

Upper Santa Ana River Wash Habitat Conservation Plan

Natural Resource Management Plan



Version 1.0 Dated: July 13, 2023

Prepared by:

San Bernardino Valley Water Conservation District
1630 West Redlands Blvd., Suite A
Redlands, California 92373
Phone 909.793.2503
sbvwcd.org

Cover Photo

Slender-horned spineflower patch monitoring in the Upper Santa Ana River Wash in 2022. Photo taken north of the Santa Ana River Channel, just west of Orange Street during the spring field season.

Table of Contents

Acronyms and Abbreviations.....	1
Background and Goals	2
Biological Goals and Objectives of the Wash Plan.....	2
Natural Resource Management Plan	3
Environmental Setting – Plan Area and Natural Resources.....	3
Land Ownership within the Plan Area	4
Natural Resources Present within the Plan Area.....	4
Vegetation.....	4
Aquatic Resources.....	6
Monitoring and Management Responsibilities.....	7
Monitoring	7
Management.....	8
Land Stewardship and Habitat Management	9
Adaptive Management	10
Management Areas.....	11
Working Landscape.....	11
Threats to Habitat Function	12
Threats-based Management.....	12
Management Response	14
Restoration of Alluvial Processes	15
Species-specific Monitoring and Management	19
San Bernardino Kangaroo Rat Monitoring and Management Activities	20
California Gnatcatcher Monitoring and Management Activities.....	28
Cactus Wren Monitoring and Management Activities	32
Slender-horned Spineflower Monitoring and Management Activities	35
Santa Ana River Woolly-star Monitoring and Management Activities.....	48
References	52
Figures 1 - 12.....	53

Acronyms and Abbreviations

ACEC	Areas of Critical Environmental Concern
AMMP	Adaptive Management and Monitoring Program
BACI	Before-After-Control-Impact design
BLM	U.S. Bureau of Land Management
BO	Biological Opinion
CACW	Cactus Wren
CAGN	California gnatcatcher
CalBG	California Botanic Garden
CAMMP	Comprehensive Adaptive Management and Monitoring Plan
CA Streambed	California Streambed
CDFW	California Department of Fish and Wildlife
CESA	California Endangered Species Act
CNDDB	California Natural Diversity Database
COI	Certificate of Inclusion
East Valley	East Valley Water District
FESA	Federal Endangered Species Act
HCP	Habitat Conservation Plan
IA	Implementing Agreement
IERCD	Inland Empire Resource Conservation District
ITP	Incidental Take Permit
MCV	Manual of California Vegetation
MSHCP	Multiple Species Habitat Conservation Plan
NRMP	Natural Resource Management Plan
OHV	Off-highway vehicle
PAO	Percent Area Occupied
Plan Area	HCP Plan Area
Preserve	Wash Plan Preserve
RAFSS	Riversidean Alluvial Fan Sage Scrub
River HCP	Upper Santa Ana River Habitat Conservation Plan
RNA	Research Natural Area
SARWS	Santa Ana River woolly-star
SBCFCD or Flood Control	San Bernardino County Flood Control District
SBKR	San Bernardino kangaroo rat
SBVMWD	San Bernardino Valley Municipal Water District
SBVWCD, Conservation District, or District	San Bernardino Valley Water Conservation District
SHA	California Endangered Species Safe Harbor Agreement
SHSF	Slender-horned Spineflower
Trust	San Bernardino Valley Conservation Trust
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
Wash	Upper Santa Ana River Floodplain
Wash Plan or HCP	Upper Santa Ana River Wash Habitat Conservation Plan
WOTS	Waters of the State
WOTUS	Waters of the United States
WSPA	Woolly-star Preserve Area

Background and Goals

Approval of the Upper Santa Ana River Wash Habitat Conservation Plan (Wash Plan or HCP) by the U.S. Fish and Wildlife Service (USFWS) was accompanied by an Incidental Take Permit (ITP) issued to the San Bernardino Valley Water Conservation District (Conservation District or District) on July 13, 2020. The primary goal of the Wash Plan is to balance ground-disturbing activities of water conservation, aggregate mining, recreational activities, and other public services in the HCP Plan Area (Plan Area) with the conservation of natural communities and populations of special-status plant and animal species.

In addition to the Conservation District, several other entities participate in the implementation of the HCP through a Certificate of Inclusion (COI) to receive coverage for their planned projects. Recognized as Participating Entities, these entities include the City of Redlands, City of Highland, San Bernardino Valley Municipal Water District (SBVMWD), East Valley Water District (East Valley), Cemex, Inc., and Robertson's Ready-Mix. The San Bernardino County Flood Control District (SBCFCD or Flood Control) has been issued an independent Implementing Agreement (IA) and ITP under the HCP.

Consistent with the ITP, the USFWS has authorized incidental take under Section 10 of the Federal Endangered Species Act (FESA) for the California gnatcatcher (CAGN; *Polioptila californica californica*) and San Bernardino kangaroo rat (SBKR; *Dipodomys merriami parvus*), and coverage for cactus wren (CACW; *Campylorhynchus brunneicapillus*). Through the ITP, the Conservation District also receives coverage of the Santa Ana River woolly-star (SARWS; *Eriastrum densifolium sanctorum*) and slender-horned spineflower (SHSF; *Dodecahema leptoceras*). The San Bernardino kangaroo rat, Santa Ana River woolly-star, and slender-horned spineflower are state-listed species and the District is seeking state authorization (Section 2081 permit under the California Endangered Species Act [CESA]) for incidental take of these species from the California Department of Fish and Wildlife (CDFW).

Biological Goals and Objectives of the Wash Plan

The biological goals of the Wash Plan are the broad, guiding principle for implementation of the HCP conservation strategy. Listed goals identified in the HCP for the above-mentioned species (identified as Covered Species) and protected habitats present within the Wash Plan Preserve (Preserve) include:

- Maintain and restore self-sustaining populations of the species covered by the Wash Plan
- Sustain the ecological processes necessary to maintain the functionality of the natural communities and habitats upon which the Covered Species depend
- Maintain connectivity among subpopulations of Covered Species and minimizing fragmentation of their habitat
- Actively manage conserved lands for the benefit of Covered Species, including control of non-native plant species, selective vegetation thinning, and habitat enhancement
- Minimize negative impacts on Covered Species and their habitats from off-highway vehicle (OHV) use, illegal dumping, edge effects, exotic species, and other disturbances

Biological objectives have been developed to describe the means through which the goals of the HCP will be accomplished (see Section 5.1.2 of the HCP). In addition to conservation actions, specific monitoring and management activities are to be implemented under the HCP to achieve the listed objectives.

One of the identified biological objectives of the Wash Plan addresses the need for the permit holder (i.e., the District) to develop a plan for the management of the Wash Plan Preserve (Section 5.1.2 of HCP; Preserve Objective 3). Consistent with this objective, a draft comprehensive natural resource management plan is to be prepared within two years of the permit issuance and finalized within three years.

Natural Resource Management Plan

As the ITP holder for the Wash Plan, and consistent with the requirements of the HCP, the District is developing this scientifically valid and cost-effective Natural Resource Management Plan (NRMP) for implementation within the Wash Plan Preserve. Consistent with the Wash Plan, the NRMP will support and document the development and implementation of an effective approach to monitoring and managing the protected natural resources within the Wash Plan Preserve. The monitoring program, to be implemented in parallel to identified management actions, will allow for determination of the status and distribution of Covered Species and protected habitats in the Wash Plan Preserve, documentation of long-term trends, and assessment of the effectiveness of specific management actions implemented to improve conditions benefiting individual species and the long-term viability of the natural communities present within the Upper Santa Ana River floodplain (Wash).

The goals and objectives of this NRMP are to be consistent with and support implementation of the conservation program described in Wash Plan. The Wash Plan is to guide the direction and development of the NRMP. The HCP provides guidance on the structure and framework of the NRMP as well as defines initial conservation, management, and monitoring priorities for the Wash Plan Preserve, highlighting the importance of monitoring and management activities to the successful implementation of the HCP.

This NRMP is meant to be a living document. Once the initial draft is approved by the Wildlife Agencies, updates to the NRMP are expected to be brought forward for review and consideration by the Wildlife Agencies every five years, or more frequently as appropriate.

Environmental Setting – Plan Area and Natural Resources

The Plan Area is in southwestern San Bernardino County, California, approximately one mile downstream of the Seven Oaks Dam, and encompasses approximately 4,892 acres, extending approximately six miles westward from Greenspot Road in the City of Highland to Alabama Street in the City of Redlands (see Figure 1.).

Within the Plan Area, the Conservation District, Flood Control, and the Participating Entities will provide for the permanent conservation of approximately 963.3 acres within the Wash Plan Preserve (District Conserved Lands and SBCFCD Conserved Lands). This area will be managed and monitored along with the 695.8 acres of District Managed Lands, owned by the Bureau of Land Management (BLM). The District Conserved, District Managed, and SBCFCD Conserved Lands result in a total area of 1,659.1 acres of habitat in the Plan Area that will be conserved and managed as the Wash Plan Preserve. The Wash Plan Preserve is generally contiguous with the existing conservation areas within the Plan Area (i.e., BLM's ACEC and USACE's Woolly-star Preserve Area [WSPA]). The Preserve also maintains a north-south

habitat linkage across the Plan Area and to natural open space outside the Plan Area to the east and west.

In the near future, additional lands, within and adjacent to the Plan Area, are planned to be set aside for the conservation and the long-term survival and enhancement of the state and federally listed species covered by the Wash Plan. These lands include areas totaling approximately 200 acres of the Wash located just east of Cone Camp Road and west of the Borrow Pit, presently recognized as Neutral Lands in the Wash Plan, and the much of the land surrounding the operations and management of the Mill Creek Recharge Facilities adjacent to the Wash Plan Preserve just southeast of the confluence of Santa Ana River and Mill Creek.

Note, the lands being set aside by San Bernardino County Flood Control District for enrollment in the Wash Plan Preserve are not presently addressed by this NRMP. If the Conservation District is contracted to manage these properties, the NRMP will be modified to capture the specific needs associated with each as considered by the Wash Plan.

Land Ownership within the Plan Area

Figures and maps available in the Wash Plan are an excellent resource for understanding land ownership within the Plan Area. Additionally, the Wash Plan details the properties involved with and procedures tied to the planned Land Exchange between SBVWCD and BLM to be completed within the first seven years of Wash Plan implementation (see Section 1.2.6 and 3.2.2 of the HCP). Note, the figures and information in this NRMP will be updated when the Land Exchange has been completed and land ownership and principal management responsibilities change across the involved properties, all of which fall within the Wash Plan Preserve.

Natural Resources Present within the Plan Area

In addition to the material referenced and highlighted in development of the Wash Plan, the Upper Santa Ana River HCP Comprehensive Adaptive Management and Monitoring Plan (CAMMP), and Santa Ana River Woolly-star Preserve Area (WSPA) Multiple Species Habitat Management Plan (MSHMP) are prominent resources for helping to establish the known distribution and status of sensitive natural resources within the Plan Area. Going forward, the information provided in the Wash Plan, CAMMP, and MSHMP will serve to inform development of specific monitoring strategies and management activities when addressing Covered Species and protected habitats addressed by this NRMP.

Vegetation

In alignment with Wash Plan Objective 10, and support of advancement of this NRMP, the Conservation District contracted with AECOM to develop a classification of natural and naturalized vegetation occurring within the Wash Plan Preserve according to the Manual of California Vegetation (MCV) developed by CDFW VegCAMP, informed by the National Park Service Vegetation Inventory. Completed in September 2022, the classification and associated decision-making key provide a consistent system for mapping vegetation to the alliance and/or association level of the MCV within the Wash Plan Preserve (see Vegetation Classification Report – AECOM 2022).

Vegetation polygons, forming the basis of the new vegetation map completed in January 2023 (see Figure 2. and Vegetation Mapping Report – AECOM 2023), were delineated to the alliance or the

association level using a combination of photointerpretation and field reconnaissance to accurately define ecological boundaries. Vegetation was mapped with a minimum mapping unit of 0.5 acre and aerial photographs of the project area taken in spring 2022 and were prepared and delivered (at 0.5-foot resolution) by GeoTerra.

Classification assignments resulted in 14 MCV alliances and 17 associations being determined for District lands. All alliances and associations are well represented in the compiled regional dataset, except for two: the *Heterotheca sessiliflora* Association and *Opuntia littoralis* - *Opuntia oricola* - *Cylindropuntia prolifera* Shrubland Alliance. *Heterotheca sessiliflora* Association was originally known as a special stand type from plots ($n=8$) collected for a vegetation inventory in Pinnacles National Park (Kittle *et al.* 2012). This association is currently included in the MCV based on the Pinnacle stands. The plot representation on District lands occupies similar alluvial habitat and with high relative cover of *H. sessiliflora*, albeit with far less nonnative cover than the plots at Pinnacles National Park. The *Opuntia* alliance named above is described principally as a coastal vegetation alliance in the MCV and is represented in the western Riverside classification by a single inland plot (CNPS 2005). The single western Riverside plot has been included in the stand table summary for this alliance.

Table 1. Manual of California Vegetation Alliance and Associations Sampled within the Wash Plan Preserve
Woodland Vegetation
<i>Salix gooddingii</i> - <i>Salix laevigata</i> Forest & Woodland Alliance
<i>Salix gooddingii</i> / <i>Baccharis salicifolia</i> Association
<i>Juniperus californica</i> Forest & Woodland Alliance
<i>Juniperus californica</i> / <i>Eriogonum fasciculatum</i> - <i>Artemisia californica</i> Association
<i>Juniperus californica</i> / herbaceous Association
Shrubland Vegetation
<i>Adenostoma fasciculatum</i> - <i>Salvia</i> spp. Shrubland Alliance
<i>Adenostoma fasciculatum</i> - <i>Salvia apiana</i> - <i>Artemisia californica</i> Association
<i>Baccharis salicifolia</i> Shrubland Alliance
<i>Baccharis salicifolia</i> – <i>Sambucus nigra</i> Association
<i>Baccharis salicifolia</i> Association
<i>Ceanothus crassifolius</i> Shrubland Alliance
<i>Ceanothus crassifolius</i> - <i>Adenostoma fasciculatum</i> - <i>Rhus ovata</i> Association
<i>Lotus scoparius</i> - <i>Lupinus albifrons</i> - <i>Eriodictyon</i> spp. Shrubland Alliance
<i>Lotus scoparius</i> Association
<i>Opuntia littoralis</i> - <i>Opuntia oricola</i> - <i>Cylindropuntia prolifera</i> Shrubland Alliance
Alliance Only
<i>Rhus ovata</i> Shrubland Alliance
<i>Rhus ovata</i> Association
<i>Encelia farinosa</i> Shrubland Alliance
<i>Encelia farinosa</i> - <i>Eriogonum fasciculatum</i> Association
<i>Lepidospartum squamatum</i> Shrubland Alliance
<i>Lepidospartum squamatum</i> - <i>Artemisia californica</i> Association
<i>Lepidospartum squamatum</i> - <i>Eriodictyon trichocalyx</i> - <i>Hesperoyucca whipplei</i> Association
<i>Lepidospartum squamatum</i> - <i>Eriogonum fasciculatum</i> Association

Herbaceous Vegetation
<i>Avena</i> spp. - <i>Bromus</i> spp. Herbaceous Semi-Natural Alliance
<i>Bromus diandrus</i> Association
<i>Bromus hordeaceus</i> - <i>Bromus tectorum</i> Association
<i>Heterotheca (oregona, sessiliflora)</i> Herbaceous Alliance
<i>Heterotheca sessiliflora</i> Association
<i>Pennisetum setaceum</i> - <i>Pennisetum ciliare</i> Herbaceous Semi-Natural Alliance
<i>Pennisetum setaceum</i> Association

It is important to note, both historically and present-day, the predominate habitat type within the Wash is Riversidean Alluvial Fan Sage Scrub [RAFSS]. RAFSS is a distinct habitat type of the coastal sage scrub community limited to river and creek floodplains of southern San Bernardino and northwestern Riverside Counties (Westman 1981). Sandy substrate is the fundamental feature of this and other alluvial systems that provides the basis for suitable habitat for many unique plant and animal species, including SBKR and SARWS. Between the early 1930s and 1980s approximately 85% of RAFSS has been displaced through spreading urbanization (Westman 1981).

As noted in the new vegetation map, California juniper woodland comprise one of the more extensive vegetation associations in the Wash Plan Preserve, covering hundreds of acres. This finding is consistent with historic records which note the juniper woodland as the most extensive vegetation-type within the Santa Ana River Wash. In a scientific proceeding by Ted Hanes in 1981, surveys of the Wash showed juniper (*Juniperus californica*) as dominate within the Santa Ana River alluvial flood vegetation plain by virtue of its size. In the study, junipers were complemented by smaller shrubs such as *Eriogonum fasciculatum*, *Eriodictyon trichocalyx*, *Opuntia littoralis*, and *Gutierrezia* sp., all noted for their importance in contributing to overall percent cover, percent density, and percent frequency of sampled vegetation. In the proceedings, Hanes recognized the alluvial fan vegetation in Upper Santa Ana River Wash represented the largest stand of California juniper on the coastal side of the Transverse Ranges in southern California. Recognizing individual juniper trees can routinely live for hundreds of years and sometimes even more than 1,000 years, the protection of these exceptionally long-lived trees that are fire vulnerable and at risk due to changing conditions and fuel loads within the Wash, becomes imperative within the Wash Plan Preserve and a focus for this NRMP.

In addition to informing management decisions today, the vegetation database compiled by AECOM will define baseline conditions for monitoring change in habitats due to major flood events and/or fires going forward. Across California, MCV and the associated vegetation mapping has been an effective tool for evaluating major changes in the structure and composition of vegetation at a coarse scale. The Wash Plan database will perform a similar function for the Wash Plan Preserve, allowing quantifiable evaluation of landscape changes through time (consistent with Preserve Action 10A, 10C).

Aquatic Resources

Other notable natural resources of interest that have informed development of this NRMP, include the location and distribution of aquatic resources, specifically the Waters of the United States (WOTUS), Waters of the State (WOTS), and the California streambed (CA Streambed). Jurisdictional delineations performed by AECOM in 2022 with support from District staff formed the basis of the new information describing the spatial distribution of aquatic resources within the Plan Area (see Figure 3.).

The total acreage of jurisdictional waters within and adjacent to the Plan Area is 533. The Plan Area is situated at the confluence of four major drainages (Santa Ana River, Mill Creek, Plunge Creek, and City Creek) as they merge with the Santa Ana River.

Upstream from the Plan Area is the headwaters of the Santa Ana River, upstream from Seven Oaks Dam. Just downstream from where the Santa Ana River flows under Greenspot Road, Mill Creek (another sub-watershed located to the southeast) flows northwest and meets the Santa Ana River. The combined Santa Ana River and Mill Creek flows downstream to the west. North of the Santa Ana River-Mill Creek confluence, Plunge Creek flows southwest parallel to the Santa Ana River until Plunge Creek meets City Creek and the Santa Ana River to the southwest of the Wash Plan Area. In addition, ten minor tributaries, as well as recently constructed channels, are also present within the Plan Area.

When reviewing the mapped jurisdictional waters, it becomes readily evident that aquatic resources do not routinely cross the alluvial fan to connect the Santa Ana River to Plunge Creek. Historically this connection was established during major storm events in 1862, 1938, and 1969. The effects (that is, the vegetative response) of the inundation and resulting erosional and depositional forces within this area of the floodplain are still evident from the aerial imagery and in field surveys. This disturbed area of the floodplain is recognized in the Wash Plan and this NRMP as the '1969 breakout'. The disturbance of RAFFS in this area due to these large storm events was significant and allowed for the creation of habitat and conditions favored by SBKR, SARWS, and SHSF that persist today, decades after the initial disturbance. With the last significant inundation dating back more than 50 years and the development of Seven Oaks Dam in 1999 muting future alluvial processes across this area of the floodplain, management activities will need to be focused in this area to re-establish important linkages among extant populations of Covered Species within the Wash Plan Preserve and limit the extent of exotic grasses now found throughout this area (see results highlighted in section on SBKR Monitoring and Management Activities) to minimize the risk and spread of fire threatening the juniper woodland and limiting the opportunities for reestablishment of native annuals once prolific across the open sandy areas of the Wash.

Monitoring and Management Responsibilities

Effective monitoring and management activities implemented in a timely fashion are of critical importance to the successful long-term stewardship and recovery of the sensitive natural resources protected by the Wash Plan. An effective plan for the management of these natural resources recognizes and calls for investment in both elements.

Monitoring

Monitoring efforts build upon the existing knowledge base established through development of the HCP concerning the distribution and status of sensitive natural resources within the Plan Area. The Wash Plan is a rich source of information to aid planning efforts in support of future monitoring and management activities, providing an overview of baseline conditions for the Plan Area with emphasis on the distribution of Covered Species within the Wash Plan Preserve (see Section 3.4). Principle threats to the habitat present in the Preserve are also identified in the HCP, as are monitoring obligations tied to both protected habitats and Covered Species (see Section 3.4 and Appendix B).

Monitoring actions to be implemented consistent with the HCP are designed to provide information on the status and trends of Covered Species and protected habitats through the full-term of the HCP. Recognizing the importance of evaluating multiple sources of information, available measures supporting description of the status and trends of Covered Species and protected habitat are to be evaluated, both individually and collectively, to make an overall determination regarding the status and trend of the species or habitat. Equally, recognizing the uncertainty often associated with the different types of available measures, an evaluation of confidence in the stated determination should be communicated by the parties tasked with completing the assessment.

Additional resources such as the River HCP CAMMP and Santa Ana River WSPA MSHMP are to be reviewed and referenced when developing the framework for the monitoring program and assessing available information supporting description of baseline conditions within the Wash.

Over the course of implementing this NRMP, cross-agency collaboration and partnerships are to be considered and pursued, when appropriate, recognizing the benefits of collaboration often extend well beyond individual agencies and result in improved conditions for the natural resources present in the Wash jointly protected by existing and future conservation plans and management agreements.

In addition to taking action to monitor for the condition and trend of natural resources, compliance monitoring is recognized as an integral part of the larger monitoring program supporting implementation of the Wash Plan as it aids in addressing accountability.

Management

The Wash Plan identifies both general management obligations associated with successful stewardship of the Wash Plan Preserve together with individual management actions directed at benefiting specific habitats and Covered Species (see Section 5.1.2 and Appendix B). When considering management across the Wash Plan Preserve, it is important to recognize both species and waters know no boundaries with regards to land ownership in the Wash. For the protected species inhabiting the Wash, such as SBKR, it is probably best to consider observed individuals, regardless of the location of the observation, as members of a single large population or series of interconnected populations occupying the Wash.

In recognizing the interconnected nature of the natural resources present within the Wash, it becomes clear the District's success in managing for SBKR is equally the success of SBCFCD, SBVMWD (as the lead entity overseeing development of the River HCP), Orange County Flood Control District (as the managing entity of the Santa Ana River WSPA MSHMP), and other key stakeholders, and vice versa. Collectively, representatives of the listed agencies should be encouraged to work collaboratively to improve conditions across the Wash regardless of ownership while still addressing the outstanding management obligations tied to individual properties. Improved conditions across the Wash maximize the likelihood the species will continue to persist indefinitely in the Upper Santa Ana River Watershed.

In contrast to a more holistic approach, fragmented management actions and conditions can threaten the long-term viability of the species, often leading to reduced population size and increased vulnerability to environmental stochasticity, that is, chance events such as extended droughts, series of extreme heat events or an unprecedented flood or fire event. In short, working collaboratively and, in effect, extending positive management actions across a greater geography is always better for the species. Equally, managers and agencies benefit from economies of scale, shared expertise and

resources, continuity in vision and approach, and the shared learning experience. Through collaboration, the species of interest is always better positioned to have the best chance at long-term persistence.

Monitoring is critical to supporting natural resource management activities. First and foremost, sustained investment in biological monitoring improves the knowledge base detailing existing and changing conditions and informs management priorities across the Wash Plan Preserve. Secondly, monitoring is essential to evaluating the efficacy of management actions implemented in support of the recovery of Covered Species.

A preferred monitoring strategy for many management actions is the Before-After-Control-Impact (BACI) design. Given management activities often need to be large in scope to be effective and often do not provide the opportunity for replication, the BACI model is an effective methodology for documenting the effectiveness of discrete or cumulative management actions in improving local conditions benefitting a single species or entire community. When the timing and location of the impact, that is, the management action, are known and adequate pre-data are collected, the BACI design is considered optimal to help isolate the effect of the response or development from natural variability.

Land Stewardship and Habitat Management

Habitat management includes two general groups of activities: (1) the general land management required to maintain a property in its current state (i.e., general land stewardship), and (2) activities and actions related to the management of habitat for Covered Species through the HCP. Management activities are most effective in supporting the goals and objectives of the HCP when they address the principal threats and stressors impacting, or with the potential to impact, the Wash Plan Preserve and individual Covered Species.

With regards to threats and stressors present within the Santa Ana River Wash, the list is varied and ranges from the presence of invasive plants, largely grasses of Mediterranean origin, that impede movement of listed species, outcompete native plants for limited water resources, and increase fuel loads, to human activity, in the form of illegal trespass, dumping, and/or establishment of unauthorized encampments, leading to the fragmentation and degradation of protected lands and increased fire risk (see Section B.7.1 of the HCP). At a landscape-scale, development pressure over the last century has resulted in substantial habitat loss and fragmentation, further isolating remaining populations of native plants and animals, and challenging the metapopulation dynamics of Covered Species. The construction of Seven Oaks Dam and several flood control levees has muted fluvial processes associated with the Santa Ana River and associated tributaries, limiting the natural disturbance regimes critical to the species and habitat dependent on early and mid-stage successional dynamics for long-term sustainability (see Section 3.4).

General Land Stewardship

General land stewardship activities are addressed in more detail in Section 5.2.2 of the HCP, *Approach to Habitat Management*.

General land stewardship activities are recognized to include:

- Trash removal
- Minimization and clean-up of illegal dumping

- Restricting unauthorized access
- Maintenance of facilities and equipment needed for habitat management

Habitat Management

Specific actions intended to improve habitat conditions and expand suitable habitat for Covered Species are identified as key elements of the HCP conservation program (see Section 5.2.2, *Approach to Habitat Management*). An Adaptive Management and Monitoring Program (AMMP) has been prepared (See Section 5.3 and Appendix B of the HCP) to provide specific details on the implementation of the habitat and species management actions identified in Section 5.2.2 of the HCP. Development of this NRMP is to be based on the current AMMP.

Adaptive Management

As described in the HCP, adaptive management is a decision-making process promoting 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 modify management actions iteratively (as understood and defined by Williams et al. 2007).

Adaptive management is necessary because of the degree of uncertainty and natural variability associated with ecosystems and their responses to management. Adaptive management is the land manager's response to new information. Adaptive management actions undertaken through the implementation of this NRMP will likely take place at the following junctures:

- In response to the results of targeted studies including pilot projects
- In response to an observed degradation of habitat quality or quantity for a Covered Species or important vegetation community
- When new information from the literature or other relevant research indicates that a feasible and superior alternative method for achieving the biological goals and objectives exists
- When monitoring indicates that the expected or desired result of a management action did not take place
- Proactively, when threats are identified through the monitoring efforts in the Plan Area

Outside of the obvious need to address funding and staffing, a few key actions are required to adaptively manage natural resources protected under a habitat conservation plan. First, the major levers or tools available to land managers that are to be applied in the field need to be explicitly defined. When defined, management actions should highlight the spatial and temporal scale by which they are to operate and effectively address issues otherwise limiting the ability of individual species to establish or expand self-sustaining populations within the Wash Plan Preserve.

Secondly, to be effective, land managers need to get to work. There needs to be real investment in the act of doing through assigning responsibilities for the implementation of specific conservation actions. Unless a team is specifically tasked with being responsible for implementing a course of action or accomplishing a specific scope, too often the important work of learning by doing does not get done.

The most valuable type of learning about natural systems happens principally in the field, and then secondarily in the office, where managers can pour over collected data and discuss the results of

performed analyses. The available literature provides a critical foundation to learning, but it is ultimately through acting in the field that teams generate new information and make the most important discoveries.

When implementing a new natural resource management program, inevitably, there is the likelihood an incredible amount of uncertainty exists about the natural systems and species that are to be managed. To overcome the absence of knowledge, an agency needs to invest in monitoring and management activities. It is only through being active managers that land managers become more familiar with and knowledgeable about the best course of action to achieve the desired result. In time, this new knowledge can be showcased through successfully predicting outcomes experienced by the natural resources over time and under different conditions.

Management Areas

Consistent with the Wash Plan (see Section 5.2.2), the primary habitat management approach to be highlighted in this resource management plan and employed by the Preserve Manager, working with the Conservation District and other partners, focuses on the maintenance and enhancement of overall habitat quality for Covered Species through: (1) the control of non-native annual grasses and other invasive non-native plants, and (2) the restoration and enhancement of slender-horned spinyflower and Santa Ana River woolly-star populations. Equally, opportunities to improve habitat conditions for San Bernardino kangaroo rat are to be pursued and implemented.

There are six management units identified by the Wash Plan (see Figure 4). These include Upland Mixed Use, Linkage Between Santa Ana River and Plunge Creek, Santa Ana River Channel, Confluence of Mill Creek and Santa Ana River, Spinyflower Contingency Parcel, and Plunge Creek. Creation of the Management Units allows for greater distinction between the individual management needs of the different areas of the Wash Plan Preserve.

Bureau of Land Management (BLM) Areas of Critical Environmental Concern (ACEC) are present within the Upper Santa Ana River floodplain (Wash). Bounded by the City of Highland to the north, and the City of Redlands to the south, the ACECs within the project plan area have an additional secondary designation of Research Natural Area (RNA), recognizing the importance of the wildlife resources and natural processes present in the landscape to research and higher education.

Working Landscape

The Wash is a working landscape. The San Bernardino Valley Water Conservation District is a Special District within California delivering groundwater recharge services to the region. Working with nature to accomplish groundwater recharge has similarities, from a conservation perspective, with agricultural activities like ranching and farming. Rarely do agencies regulate take from those activities, and, if anything, discussions usually involve description of the conservation benefits of the working landscapes and implementation of voluntary conservation measures that further benefit target species and priority landscapes above baseline conditions.

With regards to the Wash, high-value conservation elements (that is, listed species) are recognized to be present throughout the Plan Area. Practices and activities conducted by the Conservation District on the landscape are largely unchanged over the last 90+ years. The continued presence of listed species across the property in areas managed by the District are a testament to the compatibility of the District's

operations and maintenance activities with the ability of the species to meet their short (that is, day-to-day and seasonal) as well as long-term (multi-generational) needs.

One of the principal goals of the HCP and associated state permits is to ensure the commitment by the District to continue to operate the facilities in a way that is compatible with the long-term conservation of the natural resources present within the Wash Plan Preserve. Through the permitting process, the District and agencies are able to formalize an approach and commitments by the District to operate within the envelope already defining the extent of present-day activities that maintain a certain level of consistency with past approaches that have benefited the listed species. A second objective is for the District is to work collaboratively with the agencies to further document and study the response of listed species to new management activities purposely implemented by the District to improve conditions and enhance survival of the Covered Species above baseline.

Threats to Habitat Function

Within the protected and managed areas of the Wash Plan Preserve, several threats to habitat function exist with the potential to limit the long-term conservation value of enrolled properties for Covered Species and other sensitive resources. Taking a threat-based approach to the management of the Covered Species is essential to maintaining landscape-level processes and conditions necessary to accomplish the goals and objectives of the HCP.

Threats-based Management

Principal threats to the natural resources within the Wash Plan Preserve requiring management intervention include invasive plants, human activities, wildfire, and the absence of fluvial processes. Details associated with each of these threats as well as proposed management activities to address them are discussed below.

Invasive Plants

The invasive annual grasses of Mediterranean origin have proliferated throughout the Wash over the last century and now readily threaten the long-term viability of many of the natural resources present within the alluvial flood plain. The exotic grasses, which have benefited from increased nitrogen deposition over the last 75 years, are recognized to be flashy fuels, meaning they ignite quickly and burn quickly, readily able to carry wildfire. Outcompeting native plants for limited water resources, the invasive grasses initiate growth early in the new rain year, taking advantage of the first rains and establish local dominance over many of the native forbs and young seedlings of native shrubs associated with the increasingly rare RAFSS. With the increased cover following heavy rain years and/or fire events, annual grasses become established in large areas of the Wash limiting the mobility and foraging opportunities for many native small mammals, lizards, amphibians, birds, and arthropod species. Grasses limit future opportunities for re-establishment of the annual herbaceous cover historically prevalent throughout the alluvial fan as a carpet of herbaceous, annual flowering plants, present between the shrubs, flourishing during the spring months and then dying off with the onset of summer (Hanes 1981). Drying out of the invasive grasses and mustards contribute to the build-up of thatch and become a flashy fuel readily able to ignite. Humans directly or indirectly ignite most wildfires and with the rapid increase in the presence of illegal camping and other illicit activities in the Wash, the likelihood

of accidental or purposeful ignition has been magnified to unsafe levels and threatens long-term viability of native woody perennial plant species, such as the juniper, not-adapted to high-frequency repeat fire.

Human Activities

The Conservation District facilities are large open space areas adjacent to densely populated urban areas that are frequented by trespassers and squatters, including the lands enrolled in the Wash Plan Preserve. These users often damage gates, drive off designated roads harming habitat, clear habitat to create campsites, or dump household and commercial waste creating debris fields. Without frequent patrols and management, illegal dumpsites and encampments can be used habitually with the number of unauthorized trails and debris fields growing larger through time. As a management response, District staff recognize the importance of regularly patrolling the facilities for damage to fences, gates, and locks as well as the presence of encampments and illegally dumped trash. As a preventative measure, and part of the Conservation District's water operations, warning/ trespassing signs/stencils and access gates are constructed by staff and strategically placed throughout the District's facilities to prevent trespassing and vandalism. Additional measures, including the use of drone technology to help aid in the detection of trespass and unauthorized use of the natural areas of the Wash, are being discussed for implementation under this NRMP.

Fire

Increased cover of invasive grasses and other flashy fuels together with observed increases in unauthorized human activity within the Wash over the last several decades has led to heavier fuel loads and rates of ignition increasing wildfire risk threatening sensitive natural resources present on Conservation District and San Bernardino Flood Control District properties and in recognized Areas of Critical Environmental Concern (ACEC) managed by BLM. Increased human activity in the form of trespassing on public lands and the associated illegal encampments has increased ignition risk within the Wash. When coupled with increasing fuel loads resulting from substantial gains over the last several decades in the cover of invasive grasses (such as species of the genus *Bromus*) and non-native broadleaf plants (e.g., *Brassica tournefortii*), a condition has been created in the Wash where sensitive natural resources are threatened with increased environmental degradation.

Absence of Fluvial Processes

Major storm events occurring in 1862, 1938, and 1969 were the catalyst for significant disturbance of the alluvial fan located within the Upper Santa Ana River floodplain. The disturbance, in the form of severe flooding and erosion, provided for conditions, that is, the deposition of sandy and rocky alluvia, foundational to resetting the successional dynamics characteristic of the Riversidean Alluvial Fan Sage Scrub vegetation utilized by listed plant and animal species present in the Wash. Recognizing, by design, that is, through construction of Seven Oaks Dam and implementation of other flood protection measures, these major disturbance events are unlikely to occur again at the same scale and with the same ferocity in the foreseeable future, it becomes paramount for water managers and landowners with natural resource management responsibilities in the Wash to have the ability to periodically implement a series of smaller-scale, science-based management actions resulting in disturbance events whose cumulative effects on habitat condition could replicate, to a degree, the intensity and scale of disturbance otherwise accomplished through a singular severe flooding event. In the case of implementing the Wash Plan, one of the key questions that must be addressed in time is how are land

managers to manage the natural resources in the Wash over the next several decades recognizing a principle system driver, that is, major periodic disturbance in the form of wide-spread flooding, has been compromised by construction of Seven Oaks Dam, and scouring and soil deposition events fundamental to the long-term system dynamics in the Wash are now likely to be limited.

Management Response

In response to recognized threats, the District is committed to partnering with the relevant agencies and investing in proven methodologies for managing fuel loads and restoring and enhancing open habitat within the Wash. Equally, consistent with the objectives of the HCP addressing the management of human activities within the Wash Plan Preserve, the District will continue to implement activities needed to support creation and rehabilitation of effective barriers and boundary signs (Preserve Objective 2, Preserve Action 2A), investment in regular patrols (Preserve Action 2B) to identify and report illegal activities and access points to appropriate authorities, and coordinate with local authorities regarding issues of trespass and measures needed to address members of the unhoused community present in the Wash (Preserve Action 2C, Action 2D).

Opening-up Habitat and Minimizing Wildfire Risk

The creation of open habitat with a reduced fuel load, in addition to minimizing overall wildfire risk, also results in conditions favored by the San Bernardino kangaroo rat, Santa Ana River woolly Star, slender-horned spineflower, and California gnatcatcher, reinforcing the mission of the San Bernardino Valley Conservation Trust (Trust) and complementing the actions taken by key stakeholders such as BLM California, and the SBVWCD. Through the active removal and treatment of invasive grasses and broadleaf non-native plants, using mechanical, chemical, and manual means, the Conservation District is committed to working with partners in creating defensible space in strategic locations of the Wash for the purposes of slowing the rate of fire spread and restoring habitat. By addressing the incidence of illegal trespass and human encampments in the Wash, the Conservation District will be working to effectively reduce threats of ignition with focus on limiting opportunities for wildfire ignition during the most critical times of the year, such as when wind-driven fire events are most likely to occur. The Conservation District recognizes techniques used in reducing fuel loads supports the establishment of fire resilient landscapes both benefiting neighboring human communities and supporting threatened and endangered species recovery within the Wash.

Although specific measures employed to accomplish these objectives will likely be project specific, the Conservation District aims to reduce fuel loads within the Wash Plan Preserve addressing areas most burdened by high cover of invasive grasses and non-native broadleaf species with focus on the Linkage Between Santa Ana River and Plunge Creek Management Unit. Opening-up habitat in these areas would be accomplished principally by removal of live and dead (i.e., thatch) invasive plant material through mechanical (e.g., weed whipping) and chemical means (e.g., herbicide treatment targeting invasive grasses) each winter to reduce seed load and the likely prevalence of the exotic grasses and other invasive plants following conditions associated with wet winters, and through reintroducing disturbance to select areas of the Wash in the form of mechanical means by scraping and removing topsoil rich in organics and laden with exotic seed and through the spreading of native sand captured from neighboring groundwater recharge activities performed by SBVWCD on Mill Creek to bury fines (e.g.,

clay and silt) supporting invasive grasses and mustards similar to what happens during natural storm events that result in bank overtopping and sheet flow across areas of the alluvial fan.

Limiting Fire-risk through the Management of Human Activities

Action to be taken as a response to the recognized threats presented by human activities includes limiting unauthorized access to the most sensitive areas of the Wash. The Conservation District is prepared to work with partners to increase investment in measures to reduce the incidence of trespass and illegal dumping, establishment of encampments, and other illicit activities often identified as the source of ignitions. Focusing on Santa Ana River Channel and Plunge Creek Management Units, work would be accomplished through increased investment in vehicular and foot patrols of the Wash and initiating regular use of drone flights to capture an aerial perspective on habitat conditions, presence of new trails, and debris and encampments. Working with individual landowners and the regulatory agencies, the Conservation District will fortify unauthorized access points with fencing, rock barriers, and construction of gates limiting vehicular and pedestrian access, where possible. Furthermore, the Conservation District will continue to invest in increased communication and information sharing with partners to position themselves to work effectively with the unhoused population dealing with addiction and mental health issues as they look to integrate back into mainstream human communities.

Recognized Public Benefits

The aforementioned actions benefit the public through reducing fuels and limiting rates of wildfire ignition associated with illegal trespass and unauthorized encampments on public lands within the Upper Santa Ana River Wash. Indirect benefits received by BLM California include fewer incidences of illegal trespass and dumping and increased threatened and endangered species habitat protection and enhancement in recognized ACECs.

Benefits to Covered Species and Rare Habitats

The creation of open habitat with a reduced fuel load results in conditions favored by the Covered Species, reinforcing the mission of the San Bernardino Valley Conservation Trust and complementing the actions taken by key stakeholders such as BLM California, and the SBVWCD. Equally important to the successful management and conservation of Covered Species, proposed activities provide additional protection measures for the juniper woodland.

Restoration of Alluvial Processes

Habitat restoration and maintenance activities, as described in Section 2.2.8, *Habitat Enhancement and Monitoring* of the HCP, include the removal or notching of the Greenspot Levee near the eastern boundary (Greenspot Road) of the Plan Area to restore regular flooding and scour and sediment deposition to a significant habitat area on the site; and advancement of the Plunge Creek Conservation Project, where the stream course has been modified to restore natural scour and sediment deposition patterns on approximately 14 acres.

Plunge Creek Conservation Project

The Plunge Creek Conservation Project (located within the Plunge Creek Management Unit), implemented in 2020 and approved by both the USFWS and CDFW through the project-specific Biological Opinion (BO) FWS-SB-19B0182-19F1160-R001 and California Endangered Species Safe Harbor

Agreement (SHA) No. 2089-2020-002-06, engineered flow dynamics in Plunge Creek directed repeated storm flow events into areas historically covered by stormwater that became dominated by late-stage alluvial fan sage scrub habitat and disturbed annual grassland following the incision of Plunge Creek. Over the course of a series of three storm events occurring in 2021, the project resulted in the creation of 3.5 acres, 8.1 acres, and 11.7 acres of novel wetted areas following peak flows of 20 cfs, 300 cfs, and 600 cfs, respectively, with substantial erosion and sediment deposition occurring throughout the project footprint which reset conditions favorable to the establishment of early successional alluvial fan sage scrub vegetation. Furthermore, estimated amounts of water recharge accomplished during these referenced storms were 30, 100, and 355 acre-feet, respectively.

In 2023, three storm events occurring in January and March resulted in the manipulation of peak flows of 450 cfs, 560 cfs, and 520 cfs, respectively (Figure 5.). The measured activity of flow dynamics resulted in an estimated 50, 220, 154 acre-feet of groundwater recharge and total wetted areas of 8.0 acres, 9.1 acres, and 8.7 acres across the site, respectively. In total, the storms of 2021 and 2023 resulted in a total of 12.7 acres of novel rewetted areas being achieved.

Management activities to improve capacity of the Plunge Creek Conservation Project to rewet additional acres and increase the disturbance into the otherwise static areas of Plunge Creek flood plain experiencing high cover values of exotic grasses are scheduled to be implemented in 2023 and 2024 (see Figure 6.). Management activities include adding check dams to encourage breakouts across otherwise undisturbed areas and stabilize sections of the channel from additional cutting, repairing edge of soil berms to keep water in the pilot channel and away from mining areas, and adding rock to existing check dams to help encourage stream braiding and scouring.

In being able to create and enhance existing braided distributary channels through water management activities, the District's activity at Plunge Creek has highlighted the ability of the District and other water managers to influence sediment sorting within the Wash, laying shallow sheets of sand and silt over the surface of the wash in select areas beneficial to San Bernardino kangaroo rat, the Santa Ana River Woolly Star, and other sensitive species, while coarser sands and gravels are laid down in the main channels where water tends to flow more quickly.

Importantly, activities associated with the Plunge Creek Conservation Project address obligations identified in the Wash Plan tied to Jump Start Activities. In time, 250 acres of the Plunge Creek floodplain owned by the SBVWCD will be formally conserved through placement of a conservation easement on the property and, at present, more than 200 acres of the floodplain are being actively managed through invasive plant control with a focus on the removal and treatment of annual grasses through contracted work by the District with the Inland Empire Resource Conservation District. Furthermore, and consistent with identified Jump Start Activities, District staff have initiated general land stewardship on the 200 acres, including installation of fencing and signage where appropriate, trash removal, minimization and clean-up of illegal dumping, restricting unauthorized access, and the maintenance of facilities and equipment needed for habitat management.

Lastly, the Plunge Creek Conservation Project offers proof of concept to partners and other stakeholders interested in the successful management of the Wash and the identification of strategies to mitigate the effects of the construction of the Seven Oaks Dam on natural resources. Through the periodic manipulation of flow events, occurring across the spectrum of flow rates acceptable to flood control managers, the District has demonstrated the ability of land managers to direct the sedimentation

process, influencing the location of sedimentation deposition and scour and, in effect, over time, allowing for increased geographic coverage of disturbed areas within the Wash, lessening the dependence of the larger system exclusively on the effects brought about by singular severe flooding events.

In influencing the direction of low and moderate flows through the strategic and temporary placement of rock diversions in the Wash, the District is showing it can mimic natural processes in which alluvial fan sedimentation, typically restricted to one part of the fan surface called a 'depositional lobe', eventually fills in the area with sediment making it more efficient for the sedimentation process to jump or 'avulse' to a new area of the fan. The demonstration of this process of manipulating the direction of water movement at Plunge Creek under variable flow rates opens the possibility of applying the same procedures to other areas of the Wash when warranted.

As work is planned to geographically expand these efforts, areas will be prioritized based on criteria developed in consultation with the Wildlife Agencies including biological and logistical factors. Spatial planning is needed to ensure the deposition sites will be linked spatially to other activities, such as weed management to create larger blocks of high-quality habitat.

It is encouraging to note that the amount of flow necessary to achieve a positive disturbance event is available via the Conservation District's existing canals. These low flows are not likely to damage existing infrastructure and are available in most years, unlike the historic events that were otherwise wide-ranging but occurred but once every 50 years.

Greenspot Levee Removal Project

Similar to the goals and objectives of the Plunge Creek Conservation Project, the Greenspot Levee Removal Project aims to restore natural storm flows to a portion of the Santa Ana River floodplain that is no longer disturbed by natural fluvial processes following the construction of Seven Oaks Dam. Occurring within the Confluence of Mill Creek and Santa Ana River Management Unit, the project proposes to remove a portion of an existing levee west (and downstream) of the Greenspot Road Santa Ana River Bridge along a channelized portion of the Santa Ana River to restore habitat within the historic floodplain for species such as SARWS and SBKR. The levee is part of existing bank improvements, constructed beginning in 1929, to contain a 100-year flood flow beneath two downstream bridges that cross the Santa Ana River. The proposed project will remove a selected section of the levee, approximately 1,650 feet in length, to allow natural storm flows and dam releases to return to areas that flooded prior to levee construction, restoring hydrological function within the floodplain while the remaining portions of the levee continue to protect downstream bridges during flood events. Project construction depends on the results of a feasibility study; hydrologic studies; coordination with the USFWS, CDFW, and San Bernardino County Flood Control District; and issuance of all necessary permits if the project is determined to be feasible.

With regards to construction, the project is estimated to involve removal of approximately 273,000 cubic yards of soil and other materials within the project footprint. A 0.28-acre staging area would be located along the west side of Greenspot Road, which allows access into the public right of way. Access routes from the levee to the staging area, and ultimately Greenspot Road, are collocated within the levee removal footprint to minimize disturbance to the greatest possible extent.

Work will be completed by a Conservation District contractor through either the sale of rock or removal of the rock and hauling to the borrow pit. The project, as conceptually designed, includes temporary impacts to approximately 4.84 acres of potential habitat for SBKR, including 1.25 acres modeled as low suitability, 3.55 acres modeled as very low suitability, and 0.04 acres modeled as ecological process area. Based on hydrological modeling, the project is expected to restore up to 30 acres of habitat suitable for SBKR and SARWS in areas that are currently lacking natural hydrologic disturbance due to flood control structures, resulting in a substantial net benefit for the Covered Species.

Species-specific Monitoring and Management

Monitoring actions are those actions taken to track the status and trend of Covered Species and of their habitats within the Wash Plan Preserve. Monitoring efforts are to be designed to inform species-specific management strategies and tasks. Monitoring actions will be conducted within an adaptive management context so monitoring results can be linked to management actions to inform and improve the efficacy and efficiency of management activities through time (see Appendix B of the HCP).

At least every five years through the duration of the Wash Plan, the District plans to evaluate available monitoring data to assess the status and trend of Covered Species and provide measures of confidence in the reported statements based on the quality of the information available from which the assessment is made. Habitat will be evaluated in a similar fashion.

Management actions are those principal activities taken to improve or maintain the suitability of the habitat for a Covered Species or natural community. Management objectives identified in the HCP describe the means through which resource management goals of the HCP will be accomplished. Specific management activities associated with habitat restoration and enhancement, or resulting in the reduction, removal, or prevention of threats that may degrade the habitat (e.g., invasive plant infestations or trespass) are to be implemented under the HCP to achieve listed objectives.

San Bernardino Kangaroo Rat Monitoring and Management Activities

Recognizing that the loss of RAFSS over the historic range of SBKR reduced occupied SBKR habitat by an estimated 86% by the 1990s and the Santa Ana River Wash held the majority of remaining suitable habitat in the subspecies range at that time (McKernan 1997), an aggressive monitoring and management program for the species is warranted. This is especially true, as the addition of floodplain modifications over the last twenty years through flood control activities, sand and gravel mining, and road and bridge construction have further reduced the active fluvial plain within the Santa Ana Wash to a fraction of what was present historically throughout the region. To ensure collection of data in a science-based and cost-effective manner, the Conservation District coordinated with the Wildlife Agencies and USFS on development of a SBKR monitoring protocol, completed in 2002. To date, USGS has completed their internal review and publication of the Final Report covering the protocol and first-year trapping results and is analyzing data from the second year of trapping and monitoring of habitat conditions in 2022 and 2023, respectively, analysis of soils collected at each of the trapping grids, soil composition and texture analyzed by BYU. In addition, the San Bernardino Valley Conservation Trust, working closely with the USGS, USFWS, CDFW, and other partners, submitted a Section 6 grant application in early 2023 for the creation of a range-wide monitoring program to be implemented in 2024 and 2025, with single-year and multiple-year analyses provided by the USGS.

Wash Plan Requirements: SBKR Biological Objectives and Actions

Table 2. Biological objectives and actions guiding conservation, monitoring, and management activities supporting San Bernardino kangaroo rat within the Wash Plan Preserve during the initial years of Wash Plan implementation.

Activity Type	Species-specific Objective and/or Action	Description	Status
Conservation and Management	SBKR Objective 1	Permanently conserve and manage SBKR habitat within the Plan Area	Ongoing
Conservation and Management	SBKR Action 1	Permanently conserve and manage 121.4 acres of high-suitability habitat, 122.1 acres of medium suitability habitat, 191.8 acres of low suitability habitat, 321.4 acres of very low suitability habitat, and 183.1 acres of ecological process area habitat on District Conserved Lands. Provide for the management of 170.4 acres high suitability habitat, 105.6 acres of medium suitability habitat, 126.1 acres of low suitability habitat, 237.7 acres of very low suitability habitat, and 42.9 acres of ecological process area	Ongoing

		habitat to support SBKR on District Managed Lands. [Note: Additional high or medium suitability habitat in surplus of the required acreages may be used to meet the low or very low suitability acreage requirements.]	
Management	SBKR Objective 2	Maintain and increase the quality of SBKR habitat in the HCP Preserve.	Ongoing
Management	SBKR Action 2	In low, medium, and high suitability areas, control non-native grasses and other invasive plants to an average cover of less than or equal to 20% over any 3-year period.	
Management	SBKR Objective 3	Maintain a stable or increasing population of SBKR in the HCP Preserve.	Ongoing
Management	SBKR Action 3	Maintain or increase the SBKR population in 70% of the high, medium, and low SBKR types of habitats as measured over any 8-year period.	
Management	SBKR Objective 4	Maintain and increase connectivity between SBKR populations in the HCP Preserve.	
Management	SBKR Action 4A	Create a crossing for SBKR over the D-Dike in the 1938 and 1969 Santa Ana River breakout area between plunge Creek and the Santa Ana River.	
Management	SBKR Action 4B	Prioritize non-native grass control and thin shrubs as needed to enhance connectivity for SBKR between Plunge Creek and the Santa Ana River.	
Management	SBKR Objective 5	Prevent SBKR habitat and individuals within the HCP Preserve from being impacted by Covered Activities.	Ongoing
Management	SBKR Action 5	In low, medium, and high suitability SBKR habitat, qualified biologists and/or biological monitors will monitor new construction and operations and maintenance resulting in ground disturbance to ensure the Covered Activities are confined to the allotted footprint.	Ongoing
Monitoring	SBKR Objective 7	Determine the status and distribution of SBKR in the HCP	Ongoing

		Preserve, monitor long-term trends, and assess the effectiveness of management actions.	
Monitoring	SBKR Action 7A	Initiate 3 years of baseline surveys for SBKR in the HCP Preserve within 1 year of permit issuance.	Ongoing
Monitoring	SBKR Action 7B	After baseline surveys are completed, survey for SBKR in permanent and random sampling plots within the HCP Preserve every 3 years as described in the monitoring plan.	
Monitoring	SBKR Action 7C	Compare sample plots in management treatment areas to those in untreated areas to assess the results of management actions.	Ongoing

Conservation and Management

Permanent protection of SBKR habitat (SBKR Objective 1) of varying levels of suitability (SBKR Action 1) is to be accomplished through establishment of conservation easements on Conservation District property and agreements with BLM regarding approved conservation and management actions occurring on their ACECs. Actions leading to the permanent protection of habitat and populations is addressed by the terms and conditions described in the Phasing of Conservation in Section 5.2.1 of the Wash Plan and are outside of the purview of this Natural Resource Management Plan. Conservation of SBKR habitat is to occur with successful implementation of Phase 1 and Phase 2 of the Wash Plan.

Monitoring

Consistent with the Wash Plan, the development of a scientifically valid, productive, and cost-effective monitoring program for San Bernardino kangaroo (SBKR) rat within the Wash Plan Preserve. The monitoring program is to allow for determination of the status and distribution of SBKR, monitoring of the species long-term trends, and assessment of the effectiveness of management actions in maintaining and increasing the quality of SBKR habitat and population of SBKR within the Wash Plan Preserve consistent with implementation of the Upper Santa Ana River Wash HCP.

Monitoring Protocol

Consistent with the requirements of the Wash Plan to develop a monitoring program to determine status and distribution of SBKR, monitor long-term trends and assess the effectiveness of management actions, SBVWCD retained the U.S. Geological Survey (USGS) and SJM Biological Services in 2021 to develop a scientifically valid, effective, and cost-effective monitoring program for SBKR within the Wash Plan Preserve. Specific objectives guiding development of the monitoring program by USGS included:

- Evaluate detection probabilities, spatial sampling scale(s), and covariate data from existing planning documents, and use them to develop a Percent Area Occupied (PAO) monitoring protocol and occupancy model for SBKR within the Wash Preserve.

- Monitoring protocol should allow SBVWCD to meet the monitoring requirements of the Wash Plan.
- Monitoring protocol should include a density index.
- Monitoring data should strongly support informed use of Wash Plan endowment for land management actions to meet Wash Plan goals for SBKR.
- If possible, protocol should allow for combined analyses with existing preserve-level SBKR monitoring and future range-wide SBKR monitoring.
- Monitoring results should contribute to answering knowledge gaps related to SBKR where possible (e.g., short, and long-term trends in areas occupied by SBKR, SBKR densities, and SBKR responses to landscape and environmental factors, habitat management, and disturbance).
- Utilize the Wash Plan SBKR habitat suitability model to identify the number and location of stratified sampling points across the Wash Preserve, if warranted.
- Develop a monitoring program that will accommodate significant restoration in low suitability areas via weeding, substrate addition/modification, flooding and fire over the 30-year term of the Wash Plan ITP. Low suitability areas will be identified using results of habitat modeling and occupancy (or lack thereof) of SBKR.
- Incorporate long-term evaluation of the Plunge Creek Conservation Project within the Wash Plan on SBKR occupancy.
- Include the minimum amount of survey sites supported by the Wash Plan endowment to generate spatial data to inform land use and management within and adjacent to the Wash Preserve.
- Incorporate survey sites for future sampling of SBVWCD Mill Creek Conservation lands and Community Mitigation lands outside of the Preserve.
- Incorporate long-term evaluation of the Seven Oaks Dam High Flow projects.

The monitoring program includes collection of various habitat covariates used for habitat modeling to inform understanding of SBKR and their survival needs. All habitat characteristics to be measured are hypothesized to be important for SBKR habitat suitability and were based on the current SBKR habitat characterization protocol for WSPA and lands protected under the Western Riverside Multiple Species Habitat Conservation Plan.

Progress

In late summer/early fall of 2021 the USGS completed a draft monitoring protocol allowing for the collection of first year SBKR trapping data in fall of 2021 across the Wash Plan Preserve. Analysis of the first year of trapping data collected under the new sampling protocol was initiated in winter and results were made available to SBVWCD in spring 2022.

On April 7, SBVWCD hosted a regional coordination meeting discussing the SBKR monitoring approach and early results from the USGS analyses. In addition to the USFWS, CDFW, and the USGS, the meeting participants included representatives from the San Bernardino Valley Municipal Water District, San Bernardino County Flood Control, Bureau of Land Management, San Diego Zoo, Western Riverside MSHCP, and Cajon Creek Conservation Bank. In total, there were 31 people in attendance at the meeting, representing 100% participation of all of those invited. The information shared at the meeting was well-received suggesting there were opportunities for regional collaboration on monitoring of SBKR moving forward.

Monitoring

Following the SBKR monitoring program protocol developed by the USGS, the first SBKR trapping was conducted in the fall of 2021 to determine occupancy and local abundance of SBKR within the Wash Plan Preserve, with the trapping efforts purportedly spatially balanced across the Wash Plan Preserve. In spring 2022, habitat surveys were completed by the District, characterizing habitat conditions of locations trapped for SBKR to reinforce species-habitat relationships and inform future management actions. In the fall of 2022 and spring of 2023, trapping efforts and habitat surveys, respectively, were repeated following the USGS protocol for a second consecutive year.

Annual trapping activities and habitat surveys allow for determination of the status and distribution of SBKR, monitoring of the species' long-term trends, and assessment of the effectiveness of management actions in maintaining and increasing the quality of SBKR habitat and population of SBKR in the Wash Plan Preserve consistent with implementation of the Upper Santa Ana River Wash HCP (SBKR Objective 7, SBKR Action 7A, 7B, 7C).

Results

First estimates of the density and abundance of SBKR across the Wash Plan Preserve were created through implementation of the monitoring protocol in 2021 and analysis of collected data in early 2022. Using repeat captures to estimate abundance, the USGS estimated total number of San Bernardino kangaroo rats within the Wash Preserve is 2,851, with 90% Confidence Limit extending from 2,355 to 3,292 kangaroo rats.

In total, 180 unique SBKR were captured at 53 of the 101 sampled plots distributed across the Wash Plan Preserve in 2021. Across these same plots, a total of 30 unique Dulzura kangaroo rat (DKR) individuals were also captured. The DKR was noted as present in 10 of the 53 plots containing SBKR. The three plots with the greatest number of captures of SBKR, totaling 10 or more unique SBKR captures, were located within a few hundred yards of the Santa Ana River Channel east of Alabama Street and on either side of Orange Street with the Santa Ana River Channel Management Unit.

In 2022, SBKR sampling was initiated by Mikael Romich on September 7 and continued through October 28. One hundred grids were sampled in total consistent with the activities completed in 2021.

In 2022, 146 unique SBKR and 21 unique DKR individuals were captured; these totals are lower than in 2021 when 180 unique SBKR and 30 unique DKR individuals were captured. Unique SBKR captures were highest at 2 plots: 77 and 61 with 10 individuals each. Plot 77 overlaps lands currently managed by the Bureau of Land Management (BLM) east of Orange Street where a burn occurred in September 2020; it was previously mature alluvial fan sage scrub dominated by California juniper woodland in an area that had not flooded since before 1938. Plot 61 occurs in scalebroom scrub in an area that was frequently scoured up until about 1984 when the current State Route 210 bridge substantially altered downstream fluvial processes of the SAR. In 2021, plot 164 had 10 unique SBKR, but that dropped to 5 in 2022.

The total number of SBKR occupied grids was fairly consistent between 2021 and 2022 despite the 18.9% decline in total unique SBKR captures. Six plots were negative for SBKR in 2021 and positive in 2022 and 6 plots were positive for SBKR in 2021 then negative in 2022.

Of 27 plots trapped in 2021 and 2022 north and south of the Santa Ana River Channel, east and west of Orange Street, 26 plots were occupied by SBKR (96.3%) with an average of 4.4 unique SBKR per plot. These plots also showed good consistency between years with 19/20 plots SBKR occupied both years.

Of 23 plots trapped in 2021 and 2022 in the Santa Ana River breakouts, 13 plots are occupied by SBKR (56.5%) with an average of 1.7 unique SBKR per plot. These plots also showed good consistency between years with 10 of 12 plots SBKR occupied both years. Of the 28 plots located north and south of Plunge Creek in 2021 and 2022, SBKR were detected on 7 plots (25%). For the 7 SBKR positive plots, there was an average of 0.2 unique SBKR captured in 2021 and 2022. Likely due to the low population density, only 2 of 6 plots (33%) in Plunge Creek trapped in 2021 and 2022 remained occupied between years.

On May 25, 2023, the second year of implementing the SBKR habitat assessment survey protocol was completed by District staff. In total, staff spent a total of 13 days in the field this spring conducting assessments surveying 102 of the 102 plots scheduled to be trapped in the fall.

When the trapping results are viewed across both 2021 and 2022 (see Figure 7.), it is interesting to note the spatial distribution of trapped locations where SBKR was captured (positive capture) or not captured (negative capture) over the first two years of trapping. The clear majority of locations where SBKR has been noted as present falls between the Santa Ana River Channel Management Unit and Confluence of Mill Creek and Santa Ana River Management Unit.

Management

One of the principal threats recognized in the Wash Plan impacting SBKR is the presence of invasive grasses in the Wash. Information gained from habitat surveys conducted in spring of 2022 and 2023, provided new insight into the Management Units most challenged by invasive grasses (see Figure 8.). Observed cover values for invasive grasses averaged over the two-year sample period highlighted the stark differences between Management Units in grass cover values. In the Santa Ana River Channel Management Unit 46.3% of surveyed plots (19 of 41) averaged less than 20% annual grass cover and 75.6% of surveyed plots (31 of 41) averaged below 30% percent cover. Similarly, the Confluence of Santa Ana River and Mill Creek Management Unit reported 43.8% (7 of 16) with annual grass cover values under 20% and 75% (12 of 16) under 30% annual grass cover. In contrast, the Plunge Creek Management Unit averaged 21.4% (6 of 28) with annual grass cover under 20% and 50% (14 of 28) with grass cover below 30%. In the Linkage Between Santa Ana River and Plunge Creek Management Unit, only 5.6% (1 of 18 plots) averaged annual grass cover under 20% and 27.8% (5 of 18 plots) with grass cover below 30%. On the other end of the spectrum the Linkage Between Santa Ana River and Plunge Creek Management Unit had 33.3% (6 of 18 plots) with average annual grass cover values greater than 50%. No other Management Unit averaged more than 12.5% of plots with grass cover values above 50% (with individual values attributed as follows to individual Management Units: 12.5% Confluence of Santa Ana River and Mill Creek, 3.6% Plunge Creek, and 7.3% Santa Ana River Channel).

Interestingly, average grass cover values were closely correlated with the percent of plots with SBKR detections across the two survey years. Both the Santa Ana River channel Management Unit and Confluence of Santa Ana River and Mill Creek had high occupancy, at 85.4% (35 of 41 plots occupied) and 87.5% (14 of 16 plots), respectively. Plunge Creek Management Unit and Linkage Between Santa

Ana River and Plunge Creek were much lower at 28.6% (8 of 28 plots occupied) and 33.3% (6 of 18 plots), respectively.

Habitat Enhancement

Consistent with activities identified in the HCP tied to Jump Start Activities, the District is assessing opportunities to enhance the quality of the linkage between the Santa River and Plunge Creek (falling within the Linkage Between Santa Ana River and Plunge Creek Management Unit), consisting of the 1938 and 1969 flood channels created by the Santa Ana River (breakout area), by controlling non-native annual grasses and other invasive vegetation within the linkage and corridor margins, adding a crossing for SBKR of the “D-Dike,” and thinning shrubs if necessary.

As part of this process, the District is evaluating approximately 170 acres of habitat modeled as low and very low suitability for SBKR within the Wash Plan Preserve for restoration and enhancement activities (see Figure 9.). Specifically, this area has been targeted for restoration and enhancement through the addition of sand with a composition like the substrates found in occupied SBKR habitat. The purpose of the addition of fill material would be to enhance and restore SBKR habitat through soil amendments to mimic the results of historic floods which no longer occur following the construction of significant flood control and transportation infrastructure upstream of the project area. The proposed restoration activity is consistent with conservation objectives for the species highlighted in the Wash Plan (SBKR Objective 2, 4 and SBKR Action 2, 4B) and in line with recent research which showed SBKR avoids areas with higher grass cover and lower sand content, which are expected to expand over time without natural flood events (Chock et. al 2020).

To replicate historic natural conditions as closely as possible, the sand used in these projects would be from local sources only (Mill Creek, Santa Ana River), including materials sourced from groundwater recharge basins located upstream of the Project Area. The requirement for use of local sediment results in the total proposed fill amount being equal to or lower than the fill that would naturally be deposited in the area under historic hydrologic conditions. Proposed work may also include the placement of rocks or other natural materials that would serve to divert natural or channelized flows for the purpose of spreading the sand onto the floodplain.

The identified acreage for restoration and enhancement is based on a preliminary constraints analysis to determine strategic locations (adjacent to existing canals and which can be used to spread sand-laden water; key areas of low-quality habitat which, if restored, could connect multiple areas of high-quality habitat, etc.) which would otherwise not be subject to the flooding necessary for restoration. Prior to initiation of restoration activities, specific locations would be selected following review of pilot projects, SBKR monitoring results, and input and approval by USFWS and CDFW through the Wash Plan’s Preserve Management Committee.

Next Steps

Continued investment in implementation of the formal monitoring program for SBKR and coordinating region-wide surveys of the species will be a priority for the District through 2025. Management activities directly benefiting SBKR, such as targeted enhancement of the Linkage Between Santa Ana River and Plunge Creek Management Units, will be advanced through planning efforts to be conducted in the spring of 2024 and enhancement activity initiated in the fall.

Upcoming activities:

2023

- Data Analysis – PAO Modeling (Summer/Fall)
- Monitoring Program – Live Trapping (Fall)

2024

- Habitat Enhancement Planning (Winter/Spring)
- Monitoring Program – Habitat Surveys (Spring)
- Data Analysis – PAO Modeling (Spring/Summer/Fall)
- Monitoring Program – Live Trapping (Fall)
- Habitat Enhancement (Fall/Winter)

2025

- Monitoring Program – Habitat Surveys (Spring)
- Data Analysis – PAO Modeling (Summer/Fall/Winter)
- Monitoring Program – Live Trapping (Fall)
- Habitat Enhancement (Fall/Winter)

California Gnatcatcher Monitoring and Management Activities

Since approval of the Wash Plan in July 2020, the focus of the management and monitoring activities addressing California gnatcatcher (CAGN) has been on performing baseline surveys for the species within the Wash Plan Preserve consistent with the HCP (see Section 5.2.1 and table below). Surveys were designed to be completed in the spring and summer months and follow the guidance provided by the USFWS CAGN breeding survey protocol for areas located inside an HCP. Information on the location of breeding pairs of CAGN informs management activities and reinforces habitat protection measures taken to minimize human disturbance in high-value natural resource areas of the Wash.

Wash Plan Requirements: CAGN Biological Objectives and Actions

Table 3. Biological objectives and actions guiding conservation, monitoring, and management activities supporting California gnatcatcher within the Wash Plan Preserve during the initial years of Wash Plan implementation.

Activity Type	Species-specific Objective and/or Action	Description	Status
Conservation and Management	CAGN Objective 1	Permanently conserve and manage high, medium, and low-quality gnatcatcher habitat within the Plan Area	Ongoing
Conservation and Management	CAGN Action 1A	Permanently conserve and manage 47.6 acres of high-quality habitat and 65.4 acres of medium quality habitat on District Conserved Lands. Provide for the additional management of 22.8 acres high quality and 124.8 acres of medium quality habitat to support breeding and wintering gnatcatchers on District Managed Lands.	Ongoing
Conservation and Management	CAGN Action 1B	Permanently conserve and manage 603.3 acres of low-quality habitat on District Conserved Lands. Provide for the additional management of 428.2 acres low quality to provide for gnatcatcher connectivity and dispersal.	Ongoing
Management	CAGN Objective 2	Control non-native annual grasses and other invasive plant species for the benefit of gnatcatcher	
Management	CAGN Action 2	In habitat identified as suitable breeding and/or winter territory control invasive plant species to ≤20% cover	

Management	CAGN Objective 3	Maintain the quality of habitat to encourage occasional use of suitable habitat	
Management	CAGN Objective 4	Maintain nesting pairs of gnatcatchers in the Plan Area or, if they are not present, the structural components of gnatcatcher habitat required for nesting	Ongoing
Management	CAGN Action 4	Based on the results of baseline surveys for gnatcatcher, manage occupied or otherwise suitable habitat to maintain at least two nesting pairs of gnatcatchers, or maintain the structural components of gnatcatcher habitat required for nesting	Ongoing
Management	CAGN Objective 5	Prevent nesting gnatcatcher from being impacted by Covered Activities	Ongoing
Management	CAGN Action 5	In gnatcatcher habitat, between February 15 and August 30 prior to conducting Covered Activities resulting in significant vegetation disturbance, a qualified biologist will conduct pre-activity nest surveys	Ongoing
Monitoring	CAGN Objective 6	Determine the status and distribution of gnatcatcher in the HCP Preserve, monitor long-term trends, and assess the effectiveness of management actions	Ongoing
Monitoring	CAGN Action 6A	Establish survey plots and initiate 3 years of baseline surveys for gnatcatcher in the HCP Preserve within 1 year of permit issuance	Ongoing
Monitoring	CAGN Action 6B	After baseline surveys are completed, survey for gnatcatcher in permanent and random sampling plots within the HCP Preserve every 3 years as described in the monitoring plan.	

Conservation and Management

Permanent protection of gnatcatcher habitat within the Wash Plan Preserve (CAGN Objective 1) to support breeding and wintering gnatcatchers (CAGN Action 1A) and associated connectivity and dispersal (CAGN Action 1B) will be accomplished through establishment of conservation easements on Conservation District property and agreements with BLM regarding approved conservation and management actions occurring on District Managed lands as well as implementation of this NRMP.

Actions leading to the permanent protection of habitat and populations are addressed by the terms and conditions described in the Phasing of Conservation in Section 5.2.1 of the Wash Plan and are outside of the purview of this document. Conservation of identified locations is to occur with successful implementation of Phase 1 and Phase 2 of the Wash Plan.

Monitoring

In accordance with CAGN Objective 6 and CAGN Action 6A, in 2021, 2022, and 2023, permitted biologist Mikael Romich was contracted by the District to conduct surveys for CAGN consistent with the Wash Plan monitoring program. The survey methodology used for all three survey periods was based on the focused protocol breeding surveys for jurisdictions within Natural Communities Conservation Planning interim section 4(d) process, which requires three repeat surveys for every 100 acres within the area to be surveyed (USFWS 1997). Prior to selecting this methodology, the District reviewed available sampling options and determined the acreage of suitable habitat within the Wash Plan was more amenable to a full coverage census than to a statistically-based sampling effort. The survey area was held constant across all three years and totaled 300 acres each year. Given the size of the area, a total of nine surveys were required to complete the survey protocol. Surveys were performed by slowly traversing each 100-acre survey area between 0600 and 1200 each day of the surveys. Surveys are timed so the entirety of the survey area is surveyed once in April, May, and June across years.

Surveys performed in 2021 and 2022 confirmed successful breeding within the Wash even though both years are recognized as experiencing a relatively low amount of precipitation which often leads to limited productivity in the species. The similar levels of reproductive activity observed between years suggest stability within the population inhabiting the Wash. The estimated number of pairs/territories of CAGN observed within the overlapping survey areas, largely centered on the Confluence of Mill Creek and Santa Ana River Management Unit, during the survey period totaled nine territories in 2022 and eight breeding territories in 2021 (see Figure 10.). The estimated number of pairs with active nests/fledged young totaled five in 2022, with three pairs confirmed with double clutches, and two others suspected. In 2021, six pairs with successful nests were confirmed. In both years, nesting substrates included brittlebush (*Encelia farinose*), scalebroom (*Lepidospartum squamatum*), and California juniper (*Juniperus californica*). In 2021, the average individual breeding territory size was estimated at 9.1 acres.

When evaluating information from additional studies of CAGN breeding conducted in similar habitats, in addition to the information captured from the 2021 and 2022 monitoring efforts, nesting substrate selection by CAGN was found to be consistently strongly associated with brittlebush (pers comm Mikael Romich). The leafy structure of brittlebush is hypothesized to provide high levels of cover and concealment for CAGN nests. Based on field observations, nesting activity is hypothesized to occur both earlier (i.e., March) and later (i.e., July) in the season beyond what is captured when conducting the surveys during the months of April, May, and June.

Management

Recommended management strategies identified in the HCP include the control of non-native annual grasses and other invasive plant species (CAGN Objective 2) in areas with the most suitable habitat (CAGN Action 2). Most of the Wash Plan Preserve occupied by CAGN (principally occupying areas within the Confluence of Mill Creek and Santa Ana River Management Unit and to a lesser extent, the eastern

portion of Santa Ana River Channel Management Unit) has substantially lower cover values of invasive grasses relative to other areas within the Wash. Therefore, currently management is focused on minimizing fire risk and limiting unauthorized access to areas of the Wash Plan Preserve to protect and maintain breeding opportunities (consistent with CAGN Objective 4). The new vegetation map and the SBKR plots regularly surveyed for habitat suitability provide an understanding of baseline conditions with regards to general structural components and principal plant species present as well as the fine-scale assessment of grass cover and other conditions in areas actively used by gnatcatchers (addressing CAGN Action 4).

Next Steps

Although not a requirement of the Wash Plan, CAGN surveys are planned to be implemented in 2024 and 2025. Extending formal monitoring will help to refine our understanding of habitat use within the Wash Plan Preserve and inter-annual variability in the number of breeding territories and observed nesting activity. By focusing monitoring efforts within Confluence of Mill Creek and Santa Ana River Management Unit, monitoring of CAGN is concentrated in an area covering 96.5% of the modeled high-quality habitat and 56.3% of the medium quality habitat present in the Plan Area.

Upcoming activities:

2023

- Monitoring (Spring/Summer)

2024

- Monitoring (Spring/Summer)

2025

- Monitoring (Spring/Summer)
- Evaluation of First Five Years of Monitoring Data (Fall/Winter)

Cactus Wren Monitoring and Management Activities

Baseline information on the distribution of CACW and cactus patches suitable for nesting within the Plan Area summarized in the Wash Plan (see Figure 4-4) informed conservation planning efforts and take estimates supporting development of the HCP. For the purposes of this NRMP, the reported information on CACW occurrences and habitat suitability serves to guide development of the monitoring program for the species and informs the prioritization of species-specific objectives and actions identified in the HCP.

Wash Plan Requirements: CACW Biological Objectives and Actions

Table 4. Biological objectives and actions guiding conservation, monitoring, and management activities supporting cactus wren within the Wash Plan Preserve during the initial years of Wash Plan implementation.

Activity Type	Species-specific Objective and/or Action	Description	Status
Conservation and Management	CACW Objective 1	Permanently conserve and manage cactus wren habitat in the Wash Plan Preserve.	Ongoing
Conservation and Management	CACW Action 1A	Permanently conserve and manage 14.1 cactus patches and surrounding habitat to support cactus wren nesting on District Conserved Lands.	Ongoing
Conservation and Management	CACW Action 1B	Permanently provide for the additional management of 18.4 cactus patches and surrounding habitat to support cactus wren nesting on District Managed Lands.	
Management	CACW Objective 2	Establish and manage eight new cactus patches suitable for nesting cactus wren in the HCP Preserve. Patches will be a minimum size of 200 square feet with approximately 65% vegetation cover, and be located within 200 meters of occupied habitat, or follow the recommendations of the current best available science. To facilitate movement of cactus wrens, when possible, new cactus patches will be established between areas in the HCP Preserve where cactus wrens are currently known to nest.	
Management	CACW Action 2	Collect cactus pads and/or cholla stems from existing cacti,	

		preferentially from areas that will be permanently impacted and plant them at selected locations. Control nonnative annual grasses and other invasive plants within the patches during their establishment. Replant as needed to achieve management objectives.	
Management	CACW Objective 4	Maintain the quality of habitat to sustain the current breeding population of cactus wren within the HCP Preserve.	Ongoing
Management	CACW Action 4	Annually control non-native grasses and other invasive plants within 20 meters of cactus patches of sufficient size to support cactus wren to less than 20% cover.	
Management	CACW Objective 5	Prevent nesting cactus wren from being impacted by Covered Activities.	Ongoing
Management	CACW Action 5	In cactus wren habitat, between February 15 and August 30 prior to conducting Covered Activities resulting in significant vegetation disturbance, a qualified biologist will conduct pre-activity nest surveys.	Ongoing
Monitoring	CACW Objective 6	Determine the current extent and location of cactus wren occurrences in the HCP Preserve and monitor populations over time.	
Monitoring	CAGN Action 6A	Establish monitoring plots and conduct 3 years of baseline surveys for cactus wren in the HCP Preserve.	
Monitoring	CACW Action 6B	After baseline surveys are completed, survey for cactus wren in permanent and random sampling plots within the HCP Preserve every 2 years as described in the management and monitoring plan.	
Monitoring	CACW Action 6C	Compare sample plots in management treatment areas to those in untreated areas to assess the results of management actions.	

Conservation and Management

Permanent protection of cactus patches (CACW Action 1A) and suitable habitat supporting cactus wren nesting (CACW Action 1B) will be accomplished through establishment of conservation easements on

Conservation District property and agreements with BLM regarding approved conservation and management actions occurring on their ACECs. Actions leading to the permanent protection of habitat and populations is addressed by the terms and conditions described in the Phasing of Conservation in Section 5.2.1 of the Wash Plan and are outside of the purview of this Natural Resource Management Plan. Conservation of these locations is to occur with successful implementation of Phase 1 and Phase 2 of the Wash Plan.

Monitoring

Establishment of a formal monitoring program for CACW (addressing CACW Objective 6) will be established across the Wash Plan Preserve in 2024. Monitoring, once initiated, will continue for a minimum of three years to establish baseline conditions (CACW Action 6A). The survey methodology to be used will follow the protocol promoted by the San Diego Management and Monitoring Program, which prioritizes cactus mapping, visual encounters, determining breeding status, and detecting nests. When possible, monitoring efforts will look to confirm successful breeding by CACW, through the observation of fledglings and family groups.

Management

Implementation of management activities involving salvage of cactus (CACW Action 2) and expansion of new patches (CACW Objective 2) will largely be dependent on establishing the location and distribution of suitable habitat within the Wash Plan Preserve and the development activities allowing for the collection of cacti.

Next Steps

Investment in development of a formal monitoring program for CACW will begin in late 2023 with planned documentation of existing cactus scrub patches within the Wash Plan Preserve. Mapping activities will first be focused on the Plunge Creek and Confluence of Mill Creek and Santa Ana River Management Units with expansion of mapping activities to select areas of the other three Management Units in 2025. Management activities directly benefiting CACW, such as cactus salvage, will be performed opportunistically depending principally on the amount of material available for salvage and the number and location of identified receiver sites.

Upcoming activities:

2023

- Mapping Cactus Scrub (Fall/Winter)

2024

- Mapping Cactus Scrub (Winter/Spring/Summer)
- Initiation of Population Monitoring Activities (Spring/Summer)

2025

- Mapping Cactus Scrub (Winter/Spring/Summer)
- Expansion as well as Continuation of Population Monitoring Activities (Spring/Summer)

Slender-horned Spineflower Monitoring and Management Activities

At the time of writing of the HCP, of the five proposed Covered Species, spineflower was recognized to be most at risk. The Plan Area is one of only eight remaining known locations for this narrow endemic plant species and one of only two known locations in San Bernardino County. Furthermore, the cryptic nature of this plant and limitations on what is known about why it occurs in certain areas make it difficult to plan for its conservation or to identify effective mitigation for impacts. Excluding spineflower from the list of species covered by the plan was considered in the early stages of HCP preparation but was rejected in favor of the approach developed in cooperation with USFWS and CDFW.

The agreed upon approach conditions certain impacts on spineflower on the successful development of a relocation and habitat enhancement program for spineflower in the Wash Plan Preserve as part of HCP implementation. Because of the known and potential occurrence of spineflower on lands managed under the HCP, development of the relocation and enhancement program is recognized to have the potential to directly contribute to the recovery of this species. In that context, a limited amount of loss could occur without posing jeopardy to the species.

Because spineflower habitat management and population enhancement was specifically identified as critical to the success of the HCP, each annual work plan is to identify actions specific to spineflower, and the HCP Implementation Team will cooperatively endeavor to obtain additional funding to conduct research on this species through specific grants or other funding mechanisms.

Wash Plan Requirements: SHSF Biological Objectives and Actions

Table 5. Biological objectives and actions guiding conservation, monitoring, and management activities supporting slender-horned spineflower within the Wash Plan Preserve during the initial years of Wash Plan implementation.

Activity Type	Species-specific Objective and/or Action	Description	Status
Conservation	SHSF Objective 1	Permanently conserve and manage spineflower localities known to be occupied within the District Conserved and District Managed Lands of the HCP Preserve	Ongoing
Conservation	SHSF Action 1A	Permanently conserve 20 extant patches of spineflower within the District Conserved and District Managed Lands of the HCP Preserve	Ongoing
Conservation	SHSF Action 1B	Permanently conserve 36 historic spineflower locations within the District Conserved and District Managed Lands within the HCP Preserve	Ongoing

Conservation and Management	SHSF Action 2	Permanently conserve and manage 100 acres of spineflower habitat adjacent to extant and historic occurrences and/or other habitat determined through modeling and subsequent onsite evaluation to be suitable	
Management	SHSF Objective 3	Develop a robust science-based Spineflower Restoration Program to address issues unique to the maintenance and enhancement of existing slender-horned spineflower populations and the potential establishment of new populations within the HCP Preserve	Ongoing
Management	SHSF Objective 4	Establish and maintain a minimum of six new patches of spineflower in the HCP Preserve	
Management	SHSF Objective 5	Enhance and maintain all known patches of spineflower in the District Conserved and District Managed Lands	Ongoing
Management	SHSF Objective 6	Reduce invasive plant cover in suitable spineflower habitat	
Monitoring	SHSF Objective 9	Determine the location and extent of spineflower suitable habitat in the HCP Preserve	Ongoing
Monitoring	SHSF Objective 10	Determine the current extent and location of spineflower occurrences in the HCP Preserve and monitor populations trends over time	Ongoing
Monitoring	SHSF Action 10A	Establish monitoring plots and conduct 3 years of baseline surveys for spineflower in suitable habitat	Ongoing
Monitoring	SHSF Action 10B	Map the size and extent of each extant occurrence during the baseline survey and estimate the number of individuals	Ongoing
Monitoring	SHSF Action 10C	After baseline surveys are completed, survey for spineflower in permanent and random sampling plots every year	

Conservation

Permanent protection of extant patches (SHSF Action 1A) and known historic locations of SHSF (SHSF Action 1B) as well as SHSF habitat (SHSF Action 2) will be accomplished through establishment of

conservation easements on Conservation District property and agreements with BLM regarding approved conservation and management actions occurring on their ACECs. Actions leading to the permanent protection of habitat and populations is addressed by the terms and conditions described in the Phasing of Conservation in Section 5.2.1 of the Wash Plan and are outside of the purview of this Natural Resource Management Plan. With that said, it is important to recognize the 36 historic occurrences and 20 extant patches of spineflower to be protected are the 56 SHSF localities recognized by the Wash Plan, and all found within the Wash Plan Preserve. Conservation of these locations is to occur with successful implementation of Phase 1 and Phase 2 of the Wash Plan.

Conservation and Management

The permanent protection and management of 100 acres of SHSF habitat (described in SHSF Action 2) is to be accomplished through both the establishment of conservation easements and implementation of this Natural Resource Management Plan. The listed management will be accomplished by expansion of ongoing activities to enhancement of the known SHSF populations and establishment of new populations and the enhancement of surrounding areas.

Initial steps taken to enhance SHSF habitat occurred in 2021, 2022, and 2023, as implemented by the Inland Empire Resource Conservation District (IERCD). Consistent with the Memorandum of Understanding between SBVWCD and IERCD, executed in 2019, specific Task Orders were developed by SBVWCD which dedicated funds for IERCD to assist with implementing elements of the Wash Plan focused on enhancement of slender-horned spineflower habitat (SHSF Objective 5). Enhancement activities focus on the treatment and removal of non-native grasses and broadleaf weeds from areas of the Wash Plan Preserve known to support SHSF (SHSF Objective 6). Treatment activities focus on enhancing the immediate vicinity surrounding populations of SHSF and are largely focused on the removal of broadleaf weeds and non-native grasses using manual, mechanical, and chemical means.

Monitoring

Consistent with the Wash Plan SHSF Objective 10 and SHSF Actions 10A, 10B, and 10C, beginning in 2021, the Conservation District worked with Dudek to develop and implement a comprehensive survey methodology and standardized monitoring protocol for SHSF across the Wash Plan Preserve. The monitoring protocol and complementary surveys incorporate many elements of the rare plant IMG protocols used by the San Diego Management and Monitoring Program, based on methods developed and implemented by the City of San Diego. Fieldwork was initiated in the spring of 2022 and continued through spring of 2023.

Addressing SHSF Objective 9, a single comprehensive survey for SHSF populations was implemented in spring 2023. The comprehensive survey was designed to identify the location and extent of suitable habitat in the Wash Plan Preserve and definition of the extent and location of discovered SHSF populations.

The development of the monitoring program was built upon previous monitoring efforts implemented by Origin Biological and other entities including the Science Applications International Corporation (SAIC) and ELMT Consulting.

Protocol development

In late winter 2022 and spring 2023, SBVWCD held project kickoff and field meetings with Dudek to determine project tasks and responsibilities. Based on annual rainfall, the team moved forward with protocol development and monitoring of the known colonies in spring of 2022, initiating the work in May, while pushing the comprehensive Preserve-wide surveys for new populations to 2023. Annual monitoring data are collected in accordance with the Patch Monitoring Survey Protocol using the *Survey 123* platform.

Monitoring Results

2022

The Conservation District, working with Dudek, completed surveys for SHSF across the 17 recognized patches of SHSF on May 18, 19, and 24. Slender-horned spineflower was detected at seven patches, with patch No. 13 being the largest with 1,423 individuals. No other patch had more than 100 individuals. A total of 1,739 individuals were counted in 2022. Each of the patches (or colonies) surveyed in 2022 were known and surveyed by various entities in previous years with the two exceptions of Patches 1A and 1C which were discovered just beyond the established Patch 1B (previously identified as Population 1). In the newly developed survey protocol, the team established a 5-meter rule used to distinguish separate patches when boundaries of newly discovered patches are otherwise close to known patches. Following this protocol, Dudek and SBVWCD defined the two new patches as 1A and 1C, bringing the number of known patches to 19.

2023

A total of 20 patches were surveyed in 2023 (see Figure 11.). This number grew from 2022 with the discovery of a new patch just west of Patch 13 during the monitoring period. Equally important to this discovery, after no observations of SHSF just east of Orange Street in both 2021 (surveyed by Mikael Romich) and 2022, the Conservation District discovered a single plant in Patch 16.

Interestingly, when comparing numbers from 2022 with numbers from 2023 across all the surveyed patches, although the total area of the mapped patches did not change much between years (1,301 SQFT in 2022 vs 1,292 SQFT in 2023) the total number of individuals observed was about half as many in 2023 (816) relative to 2022 (1,739).

The large difference in the number of individuals observed between years is interesting as 2022 was recognized to be an exceptionally dry year (from January on) while 2023 year was incredibly wet throughout the winter and early spring. Preliminary data collected in the field suggests the size of individual plants to be much greater in 2023 when compared to 2022. The size difference may translate into a greater number of seeds produced per plant and even potentially more seeds produced in 2023 than 2022 across all the surveyed patches.

Table 6. The number of individual plants and the approximate area of patches monitored in 2022 and 2023.

Patch	2022 Approximate Area (SQFT)	2023 Approximate Area (SQFT)	2022 SHSF Individuals	2023 SHSF Individuals
1A	2	6	1	7
1B	17	1	5	1
1C	170	147	39	10
2	174	83	86	58
3	90	1	38	1
4	23	77	9	9
5	105	140	46	23
6	No SHSF Observed	No SHSF Observed	No SHSF Observed	No SHSF Observed
7	No SHSF Observed	No SHSF Observed	No SHSF Observed	No SHSF Observed
8	No SHSF Observed	No SHSF Observed	No SHSF Observed	No SHSF Observed
9	No SHSF Observed	No SHSF Observed	No SHSF Observed	No SHSF Observed
10	No SHSF Observed	No SHSF Observed	No SHSF Observed	No SHSF Observed
11	No SHSF Observed	No SHSF Observed	No SHSF Observed	No SHSF Observed
12	170	253	92	96
13	550	578	1,423**	603
13A*	N/A	5	N/A	7
14	No SHSF Observed	No SHSF Observed	No SHSF Observed	No SHSF Observed
15	No SHSF Observed	No SHSF Observed	No SHSF Observed	No SHSF Observed
16	No SHSF Observed	0.03	No SHSF Observed	1
17	No SHSF Observed	No SHSF Observed	No SHSF Observed	No SHSF Observed
18*	N/A	27	N/A	12

*discovered in 2023

**may be a slight underestimate

Comprehensive Wash Plan Preserve Survey

Conservation District staff performed phenology checks of SHSF beginning in late March 2023, extending through much of April. Information gained from phenology checks assisted Dudek in planning for the comprehensive surveys of the Wash scheduled to occur over an 11-day period in May. Phenology checks, in which the percentage of SHSF plants at a single population exhibiting characteristics of branched stems and floral clusters are noted, also aided the Conservation District staff in scheduling the planned annual monitoring of known populations of SHSF.

Comprehensive surveys for new SHSF populations of the Wash Plan Preserve were initiated by Dudek, with Conservation District support, on May 2. The project was implemented over a total of four weeks with District staff participating in field surveys with the team from Dudek on May 3, 9, 10, 11, 16, 17, 18, 23, and 24.

One new population (number 18) of slender-horned spineflower was discovered in the Upland Mixed Use Management Unit, and 82 potential out-planting locations were mapped during the spring surveys

(see Figure 12.). The new patch is in the central part of the Wash Plan Preserve on BLM property. The new patch is just outside of the 1969 breakout area and is 27 square feet in size and contained 12 individuals. The mapped out-planting locations total 3.7 acres of suitable slender-horned spinyflower habitat. Survey 123 data/attributes were collected at each of the mapped polygons to aid future evaluation and selection of potential out-planting locations.

Management

SHSF Restoration Program

Directions governing development of the restoration program are provided in the Wash Plan under SHSF Objective 3, SHSF Action 3. Details of the requirements of both SHSF Objective 3 and SHSF Action 3 are included here for reference.

The Conservation District is to develop an initial experimental Spinyflower Restoration Plan to be reviewed and approved by the Preserve Management Committee within 2 years of issuance of the ITP. The restoration plan will serve as the basis for developing a more long-term plan and strategy. Study design is to be based on the recommendations prepared by the USFWS for the HCP in 2007, with refinements made based on consultation with CDFW and other experts.

The Spinyflower Working Group (described in Section 5.2.2, *Approach to Habitat Management*) will be consulted in the development of the initial restoration plan and subsequently, as needed, to review and provide input on restoration plan revisions.

Results of applied methods are to be evaluated annually, and the restoration methods modified according to new information collected through monitoring. The initial restoration methods included in the restoration plan will be tested to determine their efficacy beginning in the third year after ITP issuance. Successful methods will be included in the annual work plan for the Wash Plan Preserve.

The initial restoration program will include the following:

- Harvesting of spinyflower seeds for an extended period, on the order of several years, to capture full genetic diversity of the seed bank from a given location, prioritizing areas that may be impacted by Covered Activities.
- Evaluation of soil composition and chemistry, terrain, vegetation, and other environmental conditions at sites where spinyflower is extant to aid in determining potential establishment sites.
- Identification and tracking of key environmental factors in the micro-environment of extant patches to provide data that could identify the more suitable environmental conditions for germination and persistence. Use field data loggers, that measure and record temperature, humidity, light, energy, and a variety of other parameters, employ soil and moisture probes, and possibly webcams or other technologies to track key environmental factors.
- In cooperation with BLM and the Wildlife Agencies, identify sites on District Managed and District Conserved Lands for spinyflower relocation, establishment, and enhancement.

The restoration program is to be a long-term study to determine if relocation and enhancement are a viable approach that could be accepted by USFWS and CDFW as feasible conservation and mitigation measures for impacts on spinyflower. Development of this program is part of the conservation strategy

for spineflower during the first phase of implementation. The outcome of the long-term study and the associated success criteria will determine whether the spineflower avoidance area (contingency parcel) can be mined in the future.

Initial Steps Taken

Consistent with the Wash Plan, the Conservation District has invested substantial resources in 2022 and 2023 in the development of the targeted SHSF Restoration Program for implementation in the Wash Plan Preserve. Activity supporting development of the Restoration Program began in 2022 with development of a standardized monitoring protocol, initiation of annual monitoring, seed collection, initiation of seed bulking activities and advancement of plans for a Preserve-wide survey and initial out planting and direct seeding in 2023.

Recognizing the long-term goal is to develop a draft restoration plan for the species that includes a landscape level analysis of ecological factors effecting success of existing and restored SHSF, the Conservation District initiated a multi-year seed germination, bulking and direct seeding trial in 2022. The multi-year nature of the work is reflective of the Conservation District acknowledging a single year is not long enough to determine the range of ecological and generational factors that will impact SHSF success. At present, the investment in restoration program development and implementation is expected to last at least 10-years and to involve on-going collaboration and contact with CDFW and USFWS in their roles as members of the Wash Plan Preserve Management Committee.

To support development of the Restoration Program, the District partnered with Dudek, the District's restoration contractor, and the California Botanic Garden (CalBG) in 2021. Working closely with Dudek and CalBG in 2022, the Conservation District established an onsite seed bulking practice and advanced planning for future seeding events at multiple out-planting locations deemed suitable for planting within the Wash Plan Preserve. Activities implemented in support of the Restoration Program are consistent with the Wash Plan objectives of increasing the amount of available seed and the knowledge base associated with establishing new populations on protected lands within the Upper Santa Ana River Wash while ensuring the maintenance of genetic diversity.

Seed Collection – 2022 Results

On June 6, 2022, the District's contractors from Dudek and the CalBG collected seeds, under the permits held by the CalBG, from the following patches shown in the table below.

Table 7. Number of SHSF plants collected, collection type, total weight and seeds from sampled patches.

Patch	Number of Plants Collected	Type of Collection	Total Weight (g)	Total Seeds
Site 1A	1	Bulk	0.0015	10
Site 1C	2	Bulk	0.006	1
Site 2	25	Bulk	0.0212	112
Site 3	15	Bulk	0.0149	71
Site 5	10	Bulk	0.0069	30
Site 12	12	Bulk	0.0313	146

Site 13	325	Bulk	0.8328	3644
Totals	390		0.9146	4014

For seed collection, cleaning, and storage, Dudek and CalBG followed the Center for Plant Conservation's *Best Practices for Collecting Seeds from Wild Rare Plant Populations*. Prior to seed collection, the SHSF populations were visited by Conservation District and Dudek staff when plants were in flower to assess population size, sampling strategy, and timing. CalBG then collected specimens in accordance with guidelines provided in their USFWS recovery permit and CDFW collections permit. CalBG employed a random sampling approach to collections to ensure the maximum genetic diversity was captured. Furthermore, populations were distinguished utilizing California Department of Fish and Wildlife's California Natural Diversity Database (CNDDDB) quarter mile rule and were identified using CNDDDB element occurrence numbers. During collection, dry fruits were placed into manila coin envelopes and field forms were completed with information regarding exact location, population status, estimated population size, the number of individuals sampled, existing or potential threats or disturbances, habitat, associated species, and any other relevant information. The information was then used to generate an accession number that will be used to track the population through propagation.

Seed Bulking

Working under California Endangered Species Act Scientific, Educational, or Management Permit No. 2081(a)-22-008-RP, the Conservation District moved forward in 2022 and 2023 with implementation of bulking and planning for out-planting activities. Because of such efforts, the Conservation District is expecting to be better positioned going forward to respond thoughtfully and quickly to changing circumstances (e.g., exacerbated drought conditions or an increased frequency of wildfire) and potential opportunities (e.g., observed El Niño conditions and forecasted wetter conditions in the upcoming winter and spring).

As the program develops over the next several years, the Conservation District expects to be able to collect and bulk seeds representing a greater amount of the genetic and phenotypic variability found in the species in the Upper Santa Ana River Wash. With the increase of volume of seed collected from different populations under different conditions (e.g., years), the District expects to be able to increase both the complexity and utility of seeding trials to better inform our collective understanding of this endangered species and how best to support its recovery.

Beyond 2023, the recovery program is designed to be permitted and given coverage through the 2081 ITP and approved HCP. Throughout the work moving forward, the Conservation District is committed to working closely with the Department and Service, and species experts through the Preserve Management Committee and the Slender-horned Spineflower Working Group.

As of spring 2023, the principal activity implemented under the approved 2081(a) permit initiated in the fall/winter of 2022 involved establishing an onsite seed bulking practice in which the restoration team, under the guidance of Dudek, the District's restoration contractor, and the California Botanic Garden, initiated growing of collected seeds in a controlled nursery setting prior to transferring plants to an onsite location (in the Wash) where the individual plants are continually watered and managed throughout the growing season (January through July) to increase size and flowering output of individual plants. The Conservation District is in favor of growing the plants in the Wash, following initial

germination and establishment, so the plants may be able to take advantage of native pollinators and maximize seed set.

Specific Activities tied to Bulking Practice

Following the successful collection of seeds in the summer of 2022, germination trials were initiated by CalBG in late 2022. Trials were conducted directly in soil in a screened lathhouse at CalBG's nursery facility, in a soil medium that is conducive for seed germination. The success of the germination was determined based on the observation of cotyledons. After trials, approximately 750 seeds were made available to germinate from the CalBG Seed Bank Collection to ideally produce a total of about 500 plants.

Once germination was completed, each seedling was grown in two-inch containers before being transplanted to regeneration beds. For the soil, CalBG used a mix of peat moss, cement sand, perlite, and fertilizer. Moreover, the regeneration beds allowed plants to reach optimal size and have the greatest potential of seed production. All propagated plants were then grown in the CalBG Nursery following all appropriate sanitation protocols that included but were not limited to seed, soil, surface, and pot sterilization in accordance with Phytophthora Working Groups guidelines.

Once established in a controlled setting, SHSF plants were then transplanted into the field growing plot in rows to facilitate maintenance. Plants were spaced approximately 12 inches from each other in and between rows. Once in the field, natural pollination between different maternal lines within and between populations to maximize genetic diversity of the bulked seed was encouraged. Additionally, a simple watering system was set up to aid in establishment and growth in the absence of natural rainfall. The watering system consists of overhead spray irrigation utilizing MP Rotator 2000 high efficiency spray nozzles to mimic low precipitation rate watering and is charged by a water truck.

Seed harvesting will occur once the first sign of mature fruits in the new plants is observed. All seeds will be hand collected across several weeks because seeds mature at different times, and this will allow CalBG and Dudek to maximize the amount of seed by collecting early- and late-maturing seeds over the entire course of the ripening process. Seeds from all maternal lines and populations will be collected as one bulk collection for 2023 and stored in a cool dry place until time of processing.

All collected chaff and inert material will be made available to Dudek for potential use during out-planting. Additionally, any seeds not used in propagation for seed bulking will be dried to less than 25-35% relative humidity at room temperature, packaged in heavy duty foil/plastic seed pouches, heat sealed, and placed into storage at -23° C at CalBG.

For the field seed bulking, the outside perimeter of the grow plot was delineated by a trenched-in silt fence and the soil surface lined with landscape fabric to reduce weed encroachment, weed seed contamination, and to facilitate SHSF seed harvesting. Prior to establishment of the bulking site, any dead grass material and herbaceous growth was removed from the site via mechanical/hand removal under the supervision of the lead ecologist from Dudek.

Seed is expected to be collected in June or July but will depend on the development status of the collective plants. The addition of water is expected to extend the growing season and size of the bulked

plants, so seed collection will likely be later in the season than natural plants. Seeds will be stored at CalBG consistent with prior years and their collection permits.

The success of seed bulking effort will be documented in terms of the number of plants, volume of material harvested, weight of seed produced, quantity of seeds produced, and viability of seeds produced. As for the germination, results of the trial will be tabulated and analyzed to determine optimal seed germination for the creation of a standard protocol.

Out-planting Locations

As the Restoration Program is expanded, the team will focus on enhancing both occupied and unoccupied SHSF habitat. Seeding into currently unoccupied areas is a conservative first step of the program that allows for testing of management methodologies with low risk to the existing populations. Lessons learned in these unoccupied areas will be incorporated into the trial approach with occupied locations.

Trial locations for initial seeding in fall 2023 will be selected based on observed similarities in soil, aspect, drainage, and water availability between the most productive colonies of SHSF based on recently collected monitoring data (that is data collected in the last 3 years) and evaluation of the prospective out-planting locations identified during the comprehensive Wash Plan Preserve survey conducted in spring 2023. For example, areas supporting the largest SHSF colonies are largely devoid of annual grasses and appear to have increased soil moisture holding capabilities compared to other areas with small and/or historic SHSF populations.

In addition to these factors, out-planting locations selected to receive native seeds from CalBG will also support native plants (such as, *Chorizanthe parryi parryi* and *Lastarriaea coriacea*) consistent with those present at known or historic populations of slender-horned spineflower.

Seeding Activities

Seeding at identified locations believed to support the establishment of new spineflower colonies is expected to be initiated in the fall of 2023. At selected sites, the Conservation District will rake in seed collected directly from monitoring SHSF patches and bulking activities. Seeding will take place within square meter plots at each selected location, with a hundred seed used per plot. Once seeded, the Conservation District would initiate monitoring throughout the remainder of the growing season and revisit and possibly re-seed sites showing promise based on monitoring results in 2024.

For the direct seeding activities, five one-by-one-meter permanent plots will be sited within each out-planting trial location in areas with similar characteristics. These five plots will be used to establish controls and test the effectiveness of hand dispersing and raking in the native seed along with the importance of the presence of cryptogamic soils and positive associations with other plant species, such as Parry's spineflower.

To measure seed viability, a sample of 50 seeds from both the field seed bulking effort and direct seeding effort will be tested for germination in the lab setting at CalBG. Collection of the seed together with the chaff and inert material more closely mimics the material that is co-distributed with seeds in a natural environment following the drying of the annual plant and dispersion of the above ground

material. Future seeding trials are likely to compare seeding success between plots seeded with naked seed, and plots seeded with seeds unseparated from associated natural materials. The presence and number of plants germinating and setting seed during the out-planting trial will be tabulated. This information will be provided in a final project report.

Additionally, Dudek will prepare a draft SHSF restoration plan for the Wash Plan Preserve area within 12 to 18 months of the cessation of bulking activities and initiation of trial direct-seeding efforts. The draft restoration plan will include a landscape level analysis of ecological factors within the Wash Plan Preserve area and their probable effects on the success of existing and restored SHSF patches and the habitat they occur within. This analysis will lead to descriptions of suitable SHSF habitat and a recommended toolkit of methods for enhancement of occupied and unoccupied but potentially suitable habitat that can be tested. Field and laboratory studies associated with and included in the preparation of the draft SHSF Restoration Plan will include description and advancement of seed collection, environmental monitoring, seed germination trials, seed bulking, and out-planting trials site selection.

Management of the seed-bulking and direct seeding activities will be adaptive and informed by lessons learned through implementation. Additional bulking efforts and seeding trials are expected to continue for many years into the future, informed by the outcome of the initial effort.

Weather Station Installation

A weather or meteorological station was installed in October 2022 at the proposed out-planting location. Two additional stations were installed in December 2022 at an extant and historic patch location. These stations allow the team to measure air temperature, relative humidity, soil moisture, soil temperature, and soil electrical conductivity, critical to understanding subtle differences in the microclimates favored by SHSF within the Wash. Having such information will allow the Conservation District to continue to improve its ability to evaluate and select appropriate out-planting locations.

Installation of the weather stations is an envisioned activity identified in the HCP (see SHSF Objective 3). The stations themselves are low-profile and will continuously upload data to the cloud using special data loggers. The equipment is temporary in nature, scheduled to remain in place for upwards of two to three years, but the information gained has the potential to positively influence the trajectory of the recovery program for the species for decades.

Pollination Study

In spring of 2023, the Conservation District, working with researchers from the University of Redlands, took the first steps towards developing a pollinator study to inform slender-horned spineflower reproduction and identify the primary pollinators of the species. As currently proposed, the pollinator study will track, identify, and record pollinators at multiple extant spineflower locations during three different surveys per location; one during early bloom, one during mid bloom, and one during late bloom to identify the pollinators that play a vital role in the fruit and seed production of SHSF. These data will inform restoration and out-planting actions included in the Program as well as recommendations that can be used across the species' range.

Early results from a pilot study initiated in June 2023 aimed at describing pollination activity of SHSF produced some of the first high-quality images of observed pollinators, including the image below of a

very small (~2 mm) cuckoo wasp in the family Chrysididae. The image was captured and produced by Dr. Dustin VanOverbeke of the University of Redlands.



Next Steps

The continued investment in the highlighted monitoring and management actions are expected to work in unison with one another to aid in the conservation and restoration of the endangered slender-horned spineflower through identifying and maintaining populations, investigating important pollinators, and establishing new populations through field seed bulking and out-planting activities.

Upcoming activities:

2023

- Seed Collection (Summer)
- Seed Bulking (Fall/Winter)
- Out-planting Location Selection (Summer/Fall)
- Direct Seeding (Fall/Winter)

2024

- Monitoring Out-planting Locations (Winter/Spring)
- Monitoring Established Colonies (Spring)
- Seed Bulking (Winter/Spring & Fall/Winter)
- Seed Collection (Summer)
- Out-planting Locations Selection (Summer/Fall)
- Direct Seeding (Fall/Winter)
- Draft Restoration Plan (Fall/Winter)

2025

- Monitoring Out-planting Locations (Winter/Spring)
- Monitoring Established Colonies (Spring)
- Seed Bulking (Winter/Spring & Fall/Winter)
- Seed Collection (Summer)
- Out-planting Locations Selection (Summer/Fall)
- Direct Seeding (Fall/Winter)
- Final Restoration Plan (Fall/Winter)

Santa Ana River Woolly-star Monitoring and Management Activities

Baseline information on the distribution of SARWS within the Plan Area summarized in the Wash Plan (see Figure 4-3) informed conservation planning efforts and take estimates supporting development of the HCP. For the purposes of this NRMP, the reported information on SARWS occurrences serves to guide development of the monitoring program for the species and informs the prioritization of species-specific objectives and actions identified in the HCP.

Wash Plan Requirements: SARWS Biological Objectives and Actions

Table 8. Biological objectives and actions guiding conservation, monitoring, and management activities supporting Santa Ana River woolly-star within the Wash Plan Preserve during the initial years of Wash Plan implementation.

Activity Type	Species-specific Objective and/or Action	Description	Status
Conservation	SARWS Objective 1	Permanently conserve known occupied woolly-star habitat.	Ongoing
Conservation	SARWS Action 1A	Permanently conserve 204.3 acres of habitat containing woolly-star in the HCP Preserve.	Ongoing
Conservation	SARWS Action 1B	Permanently conserve at least 50 additional acres of suitable habitat adjacent to occupied habitat to preserve ecological processes that maintain woolly-star habitat and to accommodate future changes in woolly-star distribution in response to environmental conditions or management's actions undertaken for the benefit of woolly-star or other Covered Species.	Ongoing
Management	SARWS Objective 2	Maintain the quality of woolly-star occupied areas and expand the current woolly-star distribution in the HCP Preserve including 99.9 acres on District Conserved Lands and 104.5 acres on District Managed Lands.	
Management	SARWS Action 2	Control non-native annual grasses and other invasive plants to $\leq 20\%$ average cover for the benefit of woolly-star on suitable unoccupied habitat throughout the HCP Preserve.	

Management	SARWS Objective 4	Detect woolly-star populations in areas where Covered Activities will result in permanent impacts, and salvage and store its seed for use in habitat enhancement and restoration within the HCP Preserve.	
Management	SARWS Objective 5	Enhance the distribution of woolly-star by planting collected seeds in selected areas of suitable habitat.	Ongoing
Management	SARWS Action 5	The Preserve Manager in consultation with the Preserve Management Committee will select one or more sites within suitable woolly-star habitat that have achieved invasive plant control objectives, for planting salvage woolly-star seeds when they become available. Planting will be scheduled and implemented as part of the annual work plan and will follow currently accepted planting methods and timing.	
Monitoring	SARWS Objective 7	Determine the current extent and location of woolly-star in the HCP Preserve, monitor population trends over time, and assess the effectiveness of management actions.	
Monitoring	SARWS Action 7A	Establish monitoring plots and conduct 3 years of baseline surveys for woolly-star in the HCP Preserve.	
Monitoring	SARWS Action 7B	After baseline surveys are completed, survey for woolly-star in permanent and random sampling plots every 5 years as described in the management and monitoring plan.	
Monitoring	SARWS Action 7C	Compare sample plots in management treatment areas to those in untreated areas to assess the results of management actions.	

Conservation

Permanent protection of known occupied habitat (SARWS Action 1A) and suitable habitat to accommodate future changes in woolly-star distribution (SARWS Action 1B) will be accomplished through establishment of conservation easements on Conservation District property and agreements

with BLM regarding approved conservation and management actions occurring on their ACECs. Actions leading to the permanent protection of habitat and populations is addressed by the terms and conditions described in the Phasing of Conservation in Section 5.2.1 of the Wash Plan and are outside of the purview of this Natural Resource Management Plan. Conservation of these locations is to occur with successful implementation of Phase 1 and Phase 2 of the Wash Plan.

Monitoring

Initial expression of a formal monitoring program for SARWS (addressing SARWS Objective 7) is to be established across the Wash Plan Preserve in 2024. Monitoring, once initiated, will continue for a minimum of three years to establish baseline conditions (SARWS Action 7A). Formal sample monitoring plots will be established within active management areas within a year of implementation of activities to measure the effectiveness of management actions (SARWS Action 7C).

Management

Work undertaken within the Plunge Creek Management Unit in 2021 and 2022 associated with the Plunge Creek Conservation Project has supported salvage and storage of SARWS seed (SARWS Objective 4) and use of collected seed for habitat enhancement purposes (SARWS Objective 5). With expansion of management activities within the Plunge Creek Management Unit, implemented by IERCD and associated with Jump Start Activities, the Conservation District has begun to address invasive plant control objectives (SARWS Objective 2) and actions (SARWS Action 2) needed to improve conditions and expand the woolly-star distribution within the Wash Plan Preserve.

Next Steps

Investment in development of a formal monitoring program for SARWS will begin in late 2023 with the expectation of trial monitoring activities being implemented in spring/summer of 2024. Management activities focus on reducing invasive grass cover within both the Plunge Creek and Linkage Between Santa Ana River and Plunge Creek Management Units. The highlighted monitoring and management actions are expected to work in unison with one another to aid in the conservation and restoration of the endangered Santa Ana River woolly-star.

Upcoming activities:

2023

- Population Monitoring Protocol Development (Fall/Winter)

2024

- Invasive Plant Control in the Plunge Creek Management Unit (Winter/Spring)
- Population Monitoring Protocol Development and Implementation (Winter/Spring/Summer)
- Fuels Reduction and Sand spreading in the Linkage Between Santa Ana River and Plunge Creek Management Unit (Fall/Winter)
- Seed Collection

2025

- Invasive Plant Control in the Plunge Creek Management Unit (Winter/Spring)

- Population Monitoring (Spring/Summer)
- Fuels Reduction and Sand spreading in the Linkage Between Santa Ana River and Plunge Creek Management Unit (Spring/Summer/Fall/Winter)
- Seeding Activities in Active Restoration and Enhancement Areas (Fall/Winter)

References

- AECOM. 2022. Vegetation Classification Report for the San Bernardino Valley Water Conservation District – With Vegetation Key & Descriptions. Prepared by AECOM. Prepared for San Bernardino Valley Water Conservation District. 64p.
- AECOM. 2023. Vegetation Mapping Report for the San Bernardino Valley Water Conservation District. Prepared by AECOM. Prepared for San Bernardino Valley Water Conservation District. 12p.
- California Native Plant Society [CNPS]. 2005. Vegetation Alliances of Western Riverside County, California. Available at <https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=18245&inline>.
- Chock, R.Y., S. M. Hennessy, T.B. Want, E. Gray and D.M. Shier 2020. A multimodel approach to guide habitat conservation and restoration for the endangered San Bernardino kangaroo rat. *Global Ecology and Conservation* 21: e00881. <https://www.sciencedirect.com/science/article/pii/S235198941930602X>
- Hanes, T. L. 1981. Vegetation of the Santa Ana River and Some Flood Control Implications in Warner, Richard E., and Kathleen M. Hendrix, editors *California Riparian Systems: Ecology, Conservation, and Productive Management*. Berkeley: University of California Press, c1984 1984.
- Kittel, G., E. Reyes, J. Evens, J. Buck and D. Johnson. 2012. Vegetation classification and mapping project report, Pinnacles National Monument. Natural Resource Report NPS/SFAN/NRR—2012/574. National Park Service, Fort Collins, Colorado.
- McKernan, R. L. 1997. The Status and Distribution of the San Bernardino Kangaroo Rat (*Dipodomys merriami parvus*): field surveys conducted between 1987 and 1996. Prepared for U.S. Fish and Wildlife Service. 62p.
- USFWS. 1997. Coastal California Gnatcatcher (*Polioptila californica californica*) Presence/Absence Survey Guidelines. February. 4p.
- Westman, W. E. 1981. Diversity relationships and succession in California coastal sage scrub. *Ecology* 62: 170-184.
- Williams, B. K., R. C. Szaro, and C. D. Shapiro. 2007. *Adaptive Management: The U.S. Department of the Interior Technical Guide*. Adaptive Management Working Group, U.S. Department of the Interior, Washington, DC.

Figures 1 - 12

Figure 1. Protected Areas within the Plan Area

Coordinate System:
NAD 1983 StatePlane California V FIPS 0405 Feet
Projection: Lambert Conformal Conic
Datum: North American 1983
Source: SBVWCD
GIS Contact: Anna Frey
M:\Wash Plan\Natural Resource Management Plan\Natural Resource Management Plan Figures
June 26, 2023

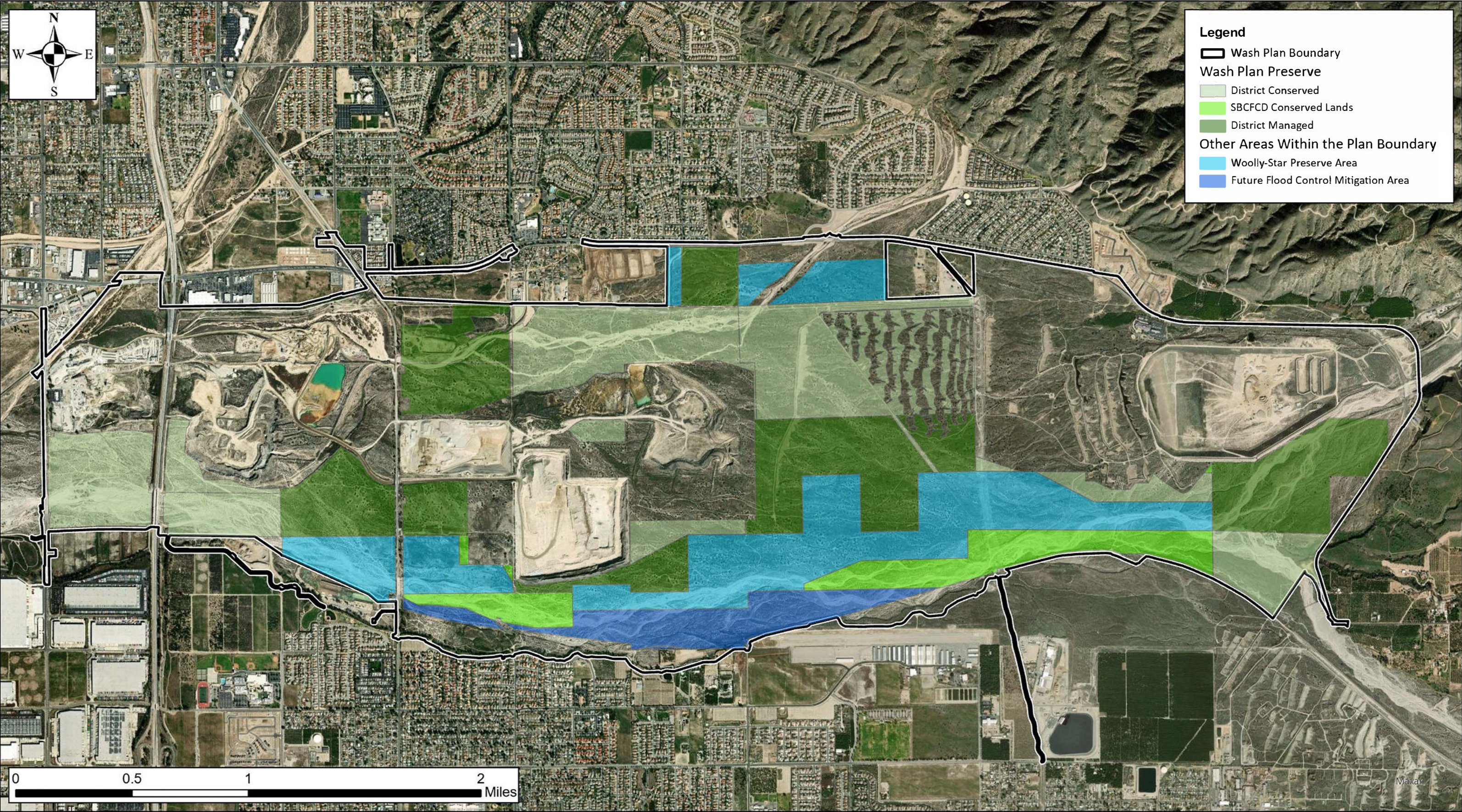


Figure 2. Vegetation Associations and Other Cover Types

Coordinate System:
NAD 1983 StatePlane California V FIPS 0405 Feet
Projection: Lambert Conformal Conic
Datum: North American 1983
Source: SBVWCD
GIS Contact: Anna Frey
M:\Wash Plan\Natural Resource Management Plan\Natural Resource Management Plan Figures
June 26, 2023

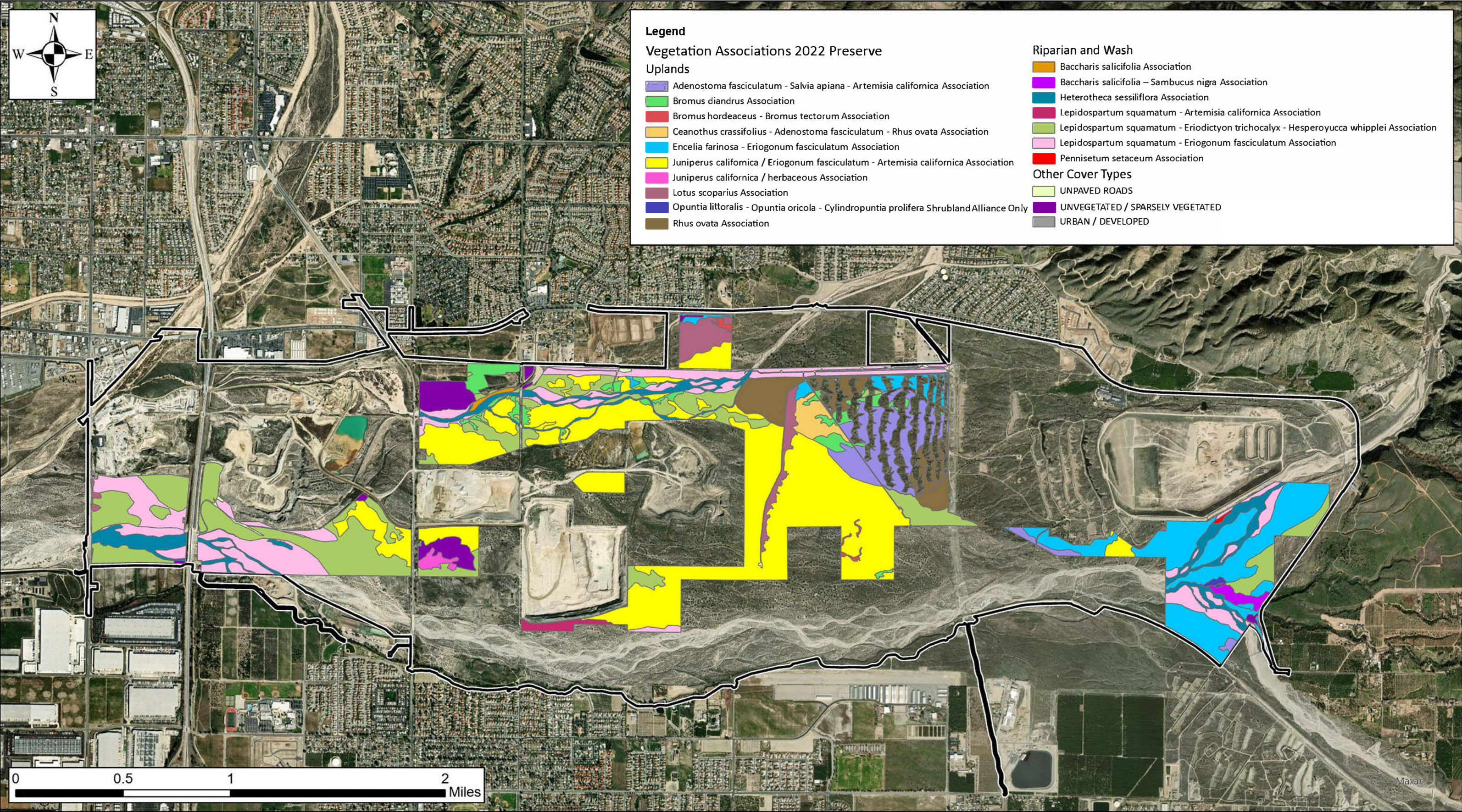


Figure 3. Plan Area Jurisdictional Waters

Coordinate System:
NAD 1983 StatePlane California V FIPS 0405 Feet
Projection: Lambert Conformal Conic
Datum: North American 1983
Source: SBVWCD
GIS Contact: Anna Frey
M:\Wash Plan\Natural Resource Management Plan\Natural Resource Management Plan Figures
June 26, 2023



**San Bernardino Valley
Water Conservation District**
Helping Nature Store Our Water

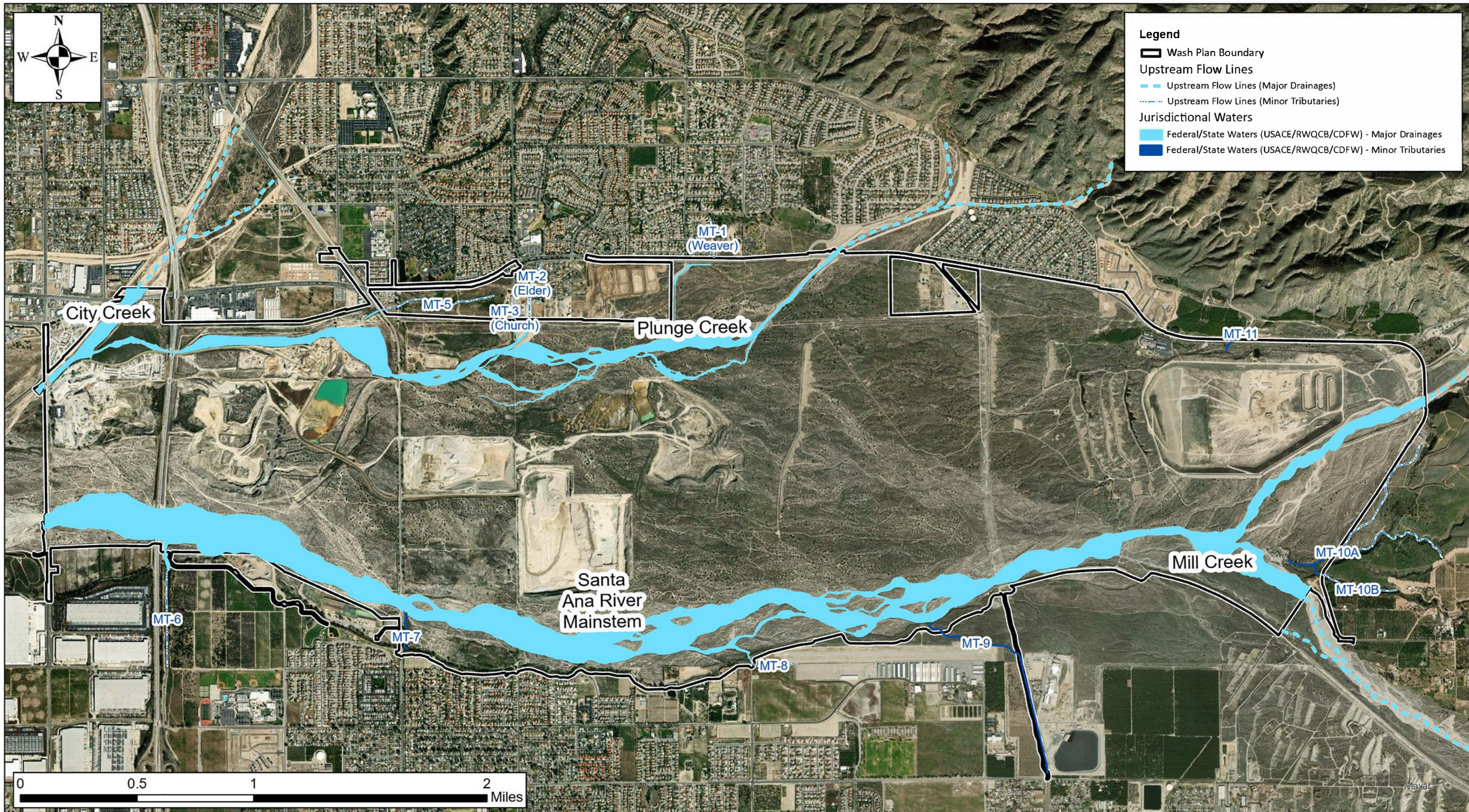


Figure 4. Management Units in the Wash Plan Preserve

Coordinate System:
NAD 1983 StatePlane California V FIPS 0405 Feet
Projection: Lambert Conformal Conic
Datum: North American 1983
Source: SBVWCD
GIS Contact: Anna Frey
M:\Wash Plan\Natural Resource Management Plan\Natural Resource Management Plan Figures
June 26, 2023

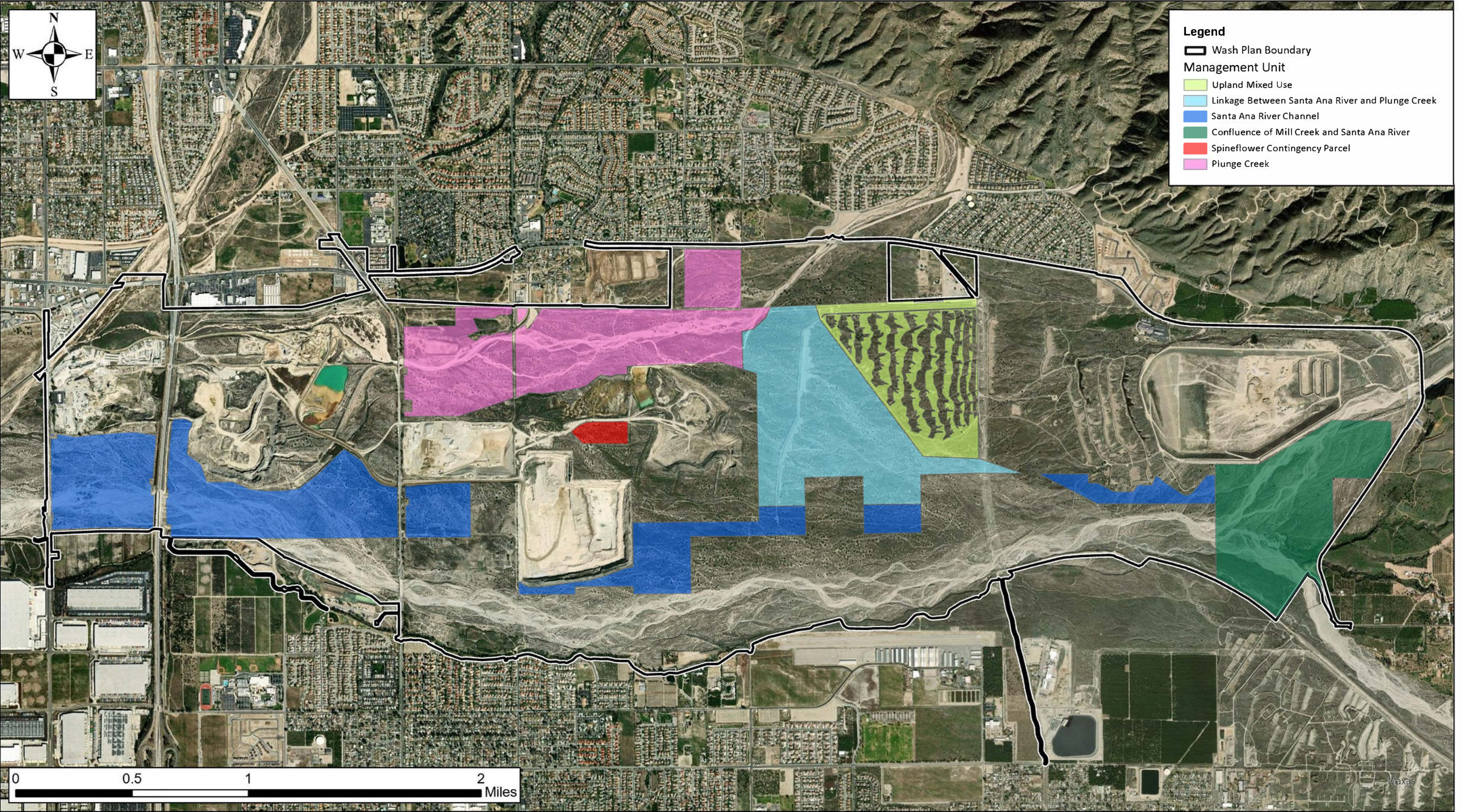


Figure 5. Plunge Creek Conservation Project Wetted Area

Coordinate System:
NAD 1983 StatePlane California V FIPS 0405 Feet
Projection: Lambert Conformal Conic
Datum: North American 1983
Source: SBVWCD
GIS Contact: Anna Frey
M:\Wash Plan\Natural Resource Management Plan\Natural Resource Management Plan Figures
June 26, 2023

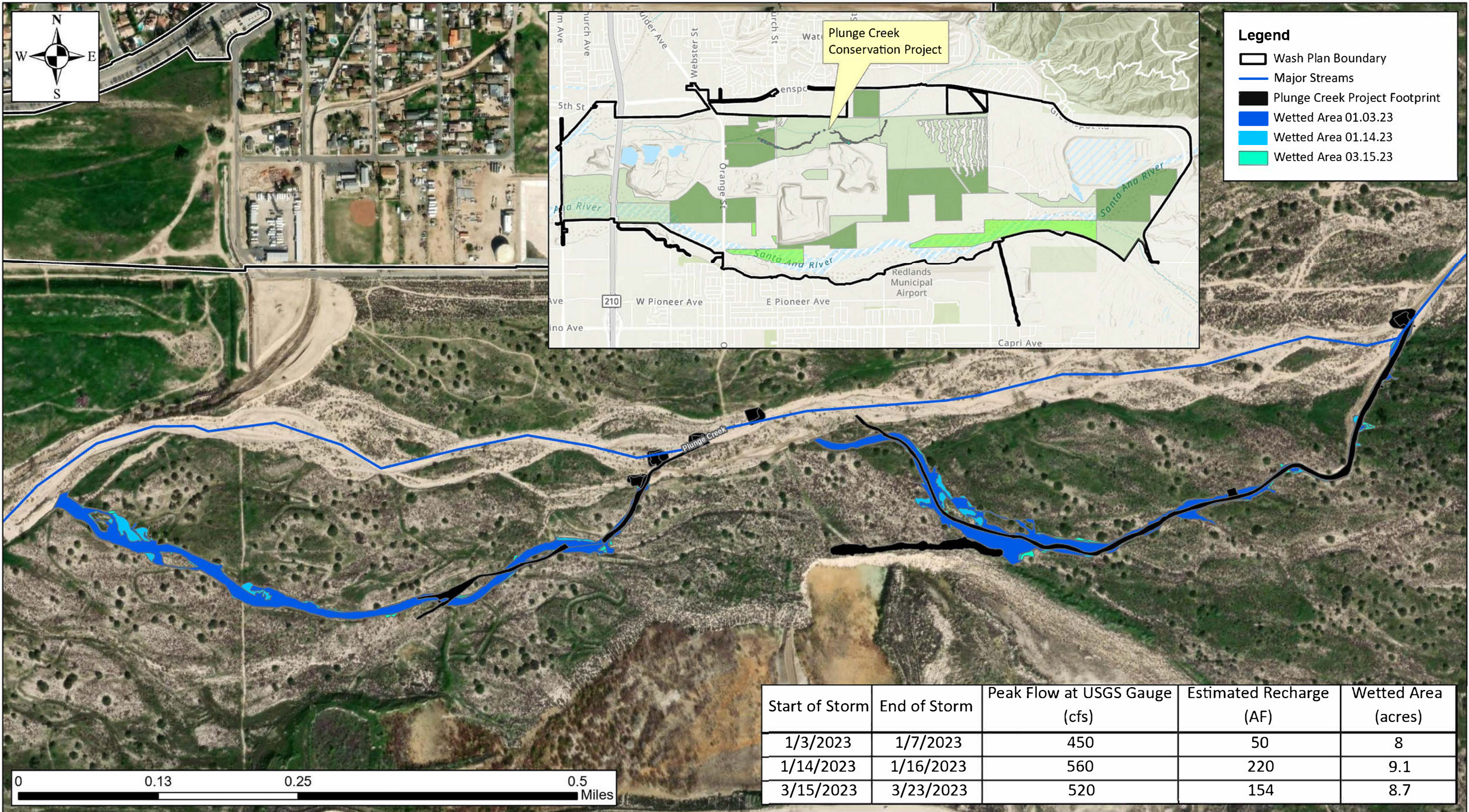


Figure 6. Plunge Creek Conservation Project Adaptive Management Plan

Coordinate System:
NAD 1983 StatePlane California V FIPS 0405 Feet
Projection: Lambert Conformal Conic
Datum: North American 1983
Source: SBVWCD
GIS Contact: Anna Frey & Katelyn Scholte
M:\Wash Plan\Natural Resource Management Plan\Natural Resource Management Plan Figures
June 26, 2023



Figure 7. SBKR Occupancy Results and Management Units

Coordinate System:
NAD 1983 StatePlane California V FIPS 0405 Feet
Projection: Lambert Conformal Conic
Datum: North American 1983
Source: SBVWCD
GIS Contact: Anna Frey
M:\Wash Plan\Natural Resource Management Plan\Natural Resource Management Plan Figures
June 26, 2023

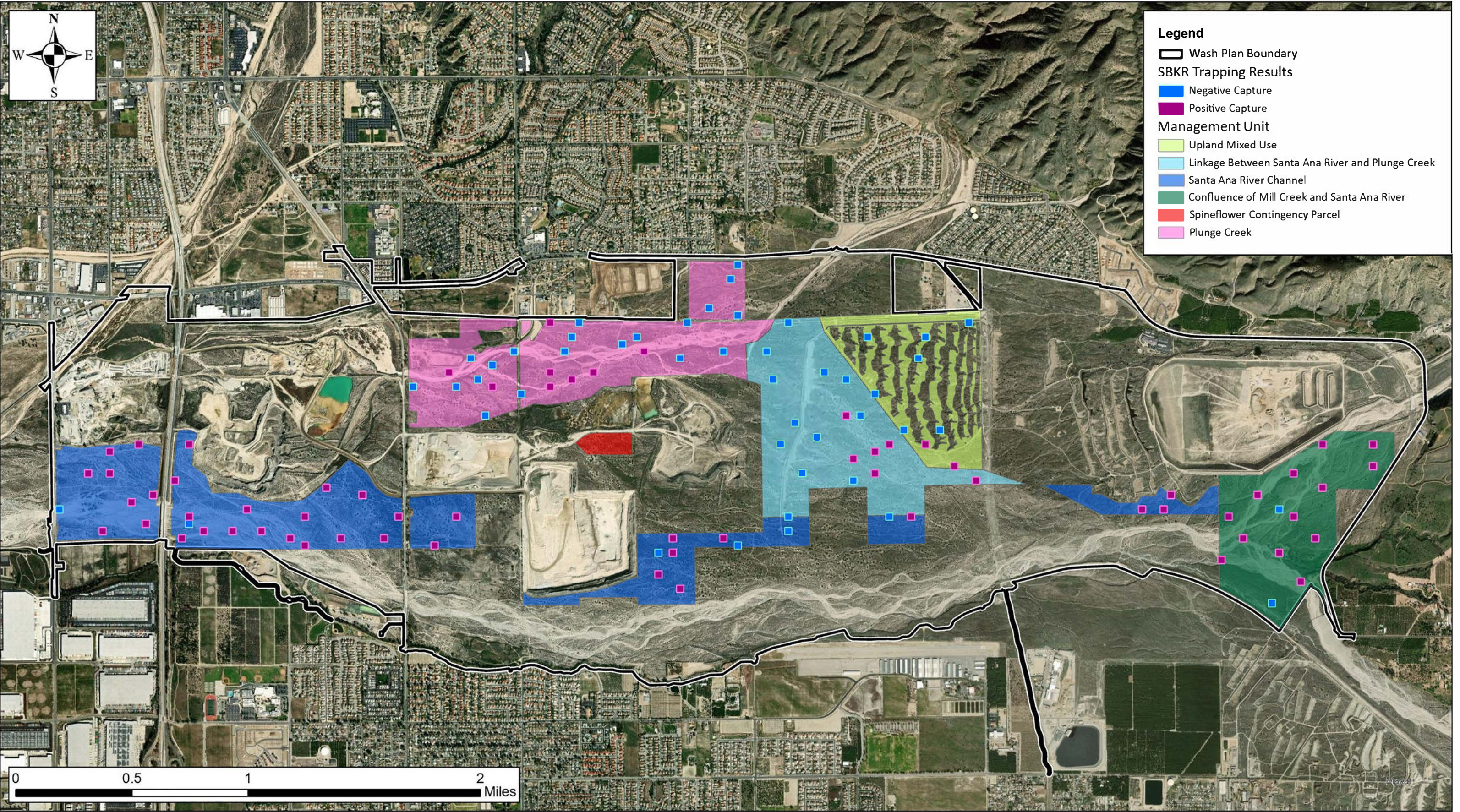


Figure 8. Average Invasive Grass Cover

Coordinate System:
NAD 1983 StatePlane California V FIPS 0405 Feet
Projection: Lambert Conformal Conic
Datum: North American 1983
Source: SBVWCD
GIS Contact: Anna Frey
M:\Wash Plan\Natural Resource Management Plan\Natural Resource Management Plan Figures
June 26, 2023

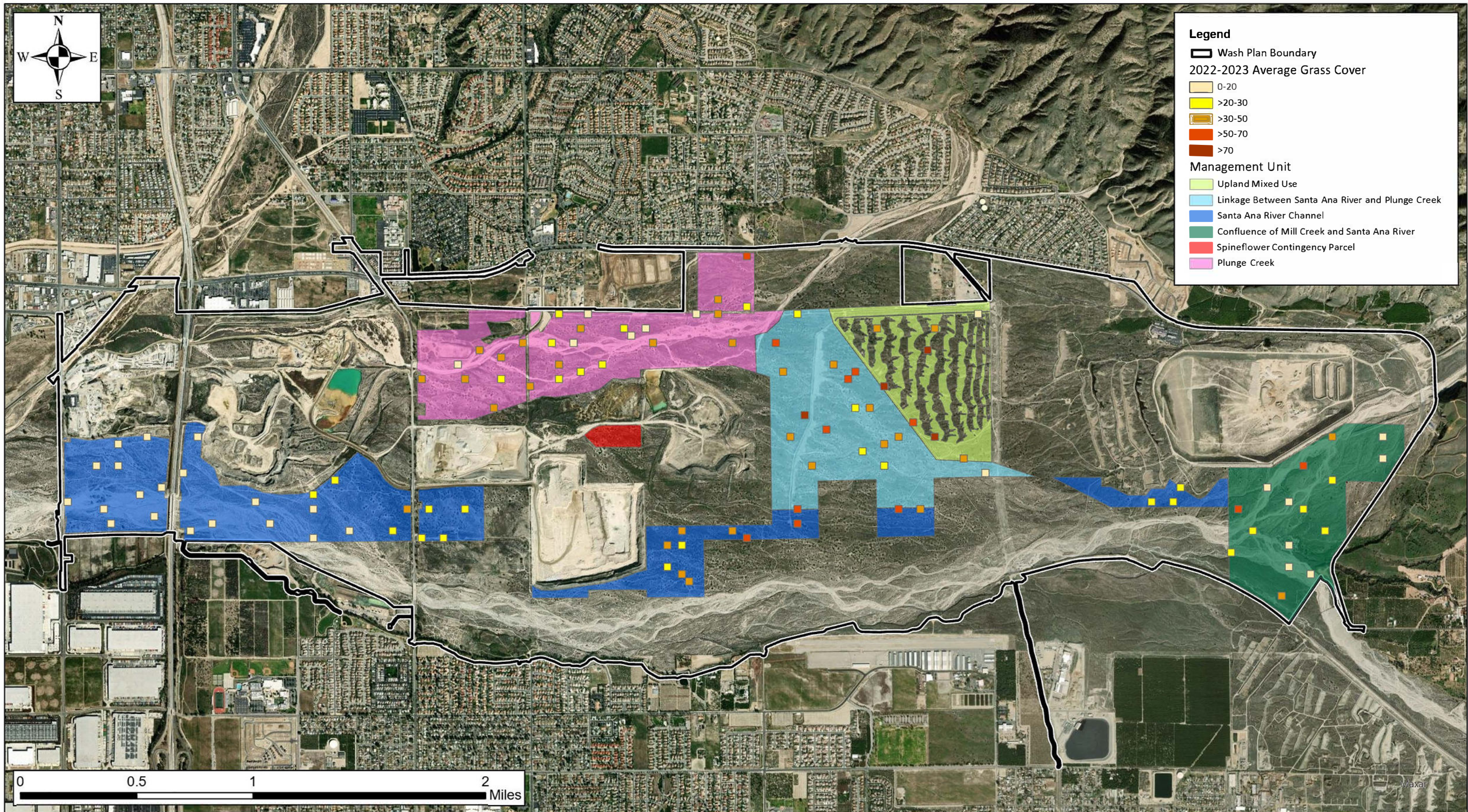


Figure 9. Potential Areas for Sand Spreading and Grass Management

Coordinate System:
NAD 1983 StatePlane California V FIPS 0405 Feet
Projection: Lambert Conformal Conic
Datum: North American 1983
Source: SBVWCD
GIS Contact: Anna Frey
M:\Wash Plan\Natural Resource Management Plan\Natural Resource Management Plan Figures
June 26, 2023

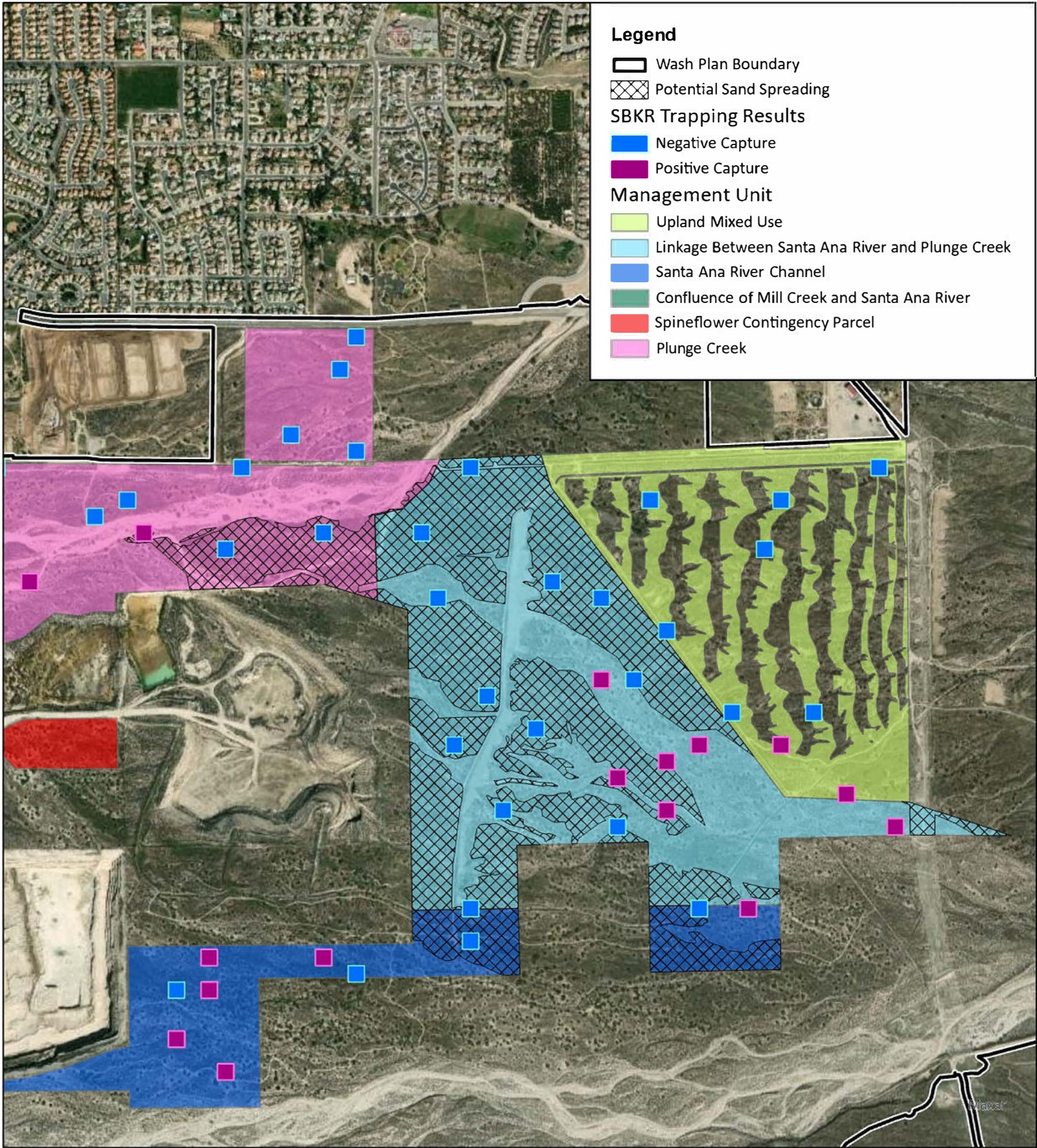
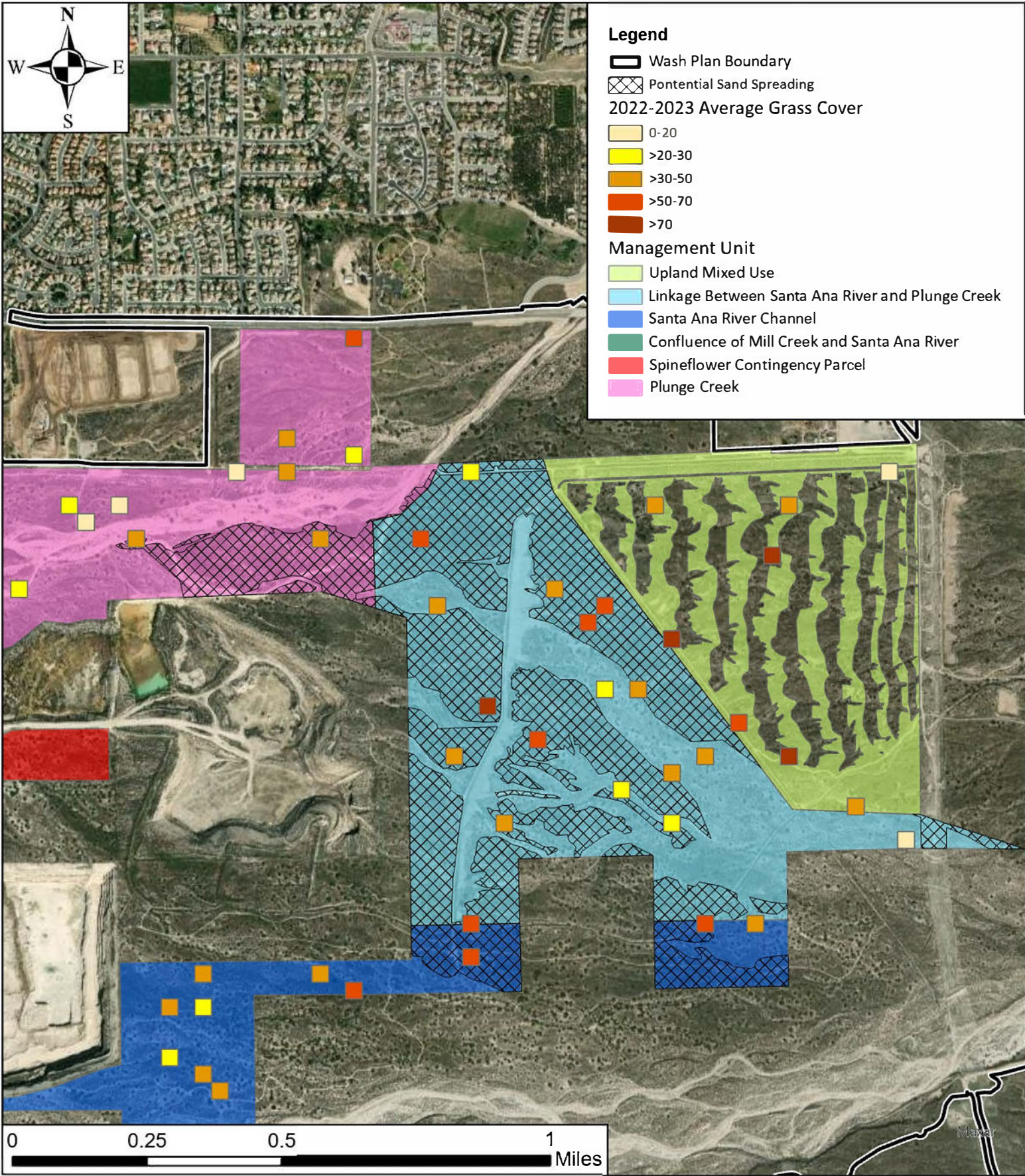


Figure 10. CAGN Monitoring Results and Survey Areas

Coordinate System:
NAD 1983 StatePlane California V FIPS 0405 Feet
Projection: Lambert Conformal Conic
Datum: North American 1983
Source: SBVWCD
GIS Contact: Anna Frey
M:\Wash Plan\Natural Resource Management Plan\Natural Resource Management Plan Figures
June 26, 2023



Figure 11. SHSF Patch Survey Results

Coordinate System:
NAD 1983 StatePlane California V FIPS 0405 Feet
Projection: Lambert Conformal Conic
Datum: North American 1983
Source: SBVWCD
GIS Contact: Anna Frey
M:\Wash Plan\Natural Resource Management Plan\Natural Resource Management Plan Figures
June 26, 2023

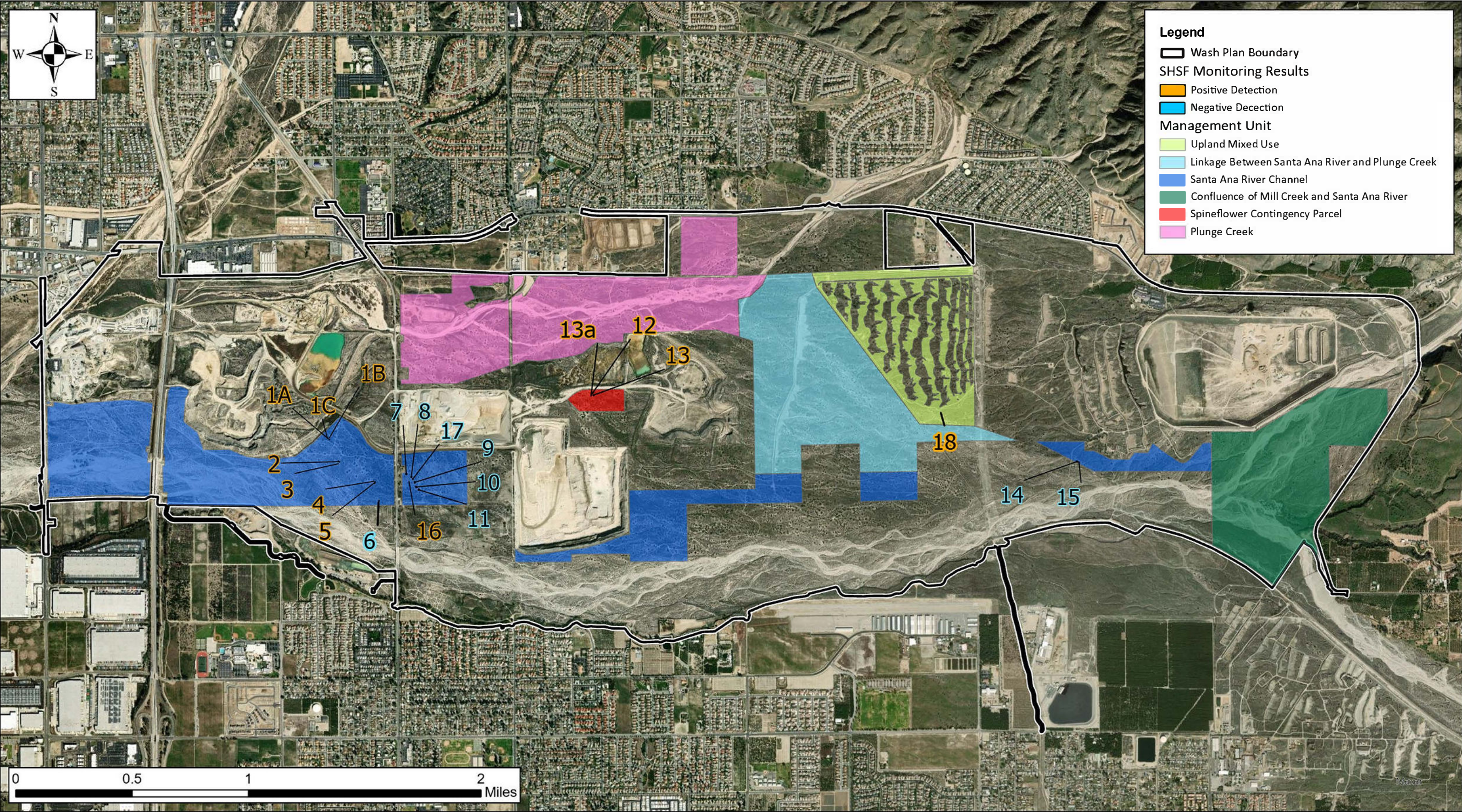


Figure 12. SHSF Potential Outplanting Locations

Coordinate System:
NAD 1983 StatePlane California V FIPS 0405 Feet
Projection: Lambert Conformal Conic
Datum: North American 1983
Source: SBVWCD
GIS Contact: Anna Frey
M:\Wash Plan\Natural Resource Management Plan\Natural Resource Management Plan Figures
June 26, 2023

