittee Agencies

A Permittee Agency may withdraw as a Permittee Agency of the JPA if the JPA and the Wildlife Agencies determine that such withdrawal will not compromise the viability of the HCP (including its conservation strategy), and the withdrawing Permittee Agency makes the JPA whole as described below.

If a Permittee Agency wishes to withdraw, that Agency will provide written notice to the Executive Director, with a copy to each Permittee Agency and each Wildlife Agency, specifying the reasons and proposed timing of withdrawal. The Executive Director will thereafter make a recommendation as to those funds needed from the withdrawing agency to make the JPA whole as described in Sections 6.2, *HCP Permit Structure,* and 6.4, *Upper SAR Joint Powers Authority*, and as will be more fully set forth in the JPA Agreement and the PFA. The Executive Director's recommendation will be forwarded to the JPA Governing Board for a final determination regarding the terms and conditions of withdrawal, which, following the board's determination, will be forwarded to the withdrawing Permittee Agency.

No withdrawal shall occur until the JPA and the withdrawing Permittee Agency have entered into a binding agreement providing for payment of any funds and including such indemnities, hold harmless provisions, and other contractual assurances as may be determined by the JPA Governing Board to be appropriate and, if required, any amendments to the HCP completed together with appropriate environmental review. Until the withdrawal is complete, and unless agreed otherwise by the JPA, a withdrawing Permittee Agency shall remain in compliance with the JPA Agreement and the PFA. In no event shall a Permittee Agency be entitled to reimbursement of any costs incurred by the JPA prior to the date of withdrawal.

If a Permittee Agency has engaged in a Covered Activity in reliance upon the ITP, the Permittee Agency may not withdraw from the HCP or the JPA, but may seek to remove other Covered Activities from the HCP as described below.

6.7.2 Removal of Covered Activities and Substitution of Mitigation Values

If a Permittee Agency determines that a Covered Activity will no longer be undertaken, then that Covered Activity may be removed from the HCP and ITP coverage. Removal will occur if a Permittee Agency decides to withdraw from the HCP and JPA in accordance with Section 6.4, or it may occur if a Permittee Agency decides to remove some but not all of its Covered Activities from the HCP and the ITP. Removal may occur only with the approval of the JPA and the Wildlife Agencies and will constitute a minor Amendment of the HCP. If a Covered Activity is removed, then any mitigation value generated by mitigation projects conducted under the HCP, and allocated by the JPA to the Covered Activity being removed either in the form of bank credits or as otherwise accounted for in the Mitigation Reserve Program, may be reallocated by the JPA to other Covered Activities.

Note that the JPA may choose not to reduce the overall mitigation requirements of the HCP and instead reserve the excess mitigation value available resulting from the removal of the Covered Activity and reallocate it to other Covered Activities proposed by the Permittee Agency removing a Covered Activity, or apply it as and if needed to address Changed Circumstances requiring the provision of additional mitigation. The terms of removal shall be approved by the JPA Governing Board and the Wildlife Agencies and shall not be effective until the JPA and the withdrawing Permittee Agency have entered into a binding agreement providing for payment of any funds and including such indemnities, and hold harmless provisions and other contractual assurances as may be determined by the JPA Governing Board to be appropriate; and, if required, any amendments to the HCP have been completed together with appropriate environmental review. In no event shall a Permittee Agency be entitled to reimbursement of any costs incurred by the JPA prior to the date a Covered Activity is removed from the ITP and the HCP, provided, however, that funds, mitigation, or other resources provided by a Permittee Agency may be reallocated as appropriate to other Covered Activities of that Permittee Agency that remain within the HCP and ITP.

6.7.3 Addition of Covered Activities

A Permittee Agency may request the JPA and the Wildlife Agencies to add a new Covered Activity to the HCP and the ITP that would potentially increase the amount of incidental take above that allocated in the ITP. Any such addition would constitute a Major Amendment of the HCP (as described below), and shall occur only upon that Permittee Agency paying into the HCP an appropriate share of past and future HCP development and implementation costs as may be determined by the JPA and the Wildlife Agencies.

6.7.4 Substitution of Covered Activities

A Permittee Agency may request the JPA and the Wildlife Agencies substitute a new Covered Activity to the HCP and the ITP in exchange for removing a Covered Activity no longer planned for implementation such that the total incidental take allocated in the ITP is the same or less. Any such substitution would constitute a Minor Amendment of the HCP (as described below), and shall occur only if the new project impacts are determined to be equal or lesser than the Covered Activity it replaced, and only with approval of the JPA Governing Board and the Wildlife Agencies.

6.7.5 HCP Amendment Process

Minor Amendments

Minor Amendments are changes that would not appreciably increase the HCP's impacts associated with Covered Activities, implementation of the conservation strategy, or additional amount of incidental take, and therefore would not require an amendment to the ITP. A Minor Amendment is not appropriate to add a new species to be covered under the HCP, or to change the boundaries of the HCP. Examples of Minor Amendments include correction of spelling errors or minor corrections in boundary descriptions. The Minor Amendment process would be accomplished through an exchange of letters between the JPA and the USFWS Palm Springs Field Office. Proposed revisions will be reviewed by USFWS upon submission of each annual report to ensure the successful implementation of the conservation strategy. USFWS will review and respond within 30 days. Revisions to measures will be approved by USFWS prior to the JPA adopting revised measures.

Major Amendments

Major Amendments to the HCP would require an amendment to the ITP. Major Amendments involve changes that do affect the amount of impact from Covered Activities, implementation of the conservation strategy, or increase in the amount of incidental take. A Major Amendment is required to add new species or to change significantly the boundaries of the HCP. Major Amendments often require amendments to the USFWS decision documents, including the NEPA document, the biological opinion, and findings and recommendations document. Major Amendments will often require additional public review and comment.

6.7.6 Suspension/Revocation

USFWS may suspend or revoke the Joint ITP if the JPA fails to implement the HCP in accordance with the terms and conditions of the permits or if suspension or revocation is otherwise required by law. Suspension or revocation of the Section 10(a)(1)(B) permit, in whole or in part, by USFWS shall be in accordance with its regulations in effect at the time of such suspension or revocation (see 50 Code of Federal Regulations [CFR] 13.27-29, 17.22(b)(8), and 17.32 (b)(8)). To avoid a situation in which a failure by one Permittee Agency compromises the incidental take authority enjoyed by the other Permittee Agencies, the IA and the PFA include mechanisms for the early identification and resolution of compliance issues. Where compliance by one Permittee Agency is not addressed following notice from USFWS and an opportunity to cure, USFWS may suspend the incidental take authorization of the non-complying Permittee Agency until such time as compliance is achieved and, if appropriate, any mitigation for a default affecting the environment has been provided or assured.

Unless the identified non-compliance affects the overall viability of the HCP, or the default is not severable, it is not anticipated that USFWS would suspend or revoke the Joint ITP as a whole.

6.7.7 Permit Renewal

Upon expiration, the Section 10(a)(1)(B) permit may be renewed without the issuance of a new ITP, in accordance with the permit renewal regulations then in effect, provided that the biological circumstances and other pertinent factors affecting Covered Species are not significantly different than those described in the original HCP. To renew the ITP, the JPA will submit the following to USFWS, in writing:

- A request to renew the ITP with reference to the original permit number.
- A certification that all statements and information provided in the original HCP and ITP application, together with any approved HCP amendments, are still true and correct, and inclusion of a list of changes.
- A description of all incidental take that has occurred under the existing ITP.
- A description of any portions of Covered Activities still to be completed.

If USFWS concurs with the information provided in the request, it will renew the ITP consistent with permit renewal procedures required by Federal regulation in effect at the time of the ITP renewal request (see 50 CFR 13.22). If the JPA files a renewal request and the request is on file with the issuing USFWS office at least 30 days prior to the ITP expiration, the ITP will remain valid while the renewal is being processed, provided the existing ITP is renewable. However, the Permittees may not impact listed species beyond the quantity of incidental take authorized by the original ITP or change the scope of the HCP. If the JPA fails to file a renewal request within 30 days prior to ITP expiration, the ITP will become invalid upon expiration. The Permittees must have complied with all annual reporting requirements to qualify for a permit renewal.

6.8 Implementing Agreement

6.8.1 Purpose of the Implementing Agreement

USFWS and the JPA will enter into an “Implementing Agreement” (IA) relating to the Upper Santa Ana River HCP concurrent with HCP approval and issuance of the Joint ITP. The IA will have a term equal to that of the HCP. Although not legally required under the Endangered Species Act, IAs are recognized in the USFWS HCP Handbook (USFWS 2016) as a potentially valuable tool that lays out the legal obligations of the parties in more detail than may be appropriate in an HCP. Given the multiple parties and wide range of Covered Activities under the HCP, USFWS determined than an IA is appropriate in this case.

The stated purposes of the IA are to (i) ensure implementation of each of the terms and conditions of the HCP and the Joint ITP; (ii) provide long-term assurances to the Permittee Agencies that, pursuant to the Federal “No Surprises” provisions of 50 CFR 17.22(b)(5) and 17.32(b)(5), as long as the terms and conditions of the IA, the HCP, and the ITP are fully satisfied, USFWS will not require the Permittee Agencies to commit additional land, water, or financial compensation, or to accept additional restrictions on the use of land, water, or other natural resources, either to minimize and mitigate the impacts of Authorized Incidental Take, or to provide for the conservation and management of the Covered Species in the Planning Area, except as provided in the IA and the HCP; and (iii) describe remedies and recourse should any Party fail to perform its obligations as set forth in the IA.

6.8.2 Contents of the Implementing Agreement

The IA outlines the basic responsibilities of USFWS, the JPA, and the Permittee Agencies under the HCP, largely along the lines described in this chapter of the HCP. It then addresses specific areas of JPA responsibility, including (i) overall plan implementation, (ii) implementation of plan-wide conservation measures, (iii) implementation of conditions on Covered Activities, (iv) establishment and management of the HCP Preserve System, (v) monitoring and adaptive management, (vi) operation of the mitigation/conservation program and other conservation actions, and (vii) coordination of the HCP ITP with the other regulatory permits. Additional topics covered by the IA include the scope and joint nature of incidental take coverage, regulatory assurances, requirements for coverage under Section 7 of the ESA, funding sources and assurances, reporting obligations, and remedies and enforcement. Remedies may include, among others, suspension or revocation of the incidental take authority under the Joint ITP of any Permittee Agency that falls out of compliance with the HCP.

6.8.3 Relationship to Other Instruments

The IA incorporates the HCP by reference. The IA includes similar language to the PFA because the PFA is intended to support the JPA's obligations under the IA. To ensure that the JPA can remain in compliance with the IA, the PFA provides to each of the Permittee Agencies a right to cure defaults by other Permittee Agencies on the part of the JPA, and a dispute resolution process to assure that, in light of the interdependent nature of the activities of the Permittee Agencies, all appropriate efforts are taken to ensure the continued success of the HCP (and the JPA's continuing performance under the IA) even if one Permittee Agency breaches or otherwise has difficulties with compliance with the terms of the HCP.

6.8.4 Dispute Resolution Process

The IA will incorporate the principles of severability included in the JPA and PFA as described in Sections 6.2 and 6.4 above. In particular, the IA will assure that, if one Permittee Agency conducts a Covered Activity in a manner inconsistent with the HCP, (i) that Permittee Agency's incidental take authority may be suspended or revoked without affecting the incidental take authority issued to the other Permittee Agencies or the JPA and (ii) any costs incurred by the JPA or other Permittee Agencies as a result of non-compliance by one Permittee Agency will be borne by the non-complying Permittee Agency and shall be reimbursed to the JPA if the JPA has incurred any associated costs. The IA also provides for notice of default, opportunity to cure, and dispute resolution provisions to assure that the HCP may continue to operate without disruption, to the extent possible, while any disputes between the parties are resolved.

If a dispute should arise between the Alliance and USFWS (or other regulatory agency), a dispute resolution process will be implemented to encourage expedient resolution of the dispute. Most issues and decisions are expected to be readily resolved at the Alliance and agency Staff Level. However, if disputes are not resolved relatively quickly, they will be elevated to the Managers

Group. If the Managers Group cannot resolve the dispute in one meeting, it will be elevated to the Directors Group, then the State Managers Group, and finally to the Appointed and Elected Official Level for final arbitration and decision (Figure 6-1).

6.9 Responses to Changed Circumstances

Section 10 regulations (50 CFR 17.22(b)(2) and 17.32(b)(2)) require that an HCP specify the procedures to be used for dealing with changed and unforeseen circumstances that may arise during the implementation of the HCP. In addition, the HCP No Surprises Rule (69 *Federal Register* 71723, December 10, 2004, as codified in 50 CFR 17.22 (b)(5) and 17.32(b)(5)) describes the obligations of the Permittees and USFWS. The purpose of the No Surprises Rule is to provide assurance to the non-federal landowners participating in habitat conservation planning under the Endangered Species Act that no additional land restrictions or financial compensation will be required for species adequately covered by a properly implemented HCP, in light of unforeseen circumstances, without the consent of the Permittees.

Changed Circumstances are defined in 50 CFR 17.3 as changes in circumstances affecting a species or geographic area covered by an HCP that can reasonably be anticipated by the Permittees and USFWS and for which contingency plans can be prepared (e.g., a fire, or other natural catastrophic event in areas prone to such event). If additional conservation and mitigation measures are deemed necessary to respond to Changed Circumstances and these additional measures were provided for in the Plan's responses to the identified Changed Circumstances (e.g., conservation management activities or mitigation measures expressly agreed to in the HCP), then the Permittees will implement those measures as specified in the Plan. However, if additional conservation management and mitigation measures are deemed necessary to respond to Changed Circumstances and such measures were not provided for in the Plan's responses to the identified Changed Circumstances, USFWS will not require these additional measures absent the consent of the Permittees, provided that the HCP is being "properly implemented" (to properly implement the HCP means fully implementing all commitments and provisions agreed to in the HCP, the IAs, and the ITPs).

Chapter 7, *Funding*, estimates an average annual cost for Changed Circumstances of approximately $225,000 to implement the HCP. Annual funding of the Changed Circumstances Reserve will be higher in early years of HCP implementation to establish the reserve (see Section 7.5.8, *Cost Uncertainties and Changed Circumstances*).

The HCP has identified and addresses six Changed Circumstances that can be reasonably anticipated in the Planning Area: Climate Change, Fire, Drought, Flood, Invasion of New Nonnative Species, and Future Listing of Non-Covered Species. Each of these Changed Circumstances is described below.

6.9.1 Climate Change

There are clear scientific data indicating that alteration of the atmosphere is causing changes in climate, including increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising sea levels. In California, it is anticipated that there will be warmer temperatures, greater extremes in weather, and larger variation between wet and dry years, but precipitation patterns are more difficult to project (Bedsworth et. al. 2018). Though annual precipitation may not vary greatly, a greater proportion of precipitation will come from larger storm events allowing for higher variability in annual rainfall depending on the size of the larger storms (Dettinger 2016). Higher nighttime temperatures are predicted, perhaps altering days of frost, daily temperature extremes, and distribution of some species (IPCC 2007). Some of the most dramatic potential climate change impacts include increased frequency and severity of extreme events, such as heat waves, wildfires, and flooding (Lenihan et al. 2006, IPCC 2007, Bedsworth et. al. 2018)). To accommodate shifts in distribution, species will need a range of large-core habitat areas connected by landscape-level linkages (Keeley et. al. 2018). The species most at risk are those that have specific habitat requirements, have limited ability to relocate, or are surrounded by development (leaving few relocation options).

Although the extent and nature of impacts from climate change within the Planning Area are unknown, some climatic models suggest that there may be changes in vegetation patterns and increases in wildfire size and frequency (Bedsworth et. al. 2018).

Response to Climate Change: The Upper Santa Ana River HCP conservation strategy protects and enhances through restoration and management of the habitat connectivity in the region. Protection of habitat connectivity, especially along ecological gradients such as elevational gradients and along natural hydrologic features, provides the opportunity for species to shift their range and area of occupied habitat in response to climate change. Additional adaptive management may be needed to enhance connectivity at key locations, or to translocate individuals across existing barriers to movement. Long-term monitoring of the distribution of Covered Species and their habitat may indicate shifts in distribution and the need to adaptively manage the integrity and function of habitat connectivity at key locations. Monitoring will occur as a part of the CAMMP) implementation, and response to climate change will be managed through enhancement of connectivity for species movement at key locations as needed.

6.9.2 Fire

A repetitive fire that results in or substantially increases the risk of type conversion (e.g., converting shrub lands to non-native grasslands or loss of riparian overstory) constitutes a Changed Circumstance. USFWS has indicated that for sage scrub and riparian habitat, repeat fires within the same footprint within 10 years of the original burn can adversely hamper natural regrowth and interrupt the ability of the habitat to rejuvenate. Diffendorfer et al. (2007) cite several sources that indicate fire cycles of 1 to 3 years within sage scrub can increase the presence of invasive weeds and lead to conversion to grassland. Ten years after a fire, shrub-dominated habitat types are expected to be fully re-established and capable of natural regeneration. In riparian habitats, invasive species such as Arundo and tamarisk appear to be making riparian areas more fire prone, and are better adapted to recover from fire than native species, leading to a decline in native species after fires (Lambert et. al. 2010). Of particular concern in the Planning Area is the prevalence of homeless encampments in riparian habitats where cooking and heating fires spark wildfire in the surrounding riparian vegetation.

Response to Fire: Based on the frequency, extent, and severity of damage from a repetitive fire, specific adaptive management tasks will be identified and implemented. Natural regrowth within the damaged area will be monitored and measures to control invasion of nonnative, invasive plant species, excessive erosion, and/or type conversion will be applied as part of the CAMMP implementation. The damage caused by wildfires will be addressed as follows:

STAFF LEVEL

ROLES & APPROACH FOR ISSUE RESOLUTION

- Regular meetings occurring quarterly or more frequently as needed
- If issue arises, clearly define issues before elevating for resolution
- If issue cannot be resolved relatively quickly (1-2 meetings), elevate immediately

TEAM

- Alliance: Preserve System Manager and/or Program Compliance Manager
- USFWS: Palm Springs Field Office staff
- CDFW: Region 6/Ontario office staff
- USACE: Los Angeles District Project Manager
- RWQCB: Santa Ana RWQCB Staff

MANAGERS GROUP

ROLES & APPROACH FOR ISSUE RESOLUTION

- Periodic meetings scheduled on a regular basis, even if there are not specific issues to elevate
- If group cannot resolve issue in one meeting, elevate immediately

TEAM

- Alliance: Technical Advisory Committee and/or Preserve Management Committee
- USFWS: Assistant Field Supervisor, Carlsbad Field Office
- CDFW: Environmental Program Manager, South Coast Region
- USACE: Chief, Los Angeles and San Bernardino Counties Section, Regulatory Division
- RWQCB: Santa Ana Team RWCQB Senior Regulatory Staff

DIRECTORS GROUP

ROLES & APPROACH FOR ISSUE RESOLUTION

- Quarterly meetings scheduled, even if there are not specific issues to elevate
- Meetings would include a briefing for group on progress and status/milestones

TEAM

- Alliance: Executive Director
- USFWS: Field Supervisor, Carlsbad Field Office
- CDFW: Regional Manager, South Coast Region
- USACE: Los Angeles Division Regulatory Branch Chief
- RWQCB: Santa Ana RWQCB Executive Officer

STATE MANAGERS

ROLES & APPROACH FOR ISSUE RESOLUTION

- Meeting scheduled if needed

TEAM

- Alliance: Executive Director and Valley District GM
- USFWS: Assistant Regional Director, HCP Coordinator Regional Office
- CDFW: Deputy Director, Ecosystem Conservation Division
- USACE: Los Angeled District Commander
- RWQCB: SWRCB Chief Deputy Executive Director for Water Quality

APPOINTED AND ELECTED OFFICIAL LEVEL

ROLES & APPROACH FOR ISSUE RESOLUTION

- Final arbitrator of elevation
- Meeting scheduled if needed

TEAM

- Alliance: Executive Director and Valley District GM
- USFWS: Regional Office Director
- CDFW: Director
- USACE: As Determined by ACOE
- RWQCB: SWRCB Executive Director

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Figure 6-1
Regulatory Agency Dispute Resolution Process
Upper Santa Ana River Habitat Conservation Plan

- Nonnative annual grasses and other invasive plants becoming established in the burn area will be controlled.
- Seed-free straw wattles or their equivalent will be placed in areas vulnerable to erosion.
- Native trees, shrubs, and annual forbs will be revegetated through seeding and/or container plants if, within 5 years of the fire, the percent cover of native vegetation is less than 30% of the pre-fire perennial and annual cover and/or in an adjacent unburned area of similar habitat.

6.9.3 Drought

For the purpose of defining Changed Circumstances, drought is defined as climatic drought of 5 to 10 years in length, as declared by the California State Department of Water Resources or, if needed, by the JPA. Longer periods of drought (greater than 10 years) are considered *Unforeseen Circumstances*.

Response to Drought: Depending upon the extent and severity of the drought, a specific adaptive management action plan will be developed and implemented as part of the CAMMP implementation. Management activities may include increased effort to control nonnative plant species and other nonnative invasive species. In extreme cases the Alliance will access and make available additional water supply from the Santa Ana River Conservation and Conjunctive Use Program (SARCCUP), or other conjunctive use program the Alliance is party to (or potentially via additional discharge from the wastewater treatment plants along the upper Santa Ana River), as a potential management tool for supplemental water and habitat maintenance (see Chapter 5).

6.9.4 Flood

A 100-year flood event as classified by the Federal Emergency Management Agency (FEMA) and determined by the Flood Control constitutes a Changed Circumstance under this HCP. However, flooding is a natural event and is not anticipated to cause sufficiently severe damage that would prevent natural regeneration within the HCP Preserve.

Response to Flood: If the extent and severity of flood damage indicate a need for increased monitoring or management, measures will be identified and applied as part of CAMMP implementation.

6.9.5 Invasion of New Nonnative Species

For the purpose of defining Changed Circumstances, invasion of new nonnative species is defined as an introduction of a nonnative species within the HCP Preserve that has either: (a) not previously been known to occur in the Planning Area and has been shown to be problematic elsewhere or (b) is a particularly problematic variety of nonnative species that is resistant to typical control measures (e.g., herbicide-resistant variety of plant). Unforeseen Circumstances would be defined as invasion within the HCP Preserve of a species not currently known to be problematic elsewhere, but that becomes so upon establishment in the HCP Preserve.

Response to Invasion of New Nonnative Species: When nonnative invasive species are discovered, actions designed to reduce such species will be applied. If an unanticipated invasion by a nonnative invasive species occurs as a result of another Changed Circumstance identified in this section (e.g., repeated fires), USFWS will be notified. The damage caused by the unanticipated invasion by the nonnative species will be addressed as follows:

- The nonnative invasive species will be mapped and their abundance at each location will be noted.
- Mapped infestations of the nonnative invasive species will be treated and re-treated as necessary to achieve control and eventual eradication.
- The response of species/habitats to the action(s) taken will be monitored.

For new nonnative invasive terrestrial plant species, where the influx of involves a species included on the California Invasive Plant Council (Cal-IPC) “List A” or State or Federal “noxious” weeds lists, USFWS and CDFW will be notified and a plan of action will be determined within 30 days of such notice.

For new nonnative invasive aquatic plants and animals, the presence and abundance of the species will be recorded during periodic Covered Species and habitat surveys. Any new nonnative invasive species not previously documented in the Planning Area (constituting a Changed Circumstance) will be brought to the immediate attention of the JPA and Wildlife Agencies, and a plan to assess the threat and response will be developed within 30 days. For previously known but particularly noxious species, a nonnative invasive species control and eradication plan will be developed and implemented within 6 months of detection.

6.9.6 Future Listings of Non-Covered Species

In the event that a species that occurs or has the potential to occur within the Planning Area that is not a Covered Species under this HCP is listed by USFWS subsequent to the issuance of the ITP, such listing will be considered a Changed Circumstance.

Response to Future Listings of Non-Covered Species: The JPA, with assistance from USFWS, will evaluate the potential effects of Covered Activities on the newly listed species and any designated critical habitat. If there is a potential for adverse effects to occur during implementation of Covered Activities, the JPA will implement measures identified by USFWS to avoid the likelihood of impact of the newly listed non-Covered Species, or modification of the newly designated critical habitat, until the HCP and Joint ITP are amended to include such species, or until USFWS notifies the JPA that such measures are no longer needed. The JPA may enter into negotiations with USFWS regarding necessary modifications to the HCP, if any, to revise or amend the Joint ITP to cover the newly listed species. If the JPA decides to pursue coverage of the species under this HCP, USFWS will provide technical assistance in identifying appropriate modifications to the HCP that will be necessary to revise or modify the Joint ITP to cover the newly listed species. USFWS will take into account habitat benefits for the newly listed species provided by existing HCP management activities. A revision to the Joint ITP to include a new species would be processed as a Major Amendment to the HCP.

6.9.7 Responses to Unforeseen Circumstances

Unforeseen Circumstances are defined in 50 CFR 17.3 as changes in circumstances that affect a species or geographic area covered by the HCP that could not reasonably be anticipated by the Permittees or USFWS at the time of the HCP’s negotiation and development, and that result in a substantial and adverse change in status of the Covered Species. The purpose of the No Surprises Rule is to provide assurances to non-federal landowners participating in habitat conservation planning under the ESA that no additional land restrictions or financial compensation will be required for species adequately covered by a properly implemented HCP, in light of Unforeseen Circumstances, without the consent of the Permittees.

In case of an unforeseen event for the Upper Santa Ana River HCP, the JPA will immediately notify USFWS staff who have functioned as the principal contacts for the HCP. In determining whether such an event constitutes an Unforeseen Circumstance, USFWS will consider, but not be limited to, the following factors: size of the current range of the affected species, percentage of range adversely affected by the HCP, percentage of range conserved by the HCP, ecological significance of that portion of the range affected by the HCP, level of knowledge about the affected species and specificity of the species-specific conservation strategy under the HCP, and whether failure to adopt additional conservation measures would appreciably reduce the likelihood of survival and recovery of the affected species in the wild.

If USFWS determines that additional conservation and mitigation measures are necessary to respond to the Unforeseen Circumstances where the HCP is being properly implemented, the additional measures required of the JPA must be as close as possible to the terms of the original HCP and must be limited to modifications within any conserved habitat area or to adjustments within lands or waters that are already set-aside in the HCP's planned preserve system. Additional conservation and mitigation measures will not involve the commitment of additional land, water, or financial compensation or restrictions on the use of land, water, or other natural resources otherwise available for use by Covered Activities under original terms of the HCP, unless agreed to by the JPA and Permittee Agencies.

Chapter 7
Funding

This chapter provides planning-level estimates of the costs to implement the Habitat Conservation Plan (HCP), identifies funding sources to pay for implementation, and describes the rationale for funding assurances.

7.1 Cost and Benefit of the HCP

The HCP is estimated to cost approximately $185.3 million, paid incrementally over the 50-year permit term and excluding inflation, and shared among the Permittee Agencies.

Over 50 years, the $185.3 million in HCP costs will allow Permittee Agencies to develop over 4 million acre-feet of water for local use, or approximately 87,000 acre-feet per year (afy) by year 15 of HCP implementation. These water resources will reduce reliance on imports from other parts of the State, increasing the area's resilience to drought and regulatory restrictions that hamper water deliveries from the State Water Project, while also keeping more of the project spending in the local economy.

While the price tag of the HCP may appear surprisingly high upon first glance, the economic benefits of the plan to water users and the local economy as a whole are substantially greater than the costs. Without the HCP in place, Permittee Agencies would need to acquire this additional 87,000 afy of water supply from more costly alternative sources. Even with a conservative assumption that it would be possible to purchase that volume of water either from wholesalers or elsewhere in the market, the HCP is projected to save the region approximately $955 million over the life of the HCP on a net present value basis[1], and create secondary benefits from investment in the local economy.[2] This total net benefit illustrates the enormity and importance of this effort and represents a benefit-cost ratio over 1.4:1.[3]

7.2 HCP Benefits

Although the cost of the HCP may seem high, the net benefits to water users and the local economy from this investment amount to an estimated $955 million, generating a benefit-cost ratio in excess of 1.4:1. This means that for every $100 spent on the project, the local economy will see an estimated $140 in benefits and avoided costs.

Over the 50-year life of the HCP, the $185.3 million investment will allow Permittee Agencies to develop over 4 million acre-feet of water cumulatively for local use, or approximately 87,000 afy by

[1] When comparing scenarios that include capital costs and a future stream of annual O&M costs, it is necessary to use net present value calculations, which discount future year expenditures so that all values are in equivalent units. The HCP cost is presented as $185.3 million on an undiscounted basis, equivalent to $126.5 million in net present value.
[2] Refer to Section 7.2, *HCP Benefits*, for a detailed accounting of this estimate. Net present value (NPV) calculations are made using an interest rate of 4.61% based on the rate used by the State Water Project in calculating water prices. A general inflation rate is assumed to be 2%. The net discount rate is 2.61%.
[3] The benefit-cost ratio is the net present value of the benefits divided by the net present value of the costs. In this case, the benefits are the avoided future costs of more expensive water sources. A ratio above 1:1 indicates net positive benefits over the life or a project or program.

year 15. These water resources will reduce reliance on imported water from other parts of the State, increasing the area's resilience to drought and the increasing uncertainty and volatility that hamper water deliveries from the State Water Project and Colorado River Aqueduct.

Without the Covered Activities enabled by the HCP and associated incidental take permits, the Permittee Agencies would not be able to optimize the use of local water resources. Instead, their best options for obtaining such a large volume of water at the same level of reliability are to purchase additional imported water or develop new supplies through desalination. It is true that in some years, particularly wet hydrologic years, a fraction of the 87,000 acre-feet of water may be available for Permittee Agencies to purchase through San Bernardino Valley Municipal Water District's (Valley District's) State Water Project allotment. However, this water would not be available in other drier years, so it would not be reliable or predictable. This reliability benefit is part of the reason that Permittee Agencies are pursuing the HCP.

Potential alternatives to meet the full 87,000 acre-feet of water include purchasing additional water or adding desalination. These options are costly compared to both current water supplies and to alternatives facilitated by the HCP. Imported water from the Metropolitan Water District of Southern California (Metropolitan), which represents the going rate of buying additional water supplies through the market, currently costs $2,007 per acre-foot for treated Tier 2 water. This Tier 2 rate is set at Metropolitan's cost of purchasing water transfers north of the Sacramento-San Joaquin Delta and includes all costs associated with moving that water to Southern California. Individual water districts could pursue their own water transfers from north of the Delta, but would be competing against Metropolitan. For this reason, the Tier 2 rate is the best proxy for the price Permittee Agencies would have to pay if they pursued their own private water transfers. Desalination is the other alternative water supply option available to Southern California that does not depend on moving water through the Delta. It is estimated to cost about $2,019 per acre-foot based on the midpoint of existing desalination projects in Southern California. Using the lower Metropolitan price as a proxy for what HCP partner agencies would need to spend to acquire new supplies, the same volume of water would cost $3.2 billion over the life of the HCP, on a net present value basis.[4] However, there is no guarantee that such a large volume of water would even be reliably available for purchase, and developing sufficient equivalent capacity of desalination projects presents its own regulatory and geographic hurdles. For these reasons, the $3.2 billion cost for an alternative portfolio is considered to be conservative and biased toward a low estimate of projected savings made possible by the HCP.

Based on the planned mix of Covered Activity water supply projects, Permittee Agencies will be able to develop the same amount of water at a net present value cost of approximately $2.2 billion. To estimate this cost, for conventional and groundwater supply Covered Activity projects, a value of $829 per acre-foot is used, based on average costs for managed aquifer recharge projects in California State grant applications (Perrone and Rhode 2016). For recycled water and indirect potable reuse projects, an average cost of $1,269 per acre-foot was used, based on the cost of the Water Replenishment District of Southern California's Groundwater Reliability Improvement Program Advanced Water Treatment Facility (Metropolitan 2016), Orange County Water District's Groundwater Replenishment System (Metropolitan 2016), and cost estimates developed by the Pacific Institute for Indirect Potable Reuse (Cooley and Phurisamban 2016).

[4] Net present value (NPV) calculations are made using an interest rate of 4.61% based on the rate used by the State Water Project in calculating water prices. The general inflation rate is assumed to be 2%. The net discount rate is 2.61%.

The net present value (NPV) of water supply costs without the HCP is $3.2 billion, compared to an NPV of $2.2 billion in water supply costs with the HCP. This is an estimated savings of $1.08 billion from water supply projects alone.

This potential savings puts the HCP total cost in perspective. The $185.3 million undiscounted total HCP cost translates to an NPV of $126.5 million. Based on the savings estimated from water supply projects and the cost of the HCP, pursuing the HCP over alternative water supply options could result in net savings of $955 million or more in net present value. This cost saving will be passed on to commercial and residential water customers throughout the HCP area.

Table 7-1. HCP Net Savings Estimate in Net Present Value ($1,000s)

	Water Supply Cost	HCP Cost	Net Savings (cost)
Without HCP	$3,243	$0	
With HCP	$2,162	$126.5[1]	
Total savings (cost)	**$1,081**	**-$126.5**	**$955**

[1] Note that this total HCP cost is presented in net present value (NPV). It is equivalent to the $185.3 million undiscounted total cost presented elsewhere in this chapter, but shown in NPV so that it can be compared to alternative scenarios on a comparable basis.

The project also helps the region move forward in addressing the threat of climate change by mitigating greenhouse gas (GHG) emissions. The habitat restoration leads to sequestering 130 metric tons in CO_2-equivalence according to the U.S. Department of Agriculture's COMET calculator.[5]

The increased local water resources reduce emissions in two ways. The first is a greater reliance on in-basin sources. This avoids emissions associated with pumping water through the State Water Project over the Tehachapi Mountains. The second is greater flexibility in storing imported water, which allows for higher deliveries in wet years and reduced deliveries in dry ones. Wet and dry conditions correspond with higher and lower output from the State's hydropower system, so GHG emissions are lower in wet years when imports can be increased. Conversely, imports are avoided in dry years when GHG emissions are higher. Because this analysis has not identified the breakdown in new supplies between local and imported sources, and deriving the differences in GHG emissions for importing in wet versus dry years requires extensive electricity system production cost modeling, those emission reductions are not quantified here.

In addition, developing new water supplies through investment in local water supply projects as well as local investment in habitat conservation creates secondary impacts in the Planning Area economy similar to an economic stimulus, when compared to purchasing imported water from Metropolitan. Using IMPLAN[6] economic modeling software, if the HCP and water project costs are spent in the local economy each year over the life of the project, the result would be an additional $402 million in economic activity,[7] and $132 million in additional income to local residents, in addition to the creation of approximately 85 jobs annually.

[5] USDA COMET Planner. http://comet-planner-cdfahsp.com/.
[6] IMPLAN software is an industry standard input-output model that allows users to estimate how regional economic impacts flow through the economy.
[7] Defined as economic output, equivalent to $195 million in value added to the economy.

7.3 Purpose of Cost Estimate and Annual HCP Implementation Budget

The cost estimates presented in this chapter have been developed for the purpose of budgeting and are not to be confused with legally authorized or required cost expenditures. Actual year-to-year expenditures will be based on HCP implementation priorities as developed in the preserve management plans and annual reports, and as determined by the Upper Santa Ana River Sustainable Resource Alliance (Alliance), technical committee, and preserve management committee. This budget is based on a projected HCP implementation schedule that may not conform with how the HCP will be implemented in response to the actual timing of Covered Activity implementation. As the HCP is adapted to changing environmental conditions and schedules and scale of Covered Activities, this budgeted amount will also change. In addition, the budget will be updated to reflect general inflation and cost escalation that cannot be readily forecasted today. Using constant dollar budget estimates instead allows more readily for comparisons across years.

7.4 HCP Cost Estimate

The HCP is estimated to cost approximately $185.3 million in 2020 dollars, including costs over 50 years without discounting and inflation. Table 7-2 to Table 7-4 summarize the total, capital, and operational costs estimated to be necessary to carry out the HCP.

The cost analysis is based on a number of assumptions regarding the timing of implementation of various components of the HCP and the estimated unit costs of land, labor, and materials. Unit cost estimates were based on the best available information and represent average unit costs. The costs of individual items will fluctuate above and below these averages. The total cost presented herein should therefore be regarded as a planning-level estimate to aid in the determination of the approximate amount of funding needed to implement the HCP. Specific costs will be refined as they are ascertained during the first years of HCP implementation, and any adjustments to the overall costs, cost-sharing agreements among Permittee Agencies, and endowment requirements will be made as needed.

Costs are organized by the following cost categories:

- Land acquisition and easements
- Habitat improvement (restoration and/or rehabilitation)
- Fish translocation
- Management and maintenance
- Monitoring and reporting
- Staffing and Program administration
- Endowment fund
- Changed Circumstance Reserve

All cost categories are mutually exclusive so that summing the category costs yields the total expected cost to implement the HCP. Note, however, that some cost items are allocated across the categories. For example, Implementing Entity (Alliance) staff salaries and overhead are apportioned across the categories because staff will perform a range of functions. Each cost category is divided into capital and operational costs. Capital costs are typically one-time costs for land, equipment, structures, or improvements. Operational costs are ongoing costs such as staff salaries and contractor fees. Costs are summarized by 5-year periods for Phases 1 through 3, and then for the remaining 35 years to encompass the 50-year permit period except for pre-permit and startup costs, which are shown as lump sums for Permit Year 0 (costs that will have been incurred prior to the initiation of HCP implementation). Costs are in 2020 dollars unless noted otherwise.

Table 7-2. Summary of Upper SAR HCP Capital Costs (1,000s 2020 dollars)

	Implementation Period (Years)					
	Initial	Phase 1	Phase 2	Phase 3	Phase 4	
Capital Costs[1]	**0[2]**	**1–5**	**6–10**	**11–15**	**16–50**	**Total Costs[3]**
Land Acquisition & Easements	$60	$18,520	$11,132	$0	$0	$29,712
Habitat Improvement	$24,350	$3,711	$800	$750	$0	$29,611
Fish Translocation	$255	$0	$0	$0	$0	$255
Management and Maintenance	$0	$0	$751	$206	$0	$957
Monitoring and Reporting	$0	$0	$0	$0	$0	$0
Staffing and Program Administration	$0	$0	$0	$0	$0	$0
Endowment Fund	$0	$0	$0	$0	$0	$0
Changed Circumstance Reserve	$0	$6,069	$1,233	$113	$0	$7,415
Total	$24,671	$28,300	$13,916	$1,069	$0	$67,956
Total Per Year		$5,660	$2,783	$214	$0	$1,359

[1] All costs rounded to the nearest $1,000.
[2] Year 0 costs are costs that will have been incurred prior to the start of the HCP.
[3] Total Costs sum across all years with no discounting.

Table 7-3. Summary of Upper SAR HCP Operating Costs (1,000s 2020 dollars)

	Implementation Period (Years)					
	Initial	Phase 1	Phase 2	Phase 3	Phase 4	
Operating Costs[1]	**0[2]**	**1–5**	**6–10**	**11–15**	**16–50**	**Total Costs[3]**
Land Acquisition & Easements	$0	$0	$0	$0	$0	$0
Habitat Improvement	$0	$3,298	$4,854	$949	$6,646	$15,747
Fish Translocation	$0	$1,135	$876	$565	$3,958	$6,535
Management and Maintenance	$0	$2,693	$3,035	$3,513	$24,589	$33,830
Monitoring and Reporting	$0	$1,797	$1,797	$2,026	$13,930	$19,551

Operating Costs[1]	Implementation Period (Years)					Total Costs[3]
	Initial	Phase 1	Phase 2	Phase 3	Phase 4	
	0[2]	1–5	6–10	11–15	16–50	
Staffing and Program Administration	$0	$2,442	$2,442	$2,307	$16,148	$23,339
Endowment Fund	$0	$1,378	$1,378	$1,378	$9,645	$13,779
Changed Circumstance Reserve	$0	$656	$881	$289	$2,018	$3,845
Total	$0	$13,399	$15,263	$11,028	$76,934	$116,626
Total Per Year		**$2,680**	**$3,053**	**$2,206**	**$2,198**	**$2,333**

[1] All costs rounded to the nearest $1,000.
[2] Year 0 costs are costs that will have been incurred prior to the start of the HCP.
[3] Total Costs sum across all years with no discounting.

Table 7-4. Summary of Upper SAR HCP Total Implementation Costs (1,000s 2020 dollars)

Total Costs[1]	Implementation Period (Years)					Total Costs[3]
	Initial	Phase 1	Phase 2	Phase 3	Phase 4	
	0[2]	1–5	6–10	11–15	16–50	
Land Acquisition & Easements	$60	$18,520	$11,132	$0	$0	$29,712
Habitat Improvement	$24,350	$6,003	$4,647	$973	$1,561	$37,534
Fish Translocation	$255	$381	$122	$72	$504	$1,334
Management and Maintenance	$0	$1,422	$2,515	$2,137	$13,515	$19,589
Monitoring and Reporting	$722	$722	$722	$722	$4,798	$7,686
Staffing and Program Administration	$0	$6,549	$6,549	$6,413	$44,891	$64,402
Endowment Fund	$0	$1,378	$1,378	$1,378	$9,646	$13,780
Changed Circumstance Reserve	$0	$6,725	$2,115	$402	$2,017	$11,259
Total	$25,393	$41,700	$29,180	$12,097	$76,932	$185,302
Total Per Year		$8,340	$5,836	$2,419	$2,198	$3,706

[1] All costs rounded to the nearest $1,000.
[2] Year 0 costs are costs that will have been incurred prior to the start of the HCP.
[3] Total Costs sum across all years with no discounting

7.5 Cost Estimate Methodology

This section provides an explanation of each cost category and the methods that were used to develop the HCP cost estimate. The spreadsheets used to develop the HCP cost estimate are provided in Appendix H, *Upper Santa Ana River HCP Cost*.

7.5.1 Land Acquisition and Easements

Land acquisition and easement cost estimates are based on a geographic information system (GIS) database of parcels within the HCP Preserve System. Note however that the total acreage of these parcels may differ compared to the acreage suitable for Covered Species habitat. Consequently, actual useable acreage for the HCP is sometimes smaller than the total acreage of each parcel. This section provides conservative cost estimates based on total land area. For more precise information on the actual planned areas of habitat improvement activities, refer to Chapter 5, *Conservation Strategy*.

The HCP conservation strategy consists of the acquisition of approximately 1,428 acres. The land parcels identified for acquisition or easements include small amounts of developed (78 acres) and agricultural (2 acres) land.

Conservation Areas

Lands proposed for acquisition will be purchased in fee title, or acquired via the recordation of a conservation easement. A total of 1,428 acres will be acquired, restored and/or rehabilitated, and monitored and managed in perpetuity. Lands proposed for acquisition include those that contain aquatic, riparian, and floodplain habitat and those supporting alluvial fan habitat. Table 7-5. shows the type and timing of all planned transactions for land acquisition. All land acquisition costs are proposed to occur within the first 10 years of HCP implementation (by Phase 2).

Table 7-5. Conservation Area Acreages[1] within Each Preserve Unit

	Transaction Type	Phase 0	Phase 1	Phase 2	Total Acres
Santa Ana River Preserve Unit: Aquatic, Riparian, and Floodplain Conservation Areas					
Anza Creek	Easement	7	0	0	7
Evans Lake	Easement	0	115	0	115
Hidden Valley Creek[2]	Easement	11	0	102	112
Hidden Valley Ponds[2]	Easement	0	13	55	69
Lower Hole Creek[2]	Easement	0	6	0	6
Management of Santa Ana Sucker Restoration on Sunnyslope Creek	Easement	0	10	0	10
Old Ranch Creek	Easement	0	18	0	18
Subtotal		18	163	157	338
Alluvial Fan Preserve Unit A: Alluvial Fan Conservation Areas					
Drainage A Woolly-Star	Acquisition and Easement	0	0	21	21
Enhanced Recharge Basins	Easement	0	295	0	295
Redlands Airport Parcels	Acquisition and Easement	40	0	0	40
Santa Ana River Refugia	Easement (HCP Partner-Owned)	0	102	0	102
San Bernardino Avenue	Acquisition and Easement	6	0	0	6

	Transaction Type	Phase 0	Phase 1	Phase 2	Total Acres
Weaver	Acquisition and Easement	17	0	0	17
Subtotal		63	397	21	481
Alluvial Fan Preserve Unit B: Alluvial Fan Conservation Areas					
Devil Creek	Easement (HCP Partner-Owned)	0	345	0	345
Subtotal		0	345	0	345
Santa Ana Sucker Translocation Preserve Unit A Conservation Areas					
City Creek	Easement (HCP Partner-Owned)	0	0	264	264
Subtotal		0	0	264	264
Total		**81**	**905**	**442**	**1,428**

[1] Acquisition of conservation lands is contingent upon successful land acquisition/conservation easement recordation. If a conservation area cannot be acquired the Alliance will pursue alternate lands with similar potential to support Covered Species. Additional lands will continue to be pursued by the Alliance, consequently the Conservation Areas listed in Table 7-6 are not reflective of the final Conservation Area list proposed for incorporation in the HCP Preserve System.
[2] CDFW retains ownership, no cost per acre. Easement transaction costs included for budgeting purposes.

The cost of land varies and is primarily dependent on location and land use zoning; however, other factors may also influence costs, including the type and quality of onsite habitat. It is anticipated that where HCP-partner agencies own lands that may be suitable for Covered Species mitigation, these lands will be offered to the HCP via recordation of conservation easements as in-kind contributions to the HCP. In other cases, easements may have already been established, so going-forward additional land acquisition costs to the HCP for those parcels are zero. In addition to the per acre cost of land, the HCP has assumed a $12,000 transaction fee for establishing an easement (on a per-property basis).

Table 7-6 outlines the acquisition costs of the Conservation Areas. Aquatic/riparian/floodplain parcels are anticipated to cost a total of $84,000, while alluvial fan lands will cost $25.1 million. In addition to the 1,428 acres comprising the HCP strategy, for the purpose of estimating land acquisition costs, Table 7-6 also includes a contingency cost for 15 additional acres of land. Total land costs are estimated at $29.7 million.

Table 7-6. Conservation Area Land Acquisition Costs[1]

	Cost Per Acre	Total Acres	Additional Easement Transaction Cost	Total Cost
Santa Ana River Preserve Unit: Aquatic, Riparian, and Floodplain Conservation Areas				
Anza Creek	$0[2]	7	$12,000	$12,000
Evans Lake	$0[2]	115	$12,000	$12,000
Hidden Valley Creek	$0[3]	112	$12,000	$12,000
Hidden Valley Ponds	$0[3]	69	$12,000	$12,000
Lower Hole Creek	$0[3]	6	$12,000	$12,000
Management of Santa Ana Sucker Restoration on Sunnyslope Creek	$0[4]	10	$12,000	$12,000

	Cost Per Acre	Total Acres	Additional Easement Transaction Cost	Total Cost
Old Ranch Creek	$0[2]	18	$12,000	$12,000
Subtotal		338	$84,000	$84,000
Alluvial Fan Preserve Unit A: Alluvial Fan Preserve Unit A Conservation Areas				
Drainage A Woolly-Star	$315,000	21	$12,000	$6,620,000
Enhanced Recharge Basins	$125,000	295	$12,000	$18,436,005
Redlands Airport Parcels	$0	40	$12,000	$12,000
San Bernardino Avenue	$0	102	$12,000	$12,000
Santa Ana River Refugia	$0	6	$12,000	$12,000
Weaver	$0	17	$12,000	$12,000
Subtotal		481	$72,000	$25,104,000
Alluvial Fan Preserve Unit B: Alluvial Fan Preserve Unit B Conservation Areas				
Devil Creek	$0	345	$12,000	$12,000
Subtotal		345	$12,000	$12,000
Santa Ana Sucker Translocation Preserve Unit A Conservation Areas				
City Creek	$0	264	$12,000	$12,000
Subtotal	$0	264	$12,000	$12,000
Subtotal All Planned Acquisition		**1,428**	**$180,000**	**$25,212,000**
Contingency Land Acquisition[6]	$300,000	15	$0	$4,500,000
Total		**1,443**	**$180,000**	**$29,712,000**

[1] Acquisition of conservation lands is contingent upon successful land acquisition/conservation easement recordation. If a conservation area cannot be acquired the Alliance will pursue alternate lands with similar potential to support Covered Species. Additional lands will continue to be pursued by the Alliance; consequently, the Conservation Areas listed in Table 7-6 are not reflective of the final Conservation Area list proposed for incorporation in the HCP Preserve System.
[2] In-kind contribution from Permittee Agency
[3] CDFW/County of Riverside retains ownership, no cost per acre. Easement transaction costs included for budgeting purposes.
[4] Long-term lease at $5/year. Rounded to zero for this analysis; easement transaction costs included for budgeting purposes.
[5] Approximately half of the 295 acres have already been purchased.
[6] Contingency land acquisition is based on the Cajon Mitigation Bank credit cost, approximately $300,000 per acre.

Land Acquisition and Easements Summary

The total land acquisition costs are estimated at $29.7 million. These costs are summarized by phase in Table 7-7..

Table 7-7. Summary of Total Land Acquisition Costs

	Phase 0	Phase 1	Phase 2	Phase 3	Phase 4	Total
Santa Ana River Preserve Unit	$24,000	$60,000	$0	$0	$0	$84,000
Alluvial Fan Preserve Unit A	$36,000	$18,448,000	$6,620,000	$0	$0	$25,104,000

	Phase 0	Phase 1	Phase 2	Phase 3	Phase 4	Total
Alluvial Fan Preserve Unit B	$0	$12,000	$0	$0	$0	$12,000
Santa Ana Sucker Translocation Preserve Unit A	$0	$0	$12,000	$0	$0	$12,000
Contingency	$0	$0	$4,500,000	$0	$0	$4,500,000
Total	**$60,000**	**$18,520,000**	**$11,132,000**	**$0**	**$0**	**$29,712,000**

7.5.2 Habitat Improvement Activities

Under the HCP Conservation Strategy all of the Conservation Areas will be subject to habitat improvement activities (restoration and/or rehabilitation) for the benefit of Covered Species. See Chapter 5, Section 5.4.3*, Conservation Areas,* for more detail on the specific habitat improvement activities planned at each site. Habitat improvement project costs are divided into the following four categories:

- Major restoration project costs
- Habitat Management and Monitoring Plan (HMMP) implementation costs
- Santa Ana River microhabitat restoration project costs
- Supplemental streamflow costs

HMMP costs take place for 5 years following habitat improvement activity implementation. Long-term maintenance and monitoring costs for all Conservation Areas are accounted for in Sections 7.5.4, *Preserve Management and Maintenance,* and 7.5.5, *Monitoring and Reporting.*

Major Restoration Project Costs

Major restoration project costs are estimated at $1.6 million.

Restoration project costs have been estimated for each restoration site. Major restoration project costs include design, planning, permitting, and construction costs for the specific restoration project (Santa Ana River tributary restoration including creek channel and riparian floodplain, as well as alluvial fan restoration projects). These costs may occur over the four phases of the HCP period but are all considered capital costs. These costs are summarized by phase and restoration site in Table 7-8. .

Five of the sites listed in Table 7-8. , have been identified for tributary restoration to increase the amount and quality of Santa Ana sucker habitat. Restoration has been initiated at three of these sites. Restoration of the other two sites is expected to take place within the first 5 years of the permit term. The cost estimates in Table 7-8. are based on already incurred and expected costs at each restoration site.

Table 7-8. Restoration Implementation Capital Costs

	Phase 1	Phase 2	Phase 3 or 4	Total
Santa Ana River Preserve Unit				
Anza Creek	$0	$0	$0	$0
Evans Lake	$0	$0	$0	$0
Hidden Valley Creek	$0	$600,000	$0	$600,000
Hidden Valley Ponds	$0	$0	$750,000	$750,000
Lower Hole Creek	$0	$50,000	$0	$50,000
Management of Santa Ana Sucker Restoration on Sunnyslope Creek	$0	$0	$0	$0
Old Ranch Creek	$0	$0	$0	$0
Subtotal	**$0**	**$650,000**	**$750,000**	**$1,400,000**
Alluvial Fan Preserve Unit A				
Drainage A Woolly-Star	$0	$150,000	$0	$150,000
Subtotal	**$0**	**$150,000**	**$0**	**$150,000**
Total	**$0**	**$800,000**	**$750,000**	**$1,550,000**

Habitat Management and Monitoring Plan Implementation

HMMP implementation covers 5 years of maintenance and monitoring costs after restoration activities are complete. ICF staff created estimates for HMMP implementation based on their experience with other management and monitoring efforts. However, because precise plans have not yet been developed estimates are broad but conservative. HMMP costs are also included for those Conservation Areas where habitat improvement activities will consist primarily of rehabilitation. The estimated $5.9 million HMMP costs are included as an operations and maintenance (O&M) cost and are summarized by phase and conservation site in Table 7-9.

Table 7-9. HMMP Costs

	Phase 1	Phase 2	Phase 3 or 4	Total
Santa Ana River Preserve Unit				
Anza Creek	$500,000	$0	$0	$500,000
Evans Lake	$0	$1,750,000	$0	$1,750,000
Hidden Valley Creek	$500,000	$1,050,000	$0	$1,550,000
Hidden Valley Ponds	$0	$300,000	$0	$300,000
Lower Hole Creek	$350,000	$250,000	$0	$600,000
Management of Santa Ana Sucker Restoration on Sunnyslope Creek	$0	$0	$0	$0
Old Ranch Creek	$500,000	$0	$0	$500,000
Subtotal	**$1,850,000**	**$3,350,000**	**$0**	**$5,200,000**
Alluvial Fan Preserve Unit A				
Drainage A Woolly-Star	$0	$75,000	$0	$75,000
Enhanced Recharge Basins	$250,000	$100,000	$0	$350,000

	Phase 1	Phase 2	Phase 3 or 4	Total
Redlands Airport Parcels	$15,000	$0	$0	$15,000
Santa Ana River Refugia	$39,000	$0	$0	$39,000
San Bernardino Avenue	$2,000	$0	$0	$2,000
Weaver	$6,000	$0	$0	$6,000
Subtotal	**$312,000**	**$175,000**	**$0**	**$487,000**
Alluvial Fan Preserve Unit B				
Devil Creek	$130,000	$0	$0	$130,000
Subtotal	**$130,000**	**$0**	**$0**	**$130,000**
Santa Ana Sucker Translocation Unit A				
City Creek	$0	$99,000	$0	$99,000
Subtotal	$0	$99,000	$0	$99,000
Total	**$2,292,000**	**$3,624,000**	**$0**	**$5,916,000**

Santa Ana River Microhabitat Enhancement

The costs for Santa Ana River microhabitat enhancement correspond to the following Santa Ana sucker (SAS) Actions associated with SAS Objective 2, as described in Chapter 5:

> **SAS Objective 2:** Increase the amount and quality of available foraging, refugia, and spawning habitat in the mainstem of the Santa Ana River through restoration and rehabilitation. A portion of this area is included in the modeled habitat for the species, while other portions are not currently suitable habitat but would be enhanced to be suitable through habitat improvement activities (e.g., restoration and/or rehabilitation).
>
> **SAS Action 2A:** Enhance sucker habitat in the mainstem of the Santa Ana River with the addition of at least six habitat nodes and/or stream bifurcation structures, enhancing at least 1.5 acres of habitat (see Section 5.5.1, *Mainstem Santa Ana River Microhabitat Creation*). Successful implementation of this measure includes increasing the relative bed coarseness (increase in exposed gravel and cobble), when compared to the baseline condition or an unmanipulated control site(s), over the cumulative habitat enhancement area equivalent to or exceeding 1.5 acres. The appropriate timing for this measurement should be when surface flow is dominated by discharged wastewater during the summer and fall months, prior to the start of the rainy season (late fall). Survey methodology for this measure will be developed as part of the CAMMP.

Santa Ana River microhabitat enhancement entails the installation of in-stream habitat structures designed to increase bed scour and habitat complexity in order to provide suitable Santa Ana sucker habitat and shelter. Unit costs for these structures are based on preliminary designs prepared by Scheevel Engineering. The costs are summarized in Table 7-10. In addition to the initial design, permitting, and construction costs, it is assumed that, on average, one habitat node will need to be rebuilt every 5 years due to washout or other event rendering the damaged node unsuitable as Santa Ana sucker habitat. The replacement cost is set to the average cost per habitat node for the three habitat structures listed in Table 7-10.

Table 7-10. Santa Ana Sucker Microhabitat Enhancement Cost Estimate by Microhabitat Type

	Elevated Inverts	Open Water Runners	Partially Submerged Groins	Total
Number of Microhabitat Nodes	4	6	6	
Total Habitat Created – low end (acres)	0.05	0.09	0.12	0.26
Total Habitat Created – high end (acres)	0.47	0.87	1.19	2.53
Construction Costs				
Design & Permitting	$76,000	$76,000	$76,000	$228,000
Construction	$976,000	$1,276,000	$1,186,000	$3,438,000
Total Capital Cost	**$1,052,000**	**$1,352,000**	**$1,262,000**	**$3,666,000**
Node replacement cost every 5 years[1]				$223,000
Expected Implementation	Years 1–5	Years 1–5	Years 1–5	

[1] Cost estimate assumes one habitat note will need to be rebuilt every 5 years due to washout or other event rendering the damaged node unsuitable Santa Ana sucker habitat.

Supplemental Streamflow Cost

To support Santa Ana sucker habitat restoration, approximately 4,272 afy of water is proposed to be supplied to Hidden Valley Creek, Hidden Valley Wetlands, and Lower Hole Creek, and approximately 5,076 afy is proposed to be conveyed to Anza Drain, Old Ranch Creek, Tequesquite Creek, and Evans Lake channel. Valley District plans to use recycled water supplies to meet these water needs. Pending approval from the State Water Resources Control Board, Division of Water Rights, tributary restoration sites will receive continuous flows using recycled water from the existing Riverside Regional Water Quality Control Plant. The City of Riverside Public Utilities Water Division has proposed the Santa Ana River Sustainable Parks and Tributaries Water Reuse Project (RPU.10) to expand the existing recycled water system to provide water to both Riverside Public Utilities (RPU) customers as well as providing water to tributary restoration sites.

According to the preliminary cost estimates developed for RPU.10 in their Habitat-Parks Recycled Water Preliminary Planning Report (RPU 2018), planning scenarios to supply water to both RPU customers and the HCP including capital costs are estimated at $48.7 million. This investment would be split evenly between the HCP and RPU, so the total capital cost included here is $24.4 million. Annual operations and maintenance costs, which include maintenance and electricity for the recycled water pump station, dechlorination, and labor, are estimated at $608,000, which would also be split evenly. For the estimated 4,272 afy needed annually, the cost share is $303,000 per year. However, it is also anticipated that the HCP would receive approximately $312,000 per year in revenue from the Inland Empire Utilities Agency (IEUA) for sending water down the Santa Ana River to meet their legal requirements. Considering the offsetting revenue from IEUA, annual operation and maintenance costs for the water source are estimated at zero with only capital costs remaining.[8]

Table 7-11 summarizes the cost of supplemental water.

[8] The parties are planning to use a water exchange, where for every acre-foot of water that is discharged to Evans Creek, Tequesquite Arroyo, Old Ranch Creek, and Anza Creek, the HCP would work with SBVWCD to provide access to a like amount of water out of the Bunker Hill Basin that RPU would extract. In addition, the water proposed to be discharged to Hole Creek and Hidden Valley would be provided to the HCP at no charge under the current proposal.

Table 7-11. Summary of Supplemental Water Costs

	Summary	Total Capital	Total Annual	Total-5-Year Period
Capital Cost	0.5 x $48.7 million	$24,400,000		
Annual O&M Cost	0.5 x $608,000		$304,000	$1,520,000
Additional Annual Capital Recovery Charge Cost	4,272 afy x $71/acre-foot		$303,000	$1,515,000
IEUA Revenue			-$625,000	-$3,125,000
Total Annual Cost			**$0**	**$0**

Summary of Habitat Improvement Cost Estimates

Table 7-12 summarizes all habitat improvement costs included in the HCP strategy. Capital investment costs for restoration projects are estimated to be $29.6 million in total; $24.4 million of which occurs prior to issuance of the HCP permit to expand the Riverside Regional Water Quality Control Plant. The remaining $5.2 million is spread out over the different phases to construct habitat improvements.

O&M costs range from $2.3 million in Phase 1, $3.8 million in Phase 2, and $1.8 million over the remainder of the 50-year permit.

The cost estimate in Table 7-12 does not include the long-term costs for management and monitoring of the Conservation Areas. As noted above, those costs are accounted for in Sections 7.5.4 *Preserve Management and Maintenance* and 7.5.5 *Monitoring and Reporting*.

Table 7-12. Summary of Total Habitat Improvement Costs ($1,000s)

	Pre-Permit	Phase 1	Phase 2	Phases 3 and 4	Total
Restoration	$0	$0	$800	$750	$1,550
HMMP					$0
Microhabitat Enhancement		$3,711			$3,711
Supplemental Streamflow (Expansion of RPU Regional Water Quality Control Plant)	$24,350				$24,350
Capital Subtotal	**$24,350**	**$3,711**	**$800**	**$750**	**$29,611**
Restoration					$0[1]
HMMP	$0	$2,292	$3,624	$0	$5,916
Microhabitat Enhancement		$0	$223	$1,784	$2,007
Supplemental Streamflow		$0	$0	$0	$0
O&M Subtotal	**$0**	**$2,292**	**$3,847**	**$1,784**	**$7,923**
Total[2]	**$24,350**	**$6,003**	**$4,647**	**$2,534**	**$37,534**

[1] O&M costs are zero because after construction, restoration sites will be managed as part of Conservation Areas in the preserve system. See Section 7.5.4, *Preserve Management and Maintenance,* for information on these costs.
[2] Note that total cost corresponds to total Restoration costs in Table 7-4. Numbers may not sum to total due to rounding.

7.5.3 Fish Translocation

Fish translocation entails creating new local populations of sucker in the mountain tributaries of the Santa Ana River, per Santa Ana sucker Objective 6, as described in Chapter 5. The costs presented in this subsection pertain to the following SAS Action*:*

- **SAS Action 6A:** Conduct a minimum of three translocations of Santa Ana sucker into mountain tributary streams following techniques and methodology outlined in the Santa Ana sucker Translocation Plan and CAMMP. Successfully re-introduce and maintain a minimum of three Santa Ana sucker populations over the life of the permit duration in at least three mountain streams tributary to the Santa Ana River.

Costs for fish translocation activities are divided into the following four categories:

- Fish translocation plan development
- Captive holding facility construction and O&M
- Translocation contractor services
- U.S. Forest Service (USFS) coordinating agreement costs

Monitoring costs associated with fish translocation are accounted for in Section 7.5.5, *Monitoring and Reporting.*

Fish Translocation Plan Development

The cost for development of the fish translocation plan that has been prepared was $255,000.

Captive Holding Facility

Construction of the Santa Ana sucker captive holding facility has already been paid for pre-permit, and is therefore not included as a going-forward HCP cost in this analysis. Annual O&M is estimated at $32,500 per fish raceway. For purposes of cost estimation, it is assumed the facility will operate two raceways for fish translocation during the first 5 years of the permit. For the remainder of the permit period, it is assumed the facility will, on average, operate one raceway in 2 out of 5 years in order to provide sufficient Santa Ana sucker stock for replacement of diminished or extirpated translocated Santa Ana sucker populations.

Translocation Contractor Services

Translocation of Santa Ana sucker populations is expected to be performed by an outside contractor. For purposes of cost estimation, it is assumed that the contractor will complete eight translocations at a cost of $7,000 per translocation during the first 5 permit years. For the remainder of the permit period, it is assumed the contractor will complete one translocation every 5 years to replace diminished or extirpated translocated Santa Ana sucker populations.

USFS Coordinating Agreement Costs

Fish translocation is expected to require coordinating agreements with and support from the USFS. Fees and other costs associated with USFS coordination are estimated to average $10,000 annually for the first 10 years of the project. However, because Valley District has an existing contract with

USFS that should last for the 5 years of the project, additional coordinating agreement costs are only anticipated for years 6 through 10.

Summary of Fish Translocation Cost Estimate

Table 7-13 summarizes the fish translocation cost estimate. Lump sum capital costs for fish translocation are estimated to be approximately $255,000 for preparation of the translocation plan prior to issuance of the HCP permits. Translocation implementation, operations, and maintenance costs are approximately $1.3 million over the life of the HCP.

The cost estimate in Table 7-13 does not include fish translocation monitoring costs. As noted above, those costs are accounted for in Section 7.5.5*.*

Table 7-13. Summary of Total Fish Translocation Costs

	Pre-Permit Capital Costs	O&M Costs				Total
		Phase 1	Phase 2	Phase 3	Phase 4	
Fish Translocation Plan Preparation	$255,000					$255,000
Captive Holding Facility	$0	$325,000	$65,000	$65,000	$455,000	$910,000
Translocation Contractor Services		$56,000	$7,000	$7,000	$49,000	$119,000
USFS Coordinating Agreement Costs		$0	$50,000	$0	$0	$50,000
O&M Subtotal		$381,000	$122,000	$72,000	$504,000	$1,079,000
Total	**$255,000**	**$381,000**	**$122,000**	**$72,000**	**$504,000**	**$1,334,000**

7.5.4 Preserve Management and Maintenance

Preserve Management and Maintenance costs are estimated at $19.6 million over the permit term. Costs cover the long-term management and maintenance of the HCP Preserve System. They also include the long-term management of restoration areas and rehabilitation areas after success criteria have been met during the 5-year HMMP period. Preserve management and maintenance costs are divided into the following categories:

- General land stewardship costs
- Restoration areas long-term management
- Rehabilitation areas long-term management

Of the 1,428 acres that will be acquired to mitigate impacts on Covered Species, approximately 78 acres are classified as urban and will not enter into the long-term management cost estimates. The remaining 1,351 acres will be managed in the long term as habitat after the 5-year HMMP monitoring period is completed.

It is assumed that management and maintenance costs will be similar, on a per acre basis, to the management and maintenance costs estimated for the Upper Santa Ana River Wash Plan HCP; therefore, those costs are used here for estimation purposes.

Some management and maintenance tasks will be required in perpetuity. These post-permit management and maintenance costs are addressed in Section 7.5.7, *Post-Permit Endowment*.

General Land Stewardship Costs

General land stewardship activities include:

- Restricting unauthorized access
- Minimization and clean-up of illegal dumping
- Maintenance of facilities and equipment needed for habitat management

These activities will be implemented primarily through contracts with the counties for ranger patrol and maintenance worker services. The costs for general land stewardship are summarized in Table 7-14 and are estimated to average $285,000 annually, or $1.4 million per 5-year period.

Table 7-14. General Land Stewardship Cost Estimate

Stewardship Activities	Assumptions	Average Annual Cost	Cost per 5-Year Period
County Parks Ranger Patrols	1 full-time employee (FTE) County Ranger Class I at fully burdened rate of $65/hour and 1 FTE County Ranger Class II at fully burdened rate of $70/hour	$254,000	$1,270,000
Maintenance	0.25 FTE County Maintenance Worker at fully burdened rate of $65/hour	$31,000	$153,000
Total		**$285,000**	**$1,422,000**

Long-Term Conservation Management

Basic habitat management activities include trash removal, thinning, and nonnative invasive plant control, including herbicide use and grazing. It is assumed that these management costs will be similar, on a per acre basis, to the management and maintenance costs estimated for the Wash Plan HCP. These costs are summarized on a per acre basis in Table 7-15. Cost estimates for fencing portions of conserved areas were also estimated based on the anticipated type, and approximate length, of fencing necessary.

Table 7-15 identifies long-term management costs for each 5-year phase of the HCP. Total costs for managing the habitat land over the long-term are $5.4 million over the life of the HCP.

Table 7-15. Long-Term Conservation Management Costs

		Phase 1	Phase 2	Phase 3	Phase 4	Total
Acres phased in		**0**	909	442	**0**	1,351
Total acres		0	909	1,351	1,351	
	Cost/ Acre	**Cost**	**Cost**	**Cost**	**Cost**	**Total Cost**
Trash removal	$11	$0	$52,000	$77,000	$537,000	$665,000
Thinning	$13	$0	$59,000	$88,000	$615,000	$761,000
Invasive plant control – herbicide	$46	$0	$209,000	$311,000	$2,175,000	$2,694,000
Invasive plant control – grazing	$5	$0	$23,000	$34,000	$236,000	$293,000
Fencing	variable	$0	$751,000	$206,000	$0	$957,000
Total		**$0**	**$1,094,000**	**$716,000**	**$3,563,000**	**$5,371,000**

Summary of Management and Maintenance Cost Estimate

Table 7-16 summarizes the estimate for preserve management and maintenance costs. Over the permit term, costs are estimated at $19.6 million.

Table 7-16. Summary of Total Management and Maintenance Costs

	Phase 1	Phase 2	Phase 3	Phase 4	Total
General Land Stewardship	$1,422,000	$1,422,000	$1,422,000	$9,952,000	$14,218,000
Conservation Areas Management	$0	$1,094,000	$716,000	$3,563,000	$5,371,000
Total[1]	**$1,422,000**	**$2,516,000**	**$2,138,000**	**$13,515,000**	**$19,589,000**

[1] Note that total cost corresponds to total Management and Maintenance costs in Table 7-4. Numbers may not sum to total due to rounding. All costs are classified as O&M costs, with the exception of fencing which is a capital cost.

7.5.5 Monitoring and Reporting

Monitoring and reporting costs are estimated to total $7.7 million over the permit term. Some monitoring and adaptive management tasks will be required in perpetuity. These post-permit monitoring and adaptive management costs are addressed in Section 7.5.7.

Monitoring and reporting are described fully in Chapter 6, *Plan Implementation*. Monitoring and reporting costs cover the following items:

- Planning, conducting, analyzing, and reporting on monitoring of ecosystems, natural communities, and Covered Species.
- Planning, conducting, analyzing, and reporting on the effectiveness of conservation measures and habitat improvement (including restoration and/or rehabilitation) activities.
- Planning surveys to assess properties prior to land acquisition.

- Preconstruction surveys and construction monitoring, if needed, prior to implementing projects such as habitat restoration and/or rehabilitation.
- Research directed at management and conservation needs of the HCP.

It is assumed that Alliance staff will plan, coordinate, and oversee all compliance, monitoring, directed research, and adaptive management functions, while outside contractors will be selectively used as needed to conduct field surveys, collect and process monitoring data, and prepare field reports.

Contractor and Other Costs

Contractor costs for collecting monitoring data are based on the frequency and type of field surveys expected to be needed for effectiveness and compliance monitoring. Contracted surveys will be carried out on an assumed 5-year frequency interval for each of the following species categories: amphibians and reptiles, rare plant species, mammals, and bird species. Surveys of fish species will be carried out in-house by program staff and therefore do not have any additional contractor costs. Surveys will take place in year 1 and every 5 years thereafter. Including both the costs of the baseline survey and the costs of monitoring surveys every 5 years, total contractor survey costs are summarized in Table 7-17 and are expected to average $594,000 annually, or $2.97 million for every 5-year period. Survey type and frequency will ultimately be determined by the Comprehensive Adaptive Management and Monitoring Program for each Covered Species.

Table 7-17. Estimated Costs for Field Surveys Grouped by Similar Covered Species

Field Survey	Survey Costs Every 5-Year Period
Amphibians and Reptiles	$180,000
Plants	$16,000
Mammals	$94,000
Birds	$304,000
Fishes[1]	$0
Total Annual Cost	**$594,000**

[1] Fish surveys will be carried out by HCP Staff and are therefore covered under staff costs. To prevent double counting the costs are not included in this table.

Vegetation Mapping

The HCP Preserve System will require periodic vegetation mapping in order to monitor changes to Covered Species habitat. Vegetation mapping will require having LiDAR flown over the Conservation Areas, as well as collection of aerial imagery to support the periodic update of vegetation maps. Collection of LiDAR data is estimated to cost $45,000, based on Valley District's past experience. Collection of aerial imagery is estimated at $47,000, but costs will be split between the HCP and RPU at a 70/30 cost share. Accordingly, $33,000 of the total cost will fall on the HCP.

Staff time to conduct the field surveys for vegetation mapping and to digitize the information into the HCP GIS database is conservatively estimated to be $50,000 based on the consulting team's analysis.[9]

[9] Makela Mangrich -ICF Biologist, June 16, 2020.

It is estimated that vegetation mapping will be required every five years for the first five years, and 10 years thereafter, i.e. in years 0, 5, 10, and 15, 25, 35, 45. In addition, mapping will also be required after a large flooding event (defined as a 20-year recurrence interval event). For cost estimation purposes it is assumed that two additional mappings will be required after flooding events in years 20 and 30.

Table 7-18 summarizes the vegetation mapping costs.

Table 7-18. Vegetation Mapping Costs

	Year 0 (pre-permit)	Phase 1	Phase 2	Phase 3	Phase 4	Total
LiDAR	$45,000	$45,000	$45,000	$45,000	224000	$404,000
Aerial Imaging	$33,000	$33,000	$33,000	$33,000	165000	$297,000
Labor	$50,000	$50,000	$50,000	$50,000	250000	$450,000
Total	**$128,000**	**$128,000**	**$128,000**	**$128,000**	**$639,000**	**$1,151,000**

Summary of Monitoring and Reporting Cost Estimate

Table 7-19 summarizes the estimate for monitoring and reporting costs. Over the permit term, costs are estimated to total $7.7 million.

Table 7-19. Summary of Total Monitoring and Reporting Costs

	Year 0 (pre-permit)	Phase 1	Phase 2	Phase 3	Phase 4	Total
Contractor Surveys and Field Reports	$594,000	$594,000	$594,000	$594,000	$4,158,000	$6,534,000
Vegetation Mapping	$128,000	$128,000	$128,000	$128,000	$639,000	$1,151,000
Total[1]	**$722,000**	**$722,000**	**$722,000**	**$722,000**	**$4,797,000**	**$7,686,000**

[1] Note that total cost corresponds to total Monitoring and Reporting costs in Table 7-4. Numbers may not sum to total due to rounding.

7.5.6 Program Administration

Program administration costs involve the support of employees, facilities, equipment, and vehicles to operate the office of the Alliance, the Joint Powers Authority (JPA) that will be the Implementing Entity of the HCP and associated regulatory compliance programs. Program administration costs also include associated costs such as travel, legal, and financial administrative assistance. Program administration costs are estimated to be, on average, $1.3 million annually during the permit term. Some program administration costs will continue beyond the permit term. These post-permit administration costs are addressed in subsection 7.5.7, *Post-Permit Endowment*.

Staffing and Overhead

Employee costs comprise the annual salaries for program administration personnel. For the purposes of the cost estimate, it is assumed that the following positions would be staffed within the Upper Santa Ana River Sustainable Resource Alliance according to the roles described in Chapter 6. There are four full-time positions and three part-time positions. The four full-time positions that will support implementation of the HCP are:

- Executive Director/Principal Scientist
- HCP Program Manager/Lead Biologist
- Preserve System and Mitigation Reserve Program Manager
- GIS Analyst/Database Manager

Three additional part-time or seasonal positions may be required to meet the obligations of the incidental take permits (ITPs) and HCP. These positions are:

- Budget Analyst/Accountant (¾ time in Years 1–10 and ½ time thereafter)
- Senior Environmental Scientist (¾ time)
- Associate Environmental Scientist (½ time)

The annual salaries and associated overhead costs for these positions are allocated across the cost categories discussed above according to the amount of time each position is expected to devote to the different HCP functions. These allocations are shown in Table 7-20 for permit years 1–10 and in Table 7-21 for permit years 11–50. Overall, 25–30% of staff time is expected to be needed for general program administration, and the remainder will be devoted to program implementation functions. This split between general administration and program implementation functions is consistent with staffing allocations in other HCPs reviewed as part of the cost analysis.

Table 7-20. Staffing Allocation by Cost Category in Full-Time Equivalents, Permit Years 1–10

		Program Implementation Labor (FTEs)					
Staff Position	**Program Admin Labor (FTEs)**	**Tributaries Restoration**	**Fish Translocation**	**Terrestrial Habitat**	**Compliance & Monitoring**	**Preserve Management**	**Total FTEs**
Executive Director/Principal Scientist	0.50	0.10	0.05	0.15	0.15	0.05	1.00
HCP Program Manager/Lead Biologist	0.15	0.20	0.20	0.20	0.20	0.05	1.00
GIS Analyst/Database Manager	0.15	0.20	0.10	0.20	0.30	0.05	1.00
Preserve System and Mitigation Reserve Program Manager	0.20	0.15	0.05	0.15	0.20	0.25	1.00
Budget Analyst/Accountant	0.75	0.00	0.00	0.00	0.00	0.00	0.75
Senior Environmental Scientist	0.00	0.25	0.25	0.00	0.25	0.00	0.75
Associate Environmental Scientist	0.00	0.20	0.20	0.10	0.00	0.00	0.50
Total FTEs	**1.75**	**1.10**	**0.85**	**0.80**	**1.10**	**0.40**	**6.00**

Table 7-21. Staffing Allocation by Cost Category in Full-Time Equivalents, Permit Years 11–50

Staff Position	Program Admin Labor (FTEs)	Program Implementation Labor (FTEs)					Total FTEs
		Tributaries Restoration	Fish Translocation	Terrestrial Habitat	Compliance & Monitoring	Preserve Management	
Executive Director/Principal Scientist	0.50	0.10	0.05	0.15	0.15	0.05	1.00
HCP Program Manager/Lead Biologist	0.15	0.10	0.10	0.25	0.25	0.15	1.00
GIS Analyst/Database Manager	0.15	0.20	0.10	0.20	0.30	0.05	1.00
Preserve System and Mitigation Reserve Program Manager	0.20	0.10	0.05	0.15	0.25	0.25	1.00
Budget Analyst/Accountant	0.50	0.00	0.00	0.00	0.00	0.00	0.50
Senior Environmental Scientist	0.00	0.20	0.15	0.00	0.35	0.05	0.75
Associate Environmental Scientist	0.00	0.10	0.10	0.20	0.05	0.05	0.50
Total FTEs	**1.50**	**0.80**	**0.55**	**0.95**	**1.35**	**0.60**	**5.75**

Bureau of Labor Statistics (BLS) data on occupational wages in California were used to estimate annual salary costs for all positions other than the GIS Analyst (BLS 2020). In the case of the GIS Analyst, data from Transparent California was used to estimate the salary cost (Transparent California 2019), then inflated to 2020 dollars using BLS' Consumer Price Index. Table 7-22 shows the estimated base annual salary for each position. The salary percentile column in the table indicates the percentile of the reference position salary range used for the base salary estimate. Two positions are set to the 75th percentile of their reference salary range, reflecting the need to recruit senior and highly qualified candidates for these positions. The other three positions are set to the 50th percentile (median) of the reference salary range. Note that actual salary costs will depend on labor market conditions at the time of hiring and may differ from the values in the table.

Table 7-22. Base Annual Salary Cost Estimates

Staffing Position	BLS Code	BLS Title	Salary Percentile	Annual Salary ($/FTE)	Direct Labor Hours[2]	Direct Hourly Rate
Executive Director/ Principal Scientist	11-9121	Natural Science Manager	75th	$188,640	1,880	$100.34
HCP Program Manager/ Lead Biologist			50th	$160,040	1,880	$85.13
Preserve System and Mitigation Reserve Program Manager			50th	$160,040	1,880	$85.13
GIS Analyst/ Database Manager[1]	N/A	N/A	50th	$86,300	1,880	$45.90
Budget Analyst/ Accountant	13-2031	Budget Analyst	50th	$73,070	1,880	$38.87

Staffing Position	BLS Code	BLS Title	Salary Percentile	Annual Salary ($/FTE)	Direct Labor Hours[2]	Direct Hourly Rate
Senior Environmental Scientist	19-2041	Environmental Scientist	75th	$108,050	1,880	$57.47
Associate Environmental Scientist			50th	$83,770	1,880	$44.56

[1]GIS Analyst salary set to the 50th percentile for a sample of 153 California public sector GIS Analyst positions; data are from Transparent California 2019, and inflated to 2020 dollars using BLS Consumer Price Index.
[2]Direct labor hours exclude paid holiday, vacation, and sick time, which are assumed to average 200 hours per year (5 weeks).

A cost multiplier of 1.48 was used to estimate non-wage staffing costs, which include benefits, paid leave, insurance, retirement, and legally required benefits.[10] The overhead multiplier is based on 10 years of published national survey data on overhead rates for architectural, engineering, and environmental planning firms.

Multiplying the base salary costs in Table 7-22 by the overhead multiplier yields the fully burdened cost of each salaried position. The fully burdened annual salary costs are summarized in Table 7-23.

Table 7-23. Fully Burdened Annual Salary Cost Estimates

Staffing Position	Base Annual Salary ($/FTE)		Overhead Multiplier		Fully Burdened Annual Cost per FTE[1]
Executive Director/Principal Scientist	$188,640	x	1.48	=	$279,000
HCP Program Manager/Lead Biologist	$160,040	x	1.48	=	$237,000
Preserve Manager	$160,040	x	1.48	=	$237,000
GIS Analyst/Database Manager	$86,300	x	1.48	=	$128,000
Budget Analyst/Accountant	$73,070	x	1.48	=	$108,000
Senior Environmental Scientist	$108,050	x	1.48	=	$160,000
Associate Environmental Scientist	$83,770	x	1.48	=	$124,000

[1]Inclusive of direct and indirect labor expenses for primary and support staff and costs for space and utilities, office furniture, equipment, and general supplies.

Annual staffing and overhead costs are estimated by multiplying the fully burdened salary costs in Table 7-23 by the FTE allocations in Table 7-21 and Table 7-22. These costs are summarized in Table 7-24.

Table 7-24. Annual Staffing and Overhead Cost Estimate

	Phase 1	Phase 2	Phase 3	Phase 4	Total
Program Administration	$1,615,000	$1,615,000	$1,480,000	$10,360,000	$15,070,000
Restoration	$1,005,000	$1,005,000	$725,000	$5,075,000	$7,810,000

[10] This analysis uses average employer cost ratios for management, professional, and related positions, office and administrative support, and natural resources, construction, and maintenance. See: https://www.bls.gov/news.release/pdf/ecec.pdf

	Phase 1	Phase 2	Phase 3	Phase 4	Total
Fish Translocation	$755,000	$755,000	$495,000	$3,465,000	$5,470,000
Preserve Management	$1,270,000	$1,270,000	$1,580,000	$11,060,000	$15,180,000
Monitoring and Reporting	$1,075,000	$1,075,000	$1,305,000	$9,135,000	$12,590,000
Total	**$5,720,000**	**$5,720,000**	**$5,585,000**	**$39,095,000**	**$56,120,000**

Other Program Administration Allowances

In addition to staffing and overhead costs, the program administration cost estimate includes annual allowances for other anticipated expenditures, including vehicle use, travel, outside legal and accounting services, and public outreach. Allowances for each cost item are summarized in Table 7-25 and are based on a review of projected and incurred costs for these items by other HCPs.

Table 7-25. Annual Allowances for Other Program Administration Expenses

	Cost per Year	Cost per 5-Year Period
Vehicle/Mileage Reimbursement	$1,500	$7,500
Travel (non-vehicular)	$6,000	$30,000
Legal & Accounting	$133,000	$665,000
Public Relations/Outreach	$25,000	$125,000
Total	**$165,500**	**$827,500**

Summary of Program Administration Cost Estimate

Table 7-26 summarizes the program administration cost estimate. The estimated cost of program administration is $64.4 million over the life of the HCP, or from $6.4 to $6.5 million per 5-year period.

Table 7-26. Summary of HCP Program Administration Costs

	Phase 1	Phase 2	Phase 3	Phase 4	Total
Staff	$5,721,000	$5,721,000	$5,586,000	$39,102,000	$56,120,000
Vehicle/Mileage Allowance	$7,500	$7,500	$7,500	$52,500	$75,000
Travel	$30,000	$30,000	$30,000	$210,000	$300,000
Legal & Accounting	$665,000	$665,000	$665,000	$4,655,000	$6,650,000
Public Relations/ Outreach	$125,000	$125,000	$125,000	$875,000	$1,250,000
Total	$6,548,500	$6,548,500	$6,413,500	$44,894,500	$64,402,000

[1] Note that total cost corresponds to total Program Administration costs in Table 7-4. Numbers may not sum to total due to rounding.

7.5.7 Post-Permit Endowment

During the duration of the HCP permit, capital and operating costs of the program will be directly funded by the Permittee Agencies. As already noted, certain management and monitoring costs will continue after the permit expires. The purpose of the endowment will be to fund these post-permit costs in perpetuity. Post-permit costs are estimated to average $572,000 annually and are summarized in Table 7-27. Note that staffing costs are not included in the post-permit endowment costs because the JPA (Alliance) and JPA staff would no longer be needed after the permit expires. At that time Valley District will assume the responsibility for contracting qualified biologists and preserve management experts to conduct monitoring, management, and reporting in the post-permit period. The final calculation of post-permit costs includes a 3% contingency, bringing the annual cost to $589,000.

To account for real inflation over the life of the permit, this annual cost is inflated by 2% per year to estimate the amount that will be necessary to fund the program at the end of the permit term. The required endowment by the end of the permit term to fund these costs is $43.8 million (in 2020 dollars). It is assumed that the Permittee Agencies will pay into the endowment at the beginning of each year commencing in the first year of the permit and each year thereafter until the last year of the permit and that the endowment will be held and prudently managed by the San Bernardino Valley Conservation Trust[11] and will earn an annual real rate of return of 4% on average. Under these assumptions, the annual contribution rate to the endowment over the term of the permit is $276,000 (in 2020 dollars).

Table 7-27. Estimated Post-Permit Annual Costs

Post-Permit Cost Items	Assumptions	Average Annual Cost
SAR Microhabitat	Average annual replacement cost for SAR microhabitat structures, per Table 7-12	$45,000
Management and Maintenance	Average annual land stewardship and habitat management costs, per Table 7-17 and Table 7-18	$405,000
Monitoring and Reporting	Average annual monitoring and reporting costs, per Table 7-22	$119,000
Conservation Easement Compliance	Based on annual fees estimated by Center for Natural Lands Management staff	$3,000
Total		**$572,000**

7.5.8 Cost Uncertainties and Changed Circumstances

Due to cost uncertainties and the possibility of changed circumstances that could affect annual program requirements and expenditures, contingency values are included in total cost calculations. Restoration costs, including upland tributaries restoration, alluvial fan restoration, and microhabitat creation include the greatest contingency at 15% to account for the greater level of uncertainty in these costs. A contingency of 10% is applied to land acquisition. The remaining cost categories,

[11] The San Bernardino Valley Conservation Trust (Conservation Trust) will be charged with holding fee title to, or conservation easements covering, land secured as mitigation for Covered Activities. The Conservation Trust is a 501(c)(3) charitable corporation qualified to hold conservation easements, endowments and other forms of security in accordance with Section 815 et seq. of the California Government Code. Financial management of the Conservation Trust will be in accordance with the prudent investor standards set forth in the California Probate Code, and the overall activities of the Conservation Trust will be governed by SB 1094, codified at Sections 65965-98 of the California Government Code. The Conservation Trust has an independent board of directors and management separate from the managers of the HCP. It is anticipated that there will be some form of Memorandum of Agreement (MOA) or Memorandum of Understanding (MOU) between the Conservation Trust and the JPA establishing a long-term relationship for the purposes of plan compliance and implementation.

including administration and overhead, general maintenance, and monitoring all use a 3% contingency because their costs are reasonably certain over time. The average cost of the contingency is $225,000 annually.

7.6 Funding Sources and Assurances

The single joint ITP permit structure was determined to be the best arrangement to facilitate ongoing coordination among the Permittee Agencies. In particular, this structure will allow the Permittees to enter into enforceable arrangements to allocate operational and funding responsibilities, and rectify any occurrence of non-compliance by a Permittee Agency. For more details on the joint ITP arrangement, refer to Section 6.2*, HCP Permit Structure,* of this report.

The structure and organization of the JPA operating under the name of Upper Santa Ana River Sustainable Resources Alliance is described in Chapter 6, and will be executed between the Permittee Agencies prior to finalization of the HCP. The costs of the HCP will be borne by the Permittee Agencies in accordance with the Joint Powers Authority Agreement, and a separate "Participation and Financing Agreement" (PFA) that fully accounts for and assigns financial responsibility of the Alliance among the Permittee Agencies. The PFA will describe the financial responsibilities of each of the Permittee Agencies with respect to the HCP and the Alliance. The cost of plan implementation will be shared among the Permittee Agencies, based on a cost-sharing mechanism developed and approved by all agencies. The cost-sharing mechanism will account for impacts of the individual Covered Activity as well as both the financial and in-kind contributions by the Permittee Agencies.

Each of the Permittee Agencies will be fully responsible for any Covered Activity undertaken by that agency under the HCP and will be required to coordinate with the Alliance staff in order to ensure consistency of the Covered Activity with the Plan. Any cost resulting from non-compliance with the terms of the ITP by any Permittee Agency will be the responsibility of the non-complying Agency.

Chapter 8
Alternatives Considered but Rejected

Section 10 of the Federal Endangered Species Act (ESA) requires that a habitat conservation plan (HCP) describe alternatives to the proposed incidental take covered in the HCP and the reasons why each alternative was not selected. As part of the development of this HCP, multiple alternatives to the proposed taking were considered.

8.1 Evolution of the Proposed HCP

As the Upper Santa Ana River (SAR) HCP development process has evolved over the time so have the analytical scenarios used as the basis for the Upper SAR HCP. Previous HCP iterations included Covered Activities that resulted in greater impacts on species and the riverine system than were acceptable or likely to be permittable under the Federal and State ESAs. Preliminary impact analyses, including substantial hydrology modeling, led to the modifications to the Covered Activities to substantially reduce the potential biological and hydrological impacts resulting in the Covered Activities. Similarly, many iterations and additions to the conservation strategy led to substantial improvements in the measures to avoid and minimize take and the expected outcomes for each species covered by the HCP. The modifications resulted in reduced impact on the Santa Ana River and increased conservation values to species in a way that protects and enhances the ecological function of the system far more than earlier iterations of the HCP.

The largest change to the proposed Covered Activities was the modification of water reuse projects in order to reduce impacts on Santa Ana sucker and other aquatic species. In an early iteration of the HCP, the initial proposed versions of Covered Activities would have resulted in much larger reductions in baseflow in the Santa Ana River, and larger impacts on covered aquatic species, especially to the Santa Ana sucker and arroyo chub. Most notably, the initial round of hydrologic modeling demonstrated that the water reuse projects, as proposed, would have resulted in a reduction of effluent discharge into the Rialto Channel and Santa Ana River by more than 50%, and a 73% loss of suitable sucker habitat (i.e., areas with suitable water depth, velocity, and river bottom substrate) in the upper reach of the Santa Ana River and a 100% loss of suitable sucker habitat in the lower reach. Given the unacceptable potential impacts on the Santa Ana sucker and other aquatic species resulting from this scenario, the original proposed version for the Covered Activities was rejected as a viable alternative. Using the hydrologic and habitat suitability modeling as a guide to determine a minimum flow necessary to maintain occupied Santa Ana sucker habitat, the Permittee Agencies then developed new alternatives for the Covered Activities, making the water reuse projects smaller and less impactful. This resulted in a commitment to a minimum amount of baseflow to be discharged into the river by the wastewater treatment plants, which reduced potential impacts on the Santa Ana sucker and other aquatic species to a level that could still sustain healthy populations in the Santa Ana River and could be fully offset through the conservation strategy of the HCP.

The current set of Covered Activities in the Upper SAR HCP, as now proposed, was determined through the partnership and the collaborative efforts with the Permittee Agencies, Wildlife Agencies, and involved stakeholders. The complete HCP conservation strategy for all covered species was also developed through this collaborative partnership, and includes a comprehensive strategy for long-term protection, restoration, and conservation to manage the natural resources and species of the Upper SAR watershed in a way that ensures long-term ecological value to the region and species recovery.

Four alternatives were thoroughly considered as potentially viable options to this HCP. Those four alternatives and the reasons why each was not selected are described below.

8.2 Alternative 1: No Project

The No Project Alternative would include the future circumstances without the HCP Preserve System for the Upper SAR HCP and Section 10 Incidental Take Permit issued jointly to the Permittee Agencies for future implementation of the proposed Covered Activities, and would also include predictable actions by persons or entities if the HCP did not occur.

Under the No Project Alternative, Section 10 permit(s) would not be issued by the U.S. Fish and Wildlife Service (USFWS) for take of the proposed Covered Species through the Upper SAR HCP and there would be no implementation of the watershed-scale, coordinated conservation strategy as is committed to by the 11 Permittee Agencies for the Proposed Project. However, that is not to say that the individual water supply projects proposed by the various water agencies would not occur, rather the Permittee Agencies would likely pursue project-by-project incidental take permits from USFWS and the California Department of Fish and Wildlife (CDFW) for the take of listed species pursuant to the Federal and State ESAs associated with implementation of Covered Activities. Conservation would also be negotiated on a project-by-project basis with each Wildlife Agency in order to appropriately offset the impacts of each individual project. There would be no regional approach to developing holistic conservation measures that provide long-term species and ecosystem benefits. Covered Activities could be implemented individually, but without the proposed Upper SAR HCP incidental take permit and the regulatory assurances that go along with it. The water resources projects that would occur under the No Project Alternative are essentially the same list of proposed future water infrastructure projects (the Covered Activities in this HCP); however, a more difficult and lengthy permitting process would likely occur if conducted individually and without any assurances that permits would be granted for any of the Covered Activities.

Impacts on species could occur under the No Project Alternative, including construction or expansion of water infrastructure or water facilities, if most or all the Covered Activities were implemented. However, the Permittee Agencies would need to seek incidental take permits through single-project HCPs (Section 10 of ESA), or through Section 7 consultation with USFWS, and through individual 2081 permits under the State ESA. Due to the difficulty in securing permits for all Covered Activities individually, it is also possible that some Covered Activities would be too costly to permit and fewer Covered Activities would be implemented, resulting in fewer impacts and incidental take under the No Project Alternative than would occur under this HCP.

While the impacts could be less than covered under this HCP if Permittee Agencies are not able to obtain take permits individually, there would also be less strategic conservation and less assurances for coordinated implementation of conservation measures. These added uncertainties adversely affect the ability of the Permittee Agencies to achieve their public mission to capture and store local water supply, which then makes the region more reliant on imported water from Northern California.

Another potential consequence of the No Project Alternative is the loss of the Upper SAR HCP as a regulatory mechanism to provide incidental take permit coverage for Santa Ana sucker translocation activities and other conservation measures, including the establishment of the HCP Preserve System. To date, no other mechanism has been identified that could provide long-term coverage to entities downstream of translocated sucker populations, such as Southern California Edison. USFWS has stated that establishment of new populations in the upper watershed is a requirement for the recovery of Santa Ana sucker. The Upper SAR HCP has the rare ability to enable the translocation effort to establish these new populations.

8.3 Alternative 2: Phase 1 Covered Activities Only

This alternative would result in an HCP that would provide incidental take coverage for only those high priority, near-term Covered Activities that are identified in Phase 1 (Years 0–5) of the Upper SAR HCP. Implementation of the Phase 1 Covered Activities would include construction and operation of fewer Covered Activities than are identified in the Upper SAR HCP.

This alternative would also only implement the Phase 1 conservation actions because mitigation is directly tied to impacts. While preservation and habitat restoration would occur during Phase 1, in proportion to Phase 1 impacts, the remainder of the proposed HCP Preserve System and Tributaries Restoration projects would not be implemented as part of the HCP regional conservation strategy. The full suite of mitigation lands and conservation actions is needed in order to attain a sustainable preserve system that incorporates the many habitat needs of species, including habitat for breeding, foraging, and connectivity. Potential impacts from Covered Activities would be reduced if only Phase 1 projects are implemented; however, it is likely that some or all future projects not included as Covered Activities under this alternative would be pursued individually by Permittee Agencies on a project-by project basis because they are key to long-term reliability of the regional water supply. If pursued independently, future development of the Covered Activities identified in Phases 2 through 4 of the Upper SAR HCP would likely result in a more difficult and lengthy permitting process. There would also be no assurances that permits would be issued for any of these Covered Activities. Conservation would also be negotiated on a project-by-project basis with each Wildlife Agency in order to appropriately offset the impacts of each individual project, which would not benefit from the regional approach and holistic conservation measures that provide long-term species and ecosystem benefits.

8.4 Alternative 3: Reduced Impacts on Santa Ana Sucker

This alternative would assume that water reuse and recycling projects that are most impactful to the Santa Ana sucker would not have permit coverage through the Upper SAR HCP, and this alternative would result in less baseflow reduction and reduced impacts on aquatic habitat in the Santa Ana River. Covered Activities that reduce baseflow have the most potential impact on Santa Ana sucker and other aquatic habitat, and therefore also require the greatest amount of conservation measures to offset their impacts. Water reuse projects like the SBMWD Recycled Water Project (WD.1) and the Rialto Wastewater Diversion and Reuse Project (Rial.1) would be substantially modified to reduce the impacts on Santa Ana sucker or would not be included as Covered Activities at all, and permit coverage for those water infrastructure projects would not be provided through the HCP.

While the reduced impacts on base flow in this alternative could likely eliminate the need for the Santa Ana Sucker Translocation project, some or all of the Tributaries Restoration projects, and many other enhancements in the Santa Ana River, there is an argument to be made that these measures to improve the long-term viability of the Santa Ana sucker population are needed now, regardless of Covered Activity implementation. Even with the current level of water in the Santa Ana River, the Santa Ana sucker population is under constant threat from rapid changes in instream flow, lack of high-quality habitat, no redundancy of other populations centers in the river system, and therefore frequent threat of extirpation. With this alternative, it is likely that many Santa Ana sucker recovery plan goals would not be achieved, or would not be implemented in a coordinated, watershed-scale manner.

8.5 Alternative 4: Reduced Impacts on San Bernardino Kangaroo Rat

Like the other alternatives, this alternative would involve implementation of fewer Covered Activities, specifically stormflow diversion projects, that are included in the Upper SAR HCP. This alternative would not include projects that divert storm flow into new or expanded recharge basins, nor would it include activities to operate and maintain new diversion structures or activities related to construction of new recharge basins and associated diversions. These projects could include substantial reduction or elimination of the Mill Creek Diversion Project (CD.1, Phase 1), Santa Ana Levee and Cuttle Weir Diversion (CD.2, Phase 1), and the Active Recharge Projects (VD.2).

The elimination of these new stormflow diversion projects would eliminate the associated additional impacts on San Bernardino kangaroo rat (SBKR) in the alluvial fan sage scrub where most of these projects are proposed. The anticipated impacts from these new water capture projects create the need for a SBKR habitat conservation, restoration, and long-term protection as offsetting mitigation for these projects. If these Covered Activities are eliminated from the HCP as a part of this alternative, then these conservation measures for SBKR would not be required as mitigation.

Without the proposed conservation measures for SBKR, some USFWS recovery goals would likely not be achieved by the HCP. Loss of a funding source and regulatory mechanism like the Upper SAR HCP to provide long-term conservation actions would make the overall recovery of SBKR more difficult. This alternative would result in fewer impacts on SBKR habitat (primarily in lower-quality SBKR habitat areas) but also result in reduced high-quality conservation measures for SBKR. Permittee Agencies could still pursue many of the same future activities by seeking individual incidental take permits for each of these Covered Activities. However, future development associated with these Covered Activities would likely result in a more difficult and lengthy permitting process. There would also be no assurances that permits would be granted for any of these Covered Activities.

Chapter 9
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Chapter 10
Glossary

Adaptive Management – A decision process that promotes flexible decision making, which can be adjusted in the face of uncertainties as outcomes from management actions and other events are better understood. Careful monitoring of these outcomes advances scientific understanding and allows for the adjustment of policies and/or operations as part of an interactive learning process. Adaptive management also recognizes the importance of natural variability in contributing to ecological resilience and productivity.

Air/Vacuum Valve – A valve used to vent the air that can become trapped in any pipeline conveying fluid.

Biological Goals – Broad, guiding principles based on conservation needs of the Covered Species developed through the Habitat Conservation Plan (HCP) process.

Biological Objectives – Conservation targets or desired future conditions designed to achieve Biological Goals of an HCP.

Biological Opinion – The document stating the opinion of the U.S. Fish and Wildlife Service (USFWS) and/or the National Oceanic and Atmospheric Administration's National Marine Fisheries Service as to whether or not a federal action is likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of critical habitat (50 Code of Federal Regulations [CFR] 402.02). A Biological Opinion is one of the decision documents of a consultation under Section 7 of the federal Endangered Species Act (FESA)**.**

Blow-Off – Dewatering of pipes that typically includes a point source of high velocity flow.

California Endangered Species Act – California Fish and Game Code Section 2050 et seq., including all regulations promulgated pursuant to that Act. The California Endangered Species Act (CESA) prohibits the California Department of Fish and Wildlife (CDFW) from authorizing any Incidental *take* of a State-listed threatened or endangered species if that take would jeopardize the continued existence of the species; all impacts on State-listed species must be fully mitigated.

California Environmental Quality Act – California Public Resources Code (PRC) 21000 21177 et seq., including all regulations promulgated pursuant to that Act. The California Environmental Quality Act (CEQA) requires State and local agencies to assess environmental impacts of proposed projects, to disclose those impacts to decision makers, and to reduce environmental impacts of a proposed project to the greatest extent practicable.

Changed Circumstances – Changes affecting a species or geographic area covered by an HCP that can reasonably be anticipated and planned for by HCP Permittees and USFWS.

Channel Pattern – Characterization of the geomorphic state of streams, including channel stability, texture and volume of sediment supply, stream gradient (sloe), and mode of sediment transport.

Clean Water Act – The Clean Water Act (33 United States Code [USC] Section 1251 et seq. [1972]) regulates discharges of pollutants into jurisdictional waters of the United States. Section 404 of the Clean Water Act regulates the discharge of dredged or fill material into jurisdictional waters, including wetlands. Section 401 of the Clean Water Act requires certification that permits for discharge into Waters of the United States comply with water quality standards. Section 402 controls direct discharges into navigable waters through the issuance of National Pollutant Discharge Elimination System (NPDES) permits.

Clearing – The removal of natural vegetation by any means, including brushing and grubbing.

Conservation Actions – Any actions taken to preserve, manage, and monitor land for conservation of Covered Species that is suitable for the species and configured and connected such that the Covered Species can maintain sustainable populations within the HCP Preserve.

Conservation Easement – Any limitation in a deed, will, or other instrument in the form of an easement, restriction, covenant, or condition, which is or has been executed on behalf of the owner of the land subject to such easement, and is binding upon successive owners of such land, and the purpose of which is to retain land predominantly in its natural, scenic, historical, agricultural, forested, or open-space condition. (California Civil Code 815)

Conserve – The terms *conserve, conserving,* and *conservation* refer to the implementation of preservation, enhancement, management, and monitoring methods that are necessary to maintain and enhance natural resources to benefit a Covered Species habitat and population, and contribute to the species recovery as described by the biological goals and objectives, and the conservation actions of the HCP. The conservation actions are implemented within the HCP Preserve System.

Covered Activities – Activities in the *Planning Area* undertaken by the Permittees and covered by the authorizations for incidental take. Covered activities include projects and Operations and Maintenance (O&M). Projects are well-defined actions that occur once in a discrete location. O&M activities are actions that occur repeatedly in one area or over a wide area (e.g., bank stabilization, storm-damage repair, maintenance of roads and facilities).

Covered Species – Those species within the HCP that will be adequately conserved through implementation of the HCP.

Critical Habitat – An area designated by USFWS pursuant to FESA. Critical habitat are those areas, whether occupied by a listed species or not, that are determined to be essential for the conservation and management of the species.

Direct Effects – The direct or immediate effects of the project on the species or its habitats (FESA definition).

Disturbed Land – Land that has been significantly modified by previous, legally authorized human activity, but continues to retain a soil substrate is considered disturbed land. This includes areas that have been graded, repeatedly cleared for fuel management purposes, and/or have experienced recurring use resulting in compacted soils and minimal potential for natural revegetation (e.g., dirt parking lots, incised trails).

Dry-Weather Flows – The flow of water in streams during the dry season when it does not typically rain (May–October). This is characterized by the average September flow in the Planning Area, when streamflows are typically the lowest.

Emergency – An event or situation that poses considerable risk to human health and safety. This risk includes, but is not strictly limited to, loss of human life, property damage, or air and water contamination threatening human health and safety.

Endangered Species – A species listed as endangered under FESA or CESA. FESA defines an endangered species as any species which is in danger of extinction throughout all or a significant portion of its range (FESA Section 3(6)). CESA defines an endangered species as a native species or subspecies of bird, mammal, fish, amphibian, reptile, or plant that is in serious danger of becoming extinct throughout all, or a significant portion, of its range due to one or more causes, including loss of habitat, change in habitat, overexploitation, predation, competition, or disease (California Fish and Game Code Section 2062)

Endangered Species Act – The Federal Endangered Species Act of 1973, as amended (16 USC 1531 et seq.), includes all regulations promulgated pursuant to FESA. The purpose of FESA is to "protect and recover imperiled species and the ecosystems upon which they depend." The California Endangered Species Act (Fish and Game Code, Chapter 1.5, Sections 2050–2115.5) conserves and protects plant and animal species at risk of extinction as identified by the California Fish and Game Commission.

Enhancement – The modification of natural resources through management actions to improve their function. Enhancement actions include invasive species removal, removal of an identified threat to the resource, management of the water sources to support habitat function, sediment management, and management of human visitation. Enhancement results in a modest gain in habitat function

Establishment (Creation) – The manipulation of the physical, chemical, or biological characteristics present to develop a habitat type or aquatic resource that did not previously exist in that space. Establishment results in a gain in both area and function.

Existing Conditions – The current physical conditions (e.g., geographic location, topography, geology, soils, climate, hydrology, and geomorphology) and biological environment of the Planning Area.

Force Main – A principal conduit (as in a sewer system) through which water is pumped as distinguished from one through which it flows by gravity.

Fully Protected Species – Those species listed in Sections 3511 (Fully Protected Birds), 4700 (Fully Protected Mammals), 5050 (Fully Protected Reptiles and Amphibians), and 5515 (Fully Protected Fish) of the California Fish and Game Code that may not be taken or possessed at any time and for which no licenses or permits may be issued for their take except for collecting these species for necessary scientific research and relocation of the bird species for the protection of livestock or as permitted under the Natural Community Conservation Planning Act (NCCPA) (California Fish and Game Code Section 2800 et seq.).

Gabion – A rock-filled cage used for erosion control, bank stabilization, and other civil engineering applications. As part of Covered Activities described in the HCP, gabions would be installed in-stream to create localized areas of scour intended to expose gravel substrate.

Geographic Information Systems – Computer-based mapping technology that manipulates geographic data in digital layers and enables one to conduct a wide array of environmental analyses.

Grading – Any excavating or filling or combination thereof, including the land in its excavated or filled condition according to a county's Grading Ordinance.

Groundwater Recharge – Activities related to construction of new structures associated with diversions, O&M of existing and new diversion structures for groundwater recharge, activities related to construction of new recharge basins, and O&M of existing and new recharge basins.

Grubbing – The removal of natural vegetation by any means, including removal of the root system.

Habitat Connectivity – The degree to which a landscape facilitates or impedes natural ecological processes, such as animal movement or seed dispersal.

Habitat Improvement, Management, and Monitoring – Activities that support the restoration and/or rehabilitation, and maintenance of habitat values in the Planning Area, including species surveys, monitoring, research, and adaptive management activities.

Harm – An act that actually kills or injures wildlife, which may include significant habitat modification.

HCP Preserve – The HCP Preserve is defined as that area that will be conserved, managed, and monitored under the direction and responsibility of the Upper SAR HCP Joint Powers Authority (JPA). It includes the areas acquired or established conservation easements for preservation and the areas restored to improve habitat conditions for Covered Species. The HCP Preserve System management and monitoring will be overseen by the JPA.

Hydrologic Period – The duration of time that a feature is inundated for in any given year.

Incidental Take Permit – The permit granting take of listed species provided such take is incidental to and not the purpose of the carrying out of an otherwise lawful activity. For purposes of the Section 10(a)(1)(B) permit, *incidental take* refers solely to species other than plant species.

Increasing Groundwater – See *Rising Groundwater*.

Indirect Effects – Those effects that are caused by or will result from the proposed action and are later in time, but are still reasonably certain to occur (FESA definition).

Joint Powers Authority – A legally created entity that allows two or more public agencies to jointly exercise common powers. The Joint Exercise of Powers Act (California Government Code Section 6500) governs Joint Powers Authorities.

Jurisdictional Waters – State and federally regulated wetlands and other waterbodies. Federally regulated waters are defined under the Clean Water Act as *waters of the United States*. Waters of the State are defined under the *Porter-Cologne Water Quality Control Act* to include any surface or groundwater within the State of California.

Lake or Streambed Alteration Agreement – Under California Fish and Game Code Section 1600 et seq. CDFW has the authority to regulate work that will "substantially divert or obstruct the natural flow of, or substantially change or use any material from the bed, channel, or bank of, any river, stream, or lake, or deposit or dispose of debris, waste, or other material containing crumbled, flaked, or ground pavement where it may pass into any river, stream, or lake."

Linkage – An area of land that supports or contributes to the long-term movement of wildlife and genetic exchange by providing live-in habitat that connects to other habitat areas, including agricultural lands that contribute to wildlife movement.

Management Actions – Those actions taken to improve and maintain the suitability of the habitat for a Covered Species by restoring or enhancing the habitat, or by reducing, removing, or preventing threats that may degrade the habitat (e.g., invasive plant infestations or trespass).

Migratory Bird Treaty Act – The Federal Migratory Bird Treaty Act (MBTA) (16 USC 701 et seq.), including all regulations promulgated pursuant to the Act. The MBTA implements four international conservation treaties and is intended to ensure the sustainability of populations of migratory birds. The MBTA prohibits take of migratory birds, parts, nests, or eggs thereof. *Take*, as defined under the MBTA includes "pursue, hunt, shoot, would, kill, trap, capture, or collect."

Mitigation – The conservation actions that offset the impacts of taking on the Covered Species.

Monitoring Actions – Those actions that are taken to track the status and trend of Covered Species populations and of their habitats within the HCP Preserve System. Monitoring actions will be conducted within an adaptive management context so that monitoring results can be linked to management actions to inform and improve the efficacy and efficiency of management actions through time.

National Environmental Policy Act – The National Environmental Policy Act of 1969 (NEPA) (42 USC Section 4321 et seq.) requires federal agencies to assess the environmental effects of federal actions and provide the public a mechanism for public participation in making decisions.

National Historic Preservation Act – The National Historic Preservation Act (NHPA) (16 USC 470 et seq.) is intended to preserve historic and archaeological sites. Section 106 of the NHPA requires federal agencies to consider the effects of proposed actions on properties eligible for inclusion in the National Register of Historic Places.

Nationwide Permit – Under Section 404(e) of the Clean Water Act, the U.S. Army Corps of Engineers can issue general permits, called Nationwide Permits, that authorize activities that have only minimal individual and cumulative adverse environmental effects.

No Surprises Rule – The purpose of USFWS' No Surprises Rule is to provide assurances to non-Federal landowners participating in habitat conservation planning under FESA that no additional land restrictions or financial compensation will be required for species adequately covered by a properly implemented HCP, in light of unforeseen circumstances, without the consent of the Permittee.

Operations and Maintenance – Activities that occur repeatedly in one location and/or in many locations over a wide area periodically and include minor construction, earth moving, or vegetation clearing activities to infrastructure**.**

Permanent Impacts – Impacts that occur when existing habitat is permanently replaced by the construction or implementation of a Covered Activity.

Permit Area – The area covered by the Incidental Take Permit, which falls within but does not include the entire Planning Area, is referred to as the Permit Area. The Upper SAR HCP Permit Area is the geographic area where the impacts of the Covered Activities are expected to occur and is depicted as the ownership, easements, and areas of O&M where all Covered Activities are located within natural habitats. The Permit Area also includes the HCP Preserve System so that the Incidental Take Permits cover the potential take associated with habitat mitigation, management, and monitoring.

Permittee Agency – The agencies that will receive incidental take coverage through implementation of the HCP (also called the *Permittees*).

Physical and Biological Features – This term replaces "primary constituent elements" in the context of critical habitat. Physical and biological features of proposed or designated critical habitat are those features that are essential to the conservation of a species, including, but not limited to: (1) space for individual and population growth, and for normal behavior; (2) food, water, air, light, minerals, or other nutritional or physiological requirements; (3) cover or shelter; (4) sites for breeding, reproduction, rearing of offspring, germination, or seed dispersal; (5) habitats that are protected from disturbance or are representative of the historic geographic and ecological distribution of a species.

Planning Area – The geographic area containing all Covered Activities and a sufficient additional area to adequately assess impacts and ensure that sufficient mitigation opportunities are available. For this HCP, the Planning Area includes portions of the Santa Ana River watershed in San Bernardino and Riverside Counties in California.

Population – An interbreeding group of individuals of the same species. The geographical limits of a population should be delineated as most appropriate for that species depending on its mobility, method of reproduction, and known distribution. Portions of a population will generally be determined based on the number of individuals; however, *area* may be the appropriate basis for some species.

Porter-Cologne Water Quality Control Act – This act governs the water quality regulation in California. It applies to surface water, groundwater, wetlands, and sources of pollution. The Act establishes Regional Water Quality Control Boards in the State Water Resources Control Board that are authorized to manage the quality of ground and surface water.

Preservation – The permanent protection and management of natural resources by setting aside or acquiring land in fee title or protected by a permanent conservation easement.

Preserve – The terms *preserve*, *preserving*, and *preservation* refer to the preservation of natural resources by setting aside or acquiring land in fee title or land protected by a permanent conservation easement. In limited circumstances, publicly owned lands that cannot be legally restricted will be considered as preservation when they will be managed under the terms of the HCP Preserve System.

Preserve Management – The actions taken to maintain, improve, and monitor a conservation or restoration site to ensure that it is in the providing the desired functions and maintained in the condition required to provide the habitat for HCP Covered Species. *Management* will include necessary measures such as trash removal, maintenance of required infrastructure (signs, gates, water conveyance structures), and access. *Monitoring* will include both monitoring of the condition of the property and the species and habitats.

Preserve System – The HCP Preserve System is composed of Conservation Areas that will be restored, rehabilitated, conserved, and/or managed as mitigation for Covered Activities through implementation of the HCP.

Projects – Well-defined actions that occur once in a discrete location (e.g., construction of new facilities, infrastructure development, capital improvement projects).

Qualified Biologist – An individual with the appropriate level of knowledge and training to conduct surveys or monitoring for a particular species or habitat. For some listed species, a qualified biologist must hold a current Section 10(a)(1)A recovery permit that authorizes the individual to conduct surveys, monitor, or assess habitat conditions.

Recharge Basin – A depression in the ground with permeable soils where surface waters are put for the express purpose of increasing the quantity (recharging) of groundwater.

Reestablishment – The manipulation of the physical, chemical, or biological characteristics of a site with the intent of returning historic functions to a former habitat. Reestablishment results in rebuilding a former habitat, and in a gain in both habitat area and functions.

Rehabilitation – Rehabilitation includes activities that improve habitat conditions of a degraded site, for example through nonnative plant management.

Restoration – Restoration includes more intensive activities than rehabilitation, such as site manipulation, with the goal of rebuilding/expanding habitat and re-instating ecological processes and services, where possible. Restoration is inclusive of reestablishment of functions in former habitats that no longer function as such, and rehabilitation of degraded and low functioning habitats. Restoration results in a gain of area or function. The term *restoration* is inclusive of *restoration, establishment*, and *reestablishment*.

Rising Groundwater – Occurs when the depth to groundwater decreases and the level of groundwater becomes closer to the surface of the ground than it was previously.

Sandbox – A settling pond that allows sediment and silt to drop out of the water before entering water flowlines.

Section 10(a)(1)(A) Permit – A permit issued by USFWS under Section 10(a)(1)(A) of FESA that allows take as part of activities intended to foster recovery of a listed species. Typical permitted activities include scientific research involving abundance surveys, presence/absence surveys, genetic research, relocations, telemetry surveys, and capture or marking.

Section 10(a)(1)(B) Permit – A permit issued by USFWS under Section 10(a)(1)(B) of FESA (16 USC 1539(a)(1)(B)) to allow the incidental take of Covered Species, to the extent take of such species is otherwise prohibited under Section 9 of FESA. *Take* under FESA does not apply to plant species, and take of listed plant species is not prohibited under FESA or authorized under a Section 10(a)(1)(B) permit. However, plant species adequately conserved by this HCP are listed in the 10(a)(1)(B) permit in recognition of the conservation measures and benefits provided for them under the HCP and receive assurances pursuant to USFWS' *No Surprises Rule*.

Section 1600 – Section 1600 of the California Fish and Game Code regulates alterations to permanent or intermittent stream courses.

Section 2081 – Section 2081(b) of CESA authorizes CDFW to allow, by permit, the take of an endangered, threatened, or candidate species, provided permit issuance criteria are met.

Section 7 – Section 7(a)(2) of FESA (16 USC 1536 (a)(2)) requires that any federal agency that permits, licenses, funds, or otherwise authorizes activities that may affect species listed under FESA consult with USFWS to ensure that its actions will not jeopardize the continued existence of any listed species or adversely modify the designated critical habitat of a listed species.

Sensitive Species – Species that meet any of the following criteria: (1) those species that are included on generally accepted and documented lists of plants and animals of endangered, threatened, candidate, or of special concern by the federal government or State of California; (2) narrow endemic species or sensitive plant species (as defined herein); or (3) those species that meet the definition of “rare or endangered species” under Section 15380 of the CEQA Guidelines.

Solar Energy Development – Activities related to the construction and maintenance of new solar facilities.

Suitable Habitat – An area that meets the habitat needs of a species and is likely to be utilized by that species at some point within a 5-year period. If an area appears to contain the appropriate elements for a species and is within dispersal distance of known populations and without substantial barriers, it should be considered suitable unless demonstrated otherwise through appropriate and adequate field surveys.

Take – Refers to the meaning provided by FESA and the California Fish and Game Code, including relevant regulations and case law. Under FESA, *take* is defined as to “harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct (16 USC 1532(19)) and *harm* has been further defined to “include any act which actually kills or injures fish or wildlife” including “significant habitat modification or degradation that significantly impairs essential behavioral patterns of fish or wildlife” (40 *Federal Register* 44412 and 46 *Federal Register* 54748).

Take Authorization – Permit authority granted through a Section 10(a)(1)(B) permit pursuant to FESA, a Section 2081 permit granted pursuant to CESA, or a Section 2835 permit pursuant to the NCCPA.

Temporary Impacts – Impacts that result in removal of habitat, but for which, following completion of the activity, the habitat is then restored or allowed to regrow and recover habitat value for Covered Species.

Threatened Species – A species listed as *threatened* under FESA or CESA that is likely to become *endangered* in the foreseeable future.

Unforeseen Circumstances – Changes in circumstances affecting a species or geographic area covered by the HCP that could not reasonably have been anticipated by HCP Permittees or USFWS at the time of the HCP's negotiation and development, which result in a substantial and adverse change in the status of the Covered Species.

Urban Runoff – Water that enters the system through storm drains. Urban runoff is generally caused by overwatering of landscaped areas, or other extraneous flows from residential, commercial, and industrial areas.

Viable – Capable of maintaining normal ecosystem functions over the long term that sustain a full suite of native or naturalized species without intensive direct human intervention.

Water Reuse Projects – Activities related to projects associated with water reuse, including construction of new water treatment plants and associated facilities, and O&M of existing and new water treatment plants and associated facilities.

Wells and Water Conveyance Infrastructure – Activities related to the creation of new wells and associated development (pipelines, access roads, reservoirs, bridges) and the O&M of this infrastructure and associated development.

Wet-Weather Flows – The flow of water in streams during the wet season when this region typically receives most of its rain (November–April). This is characterized by the average March flow in the Planning Area, when streamflows are typically the highest.

Width-Depth Ratio – Measurement of the ratio of a channel's wetted width to flow depth for a given flood stage.

Wildlife Corridor – A specific route that is used for movement and migration of species. A wildlife corridor may be different from a linkage because it represents a smaller or narrower avenue for movement.

Chapter 11
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Appendix A

Covered Activities Permit Matrix

Table A-1. Expected Regulatory Permits and Environmental Compliances Needed by Each Covered Activity

Covered Activity ID	Federal ESA (USFWS Sec. 10 HCP)	State ESA (CDFW 2081 or NCCP)	Federal Clean Water Act (USACE 404)	State Water Quality Certification and Waste Discharge Requirements (RWQCB 401 and Porter Cologne Water Quality Control Act)	State Lake and Streambed Alteration (CDFW 1602)	State Wastewater Change of Use Petition (1211 SWRCB)	Federal Rivers and Harbors Act (USACE 408)	National Historic Preservation Act (NHPA 106 Compliance)	California Environmental Quality Control Act (CEQA Compliance)
CD.1	•	--	•	•	•	--	•	•	•
CD.2	•	--	•	•	•	--	•	•	•
EV.1	•	--	--	--	•	•	--	•	•
EV.2	•	•	•	•	•	--	--	•	•
EV.3	•	•	•	•	•	--	--	•	•
EV.4.01–4.03	•	•	•	•	•	•	•	•	•
EV.5	•	•	--	--	--	--	--	•	•
IEUA.1.01–1.13	•	•	•	•	•	--	--	•	•
IEUA.2	•	--	•	•	•	--	--	•	•
IEUA.3.01–3.06	•	--	--	--	--	--	--	•	•
IEUA.4	•	•	--	--	--	•	--	•	•
Met.1	•	--	--	--	--	--	--	•	•
Met.2	•	•	•	•	•	--	--	•	•
Met.3	•	•	•	•	•	--	--	•	•
OCWD.1	•	--	--	--	--	--	--	•	•
Rial.1	•	•	•	•	•	•	--	•	•
RPU.1	•	•	•	•	•	--	--	•	•
RPU.2	•	•	•	•	•	--	--	•	•
RPU.3	•	•	•	•	•	--	--	•	•
RPU.4	•	•	•	•	•	--	--	•	•
RPU.5	•	•	•	•	•	--	•	•	•
RPU.6	•	--	--	--	--	--	--	•	•
RPU.7	•	•	--	--	•	--	--	•	•
RPU.8	•	•	•	•	•	--	--	•	•
RPU.9	•	--	--	--	--	•	--	•	•
RPU.10	•	•	•	•	•	--	--	•	•

Covered Activity ID	Federal ESA (USFWS Sec. 10 HCP)	State ESA (CDFW 2081 or NCCP)	Federal Clean Water Act (USACE 404)	State Water Quality Certification and Waste Discharge Requirements (RWQCB 401 and Porter Cologne Water Quality Control Act)	State Lake and Streambed Alteration (CDFW 1602)	State Wastewater Change of Use Petition (1211 SWRCB)	Federal Rivers and Harbors Act (USACE 408)	National Historic Preservation Act (NHPA 106 Compliance)	California Environmental Quality Control Act (CEQA Compliance)
RPU.11	•					--	--	•	•
RPU.12	•	•	•	•	•	--	--	•	•
RPU.13	•	--	--	--	--	--	--	•	•
RPU.14	•	•	•	•	•	--	--	•	•
RPU.15	•	•	•	•	•	--	--	•	•
Conserv.1	•	•	•	•	•	--	--	•	•
Conserv.2	•	•	•	•	•	--	--	•	•
Conserv.3	•	•	•	•	•	--	--	•	•
Conserv.4	•	•	•	•	•	--	--	•	•
Conserv.5	•	•	•	•	•	--	--	•	•
Conserv.6	•	•	•	•	•	--	--	•	•
Conserv.7	•	•	•	•	•	--	--	•	•
Conserv.8	•	•	•	•	•	--	--	•	•
Conserv.9	•	•	•	•	•	--	--	•	•
Conserv.10	•	•	•	•	•	--	--	•	•
Conserv.11	•	•	•	•	•	--	--	•	•
Conserv.12	•	•	--	--	•	--	--	•	•
Conserv.13	•	•	--	--	•	--	--	•	•
Conserv.14	•	•	•	•	•	--	--	•	•
Conserv.15	•	•	--	--	--	--	--	•	•
Conserv.16	•	•	--	--	--	--	--	•	•
Conserv.17	•	•	--	--	--	--	--	•	•
Conserv.18	•	•	--	--	--	--	--	•	•
Conserv.19	•	•	--	--	•	--	--	•	•
Conserv.20	•	•	--	--	•	--	--	•	•
VD.1	•	--	--	--	--	--	•	•	•
VD.2.02–2.14	•	•	•	•	•	--	•	•	•
VD.3	•	•	•	•	•	--	--	•	•

Covered Activity ID	Federal ESA (USFWS Sec. 10 HCP)	State ESA (CDFW 2081 or NCCP)	Federal Clean Water Act (USACE 404)	State Water Quality Certification and Waste Discharge Requirements (RWQCB 401 and Porter Cologne Water Quality Control Act)	State Lake and Streambed Alteration (CDFW 1602)	State Wastewater Change of Use Petition (1211 SWRCB)	Federal Rivers and Harbors Act (USACE 408)	National Historic Preservation Act (NHPA 106 Compliance)	California Environmental Quality Control Act (CEQA Compliance)
VD.4	•	•	•	•	•	--	--	•	•
WD.1	•	•	•	•	•	•	--	•	•
WD.2	•	•	•	•	•	--	--	•	•
WD.3	•	--	•	•	•	--	--	•	•
WD.4	•	--	--	--	--	--	--	•	•
WD.5	•	•	•	•	•	--	--	•	•
West.1	•	•	•	•	•	--	--	•	•
West.2	•	•	•	•	•	--	--	•	•
West.3	•	--	--	--	--	--	--	•	•
West.4	•	--	•	•	•	--	--	•	•
West.5	•	--	•	•	•	•	--	•	•
West.6	•	--	•	•	•	--	--	•	•
West.7	•	•	•	•	•	--	--	•	•
West.8	•	•	•	•	•	--	--	•	•
West.9	•	--	•	•	•	--	--	•	•
West.10	•	--	--	--	--	--	--	•	•
WV.1	•	•	•	•	•	--	--	•	•
WV.2	•	•	•	•	•	--	--	•	•
WV.3	•	--	--	--	--	--	--	•	•
WV.4	•	--	•	•	•	•	--	•	•
WV.5	•	•	--	--	--	--	--	•	•
WV.6	•	•	•	•	•	--	--	•	•

ESA = Endangered Species Act; CDFW = California Department of Fish and Wildlife; HCP = Habitat Conservation Plan; RWQCB = Regional Water Quality Control Board; SWRCB – State Water Resources Control Board; USACE = U.S. Army Corps of Engineers.

Conservation District (CD) = San Bernardino Valley Water Conservation District, East Valley (EV) = East Valley Water District; IEUA = Inland Empire Utilities Agency; Metropolitan (Met) = Metropolitan Water District of Southern California; OCWD = Orange County Water District; Rialto (Rial) = Rialto Utility Authority; RPU = Riverside Public Utilities; SBMWD = San Bernardino Municipal Water Department; SCE = Southern California Edison; Valley District (VD) = San Bernardino Valley Municipal Water District; Water Department (WD) = San Bernardino Municipal Water Department; West Valley (WV) = West Valley Water District; Western (West.) = Western Municipal Water District of Riverside County.

Appendix B

Selection of Baseline Period for Hydrology Analysis

Appendix B
Selection of Baseline Period for Hydrology Analysis

Hydrology Data Sources

Multiple hydrology data sources, both measured and modeled, have been analyzed for the Habitat Conservation Plan's (HCP's) baseline hydrology analysis. The primary sources include the measured U.S. Geological Survey (USGS) flow data and the modeled mean daily flow data (hydrology fconsultant sources: Wildermuth, and Geoscience). As part of our hydrology analysis we have performed statistical analysis on the flow data, including exceedance analysis, to determine how often flows of a given magnitude occur on a particular stream reach. In order to compare the modeling data sources with each other it is necessary to use the same base period of analysis for each data set. This is important not only for analyzing the differences between the modeled flow data for the same location, but also to enable use of all of the available data sets (some geographic areas are only covered by one or two of the data sets, yet comparisons need to be made across the entire study area). The periods of record among the data sources vary. For example, the period of record for the USGS data includes records for some gages extending back into the 1800s, while other gages have only been installed and collecting data for less than 20 years.

The modeled flow data (provided by Geoscience and Wildermuth) are based on precipitation records, which are used as input into rainfall-runoff- routing models. The Geoscience model is based on precipitation records from 1934–2008 and the Wildermuth model on precipitation records from 1950–1999. It should be noted that while the precipitation records for the modeled data extend back to 1934 and 1950, respectively, the land use conditions used in each model are based on recent land use patterns. Land use conditions are used in the models to determine how the precipitation translates into runoff and are based on recent conditions at the time each model was developed. Geoscience's Active Recharge Project model assumes 2005 land use conditions, and Wildermuth's Wasteload Allocation Model uses 2000 land use conditions. The modeled data uses a historic precipitation record to include a mixture of years that were drier and wetter than the long-term average to determine how the runoff volumes generated from the precipitation vary with water year type. In other words, the 1934 data from the Geoscience model should be interpreted as the amount of runoff that would occur under 2005 year land use conditions if the precipitation patterns from 1934 occurred in 2005.

Precipitation Analysis

The precipitation data and cumulative precipitation departure graph described below were prepared and provided by Farid Boushaki, Ph.D., P.E., with Riverside Public Utilities. Precipitation records from the San Bernardino Hospital Gage are available for 122 years spanning the period 1892–2014 (water years 1893–2014, see Figure B-1). The annual average precipitation over the 1892–2004 period is 16.0 inches. The annual minimum and maximum over this same period is 2.4 and 36.6 inches, respectively (calculated using water years that begin October 1 and end September 30). For the purposes of this analysis the rainfall record at this gage is assumed to be representative of climatic conditions for the area included in the Santa Ana River HCP with the acknowledgement that absolute precipitation values vary widely throughout the region. The gage does not account for variability in annual snowpack.

Cumulative precipitation departure analysis is a technique used by hydrologists to characterize trends in precipitation time-series data. The cumulative departure line in Figure B-1 is calculated by calculating the difference between a given year's total annual rainfall and the long term average then cumulatively adding each successive year's precipitation departure to the running total from the previous year. A downward trend in the cumulative departure line indicates drier than average conditions whereas an upward trending line indicates wetter than average conditions. Wet and dry classifications are labeled at the bottom of Figure B-1. These classifications are based on interpretation of the precipitation trends. The data indicate the last wet trend occurred for 8 years from 1991–1998, which transitioned into a dry period that has lasted from 1999 to the most recent data in 2014. Although there have been individual years with wetter than average rainfall in the 1999–2014 period (i.e., 2004, 2005, and 2010), the overall pattern is drier than average conditions. Viewed historically, the 1892–1904 period had a greater negative cumulative departure than the 1999–2014 period[1]. Only by analyzing future years of data beyond 2014 will we be able to determine that if the current dry period continues it could cause the trend of net deficit to equal or exceed the deficit obtained in 1904.

Selection of Hydrology Base Period

The cumulative precipitation departure analysis was used to select a base period from the precipitation record that includes a mixture of years that is representative of the long-term average. The base period must begin no earlier than 1950 and end no later than 1999 in order to compare the Geoscience and Wildermuth data. For the reasons described below, we recommend selecting a 25-year base period that begins in 1966 and ends in 1990 as this period allows use of both modeling data sets and includes a dry and wet period that is representative of the long-term conditions measured at the precipitation gage.

Table B-1 compares precipitation statistics of the 1966–1990 period with the gage record of 1892–2014 and the past 20 years of 1995–2014. The annual average precipitation over the recommended base period of 1966–1990 is 16.4 inches, which is similar to the 1892–2014 period (16.0 inches) and slightly higher than the 1995–2014 period (14.0 inches). The percentage of the years with annual rainfall less than the long-term average over the 1966-1990 period is 60%, which is similar to both the 1892-2014 period (56%) and 1995-2014 period (65%). The minimum annual rainfall that occurred in the 1966-1990 period is 8.9 inches. This is higher than both the 1892-2014 and 1995-2014 periods since the lowest annual precipitation ever recorded at the gage of 2.4 inches occurred in 2001.

Figure B-2 shows frequency distributions of mean annual precipitation for both the 1892-2014 period and 1966–1990 period. The red columns indicate the actual number of years of precipitation within the frequency bin interval and the black line curve represents how the frequency distribution would look if the data had a normal distribution around the mean. The intent of showing the normal distribution curve on the graphs is to highlight that the actual distribution frequency is skewed and not normally distributed. The distribution curves were used to designate Dry, Intermediate, and Wet water year type classifications specific to this study. ICF designated Dry years have less than 11 inches of annual precipitation, Intermediate years have 11-19 inches, and Wet years have more than 19 inches of annual precipitation. Table B-2 compares water year type statistics for the 1892–

2014, 1995–2014, and 1966–1990 periods. The results show strong similarity in the percentage of years designated in each of the three water year types between the long term period of 1892–2014 and the selected baseline period of 1966–1990.

In summary, the precipitation record from the recommended base period of 1966–1990 is similar to both the long-term and previous 20-year records in terms of the annual average rainfall and distribution of wetter and drier than average years.

Table B-1. Statistical Comparison of Annual Precipitation for Different Hydrologic Periods

Period	Years In Period	Annual Average (inches)	% Years Below Annual Average	% Years Above Annual Average	Annual Minimum Over Period (inches)	Annual Maximum Over Period (inches)
1892–2014	122	16.0	56	44	2.4	36.6
1950–1999	50	16.0	64	36	6.0	34.4
1966–1990	25	16.4	60	40	8.9	32.4
1995–2014	20	14.0	65	35	2.4	32.7

Table B-2. Comparison of Water Year Type Characteristics Between the 1892–2014, 1995–2014, and 1966–1990 Periods

Period	Water Year Type	Rainfall (inches)	# Years	% Years	Average Rainfall (inches)
1892–2014	Dry	<11	30	24%	8.7
	Intermediate	11–19	62	50%	14.7
	Wet	>19	31	25%	25.4
1995–2014	Dry	<11	9	45%	7.7
	Intermediate	11–19	7	35%	14.4
	Wet	>19	4	20%	27.6
1966–1990	Dry	<11	6	24%	9.8
	Intermediate	11–19	14	56%	14.7
	Wet	>19	5	20%	29.3

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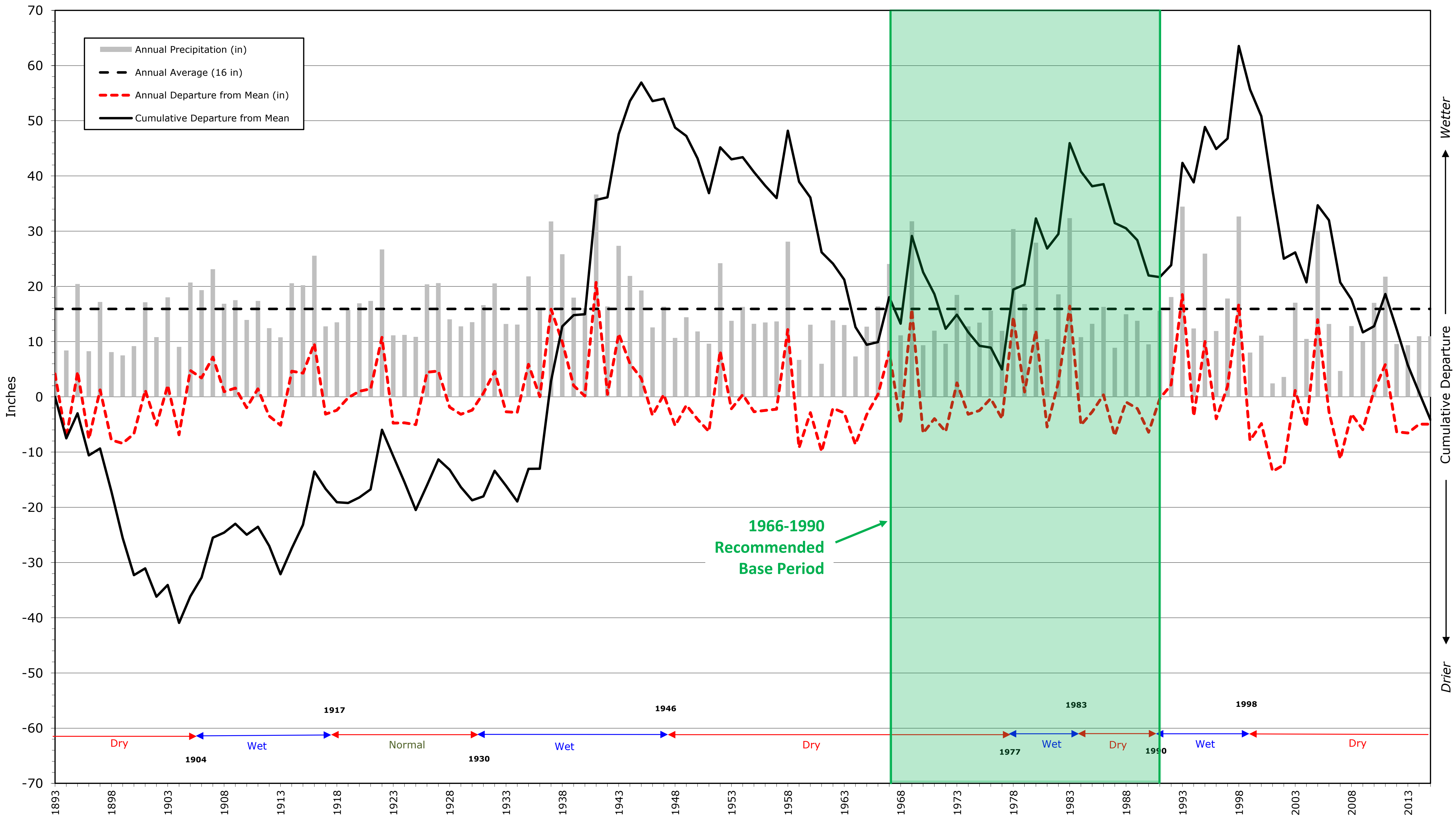

Source: Farid Boushaki, Riverside Public Utilities.

Figure B-1. San Bernardino Hospital Gage Cumulative Precipitation Departure Analysis from 1892–2014

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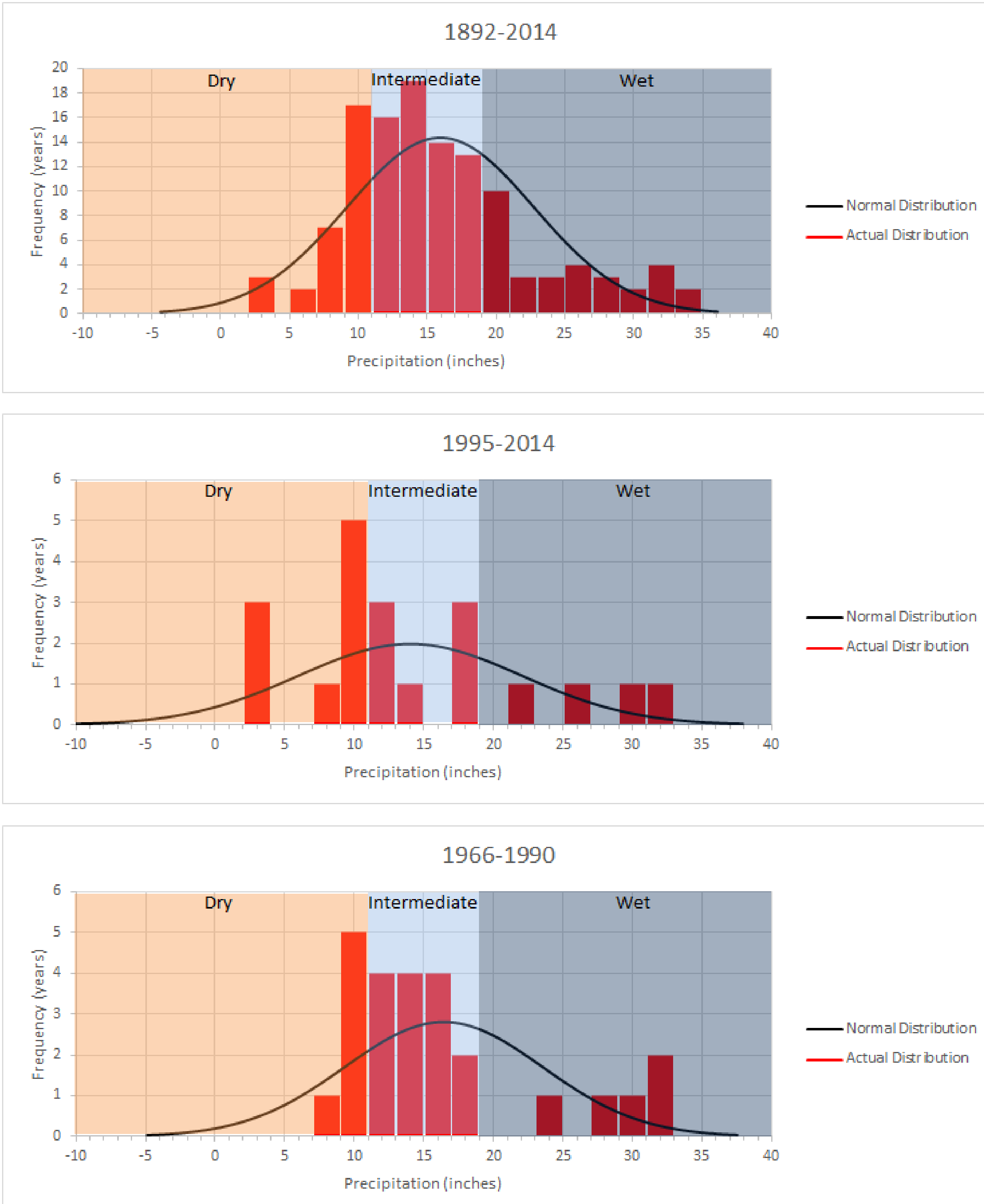

Figure B-2. Frequency Distribution Curves and Water Year Type Designations for 1892–2014, 1995–2014, and 1966–1990 Periods Based on San Bernardino Hospital Gage Precipitation Data

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Appendix C

Monthly and Annual Flows for Exceedance Probabilities at Existing Conditions and with Covered Activities

			All Flows in Cubic Feet per Second												
Drainage	**Node**	**Exceedance**	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**	**Annual**
Borea Daley Creek	SE-26	0.95	0.24	0.34	0.40	0.42	0.40	0.38	0.34	0.31	0.29	0.27	0.25	0.24	0.27
Borea Daley Creek	SE-26	0.75	0.35	0.51	0.58	0.50	0.46	0.42	0.38	0.34	0.32	0.29	0.27	0.29	0.35
Borea Daley Creek	SE-26	0.50	0.67	0.80	0.98	0.80	0.57	0.47	0.41	0.37	0.34	0.31	0.32	0.39	0.46
Borea Daley Creek	SE-26	0.25	1.14	1.84	3.39	1.79	1.16	0.73	0.53	0.44	0.40	0.40	0.41	0.79	0.83
Borea Daley Creek	SE-26	0.05	18.03	20.33	15.71	4.67	2.70	1.84	0.94	0.73	0.71	0.83	8.16	10.94	5.52
Borea Daley Creek	SE-26	mean	3.09	4.23	3.72	1.82	1.06	0.68	0.50	0.56	0.61	0.67	1.57	2.25	1.72
Borea Daley Creek	SE-25	0.95	0.01	0.01	0.04	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Borea Daley Creek	SE-25	0.75	0.02	0.09	0.11	0.06	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Borea Daley Creek	SE-25	0.50	0.17	0.21	0.30	0.21	0.07	0.02	0.01	0.01	0.01	0.01	0.01	0.02	0.03
Borea Daley Creek	SE-25	0.25	0.36	0.84	0.85	0.84	0.40	0.14	0.04	0.01	0.01	0.01	0.02	0.14	0.20
Borea Daley Creek	SE-25	0.05	1.24	2.67	3.17	1.91	1.13	0.84	0.18	0.09	0.07	0.10	0.39	0.86	1.23
Borea Daley Creek	SE-25	mean	0.46	1.12	1.05	0.53	0.30	0.13	0.04	0.03	0.02	0.03	0.08	0.25	0.33
Borea Daley Creek	SE-24	0.95	0.00	0.00	0.03	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Borea Daley Creek	SE-24	0.75	0.01	0.07	0.10	0.05	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Borea Daley Creek	SE-24	0.50	0.15	0.19	0.26	0.19	0.06	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.02
Borea Daley Creek	SE-24	0.25	0.30	0.81	0.81	0.81	0.39	0.13	0.03	0.00	0.00	0.00	0.01	0.10	0.17
Borea Daley Creek	SE-24	0.05	0.83	2.56	2.92	1.82	1.07	0.81	0.17	0.07	0.05	0.05	0.18	0.81	1.00
Borea Daley Creek	SE-24	mean	0.38	1.02	0.96	0.50	0.28	0.12	0.03	0.01	0.01	0.01	0.03	0.19	0.29
Cable Creek	NW-17	0.95	0.08	0.14	0.15	0.14	0.12	0.10	0.08	0.08	0.07	0.07	0.08	0.08	0.08
Cable Creek	NW-17	0.75	0.17	0.22	0.26	0.20	0.16	0.13	0.11	0.09	0.09	0.08	0.09	0.12	0.12
Cable Creek	NW-17	0.50	0.31	0.40	0.60	0.39	0.24	0.17	0.13	0.12	0.11	0.11	0.13	0.20	0.20
Cable Creek	NW-17	0.25	1.34	2.45	7.63	2.87	0.62	0.34	0.24	0.19	0.20	0.19	0.26	0.65	0.51
Cable Creek	NW-17	0.05	44.19	87.97	76.26	26.70	12.12	2.63	0.68	0.51	0.47	0.81	8.90	22.67	20.48
Cable Creek	NW-17	mean	9.55	21.21	17.16	5.43	2.29	0.52	0.23	0.55	0.69	0.71	3.08	5.56	5.50
Cable Creek	NW-16	0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cable Creek	NW-16	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cable Creek	NW-16	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cable Creek	NW-16	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cable Creek	NW-16	0.05	0.39	17.45	12.66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cable Creek	NW-16	mean	2.62	7.50	4.67	0.27	0.00	0.00	0.00	0.06	0.08	0.05	0.27	1.26	1.37
Cable Creek	NW-13	0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cable Creek	NW-13	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cable Creek	NW-13	0.50	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cable Creek	NW-13	0.25	0.03	4.25	6.76	4.88	0.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cable Creek	NW-13	0.05	13.03	34.70	31.05	15.95	7.02	0.83	0.00	0.00	0.00	0.00	0.47	7.12	10.68
Cable Creek	NW-13	mean	3.92	10.31	8.91	3.45	1.18	0.12	0.00	0.06	0.09	0.08	0.52	2.02	2.52
Cable Creek	NW-12	0.95	0.17	0.49	1.28	0.78	0.50	0.35	0.27	0.21	0.18	0.17	0.16	0.16	0.18
Cable Creek	NW-12	0.75	0.61	2.06	2.79	2.00	1.18	0.67	0.43	0.30	0.23	0.20	0.19	0.24	0.35
Cable Creek	NW-12	0.50	3.39	4.23	5.45	4.46	2.33	1.05	0.60	0.40	0.31	0.26	0.29	0.57	1.03
Cable Creek	NW-12	0.25	5.55	10.07	12.28	10.94	6.45	3.14	1.31	0.76	0.56	0.43	0.60	2.66	3.85
Cable Creek	NW-12	0.05	17.03	38.32	35.84	21.46	12.79	6.71	3.08	1.60	1.66	1.95	5.10	12.36	16.07
Cable Creek	NW-12	mean	6.89	14.00	13.08	7.35	4.25	2.12	1.02	0.67	0.60	0.55	1.27	3.65	4.57
Cajon Wash	NW-19	0.95	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Cajon Wash	NW-19	0.75	0.01	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Cajon Wash	NW-19	0.50	0.02	0.03	0.04	0.03	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02

			All Flows in Cubic Feet per Second												
Drainage	**Node**	**Exceedance**	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**	**Annual**
Cajon Wash	NW-19	0.25	0.07	0.11	0.45	0.12	0.06	0.03	0.02	0.02	0.02	0.02	0.02	0.04	0.04
Cajon Wash	NW-19	0.05	10.74	37.25	32.85	5.63	1.54	0.17	0.08	0.05	0.04	0.04	0.78	3.46	3.24
Cajon Wash	NW-19	mean	6.80	16.66	10.01	1.19	0.31	0.04	0.02	0.19	0.37	0.20	1.54	3.08	3.30
Cajon Wash	NW-18	0.95	0.02	0.03	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.02	0.02	0.02
Cajon Wash	NW-18	0.75	0.04	0.06	0.10	0.05	0.04	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Cajon Wash	NW-18	0.50	0.14	0.19	0.23	0.17	0.07	0.04	0.03	0.02	0.03	0.03	0.03	0.05	0.05
Cajon Wash	NW-18	0.25	0.53	1.18	2.19	1.64	0.71	0.19	0.06	0.05	0.06	0.13	0.12	0.25	0.29
Cajon Wash	NW-18	0.05	11.43	32.59	31.11	16.07	10.25	3.47	1.70	0.89	0.58	0.28	1.18	3.83	8.41
Cajon Wash	NW-18	mean	4.23	8.00	7.51	2.55	1.68	0.66	0.28	0.20	0.37	0.15	1.09	1.97	2.36
Chino Creek	NCH16	0.95	40.00	36.90	32.10	25.60	22.00	12.50	14.60	12.20	14.60	19.80	25.30	39.20	12.30
Chino Creek	NCH16	0.75	40.00	36.90	32.10	25.70	22.10	12.70	14.60	12.20	14.70	20.00	25.30	39.20	14.70
Chino Creek	NCH16	0.50	40.00	36.90	32.70	26.00	22.20	12.90	14.60	12.30	14.80	20.10	25.30	39.20	25.30
Chino Creek	NCH16	0.25	70.80	95.50	104.35	35.50	22.30	13.10	14.70	12.40	15.00	20.20	29.50	55.75	39.20
Chino Creek	NCH16	0.05	1954.91	1572.10	1091.87	264.61	37.52	13.40	14.80	12.40	38.09	60.00	749.17	1079.09	418.05
Chino Creek	NCH16	mean	336.76	324.46	265.91	73.23	33.36	13.99	15.13	19.34	31.42	38.08	157.60	216.44	126.29
Chino Creek	NCH12	0.95	13.50	15.30	13.80	13.90	10.10	6.50	6.60	4.70	3.50	5.10	6.70	9.00	3.60
Chino Creek	NCH12	0.75	13.50	15.30	13.80	13.90	10.10	6.50	6.60	4.70	3.50	5.10	6.70	9.00	6.50
Chino Creek	NCH12	0.50	13.50	15.30	13.80	13.90	10.10	6.60	6.60	4.70	3.60	5.20	6.70	9.00	9.00
Chino Creek	NCH12	0.25	17.40	16.40	17.50	14.00	10.10	6.60	6.60	4.70	3.60	5.20	6.70	9.00	13.90
Chino Creek	NCH12	0.05	955.29	866.93	561.05	119.69	11.19	6.60	6.60	4.80	9.94	23.97	450.63	506.85	197.75
Chino Creek	NCH12	mean	148.39	151.08	119.29	35.18	15.51	7.62	6.86	9.04	13.45	15.32	75.82	95.65	57.33
Chino Creek	NCH11	0.95	13.50	15.30	13.80	13.90	10.10	6.50	6.60	4.70	3.50	5.10	6.70	9.00	3.60
Chino Creek	NCH11	0.75	13.50	15.30	13.80	13.90	10.10	6.50	6.60	4.70	3.50	5.10	6.70	9.00	6.50
Chino Creek	NCH11	0.50	13.50	15.30	13.80	13.90	10.10	6.60	6.60	4.70	3.60	5.20	6.70	9.00	9.00
Chino Creek	NCH11	0.25	17.10	16.18	17.00	14.00	10.10	6.60	6.60	4.70	3.60	5.20	6.70	9.00	13.80
Chino Creek	NCH11	0.05	776.39	708.45	481.87	105.09	11.05	6.60	6.60	4.80	9.26	19.22	386.20	439.51	174.65
Chino Creek	NCH11	mean	125.78	128.89	102.11	32.16	14.73	7.61	6.82	8.52	12.27	13.64	63.95	81.08	49.43
Chino Creek	NCH10	0.95	5.10	7.60	8.70	10.30	6.20	5.10	6.10	4.20	2.70	2.00	1.90	2.00	1.90
Chino Creek	NCH10	0.75	5.10	7.60	8.70	10.40	6.20	5.10	6.10	4.20	2.80	2.00	1.90	2.00	2.80
Chino Creek	NCH10	0.50	5.10	7.60	8.70	10.40	6.20	5.20	6.10	4.30	2.80	2.10	1.90	2.00	5.20
Chino Creek	NCH10	0.25	8.30	8.28	11.85	10.40	6.20	5.20	6.10	4.30	2.80	2.10	1.90	2.00	8.60
Chino Creek	NCH10	0.05	608.42	587.80	398.68	88.75	7.15	5.20	6.20	4.30	8.16	15.49	314.55	371.04	140.05
Chino Creek	NCH10	mean	99.69	103.35	83.47	26.22	10.31	6.19	6.30	7.78	10.49	9.25	49.66	62.58	39.31
Chino Creek	NCH09	0.95	5.10	7.60	8.70	10.30	6.20	5.10	6.10	4.20	2.70	2.00	1.90	2.00	1.90
Chino Creek	NCH09	0.75	5.10	7.60	8.70	10.40	6.20	5.10	6.10	4.20	2.80	2.00	1.90	2.00	2.80
Chino Creek	NCH09	0.50	5.10	7.60	8.70	10.40	6.20	5.20	6.10	4.30	2.80	2.10	1.90	2.00	5.20
Chino Creek	NCH09	0.25	7.95	8.28	11.75	10.40	6.20	5.20	6.10	4.30	2.80	2.10	1.90	2.00	8.55
Chino Creek	NCH09	0.05	559.59	558.20	372.19	85.02	7.15	5.20	6.20	4.30	8.10	13.79	285.34	348.13	131.25
Chino Creek	NCH09	mean	92.73	96.34	78.11	25.21	10.06	6.18	6.29	7.63	9.99	8.64	45.67	57.93	36.78
City Creek	SE-41	0.95	0.41	0.82	1.24	0.56	0.50	0.39	0.34	0.31	0.29	0.29	0.33	0.37	0.33
City Creek	SE-41	0.75	2.55	3.52	3.82	2.98	1.24	0.54	0.41	0.35	0.34	0.36	0.42	0.66	0.46
City Creek	SE-41	0.50	5.50	6.36	7.53	5.87	3.54	1.06	0.49	0.42	0.40	0.45	0.81	3.26	2.35
City Creek	SE-41	0.25	9.69	15.28	26.38	19.64	9.49	3.44	1.08	0.59	0.77	2.01	3.79	7.83	6.96
City Creek	SE-41	0.05	49.91	114.15	147.92	59.10	31.67	16.36	9.46	6.84	5.30	6.06	18.40	33.84	41.15
City Creek	SE-41	mean	20.56	44.25	36.82	15.50	8.38	4.02	2.19	1.68	1.65	1.87	5.60	11.78	12.69

			All Flows in Cubic Feet per Second												
Drainage	**Node**	**Exceedance**	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**	**Annual**
City Creek	SE-39	0.95	0.17	0.45	0.89	0.18	0.13	0.04	0.01	0.01	0.01	0.02	0.08	0.12	0.02
City Creek	SE-39	0.75	2.08	2.93	3.30	2.36	0.77	0.12	0.04	0.03	0.03	0.09	0.15	0.35	0.13
City Creek	SE-39	0.50	4.87	5.74	6.64	5.24	3.02	0.59	0.10	0.08	0.08	0.14	0.47	2.72	1.85
City Creek	SE-39	0.25	8.43	13.71	22.37	17.43	8.77	2.96	0.58	0.17	0.26	1.39	3.28	6.91	6.23
City Creek	SE-39	0.05	34.20	111.02	140.86	55.82	29.63	15.14	8.77	6.11	4.66	5.28	12.52	23.59	35.95
City Creek	SE-39	mean	18.29	41.61	34.36	14.19	7.57	3.45	1.72	1.16	1.10	1.27	4.27	10.03	11.42
City Creek	SE-37	0.95	2.20	2.81	3.27	2.30	1.70	0.50	0.10	0.10	0.10	0.20	1.00	1.60	0.20
City Creek	SE-37	0.75	4.40	5.21	5.51	4.71	3.11	1.50	0.50	0.30	0.40	1.10	2.00	2.80	1.70
City Creek	SE-37	0.50	7.11	7.92	9.21	7.42	5.32	3.00	1.30	0.99	1.00	1.89	2.90	4.82	4.20
City Creek	SE-37	0.25	12.04	17.94	30.52	23.18	13.01	5.22	2.91	2.30	2.61	3.53	5.61	9.82	8.61
City Creek	SE-37	0.05	41.75	116.85	146.76	63.36	38.09	20.09	13.02	8.51	6.92	7.52	15.01	32.28	43.38
City Creek	SE-37	mean	21.18	44.69	38.05	18.10	10.95	5.82	3.21	2.26	2.28	2.87	6.46	12.75	13.89
City Creek Channel	SE-52	0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
City Creek Channel	SE-52	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
City Creek Channel	SE-52	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
City Creek Channel	SE-52	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
City Creek Channel	SE-52	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
City Creek Channel	SE-52	mean	0.21	0.39	0.14	0.00	0.00	0.00	0.00	0.05	0.05	0.04	0.11	0.22	0.10
City Creek Channel	SE-51	0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
City Creek Channel	SE-51	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
City Creek Channel	SE-51	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
City Creek Channel	SE-51	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
City Creek Channel	SE-51	0.05	0.01	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
City Creek Channel	SE-51	mean	0.18	0.28	0.12	0.00	0.00	0.00	0.00	0.03	0.03	0.03	0.10	0.17	0.08
City Creek Channel	SE-50	0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
City Creek Channel	SE-50	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
City Creek Channel	SE-50	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
City Creek Channel	SE-50	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
City Creek Channel	SE-50	0.05	0.07	0.12	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
City Creek Channel	SE-50	mean	0.18	0.25	0.12	0.01	0.00	0.00	0.00	0.03	0.03	0.03	0.10	0.15	0.07
Cucamonga Creek	NCC19	0.95	24.00	18.90	16.40	10.00	10.10	4.00	6.30	5.50	8.80	12.50	16.00	27.40	4.40
Cucamonga Creek	NCC19	0.75	24.00	18.90	16.40	10.10	10.20	4.10	6.30	5.50	8.80	12.60	16.00	27.40	8.70
Cucamonga Creek	NCC19	0.50	24.00	18.90	16.60	10.30	10.30	4.30	6.30	5.60	8.90	12.70	16.00	27.40	12.70
Cucamonga Creek	NCC19	0.25	40.10	46.58	71.35	16.33	10.40	4.40	6.40	5.60	9.10	12.80	18.18	34.55	24.00
Cucamonga Creek	NCC19	0.05	937.92	654.50	534.66	139.44	20.00	4.56	6.50	5.70	12.23	28.63	316.13	434.42	188.55
Cucamonga Creek	NCC19	mean	177.46	162.03	138.31	35.30	15.81	4.34	6.55	8.16	15.27	20.11	75.26	112.93	63.90
Cucamonga Creek	NCC18	0.95	24.00	18.90	16.40	10.00	10.10	4.00	6.30	5.50	8.80	12.50	16.00	27.40	4.40
Cucamonga Creek	NCC18	0.75	24.00	18.90	16.40	10.10	10.20	4.10	6.30	5.50	8.80	12.60	16.00	27.40	8.70
Cucamonga Creek	NCC18	0.50	24.00	18.90	16.60	10.30	10.30	4.30	6.30	5.60	8.90	12.70	16.00	27.40	12.70
Cucamonga Creek	NCC18	0.25	40.05	45.65	71.35	16.33	10.40	4.40	6.40	5.60	9.10	12.80	18.18	34.55	24.00
Cucamonga Creek	NCC18	0.05	872.10	645.43	531.56	139.11	20.00	4.50	6.50	5.70	12.23	28.60	302.95	429.42	185.10
Cucamonga Creek	NCC18	mean	173.44	157.69	135.23	34.96	15.75	4.34	6.55	8.08	15.15	19.97	73.50	110.67	62.57
Day Creek	NDY19	0.95	0.00	0.00	0.00	0.00	0.10	0.10	0.17	0.20	0.00	0.00	0.00	0.00	0.00
Day Creek	NDY19	0.75	0.10	0.10	0.00	0.30	0.20	0.30	0.20	0.20	0.10	0.00	0.00	0.00	0.20
Day Creek	NDY19	0.50	1.80	2.70	3.10	0.90	0.40	0.30	0.30	0.30	0.20	0.10	0.30	1.20	0.30

			All Flows in Cubic Feet per Second												
Drainage	**Node**	**Exceedance**	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**	**Annual**
Day Creek	NDY19	0.25	15.70	21.50	24.05	3.50	0.70	0.50	0.30	0.30	0.30	0.70	4.48	7.50	2.20
Day Creek	NDY19	0.05	256.14	199.25	153.03	40.30	3.36	1.16	0.50	1.43	4.31	7.54	95.17	126.29	73.05
Day Creek	NDY19	mean	58.57	53.36	42.77	8.72	2.08	0.48	0.36	1.41	2.25	2.84	21.22	30.87	18.60
Devil Canyon Creek	NW-11	0.95	0.05	0.08	0.09	0.09	0.08	0.07	0.06	0.06	0.05	0.05	0.05	0.05	0.05
Devil Canyon Creek	NW-11	0.75	0.08	0.11	0.12	0.11	0.09	0.08	0.07	0.06	0.06	0.05	0.06	0.07	0.07
Devil Canyon Creek	NW-11	0.50	0.14	0.16	0.20	0.15	0.12	0.10	0.07	0.07	0.06	0.06	0.07	0.10	0.10
Devil Canyon Creek	NW-11	0.25	0.62	1.41	5.55	1.89	0.21	0.14	0.09	0.08	0.08	0.08	0.10	0.24	0.17
Devil Canyon Creek	NW-11	0.05	35.00	56.12	55.94	24.95	10.65	1.70	0.18	0.14	0.17	0.37	6.06	17.92	16.79
Devil Canyon Creek	NW-11	mean	5.84	12.37	11.13	4.42	1.88	0.30	0.09	0.33	0.42	0.44	2.23	3.47	3.53
Devil Canyon Creek	NW-10	0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Devil Canyon Creek	NW-10	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Devil Canyon Creek	NW-10	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Devil Canyon Creek	NW-10	0.25	0.08	0.84	4.91	1.49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Devil Canyon Creek	NW-10	0.05	27.96	51.01	52.65	24.28	10.27	1.48	0.00	0.00	0.00	0.00	4.41	13.77	14.53
Devil Canyon Creek	NW-10	mean	5.05	11.48	10.33	4.04	1.70	0.18	0.00	0.20	0.28	0.27	1.78	2.86	3.14
Devil Canyon Creek	NW-9	0.95	0.26	0.31	0.38	0.30	0.28	0.25	0.22	0.19	0.17	0.15	0.14	0.15	0.17
Devil Canyon Creek	NW-9	0.75	1.25	1.20	1.16	0.80	0.49	0.33	0.27	0.23	0.20	0.18	0.22	0.29	0.33
Devil Canyon Creek	NW-9	0.50	2.29	3.24	3.99	2.75	1.68	0.65	0.73	0.45	0.37	0.33	0.69	1.87	1.12
Devil Canyon Creek	NW-9	0.25	4.95	6.64	10.90	7.36	3.52	2.23	1.61	1.05	1.03	1.12	1.89	3.93	3.03
Devil Canyon Creek	NW-9	0.05	36.55	56.04	59.04	30.11	15.97	7.22	3.40	2.13	2.31	3.25	12.92	22.12	21.84
Devil Canyon Creek	NW-9	mean	8.17	14.91	13.99	7.22	4.03	1.81	1.08	0.98	1.09	1.20	3.46	5.46	5.23
Devil Canyon Creek	NW-2	0.95	0.02	0.02	0.03	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Devil Canyon Creek	NW-2	0.75	0.85	0.59	0.62	0.32	0.13	0.02	0.01	0.01	0.01	0.01	0.01	0.09	0.02
Devil Canyon Creek	NW-2	0.50	1.82	2.29	2.77	2.10	1.27	0.36	0.37	0.07	0.03	0.08	0.48	1.54	0.76
Devil Canyon Creek	NW-2	0.25	3.87	5.10	7.86	5.86	2.88	1.80	1.25	0.74	0.77	0.87	1.55	3.05	2.35
Devil Canyon Creek	NW-2	0.05	17.26	38.95	50.30	23.22	14.09	5.92	2.69	1.84	1.86	2.28	5.13	9.56	13.22
Devil Canyon Creek	NW-2	mean	5.06	10.90	10.41	5.53	3.17	1.34	0.75	0.55	0.61	0.64	1.94	3.26	3.64
Devil Canyon Creek	NW-1	0.95	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Devil Canyon Creek	NW-1	0.75	0.82	0.58	0.59	0.30	0.11	0.01	0.00	0.00	0.00	0.00	0.00	0.09	0.01
Devil Canyon Creek	NW-1	0.50	1.81	2.22	2.61	2.08	1.27	0.36	0.36	0.07	0.01	0.07	0.38	1.50	0.76
Devil Canyon Creek	NW-1	0.25	3.57	4.96	7.52	5.68	2.87	1.79	1.25	0.75	0.77	0.87	1.48	2.89	2.28
Devil Canyon Creek	NW-1	0.05	16.10	36.72	50.17	23.12	13.99	5.87	2.67	1.85	1.86	2.27	4.64	8.99	13.09
Devil Canyon Creek	NW-1	mean	4.86	10.68	10.21	5.45	3.13	1.33	0.74	0.54	0.58	0.61	1.83	3.11	3.55
East Twin Creek	SE-78	0.95	0.26	0.35	0.38	0.33	0.29	0.26	0.19	0.18	0.21	0.22	0.26	0.29	0.21
East Twin Creek	SE-78	0.75	0.41	0.46	0.50	0.42	0.34	0.31	0.23	0.21	0.23	0.24	0.29	0.36	0.28
East Twin Creek	SE-78	0.50	0.61	0.66	0.70	0.58	0.43	0.35	0.25	0.22	0.25	0.27	0.36	0.47	0.41
East Twin Creek	SE-78	0.25	1.04	1.89	5.92	2.01	0.75	0.52	0.34	0.29	0.32	0.38	0.49	0.91	0.68
East Twin Creek	SE-78	0.05	95.35	130.21	90.73	19.38	2.38	1.14	0.70	0.56	0.64	2.96	33.16	58.53	23.12
East Twin Creek	SE-78	mean	19.07	29.99	20.21	4.51	1.25	0.48	0.33	1.38	1.83	2.28	8.40	14.19	8.55
East Twin Creek	SE-54	0.95	0.43	0.57	0.63	0.63	0.61	0.57	0.43	0.39	0.42	0.42	0.45	0.45	0.44
East Twin Creek	SE-54	0.75	0.61	0.71	0.79	0.73	0.70	0.65	0.50	0.45	0.47	0.46	0.49	0.54	0.53
East Twin Creek	SE-54	0.50	0.86	0.96	1.03	0.94	0.81	0.72	0.56	0.50	0.51	0.51	0.57	0.68	0.71
East Twin Creek	SE-54	0.25	1.40	2.46	7.21	2.67	1.19	0.95	0.72	0.61	0.62	0.67	0.74	1.22	1.05
East Twin Creek	SE-54	0.05	107.31	138.23	98.94	19.12	3.35	1.67	1.22	1.01	1.06	3.64	34.13	56.39	23.05
East Twin Creek	SE-54	mean	19.71	30.75	21.40	5.27	1.76	0.87	0.67	1.66	2.14	2.63	8.92	14.66	9.10

			All Flows in Cubic Feet per Second												
Drainage	**Node**	**Exceedance**	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**	**Annual**
East Twin Creek	SE-53	0.95	0.33	0.44	0.48	0.49	0.47	0.43	0.33	0.30	0.32	0.32	0.34	0.35	0.33
East Twin Creek	SE-53	0.75	0.46	0.54	0.60	0.56	0.54	0.50	0.39	0.35	0.36	0.35	0.38	0.41	0.41
East Twin Creek	SE-53	0.50	0.66	0.74	0.79	0.72	0.62	0.55	0.43	0.38	0.39	0.39	0.43	0.51	0.54
East Twin Creek	SE-53	0.25	1.07	1.90	5.83	2.00	0.91	0.72	0.55	0.46	0.47	0.50	0.56	0.93	0.79
East Twin Creek	SE-53	0.05	89.23	117.18	86.08	15.34	2.68	1.22	0.90	0.75	0.79	2.71	26.84	49.84	18.02
East Twin Creek	SE-53	mean	17.18	28.07	19.10	4.37	1.37	0.66	0.51	1.37	1.76	2.14	7.46	12.68	7.95
East Twin Creek	SE-32	0.95	0.22	0.29	0.32	0.33	0.32	0.29	0.23	0.21	0.22	0.22	0.23	0.23	0.23
East Twin Creek	SE-32	0.75	0.31	0.36	0.40	0.37	0.36	0.33	0.26	0.23	0.24	0.23	0.25	0.27	0.27
East Twin Creek	SE-32	0.50	0.44	0.48	0.52	0.48	0.42	0.37	0.29	0.26	0.26	0.26	0.29	0.34	0.35
East Twin Creek	SE-32	0.25	0.70	1.37	4.42	1.28	0.59	0.48	0.36	0.31	0.31	0.32	0.36	0.62	0.52
East Twin Creek	SE-32	0.05	82.99	111.08	81.32	12.25	1.93	0.74	0.55	0.47	0.52	2.01	24.17	47.52	15.13
East Twin Creek	SE-32	mean	15.75	26.33	17.72	3.76	1.03	0.43	0.33	1.11	1.46	1.81	6.63	11.48	7.22
East Twin Creek	SE-21	0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
East Twin Creek	SE-21	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
East Twin Creek	SE-21	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
East Twin Creek	SE-21	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
East Twin Creek	SE-21	0.05	0.00	14.43	21.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
East Twin Creek	SE-21	mean	3.64	10.47	6.32	0.60	0.00	0.00	0.00	0.00	0.02	0.00	0.55	2.54	1.97
East Twin Creek	SE-19	0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
East Twin Creek	SE-19	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
East Twin Creek	SE-19	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
East Twin Creek	SE-19	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
East Twin Creek	SE-19	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
East Twin Creek	SE-19	mean	0.20	0.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.05
East Twin Creek	SE-17	0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
East Twin Creek	SE-17	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
East Twin Creek	SE-17	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
East Twin Creek	SE-17	0.25	0.00	0.25	5.24	1.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
East Twin Creek	SE-17	0.05	15.92	58.87	72.15	32.46	11.96	1.41	0.00	0.00	0.00	0.00	0.00	7.39	16.11
East Twin Creek	SE-17	mean	5.67	15.33	14.69	5.96	1.93	0.22	0.00	0.15	0.10	0.15	1.02	4.14	4.05
East Twin Creek	SE-13	0.95	0.98	1.14	1.21	0.91	0.98	0.61	0.41	0.41	0.41	0.31	0.51	0.51	0.43
East Twin Creek	SE-13	0.75	2.12	2.32	2.52	2.12	1.71	1.01	0.61	0.51	0.51	0.61	0.91	1.30	1.01
East Twin Creek	SE-13	0.50	3.03	3.44	4.41	3.58	2.53	1.51	0.91	0.71	0.81	1.01	1.52	2.65	2.11
East Twin Creek	SE-13	0.25	5.25	6.62	12.77	8.76	5.51	3.63	2.32	1.77	1.84	2.01	2.81	4.22	4.22
East Twin Creek	SE-13	0.05	22.92	40.61	63.15	31.59	17.10	11.06	6.93	4.72	4.11	5.45	10.45	15.74	19.54
East Twin Creek	SE-13	mean	7.66	13.84	14.69	8.79	5.32	3.11	1.98	1.69	1.52	1.97	3.62	6.50	5.85
Little Sand Creek	SE-30	0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Little Sand Creek	SE-30	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Little Sand Creek	SE-30	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Little Sand Creek	SE-30	0.25	0.00	0.22	2.07	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Little Sand Creek	SE-30	0.05	29.55	33.54	23.87	4.40	0.67	0.00	0.00	0.00	0.00	0.41	12.00	16.21	6.01
Little Sand Creek	SE-30	mean	4.17	5.46	4.20	1.19	0.25	0.00	0.00	0.26	0.39	0.54	2.08	3.01	1.78
Little Sand Creek	SE-29	0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Little Sand Creek	SE-29	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Little Sand Creek	SE-29	0.50	0.05	0.22	0.46	0.22	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

			All Flows in Cubic Feet per Second												
Drainage	**Node**	**Exceedance**	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**	**Annual**
Little Sand Creek	SE-29	0.25	0.82	1.50	3.79	1.44	0.68	0.15	0.01	0.00	0.00	0.00	0.00	0.36	0.31
Little Sand Creek	SE-29	0.05	29.12	32.97	23.98	5.75	2.48	1.40	0.41	0.20	0.21	0.54	12.95	16.84	7.46
Little Sand Creek	SE-29	mean	4.30	5.75	4.67	1.77	0.68	0.21	0.07	0.28	0.40	0.57	2.10	3.09	1.97
Little Sand Creek	SE-28	0.95	0.18	0.34	0.42	0.45	0.44	0.41	0.35	0.30	0.27	0.23	0.20	0.19	0.24
Little Sand Creek	SE-28	0.75	0.34	0.56	0.64	0.56	0.52	0.47	0.41	0.35	0.31	0.26	0.24	0.26	0.36
Little Sand Creek	SE-28	0.50	0.75	0.92	1.14	0.93	0.66	0.54	0.45	0.39	0.34	0.30	0.30	0.40	0.51
Little Sand Creek	SE-28	0.25	1.38	2.17	4.50	2.10	1.36	0.85	0.62	0.49	0.44	0.43	0.45	0.92	0.97
Little Sand Creek	SE-28	0.05	31.31	35.26	26.07	6.35	3.16	2.12	1.12	0.85	0.87	1.01	14.13	18.46	8.14
Little Sand Creek	SE-28	mean	4.96	6.49	5.42	2.43	1.30	0.78	0.57	0.72	0.81	0.93	2.52	3.60	2.52
Little Sand Creek	SE-27	0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Little Sand Creek	SE-27	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Little Sand Creek	SE-27	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Little Sand Creek	SE-27	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Little Sand Creek	SE-27	0.05	1.42	1.53	0.95	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.42	0.00
Little Sand Creek	SE-27	mean	0.29	0.51	0.21	0.03	0.01	0.00	0.00	0.02	0.02	0.03	0.10	0.16	0.11
Little Sand Creek	SE-76	0.95	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Little Sand Creek	SE-76	0.75	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Little Sand Creek	SE-76	0.50	0.01	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Little Sand Creek	SE-76	0.25	0.02	0.02	0.04	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.02	0.02
Little Sand Creek	SE-76	0.05	0.59	0.62	0.52	0.10	0.03	0.02	0.02	0.02	0.02	0.02	0.28	0.35	0.13
Little Sand Creek	SE-76	mean	0.19	0.39	0.15	0.04	0.02	0.01	0.01	0.02	0.02	0.02	0.05	0.09	0.08
Little Sand Creek	SE-75	0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Little Sand Creek	SE-75	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Little Sand Creek	SE-75	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Little Sand Creek	SE-75	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Little Sand Creek	SE-75	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Little Sand Creek	SE-75	mean	0.10	0.30	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.04
Little Sand Creek	SE-23	0.95	0.02	0.05	0.09	0.07	0.06	0.05	0.04	0.04	0.03	0.03	0.02	0.02	0.03
Little Sand Creek	SE-23	0.75	0.06	0.14	0.18	0.12	0.09	0.07	0.05	0.04	0.04	0.03	0.03	0.03	0.05
Little Sand Creek	SE-23	0.50	0.25	0.30	0.39	0.31	0.16	0.10	0.07	0.06	0.05	0.04	0.04	0.06	0.10
Little Sand Creek	SE-23	0.25	0.45	0.96	1.07	1.02	0.57	0.25	0.14	0.09	0.08	0.06	0.07	0.20	0.29
Little Sand Creek	SE-23	0.05	1.73	3.73	3.88	2.38	1.44	0.75	0.31	0.19	0.17	0.17	0.48	1.20	1.59
Little Sand Creek	SE-23	mean	0.65	1.48	1.35	0.70	0.41	0.21	0.11	0.08	0.08	0.07	0.13	0.35	0.46
Little Sand Creek	SE-22	0.95	0.02	0.04	0.09	0.07	0.05	0.04	0.04	0.03	0.03	0.03	0.02	0.02	0.02
Little Sand Creek	SE-22	0.75	0.05	0.13	0.17	0.12	0.09	0.06	0.05	0.04	0.03	0.03	0.02	0.03	0.04
Little Sand Creek	SE-22	0.50	0.22	0.28	0.36	0.30	0.16	0.10	0.07	0.05	0.04	0.04	0.03	0.06	0.09
Little Sand Creek	SE-22	0.25	0.41	0.93	0.99	1.00	0.55	0.24	0.14	0.09	0.07	0.06	0.06	0.16	0.27
Little Sand Creek	SE-22	0.05	1.45	3.67	3.71	2.33	1.41	0.73	0.30	0.19	0.15	0.15	0.31	1.06	1.45
Little Sand Creek	SE-22	mean	0.60	1.42	1.30	0.67	0.39	0.20	0.11	0.08	0.07	0.06	0.09	0.31	0.44
Lytle Creek	NW-28	0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lytle Creek	NW-28	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lytle Creek	NW-28	0.50	0.00	0.00	0.36	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lytle Creek	NW-28	0.25	1.23	2.16	5.59	4.19	2.05	0.12	0.00	0.00	0.00	0.04	0.00	0.67	0.63
Lytle Creek	NW-28	0.05	55.10	99.79	94.22	49.82	38.10	16.07	7.74	3.59	1.92	1.05	14.55	27.63	34.67
Lytle Creek	NW-28	mean	24.34	34.28	26.72	8.14	5.69	2.63	1.09	0.96	0.90	0.80	6.17	8.30	9.88

			All Flows in Cubic Feet per Second												
Drainage	**Node**	**Exceedance**	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**	**Annual**
Lytle Creek	NW-26	0.95	0.19	0.41	0.44	0.46	0.44	0.39	0.33	0.29	0.24	0.21	0.21	0.20	0.24
Lytle Creek	NW-26	0.75	0.58	0.74	0.85	0.84	0.70	0.55	0.44	0.37	0.32	0.28	0.27	0.31	0.42
Lytle Creek	NW-26	0.50	1.06	1.40	2.19	1.33	0.86	0.67	0.52	0.45	0.39	0.36	0.44	0.67	0.77
Lytle Creek	NW-26	0.25	3.88	5.70	10.23	9.00	5.64	1.59	1.05	0.83	0.89	1.51	1.33	2.71	2.81
Lytle Creek	NW-26	0.05	75.71	127.71	126.61	68.38	53.01	24.13	13.85	8.15	5.50	3.76	22.44	38.83	48.55
Lytle Creek	NW-26	mean	28.72	41.02	34.41	12.41	8.95	4.73	2.58	2.26	2.04	1.87	8.28	11.31	13.07
Lytle Creek	NW-20	0.95	0.10	0.13	0.12	0.11	0.10	0.08	0.07	0.06	0.06	0.06	0.07	0.09	0.07
Lytle Creek	NW-20	0.75	0.25	0.40	0.38	0.29	0.21	0.12	0.10	0.09	0.09	0.09	0.11	0.12	0.11
Lytle Creek	NW-20	0.50	0.61	0.65	0.95	0.63	0.43	0.26	0.13	0.11	0.12	0.15	0.24	0.41	0.40
Lytle Creek	NW-20	0.25	1.88	2.94	4.88	5.37	2.31	0.99	0.62	0.60	0.65	0.76	0.95	1.16	1.86
Lytle Creek	NW-20	0.05	22.96	81.17	98.98	63.12	53.18	24.76	14.17	8.62	5.51	3.42	3.30	7.91	27.99
Lytle Creek	NW-20	mean	17.88	21.54	21.93	9.76	8.35	4.51	2.35	1.60	1.05	0.83	4.32	4.90	8.19
Lytle Creek Channel	NW-29	0.95	0.06	0.08	0.09	0.10	0.10	0.10	0.09	0.09	0.08	0.07	0.07	0.06	0.07
Lytle Creek Channel	NW-29	0.75	0.08	0.10	0.11	0.11	0.11	0.11	0.10	0.09	0.09	0.08	0.07	0.07	0.09
Lytle Creek Channel	NW-29	0.50	0.11	0.14	0.51	0.14	0.12	0.12	0.11	0.10	0.09	0.08	0.08	0.09	0.11
Lytle Creek Channel	NW-29	0.25	1.70	2.71	7.58	5.01	2.48	0.19	0.13	0.12	0.12	0.14	0.11	1.04	1.02
Lytle Creek Channel	NW-29	0.05	72.10	110.81	100.58	52.68	38.96	16.68	8.25	4.03	2.33	1.63	21.64	37.80	39.60
Lytle Creek Channel	NW-29	mean	26.51	36.64	28.77	8.99	6.06	2.84	1.27	1.24	1.23	1.20	7.40	9.98	10.88
Mill Creek	SE-56	0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mill Creek	SE-56	0.75	0.29	0.37	0.35	0.24	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mill Creek	SE-56	0.50	2.46	4.23	3.38	1.97	1.31	1.06	1.37	1.10	1.03	0.78	1.04	1.47	1.35
Mill Creek	SE-56	0.25	9.06	11.77	13.20	14.36	18.31	15.02	7.36	7.24	5.44	2.87	5.72	8.58	8.37
Mill Creek	SE-56	0.05	17.75	46.33	228.97	237.03	292.26	115.44	36.49	19.47	12.31	9.09	13.03	22.11	82.71
Mill Creek	SE-56	mean	23.79	32.63	44.84	38.91	38.35	20.76	7.06	4.44	4.82	2.29	7.84	13.09	19.82
Mission Creek	SE-73	0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mission Creek	SE-73	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mission Creek	SE-73	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mission Creek	SE-73	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mission Creek	SE-73	0.05	76.15	83.31	54.98	6.54	0.00	0.00	0.00	0.00	0.00	0.08	20.07	35.03	7.86
Mission Creek	SE-73	mean	10.54	12.38	8.55	2.14	0.39	0.00	0.00	0.78	1.07	1.37	5.51	7.90	4.18
Mission Creek	SE-62	0.95	0.15	0.43	0.56	0.62	0.66	0.64	0.56	0.47	0.40	0.29	0.25	0.20	0.32
Mission Creek	SE-62	0.75	0.47	0.67	0.84	0.83	0.86	0.79	0.69	0.58	0.49	0.40	0.33	0.33	0.56
Mission Creek	SE-62	0.50	0.85	1.09	1.22	1.18	1.04	0.92	0.79	0.67	0.58	0.48	0.44	0.58	0.81
Mission Creek	SE-62	0.25	1.65	2.30	5.08	2.36	1.69	1.34	1.09	0.86	0.75	0.76	0.74	1.31	1.37
Mission Creek	SE-62	0.05	60.43	64.49	46.91	9.01	3.63	2.56	1.97	1.57	1.47	2.01	23.98	32.88	11.41
Mission Creek	SE-62	mean	8.83	10.52	8.57	3.53	1.81	1.18	0.98	1.34	1.48	1.69	4.81	6.68	4.25
Mission Creek	SE-61	0.95	0.87	1.14	1.27	1.32	1.37	1.35	1.27	1.19	1.11	1.00	0.96	0.91	1.03
Mission Creek	SE-61	0.75	1.17	1.37	1.54	1.53	1.56	1.50	1.40	1.30	1.21	1.11	1.05	1.04	1.27
Mission Creek	SE-61	0.50	1.54	1.77	1.90	1.87	1.73	1.62	1.50	1.38	1.29	1.19	1.15	1.27	1.51
Mission Creek	SE-61	0.25	2.22	2.83	5.46	2.86	2.35	2.02	1.79	1.57	1.46	1.46	1.44	1.92	2.02
Mission Creek	SE-61	0.05	56.72	59.43	43.48	8.95	4.20	3.19	2.63	2.25	2.12	2.28	22.69	30.49	10.96
Mission Creek	SE-61	mean	8.76	10.41	8.59	4.00	2.44	1.87	1.68	1.99	2.11	2.29	5.09	6.79	4.64
Mission Creek	SE-60	0.95	0.85	1.12	1.24	1.29	1.34	1.32	1.25	1.17	1.09	0.98	0.94	0.89	1.00
Mission Creek	SE-60	0.75	1.14	1.33	1.50	1.50	1.53	1.46	1.38	1.27	1.18	1.09	1.02	1.02	1.24
Mission Creek	SE-60	0.50	1.49	1.71	1.84	1.81	1.70	1.58	1.47	1.36	1.26	1.16	1.12	1.24	1.47

			All Flows in Cubic Feet per Second												
Drainage	Node	Exceedance	January	February	March	April	May	June	July	August	September	October	November	December	Annual
Mission Creek	SE-60	0.25	2.06	2.67	5.25	2.76	2.29	1.98	1.75	1.54	1.42	1.41	1.39	1.77	1.93
Mission Creek	SE-60	0.05	53.93	56.69	40.93	8.31	4.08	3.11	2.57	2.20	2.04	2.17	21.60	28.99	10.31
Mission Creek	SE-60	mean	8.29	9.91	8.16	3.84	2.37	1.83	1.64	1.93	2.03	2.19	4.82	6.41	4.43
Plunge Creek	SE-57	0.95	0.07	0.14	0.16	0.10	0.09	0.07	0.06	0.05	0.05	0.05	0.05	0.06	0.06
Plunge Creek	SE-57	0.75	0.27	0.37	0.41	0.31	0.17	0.09	0.07	0.06	0.06	0.06	0.07	0.09	0.08
Plunge Creek	SE-57	0.50	0.54	0.69	1.04	0.62	0.36	0.15	0.08	0.07	0.07	0.07	0.10	0.33	0.26
Plunge Creek	SE-57	0.25	2.21	5.32	15.37	9.70	1.99	0.37	0.17	0.12	0.12	0.24	0.42	1.03	0.83
Plunge Creek	SE-57	0.05	57.71	162.44	200.00	51.32	17.72	6.66	1.98	0.85	0.61	0.73	10.50	18.62	28.63
Plunge Creek	SE-57	mean	23.40	56.37	42.96	10.66	3.91	1.25	0.41	0.46	0.64	0.62	5.13	13.03	13.01
Plunge Creek	SE-48	0.95	0.15	0.23	0.26	0.21	0.20	0.12	0.10	0.09	0.08	0.08	0.09	0.12	0.10
Plunge Creek	SE-48	0.75	0.31	0.40	0.49	0.38	0.29	0.18	0.12	0.11	0.10	0.11	0.12	0.20	0.16
Plunge Creek	SE-48	0.50	0.48	0.61	1.12	0.56	0.38	0.24	0.16	0.13	0.13	0.16	0.20	0.33	0.32
Plunge Creek	SE-48	0.25	1.42	3.18	6.71	4.94	1.96	0.52	0.34	0.26	0.21	0.23	0.40	0.77	0.70
Plunge Creek	SE-48	0.05	19.29	80.00	81.80	17.08	7.23	3.35	1.07	0.69	0.58	0.55	1.98	6.39	10.34
Plunge Creek	SE-48	mean	9.23	20.03	16.18	4.50	1.80	0.73	0.32	0.26	0.42	0.28	2.30	6.07	5.10
Plunge Creek	SE-45	0.95	0.40	0.55	0.65	0.50	0.42	0.20	0.13	0.12	0.10	0.12	0.13	0.27	0.15
Plunge Creek	SE-45	0.75	0.77	1.04	1.22	0.94	0.64	0.37	0.20	0.17	0.17	0.22	0.30	0.52	0.32
Plunge Creek	SE-45	0.50	1.24	1.53	2.93	1.42	0.95	0.55	0.30	0.25	0.25	0.35	0.45	0.85	0.75
Plunge Creek	SE-45	0.25	3.74	7.58	15.14	10.66	5.61	1.22	0.70	0.49	0.42	0.50	0.91	1.70	1.57
Plunge Creek	SE-45	0.05	36.04	87.53	90.15	28.06	13.35	7.10	2.22	1.25	1.07	1.12	4.99	14.14	19.25
Plunge Creek	SE-45	mean	11.26	21.99	19.69	7.64	3.61	1.60	0.63	0.46	0.75	0.55	3.02	7.55	6.48
Rialto Channel/Cactus Channel	NFRC06	0.95	9.60	9.50	9.40	9.20	9.20	9.10	9.00	9.00	9.20	9.40	9.50	9.60	9.00
Rialto Channel/Cactus Channel	NFRC06	0.75	9.60	9.50	9.40	9.20	9.20	9.10	9.00	9.00	9.20	9.40	9.50	9.60	9.20
Rialto Channel/Cactus Channel	NFRC06	0.50	9.60	9.50	9.40	9.20	9.20	9.10	9.00	9.00	9.20	9.40	9.50	9.60	9.40
Rialto Channel/Cactus Channel	NFRC06	0.25	11.40	10.60	14.00	9.20	9.20	9.10	9.00	9.00	9.20	9.40	9.50	9.90	9.60
Rialto Channel/Cactus Channel	NFRC06	0.05	147.69	134.08	103.24	32.04	9.90	9.10	9.00	9.00	9.65	15.03	92.71	104.64	46.80
Rialto Channel/Cactus Channel	NFRC06	mean	29.97	32.33	27.95	13.59	10.19	9.14	9.09	10.03	10.86	11.53	22.24	26.28	17.70
San Sevaine Creek	NSS31	0.95	0.00	0.00	0.00	1.30	1.40	1.50	1.80	1.70	1.30	0.80	0.00	0.00	0.00
San Sevaine Creek	NSS31	0.75	0.00	0.00	0.00	1.40	1.50	1.60	1.80	1.80	1.40	0.90	0.00	0.00	0.00
San Sevaine Creek	NSS31	0.50	0.00	0.00	0.00	1.50	1.60	1.90	1.90	1.90	1.40	1.00	0.00	0.00	1.50
San Sevaine Creek	NSS31	0.25	5.55	3.68	10.25	1.70	1.60	2.00	1.90	1.90	1.70	1.10	0.10	0.60	1.90
San Sevaine Creek	NSS31	0.05	376.10	347.65	244.29	46.14	3.40	2.00	2.00	2.00	2.40	10.49	168.81	211.65	91.40
San Sevaine Creek	NSS31	mean	68.17	71.63	52.85	11.37	3.70	2.08	2.13	3.57	4.71	5.40	31.50	42.52	24.76
San Timoteo Wash	SE-79	0.95	0.08	0.25	0.37	0.45	0.48	0.47	0.42	0.36	0.30	0.22	0.15	0.11	0.21
San Timoteo Wash	SE-79	0.75	0.41	0.45	0.64	0.62	0.65	0.60	0.51	0.43	0.37	0.29	0.24	0.24	0.45
San Timoteo Wash	SE-79	0.50	0.74	0.84	1.19	1.03	0.91	0.81	0.62	0.55	0.49	0.43	0.46	0.52	0.69
San Timoteo Wash	SE-79	0.25	1.77	2.04	4.49	2.36	1.62	1.25	0.99	0.86	0.78	0.76	1.24	1.53	1.36
San Timoteo Wash	SE-79	0.05	54.71	56.48	48.73	8.12	3.19	2.41	1.99	1.50	1.82	2.99	18.55	31.84	11.08
San Timoteo Wash	SE-79	mean	10.77	15.30	9.00	2.79	1.75	1.08	0.87	1.06	1.38	1.37	4.70	7.23	4.72
San Timoteo Wash	SE-77	0.95	0.10	0.13	0.15	0.15	0.15	0.15	0.14	0.13	0.13	0.12	0.11	0.11	0.12
San Timoteo Wash	SE-77	0.75	0.13	0.16	0.17	0.17	0.17	0.17	0.16	0.15	0.14	0.13	0.12	0.12	0.14
San Timoteo Wash	SE-77	0.50	0.18	0.20	0.22	0.21	0.19	0.18	0.17	0.15	0.15	0.14	0.13	0.15	0.17
San Timoteo Wash	SE-77	0.25	0.28	0.37	0.81	0.36	0.26	0.22	0.19	0.17	0.16	0.16	0.16	0.23	0.23
San Timoteo Wash	SE-77	0.05	8.49	8.55	6.72	1.42	0.55	0.36	0.28	0.23	0.23	0.31	3.74	4.91	1.73
San Timoteo Wash	SE-77	mean	1.26	1.41	1.21	0.54	0.30	0.21	0.18	0.23	0.26	0.29	0.73	0.98	0.63

			All Flows in Cubic Feet per Second												
Drainage	**Node**	**Exceedance**	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**	**Annual**
San Timoteo Wash	SE-68	0.95	0.19	0.24	0.28	0.29	0.29	0.29	0.26	0.24	0.24	0.22	0.21	0.20	0.22
San Timoteo Wash	SE-68	0.75	0.30	0.30	0.36	0.35	0.35	0.32	0.29	0.27	0.26	0.24	0.23	0.24	0.29
San Timoteo Wash	SE-68	0.50	0.42	0.45	0.57	0.49	0.47	0.42	0.34	0.30	0.29	0.29	0.32	0.33	0.38
San Timoteo Wash	SE-68	0.25	1.00	0.99	2.30	1.14	0.89	0.69	0.57	0.50	0.45	0.48	0.71	0.79	0.70
San Timoteo Wash	SE-68	0.05	32.78	42.53	24.81	4.18	1.72	1.39	1.07	0.86	1.14	1.80	9.86	17.63	5.66
San Timoteo Wash	SE-68	mean	7.69	11.84	5.98	1.45	1.02	0.58	0.47	0.57	0.86	0.80	3.00	4.89	3.22
San Timoteo Wash	SE-64	0.95	0.10	0.13	0.14	0.15	0.16	0.15	0.14	0.13	0.13	0.12	0.11	0.10	0.12
San Timoteo Wash	SE-64	0.75	0.16	0.16	0.19	0.19	0.19	0.17	0.16	0.14	0.14	0.13	0.12	0.12	0.15
San Timoteo Wash	SE-64	0.50	0.24	0.25	0.36	0.29	0.29	0.24	0.19	0.17	0.16	0.15	0.17	0.18	0.22
San Timoteo Wash	SE-64	0.25	0.73	0.70	1.56	0.80	0.66	0.50	0.38	0.33	0.32	0.35	0.54	0.60	0.49
San Timoteo Wash	SE-64	0.05	24.05	36.81	18.24	2.65	1.34	1.12	0.84	0.70	0.97	1.43	6.41	11.77	3.87
San Timoteo Wash	SE-64	mean	6.63	10.64	4.96	0.98	0.77	0.40	0.31	0.37	0.64	0.54	2.38	4.07	2.68
San Timoteo Wash	SE-63	0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
San Timoteo Wash	SE-63	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
San Timoteo Wash	SE-63	0.50	0.01	0.01	0.14	0.03	0.04	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.01
San Timoteo Wash	SE-63	0.25	0.39	0.36	0.63	0.33	0.25	0.21	0.14	0.11	0.12	0.20	0.39	0.39	0.25
San Timoteo Wash	SE-63	0.05	19.84	28.99	14.23	1.18	1.01	0.76	0.55	0.52	0.72	1.02	3.11	5.54	2.11
San Timoteo Wash	SE-63	mean	5.65	9.53	3.98	0.49	0.47	0.17	0.12	0.15	0.39	0.28	1.80	3.30	2.16
Sand Creek	SE-33	0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sand Creek	SE-33	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sand Creek	SE-33	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sand Creek	SE-33	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sand Creek	SE-33	0.05	0.00	1.14	0.92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sand Creek	SE-33	mean	0.66	2.08	1.24	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.29	0.35
Sand Creek	SE-18	0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sand Creek	SE-18	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sand Creek	SE-18	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sand Creek	SE-18	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sand Creek	SE-18	0.05	0.00	5.63	4.80	1.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sand Creek	SE-18	mean	0.78	2.42	1.75	0.19	0.01	0.00	0.00	0.00	0.00	0.00	0.03	0.33	0.45
Santa Ana River	NSAR381	0.95	202.07	160.90	146.77	126.40	105.30	82.20	76.00	73.50	79.80	95.90	116.00	147.27	74.55
Santa Ana River	NSAR381	0.75	204.90	162.30	152.20	132.10	110.30	84.83	77.10	73.70	81.70	99.20	119.90	152.90	88.80
Santa Ana River	NSAR381	0.50	208.60	168.90	163.40	138.10	116.40	88.55	79.40	74.10	84.00	103.60	126.90	157.20	128.60
Santa Ana River	NSAR381	0.25	317.50	352.13	553.10	278.15	139.15	95.08	82.60	76.15	87.80	107.90	143.75	224.30	189.45
Santa Ana River	NSAR381	0.05	4157.57	3513.38	2660.58	843.73	591.03	284.20	135.42	138.18	138.46	207.40	1631.47	2320.36	1116.05
Santa Ana River	NSAR381	mean	905.99	1011.43	800.78	309.92	204.48	115.89	89.39	99.47	122.66	142.59	411.78	571.40	395.92
Santa Ana River	NSAR38	0.95	125.70	86.50	82.70	77.80	70.70	64.90	61.20	61.10	62.70	67.10	72.60	79.80	61.40
Santa Ana River	NSAR38	0.75	127.30	87.20	85.00	80.30	72.70	66.00	61.75	61.20	63.30	68.40	74.20	82.40	67.40
Santa Ana River	NSAR38	0.50	130.30	92.90	93.50	83.25	75.40	67.55	62.80	61.40	64.30	70.20	77.45	84.30	80.20
Santa Ana River	NSAR38	0.25	181.40	204.03	373.85	159.90	91.05	71.90	64.20	62.50	65.78	72.10	86.68	113.90	118.85
Santa Ana River	NSAR38	0.05	1899.87	2069.08	1595.77	728.15	549.60	256.28	117.13	121.56	97.78	116.38	878.00	1283.06	709.75
Santa Ana River	NSAR38	mean	532.15	648.95	500.75	210.49	154.69	94.52	72.72	79.65	86.74	92.01	231.88	323.65	250.41
Santa Ana River	NSAR37	0.95	48.00	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30
Santa Ana River	NSAR37	0.75	48.00	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30
Santa Ana River	NSAR37	0.50	48.00	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30

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Drainage	**Node**	**Exceedance**	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**	**Annual**
Santa Ana River	NSAR37	0.25	48.00	2.30	3.40	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30
Santa Ana River	NSAR37	0.05	284.36	548.50	502.33	175.45	60.20	8.92	2.30	2.30	2.30	2.40	47.16	112.69	66.00
Santa Ana River	NSAR37	mean	140.58	142.35	97.07	25.94	9.39	3.45	2.42	3.99	4.48	4.48	29.43	45.34	41.95
Santa Ana River	NSAR36	0.95	85.30	86.50	82.70	77.80	70.70	64.90	61.20	61.10	62.70	67.10	72.60	79.80	61.40
Santa Ana River	NSAR36	0.75	86.90	87.20	85.00	80.30	72.70	66.00	61.75	61.20	63.30	68.40	74.13	82.40	67.40
Santa Ana River	NSAR36	0.50	90.00	92.90	93.40	83.25	75.40	67.55	62.80	61.40	64.30	70.20	77.40	84.30	80.20
Santa Ana River	NSAR36	0.25	140.20	200.75	347.85	156.90	91.05	71.88	64.20	62.50	65.78	72.10	86.68	113.00	94.90
Santa Ana River	NSAR36	0.05	1612.82	1642.50	1239.89	562.70	498.15	256.28	116.82	120.52	97.78	113.93	818.03	1125.69	601.55
Santa Ana River	NSAR36	mean	400.66	511.87	408.28	188.04	148.27	93.74	72.63	78.03	84.67	90.03	205.38	281.89	212.15
Santa Ana River	NSAR352	0.95	85.30	86.50	82.70	77.80	70.70	64.90	61.20	61.10	62.70	67.10	72.60	79.80	61.40
Santa Ana River	NSAR352	0.75	86.90	87.20	85.00	80.30	72.70	66.00	61.75	61.20	63.30	68.40	74.13	82.40	67.40
Santa Ana River	NSAR352	0.50	90.00	92.90	93.40	83.25	75.40	67.55	62.80	61.40	64.30	70.20	77.40	84.30	80.20
Santa Ana River	NSAR352	0.25	140.20	200.75	347.50	156.90	91.05	71.88	64.20	62.50	65.78	72.10	86.68	113.00	94.90
Santa Ana River	NSAR352	0.05	1608.31	1642.28	1238.84	562.70	498.15	256.28	116.82	120.52	97.78	113.93	817.92	1125.00	599.10
Santa Ana River	NSAR352	mean	399.88	511.03	407.66	187.94	148.26	93.74	72.63	78.01	84.64	89.99	205.00	281.42	211.87
Santa Ana River	NSAR351	0.95	85.30	86.50	82.70	77.80	70.70	64.90	61.20	61.10	62.70	67.10	72.60	79.80	61.35
Santa Ana River	NSAR351	0.75	86.90	87.20	85.00	80.30	72.70	66.00	61.75	61.20	63.30	68.40	74.13	82.40	67.40
Santa Ana River	NSAR351	0.50	90.00	92.85	93.20	83.25	75.40	67.55	62.80	61.40	64.30	70.20	77.40	84.30	80.20
Santa Ana River	NSAR351	0.25	139.60	199.10	344.75	156.90	91.05	71.88	64.20	62.50	65.78	72.05	86.68	113.00	94.90
Santa Ana River	NSAR351	0.05	1581.72	1639.40	1231.56	562.70	498.15	256.28	116.82	120.52	97.78	113.90	813.57	1117.04	593.05
Santa Ana River	NSAR351	mean	395.29	506.11	403.89	187.18	148.11	93.73	72.62	77.84	84.35	89.69	202.60	278.51	210.20
Santa Ana River	NSAR35	0.95	85.30	86.50	82.70	77.80	70.70	64.90	61.20	61.10	62.70	67.10	72.60	79.80	61.35
Santa Ana River	NSAR35	0.75	86.90	87.20	85.00	80.30	72.70	66.00	61.75	61.20	63.30	68.40	74.13	82.40	67.40
Santa Ana River	NSAR35	0.50	90.00	92.85	93.20	83.25	75.40	67.55	62.80	61.40	64.30	70.20	77.40	84.30	80.20
Santa Ana River	NSAR35	0.25	139.60	199.10	344.75	156.90	91.05	71.88	64.20	62.50	65.78	72.05	86.68	113.00	94.90
Santa Ana River	NSAR35	0.05	1581.72	1639.40	1231.56	562.70	498.15	256.28	116.82	120.52	97.78	113.90	813.57	1117.04	593.05
Santa Ana River	NSAR35	mean	395.29	506.11	403.89	187.18	148.11	93.73	72.62	77.84	84.35	89.69	202.60	278.51	210.20
Santa Ana River	NSAR34	0.95	85.30	86.50	82.70	77.80	70.70	64.90	61.20	61.10	62.70	67.10	72.60	79.80	61.35
Santa Ana River	NSAR34	0.75	86.90	87.20	85.00	80.30	72.70	66.00	61.75	61.20	63.30	68.40	74.13	82.40	67.40
Santa Ana River	NSAR34	0.50	90.00	92.85	93.20	83.25	75.40	67.55	62.80	61.40	64.30	70.20	77.40	84.30	80.20
Santa Ana River	NSAR34	0.25	139.60	199.10	344.75	156.90	91.05	71.88	64.20	62.50	65.78	72.05	86.68	113.00	94.90
Santa Ana River	NSAR34	0.05	1581.72	1639.40	1231.56	562.70	498.15	256.28	116.82	120.52	97.78	113.90	813.57	1117.04	593.05
Santa Ana River	NSAR34	mean	395.29	506.11	403.89	187.18	148.11	93.73	72.62	77.84	84.35	89.69	202.60	278.51	210.20
Santa Ana River	NSAR332	0.95	86.40	87.60	83.70	78.90	71.70	65.90	62.30	62.20	63.70	68.10	73.70	80.80	62.40
Santa Ana River	NSAR332	0.75	88.00	88.30	86.10	81.40	73.80	67.10	62.80	62.30	64.40	69.50	75.23	83.50	68.40
Santa Ana River	NSAR332	0.50	91.00	93.90	94.30	84.30	76.40	68.60	63.80	62.40	65.30	71.30	78.50	85.40	81.30
Santa Ana River	NSAR332	0.25	140.70	194.13	345.90	157.95	92.10	72.90	65.30	63.50	66.80	73.10	87.75	114.10	95.95
Santa Ana River	NSAR332	0.05	1575.92	1639.58	1230.07	559.68	499.42	257.48	117.92	121.62	98.47	114.94	809.11	1115.57	592.20
Santa Ana River	NSAR332	mean	393.82	504.22	402.92	187.94	149.13	94.81	73.69	78.82	85.27	90.65	202.43	277.95	210.35
Santa Ana River	NSAR331	0.95	88.30	89.50	85.60	80.80	73.60	67.80	64.10	64.00	65.60	70.00	75.50	82.70	64.30
Santa Ana River	NSAR331	0.75	89.85	90.20	88.00	83.30	75.70	69.00	64.70	64.10	66.30	71.30	77.10	85.40	70.30
Santa Ana River	NSAR331	0.50	92.90	95.80	96.20	86.20	78.30	70.50	65.70	64.30	67.20	73.10	80.35	87.20	83.10
Santa Ana River	NSAR331	0.25	142.60	196.13	348.00	159.88	94.00	74.78	67.20	65.40	68.70	75.00	89.65	116.00	97.85
Santa Ana River	NSAR331	0.05	1607.90	1672.05	1248.86	561.88	501.52	259.48	119.82	123.52	100.37	116.84	811.57	1129.75	594.35
Santa Ana River	NSAR331	mean	398.13	509.02	407.02	190.29	151.11	96.69	75.56	80.79	87.26	92.64	205.38	281.40	213.15

			All Flows in Cubic Feet per Second												
Drainage	**Node**	**Exceedance**	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**	**Annual**
Santa Ana River	NSAR33	0.95	92.60	93.80	90.00	85.10	77.90	72.10	68.40	68.30	69.90	74.30	79.90	87.00	68.60
Santa Ana River	NSAR33	0.75	94.20	94.53	92.35	87.60	80.00	73.30	69.00	68.40	70.60	75.70	81.43	89.70	74.60
Santa Ana River	NSAR33	0.50	97.30	100.15	100.60	90.55	82.60	74.80	70.00	68.60	71.50	77.50	84.70	91.60	87.50
Santa Ana River	NSAR33	0.25	147.05	200.63	352.65	164.35	98.40	79.10	71.50	69.70	73.00	79.30	93.98	120.40	102.20
Santa Ana River	NSAR33	0.05	1642.72	1707.35	1260.20	566.78	506.35	264.08	124.25	127.92	104.67	121.24	816.67	1135.05	599.30
Santa Ana River	NSAR33	mean	405.01	516.61	413.61	195.01	155.57	101.06	79.88	85.21	91.70	97.08	210.73	287.26	218.42
Santa Ana River	NSAR321	0.95	94.70	96.03	92.10	87.05	79.90	74.00	70.40	70.30	71.90	76.40	82.05	89.10	70.60
Santa Ana River	NSAR321	0.75	95.90	96.50	94.10	89.20	81.90	75.20	70.95	70.40	72.60	77.70	83.50	91.30	76.50
Santa Ana River	NSAR321	0.50	97.10	99.00	99.00	91.50	84.40	76.60	72.00	70.60	73.40	79.20	86.00	93.20	88.70
Santa Ana River	NSAR321	0.25	124.65	159.05	327.85	153.40	99.75	80.08	73.40	71.05	74.80	81.10	89.18	107.40	99.90
Santa Ana River	NSAR321	0.05	1352.61	1527.73	1085.82	550.16	508.23	266.09	126.11	129.95	105.51	115.35	685.42	934.85	548.70
Santa Ana River	NSAR321	mean	349.61	466.46	373.85	188.70	155.81	102.86	81.79	86.12	91.77	96.56	192.15	259.24	202.41
Santa Ana River	NSAR32	0.95	96.80	98.20	94.30	89.20	82.00	76.10	72.50	72.40	74.00	78.50	84.15	91.27	72.70
Santa Ana River	NSAR32	0.75	98.10	98.60	96.30	91.40	84.00	77.30	73.05	72.50	74.70	79.80	85.60	93.40	78.60
Santa Ana River	NSAR32	0.50	99.20	101.10	101.10	93.60	86.50	78.70	74.10	72.70	75.50	81.30	88.20	95.30	90.90
Santa Ana River	NSAR32	0.25	126.85	161.13	330.25	155.68	101.90	82.18	75.50	73.15	76.90	83.20	91.28	109.55	102.10
Santa Ana River	NSAR32	0.05	1363.34	1547.23	1088.72	552.76	510.73	268.49	128.31	132.15	107.66	117.48	686.07	934.69	551.20
Santa Ana River	NSAR32	mean	352.84	470.03	377.01	190.96	158.01	105.01	83.91	88.29	93.93	98.73	194.65	261.97	204.94
Santa Ana River	NSAR311	0.95	99.70	101.20	97.20	90.50	83.30	77.00	73.70	73.50	75.30	80.30	87.10	94.20	73.70
Santa Ana River	NSAR311	0.75	101.00	101.50	99.20	92.73	85.30	78.30	74.20	73.60	76.00	81.55	88.50	96.30	80.20
Santa Ana River	NSAR311	0.50	102.00	103.60	103.50	95.20	87.90	80.10	75.10	73.70	77.10	83.20	91.05	98.20	92.70
Santa Ana River	NSAR311	0.25	122.45	145.63	268.25	151.30	101.15	83.15	76.35	74.30	78.40	85.30	93.48	109.25	103.80
Santa Ana River	NSAR311	0.05	958.28	1153.43	942.58	542.13	512.56	265.09	129.24	132.46	108.08	111.73	502.22	700.63	524.40
Santa Ana River	NSAR311	mean	288.04	402.17	327.75	182.57	157.30	105.90	84.74	87.70	92.21	96.30	166.12	222.63	183.33
Santa Ana River	NSAR31	0.95	102.07	103.50	99.57	92.80	85.60	79.30	76.00	75.80	77.60	82.60	89.40	96.50	76.00
Santa Ana River	NSAR31	0.75	103.30	103.90	101.50	95.10	87.60	80.60	76.50	75.90	78.30	83.85	90.90	98.70	82.50
Santa Ana River	NSAR31	0.50	104.40	106.00	105.90	97.50	90.20	82.40	77.40	76.00	79.40	85.50	93.40	100.50	95.00
Santa Ana River	NSAR31	0.25	124.85	148.03	270.80	153.70	103.45	85.45	78.65	76.60	80.70	87.60	95.78	111.55	106.15
Santa Ana River	NSAR31	0.05	962.04	1160.00	946.10	544.87	515.26	267.59	131.64	134.83	110.38	114.03	504.93	703.43	527.10
Santa Ana River	NSAR31	mean	290.95	405.40	330.74	185.03	159.68	108.24	87.05	90.04	94.55	98.65	168.65	225.32	185.90
Santa Ana River	NSAR301	0.95	108.20	109.63	105.70	98.90	91.70	85.40	82.00	81.80	83.60	88.70	95.50	102.67	82.10
Santa Ana River	NSAR301	0.75	109.50	110.00	107.70	101.20	93.70	86.70	82.50	81.90	84.33	89.90	97.00	104.80	88.50
Santa Ana River	NSAR301	0.50	110.50	112.10	112.00	103.60	96.30	88.50	83.40	82.10	85.50	91.60	99.50	106.70	101.10
Santa Ana River	NSAR301	0.25	131.05	153.70	274.35	159.70	109.65	91.18	84.70	82.60	86.78	93.70	101.88	117.40	112.25
Santa Ana River	NSAR301	0.05	947.80	1160.10	937.00	552.03	522.36	274.19	137.84	141.13	116.58	119.67	494.08	692.95	530.60
Santa Ana River	NSAR301	mean	294.95	408.88	335.08	190.76	165.81	114.37	93.11	96.03	100.43	104.53	173.33	229.92	191.15
Santa Ana River	NSAR30	0.95	110.90	112.33	108.40	101.60	94.40	88.10	84.70	84.50	86.30	91.40	98.15	105.37	84.70
Santa Ana River	NSAR30	0.75	112.20	112.70	110.40	103.90	96.40	89.33	85.20	84.60	87.03	92.55	99.60	107.50	91.20
Santa Ana River	NSAR30	0.50	113.20	114.80	114.70	106.30	99.00	91.20	86.10	84.70	88.10	94.30	102.20	109.40	103.80
Santa Ana River	NSAR30	0.25	133.75	156.50	277.25	162.50	112.35	93.88	87.40	85.30	89.40	96.35	104.58	120.10	114.95
Santa Ana River	NSAR30	0.05	951.96	1167.83	940.95	555.17	525.49	277.09	140.64	143.83	119.28	122.37	497.18	696.25	533.70
Santa Ana River	NSAR30	mean	298.31	412.62	338.54	193.60	168.58	117.07	95.78	98.74	103.15	107.25	176.26	233.02	194.12
Santa Ana River	NSAR29	0.95	112.00	113.50	109.50	102.75	95.50	89.20	85.80	85.60	87.40	92.50	99.30	106.50	85.80
Santa Ana River	NSAR29	0.75	113.30	113.90	111.50	105.00	97.50	90.50	86.30	85.70	88.13	93.70	100.80	108.60	92.30
Santa Ana River	NSAR29	0.50	114.40	116.00	115.90	107.45	100.10	92.30	87.20	85.80	89.25	95.40	103.30	110.50	104.90

			All Flows in Cubic Feet per Second												
Drainage	Node	Exceedance	January	February	March	April	May	June	July	August	September	October	November	December	Annual
Santa Ana River	NSAR29	0.25	134.95	157.60	278.45	163.63	113.45	94.98	88.50	86.40	90.58	97.50	105.70	121.25	116.10
Santa Ana River	NSAR29	0.05	953.36	1169.30	942.35	556.47	526.79	278.29	141.74	145.03	120.43	123.50	498.48	697.55	535.00
Santa Ana River	NSAR29	mean	299.55	413.93	339.81	194.78	169.73	118.21	96.91	99.87	104.28	108.39	177.43	234.22	195.31
Santa Ana River	NSAR28	0.95	113.80	115.30	111.30	104.50	97.30	90.90	87.50	87.40	89.20	94.30	101.05	108.27	87.60
Santa Ana River	NSAR28	0.75	115.10	115.60	113.30	106.80	99.30	92.20	88.00	87.40	89.90	95.45	102.50	110.40	94.10
Santa Ana River	NSAR28	0.50	116.10	117.70	117.60	109.20	101.90	94.10	89.00	87.60	91.00	97.20	105.05	112.30	106.70
Santa Ana River	NSAR28	0.25	136.65	159.40	279.65	165.43	115.25	96.78	90.20	88.10	92.30	99.20	107.48	123.05	117.85
Santa Ana River	NSAR28	0.05	947.69	1170.78	934.17	558.47	528.79	280.19	143.54	146.83	122.18	125.27	493.65	692.20	536.15
Santa Ana River	NSAR28	mean	300.17	414.48	340.62	196.29	171.48	119.97	98.65	101.57	105.91	110.00	178.51	235.24	196.62
Santa Ana River	NSAR27	0.95	115.40	116.90	112.97	106.15	98.90	92.60	89.20	89.00	90.80	95.90	102.70	109.90	89.20
Santa Ana River	NSAR27	0.75	116.70	117.30	114.90	108.43	100.90	93.90	89.70	89.10	91.50	97.05	104.20	112.00	95.70
Santa Ana River	NSAR27	0.50	117.80	119.35	119.10	110.90	103.50	95.70	90.60	89.20	92.60	98.80	106.70	113.90	108.20
Santa Ana River	NSAR27	0.25	137.25	159.15	267.70	165.98	116.90	98.28	91.90	89.80	93.90	100.90	109.08	124.00	119.30
Santa Ana River	NSAR27	0.05	860.29	1159.53	895.35	556.46	530.39	281.99	145.24	148.53	123.88	125.98	467.42	633.66	530.45
Santa Ana River	NSAR27	mean	291.21	403.22	332.34	195.09	172.62	121.58	100.21	102.05	106.53	110.48	174.14	229.93	193.88
Santa Ana River	NSAR25	0.95	73.30	75.10	71.70	65.45	58.40	52.50	49.30	49.00	50.10	54.40	60.75	67.70	49.30
Santa Ana River	NSAR25	0.75	74.60	75.50	73.70	67.73	60.40	53.80	49.80	49.00	50.80	55.55	62.20	69.85	54.90
Santa Ana River	NSAR25	0.50	75.70	77.55	77.80	70.20	63.10	55.60	50.70	49.20	51.90	57.30	64.80	71.70	66.90
Santa Ana River	NSAR25	0.25	95.20	117.55	226.90	125.48	76.45	58.25	52.00	49.80	53.20	59.40	67.18	81.85	77.60
Santa Ana River	NSAR25	0.05	819.72	1119.73	855.68	516.91	491.02	242.49	105.64	108.73	83.28	84.58	426.43	592.73	491.10
Santa Ana River	NSAR25	mean	249.65	362.45	291.86	154.63	132.31	81.60	60.37	62.08	65.90	69.04	132.45	188.13	153.13
Santa Ana River	NSAR244	0.95	31.50	31.50	31.30	31.20	31.10	31.00	30.90	31.00	31.10	31.30	31.40	31.50	31.00
Santa Ana River	NSAR244	0.75	31.70	31.70	31.60	31.30	31.20	31.00	31.00	31.00	31.10	31.30	31.40	31.60	31.20
Santa Ana River	NSAR244	0.50	32.50	33.75	36.10	32.20	31.30	31.10	31.00	31.00	31.20	31.30	31.60	32.10	31.60
Santa Ana River	NSAR244	0.25	51.30	72.25	172.70	85.78	46.35	33.30	31.10	31.20	31.40	31.50	33.65	42.70	39.70
Santa Ana River	NSAR244	0.05	724.28	1031.55	782.30	475.25	459.49	218.83	85.05	80.80	62.51	55.61	357.84	496.56	447.75
Santa Ana River	NSAR244	mean	195.34	302.96	237.97	115.44	101.77	57.79	40.87	43.13	44.47	42.42	94.17	142.44	117.28
Santa Ana River	NSAR243	0.95	31.50	31.50	31.30	31.20	31.10	31.00	30.90	31.00	31.10	31.30	31.40	31.50	31.00
Santa Ana River	NSAR243	0.75	31.70	31.70	31.60	31.30	31.20	31.00	31.00	31.00	31.10	31.30	31.40	31.60	31.20
Santa Ana River	NSAR243	0.50	32.50	33.75	36.10	32.20	31.30	31.10	31.00	31.00	31.20	31.30	31.60	32.10	31.60
Santa Ana River	NSAR243	0.25	51.30	72.25	172.70	85.78	46.35	33.30	31.10	31.20	31.40	31.50	33.65	42.70	39.70
Santa Ana River	NSAR243	0.05	724.28	1031.55	782.30	475.25	459.49	218.83	85.05	80.80	62.51	55.61	357.84	496.56	447.75
Santa Ana River	NSAR243	mean	195.34	302.96	237.97	115.44	101.77	57.79	40.87	43.13	44.47	42.42	94.17	142.44	117.28
Santa Ana River	NSAR242	0.95	31.50	31.50	31.30	31.20	31.10	31.00	30.90	31.00	31.10	31.30	31.40	31.50	31.00
Santa Ana River	NSAR242	0.75	31.70	31.70	31.60	31.30	31.20	31.00	31.00	31.00	31.10	31.30	31.40	31.60	31.20
Santa Ana River	NSAR242	0.50	32.50	33.75	36.10	32.20	31.30	31.10	31.00	31.00	31.20	31.30	31.60	32.10	31.60
Santa Ana River	NSAR242	0.25	51.30	72.25	172.70	85.78	46.35	33.30	31.10	31.20	31.40	31.50	33.65	42.70	39.70
Santa Ana River	NSAR242	0.05	724.28	1031.55	782.30	475.25	459.49	218.83	85.05	80.80	62.51	55.61	357.84	496.56	447.75
Santa Ana River	NSAR242	mean	195.34	302.96	237.97	115.44	101.77	57.79	40.87	43.13	44.47	42.42	94.17	142.44	117.28
Santa Ana River	NSAR241	0.95	31.50	31.50	31.30	31.20	31.10	31.00	30.90	31.00	31.10	31.30	31.40	31.50	31.00
Santa Ana River	NSAR241	0.75	31.70	31.70	31.60	31.30	31.20	31.00	31.00	31.00	31.10	31.30	31.40	31.60	31.20
Santa Ana River	NSAR241	0.50	32.50	33.75	36.10	32.20	31.30	31.10	31.00	31.00	31.20	31.30	31.60	32.10	31.60
Santa Ana River	NSAR241	0.25	51.30	72.25	172.70	85.78	46.35	33.30	31.10	31.20	31.40	31.50	33.65	42.70	39.70
Santa Ana River	NSAR241	0.05	724.28	1031.55	782.30	475.25	459.49	218.83	85.05	80.80	62.51	55.61	357.84	496.56	447.75
Santa Ana River	NSAR241	mean	195.34	302.96	237.97	115.44	101.77	57.79	40.87	43.13	44.47	42.42	94.17	142.44	117.28

			All Flows in Cubic Feet per Second												
Drainage	**Node**	**Exceedance**	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**	**Annual**
Santa Ana River	NSAR24	0.95	31.50	31.50	31.30	31.20	31.10	31.00	30.90	31.00	31.10	31.30	31.40	31.50	31.00
Santa Ana River	NSAR24	0.75	31.70	31.70	31.60	31.30	31.20	31.00	31.00	31.00	31.10	31.30	31.40	31.60	31.20
Santa Ana River	NSAR24	0.50	32.50	33.75	36.10	32.20	31.30	31.10	31.00	31.00	31.20	31.30	31.60	32.10	31.60
Santa Ana River	NSAR24	0.25	51.30	72.25	172.70	85.78	46.35	33.30	31.10	31.20	31.40	31.50	33.65	42.70	39.70
Santa Ana River	NSAR24	0.05	724.28	1031.55	782.30	475.25	459.49	218.83	85.05	80.80	62.51	55.61	357.84	496.56	447.75
Santa Ana River	NSAR24	mean	195.34	302.96	237.97	115.44	101.77	57.79	40.87	43.13	44.47	42.42	94.17	142.44	117.28
Santa Ana River	NSAR232	0.95	31.50	31.50	31.30	31.20	31.10	31.00	30.90	31.00	31.10	31.30	31.40	31.50	31.00
Santa Ana River	NSAR232	0.75	31.70	31.70	31.60	31.30	31.20	31.00	31.00	31.00	31.10	31.30	31.40	31.60	31.20
Santa Ana River	NSAR232	0.50	32.50	33.70	36.10	32.15	31.30	31.10	31.00	31.00	31.20	31.30	31.60	32.10	31.60
Santa Ana River	NSAR232	0.25	51.05	72.25	170.40	83.88	46.35	33.30	31.10	31.20	31.40	31.50	33.43	42.70	39.60
Santa Ana River	NSAR232	0.05	685.41	972.85	778.07	474.07	459.49	218.83	85.05	80.59	62.18	52.15	339.06	473.27	443.25
Santa Ana River	NSAR232	mean	189.97	296.31	232.79	114.28	101.57	57.77	40.83	42.90	44.01	41.89	91.39	138.94	115.12
Santa Ana River	NSAR231	0.95	31.50	31.50	31.30	31.20	31.10	31.00	30.90	31.00	31.10	31.30	31.40	31.50	31.00
Santa Ana River	NSAR231	0.75	31.70	31.70	31.60	31.30	31.20	31.00	31.00	31.00	31.10	31.30	31.40	31.60	31.20
Santa Ana River	NSAR231	0.50	32.50	33.70	36.10	32.15	31.30	31.10	31.00	31.00	31.20	31.30	31.60	32.10	31.60
Santa Ana River	NSAR231	0.25	51.05	72.25	170.40	83.88	46.35	33.30	31.10	31.20	31.40	31.50	33.43	42.70	39.60
Santa Ana River	NSAR231	0.05	685.41	972.85	778.07	474.07	459.49	218.83	85.05	80.59	62.18	52.15	339.06	473.27	443.25
Santa Ana River	NSAR231	mean	189.97	296.31	232.79	114.28	101.57	57.77	40.83	42.90	44.01	41.89	91.39	138.94	115.12
Santa Ana River	NSAR23	0.95	31.50	31.50	31.30	31.20	31.10	31.00	30.90	31.00	31.10	31.30	31.40	31.50	31.00
Santa Ana River	NSAR23	0.75	31.70	31.70	31.60	31.30	31.20	31.00	31.00	31.00	31.10	31.30	31.40	31.60	31.20
Santa Ana River	NSAR23	0.50	32.50	33.70	36.10	32.15	31.30	31.10	31.00	31.00	31.20	31.30	31.60	32.10	31.60
Santa Ana River	NSAR23	0.25	51.05	72.25	170.40	83.88	46.35	33.30	31.10	31.20	31.40	31.50	33.43	42.70	39.60
Santa Ana River	NSAR23	0.05	685.41	972.85	778.07	474.07	459.49	218.83	85.05	80.59	62.18	52.15	339.06	473.27	443.25
Santa Ana River	NSAR23	mean	189.97	296.31	232.79	114.28	101.57	57.77	40.83	42.90	44.01	41.89	91.39	138.94	115.12
Santa Ana River	NSAR22	0.95	35.30	35.30	35.20	35.10	35.00	34.90	34.80	34.80	35.00	35.10	35.30	35.30	34.80
Santa Ana River	NSAR22	0.75	35.55	35.60	35.50	35.20	35.00	34.90	34.80	34.80	35.00	35.20	35.30	35.40	35.00
Santa Ana River	NSAR22	0.50	36.30	37.55	39.90	36.00	35.10	34.90	34.80	34.80	35.00	35.20	35.40	35.90	35.40
Santa Ana River	NSAR22	0.25	54.95	76.25	174.55	87.88	50.25	37.18	34.90	35.00	35.30	35.30	37.25	46.60	43.50
Santa Ana River	NSAR22	0.05	742.49	1048.58	846.89	486.11	468.46	223.13	89.05	84.59	66.18	56.05	343.56	485.11	448.75
Santa Ana River	NSAR22	mean	198.65	307.48	243.42	120.17	106.29	61.69	44.69	47.01	48.16	46.07	97.28	146.06	121.29
Santa Ana River	NSAR21	0.95	37.60	37.50	37.40	37.30	37.20	37.10	37.00	37.00	37.20	37.40	37.50	37.60	37.00
Santa Ana River	NSAR21	0.75	37.80	37.80	37.70	37.40	37.20	37.10	37.00	37.00	37.20	37.40	37.50	37.70	37.20
Santa Ana River	NSAR21	0.50	38.60	39.80	42.20	38.20	37.30	37.10	37.00	37.00	37.20	37.40	37.60	38.10	37.60
Santa Ana River	NSAR21	0.25	56.85	78.25	170.80	90.00	52.55	39.38	37.20	37.25	37.50	37.60	39.30	48.80	45.70
Santa Ana River	NSAR21	0.05	733.85	1035.10	844.28	494.07	475.49	225.63	91.35	85.84	68.48	55.99	342.93	489.38	451.30
Santa Ana River	NSAR21	mean	198.10	306.75	244.12	122.54	109.02	63.94	46.89	49.18	50.16	48.04	98.13	146.62	122.68
Santa Ana River	NSAR20	0.95	49.30	49.30	49.20	49.00	49.00	48.80	48.80	48.80	49.00	49.10	49.30	49.30	48.80
Santa Ana River	NSAR20	0.75	49.55	49.60	49.50	49.20	49.00	48.90	48.80	48.80	49.00	49.10	49.30	49.40	49.00
Santa Ana River	NSAR20	0.50	50.40	51.60	54.00	50.00	49.10	48.90	48.80	48.80	49.00	49.20	49.40	49.90	49.40
Santa Ana River	NSAR20	0.25	68.40	88.60	179.50	98.55	64.45	51.08	48.90	49.00	49.30	49.30	51.08	60.70	57.40
Santa Ana River	NSAR20	0.05	832.14	1127.55	937.45	549.55	525.62	238.73	103.65	97.30	80.48	66.95	334.47	533.59	487.85
Santa Ana River	NSAR20	mean	214.27	326.73	266.21	139.62	125.53	76.01	58.74	61.27	62.10	59.99	111.15	161.04	137.59
Santa Ana River	NSAR19	0.95	8.50	8.50	8.40	8.20	8.20	8.00	8.00	8.00	8.10	8.30	8.40	8.50	8.00
Santa Ana River	NSAR19	0.75	8.70	8.70	8.70	8.40	8.20	8.10	8.00	8.00	8.20	8.30	8.50	8.60	8.20
Santa Ana River	NSAR19	0.50	9.50	10.80	13.20	9.20	8.30	8.10	8.00	8.00	8.20	8.40	8.60	9.10	8.60

			All Flows in Cubic Feet per Second												
Drainage	**Node**	**Exceedance**	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**	**Annual**
Santa Ana River	NSAR19	0.25	27.55	47.80	138.70	57.75	23.65	10.28	8.10	8.20	8.50	8.50	10.20	19.90	16.60
Santa Ana River	NSAR19	0.05	793.77	1089.28	899.25	509.35	485.22	197.97	62.85	56.50	39.68	26.15	293.77	493.32	447.30
Santa Ana River	NSAR19	mean	173.64	286.18	225.67	98.91	84.79	35.20	17.94	20.47	21.30	19.18	70.41	120.35	96.87
Santa Ana River	NSAR18	0.95	0.30	0.30	0.40	0.30	0.20	0.20	0.10	0.10	0.10	0.10	0.20	0.20	0.10
Santa Ana River	NSAR18	0.75	0.80	0.90	1.00	0.60	0.40	0.30	0.20	0.10	0.20	0.20	0.30	0.50	0.30
Santa Ana River	NSAR18	0.50	2.60	3.90	5.90	2.35	0.60	0.30	0.20	0.20	0.20	0.30	0.60	1.50	0.60
Santa Ana River	NSAR18	0.25	14.25	30.18	98.90	44.23	16.50	3.70	0.50	0.60	0.60	0.60	3.28	10.95	9.00
Santa Ana River	NSAR18	0.05	657.83	939.75	816.93	497.15	480.92	192.03	56.39	50.40	32.60	13.16	201.14	376.11	408.70
Santa Ana River	NSAR18	mean	146.95	257.54	201.49	88.06	76.83	27.87	10.45	12.06	12.06	9.32	50.46	96.89	81.59
Santa Ana River	NSAR17	0.95	0.30	0.30	0.40	0.30	0.20	0.20	0.10	0.10	0.10	0.10	0.20	0.20	0.10
Santa Ana River	NSAR17	0.75	0.80	0.90	1.00	0.60	0.40	0.30	0.20	0.10	0.20	0.20	0.30	0.50	0.30
Santa Ana River	NSAR17	0.50	2.70	4.00	5.90	2.45	0.60	0.30	0.20	0.20	0.20	0.30	0.60	1.50	0.70
Santa Ana River	NSAR17	0.25	14.35	27.90	91.05	41.30	16.45	3.80	0.55	0.70	0.60	0.60	3.10	10.50	8.60
Santa Ana River	NSAR17	0.05	597.66	913.95	813.87	497.35	481.02	192.13	56.49	50.50	32.70	12.03	183.41	334.08	395.15
Santa Ana River	NSAR17	mean	141.12	251.33	196.48	86.89	76.63	27.89	10.45	11.20	11.61	8.72	47.95	92.31	79.32
Santa Ana River	NSAR16	0.95	0.40	0.50	0.50	0.40	0.30	0.30	0.20	0.20	0.20	0.20	0.30	0.30	0.20
Santa Ana River	NSAR16	0.75	1.10	1.30	1.40	0.90	0.50	0.40	0.30	0.20	0.20	0.30	0.40	0.70	0.40
Santa Ana River	NSAR16	0.50	3.40	4.70	6.60	3.15	0.80	0.50	0.30	0.30	0.30	0.40	0.80	2.10	0.90
Santa Ana River	NSAR16	0.25	15.05	28.68	91.85	42.00	17.15	4.50	0.75	0.90	0.90	0.80	3.80	11.30	9.40
Santa Ana River	NSAR16	0.05	602.78	923.03	822.77	500.45	483.82	192.93	57.29	51.23	33.50	12.80	184.21	334.95	396.25
Santa Ana River	NSAR16	mean	142.16	252.67	197.91	87.76	77.28	28.22	10.70	11.47	11.87	8.98	48.49	93.11	79.99
Santa Ana River	NSAR151	0.95	0.50	0.60	0.60	0.60	0.40	0.40	0.30	0.20	0.20	0.30	0.30	0.40	0.30
Santa Ana River	NSAR151	0.75	1.35	1.60	1.80	1.10	0.70	0.50	0.30	0.30	0.30	0.30	0.50	0.80	0.50
Santa Ana River	NSAR151	0.50	4.00	5.00	6.80	3.55	1.00	0.60	0.40	0.30	0.30	0.40	1.00	2.60	1.10
Santa Ana River	NSAR151	0.25	15.40	27.15	87.95	42.15	17.75	5.00	0.90	1.10	1.00	1.00	4.20	11.65	9.60
Santa Ana River	NSAR151	0.05	586.63	915.93	828.70	502.85	486.02	193.57	57.89	50.71	33.87	11.96	170.68	315.51	389.10
Santa Ana River	NSAR151	mean	138.36	248.55	194.78	87.45	77.57	28.47	10.88	11.00	11.69	8.63	46.92	90.27	78.66
Santa Ana River	NSAR15	0.95	0.70	0.90	0.90	0.80	0.60	0.50	0.40	0.30	0.30	0.40	0.40	0.60	0.40
Santa Ana River	NSAR15	0.75	1.85	2.20	2.50	1.50	0.90	0.70	0.50	0.40	0.40	0.40	0.70	1.15	0.70
Santa Ana River	NSAR15	0.50	4.70	5.80	7.60	4.25	1.40	0.80	0.60	0.40	0.50	0.60	1.40	3.30	1.60
Santa Ana River	NSAR15	0.25	16.15	27.85	88.75	42.95	18.55	5.78	1.30	1.50	1.40	1.40	4.98	12.45	10.40
Santa Ana River	NSAR15	0.05	591.55	925.20	837.80	506.21	488.95	194.43	58.69	51.51	34.67	12.76	171.48	316.41	390.20
Santa Ana River	NSAR15	mean	139.47	249.97	196.29	88.42	78.33	28.87	11.19	11.31	12.01	8.96	47.55	91.15	79.41
Santa Ana River	NSAR14	0.95	1.07	1.40	1.40	1.20	1.00	0.80	0.60	0.50	0.50	0.60	0.70	1.00	0.60
Santa Ana River	NSAR14	0.75	2.80	3.13	3.40	2.40	1.50	1.10	0.80	0.60	0.60	0.70	1.00	1.85	1.00
Santa Ana River	NSAR14	0.50	5.60	6.75	8.50	5.20	2.20	1.30	1.00	0.70	0.80	1.00	2.20	4.30	2.50
Santa Ana River	NSAR14	0.25	16.85	28.70	88.65	43.90	19.45	6.78	2.00	2.40	2.28	2.20	5.88	13.30	11.30
Santa Ana River	NSAR14	0.05	584.74	916.78	849.63	510.55	492.85	195.53	59.69	52.39	35.67	12.92	168.69	317.61	388.90
Santa Ana River	NSAR14	mean	139.94	250.68	197.40	89.55	79.40	29.51	11.68	11.73	12.41	9.40	47.95	91.72	80.06
Santa Ana River	RNASRP	0.95	1.66	2.08	2.23	1.93	1.52	1.33	0.93	0.76	0.83	0.92	1.05	1.47	0.94
Santa Ana River	RNASRP	0.75	3.65	4.03	4.33	3.25	2.26	1.69	1.17	0.93	0.96	1.06	1.55	2.75	1.56
Santa Ana River	RNASRP	0.50	6.47	7.66	9.35	6.09	3.05	2.01	1.47	1.13	1.20	1.53	3.11	5.16	3.37
Santa Ana River	RNASRP	0.25	16.97	27.87	83.93	44.92	20.29	7.68	2.84	3.32	3.09	3.06	6.75	14.24	12.03
Santa Ana River	RNASRP	0.05	539.98	883.61	846.90	513.21	496.17	196.62	60.63	53.31	36.67	13.75	160.48	305.59	382.57
Santa Ana River	RNASRP	mean	133.80	244.00	192.44	90.07	80.37	30.26	12.16	12.10	12.56	9.82	46.15	87.77	78.42

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Santa Ana River	NSAR13	0.95	1.67	2.10	2.20	1.90	1.50	1.30	0.90	0.80	0.80	0.90	1.10	1.50	0.90
Santa Ana River	NSAR13	0.75	3.65	4.03	4.30	3.30	2.30	1.70	1.20	0.90	1.00	1.10	1.53	2.75	1.60
Santa Ana River	NSAR13	0.50	6.50	7.65	9.30	6.10	3.10	2.00	1.50	1.10	1.20	1.50	3.10	5.20	3.40
Santa Ana River	NSAR13	0.25	16.95	27.85	83.90	44.90	20.30	7.68	2.80	3.30	3.10	3.05	6.78	14.20	12.00
Santa Ana River	NSAR13	0.05	539.98	883.63	846.92	513.20	496.15	196.63	60.60	53.30	36.67	13.75	160.45	305.56	382.60
Santa Ana River	NSAR13	mean	133.80	244.00	192.44	90.07	80.37	30.26	12.16	12.10	12.56	9.82	46.15	87.77	78.42
Santa Ana River	US RNASRP	0.95	1.66	2.08	2.23	1.93	1.52	1.33	0.93	0.76	0.83	0.92	1.05	1.47	0.94
Santa Ana River	US RNASRP	0.75	3.65	4.03	4.33	3.25	2.26	1.69	1.17	0.93	0.96	1.06	1.55	2.75	1.56
Santa Ana River	US RNASRP	0.50	6.47	7.66	9.35	6.09	3.05	2.01	1.47	1.13	1.20	1.53	3.11	5.16	3.37
Santa Ana River	US RNASRP	0.25	16.97	27.87	83.93	44.92	20.29	7.68	2.84	3.32	3.09	3.06	6.75	14.24	12.03
Santa Ana River	US RNASRP	0.05	539.98	883.61	846.90	513.21	496.17	196.62	60.63	53.31	36.67	13.75	160.48	305.59	382.57
Santa Ana River	US RNASRP	mean	133.80	244.00	192.44	90.07	80.37	30.26	12.16	12.10	12.56	9.82	46.15	87.77	78.42
Santa Ana River	SE-74	0.95	0.05	0.12	0.16	0.15	0.14	0.13	0.12	0.10	0.09	0.07	0.06	0.06	0.08
Santa Ana River	SE-74	0.75	0.25	0.22	0.36	0.29	0.26	0.21	0.16	0.13	0.12	0.10	0.10	0.11	0.16
Santa Ana River	SE-74	0.50	0.61	1.48	1.88	0.87	0.41	0.30	0.25	0.19	0.19	0.14	0.19	0.40	0.35
Santa Ana River	SE-74	0.25	5.79	13.45	48.36	28.87	12.13	5.09	1.12	0.93	0.94	0.44	1.10	4.19	3.82
Santa Ana River	SE-74	0.05	404.04	679.00	712.23	482.96	468.65	182.99	49.49	48.28	32.23	5.66	103.36	219.63	321.12
Santa Ana River	SE-74	mean	92.58	190.63	149.17	74.53	71.02	25.53	9.63	9.12	9.23	5.84	31.08	66.10	60.51
Santa Ana River	SE-58	0.95	0.03	0.04	0.06	0.05	0.05	0.05	0.05	0.04	0.03	0.03	0.02	0.01	0.03
Santa Ana River	SE-58	0.75	0.08	0.13	0.15	0.14	0.12	0.10	0.07	0.06	0.05	0.04	0.03	0.04	0.07
Santa Ana River	SE-58	0.50	0.84	1.64	1.57	0.69	0.32	0.25	0.28	0.20	0.28	0.11	0.20	0.62	0.37
Santa Ana River	SE-58	0.25	5.43	7.58	12.69	12.17	10.87	7.75	2.40	2.45	2.10	0.71	2.04	4.05	4.08
Santa Ana River	SE-58	0.05	73.43	314.19	439.81	499.64	506.18	231.99	61.96	57.25	40.15	3.97	24.63	70.25	242.07
Santa Ana River	SE-58	mean	34.41	85.01	80.86	67.37	76.49	32.76	13.28	10.24	6.97	1.94	10.66	28.69	37.12
Santa Ana River	SE-55	0.95	0.02	0.03	0.05	0.04	0.04	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Santa Ana River	SE-55	0.75	0.05	0.06	0.09	0.07	0.06	0.05	0.04	0.03	0.03	0.02	0.02	0.02	0.04
Santa Ana River	SE-55	0.50	0.09	0.15	0.18	0.17	0.11	0.07	0.05	0.04	0.04	0.03	0.04	0.04	0.07
Santa Ana River	SE-55	0.25	0.28	0.79	0.71	0.72	0.44	0.29	0.20	0.14	0.15	0.07	0.08	0.13	0.28
Santa Ana River	SE-55	0.05	29.94	261.36	261.91	260.48	450.95	140.64	63.57	56.03	44.36	0.31	0.37	2.84	170.84
Santa Ana River	SE-55	mean	11.21	55.10	41.19	36.73	48.12	20.87	11.99	10.44	4.93	0.70	3.30	16.96	21.60
Temescal Wash	NTE24	0.95	48.00	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30
Temescal Wash	NTE24	0.75	48.00	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30
Temescal Wash	NTE24	0.50	48.00	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30
Temescal Wash	NTE24	0.25	48.00	2.30	3.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30
Temescal Wash	NTE24	0.05	279.97	548.50	502.33	175.45	60.20	8.92	2.30	2.30	2.30	2.40	45.31	109.04	65.30
Temescal Wash	NTE24	mean	139.40	140.65	95.90	25.78	9.37	3.44	2.42	3.96	4.43	4.43	28.96	44.81	41.50
Temescal Wash	NTE23	0.95	48.00	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30
Temescal Wash	NTE23	0.75	48.00	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30
Temescal Wash	NTE23	0.50	48.00	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30
Temescal Wash	NTE23	0.25	48.00	2.30	3.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30
Temescal Wash	NTE23	0.05	279.97	548.50	502.33	175.45	60.20	8.92	2.30	2.30	2.30	2.40	45.31	109.04	65.30
Temescal Wash	NTE23	mean	139.40	140.65	95.90	25.78	9.37	3.44	2.42	3.96	4.43	4.43	28.96	44.81	41.50
Temescal Wash	NTE22	0.95	48.00	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30
Temescal Wash	NTE22	0.75	48.00	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30
Temescal Wash	NTE22	0.50	48.00	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30

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Temescal Wash	NTE22	0.25	48.00	2.30	3.15	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30
Temescal Wash	NTE22	0.05	258.43	539.73	502.33	175.45	58.87	8.92	2.30	2.30	2.30	2.40	38.11	94.13	61.30
Temescal Wash	NTE22	mean	135.14	134.90	91.86	25.13	9.28	3.41	2.41	3.84	4.21	4.19	26.98	42.51	39.89
The Zanja	SE-59	0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
The Zanja	SE-59	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
The Zanja	SE-59	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
The Zanja	SE-59	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
The Zanja	SE-59	0.05	6.46	8.17	5.24	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.08	1.36	0.01
The Zanja	SE-59	mean	1.09	1.85	1.00	0.17	0.03	0.00	0.00	0.08	0.10	0.12	0.46	0.78	0.47
Upper Warm Creek	SE-31	0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Upper Warm Creek	SE-31	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Upper Warm Creek	SE-31	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Upper Warm Creek	SE-31	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Upper Warm Creek	SE-31	0.05	28.61	33.55	19.52	0.59	0.00	0.00	0.00	0.00	0.00	0.00	5.05	9.09	0.80
Upper Warm Creek	SE-31	mean	4.96	7.11	4.36	0.72	0.13	0.00	0.00	0.39	0.50	0.60	2.28	3.59	2.03
Upper Warm Creek	SE-20	0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Upper Warm Creek	SE-20	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Upper Warm Creek	SE-20	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Upper Warm Creek	SE-20	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Upper Warm Creek	SE-20	0.05	6.65	9.37	4.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.33	0.00
Upper Warm Creek	SE-20	mean	2.00	3.79	2.05	0.13	0.02	0.00	0.00	0.15	0.17	0.19	0.69	1.36	0.87
Warm Creek	NW-35	0.95	1.32	1.84	1.78	1.59	1.26	1.09	0.71	0.57	0.65	0.75	0.89	1.28	0.73
Warm Creek	NW-35	0.75	2.95	3.25	3.55	2.71	1.78	1.34	0.89	0.70	0.75	0.85	1.22	2.05	1.18
Warm Creek	NW-35	0.50	4.87	5.42	6.00	4.27	2.34	1.56	1.08	0.80	0.85	1.20	2.43	4.27	2.21
Warm Creek	NW-35	0.25	8.78	9.87	13.11	6.36	4.14	2.23	1.43	1.09	1.36	1.95	5.41	6.79	5.00
Warm Creek	NW-35	0.05	62.65	65.58	53.02	17.34	6.38	3.54	2.46	1.93	3.92	6.38	23.42	49.26	19.49
Warm Creek	NW-35	mean	14.70	16.73	14.50	6.55	3.29	1.88	1.26	1.74	2.10	2.78	7.66	11.69	7.03
Warm Creek	NW-34	0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Warm Creek	NW-34	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Warm Creek	NW-34	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Warm Creek	NW-34	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Warm Creek	NW-34	0.05	0.00	1.78	3.44	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Warm Creek	NW-34	mean	0.01	0.32	0.44	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07
Warm Creek	NW-33	0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Warm Creek	NW-33	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Warm Creek	NW-33	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Warm Creek	NW-33	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Warm Creek	NW-33	0.05	12.53	11.97	8.66	0.65	0.00	0.00	0.00	0.00	0.00	0.02	3.36	5.49	0.91
Warm Creek	NW-33	mean	1.71	1.88	1.34	0.33	0.06	0.00	0.00	0.14	0.19	0.24	0.93	1.31	0.67
Warm Creek	NW-32	0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Warm Creek	NW-32	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Warm Creek	NW-32	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Warm Creek	NW-32	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Warm Creek	NW-32	0.05	11.58	11.07	8.17	0.83	0.00	0.00	0.00	0.00	0.00	0.07	3.61	5.25	1.07
Warm Creek	NW-32	mean	1.54	1.69	1.23	0.32	0.06	0.00	0.00	0.12	0.17	0.22	0.85	1.18	0.61

			All Flows in Cubic Feet per Second												
Drainage	**Node**	**Exceedance**	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**	**Annual**
Warm Creek	NW-31	0.95	0.03	0.04	0.05	0.05	0.04	0.04	0.04	0.04	0.04	0.03	0.03	0.03	0.03
Warm Creek	NW-31	0.75	0.05	0.05	0.06	0.05	0.05	0.05	0.04	0.04	0.04	0.03	0.04	0.04	0.04
Warm Creek	NW-31	0.50	0.06	0.07	0.07	0.07	0.06	0.05	0.04	0.04	0.04	0.04	0.04	0.05	0.05
Warm Creek	NW-31	0.25	0.10	0.13	0.25	0.12	0.08	0.06	0.05	0.04	0.04	0.04	0.05	0.09	0.07
Warm Creek	NW-31	0.05	8.85	8.50	6.30	1.01	0.17	0.09	0.07	0.06	0.07	0.26	3.01	4.16	1.23
Warm Creek	NW-31	mean	1.27	1.39	1.06	0.34	0.12	0.06	0.05	0.13	0.17	0.22	0.71	0.98	0.54
Warm Creek	NW-30	0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Warm Creek	NW-30	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Warm Creek	NW-30	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Warm Creek	NW-30	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Warm Creek	NW-30	0.05	2.29	2.35	1.17	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.29	0.02
Warm Creek	NW-30	mean	0.37	0.43	0.27	0.05	0.01	0.00	0.00	0.03	0.04	0.05	0.19	0.28	0.14
Waterman Canyon Creek	SE-12	0.95	0.06	0.26	0.77	0.41	0.22	0.13	0.09	0.06	0.06	0.05	0.05	0.06	0.06
Waterman Canyon Creek	SE-12	0.75	0.37	1.29	1.76	1.23	0.68	0.33	0.18	0.11	0.08	0.07	0.07	0.11	0.16
Waterman Canyon Creek	SE-12	0.50	2.16	2.72	3.49	2.81	1.43	0.57	0.28	0.17	0.13	0.12	0.13	0.34	0.58
Waterman Canyon Creek	SE-12	0.25	3.56	6.62	8.00	7.10	4.16	1.97	0.73	0.39	0.28	0.22	0.35	1.73	2.45
Waterman Canyon Creek	SE-12	0.05	11.52	25.35	23.10	13.92	8.33	4.36	1.92	0.94	0.96	1.20	3.22	8.07	10.48
Waterman Canyon Creek	SE-12	mean	4.46	8.93	8.37	4.75	2.70	1.29	0.56	0.35	0.32	0.30	0.81	2.33	2.90
Waterman Canyon Creek	SE-11	0.95	0.07	0.26	0.76	0.41	0.23	0.14	0.09	0.07	0.06	0.05	0.05	0.06	0.07
Waterman Canyon Creek	SE-11	0.75	0.35	1.23	1.70	1.21	0.67	0.33	0.19	0.12	0.09	0.08	0.07	0.11	0.16
Waterman Canyon Creek	SE-11	0.50	2.01	2.52	3.32	2.70	1.39	0.56	0.29	0.18	0.13	0.12	0.13	0.32	0.56
Waterman Canyon Creek	SE-11	0.25	3.28	6.13	7.37	6.64	3.90	1.86	0.71	0.38	0.27	0.21	0.33	1.49	2.30
Waterman Canyon Creek	SE-11	0.05	10.00	22.99	20.62	12.57	7.60	3.98	1.78	0.88	0.92	1.08	2.76	7.30	9.48
Waterman Canyon Creek	SE-11	mean	4.16	8.40	7.79	4.39	2.52	1.22	0.54	0.33	0.30	0.27	0.71	2.14	2.70

			All Streamflows in Cubic Feet per Second												
Drainage	**Node**	**Exceedance**	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**	**Annual**
Borea Daley Creek	SE-26	0.95	0.24	0.34	0.40	0.42	0.40	0.38	0.34	0.31	0.29	0.27	0.25	0.24	0.27
Borea Daley Creek	SE-26	0.75	0.35	0.51	0.58	0.50	0.46	0.42	0.38	0.34	0.32	0.29	0.27	0.29	0.35
Borea Daley Creek	SE-26	0.50	0.67	0.80	0.98	0.80	0.57	0.47	0.41	0.37	0.34	0.31	0.32	0.39	0.46
Borea Daley Creek	SE-26	0.25	1.14	1.84	3.39	1.79	1.16	0.73	0.53	0.44	0.40	0.40	0.41	0.79	0.83
Borea Daley Creek	SE-26	0.05	18.03	20.33	15.71	4.67	2.70	1.84	0.94	0.73	0.71	0.83	8.16	10.94	5.52
Borea Daley Creek	SE-26	mean	3.09	4.23	3.72	1.82	1.06	0.68	0.50	0.56	0.61	0.67	1.57	2.25	1.72
Borea Daley Creek	SE-25	0.95	0.01	0.01	0.04	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Borea Daley Creek	SE-25	0.75	0.02	0.09	0.11	0.06	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Borea Daley Creek	SE-25	0.50	0.17	0.21	0.30	0.21	0.07	0.02	0.01	0.01	0.01	0.01	0.01	0.02	0.03
Borea Daley Creek	SE-25	0.25	0.36	0.84	0.85	0.84	0.40	0.14	0.04	0.01	0.01	0.01	0.02	0.14	0.20
Borea Daley Creek	SE-25	0.05	1.24	2.67	3.17	1.91	1.13	0.84	0.18	0.09	0.07	0.10	0.39	0.86	1.23
Borea Daley Creek	SE-25	mean	0.46	1.12	1.05	0.53	0.30	0.13	0.04	0.03	0.02	0.03	0.08	0.25	0.33
Borea Daley Creek	SE-24	0.95	0.00	0.00	0.03	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Borea Daley Creek	SE-24	0.75	0.01	0.07	0.10	0.05	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Borea Daley Creek	SE-24	0.50	0.15	0.19	0.26	0.19	0.06	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.02
Borea Daley Creek	SE-24	0.25	0.30	0.81	0.81	0.81	0.39	0.13	0.03	0.00	0.00	0.00	0.01	0.10	0.17
Borea Daley Creek	SE-24	0.05	0.83	2.56	2.92	1.82	1.07	0.81	0.17	0.07	0.05	0.05	0.18	0.81	1.00
Borea Daley Creek	SE-24	mean	0.38	1.02	0.96	0.50	0.28	0.12	0.03	0.01	0.01	0.01	0.03	0.19	0.29
Cable Creek	NW-17	0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cable Creek	NW-17	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cable Creek	NW-17	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cable Creek	NW-17	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cable Creek	NW-17	0.05	0.00	0.00	12.32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cable Creek	NW-17	mean	3.42	12.48	7.18	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.36	1.37	2.02
Cable Creek	NW-16	0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cable Creek	NW-16	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cable Creek	NW-16	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cable Creek	NW-16	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cable Creek	NW-16	0.05	0.00	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cable Creek	NW-16	mean	1.66	5.75	3.43	0.02	0.00	0.00	0.00	0.01	0.02	0.01	0.01	0.80	0.95
Cable Creek	NW-13	0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cable Creek	NW-13	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cable Creek	NW-13	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cable Creek	NW-13	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cable Creek	NW-13	0.05	0.00	5.49	10.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cable Creek	NW-13	mean	1.70	6.13	4.29	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.83	1.07
Cable Creek	NW-12	0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cable Creek	NW-12	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cable Creek	NW-12	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cable Creek	NW-12	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cable Creek	NW-12	0.05	0.00	11.11	14.92	0.99	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cable Creek	NW-12	mean	1.73	6.35	4.94	0.32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.84	1.16
Cajon Wash	NW-19	0.95	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00
Cajon Wash	NW-19	0.75	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.01	0.01
Cajon Wash	NW-19	0.50	0.01	0.02	0.03	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01

			All Streamflows in Cubic Feet per Second												
Drainage	**Node**	**Exceedance**	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**	**Annual**
Cajon Wash	NW-19	0.25	0.03	0.05	0.06	0.05	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.02
Cajon Wash	NW-19	0.05	0.40	1.54	1.75	0.14	0.10	0.07	0.04	0.03	0.02	0.02	0.11	0.15	0.13
Cajon Wash	NW-19	mean	2.77	8.43	3.70	0.07	0.03	0.02	0.01	0.02	0.02	0.02	0.18	0.95	1.31
Cajon Wash	NW-18	0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cajon Wash	NW-18	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cajon Wash	NW-18	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cajon Wash	NW-18	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cajon Wash	NW-18	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cajon Wash	NW-18	mean	1.80	3.93	2.63	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.46	0.54	0.77
Chino Creek	NCH16	0.95	20.90	17.00	14.70	10.80	7.70	3.10	2.30	2.30	3.90	7.00	12.40	16.30	2.30
Chino Creek	NCH16	0.75	20.90	17.00	14.70	10.80	7.70	3.10	2.30	2.30	3.90	7.00	12.40	16.30	3.90
Chino Creek	NCH16	0.50	20.90	17.10	14.90	10.80	7.70	3.10	2.30	2.30	3.90	7.00	12.40	16.30	10.80
Chino Creek	NCH16	0.25	49.50	73.28	85.35	19.30	7.70	3.10	2.30	2.30	3.90	7.00	14.28	32.75	17.10
Chino Creek	NCH16	0.05	1920.79	1542.85	1062.60	248.60	22.19	3.60	2.30	2.40	19.01	41.83	723.41	1051.48	396.25
Chino Creek	NCH16	mean	315.54	302.41	247.11	57.68	18.69	4.24	2.77	9.15	19.69	24.36	142.02	191.76	110.45
Chino Creek	NCH12	0.95	7.70	5.40	5.40	4.60	3.10	0.80	0.80	0.80	0.80	0.80	3.10	4.60	0.80
Chino Creek	NCH12	0.75	7.70	5.40	5.40	4.60	3.10	0.80	0.80	0.80	0.80	0.80	3.10	4.60	0.80
Chino Creek	NCH12	0.50	7.70	5.40	5.40	4.60	3.10	0.80	0.80	0.80	0.80	0.80	3.10	4.60	3.10
Chino Creek	NCH12	0.25	11.45	6.45	9.40	4.60	3.10	0.80	0.80	0.80	0.80	0.80	3.10	4.70	5.40
Chino Creek	NCH12	0.05	939.59	854.63	550.16	110.25	4.26	0.80	0.80	0.80	6.46	16.49	446.18	499.19	189.85
Chino Creek	NCH12	mean	141.86	139.90	110.15	25.63	8.49	1.85	1.06	5.11	10.31	10.85	71.92	90.70	51.08
Chino Creek	NCH11	0.95	7.70	5.40	5.40	4.60	3.10	0.80	0.80	0.80	0.80	0.80	3.10	4.60	0.80
Chino Creek	NCH11	0.75	7.70	5.40	5.40	4.60	3.10	0.80	0.80	0.80	0.80	0.80	3.10	4.60	0.80
Chino Creek	NCH11	0.50	7.70	5.40	5.40	4.60	3.10	0.80	0.80	0.80	0.80	0.80	3.10	4.60	3.10
Chino Creek	NCH11	0.25	11.15	6.10	8.60	4.60	3.10	0.80	0.80	0.80	0.80	0.80	3.10	4.70	5.40
Chino Creek	NCH11	0.05	767.97	695.45	469.89	95.60	4.12	0.80	0.80	0.80	5.80	13.79	380.62	433.24	167.90
Chino Creek	NCH11	mean	119.26	117.71	92.98	22.61	7.71	1.83	1.02	4.59	9.12	9.17	60.05	76.13	43.17
Chino Creek	NCH10	0.95	3.10	1.50	1.50	1.50	1.50	0.00	0.00	0.00	0.00	0.00	1.50	1.50	0.00
Chino Creek	NCH10	0.75	3.10	1.50	1.50	1.50	1.50	0.00	0.00	0.00	0.00	0.00	1.50	1.50	0.00
Chino Creek	NCH10	0.50	3.10	1.50	1.50	1.50	1.50	0.00	0.00	0.00	0.00	0.00	1.50	1.50	1.50
Chino Creek	NCH10	0.25	6.20	2.20	4.60	1.50	1.50	0.00	0.00	0.00	0.00	0.00	1.50	1.60	1.50
Chino Creek	NCH10	0.05	603.88	578.30	389.02	79.25	2.62	0.00	0.00	0.00	4.64	12.99	312.53	368.47	136.95
Chino Creek	NCH10	mean	96.93	95.99	75.55	17.12	5.59	1.02	0.19	3.49	7.30	7.08	48.97	61.52	34.78
Chino Creek	NCH09	0.95	3.10	1.50	1.50	1.50	1.50	0.00	0.00	0.00	0.00	0.00	1.50	1.50	0.00
Chino Creek	NCH09	0.75	3.10	1.50	1.50	1.50	1.50	0.00	0.00	0.00	0.00	0.00	1.50	1.50	0.00
Chino Creek	NCH09	0.50	3.10	1.50	1.50	1.50	1.50	0.00	0.00	0.00	0.00	0.00	1.50	1.50	1.50
Chino Creek	NCH09	0.25	5.90	2.20	4.50	1.50	1.50	0.00	0.00	0.00	0.00	0.00	1.50	1.60	1.50
Chino Creek	NCH09	0.05	554.70	549.80	363.85	75.65	2.62	0.00	0.00	0.00	4.64	11.57	283.65	344.36	127.85
Chino Creek	NCH09	mean	89.98	88.98	70.19	16.11	5.33	1.01	0.18	3.34	6.80	6.47	44.98	56.87	32.26
City Creek	SE-41	0.95	0.22	0.32	0.35	0.37	0.37	0.35	0.31	0.28	0.27	0.25	0.24	0.23	0.26
City Creek	SE-41	0.75	0.33	0.40	0.46	0.43	0.43	0.40	0.35	0.32	0.30	0.27	0.26	0.27	0.33
City Creek	SE-41	0.50	0.49	0.56	0.65	0.58	0.50	0.44	0.38	0.34	0.32	0.30	0.30	0.37	0.42
City Creek	SE-41	0.25	0.84	1.14	2.58	1.12	0.77	0.60	0.50	0.42	0.39	0.41	0.44	0.67	0.67
City Creek	SE-41	0.05	19.98	44.62	85.01	10.60	1.89	1.29	0.91	0.75	0.70	0.85	6.47	11.22	7.86
City Creek	SE-41	mean	11.58	31.20	20.29	2.24	0.91	0.58	0.47	0.52	0.55	0.61	2.25	5.04	6.22

			All Streamflows in Cubic Feet per Second												
Drainage	**Node**	**Exceedance**	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**	**Annual**
City Creek	SE-39	0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
City Creek	SE-39	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
City Creek	SE-39	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
City Creek	SE-39	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
City Creek	SE-39	0.05	0.00	30.59	81.56	3.55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
City Creek	SE-39	mean	9.30	28.50	17.88	0.93	0.10	0.00	0.00	0.00	0.00	0.00	0.92	3.28	4.95
City Creek	SE-37	0.95	2.20	2.81	3.27	2.30	1.70	0.50	0.10	0.10	0.10	0.20	1.00	1.60	0.20
City Creek	SE-37	0.75	4.40	5.21	5.51	4.71	3.11	1.50	0.50	0.30	0.40	1.10	2.00	2.80	1.70
City Creek	SE-37	0.50	7.11	7.92	9.21	7.42	5.32	3.00	1.30	0.99	1.00	1.89	2.90	4.82	4.20
City Creek	SE-37	0.25	12.04	17.94	30.52	23.18	13.01	5.22	2.91	2.30	2.61	3.53	5.61	9.82	8.61
City Creek	SE-37	0.05	41.75	116.85	146.76	63.36	38.09	20.09	13.02	8.51	6.92	7.52	15.01	32.28	43.38
City Creek	SE-37	mean	21.18	44.69	38.05	18.10	10.95	5.82	3.21	2.26	2.28	2.87	6.46	12.75	13.89
City Creek Channel	SE-52	0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
City Creek Channel	SE-52	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
City Creek Channel	SE-52	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
City Creek Channel	SE-52	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
City Creek Channel	SE-52	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
City Creek Channel	SE-52	mean	0.21	0.39	0.14	0.00	0.00	0.00	0.00	0.05	0.05	0.04	0.11	0.22	0.10
City Creek Channel	SE-51	0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
City Creek Channel	SE-51	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
City Creek Channel	SE-51	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
City Creek Channel	SE-51	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
City Creek Channel	SE-51	0.05	0.01	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
City Creek Channel	SE-51	mean	0.18	0.28	0.12	0.00	0.00	0.00	0.00	0.03	0.03	0.03	0.10	0.17	0.08
City Creek Channel	SE-50	0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
City Creek Channel	SE-50	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
City Creek Channel	SE-50	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
City Creek Channel	SE-50	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
City Creek Channel	SE-50	0.05	0.07	0.12	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
City Creek Channel	SE-50	mean	0.18	0.25	0.12	0.01	0.00	0.00	0.00	0.03	0.03	0.03	0.10	0.15	0.07
Cucamonga Creek	NCC19	0.95	10.80	9.30	7.80	4.60	3.10	0.80	0.80	0.80	1.50	4.60	7.80	9.30	0.80
Cucamonga Creek	NCC19	0.75	10.80	9.30	7.80	4.60	3.10	0.80	0.80	0.80	1.50	4.60	7.80	9.30	1.50
Cucamonga Creek	NCC19	0.50	10.90	9.30	7.80	4.60	3.10	0.80	0.80	0.80	1.50	4.60	7.80	9.30	4.60
Cucamonga Creek	NCC19	0.25	25.95	35.55	61.25	10.35	3.10	0.80	0.80	0.80	1.50	4.60	8.30	17.20	9.30
Cucamonga Creek	NCC19	0.05	891.87	641.55	524.15	131.43	12.19	1.20	0.80	0.80	4.00	15.12	292.85	397.57	176.30
Cucamonga Creek	NCC19	mean	162.89	151.50	128.99	29.44	8.49	0.88	1.00	3.21	7.44	11.46	64.66	93.62	54.90
Cucamonga Creek	NCC18	0.95	10.80	9.30	7.80	4.60	3.10	0.80	0.80	0.80	1.50	4.60	7.80	9.30	0.80
Cucamonga Creek	NCC18	0.75	10.80	9.30	7.80	4.60	3.10	0.80	0.80	0.80	1.50	4.60	7.80	9.30	1.50
Cucamonga Creek	NCC18	0.50	10.90	9.30	7.80	4.60	3.10	0.80	0.80	0.80	1.50	4.60	7.80	9.30	4.60
Cucamonga Creek	NCC18	0.25	25.30	34.83	61.15	10.35	3.10	0.80	0.80	0.80	1.50	4.60	8.30	17.00	9.30
Cucamonga Creek	NCC18	0.05	843.72	634.43	521.68	131.05	12.19	1.10	0.80	0.80	4.00	15.12	286.28	392.85	171.80
Cucamonga Creek	NCC18	mean	158.87	147.16	125.90	29.09	8.43	0.88	1.00	3.13	7.31	11.31	62.90	91.36	53.56
Day Creek	NDY19	0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Day Creek	NDY19	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Day Creek	NDY19	0.50	0.80	1.80	1.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.00

			All Streamflows in Cubic Feet per Second												
Drainage	**Node**	**Exceedance**	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**	**Annual**
Day Creek	NDY19	0.25	9.90	14.90	15.75	1.40	0.00	0.00	0.00	0.00	0.00	0.00	1.88	4.35	0.60
Day Creek	NDY19	0.05	207.31	162.30	133.30	24.66	0.83	0.00	0.00	0.00	0.95	2.03	71.38	109.25	58.40
Day Creek	NDY19	mean	52.31	47.36	36.56	5.97	1.25	0.03	0.02	0.72	0.94	1.37	15.61	25.98	15.55
Devil Canyon Creek	NW-11	0.95	0.05	0.08	0.09	0.09	0.08	0.07	0.06	0.06	0.05	0.05	0.05	0.05	0.05
Devil Canyon Creek	NW-11	0.75	0.08	0.11	0.12	0.11	0.09	0.08	0.07	0.06	0.06	0.05	0.06	0.07	0.07
Devil Canyon Creek	NW-11	0.50	0.14	0.16	0.18	0.15	0.12	0.10	0.07	0.07	0.06	0.06	0.07	0.10	0.10
Devil Canyon Creek	NW-11	0.25	0.24	0.32	1.20	0.32	0.20	0.14	0.09	0.08	0.08	0.08	0.10	0.19	0.17
Devil Canyon Creek	NW-11	0.05	16.45	29.17	35.35	2.99	0.40	0.26	0.18	0.14	0.16	0.24	2.58	5.62	2.73
Devil Canyon Creek	NW-11	mean	3.35	8.59	6.65	1.04	0.23	0.12	0.09	0.23	0.28	0.31	1.20	1.70	1.95
Devil Canyon Creek	NW-10	0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Devil Canyon Creek	NW-10	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Devil Canyon Creek	NW-10	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Devil Canyon Creek	NW-10	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Devil Canyon Creek	NW-10	0.05	11.58	21.92	33.08	1.67	0.00	0.00	0.00	0.00	0.00	0.00	0.34	2.89	0.63
Devil Canyon Creek	NW-10	mean	2.56	7.70	5.84	0.65	0.03	0.00	0.00	0.11	0.13	0.14	0.75	1.09	1.55
Devil Canyon Creek	NW-9	0.95	0.13	0.21	0.26	0.27	0.25	0.22	0.20	0.18	0.16	0.15	0.13	0.13	0.15
Devil Canyon Creek	NW-9	0.75	0.22	0.36	0.41	0.34	0.30	0.26	0.23	0.20	0.18	0.16	0.15	0.16	0.21
Devil Canyon Creek	NW-9	0.50	0.50	0.62	0.80	0.61	0.40	0.31	0.26	0.22	0.19	0.18	0.19	0.25	0.30
Devil Canyon Creek	NW-9	0.25	1.06	1.61	3.73	1.58	0.87	0.52	0.36	0.29	0.26	0.24	0.26	0.65	0.64
Devil Canyon Creek	NW-9	0.05	21.36	31.50	39.59	9.75	2.34	1.28	0.70	0.51	0.51	0.67	8.30	11.66	8.65
Devil Canyon Creek	NW-9	mean	4.14	9.50	8.08	2.19	0.86	0.48	0.33	0.43	0.48	0.56	1.67	2.27	2.55
Devil Canyon Creek	NW-2	0.95	0.02	0.02	0.03	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Devil Canyon Creek	NW-2	0.75	0.85	0.59	0.62	0.32	0.13	0.02	0.01	0.01	0.01	0.01	0.01	0.09	0.02
Devil Canyon Creek	NW-2	0.50	1.82	2.29	2.77	2.10	1.27	0.36	0.37	0.07	0.03	0.08	0.48	1.54	0.76
Devil Canyon Creek	NW-2	0.25	3.87	5.10	7.86	5.86	2.88	1.80	1.25	0.74	0.77	0.87	1.55	3.05	2.35
Devil Canyon Creek	NW-2	0.05	17.26	38.95	50.30	23.22	14.09	5.92	2.69	1.84	1.86	2.28	5.13	9.56	13.22
Devil Canyon Creek	NW-2	mean	5.06	10.90	10.41	5.53	3.17	1.34	0.75	0.55	0.61	0.64	1.94	3.26	3.64
Devil Canyon Creek	NW-1	0.95	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Devil Canyon Creek	NW-1	0.75	0.82	0.58	0.59	0.30	0.11	0.01	0.00	0.00	0.00	0.00	0.00	0.09	0.01
Devil Canyon Creek	NW-1	0.50	1.81	2.22	2.61	2.08	1.27	0.36	0.36	0.07	0.01	0.07	0.38	1.50	0.76
Devil Canyon Creek	NW-1	0.25	3.57	4.96	7.52	5.68	2.87	1.79	1.25	0.75	0.77	0.87	1.48	2.89	2.28
Devil Canyon Creek	NW-1	0.05	16.10	36.72	50.17	23.12	13.99	5.87	2.67	1.85	1.86	2.27	4.64	8.99	13.09
Devil Canyon Creek	NW-1	mean	4.86	10.68	10.21	5.45	3.13	1.33	0.74	0.54	0.58	0.61	1.83	3.11	3.55
East Twin Creek	SE-78	0.95	0.26	0.35	0.38	0.33	0.29	0.26	0.19	0.18	0.21	0.22	0.26	0.29	0.21
East Twin Creek	SE-78	0.75	0.41	0.46	0.50	0.42	0.34	0.31	0.23	0.21	0.23	0.24	0.29	0.36	0.28
East Twin Creek	SE-78	0.50	0.61	0.66	0.70	0.58	0.43	0.35	0.25	0.22	0.25	0.27	0.36	0.47	0.41
East Twin Creek	SE-78	0.25	1.04	1.81	5.30	2.00	0.75	0.52	0.34	0.29	0.32	0.38	0.49	0.90	0.68
East Twin Creek	SE-78	0.05	92.79	122.02	80.35	18.58	2.38	1.14	0.70	0.56	0.64	2.96	33.16	43.22	20.96
East Twin Creek	SE-78	mean	17.76	27.60	18.12	4.03	1.25	0.48	0.33	1.38	1.81	2.28	7.97	13.22	7.92
East Twin Creek	SE-54	0.95	0.43	0.57	0.63	0.63	0.61	0.57	0.43	0.39	0.42	0.42	0.45	0.45	0.44
East Twin Creek	SE-54	0.75	0.61	0.71	0.79	0.73	0.70	0.65	0.50	0.45	0.47	0.46	0.49	0.54	0.53
East Twin Creek	SE-54	0.50	0.86	0.96	1.03	0.94	0.81	0.72	0.56	0.50	0.51	0.51	0.57	0.68	0.71
East Twin Creek	SE-54	0.25	1.40	2.39	6.95	2.66	1.19	0.95	0.72	0.61	0.62	0.67	0.74	1.19	1.05
East Twin Creek	SE-54	0.05	104.04	134.19	92.49	16.24	3.35	1.67	1.22	1.01	1.06	3.64	34.13	49.03	19.67
East Twin Creek	SE-54	mean	18.38	28.29	19.15	4.77	1.76	0.87	0.67	1.66	2.12	2.63	8.49	13.66	8.44

			All Streamflows in Cubic Feet per Second												
Drainage	**Node**	**Exceedance**	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**	**Annual**
East Twin Creek	SE-53	0.95	0.33	0.44	0.48	0.49	0.47	0.43	0.33	0.30	0.32	0.32	0.34	0.35	0.33
East Twin Creek	SE-53	0.75	0.46	0.54	0.60	0.56	0.54	0.50	0.39	0.35	0.36	0.35	0.38	0.41	0.41
East Twin Creek	SE-53	0.50	0.66	0.74	0.79	0.72	0.62	0.55	0.43	0.38	0.39	0.39	0.43	0.51	0.54
East Twin Creek	SE-53	0.25	1.07	1.76	5.61	1.99	0.91	0.72	0.55	0.46	0.47	0.50	0.56	0.93	0.79
East Twin Creek	SE-53	0.05	86.50	111.53	76.73	12.60	2.68	1.22	0.90	0.75	0.79	2.71	26.84	38.99	15.41
East Twin Creek	SE-53	mean	15.85	25.62	16.85	3.86	1.37	0.66	0.51	1.37	1.74	2.14	7.02	11.68	7.29
East Twin Creek	SE-32	0.95	0.22	0.29	0.32	0.33	0.32	0.29	0.23	0.21	0.22	0.22	0.23	0.23	0.23
East Twin Creek	SE-32	0.75	0.31	0.36	0.40	0.37	0.36	0.33	0.26	0.23	0.24	0.23	0.25	0.27	0.27
East Twin Creek	SE-32	0.50	0.44	0.48	0.52	0.48	0.42	0.37	0.29	0.26	0.26	0.26	0.29	0.34	0.35
East Twin Creek	SE-32	0.25	0.70	1.25	4.27	1.28	0.59	0.48	0.36	0.31	0.31	0.32	0.36	0.62	0.52
East Twin Creek	SE-32	0.05	80.42	103.47	71.29	10.07	1.93	0.74	0.55	0.47	0.52	2.01	24.17	35.68	12.75
East Twin Creek	SE-32	mean	14.41	23.88	15.47	3.25	1.03	0.43	0.33	1.11	1.44	1.81	6.20	10.48	6.56
East Twin Creek	SE-21	0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
East Twin Creek	SE-21	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
East Twin Creek	SE-21	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
East Twin Creek	SE-21	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
East Twin Creek	SE-21	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
East Twin Creek	SE-21	mean	2.30	8.02	4.07	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.12	1.54	1.31
East Twin Creek	SE-19	0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
East Twin Creek	SE-19	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
East Twin Creek	SE-19	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
East Twin Creek	SE-19	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
East Twin Creek	SE-19	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
East Twin Creek	SE-19	mean	0.20	0.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.05
East Twin Creek	SE-17	0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
East Twin Creek	SE-17	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
East Twin Creek	SE-17	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
East Twin Creek	SE-17	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
East Twin Creek	SE-17	0.05	0.00	21.55	41.54	3.71	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
East Twin Creek	SE-17	mean	2.67	9.98	7.92	1.14	0.03	0.00	0.00	0.00	0.02	0.00	0.28	1.74	1.94
East Twin Creek	SE-13	0.95	0.98	1.14	1.21	0.91	0.98	0.61	0.41	0.41	0.41	0.31	0.51	0.51	0.43
East Twin Creek	SE-13	0.75	2.12	2.32	2.52	2.12	1.71	1.01	0.61	0.51	0.51	0.61	0.91	1.30	1.01
East Twin Creek	SE-13	0.50	3.03	3.44	4.41	3.58	2.53	1.51	0.91	0.71	0.81	1.01	1.52	2.65	2.11
East Twin Creek	SE-13	0.25	5.25	6.62	12.77	8.76	5.51	3.63	2.32	1.77	1.84	2.01	2.81	4.22	4.22
East Twin Creek	SE-13	0.05	22.92	40.61	63.15	31.59	17.10	11.06	6.93	4.72	4.11	5.45	10.45	15.74	19.54
East Twin Creek	SE-13	mean	7.66	13.84	14.69	8.79	5.32	3.11	1.98	1.69	1.52	1.97	3.62	6.50	5.85
Little Sand Creek	SE-30	0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Little Sand Creek	SE-30	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Little Sand Creek	SE-30	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Little Sand Creek	SE-30	0.25	0.00	0.22	2.07	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Little Sand Creek	SE-30	0.05	29.55	33.54	23.87	4.40	0.67	0.00	0.00	0.00	0.00	0.41	12.00	16.21	6.01
Little Sand Creek	SE-30	mean	4.17	5.46	4.20	1.19	0.25	0.00	0.00	0.26	0.39	0.54	2.08	3.01	1.78
Little Sand Creek	SE-29	0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Little Sand Creek	SE-29	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Little Sand Creek	SE-29	0.50	0.05	0.22	0.46	0.22	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

			All Streamflows in Cubic Feet per Second												
Drainage	**Node**	**Exceedance**	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**	**Annual**
Little Sand Creek	SE-29	0.25	0.82	1.50	3.79	1.44	0.68	0.15	0.01	0.00	0.00	0.00	0.00	0.36	0.31
Little Sand Creek	SE-29	0.05	29.12	32.97	23.98	5.75	2.48	1.40	0.41	0.20	0.21	0.54	12.95	16.84	7.46
Little Sand Creek	SE-29	mean	4.30	5.75	4.67	1.77	0.68	0.21	0.07	0.28	0.40	0.57	2.10	3.09	1.97
Little Sand Creek	SE-28	0.95	0.18	0.34	0.42	0.45	0.44	0.41	0.35	0.30	0.27	0.23	0.20	0.19	0.24
Little Sand Creek	SE-28	0.75	0.34	0.56	0.64	0.56	0.52	0.47	0.41	0.35	0.31	0.26	0.24	0.26	0.36
Little Sand Creek	SE-28	0.50	0.75	0.92	1.14	0.93	0.66	0.54	0.45	0.39	0.34	0.30	0.30	0.40	0.51
Little Sand Creek	SE-28	0.25	1.38	2.17	4.50	2.10	1.36	0.85	0.62	0.49	0.44	0.43	0.45	0.92	0.97
Little Sand Creek	SE-28	0.05	31.31	35.26	26.07	6.35	3.16	2.12	1.12	0.85	0.87	1.01	14.13	18.46	8.14
Little Sand Creek	SE-28	mean	4.96	6.49	5.42	2.43	1.30	0.78	0.57	0.72	0.81	0.93	2.52	3.60	2.52
Little Sand Creek	SE-27	0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Little Sand Creek	SE-27	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Little Sand Creek	SE-27	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Little Sand Creek	SE-27	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Little Sand Creek	SE-27	0.05	1.42	1.53	0.95	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.42	0.00
Little Sand Creek	SE-27	mean	0.29	0.51	0.21	0.03	0.01	0.00	0.00	0.02	0.02	0.03	0.10	0.16	0.11
Little Sand Creek	SE-76	0.95	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Little Sand Creek	SE-76	0.75	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Little Sand Creek	SE-76	0.50	0.01	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Little Sand Creek	SE-76	0.25	0.02	0.02	0.04	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.02	0.02
Little Sand Creek	SE-76	0.05	0.59	0.62	0.52	0.10	0.03	0.02	0.02	0.02	0.02	0.02	0.28	0.35	0.13
Little Sand Creek	SE-76	mean	0.19	0.39	0.15	0.04	0.02	0.01	0.01	0.02	0.02	0.02	0.05	0.09	0.08
Little Sand Creek	SE-75	0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Little Sand Creek	SE-75	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Little Sand Creek	SE-75	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Little Sand Creek	SE-75	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Little Sand Creek	SE-75	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Little Sand Creek	SE-75	mean	0.10	0.30	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.04
Little Sand Creek	SE-23	0.95	0.02	0.05	0.09	0.07	0.06	0.05	0.04	0.04	0.03	0.03	0.02	0.02	0.03
Little Sand Creek	SE-23	0.75	0.06	0.14	0.18	0.12	0.09	0.07	0.05	0.04	0.04	0.03	0.03	0.03	0.05
Little Sand Creek	SE-23	0.50	0.25	0.30	0.39	0.31	0.16	0.10	0.07	0.06	0.05	0.04	0.04	0.06	0.10
Little Sand Creek	SE-23	0.25	0.45	0.96	1.07	1.02	0.57	0.25	0.14	0.09	0.08	0.06	0.07	0.20	0.29
Little Sand Creek	SE-23	0.05	1.73	3.73	3.88	2.38	1.44	0.75	0.31	0.19	0.17	0.17	0.48	1.20	1.59
Little Sand Creek	SE-23	mean	0.65	1.48	1.35	0.70	0.41	0.21	0.11	0.08	0.08	0.07	0.13	0.35	0.46
Little Sand Creek	SE-22	0.95	0.02	0.04	0.09	0.07	0.05	0.04	0.04	0.03	0.03	0.03	0.02	0.02	0.02
Little Sand Creek	SE-22	0.75	0.05	0.13	0.17	0.12	0.09	0.06	0.05	0.04	0.03	0.03	0.02	0.03	0.04
Little Sand Creek	SE-22	0.50	0.22	0.28	0.36	0.30	0.16	0.10	0.07	0.05	0.04	0.04	0.03	0.06	0.09
Little Sand Creek	SE-22	0.25	0.41	0.93	0.99	1.00	0.55	0.24	0.14	0.09	0.07	0.06	0.06	0.16	0.27
Little Sand Creek	SE-22	0.05	1.45	3.67	3.71	2.33	1.41	0.73	0.30	0.19	0.15	0.15	0.31	1.06	1.45
Little Sand Creek	SE-22	mean	0.60	1.42	1.30	0.67	0.39	0.20	0.11	0.08	0.07	0.06	0.09	0.31	0.44
Lytle Creek	NW-28	0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lytle Creek	NW-28	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lytle Creek	NW-28	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lytle Creek	NW-28	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lytle Creek	NW-28	0.05	0.00	37.05	48.62	5.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lytle Creek	NW-28	mean	18.17	26.60	16.73	1.17	0.37	0.00	0.00	0.01	0.23	0.00	3.23	3.89	5.76

			All Streamflows in Cubic Feet per Second												
Drainage	**Node**	**Exceedance**	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**	**Annual**
Lytle Creek	NW-26	0.95	0.16	0.30	0.36	0.40	0.39	0.35	0.30	0.25	0.21	0.18	0.18	0.17	0.20
Lytle Creek	NW-26	0.75	0.32	0.46	0.57	0.53	0.51	0.45	0.38	0.32	0.27	0.22	0.20	0.21	0.33
Lytle Creek	NW-26	0.50	0.62	0.80	0.98	0.83	0.65	0.53	0.44	0.36	0.31	0.26	0.27	0.38	0.50
Lytle Creek	NW-26	0.25	1.49	2.35	6.04	2.33	1.33	0.87	0.67	0.51	0.46	0.47	0.50	1.06	1.03
Lytle Creek	NW-26	0.05	44.11	52.78	56.36	11.51	4.22	2.47	1.57	1.17	1.07	1.86	17.56	23.89	14.51
Lytle Creek	NW-26	mean	19.74	25.70	18.21	3.18	1.49	0.84	0.63	0.85	0.96	1.12	5.20	5.83	6.89
Lytle Creek	NW-20	0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lytle Creek	NW-20	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lytle Creek	NW-20	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lytle Creek	NW-20	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lytle Creek	NW-20	0.05	0.00	5.19	29.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lytle Creek	NW-20	mean	11.61	12.42	9.67	0.23	0.00	0.00	0.00	0.00	0.00	0.00	2.10	0.76	3.02
Lytle Creek Channel	NW-29	0.95	0.06	0.08	0.09	0.10	0.10	0.10	0.09	0.09	0.08	0.07	0.07	0.06	0.07
Lytle Creek Channel	NW-29	0.75	0.08	0.10	0.11	0.11	0.11	0.11	0.10	0.09	0.09	0.08	0.07	0.07	0.09
Lytle Creek Channel	NW-29	0.50	0.11	0.12	0.14	0.13	0.12	0.12	0.11	0.10	0.09	0.08	0.08	0.09	0.11
Lytle Creek Channel	NW-29	0.25	0.17	0.22	1.17	0.27	0.16	0.14	0.13	0.11	0.10	0.10	0.10	0.14	0.14
Lytle Creek Channel	NW-29	0.05	23.19	51.79	50.95	10.41	2.53	0.22	0.18	0.16	0.15	0.28	7.53	10.30	7.88
Lytle Creek Channel	NW-29	mean	20.55	29.07	18.77	1.95	0.68	0.14	0.12	0.25	0.54	0.40	4.48	5.56	6.76
Mill Creek	SE-56	0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mill Creek	SE-56	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mill Creek	SE-56	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mill Creek	SE-56	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mill Creek	SE-56	0.05	0.00	31.32	220.39	236.57	291.71	115.44	28.33	0.00	0.00	0.00	0.00	1.45	79.36
Mill Creek	SE-56	mean	17.84	24.22	38.77	35.44	35.77	18.15	3.20	0.23	1.42	0.03	4.09	7.97	15.54
Mission Creek	SE-73	0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mission Creek	SE-73	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mission Creek	SE-73	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mission Creek	SE-73	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mission Creek	SE-73	0.05	76.15	83.31	54.98	6.54	0.00	0.00	0.00	0.00	0.00	0.08	20.07	35.03	7.86
Mission Creek	SE-73	mean	10.54	12.38	8.55	2.14	0.39	0.00	0.00	0.78	1.07	1.37	5.51	7.90	4.18
Mission Creek	SE-62	0.95	0.15	0.43	0.56	0.62	0.66	0.64	0.56	0.47	0.40	0.29	0.25	0.20	0.32
Mission Creek	SE-62	0.75	0.47	0.67	0.84	0.83	0.86	0.79	0.69	0.58	0.49	0.40	0.33	0.33	0.56
Mission Creek	SE-62	0.50	0.85	1.09	1.22	1.18	1.04	0.92	0.79	0.67	0.58	0.48	0.44	0.58	0.81
Mission Creek	SE-62	0.25	1.65	2.30	5.08	2.36	1.69	1.34	1.09	0.86	0.75	0.76	0.74	1.31	1.37
Mission Creek	SE-62	0.05	60.43	64.49	46.91	9.01	3.63	2.56	1.97	1.57	1.47	2.01	23.98	32.88	11.41
Mission Creek	SE-62	mean	8.83	10.52	8.57	3.53	1.81	1.18	0.98	1.34	1.48	1.69	4.81	6.68	4.25
Mission Creek	SE-61	0.95	0.87	1.14	1.27	1.32	1.37	1.35	1.27	1.19	1.11	1.00	0.96	0.91	1.03
Mission Creek	SE-61	0.75	1.17	1.37	1.54	1.53	1.56	1.50	1.40	1.30	1.21	1.11	1.05	1.04	1.27
Mission Creek	SE-61	0.50	1.54	1.77	1.90	1.87	1.73	1.62	1.50	1.38	1.29	1.19	1.15	1.27	1.51
Mission Creek	SE-61	0.25	2.22	2.83	5.46	2.86	2.35	2.02	1.79	1.57	1.46	1.46	1.44	1.92	2.02
Mission Creek	SE-61	0.05	56.72	59.43	43.48	8.95	4.20	3.19	2.63	2.25	2.12	2.28	22.69	30.49	10.96
Mission Creek	SE-61	mean	8.76	10.41	8.59	4.00	2.44	1.87	1.68	1.99	2.11	2.29	5.09	6.79	4.64
Mission Creek	SE-60	0.95	0.85	1.12	1.24	1.29	1.34	1.32	1.25	1.17	1.09	0.98	0.94	0.89	1.00
Mission Creek	SE-60	0.75	1.14	1.33	1.50	1.50	1.53	1.46	1.38	1.27	1.18	1.09	1.02	1.02	1.24
Mission Creek	SE-60	0.50	1.49	1.71	1.84	1.81	1.70	1.58	1.47	1.36	1.26	1.16	1.12	1.24	1.47

			All Streamflows in Cubic Feet per Second												
Drainage	**Node**	**Exceedance**	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**	**Annual**
Mission Creek	SE-60	0.25	2.06	2.67	5.25	2.76	2.29	1.98	1.75	1.54	1.42	1.41	1.39	1.77	1.93
Mission Creek	SE-60	0.05	53.93	56.69	40.93	8.31	4.08	3.11	2.57	2.20	2.04	2.17	21.60	28.99	10.31
Mission Creek	SE-60	mean	8.29	9.91	8.16	3.84	2.37	1.83	1.64	1.93	2.03	2.19	4.82	6.41	4.43
Plunge Creek	SE-57	0.95	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Plunge Creek	SE-57	0.75	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Plunge Creek	SE-57	0.50	0.01	0.02	0.02	0.02	0.01	0.01	0.01	0.00	0.01	0.00	0.01	0.01	0.01
Plunge Creek	SE-57	0.25	0.04	0.07	0.09	0.06	0.04	0.02	0.02	0.01	0.01	0.01	0.02	0.03	0.03
Plunge Creek	SE-57	0.05	12.39	128.89	170.62	21.53	0.34	0.18	0.11	0.09	0.07	0.06	0.07	0.15	0.61
Plunge Creek	SE-57	mean	18.86	50.06	34.12	4.31	0.42	0.04	0.02	0.09	0.25	0.09	3.16	9.82	9.89
Plunge Creek	SE-48	0.95	0.15	0.23	0.26	0.21	0.20	0.12	0.10	0.09	0.08	0.08	0.09	0.12	0.10
Plunge Creek	SE-48	0.75	0.31	0.40	0.49	0.38	0.29	0.18	0.12	0.11	0.10	0.11	0.12	0.20	0.16
Plunge Creek	SE-48	0.50	0.48	0.61	1.12	0.56	0.38	0.24	0.16	0.13	0.13	0.16	0.20	0.33	0.32
Plunge Creek	SE-48	0.25	1.42	3.18	6.71	4.94	1.96	0.52	0.34	0.26	0.21	0.23	0.40	0.77	0.70
Plunge Creek	SE-48	0.05	19.29	80.00	81.80	17.08	7.23	3.35	1.07	0.69	0.58	0.55	1.98	6.39	10.34
Plunge Creek	SE-48	mean	9.23	20.03	16.18	4.50	1.80	0.73	0.32	0.26	0.42	0.28	2.30	6.07	5.10
Plunge Creek	SE-45	0.95	0.40	0.55	0.65	0.50	0.42	0.20	0.13	0.12	0.10	0.12	0.13	0.27	0.15
Plunge Creek	SE-45	0.75	0.77	1.04	1.22	0.94	0.64	0.37	0.20	0.17	0.17	0.22	0.30	0.52	0.32
Plunge Creek	SE-45	0.50	1.24	1.53	2.93	1.42	0.95	0.55	0.30	0.25	0.25	0.35	0.45	0.85	0.75
Plunge Creek	SE-45	0.25	3.74	7.58	15.14	10.66	5.61	1.22	0.70	0.49	0.42	0.50	0.91	1.70	1.57
Plunge Creek	SE-45	0.05	36.04	87.53	90.15	28.06	13.35	7.10	2.22	1.25	1.07	1.12	4.99	14.14	19.25
Plunge Creek	SE-45	mean	11.26	21.99	19.69	7.64	3.61	1.60	0.63	0.46	0.75	0.55	3.02	7.55	6.48
Rialto Channel/Cactus Channel	NFRC06	0.95	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00
Rialto Channel/Cactus Channel	NFRC06	0.75	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00
Rialto Channel/Cactus Channel	NFRC06	0.50	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00
Rialto Channel/Cactus Channel	NFRC06	0.25	8.85	8.10	11.60	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.30	7.00
Rialto Channel/Cactus Channel	NFRC06	0.05	145.16	131.58	100.87	29.84	7.70	7.00	7.00	7.00	7.46	12.66	90.21	102.07	44.35
Rialto Channel/Cactus Channel	NFRC06	mean	27.39	29.83	25.57	11.39	8.00	7.05	7.09	8.03	8.66	9.13	19.74	23.69	15.40
San Sevaine Creek	NSS31	0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
San Sevaine Creek	NSS31	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
San Sevaine Creek	NSS31	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
San Sevaine Creek	NSS31	0.25	0.90	1.15	1.55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.00
San Sevaine Creek	NSS31	0.05	273.36	265.38	182.54	7.66	0.20	0.00	0.00	0.00	0.25	1.03	132.88	155.17	24.10
San Sevaine Creek	NSS31	mean	51.39	50.65	35.34	5.15	1.02	0.04	0.16	1.04	1.94	2.44	21.81	30.22	16.62
San Timoteo Wash	SE-79	0.95	0.08	0.25	0.37	0.45	0.48	0.47	0.42	0.36	0.30	0.22	0.15	0.11	0.21
San Timoteo Wash	SE-79	0.75	0.41	0.45	0.64	0.62	0.65	0.60	0.51	0.43	0.37	0.29	0.24	0.24	0.45
San Timoteo Wash	SE-79	0.50	0.74	0.84	1.19	1.03	0.91	0.81	0.62	0.55	0.49	0.43	0.46	0.52	0.69
San Timoteo Wash	SE-79	0.25	1.77	2.04	4.49	2.36	1.62	1.25	0.99	0.86	0.78	0.76	1.24	1.53	1.36
San Timoteo Wash	SE-79	0.05	54.71	56.48	48.73	8.12	3.19	2.41	1.99	1.50	1.82	2.99	18.55	31.84	11.08
San Timoteo Wash	SE-79	mean	10.77	15.30	9.00	2.79	1.75	1.08	0.87	1.06	1.38	1.37	4.70	7.23	4.72
San Timoteo Wash	SE-77	0.95	0.10	0.13	0.15	0.15	0.15	0.15	0.14	0.13	0.13	0.12	0.11	0.11	0.12
San Timoteo Wash	SE-77	0.75	0.13	0.16	0.17	0.17	0.17	0.17	0.16	0.15	0.14	0.13	0.12	0.12	0.14
San Timoteo Wash	SE-77	0.50	0.18	0.20	0.22	0.21	0.19	0.18	0.17	0.15	0.15	0.14	0.13	0.15	0.17
San Timoteo Wash	SE-77	0.25	0.28	0.37	0.81	0.36	0.26	0.22	0.19	0.17	0.16	0.16	0.16	0.23	0.23
San Timoteo Wash	SE-77	0.05	8.49	8.55	6.72	1.42	0.55	0.36	0.28	0.23	0.23	0.31	3.74	4.91	1.73
San Timoteo Wash	SE-77	mean	1.26	1.41	1.21	0.54	0.30	0.21	0.18	0.23	0.26	0.29	0.73	0.98	0.63

			All Streamflows in Cubic Feet per Second												
Drainage	**Node**	**Exceedance**	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**	**Annual**
San Timoteo Wash	SE-68	0.95	0.19	0.24	0.28	0.29	0.29	0.29	0.26	0.24	0.24	0.22	0.21	0.20	0.22
San Timoteo Wash	SE-68	0.75	0.30	0.30	0.36	0.35	0.35	0.32	0.29	0.27	0.26	0.24	0.23	0.24	0.29
San Timoteo Wash	SE-68	0.50	0.42	0.45	0.57	0.49	0.47	0.42	0.34	0.30	0.29	0.29	0.32	0.33	0.38
San Timoteo Wash	SE-68	0.25	1.00	0.99	2.30	1.14	0.89	0.69	0.57	0.50	0.45	0.48	0.71	0.79	0.70
San Timoteo Wash	SE-68	0.05	32.78	42.53	24.81	4.18	1.72	1.39	1.07	0.86	1.14	1.80	9.86	17.63	5.66
San Timoteo Wash	SE-68	mean	7.69	11.84	5.98	1.45	1.02	0.58	0.47	0.57	0.86	0.80	3.00	4.89	3.22
San Timoteo Wash	SE-64	0.95	0.10	0.13	0.14	0.15	0.16	0.15	0.14	0.13	0.13	0.12	0.11	0.10	0.12
San Timoteo Wash	SE-64	0.75	0.16	0.16	0.19	0.19	0.19	0.17	0.16	0.14	0.14	0.13	0.12	0.12	0.15
San Timoteo Wash	SE-64	0.50	0.24	0.25	0.36	0.29	0.29	0.24	0.19	0.17	0.16	0.15	0.17	0.18	0.22
San Timoteo Wash	SE-64	0.25	0.73	0.70	1.56	0.80	0.66	0.50	0.38	0.33	0.32	0.35	0.54	0.60	0.49
San Timoteo Wash	SE-64	0.05	24.05	36.81	18.24	2.65	1.34	1.12	0.84	0.70	0.97	1.43	6.41	11.77	3.87
San Timoteo Wash	SE-64	mean	6.63	10.64	4.96	0.98	0.77	0.40	0.31	0.37	0.64	0.54	2.38	4.07	2.68
San Timoteo Wash	SE-63	0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
San Timoteo Wash	SE-63	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
San Timoteo Wash	SE-63	0.50	0.01	0.01	0.14	0.03	0.04	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.01
San Timoteo Wash	SE-63	0.25	0.39	0.36	0.63	0.33	0.25	0.21	0.14	0.11	0.12	0.20	0.39	0.39	0.25
San Timoteo Wash	SE-63	0.05	19.84	28.99	14.23	1.18	1.01	0.76	0.55	0.52	0.72	1.02	3.11	5.54	2.11
San Timoteo Wash	SE-63	mean	5.65	9.53	3.98	0.49	0.47	0.17	0.12	0.15	0.39	0.28	1.80	3.30	2.16
Sand Creek	SE-33	0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sand Creek	SE-33	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sand Creek	SE-33	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sand Creek	SE-33	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sand Creek	SE-33	0.05	0.00	1.14	0.92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sand Creek	SE-33	mean	0.66	2.08	1.24	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.29	0.35
Sand Creek	SE-18	0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sand Creek	SE-18	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sand Creek	SE-18	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sand Creek	SE-18	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sand Creek	SE-18	0.05	0.00	5.63	4.80	1.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sand Creek	SE-18	mean	0.78	2.42	1.75	0.19	0.01	0.00	0.00	0.00	0.00	0.00	0.03	0.33	0.45
Santa Ana River	NSAR381	0.95	156.47	115.60	104.37	85.20	64.80	46.90	39.10	38.70	43.00	56.40	77.60	98.00	39.10
Santa Ana River	NSAR381	0.75	159.55	117.10	108.95	89.90	69.00	49.10	39.90	38.75	44.80	59.90	81.43	103.20	49.80
Santa Ana River	NSAR381	0.50	161.50	119.45	113.40	95.80	74.40	52.50	41.40	39.00	47.20	64.10	87.90	107.30	84.10
Santa Ana River	NSAR381	0.25	234.60	225.65	304.75	134.08	80.10	56.70	43.20	39.90	50.20	68.90	96.75	139.05	119.90
Santa Ana River	NSAR381	0.05	3784.19	3182.13	2205.10	616.48	382.35	78.86	45.10	42.63	78.91	136.17	1379.22	2044.33	908.45
Santa Ana River	NSAR381	mean	800.48	881.80	666.19	214.98	128.75	60.25	42.82	56.43	78.08	95.79	339.50	475.78	317.43
Santa Ana River	NSAR38	0.95	99.80	61.20	57.90	51.89	45.10	39.70	36.60	36.30	37.20	41.10	47.30	53.90	36.50
Santa Ana River	NSAR38	0.75	101.20	61.70	59.90	53.90	46.80	40.60	36.90	36.40	37.80	42.60	48.80	56.30	40.30
Santa Ana River	NSAR38	0.50	102.40	63.70	62.30	56.20	48.80	42.00	37.60	36.50	38.70	44.10	51.60	57.90	50.90
Santa Ana River	NSAR38	0.25	127.75	100.45	149.70	67.65	51.20	43.70	38.50	36.70	39.80	45.80	54.85	66.80	63.90
Santa Ana River	NSAR38	0.05	1541.89	1606.10	1393.48	496.21	349.88	63.18	39.30	37.30	45.23	64.07	655.10	1041.99	471.75
Santa Ana River	NSAR38	mean	447.85	541.35	384.95	131.06	93.60	48.63	38.50	46.79	53.90	58.94	175.15	252.74	187.75
Santa Ana River	NSAR37	0.95	48.00	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30
Santa Ana River	NSAR37	0.75	48.00	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30
Santa Ana River	NSAR37	0.50	48.00	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30

			All Streamflows in Cubic Feet per Second												
Drainage	**Node**	**Exceedance**	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**	**Annual**
Santa Ana River	NSAR37	0.25	48.00	2.30	3.40	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30
Santa Ana River	NSAR37	0.05	284.36	548.50	502.33	175.45	60.20	8.92	2.30	2.30	2.30	2.40	47.16	112.69	66.00
Santa Ana River	NSAR37	mean	140.58	142.35	97.07	25.94	9.39	3.45	2.42	3.99	4.48	4.48	29.43	45.34	41.95
Santa Ana River	NSAR36	0.95	59.40	61.20	57.90	51.80	45.10	39.70	36.60	36.30	37.20	41.10	47.30	53.90	36.50
Santa Ana River	NSAR36	0.75	60.80	61.70	59.90	53.63	46.80	40.60	36.90	36.40	37.80	42.60	48.80	56.30	40.30
Santa Ana River	NSAR36	0.50	62.00	63.70	62.20	55.80	48.80	42.00	37.60	36.50	38.70	44.10	51.60	57.90	50.70
Santa Ana River	NSAR36	0.25	86.15	98.60	132.00	60.68	51.15	43.50	38.50	36.70	39.80	45.80	54.85	66.45	61.50
Santa Ana River	NSAR36	0.05	1298.68	1358.38	917.18	327.47	304.78	54.58	39.30	37.30	44.57	63.36	552.36	765.02	378.75
Santa Ana River	NSAR36	mean	316.35	404.27	292.49	108.62	87.17	47.85	38.41	45.16	51.84	56.96	148.65	210.98	149.49
Santa Ana River	NSAR352	0.95	59.40	61.20	57.90	51.80	45.10	39.70	36.60	36.30	37.20	41.10	47.30	53.90	36.50
Santa Ana River	NSAR352	0.75	60.80	61.70	59.90	53.63	46.80	40.60	36.90	36.40	37.80	42.60	48.80	56.30	40.30
Santa Ana River	NSAR352	0.50	62.00	63.70	62.20	55.80	48.80	42.00	37.60	36.50	38.70	44.10	51.60	57.90	50.70
Santa Ana River	NSAR352	0.25	86.15	98.60	131.70	60.68	51.15	43.50	38.50	36.70	39.80	45.80	54.85	66.40	61.50
Santa Ana River	NSAR352	0.05	1295.98	1354.10	917.18	327.47	304.78	54.58	39.30	37.30	44.57	63.36	549.45	761.52	377.55
Santa Ana River	NSAR352	mean	315.58	403.43	291.86	108.52	87.16	47.85	38.41	45.14	51.80	56.92	148.28	210.50	149.21
Santa Ana River	NSAR351	0.95	59.40	61.20	57.90	51.80	45.10	39.70	36.60	36.30	37.20	41.10	47.30	53.90	36.50
Santa Ana River	NSAR351	0.75	60.80	61.70	59.90	53.63	46.80	40.60	36.90	36.40	37.80	42.60	48.80	56.30	40.30
Santa Ana River	NSAR351	0.50	62.00	63.70	62.20	55.80	48.80	42.00	37.60	36.50	38.70	44.10	51.60	57.90	50.70
Santa Ana River	NSAR351	0.25	85.50	96.73	128.80	60.68	51.10	43.50	38.50	36.70	39.80	45.80	54.85	66.35	61.50
Santa Ana River	NSAR351	0.05	1286.88	1332.75	917.18	326.94	304.78	54.58	39.30	37.30	44.57	63.36	526.08	751.57	367.30
Santa Ana River	NSAR351	mean	310.98	398.51	288.09	107.75	87.01	47.85	38.40	44.97	51.51	56.62	145.88	207.59	147.54
Santa Ana River	NSAR35	0.95	59.40	61.20	57.90	51.80	45.10	39.70	36.60	36.30	37.20	41.10	47.30	53.90	36.50
Santa Ana River	NSAR35	0.75	60.80	61.70	59.90	53.63	46.80	40.60	36.90	36.40	37.80	42.60	48.80	56.30	40.30
Santa Ana River	NSAR35	0.50	62.00	63.70	62.20	55.80	48.80	42.00	37.60	36.50	38.70	44.10	51.60	57.90	50.70
Santa Ana River	NSAR35	0.25	85.50	96.73	128.80	60.68	51.10	43.50	38.50	36.70	39.80	45.80	54.85	66.35	61.50
Santa Ana River	NSAR35	0.05	1286.88	1332.75	917.18	326.94	304.78	54.58	39.30	37.30	44.57	63.36	526.08	751.57	367.30
Santa Ana River	NSAR35	mean	310.98	398.51	288.09	107.75	87.01	47.85	38.40	44.97	51.51	56.62	145.88	207.59	147.54
Santa Ana River	NSAR34	0.95	59.40	61.20	57.90	51.80	45.10	39.70	36.60	36.30	37.20	41.10	47.30	53.90	36.50
Santa Ana River	NSAR34	0.75	60.80	61.70	59.90	53.63	46.80	40.60	36.90	36.40	37.80	42.60	48.80	56.30	40.30
Santa Ana River	NSAR34	0.50	62.00	63.70	62.20	55.80	48.80	42.00	37.60	36.50	38.70	44.10	51.60	57.90	50.70
Santa Ana River	NSAR34	0.25	85.50	96.73	128.80	60.68	51.10	43.50	38.50	36.70	39.80	45.80	54.85	66.35	61.50
Santa Ana River	NSAR34	0.05	1286.88	1332.75	917.18	326.94	304.78	54.58	39.30	37.30	44.57	63.36	526.08	751.57	367.30
Santa Ana River	NSAR34	mean	310.98	398.51	288.09	107.75	87.01	47.85	38.40	44.97	51.51	56.62	145.88	207.59	147.54
Santa Ana River	NSAR332	0.95	60.50	62.30	58.90	52.90	46.20	40.70	37.70	37.40	38.20	42.20	48.30	54.90	37.50
Santa Ana River	NSAR332	0.75	61.90	62.70	60.90	54.70	47.90	41.70	38.00	37.40	38.80	43.60	49.80	57.35	41.30
Santa Ana River	NSAR332	0.50	63.10	64.80	63.20	56.90	49.80	43.10	38.60	37.50	39.80	45.20	52.60	58.90	51.80
Santa Ana River	NSAR332	0.25	86.45	97.80	129.90	61.78	52.15	44.60	39.50	37.70	40.90	46.80	55.88	67.35	62.50
Santa Ana River	NSAR332	0.05	1280.45	1327.60	920.01	328.14	305.88	55.62	40.30	38.33	45.57	64.39	518.15	744.53	363.95
Santa Ana River	NSAR332	mean	309.30	396.38	286.90	108.40	87.99	48.91	39.45	45.94	52.41	57.56	145.57	206.85	147.59
Santa Ana River	NSAR331	0.95	62.30	64.20	60.80	54.70	48.00	42.60	39.50	39.20	40.00	44.00	50.20	56.80	39.40
Santa Ana River	NSAR331	0.75	63.80	64.60	62.80	56.53	49.70	43.50	39.80	39.20	40.70	45.40	51.70	59.20	43.20
Santa Ana River	NSAR331	0.50	64.90	66.60	65.10	58.70	51.70	44.90	40.50	39.30	41.60	47.00	54.50	60.80	53.60
Santa Ana River	NSAR331	0.25	88.30	99.70	131.80	63.60	54.00	46.40	41.30	39.50	42.70	48.70	57.78	69.20	64.40
Santa Ana River	NSAR331	0.05	1301.18	1350.23	926.50	330.20	307.98	57.48	42.10	40.13	47.42	66.29	520.31	746.80	366.05
Santa Ana River	NSAR331	mean	313.05	400.53	290.39	110.47	89.89	50.74	41.28	47.84	54.34	59.48	148.19	209.85	150.12

			All Streamflows in Cubic Feet per Second												
Drainage	**Node**	**Exceedance**	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**	**Annual**
Santa Ana River	NSAR33	0.95	66.60	68.50	65.10	59.00	52.30	46.80	43.70	43.40	44.30	48.30	54.40	61.10	43.60
Santa Ana River	NSAR33	0.75	68.10	68.90	67.10	60.83	54.00	47.80	44.10	43.50	44.90	49.70	56.00	63.50	47.40
Santa Ana River	NSAR33	0.50	69.20	70.95	69.40	63.00	56.00	49.20	44.70	43.60	45.90	51.30	58.80	65.10	57.90
Santa Ana River	NSAR33	0.25	92.65	104.10	136.20	67.90	58.30	50.70	45.60	43.80	47.00	52.90	62.05	73.55	68.70
Santa Ana River	NSAR33	0.05	1316.38	1368.98	931.63	334.84	312.58	61.78	46.40	44.43	51.67	70.59	525.16	751.83	370.75
Santa Ana River	NSAR33	mean	319.27	407.40	296.49	114.94	94.24	55.02	45.53	52.18	58.70	63.84	153.20	215.29	155.11
Santa Ana River	NSAR321	0.95	68.60	70.63	67.20	61.20	54.50	49.10	46.00	45.70	46.50	50.50	56.70	63.30	45.80
Santa Ana River	NSAR321	0.75	69.70	71.00	68.50	62.90	56.20	50.00	46.30	45.70	47.20	51.80	58.20	64.90	49.55
Santa Ana River	NSAR321	0.50	70.60	71.20	69.90	64.90	58.20	51.40	47.00	45.80	48.10	53.30	60.40	66.70	60.00
Santa Ana River	NSAR321	0.25	78.40	77.78	105.25	66.68	60.40	52.90	47.80	46.00	49.18	55.20	62.38	68.40	70.00
Santa Ana River	NSAR321	0.05	991.25	1122.60	801.31	329.71	313.04	64.02	48.60	46.40	50.86	67.00	474.86	620.89	344.70
Santa Ana River	NSAR321	mean	269.82	362.92	262.71	111.28	95.26	57.22	47.75	53.74	60.06	64.74	140.06	191.99	142.03
Santa Ana River	NSAR32	0.95	68.40	70.43	66.90	61.00	54.30	48.80	45.70	45.40	46.30	50.20	56.40	63.10	45.60
Santa Ana River	NSAR32	0.75	69.50	70.80	68.30	62.70	56.00	49.70	46.00	45.40	46.90	51.50	58.00	64.70	49.30
Santa Ana River	NSAR32	0.50	70.40	70.90	69.70	64.70	58.00	51.10	46.70	45.50	47.80	53.10	60.10	66.40	59.70
Santa Ana River	NSAR32	0.25	78.20	77.58	105.10	66.38	60.10	52.70	47.60	45.70	48.90	54.90	62.10	68.15	69.80
Santa Ana River	NSAR32	0.05	990.91	1116.53	800.12	329.76	313.04	63.78	48.40	46.10	50.56	66.77	473.96	617.92	344.45
Santa Ana River	NSAR32	mean	270.22	363.61	263.17	111.06	95.03	56.98	47.48	53.51	59.82	64.53	139.93	192.16	142.02
Santa Ana River	NSAR311	0.95	71.30	73.33	69.77	63.90	57.20	51.70	48.60	48.30	49.20	53.10	59.30	66.00	48.50
Santa Ana River	NSAR311	0.75	72.40	73.70	71.10	65.60	58.90	52.60	48.90	48.30	49.80	54.40	60.90	67.60	52.20
Santa Ana River	NSAR311	0.50	73.30	73.90	72.60	67.60	60.90	54.00	49.60	48.40	50.65	56.00	62.80	69.40	62.60
Santa Ana River	NSAR311	0.25	78.05	77.65	103.45	69.20	63.10	55.60	50.50	48.60	51.70	57.80	65.00	70.90	72.60
Santa Ana River	NSAR311	0.05	746.50	826.08	726.43	332.79	315.89	65.21	51.30	49.00	52.80	67.64	344.80	502.95	317.55
Santa Ana River	NSAR311	mean	221.83	316.41	231.07	108.75	96.93	59.85	50.21	55.41	60.79	65.00	120.94	164.88	128.38
Santa Ana River	NSAR31	0.95	73.60	75.63	72.07	66.20	59.50	54.00	50.80	50.50	51.40	55.40	61.60	68.30	50.70
Santa Ana River	NSAR31	0.75	74.70	76.00	73.40	67.90	61.20	54.90	51.20	50.60	52.10	56.70	63.10	69.90	54.40
Santa Ana River	NSAR31	0.50	75.60	76.20	74.90	69.90	63.10	56.30	51.80	50.70	52.95	58.20	65.10	71.70	64.90
Santa Ana River	NSAR31	0.25	80.35	79.95	105.75	71.50	65.30	57.80	52.70	50.90	54.00	60.10	67.30	73.20	74.90
Santa Ana River	NSAR31	0.05	749.37	828.98	729.26	335.35	318.42	67.51	53.50	51.30	55.10	69.94	347.36	505.65	320.10
Santa Ana River	NSAR31	mean	224.55	319.44	233.87	111.10	99.25	62.11	52.47	57.70	63.09	67.28	123.37	167.45	130.85
Santa Ana River	NSAR301	0.95	79.70	81.70	78.10	72.20	65.40	59.90	56.80	56.50	57.40	61.40	67.60	74.30	56.70
Santa Ana River	NSAR301	0.75	80.65	82.10	79.40	73.90	67.20	60.90	57.10	56.50	58.00	62.60	69.10	75.90	60.40
Santa Ana River	NSAR301	0.50	81.60	82.20	80.90	75.90	69.10	62.30	57.80	56.60	58.85	64.20	71.10	77.70	70.90
Santa Ana River	NSAR301	0.25	86.40	86.03	111.20	77.50	71.30	63.80	58.70	56.80	59.90	66.10	73.30	79.20	80.90
Santa Ana River	NSAR301	0.05	730.96	819.80	733.26	340.16	325.12	73.51	59.50	57.20	61.00	75.73	335.04	491.71	325.85
Santa Ana River	NSAR301	mean	228.03	322.40	237.69	116.52	105.19	68.08	58.39	63.56	68.82	73.01	127.77	171.71	135.82
Santa Ana River	NSAR30	0.95	79.20	81.23	77.60	71.80	65.00	59.40	56.30	56.00	56.90	60.90	67.10	73.90	56.20
Santa Ana River	NSAR30	0.75	80.25	81.60	78.90	73.50	66.70	60.40	56.60	56.00	57.50	62.20	68.70	75.50	59.90
Santa Ana River	NSAR30	0.50	81.20	81.80	80.50	75.50	68.70	61.80	57.30	56.10	58.35	63.70	70.70	77.20	70.40
Santa Ana River	NSAR30	0.25	86.00	85.63	110.80	77.10	70.90	63.30	58.20	56.30	59.40	65.60	72.80	78.80	80.50
Santa Ana River	NSAR30	0.05	731.16	820.00	733.46	340.06	325.02	73.11	59.00	56.70	60.60	75.26	334.94	491.71	325.75
Santa Ana River	NSAR30	mean	228.08	322.82	237.84	116.15	104.78	67.61	57.91	63.10	68.38	72.57	127.48	171.58	135.57
Santa Ana River	NSAR29	0.95	80.30	82.40	78.77	72.90	66.10	60.50	57.40	57.10	58.00	62.00	68.20	75.00	57.30
Santa Ana River	NSAR29	0.75	81.35	82.80	80.10	74.60	67.80	61.50	57.80	57.10	58.60	63.30	69.80	76.60	61.00
Santa Ana River	NSAR29	0.50	82.30	82.90	81.60	76.60	69.80	62.90	58.40	57.20	59.45	64.80	71.80	78.40	71.60

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Drainage	**Node**	**Exceedance**	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**	**Annual**
Santa Ana River	NSAR29	0.25	87.10	86.73	111.95	78.20	72.00	64.40	59.30	57.50	60.50	66.70	73.90	79.90	81.60
Santa Ana River	NSAR29	0.05	732.53	821.40	734.76	341.26	326.22	74.21	60.10	57.80	61.70	76.43	336.14	493.01	326.95
Santa Ana River	NSAR29	mean	229.27	324.08	239.05	117.28	105.91	68.72	59.02	64.22	69.48	73.69	128.63	172.75	136.72
Santa Ana River	NSAR28	0.95	82.10	84.10	80.50	74.60	67.80	62.30	59.10	58.80	59.70	63.70	70.00	76.70	59.00
Santa Ana River	NSAR28	0.75	83.10	84.50	81.80	76.30	69.50	63.20	59.50	58.90	60.30	65.00	71.50	78.30	62.70
Santa Ana River	NSAR28	0.50	84.00	84.60	83.40	78.30	71.50	64.60	60.10	59.00	61.20	66.60	73.50	80.10	73.30
Santa Ana River	NSAR28	0.25	88.80	88.45	113.20	79.90	73.70	66.20	61.00	59.20	62.30	68.40	75.70	81.70	83.40
Santa Ana River	NSAR28	0.05	722.02	821.15	732.45	341.91	328.12	75.91	61.80	59.50	63.40	78.06	332.49	486.87	328.10
Santa Ana River	NSAR28	mean	229.82	324.56	239.78	118.73	107.60	70.45	60.71	65.88	71.08	75.27	129.67	173.70	137.99
Santa Ana River	NSAR27	0.95	80.60	82.63	79.00	73.10	66.30	60.80	57.60	57.30	58.20	62.20	68.50	75.20	57.50
Santa Ana River	NSAR27	0.75	81.65	83.00	80.30	74.80	68.10	61.70	58.00	57.40	58.90	63.50	70.10	76.80	61.20
Santa Ana River	NSAR27	0.50	82.60	83.20	81.80	76.80	70.10	63.10	58.60	57.50	59.70	65.10	72.00	78.60	71.60
Santa Ana River	NSAR27	0.25	86.40	86.75	110.15	78.50	72.30	64.70	59.50	57.70	60.80	67.00	74.20	80.20	81.90
Santa Ana River	NSAR27	0.05	659.28	743.95	672.49	339.29	326.89	73.52	60.30	58.10	61.90	74.99	290.90	429.82	317.90
Santa Ana River	NSAR27	mean	217.71	310.14	228.34	114.38	105.61	68.91	59.15	63.22	68.57	72.62	122.16	165.25	132.10
Santa Ana River	NSAR25	0.95	64.40	66.43	62.80	56.90	50.10	44.50	41.30	41.00	41.90	46.00	52.20	59.00	41.20
Santa Ana River	NSAR25	0.75	65.45	66.90	64.10	58.60	51.80	45.40	41.70	41.10	42.60	47.20	53.80	60.60	45.00
Santa Ana River	NSAR25	0.50	66.40	67.00	65.60	60.60	53.80	46.90	42.30	41.20	43.40	48.80	55.80	62.40	55.40
Santa Ana River	NSAR25	0.25	70.20	70.58	94.05	62.30	56.00	48.40	43.20	41.40	44.50	50.70	58.00	64.00	65.70
Santa Ana River	NSAR25	0.05	644.48	729.25	657.69	323.83	311.42	57.28	44.00	41.70	45.60	58.79	275.40	414.52	302.40
Santa Ana River	NSAR25	mean	201.90	294.76	212.72	98.26	89.47	52.64	42.84	46.93	52.31	56.37	106.10	149.33	116.06
Santa Ana River	NSAR244	0.95	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00
Santa Ana River	NSAR244	0.75	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00
Santa Ana River	NSAR244	0.50	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00
Santa Ana River	NSAR244	0.25	25.90	26.08	47.75	23.40	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.75	23.00
Santa Ana River	NSAR244	0.05	499.52	626.05	581.82	283.56	281.06	32.79	23.00	23.00	24.10	31.53	217.43	311.99	239.85
Santa Ana River	NSAR244	mean	147.58	235.26	158.81	59.06	58.91	28.82	23.31	27.96	30.87	29.74	67.80	103.63	80.19
Santa Ana River	NSAR243	0.95	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00
Santa Ana River	NSAR243	0.75	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00
Santa Ana River	NSAR243	0.50	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00
Santa Ana River	NSAR243	0.25	22.90	23.00	44.75	20.40	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.70	20.00
Santa Ana River	NSAR243	0.05	496.52	622.98	578.82	280.56	278.06	29.79	20.00	20.00	21.06	28.46	214.43	308.99	236.85
Santa Ana River	NSAR243	mean	144.57	232.26	155.80	56.05	55.90	25.82	20.31	24.96	27.87	26.74	64.80	100.62	77.19
Santa Ana River	NSAR242	0.95	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00
Santa Ana River	NSAR242	0.75	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00
Santa Ana River	NSAR242	0.50	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00
Santa Ana River	NSAR242	0.25	22.90	23.00	44.75	20.40	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.70	20.00
Santa Ana River	NSAR242	0.05	496.52	622.98	578.82	280.56	278.06	29.79	20.00	20.00	21.06	28.46	214.43	308.99	236.85
Santa Ana River	NSAR242	mean	144.57	232.26	155.80	56.05	55.90	25.82	20.31	24.96	27.87	26.74	64.80	100.62	77.19
Santa Ana River	NSAR241	0.95	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00
Santa Ana River	NSAR241	0.75	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00
Santa Ana River	NSAR241	0.50	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00
Santa Ana River	NSAR241	0.25	22.90	23.00	44.75	20.40	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.70	20.00
Santa Ana River	NSAR241	0.05	496.52	622.98	578.82	280.56	278.06	29.79	20.00	20.00	21.06	28.46	214.43	308.99	236.85
Santa Ana River	NSAR241	mean	144.57	232.26	155.80	56.05	55.90	25.82	20.31	24.96	27.87	26.74	64.80	100.62	77.19

			All Streamflows in Cubic Feet per Second												
Drainage	**Node**	**Exceedance**	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**	**Annual**
Santa Ana River	NSAR24	0.95	19.00	19.00	19.00	19.00	19.00	19.00	19.00	19.00	19.00	19.00	19.00	19.00	19.00
Santa Ana River	NSAR24	0.75	19.00	19.00	19.00	19.00	19.00	19.00	19.00	19.00	19.00	19.00	19.00	19.00	19.00
Santa Ana River	NSAR24	0.50	19.00	19.00	19.00	19.00	19.00	19.00	19.00	19.00	19.00	19.00	19.00	19.00	19.00
Santa Ana River	NSAR24	0.25	21.90	22.00	43.70	19.40	19.00	19.00	19.00	19.00	19.00	19.00	19.00	19.70	19.00
Santa Ana River	NSAR24	0.05	495.52	621.98	577.82	279.46	277.03	28.79	19.00	19.00	20.06	27.46	213.43	307.99	235.85
Santa Ana River	NSAR24	mean	143.57	231.25	154.79	55.05	54.90	24.82	19.31	23.96	26.87	25.74	63.79	99.62	76.18
Santa Ana River	NSAR232	0.95	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00
Santa Ana River	NSAR232	0.75	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00
Santa Ana River	NSAR232	0.50	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00
Santa Ana River	NSAR232	0.25	18.75	18.95	39.65	16.40	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.65	16.00
Santa Ana River	NSAR232	0.05	470.04	610.05	541.18	276.46	271.79	24.66	16.00	16.00	16.91	23.84	178.80	278.25	218.20
Santa Ana River	NSAR232	mean	135.20	221.60	146.61	50.89	51.70	21.80	16.27	20.72	23.41	22.21	58.02	93.12	71.03
Santa Ana River	NSAR231	0.95	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00
Santa Ana River	NSAR231	0.75	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00
Santa Ana River	NSAR231	0.50	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00
Santa Ana River	NSAR231	0.25	18.75	18.95	39.65	16.40	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.65	16.00
Santa Ana River	NSAR231	0.05	470.04	610.05	541.18	276.46	271.79	24.66	16.00	16.00	16.91	23.84	178.80	278.25	218.20
Santa Ana River	NSAR231	mean	135.20	221.60	146.61	50.89	51.70	21.80	16.27	20.72	23.41	22.21	58.02	93.12	71.03
Santa Ana River	NSAR23	0.95	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00
Santa Ana River	NSAR23	0.75	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00
Santa Ana River	NSAR23	0.50	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00
Santa Ana River	NSAR23	0.25	18.75	18.95	39.65	16.40	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.65	16.00
Santa Ana River	NSAR23	0.05	470.04	610.05	541.18	276.46	271.79	24.66	16.00	16.00	16.91	23.84	178.80	278.25	218.20
Santa Ana River	NSAR23	mean	135.20	221.60	146.61	50.89	51.70	21.80	16.27	20.72	23.41	22.21	58.02	93.12	71.03
Santa Ana River	NSAR22	0.95	19.80	19.80	19.80	19.80	19.80	19.80	19.80	19.80	19.80	19.80	19.80	19.80	19.80
Santa Ana River	NSAR22	0.75	19.80	19.80	19.80	19.80	19.80	19.80	19.80	19.80	19.80	19.80	19.80	19.80	19.80
Santa Ana River	NSAR22	0.50	19.80	19.80	19.80	19.80	19.80	19.80	19.80	19.80	19.80	19.80	19.80	19.80	19.80
Santa Ana River	NSAR22	0.25	22.55	22.75	43.50	20.10	19.80	19.80	19.80	19.80	19.80	19.80	19.80	20.45	19.80
Santa Ana River	NSAR22	0.05	481.14	651.10	567.53	280.86	276.19	28.46	19.80	19.80	20.67	27.71	183.06	282.65	222.50
Santa Ana River	NSAR22	mean	142.39	230.64	154.69	55.30	55.66	25.61	20.07	24.74	27.46	26.21	62.99	99.00	76.28
Santa Ana River	NSAR21	0.95	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00
Santa Ana River	NSAR21	0.75	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00
Santa Ana River	NSAR21	0.50	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00
Santa Ana River	NSAR21	0.25	24.20	24.88	44.80	22.30	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.55	22.00
Santa Ana River	NSAR21	0.05	461.71	658.38	563.49	283.46	278.69	30.39	22.00	22.00	22.66	29.43	172.78	261.13	220.45
Santa Ana River	NSAR21	mean	141.29	229.17	154.34	56.96	57.86	27.81	22.25	26.86	29.43	28.10	63.53	99.12	77.29
Santa Ana River	NSAR20	0.95	33.60	33.60	33.60	33.60	33.60	33.60	33.60	33.60	33.60	33.60	33.60	33.60	33.60
Santa Ana River	NSAR20	0.75	33.60	33.60	33.60	33.60	33.60	33.60	33.60	33.60	33.60	33.60	33.60	33.60	33.60
Santa Ana River	NSAR20	0.50	33.60	33.60	33.60	33.60	33.60	33.60	33.60	33.60	33.60	33.60	33.60	33.60	33.60
Santa Ana River	NSAR20	0.25	35.80	36.28	55.10	33.90	33.60	33.60	33.60	33.60	33.60	33.60	33.60	34.05	33.60
Santa Ana River	NSAR20	0.05	471.45	705.58	600.58	293.30	292.09	42.05	33.60	33.60	34.10	39.96	164.99	250.26	222.60
Santa Ana River	NSAR20	mean	154.31	244.77	169.58	68.96	70.05	39.45	33.83	38.59	41.08	39.60	74.64	110.88	89.69
Santa Ana River	NSAR19	0.95	5.90	5.90	5.90	5.90	5.90	5.90	5.90	5.90	5.90	5.90	5.90	5.90	5.90
Santa Ana River	NSAR19	0.75	5.90	5.90	5.90	5.90	5.90	5.90	5.90	5.90	5.90	5.90	5.90	5.90	5.90
Santa Ana River	NSAR19	0.50	5.90	5.90	5.90	5.90	5.90	5.90	5.90	5.90	5.90	5.90	5.90	5.90	5.90

			All Streamflows in Cubic Feet per Second												
Drainage	**Node**	**Exceedance**	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**	**Annual**
Santa Ana River	NSAR19	0.25	8.10	8.60	27.45	6.28	5.90	5.90	5.90	5.90	5.90	5.90	5.90	6.40	5.90
Santa Ana River	NSAR19	0.05	444.04	679.65	573.98	265.70	264.49	14.40	5.90	5.90	6.46	12.29	137.39	222.66	195.05
Santa Ana River	NSAR19	mean	126.76	217.27	142.06	41.31	42.38	11.76	6.13	10.90	13.40	11.91	47.00	83.27	62.06
Santa Ana River	NSAR18	0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Santa Ana River	NSAR18	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Santa Ana River	NSAR18	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Santa Ana River	NSAR18	0.25	0.00	0.00	2.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Santa Ana River	NSAR18	0.05	321.03	548.05	476.79	260.92	260.69	10.06	0.00	0.00	0.10	1.10	47.29	112.34	125.45
Santa Ana River	NSAR18	mean	101.51	189.86	118.91	31.55	35.88	5.94	0.15	4.05	5.95	4.05	28.89	61.43	48.29
Santa Ana River	NSAR17	0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Santa Ana River	NSAR17	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Santa Ana River	NSAR17	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Santa Ana River	NSAR17	0.25	0.00	0.00	1.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Santa Ana River	NSAR17	0.05	271.05	511.85	463.21	260.76	260.69	10.11	0.00	0.00	0.10	0.43	26.12	75.89	106.15
Santa Ana River	NSAR17	mean	95.65	183.60	113.85	30.33	35.66	5.93	0.13	3.18	5.48	3.43	26.35	56.80	45.99
Santa Ana River	NSAR16	0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Santa Ana River	NSAR16	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Santa Ana River	NSAR16	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Santa Ana River	NSAR16	0.25	0.00	0.00	1.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Santa Ana River	NSAR16	0.05	271.88	515.28	465.74	261.60	261.59	10.91	0.00	0.00	0.10	0.63	26.87	76.69	106.95
Santa Ana River	NSAR16	mean	96.07	184.25	114.48	30.53	35.83	5.99	0.14	3.21	5.53	3.49	26.54	57.10	46.22
Santa Ana River	NSAR151	0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Santa Ana River	NSAR151	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Santa Ana River	NSAR151	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Santa Ana River	NSAR151	0.25	0.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Santa Ana River	NSAR151	0.05	232.84	511.10	456.02	262.30	262.29	11.41	0.00	0.00	0.00	0.10	5.96	58.23	97.30
Santa Ana River	NSAR151	mean	91.78	179.60	110.71	29.69	35.74	6.02	0.13	2.57	5.17	2.95	24.66	53.84	44.54
Santa Ana River	NSAR15	0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Santa Ana River	NSAR15	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Santa Ana River	NSAR15	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Santa Ana River	NSAR15	0.25	0.00	0.00	0.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Santa Ana River	NSAR15	0.05	233.74	514.60	458.41	263.16	263.09	12.21	0.00	0.00	0.00	0.20	6.72	59.03	98.10
Santa Ana River	NSAR15	mean	92.18	180.24	111.33	29.88	35.91	6.07	0.13	2.59	5.21	2.99	24.83	54.10	44.75
Santa Ana River	NSAR14	0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Santa Ana River	NSAR14	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Santa Ana River	NSAR14	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Santa Ana River	NSAR14	0.25	0.00	0.00	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Santa Ana River	NSAR14	0.05	215.91	519.20	460.06	264.26	264.29	13.21	0.00	0.00	0.00	0.00	5.67	58.68	95.60
Santa Ana River	NSAR14	mean	91.62	179.85	111.17	29.88	36.08	6.14	0.13	2.57	5.15	2.92	24.50	53.76	44.61
Santa Ana River	RNASRP	0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Santa Ana River	RNASRP	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Santa Ana River	RNASRP	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Santa Ana River	RNASRP	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Santa Ana River	RNASRP	0.05	161.85	412.23	439.94	265.39	265.42	14.11	0.00	0.00	0.00	0.00	0.00	0.21	81.97
Santa Ana River	RNASRP	mean	84.42	172.06	104.98	29.30	36.11	6.19	0.00	2.40	4.74	2.71	21.87	48.83	42.12

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Drainage	**Node**	**Exceedance**	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**	**Annual**
Santa Ana River	NSAR13	0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Santa Ana River	NSAR13	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Santa Ana River	NSAR13	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Santa Ana River	NSAR13	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Santa Ana River	NSAR13	0.05	161.86	412.20	439.97	265.36	265.39	14.11	0.00	0.00	0.00	0.00	0.00	0.21	82.00
Santa Ana River	NSAR13	mean	84.42	172.06	104.98	29.30	36.11	6.19	0.00	2.40	4.74	2.71	21.87	48.83	42.12
Santa Ana River	US RNASRP	0.95	1.57	2.04	2.08	1.87	1.50	1.32	0.91	0.75	0.82	0.91	1.04	1.47	0.92
Santa Ana River	US RNASRP	0.75	3.34	3.58	4.01	3.09	2.15	1.63	1.14	0.91	0.94	1.04	1.41	2.40	1.45
Santa Ana River	US RNASRP	0.50	5.42	6.14	6.85	5.06	2.78	1.91	1.36	1.05	1.08	1.41	2.82	4.65	2.95
Santa Ana River	US RNASRP	0.25	12.24	14.55	57.30	19.96	7.66	3.09	1.97	1.52	2.18	2.42	6.37	9.52	7.85
Santa Ana River	US RNASRP	0.05	361.25	611.63	639.34	464.79	464.82	213.51	77.95	62.68	33.01	10.27	107.11	187.85	281.37
Santa Ana River	US RNASRP	mean	111.52	201.85	152.76	66.61	74.03	32.03	11.73	11.07	11.52	7.82	37.45	69.35	64.93
Santa Ana River	SE-74	0.95	0.05	0.08	0.11	0.13	0.13	0.12	0.11	0.09	0.08	0.07	0.06	0.05	0.07
Santa Ana River	SE-74	0.75	0.12	0.14	0.19	0.18	0.17	0.16	0.13	0.11	0.10	0.08	0.08	0.08	0.12
Santa Ana River	SE-74	0.50	0.24	0.30	0.43	0.32	0.26	0.21	0.16	0.14	0.12	0.11	0.12	0.16	0.19
Santa Ana River	SE-74	0.25	0.72	3.35	37.33	12.64	3.26	0.55	0.33	0.24	0.25	0.21	0.28	0.77	0.72
Santa Ana River	SE-74	0.05	274.75	450.26	563.92	454.16	458.84	210.24	75.43	60.64	30.34	3.48	70.70	144.64	233.76
Santa Ana River	SE-74	mean	76.27	156.05	119.50	58.11	70.06	30.01	10.35	9.07	8.88	4.65	25.31	52.11	51.14
Santa Ana River	SE-58	0.95	0.00	0.03	0.05	0.05	0.05	0.05	0.05	0.04	0.03	0.02	0.02	0.00	0.02
Santa Ana River	SE-58	0.75	0.04	0.05	0.07	0.07	0.07	0.07	0.06	0.05	0.04	0.03	0.02	0.02	0.05
Santa Ana River	SE-58	0.50	0.07	0.11	0.18	0.15	0.11	0.08	0.07	0.06	0.05	0.04	0.03	0.05	0.07
Santa Ana River	SE-58	0.25	0.35	0.78	4.04	5.65	1.77	0.29	0.15	0.11	0.10	0.07	0.09	0.20	0.34
Santa Ana River	SE-58	0.05	39.56	67.47	502.99	483.31	510.21	265.52	130.12	77.97	40.78	0.58	10.69	25.70	154.59
Santa Ana River	SE-58	mean	21.80	55.68	60.00	55.64	78.09	38.17	15.22	10.24	6.75	0.61	6.09	16.39	30.24
Santa Ana River	SE-55	0.95	0.02	0.03	0.05	0.04	0.04	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Santa Ana River	SE-55	0.75	0.05	0.06	0.09	0.07	0.06	0.05	0.04	0.03	0.03	0.02	0.02	0.02	0.04
Santa Ana River	SE-55	0.50	0.09	0.15	0.18	0.17	0.11	0.07	0.05	0.04	0.04	0.03	0.04	0.04	0.07
Santa Ana River	SE-55	0.25	0.25	0.70	0.70	0.65	0.44	0.29	0.20	0.14	0.15	0.07	0.08	0.13	0.27
Santa Ana River	SE-55	0.05	1.39	5.45	43.32	242.12	452.29	224.67	149.11	123.98	55.66	0.31	0.37	0.79	79.97
Santa Ana River	SE-55	mean	0.71	29.50	23.46	26.36	50.91	27.82	17.57	14.33	7.50	0.08	0.12	6.16	16.97
Temescal Wash	NTE24	0.95	48.00	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30
Temescal Wash	NTE24	0.75	48.00	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30
Temescal Wash	NTE24	0.50	48.00	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30
Temescal Wash	NTE24	0.25	48.00	2.30	3.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30
Temescal Wash	NTE24	0.05	279.97	548.50	502.33	175.45	60.20	8.92	2.30	2.30	2.30	2.40	45.31	109.04	65.30
Temescal Wash	NTE24	mean	139.40	140.65	95.90	25.78	9.37	3.44	2.42	3.96	4.43	4.43	28.96	44.81	41.50
Temescal Wash	NTE23	0.95	48.00	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30
Temescal Wash	NTE23	0.75	48.00	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30
Temescal Wash	NTE23	0.50	48.00	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30
Temescal Wash	NTE23	0.25	48.00	2.30	3.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30
Temescal Wash	NTE23	0.05	279.97	548.50	502.33	175.45	60.20	8.92	2.30	2.30	2.30	2.40	45.31	109.04	65.30
Temescal Wash	NTE23	mean	139.40	140.65	95.90	25.78	9.37	3.44	2.42	3.96	4.43	4.43	28.96	44.81	41.50
Temescal Wash	NTE22	0.95	48.00	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30
Temescal Wash	NTE22	0.75	48.00	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30
Temescal Wash	NTE22	0.50	48.00	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30

			All Streamflows in Cubic Feet per Second												
Drainage	**Node**	**Exceedance**	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**	**Annual**
Temescal Wash	NTE22	0.25	48.00	2.30	3.15	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30
Temescal Wash	NTE22	0.05	258.43	539.73	502.33	175.45	58.87	8.92	2.30	2.30	2.30	2.40	38.11	94.13	61.30
Temescal Wash	NTE22	mean	135.14	134.90	91.86	25.13	9.28	3.41	2.41	3.84	4.21	4.19	26.98	42.51	39.89
The Zanja	SE-59	0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
The Zanja	SE-59	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
The Zanja	SE-59	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
The Zanja	SE-59	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
The Zanja	SE-59	0.05	6.46	8.17	5.24	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.08	1.36	0.01
The Zanja	SE-59	mean	1.09	1.85	1.00	0.17	0.03	0.00	0.00	0.08	0.10	0.12	0.46	0.78	0.47
Upper Warm Creek	SE-31	0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Upper Warm Creek	SE-31	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Upper Warm Creek	SE-31	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Upper Warm Creek	SE-31	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Upper Warm Creek	SE-31	0.05	28.61	33.55	19.52	0.59	0.00	0.00	0.00	0.00	0.00	0.00	5.05	9.09	0.80
Upper Warm Creek	SE-31	mean	4.96	7.11	4.36	0.72	0.13	0.00	0.00	0.39	0.50	0.60	2.28	3.59	2.03
Upper Warm Creek	SE-20	0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Upper Warm Creek	SE-20	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Upper Warm Creek	SE-20	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Upper Warm Creek	SE-20	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Upper Warm Creek	SE-20	0.05	6.65	9.37	4.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.33	0.00
Upper Warm Creek	SE-20	mean	2.00	3.79	2.05	0.13	0.02	0.00	0.00	0.15	0.17	0.19	0.69	1.36	0.87
Warm Creek	NW-35	0.95	1.32	1.84	1.78	1.59	1.26	1.09	0.71	0.57	0.65	0.75	0.89	1.28	0.73
Warm Creek	NW-35	0.75	2.95	3.25	3.55	2.71	1.78	1.34	0.89	0.70	0.75	0.85	1.22	2.05	1.18
Warm Creek	NW-35	0.50	4.87	5.42	6.00	4.27	2.34	1.56	1.08	0.80	0.85	1.20	2.43	4.27	2.21
Warm Creek	NW-35	0.25	8.78	9.87	13.11	6.36	4.14	2.23	1.43	1.09	1.36	1.95	5.41	6.79	5.00
Warm Creek	NW-35	0.05	62.65	65.58	53.02	17.34	6.38	3.54	2.46	1.93	3.92	6.38	23.42	49.26	19.49
Warm Creek	NW-35	mean	14.70	16.73	14.50	6.55	3.29	1.88	1.26	1.74	2.10	2.78	7.66	11.69	7.03
Warm Creek	NW-34	0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Warm Creek	NW-34	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Warm Creek	NW-34	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Warm Creek	NW-34	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Warm Creek	NW-34	0.05	0.00	1.78	3.44	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Warm Creek	NW-34	mean	0.01	0.32	0.44	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07
Warm Creek	NW-33	0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Warm Creek	NW-33	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Warm Creek	NW-33	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Warm Creek	NW-33	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Warm Creek	NW-33	0.05	12.53	11.97	8.66	0.65	0.00	0.00	0.00	0.00	0.00	0.02	3.36	5.49	0.91
Warm Creek	NW-33	mean	1.71	1.88	1.34	0.33	0.06	0.00	0.00	0.14	0.19	0.24	0.93	1.31	0.67
Warm Creek	NW-32	0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Warm Creek	NW-32	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Warm Creek	NW-32	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Warm Creek	NW-32	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Warm Creek	NW-32	0.05	11.58	11.07	8.17	0.83	0.00	0.00	0.00	0.00	0.00	0.07	3.61	5.25	1.07
Warm Creek	NW-32	mean	1.54	1.69	1.23	0.32	0.06	0.00	0.00	0.12	0.17	0.22	0.85	1.18	0.61

			All Streamflows in Cubic Feet per Second												
Drainage	**Node**	**Exceedance**	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**	**Annual**
Warm Creek	NW-31	0.95	0.03	0.04	0.05	0.05	0.04	0.04	0.04	0.04	0.04	0.03	0.03	0.03	0.03
Warm Creek	NW-31	0.75	0.05	0.05	0.06	0.05	0.05	0.05	0.04	0.04	0.04	0.03	0.04	0.04	0.04
Warm Creek	NW-31	0.50	0.06	0.07	0.07	0.07	0.06	0.05	0.04	0.04	0.04	0.04	0.04	0.05	0.05
Warm Creek	NW-31	0.25	0.10	0.13	0.25	0.12	0.08	0.06	0.05	0.04	0.04	0.04	0.05	0.09	0.07
Warm Creek	NW-31	0.05	8.85	8.50	6.30	1.01	0.17	0.09	0.07	0.06	0.07	0.26	3.01	4.16	1.23
Warm Creek	NW-31	mean	1.27	1.39	1.06	0.34	0.12	0.06	0.05	0.13	0.17	0.22	0.71	0.98	0.54
Warm Creek	NW-30	0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Warm Creek	NW-30	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Warm Creek	NW-30	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Warm Creek	NW-30	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Warm Creek	NW-30	0.05	2.29	2.35	1.17	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.29	0.02
Warm Creek	NW-30	mean	0.37	0.43	0.27	0.05	0.01	0.00	0.00	0.03	0.04	0.05	0.19	0.28	0.14
Waterman Canyon Creek	SE-12	0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Waterman Canyon Creek	SE-12	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Waterman Canyon Creek	SE-12	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Waterman Canyon Creek	SE-12	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Waterman Canyon Creek	SE-12	0.05	0.00	12.87	13.45	4.86	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Waterman Canyon Creek	SE-12	mean	1.17	4.65	3.76	0.69	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.55	0.89
Waterman Canyon Creek	SE-11	0.95	0.07	0.26	0.76	0.41	0.23	0.14	0.09	0.07	0.06	0.05	0.05	0.06	0.07
Waterman Canyon Creek	SE-11	0.75	0.35	1.23	1.70	1.21	0.67	0.33	0.19	0.12	0.09	0.08	0.07	0.11	0.16
Waterman Canyon Creek	SE-11	0.50	2.01	2.52	3.32	2.70	1.39	0.56	0.29	0.18	0.13	0.12	0.13	0.32	0.56
Waterman Canyon Creek	SE-11	0.25	3.28	6.13	7.37	6.64	3.90	1.86	0.71	0.38	0.27	0.21	0.33	1.49	2.30
Waterman Canyon Creek	SE-11	0.05	10.00	22.99	20.62	12.57	7.60	3.98	1.78	0.88	0.92	1.08	2.76	7.30	9.48
Waterman Canyon Creek	SE-11	mean	4.16	8.40	7.79	4.39	2.52	1.22	0.54	0.33	0.30	0.27	0.71	2.14	2.70

Appendix D
Santa Ana River High Flow Effects Analysis

Appendix D
Santa Ana River High Flow Effects Analysis

Importance of Channel Maintenance Flows

The Covered Activities will decrease the magnitude, frequency, and duration of high flow flood events in the Santa Ana River and several tributaries, primarily through diversion of stream flow into groundwater recharge basins. The alteration of low flow conditions and how it affects aquatic ecology and Santa Ana sucker habitat suitability are described elsewhere in Chapter 4 of the HCP. This analysis focuses on how the Covered Activities would affect channel maintenance flows. Channel maintenance flows are described herein as instream flows necessary to maintain the physical character of the stream channel (Schmidt and Potyondy 2004). Maintenance of the physical habitat is in turn essential for healthy aquatic and terrestrial habitat and reducing flood risk. Schmidt and Potyondy (2004) describe the following benefits of channel maintenance flows:

- Convey water and sediment from tributary areas through the stream system without aggradation (net raising) or degradation (net lowering) of the channel bed.
- Maintain the relationship between the channel and the floodplain by temporarily storing flood flows on the floodplain.
- Maintain the ability of the stream to dissipate energy on the floodplain.
- Maintain essential channel capacity to avoid increasing flood risk to adjacent and downstream facilities.
- Maintain pools, riffles, meanders, and other physical habitats necessary to sustain aquatic ecosystems.

Channel maintenance flows are also essential for maintaining healthy riparian vegetation and the numerous benefits it provides, including habitat, root cohesion to protect against excessive erosion, shading to regulate stream temperatures, and nutrient filtering. Channel maintenance flows sustain riparian vegetation by (Schmidt and Potyondy 2004):

- Providing a source of abundant moisture.
- Transporting seed and propagules.
- Depositing sediment and scouring areas of the floodplain to create and maintain regeneration sites.
- Suppressing vegetation growth and encroachment of the main channel by several mechanisms including scour and inundation.

Loss of riparian vegetation can lead to increased erosion of sediments forming channel banks and floodplains. Rapid transport and eventual deposition of this sediment downstream can cause flooding problems and degrade aquatic habitats. Furthermore, riparian vegetation stores flood water, at least temporarily, and slows the pace of the flood wave as it moves down the watershed, thereby reducing flooding levels downstream (Anderson 2006).

The upper reaches of the mainstem Santa Ana River and tributaries City Creek and Mill Creek are designated as critical habitat for the Santa Ana sucker. These reaches are not listed as critical habitat because they currently sustain Santa Ana sucker habitat, but because they are important sources of coarse sediment and transport of these sediments to lower reaches of the Santa Ana River (e.g., downstream of RIX) is essential for sustaining sucker habitat in occupied reaches. Channel maintenance flows are necessary to maintain the balance of sediment transport and deposition in the stream system, and this includes continued transport of coarse sediment from the tributaries containing a supply of coarse sediment to reaches lower in the system.

The magnitude, frequency, and duration of flood flows necessary for performing channel maintenance can vary depending on the characteristics of the channel morphology. Most of the channels affected by covered activity hydrology changes have braided morphology (Figure 3-11). The recurrence interval, also known as the return period, is the average interval of time in years for which the discharge magnitude of a given flood will be equaled or exceeded. Surian et al. (2014) present a conceptual framework that relates recurrence interval flows with channel maintenance fluvial processes in the braided rivers they studied (Figure 3-16). Braided channel processes of sediment transport in channels and on low bars, in-channel bank erosion, sudden channel shifts into new channel braids, and vegetation erosion can all occur at frequently occurring flood events with recurrence intervals of less than a 1-year return period. It can require larger recurrence interval events of up to 2.5 years for the process of sediment transport on high bars. The framework model illustrates that fluvial process occur under a range of discharges, not a single discharge, and relatively infrequent floods (recurrence intervals in the 1- to 3-year range) are important drivers of braided channel morphology (Surian et al. 2014). Flow regulations that affect frequent, low magnitude floods with recurrence intervals in the 1- to 3-year range can significantly change braided river vegetation dynamics and the transport of coarse sediment (Surian et al. 2014).

Flood events that occur one or more times per year are drivers of bank and vegetation erosion, and sediment transport in active channel branches, while larger floods can lead to widening of the active part of the river, creation of new channel braids, and complete rearrangement of the channel network that substantially modifies the distribution of terrestrial and aquatic habitat (Bertoldi and Tubino 2010).

Analysis of Channel Maintenance Flows

Methods

ICF evaluated changes in flooding and sediment transport to assess how the Covered Activities would alter high flows and channel maintenance processes. Three different analyses were performed:

1. **Change in the Flow Magnitude of the 1.25-year Flood.** The change in the flow magnitude between the baseline and with Covered Activities conditions corresponding to the 1.25-year recurrence was evaluated. As described above, the 1.25-year flood is in the range of events that have been shown to be a key driver of geomorphic processes and vegetation dynamics in braided channel systems. Understanding how the Covered Activities would alter the 1.25-year flood provides insight into the extent to which channel maintenance processes may be altered.

2. **Change in Bedload Transport for the 1.25-year Flood.** Based on the change in the flow magnitude of the 1.25-year flood, bedload transport calculations were performed to assess how altered flows translate into altered sediment transport, which is a primary channel maintenance function.
3. **Change in the Bedload Transport Over the Entire Hydrograph.** Because fluvial process occur under a range of discharges, not just the 1.25-year flood, analysis was performed at select locations to understand how altered hydrology would cumulatively affect sediment transport for all flows in the hydrograph. Bedload transport rating curves were developed to show how the Covered Activities would change sediment transport to downstream reaches for every flow – from the lowest to highest flow over the HCP 25-year hydro period.

The focus of the high flow effects analysis is on the mainstem Santa Ana River extending from near Seven Oaks Dam and downstream to near Prado, and major tributaries from Lytle Creek and further upstream. Tributaries downstream of Lytle Creek are not included in the analysis since they are: (1) not significant sources of sediment compared to the upper tributaries; (2) most of the lower tributaries are concrete conveyance channels devoid of natural geomorphic processes; and (3) are not designated as critical habitat for sediment sources.

Change in the Flow Magnitude of the 1.25-year Flood

Determination of the flow magnitude that corresponds to different recurrence intervals (e.g., the 1.25-year flood) is usually based on peak instantaneous flows. The peak instantaneous flow for a given water year is typically determined by querying USGS gage records of flow levels reported on a 15-minute interval to find the largest value that occurred in the year. Several USGS gages exist in the study area. The peak flow data was downloaded from the USGS online records for several gages on the mainstem Santa Ana River and tributaries and Bulletin 17C (England et al. 2018) methods were used to calculate flood recurrence intervals. Values for the 1.25-year flood are listed in Table D-1.

The hydrology analysis used for the effects analysis is based on modeled mean daily flows and does not include peak instantaneous flows (see Chapter 3). ICF used a procedure to correlate the peak flow recurrence interval with mean daily discharge. A flow duration curve was created from the mean daily flow records at the U.S. Geological Survey (USGS) gages and the exceedance probability (probability that a flow will be equaled or exceeded on a given day) corresponding to the 1.25-year flood was determined. See Figures D-2 through D-15 for graphs of the flow duration curves prepared for the analysis that show the baseline and with covered activity conditions. For example, for the USGS Santa Ana River at MWD crossing gage, the 1.25-year flood is 3,080 cubic feet per second (cfs), which has a mean daily exceedance probability of 0.33% (on average is equaled or exceeded 1.2 days per year). Then, flow duration curves were developed from the modeled mean daily discharges at select model node locations. The same exceedance probability determined from the USGS gage was used to determine the corresponding modeled mean daily flow. Continuing the example, a 0.33% exceedance for node NSAR 232 located near the MWD gage has a corresponding baseline mean daily flow of 2,971 cfs. This is not an exact correlation of peak flow with mean daily flow since the peak instantaneous flow duration may have been less than a day, and thus the mean flow for the entire day would be less than the peak. However, this approach uses a consistent method, and, as the results in Table D-1 show, the peak instantaneous and modeled mean daily baseline flows have similar magnitudes for most gages.

Change in Bedload Transport for the 1.25-year Flood

2D Hydraulic Modeling

Bedload transport analysis was performed using 2D hydraulic modeling and field-measured bed sediment particle size analysis. Two-dimensional hydraulic modeling was performed using the SRH-2D numerical model (Lai 2008) at 22 locations in the study area to support the HCP effects analysis. The locations of the 2D hydraulic model assessment reaches are mapped in Figure D-1.

The SRH-2D numerical model was created by the U.S. Bureau of Reclamation at its Technical Service Center in Denver, Colorado. The model is a 2D depth-averaged velocity, finite element model. The model was run using a steady state flow condition for all scenarios analyzed. All model set-up, including mesh generation and boundary condition establishment, was performed in Aquaveo's SMS software. Elevations in the model are based on LiDAR flown in 2015, with the exception of model sites located on the downstream of the Rialto and RIX effluent discharges, in which the LiDAR was supplemented with field-surveyed bathymetry (see Chapter 3 for more discussion). The resolution of the modeling mesh is typically 3 feet spacing between model nodes, which is the same resolution of the raster cell size in the LiDAR elevation surface.

As described in Chapter 3 for the Santa Ana sucker effects analysis, field-surveyed water surface elevations and discharge measurements were used to calibrate Manning's n roughness values specified in the models for model sites located downstream of the Rialto and RIX effluent discharges. For the other sites that are typically dry (and were dry when the 2015 LiDAR was flown), roughness values for the modeling mesh were not calibrated, but instead were specified. Roughness values used in the modeling sites for the channel typically ranged from 0.025 to 0.035. The specified roughness value was determined based on consideration of grain roughness (Limerinos 1970) related to particle size and surface irregularities that also provide roughness and are not already accounted for in the density of the node spacing in the mesh surface or grain size (Tonina and Jorde 2013). These 2D roughness values are lower than what was used in the 1D hydraulic model because much of the bedform roughness and other flow resistance factors (e.g., channel geometry) are accounted for in the 2D mesh. Manning's n values in vegetated areas typically ranged from 0.06 to over 0.1 depending on the vegetation density.

Upstream boundary conditions were set at locations where the flow is concentrated into one channel braid. The water surface elevations assigned to the models' downstream boundary conditions were determined from 1D calculations of discharge and water surface elevation using the Manning's equation. The parabolic turbulence coefficient was set to 0.6 in the model (Pasternack 2011). Monitoring lines and points were established on the model to monitor water surface elevations and continuity calculations during the model run. Each modeled flow was run at a time step of 1 second or less until an acceptable level of convergence was obtained in continuity, water surface elevations, and velocities.

Eleven of the 2D model sites were used in the sediment transport analysis (see Table D-2). The model reach lengths average 2,280 feet, with a range from 745 feet (SAR-USGS Reach 9 Downstream of RIX) to 3,600 feet (Cajon Wash). Model reaches are shorter where bathymetric field surveys were required (it is time intensive to survey bathymetry over long reaches) and longer where use of the LiDAR elevations alone was sufficient for the modeling. The mean daily flows for both the baseline and with Covered Activities condition at the 1.25-year flood recurrence (Table D-1) were run in the model.

Channel Bed Sediment Analysis

Sediment transport analysis requires specification of the particle size gradation of the channel bed sediment. ICF obtained field-measured channel bed particle size sediment data from 3 sources: (1) USGS unpublished data collected in 2014–2015; (2) ESA (2015); and (3) U.S. Army Corps of Engineers unpublished data collected in 2017–2018. ICF calculated cumulative frequency grain sizes for different fractions (e.g., D_{50} = median grain size for which half the sediment sampled is finer in size), sediment sorting parameters to see how well or poorly sorted the sediment is, and the percent of each sample that is in sand, gravel, cobble, or boulder size fractions based on the Wentworth scale.

Sediment Transport Equation

The Wilcock and Crowe (2003) surface-based transport model for mixed-size bed sediments was used for the analysis. The Wilcock and Crowe model is a set of equations that are commonly used to estimate the rate that sediment is transported in channels with a sand and gravel bed sediment mixture. The Wilcock and Crowe equation was developed to calculate transport for all sediment fractions found in the bed rather than just using the D_{50} as some equations do. Importantly, this equation considers the effect of relative particle size variations within the sediment mixture and how different percentages of bed sand content affect the transport of other size fractions.

Shear stress is a key input in the Wilcock and Crowe (2003) sediment model. The local shear velocity u^* (feet per second [ft/s]) related to grain-induced resistance, from which local shear stress (pounds per square feet [lb/ft^2]) was calculated, was determined from a variation of Keulegan's (1938) resistance law for rough flow presented by Wilcock (2001) as:

$$\frac{U}{u^*} = 8.1\left(\frac{h}{k_s}\right)^{0.167}$$

where U is flow velocity (ft/s), h is flow depth (ft), and k_s is the bed roughness height (ft) calculated as twice the D_{65} particle size (Wilcock 2001).

Sediment transport calculations were performed in user-created Excel spreadsheets. The hydraulic depth and velocity output for every node in the SRH-2D model was imported into Excel and used to calculate shear stress and sediment transport rates at every model node. Table D-2 shows which bed sediment sample was used for each 2D model site. From this process the sediment transport for a given flow magnitude was calculated over a continuous model reach. At the flow level that corresponds to the 1.25-year flood, sediment transport was calculated over model reaches several acres in size. Performing the analysis over continuous channel area reaches, as opposed to limited to single cross-sections employed in a 1D analysis, allows for better capture of the variability in sediment transport that occurs through the different morphologic units found within a reach. Because sediment transport values are often reported as a rate along a cross-section, the total sediment transport for the reach was divided by the reach length to calculate a reach-averaged transport rate.

Change in the Bedload Transport Over the Entire Hydrograph

Bedload transport rating curves were developed for 6 of the 11 locations assessed for the 1.25-year flood (Table D-4). The curves were used to show how the Covered Activities would change sediment transport to downstream reaches for every flow – from the lowest to highest flow over the HCP 25-year hydro period. The analysis was performed for 3 Santa Ana River locations (Greenspot Road, upstream of East Twin Creek, and downstream of RIX) and 3 major tributaries that are important sediment sources to downstream reaches (Mill Creek, City Creek, and Lytle Creek). The same 2D hydraulic modeling and sediment transport calculation methods described above for the 1.25-year analysis were used for the curve development. Several different flows that span the range of low to maximum flows in the hydrology model hydrographs for each location were run in 2D models and the hydraulic output was used to perform the bedload calculations. The bedload transport rates determined for each flow were used to develop a curve from which an equation was fit through the points. This equation that predicts the bedload transport rate for a given flow rate was then used to calculate bedload transport for every daily flow in the hydrograph.

Results

Change in the Flow Magnitude of the 1.25-year Flood

The Covered Activities would decrease the mean daily discharge exceedance flow that corresponds to the 1.25-year flood for all locations (Table D-1). The decrease is the smallest on Mill Creek (4%) and largest on Lytle Creek upstream of Cajon Wash (77%). For the Santa Ana River locations the magnitude of the reductions progressively decrease downstream: 34% at Greenspot Road, 18% downstream of Mill Creek, and reaching a low of 7% at the E Street gage location (Node SE-74 upstream of Lytle Creek). Downstream of Lytle Creek, the Santa Ana River 1.25-year flood reductions increase again to 19%. This is attributed to the substantial flow reductions created by Covered Activities on the Lytle Creek and Cajon Wash tributaries that affect Santa Ana River flows. At the most downstream Santa Ana River location evaluated (Site 3A downstream of I-15) the reduction is 15%. Lower City Creek (just upstream of the confluence with Plunge Creek) has a 42% decrease in the 1.25-year flood reduction.

Change in Bedload Transport for the 1.25-year Flood

Particle size analysis of the channel bed sediment samples shows that most of the assessment reaches are composed of fine grained, poorly sorted, sandy sediment (Table D-2). The exceptions are steeper reaches in the upper watershed on the Santa Ana River at Greenspot Road and Mill Creek (dominant small cobble size), the Rialto Channel (dominant coarse gravel), and Santa Ana River ESA Middle Reach downstream of Highway 60 (dominant fine gravel size).

Results for the modeled sediment transport for the 11 assessment reaches are presented in Table D-3. The table lists the change between the baseline and covered activity conditions for streamflow of the 1.25-year food, change in total sediment transport, and change in fractional sediment transport. Graphs showing comparisons for transport of all the fractional sizes analyzed are presented in Figures D-16 through D-25.[1]

Under the baseline condition, Mill Creek has the largest sediment transport rate (15,781 tons/day) and is nearly 3 times greater than the second largest tributary site of Lytle Creek upstream of Cajon Wash (5,295 tons/day). Mill Creek's steep bed slope (4.1%) is the highest of all reaches assessed and a primary factor for why this tributary is the largest sediment source. A 4% reduction in Mill Creek's 1.25-year flood under the Covered Activities condition also results in a 4% reduction in sediment

[1] A fractional graph of D_i sediment sizes is not included for Mill Creek because the differences in baseline condition and covered activity condition flows at the 1.25-year flood are so minimal. However, a comparison of sand, gravel, cobble, and boulder fractions is listed in Table D-3.

transport. Lytle Creek upstream of Cajon Wash has a 75% reduction in the 1.25-year flood that results in a 72% reduction in a sediment transport. This is the largest reduction of all sites assessed. Other tributary reductions in sediment transport include 59% at Lytle Creek downstream of Cajon Wash, 48% at Cajon Wash, and 49% at lower City Creek. For the Santa Ana River assessment sites, the location at Greenspot Road has the largest reduction (41%). The other Santa Ana River locations have reductions ranging from 12% (ESA Middle Reach and upstream of East Twin Creek) up to 24% (USGS Reach 9 downstream of RIX).

In terms of the fractional size components of the total sediment load, Mill Creek is the largest supplier of gravel and cobble at the 1.2-year flood under the baseline condition (Table D-3). Under the Covered Activities, the Santa Ana River at Greenspot Road has the largest reduction in transport of gravel (1,508 tons/day; 40%) and cobble (1,004 tons/day; 42%) followed by the Santa Ana River downstream of Mill Creek (702 tons/day gravel; 26% and 436 tons/day cobble; 30%). Lytle Creek upstream of Cajon Wash also has a notable reduction in gravel transport (794 tons/day; 75%).

Change in the Bedload Transport Over the Entire Hydrograph

Results of the sediment transport analysis over the entire hydrograph are listed in Table D-4. The sediment transport rating curves that were used to determine the values in Table D-4 are presented in Figures D-26 through D-31, as well as graphical bar charts of the fractional transport rates listed in Table D-4 in Figures D-32 through D-37. Mill Creek by far has the largest total sediment load under the baseline condition of all sites at 1,184,365 tons/year, and is also the largest supplier of combined gravel and cobble to the Santa Ana River. Under the Covered Activities condition, Mill Creek's streamflow would be reduced by 3,105 acre-feet/year (22%), resulting in a sediment supply reduction of 215,357 tons/year (18%). The Santa Ana River at Greenspot Road is the location with the second largest baseline condition total sediment load at 280,296 tons/year. Under the Covered Activities, this location's streamflow would be reduced by 3,357 acre-feet/year (21%), resulting in a sediment supply reduction of 57,404 tons/year (20%). The third largest baseline condition total sediment load is the Santa Ana River USGS Reach 9 downstream of RIX at 177,376 tons/year. Under the Covered Activities, this location's streamflow would be reduced by 34,698 acre-feet/year (35%), resulting in a sediment supply reduction of -63,486 tons/year (36%). Total sediment load would be reduced by 45% at lower City Creek, 49% at Lytle Creek downstream of Cajon Wash (which is the largest percent reduction of all sites), and 18% at the Santa Ana River upstream of East Twin Creek.

In terms of the fractional size components of the total sediment load, Mill Creek is the largest supplier of gravel and cobble under the baseline condition (Table D-4). Under the Covered Activities condition, gravel transport would be reduced by 17% and cobble by 10%. The Santa Ana River at Greenspot Road is the second largest supplier of gravel and cobble, and it would experience reductions of gravel transport by 26% and cobble by 18%. On a percentage basis, Lytle Creek downstream of Cajon Wash would have the largest reduction in gravel transport (48%) and cobble transport (35%).

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Table D-1. Flow Magnitudes for the 1.25-Year Flood Determined at USGS Gages and Determination of Corresponding Mean Daily Discharge Exceedance Probabilities

Gage Number	Gage Name	1.25-yr Recurrence Interval Flow[3] (cfs)	USGS Mean Daily Discharge Annual Exceedance Probability of the 1.25-yr Flood[4] (%)	Hydrology Model Node	Exceedance Probability used for the Modeled Mean Daily Discharge Hydrology[5] (%)	Average Number Days per Year Equaled or Exceeded[6] (days)	Baseline Flow at Exceedance Probability (cfs)	Covered Activity Flow at Exceedance Probability (cfs)	Change in Flow (Baseline minus Covered Activity) (cfs)	Change in Flow (%)	2D Hydraulic Model Assessment Reach
11051500	SAR near Mentone 1891-1998 Pre-Seven Oaks Dam Construction (pre-Nov. 2009)	263	3.02	SE-55 Up SAR	3.02	11.02	259	170	89	-34%	SAR at Greenspot Rd
11051500	SAR near Mentone 1999-2017 Post-Seven Oaks Dam Construction (since Nov. 2009)	70	8.20	SE-55 Up SAR	8.20	29.93	53	26	27	-51%	
				SE-55 UP SAR +SE-56 UP Mill Crk	3.00[1]	10.95	401	328	73	-18%	SAR Downstream of Mill Creek
				SE-57 E Low City Crk III + SE-58 Mid SAR	2.73[2]	9.97	473	429	44	-9%	SAR Upstream of East Twin Creek
11059300	SAR at E St near San Bernardino	1,710	0.50	SE-74 SAR E St	0.50	1.83	1,604	1,498	106	-7%	
11066460	SAR at MWD Crossing	3,080	0.33	NSAR 20[7]	0.42	1.53	3,178	2,580	599	-19%	SAR - USGS Reach 9 Downstream of RIX
				NSAR 232[7]	0.42	1.53	2,971	2,421	550	-19%	SAR - ESA Middle Reach
				NSAR 351	0.33	1.20	5,948	5,053	896	-15%	SAR - Site 3A Downstream of I-15
11054000	Mill Creek near Yucaipa (1948-1986)	82	4.88	SE-56 UP Mill Crk	4.88	17.81	84	81	3	-4%	Mill Creek Upstream of SAR
11055800	City Creek near Highland	132	0.86	SE-39 Mid City Crk	0.86	3.14	176	102	74	-42%	Lower City Creek
				SE-49 E Low City Crk II	0.86	3.14	274	237	37	-13%	
11062000	Lytle Creek near Fontana	176	2.02	NW-20 Upper Lytle Creek	1.15[8]	4.20	100	23	77	-77%	Lytle Creek Upstream of Cajon Wash
				NW-26 Lower Lytle Creek	1.15[8]	4.20	159	72	87	-55%	Lytle Creek Downstream of Cajon Wash
11063510	Cajon Creek Below Lone Pine Creek Near Keenbrook	186	0.39	NW-18 Upper Cajon Crk	0.39	1.42	100	54	46	-46%	Cajon Wash

[1] 3% Probability used since similar to long-term SAR near Mentone gage values

[2] 2.7% Probability is a drainage area weighted average of SAR near Mentone, Mill Creek, City Creek & Plunge Creek gages

[3] Determined from Log-Pearson Type III analysis of peak instantaneous flow records

[4] Determined by finding the discharge magnitude on an annual flow duration curve of mean daily discharge values that corresponds to the 1.25-yr flood magnitude

[5] The same exceedance probability used as determined for the representative USGS gage except for some instances where interpolation was used where model nodes are located between different USGS gages

[6] Calculated as the annual exceedance probability multiplied by 365 days

[7] Calculated as the average of the E Street and MWD Crossing gages

[8] Since a value using 2.02 results in 0 cfs (and no sediment transport) for the Covered Activity flow, a value of 1.15 is used to show some level of sediment transport under a low flow condition for comparison

Table D-2. Particle Size Analysis of Channel Bed Sediment Samples

Source	Site	2D Hydraulic Model Assessment Reach & Bed Slope	D_5 (mm)	D_{10} (mm)	D_{16} (mm)	D_{50} (mm)	D_{65} (mm)	D_{84} (mm)	D_{90} (mm)	D_{95} (mm)	Folk & Ward Sorting (S_o)	Dominant Class Size (mm)	Percent in Dominant Class (%)	Finer than Sand (%)	Sand (%)	Gravel (%)	Cobble (%)	Boulder (%)
USGS	SAR near Greenspot Road	SAR at Greenspot Rd (2.7%) SAR Downstream of Mill Creek (2.2%)	0.64	2.93	7.75	102.24	168.69	328.11	408.12	489.51	very poor	128.00	21.41	0.90	7.80	26.82	41.65	22.82
USGS	SAR near Orange Street		0.11	0.16	0.22	0.67	1.41	42.84	103.66	190.56	very poor	0.50	24.00	2.05	67.07	17.33	11.11	2.44
USGS	SAR near Tippecanoe Avenue	SAR Upstream of East Twin Creek (0.7%)	0.14	0.23	0.31	0.90	1.57	11.02	27.16	54.57	very poor	1.00	26.00	2.02	68.92	25.26	3.79	0.00
USGS	SAR Upstream of Rialto Drain		0.09	0.14	0.18	0.50	0.86	5.66	7.75	12.39	very poor	0.50	27.00	3.05	70.69	25.91	0.35	0.00
USGS	Mill Creek near Greenspot Road	Mill Creek Upstream of SAR (4.1%)	0.19	0.30	0.44	16.62	39.93	96.32	125.75	190.68	very poor	128.00	15.60	0.02	23.18	51.60	23.60	1.60
USGS	City Creek near 5th Street	Lower City Creek (0.7%)	0.15	0.25	0.31	0.94	1.93	5.66	7.19	11.06	poor	1.00	23.00	2.01	63.66	34.33	0.00	0.00
USGS	Lytle Creek near Hwy 66	Lytle Creek Downstream of Cajon Wash (1.1%) Lytle Creek Upstream of Cajon Wash (1.9%) Cajon Wash (2.0%)	0.10	0.15	0.21	0.59	1.47	6.62	10.75	26.91	very poor	0.50	26.00	3.03	64.33	30.95	1.68	0.00
USGS	Rialto Channel		4.50	6.68	8.85	21.88	32.10	63.52	83.76	105.68	poor	32.00	27.19	0.00	0.88	83.33	15.79	0.00
USGS	SAR Upstream of RIX	SAR - USGS Reach 9 Downstream of RIX (0.4%)	0.30	0.37	0.47	0.88	1.20	1.94	2.78	3.94	poor	1.00	40.31	0.00	85.25	14.75	0.00	0.00
USGS	SAR near Riverside Avenue		0.23	0.28	0.32	0.78	1.26	3.07	4.76	7.46	poor	0.50	27.77	0.01	77.38	22.61	0.00	0.00
USGS	SAR near Market Street		0.26	0.31	0.36	0.85	1.29	2.71	3.84	6.47	poor	1.00	29.46	0.00	78.77	21.23	0.00	0.00
ESA	ESA Upper Reach Site		0.38	0.59	1.58	19.73	32.25	53.31	60.59	67.41	very poor	50.00	25.30	0.00	17.00	75.57	7.43	0.00
ESA	ESA Riverside Site		0.34	0.47	0.73	5.05	10.75	19.31	22.73	29.34	very poor	25.00	25.50	0.00	28.50	71.50	0.00	0.00
ESA	ESA Middle Reach Site	SAR – ESA Middle Reach (0.3%)	0.30	0.36	0.46	1.90	3.31	8.37	12.12	17.36	poor	4.80	23.50	0.00	51.50	48.50	0.00	0.00
ESA	ESA Lower Reach Site		0.22	0.29	0.34	0.69	1.07	2.15	3.27	4.63	poor	0.85	17.00	0.00	83.00	17.00	0.00	0.00
Corps	SAR Downstream of I-15 (TP-17-72-1)	SAR – Site 3A (0.2%)	0.18	0.24	0.31	0.60	0.82	1.34	1.95	3.35	poor	0.60	36.00	0.00	90.37	9.63	0.00	0.00

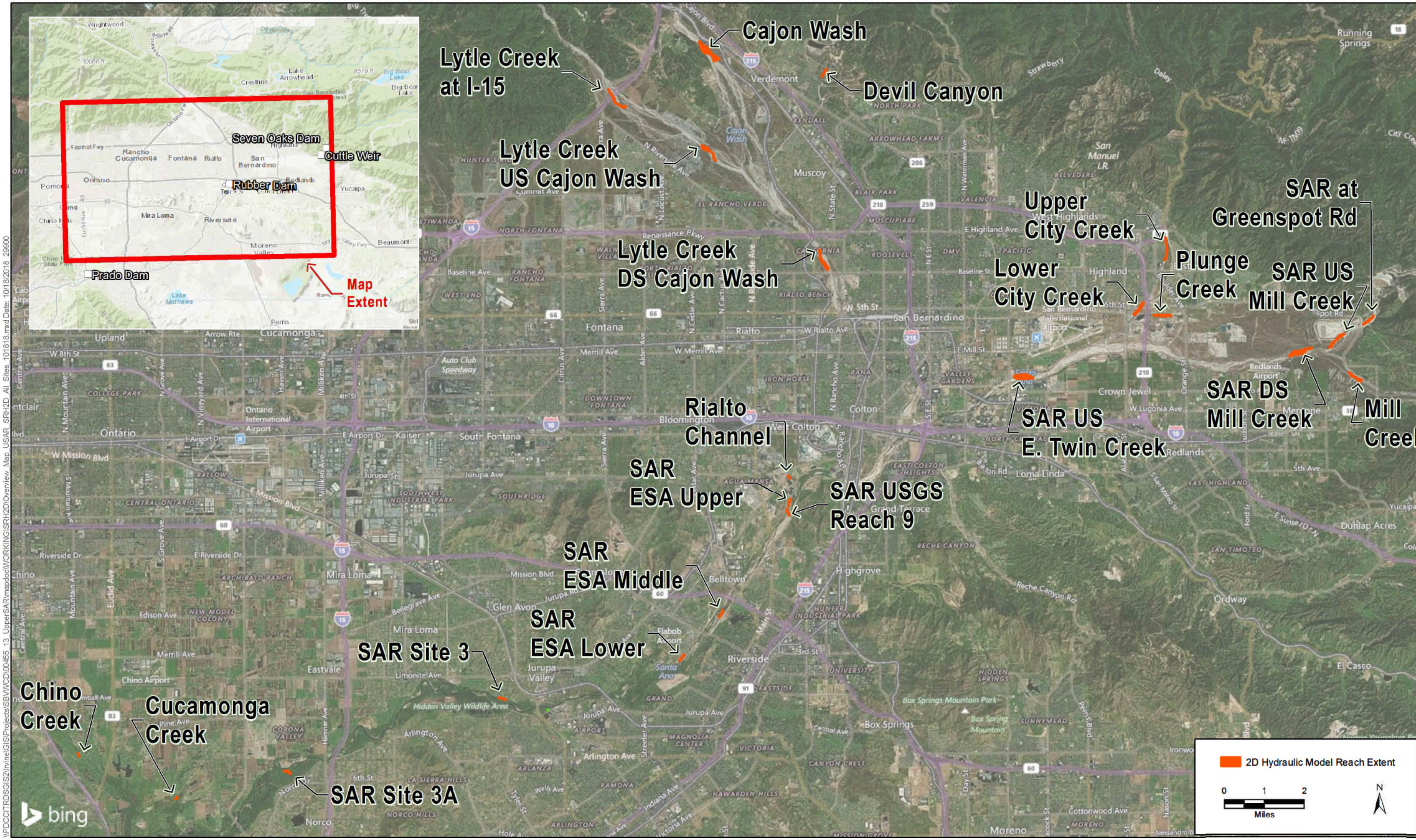
Sources: USGS unpublished sediment data collected 2014-2015; ESA 2015; Corps unpublished sediment data collected 2017-2018

Table D-3. Sediment Transport Effects From Reductions in the Mean Daily Discharge that Corresponds to the 1.25-Year Flood Recurrence Interval

	Streamflow				Total Bedload Transport				Fractional Bedload Transport															
2D Hydraulic Model Assessment Reach	Baseline (cfs)	With Cov. Act. (cfs)	Change from Baseline (cfs)	Change from Baseline (%)	Baseline (t/d)	With Cov. Act. (t/d)	Change from Baseline (t/d)	Change from Baseline (%)	Baseline Sand (t/d)	With Cov. Act. Sand (t/d)	Sand Change from Baseline (t/d)	Sand Change from Baseline (%)	Baseline Gravel (t/d)	With Cov. Act. Gravel (t/d)	Gravel Change from Baseline (t/d)	Gravel Change from Baseline (%)	Baseline Cobble (t/d)	With Cov. Act. Cobble (t/d)	Cobble Change from Baseline (t/d)	Cobble Change from Baseline (%)	Baseline Boulder (t/d)	With Cov. Act. Boulder (t/d)	Boulder Change from Baseline (t/d)	Boulder Change from Baseline (%)
Mill Creek Upstream of SAR	84	81	-3	-4%	15,781	15,139	-643	-4%	6,407	6,171	-236	-4%	8,557	8,199	-358	-4%	815	766	-49	-6%	2	2	0	-4%
Lower City Creek	176	102	-74	-42%	1,100	556	-544	-49%	904	465	-439	-49%	196	92	-105	-53%	0	0	0	0%	0	0	0	0%
Lytle Creek Upstream of Cajon Wash	100	25	-75	-75%	5,295	1,472	-3,823	-72%	4,224	1,201	-3,023	-72%	1,063	269	-794	-75%	8	2	-6	-79%	0	0	0	0%
Lytle Creek Downstream of Cajon Wash	159	72	-87	-55%	1,737	721	-1,017	-59%	1,497	633	-864	-58%	240	88	-152	-63%	0	0	0	-66%	0	0	0	0%
Cajon Wash	100	54	-46	-46%	2,167	1,117	-1,049	-48%	1,847	966	-881	-48%	319	151	-168	-53%	0	0	0	-52%	0	0	0	0%
SAR at Greenspot Rd	259	170	-89	-34%	8,201	4,872	-3,328	-41%	1,949	1,196	-753	-39%	3,747	2,240	-1,508	-40%	2,365	1,361	-1,004	-42%	140	76	-64	-46%
SAR Downstream of Mill Creek	401	328	-73	-18%	5,660	4,136	-1,524	-27%	1,482	1,120	-362	-24%	2,660	1,958	-702	-26%	1,462	1,026	-436	-30%	56	32	-24	-43%
SAR Upstream of East Twin Creek	473	429	-44	-9%	959	846	-113	-12%	877	776	-102	-12%	81	70	-11	-14%	0	0	0	-32%	0	0	0	0%
SAR - USGS Reach 9 Downstream of RIX	3,178	2,580	-598	-19%	7,626	5,790	-1,836	-24%	6,862	5,226	-1,636	-24%	764	564	-200	-26%	0	0	0	0%	0	0	0	0%
SAR - ESA Middle Reach	2,971	2,421	-550	-19%	2,490	2,197	-293	-12%	1,641	1,443	-199	-12%	849	754	-94	-11%	0	0	0	0%	0	0	0	0%
SAR - Site 3A Downstream of I-15	5,948	5,053	-895	-15%	2,157	1,806	-352	-16%	1,179	990	-190	-16%	978	816	-162	-17%	0	0	0	0%	0	0	0	0%

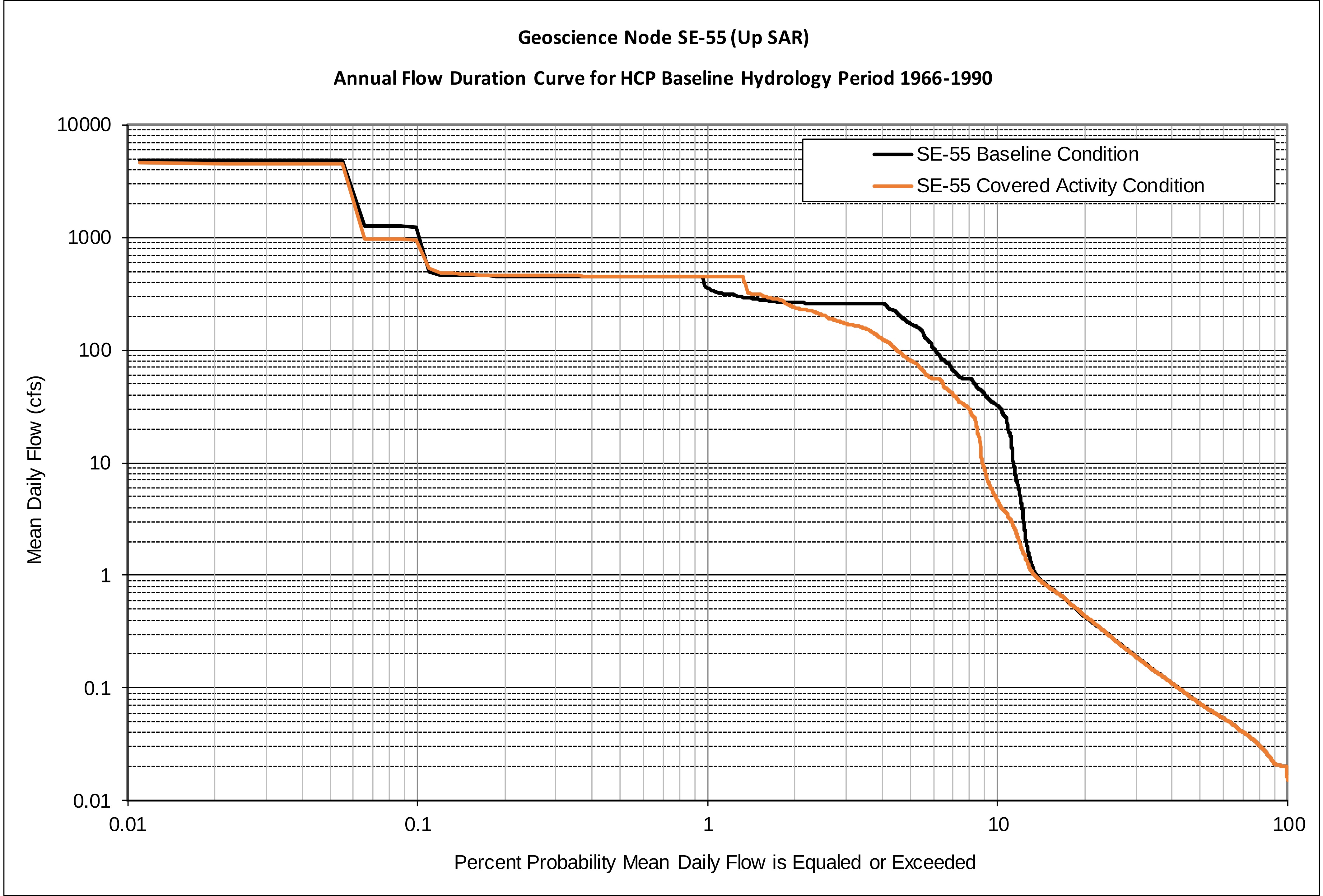
Table D-4. Sediment Transport Effects From Changes in Hydrology Calculated for Every Mean Daily Discharge Over the 25-Year 1966-1990 Base Hydro Period

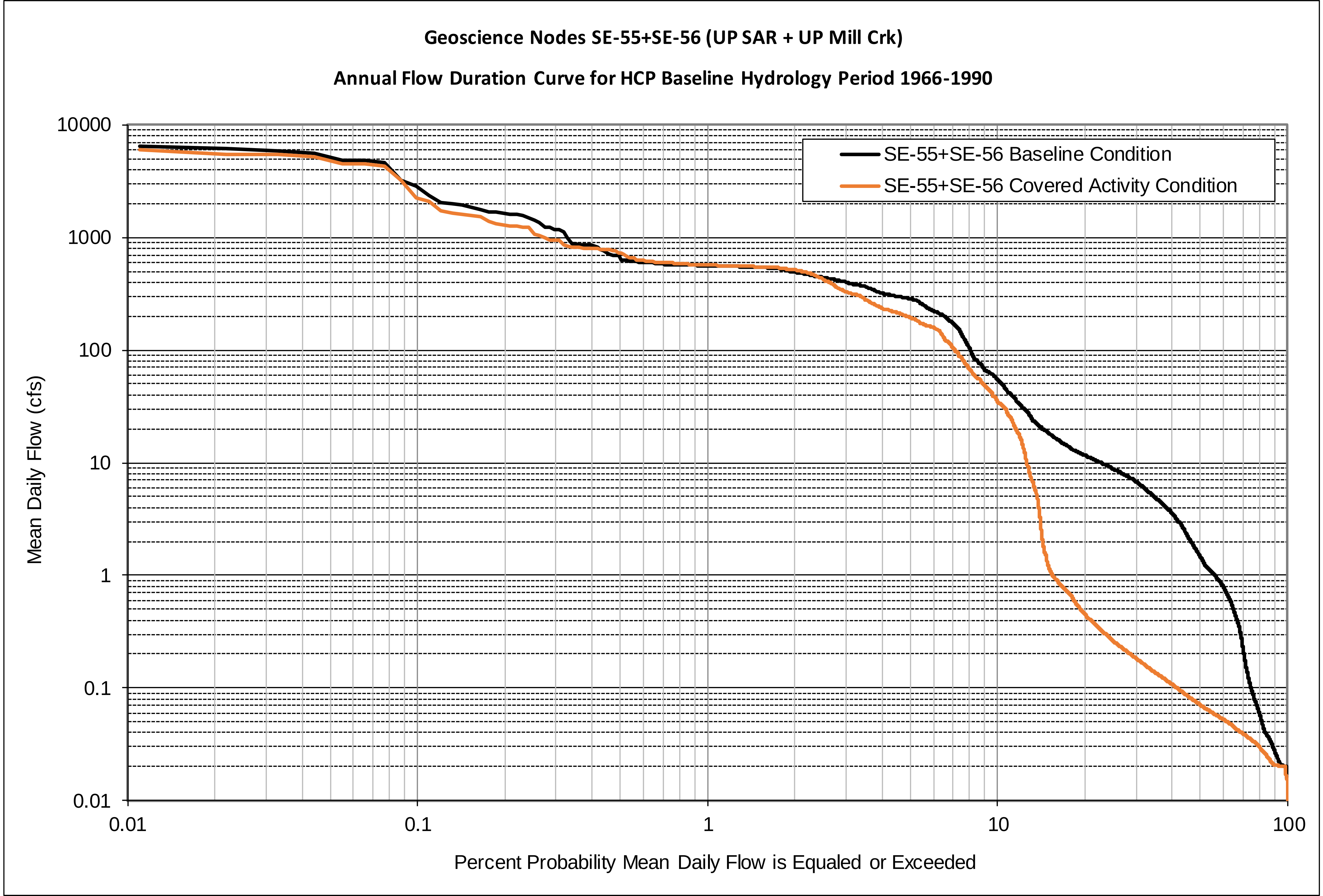
	Streamflow				Total Bedload Transport				Fractional Bedload Transport															
	1966-1990 Annual Average				1966-1990 Annual Average				1966-1990 Annual Average															
2D Hydraulic Model Assessment Reach	Baseline (ac-ft)	With Cov. Act. (ac-ft)	Change from Baseline (ac-ft)	Change from Baseline (%)	Baseline (t/yr)	With Cov. Act. (t/yr)	Change from Baseline (t/yr)	Change from Baseline (%)	Baseline Sand (t/yr)	With Cov. Act. Sand (t/yr)	Sand Change from Baseline (t/yr)	Sand Change from Baseline (%)	Baseline Gravel (t/yr)	With Cov. Act. Gravel (t/yr)	Gravel Change from Baseline (t/yr)	Gravel Change from Baseline (%)	Baseline Cobble (t/yr)	With Cov. Act. Cobble (t/yr)	Cobble Change from Baseline (t/yr)	Cobble Change from Baseline (%)	Baseline Boulder (t/yr)	With Cov. Act. Boulder (t/yr)	Boulder Change from Baseline (t/yr)	Boulder Change from Baseline (%)
Mill Creek Upstream of SAR	14,362	11,257	-3,105	-22%	1,184,365	968,978	-215,387	-18%	466,051	370,450	-95,601	-21%	641,526	529,443	-112,083	-17%	75,564	67,955	-7,609	-10%	967	912	-55	-6%
Lower City Creek	8,275	3,585	-4,689	-57%	22,964	12,683	-10,280	-45%	18,838	10,124	-8,713	-46%	4,126	2,559	-1,567	-38%	0	0	0	0%	0	0	0	0%
Lytle Creek Downstream of Cajon Wash	9,471	4,989	-4,482	-47%	48,938	24,846	-24,092	-49%	41,864	21,154	-20,711	-49%	7,052	3,678	-3,374	-48%	23	15	-8	-35%	0	0	0	0%
SAR at Greenspot Rd	15,650	12,292	-3,357	-21%	280,296	222,892	-57,404	-20%	63,450	44,720	-18,729	-30%	125,237	93,156	-32,081	-26%	84,766	69,372	-15,394	-18%	6,340	5,153	-1,187	-19%
SAR Upstream of East Twin Creek	36,313	29,072	-7,241	-20%	39,531	32,267	-7,264	-18%	35,847	29,020	-6,827	-19%	3,668	3,131	-537	-15%	15	16	1	7%	0	0	0	0%
SAR - USGS Reach 9 Downstream of RIX	99,675	64,977	-34,698	-35%	177,376	113,891	-63,486	-36%	161,323	103,717	-57,606	-36%	16,053	10,174	-5,879	-37%	0	0	0	0%	0	0	0	0%



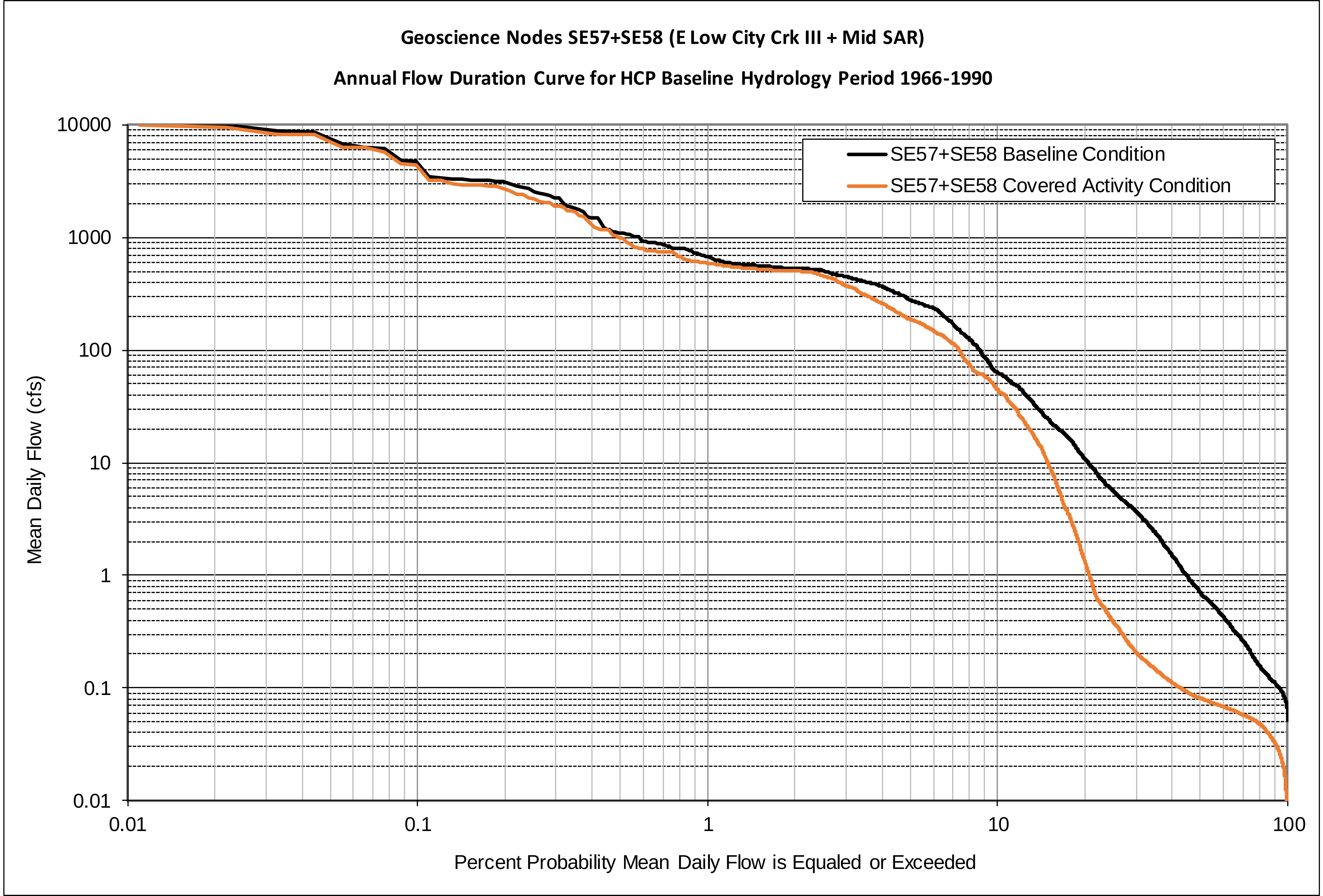
Upper Santa Ana River Habitat Conservation Plan

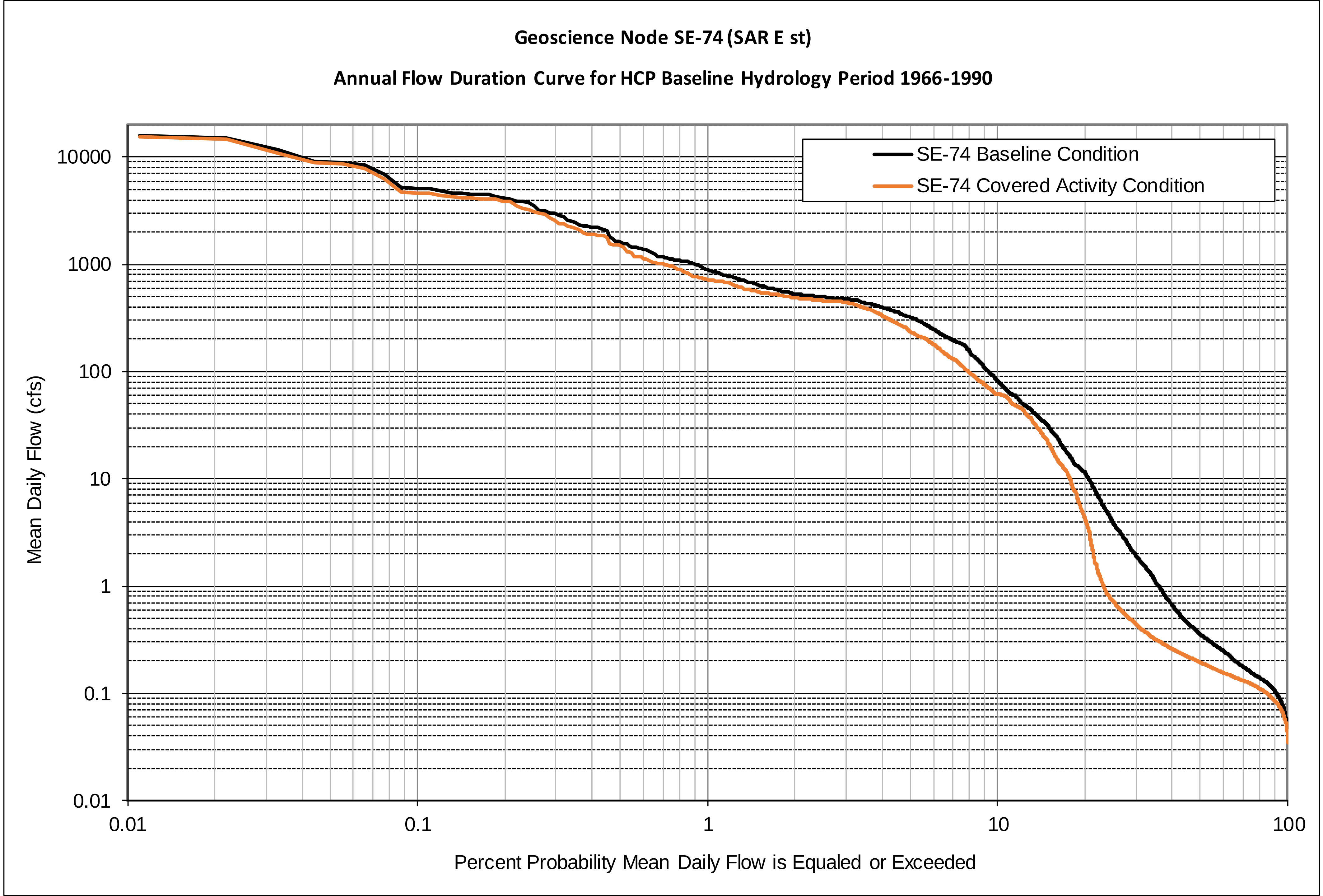
Figure D-1
Santa Ana River - Locations of 2D Hydraulic Model Assessment Reaches


Geoscience Node SE-55 (Up SAR)
Annual Flow Duration Curve for HCP Baseline Hydrology Period 1966-1990
SE-55 Baseline Condition
SE-55 Covered Activity Condition
Mean Daily Flow (cfs)
10000
1000
100
10
1
0.1
0.01
0.01
0.1
1
10
100
Percent Probability Mean Daily Flow is Equaled or Exceeded



Geoscience Nodes SE-55+SE-56 (UP SAR + UP Mill Crk)
Annual Flow Duration Curve for HCP Baseline Hydrology Period 1966-1990
SE-55+SE-56 Baseline Condition
SE-55+SE-56 Covered Activity Condition
Mean Daily Flow (cfs)
10000
1000
100
10
1
0.1
0.01
0.01
0.1
1
10
100
Percent Probability Mean Daily Flow is Equaled or Exceeded

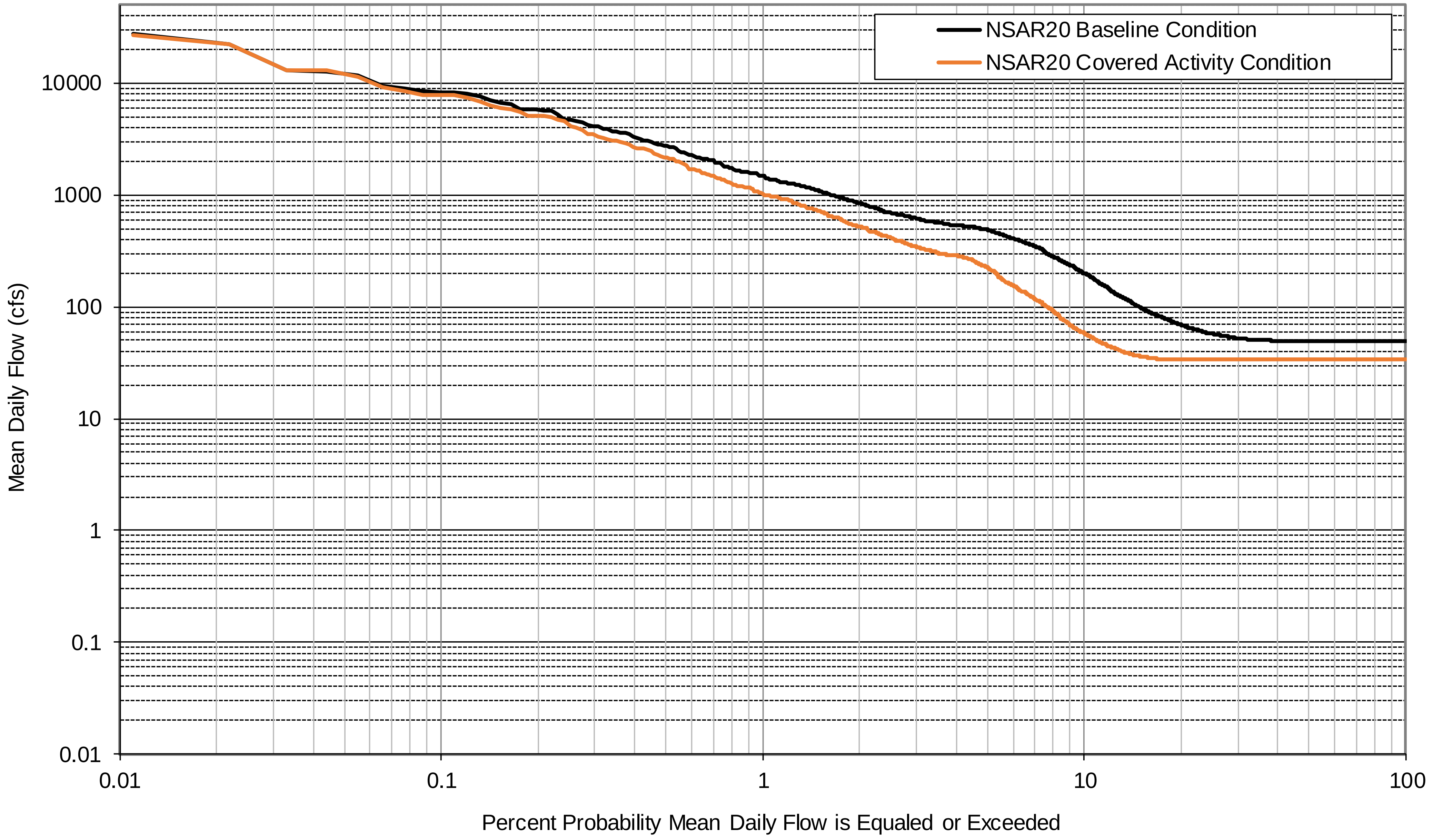

Geoscience Nodes SE57+SE58 (E Low City Crk III + Mid SAR)
Annual Flow Duration Curve for HCP Baseline Hydrology Period 1966-1990
SE57+SE58 Baseline Condition
SE57+SE58 Covered Activity Condition
Mean Daily Flow (cfs)
10000
1000
100
10
1
0.1
0.01
0.01
0.1
1
10
100
Percent Probability Mean Daily Flow is Equaled or Exceeded

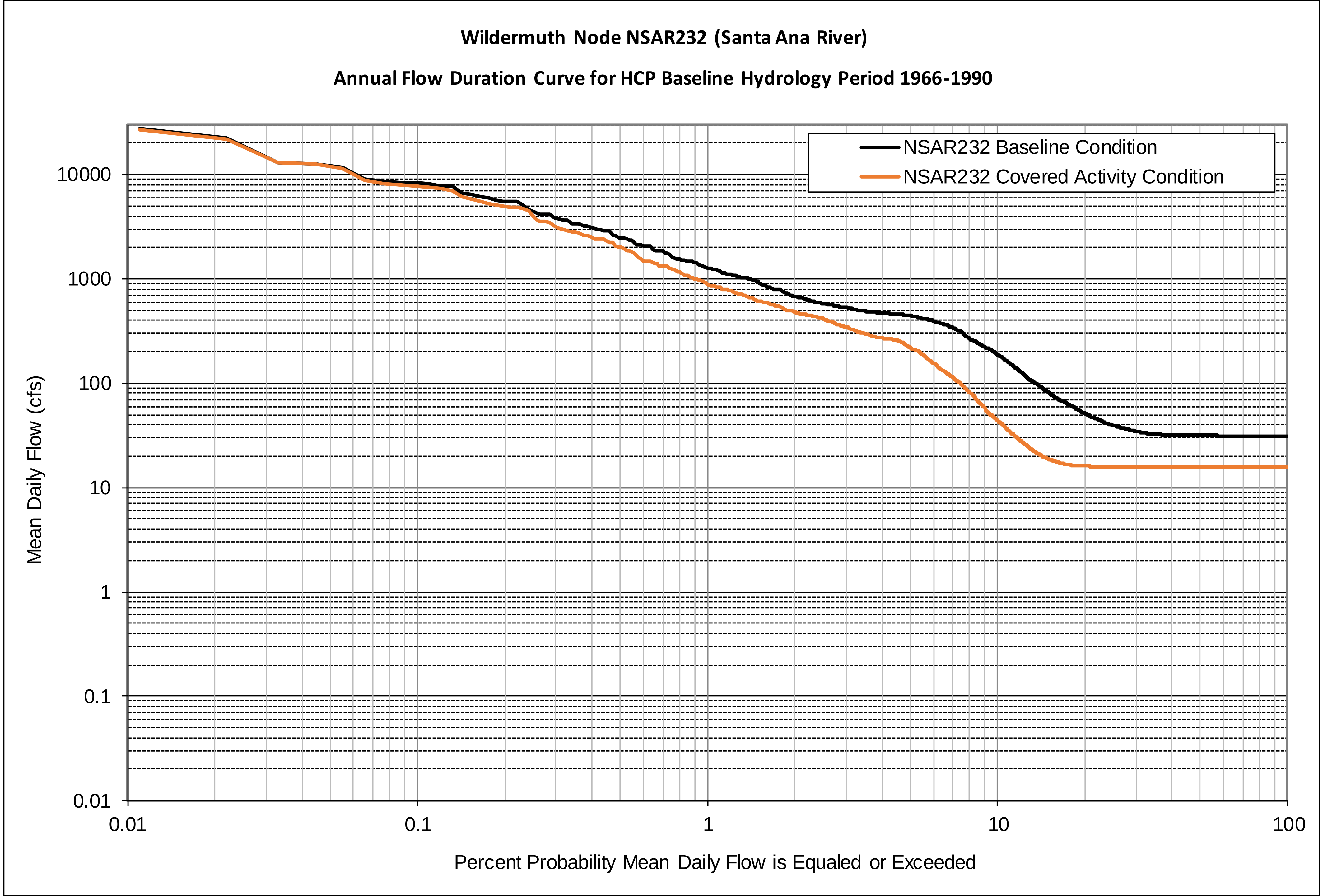


Geoscience Node SE-74 (SAR E st)
Annual Flow Duration Curve for HCP Baseline Hydrology Period 1966-1990
SE-74 Baseline Condition
SE-74 Covered Activity Condition
Mean Daily Flow (cfs)
10000
1000
100
10
1
0.1
0.01
0.01
0.1
1
10
100
Percent Probability Mean Daily Flow is Equaled or Exceeded

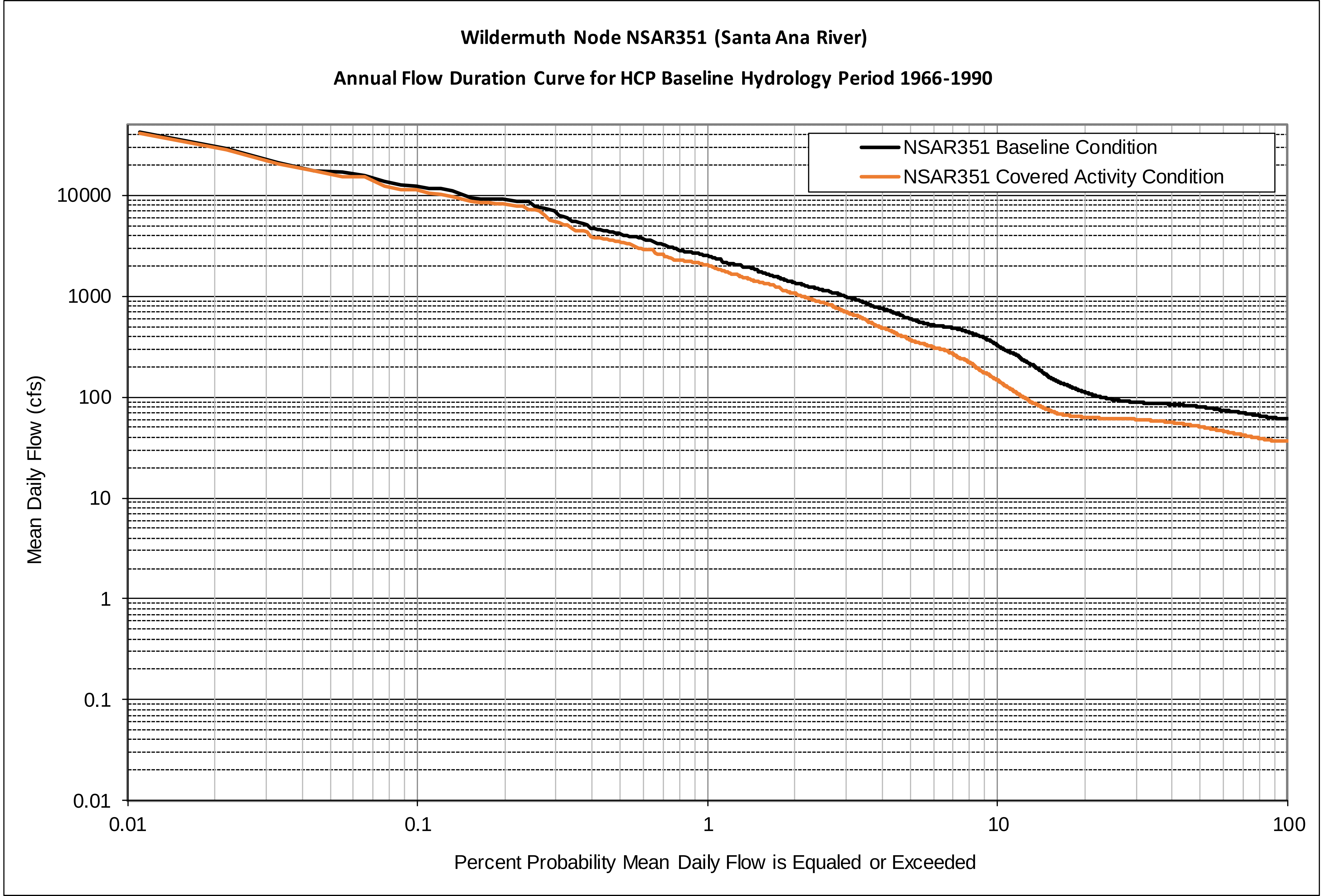
Wildermuth Node NSAR20 (Santa Ana River)

Annual Flow Duration Curve for HCP Baseline Hydrology Period 1966-1990

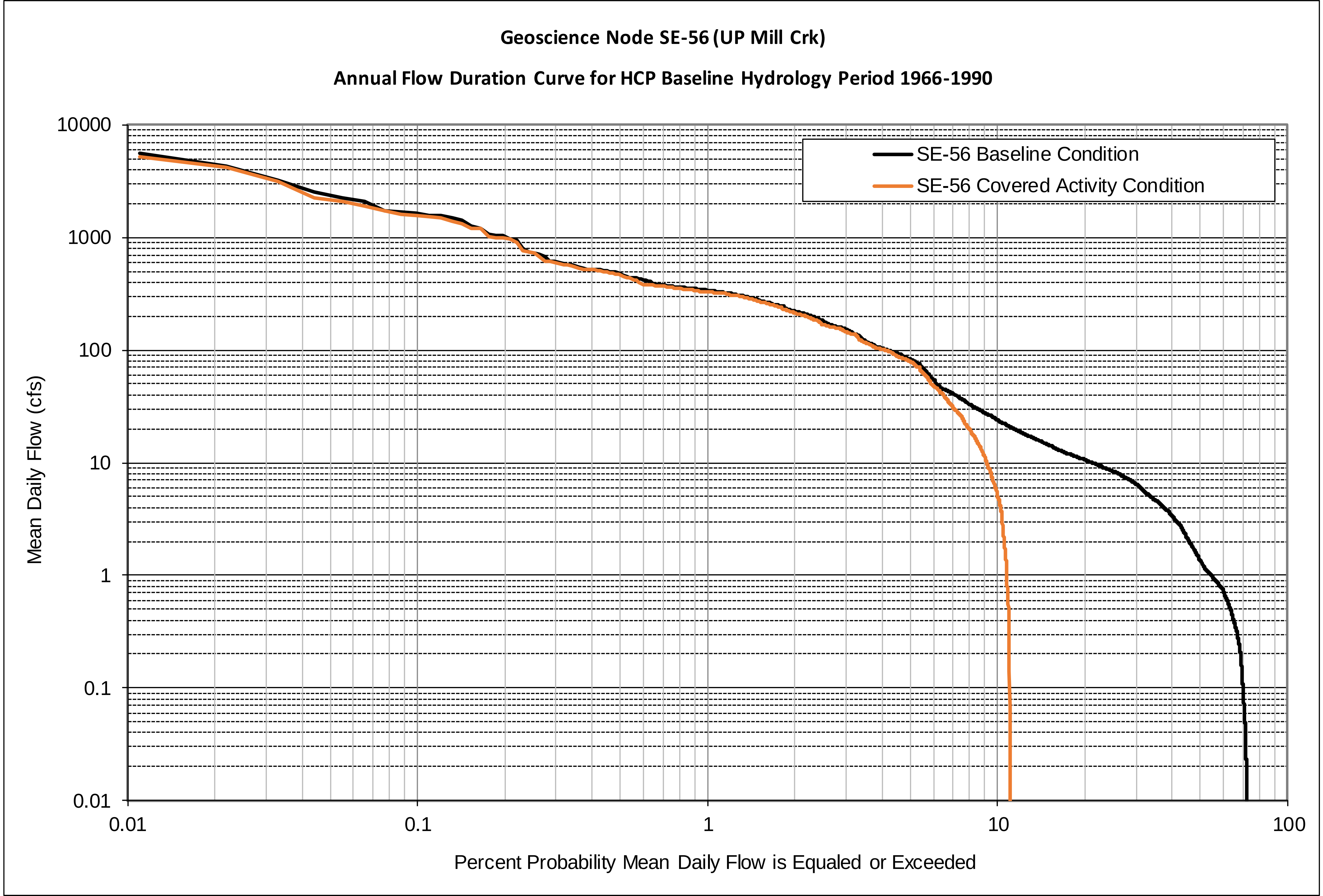


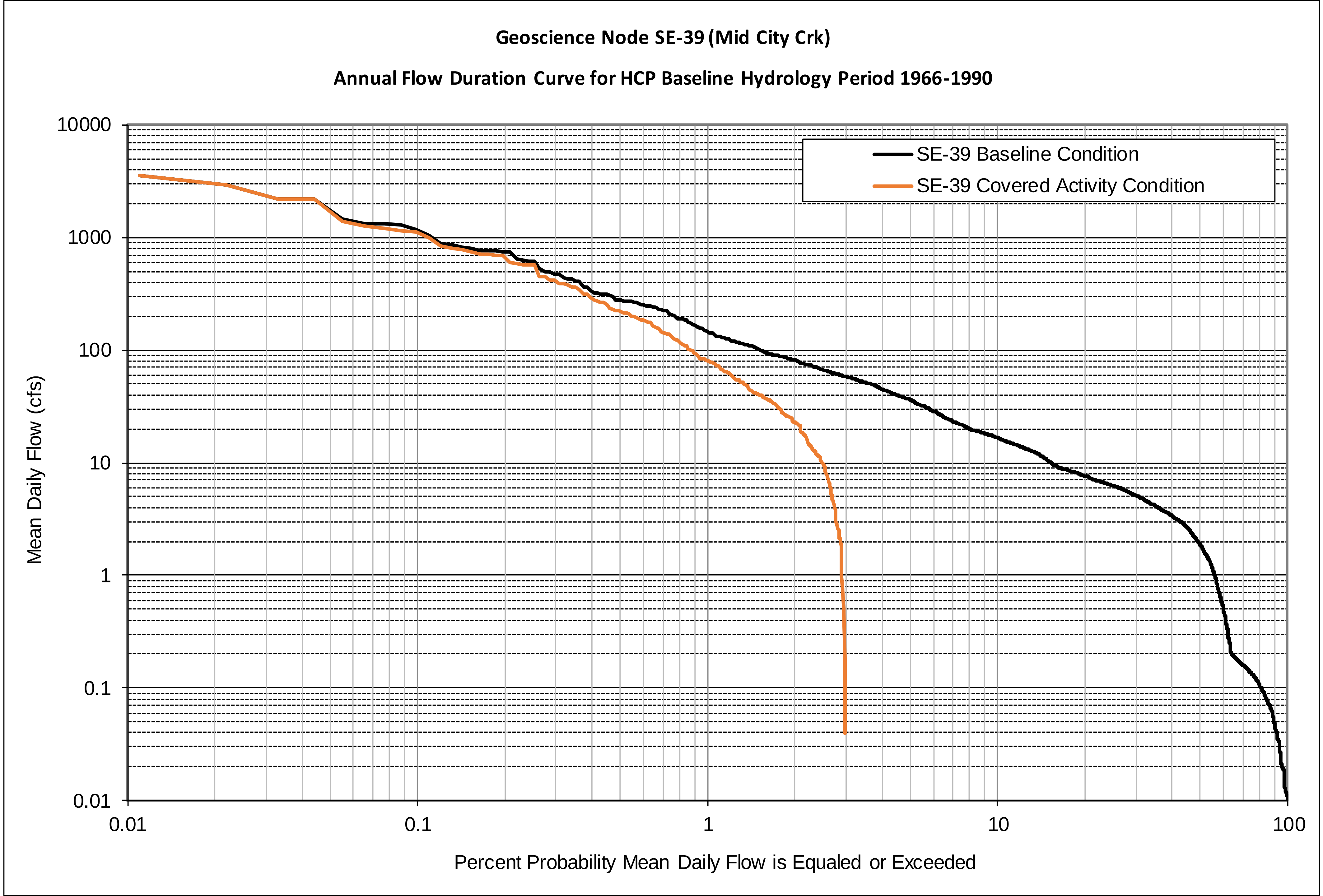


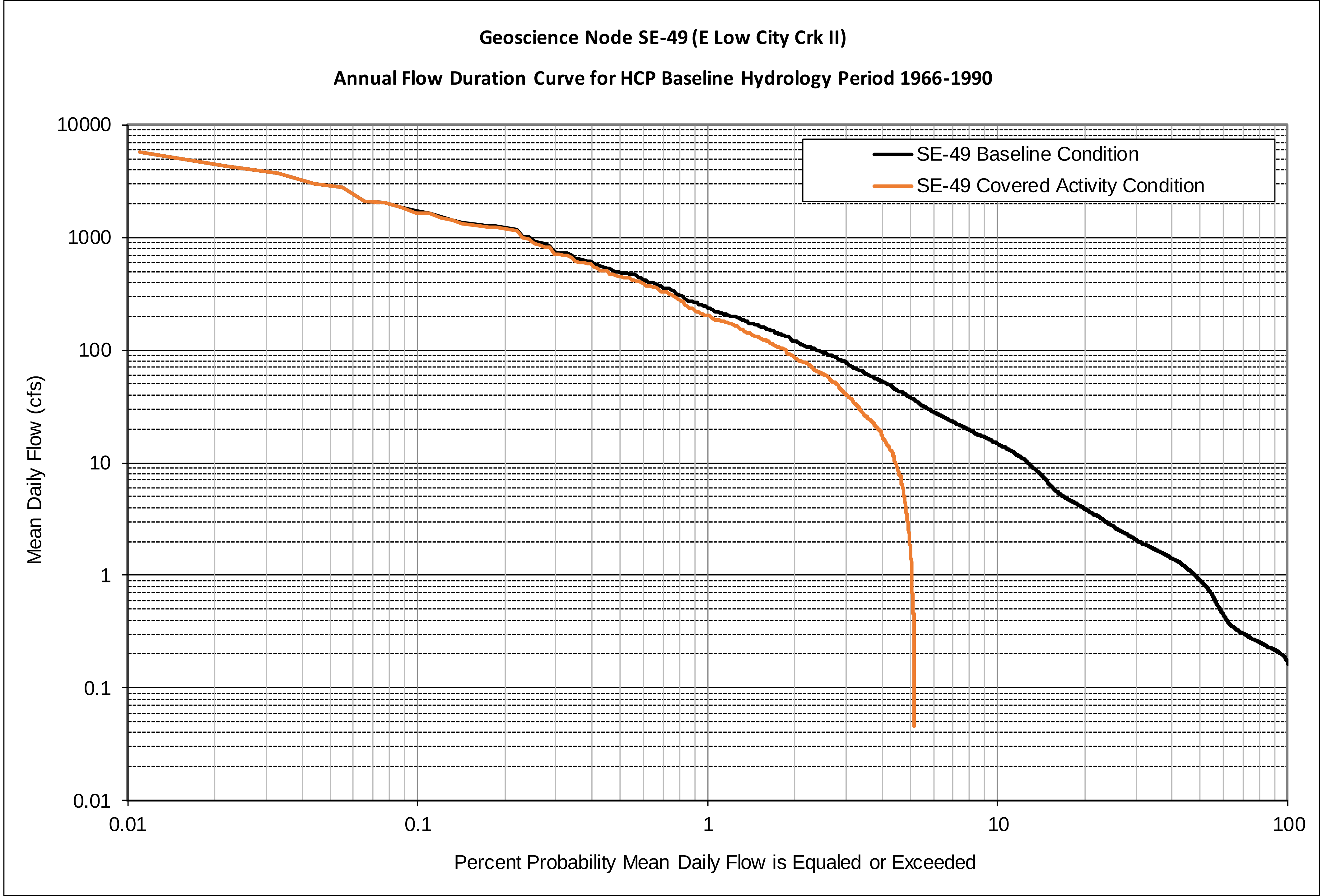
Wildermuth Node NSAR232 (Santa Ana River)
Annual Flow Duration Curve for HCP Baseline Hydrology Period 1966-1990
NSAR232 Baseline Condition
NSAR232 Covered Activity Condition
Mean Daily Flow (cfs)
10000
1000
100
10
1
0.1
0.01
0.01
0.1
1
10
100
Percent Probability Mean Daily Flow is Equaled or Exceeded



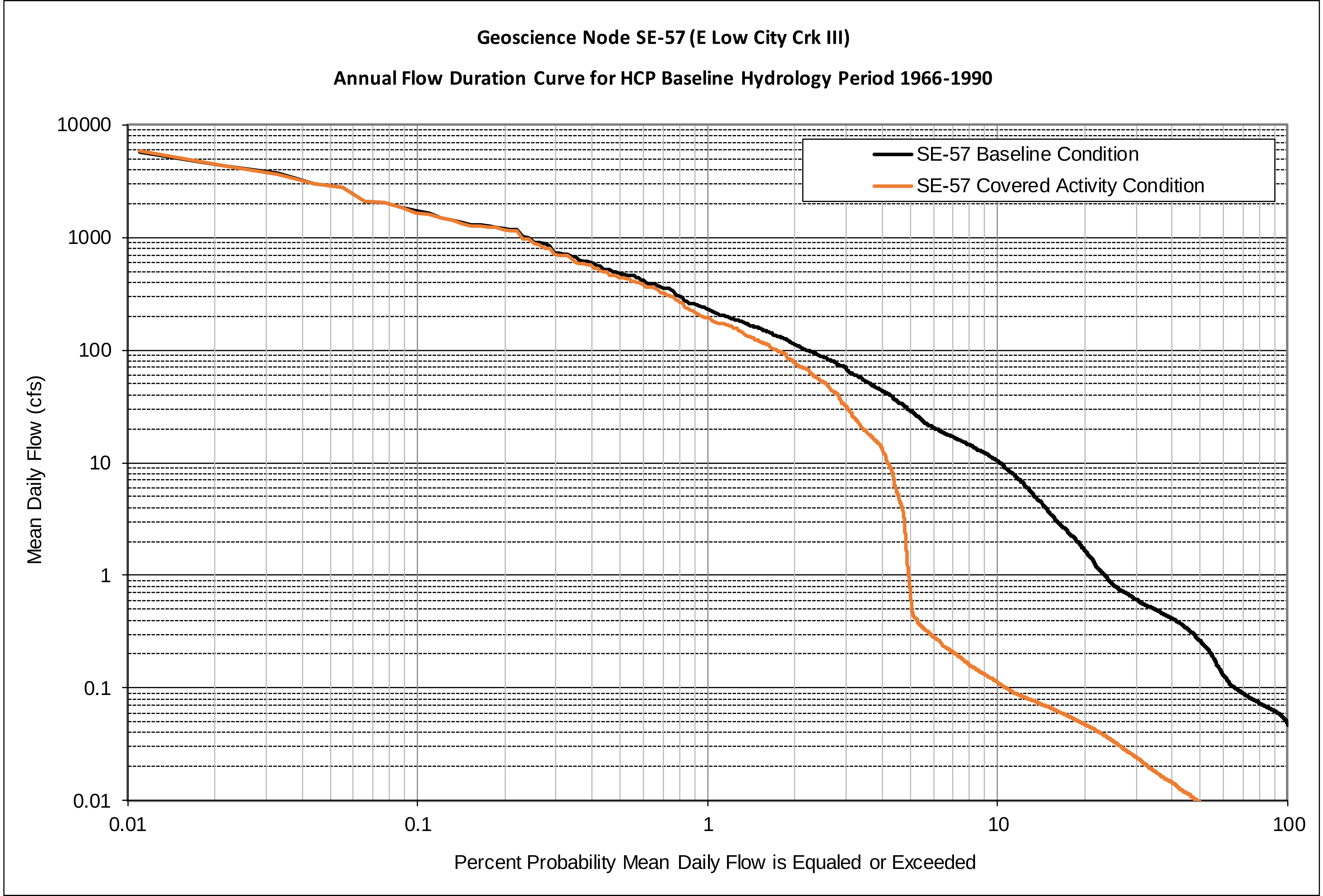
Wildermuth Node NSAR351 (Santa Ana River)
Annual Flow Duration Curve for HCP Baseline Hydrology Period 1966-1990
NSAR351 Baseline Condition
NSAR351 Covered Activity Condition
Mean Daily Flow (cfs)
10000
1000
100
10
1
0.1
0.01
0.01
0.1
1
10
100
Percent Probability Mean Daily Flow is Equaled or Exceeded


Geoscience Node SE-56 (UP Mill Crk)
Annual Flow Duration Curve for HCP Baseline Hydrology Period 1966-1990
SE-56 Baseline Condition
SE-56 Covered Activity Condition
Mean Daily Flow (cfs)
10000
1000
100
10
1
0.1
0.01
0.01
0.1
1
10
100
Percent Probability Mean Daily Flow is Equaled or Exceeded

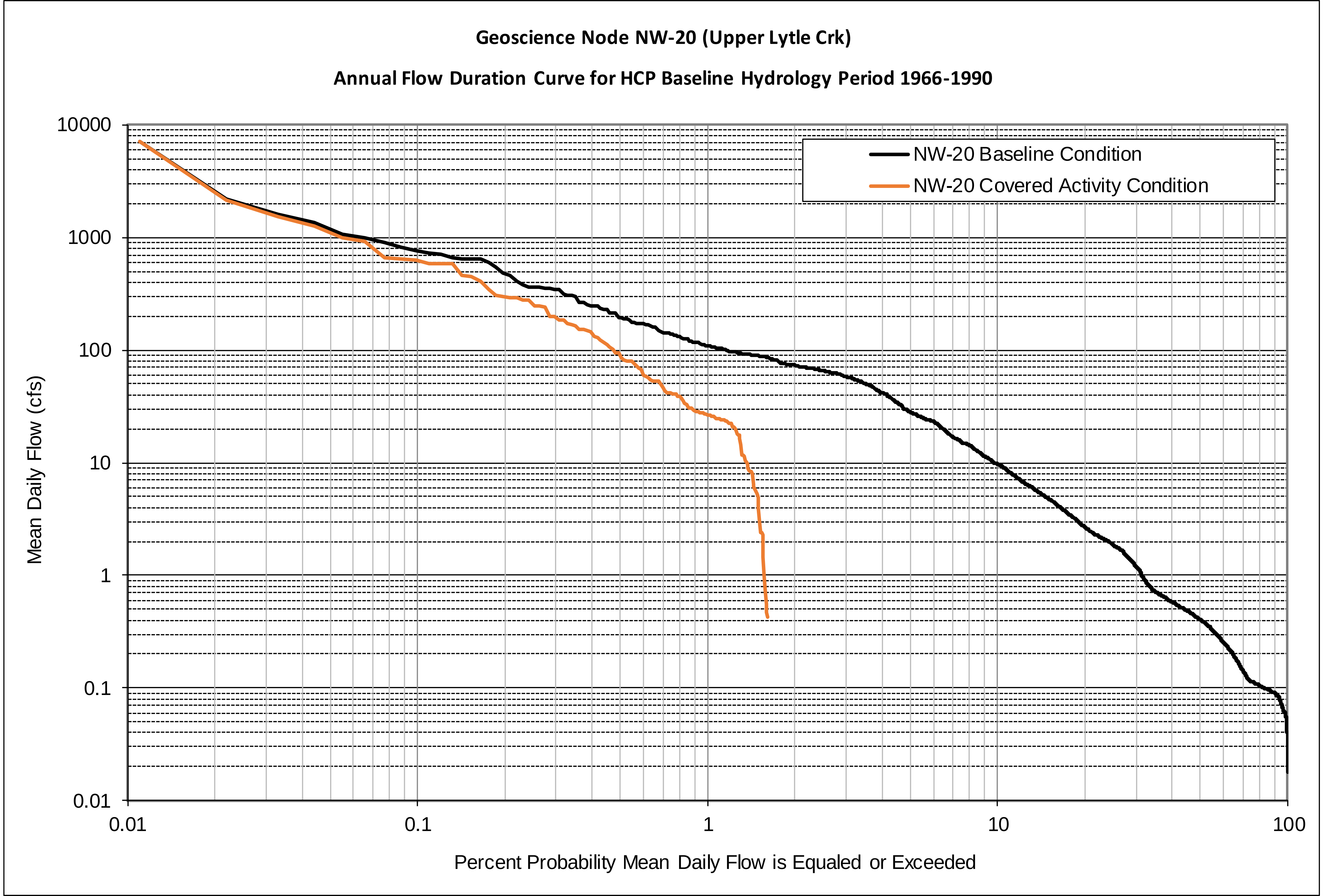

Geoscience Node SE-39 (Mid City Crk)
Annual Flow Duration Curve for HCP Baseline Hydrology Period 1966-1990
SE-39 Baseline Condition
SE-39 Covered Activity Condition
Mean Daily Flow (cfs)
10000
1000
100
10
1
0.1
0.01
0.01
0.1
1
10
100
Percent Probability Mean Daily Flow is Equaled or Exceeded



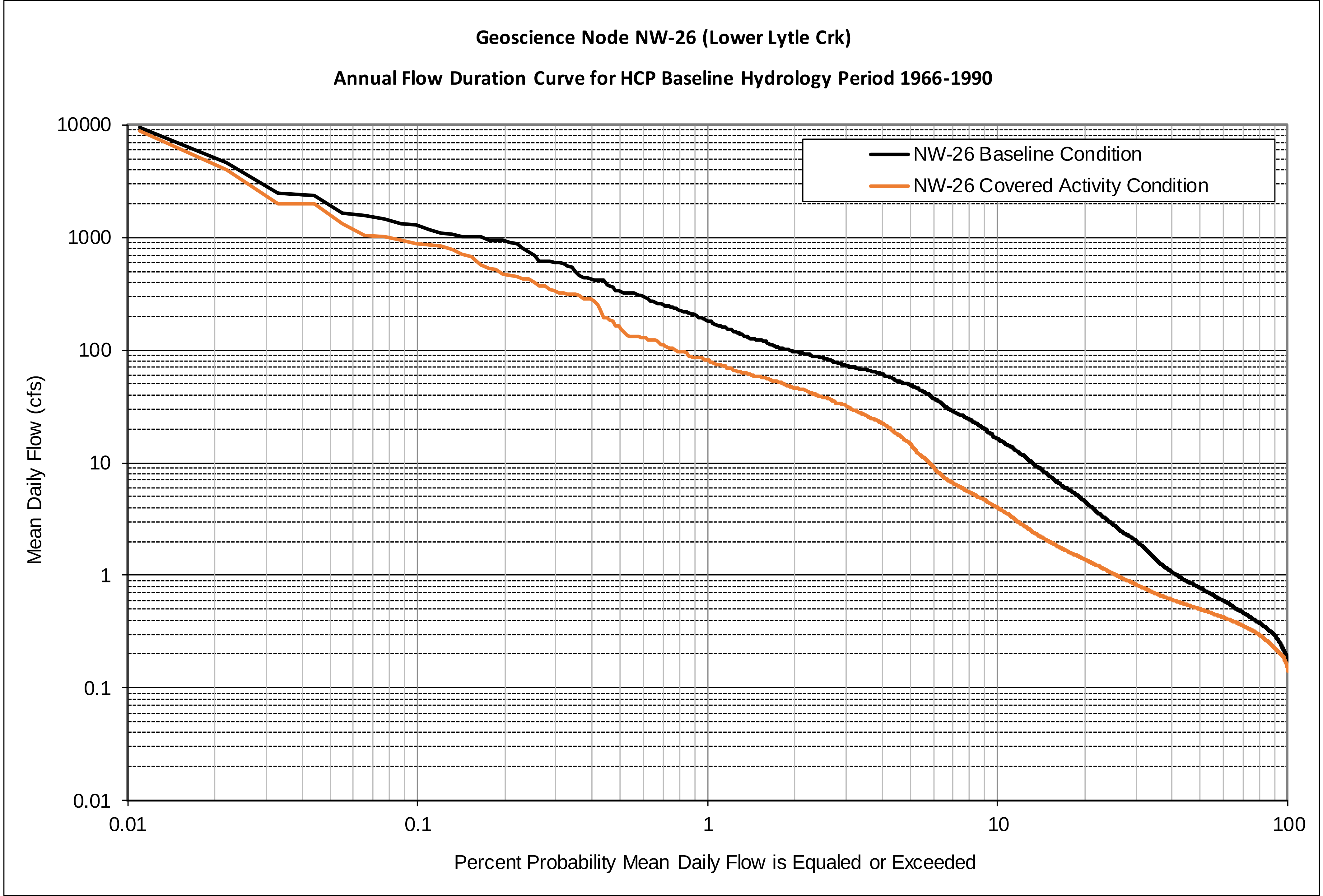
Geoscience Node SE-49 (E Low City Crk II)
Annual Flow Duration Curve for HCP Baseline Hydrology Period 1966-1990
SE-49 Baseline Condition
SE-49 Covered Activity Condition
Mean Daily Flow (cfs)
10000
1000
100
10
1
0.1
0.01
0.01
0.1
1
10
100
Percent Probability Mean Daily Flow is Equaled or Exceeded

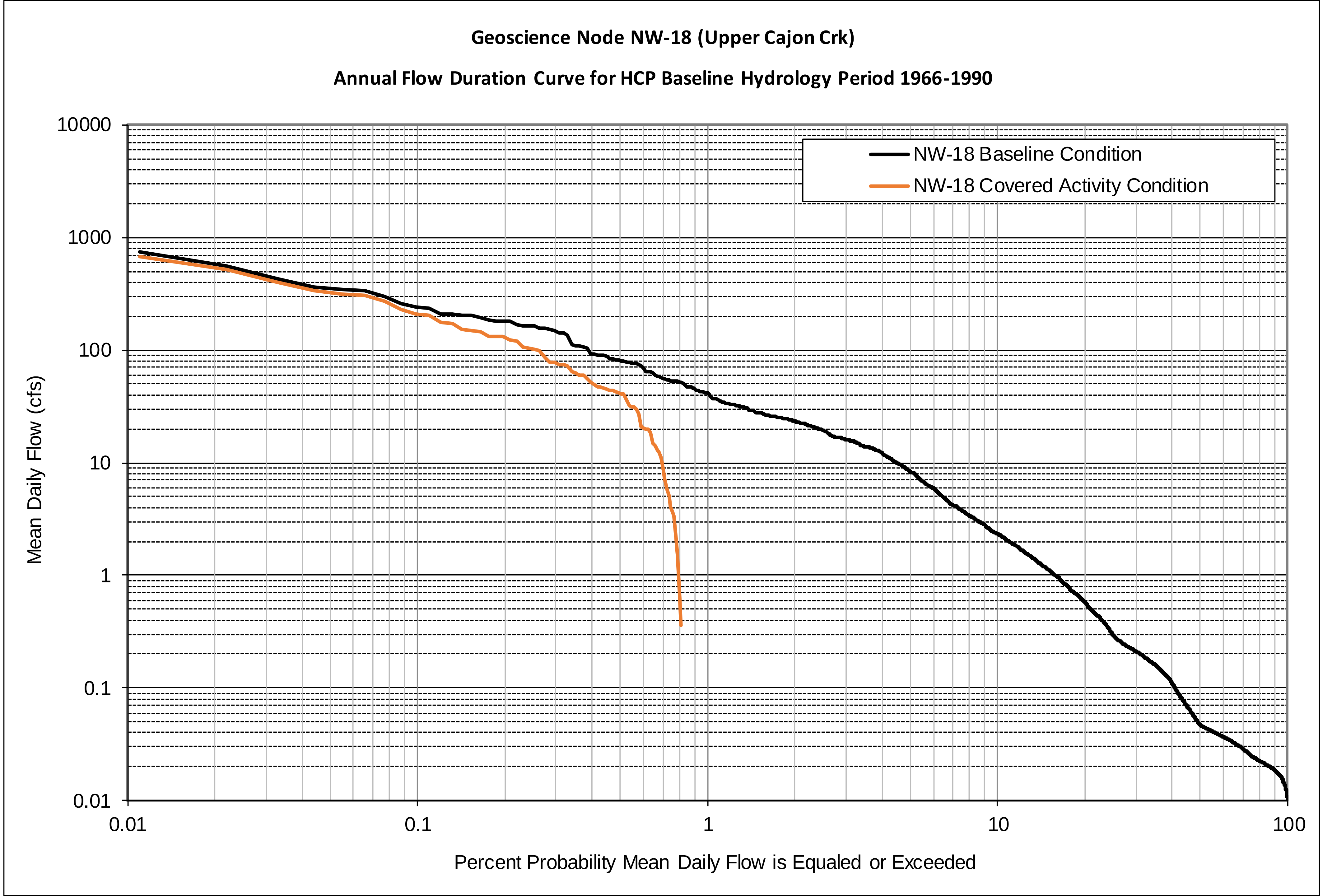


Geoscience Node SE-57 (E Low City Crk III)
Annual Flow Duration Curve for HCP Baseline Hydrology Period 1966-1990
SE-57 Baseline Condition
SE-57 Covered Activity Condition
Mean Daily Flow (cfs)
10000
1000
100
10
1
0.1
0.01
0.01
0.1
1
10
100
Percent Probability Mean Daily Flow is Equaled or Exceeded



Geoscience Node NW-20 (Upper Lytle Crk)
Annual Flow Duration Curve for HCP Baseline Hydrology Period 1966-1990
NW-20 Baseline Condition
NW-20 Covered Activity Condition
Mean Daily Flow (cfs)
10000
1000
100
10
1
0.1
0.01
0.01
0.1
1
10
100
Percent Probability Mean Daily Flow is Equaled or Exceeded


Geoscience Node NW-26 (Lower Lytle Crk)
Annual Flow Duration Curve for HCP Baseline Hydrology Period 1966-1990
NW-26 Baseline Condition
NW-26 Covered Activity Condition
Mean Daily Flow (cfs)
10000
1000
100
10
1
0.1
0.01
0.01
0.1
1
10
100
Percent Probability Mean Daily Flow is Equaled or Exceeded



Geoscience Node NW-18 (Upper Cajon Crk)
Annual Flow Duration Curve for HCP Baseline Hydrology Period 1966-1990
NW-18 Baseline Condition
NW-18 Covered Activity Condition
Mean Daily Flow (cfs)
10000
1000
100
10
1
0.1
0.01
0.01
0.1
1
10
100
Percent Probability Mean Daily Flow is Equaled or Exceeded

Figure D-16. Santa Ana River Upstream of Greenspot Rd

Wilcock & Crowe (2003) - Modeled Fractional Bed Load per Wetted Width

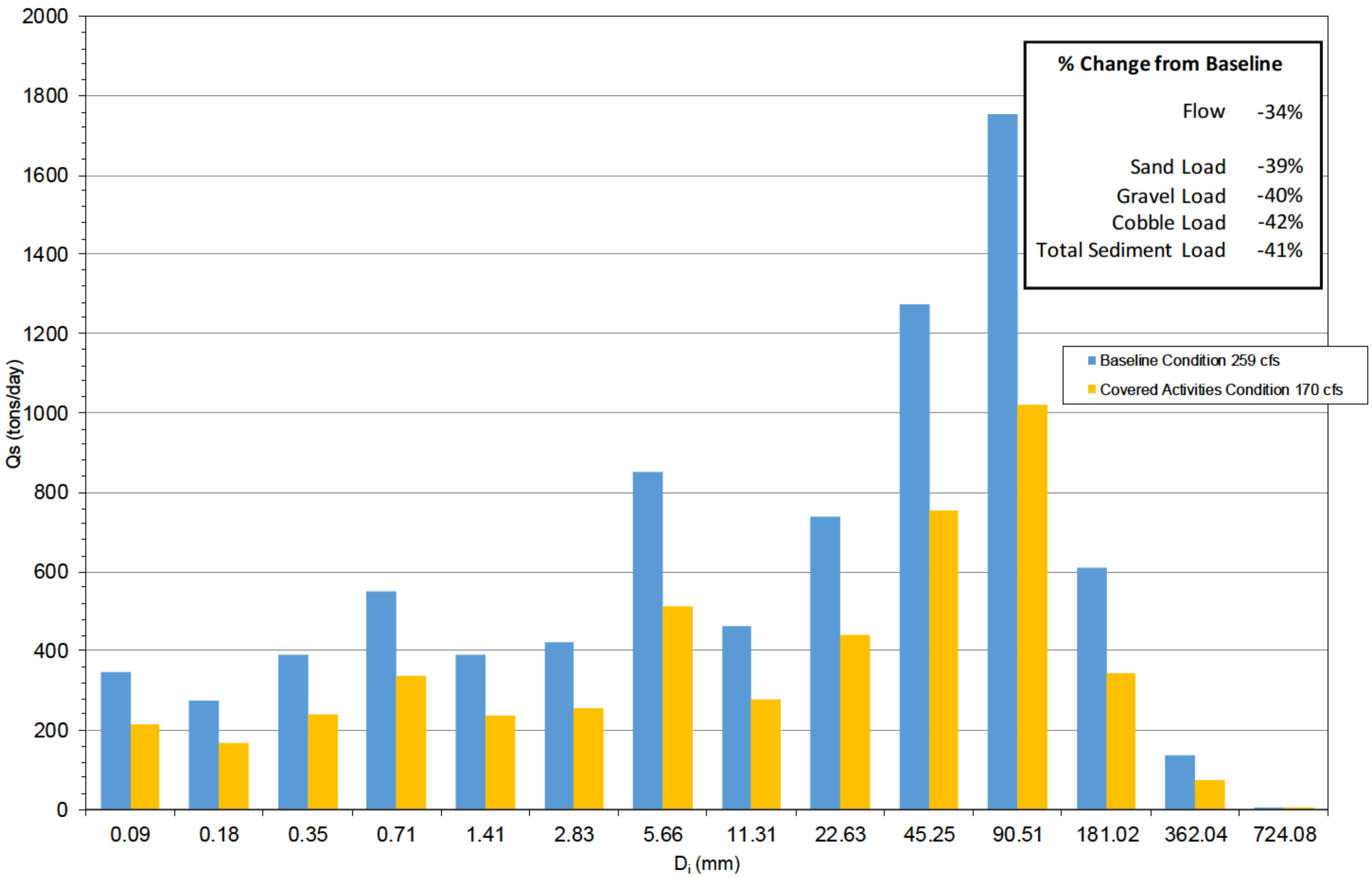


Figure D-17. Santa Ana River Downstream of Mill Creek

Wilcock & Crowe (2003) - Modeled Fractional Bed Load per Wetted Width

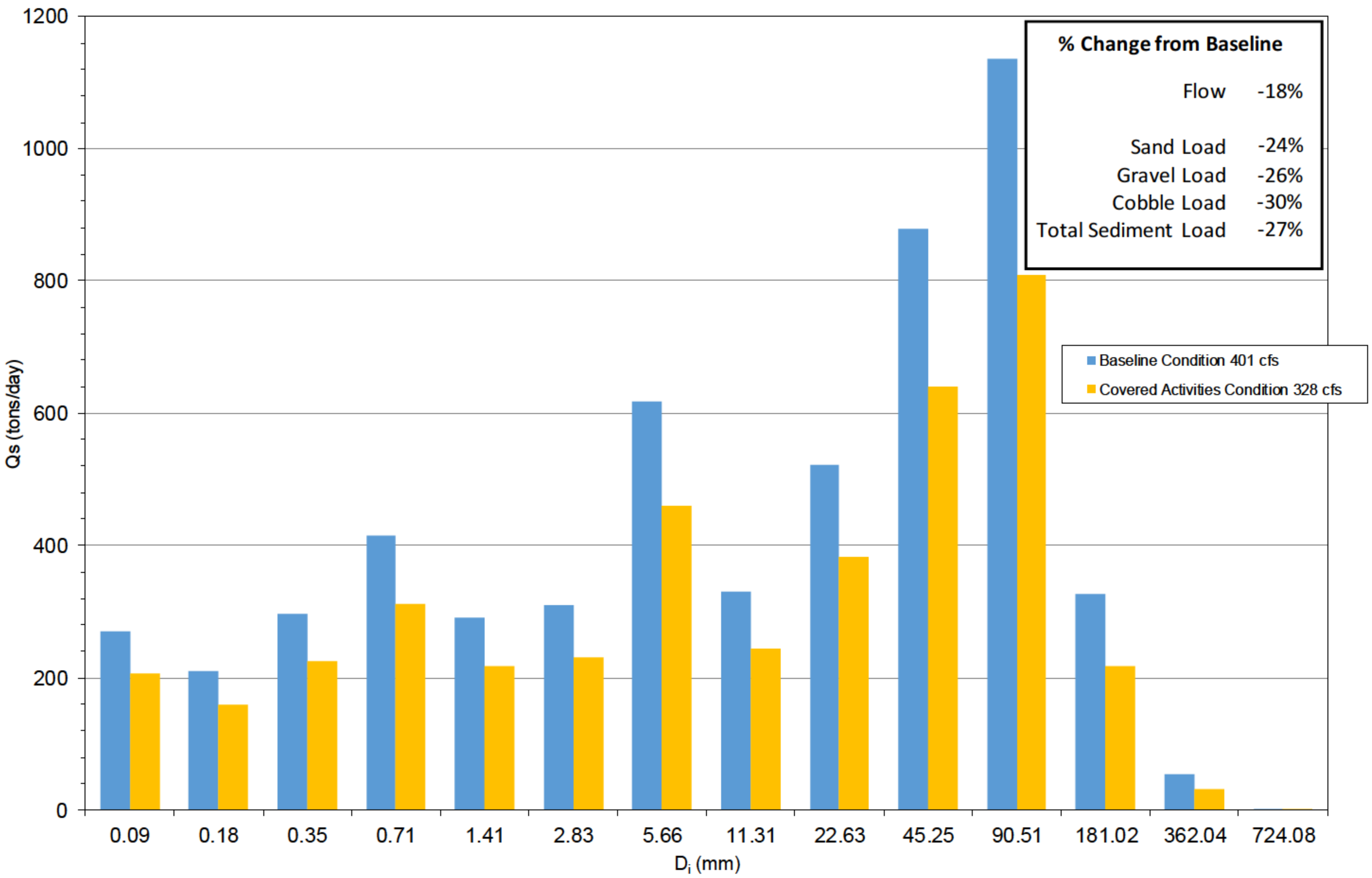
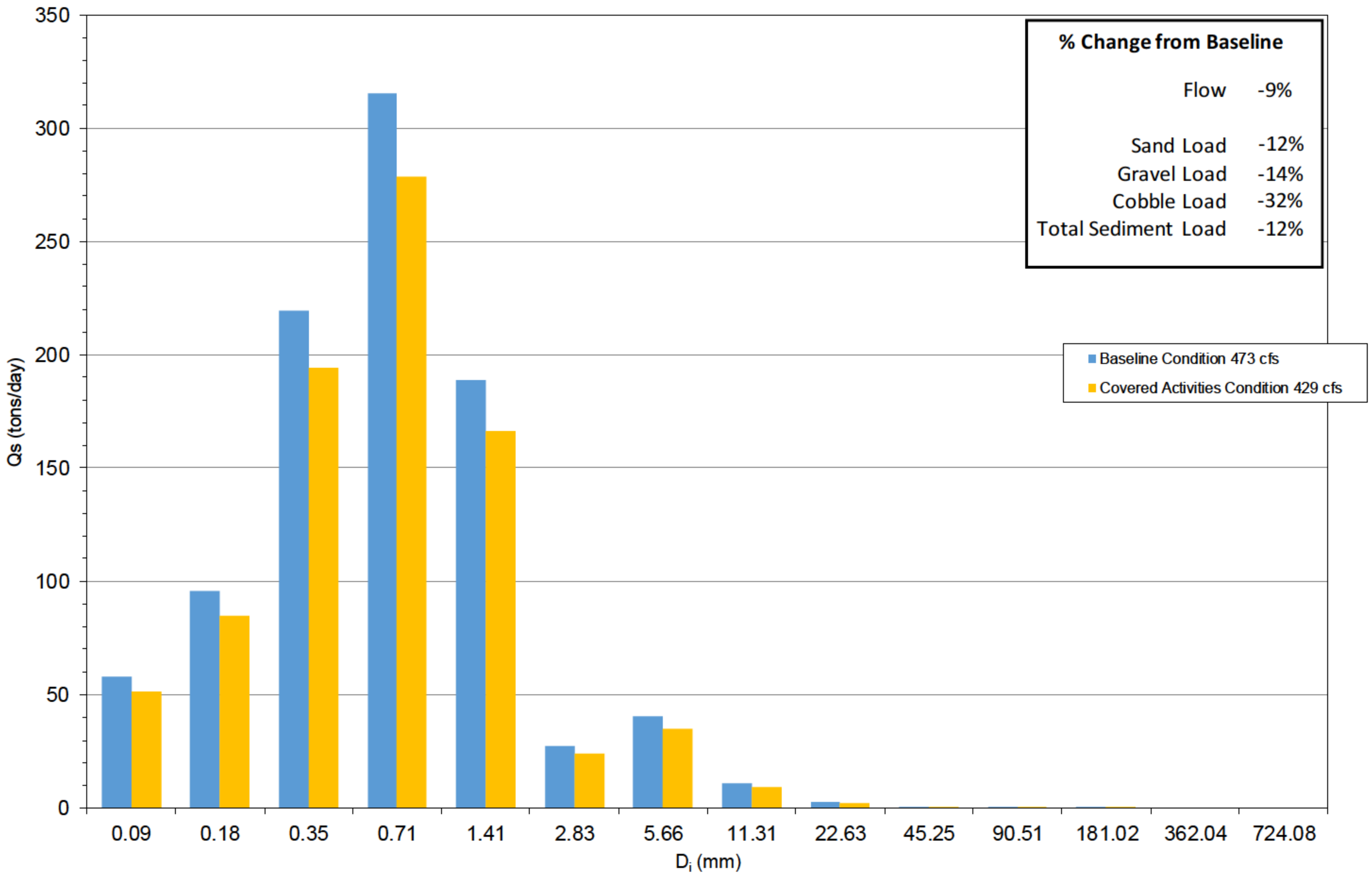


Figure D-18. Santa Ana River Upstream of East Twin Creek

Wilcock & Crowe (2003) - Modeled Fractional Bed Load per Wetted Width



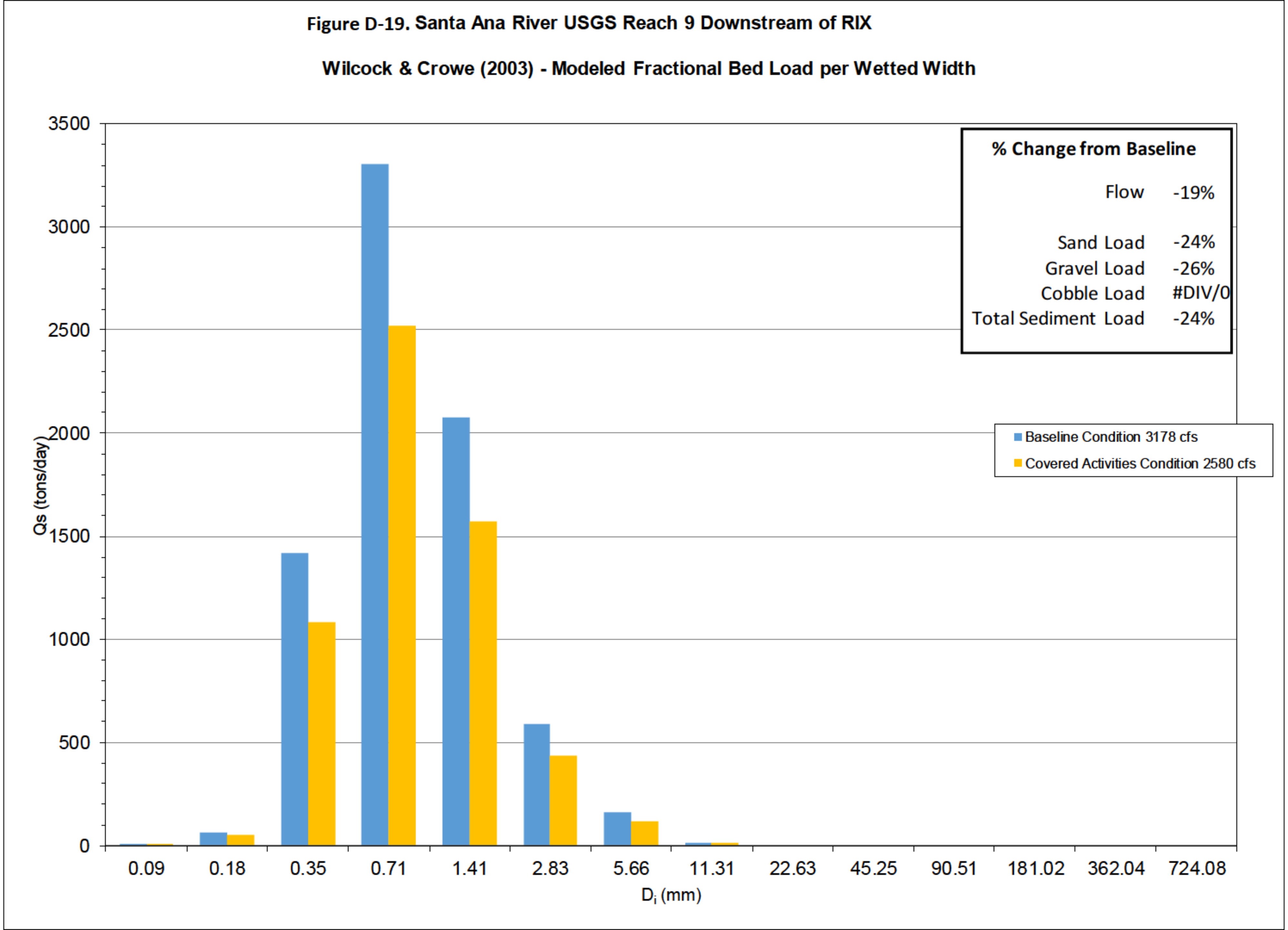


Figure D-19. Santa Ana River USGS Reach 9 Downstream of RIX
Wilcock & Crowe (2003) - Modeled Fractional Bed Load per Wetted Width
% Change from Baseline
Flow -19%
Sand Load -24%
Gravel Load -26%
Cobble Load #DIV/0
Total Sediment Load -24%
Baseline Condition 3178 cfs
Covered Activities Condition 2580 cfs
Qs (tons/day)
3500
3000
2500
2000
1500
1000
500
0
0.09
0.18
0.35
0.71
1.41
2.83
5.66
11.31
22.63
45.25
90.51
181.02
362.04
724.08
Di (mm)

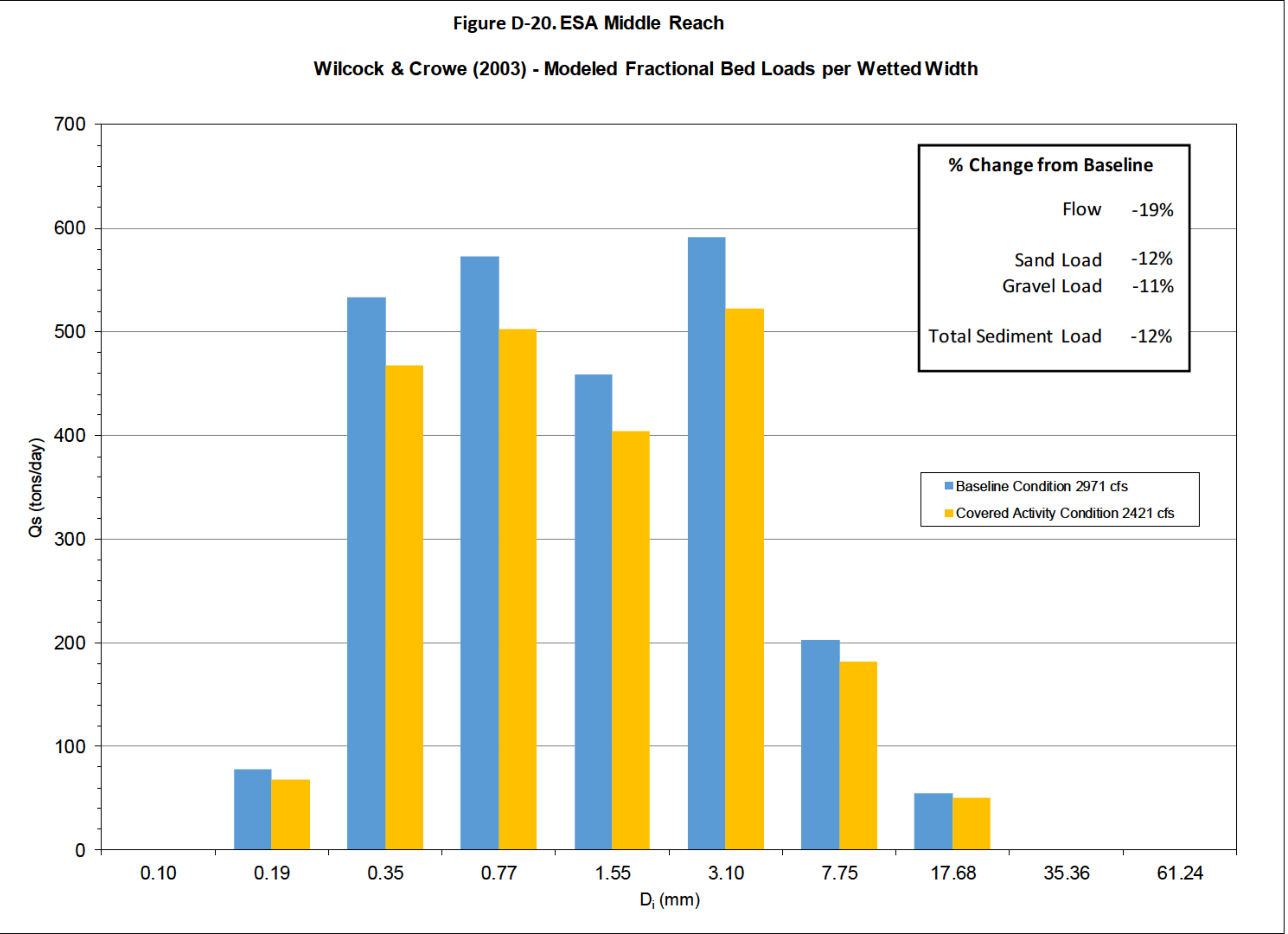


Figure D-20. ESA Middle Reach
Wilcock & Crowe (2003) - Modeled Fractional Bed Loads per Wetted Width
% Change from Baseline
Flow -19%
Sand Load -12%
Gravel Load -11%
Total Sediment Load -12%
Baseline Condition 2971 cfs
Covered Activity Condition 2421 cfs
Qs (tons/day)
0
100
200
300
400
500
600
700
0.10
0.19
0.35
0.77
1.55
3.10
7.75
17.68
35.36
61.24
Di (mm)

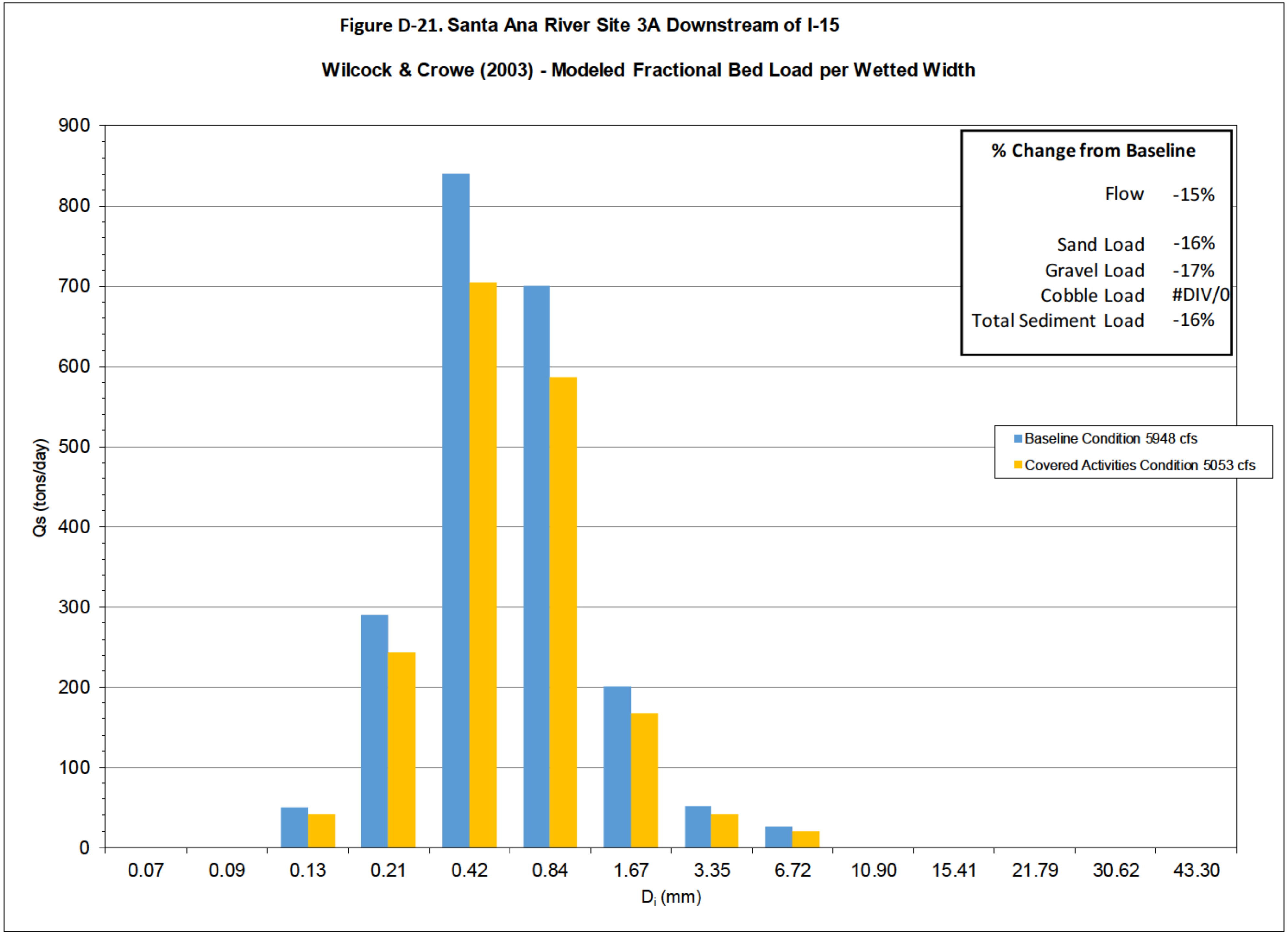


Figure D-21. Santa Ana River Site 3A Downstream of I-15
Wilcock & Crowe (2003) - Modeled Fractional Bed Load per Wetted Width
% Change from Baseline
Flow -15%
Sand Load -16%
Gravel Load -17%
Cobble Load #DIV/0
Total Sediment Load -16%
Baseline Condition 5948 cfs
Covered Activities Condition 5053 cfs
Qs (tons/day)
900
800
700
600
500
400
300
200
100
0
0.07
0.09
0.13
0.21
0.42
0.84
1.67
3.35
6.72
10.90
15.41
21.79
30.62
43.30
Di (mm)

Figure D-22. Lower City Creek

Wilcock & Crowe (2003) - Modeled Fractional Bed Loads per Wetted Width

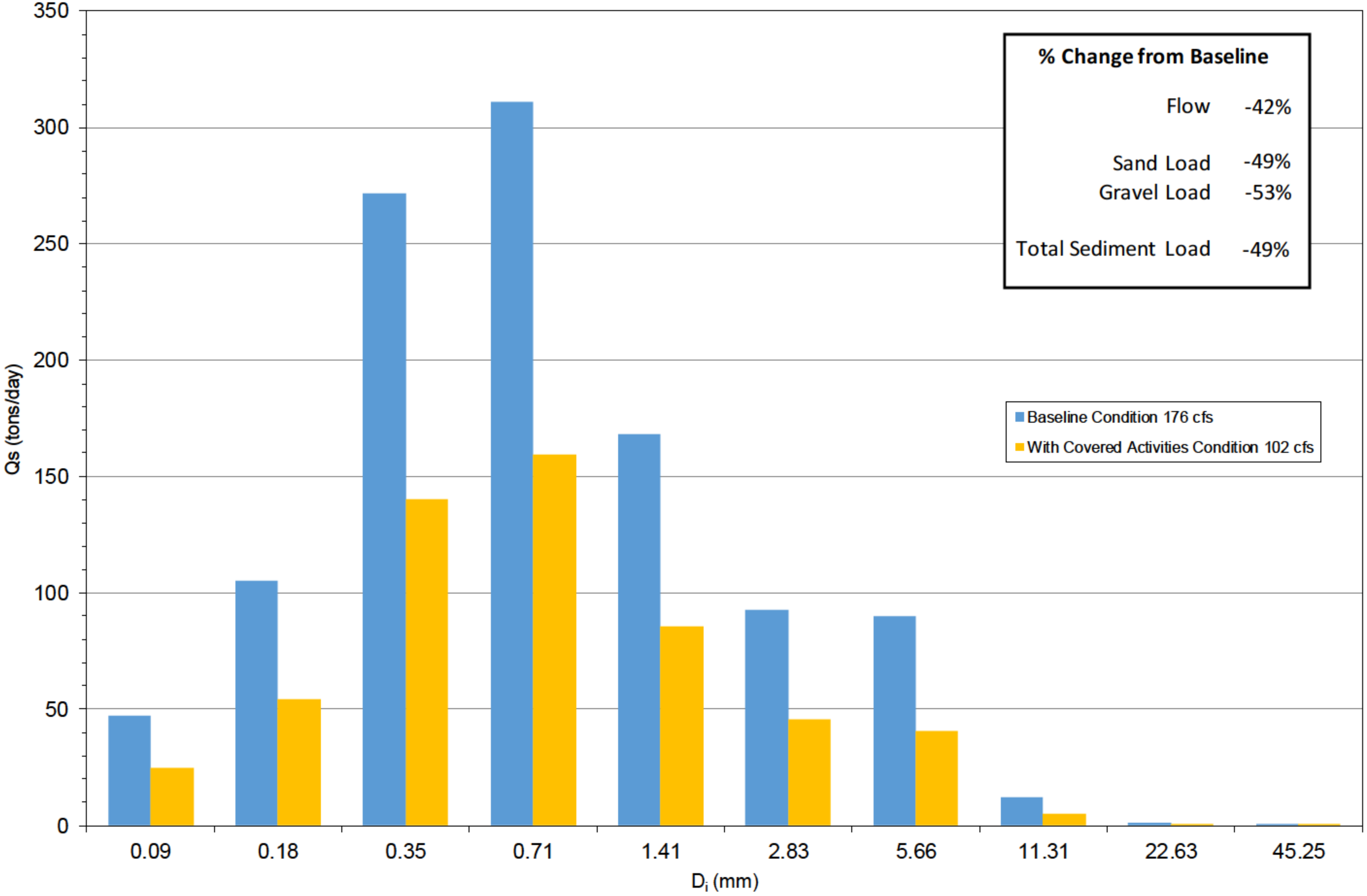


Figure D-23. Lytle Creek Upstream of Cajon Wash

Wilcock & Crowe (2003) - Modeled Fractional Bed Load per Wetted Width

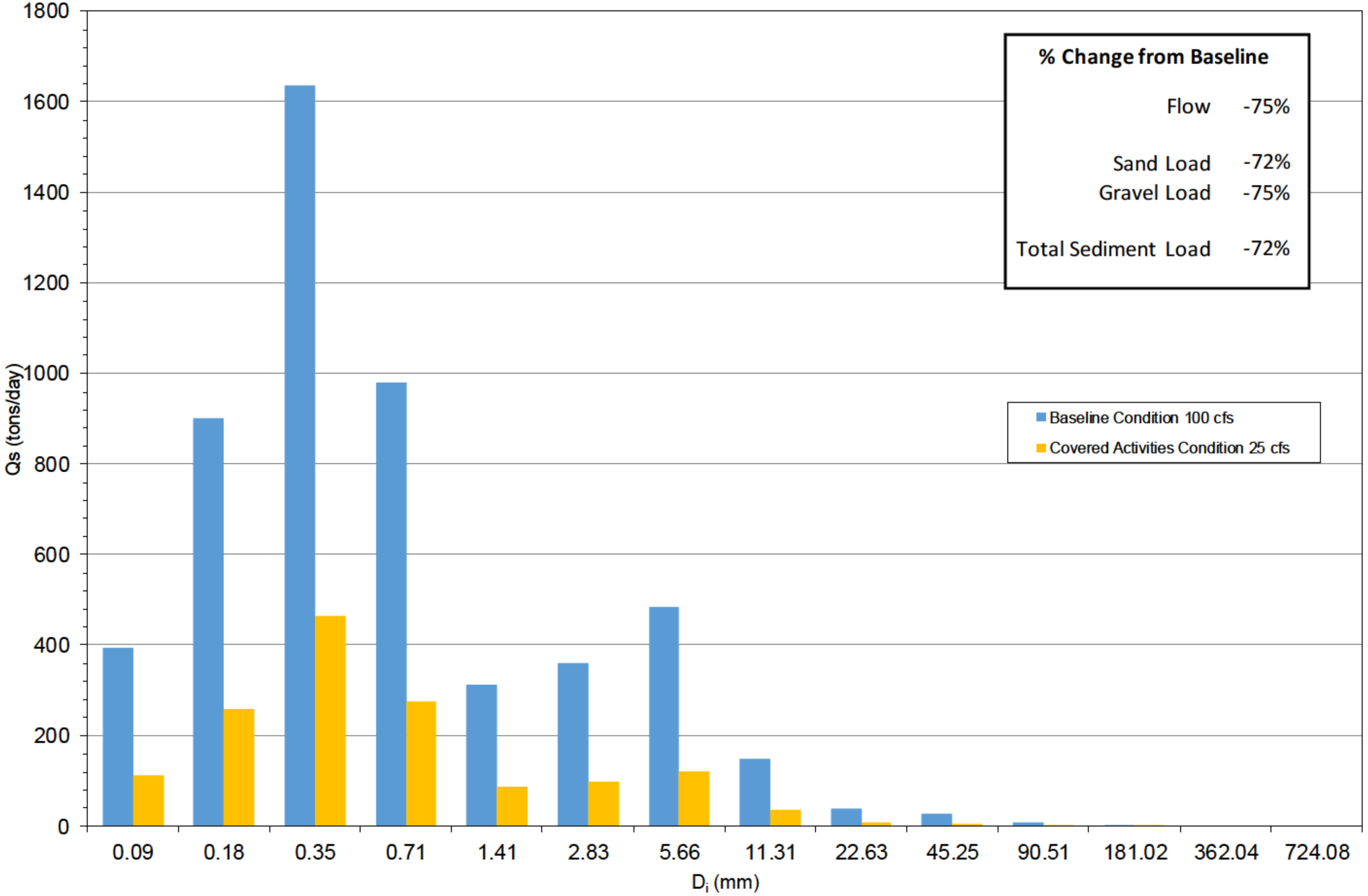


Figure D-24. Lytle Creek Upstream of Base Line St

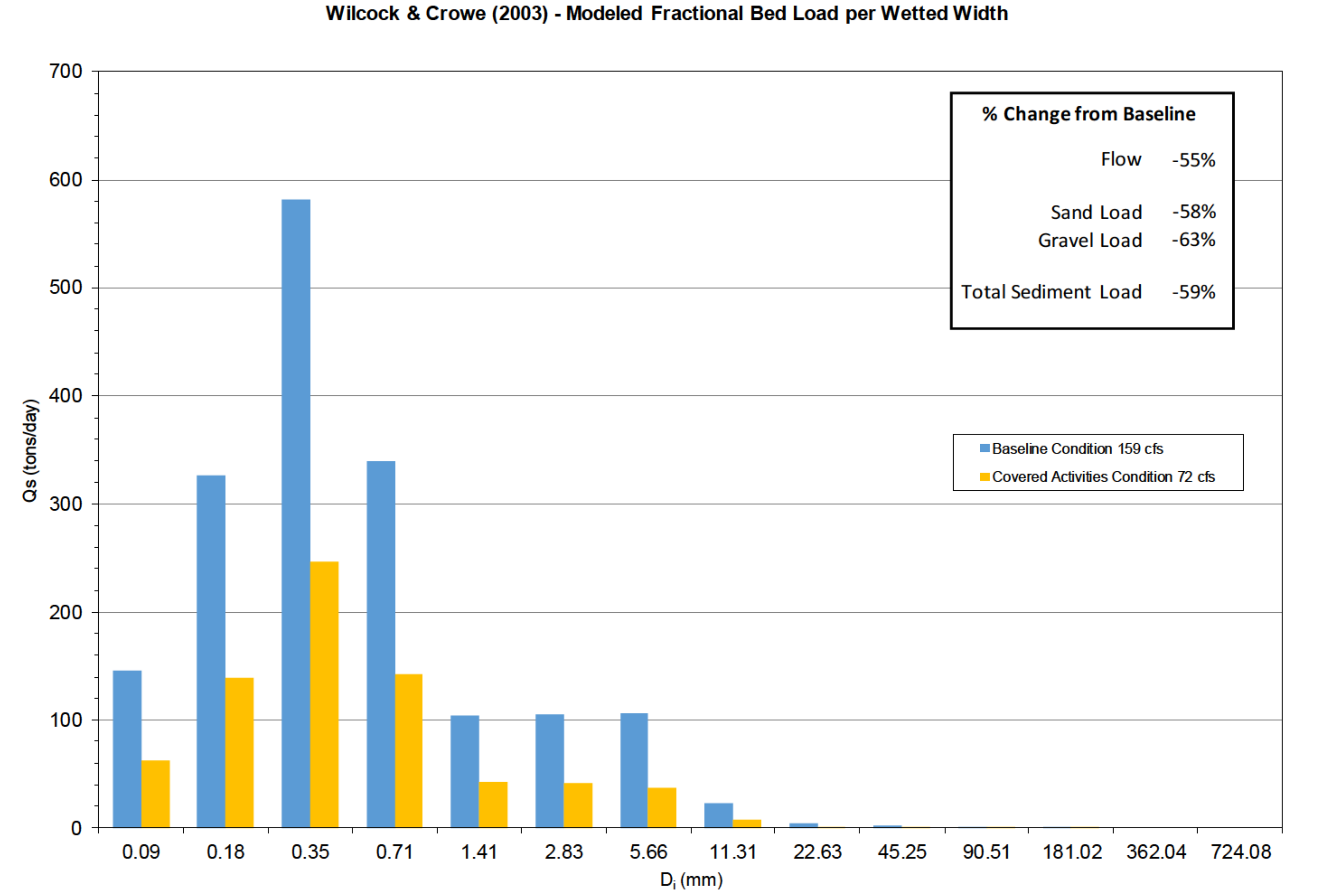
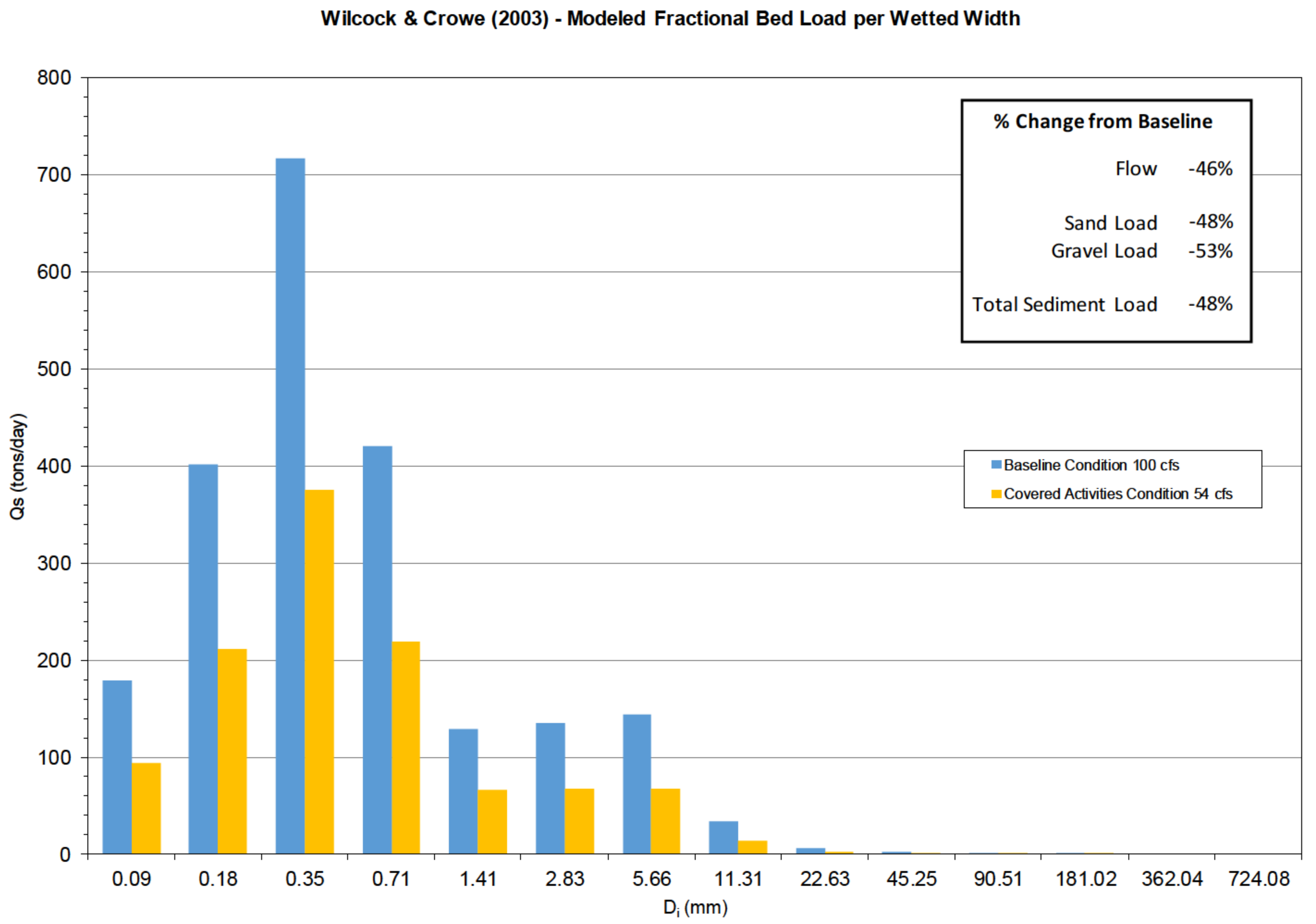
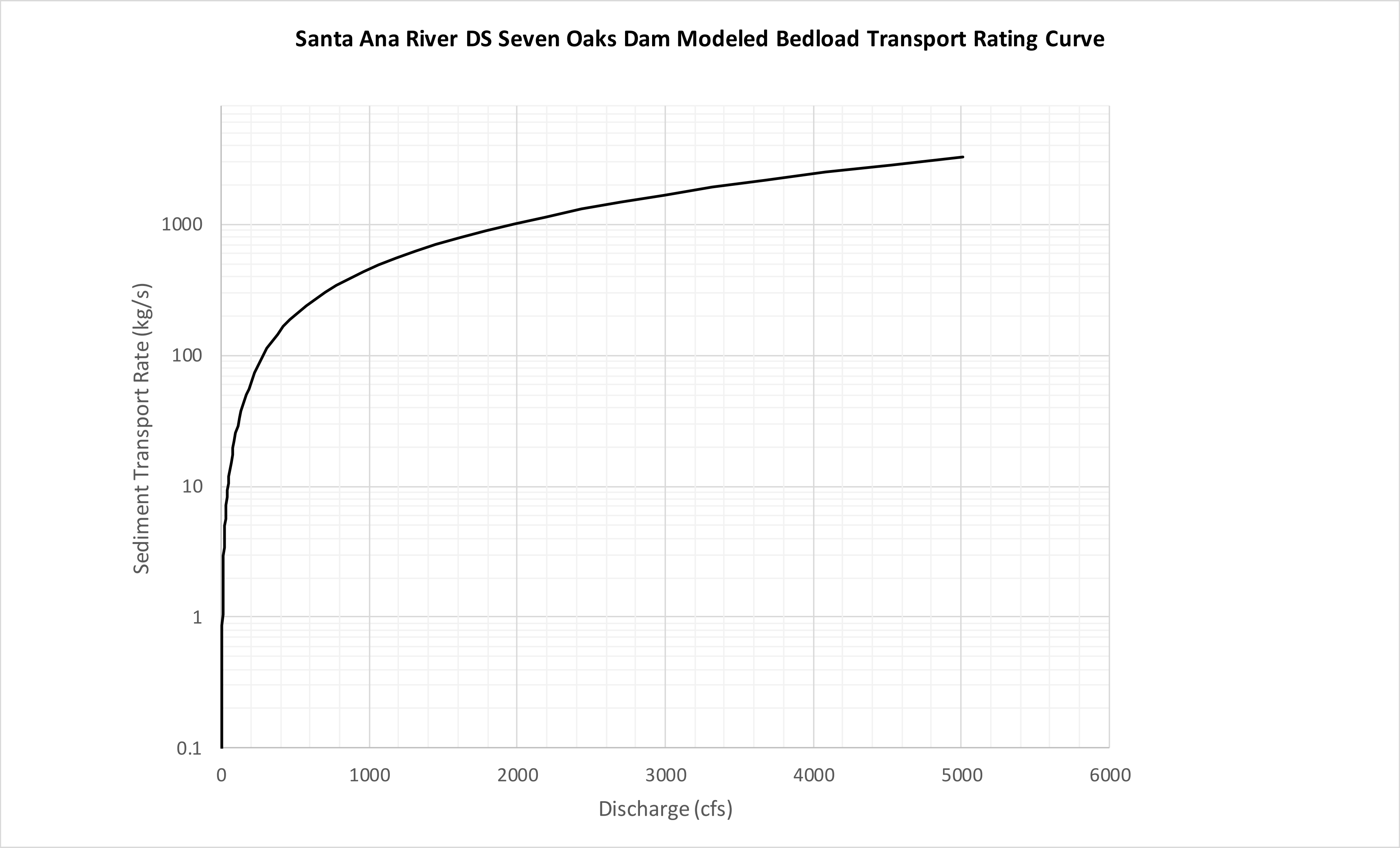
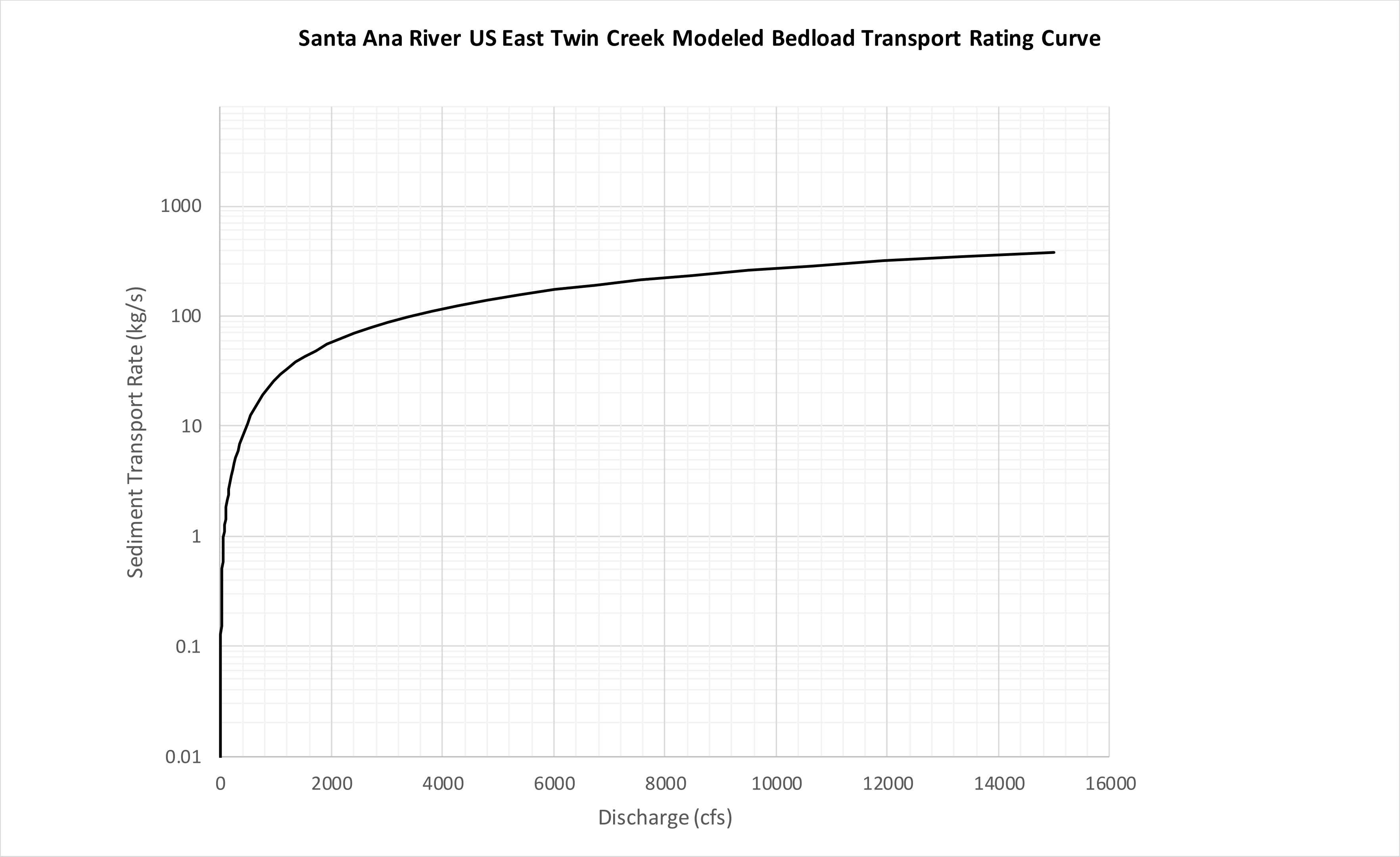
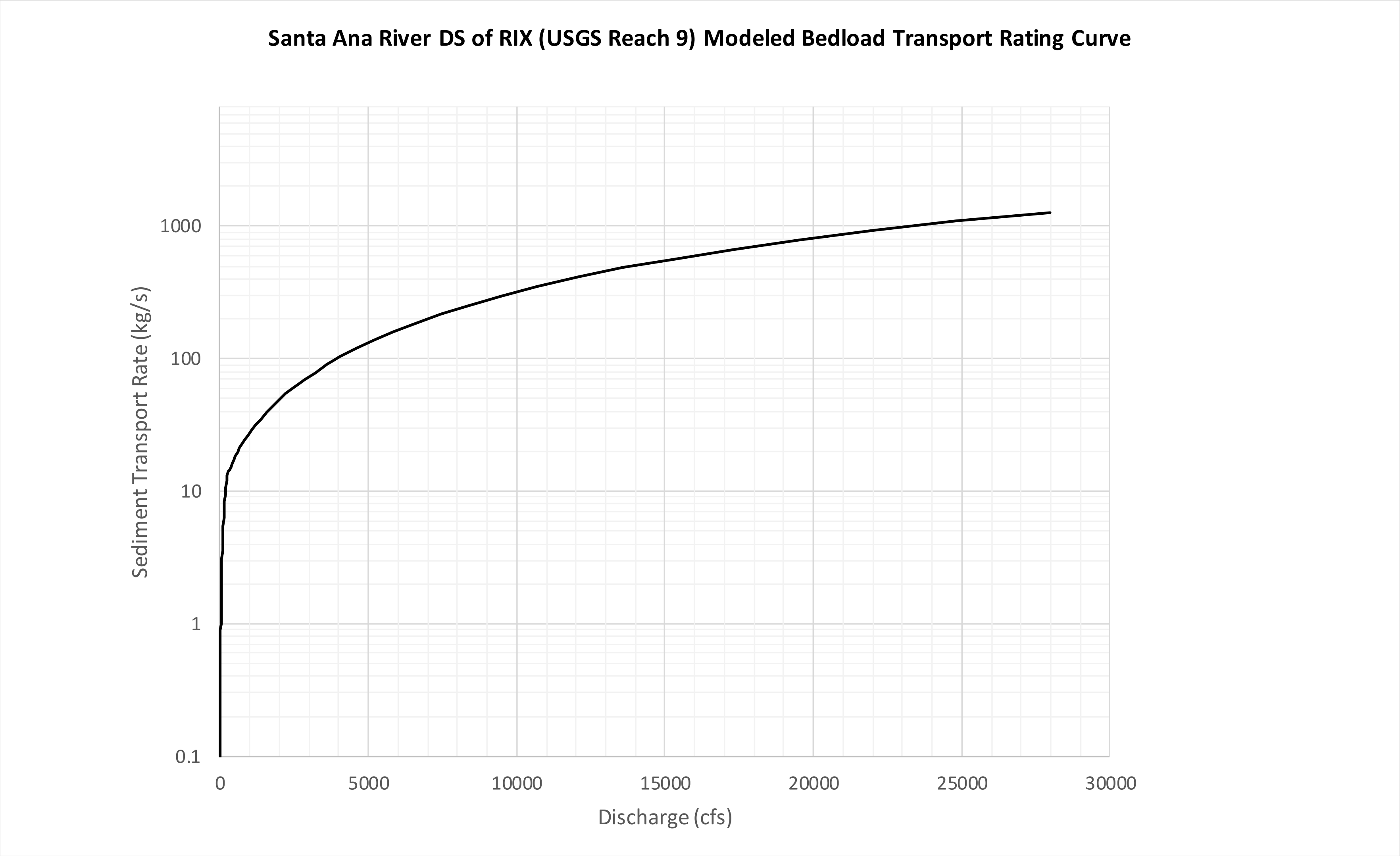


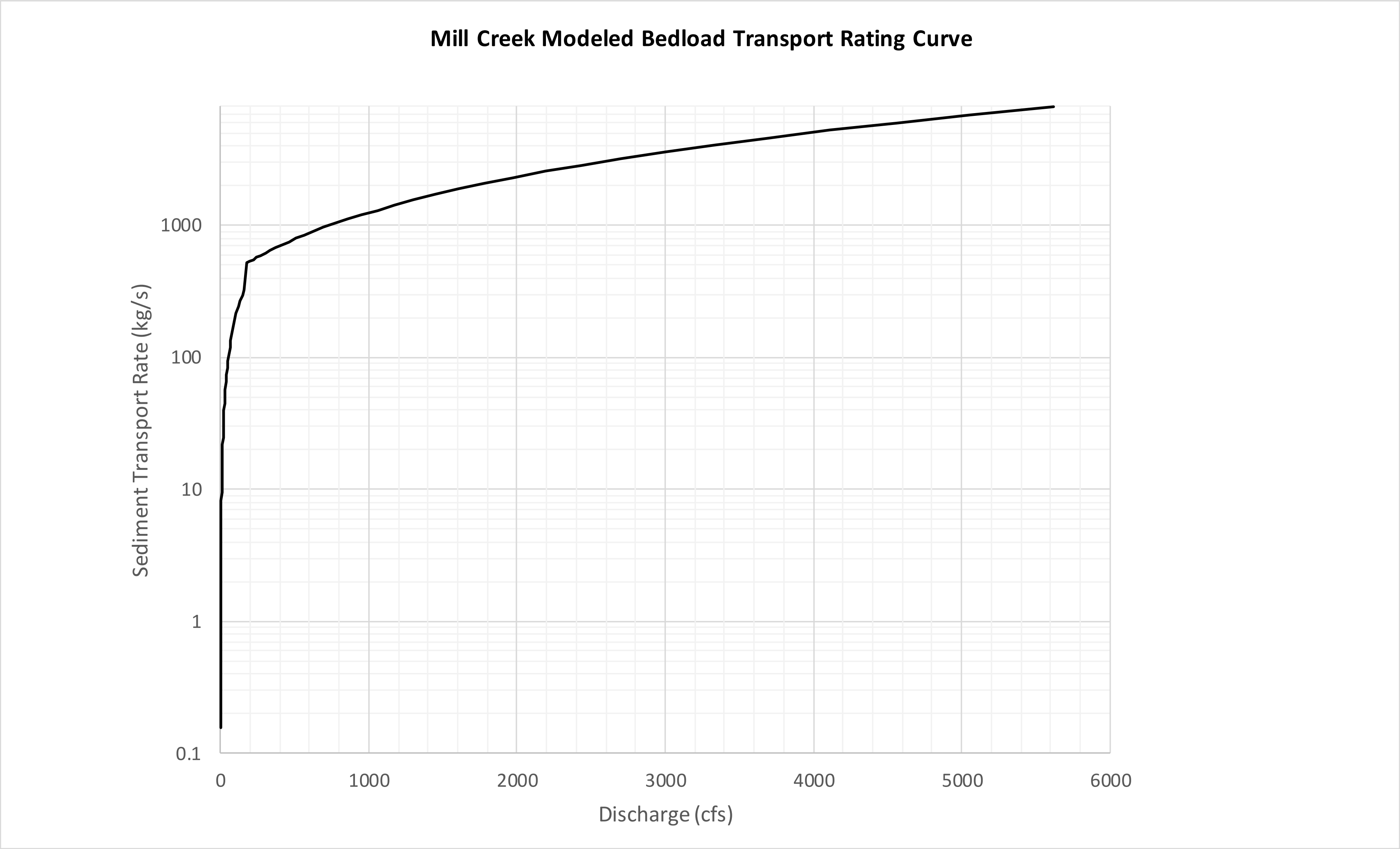
Figure D-25. Cajon Wash

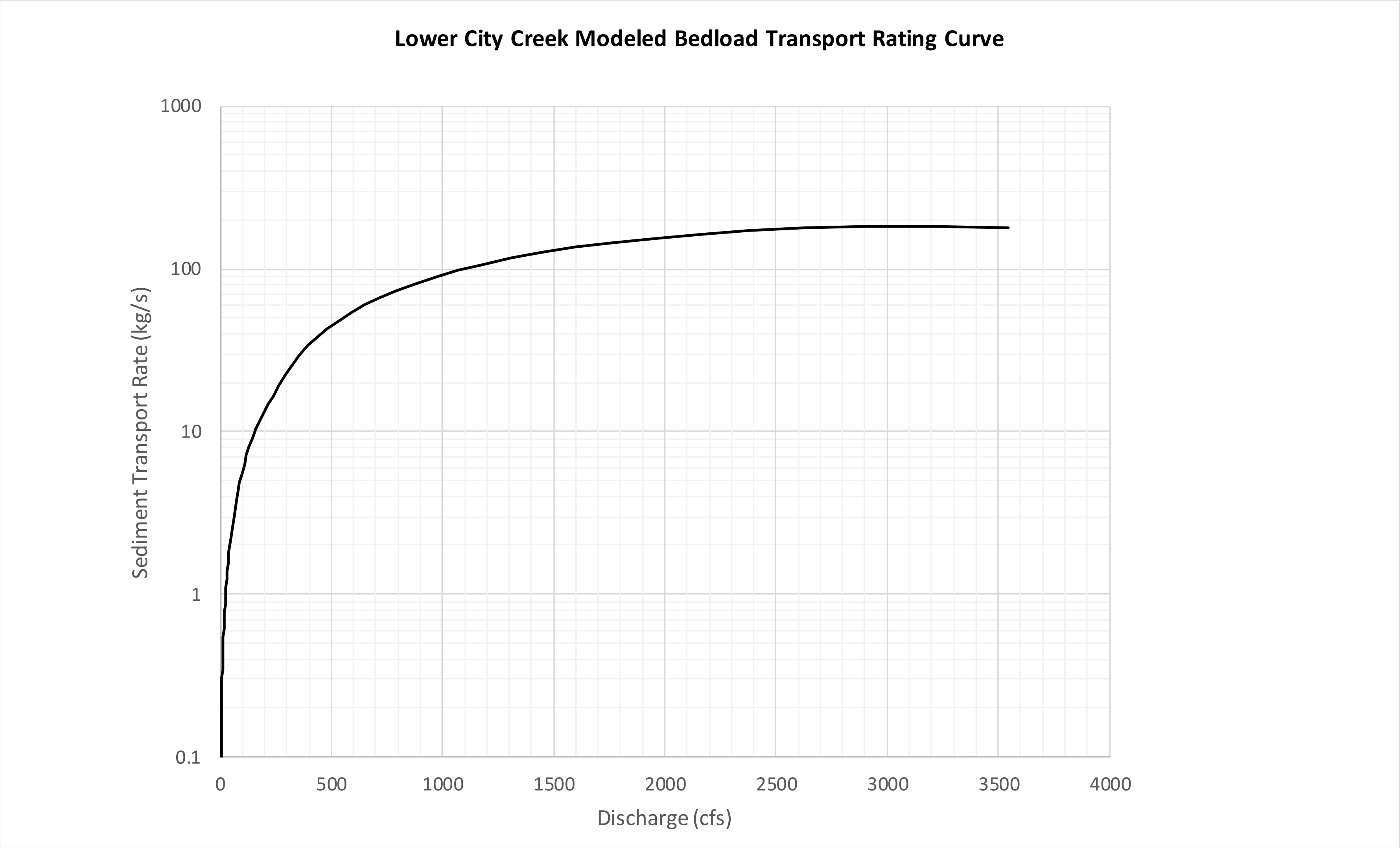



Santa Ana River DS Seven Oaks Dam Modeled Bedload Transport Rating Curve
Sediment Transport Rate (kg/s)
1000
100
10
1
0.1
0
1000
2000
3000
4000
5000
6000
Discharge (cfs)

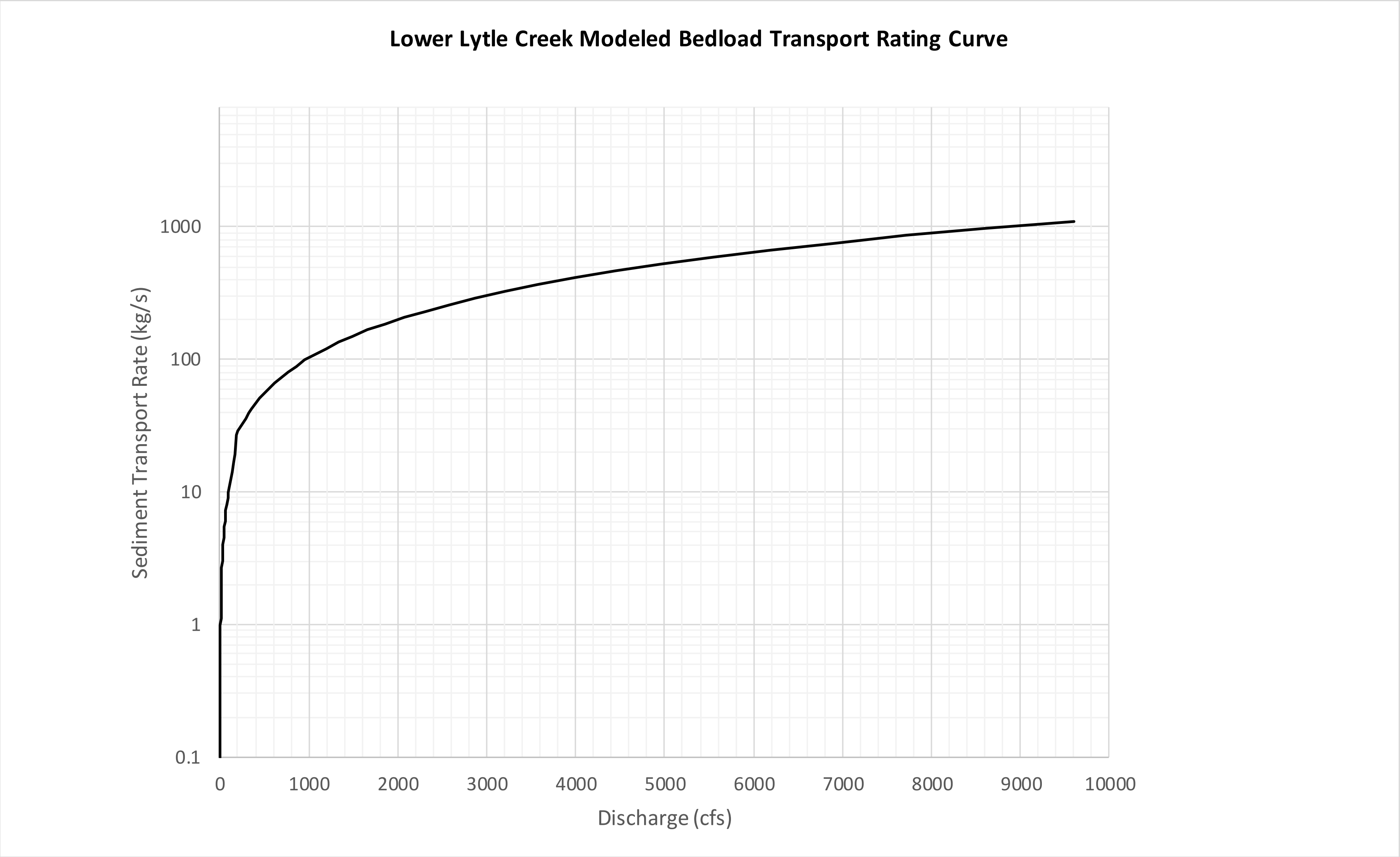

Santa Ana River US East Twin Creek Modeled Bedload Transport Rating Curve
1000
100
10
1
0.1
0.01
Sediment Transport Rate (kg/s)
0
2000
4000
6000
8000
10000
12000
14000
16000
Discharge (cfs)


Santa Ana River DS of RIX (USGS Reach 9) Modeled Bedload Transport Rating Curve
Sediment Transport Rate (kg/s)
1000
100
10
1
0.1
0
5000
10000
15000
20000
25000
30000
Discharge (cfs)


Mill Creek Modeled Bedload Transport Rating Curve
Sediment Transport Rate (kg/s)
1000
100
10
1
0.1
0
1000
2000
3000
4000
5000
6000
Discharge (cfs)



Lower City Creek Modeled Bedload Transport Rating Curve
Sediment Transport Rate (kg/s)
1000
100
10
1
0.1
0
500
1000
1500
2000
2500
3000
3500
4000
Discharge (cfs)



Lower Lytle Creek Modeled Bedload Transport Rating Curve
Sediment Transport Rate (kg/s)
1000
100
10
1
0.1
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
Discharge (cfs)

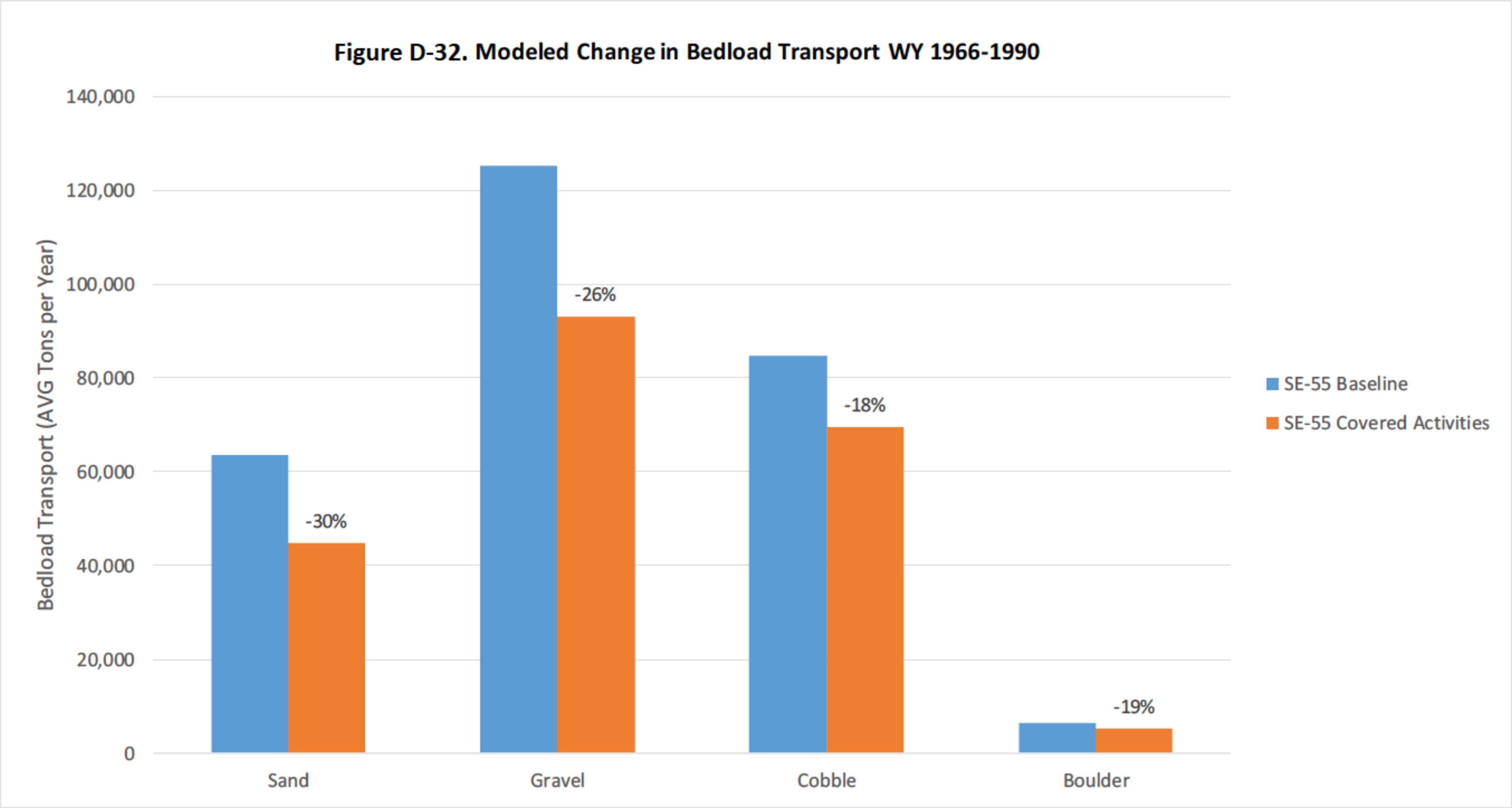


Figure D-32. Modeled Change in Bedload Transport WY 1966-1990
Bedload Transport (AVG Tons per Year)
140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
-30%
-26%
-18%
-19%
Sand
Gravel
Cobble
Boulder
SE-55 Baseline
SE-55 Covered Activities

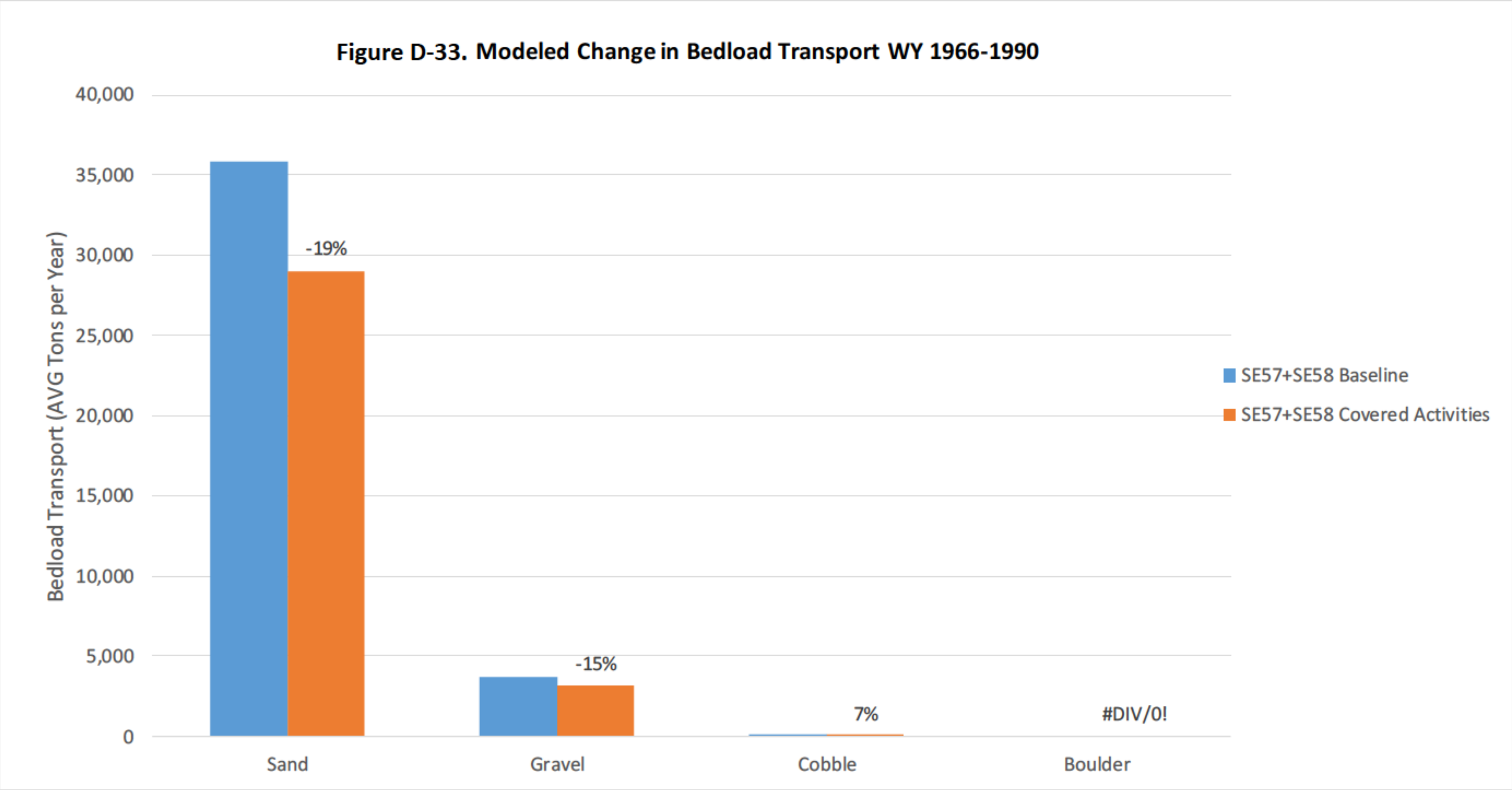


Figure D-33. Modeled Change in Bedload Transport WY 1966-1990
Bedload Transport (AVG Tons per Year)
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
-19%
-15%
7%
#DIV/0!
Sand
Gravel
Cobble
Boulder
SE57+SE58 Baseline
SE57+SE58 Covered Activities

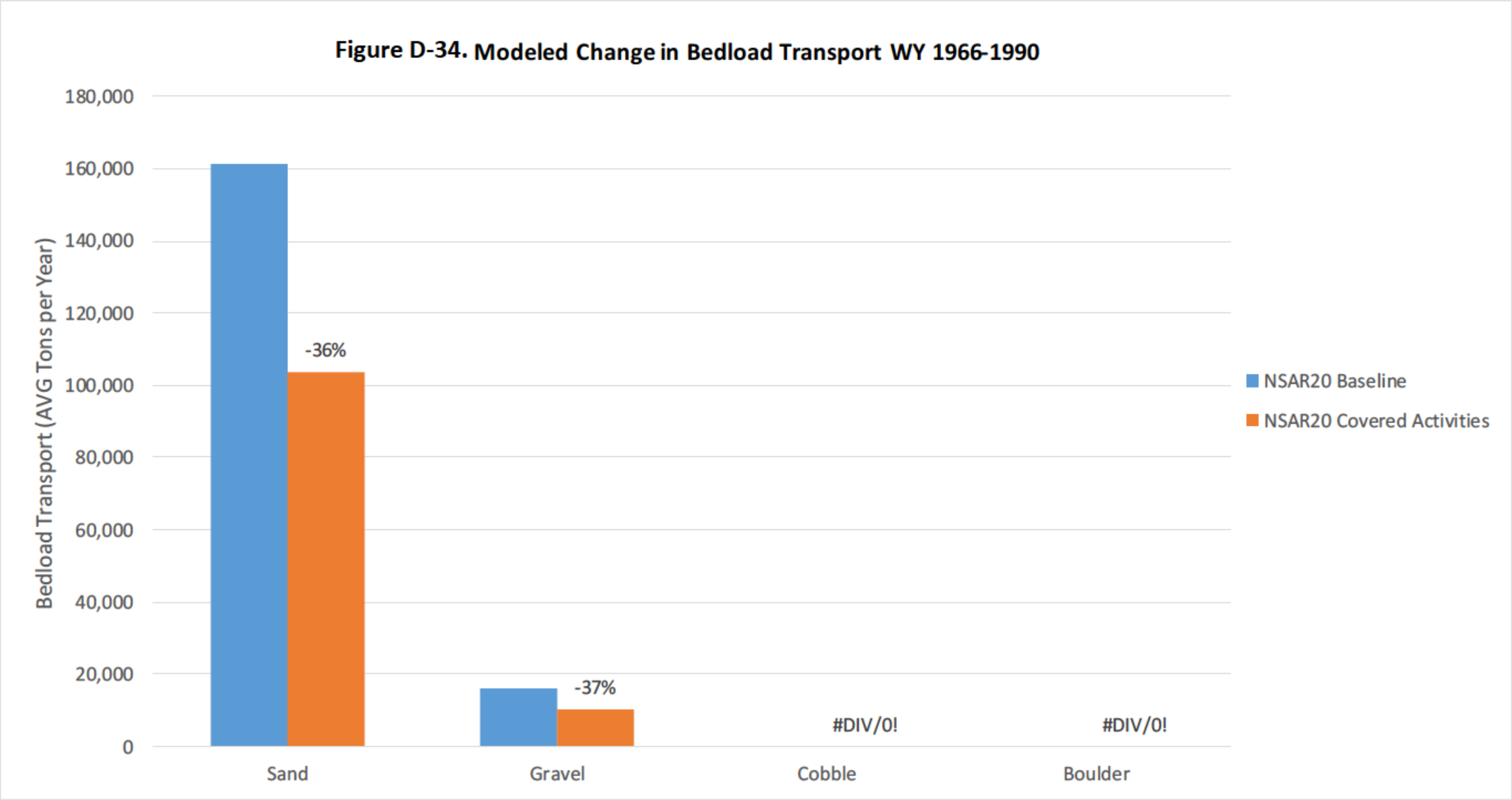


Figure D-34. Modeled Change in Bedload Transport WY 1966-1990
Bedload Transport (AVG Tons per Year)
180,000
160,000
140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
-36%
-37%
#DIV/0!
#DIV/0!
Sand
Gravel
Cobble
Boulder
NSAR20 Baseline
NSAR20 Covered Activities

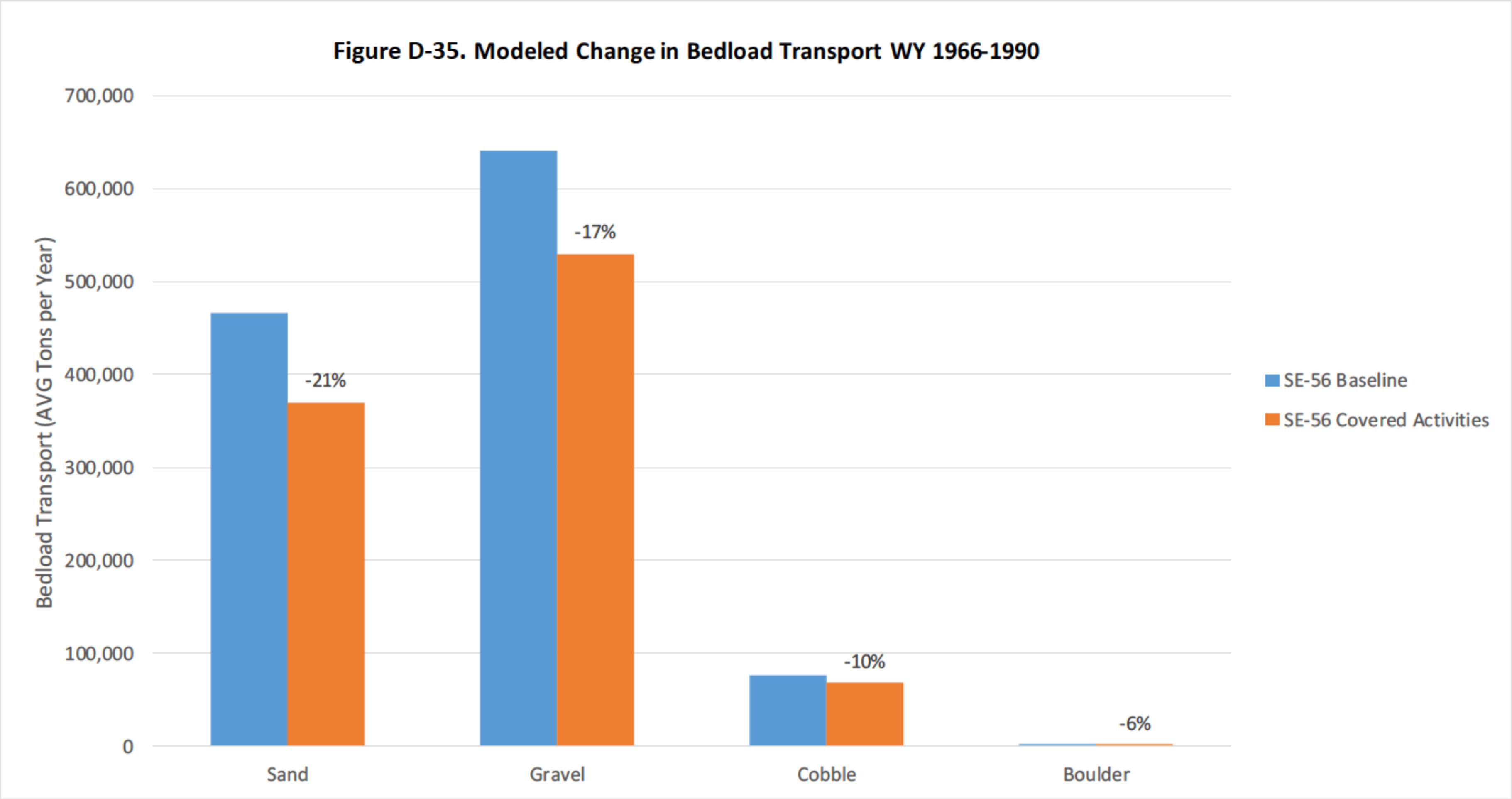


Figure D-35. Modeled Change in Bedload Transport WY 1966-1990
Bedload Transport (AVG Tons per Year)
700,000
600,000
500,000
400,000
300,000
200,000
100,000
0
-21%
-17%
-10%
-6%
Sand
Gravel
Cobble
Boulder
SE-56 Baseline
SE-56 Covered Activities

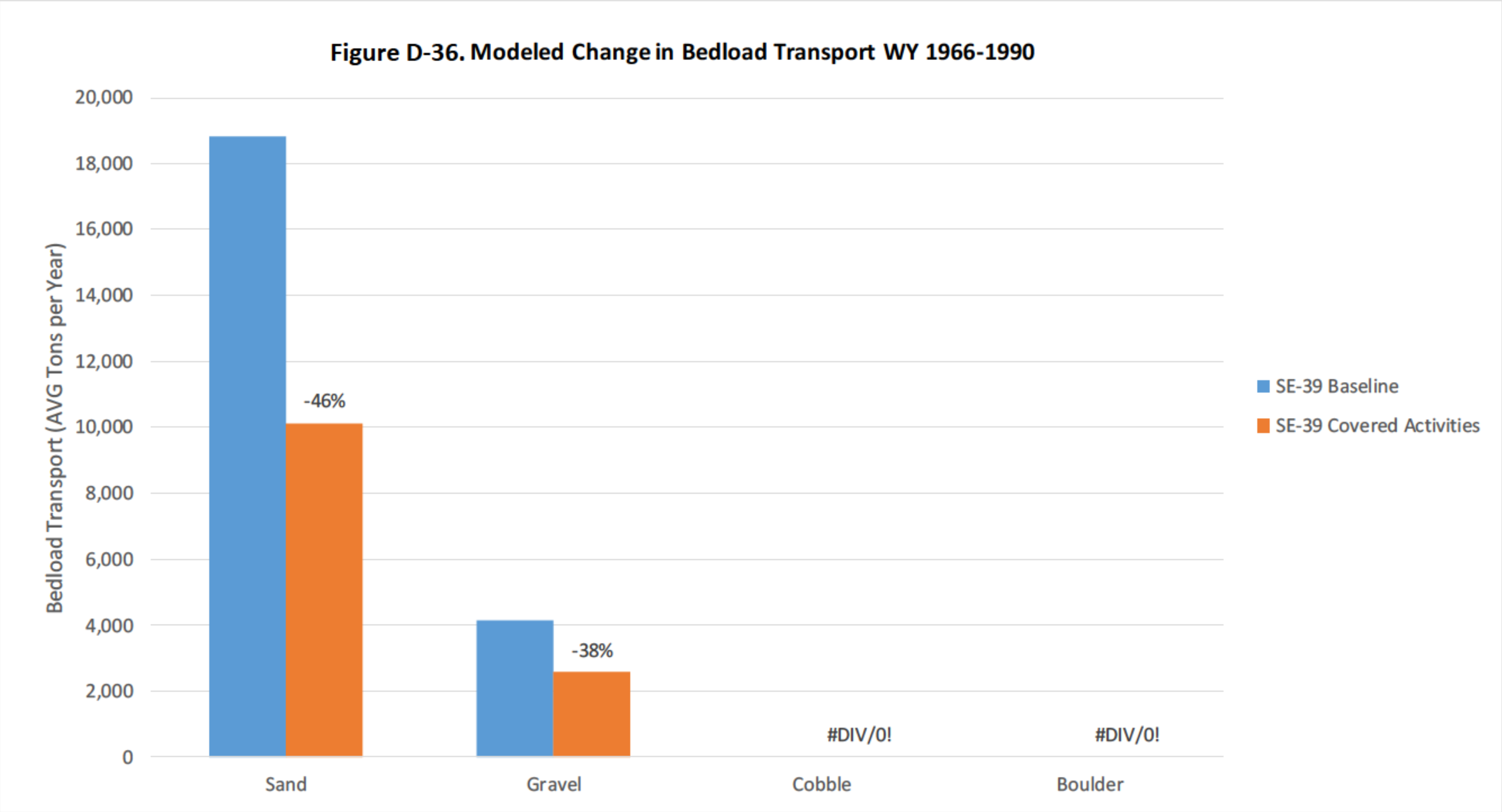


Figure D-36. Modeled Change in Bedload Transport WY 1966-1990
Bedload Transport (AVG Tons per Year)
20,000
18,000
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
-46%
-38%
#DIV/0!
#DIV/0!
Sand
Gravel
Cobble
Boulder
SE-39 Baseline
SE-39 Covered Activities

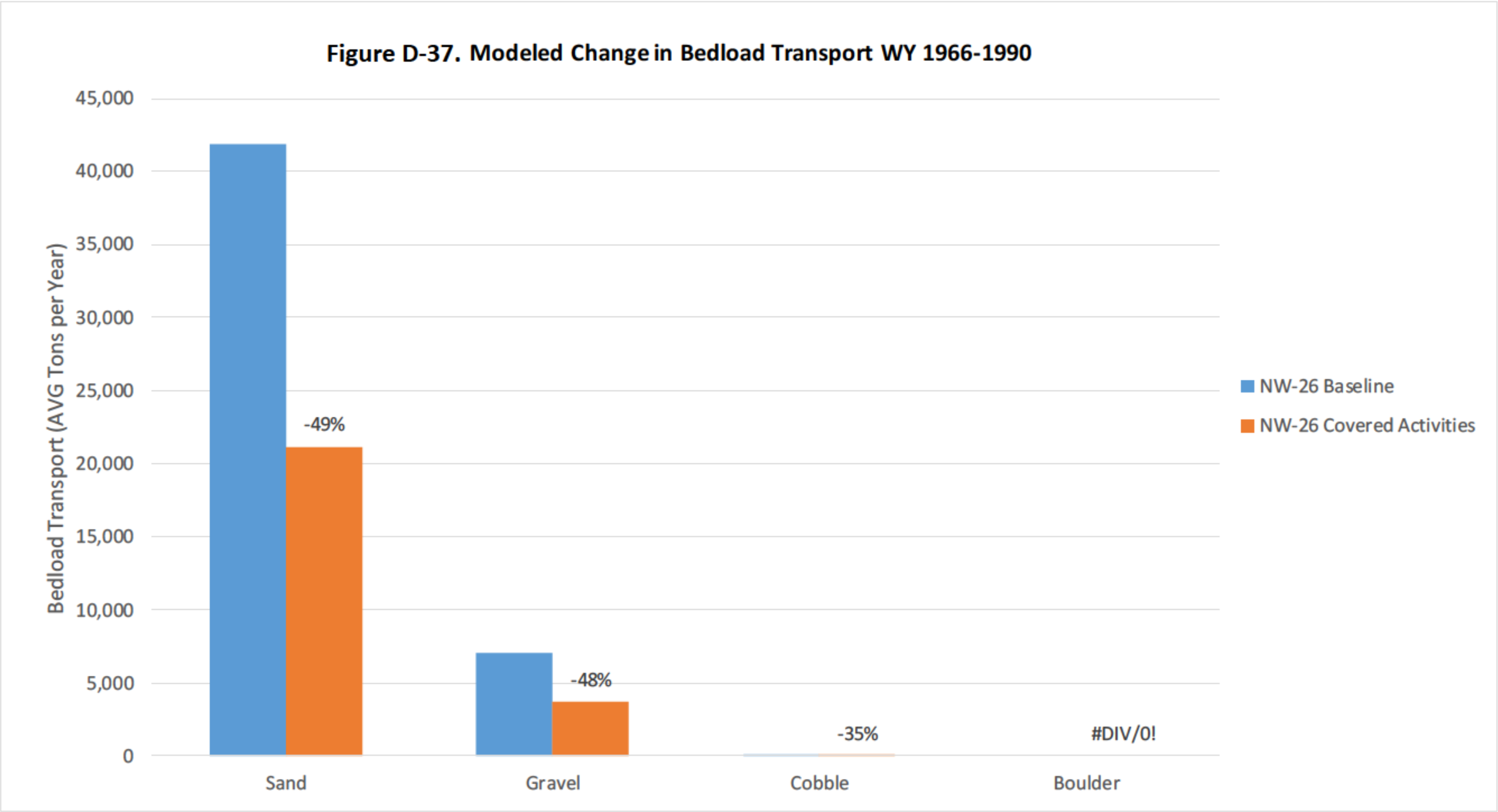


Figure D-37. Modeled Change in Bedload Transport WY 1966-1990
Bedload Transport (AVG Tons per Year)
45,000
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
-49%
-48%
-35%
#DIV/0!
Sand
Gravel
Cobble
Boulder
NW-26 Baseline
NW-26 Covered Activities

Appendix E

Santa Ana Sucker Habitat Suitability Analysis

Appendix E
Santa Ana Sucker Habitat Suitability Analysis

Introduction

This appendix provides a summary of the methods used to model Santa Ana sucker (*Catostomus santaanae*) habitat preferences and assess habitat parameters. The appendix reviews recent habitat preference data for the Santa Ana sucker (SASU) for the purpose of providing SASU habitat suitability criteria. Select criteria were used to model effects on SASU habitat for the Upper Santa Ana River Habitat Conservation Plan, as well as habitat restoration activities in the upper Santa Ana River.

Various sources were used to assess habitat criteria, including peer reviewed scientific articles, unpublished technical documents, and inter-agency reports. The aim was to compare and select the most scientifically defensible estimates of SASU habitat preference. Habitat variables were ranked by importance which assisted in setting priorities in the design and creation of novel habitat for SASU.

There are limitations associated with the materials used in this study. First, the available literature on SASU habitat preference is limited, and most of the work used in this report was conducted in the last 15 years. Observations made during this time reflect the presentation of the habitat as it has been during this period, and do not offer any historical context with regards to habitat characteristics prior to the last two decades. Second, reviewed works sampled different drainages and locations, and measured habitat variables in different ways. A diversity of sample locations may be viewed both positively and negatively, but differences in methods to measure the various habitat elements impeded comparison between studies.

An additional limitation is that many of the habitat elements specified in the literature are confounded with each other. For example, discharge, water depth and velocity influence habitat type and substrate. Gradient affects velocity, and therefor habitat type and substrate which has a direct effect on cover type. This inter-connectedness complicates ranking variables by their importance, and optimal SASU preference is likely to be composed of a number of habitat elements.

Methods

Literature Review

Five studies of SASU habitat preference were collected from various sources. These include two peer reviewed publications (Saiki et al. 2007; Thompson et al. 2010) and three technical reports (Haglund et al. 2003; Aspen Environmental Group 2016; Wulff et al. 2018). This was not an exhaustive search but included the known documents for which primary measures of SASU habitat preferences were reported.

From these reports, a suite of habitat variables and their ranges were cataloged. These variables include the following: canopy cover, cover type, discharge, gradient, habitat type, substrate, velocity, and water depth. Not all sources contained measures of each type, and some sources only reported two or three.

Ranking

In compiling and ranking the various elements measured (Table E-1), preference was given to studies that reported goodness of fit values for modeled data ($R^{squared}$ values) and/or Akaiki Information Criterion (AIC) model weights. In addition, preference was given to variables for which upper and lower bounds had been observed. Lower bounds were frequently reported, but few measures also captured the upper bounds of habitat preference. Ultimately this was likely not the fault of the investigators, but more a reflection of the limited range of habitats presented during investigation.

Results

Table E-1. Ranked Habitat Variables

Variable	Rank	No# of measures	Confidence	Optimal Value	Range
Substrate	1	5	high	60% cobble	30-70%
Discharge	2	1	low	17.5-106 ft^3/s	
Velocity	3	5	moderate*	1.64 f/s	0.65-3.2
Gradient	4	1	moderate	1.75-2.20 % gradient	0.5-3.0
Habitat Type	5	2	high	80% riffle	30-100%
Water Depth	6	4	high	>1.5 ft	0.3-2.3
Canopy Cover	7	1	high	0% cover	0-20% cover
Aquatic Cover Type	8	2	high	cobble/boulder/algae	

*No upper bound for preference variable observed

Variable: Canopy cover

Aspen Environmental Group's SASU habitat preference data collected in Big Tujunga indicates a negative relationship between SASU condition factor and canopy cover (2016). Condition factors were elevated at canopy cover values less than 30%. The combined data for 2011-2013 shows a strong (but not fitted) relationship between raw abundance of SASU and % canopy cover. All observations of 50 or more animals took place at canopy cover values less than 30%, and most were at 15% or less.

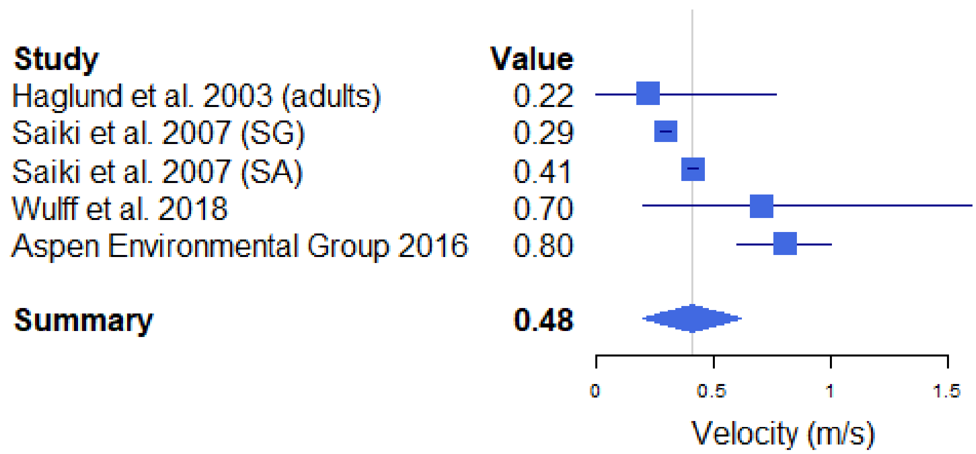
Variable: Cover type

Wulff et al. comprehensively measured cover type and found that SASU had a strong preference for both cobble/boulder cover and filamentous algae cover, using both at greater than average rates

(2018). Saiki et al. reported similar findings, indicating that fish in the San Gabriel River also used cobble and boulder for cover (2007). At the MWD crossing site in the Santa Ana river, where substrates were exclusively sand, fish utilized emergent vegetation instead. Reported rates of cover use were high at 98% for both cover types.

Variable: Discharge/Velocity

Thompson et al. (2010) suggest that Saiki et al. (2007) observed a negative correlation with higher discharge in their study. This is based on the failure to observe SASU at one of three sites. The site also had discharge measures greater than 8 m^3/s. This observation is based on correlational data, and there is currently no other evidence for an upper discharge limit on habitat preference. However, it is probable that the relationship between preference and discharge in SASU is parabolic per Thompson et al. (2010).



Notes: Values from Haglund et al. 2003 for juveniles are excluded.
SG = San Gabriel River. SA = Santa Ana River.
Values provided by Aspen Environmental are recommended, not observed.

Figure E-1. Summary of Velocity Measures by Study

Aspen Environmental provided a recommendation based on the Big Tujunga data indicating that velocities between 1.6-3.6 fps and 2.0-3.3 fps were optimal, but did not provide any observational data to support the relationship (2016).

Wulff et al.'s (2018) data indicates SASU preference for mean water column velocities of 0.7 m/s, but occupying a normal distribution of ranges from 0.1-1.6 m/s

Variable: Gradient

Aspen's Big Tujunga data indicates a gradient preference for SASU that ranges from 1.75% to 2.2%. This may represent optimum gradient preference for SASU, but it should be kept in mind that the species was present throughout the measured gradient range (0.5 to 3%) and that most observations were made at gradients between 0.5 and 1.75%.

Variable: Habitat type

The three major habitat types reviewed by the various studies are riffle, run and pool.

Aspen's Big Tujunga data indicates a strong preference by SASU to occupy reaches with greater percent riffle. Likewise there is an inverse relationship with percent pool. Reaches with less than 15% pool and greater than 60% riffle contained the highest concentrations of SASU as measured by raw abundance scores. The Aspen Environmental report is the only data presented with goodness of fit measures. The R^2 values for pools is 0.41, indicating a moderate fit for the data. The riffle R^2 value is 0.66, indicating a tighter fit and a stronger relationship. The modeled curve indicates no measured upper bound to riffle preference by SASU.

Variable: Substrate

The substrate types reviewed by the various studies are some combination of the following: silt, sand, gravel, cobble, and boulder.

Aspen's Big Tujunga data indicates strong preferences by SASU for coarser substrates. The data for percent cobble indicates a strong relationship between raw abundance and presence of cobble substrates (R^2 value 0.73). There is a corresponding negative relationship between percent silt and SASU raw abundance and the relationship is strong (R^2 value 0.65) but not as strong as the relationship with cobble. The modeled curve indicates no upper bound to cobble preference by SASU. There is some indication in the data and discussion by Aspen alluding to the relative importance of fish density in driving habitat selection for sites with greater percent cobble. At low fish densities, fish will occupy sites that have less percent cobble. Aspen only saw fish densities over 50 SASU raw abundance at sites greater than 3:1 cobble: sand values.

Wulff et al. indicate the same relationship, with SASU preferentially occupying cobble, then gravel, then sand (2016). But their data do not contain measures over silt so there was no opportunity to test the negative relationship indicated by the Aspen data. SASU occupied boulder/cobble mixes and filamentous algae surfaces preferentially over all other substrate types.

Variable: Water depth

Aspen provides a recommendation based on the Big Tujunga data indicating that depths between 24.9-59.9 cm with high water velocities (see above) are optimal, but did not provide any observational data to support the relationship.

Wulff et al. indicates a similar pattern, with animals preferentially occupying habitat with water depths greater than 25cm. The data are either bimodal or heavily skewed to observations in deeper habitat, with most observations at 45cm depth, and a long tail into the 120cm range.

Selection of Model Data

A variety of habitat parameters were initially evaluated for inclusion in modeling suitable SASU habitat. These parameters included: substrate, discharge, velocity, gradient, habitat type, water depth, canopy cover, and cover type. These variables were often co-dependent, with velocity and gradient being linked tightly to substrate and habitat type. In reviewing available variables for model selection, discharge, velocity, gradient and water depth were singled out as being more easily modeled using existing tools than other variables such as substrate, habitat type, canopy cover and cover type.

In reviewing data on habitat type, canopy cover, and cover type, we were unable to identify any available resources for estimating these variables for the purpose of modeling SASU habitat parameters within reaches of interest (main-stem Santa Ana River). Observations on habitat type were confounded by differences in methodology between studies as well. Canopy cover was confounded with incidence of solar exposure and likely possesses a bimodal relationship with SASU habitat preference, whereby increased cover is favorable up to the point where it limits food availability in the form of algal growth. Cover type was also confounded by these problems and not uniformly observed between studies.

There are currently no available resources for comprehensive estimates of substrate type within reaches of interest for modeling purposes. To add substrate as a model element, these resources would have to be developed alongside the model. Concurrent work on substrate presentation in SASU occupied habitat indicates that sand mobilization and bed scour occur at water velocities of 1.2 fps and greater (ESA Associates 2015). For the purposes of variable selection and model building, we assume that channel velocities greater than 1.2 fps will result in bed scour and presentation of coarse substrates.

Reach vs. Individual

The majority of preference data to date (August 2020) recorded for SASU was conducted at the reach level (4 of 5 studies). Reach level habitat preference reporting generally tied SASU abundance and presence/absence data to habitat data collected at a range of river reach distances (typically 10, 25 or 100m). This reach level habitat preference data was difficult to translate into specific habitat preferences for SASU because of the lack of uniformity among reach lengths and methods between studies. One study (Wulff et al. 2018) collected SASU habitat preference data at the level of the individual through direct observation using snorkel surveys.

Data collected at the unit of the individual allows for greater confidence in estimating SASU habitat preferences at scales finer than the reach level. With well supported habitat preference data, habitat quality can be accurately modeled down to meter or even sub-meter scales. We used Wulff et al.'s 2015 and 2016 data to construct SASU habitat preference curves for depth and velocity. Using these preference curves, we modeled habitat quality over a range of discharges in the main channel of the Santa Ana River.

Data Collection

Wulff et al.'s methods and results were compiled into a report submitted to San Bernardino Valley Water Conservation District (Wulff et al. 2018). Field work continued past this date and additional preference data was compiled by USGS. Data from this report as well as from direct communications with Dr. Larry Brown was used in this analysis to construct the habitat preference model. The data consisted of two field seasons (winter 2014/2015; hereafter 2015 & winter 2015/2016; hereafter

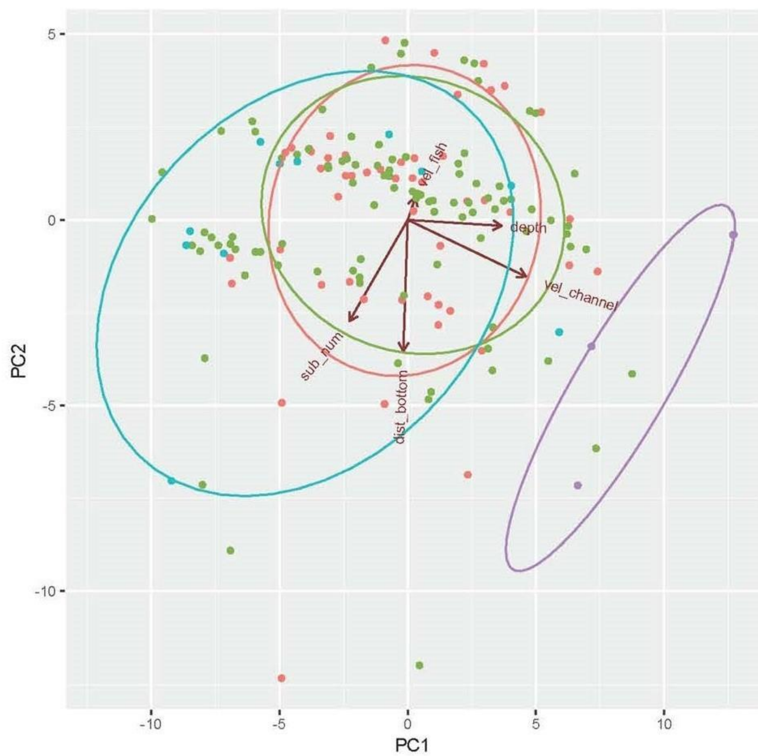
2016). For 2015, when fish were observed in groups, the number of fish observed within a group was reported (Total number of observations = 497) but preference data was taken once for the group. For 2016, records were taken for each individual, and the number of fish observed in a group was not reported (Total number of observations=330). When pooled, the data consisted of 827 SASU observations, along with the water depth, fish depth, substrate, water velocity, cover type, and distance to nearest cover for each observation.

Size Class Analysis

A potential concern associated with the data was skewing based on size class. If fish from different size classes have different habitat preferences, this may hamper modeling efforts. At worst, some size class based habitat preference might not be captured by the average preferences for the 827 observations that were made. To assess the existence of distinct habitat preferences based on size class, a cluster analysis of the observations was performed. This analysis included all recorded habitat measures including the following: water depth, water velocity at fish, water velocity in channel, distance from bottom, and substrate. Size classes were broken into four groups based on previous research indicating approximate length measurements for year-class. The size classes were as follows: 50-79mm for year 0+, 80-129mm for year 1+, 130-159mm for year 2+, and 160mm+ for year 3+. Cluster analysis was conducted in the R statistical computing environment (version 3.3.3) using the *prcomp* fuction in the base package (R Foundation for Statistical Computing 2017). The biplot of SASU habitat preference was produced using the ggbiplot package.

Cluster analysis indicated strong overlap in habitat preference for most size classes (0+ to 2+) with the exception of year 3+ animals (Figure E-2.). These year 3+ animals exhibiting a preference for deeper, faster moving water than smaller size classes. However the year 3+ cohort was comprised of three observations. With such a small sample size, it is unclear if the separation is due to sampling artifacts or truly represents differences in preference. Importantly, some year 1+ observations overlapped with the year 3+ observations, indicating that smaller animals were not excluded from these habitats. Ultimately, we concluded that the data was broadly reflective of habitat preference for all size classes of SASU and appropriate for use in the model except for larvae.

Larval habitat is typified by shallow backwater habitat with reduced water velocity and elevated temperature (Moyle 2002). An assumption of the current modeling effort is that habitat suitable for larval rearing is broadly available throughout all wetted portions of the main-stem Santa Ana River, and that when elements suitable for larger size classes are present, larval habitat will also be present.



Size Class	Size Range
0+	50-70mm
1+	80-120mm
2+	140-150mm
3+	160mm

Notes: Circles Represent the Four Size Classes

Figure E-2. Cluster Plot of SASU Habitat Preference Clusters.

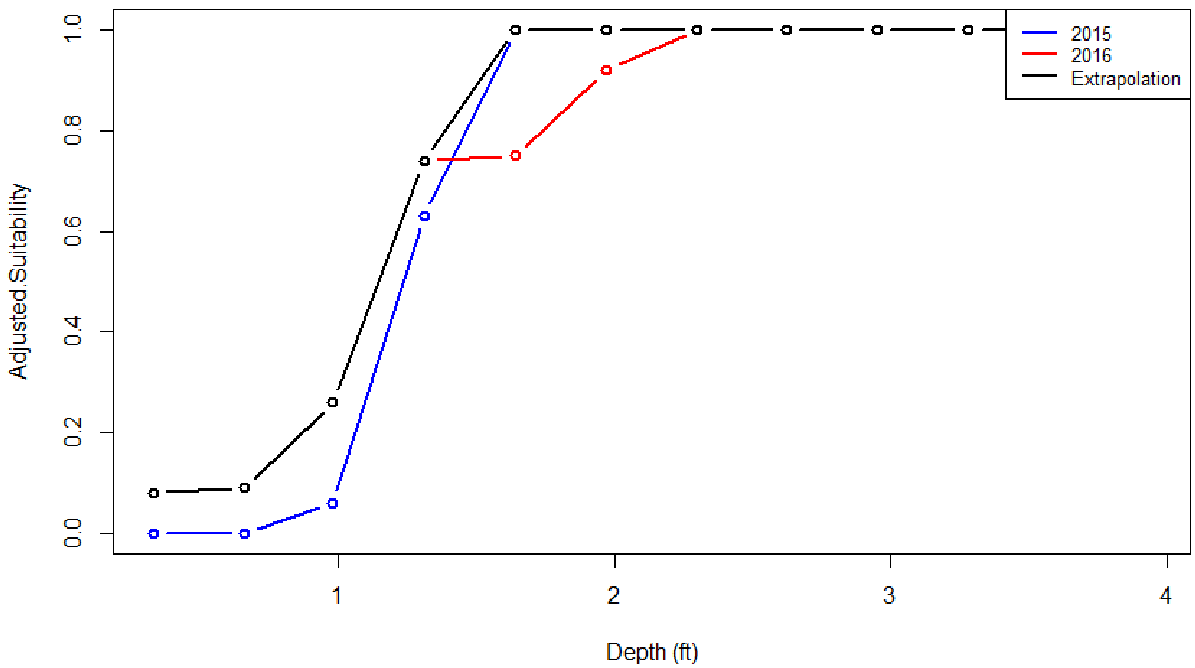
Habitat Suitability Criteria

Wulff et al. utilized Ivlev's Electivity Index to calculate habitat utilization curves based on habitat availability and observed utilization by SASU (2018). The index is an equation originally developed to model feeding preference with regards to prey selection by planktonic feeding fishes. The index allows for the development of a value (range: -1 to 1) that represents the observed animal's preference for a specific prey item over other available items. In the case of this study, the index allows for calculating a fish's preference for an individual habitat type over other available habitat types. Taken from Wulff et al.

> "Ivlev's Electivity Index is calculated as, $E_i = (r_i - p_i)/(r_i + p_i)$, where r_i is the proportion of a resource utilized and p_i is the proportion of the resource in the environment. Values range from -1 (complete avoidance) to 1 (complete utilization). Like all selection indices, quantitative index values should be used with caution, especially when small sample sizes are used to calculate r_i or p_i (Lechowicz, 1982). We use the index as a general indicator of selection or avoidance."

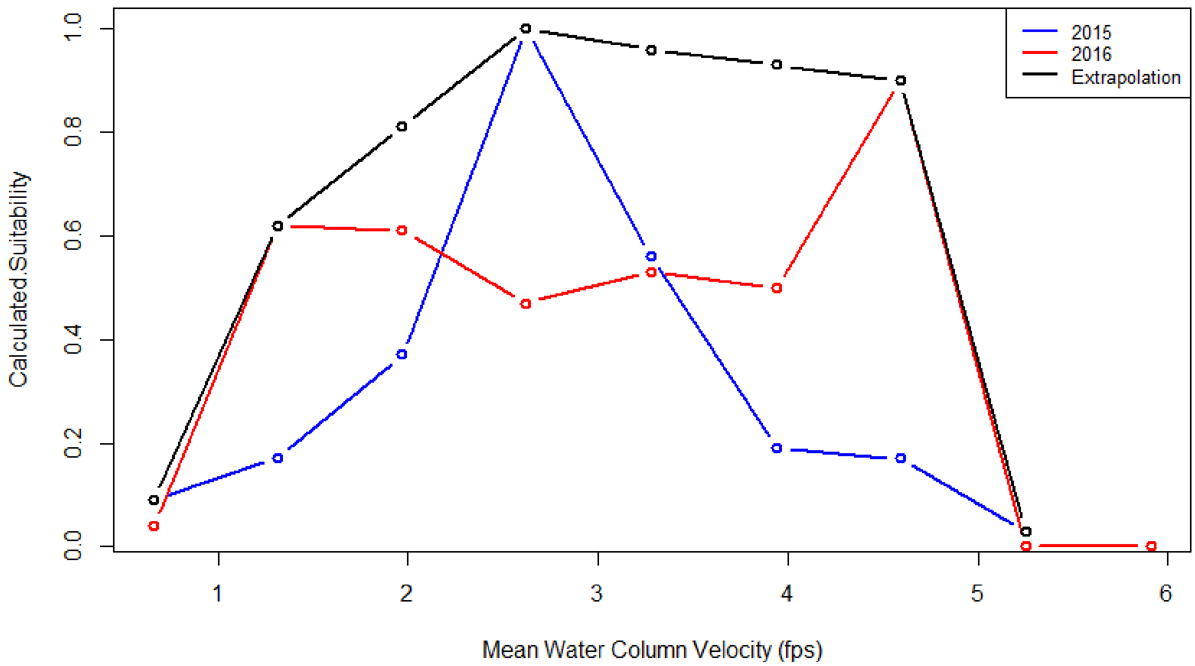
Electivity scores were converted to habitat suitability indices by scaling observed index values for the most used category to 1.0 and least used to 0. In their report, Wulff et al. adjusted some 2015 suitability scores based on habitat availability and expert knowledge of typical fish preference. This adjustment was made for depth values only and velocity preference scores were unmodified. This adjustment was justified because available habitat deeper than 50 cm within the survey reaches was rare, skewing index values. This resulted in several depressed or even negative scores for depths greater than 70 cm. All scores in the 2015 data at depths greater than 50 cm were adjusted to 1.0 to more accurately reflect SASU preference.

For the purposes of the current study, only the depth and water velocity preference data were utilized. Wulff et al. provided raw suitability scores for 2015 and 2016 directly to the authors. The separate suitability scores for SASU habitat preferences (depth and velocity) for the two field seasons were merged to create combined preference scores which could then be applied in the model. In composing the combined suitability index, the higher of the values for each season was used. As a result, the model may slightly over-predict suitable habitat.



Notes: Wulff et al.'s 2015 and 2016 raw data are shown in red and blue, with the extrapolated values in black.

Figure E-3. Depth Suitability Index



Notes: Wulff et al.'s 2015 and 2016 raw data are shown in red and blue, with the extrapolated values in black.

Figure E-4. Velocity Suitability Index

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 E-2).

Table E-2. 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

Model Implementation

Model Methods

The modeling of suitable 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 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 (site USGS Reach 9) to the most downstream site (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 in Figure E-5). The total assessed channel length from the Rialto Channel to the downstream end of the Santa Ana River near Prado is 21.1 miles.

Flow depths and velocities were modeled for a range of discharges in the 2D hydraulic modeling software SRH-2D. The 2D hydraulic models require 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 required bathymetric surveys of the low-flow channel to supplement the 2015 LiDAR data since LiDAR does not capture underwater elevations. Bathymetry surveys were previously performed at four of the sites. ESA field surveyed bathymetry at the 3 ESA sites in Figure E-5 in July 2015 as part of work to evaluate potential RIX facility flow reductions on sucker habitat (ESA 2015). The USGS also field surveyed bathymetry in 2015 in "USGS Reach 9" just downstream of the RIX facility. ICF used the USGS and ESA bathymetry data for this study. ICF added 3 new assessment sites for this study. Site 3 and Site 3A in Figure E-5 were added to assess sucker habitat at locations further downstream of the Santa Ana River, and a site was added on the Rialto Channel. New field surveys of bathymetry for these 3 sites were performed in December 2017. Model elevation surfaces made from the combined bathymetry and LiDAR sources have nodes spaced typically around 3 feet from each other.

The Manning's n roughness values in the 2D model created for each site were calibrated with field measurements. The n values calibrated with measurements of water levels and velocity measurements made as part of the ESA (2015) study were also used in this study. Water surface elevations were surveyed at all the other sites and through correlation with discharge readings at the time of the surveys were used to calibrate n values until a best fit was obtained between modeled and measured water surfaces. The Santa Ana River modeled reaches range in low-flow channel length from 975 feet to 1,200 feet and the Rialto Channel model reach is 500 feet long. Details on model reach lengths, bed slopes, and channel widths are listed in Table E-3. A series of flows was 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 preferred sucker habitat suitability range shown in the habitat suitability matrix in Table E-2 above.

Table E-3. 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

Model Results

Table E-3 summarizes the amount of suitable habitat determined for all 7 of the 2D assessment sites. The table lists the August through October 95% exceedance flow (i.e., 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. The months of August through October were selected because these are typically the 3 months of the year with the lowest flows and thus allow for habitat assessment under limiting flow conditions when preferred habitat is likely the lowest it will be for the year. The amount of existing conditions suitable habitat (in acres, acres per 1000 feet of channel, and as a percent of the total wetted area) is shown in Table E-3.

Figures E-6 through E-12 are graphs showing several outputs important for the sucker effects analysis. A graph prepared for each model reach shows the following:

- A curve (red squares) showing the total wetted area in acres for a modeled flow
- A curve (black circles) showing the preferred habitat in acres for the modeled flow
- A curve (blue X's) showing the percent of a modeled flow's wetted area that is preferred habitat

- The two vertical black lines show the average August through October 95% exceedance flow for both the existing conditions and with HCP covered activity conditions.

The curves show how preferred sucker habitat would change due to flow changes at 7 specific locations. For the HCP effects analysis it is necessary to understand how suitability would change 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). The following process was used to take the output from the curves and extrapolate for the non-2D model reaches.

Hydrology models that calculate mean daily flows were developed for the HCP to show how streamflows would change due to the covered activities. The hydrology models use a base hydrology period that is considered representative of the distribution of dry, average, and wet water year types experienced in the study area. The details of the hydrology modeling are discussed in more detail in Section 3.6.3, Hydrologic Modeling as the Foundation for Hydrologic Analysis. The hydrology models provide mean daily flow values at 31 model nodes located between the Rialto Channel and Prado (see Figure E-13 for a map of the hydrology nodes). The nodes are generally located at locations where flows change, such as wastewater treatment plant outfalls or channel confluences. A map of August through October 95% exceedance flows for the existing conditions is shown in Figure E-14 and for the covered activity condition in Figure E-15.

Table E-6 shows the results of the process to assess sucker suitability continuously throughout the study area. A description of the columns in this table will aid understanding of the steps involved in the calculations:

1. The **Reach Description** column describes geographic boundaries between the reaches. Reaches were created between each of the 31 nodes since flow changes occur at these locations from flow inputs (effluent discharges or tributaries) or losses (streambed infiltration).
2. **Reach Length** is the distance of the reach between the hydrology model nodes.
3. **Hydro Model Node(s) Used** lists the node used for the mean daily flow value. Note that a reach uses the hydrology corresponding to the node at the upstream end of the reach.
4. **Existing Conditions Aug-Oct 95% Exceedance Flow (cfs)** is from the hydrology model node. These values are also mapped in Figure E-14.
5. **Covered Activity Aug-Oct 95% Exceedance Flow (cfs)** is from the hydrology model node. These values are also mapped in Figure E-15.
6. **Existing Conditions minus Covered Activity Aug-Oct 95% Exceedance Flow (cfs)** shows how implementation of the covered activities would change the flow in the reach.
7. **Sucker Habitat Curve Used** identifies which of the 7 curves in Figures E-6 through E-12 were used for the specific reach calculations.
8. **Existing Conditions Preferred Habitat as % Wetted Area** is determined from the sucker habitat curve. The value is the percent of the total wetted area that meets the suitable habitat criteria and it is calculated from the location on the curve that corresponds to the flow magnitude from Step 4.

9. **Covered Activity Preferred Habitat as % Wetted Area** is defined the same as Step 8 but it uses the location on the curve that corresponds to the flow magnitude from Step 5.
10. **Existing Conditions Preferred Habitat (acres)** is the area within a reach that meets suitable habitat criteria under the existing conditions flow condition. The unit suitable area calculated for the 2D model reach (i.e., acres per 1,000 feet of channel length) and the actual reach length (Step 2) were used to calculate the actual suitable habitat in the reach.
11. **Covered Activity Preferred Habitat (acres)** is defined the same as Step 10 except it uses the unit suitable habitat area under the covered activity flow condition.
12. **Change in Preferred Habitat from Existing Condition (acres)** shows how implementation of the covered activities would change suitable habitat area in the reach. These values are also mapped in Figure E-16.
13. **Change in Preferred Habitat from Existing Condition (%)** shows the percent change in suitable habitat that implementation of the covered activities would create in the reach. These values are also mapped in Figure E-17.
14. **Notes on Existing Condition Hydrology** identifies key hydrology changes that occur with the reaches. This includes assumptions used in the hydrology model for effluent discharges and Riverside Narrows upwelling.
15. **Notes on Covered Activity Condition Hydrology** identifies key hydrology changes that occur with the reaches due to implementation of the covered activities. This includes assumptions used in the hydrology model for reductions in effluent discharges at Rialto and RIX, and for redistribution of existing conditions effluent discharges at the Regional Water Quality Control Plant into planned tributary restoration sites and for use in public parks. Reductions in flows from San Sevaine Creek and Day Creek due to IEUA covered activities are also identified.

The sum of all the habitat meeting the preferred depth and velocity criteria for the reaches is 6.05 acres for the existing conditions and 2.17 acres for the covered activity conditions. The final step of the habitat suitability analysis was to overlay the model reaches with the data mapping the distribution of suitable bottom substrate (i.e., cobble and/or gravel >10%) to estimate how much of the habitat with the preferred depth and velocity co-occurs with suitable substrate.

Santa Ana Sucker Preferred Habitat Quantification

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. 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 (Table E-4). 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.

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.

Channel bottom data (substrate) was collected during Riverwalk. 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. 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). 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.

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 2010). Table E-4 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).

Impact of Covered Activities on Santa Ana Sucker Preferred Habitat

The same preferred habitat quantification described above was repeated using the flows from the HCP Hydrology Model with the effects of the Covered Activities included. The results of that impact assessment of the Santa Ana sucker estimates the permanent loss of 1.3 acres out of a total of 2.2 acres of modeled preferred habitat (suitable depth and water velocity, and coarse substrate present) within the 21.1-mile assessment area of the Santa Ana River (Table E-5).

Table E-4. 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%)

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 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%)
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%)

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 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.

Table E-5. Potential Impacts on Santa Ana Sucker Modeled Preferred Habitat from Hydrologic Effects of Covered Activities

Reach Description[1]	Hydro Model Node[1]	Reach Length (feet)	Acres with Preferred Depth and Velocity per 1,000 Feet	Existing Acres of Preferred Habitat	Acres of Preferred Habitat with Covered Activities	Percent Reduction
Rialto Channel DS of Rialto outfall	NFRC-06	1,705	0.01	0.019	0.007	63.2%
SAR DS Rialto Channel and US RIX outfall	NSAR19	1,141	0.00	0.000	0.000	0.0%
SAR DS RIX outfall and US Riverside Ave (@ ESA Upper model site)	NSAR20	6,865	0.13	0.910	0.501	44.9%
SAR DS Riverside Ave and US node NSAR 22	NSAR21	3,242	0.09	0.279	0.112	59.9%
SAR DS node NSAR 22 and US Market St	NSAR22	5,624	0.08	0.425	0.122	71.3%
SAR DS Market St and US Hwy 60	NSAR23	1,576	0.06	0.093	0.021	77.4%
SAR DS Hwy 60 and US node NSAR 232	NSAR231	1,804	0.06	0.106	0.025	76.4%
SAR DS Hwy 60 and US Mission Blvd (@ ESA Middle model site)	NSAR232	4,000	0.06	0.236	0.055	76.7%
SAR DS Mission Blvd and US node NSAR 241 (@ ESA Lower model site)	NSAR24	5,679	0.01	0.064	0.010	84.4%
SAR DS node NSAR 241 and US node NSAR 242 (Tequesquite Arroyo reach)	NSAR241	7,883	0.00	0.016	0.000	100.0%
Total Suitable Habitat				**2.148**	**0.853**	**60.3%**

[1]Refer to Table E-6 for a listing of all reaches within the 21.1-mile assessment reach over which Santa Ana sucker habitat was modelled. Only reaches with suitable substrate proportion (>10% gravel/cobble) are included in this table.

DS = downstream; NSAR = north Santa Ana River; US = upstream.

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Table E-6. Model Results

Drainage	Reach Description	Channel Type	Reach Length (ft)	Hydro Model Node(s) Used	Existing Conditions Aug-Oct 95% Exceedance Flow (cfs)	Covered Activity Aug-Oct 95% Exceedance Flow (cfs)	Existing Conditions minus Covered Activity Aug-Oct 95% Exceedance Flow (cfs)	Sucker Habitat Curve Used	Existing Conditions Preferred Habitat as % Wetted Area	Covered Activity Preferred Habitat as % Wetted Area	Existing Conditions Preferred Habitat (acres)	Covered Activity Preferred Habitat (acres)	Change in Preferred Habitat from Existing Condition (acres)	Change in Preferred Habitat from Existing Condition (%)	Notes on Existing Condition Hydrology	Notes on Covered Activity Condition Hydrology
Rialto Channel	Rialto Channel DS of Rialto outfall	Straight Channelized Slope < 2% WD < 50	1,705	NFRC06	9.2	7.0	2.2	Rialto Channel	3.3%	1.3%	0.019	0.007	0.012	-62.6%		
Santa Ana River	SAR DS Rialto Channel & US RIX outfall	Braided/Braided Channelized Slope < 2% WD > 175	1,141	NSAR19	8.1	5.9	2.2	Average ESA Upper Reach & USGS Reach 9	0.0%	0.0%	0.000	0.000	0.000	#DIV/0!	Rialto existing conditions effluent: 9.3 cfs	Rialto covered activity effluent: 7.0 cfs
Santa Ana River	SAR DS RIX outfall & US Riverside Ave (@ ESA Upper model site)	Braided/Braided Channelized Slope < 2% WD > 175	6,865	NSAR20	49.0	33.6	15.4	Average ESA Upper Reach & USGS Reach 9	22.2%	12.9%	0.910	0.501	0.409	-44.9%	RIX existing conditions effluent: 41.2 cfs	RIX covered activity effluent: 28.0 cfs
Santa Ana River	SAR DS Riverside Ave & US node NSAR 22	Braided/Braided Channelized Slope < 2% WD > 175	3,242	NSAR21	37.2	22.0	15.2	Average ESA Upper Reach & USGS Reach 9	15.0%	6.6%	0.279	0.112	0.167	-59.8%		
Santa Ana River	SAR DS node NSAR 22 & US Market St	Braided/Braided Channelized Slope < 2% WD 50-175	5,624	NSAR22	35.0	19.8	15.2	ESA Middle Reach	13.8%	4.6%	0.425	0.122	0.303	-71.3%		
Santa Ana River	SAR DS Market St & US Hwy 60	Braided/Braided Channelized Slope < 2% WD 50-175	1,576	NSAR23	31.1	16.0	15.1	ESA Middle Reach	11.0%	3.1%	0.093	0.021	0.071	-76.9%		
Santa Ana River	SAR DS Hwy 60 and US node NSAR 232	Braided/Braided Channelized Slope < 2% WD 50-175	1,804	NSAR231	31.1	16.0	15.1	ESA Middle Reach	11.0%	3.1%	0.106	0.025	0.082	-76.9%		
Santa Ana River	SAR DS Hwy 60 & US Mission Blvd (@ ESA Middle model site)	Braided/Braided Channelized Slope < 2% WD 50-175	4,000	NSAR232	31.1	16.0	15.1	ESA Middle Reach	11.0%	3.1%	0.236	0.055	0.182	-76.9%		
Santa Ana River	SAR DS Mission Blvd & US node NSAR 241 (@ ESA Lower model site)	Braided/Braided Channelized Slope < 2% WD 50-175	5,679	NSAR24	31.1	19.0	12.1	ESA Lower Reach	1.2%	0.2%	0.064	0.010	0.054	-84.3%		3 cfs input at Evans Lake from Purple Pipe
Santa Ana River	SAR DS node NSAR 241 & US node NSAR 242 (Tequesquite Arroyo reach)	Low Gradient Meandering Slope < 2% WD 50-175	7,883	NSAR241	31.1	20.0	11.1	Santa Ana River Site 3	0.1%	0.0%	0.016	0.000	0.016	-100.0%		1 cfs input at Tequesquite Arroyo from Purple Pipe
Santa Ana River	SAR DS node NSAR 242 & US node NSAR 243	Low Gradient Meandering Slope < 2% WD 50-175	1,842	NSAR242	31.1	20.0	11.1	Santa Ana River Site 3	0.1%	0.0%	0.004	0.000	0.004	-100.0%		

Drainage	Reach Description	Channel Type	Reach Length (ft)	Hydro Model Node(s) Used	Existing Conditions Aug-Oct 95% Exceedance Flow (cfs)	Covered Activity Aug-Oct 95% Exceedance Flow (cfs)	Existing Conditions minus Covered Activity Aug-Oct 95% Exceedance Flow (cfs)	Sucker Habitat Curve Used	Existing Conditions Preferred Habitat as % Wetted Area	Covered Activity Preferred Habitat as % Wetted Area	Existing Conditions Preferred Habitat (acres)	Covered Activity Preferred Habitat (acres)	Change in Preferred Habitat from Existing Condition (acres)	Change in Preferred Habitat from Existing Condition (%)	Notes on Existing Condition Hydrology	Notes on Covered Activity Condition Hydrology
Santa Ana River	SAR Anza Creek reach	Low Gradient Meandering Slope < 2% WD 50-175	1,826	NSAR243	31.1	20.0	11.1	Santa Ana River Site 3	0.1%	0.0%	0.004	0.000	0.004	-100.0%		
Santa Ana River	SAR DS of Anza Creek/railroad bridge & US pipeline crossing	Low Gradient Meandering Slope < 2% WD 50-175	3,703	NSAR244	31.1	23.0	8.1	Santa Ana River Site 3	0.1%	0.0%	0.008	0.000	0.008	-100.0%		3 cfs input at Anza Creek/Old Ranch Creek from Purple Pipe
Santa Ana River	SAR DS of pipeline crossing & US RWQCP	Low Gradient Meandering Slope < 2% WD 50-175	4,700	NSAR25	51.2	43.0	8.2	Santa Ana River Site 3	1.3%	0.7%	0.114	0.062	0.052	-45.4%	Riverside Narrows upwelling of ~20 cfs	Riverside Narrows upwelling of ~20 cfs
Santa Ana River	SAR DS of RWQCP & US of Van Buren Blvd	Low Gradient Meandering Slope < 2% WD 50-175	1,305	NSAR26	45.8	37.6	8.1	Santa Ana River Site 3	0.9%	0.4%	0.022	0.010	0.012	-55.5%		
Santa Ana River	SAR DS Van Buren Blvd (Hole Creek reach)	Low Gradient Meandering Slope < 2% WD 50-175	1,647	NSAR27	91.9	59.2	32.7	Santa Ana River Site 3	6.0%	2.0%	0.190	0.062	0.128	-67.5%	RWQCP existing conditions effluent of 47 cfs	RWQCP covered activity effluent of 23 cfs
Santa Ana River	SAR DS node NSAR 28 & US node NSAR 29	Low Gradient Meandering Slope < 2% WD 50-175	1,777	NSAR28	90.3	60.7	29.6	Santa Ana River Site 3	5.7%	2.1%	0.197	0.072	0.125	-63.6%		3 cfs input at Hole Creek from Purple Pipe
Santa Ana River	SAR DS node NSAR 29 & US node NSAR 30	Low Gradient Meandering Slope < 2% WD 50-175	1,010	NSAR29	88.5	59.0	29.5	Santa Ana River Site 3	5.4%	2.0%	0.107	0.038	0.069	-64.8%		
Santa Ana River	SAR DS node NSAR 30 & US node NSAR 301	Low Gradient Meandering Slope < 2% WD 50-175	2,990	NSAR30	87.4	57.9	29.5	Santa Ana River Site 3	5.3%	1.9%	0.306	0.105	0.201	-65.7%		
Santa Ana River	SAR DS node NSAR 301 & US node NSAR 31	Low Gradient Meandering Slope < 2% WD 50-175	7,793	NSAR301	84.7	58.4	26.3	Santa Ana River Site 3	4.9%	1.9%	0.741	0.281	0.459	-62.0%		3 cfs input at Hidden Valley Creek from Purple Pipe
Santa Ana River	SAR DS node NSAR 31 & US node NSAR 311 (San Antonio Creek reach)	Low Gradient Meandering Slope < 2% WD 50-175	1,493	NSAR31	78.7	52.4	26.2	Santa Ana River Site 3	4.1%	1.4%	0.119	0.039	0.080	-67.2%		
Santa Ana River	SAR DS node NSAR 311 & US node NSAR 32	Low Gradient Meandering Slope < 2% WD 50-175	1,900	NSAR311	76.4	50.2	26.2	Santa Ana River Site 3	3.8%	1.2%	0.140	0.043	0.097	-69.2%		
Santa Ana River	SAR DS node NSAR 32 & US node NSAR 321	Low Gradient Meandering Slope < 2% WD 50-175	4,855	NSAR32	75.0	47.3	27.7	Santa Ana River Site 3	3.7%	1.0%	0.342	0.091	0.252	-73.5%		1.3 cfs flow reduction from San Sevaine Creek

Drainage	Reach Description	Channel Type	Reach Length (ft)	Hydro Model Node(s) Used	Existing Conditions Aug-Oct 95% Exceedance Flow (cfs)	Covered Activity Aug-Oct 95% Exceedance Flow (cfs)	Existing Conditions minus Covered Activity Aug-Oct 95% Exceedance Flow (cfs)	Sucker Habitat Curve Used	Existing Conditions Preferred Habitat as % Wetted Area	Covered Activity Preferred Habitat as % Wetted Area	Existing Conditions Preferred Habitat (acres)	Covered Activity Preferred Habitat (acres)	Change in Preferred Habitat from Existing Condition (acres)	Change in Preferred Habitat from Existing Condition (%)	Notes on Existing Condition Hydrology	Notes on Covered Activity Condition Hydrology
																covered activities
Santa Ana River	SAR DS node NSAR 321 & US node NSAR 33 (Day Creek reach)	Low Gradient Meandering Slope < 2% WD 50-175	2,968	NSAR321	72.9	47.6	25.3	Santa Ana River Site 3	3.4%	1.0%	0.195	0.057	0.138	-71.0%		2.3 cfs input at from Hidden Valley Ponds outfall from Purple Pipe
Santa Ana River	SAR DS node NSAR 33 & US node NSAR 331	Low Gradient Meandering Slope < 2% WD 50-175	4,953	NSAR33	70.8	45.3	25.5	Santa Ana River Site 3A	2.8%	1.1%	0.261	0.097	0.164	-62.9%		0.7 cfs flow reduction from Day Creek covered activities
Santa Ana River	SAR DS node NSAR 331 & US node NSAR 332	Low Gradient Meandering Slope < 2% WD 50-175	3,354	NSAR331	66.5	41.1	25.5	Santa Ana River Site 3A	2.4%	0.9%	0.154	0.052	0.102	-66.3%		
Santa Ana River	SAR DS node NSAR 332 & US node NSAR 34 (I-15)	Low Gradient Meandering Slope < 2% WD 50-175	1,724	NSAR332	64.7	39.3	25.4	Santa Ana River Site 3A	2.3%	0.8%	0.074	0.024	0.050	-67.8%		
Santa Ana River	SAR DS node NSAR 34 (I-15) & US node NSAR 35	Low Gradient Meandering Slope < 2% WD 50-175	1,388	NSAR34	63.6	38.2	25.4	Santa Ana River Site 3A	2.2%	0.7%	0.058	0.018	0.040	-68.7%		
Santa Ana River	SAR DS node NSAR 35 & US node NSAR 351	Low Gradient Meandering Slope < 2% WD 50-175	2,064	NSAR35	63.6	38.2	25.4	Santa Ana River Site 3A	2.2%	0.7%	0.086	0.027	0.059	-68.7%		
Santa Ana River	SAR DS node NSAR 351 & US node NSAR 352	Low Gradient Meandering Slope < 2% WD 50-175	11,399	NSAR351	63.6	38.2	25.4	Santa Ana River Site 3A	2.2%	0.7%	0.474	0.148	0.326	-68.7%		
Santa Ana River	SAR DS node NSAR 352 & US node NSAR 36 (entrance into Prado)	Low Gradient Meandering Slope < 2% WD 50-175	7,293	NSAR352	63.6	38.2	25.4	Santa Ana River Site 3A	2.2%	0.7%	0.303	0.095	0.209	-68.7%		

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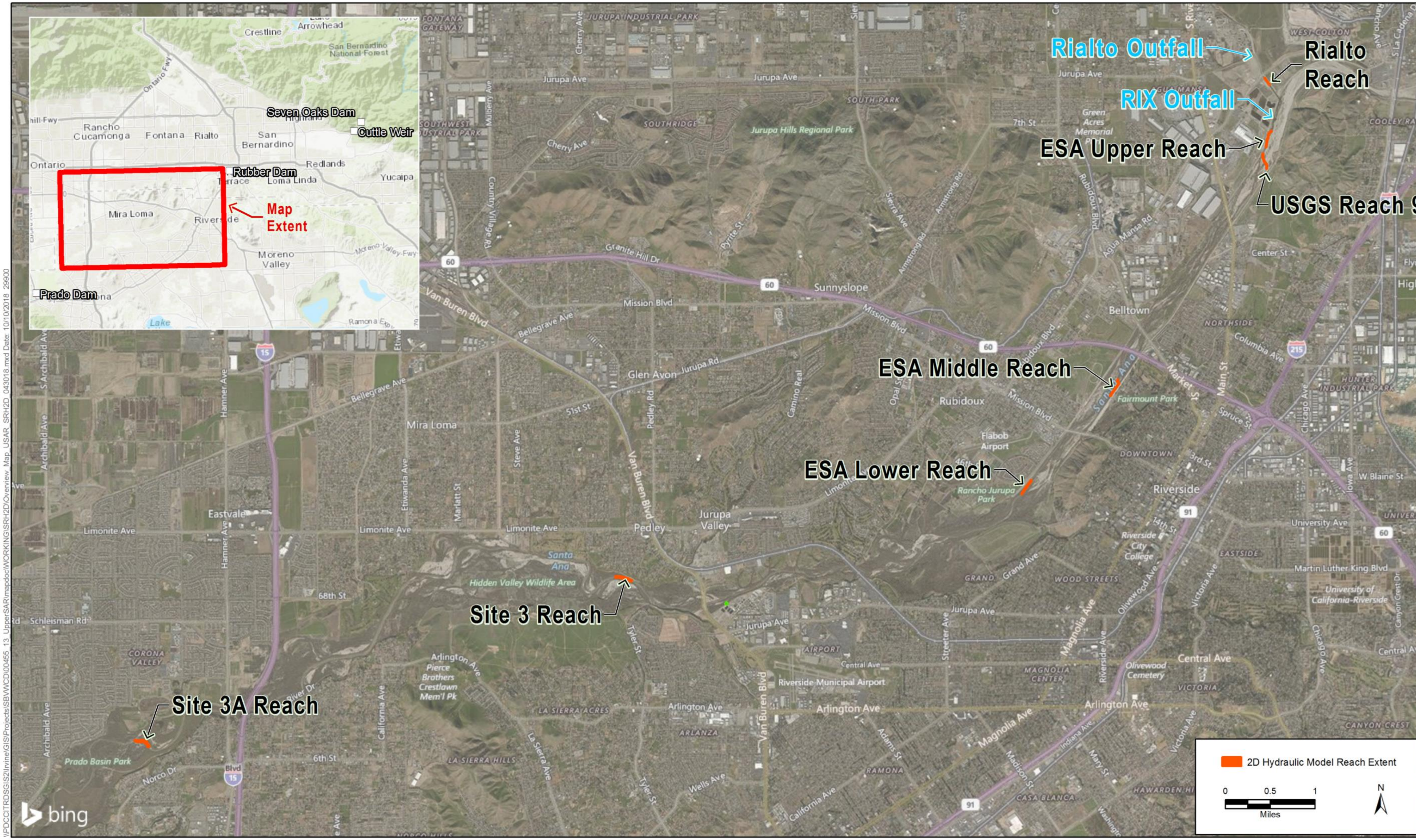

Figure E-5. Santa Ana River Hydraulic & Habitat Modeling Reaches Downstream of Rialto

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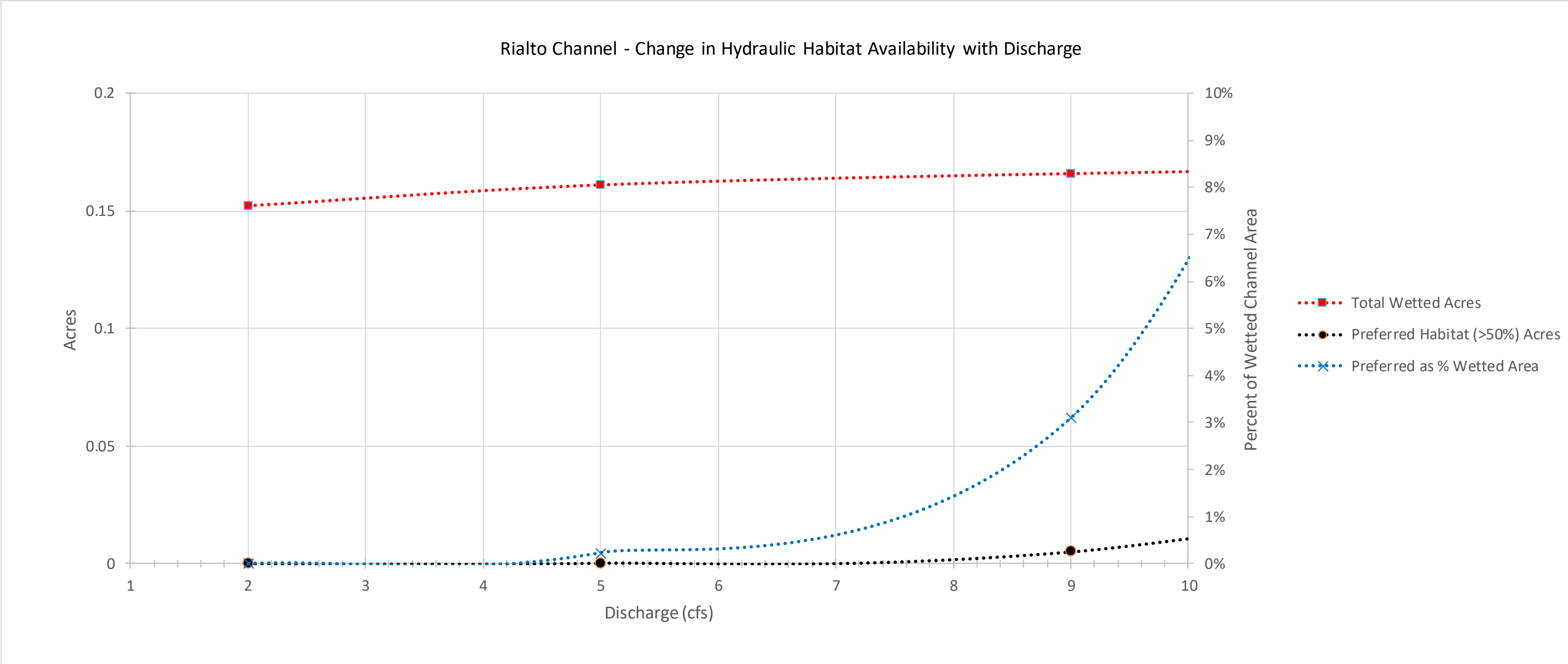

Figure E-6. Rialto Channel – Change in Hydraulic Habitat Availability with Discharge

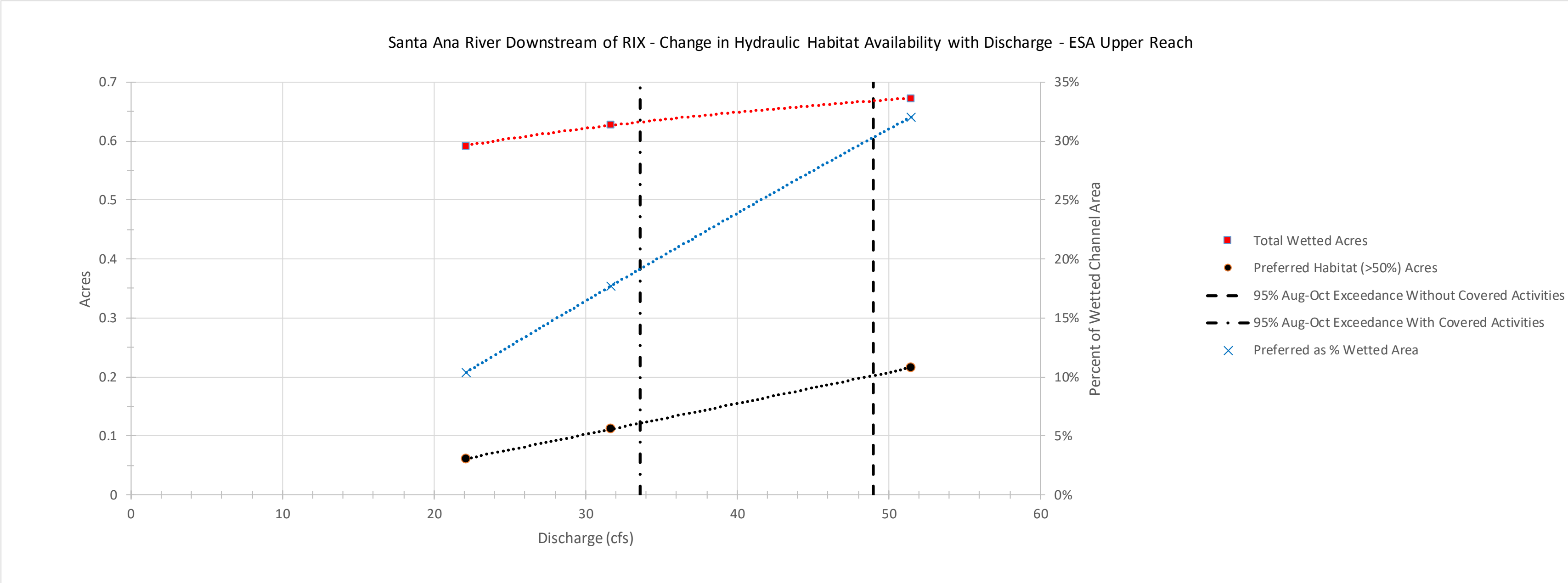

Figure E-7. Santa Ana River Downstream of RIX – ESA Upper Reach – Change in Hydraulic Habitat Availability with Discharge

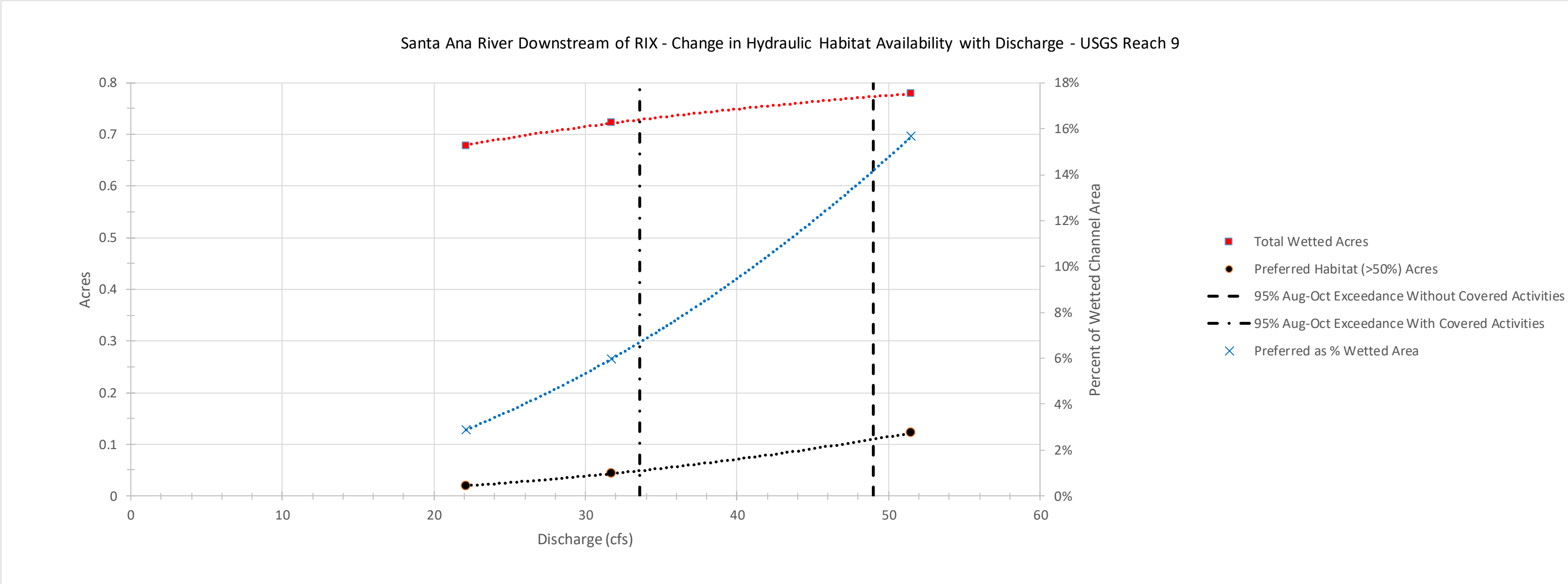

Figure E-8. Santa Ana River Downstream of RIX – USGS Reach 9 – Change in Hydraulic Habitat Availability with Discharge

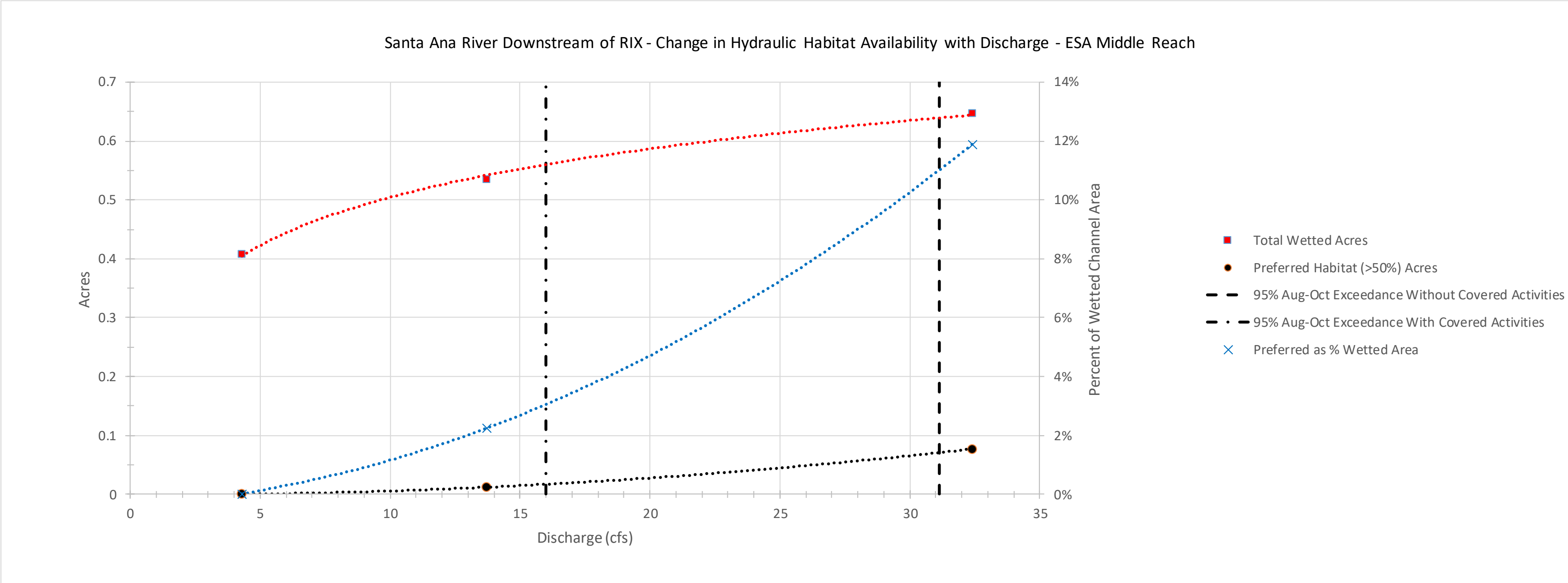

Figure E-9. Santa Ana River Downstream of RIX – ESA Middle Reach – Change in Hydraulic Habitat Availability with Discharge

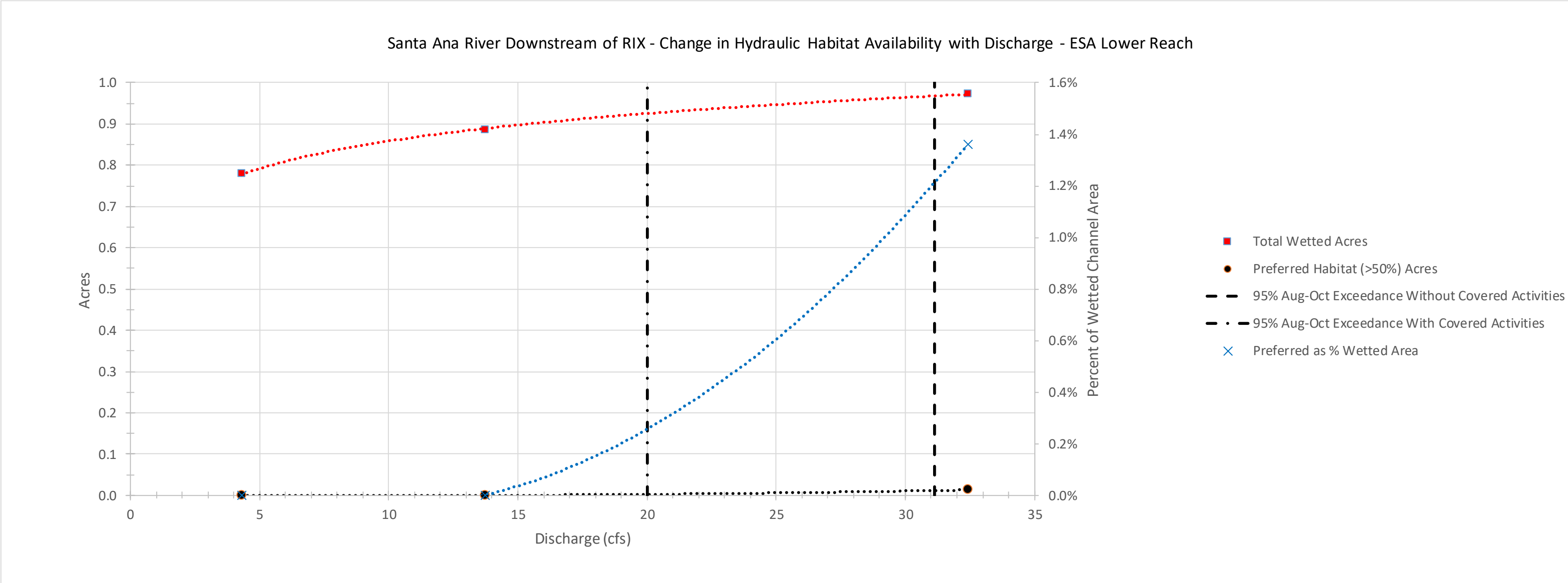

Figure E-10. Santa Ana River Downstream of RIX – ESA Lower Reach – Change in Hydraulic Habitat Availability with Discharge

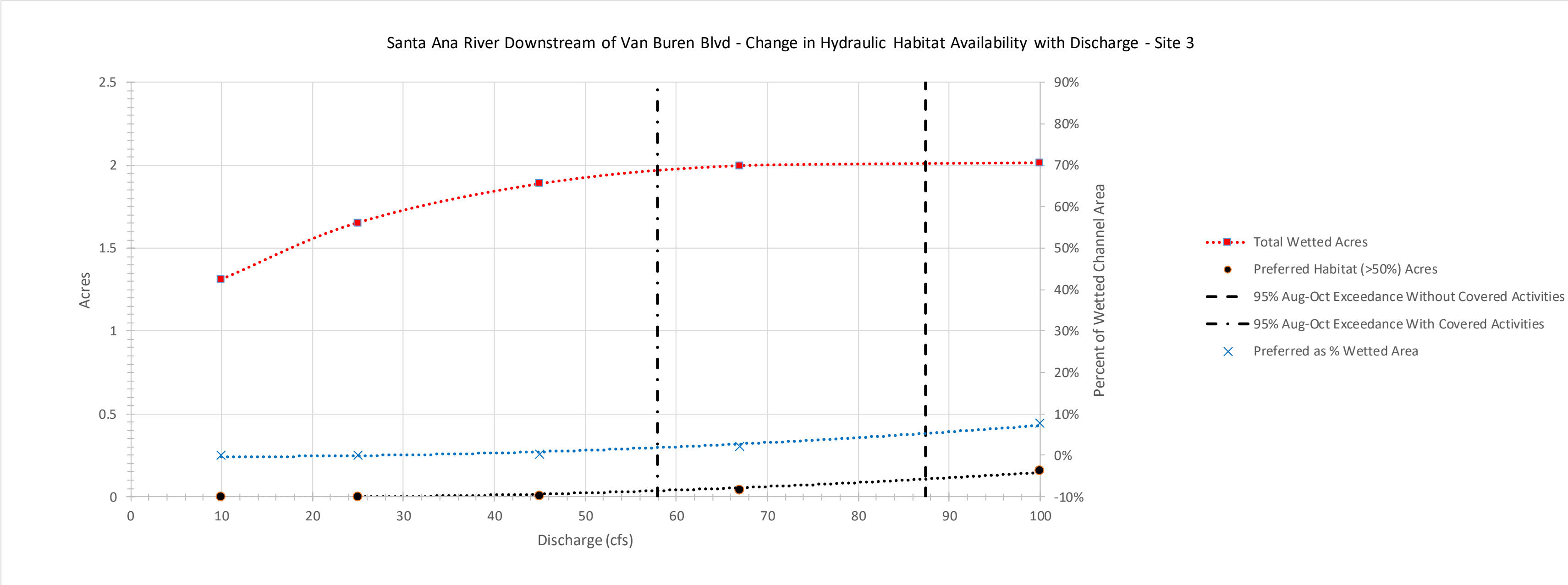

Figure E-11. Santa Ana River Downstream of Van Buren Blvd – Site 3 – Change in Hydraulic Habitat Availability with Discharge

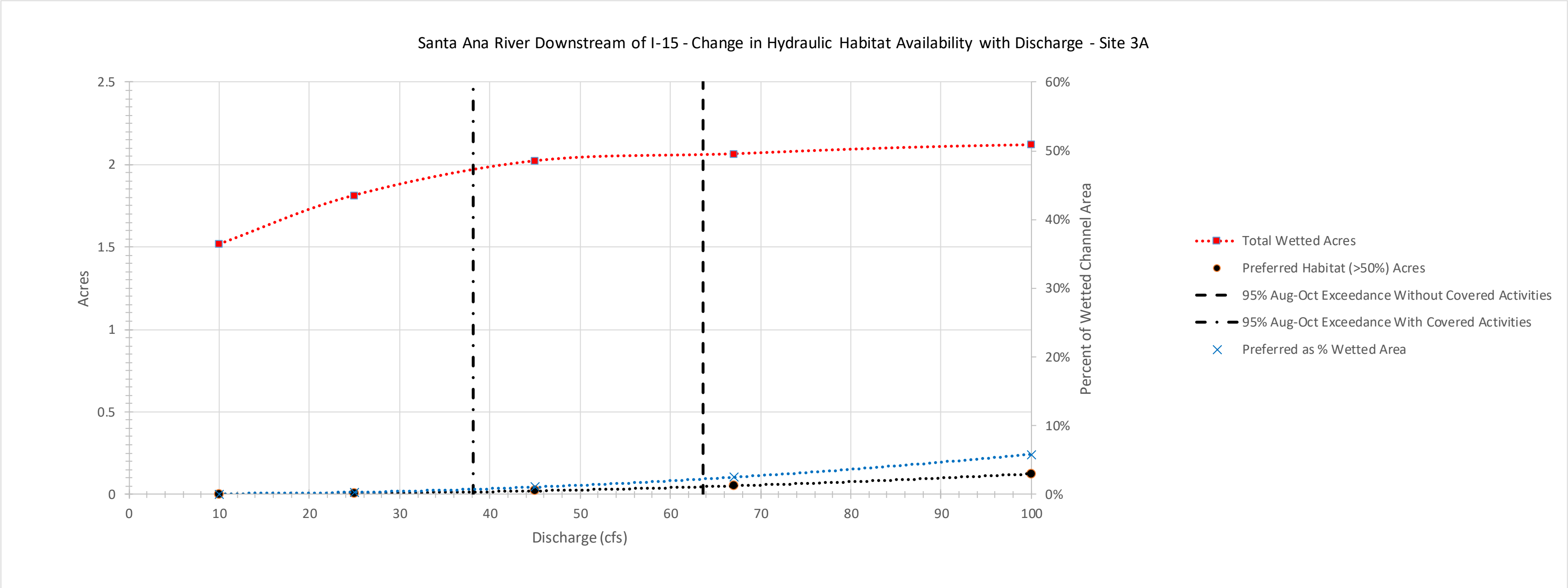

Figure E-12. Santa Ana River Downstream of I-15 – Site 3A – Change in Hydraulic Habitat Availability with Discharge

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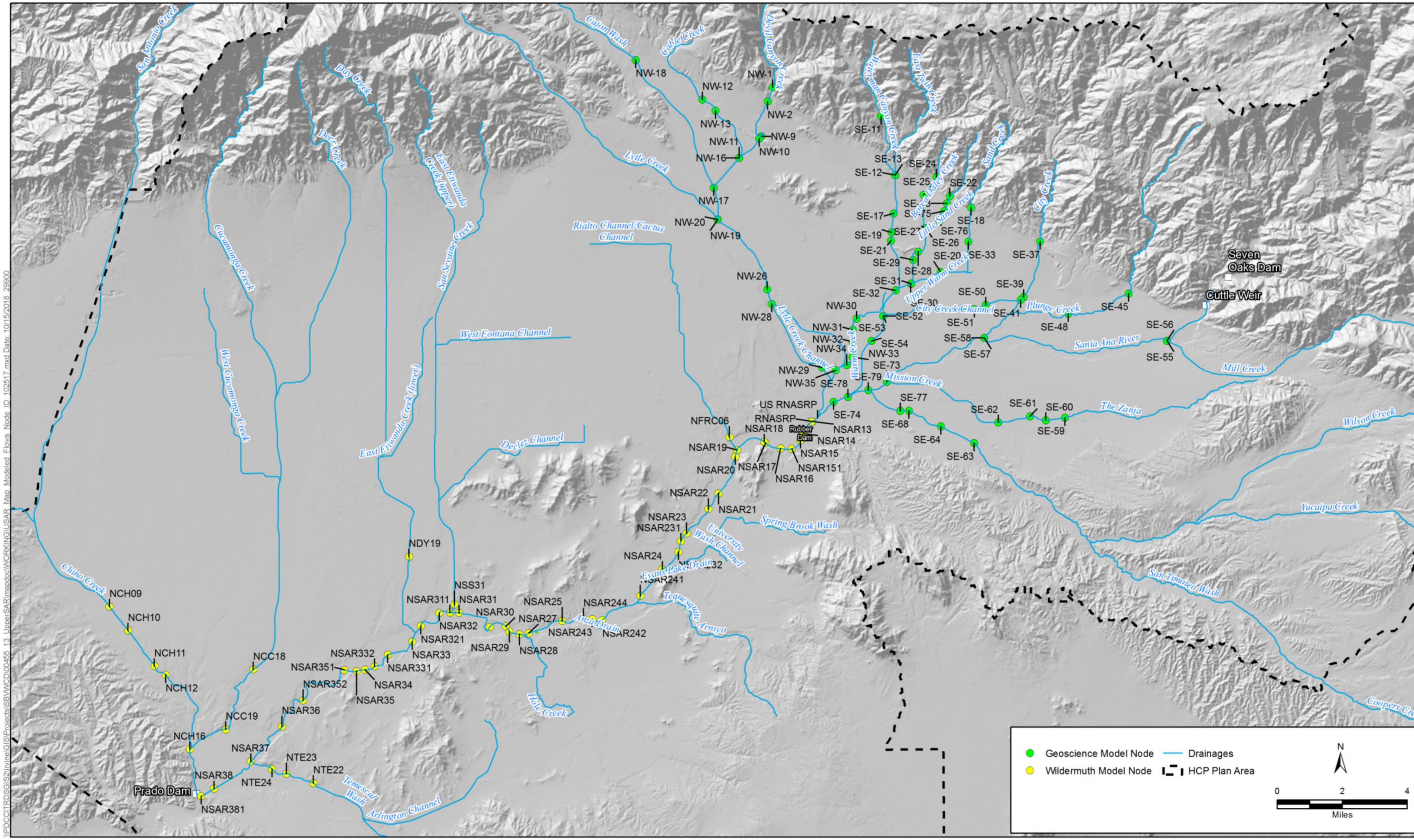

Figure E-13. Node Locations of Upper Santa Ana River HCP Hydrology Models

Figure E-14. Average August-October 95% Exceedance Flow (cfs) for the Baseline Condition

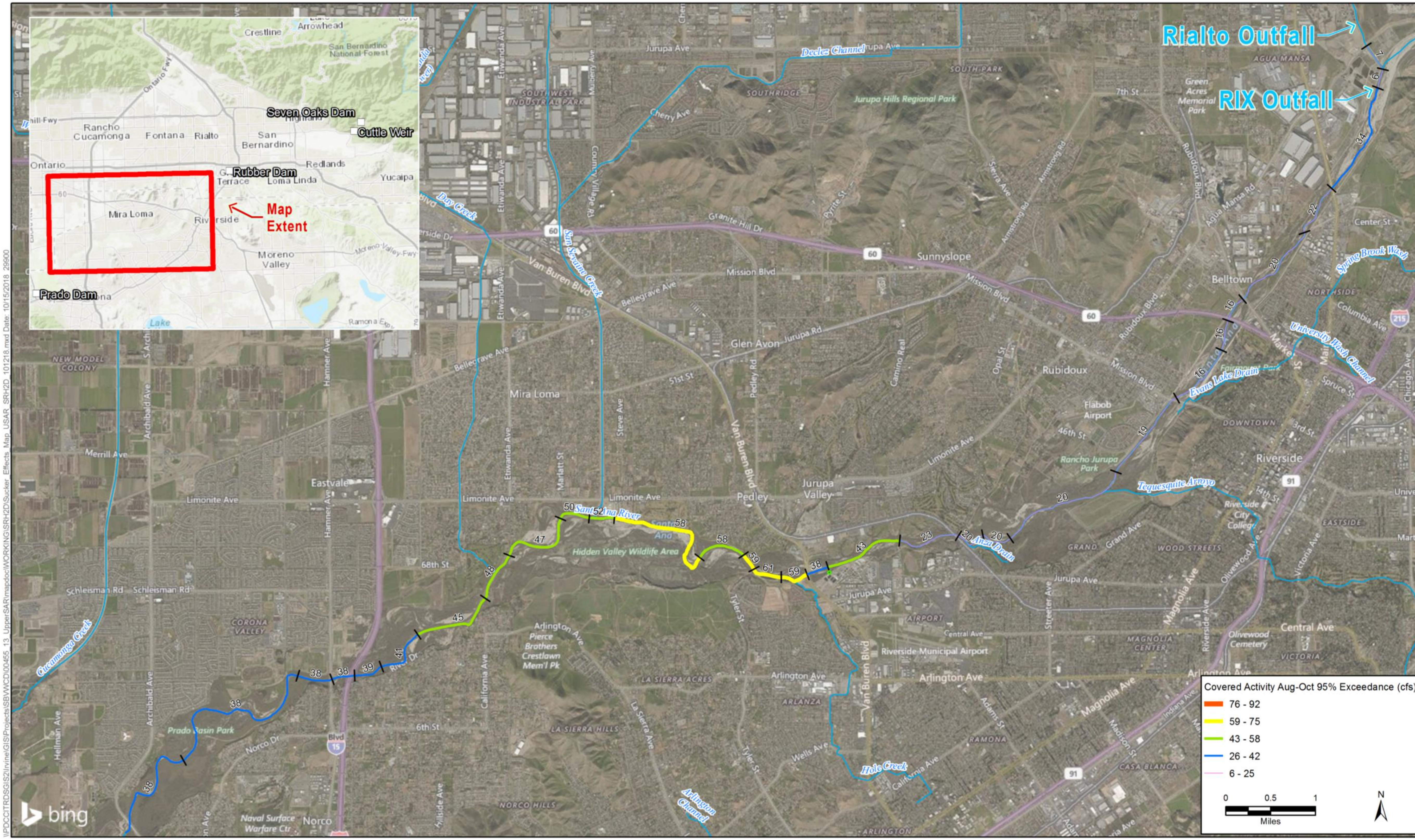

Figure E-15. Average August-October 95% Exceedance Flow (cfs) for the Covered Activity Condition

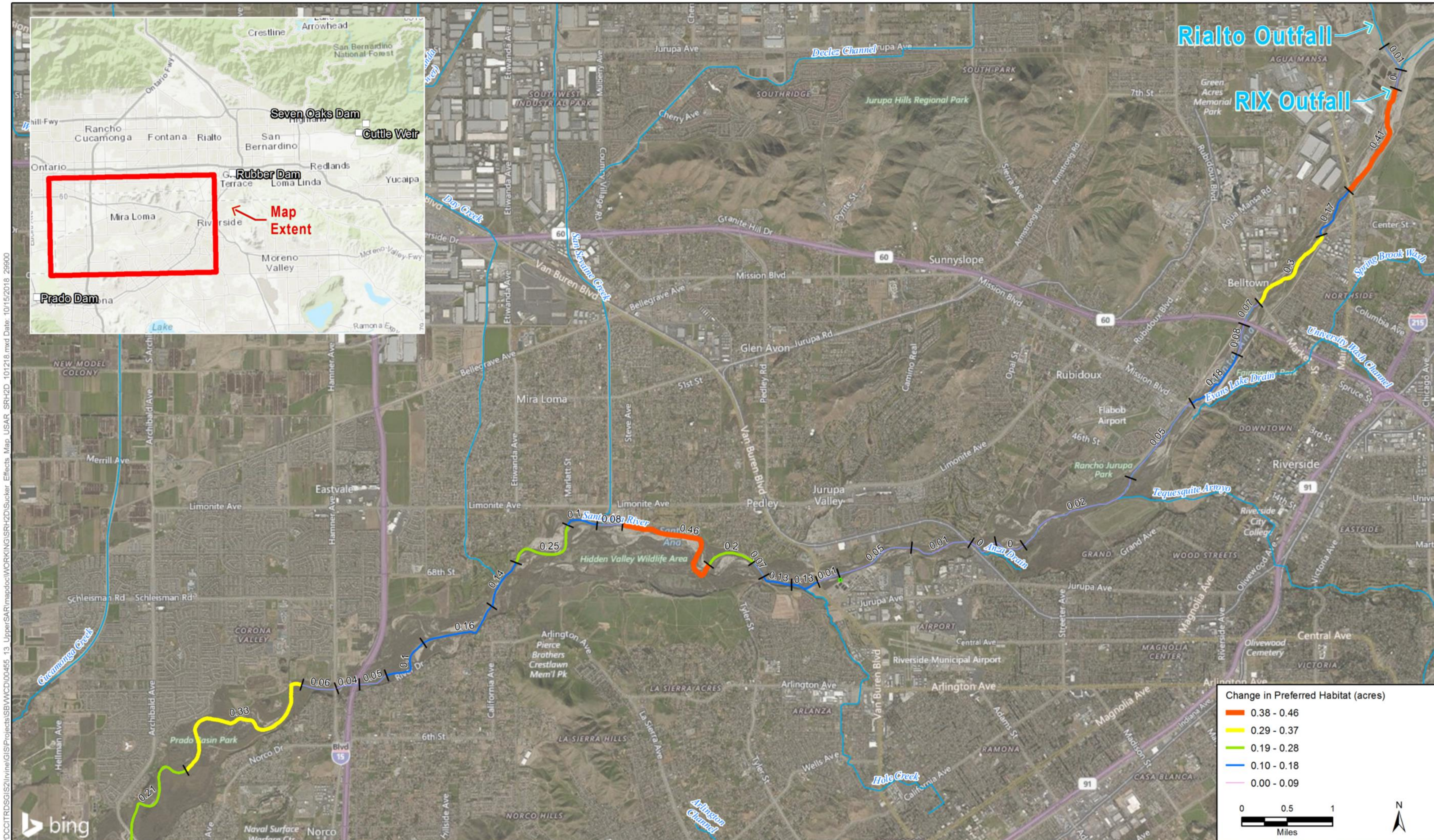

Figure E-16. Change in Preferred Habitat (acres) for the Santa Ana Sucker between Baseline and with Covered Activities Conditions

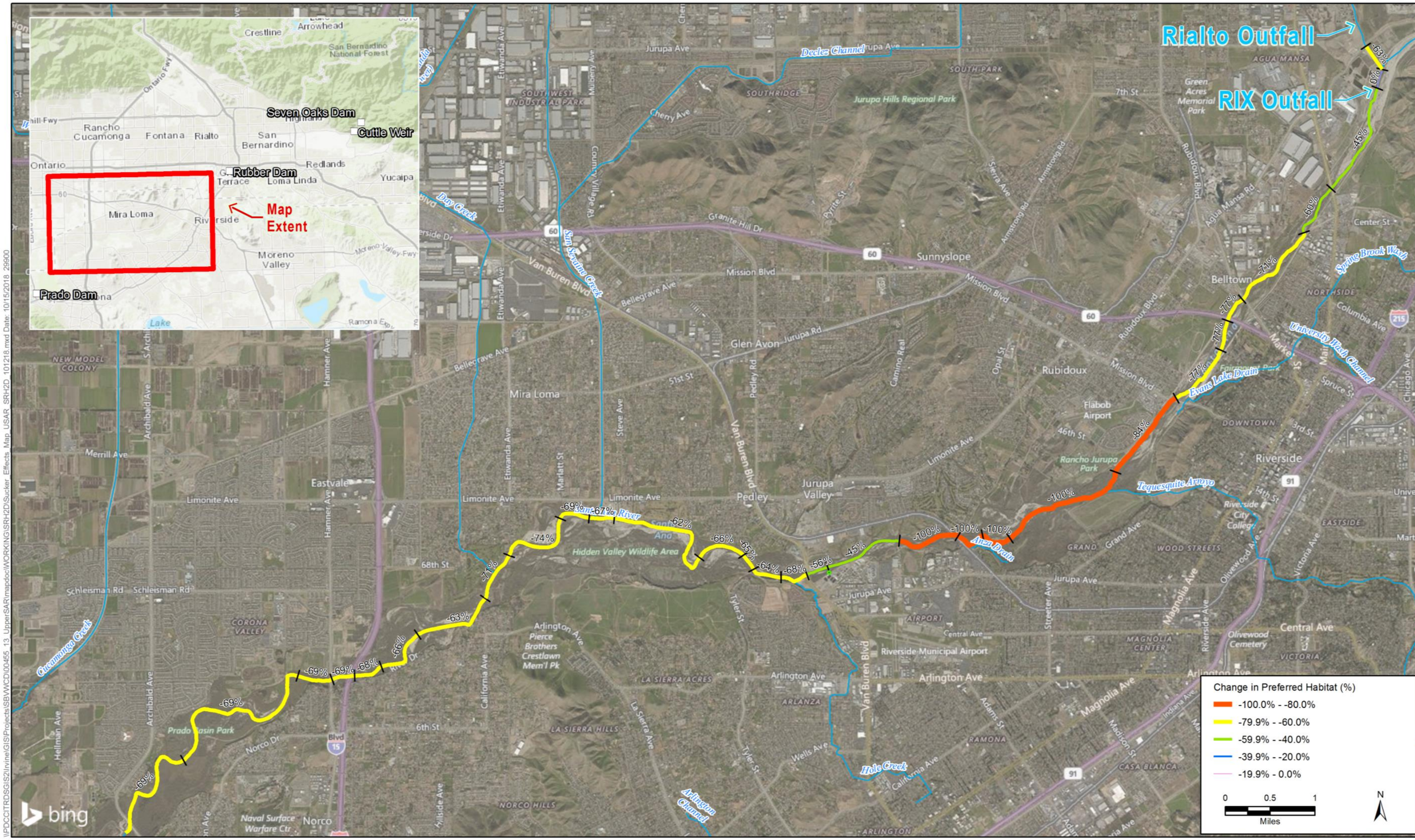

Figure E-17. Change in Preferred Habitat (%) for the Santa Ana Sucker between Baseline and with Covered Activities Conditions

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Appendix F

Covered Activity Impacts

SPECIES MODELS IMPACTS
City of Rialto Public Works (Rial)

Acres Impacted Permanent (Temporary)	Water Reuse Projects	Rialto Total
Species and Model Catgory	**Rial.1**	
Plants		
Slender-horned spineflower		
Current Occupied Habitat	-- (--)	-- (--)
Historic Occupied Habitat	-- (--)	-- (--)
Potentially Suitable Habitat	-- (--)	-- (--)
Santa Ana River woolly-star		
Potentially Suitable Habitat	-- (--)	-- (--)
Invertebrates		
Delhi sands flower-loving fly		
Potentially Suitable Habitat	-- (--)	-- (--)
Potentially Suitable Habitat (Extirpated)	-- (--)	-- (--)
Amphibians and Reptiles		
Arroyo toad		
Suitable Breeding Habitat	-- (--)	-- (--)
Non-Breeding Upland Habitat	-- (--)	-- (--)
Permeable Movement Area (Dev, Ag, Disturbed)	-- (--)	-- (--)
Mountain yellow-legged frog		
Potentially Suitable Aquatic Habitat	-- (--)	-- (--)
Refugia/Foraging/Dispersal Habitat	-- (--)	-- (--)
Western spadefoot		
Potentially Suitable Habitat	-- (0.2)	-- (0.2)
California glossy snake		
Potentially Suitable Habitat	-- (--)	-- (--)
South coast garter snake		
Potentially Suitable Habitat	-- (--)	-- (--)
Western pond turtle		
Aquatic Habitat	-- (--)	-- (--)
Potentially Suitable Upland Habitat	-- (--)	-- (--)
Birds		
Tricolored blackbird		
Suitable Colony Habitat	-- (--)	-- (--)
Breeding Season Foraging - Natural	7.8 (--)	7.8 (--)
Breeding Season Foraging - Agriculture	-- (--)	-- (--)
Non-Breeding Season Foraging - Natural	-- (--)	-- (--)
Non-Breeding Season Foraging - Agriculture	-- (--)	-- (--)
Burrowing owl		
Potentially Suitable Habitat	7.8 (0.2)	7.8 (0.2)
Cactus wren		
Known Suitable Nesting	-- (--)	-- (--)
Potential Nesting and Foraging Habitat	7.8 (0.2)	7.8 (0.2)
Recently Burned (2008 - 2018)	-- (--)	-- (--)
Yellow-breasted chat		
Potentially Suitable Habitat	1.2 (--)	1.2 (--)
Yellow-billed cuckoo		
High Value Breeding Habitat	-- (--)	-- (--)
Other Potentially Suitable Breeding Habitat	-- (--)	-- (--)
Southwestern willow flycatcher		
Core Southwestern Willow Flycatcher Habitat	-- (--)	-- (--)
Very High Value Habitat	-- (--)	-- (--)
High Value Habitat	-- (--)	-- (--)
Moderate Value Habitat	-- (--)	-- (--)
Other Potentially Suitable Habitat	1.2 (--)	1.2 (--)

SPECIES MODELS IMPACTS
City of Rialto Public Works (Rial)

Acres Impacted Permanent (Temporary)	Water Reuse Projects	Rialto Total
Species and Model Catgory	**Rial.1**	
Coastal California gnatcatcher		
Very High Value Habitat	-- (--)	-- (--)
High Value Habitat	-- (--)	-- (--)
Moderate Value Habitat	-- (--)	-- (--)
Low Value Habitat	-- (--)	-- (--)
Other Suitable Habitat	-- (--)	-- (--)
Least Bell's vireo		
Core Breeding Habitat	-- (--)	-- (--)
Other Breeding Habitat	1.2 (--)	1.2 (--)
Mammals		
Los Angeles pocket mouse		
Potentially Suitable Habitat	-- (0.2)	-- (0.2)
San Bernardino kangaroo rat		
Suitable Habitat	-- (--)	-- (--)

SPECIES MODELS IMPACTS
San Bernardino Valley Water Conservation District (CD)

Acres Impacted Permanent (Temporary)	Groundwater Recharge		Conservation District Total
Species and Model Catgory	CD.1	CD.2	
Plants			
Slender-horned spineflower			
Current Occupied Habitat	-- (--)	-- (--)	-- (--)
Historic Occupied Habitat	-- (--)	-- (--)	-- (--)
Potentially Suitable Habitat	0.1 (--)	-- (--)	0.1 (--)
Santa Ana River woolly-star			
Potentially Suitable Habitat	0.2 (--)	0.1 (--)	0.3 (--)
Invertebrates			
Delhi sands flower-loving fly			
Potentially Suitable Habitat	-- (--)	-- (--)	-- (--)
Potentially Suitable Habitat (Extirpated)	-- (--)	-- (--)	-- (--)
Amphibians and Reptiles			
Arroyo toad			
Suitable Breeding Habitat	-- (--)	-- (--)	-- (--)
Non-Breeding Upland Habitat	-- (--)	-- (--)	-- (--)
Permeable Movement Area (Dev, Ag, Disturbed)	-- (--)	-- (--)	-- (--)
Mountain yellow-legged frog			
Potentially Suitable Aquatic Habitat	-- (--)	-- (--)	-- (--)
Refugia/Foraging/Dispersal Habitat	-- (--)	-- (--)	-- (--)
Western spadefoot			
Potentially Suitable Habitat	0.1 (--)	0.1 (--)	0.2 (--)
California glossy snake			
Potentially Suitable Habitat	0.3 (--)	-- (--)	0.3 (--)
South coast garter snake			
Potentially Suitable Habitat	-- (--)	-- (--)	-- (--)
Western pond turtle			
Aquatic Habitat	-- (--)	-- (--)	-- (--)
Potentially Suitable Upland Habitat	-- (--)	-- (--)	-- (--)
Birds			
Tricolored blackbird			
Suitable Colony Habitat	-- (--)	-- (--)	-- (--)
Breeding Season Foraging - Natural	-- (--)	-- (--)	-- (--)
Breeding Season Foraging - Agriculture	-- (--)	-- (--)	-- (--)
Non-Breeding Season Foraging - Natural	-- (--)	-- (--)	-- (--)
Non-Breeding Season Foraging - Agriculture	-- (--)	-- (--)	-- (--)
Burrowing owl			
Potentially Suitable Habitat	-- (--)	-- (--)	-- (--)
Cactus wren			
Known Suitable Nesting	-- (--)	-- (--)	-- (--)
Potential Nesting and Foraging Habitat	0.1 (--)	-- (--)	0.1 (--)
Recently Burned (2008 - 2018)	-- (--)	-- (--)	-- (--)
Yellow-breasted chat			
Potentially Suitable Habitat	-- (--)	-- (--)	-- (--)
Yellow-billed cuckoo			
High Value Breeding Habitat	-- (--)	-- (--)	-- (--)
Other Potentially Suitable Breeding Habitat	-- (--)	-- (--)	-- (--)
Southwestern willow flycatcher			
Core Southwestern Willow Flycatcher Habitat	-- (--)	-- (--)	-- (--)
Very High Value Habitat	-- (--)	-- (--)	-- (--)
High Value Habitat	-- (--)	-- (--)	-- (--)
Moderate Value Habitat	-- (--)	-- (--)	-- (--)
Other Potentially Suitable Habitat	-- (--)	-- (--)	-- (--)

SPECIES MODELS IMPACTS
San Bernardino Valley Water Conservation District (CD)

Acres Impacted Permanent (Temporary)	Groundwater Recharge		Conservation District Total
Species and Model Catgory	**CD.1**	**CD.2**	
Coastal California gnatcatcher			
Very High Value Habitat	-- (--)	-- (--)	-- (--)
High Value Habitat	-- (--)	-- (--)	-- (--)
Moderate Value Habitat	0.1 (--)	-- (--)	0.1 (--)
Low Value Habitat	-- (--)	-- (--)	-- (--)
Other Suitable Habitat	-- (--)	-- (--)	-- (--)
Least Bell's vireo			
Core Breeding Habitat	-- (--)	-- (--)	-- (--)
Other Breeding Habitat	-- (--)	-- (--)	-- (--)
Mammals			
Los Angeles pocket mouse			
Potentially Suitable Habitat	0.1 (--)	-- (--)	0.1 (--)
San Bernardino kangaroo rat			
Suitable Habitat	0.3 (--)	0.1 (--)	0.4 (--)

SPECIES MODELS IMPACTS
East Valley Water District (EV)

Acres Impacted Permanent (Temporary) *facility is an existing basin subject to routine O&M activities	Water Reuse Projects			Groundwater Recharge	Wells and Water Conveyance Infrastructure			East Valley Total
Species and Model Catgory	**EV.1**	**EV.4.01**	**EV.4.02**	**EV.4.03***	**EV.2**	**EV.3**	**EV.5**	
Plants								
Slender-horned spineflower								
Current Occupied Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Historic Occupied Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Potentially Suitable Habitat	0.1 (--)	-- (--)	-- (--)	19.1 (--)	-- (1.5)	2.1 (--)	0.8 (0.2)	22.1 (1.7)
Santa Ana River woolly-star								
Potentially Suitable Habitat	-- (--)	-- (--)	-- (0.2)	19.1 (--)	-- (0.9)	2.1 (--)	0.3 (0.2)	21.5 (1.3)
Invertebrates								
Delhi sands flower-loving fly								
Potentially Suitable Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Potentially Suitable Habitat (Extirpated)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Amphibians and Reptiles								
Arroyo toad								
Suitable Breeding Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Non-Breeding Upland Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Permeable Movement Area (Dev, Ag, Disturbed)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Mountain yellow-legged frog								
Potentially Suitable Aquatic Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Refugia/Foraging/Dispersal Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (0.1)	0.5 (--)	0.3 (--)	0.8 (0.1)
Western spadefoot								
Potentially Suitable Habitat	0.1 (--)	-- (--)	-- (0.3)	24.1 (--)	-- (0.7)	1.7 (--)	0.4 (0.2)	26.3 (1.2)
California glossy snake								
Potentially Suitable Habitat	0.1 (--)	17.0 (--)	-- (1.5)	24.2 (--)	-- (2.4)	4.9 (--)	1.2 (0.2)	47.4 (4.1)
South coast garter snake								
Potentially Suitable Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Western pond turtle								
Aquatic Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Potentially Suitable Upland Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Birds								
Tricolored blackbird								
Suitable Colony Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Breeding Season Foraging - Natural	-- (--)	17.0 (--)	-- (1.0)	-- (--)	-- (0.3)	2.1 (--)	-- (--)	19.1 (1.3)
Breeding Season Foraging - Agriculture	-- (--)	-- (--)	-- (--)	-- (--)	-- (0.1)	-- (--)	-- (--)	-- (0.1)
Non-Breeding Season Foraging - Natural	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Non-Breeding Season Foraging - Agriculture	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Burrowing owl								

SPECIES MODELS IMPACTS
East Valley Water District (EV)

Acres Impacted Permanent (Temporary) *facility is an existing basin subject to routine O&M activities	Water Reuse Projects			Groundwater Recharge	Wells and Water Conveyance Infrastructure			East Valley Total
Species and Model Catgory	**EV.1**	**EV.4.01**	**EV.4.02**	**EV.4.03***	**EV.2**	**EV.3**	**EV.5**	
Potentially Suitable Habitat	-- (--)	17.0 (--)	-- (1.5)	38.2 (--)	-- (2.3)	4.6 (--)	0.9 (0.3)	60.7 (4.1)
Cactus wren								
Known Suitable Nesting	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	0.1 (--)	0.1 (--)
Potential Nesting and Foraging Habitat	-- (--)	17.0 (--)	-- (1.3)	24.2 (--)	-- (2.3)	4.6 (--)	0.8 (0.3)	46.6 (3.9)
Recently Burned (2008 - 2018)	0.1 (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	0.1 (--)
Yellow-breasted chat								
Potentially Suitable Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (0.1)	0.1 (--)	-- (--)	0.1 (0.1)
Yellow-billed cuckoo								
High Value Breeding Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Other Potentially Suitable Breeding Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Southwestern willow flycatcher								
Core Southwestern Willow Flycatcher Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Very High Value Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
High Value Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Moderate Value Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Other Potentially Suitable Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (0.1)	0.1 (--)	-- (--)	0.1 (0.1)
Coastal California gnatcatcher								
Very High Value Habitat	-- (--)	-- (--)	-- (--)	10.6 (--)	-- (0.2)	0.2 (--)	-- (0.1)	10.8 (0.3)
High Value Habitat	-- (--)	-- (--)	-- (--)	2.5 (--)	-- (0.3)	1.0 (--)	0.3 (--)	3.8 (0.3)
Moderate Value Habitat	0.1 (--)	-- (--)	-- (--)	4.8 (--)	-- (0.3)	0.6 (--)	-- (0.2)	5.5 (0.5)
Low Value Habitat	-- (--)	-- (--)	-- (--)	1.2 (--)	-- (0.4)	0.1 (--)	0.4 (--)	1.7 (0.4)
Other Suitable Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Least Bell's vireo								
Core Breeding Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Other Breeding Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (0.1)	0.1 (--)	-- (--)	0.1 (0.1)
Mammals								
Los Angeles pocket mouse								
Potentially Suitable Habitat	0.1 (--)	17.0 (--)	-- (1.3)	24.2 (--)	-- (1.8)	4.4 (--)	0.6 (0.2)	46.3 (3.3)
San Bernardino kangaroo rat								
Suitable Habitat	-- (--)	-- (--)	-- (1.4)	41.1 (--)	-- (1.4)	3.5 (--)	1.0 (0.5)	45.6 (3.3)

SPECIES MODELS IMPACTS
Inland Empire Utilities Agency (IEUA)

Acres Impacted Permanent (Temporary) *facility is an existing basin subject to routine O&M activities	Water Reuse Projects	Groundwater Recharge																		Habitat Improvement, Management, and Monitoring	IEUA Total
Species and Model Catgory	**IEUA.4**	**IEUA.1.01***	**IEUA.1.02***	**IEUA.1.03***	**IEUA.1.05***	**IEUA.1.07***	**IEUA.1.09***	**IEUA.1.10***	**IEUA.1.11***	**IEUA.1.12**	**IEUA.2.01***	**IEUA.2.03***	**IEUA.2.04***	**IEUA.2.05***	**IEUA.2.06***	**IEUA.2.08***	**IEUA.3.01**	**IEUA.3.02**	**IEUA.3.04**	**IEUA.1.13**	
Plants																					
Slender-horned spineflower																					
Current Occupied Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Historic Occupied Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Potentially Suitable Habitat	-- (--)	-- (--)	-- (--)	-- (0.1)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	13.6 (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	13.6 (0.1)
Santa Ana River woolly-star																					
Potentially Suitable Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	3.2 (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	3.2 (--)
Invertebrates																					
Delhi sands flower-loving fly																					
Potentially Suitable Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Potentially Suitable Habitat	-- (--)	63.4 (--)	-- (--)	-- (--)	-- (--)	22.0 (--)	-- (--)	-- (--)	-- (--)	14.3 (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	99.7 (--)
Amphibians and Reptiles																					
Arroyo toad																					
Suitable Breeding Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	24.9 (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	24.9 (--)
Non-Breeding Upland Habitat	-- (--)	-- (--)	-- (--)	5.7 (0.3)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	16.4 (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	22.1 (0.3)
Permeable Movement Area (Dev, Ag, Disturbed)	-- (--)	-- (--)	-- (--)	61.9 (1.9)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	1.0 (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	62.9 (1.9)
Mountain yellow-legged frog																					
Potentially Suitable Aquatic Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Refugia/Foraging/Dispersal Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Western spadefoot																					
Potentially Suitable Habitat	-- (--)	-- (--)	-- (--)	63.2 (0.3)	-- (--)	11.9 (--)	-- (--)	6.7 (--)	-- (--)	12.1 (--)	-- (--)	-- (--)	-- (--)	14.5 (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	108.4 (0.3)
California glossy snake																					
Potentially Suitable Habitat	-- (--)	-- (--)	-- (--)	16.3 (0.3)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	13.6 (--)	-- (--)	-- (--)	-- (--)	41.1 (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	71.0 (0.3)
South coast garter snake																					
Potentially Suitable Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Western pond turtle																					
Aquatic Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Potentially Suitable Upland Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Birds																					
Tricolored blackbird																					
Suitable Colony Habitat	-- (--)	28.1 (--)	0.2 (--)	-- (--)	-- (--)	-- (--)	2.8 (--)	-- (--)	3.3 (--)	-- (--)	6.0 (--)	-- (--)	-- (--)	-- (--)	7.6 (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	48.0 (--)
Breeding Season Foraging - Natural	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	7.6 (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	7.6 (--)
Breeding Season Foraging - Agriculture	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Non-Breeding Season Foraging - Natural	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Non-Breeding Season Foraging - Agriculture	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Burrowing owl																					
Potentially Suitable Habitat	-- (--)	-- (--)	15.1 (--)	40.0 (0.3)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	13.6 (--)	-- (--)	-- (--)	-- (--)	16.5 (--)	7.6 (--)	14.1 (--)	-- (--)	-- (--)	-- (--)	-- (--)	106.9 (0.3)
Cactus wren																					
Known Suitable Nesting	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Potential Nesting and Foraging Habitat	-- (--)	-- (--)	15.1 (--)	40.0 (0.3)	1.8 (--)	-- (--)	-- (--)	-- (--)	-- (--)	13.6 (--)	0.1 (--)	8.2 (--)	-- (--)	16.5 (--)	7.6 (--)	14.1 (--)	-- (--)	-- (--)	-- (--)	-- (--)	117.0 (0.3)
Recently Burned (2008 - 2018)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Yellow-breasted chat																					
Potentially Suitable Habitat	-- (--)	25.4 (--)	0.2 (--)	14.0 (--)	-- (--)	1.1 (--)	2.1 (--)	-- (--)	2.8 (--)	-- (--)	6.0 (--)	-- (--)	-- (--)	-- (--)	7.6 (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	59.2 (--)
Yellow-billed cuckoo																					
High Value Breeding Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Other Potentially Suitable Breeding Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Southwestern willow flycatcher																					
Core Southwestern Willow Flycatcher Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Very High Value Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
High Value Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Moderate Value Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Other Potentially Suitable Habitat	-- (--)	25.4 (--)	0.2 (--)	14.0 (--)	-- (--)	1.1 (--)	2.1 (--)	-- (--)	2.8 (--)	-- (--)	6.0 (--)	-- (--)	-- (--)	-- (--)	7.6 (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	59.2 (--)
Coastal California gnatcatcher																					
Very High Value Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)

SPECIES MODELS IMPACTS
Inland Empire Utilities Agency (IEUA)

Acres Impacted Permanent (Temporary) *facility is an existing basin subject to routine O&M activities	Water Reuse Projects	Groundwater Recharge																		Habitat Improvement, Management, and Monitoring	IEUA Total
Species and Model Catgory	**IEUA.4**	**IEUA.1.01***	**IEUA.1.02***	**IEUA.1.03***	**IEUA.1.05***	**IEUA.1.07***	**IEUA.1.09***	**IEUA.1.10***	**IEUA.1.11***	**IEUA.1.12**	**IEUA.2.01***	**IEUA.2.03***	**IEUA.2.04***	**IEUA.2.05***	**IEUA.2.06***	**IEUA.2.08***	**IEUA.3.01**	**IEUA.3.02**	**IEUA.3.04**	**IEUA.1.13**	
High Value Habitat	-- (--)	-- (--)	0.7 (--)	0.8 (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	1.5 (--)
Moderate Value Habitat	-- (--)	-- (--)	4.0 (--)	3.9 (0.1)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	4.9 (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	12.8 (0.1)
Low Value Habitat	-- (--)	-- (--)	6.6 (--)	7.7 (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	8.7 (--)	-- (--)	2.7 (--)	4.8 (--)	36.7 (--)	-- (--)	12.9 (--)	-- (--)	-- (--)	-- (--)	-- (--)	80.1 (--)
Other Suitable Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Least Bell's vireo																					
Core Breeding Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Other Breeding Habitat	-- (--)	25.4 (--)	0.2 (--)	14.0 (--)	-- (--)	1.1 (--)	2.1 (--)	-- (--)	2.8 (--)	-- (--)	6.0 (--)	-- (--)	-- (--)	-- (--)	7.6 (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	59.2 (--)
Mammals																					
Los Angeles pocket mouse																					
Potentially Suitable Habitat	-- (--)	-- (--)	15.1 (--)	40.0 (0.3)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	13.6 (--)	0.1 (--)	8.2 (--)	-- (--)	16.5 (--)	7.6 (--)	14.1 (--)	-- (--)	-- (--)	-- (--)	-- (--)	115.2 (0.3)
San Bernardino kangaroo rat																					
Suitable Habitat	-- (--)	-- (--)	31.5 (--)	68.7 (0.1)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	42.1 (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	142.3 (0.1)

SPECIES MODELS IMPACTS
Metropolitan Water District of Southern California (Met)

Acres Impacted Permanent (Temporary)	Wells and Water Conveyance Infrastructure			Metropolitan Total
Species and Model Catgory	**Met.1**	**Met.2**	**Met.3**	
Plants				
Slender-horned spineflower				
Current Occupied Habitat	-- (--)	-- (--)	-- (--)	-- (--)
Historic Occupied Habitat	-- (--)	-- (--)	-- (--)	-- (--)
Potentially Suitable Habitat	-- (--)	-- (12.4)	29.2 (--)	29.2 (12.4)
Santa Ana River woolly-star				
Potentially Suitable Habitat	-- (--)	-- (4.6)	9.5 (--)	9.5 (4.6)
Invertebrates				
Delhi sands flower-loving fly				
Potentially Suitable Habitat	-- (--)	-- (--)	0.2 (--)	0.2 (--)
Potentially Suitable Habitat (Extirpated)	-- (--)	-- (0.1)	0.1 (--)	0.1 (0.1)
Amphibians and Reptiles				
Arroyo toad				
Suitable Breeding Habitat	-- (--)	-- (0.1)	0.3 (--)	0.3 (0.1)
Non-Breeding Upland Habitat	-- (--)	-- (1.0)	0.9 (--)	0.9 (1.0)
Permeable Movement Area (Dev, Ag, Disturbed)	-- (--)	-- (2.1)	3.4 (--)	3.4 (2.1)
Mountain yellow-legged frog				
Potentially Suitable Aquatic Habitat	-- (--)	-- (--)	0.5 (--)	0.5 (--)
Refugia/Foraging/Dispersal Habitat	-- (--)	-- (5.3)	11.7 (--)	11.7 (5.3)
Western spadefoot				
Potentially Suitable Habitat	-- (--)	-- (9.6)	19.7 (--)	19.7 (9.6)
California glossy snake				
Potentially Suitable Habitat	0.1 (--)	-- (18.2)	38.5 (--)	38.6 (18.2)
South coast garter snake				
Potentially Suitable Habitat	0.1 (--)	-- (0.4)	2.7 (--)	2.8 (0.4)
Western pond turtle				
Aquatic Habitat	-- (--)	-- (--)	0.6 (--)	0.6 (--)
Potentially Suitable Upland Habitat	0.1 (--)	-- (1.3)	6.1 (--)	6.2 (1.3)
Birds				
Tricolored blackbird				
Suitable Colony Habitat	-- (--)	-- (0.1)	0.4 (--)	0.4 (0.1)
Breeding Season Foraging - Natural	-- (--)	-- (7.0)	15.7 (--)	15.7 (7.0)
Breeding Season Foraging - Agriculture	-- (--)	-- (4.1)	15.1 (--)	15.1 (4.1)
Non-Breeding Season Foraging - Natural	-- (--)	-- (0.1)	0.3 (--)	0.3 (0.1)
Non-Breeding Season Foraging - Agriculture	-- (--)	-- (--)	-- (--)	-- (--)
Burrowing owl				
Potentially Suitable Habitat	0.1 (--)	-- (23.8)	63.5 (--)	63.6 (23.8)
Cactus wren				
Known Suitable Nesting	-- (--)	-- (0.1)	0.1 (--)	0.1 (0.1)
Potential Nesting and Foraging Habitat	0.1 (--)	-- (20.6)	48.9 (--)	49.0 (20.6)
Recently Burned (2008 - 2018)	-- (--)	-- (0.7)	1.1 (--)	1.1 (0.7)
Yellow-breasted chat				
Potentially Suitable Habitat	-- (--)	-- (0.6)	3.0 (--)	3.0 (0.6)
Yellow-billed cuckoo				
High Value Breeding Habitat	-- (--)	-- (--)	-- (--)	-- (--)
Other Potentially Suitable Breeding Habitat	-- (--)	-- (--)	0.1 (--)	0.1 (--)
Southwestern willow flycatcher				
Core Southwestern Willow Flycatcher Habitat	-- (--)	-- (--)	-- (--)	-- (--)
Very High Value Habitat	-- (--)	-- (--)	-- (--)	-- (--)
High Value Habitat	-- (--)	-- (--)	-- (--)	-- (--)
Moderate Value Habitat	-- (--)	-- (--)	-- (--)	-- (--)
Other Potentially Suitable Habitat	-- (--)	-- (0.6)	3.0 (--)	3.0 (0.6)

SPECIES MODELS IMPACTS
Metropolitan Water District of Southern California (Met)

Acres Impacted Permanent (Temporary)	Wells and Water Conveyance Infrastructure			Metropolitan Total
Species and Model Catgory	**Met.1**	**Met.2**	**Met.3**	
Coastal California gnatcatcher				
Very High Value Habitat	-- (--)	-- (1.2)	1.9 (--)	1.9 (1.2)
High Value Habitat	-- (--)	-- (0.9)	2.3 (--)	2.3 (0.9)
Moderate Value Habitat	-- (--)	-- (1.8)	5.7 (--)	5.7 (1.8)
Low Value Habitat	-- (--)	-- (6.9)	14.2 (--)	14.2 (6.9)
Other Suitable Habitat	-- (--)	-- (0.2)	0.8 (--)	0.8 (0.2)
Least Bell's vireo				
Core Breeding Habitat	-- (--)	-- (--)	0.2 (--)	0.2 (--)
Other Breeding Habitat	-- (--)	-- (0.5)	2.8 (--)	2.8 (0.5)
Mammals				
Los Angeles pocket mouse				
Potentially Suitable Habitat	0.1 (--)	-- (16.0)	32.0 (--)	32.1 (16.0)
San Bernardino kangaroo rat				
Suitable Habitat	-- (--)	-- (9.0)	18.5 (--)	18.5 (9.0)

SPECIES MODELS IMPACTS
Orange County Water District (OCWD)

Acres Impacted Permanent (Temporary)	Wells and Water Conveyance Infrastructure	Habitat Improvement, Management, and Monitoring		OCWD Total
Species and Model Catgory	**OCWD.1**	**Conserv.10**	**Conserv.11**	
Plants				
Slender-horned spineflower				
Current Occupied Habitat	-- (--)	-- (--)	-- (--)	-- (--)
Historic Occupied Habitat	-- (--)	-- (--)	-- (--)	-- (--)
Potentially Suitable Habitat	-- (--)	-- (--)	-- (--)	-- (--)
Santa Ana River woolly-star				
Potentially Suitable Habitat	-- (7.7)	-- (--)	-- (--)	-- (7.7)
Invertebrates				
Delhi sands flower-loving fly				
Potentially Suitable Habitat	-- (--)	-- (--)	-- (--)	-- (--)
Potentially Suitable Habitat (Extirpated)	-- (1.5)	-- (--)	-- (--)	-- (1.5)
Amphibians and Reptiles				
Arroyo toad				
Suitable Breeding Habitat	-- (--)	-- (--)	-- (--)	-- (--)
Non-Breeding Upland Habitat	-- (--)	-- (--)	-- (--)	-- (--)
Permeable Movement Area (Dev, Ag, Disturbed)	-- (--)	-- (--)	-- (--)	-- (--)
Mountain yellow-legged frog				
Potentially Suitable Aquatic Habitat	-- (--)	-- (--)	-- (--)	-- (--)
Refugia/Foraging/Dispersal Habitat	-- (--)	-- (--)	-- (--)	-- (--)
Western spadefoot				
Potentially Suitable Habitat	-- (--)	-- (--)	-- (--)	-- (--)
California glossy snake				
Potentially Suitable Habitat	-- (--)	-- (--)	-- (--)	-- (--)
South coast garter snake				
Potentially Suitable Habitat	-- (36.9)	-- (--)	-- (--)	-- (36.9)
Western pond turtle				
Aquatic Habitat	-- (4.0)	-- (--)	-- (--)	-- (4.0)
Potentially Suitable Upland Habitat	-- (39.9)	-- (--)	-- (--)	-- (39.9)
Birds				
Tricolored blackbird				
Suitable Colony Habitat	-- (9.3)	-- (--)	-- (--)	-- (9.3)
Breeding Season Foraging - Natural	-- (--)	-- (--)	-- (--)	-- (--)
Breeding Season Foraging - Agriculture	-- (0.1)	-- (--)	-- (--)	-- (0.1)
Non-Breeding Season Foraging - Natural	-- (--)	-- (--)	-- (--)	-- (--)
Non-Breeding Season Foraging - Agriculture	-- (--)	-- (--)	-- (--)	-- (--)
Burrowing owl				
Potentially Suitable Habitat	-- (0.1)	-- (--)	-- (--)	-- (0.1)
Cactus wren				
Known Suitable Nesting	-- (--)	-- (--)	-- (--)	-- (--)
Potential Nesting and Foraging Habitat	-- (--)	-- (--)	-- (--)	-- (--)
Recently Burned (2008 - 2018)	-- (--)	-- (--)	-- (--)	-- (--)
Yellow-breasted chat				
Potentially Suitable Habitat	-- (15.4)	-- (--)	-- (--)	-- (15.4)
Yellow-billed cuckoo				
High Value Breeding Habitat	-- (0.6)	-- (--)	-- (--)	-- (0.6)
Other Potentially Suitable Breeding Habitat	-- (--)	-- (--)	-- (--)	-- (--)
Southwestern willow flycatcher				
Core Southwestern Willow Flycatcher Habitat	-- (0.8)	-- (--)	-- (--)	-- (0.8)
Very High Value Habitat	-- (0.3)	-- (--)	-- (--)	-- (0.3)
High Value Habitat	-- (0.2)	-- (--)	-- (--)	-- (0.2)
Moderate Value Habitat	-- (0.1)	-- (--)	-- (--)	-- (0.1)
Other Potentially Suitable Habitat	-- (14.1)	-- (--)	-- (--)	-- (14.1)
Coastal California gnatcatcher				
Very High Value Habitat	-- (--)	-- (--)	-- (--)	-- (--)

SPECIES MODELS IMPACTS
Orange County Water District (OCWD)

Acres Impacted Permanent (Temporary)	Wells and Water Conveyance Infrastructure	Habitat Improvement, Management, and Monitoring		OCWD Total
Species and Model Catgory	**OCWD.1**	**Conserv.10**	**Conserv.11**	
High Value Habitat	-- (--)	-- (--)	-- (--)	-- (--)
Moderate Value Habitat	-- (--)	-- (--)	-- (--)	-- (--)
Low Value Habitat	-- (--)	-- (--)	-- (--)	-- (--)
Other Suitable Habitat	-- (--)	-- (--)	-- (--)	-- (--)
Least Bell's vireo				
Core Breeding Habitat	-- (15.4)	-- (--)	-- (--)	-- (15.4)
Other Breeding Habitat	-- (--)	-- (--)	-- (--)	-- (--)
Mammals				
Los Angeles pocket mouse				
Potentially Suitable Habitat	-- (--)	-- (--)	-- (--)	-- (--)
San Bernardino kangaroo rat				
Suitable Habitat	-- (--)	-- (--)	-- (--)	-- (--)

SPECIES MODELS IMPACTS
Riverside Public Utilities (RPU)

Acres Impacted Permanent (Temporary)	Water Reuse Projects	Groundwater Recharge		Wells and Water Conveyance Infrastructure											Solar Energy Development	RPU Total
Species and Model Catgory	**RPU.09**	**RPU.05**	**RPU.08**	**RPU.01**	**RPU.02**	**RPU.03**	**RPU.04**	**RPU.06**	**RPU.07**	**RPU.10**	**RPU.12**	**RPU.13**	**RPU.14**	**RPU.15**	**RPU.11**	
Plants																
Slender-horned spineflower																
Current Occupied Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Historic Occupied Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Potentially Suitable Habitat	-- (--)	-- (--)	-- (--)	-- (0.2)	-- (2.2)	-- (0.2)	-- (--)	-- (0.8)	-- (0.1)	-- (2.9)	40.5 (--)	-- (--)	-- (0.1)	-- (0.4)	5.5 (--)	46.0 (6.9)
Santa Ana River woolly-star																
Potentially Suitable Habitat	-- (--)	5.0 (--)	-- (--)	-- (0.8)	-- (3.2)	-- (2.6)	-- (--)	-- (0.8)	-- (1.0)	-- (0.5)	42.2 (--)	-- (--)	-- (0.4)	-- (0.2)	5.5 (--)	52.7 (9.5)
Invertebrates																
Delhi sands flower-loving fly																
Potentially Suitable Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (0.1)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (0.1)
Potentially Suitable Habitat (Extirpated)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Amphibians and Reptiles																
Arroyo toad																
Suitable Breeding Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Non-Breeding Upland Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Permeable Movement Area (Dev, Ag, Disturbed)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Mountain yellow-legged frog																
Potentially Suitable Aquatic Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Refugia/Foraging/Dispersal Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Western spadefoot																
Potentially Suitable Habitat	2.5 (--)	57.5 (--)	-- (--)	-- (--)	-- (4.5)	-- (0.3)	-- (--)	-- (0.2)	-- (0.7)	-- (--)	117.7 (--)	0.9 (--)	-- (0.3)	-- (0.8)	15.3 (--)	193.9 (6.8)
California glossy snake																
Potentially Suitable Habitat	2.5 (--)	94.1 (--)	13.2 (--)	-- (3.4)	-- (5.8)	-- (3.5)	-- (--)	-- (0.8)	-- (1.1)	-- (5.4)	138.4 (--)	1.0 (--)	-- (1.0)	-- (2.1)	15.7 (--)	264.9 (23.1)
South coast garter snake																
Potentially Suitable Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (3.9)	11.7 (--)	-- (--)	-- (--)	-- (0.2)	-- (--)	11.7 (4.1)
Western pond turtle																
Aquatic Habitat	-- (--)	-- (--)	-- (--)	-- (0.4)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	0.2 (--)	-- (--)	-- (--)	-- (0.2)	-- (--)	0.2 (0.6)
Potentially Suitable Upland Habitat	-- (--)	-- (--)	-- (--)	-- (2.1)	-- (--)	-- (--)	0.7 (--)	-- (--)	-- (--)	-- (5.5)	11.2 (--)	-- (--)	-- (--)	-- (0.5)	-- (--)	11.9 (8.1)
Birds																
Tricolored blackbird																
Suitable Colony Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (0.1)	-- (--)	-- (--)	-- (--)	-- (0.1)	-- (0.2)	2.9 (--)	-- (--)	-- (--)	-- (--)	-- (--)	2.9 (0.4)
Breeding Season Foraging - Natural	-- (--)	51.2 (--)	6.9 (--)	-- (0.9)	-- (0.7)	-- (--)	-- (--)	-- (--)	-- (--)	-- (0.3)	39.8 (--)	0.9 (--)	-- (--)	-- (0.9)	5.6 (--)	104.4 (2.8)
Breeding Season Foraging - Agriculture	-- (--)	-- (--)	4.8 (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (1.7)	-- (--)	4.8 (1.7)
Non-Breeding Season Foraging - Natural	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Non-Breeding Season Foraging - Agriculture	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Burrowing owl																
Potentially Suitable Habitat	2.5 (--)	52.5 (--)	0.7 (--)	-- (1.2)	-- (4.6)	-- (0.2)	-- (--)	-- (0.8)	-- (0.2)	-- (7.3)	136.5 (--)	0.9 (--)	-- (0.1)	-- (3.6)	15.7 (--)	208.8 (18.0)
Cactus wren																
Known Suitable Nesting	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Potential Nesting and Foraging Habitat	2.5 (--)	52.5 (--)	13.2 (--)	-- (1.2)	-- (4.6)	-- (0.2)	-- (--)	-- (0.8)	-- (0.2)	-- (8.7)	136.4 (--)	0.9 (--)	-- (0.1)	-- (2.2)	15.7 (--)	221.2 (18.0)
Recently Burned (2008 - 2018)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Yellow-breasted chat																
Potentially Suitable Habitat	-- (--)	6.0 (--)	1.3 (--)	-- (1.1)	-- (0.3)	-- (0.3)	0.7 (--)	-- (--)	-- (0.6)	-- (4.4)	27.7 (--)	-- (--)	-- (0.4)	-- (0.5)	-- (--)	35.7 (7.6)
Yellow-billed cuckoo																
High Value Breeding Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Other Potentially Suitable Breeding Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	0.3 (--)	-- (--)	-- (--)	-- (3.6)	8.3 (--)	-- (--)	-- (--)	-- (0.2)	-- (--)	8.6 (3.8)
Southwestern willow flycatcher																
Core Southwestern Willow Flycatcher Habitat	-- (--)	6.0 (--)	-- (--)	-- (1.1)	-- (--)	-- (0.2)	0.4 (--)	-- (--)	-- (--)	-- (--)	9.1 (--)	-- (--)	-- (0.4)	-- (0.1)	-- (--)	15.5 (1.8)
Very High Value Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (0.1)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (0.1)
High Value Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Moderate Value Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Other Potentially Suitable Habitat	-- (--)	-- (--)	1.3 (--)	-- (--)	-- (0.3)	-- (--)	0.3 (--)	-- (--)	-- (0.6)	-- (4.3)	18.6 (--)	-- (--)	-- (--)	-- (0.4)	-- (--)	20.2 (5.6)
Coastal California gnatcatcher																
Very High Value Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (0.6)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	6.7 (--)	-- (--)	-- (--)	-- (--)	0.7 (--)	7.4 (0.6)

SPECIES MODELS IMPACTS
Riverside Public Utilities (RPU)

Acres Impacted Permanent (Temporary)	Water Reuse Projects	Groundwater Recharge		Wells and Water Conveyance Infrastructure											Solar Energy Development	RPU Total
Species and Model Catgory	**RPU.09**	**RPU.05**	**RPU.08**	**RPU.01**	**RPU.02**	**RPU.03**	**RPU.04**	**RPU.06**	**RPU.07**	**RPU.10**	**RPU.12**	**RPU.13**	**RPU.14**	**RPU.15**	**RPU.11**	
High Value Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (0.8)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	2.2 (--)	-- (--)	-- (--)	-- (--)	-- (--)	2.2 (0.8)
Moderate Value Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (0.4)	-- (--)	-- (--)	-- (--)	-- (0.2)	-- (0.3)	2.7 (--)	-- (--)	-- (0.1)	-- (0.1)	-- (--)	2.7 (1.1)
Low Value Habitat	-- (--)	-- (--)	-- (--)	-- (0.2)	-- (1.8)	-- (0.2)	-- (--)	-- (--)	-- (--)	-- (2.4)	33.1 (--)	-- (--)	-- (--)	-- (0.2)	4.8 (--)	37.9 (4.8)
Other Suitable Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (0.1)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (0.1)
Least Bell's vireo																
Core Breeding Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (1.0)	-- (--)	-- (--)	-- (--)	-- (0.1)	-- (--)	-- (1.1)
Other Breeding Habitat	-- (--)	6.0 (--)	1.3 (--)	-- (1.1)	-- (0.3)	-- (0.3)	0.7 (--)	-- (--)	-- (0.6)	-- (3.5)	27.7 (--)	-- (--)	-- (0.4)	-- (0.3)	-- (--)	35.7 (6.5)
Mammals																
Los Angeles pocket mouse																
Potentially Suitable Habitat	2.5 (--)	52.5 (--)	13.2 (--)	-- (1.1)	-- (4.6)	-- (0.2)	-- (--)	-- (0.8)	-- (0.2)	-- (5.4)	136.4 (--)	0.9 (--)	-- (0.1)	-- (1.8)	15.7 (--)	221.2 (14.2)
San Bernardino kangaroo rat																
Suitable Habitat	-- (--)	5.0 (--)	-- (--)	-- (0.8)	-- (2.1)	-- (2.6)	-- (--)	-- (--)	-- (0.3)	-- (--)	9.7 (--)	-- (--)	-- (0.4)	-- (0.1)	3.0 (--)	17.7 (6.3)

SPECIES MODELS IMPACTS
San Bernardino Valley Municipal Water District (VD)

Acres Impacted Permanent (Temporary) *facility is an existing basin subject to routine O&M activities	Groundwater Recharge															Wells and Water Conveyance Infrastructure
Species and Model Catgory	**VD.1***	**VD.2.02**	**VD.2.03**	**VD.2.04**	**VD.2.05**	**VD.2.06**	**VD.2.07**	**VD.2.08**	**VD.2.09**	**VD.2.10**	**VD.2.11***	**VD.2.12***	**VD.2.13***	**VD.2.14***	**VD.3**	**VD.4**
Plants																
Slender-horned spineflower																
Current Occupied Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Historic Occupied Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Potentially Suitable Habitat	-- (--)	69.5 (--)	10.6 (--)	0.8 (--)	17.7 (--)	21.6 (--)	0.5 (--)	32.9 (--)	7.4 (--)	1.9 (--)	2.4 (--)	5.8 (--)	3.4 (--)	-- (--)	-- (11.0)	-- (15.1)
Santa Ana River woolly-star																
Potentially Suitable Habitat	6.2 (--)	77.4 (--)	62.4 (--)	0.6 (--)	20.4 (--)	24.2 (--)	0.5 (--)	23.1 (--)	89.3 (--)	8.0 (--)	4.3 (--)	-- (--)	2.3 (--)	-- (--)	-- (11.1)	-- (10.8)
Invertebrates																
Delhi sands flower-loving fly																
Potentially Suitable Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Potentially Suitable Habitat (Extirpated)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Amphibians and Reptiles																
Arroyo toad																
Suitable Breeding Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Non-Breeding Upland Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Permeable Movement Area (Dev, Ag, Disturbed)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Mountain yellow-legged frog																
Potentially Suitable Aquatic Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	3.7 (--)	1.7 (--)	-- (--)	-- (--)	-- (--)
Refugia/Foraging/Dispersal Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	70.0 (--)	92.1 (--)	-- (--)	-- (--)	-- (1.3)
Western spadefoot																
Potentially Suitable Habitat	-- (--)	68.6 (--)	7.2 (--)	0.8 (--)	17.4 (--)	21.8 (--)	0.5 (--)	42.9 (--)	4.4 (--)	0.6 (--)	40.8 (--)	21.8 (--)	112.1 (--)	2.0 (--)	0.1 (11.5)	-- (14.8)
California glossy snake																
Potentially Suitable Habitat	8.6 (--)	73.0 (--)	40.5 (--)	0.9 (--)	20.4 (--)	23.4 (--)	0.5 (--)	43.2 (--)	80.8 (--)	4.3 (--)	28.7 (--)	6.7 (--)	12.3 (--)	0.3 (--)	-- (12.4)	-- (23.5)
South coast garter snake																
Potentially Suitable Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Western pond turtle																
Aquatic Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Potentially Suitable Upland Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Birds																
Tricolored blackbird																
Suitable Colony Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	2.8 (--)	-- (--)	-- (--)	-- (--)	-- (0.1)
Breeding Season Foraging - Natural	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	0.5 (--)	0.1 (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (0.5)
Breeding Season Foraging - Agriculture	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (2.2)
Non-Breeding Season Foraging - Natural	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Non-Breeding Season Foraging - Agriculture	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (0.2)
Burrowing owl																
Potentially Suitable Habitat	8.3 (--)	72.8 (--)	10.6 (--)	0.5 (--)	14.8 (--)	22.9 (--)	0.5 (--)	33.4 (--)	7.4 (--)	2.6 (--)	28.7 (--)	9.5 (--)	-- (--)	0.3 (--)	-- (11.5)	-- (14.8)
Cactus wren																
Known Suitable Nesting	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	14.2 (--)	-- (--)	-- (--)	0.2 (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (0.1)
Potential Nesting and Foraging Habitat	8.3 (--)	73.0 (--)	10.6 (--)	0.8 (--)	17.7 (--)	8.7 (--)	0.5 (--)	33.4 (--)	7.2 (--)	2.6 (--)	28.7 (--)	9.5 (--)	8.3 (--)	0.3 (--)	-- (11.5)	-- (15.5)
Recently Burned (2008 - 2018)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (1.1)
Yellow-breasted chat																
Potentially Suitable Habitat	1.0 (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	0.1 (--)	14.6 (--)	0.2 (--)	4.3 (--)	1.2 (--)	-- (--)	-- (--)	-- (0.4)
Yellow-billed cuckoo																
High Value Breeding Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Other Potentially Suitable Breeding Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (0.1)
Southwestern willow flycatcher																
Core Southwestern Willow Flycatcher Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Very High Value Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
High Value Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Moderate Value Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Other Potentially Suitable Habitat	1.0 (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	0.1 (--)	14.6 (--)	0.2 (--)	4.3 (--)	1.2 (--)	-- (--)	-- (--)	-- (0.4)
Coastal California gnatcatcher																
Very High Value Habitat	-- (--)	-- (--)	-- (--)	-- (--)	5.3 (--)	9.9 (--)	-- (--)	0.1 (--)	1.2 (--)	-- (--)	-- (--)	-- (--)	3.2 (--)	-- (--)	-- (1.6)	-- (1.2)
High Value Habitat	1.9 (--)	-- (--)	-- (--)	0.5 (--)	7.5 (--)	3.8 (--)	-- (--)	9.8 (--)	4.7 (--)	-- (--)	-- (--)	2.1 (--)	0.4 (--)	-- (--)	-- (8.6)	-- (1.9)
Moderate Value Habitat	3.4 (--)	-- (--)	-- (--)	0.3 (--)	3.4 (--)	4.3 (--)	-- (--)	9.7 (--)	0.5 (--)	0.3 (--)	0.3 (--)	0.5 (--)	0.2 (--)	-- (--)	-- (1.2)	-- (2.9)
Low Value Habitat	1.5 (--)	0.6 (--)	9.8 (--)	-- (--)	1.5 (--)	4.7 (--)	0.5 (--)	3.5 (--)	1.0 (--)	1.5 (--)	15.6 (--)	3.1 (--)	1.5 (--)	0.3 (--)	-- (0.1)	-- (8.7)
Other Suitable Habitat	1.0 (--)	68.5 (--)	0.8 (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	0.2 (--)	-- (--)	-- (--)	-- (--)	-- (0.1)
Least Bell's vireo																
Core Breeding Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Other Breeding Habitat	1.0 (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	0.1 (--)	14.6 (--)	0.2 (--)	4.3 (--)	1.2 (--)	-- (--)	-- (--)	-- (0.4)
Mammals																
Los Angeles pocket mouse																
Potentially Suitable Habitat	6.4 (--)	72.5 (--)	10.6 (--)	0.8 (--)	17.7 (--)	22.9 (--)	0.5 (--)	33.4 (--)	7.3 (--)	2.6 (--)	28.7 (--)	9.2 (--)	8.3 (--)	0.3 (--)	-- (11.2)	-- (18.6)
San Bernardino kangaroo rat																
Suitable Habitat	-- (--)	17.6 (--)	81.5 (--)	1.2 (--)	20.4 (--)	27.0 (--)	0.5 (--)	-- (--)	84.5 (--)	28.9 (--)	33.1 (--)	26.3 (--)	119.9 (--)	-- (--)	-- (23.4)	-- (19.6)

Acres Impacted Permanent (Temporary) *facility is an existing basin subject to routine O&M activities	Habitat Improvement, Management, and Monitoring																		Valley District Total
Species and Model Catgory	**Conserv.01**	**Conserv.02**	**Conserv.03**	**Conserv.04**	**Conserv.05**	**Conserv.06**	**Conserv.07**	**Conserv.08**	**Conserv.09**	**Conserv.12**	**Conserv.13**	**Conserv.14**	**Conserv.15**	**Conserv.16**	**Conserv.17**	**Conserv.18**	**Conserv.19**	**Conserv.20**	
Plants																			
Slender-horned spineflower																			
Current Occupied Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Historic Occupied Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Potentially Suitable Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	174.5 (26.1)
Santa Ana River woolly-star																			
Potentially Suitable Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	318.7 (21.9)
Invertebrates																			
Delhi sands flower-loving fly																			
Potentially Suitable Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Potentially Suitable Habitat (Extirpated)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Amphibians and Reptiles																			
Arroyo toad																			
Suitable Breeding Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Non-Breeding Upland Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Permeable Movement Area (Dev, Ag, Disturbed)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Mountain yellow-legged frog																			
Potentially Suitable Aquatic Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	5.4 (--)
Refugia/Foraging/Dispersal Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	162.1 (1.3)
Western spadefoot																			
Potentially Suitable Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	341.0 (26.3)
California glossy snake																			
Potentially Suitable Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	343.6 (35.9)
South coast garter snake																			
Potentially Suitable Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Western pond turtle																			
Aquatic Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Potentially Suitable Upland Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Birds																			
Tricolored blackbird																			
Suitable Colony Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	2.8 (0.1)
Breeding Season Foraging - Natural	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	0.6 (0.5)
Breeding Season Foraging - Agriculture	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (2.2)
Non-Breeding Season Foraging - Natural	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Non-Breeding Season Foraging - Agriculture	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (0.2)
Burrowing owl																			
Potentially Suitable Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	212.3 (26.3)
Cactus wren																			
Known Suitable Nesting	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	14.4 (0.1)
Potential Nesting and Foraging Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	209.6 (27.0)
Recently Burned (2008 - 2018)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (1.1)
Yellow-breasted chat																			
Potentially Suitable Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	21.4 (0.4)
Yellow-billed cuckoo																			
High Value Breeding Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Other Potentially Suitable Breeding Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (0.1)
Southwestern willow flycatcher																			
Core Southwestern Willow Flycatcher Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Very High Value Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
High Value Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Moderate Value Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Other Potentially Suitable Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	21.4 (0.4)
Coastal California gnatcatcher																			
Very High Value Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	19.7 (2.8)
High Value Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	30.7 (10.5)
Moderate Value Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	22.9 (4.1)
Low Value Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	45.1 (8.8)
Other Suitable Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	70.5 (0.1)
Least Bell's vireo																			
Core Breeding Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Other Breeding Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	21.4 (0.4)
Mammals																			
Los Angeles pocket mouse																			
Potentially Suitable Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	221.2 (29.8)
San Bernardino kangaroo rat																			
Suitable Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	440.9 (43.0)

SPECIES MODELS IMPACTS
San Bernardino Municipal Water Department (WD)

Acres Impacted Permanent (Temporary)	Water Reuse Projects	Groundwater Recharge	Wells and Water Conveyance Infrastructure			Water Department Total
Species and Model Catgory	**WD.1**	**WD.4**	**WD.2**	**WD.3**	**WD.5**	
Plants						
Slender-horned spineflower						
Current Occupied Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Historic Occupied Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Potentially Suitable Habitat	0.3 (1.9)	-- (0.8)	-- (0.1)	-- (0.9)	-- (2.9)	0.3 (6.6)
Santa Ana River woolly-star						
Potentially Suitable Habitat	0.4 (2.6)	-- (0.8)	-- (1.9)	-- (--)	-- (1.8)	0.4 (7.1)
Invertebrates						
Delhi sands flower-loving fly						
Potentially Suitable Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Potentially Suitable Habitat (Extirpated)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Amphibians and Reptiles						
Arroyo toad						
Suitable Breeding Habitat	-- (--)	-- (--)	-- (--)	-- (0.6)	0.1 (0.2)	0.1 (0.8)
Non-Breeding Upland Habitat	-- (--)	-- (--)	-- (--)	0.4 (0.9)	0.1 (0.6)	0.5 (1.5)
Permeable Movement Area (Dev, Ag, Disturbed)	-- (--)	-- (--)	-- (--)	-- (1.1)	0.2 (0.4)	0.2 (1.5)
Mountain yellow-legged frog						
Potentially Suitable Aquatic Habitat	-- (0.2)	-- (--)	-- (--)	-- (--)	-- (--)	-- (0.2)
Refugia/Foraging/Dispersal Habitat	0.7 (1.5)	-- (--)	-- (--)	0.4 (0.8)	0.1 (1.5)	1.2 (3.8)
Western spadefoot						
Potentially Suitable Habitat	0.5 (2.2)	-- (0.8)	-- (1.2)	-- (0.7)	-- (2.8)	0.5 (7.7)
California glossy snake						
Potentially Suitable Habitat	0.5 (3.2)	-- (0.8)	-- (3.2)	0.4 (1.2)	-- (5.5)	0.9 (13.9)
South coast garter snake						
Potentially Suitable Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Western pond turtle						
Aquatic Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Potentially Suitable Upland Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Birds						
Tricolored blackbird						
Suitable Colony Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Breeding Season Foraging - Natural	-- (0.7)	-- (--)	-- (--)	-- (--)	-- (0.5)	-- (1.2)
Breeding Season Foraging - Agriculture	-- (0.6)	-- (--)	-- (--)	-- (--)	-- (--)	-- (0.6)
Non-Breeding Season Foraging - Natural	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Non-Breeding Season Foraging - Agriculture	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Burrowing owl						
Potentially Suitable Habitat	0.3 (3.2)	-- (0.8)	-- (0.2)	-- (--)	-- (3.6)	0.3 (7.8)
Cactus wren						
Known Suitable Nesting	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Potential Nesting and Foraging Habitat	0.5 (3.1)	-- (0.8)	-- (0.2)	-- (0.9)	-- (4.5)	0.5 (9.5)
Recently Burned (2008 - 2018)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Yellow-breasted chat						
Potentially Suitable Habitat	0.9 (0.7)	-- (--)	-- (1.1)	-- (--)	-- (0.2)	0.9 (2.0)
Yellow-billed cuckoo						
High Value Breeding Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Other Potentially Suitable Breeding Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Southwestern willow flycatcher						
Core Southwestern Willow Flycatcher Habitat	-- (0.2)	-- (--)	-- (0.8)	-- (--)	-- (0.1)	-- (1.1)
Very High Value Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
High Value Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Moderate Value Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Other Potentially Suitable Habitat	0.9 (0.5)	-- (--)	-- (0.2)	-- (--)	-- (--)	0.9 (0.7)
Coastal California gnatcatcher						
Very High Value Habitat	-- (0.2)	-- (--)	-- (--)	-- (--)	-- (0.1)	-- (0.3)
High Value Habitat	-- (0.1)	-- (--)	-- (--)	-- (--)	-- (0.2)	-- (0.3)
Moderate Value Habitat	-- (0.6)	-- (0.1)	-- (--)	-- (--)	-- (0.2)	-- (0.9)
Low Value Habitat	0.3 (0.9)	-- (0.7)	-- (0.1)	-- (--)	-- (1.7)	0.3 (3.4)
Other Suitable Habitat	-- (--)	-- (--)	-- (--)	-- (0.9)	-- (0.7)	-- (1.6)
Least Bell's vireo						
Core Breeding Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Other Breeding Habitat	0.9 (0.7)	-- (--)	-- (1.1)	-- (--)	-- (0.2)	0.9 (2.0)
Mammals						
Los Angeles pocket mouse						
Potentially Suitable Habitat	0.5 (3.1)	-- (0.8)	-- (0.2)	-- (0.3)	-- (4.2)	0.5 (8.6)

SPECIES MODELS IMPACTS
San Bernardino Municipal Water Department (WD)

Acres Impacted Permanent (Temporary)	Water Reuse Projects	Groundwater Recharge	Wells and Water Conveyance Infrastructure			Water Department Total
Species and Model Catgory	**WD.1**	**WD.4**	**WD.2**	**WD.3**	**WD.5**	
San Bernardino kangaroo rat						
Suitable Habitat	0.3 (2.9)	-- (0.3)	-- (1.6)	-- (1.0)	-- (2.6)	0.3 (8.4)

SPECIES MODELS IMPACTS
West Valley Water District (WV)

Acres Impacted Permanent (Temporary) *facility is an existing basin subject to routine O&M activities	Water Reuse Projects	Groundwater Recharge	Wells and Water Conveyance Infrastructure				West Valley Total
Species and Model Catgory	**WV.4**	**WV.1***	**WV.2**	**WV.3**	**WV.5**	**WV.6**	
Plants							
Slender-horned spineflower							
Current Occupied Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Historic Occupied Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Potentially Suitable Habitat	-- (--)	-- (--)	-- (0.2)	-- (--)	0.2 (--)	-- (2.7)	0.2 (2.9)
Santa Ana River woolly-star							
Potentially Suitable Habitat	0.1 (--)	-- (--)	-- (0.3)	-- (--)	0.2 (--)	-- (3.6)	0.3 (3.9)
Invertebrates							
Delhi sands flower-loving fly							
Potentially Suitable Habitat	-- (--)	-- (--)	-- (0.3)	-- (--)	-- (--)	-- (0.8)	-- (1.1)
Potentially Suitable Habitat (Extirpated)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Amphibians and Reptiles							
Arroyo toad							
Suitable Breeding Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Non-Breeding Upland Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Permeable Movement Area (Dev, Ag, Disturbed)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Mountain yellow-legged frog							
Potentially Suitable Aquatic Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Refugia/Foraging/Dispersal Habitat	-- (--)	-- (--)	-- (--)	0.3 (--)	-- (--)	-- (2.2)	0.3 (2.2)
Western spadefoot							
Potentially Suitable Habitat	0.1 (--)	7.7 (--)	-- (0.3)	-- (--)	0.1 (--)	-- (6.8)	7.9 (7.1)
California glossy snake							
Potentially Suitable Habitat	0.1 (--)	7.8 (--)	-- (0.6)	0.3 (--)	0.2 (--)	-- (8.8)	8.4 (9.4)
South coast garter snake							
Potentially Suitable Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Western pond turtle							
Aquatic Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Potentially Suitable Upland Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Birds							
Tricolored blackbird							
Suitable Colony Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Breeding Season Foraging - Natural	-- (--)	-- (--)	-- (0.3)	-- (--)	-- (--)	-- (2.5)	-- (2.8)
Breeding Season Foraging - Agriculture	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (0.5)	-- (0.5)
Non-Breeding Season Foraging - Natural	0.1 (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (0.2)	0.1 (0.2)
Non-Breeding Season Foraging - Agriculture	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Burrowing owl							

SPECIES MODELS IMPACTS
West Valley Water District (WV)

Acres Impacted Permanent (Temporary) *facility is an existing basin subject to routine O&M activities	Water Reuse Projects	Groundwater Recharge	Wells and Water Conveyance Infrastructure				West Valley Total
Species and Model Catgory	**WV.4**	**WV.1***	**WV.2**	**WV.3**	**WV.5**	**WV.6**	
Potentially Suitable Habitat	0.1 (--)	4.0 (--)	-- (0.7)	-- (--)	0.2 (--)	-- (7.0)	4.3 (7.7)
Cactus wren							
Known Suitable Nesting	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Potential Nesting and Foraging Habitat	0.1 (--)	4.0 (--)	-- (0.6)	-- (--)	0.2 (--)	-- (7.2)	4.3 (7.8)
Recently Burned (2008 - 2018)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (0.2)	-- (0.2)
Yellow-breasted chat							
Potentially Suitable Habitat	-- (--)	3.2 (--)	-- (--)	-- (--)	-- (--)	-- (--)	3.2 (--)
Yellow-billed cuckoo							
High Value Breeding Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Other Potentially Suitable Breeding Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Southwestern willow flycatcher							
Core Southwestern Willow Flycatcher Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Very High Value Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
High Value Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Moderate Value Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Other Potentially Suitable Habitat	-- (--)	3.2 (--)	-- (--)	-- (--)	-- (--)	-- (--)	3.2 (--)
Coastal California gnatcatcher							
Very High Value Habitat	-- (--)	-- (--)	-- (0.1)	-- (--)	-- (--)	-- (0.1)	-- (0.2)
High Value Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (0.1)	-- (0.1)
Moderate Value Habitat	-- (--)	1.2 (--)	-- (0.1)	-- (--)	0.1 (--)	-- (0.1)	1.3 (0.2)
Low Value Habitat	-- (--)	1.3 (--)	-- (0.1)	-- (--)	0.1 (--)	-- (2.7)	1.4 (2.8)
Other Suitable Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (0.5)	-- (0.5)
Least Bell's vireo							
Core Breeding Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Other Breeding Habitat	-- (--)	3.2 (--)	-- (--)	-- (--)	-- (--)	-- (--)	3.2 (--)
Mammals							
Los Angeles pocket mouse							
Potentially Suitable Habitat	0.1 (--)	4.0 (--)	-- (0.7)	-- (--)	0.2 (--)	-- (7.2)	4.3 (7.9)
San Bernardino kangaroo rat							
Suitable Habitat	-- (--)	15.3 (--)	-- (0.4)	-- (--)	0.3 (--)	-- (2.1)	15.6 (2.5)

SPECIES MODELS IMPACTS
Western Municipal Water District of Riverside County (West)

Acres Impacted Permanent (Temporary)	Groundwater Recharge	Wells and Water Conveyance Infrastructure								Western Total
Species and Model Catgory	**West.06**	**West.01**	**West.02**	**West.03**	**West.04**	**West.07**	**West.08**	**West.09**	**West.10**	
Plants										
Slender-horned spineflower										
Current Occupied Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Historic Occupied Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Potentially Suitable Habitat	-- (--)	4.7 (50.1)	-- (5.1)	-- (--)	-- (0.4)	4.9 (0.9)	-- (--)	-- (0.7)	15.6 (--)	25.2 (57.2)
Santa Ana River woolly-star										
Potentially Suitable Habitat	-- (--)	0.1 (1.2)	-- (0.1)	-- (--)	-- (0.1)	-- (0.1)	-- (--)	-- (--)	-- (--)	0.1 (1.5)
Invertebrates										
Delhi sands flower-loving fly										
Potentially Suitable Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Potentially Suitable Habitat (Extirpated)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Amphibians and Reptiles										
Arroyo toad										
Suitable Breeding Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Non-Breeding Upland Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Permeable Movement Area (Dev, Ag, Disturbed)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Mountain yellow-legged frog										
Potentially Suitable Aquatic Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Refugia/Foraging/Dispersal Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Western spadefoot										
Potentially Suitable Habitat	-- (--)	4.5 (45.8)	-- (4.6)	-- (--)	-- (0.5)	1.4 (1.3)	-- (--)	-- (0.1)	0.4 (--)	6.3 (52.3)
California glossy snake										
Potentially Suitable Habitat	-- (--)	5.6 (59.2)	-- (5.9)	-- (--)	-- (0.6)	5.1 (2.4)	-- (0.1)	-- (0.2)	15.6 (--)	26.3 (68.4)
South coast garter snake										
Potentially Suitable Habitat	-- (--)	0.1 (1.1)	-- (0.1)	-- (--)	-- (--)	-- (0.9)	-- (--)	-- (--)	-- (--)	0.1 (2.1)
Western pond turtle										
Aquatic Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (0.1)	-- (--)	-- (--)	-- (--)	-- (0.1)
Potentially Suitable Upland Habitat	-- (--)	0.3 (3.1)	-- (0.3)	-- (--)	-- (--)	-- (1.1)	-- (--)	-- (--)	-- (--)	0.3 (4.5)
Birds										
Tricolored blackbird										
Suitable Colony Habitat	1.0 (--)	-- (0.5)	-- (0.1)	-- (--)	-- (--)	-- (--)	-- (0.1)	-- (--)	-- (--)	1.0 (0.7)
Breeding Season Foraging - Natural	-- (--)	2.4 (24.6)	-- (2.5)	-- (--)	-- (0.2)	-- (0.7)	-- (--)	-- (--)	-- (--)	2.4 (28.0)
Breeding Season Foraging - Agriculture	2.0 (--)	7.3 (75.1)	-- (--)	0.7 (--)	-- (--)	25.6 (14.4)	-- (2.4)	-- (--)	11.4 (--)	47.0 (91.9)
Non-Breeding Season Foraging - Natural	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Non-Breeding Season Foraging - Agriculture	-- (--)	0.1 (0.6)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	0.1 (0.6)
Burrowing owl										
Potentially Suitable Habitat	2.0 (--)	11.8 (124.8)	-- (7.1)	0.7 (--)	-- (0.9)	50.2 (17.8)	-- (3.4)	-- (0.4)	6.6 (--)	71.3 (154.4)
Cactus wren										
Known Suitable Nesting	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Potential Nesting and Foraging Habitat	-- (--)	7.6 (80.4)	-- (8.1)	-- (--)	-- (0.9)	5.1 (2.8)	-- (0.1)	-- (0.7)	12.7 (--)	25.4 (93.0)

SPECIES MODELS IMPACTS
Western Municipal Water District of Riverside County (West)

Acres Impacted Permanent (Temporary)	Groundwater Recharge	Wells and Water Conveyance Infrastructure								Western Total
Species and Model Catgory	West.06	West.01	West.02	West.03	West.04	West.07	West.08	West.09	West.10	
Recently Burned (2008 - 2018)	-- (--)	0.4 (4.0)	-- (0.4)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	0.4 (4.4)
Yellow-breasted chat										
Potentially Suitable Habitat	1.0 (--)	1.0 (12.1)	-- (1.0)	-- (--)	-- (--)	-- (0.8)	-- (4.8)	-- (--)	-- (--)	2.0 (18.7)
Yellow-billed cuckoo										
High Value Breeding Habitat	-- (--)	-- (0.1)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (0.1)
Other Potentially Suitable Breeding Habitat	-- (--)	0.1 (1.7)	-- (0.1)	-- (--)	-- (--)	-- (0.4)	-- (2.2)	-- (--)	-- (--)	0.1 (4.4)
Southwestern willow flycatcher										
Core Southwestern Willow Flycatcher Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Very High Value Habitat	-- (--)	-- (0.1)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (0.1)
High Value Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (0.1)	-- (--)	-- (--)	-- (--)	-- (0.1)
Moderate Value Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Other Potentially Suitable Habitat	1.0 (--)	1.0 (12.1)	-- (1.0)	-- (--)	-- (--)	-- (0.8)	-- (4.8)	-- (--)	-- (--)	2.0 (18.7)
Coastal California gnatcatcher										
Very High Value Habitat	-- (--)	0.1 (0.5)	-- (0.1)	-- (--)	-- (--)	0.7 (--)	-- (--)	-- (--)	-- (--)	0.8 (0.6)
High Value Habitat	-- (--)	0.3 (3.6)	-- (0.4)	-- (--)	-- (--)	4.2 (0.1)	-- (--)	-- (--)	1.0 (--)	5.5 (4.1)
Moderate Value Habitat	-- (--)	1.0 (10.7)	-- (1.1)	-- (--)	-- (0.1)	-- (0.3)	-- (--)	-- (--)	3.6 (--)	4.6 (12.2)
Low Value Habitat	-- (--)	3.1 (33.3)	-- (3.4)	-- (--)	-- (0.2)	-- (0.4)	-- (--)	-- (0.6)	5.0 (--)	8.1 (37.9)
Other Suitable Habitat	-- (--)	0.1 (1.5)	-- (0.1)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	0.1 (1.6)
Least Bell's vireo										
Core Breeding Habitat	-- (--)	-- (0.2)	-- (--)	-- (--)	-- (--)	-- (0.5)	-- (--)	-- (--)	-- (--)	-- (0.7)
Other Breeding Habitat	1.0 (--)	1.0 (12.0)	-- (1.0)	-- (--)	-- (--)	-- (0.4)	-- (4.8)	-- (--)	-- (--)	2.0 (18.2)
Mammals										
Los Angeles pocket mouse										
Potentially Suitable Habitat	-- (--)	5.3 (55.3)	-- (5.6)	-- (--)	-- (0.6)	5.1 (2.4)	-- (0.1)	-- (0.2)	5.5 (--)	15.9 (64.2)
San Bernardino kangaroo rat										
Suitable Habitat	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)

VEGETATION IMPACTS
City of Rialto Public Works (Rial)

Acres Impacted Permanent (Temporary)	Water Reuse Projects	City of Rialto Total
Vegetation Communities	**Rial.1**	
Riparian		
Interior Warm and Cool Desert Riparian Forest	1.2 (--)	1.2 (--)
Warm Desert Lowland Freshwater Marsh, Wet Meadow, and Shrubland	-- (--)	-- (--)
Wetlands		
Western North American Disturbed Marsh, Wet Meadow, and Shrubland	-- (--)	-- (--)
Western North American Freshwater Aquatic Vegetation	-- (--)	-- (--)
Western North American Montane-Subalpine-Boreal Marsh, Wet Meadow, and Shrubland	-- (--)	-- (--)
Western North American Temperate and Boreal Freshwater Marsh, Wet Meadow, and Shrubland	-- (--)	-- (--)
Water		
Dry Channel/Shrubland	4.5 (--)	4.5 (--)
Permanent Water	1.3 (--)	1.3 (--)
Water in Existing Basins	-- (--)	-- (--)
Shrublands		
Alluvial Fan Sage Scrub	-- (--)	-- (--)
Californian Chaparral	-- (--)	-- (--)
Californian Coastal Scrub	-- (--)	-- (--)
Great Basin-Intermountain Xeric-Riparian Scrub	-- (--)	-- (--)
North American Warm-Desert Xeric-Riparian Scrub	-- (--)	-- (--)
Grasslands		
Californian Annual and Perennial Grassland	7.8 (0.2)	7.8 (0.2)
Californian Disturbed Grassland, Meadow, and Scrub	-- (--)	-- (--)
Woodlands		
Californian Disturbed Forest	-- (--)	-- (--)
Californian Forest and Woodland	-- (--)	-- (--)
Intermountain Singleleaf Pinyon-Utah Juniper-Western Juniper Woodland	-- (--)	-- (--)
Rock Outcrops		
Western North American Cliff, Scree, and Rock Vegetation	-- (--)	-- (--)
Agriculture		
Herbaceous Agricultural Vegetation	-- (--)	-- (--)
Woody Agricultural Vegetation	-- (--)	-- (--)

San Bernardino Valley Water Conservation District (CD)

Acres Impacted Permanent (Temporary)	Groundwater Recharge		Conservation District Total
Vegetation Communities	**CD.1**	**CD.2**	
Riparian			
Interior Warm and Cool Desert Riparian Forest	-- (--)	-- (--)	-- (--)
Warm Desert Lowland Freshwater Marsh, Wet Meadow, and Shrubland	-- (--)	-- (--)	-- (--)
Wetlands			
Western North American Disturbed Marsh, Wet Meadow, and Shrubland	-- (--)	-- (--)	-- (--)
Western North American Freshwater Aquatic Vegetation	-- (--)	-- (--)	-- (--)
Western North American Montane-Subalpine-Boreal Marsh, Wet Meadow, and Shrubland	-- (--)	-- (--)	-- (--)
Western North American Temperate and Boreal Freshwater Marsh, Wet Meadow, and Shrubland	-- (--)	-- (--)	-- (--)
Water			
Dry Channel/Shrubland	-- (--)	0.2 (--)	0.2 (--)
Permanent Water	-- (--)	-- (--)	-- (--)
Water in Existing Basins	-- (--)	-- (--)	-- (--)
Shrublands			
Alluvial Fan Sage Scrub	0.3 (--)	0.1 (--)	0.4 (--)
Californian Chaparral	-- (--)	-- (--)	-- (--)
Californian Coastal Scrub	-- (--)	-- (--)	-- (--)
Great Basin-Intermountain Xeric-Riparian Scrub	-- (--)	-- (--)	-- (--)
North American Warm-Desert Xeric-Riparian Scrub	-- (--)	-- (--)	-- (--)
Grasslands			
Californian Annual and Perennial Grassland	-- (--)	-- (--)	-- (--)
Californian Disturbed Grassland, Meadow, and Scrub	-- (--)	-- (--)	-- (--)
Woodlands			
Californian Disturbed Forest	-- (--)	-- (--)	-- (--)
Californian Forest and Woodland	-- (--)	-- (--)	-- (--)
Intermountain Singleleaf Pinyon-Utah Juniper-Western Juniper Woodland	-- (--)	-- (--)	-- (--)
Rock Outcrops			
Western North American Cliff, Scree, and Rock Vegetation	-- (--)	-- (--)	-- (--)
Agriculture			
Herbaceous Agricultural Vegetation	-- (--)	-- (--)	-- (--)
Woody Agricultural Vegetation	-- (--)	-- (--)	-- (--)

VEGETATION IMPACTS
East Valley Water District (EV)

Acres Impacted Permanent (Temporary) *facility is an existing basin subject to routine O&M activities	Water Reuse Projects			Groundwater Recharge	Wells and Water Conveyance Infrastructure			East Valley Total
Vegetation Communities	**EV.1**	**EV.4.01**	**EV.4.02**	**EV.4.03***	**EV.2**	**EV.3**	**EV.5**	
Riparian								
Interior Warm and Cool Desert Riparian Forest	-- (--)	-- (--)	-- (--)	-- (--)	-- (0.1)	0.1 (--)	-- (--)	0.1 (0.1)
Warm Desert Lowland Freshwater Marsh, Wet Meadow, and Shrubland	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Wetlands								
Western North American Disturbed Marsh, Wet Meadow, and Shrubland	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Western North American Freshwater Aquatic Vegetation	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Western North American Montane-Subalpine-Boreal Marsh, Wet Meadow, and Shrubland	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Western North American Temperate and Boreal Freshwater Marsh, Wet Meadow, and Shrubland	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Water								
Dry Channel/Shrubland	-- (--)	-- (--)	-- (--)	-- (--)	-- (0.2)	0.2 (--)	-- (--)	0.2 (0.2)
Permanent Water	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	0.2 (--)	-- (--)	0.2 (--)
Water in Existing Basins	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Shrublands								
Alluvial Fan Sage Scrub	-- (--)	-- (--)	-- (0.2)	19.1 (--)	-- (0.9)	2.7 (--)	0.8 (0.3)	22.6 (1.4)
Californian Chaparral	-- (--)	-- (--)	-- (--)	-- (--)	-- (0.2)	0.1 (--)	0.4 (--)	0.5 (0.2)
Californian Coastal Scrub	0.1 (--)	-- (--)	-- (--)	-- (--)	-- (0.3)	0.1 (--)	0.2 (--)	0.4 (0.3)
Great Basin-Intermountain Xeric-Riparian Scrub	-- (--)	-- (--)	-- (--)	-- (--)	-- (0.5)	0.1 (--)	0.4 (--)	0.5 (0.5)
North American Warm-Desert Xeric-Riparian Scrub	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	0.1 (--)	-- (--)	0.1 (--)
Grasslands								
Californian Annual and Perennial Grassland	-- (--)	17.0 (--)	-- (1.2)	5.2 (--)	-- (0.8)	2.5 (--)	0.1 (--)	24.8 (2.0)
Californian Disturbed Grassland, Meadow, and Scrub	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Woodlands								
Californian Disturbed Forest	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Californian Forest and Woodland	-- (--)	-- (--)	-- (--)	-- (--)	-- (0.2)	-- (--)	-- (--)	-- (0.2)
Intermountain Singleleaf Pinyon-Utah Juniper-Western Juniper Woodland	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Rock Outcrops								
Western North American Cliff, Scree, and Rock Vegetation	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Agriculture								
Herbaceous Agricultural Vegetation	-- (--)	-- (--)	-- (0.2)	14.0 (--)	-- (0.2)	-- (--)	-- (--)	14.0 (0.4)
Woody Agricultural Vegetation	1.4 (--)	-- (--)	-- (--)	-- (--)	-- (0.1)	0.6 (--)	-- (--)	2.0 (0.1)

VEGETATION IMPACTS
Inland Empire Utilities Agency (IEUA)

Acres Impacted Permanent (Temporary) *facility is an existing basin subject to routine O&M activities	Water Reuse Projects	Groundwater Recharge																							Habitat Improvement, Management, and Monitoring	
Vegetation Communities	**IEUA.4**	**IEUA.1.01***	**IEUA.1.02***	**IEUA.1.03***	**IEUA.1.04***	**IEUA.1.05***	**IEUA.1.06***	**IEUA.1.07***	**IEUA.1.08***	**IEUA.1.09***	**IEUA.1.10***	**IEUA.1.11***	**IEUA.1.12**	**IEUA.2.01***	**IEUA.2.02***	**IEUA.2.03***	**IEUA.2.04***	**IEUA.2.05***	**IEUA.2.06***	**IEUA.2.07***	**IEUA.2.08***	**IEUA.3.01**	**IEUA.3.02**	**IEUA.3.04**	**IEUA.1.13**	**IEUA Total**
Riparian																										
Interior Warm and Cool Desert Riparian Forest	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Warm Desert Lowland Freshwater Marsh, Wet Meadow, and Shrubland	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Wetlands																										
Western North American Disturbed Marsh, Wet Meadow, and Shrubland	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Western North American Freshwater Aquatic Vegetation	-- (--)	2.8 (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	0.7 (--)	-- (--)	0.4 (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	3.9 (--)
Western North American Montane-Subalpine-Boreal Marsh, Wet Meadow, and Shrubland	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Western North American Temperate and Boreal Freshwater Marsh, Wet Meadow, and Shrubland	-- (--)	25.4 (--)	0.2 (--)	14.0 (--)	-- (--)	-- (--)	-- (--)	1.1 (--)	-- (--)	2.1 (--)	-- (--)	2.8 (--)	-- (--)	6.0 (--)	-- (--)	-- (--)	-- (--)	-- (--)	7.6 (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	59.2 (--)
Water																										
Dry Channel/Shrubland	-- (--)	-- (--)	-- (--)	0.1 (--)	-- (--)	0.1 (--)	-- (--)	1.6 (--)	2.6 (--)	11.2 (--)	-- (--)	0.2 (--)	0.9 (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	16.7 (--)
Permanent Water	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	0.9 (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	0.9 (--)
Water in Existing Basins	-- (--)	35.3 (--)	17.0 (--)	115.1 (--)	25.5 (--)	35.5 (--)	61.5 (--)	19.6 (--)	1.9 (--)	18.5 (--)	29.8 (--)	39.2 (--)	-- (--)	23.1 (--)	10.2 (--)	8.1 (--)	21.9 (--)	-- (--)	2.2 (--)	15.2 (--)	15.8 (--)	-- (--)	-- (--)	-- (--)	-- (--)	495.4 (--)
Shrublands																										
Alluvial Fan Sage Scrub	-- (--)	-- (--)	15.2 (--)	17.3 (0.2)	0.1 (--)	0.1 (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	41.7 (--)	-- (--)	-- (--)	7.6 (--)	-- (--)	-- (--)	-- (--)	-- (--)	82.0 (0.2)
Californian Chaparral	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Californian Coastal Scrub	-- (--)	-- (--)	-- (--)	22.9 (0.1)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	13.6 (--)	-- (--)	-- (--)	8.2 (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	44.7 (0.1)
Great Basin-Intermountain Xeric-Riparian Scrub	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
North American Warm-Desert Xeric-Riparian Scrub	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Grasslands																										
Californian Annual and Perennial Grassland	-- (--)	-- (--)	-- (--)	-- (0.1)	-- (--)	1.8 (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	0.1 (--)	-- (--)	-- (--)	-- (--)	-- (--)	7.6 (--)	-- (--)	6.5 (--)	-- (--)	-- (--)	-- (--)	-- (--)	16.0 (0.1)
Californian Disturbed Grassland, Meadow, and Scrub	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Woodlands																										
Californian Disturbed Forest	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Californian Forest and Woodland	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Intermountain Singleleaf Pinyon-Utah Juniper-Western Juniper Woodland	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Rock Outcrops																										
Western North American Cliff, Scree, and Rock Vegetation	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Agriculture																										
Herbaceous Agricultural Vegetation	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Woody Agricultural Vegetation	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)

VEGETATION IMPACTS

Metropolitan Water District of Southern California (Met)

Acres Impacted Permanent (Temporary)	Wells and Water Conveyance Infrastructure			Metropolitan Total
Vegetation Communities	**Met.1**	**Met.2**	**Met.3**	
Riparian				
Interior Warm and Cool Desert Riparian Forest	-- (--)	-- (0.5)	2.6 (--)	2.6 (0.5)
Warm Desert Lowland Freshwater Marsh, Wet Meadow, and Shrubland	-- (--)	-- (0.2)	0.8 (--)	0.8 (0.2)
Wetlands				
Western North American Disturbed Marsh, Wet Meadow, and Shrubland	-- (--)	-- (--)	-- (--)	-- (--)
Western North American Freshwater Aquatic Vegetation	-- (--)	-- (--)	-- (--)	-- (--)
Western North American Montane-Subalpine-Boreal Marsh, Wet Meadow, and Shrubland	-- (--)	-- (0.1)	0.2 (--)	0.2 (0.1)
Western North American Temperate and Boreal Freshwater Marsh, Wet Meadow, and Shrubland	-- (--)	-- (0.1)	0.4 (--)	0.4 (0.1)
Water				
Dry Channel/Shrubland	-- (--)	-- (1.1)	3.9 (--)	3.9 (1.1)
Permanent Water	-- (--)	-- (1.0)	4.8 (--)	4.8 (1.0)
Water in Existing Basins	-- (--)	-- (--)	-- (--)	-- (--)
Shrublands				
Alluvial Fan Sage Scrub	-- (--)	-- (7.2)	10.3 (--)	10.3 (7.2)
Californian Chaparral	-- (--)	-- (6.3)	11.2 (--)	11.2 (6.3)
Californian Coastal Scrub	-- (--)	-- (6.0)	18.6 (--)	18.6 (6.0)
Great Basin-Intermountain Xeric-Riparian Scrub	-- (--)	-- (0.4)	1.4 (--)	1.4 (0.4)
North American Warm-Desert Xeric-Riparian Scrub	-- (--)	-- (--)	0.1 (--)	0.1 (--)
Grasslands				
Californian Annual and Perennial Grassland	0.1 (--)	-- (9.6)	22.4 (--)	22.5 (9.6)
Californian Disturbed Grassland, Meadow, and Scrub	-- (--)	-- (--)	-- (--)	-- (--)
Woodlands				
Californian Disturbed Forest	-- (--)	-- (--)	0.3 (--)	0.3 (--)
Californian Forest and Woodland	-- (--)	-- (0.5)	1.4 (--)	1.4 (0.5)
Intermountain Singleleaf Pinyon-Utah Juniper-Western Juniper Woodland	-- (--)	-- (--)	-- (--)	-- (--)
Rock Outcrops				
Western North American Cliff, Scree, and Rock Vegetation	-- (--)	-- (0.3)	0.4 (--)	0.4 (0.3)
Agriculture				
Herbaceous Agricultural Vegetation	-- (--)	-- (4.9)	17.1 (--)	17.1 (4.9)
Woody Agricultural Vegetation	-- (--)	-- (0.2)	0.3 (--)	0.3 (0.2)

VEGETATION IMPACTS

Orange County Water District (OCWD)

Acres Impacted Permanent (Temporary)	Wells and Water Conveyance Infrastructure	Habitat Improvement, Management, and Monitoring		OCWD Total
Vegetation Communities	**OCWD.1**	**Conserv.10**	**Conserv.11**	
Riparian				
Interior Warm and Cool Desert Riparian Forest	-- (7.8)	-- (--)	-- (--)	-- (7.8)
Warm Desert Lowland Freshwater Marsh, Wet Meadow, and Shrubland	-- (--)	-- (--)	-- (--)	-- (--)
Wetlands				
Western North American Disturbed Marsh, Wet Meadow, and Shrubland	-- (--)	-- (--)	-- (--)	-- (--)
Western North American Freshwater Aquatic Vegetation	-- (1.8)	-- (--)	-- (--)	-- (1.8)
Western North American Montane-Subalpine-Boreal Marsh, Wet Meadow, and Shrubland	-- (--)	-- (--)	-- (--)	-- (--)
Western North American Temperate and Boreal Freshwater Marsh, Wet Meadow, and Shrubland	-- (7.5)	-- (--)	-- (--)	-- (7.5)
Water				
Dry Channel/Shrubland	-- (24.2)	-- (--)	-- (--)	-- (24.2)
Permanent Water	-- (2.6)	-- (--)	-- (--)	-- (2.6)
Water in Existing Basins	-- (--)	-- (--)	-- (--)	-- (--)
Shrublands				
Alluvial Fan Sage Scrub	-- (--)	-- (--)	-- (--)	-- (--)
Californian Chaparral	-- (--)	-- (--)	-- (--)	-- (--)
Californian Coastal Scrub	-- (--)	-- (--)	-- (--)	-- (--)
Great Basin-Intermountain Xeric-Riparian Scrub	-- (--)	-- (--)	-- (--)	-- (--)
North American Warm-Desert Xeric-Riparian Scrub	-- (--)	-- (--)	-- (--)	-- (--)
Grasslands				
Californian Annual and Perennial Grassland	-- (--)	-- (--)	-- (--)	-- (--)
Californian Disturbed Grassland, Meadow, and Scrub	-- (--)	-- (--)	-- (--)	-- (--)
Woodlands				
Californian Disturbed Forest	-- (--)	-- (--)	-- (--)	-- (--)
Californian Forest and Woodland	-- (--)	-- (--)	-- (--)	-- (--)
Intermountain Singleleaf Pinyon-Utah Juniper-Western Juniper Woodland	-- (--)	-- (--)	-- (--)	-- (--)
Rock Outcrops				
Western North American Cliff, Scree, and Rock Vegetation	-- (--)	-- (--)	-- (--)	-- (--)
Agriculture				
Herbaceous Agricultural Vegetation	-- (0.1)	-- (--)	-- (--)	-- (0.1)
Woody Agricultural Vegetation	-- (--)	-- (--)	-- (--)	-- (--)

VEGETATION IMPACTS
Riverside Public Utilities (RPU)

Acres Impacted Permanent (Temporary)	Water Reuse Projects	Groundwater Recharge		Wells and Water Conveyance Infrastructure											Solar Energy Development	RPU Total
Vegetation Communities	**RPU.09**	**RPU.05**	**RPU.08**	**RPU.01**	**RPU.02**	**RPU.03**	**RPU.04**	**RPU.06**	**RPU.07**	**RPU.10**	**RPU.12**	**RPU.13**	**RPU.14**	**RPU.15**	**RPU.11**	
Riparian																
Interior Warm and Cool Desert Riparian Forest	-- (--)	5.0 (--)	1.1 (--)	-- (1.1)	-- (0.2)	-- (0.2)	0.7 (--)	-- (--)	-- (0.5)	-- (4.3)	22.8 (--)	-- (--)	-- (0.3)	-- (0.4)	-- (--)	29.6 (7.0)
Warm Desert Lowland Freshwater Marsh, Wet Meadow, and Shrubland	-- (--)	-- (--)	-- (--)	-- (0.1)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (0.1)
Wetlands																
Western North American Disturbed Marsh, Wet Meadow, and Shrubland	-- (--)	-- (--)	-- (--)	-- (--)	-- (0.1)	-- (--)	-- (--)	-- (--)	-- (0.1)	-- (--)	2.9 (--)	-- (--)	-- (--)	-- (--)	-- (--)	2.9 (0.2)
Western North American Freshwater Aquatic Vegetation	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Western North American Montane-Subalpine-Boreal Marsh, Wet Meadow, and Shrubland	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Western North American Temperate and Boreal Freshwater Marsh, Wet Meadow, and Shrubland	-- (--)	0.9 (--)	0.2 (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (0.1)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	1.1 (0.1)
Water																
Dry Channel/Shrubland	-- (--)	0.2 (--)	10.0 (--)	-- (--)	-- (0.1)	-- (--)	-- (--)	-- (--)	-- (0.7)	-- (0.2)	1.6 (--)	-- (--)	-- (--)	-- (0.4)	-- (--)	11.8 (1.4)
Permanent Water	-- (--)	22.0 (--)	-- (--)	-- (0.4)	-- (0.1)	-- (0.6)	-- (--)	-- (--)	-- (0.1)	-- (--)	0.2 (--)	-- (--)	-- (0.1)	-- (0.6)	-- (--)	22.2 (1.9)
Water in Existing Basins	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Shrublands																
Alluvial Fan Sage Scrub	-- (--)	5.6 (--)	-- (--)	-- (0.8)	-- (2.1)	-- (2.6)	-- (--)	-- (--)	-- (0.3)	-- (0.5)	9.7 (--)	-- (--)	-- (0.4)	-- (0.2)	3.0 (--)	18.3 (6.9)
Californian Chaparral	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Californian Coastal Scrub	-- (--)	-- (--)	-- (--)	-- (0.1)	-- (1.0)	-- (--)	-- (--)	-- (0.8)	-- (--)	-- (1.6)	32.0 (--)	-- (--)	-- (--)	-- (0.4)	2.5 (--)	34.5 (3.9)
Great Basin-Intermountain Xeric-Riparian Scrub	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
North American Warm-Desert Xeric-Riparian Scrub	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (0.8)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (0.8)
Grasslands																
Californian Annual and Perennial Grassland	2.5 (--)	52.5 (--)	13.2 (--)	-- (0.9)	-- (2.4)	-- (--)	-- (--)	-- (--)	-- (--)	-- (5.9)	95.4 (--)	0.9 (--)	-- (--)	-- (1.7)	10.2 (--)	174.7 (10.9)
Californian Disturbed Grassland, Meadow, and Scrub	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (0.1)	-- (--)	-- (0.1)
Woodlands																
Californian Disturbed Forest	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (0.4)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (0.4)
Californian Forest and Woodland	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Intermountain Singleleaf Pinyon-Utah Juniper-Western Juniper Woodland	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Rock Outcrops																
Western North American Cliff, Scree, and Rock Vegetation	-- (--)	9.1 (--)	-- (--)	-- (--)	-- (0.2)	-- (--)	-- (--)	-- (--)	-- (0.1)	-- (--)	0.1 (--)	-- (--)	-- (0.1)	-- (0.1)	-- (--)	9.2 (0.5)
Agriculture																
Herbaceous Agricultural Vegetation	-- (--)	-- (--)	4.8 (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (0.1)	-- (--)	-- (--)	-- (--)	-- (2.1)	-- (--)	4.8 (2.2)
Woody Agricultural Vegetation	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)

VEGETATION IMPACTS
San Bernardino Valley Municipal Water District (VD)

Acres Impacted Permanent (Temporary) *facility is an existing basin subject to routine O&M activities	Groundwater Recharge															Wells and Water Conveyance Infrastructure
Vegetation Communities	**VD.1***	**VD.2.02**	**VD.2.03**	**VD.2.04**	**VD.2.05**	**VD.2.06**	**VD.2.07**	**VD.2.08**	**VD.2.09**	**VD.2.10**	**VD.2.11***	**VD.2.12***	**VD.2.13***	**VD.2.14***	**VD.3**	**VD.4**
Riparian																
Interior Warm and Cool Desert Riparian Forest	1.0 (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	0.1 (--)	11.7 (--)	-- (--)	0.7 (--)	-- (--)	-- (--)	-- (--)	-- (0.4)
Warm Desert Lowland Freshwater Marsh, Wet Meadow, and Shrubland	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Wetlands																
Western North American Disturbed Marsh, Wet Meadow, and Shrubland	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Western North American Freshwater Aquatic Vegetation	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	2.8 (--)	-- (--)	-- (--)	-- (--)	-- (0.1)
Western North American Montane-Subalpine-Boreal Marsh, Wet Meadow, and Shrubland	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Western North American Temperate and Boreal Freshwater Marsh, Wet Meadow, and Shrubland	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	2.9 (--)	0.2 (--)	3.6 (--)	1.2 (--)	-- (--)	-- (--)	-- (--)
Water																
Dry Channel/Shrubland	22.5 (--)	0.4 (--)	-- (--)	-- (--)	-- (--)	0.2 (--)	-- (--)	-- (--)	5.2 (--)	-- (--)	-- (--)	0.4 (--)	-- (--)	-- (--)	0.3 (--)	-- (0.7)
Permanent Water	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	4.6 (--)	32.4 (--)	-- (--)	-- (--)	-- (--)	-- (0.5)
Water in Existing Basins	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	5.8 (--)	-- (--)	107.1 (--)	2.7 (--)	-- (--)	-- (--)
Shrublands																
Alluvial Fan Sage Scrub	-- (--)	17.7 (--)	77.3 (--)	1.0 (--)	22.0 (--)	24.5 (--)	0.5 (--)	-- (--)	84.1 (--)	8.0 (--)	29.7 (--)	34.2 (--)	29.9 (--)	-- (--)	-- (13.8)	-- (16.2)
Californian Chaparral	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	9.8 (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (2.1)
Californian Coastal Scrub	6.5 (--)	57.8 (--)	-- (--)	-- (--)	-- (--)	0.1 (--)	-- (--)	23.1 (--)	0.4 (--)	-- (--)	-- (--)	1.5 (--)	-- (--)	0.3 (--)	-- (0.4)	-- (3.1)
Great Basin-Intermountain Xeric-Riparian Scrub	-- (--)	0.4 (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	0.1 (--)	-- (--)	-- (--)	-- (--)	-- (0.8)
North American Warm-Desert Xeric-Riparian Scrub	1.4 (--)	1.1 (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	0.4 (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Grasslands																
Californian Annual and Perennial Grassland	0.5 (--)	3.5 (--)	-- (--)	-- (--)	-- (--)	0.2 (--)	-- (--)	10.3 (--)	0.1 (--)	0.7 (--)	12.8 (--)	0.5 (--)	3.0 (--)	-- (--)	-- (--)	-- (1.9)
Californian Disturbed Grassland, Meadow, and Scrub	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Woodlands																
Californian Disturbed Forest	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	2.3 (--)	-- (--)	-- (--)	-- (--)	-- (--)
Californian Forest and Woodland	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (0.1)
Intermountain Singleleaf Pinyon-Utah Juniper-Western Juniper Woodland	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Rock Outcrops																
Western North American Cliff, Scree, and Rock Vegetation	2.3 (--)	-- (--)	0.1 (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	0.6 (--)	-- (--)	-- (--)	-- (--)	4.0 (--)	-- (--)	-- (1.0)	-- (1.1)
Agriculture																
Herbaceous Agricultural Vegetation	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (3.6)
Woody Agricultural Vegetation	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (0.1)	-- (1.7)

Acres Impacted Permanent (Temporary)	Habitat Improvement, Management, and Monitoring																				Valley District Total
Vegetation Communities	**Conserv.01**	**Conserv.02**	**Conserv.03**	**Conserv.04**	**Conserv.05**	**Conserv.06**	**Conserv.07**	**Conserv.08**	**Conserv.09**	**Conserv.10**	**Conserv.11**	**Conserv.12**	**Conserv.13**	**Conserv.14**	**Conserv.15**	**Conserv.16**	**Conserv.17**	**Conserv.18**	**Conserv.19**	**Conserv.20**	
Riparian																					
Interior Warm and Cool Desert Riparian Forest	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	13.5 (0.4)
Warm Desert Lowland Freshwater Marsh, Wet Meadow, and Shrubland	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Wetlands																					
Western North American Disturbed Marsh, Wet Meadow, and Shrubland	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Western North American Freshwater Aquatic Vegetation	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	2.8 (0.1)
Western North American Montane-Subalpine-Boreal Marsh, Wet Meadow, and Shrubland	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Western North American Temperate and Boreal Freshwater Marsh, Wet Meadow, and Shrubland	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	7.9 (--)
Water																					
Dry Channel/Shrubland	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	29.0 (0.7)
Permanent Water	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	37.0 (0.5)
Water in Existing Basins	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	115.6 (--)
Shrublands																					
Alluvial Fan Sage Scrub	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	328.9 (30.0)
Californian Chaparral	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	9.8 (2.1)
Californian Coastal Scrub	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	89.7 (3.5)
Great Basin-Intermountain Xeric-Riparian Scrub	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	0.5 (0.8)
North American Warm-Desert Xeric-Riparian Scrub	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	2.9 (--)
Grasslands																					
Californian Annual and Perennial Grassland	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	31.6 (1.9)
Californian Disturbed Grassland, Meadow, and Scrub	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Woodlands																					
Californian Disturbed Forest	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	2.3 (--)
Californian Forest and Woodland	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (0.1)
Intermountain Singleleaf Pinyon-Utah Juniper-Western Juniper Woodland	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Rock Outcrops																					
Western North American Cliff, Scree, and Rock Vegetation	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	7.0 (2.1)
Agriculture																					
Herbaceous Agricultural Vegetation	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (3.6)
Woody Agricultural Vegetation	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (1.8)

VEGETATION IMPACTS
San Bernardino Municipal Water Department (WD)

Acres Impacted Permanent (Temporary)	Water Reuse Projects	Groundwater Recharge	Wells and Water Conveyance Infrastructure			Water Department Total
Vegetation Communities	**WD.1**	**WD.4**	**WD.2**	**WD.3**	**WD.5**	
Riparian						
Interior Warm and Cool Desert Riparian Forest	-- (0.7)	-- (--)	-- (1.1)	-- (--)	-- (0.2)	-- (2.0)
Warm Desert Lowland Freshwater Marsh, Wet Meadow, and Shrubland	-- (--)	-- (--)	-- (0.1)	-- (--)	-- (--)	-- (0.1)
Wetlands						
Western North American Disturbed Marsh, Wet Meadow, and Shrubland	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Western North American Freshwater Aquatic Vegetation	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Western North American Montane-Subalpine-Boreal Marsh, Wet Meadow, and Shrubland	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Western North American Temperate and Boreal Freshwater Marsh, Wet Meadow, and Shrubland	0.9 (--)	-- (--)	-- (--)	-- (--)	-- (--)	0.9 (--)
Water						
Dry Channel/Shrubland	0.3 (1.4)	-- (--)	-- (0.4)	-- (--)	0.1 (0.3)	0.4 (2.1)
Permanent Water	0.4 (0.3)	-- (--)	-- (0.6)	-- (--)	-- (0.4)	0.4 (1.3)
Water in Existing Basins	-- (0.2)	-- (--)	-- (--)	-- (--)	-- (--)	-- (0.2)
Shrublands						
Alluvial Fan Sage Scrub	0.3 (2.8)	-- (0.3)	-- (1.6)	-- (1.0)	-- (2.6)	0.3 (8.3)
Californian Chaparral	-- (--)	-- (--)	-- (--)	0.4 (0.3)	-- (0.5)	0.4 (0.8)
Californian Coastal Scrub	-- (--)	-- (0.5)	-- (--)	-- (0.1)	-- (1.0)	-- (1.6)
Great Basin-Intermountain Xeric-Riparian Scrub	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
North American Warm-Desert Xeric-Riparian Scrub	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Grasslands						
Californian Annual and Perennial Grassland	0.2 (1.2)	-- (--)	-- (0.1)	-- (--)	-- (1.6)	0.2 (2.9)
Californian Disturbed Grassland, Meadow, and Scrub	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Woodlands						
Californian Disturbed Forest	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Californian Forest and Woodland	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Intermountain Singleleaf Pinyon-Utah Juniper-Western Juniper Woodland	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Rock Outcrops						
Western North American Cliff, Scree, and Rock Vegetation	-- (0.1)	-- (--)	-- (0.2)	-- (--)	-- (0.2)	-- (0.5)
Agriculture						
Herbaceous Agricultural Vegetation	-- (0.6)	-- (--)	-- (--)	-- (--)	-- (0.1)	-- (0.7)
Woody Agricultural Vegetation	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)

VEGETATION IMPACTS
West Valley Water District (WV)

Acres Impacted Permanent (Temporary) *facility is an existing basin subject to routine O&M activities	Water Reuse Projects	Groundwater Recharge	Wells and Water Conveyance Infrastructure				West Valley Total
Vegetation Communities	WV.4	WV.1*	WV.2	WV.3	WV.5	WV.6	
Riparian							
Interior Warm and Cool Desert Riparian Forest	-- (--)	1.9 (--)	-- (--)	-- (--)	-- (--)	-- (--)	1.9 (--)
Warm Desert Lowland Freshwater Marsh, Wet Meadow, and Shrubland	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Wetlands							
Western North American Disturbed Marsh, Wet Meadow, and Shrubland	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Western North American Freshwater Aquatic Vegetation	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Western North American Montane-Subalpine-Boreal Marsh, Wet Meadow, and Shrubland	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Western North American Temperate and Boreal Freshwater Marsh, Wet Meadow, and Shrubland	-- (--)	1.2 (--)	-- (--)	-- (--)	-- (--)	-- (--)	1.2 (--)
Water							
Dry Channel/Shrubland	0.3 (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (0.1)	0.3 (0.1)
Permanent Water	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Water in Existing Basins	-- (--)	7.5 (--)	-- (--)	-- (--)	-- (--)	-- (--)	7.5 (--)
Shrublands							
Alluvial Fan Sage Scrub	-- (--)	2.6 (--)	-- (0.2)	-- (--)	0.2 (--)	-- (3.3)	2.8 (3.5)
Californian Chaparral	-- (--)	-- (--)	-- (--)	0.3 (--)	-- (--)	-- (1.6)	0.3 (1.6)
Californian Coastal Scrub	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (0.5)	-- (0.5)
Great Basin-Intermountain Xeric-Riparian Scrub	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
North American Warm-Desert Xeric-Riparian Scrub	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Grasslands							
Californian Annual and Perennial Grassland	0.1 (--)	1.4 (--)	-- (0.4)	-- (--)	-- (--)	-- (3.8)	1.5 (4.2)
Californian Disturbed Grassland, Meadow, and Scrub	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Woodlands							
Californian Disturbed Forest	0.2 (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	0.2 (--)
Californian Forest and Woodland	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Intermountain Singleleaf Pinyon-Utah Juniper-Western Juniper Woodland	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Rock Outcrops							
Western North American Cliff, Scree, and Rock Vegetation	-- (--)	0.7 (--)	-- (0.1)	-- (--)	-- (--)	-- (0.1)	0.7 (0.2)
Agriculture							
Herbaceous Agricultural Vegetation	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (0.5)	-- (0.5)
Woody Agricultural Vegetation	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)

VEGETATION IMPACTS
Western Municipal Water District of Riverside County (West)

Acres Impacted Permanent (Temporary)	Water Reuse Projects	Groundwater Recharge	Wells and Water Conveyance Infrastructure								Western Total
Vegetation Communities	**West.05**	**West.06**	**West.01**	**West.02**	**West.03**	**West.04**	**West.07**	**West.08**	**West.09**	**West.10**	
Riparian											
Interior Warm and Cool Desert Riparian Forest	-- (--)	-- (--)	1.0 (11.9)	-- (1.0)	-- (--)	-- (--)	-- (0.9)	-- (4.5)	-- (--)	-- (--)	1.0 (18.3)
Warm Desert Lowland Freshwater Marsh, Wet Meadow, and Shrubland	-- (--)	-- (--)	0.2 (2.2)	-- (0.2)	-- (--)	-- (--)	-- (--)	-- (0.9)	-- (--)	-- (--)	0.2 (3.3)
Wetlands											
Western North American Disturbed Marsh, Wet Meadow, and Shrubland	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Western North American Freshwater Aquatic Vegetation	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Western North American Montane-Subalpine-Boreal Marsh, Wet Meadow, and Shrubland	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Western North American Temperate and Boreal Freshwater Marsh, Wet Meadow, and Shrubland	-- (--)	1.0 (--)	0.1 (0.8)	-- (0.1)	-- (--)	-- (--)	-- (--)	-- (0.3)	-- (--)	-- (--)	1.1 (1.2)
Water											
Dry Channel/Shrubland	0.3 (--)	0.2 (--)	0.4 (3.8)	-- (0.4)	-- (--)	-- (--)	-- (0.2)	-- (0.1)	-- (0.1)	-- (--)	0.9 (4.6)
Permanent Water	1.4 (--)	-- (--)	-- (0.2)	-- (--)	-- (--)	-- (0.1)	-- (0.1)	-- (0.1)	-- (--)	-- (--)	1.4 (0.5)
Water in Existing Basins	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Shrublands											
Alluvial Fan Sage Scrub	-- (--)	-- (--)	-- (0.3)	-- (--)	-- (--)	-- (--)	-- (0.1)	-- (--)	-- (--)	-- (--)	-- (0.4)
Californian Chaparral	-- (--)	-- (--)	0.1 (1.5)	-- (0.1)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	2.8 (--)	2.9 (1.6)
Californian Coastal Scrub	-- (--)	-- (--)	4.7 (50.0)	-- (5.0)	-- (--)	-- (0.4)	4.9 (0.9)	-- (--)	-- (0.7)	12.7 (--)	22.3 (57.0)
Great Basin-Intermountain Xeric-Riparian Scrub	-- (--)	-- (--)	-- (0.5)	-- (0.1)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (0.6)
North American Warm-Desert Xeric-Riparian Scrub	-- (--)	-- (--)	-- (0.4)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (0.4)
Grasslands											
Californian Annual and Perennial Grassland	-- (--)	-- (--)	3.2 (33.2)	-- (3.3)	-- (--)	-- (0.5)	0.2 (1.9)	-- (0.1)	-- (--)	-- (--)	3.4 (39.0)
Californian Disturbed Grassland, Meadow, and Scrub	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Woodlands											
Californian Disturbed Forest	-- (--)	-- (--)	0.1 (1.0)	-- (0.1)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	0.1 (1.1)
Californian Forest and Woodland	-- (--)	-- (--)	-- (0.1)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (0.1)
Intermountain Singleleaf Pinyon-Utah Juniper-Western Juniper Woodland	-- (--)	-- (--)	0.1 (0.5)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	0.1 (0.5)
Rock Outcrops											
Western North American Cliff, Scree, and Rock Vegetation	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)
Agriculture											
Herbaceous Agricultural Vegetation	-- (--)	2.0 (--)	8.3 (85.6)	-- (--)	0.7 (--)	-- (--)	45.0	-- (3.3)	-- (--)	11.6 (--)	67.6 (104.2)
Woody Agricultural Vegetation	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (--)	-- (0.2)	-- (--)	-- (--)	-- (--)	-- (0.2)

Appendix G

Covered Activity Avoidance and Minimization Measures

Covered Activity ID	All Covered Activities (AMM 1-28)	Riparian Area and Aquatic Habitat Protection (AMM 29-35)	Alluvial Fan Sage Scrub Protection (AMM 36)	Special Status Fish and Other Aquatic Species Protection (AMM 37)	Breeding Bird Protection (AMM 38-39)	ARTO AM 1-4	DSFF AM 1-3	SHSP AMM- 1-4	SARW AMM- 1-6	SAS AMM- 1-5	ARCH (SAS AMM 1-5)	SASD AMM-1-2	MYLF AMM 1-3	WESP AMM 1-4	TRBL AMM-1-2	CGSN AMM-1-5	SCGS AMM-1-6	SWPT AMM-1-4	BUOW AMM-1	WYBC AMM-1-3	YBCH AMM-1-3	SWFL AMM-1-3	CAGN AMM-1-3	CACW AMM-1-4	LBV AMM-1-3	LAPM (SBKR AMM 1-7)	SBKR AMM 1-7
CD.1	•		•	•	•			•	•	•				•		•			•				•	•		•	•
CD.2	•	•	•	•	•			•	•	•				•		•			•		•	•	•	•	•	•	•
EV.1	•		•		•			•						•		•			•				•	•		•	
EV.2	•	•	•		•			•	•				•	•	•	•			•		•	•	•	•	•	•	•
EV.3	•	•	•		•			•	•				•	•	•	•			•		•	•	•	•	•	•	•
EV.4.01 – 4.03	•	•	•	•	•			•	•	•	•			•	•	•			•				•	•		•	•
EV.5	•	•	•		•			•	•				•	•		•			•		•	•	•	•	•	•	•
IEUA.1.01 – 1.13	•	•	•	•	•	•	•	•	•					•	•	•			•		•	•	•	•	•	•	•
IEUA.2.01 - 2.08	•	•	•	•	•	•								•	•	•			•		•	•	•	•	•	•	•
IEUA.3.01 – 3.06	•		•		•		•		•																		
IEUA.4	N/A																										
Met.1	•	•	•	•	•			•	•	•	•					•	•	•	•		•	•	•	•	•	•	
Met.2	•	•	•	•	•	•	•	•	•	•	•		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Met.3	•	•	•	•	•	•	•	•	•	•	•		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
OCWD.1	•	•	•	•	•		•		•	•	•				•		•	•	•	•	•	•	•	•	•	•	
Rial.1	•	•	•	•	•		•			•	•			•	•				•		•	•	•	•	•	•	
RPU.1	•	•	•	•	•			•	•	•	•				•	•		•	•		•	•	•	•	•	•	•
RPU.2	•	•	•		•			•	•					•	•	•			•		•	•	•	•	•	•	•
RPU.3	•	•	•		•			•	•					•	•	•			•		•	•	•	•	•	•	•
RPU.4	•	•		•	•										•		•	•		•	•	•			•		
RPU.5	•	•	•		•				•					•	•	•			•		•	•		•	•	•	•
RPU.6	•		•		•			•	•					•		•			•				•	•		•	
RPU.7	•	•	•		•			•	•					•	•	•			•		•	•	•	•	•	•	•
RPU.8	•	•	•		•										•	•			•		•	•		•	•	•	
RPU.9	•		•		•									•		•			•					•		•	
RPU.10	•	•	•	•	•		•	•	•	•	•				•	•	•	•	•	•	•	•	•	•	•	•	
RPU.11	•	•	•		•			•	•					•	•	•			•		•	•	•	•	•	•	•
RPU.12	•	•	•	•	•			•	•					•	•	•	•	•	•	•	•	•	•	•	•	•	•
RPU.13	•	•	•		•									•	•	•			•					•		•	
RPU.14	•	•	•		•			•	•					•	•	•			•		•	•	•	•	•	•	•
RPU.15	•	•	•	•	•			•	•					•	•	•	•	•	•	•	•	•	•	•	•	•	•
Conserv.1	•	•	•	•	•				•	•					•	•	•	•	•	•	•	•	•	•	•	•	
Conserv.2	•	•	•	•	•			•	•	•					•	•	•	•	•		•	•	•	•	•	•	
Conserv.3	•	•	•	•	•				•	•					•	•	•	•	•		•	•	•	•	•	•	
Conserv.4	•	•	•	•	•			•	•	•					•	•	•	•	•		•	•	•	•	•	•	
Conserv.5	•	•	•	•	•		•	•	•	•					•	•	•	•	•	•	•	•	•	•	•	•	
Conserv.6	•	•	•	•	•				•	•					•	•	•	•	•		•	•		•		•	
Conserv.7	•	•	•	•	•		•		•	•					•	•	•	•	•	•	•	•		•	•	•	

Covered Activity ID	All Covered Activities (AMM 1-28)	Riparian Area and Aquatic Habitat Protection (AMM 29-35)	Alluvial Fan Sage Scrub Protection (AMM 36)	Special Status Fish and Other Aquatic Species Protection (AMM 37)	Breeding Bird Protection (AMM 38-39)	ARTO AM 1-4	DSFF AM 1-3	SHSP AMM- 1-4	SARW AMM- 1-6	SAS AMM- 1-5	ARCH (SAS AMM 1-5)	SASD AMM-1-2	MYLF AMM 1-3	WESP AMM 1-4	TRBL AMM-1-2	CGSN AMM-1-5	SCGS AMM-1-6	SWPT AMM-1-4	BUOW AMM-1	WYBC AMM-1-3	YBCH AMM-1-3	SWFL AMM-1-3	CAGN AMM-1-3	CACW AMM-1-4	LBV AMM-1-3	LAPM (SBKR AMM 1-7)	SBKR AMM 1-7
Conserv.8	•	•	•	•	•					•		•			•		•	•	•	•	•	•			•		
Conserv.9	•	•	•		•										•	•	•	•	•		•	•		•	•	•	
Conserv.10	•	•	•	•	•		•		•	•					•	•	•	•	•	•	•	•	•	•	•	•	
Conserv.11	•	•	•	•	•		•		•	•					•		•	•	•	•	•	•			•		
Conserv.12	•		•		•			•	•			•		•	•	•			•		•	•	•	•	•	•	
Conserv.13	•		•		•			•	•					•		•			•				•	•		•	•
Conserv.14	•		•		•									•	•	•			•					•		•	
Conserv.15	•	•	•		•									•	•	•			•					•		•	
Conserv.16	•	•	•		•			•	•					•	•	•			•	•	•	•	•	•	•	•	•
Conserv.17	•	•	•		•			•	•					•		•			•				•	•		•	
Conserv.18	•	•	•		•			•	•					•		•			•				•	•		•	•
Conserv.19	•	•	•	•	•			•	•					•		•			•				•	•		•	•
Conserv.20	•	•	•	•	•			•	•	•			•	•		•			•		•	•	•	•	•	•	•
VD.1	•	•	•	•	•				•	•						•			•		•	•	•	•	•	•	
VD.2.02 – 2.14	•	•	•	•	•			•	•	•			•	•	•	•			•		•	•	•	•	•	•	•
VD.3	•	•	•	•	•			•	•	•				•		•			•				•	•		•	•
VD.4	•	•	•	•	•			•	•	•			•	•	•	•			•	•	•	•	•	•	•	•	•
WD.1	•	•	•	•	•			•	•	•		•	•	•	•	•			•		•	•	•	•	•	•	•
WD.2	•	•	•	•	•			•	•	•				•		•			•		•	•	•	•	•	•	•
WD.3	•	•	•		•	•		•					•	•		•							•	•		•	•
WD.4	•		•		•			•	•					•		•			•				•	•		•	•
WD.5	•	•	•	•	•	•	•	•	•	•			•	•	•	•			•		•	•	•	•	•	•	•
West.1	•	•	•	•	•			•	•	•				•	•	•	•	•	•	•	•	•	•	•	•	•	
West.2	•	•	•	•	•			•	•	•				•	•	•	•	•	•	•	•	•	•	•	•	•	
West.3	•	•	•		•										•				•		•	•			•		
West.4	•	•	•	•	•			•	•	•				•	•	•			•				•	•		•	
West.5	•	•		•	•					•																	
West.6	•	•	•		•										•				•		•	•			•		
West.7	•	•	•	•	•		•	•	•	•				•	•	•	•	•	•	•	•	•	•	•	•	•	•
West.8	•	•	•	•	•										•	•			•	•	•	•		•	•	•	
West.9	•	•	•	•	•			•						•		•			•		•	•	•	•	•	•	
West.10	•		•	•	•			•						•	•	•			•				•	•		•	
WV.1	•	•	•	•	•									•		•			•		•	•	•	•	•	•	•
WV.2	•		•	•	•		•	•	•					•	•	•			•				•	•	•	•	•
WV.3	•	•	•		•								•	•		•											
WV.4	•		•	•	•			•	•			•		•	•	•			•				•	•		•	•
WV.5	•	•	•	•	•			•	•					•	•	•			•		•	•	•	•	•	•	•
WV.6	•	•	•	•	•		•	•	•	•			•	•	•	•		•	•	•	•	•	•	•	•	•	•

Appendix H
Cost Summary

HCP Cost Summary

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Restoration Contingency	15%
Land Acquisition Contingency	10%
Remaining Contingency	3%

1000s

Table 7-3

Total Operating Costs	Pre-Permit Costs	5-Yr Cost by Plan Period: Yrs 1-5	Yrs 6-10	Yrs 11-15	Yrs 16-20	Yrs 21-25	Yrs 26-30	Yrs 31-35	Yrs 36-40	Yrs 41-45	Yrs 46-50	Undiscounted Total Cost
Land Costs												
Restoration	$0	$3,298	$4,854	$949	$949	$949	$949	$949	$949	$949	$949	**$15,747**
SAR Fish Translocation	$0	$1,135	$876	$565	$565	$565	$565	$565	$565	$565	$565	**$6,535**
Management and Maintenance	$0	$2,693	$3,035	$3,513	$3,513	$3,513	$3,513	$3,513	$3,513	$3,513	$3,513	**$33,830**
Monitoring and Reporting	$1	$1,797	$1,797	$2,026	$2,026	$2,026	$2,026	$2,026	$1,899	$2,026	$1,899	**$19,550**
Program Administration	$0	$2,442	$2,442	$2,307	$2,307	$2,307	$2,307	$2,307	$2,307	$2,307	$2,307	**$23,339**
Subtotal	$ 1	**$11,365**	**$13,004**	**$9,361**	**$9,361**	**$9,361**	**$9,361**	**$9,361**	**$9,233**	**$9,361**	**$9,233**	**$99,001**
Average Annual Cost:	NA	$ 2,273	$ 2,601	$ 1,872	$ 1,872	$ 1,872	$ 1,872	$ 1,872	$ 1,847	$ 1,872	$ 1,847	
Endowment Fund	$0	$1,378	$1,378	$1,378	$1,378	$1,378	$1,378	$1,378	$1,378	$1,378	$1,378	**$13,779**
Restoration Changed Circumstance	$0	$495	$728	$142	$142	$142	$142	$142	$142	$142	$142	**$2,362**
Remaining Changed Circumstance	$0	$161	$153	$147	$147	$147	$147	$147	$143	$147	$143	**$1,483**
Total Changed Circumstance Reserve	$0	$656	$881	$289	$289	$289	$289	$289	$286	$289	$286	**$3,845**
Total	$1	$13,399	$15,263	$11,028	$11,028	$11,028	$11,028	$11,028	$10,896	$11,028	$10,896	**$116,625**

Staffing & Program Overhead Costs	Pre-Permit Costs	5-Yr Cost by Plan Period: Yrs 1-5	Yrs 6-10	Yrs 11-15	Yrs 16-20	Yrs 21-25	Yrs 26-30	Yrs 31-35	Yrs 36-40	Yrs 41-45	Yrs 46-50	Undiscounted Total Cost
Land costs												
Restoration	$ -	$ 1,006	$ 1,006	$ 726	$ 726	$ 726	$ 726	$ 726	$ 726	$ 726	$ 726	$ 7,824
SAR Fish Translocation	$ -	$ 754	$ 754	$ 493	$ 493	$ 493	$ 493	$ 493	$ 493	$ 493	$ 493	$ 5,456
Management and Maintenance	$ -	$ 1,271	$ 1,271	$ 1,582	$ 1,582	$ 1,582	$ 1,582	$ 1,582	$ 1,582	$ 1,582	$ 1,582	$ 15,199
Monitoring and Reporting	$ -	$ 1,075	$ 1,075	$ 1,305	$ 1,305	$ 1,305	$ 1,305	$ 1,305	$ 1,305	$ 1,305	$ 1,305	$ 12,587
Program Administration	$ -	$ 1,615	$ 1,615	$ 1,479	$ 1,479	$ 1,479	$ 1,479	$ 1,479	$ 1,479	$ 1,479	$ 1,479	$ 15,064
Subtotal Staffing & Overhead:	**$ -**	**$ 5,721**	**$ 5,721**	**$ 5,586**	**$ 5,586**	**$ 5,586**	**$ 5,586**	**$ 5,586**	**$ 5,586**	**$ 5,586**	**$ 5,586**	**$ 56,130**
Average Annual Cost:	NA	$ 1,144	$ 1,144	$ 1,117	$ 1,117	$ 1,117	$ 1,117	$ 1,117	$ 1,117	$ 1,117	$ 1,117	

Other Operating Costs	Pre-Permit Costs	5-Yr Cost by Plan Period: Yrs 1-5	Yrs 6-10	Yrs 11-15	Yrs 16-20	Yrs 21-25	Yrs 26-30	Yrs 31-35	Yrs 36-40	Yrs 41-45	Yrs 46-50	Undiscounted Total Cost
Land Costs												
Restoration	$0	$2,292	$3,847	$223	$223	$223	$223	$223	$223	$223	$223	$7,923
SAR Fish Translocation	$0	$381	$122	$72	$72	$72	$72	$72	$72	$72	$72	$1,079
Monitoring and Reporting	$722	$722	$722	$722	$722	$722	$722	$722	$594	$722	$594	$7,685
Management and Maintenance	$0	$1,422	$1,764	$1,931	$1,931	$1,931	$1,931	$1,931	$1,931	$1,931	$1,931	$18,631
Program Administration	$0	$828	$828	$828	$828	$828	$828	$828	$828	$828	$828	$8,275
Subtotal Other Operating Costs:	**$ 722**	**$5,644**	**$7,283**	**$3,775**	**$3,775**	**$3,775**	**$3,775**	**$3,775**	**$3,647**	**$3,775**	**$3,647**	**$ 43,594**
Average Annual Cost:	NA	$ 1,129	$ 1,457	$ 755	$ 755	$ 755	$ 755	$ 755	$ 729	$ 755	$ 729	

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Table 7-2

Non-Recurring Capital Costs

	Pre-Permit Costs	5-Yr Cost by Plan Period Yrs 1-5	Yrs 6-10	Yrs 11-15	Yrs 16-20	Yrs 21-25	Yrs 26-30	Yrs 31-35	Yrs 36-40	Yrs 41-45	Yrs 46-50	Undiscounted Total Cost
Land Costs	$60	$18,520	$11,132	$0	$0	$0	$0	$0	$0	$0	$0	**$29,712**
Restoration	$24,350	$3,711	$800	$750	$0	$0	$0	$0	$0	$0	$0	**$29,611**
SAR Fish Translocation	$255	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	**$255**
Management and Maintenance	$0	$0	$751	$206	$0	$0	$0	$0	$0	$0	$0	**$957**
Monitoring and Reporting	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	**$0**
Program Administration	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	**$0**
Subtotal Non-Recurring Capital Costs:	**$24,665**	**$22,231**	**$12,683**	**$956**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$60,536**
Average Annual Cost:	NA	$ 4,446	$ 2,537	$ 191	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
Restoration Changed Circumstance	$3,653	$557	$120	$113	$0	$0	$0	$0	$0	$0	$0	**$4,442**
Land Acquisition Changed Circumstance	$6	$1,852	$1,113	$0	$0	$0	$0	$0	$0	$0	$0	$2,971
Remaining Changed Circumstance	$8	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	**$8**
Total Changed Circumstance Reserve	$3,666	$2,409	$1,233	$113	$0	$0	$0	$0	$0	$0	$0	**$7,421**
Total	$28,332	$24,639	$13,916	$1,069	$0	$0	$0	$0	$0	$0	$0	**$67,956**

Table 7-1

Total Program Costs

	Pre-Permit Costs	5-Yr Cost by Plan Period Yrs 1-5	Yrs 6-10	Yrs 11-15	Yrs 16-20	Yrs 21-25	Yrs 26-30	Yrs 31-35	Yrs 36-40	Yrs 41-45	Yrs 46-50	Undiscounted Total Cost
Land Costs	$60	$18,520	$11,132	$0	$0	$0	$0	$0	$0	$0	$0	**$29,712**
Restoration	$24,350	$6,003	$4,647	$973	$223	$223	$223	$223	$223	$223	$223	**$37,534**
SAR Fish Translocation	$255	$381	$122	$72	$72	$72	$72	$72	$72	$72	$72	**$1,334**
Management and Maintenance	$0	$1,422	$2,515	$2,137	$1,931	$1,931	$1,931	$1,931	$1,931	$1,931	$1,931	**$19,591**
Monitoring and Reporting	$722	$722	$722	$722	$722	$722	$722	$722	$594	$722	$594	**$7,686**
Staffing and Program Administration	$0	$6,549	$6,549	$6,413	$6,413	$6,413	$6,413	$6,413	$6,413	$6,413	$6,413	**$64,402**
Grand Total Program Costs:	**$25,387**	**$33,597**	**$25,687**	**$10,317**	**$9,361**	**$9,361**	**$9,361**	**$9,361**	**$9,233**	**$9,361**	**$9,233**	**$160,259**
Average Annual Cost:	NA	$ 6,719	$ 5,137	$ 2,063	$ 1,872	$ 1,872	$ 1,872	$ 1,872	$ 1,847	$ 1,872	$ 1,847	
Endowment Fund	$0	$1,378	$1,378	$1,378	$1,378	$1,378	$1,378	$1,378	$1,378	$1,378	$1,378	**$13,779**
Restoration Changed Circumstance	$0	$4,704	$848	$255	$142	$142	$142	$142	$142	$142	$142	**$6,804**
Land Acquisition Changed Circumstance	$0	$1,858	$1,113	$0	$0	$0	$0	$0	$0	$0	$0	$2,971
Remaining Changed Circumstance	$0	$169	$153	$147	$147	$147	$147	$147	$143	$147	$143	**$1,490**
Total Changed Circumstance Reserve	$0	$6,731	$2,115	$402	$289	$289	$289	$289	$286	$289	$286	**$11,265**
Total	$25,387	$41,706	$29,180	$12,097	$11,028	$11,028	$11,028	$11,028	$10,897	$11,028	$10,897	**$185,303**

Program Administration Costs

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Capital Costs		Pre-Permit Costs	Cost by Plan Period Yrs 1-5	Yrs 6-10	Yrs 11-15	Yrs 16-20	Yrs 21-25	Yrs 26-30	Yrs 31-35	Yrs 36-40	Yrs 41-45	Yrs 46-50	Undiscounted Total Cost
Staff and Overhead													$0
Vehicle/Mileage Allowance													$0
Travel													$0
Legal & Accounting													$0
Public Relations/Outreach													$0
Capital Subtotal:	**Per Period**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
	Per Year	NA	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	

Operational Costs		Pre-Permit Costs	Cost by Plan Period Yrs 1-5	Yrs 6-10	Yrs 11-15	Yrs 16-20	Yrs 21-25	Yrs 26-30	Yrs 31-35	Yrs 36-40	Yrs 41-45	Yrs 46-50	Undiscounted Total Cost
Staff and Overhead			$1,614,621	$1,614,621	$1,479,373	$1,479,373	$1,479,373	$1,479,373	$1,479,373	$1,479,373	$1,479,373	$1,479,373	$15,064,228
Vehicle/Mileage Allowance			$7,500	$7,500	$7,500	$7,500	$7,500	$7,500	$7,500	$7,500	$7,500	$7,500	$75,000
Travel			$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$300,000
Legal & Accounting			$665,000	$665,000	$665,000	$665,000	$665,000	$665,000	$665,000	$665,000	$665,000	$665,000	$6,650,000
Public Relations/Outreach			$125,000	$125,000	$125,000	$125,000	$125,000	$125,000	$125,000	$125,000	$125,000	$125,000	$1,250,000
Operational Subtotal:	**Per Period**	**$0**	**$2,442,121**	**$2,442,121**	**$2,306,873**	**$2,306,873**	**$2,306,873**	**$2,306,873**	**$2,306,873**	**$2,306,873**	**$2,306,873**	**$2,306,873**	
	Per Year	NA	**$488,424**	**$488,424**	**$461,375**	**$461,375**	**$461,375**	**$461,375**	**$461,375**	**$461,375**	**$461,375**	**$461,375**	

Total Program Administration Costs		Pre-Permit Costs	Cost by Plan Period Yrs 1-5	Yrs 6-10	Yrs 11-15	Yrs 16-20	Yrs 21-25	Yrs 26-30	Yrs 31-35	Yrs 36-40	Yrs 41-45	Yrs 46-50	Undiscounted Total Cost
Staff and Overhead			$1,614,621	$1,614,621	$1,479,373	$1,479,373	$1,479,373	$1,479,373	$1,479,373	$1,479,373	$1,479,373	$1,479,373	$15,064,228
Vehicle/Mileage Allowance			$7,500	$7,500	$7,500	$7,500	$7,500	$7,500	$7,500	$7,500	$7,500	$7,500	$75,000
Travel			$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$300,000
Legal & Accounting			$665,000	$665,000	$665,000	$665,000	$665,000	$665,000	$665,000	$665,000	$665,000	$665,000	$6,650,000
Public Relations/Outreach			$125,000	$125,000	$125,000	$125,000	$125,000	$125,000	$125,000	$125,000	$125,000	$125,000	$1,250,000
Program Administration Total:	**Per Period**	**$0**	**$2,442,121**	**$2,442,121**	**$2,306,873**	**$2,306,873**	**$2,306,873**	**$2,306,873**	**$2,306,873**	**$2,306,873**	**$2,306,873**	**$2,306,873**	
	Per Year	NA	**$488,424**	**$488,424**	**$461,375**	**$461,375**	**$461,375**	**$461,375**	**$461,375**	**$461,375**	**$461,375**	**$461,375**	
			$322,924.23										

Staff and Overhead	Fully Burdened Annual Cost per FTE	Pre-Permit Costs	Number of FTEs by Plan Period Yrs 1-5	Yrs 6-10	Yrs 11-15	Yrs 16-20	Yrs 21-25	Yrs 26-30	Yrs 31-35	Yrs 36-40	Yrs 41-45	Yrs 46-50	Undiscounted Total Cost
Executive Director/Principal Scientist	$279,329		0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	
HCP Program Manager/Lead Biologist	$236,979		0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	
Preserve Manager	$236,979		0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	
Senior Environmental Scientist	$159,980		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Associate Environmental Scientist	$124,042		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
GIS Analyst/Database Manager	$127,789		0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	
Budget Analyst/Accountant	$108,198		0.75	0.75	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	
Empty	$0		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Empty	$0		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
	Total FTE	**0.00**	**1.75**	**1.75**	**1.50**	**1.50**	**1.50**	**1.50**	**1.50**	**1.50**	**1.50**	**1.50**	
	Cost per period	**$0**	**$1,614,621**	**$1,614,621**	**$1,479,373**	**$1,479,373**	**$1,479,373**	**$1,479,373**	**$1,479,373**	**$1,479,373**	**$1,479,373**	**$1,479,373**	**$15,064,228**
	Cost per year	**$0**	**$322,924**	**$322,924**	**$295,875**	**$295,875**	**$295,875**	**$295,875**	**$295,875**	**$295,875**	**$295,875**	**$295,875**	

Notes:

Fully burdened annual cost per FTE includes salary and benefits and allowances for salaries and benefits of support staff (e.g. secretaries, IT support) and associated overhead, including space and utility costs, office furniture, equipement, and supplies.

Program Administration Costs **Page 2 of 2**

Other Administrative Costs

Vehicle/Mileage Allowance		Pre-Permit	Total Cost Per 5-Year Period										Undiscounted
Assumptions:	Cost per period	Costs	Yrs 1-5	Yrs 6-10	Yrs 11-15	Yrs 16-20	Yrs 21-25	Yrs 26-30	Yrs 31-35	Yrs 36-40	Yrs 41-45	Yrs 46-50	Total Cost
annual mileage allowance ($/yr)	$1,500		$7,500	$7,500	$7,500	$7,500	$7,500	$7,500	$7,500	$7,500	$7,500	$7,500	$75,000
	annual cost based on actual ECCC HCP experience through 2016												

Travel		Pre-Permit	Total Cost Per 5-Year Period										Undiscounted
Assumptions:	Cost per period	Costs	Yrs 1-5	Yrs 6-10	Yrs 11-15	Yrs 16-20	Yrs 21-25	Yrs 26-30	Yrs 31-35	Yrs 36-40	Yrs 41-45	Yrs 46-50	Total Cost
annual travel expense ($/yr)	$6,000		$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$300,000
	annual cost based on actual ECCC HCP experience through 2016												

Legal & Accounting		Pre-Permit	Total Cost Per 5-Year Period										Undiscounted
Assumptions:	Cost per period	Costs	Yrs 1-5	Yrs 6-10	Yrs 11-15	Yrs 16-20	Yrs 21-25	Yrs 26-30	Yrs 31-35	Yrs 36-40	Yrs 41-45	Yrs 46-50	Total Cost
annual cost for legal assistance	$100,000		$500,000	$500,000	$500,000	$500,000	$500,000	$500,000	$500,000	$500,000	$500,000	$500,000	$5,000,000
annual cost for financial assistance	$13,000		$65,000	$65,000	$65,000	$65,000	$65,000	$65,000	$65,000	$65,000	$65,000	$65,000	$650,000
annual cost for financial audits	$20,000		$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$1,000,000
	annual cost assumption used in ECCC HCP												

Public Relations/Outreach		Pre-Permit	Total Cost Per 5-Year Period										Undiscounted
Assumptions:	Cost per period	Costs	Yrs 1-5	Yrs 6-10	Yrs 11-15	Yrs 16-20	Yrs 21-25	Yrs 26-30	Yrs 31-35	Yrs 36-40	Yrs 41-45	Yrs 46-50	Total Cost
annual cost for published materials	$5,000		$25,000	$25,000	$25,000	$25,000	$25,000	$25,000	$25,000	$25,000	$25,000	$25,000	$250,000
annual cost for public events	$10,000		$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$500,000
annual cost for web development	$10,000		$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$500,000
	annual cost assumption used in ECCC HCP												

Land Acquisition/Easements

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Capital Costs		Pre-Permit Costs	Cost by Plan Period Yrs 1-5	Yrs 6-10	Yrs 11-15	Yrs 16-20	Yrs 21-25	Yrs 26-30	Yrs 31-35	Yrs 36-40	Yrs 41-45	Yrs 46-50	Undiscounted Total Cost
Staff and Overhead													$0
Design/Enviro/Permitting		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Land Acquisition		$60,000	$18,519,721	$11,131,992	$0	$0	$0	$0	$0	$0	$0	$0	$29,711,713
Construction		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
O&M													$0
Capital Subtotal:	**Per Period**	**$60,000**	**$18,519,721**	**$11,131,992**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$29,711,713**
	Per Year	NA	**$3,703,944**	**$2,226,398**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	

Operational Costs		Pre-Permit Costs	Cost by Plan Period Yrs 1-5	Yrs 6-10	Yrs 11-15	Yrs 16-20	Yrs 21-25	Yrs 26-30	Yrs 31-35	Yrs 36-40	Yrs 41-45	Yrs 46-50	Undiscounted Total Cost
Staff and Overhead		$0	$1,006,185	$1,006,185	$726,434	$726,434	$726,434	$726,434	$726,434	$726,434	$726,434	$726,434	$7,823,840
Design/Enviro/Permitting													$0
Land Acquisition													$0
Construction													$0
O&M		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Operational Subtotal:	**Per Period**	**$0**	**$1,006,185**	**$1,006,185**	**$726,434**	**$726,434**	**$726,434**	**$726,434**	**$726,434**	**$726,434**	**$726,434**	**$726,434**	**$7,823,840**
	Per Year	NA	**$201,237**	**$201,237**	**$145,287**	**$145,287**	**$145,287**	**$145,287**	**$145,287**	**$145,287**	**$145,287**	**$145,287**	

Total Tributaries Restoration Costs		Pre-Permit Costs	Cost by Plan Period Yrs 1-5	Yrs 6-10	Yrs 11-15	Yrs 16-20	Yrs 21-25	Yrs 26-30	Yrs 31-35	Yrs 36-40	Yrs 41-45	Yrs 46-50	Undiscounted Total Cost
Staff and Overhead		$0	$1,006,185	$1,006,185	$726,434	$726,434	$726,434	$726,434	$726,434	$726,434	$726,434	$726,434	$7,823,840
Design/Enviro/Permitting		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Land Acquisition		$60,000	$18,519,721	$11,131,992	$0	$0	$0	$0	$0	$0	$0	$0	$29,711,713
Construction		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
O&M		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
SAR Tributaries Restoration Total:	**Per Period**	**$60,000**	**$19,525,906**	**$12,138,177**	**$726,434**	**$726,434**	**$726,434**	**$726,434**	**$726,434**	**$726,434**	**$726,434**	**$726,434**	**$37,535,553**
	Per Year	NA	**$3,905,181**	**$2,427,635**	**$145,287**	**$145,287**	**$145,287**	**$145,287**	**$145,287**	**$145,287**	**$145,287**	**$145,287**	

Staff and Overhead	Fully Burdened Cost per FTE	Pre-Permit Costs	Number of FTEs by Plan Period Yrs 1-5	Yrs 6-10	Yrs 11-15	Yrs 16-20	Yrs 21-25	Yrs 26-30	Yrs 31-35	Yrs 36-40	Yrs 41-45	Yrs 46-50	Undiscounted Total Cost
Executive Director/Principal Scientist	279328.73	0	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	
HCP Program Manager/Lead Biologist	236979.27	0	0.20	0.20	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	
Preserve Manager	236979.27	0	0.15	0.15	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	
Senior Environmental Scientist	159980.26	0	0.25	0.25	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	
Associate Environmental Scientist	124042.45	0	0.20	0.20	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	
GIS Analyst/Database Manager	127788.75	0	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	
Budget Analyst/Accountant	108198.42	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Empty	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Empty	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
	Total FTE	**0.00**	**1.10**	**1.10**	**0.80**	**0.80**	**0.80**	**0.80**	**0.80**	**0.80**	**0.80**	**0.80**	
	Cost per period	**$0**	**$1,006,185**	**$1,006,185**	**$726,434**	**$726,434**	**$726,434**	**$726,434**	**$726,434**	**$726,434**	**$726,434**	**$726,434**	**$7,823,840**
	Cost per year	**$0**	**$201,237**	**$201,237**	**$145,287**	**$145,287**	**$145,287**	**$145,287**	**$145,287**	**$145,287**	**$145,287**	**$145,287**	

Notes:

Fully burdened annual cost per FTE includes salary and benefits and allowances for salaries and benefits of support staff (e.g. secretaries, IT support) and associated overhead, including space and utility costs, office furniture, equipement, and supplies.

Land Acquisition/Easements

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Sum of Tributaries Restoration Project Costs

	Cost Type	Pre-Permit Costs	Cost by Plan Period Yrs 1-5	Yrs 6-10	Yrs 11-15	Yrs 16-20	Yrs 21-25	Yrs 26-30	Yrs 31-35	Yrs 36-40	Yrs 41-45	Yrs 46-50	Undiscounted Total Cost
Design/Enviro/Permitting	Capital	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Land Acquisition	Capital	$60,000	$18,519,721	$11,131,992	$0	$0	$0	$0	$0	$0	$0	$0	$29,711,713
Construction	Capital	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
O&M	Operational	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Capital		$60,000	$18,519,721	$11,131,992	$0	$0	$0	$0	$0	$0	$0	$0	$29,711,713
Total Operational		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0

Cost estimates of individual restoration projects

Anza Creek and Old Ranch (14 acres, 1.3 stream miles)

		Pre-Permit Costs	Cost by Plan Period Yrs 1-5	Yrs 6-10	Yrs 11-15	Yrs 16-20	Yrs 21-25	Yrs 26-30	Yrs 31-35	Yrs 36-40	Yrs 41-45	Yrs 46-50	Undiscounted Total Cost
	acres		18.32	0									
Total land Acquisition	Land Acquisition	$0	$18,423,721	$6,607,992	$0	$0							$25,031,713
Total easement transaction cost	Land Acquisition	$60,000	$96,000	$4,524,000									$4,680,000

SAR Fish Translocation

Capital Costs		Pre-Permit	Cost by Plan Period										Undiscounted
		Costs	Yrs 1-5	Yrs 6-10	Yrs 11-15	Yrs 16-20	Yrs 21-25	Yrs 26-30	Yrs 31-35	Yrs 36-40	Yrs 41-45	Yrs 46-50	Total Cost
Staff and Overhead													$0
Design/Enviro/Permitting		$255,476	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$255,476
Land Acquisition		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Construction		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
O&M													$0
Empty													$0
Empty													$0
Empty													$0
Empty													$0
Capital Subtotal:	**Per Period**	**$255,476**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$255,476**
	Per Year	**$51,095**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	

Operational Costs		Pre-Permit	Cost by Plan Period										Undiscounted
		Costs	Yrs 1-5	Yrs 6-10	Yrs 11-15	Yrs 16-20	Yrs 21-25	Yrs 26-30	Yrs 31-35	Yrs 36-40	Yrs 41-45	Yrs 46-50	Total Cost
Staff and Overhead		$0	$753,968	$753,968	$493,467	$493,467	$493,467	$493,467	$493,467	$493,467	$493,467	$493,467	$5,455,676
Design/Enviro/Permitting													$0
Land Acquisition													$0
Construction													$0
O&M		$0	$381,000	$122,000	$72,000	$72,000	$72,000	$72,000	$72,000	$72,000	$72,000	$72,000	$1,079,000
Empty													$0
Empty													$0
Empty													$0
Empty													$0
Operational Subtotal:	**Per Period**	**$0**	**$1,134,968**	**$875,968**	**$565,467**	**$565,467**	**$565,467**	**$565,467**	**$565,467**	**$565,467**	**$565,467**	**$565,467**	**$6,534,676**
	Per Year	**$0**	**$226,994**	**$175,194**	**$113,093**	**$113,093**	**$113,093**	**$113,093**	**$113,093**	**$113,093**	**$113,093**	**$113,093**	

Total Fish Translocation Costs		Pre-Permit	Cost by Plan Period										Undiscounted
		Costs	Yrs 1-5	Yrs 6-10	Yrs 11-15	Yrs 16-20	Yrs 21-25	Yrs 26-30	Yrs 31-35	Yrs 36-40	Yrs 41-45	Yrs 46-50	Total Cost
Staff and Overhead		$0	$753,968	$753,968	$493,467	$493,467	$493,467	$493,467	$493,467	$493,467	$493,467	$493,467	$5,455,676
Design/Enviro/Permitting		$255,476	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$255,476
Land Acquisition		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Construction		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
O&M		$0	$381,000	$122,000	$72,000	$72,000	$72,000	$72,000	$72,000	$72,000	$72,000	$72,000	$1,079,000
Fish Translocation Total:	**Per Period**	**$255,476**	**$1,134,968**	**$875,968**	**$565,467**	**$565,467**	**$565,467**	**$565,467**	**$565,467**	**$565,467**	**$565,467**	**$565,467**	**$6,790,153**
	Per Year	**$51,095**	**$226,994**	**$175,194**	**$113,093**	**$113,093**	**$113,093**	**$113,093**	**$113,093**	**$113,093**	**$113,093**	**$113,093**	

	Fully Burdened	Pre-Permit	Number of FTEs by Plan Period										Undiscounted
Staff and Overhead	Cost per FTE	Costs	Yrs 1-5	Yrs 6-10	Yrs 11-15	Yrs 16-20	Yrs 21-25	Yrs 26-30	Yrs 31-35	Yrs 36-40	Yrs 41-45	Yrs 46-50	Total Cost
Executive Director/Principal Scientist	$279,329	0	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	
HCP Program Manager/Lead Biologist	$236,979	0	0.20	0.20	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	
Preserve Manager	$236,979	0	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	
Senior Environmental Scientist	$159,980	0	0.25	0.25	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	
Associate Environmental Scientist	$124,042	0	0.20	0.20	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	
GIS Analyst/Database Manager	$127,789	0	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	
Budget Analyst/Accountant	$108,198	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
	Total FTE	**0.00**	**0.85**	**0.85**	**0.55**	**0.55**	**0.55**	**0.55**	**0.55**	**0.55**	**0.55**	**0.55**	
	Cost per period	**$0**	**$753,968**	**$753,968**	**$493,467**	**$493,467**	**$493,467**	**$493,467**	**$493,467**	**$493,467**	**$493,467**	**$493,467**	**$5,455,676**
	Cost per year	**$0**	**$150,794**	**$150,794**	**$98,693**	**$98,693**	**$98,693**	**$98,693**	**$98,693**	**$98,693**	**$98,693**	**$98,693**	

Notes:

Fully burdened annual cost per FTE includes salary and benefits and allowances for salaries and benefits of support staff (e.g. secretaries, IT support) and associated overhead, including space and utility costs, office furniture, equipement, and supplies.

SAR Fish Translocation

Sum Translocation Project Costs

		Pre-Permit	Cost by Plan Period										Undiscounted
	Cost Type	Costs	Yrs 1-5	Yrs 6-10	Yrs 11-15	Yrs 16-20	Yrs 21-25	Yrs 26-30	Yrs 31-35	Yrs 36-40	Yrs 41-45	Yrs 46-50	Total Cost
Design/Enviro/Permitting	Capital	$255,476	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$255,476
Land Acquisition	Capital	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Construction	Capital	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
O&M	Operational	$0	$381,000	$122,000	$72,000	$72,000	$72,000	$72,000	$72,000	$72,000	$72,000	$72,000	$1,079,000
empty		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
empty		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
empty		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0

Cost estimates of individual translocation projects

Translocation costs		Pre-Permit	Cost by Plan Period										Undiscounted
		Costs	Yrs 1-5	Yrs 6-10	Yrs 11-15	Yrs 16-20	Yrs 21-25	Yrs 26-30	Yrs 31-35	Yrs 36-40	Yrs 41-45	Yrs 46-50	Total Cost
Translocation Plan Development	Design/Enviro/I	$255,476											$255,476
Translocation Contractor Costs 1/	O&M	$0	$56,000	$7,000	$7,000	$7,000	$7,000	$7,000	$7,000	$7,000	$7,000	$7,000	$119,000
Captive Propagation Facility O&M	O&M	$0	$325,000	$65,000	$65,000	$65,000	$65,000	$65,000	$65,000	$65,000	$65,000	$65,000	$910,000
Fish Translocation Mgt Agree w/ USFS	O&M		$0	$50,000	$0	$0	$0	$0	$0	$0	$0	$0	$50,000

1/ For Yrs 1 & 2 assumes contract with licensed biologist for 4 streams per year @ $7,000 per stream. For Yrs 6-50, assumes 1 stream translocation every 5 years @ $7,000 for periodic replacement of fish stock

Restoration **Page 1 of 2**

Capital Costs		Pre-Permit Costs	Yrs 1-5	Yrs 6-10	Yrs 11-15	Yrs 16-20	Yrs 21-25	Yrs 26-30	Yrs 31-35	Yrs 36-40	Yrs 41-45	Yrs 46-50	Undiscounted Total Cost
			Cost by Plan Period										
Staff and Overhead													$0
Design/Enviro/Permitting		$0	$227,308	$0	$0	$0	$0	$0	$0	$0	$0	$0	$227,308
Land Acquisition		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Construction		$0	$3,483,800	$800,000	$750,000	$0	$0	$0	$0	$0	$0	$0	$5,033,800
O&M													$0
Supplemental Water Supply		$24,350,000											$24,350,000
Empty													$0
Empty													$0
Empty													$0
Capital Subtotal:	**Per Period**	**$24,350,000**	**$3,711,108**	**$800,000**	**$750,000**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$29,611,108**
	Per Year	NA	**$742,222**	**$160,000**	**$150,000**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	

Operational Costs		Pre-Permit Costs	Yrs 1-5	Yrs 6-10	Yrs 11-15	Yrs 16-20	Yrs 21-25	Yrs 26-30	Yrs 31-35	Yrs 36-40	Yrs 41-45	Yrs 46-50	Undiscounted Total Cost
			Cost by Plan Period										
Staff and Overhead		$0	$1,006,185	$1,006,185	$726,434	$726,434	$726,434	$726,434	$726,434	$726,434	$726,434	$726,434	$7,823,840
Design/Enviro/Permitting													$0
Land Acquisition													$0
Construction													$0
O&M		$0	$2,292,217	$3,847,446	$222,967	$222,967	$222,967	$222,967	$222,967	$222,967	$222,967	$222,967	$7,923,396
Supplemental Water Supply			$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Operational Subtotal:	**Per Period**	**$0**	**$3,298,402**	**$4,853,630**	**$949,401**	**$949,401**	**$949,401**	**$949,401**	**$949,401**	**$949,401**	**$949,401**	**$949,401**	**$15,747,236**
	Per Year	NA	**$659,680**	**$970,726**	**$189,880**	**$189,880**	**$189,880**	**$189,880**	**$189,880**	**$189,880**	**$189,880**	**$189,880**	

Total Tributaries Restoration Costs		Pre-Permit Costs	Yrs 1-5	Yrs 6-10	Yrs 11-15	Yrs 16-20	Yrs 21-25	Yrs 26-30	Yrs 31-35	Yrs 36-40	Yrs 41-45	Yrs 46-50	Undiscounted Total Cost
			Cost by Plan Period										
Staff and Overhead		$0	$1,006,185	$1,006,185	$726,434	$726,434	$726,434	$726,434	$726,434	$726,434	$726,434	$726,434	$7,823,840
Design/Enviro/Permitting		$0	$227,308	$0	$0	$0	$0	$0	$0	$0	$0	$0	$227,308
Land Acquisition		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Construction		$0	$3,483,800	$800,000	$750,000	$0	$0	$0	$0	$0	$0	$0	$5,033,800
O&M		$0	$2,292,217	$3,847,446	$222,967	$222,967	$222,967	$222,967	$222,967	$222,967	$222,967	$222,967	$7,923,396
Supplemental Water Supply		$24,350,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$24,350,000
SAR Tributaries Restoration Total:	**Per Period**	**$24,350,000**	**$7,009,510**	**$5,653,630**	**$1,699,401**	**$949,401**	**$949,401**	**$949,401**	**$949,401**	**$949,401**	**$949,401**	**$949,401**	**$45,358,344**
	Per Year	NA	**$1,401,902**	**$1,130,726**	**$339,880**	**$189,880**	**$189,880**	**$189,880**	**$189,880**	**$189,880**	**$189,880**	**$189,880**	

Staff and Overhead	Fully Burdened Cost per FTE	Pre-Permit Costs	Yrs 1-5	Yrs 6-10	Yrs 11-15	Yrs 16-20	Yrs 21-25	Yrs 26-30	Yrs 31-35	Yrs 36-40	Yrs 41-45	Yrs 46-50	Undiscounted Total Cost
			Number of FTEs by Plan Period										
Executive Director/Principal Scientist	279328.73	0	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	
HCP Program Manager/Lead Biologist	236979.27	0	0.20	0.20	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	
Preserve Manager	236979.27	0	0.15	0.15	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	
Senior Environmental Scientist	159980.26	0	0.25	0.25	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	
Associate Environmental Scientist	124042.45	0	0.20	0.20	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	
GIS Analyst/Database Manager	127788.75	0	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	
Budget Analyst/Accountant	108198.42	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Empty	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Empty	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
	Total FTE	**0.00**	**1.10**	**1.10**	**0.80**	**0.80**	**0.80**	**0.80**	**0.80**	**0.80**	**0.80**	**0.80**	
	Cost per period	**$0**	**$1,006,185**	**$1,006,185**	**$726,434**	**$726,434**	**$726,434**	**$726,434**	**$726,434**	**$726,434**	**$726,434**	**$726,434**	**$7,823,840**
	Cost per year	**$0**	**$201,237**	**$201,237**	**$145,287**	**$145,287**	**$145,287**	**$145,287**	**$145,287**	**$145,287**	**$145,287**	**$145,287**	

Notes:

Fully burdened annual cost per FTE includes salary and benefits and allowances for salaries and benefits of support staff (e.g. secretaries, IT support) and associated overhead, including space and utility costs, office furniture, equipement, and supplies.

Restoration

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Sum of Tributaries Restoration Project Costs

	Cost Type	Pre-Permit Costs	Cost by Plan Period Yrs 1-5	Yrs 6-10	Yrs 11-15	Yrs 16-20	Yrs 21-25	Yrs 26-30	Yrs 31-35	Yrs 36-40	Yrs 41-45	Yrs 46-50	Undiscounted Total Cost
Design/Enviro/Permitting	Capital	$0	$227,308	$0	$0	$0	$0	$0	$0	$0	$0	$0	$227,308
Land Acquisition	Capital	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Construction	Capital	$0	$3,483,800	$800,000	$750,000	$0	$0	$0	$0	$0	$0	$0	$5,033,800
O&M	Operational	$0	$2,292,217	$3,847,446	$222,967	$222,967	$222,967	$222,967	$222,967	$222,967	$222,967	$222,967	$7,923,396
Supplemental Water	Capital	$24,350,000	0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$24,350,000
Supplemental Water	Operational	$0	-	-	-	-	-	-	-	-	-	-	$0
Total Capital		$0	$3,711,108	$800,000	$750,000	$0	$0	$0	$0	$0	$0	$0	$5,261,108
Total Operational		$0	$2,292,217	$3,847,446	$222,967	$222,967	$222,967	$222,967	$222,967	$222,967	$222,967	$222,967	$7,923,396
Supplemental Streamflow--Capital		$24,350,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$24,350,000
Supplemental Streamflow--Operational		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0

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Cost estimates of individual restoration projects v 2. HCP Conservation Cost Breakdown

All restoration projects acres 18.32 0

		Pre-Permit Costs	Cost by Plan Period Yrs 1-5	Yrs 6-10	Yrs 11-15	Yrs 16-20	Yrs 21-25	Yrs 26-30	Yrs 31-35	Yrs 36-40	Yrs 41-45	Yrs 46-50	Undiscounted Total Cost
Restoration implementation	Construction	$0	$0	$800,000	$750,000								$1,550,000
HMMP--restoration areas	O&M	$0	$2,100,000	$3,525,000	$0								$5,625,000
HMMP--no restoration areas	O&M		$192,217	$99,479									
Land Acquisition	Land Acquisition	$0	$0	$0									$0
Construction	Construction	$0											$0
Site Maintenance (5 yrs, weeding, irrigation, etc.)	O&M	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0

Microhabitat Creation		Pre-Permit Costs	Cost by Plan Period Yrs 1-5	Yrs 6-10	Yrs 11-15	Yrs 16-20	Yrs 21-25	Yrs 26-30	Yrs 31-35	Yrs 36-40	Yrs 41-45	Yrs 46-50	Undiscounted Total Cost
Design	Design/Enviro/Pe	$0	$67,308										$67,308
CEQA	Design/Enviro/Pe	$0	$80,000										$80,000
Permitting	Design/Enviro/Pe	$0	$80,000										$80,000
Construction Nodes - Elevated Invert (4 no	Construction	$0	$1,059,200										$1,059,200
Construction Nodes - Open Water Runner	Construction	$0	$1,509,600										$1,509,600
Construction Nodes - Partially Submerged	Construction	$0	$915,000										$915,000
Construction Nodes - Boulder Array	Construction	$0	$0										$0
Replacement of Nodes 1/	O&M	$0	$0	$222,967	$222,967	$222,967	$222,967	$222,967	$222,967	$222,967	$222,967	$222,967	$2,006,700

1/ Assumes a node has to be re-built once every five years; assumes cost is average for individual node projects (see v2.HCP Micro worksheet)

Preserve Management/Maintenance/Protection **Page 1 of 2**

Capital Costs		Pre-Permit Costs	Cost by Plan Period: Yrs 1-5	Yrs 6-10	Yrs 11-15	Yrs 16-20	Yrs 21-25	Yrs 26-30	Yrs 31-35	Yrs 36-40	Yrs 41-45	Yrs 46-50	Undiscounted Total Cost
Staff and Overhead													
Design/Enviro/Permitting													$0
Land Acquisition													$0
Construction				$751,103	$206,370								$957,473
O&M													$0
Empty													$0
Empty													$0
Empty													$0
Empty													$0
Capital Subtotal:	**Per Period**		**$0**	**$751,103**	**$206,370**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$957,473**
	Per Year		**$0**	**$150,221**	**$41,274**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	

Operational Costs		Pre-Permit Costs	Cost by Plan Period: Yrs 1-5	Yrs 6-10	Yrs 11-15	Yrs 16-20	Yrs 21-25	Yrs 26-30	Yrs 31-35	Yrs 36-40	Yrs 41-45	Yrs 46-50	Undiscounted Total Cost
Staff and Overhead		$0	$1,271,269	$1,271,269	$1,582,030	$1,582,030	$1,582,030	$1,582,030	$1,582,030	$1,582,030	$1,582,030	$1,582,030	$15,198,776
Design/Enviro/Permitting													$0
Land Acquisition													$0
Construction													$0
O&M		$0	$1,421,750	$1,764,111	$1,930,687	$1,930,687	$1,930,687	$1,930,687	$1,930,687	$1,930,687	$1,930,687	$1,930,687	$18,631,359
Operational Subtotal:	**Per Period**		**$2,693,019**	**$3,035,380**	**$3,512,717**	**$3,512,717**	**$3,512,717**	**$3,512,717**	**$3,512,717**	**$3,512,717**	**$3,512,717**	**$3,512,717**	**$33,830,135**
	Per Year		**$538,604**	**$607,076**	**$702,543**	**$702,543**	**$702,543**	**$702,543**	**$702,543**	**$702,543**	**$702,543**	**$702,543**	

Total Preserve Management Costs		Pre-Permit Costs	Cost by Plan Period: Yrs 1-5	Yrs 6-10	Yrs 11-15	Yrs 16-20	Yrs 21-25	Yrs 26-30	Yrs 31-35	Yrs 36-40	Yrs 41-45	Yrs 46-50	Undiscounted Total Cost
Staff and Overhead			$1,271,269	$1,271,269	$1,582,030	$1,582,030	$1,582,030	$1,582,030	$1,582,030	$1,582,030	$1,582,030	$1,582,030	$15,198,776
Design/Enviro/Permitting			$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Land Acquisition			$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Construction			$0	$751,103	$206,370	$0	$0	$0	$0	$0	$0	$0	$957,473
O&M			$1,421,750	$1,764,111	$1,930,687	$1,930,687	$1,930,687	$1,930,687	$1,930,687	$1,930,687	$1,930,687	$1,930,687	$18,631,359
Preserve Management Total:	**Per Period**		**$2,693,019**	**$3,786,483**	**$3,719,087**	**$3,512,717**	**$3,512,717**	**$3,512,717**	**$3,512,717**	**$3,512,717**	**$3,512,717**	**$3,512,717**	**$34,787,608**
	Per Year		**$538,604**	**$757,297**	**$743,817**	**$702,543**	**$702,543**	**$702,543**	**$702,543**	**$702,543**	**$702,543**	**$702,543**	

Staff and Overhead	Fully Burdened Annual Cost per FTE	Pre-Permit Costs	Number of FTEs by Plan Period: Yrs 1-5	Yrs 6-10	Yrs 11-15	Yrs 16-20	Yrs 21-25	Yrs 26-30	Yrs 31-35	Yrs 36-40	Yrs 41-45	Yrs 46-50	Undiscounted Total Cost
Executive Director/Principal Scientist	$279,329		0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	
HCP Program Manager/Lead Biologist	$236,979		0.25	0.25	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	
Preserve Manager	$236,979		0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	
Senior Environmental Scientist	$159,980		0.00	0.00	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	
Associate Environmental Scientist	$124,042		0.10	0.10	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	
GIS Analyst/Database Manager	$127,789		0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	
Budget Analyst/Accountant	$108,198		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Empty	$0		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Empty	$0		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
	Total FTE	**0.00**	**1.20**	**1.20**	**1.55**	**1.55**	**1.55**	**1.55**	**1.55**	**1.55**	**1.55**	**1.55**	
	Cost per period	**$0**	**$1,271,269**	**$1,271,269**	**$1,582,030**	**$1,582,030**	**$1,582,030**	**$1,582,030**	**$1,582,030**	**$1,582,030**	**$1,582,030**	**$1,582,030**	**$15,198,776**
	Cost per year	**$0**	**$254,254**	**$254,254**	**$316,406**	**$316,406**	**$316,406**	**$316,406**	**$316,406**	**$316,406**	**$316,406**	**$316,406**	

Notes:

Fully burdened annual cost per FTE includes salary and benefits and allowances for salaries and benefits of support staff (e.g. secretaries, IT support) and associated overhead, including space and utility costs, office furniture, equipement, and supplies.

Preserve Management/Maintenance/Protection   Page 2 of 2

Other Preserve Management Costs

Site Patrols (Contractors)

Assumptions:	Cost per period	Pre-Permit	Cost by Plan Period										Undiscounted
County Ranger II annual contract ($/yr)	$131,600		Yrs 1-5	Yrs 6-10	Yrs 11-15	Yrs 16-20	Yrs 21-25	Yrs 26-30	Yrs 31-35	Yrs 36-40	Yrs 41-45	Yrs 46-50	Total Cost
County Ranger I annual contract ($/yr)	$122,200		$1,269,000	$1,269,000	$1,269,000	$1,269,000	$1,269,000	$1,269,000	$1,269,000	$1,269,000	$1,269,000	$1,269,000	$12,690,000

County Fully-burdened labor rate is $70/hr, per May 3, 2018 email from Dustin McClain (DMcLain@RIVCO.ORG); 1.0 FTE, 1880 direct labor hours per year
County Fully-burdened labor rate is $65/hr, per May 3, 2018 email from Dustin McClain (DMcLain@RIVCO.ORG); 1.0 FTE, 1880 direct labor hours per year

Maintenance & Repairs (Contractors)

		Pre-Permit	Cost by Plan Period										Undiscounted
Assumptions:	Cost per period	Costs	Yrs 1-5	Yrs 6-10	Yrs 11-15	Yrs 16-20	Yrs 21-25	Yrs 26-30	Yrs 31-35	Yrs 36-40	Yrs 41-45	Yrs 46-50	Total Cost
Maintenance Annual Contract	$30,550		$152,750	$152,750	$152,750	$152,750	$152,750	$152,750	$152,750	$152,750	$152,750	$152,750	$1,527,500

County Fully-burdened labor rate is $65/hr, per May 3, 2018 email from Dustin McClain (DMcLain@RIVCO.ORG); 0.25 FTE, 470 direct labor hours per year

Habitat Management

Assumptions:	Cost per acre	Pre-Permit	Cost by Plan Period										Undiscounted
		Costs	Yrs 1-5	Yrs 6-10	Yrs 11-15	Yrs 16-20	Yrs 21-25	Yrs 26-30	Yrs 31-35	Yrs 36-40	Yrs 41-45	Yrs 46-50	Total Cost
trash removal	11.36		$0	$51,609	$76,719	$76,719	$76,719	$76,719	$76,719	$76,719	$76,719	$76,719	$665,359
Thinning	13		$0	$59,059	$87,794	$87,794	$87,794	$87,794	$87,794	$87,794	$87,794	$87,794	$761,414
Invasive plant control--herbicide	46		$0	$208,978	$310,657	$310,657	$310,657	$310,657	$310,657	$310,657	$310,657	$310,657	$2,694,235
Invasive plant control--grazing	5		$0	$22,715	$33,767	$33,767	$33,767	$33,767	$33,767	$33,767	$33,767	$33,767	$292,852
Fencing	0		$0	$751,103	$206,370	$0	$0	$0	$0	$0	$0	$0	$957,473
			phase 1	phase 2	phase 3	phase 4							
Total acres by phase			-	909	1,351	1,351	1,351	1,351	1,351	1,351	1,351	1,351	

Monitoring and Reporting

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Capital Costs		Pre-Permit Costs	Cost by Plan Period Yrs 1-5	Yrs 6-10	Yrs 11-15	Yrs 16-20	Yrs 21-25	Yrs 26-30	Yrs 31-35	Yrs 36-40	Yrs 41-45	Yrs 46-50	Undiscounted Total Cost
Staff and Overhead													
Vegetation mapping													$0
Travel													$0
Field Monitoring (Contractors)													$0
Directed Research (contractors)													$0
Adaptive Management													$0
Empty													$0
Empty													$0
Empty													$0
Capital Subtotal:	**Per Period**		**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
	Per Year		**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	

Operational Costs		Pre-Permit Costs	Cost by Plan Period Yrs 1-5	Yrs 6-10	Yrs 11-15	Yrs 16-20	Yrs 21-25	Yrs 26-30	Yrs 31-35	Yrs 36-40	Yrs 41-45	Yrs 46-50	Undiscounted Total Cost
Staff and Overhead		$0	$1,075,114	$1,075,114	$1,304,604	$1,304,604	$1,304,604	$1,304,604	$1,304,604	$1,304,604	$1,304,604	$1,304,604	$12,587,058
Vegetation mapping		$127,875	$127,875	$127,875	$127,875	$127,875	$127,875	$127,875	$127,875	$0	$127,875	$0	$1,150,875
Field Monitoring (Contractors)		$594,000	$594,000	$594,000	$594,000	$594,000	$594,000	$594,000	$594,000	$594,000	$594,000	$594,000	$6,534,000
Empty													$0
Empty													$0
Empty													$0
Operational Subtotal:	**Per Period**	**$721,875**	**$1,796,989**	**$1,796,989**	**$2,026,479**	**$2,026,479**	**$2,026,479**	**$2,026,479**	**$2,026,479**	**$1,898,604**	**$2,026,479**	**$1,898,604**	**$19,550,058**
	Per Year	**$144,375**	**$359,398**	**$359,398**	**$405,296**	**$405,296**	**$405,296**	**$405,296**	**$405,296**	**$379,721**	**$405,296**	**$379,721**	

Total Compliance, Permitting, Monitoring Costs		Pre-Permit Costs	5 Yrs 1-5	5 Yrs 6-10	5 Yrs 11-15	5 Yrs 16-20	5 Yrs 21-25	5 Yrs 26-30	5 Yrs 31-35	5 Yrs 36-40	5 Yrs 41-45	5 Yrs 46-50	Undiscounted Total Cost
Staff and Overhead			$1,075,114	$1,075,114	$1,304,604	$1,304,604	$1,304,604	$1,304,604	$1,304,604	$1,304,604	$1,304,604	$1,304,604	$12,587,058
Vegetation mapping		$127,875	$127,875	$127,875	$127,875	$127,875	$127,875	$127,875	$127,875	$0	$127,875	$0	$1,150,875
Field Monitoring (Contractors)		$594,000	$594,000	$594,000	$594,000	$594,000	$594,000	$594,000	$594,000	$594,000	$594,000	$594,000	$6,534,000
USFS Coordingating Agreement													
ompliance, Permitting, Monitoring Total:	**Per Period**		**$1,796,989**	**$1,796,989**	**$2,026,479**	**$2,026,479**	**$2,026,479**	**$2,026,479**	**$2,026,479**	**$1,898,604**	**$2,026,479**	**$1,898,604**	**$19,550,058**
	Per Year		**$359,398**	**$359,398**	**$405,296**	**$405,296**	**$405,296**	**$405,296**	**$405,296**	**$379,721**	**$405,296**	**$379,721**	

Staff and Overhead	Fully Burdened Cost per FTE	Pre-Permit Costs	Number of FTEs by Plan Period Yrs 1-5	Yrs 6-10	Yrs 11-15	Yrs 16-20	Yrs 21-25	Yrs 26-30	Yrs 31-35	Yrs 36-40	Yrs 41-45	Yrs 46-50	Undiscounted Total Cost
Executive Director/Principal Scientist	$279,329		0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	
HCP Program Manager/Lead Biologist	$236,979		0.20	0.20	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	
GIS Analyst/Database Manager	$127,789		0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	
Preserve Manager	$236,979		0.20	0.20	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	
Budget Analyst/Accountant	$108,198		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Senior Environmental Scientist	$159,980		0.25	0.25	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	
Associate Environmental Scientist	$124,042		0.00	0.00	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	
	Total FTE	**0.00**	**1.10**	**1.10**	**1.35**	**1.35**	**1.35**	**1.35**	**1.35**	**1.35**	**1.35**	**1.35**	
	Cost per period	**$0**	**$1,075,114**	**$1,075,114**	**$1,304,604**	**$1,304,604**	**$1,304,604**	**$1,304,604**	**$1,304,604**	**$1,304,604**	**$1,304,604**	**$1,304,604**	**$12,587,058**
	Cost per year	**$0**	**$215,023**	**$215,023**	**$260,921**	**$260,921**	**$260,921**	**$260,921**	**$260,921**	**$260,921**	**$260,921**	**$260,921**	

Notes:

Fully burdened annual cost per FTE includes salary and benefits and allowances for salaries and benefits of support staff (e.g. secretaries, IT support) and associated overhead, including space and utility costs, office furniture, equipement, and supplies.

Monitoring and Reporting

Other Compliance/Monitoring/Permitting Costs

Vegetation Mapping	8.47	Pre-Permit	Cost by Plan Period										Undiscounted
		Costs	Yrs 1-5	Yrs 6-10	Yrs 11-15	Yrs 16-20	Yrs 21-25	Yrs 26-30	Yrs 31-35	Yrs 36-40	Yrs 41-45	Yrs 46-50	Total Cost
LiDAR	O&M	$44,875	$44,875	$44,875	$44,875	$44,875	$44,875	$44,875	$44,875		$44,875		$403,875
imagery	O&M	$33,000	$33,000	$33,000	$33,000	$33,000	$33,000	$33,000	$33,000		$33,000		$297,000
Labor Costs	O&M	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000		$50,000		$450,000
	Cost per year	**$127,875**	**$127,875**	**$127,875**	**$127,875**	**$127,875**	**$127,875**	**$127,875**	**$127,875**	**$0**	**$127,875**	**$0**	

Notes:

		Pre-Permit	Cost by Plan Period										Undiscounted
Field Monitoring (Contractors)		Costs	Yrs 1-5	Yrs 6-10	Yrs 11-15	Yrs 16-20	Yrs 21-25	Yrs 26-30	Yrs 31-35	Yrs 36-40	Yrs 41-45	Yrs 46-50	Total Cost
Amphibians and Reptiles	$180,000	$180,000	$180,000	$180,000	$180,000	$180,000	$180,000	$180,000	$180,000	$180,000	$180,000	$180,000	$1,980,000
Rare plant species	$16,000	$16,000	$16,000	$16,000	$16,000	$16,000	$16,000	$16,000	$16,000	$16,000	$16,000	$16,000	$176,000
SBKR, Pocketmouse	$94,000	$94,000	$94,000	$94,000	$94,000	$94,000	$94,000	$94,000	$94,000	$94,000	$94,000	$94,000	$1,034,000
All bird species, riparian habitat	$304,000	$304,000	$304,000	$304,000	$304,000	$304,000	$304,000	$304,000	$304,000	$304,000	$304,000	$304,000	$3,344,000
Fish species	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Delhi Sands Fly	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Cost per period	**$594,000**	**$594,000**	**$594,000**	**$594,000**	**$594,000**	**$594,000**	**$594,000**	**$594,000**	**$594,000**	**$594,000**	**$594,000**	**$5,940,000**
	Cost per year	**NA**	**$118,800**	**$118,800**	**$118,800**	**$118,800**	**$118,800**	**$118,800**	**$118,800**	**$118,800**	**$118,800**	**$118,800**	

Notes:

1/ For Yrs 6-10 assumes USGS survey of 1 stream per year @ $138,000 per survey; Yrs 11-50 USGS survey of 1 stream every 2 years @ $138,000 per survey

2/ Assumes $25,000/year for monitoring Mountain Yellow Legged Frog habitat starting in Yr 1

Endowment Fund Page 1 of 2

Nominal Rate of Return	4.0%
Inflation Rate	2.0%
Real Rate of Return	4.0%
Post-Permit Withdrawal %	3.8%
Post Permit Annual Expenditure in 2020 $	$572,000
Post Permit Annual Expenditure (w contingency)	$589,160
Post Permit Annual Expenditure (w contingency) accounting for 2% inflation	**$1,682,838**
Initial Year of HCP	2023

target value at 50 year mark
$43,753,793

annual payment to meet target value
$275,573 $1,377.87
$276,000

Endowment Funding Assumes Contributions and Withdrawals occur at beginning of each period.

Plan Year	Beginning Balance	Contributions	Withdrawals	Investment Return	Ending Balance
1	$0	$275,573	$0	$11,023	$286,596
2	$286,596	$275,573	$0	$22,487	$584,656
3	$584,656	$275,573	$0	$34,409	$894,638
4	$894,638	$275,573	$0	$46,808	$1,217,020
5	$1,217,020	$275,573	$0	$59,704	$1,552,297
6	$1,552,297	$275,573	$0	$73,115	$1,900,985
7	$1,900,985	$275,573	$0	$87,062	$2,263,620
8	$2,263,620	$275,573	$0	$101,568	$2,640,761
9	$2,640,761	$275,573	$0	$116,653	$3,032,988
10	$3,032,988	$275,573	$0	$132,342	$3,440,904
11	$3,440,904	$275,573	$0	$148,659	$3,865,136
12	$3,865,136	$275,573	$0	$165,628	$4,306,337
13	$4,306,337	$275,573	$0	$183,276	$4,765,187
14	$4,765,187	$275,573	$0	$201,630	$5,242,391
15	$5,242,391	$275,573	$0	$220,719	$5,738,682
16	$5,738,682	$275,573	$0	$240,570	$6,254,826
17	$6,254,826	$275,573	$0	$261,216	$6,791,615
18	$6,791,615	$275,573	$0	$282,688	$7,349,876
19	$7,349,876	$275,573	$0	$305,018	$7,930,467
20	$7,930,467	$275,573	$0	$328,242	$8,534,282
21	$8,534,282	$275,573	$0	$352,394	$9,162,249
22	$9,162,249	$275,573	$0	$377,513	$9,815,335
23	$9,815,335	$275,573	$0	$403,636	$10,494,545
24	$10,494,545	$275,573	$0	$430,805	$11,200,922
25	$11,200,922	$275,573	$0	$459,060	$11,935,555
26	$11,935,555	$275,573	$0	$488,445	$12,699,574
27	$12,699,574	$275,573	$0	$519,006	$13,494,153
28	$13,494,153	$275,573	$0	$550,789	$14,320,515
29	$14,320,515	$275,573	$0	$583,844	$15,179,932
30	$15,179,932	$275,573	$0	$618,220	$16,073,725
31	$16,073,725	$275,573	$0	$653,972	$17,003,270
32	$17,003,270	$275,573	$0	$691,154	$17,969,997
33	$17,969,997	$275,573	$0	$729,823	$18,975,393
34	$18,975,393	$275,573	$0	$770,039	$20,021,005
35	$20,021,005	$275,573	$0	$811,863	$21,108,441
36	$21,108,441	$275,573	$0	$855,361	$22,239,375
37	$22,239,375	$275,573	$0	$900,598	$23,415,546
38	$23,415,546	$275,573	$0	$947,645	$24,638,764
39	$24,638,764	$275,573	$0	$996,573	$25,910,911
40	$25,910,911	$275,573	$0	$1,047,459	$27,233,943
41	$27,233,943	$275,573	$0	$1,100,381	$28,609,897
42	$28,609,897	$275,573	$0	$1,155,419	$30,040,889
43	$30,040,889	$275,573	$0	$1,212,658	$31,529,121
44	$31,529,121	$275,573	$0	$1,272,188	$33,076,882
45	$33,076,882	$275,573	$0	$1,334,098	$34,686,553
46	$34,686,553	$275,573	$0	$1,398,485	$36,360,612
47	$36,360,612	$275,573	$0	$1,465,447	$38,101,632
48	$38,101,632	$275,573	$0	$1,535,088	$39,912,293
49	$39,912,293	$275,573	$0	$1,607,515	$41,795,381
50	$41,795,381	$275,573	$0	$1,682,838	$43,753,793 << End of Permit

Annual % Change in

Withdraw Endowment Ending

Endowment Fund **Page 1 of 2**

Plan Year	Beginning Balance	Contributions	Withdrawals	Investment Return	Ending Balance		Amount	Balance
51	$43,753,793	$0	$1,682,838	$1,817,465	$47,254,096	<< Begin of Post-Permit		
52	$47,254,096	$0	$1,682,838	$1,957,477	$50,894,412		0.0000%	7.7037%
53	$50,894,412	$0	$1,682,838	$2,103,090	$54,680,340		0.0000%	7.4388%
54	$54,680,340	$0	$1,682,838	$2,254,527	$58,617,705		0.0000%	7.2007%
55	$58,617,705	$0	$1,682,838	$2,412,022	$62,712,565		0.0000%	6.9857%
56	$62,712,565	$0	$1,682,838	$2,575,816	$66,971,219		0.0000%	6.7908%
57	$66,971,219	$0	$1,682,838	$2,746,162	$71,400,220		0.0000%	6.6133%
58	$71,400,220	$0	$1,682,838	$2,923,322	$76,006,380		0.0000%	6.4512%
59	$76,006,380	$0	$1,682,838	$3,107,569	$80,796,787		0.0000%	6.3026%
60	$80,796,787	$0	$1,682,838	$3,299,185	$85,778,810		0.0000%	6.1661%
61	$85,778,810	$0	$1,682,838	$3,498,466	$90,960,115		0.0000%	6.0403%
62	$90,960,115	$0	$1,682,838	$3,705,718	$96,348,671		0.0000%	5.9241%
63	$96,348,671	$0	$1,682,838	$3,921,260	$101,952,769		0.0000%	5.8165%
64	$101,952,769	$0	$1,682,838	$4,145,424	$107,781,032		0.0000%	5.7166%
65	$107,781,032	$0	$1,682,838	$4,378,555	$113,842,425		0.0000%	5.6238%
66	$113,842,425	$0	$1,682,838	$4,621,011	$120,146,274		0.0000%	5.5373%
67	$120,146,274	$0	$1,682,838	$4,873,164	$126,702,276		0.0000%	5.4567%
68	$126,702,276	$0	$1,682,838	$5,135,405	$133,520,519		0.0000%	5.3813%
69	$133,520,519	$0	$1,682,838	$5,408,134	$140,611,491		0.0000%	5.3108%
70	$140,611,491	$0	$1,682,838	$5,691,773	$147,986,103		0.0000%	5.2447%
71	$147,986,103	$0	$1,682,838	$5,986,758	$155,655,699		0.0000%	5.1826%
72	$155,655,699	$0	$1,682,838	$6,293,541	$163,632,078		0.0000%	5.1244%
73	$163,632,078	$0	$1,682,838	$6,612,597	$171,927,513		0.0000%	5.0696%
74	$171,927,513	$0	$1,682,838	$6,944,414	$180,554,765		0.0000%	5.0180%
75	$180,554,765	$0	$1,682,838	$7,289,504	$189,527,108		0.0000%	4.9693%
76	$189,527,108	$0	$1,682,838	$7,648,398	$198,858,344		0.0000%	4.9234%
77	$198,858,344	$0	$1,682,838	$8,021,647	$208,562,829		0.0000%	4.8801%
78	$208,562,829	$0	$1,682,838	$8,409,827	$218,655,494		0.0000%	4.8391%
79	$218,655,494	$0	$1,682,838	$8,813,533	$229,151,866		0.0000%	4.8004%
80	$229,151,866	$0	$1,682,838	$9,233,388	$240,068,092		0.0000%	4.7638%
81	$240,068,092	$0	$1,682,838	$9,670,037	$251,420,967		0.0000%	4.7290%
82	$251,420,967	$0	$1,682,838	$10,124,152	$263,227,958		0.0000%	4.6961%
83	$263,227,958	$0	$1,682,838	$10,596,432	$275,507,228		0.0000%	4.6649%
84	$275,507,228	$0	$1,682,838	$11,087,603	$288,277,669		0.0000%	4.6352%
85	$288,277,669	$0	$1,682,838	$11,598,420	$301,558,927		0.0000%	4.6071%
86	$301,558,927	$0	$1,682,838	$12,129,671	$315,371,436		0.0000%	4.5804%
87	$315,371,436	$0	$1,682,838	$12,682,171	$329,736,445		0.0000%	4.5549%
88	$329,736,445	$0	$1,682,838	$13,256,771	$344,676,054		0.0000%	4.5308%
89	$344,676,054	$0	$1,682,838	$13,854,356	$360,213,248		0.0000%	4.5078%
90	$360,213,248	$0	$1,682,838	$14,475,843	$376,371,930		0.0000%	4.4859%
91	$376,371,930	$0	$1,682,838	$15,122,191	$393,176,959		0.0000%	4.4650%
92	$393,176,959	$0	$1,682,838	$15,794,392	$410,654,189		0.0000%	4.4451%
93	$410,654,189	$0	$1,682,838	$16,493,481	$428,830,508		0.0000%	4.4262%
94	$428,830,508	$0	$1,682,838	$17,220,534	$447,733,880		0.0000%	4.4081%
95	$447,733,880	$0	$1,682,838	$17,976,669	$467,393,387		0.0000%	4.3909%
96	$467,393,387	$0	$1,682,838	$18,763,049	$487,839,274		0.0000%	4.3744%
97	$487,839,274	$0	$1,682,838	$19,580,884	$509,102,997		0.0000%	4.3588%
98	$509,102,997	$0	$1,682,838	$20,431,433	$531,217,269		0.0000%	4.3438%
99	$531,217,269	$0	$1,682,838	$21,316,004	$554,216,111		0.0000%	4.3295%
100	$554,216,111	$0	$1,682,838	$22,235,958	$578,134,907		0.0000%	4.3158%