



## 2023 Annual Monitoring Report (Year 4)

### Devil's Gate Off-Site Mitigation Project

**Los Angeles County, California**  
USACE File No. SPL-2014-00591  
CDFW Tracking No. 1600-2015-0263-R5  
RWQCB File No. 15-053



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October 2023

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## List of Acronyms

<b>BEI</b>	Bank Enabling Instrument
<b>Cal-IPC</b>	California Invasive Plant Council
<b>CDFW</b>	California Department of Fish and Wildlife
<b>CIR</b>	Colour-infrared
<b>GIS</b>	Geographic Information System
<b>GPS</b>	Global Positioning System
<b>HMMP</b>	Habitat Mitigation and Monitoring
<b>LACFCD</b>	Los Angeles County Flood Control District
<b>NNIP</b>	Non-Native Invasive Plant
<b>NDVI</b>	Normalized Difference Vegetation Index
<b>RWQCB</b>	Regional Water Quality Control Board
<b>UAV</b>	Unmanned Aerial Vehicle
<b>USACE</b>	United States Army Corps of Engineers
<b>WOUS</b>	Waters of the United States
<b>WRA</b>	WRA, Inc.



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# 1 PROJECT OVERVIEW

This is the fourth annual report for the Devil’s Gate Off-Site Mitigation Project as required under the terms of the approved Devil’s Gate Off-Site Mitigation Project Habitat Mitigation and Monitoring Plan (HMMP; WRA 2018). The United States Army Corps of Engineers (USACE) permit authorizing the HMMP requires the annual reports be submitted to the USACE, the California Department of Fish and Wildlife (CDFW), and the Regional Water Quality Control Board (RWQCB) (Permitting Agencies) by October 1<sup>st</sup> throughout the five-year maintenance and monitoring period.

Restoration activities at the Devil’s Gate Off-Site Mitigation Project Site were completed as outlined in the as-built memo submitted to the Permitting Agencies and dated April 23, 2019 (WRA 2019). This report includes information on the site conditions, continued restoration activities, performance monitoring, and management recommendations.

## 1.1 Permit File Numbers

- U.S. Army Corps of Engineers Section 404 (File No. SPL-2014-00591)
- California Department of Fish and Wildlife Section 1602 Streambed Alteration Agreement (Notification No. 1600-2015-0263-R5)
- Los Angeles Regional Water Quality Control Board Section 401 Water Quality Certification (File No. 15-053)

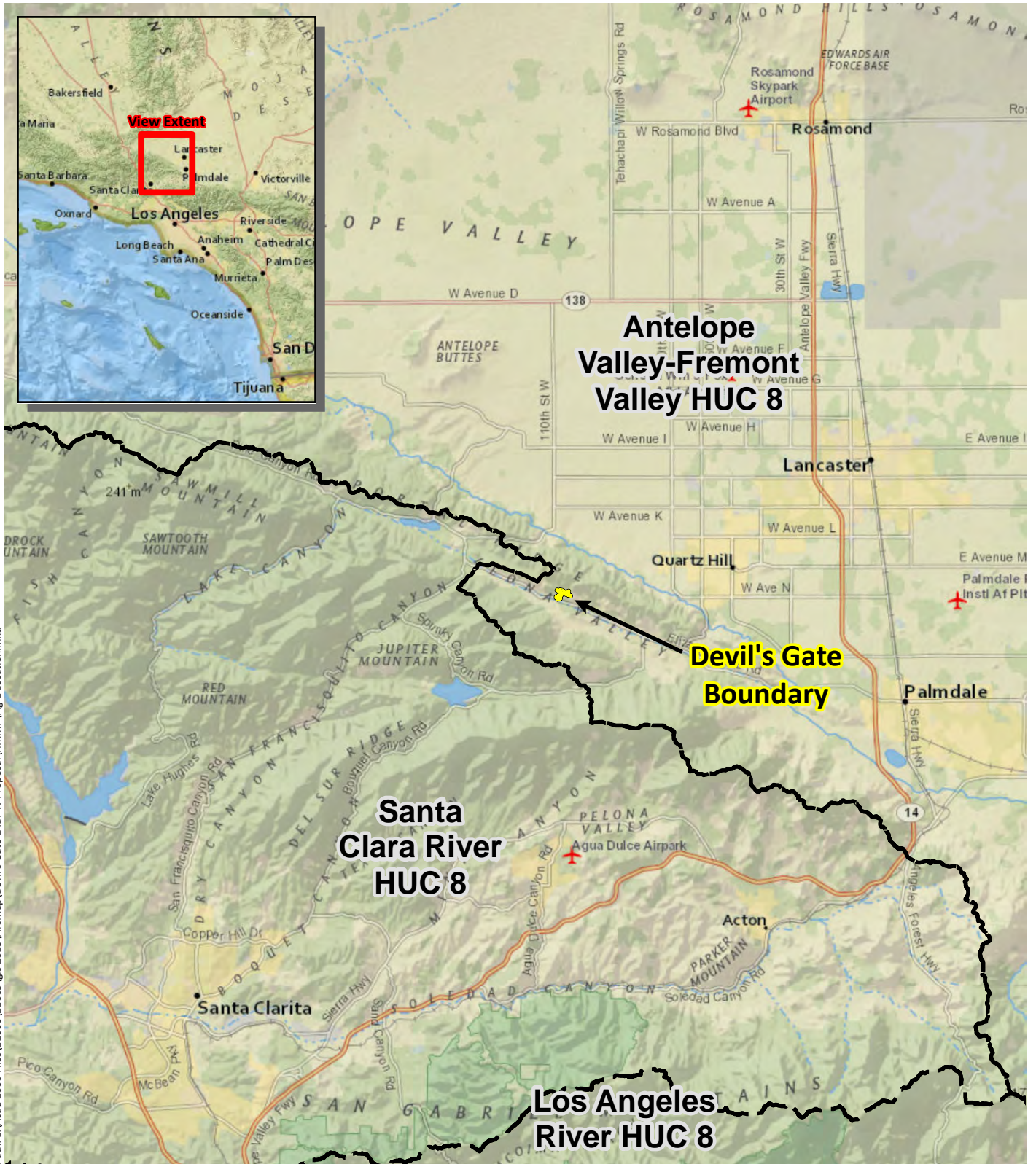
This annual report is prepared pursuant to the above permits, as set forth by the HMMP prepared by WRA, Inc. (WRA), dated October 17, 2018.

## 1.2 Project Description

The Devil’s Gate Off-Site Mitigation Project (Project) serves as an off-site mitigation project for the Los Angeles County Flood Control District (LACFCD) Devil’s Gate Sediment Removal and Maintenance Project, which was proposed to remove vegetation and 1.7 million cubic yards (cy) of sediment from a 65.56-acre area within the reservoir above the Devil’s Gate Dam (Impact Site). The Sediment Removal Project will directly impact 1.52 acres of USACE jurisdictional wetlands and 32.54 acres of USACE non-wetland Waters of the United States (WOUS). LACFCD proposed to compensate for these temporary and permanent impacts through a combination of on-site and off-site mitigation projects, as required by the USACE Section 404 Permit (SPL-2014-00591), the CDFW Lake or Streambed Alteration Agreement (1600-2015-0263-R5), and the RWQCB Section 401 Certification (15-053). On-site mitigation objectives are described in the Devil’s Gate Sediment Removal and Management Project Habitat Mitigation and Monitoring Plan (ECORP 2018).

LACFCD satisfied the off-site mitigation requirement by engaging Land Veritas Corp (Bank Sponsor) to implement the Project in a 31.55-acre portion of the Petersen Ranch Mitigation Bank (Bank). The Bank is in northern Los Angeles County near Leona Valley, California (Figure 1). The Project took place at and surrounding a large sag pond (Pond D) on the east end of the Bank (Mitigation Site; Figure 2). Mitigation actions focused on enhancing existing seasonal wetlands that support mulefat (*Baccharis salicifolia*) and willow (*Salix* sp.) populations, creating new mulefat/willow dominated habitats, and preserving alluvial scrub areas around Pond D. The created, restored, and preserved communities are of a similar type and provide similar or greater functions to those affected at the Impact Site.





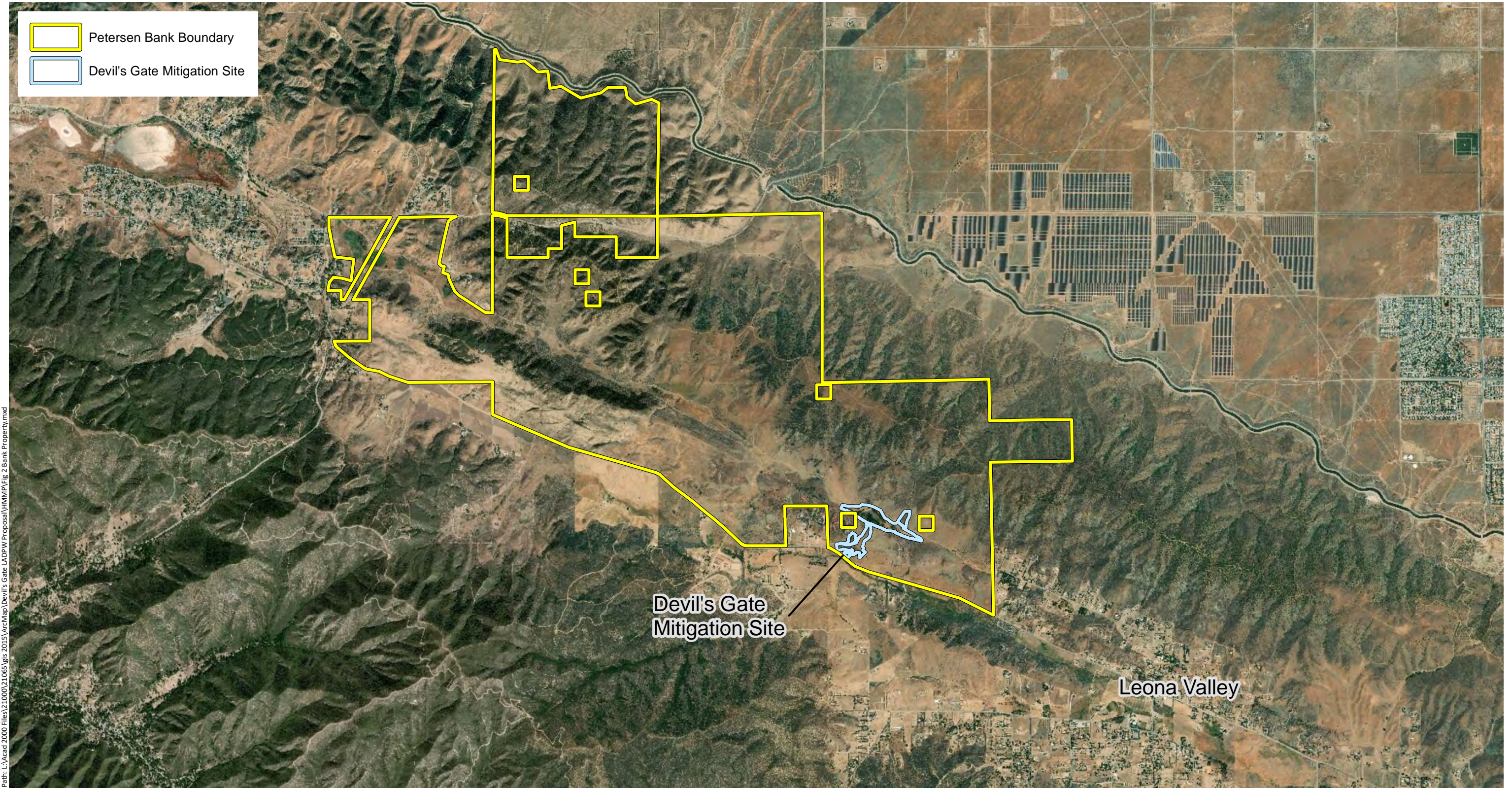
Sources: National Geographic, WRA | Prepared By: czumwalt, 8/2/2018

**Figure 1. Petersen Ranch Mitigation Bank Location Map**

Petersen Ranch Mitigation Bank  
Los Angeles County, California

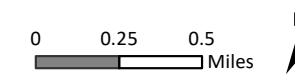






**Figure 2. Mitigation Site Location Map**

Petersen Ranch Mitigation Bank  
 Los Angeles County, California



### **1.3 Monitoring and Reporting Tasks**

This report addresses the Year 4 monitoring and reporting requirements of the Mitigation Site outlined in the HMMP, including the management and maintenance tasks completed this year, a description of the overall condition of the Mitigation Site, and the status of maintenance activities; performance monitoring activities and results; and management and maintenance activities proposed for the upcoming year, including proposed remedial actions.

### **1.4 Status Summary**

Habitat restoration and enhancement activities were completed in April 2019, as described in the as-built report letter dated April 23, 2019. This includes planting of over 10,000 willow and mulefat live stakes and installation of cattle exclusion fencing. The mitigation site is now in Year 4 of the management and monitoring period, which will continue until the final (Year 5) performance standards have been met. As presented in this report, the Mitigation Site is meeting all Year 4 performance standards.



## 2 MITIGATION SITE EXISTING CONDITIONS

### 2.1 Location

The Mitigation Site is located approximately 32 miles north of the Impact Site within the agency approved Petersen Ranch Mitigation Bank. The 31.55-acre Mitigation Site is located within the eastern portion of the Bank (Figure 2). The Mitigation Site lies within Phase D of the Bank Property, which is part of the larger, 4,103-acre Bank. Within Phase D, a large sag pond (Pond D) and associated wetland complex had been identified as having opportunities for improvement of existing habitat. Opportunities included establishment and enhancement of wetlands, non-wetland WOUS, and associated buffer habitats. The buffer habitats were restored and enhanced to not only provide protection for the on-site aquatic resources but also to improve the overall function of the watershed. Additional details describing the mitigation bank can be found in the Bank Enabling Instrument (BEI) (Land Veritas Corp. 2016) and in the Biological Resource Inventory (BRI; BEI Exhibit H).

### 2.2 Existing Habitat

A BRI was conducted by WRA at the Bank Property in January and February of 2013 (WRA 2013). In total, 11 biological communities were identified within the Mitigation Site: two wetlands and waters communities, four riparian communities, two sensitive terrestrial communities, and three non-sensitive terrestrial communities. Descriptions of the two communities targeted for restoration at the Mitigation Site are included below. In addition, Appendix A presents a list of observed plant species at the Mitigation Site.

Mulefat thickets (*Baccharis salicifolia* Shrubland Alliance, G5 S4, 1602 and Porter Cologne jurisdictional habitat). The Mulefat Thickets Alliance is widespread in canyon bottoms, floodplains, irrigation ditches, lake margins, and stream channels (Sawyer *et al.*, 2009). This alliance covered 6.21 acres of the Mitigation Site. Mulefat thickets integrate with Fremont cottonwood (*Populus fremontii*) forest, arroyo willow (*Salix lasiolepis*) thickets, stretchberry (*Forestiera pubescens*) thickets, and Mexican rush (*Juncus mexicanus*) marshes. Mulefat comprised greater than 50 percent relative cover in the shrub layer. Typically, mulefat was the only species in the shrub layer. In rare instances, other shrub species included arroyo willow, elderberry (*Sambucus nigra* ssp. *caerulea*), and stretchberry. Herbaceous groundcover was composed of Mexican rush, clustered field sedge (*Carex praegracilis*), stinging nettle (*Urtica dioica*), ripgut brome (*Bromus diandrus*), and ruderal weeds.

Red willow thickets (*Salix laevigata* Woodland Alliance, G3 S3, 1602 and Porter Cologne jurisdictional habitat). Red willow thickets are widespread and occur in ditches, floodplains, lake edges, and low gradient depositions along streams (Sawyer *et al.*, 2009). This alliance covered 0.65 acres of the Mitigation Site. Red willow comprised greater than 50 percent relative cover in the tree canopy, or greater than 30 percent relative cover in the tree canopy if arroyo willow was in the subcanopy. The understory shrub layer often contained mulefat. Herbaceous groundcover was composed of Mexican rush, clustered field sedge, stinging nettle, water smartweed (*Persicaria amphibia*), ripgut brome, and ruderal weeds.



### 3 MITIGATION ACTIVITIES

The Project involved installing cattle exclusion fencing, removing and managing invasive plant species, planting mulefat and willow, and supplementing hydrology when necessary to sustain the restored habitat, as well as guaranteeing the long-term legal protection of the Mitigation Site with a conservation easement.

Figure 3 presents the locations of the cattle exclusion fencing, planting areas, and preservation areas.

#### 3.1 Cattle Exclusion Fencing

A wildlife-friendly cattle exclusion fence was installed around the designated planting areas to prevent livestock from grazing on riparian plants. Alignment of the cattle exclusion fencing was adjusted during installation to avoid sensitive habitat while providing full constructability.

#### 3.2 Invasive Species Management and Considerations

Initial weed eradication efforts included targeted grow kill cycles, and control of any non-grass invasive species present within the designated planting areas (including CAL-IPC moderate and limited species).

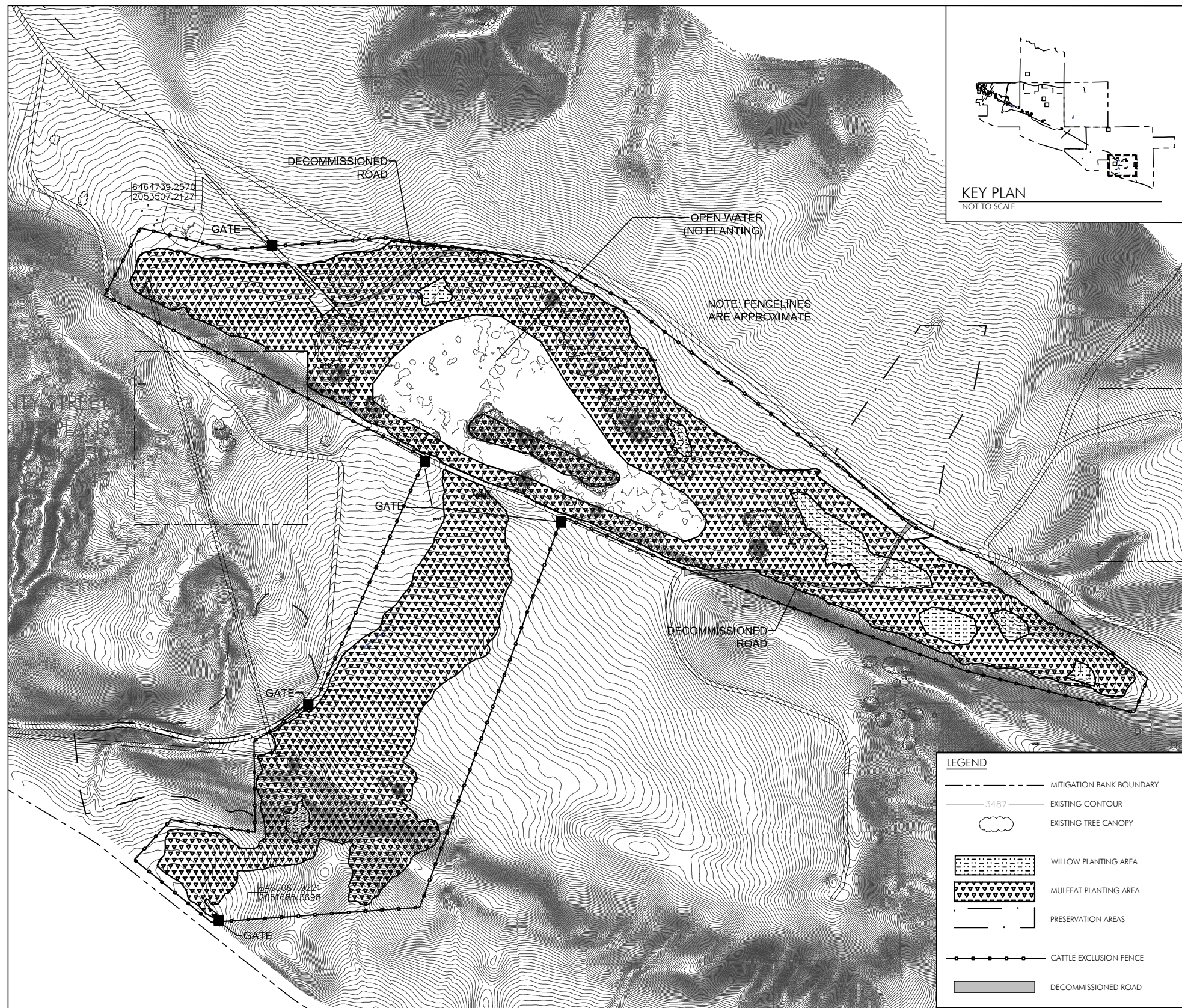
#### 3.3 Planting Areas

Planting areas are within and immediately surrounding areas that previously supported sparse or scattered stands of mulefat, willow, and other riparian species. These areas were planted with 9,338 mulefat live stakes and 1,106 mixed red and arroyo willow live stake plantings to achieve an average density of 500-stems per acre, similar to existing high density mulefat and willow stands within the Mitigation Site. All plantings were live pole cuttings harvested from plants within the Bank to preserve local genetics. Willow plantings were focused only in the wettest portion of the Mitigation Site, primarily around Pond D, as well as a few other locations where groundwater seeps were sufficient to support the species; mulefat plantings are therefore more widespread throughout the Mitigation Site. In total, 27.67 acres were planted.

#### 3.4 Preservation Areas

Two distinct preservation areas are located in the northeast and southwest of the Mitigation Site. They are dominated by California buckwheat (*Eriogonum fasciculatum*) in the northeast, and Parish's sagebrush (*Artemisia tridentata* ssp. *parishii*), thick leafed yerba santa (*Eriodictyon crassifolium*), and California buckwheat in the southwest. In total, 6.60 acres were preserved. These areas are located on alluvial fans and ephemeral drainages that receive periodic sediment and surface flows and support high quality habitat for xeric riparian communities.



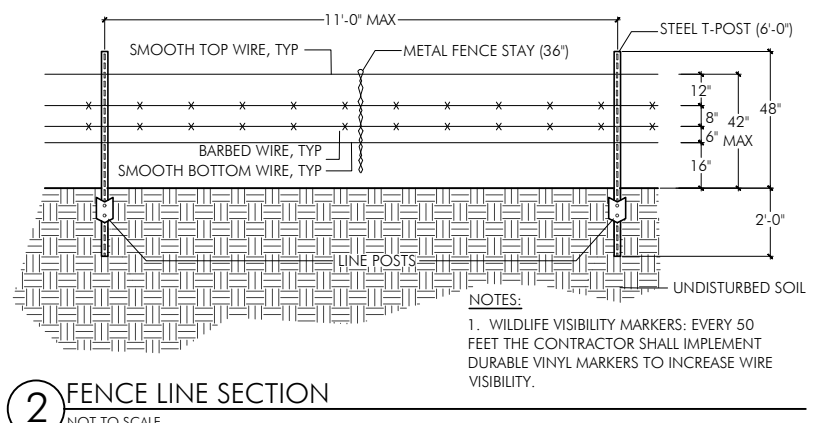
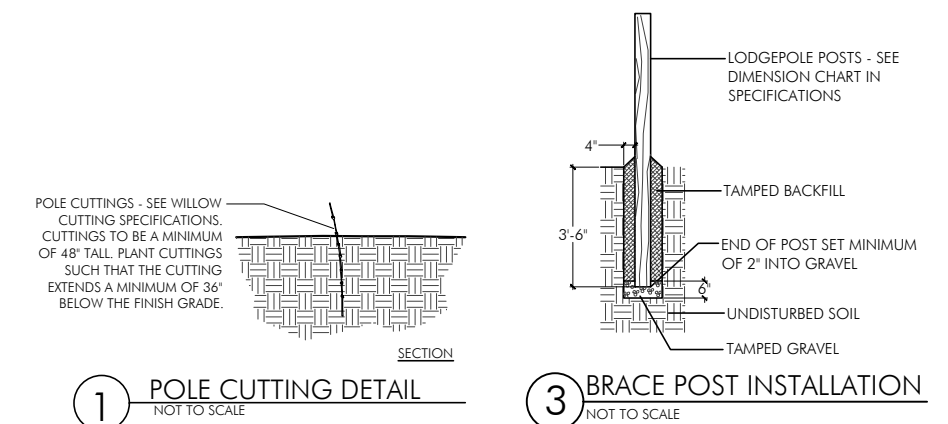


**MULEFAT AREA PLANT SCHEDULE**

BOTANICAL NAME	COMMON NAME	CONTAINER SIZE	QUANTITY
BACCHARIS SALICIFOLIA	MULEFAT	4' LIVE STAKE	9,338

**WILLOW AREA PLANT SCHEDULE**

BOTANICAL NAME	COMMON NAME	CONTAINER SIZE	QUANTITY
SALIX LAEVIGATA	RED WILLOW	4' LIVE STAKE	885
SALIX LASIOLEPIS	ARROYO WILLOW	4' LIVE STAKE	221



NOTES:  
 1. WILDLIFE VISIBILITY MARKERS: EVERY 50 FEET THE CONTRACTOR SHALL IMPLEMENT DURABLE VINYL MARKERS TO INCREASE WIRE VISIBILITY.

PLANTING AND FENCING PLAN



WRA JOB #21065				
DATE: 04/20/2019				
DESIGNED BY: RBB/RFP				
DRAWN BY: RFP				
CHECKED BY: RBB	NO.	DATE	BY	REVISIONS

**PETERSEN RANCH  
 MITIGATION BANK**  
 LEONA VALLEY, LOS ANGELES COUNTY CA

**FIGURE 3: DEVIL'S GATE  
 OFFSITE MITIGATION  
 AS-BUILT PLAN**

## 4 MONITORING AND PERFORMANCE STANDARDS

This section details annual performance standards and monitoring methods. Monitoring is conducted annually throughout the monitoring and maintenance period to demonstrate success of the mitigation activities. Monitoring is conducted in spring or early summer and is timed to follow the blooming periods of target weed species, so that any necessary control measures are implemented prior to the invasive species setting seed. Percent cover of mulefat and willow species within the Mitigation Site is assessed using plots spaced along four permanent 50-meter transects. Target invasive plant species is mapped annually and treated on an as-needed basis. Success is evaluated based on achieving the target standards presented below.

Restoration and enhancement activities were completed at the Mitigation Site in April 2019, so this report summarizes the fourth year of annual monitoring.

### 4.1 Planting Area Performance Standards

Performance standards for mulefat and willow installed in the planting areas are based on absolute cover assessed by visual estimation during the five-year monitoring period. Absolute cover of mulefat and willow is assessed in planting areas using the methods outlined in Section 4.2. Additionally, absolute cover of California Invasive Plant Council (Cal-IPC) rated High broad-leaved plant species is assessed in conjunction with mulefat and willow cover. The performance standards that are used to assess the success of the Mitigation Site are shown in Table 1.



Table 1. Performance Standards for Planting Areas

PERFORMANCE STANDARD	MONITORING YEAR					MONITORING FREQUENCY
	1	2	3	4	5	
By year 2, the planting areas must contain 10% or more absolute cover of mulefat or willow, or demonstrate 80% survivorship.		X				Annually
By year 3, the planting areas must contain 25% or more absolute cover of mulefat or willow, or demonstrate 80% survivorship.			X			Annually
By year 4, planting areas must contain 40% or more absolute cover of mulefat or willow.				X		Annually
By year 5, planting areas must contain 68% or more absolute cover of mulefat or willow.					X	Annually
Percent cover of Cal-IPC rated high broad-leaved invasive plant species must cover no more than 10% absolute cover of the Mitigation Site.		X	X	X	X	Annually

## 4.2 Performance Monitoring Methods

The Mitigation Site planting areas were monitored for cover of willow and mulefat plantings, and cover of Cal-IPC High-rated broad-leaved invasive species (“invasive weeds”). Absolute cover of willow, mulefat, and invasive weeds was monitored in planting areas using four permanent transects. In addition to transect monitoring, a drone was used to assess site-wide cover of mulefat and willow plantings.

### 4.2.1 Transect Monitoring

Permanent 50-meter transects were established within planting areas (Figure 4). Transects were permanently marked in the field using T-posts. Global Positioning System (GPS) points were recorded to repeat transect monitoring in future years, and photos were taken at the start and end of each transect. Each 50-meter transect was surveyed by walking a 2.5-meter-wide belt transect and recording species and species cover class<sup>1</sup> every 5 meters, resulting in 10 sampling plots per transect. Species and species cover class were recorded within each plot to assess the performance standards outlined in Table 1. A photograph was taken at the beginning and end of each transect (Appendix C). The cover of mulefat and willow was then calculated by averaging the sums of the cover of mulefat and willow for each transect.

### 4.2.2 Drone Monitoring

A WRA licensed pilot flew the entire Mitigation Site with a Phantom 4 Multispectral Unmanned Aerial Vehicle (UAV) collecting data from 5 wavelength bands: Red, Green, Blue, Red-Edge, and Near Infrared. The data was then stitched together using Pix4D photogrammetry software. The output datasets included an RGB and Color-Infrared (CIR) photomosaics. Using Geographic Information Systems (GIS) software, a Normalized Difference Vegetation Index (NDVI) analysis was performed on the CIR imagery using the individual bands collected by the UAV. Utilizing the NDVI, data vegetation types were classified in GIS and exported into vector format. The vector format data was then used to calculate site-wide absolute vegetation cover. Additionally, Pix4D software was used to create a Digital Surface Model (DSM) from the UAV data. The DSM was used in concert with publicly available lidar data to create a vegetation height profile for the entire Mitigation Site, which utilized three height classes (< 3 ft., 3 - 10 ft., and > 12 ft.).

## 4.3 Inspections for Mitigation Maintenance

Maintenance inspections and activities during the five-year plant establishment period in the created and enhanced riparian areas are required to facilitate the restoration (Table 2). Conditions are evaluated multiple times per year and if deficiencies are noted, they are assessed, documented, and remedied as quickly as necessary to prevent further damage, per the corresponding maintenance action described in Table 2.

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<sup>1</sup> Cover classes are as follows: 0=<1%, 1=1-5%, 2=5-25%, 3=25-50%, 4=50-75%, 5=75-95%, 6=95-100%





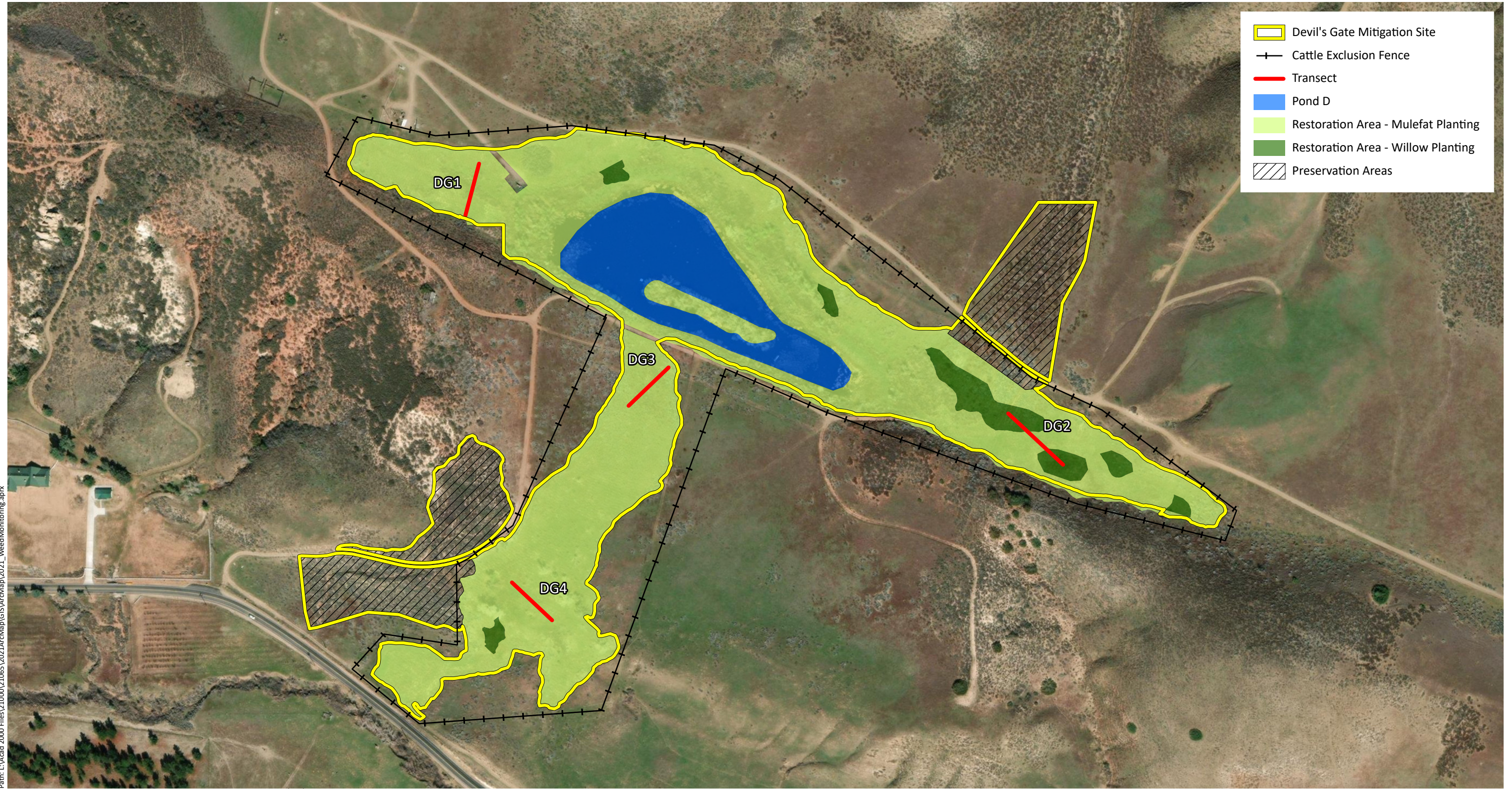
**Table 2. Maintenance Inspection Types and Actions**

INSPECTION TYPE	CORRESPONDING MAINTENANCE ACTION
Signs of erosion	Repair of slopes and installation of erosion protections
Non-native invasive plants (NNIPs) mapping	Plant removal or management to control establishment and spread
Condition of cattle exclusion fencing	Fence repair
Proper hydrologic conditions	Adjust water augmentation

Mapping of non-native, invasive plant (NNIP) species targeted for management was conducted regularly throughout the year. WRA biologists traversed the planting area on foot, focusing on locations where target NNIPs had been observed in past years, and mapped each target NNIP species occurrence that was encountered. The targets of the surveys were NNIP species rated Cal-IPC High, and species rated Cal-IPC Moderate, or Limited that are specifically known to be nuisance species either regionally or locally. Mapping was not conducted within preservation areas.

Other species that are not of regional or local concern were not mapped, but their presence was recorded in the Mitigation Site Species List (Appendix A).





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Sources: 2016 DigitalGlobe Aerial, WRA | Prepared By: njander, 9/27/2021

**Figure 4. Mitigation Site Monitoring Locations**

## 5 RESULTS

### 5.1 Performance Monitoring

Year 4 monitoring activities were completed at the Mitigation Site in July 2023. Currently the Mitigation Site is meeting all Year 4 performance standards (Table 3). The complete annual monitoring data for the four monitoring transects is included in Appendix A. UAV multispectral analysis results are summarized below in Table 4 and depicted below in Figure 5. Appendix B presents all species observed within the Mitigation Site during both transect and site-wide surveys. Photo monitoring photos and transect photos are included in Appendix C.

#### 5.1.1 Mulefat and Willow Cover

Cover of mulefat and willow was variable at the four monitoring transects, averaging 43% absolute cover (Table 3). Mulefat was more abundant than willow within the monitoring transects and was the dominant woody riparian species. Other native species with notable absolute cover within transects included field sedge (15%), beardless wild rye (*Elymus triticoides*; 14%), Mexican rush (9%), and rubber rabbitbrush (*Ericameria nauseosa*) (8%).

The UAV multispectral analysis indicated that there was a total of 14.91 acres of mulefat cover and 0.79 acres of willow cover across the 23.26-acre planting area, which equates to a combined mulefat and willow cover of 67%. The focus of this analysis was mulefat and willow cover. When possible, other vegetation cover was mapped; however, it was beyond the scope of this analysis to assess all the vegetation cover throughout the planting area. As a result, 3.33 acres of the planting area was not assigned a cover species. Based on site knowledge and transect data, we know that this 3.33 acres of cover was comprised of native, non-native, wetland, and upland species.

#### 5.1.2 Cal-IPC High Broad-Leaved Invasive Species Cover

Percent cover of Cal-IPC rated high broad-leaved invasive plant species averaged less than 1% across all transects (Table 3). Only one Cal-IPC High-rated broad-leaved invasive species, perennial pepperweed (*Lepidium latifolium*), was observed in the Mitigation Site (see Section 5.2.2).



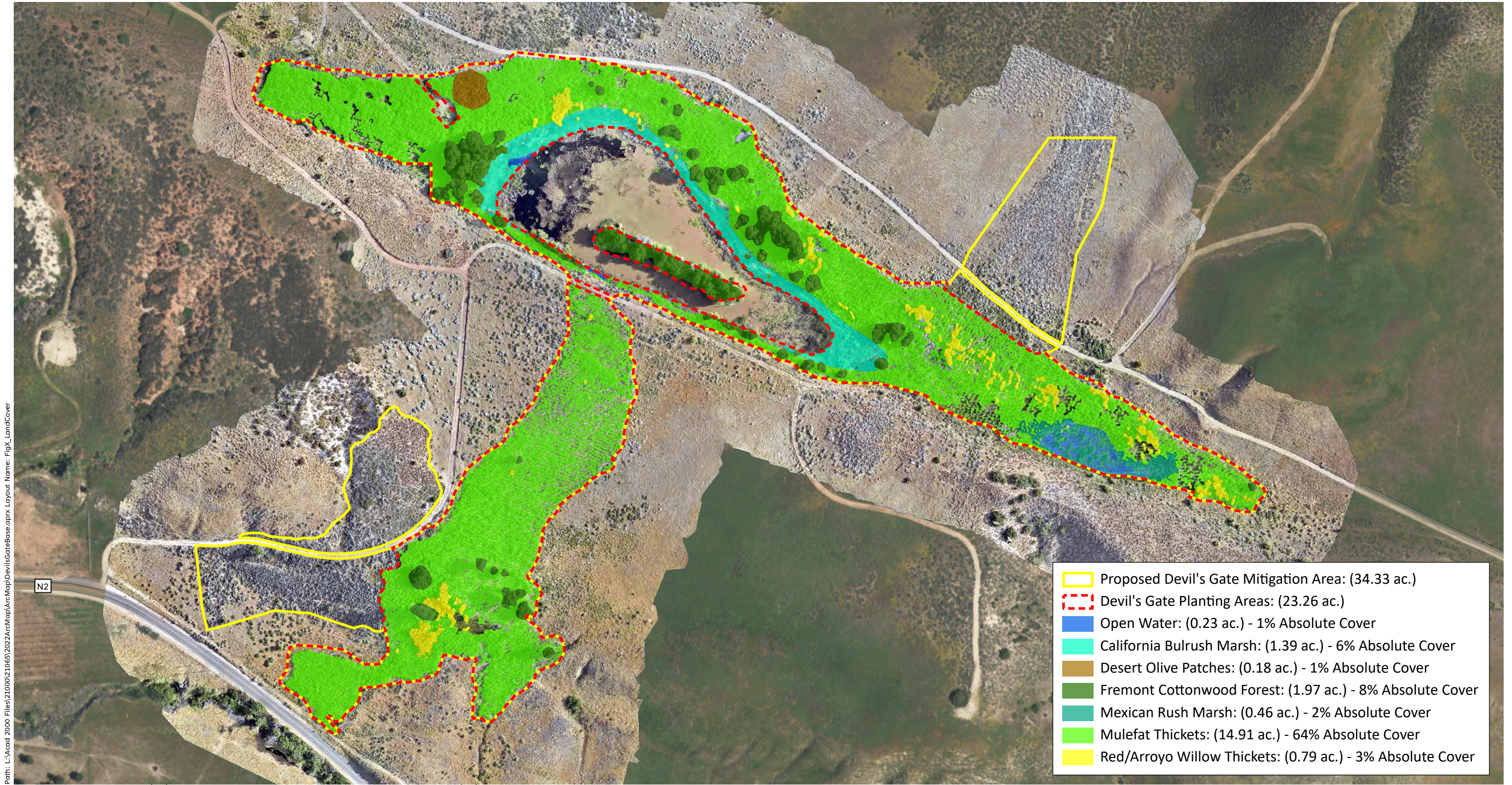
**Table 3. Year 4 Performance Monitoring Results – Absolute Cover of Mulefat & Willow and Absolute Cover of Non-Native Invasive Broad-Leaved Plant Species within the Mitigation Site**

PERFORMANCE METRIC	DG1	DG2	DG3	DG4	AVERAGE	YEAR 4 PERFORMANCE STANDARD	YEAR 4 PERFORMANCE STANDARD MET?
<b>Native Plant Cover</b>							
<b>Native Wetland and Riparian Cover</b>	137	89	61	67	89	N/A	N/A
<b>Native Wetland Cover</b>	59	65	11	47	45	N/A	N/A
<b>Native Riparian Cover</b>	79	24	50	20	43	>40%	<b>Yes</b>
<b>Mulefat</b>	79	16	50	20	41	N/A	N/A
<b>Willow</b>	0	8	0	0	2	N/A	N/A
<b>Invasive Plant Cover</b>							
<b>Cal-IPC High Cover*</b>	0%	0%	0%	0%	0%	<10%	<b>Yes</b>
<i>*Broad-leaved plant species rated High per Cal-IPC (grasses excluded)</i>							

**Table 4. Year 4 UAV Multispectral Analysis Results – Vegetation Absolute Cover of Mulefat & Willow**

Cover Type	Acres of Vegetation Absolute Cover	Percent Absolute Cover
<b>Native Wetland and Riparian Vegetation and Waters</b>	<b>19.70</b>	<b>86%</b>
<b>Native Wetland Vegetation</b>	<b>1.85</b>	<b>8%</b>
California bullrush ( <i>Schoenoplectus californicus</i> )	1.39	6%
Mexican Rush ( <i>Juncus mexicanus</i> )	0.46	2%
<b>Native Riparian Vegetation</b>	<b>17.85</b>	<b>77%</b>
Desert olive ( <i>Forestiera pubescens</i> )	0.18	1%
Fremont cottonwood ( <i>Populus fremontii</i> )	1.97	8%
Mulefat ( <i>Baccharis salicifolia</i> )	14.91	64%
Willow ( <i>Salix</i> spp.)	0.79	3%
<b>Waters</b>	<b>0.23</b>	<b>1%</b>
Open Water	0.23	1%
<b>Other</b>	<b>3.33</b>	<b>14%</b>





**Figure 5. Year 4 UAV Multispectral Analysis Results – Vegetation Absolute Cover**

Devil's Gate Planting Areas  
 Petersen Ranch  
 Los Angeles County, CA



## 5.2 Mitigation Maintenance Inspections

### 5.2.1 Erosion

There were no indications of erosion observed at the Mitigation Site this year. Therefore, no maintenance activities were implemented to address erosion issues.

### 5.2.2 Target Non-Native Invasive Plant Species Mapping

Several NNIP species of concern were observed within the Mitigation Site and were targeted for management. Management actions were rapidly deployed to control the spread of these species and are detailed below.

Three Cal-IPC High grasses are present: red brome, cheatgrass, and medusahead (*Elymus caput-medusae*). Red brome and cheatgrass were the most abundant of the Cal-IPC High species present at the Mitigation Site, and both are locally abundant in the region and within the Bank property. These species are managed within the Mitigation Site to promote the establishment of native species. In previous years, only one medusahead skeleton occurrence was observed within the Mitigation Site. This small population was monitored several times throughout the year to ensure that treatment was properly timed and that any surviving individuals were treated during follow-up treatments. In addition to the previously documented population, a new population was observed at the southern end of the Mitigation Site, next to Elizabeth Lake Road. This medusahead population flowered and set seed between maintenance inspection visits. Additional maintenance inspections targeting medusahead will be implemented in 2024.

Perennial pepperweed, a broad-leaved plant species ranked High by Cal-IPC, observed for the first time at the Mitigation Site in 2021, continues to be treated in the areas it was observed. One population has expanded and is now present in low densities at the DG4 monitoring transect (Figure 4). Land Veritas staff have been trained or retrained on the identification of this species and best practices for controlling perennial pepperweed, and efforts to control populations of perennial pepperweed are ongoing.

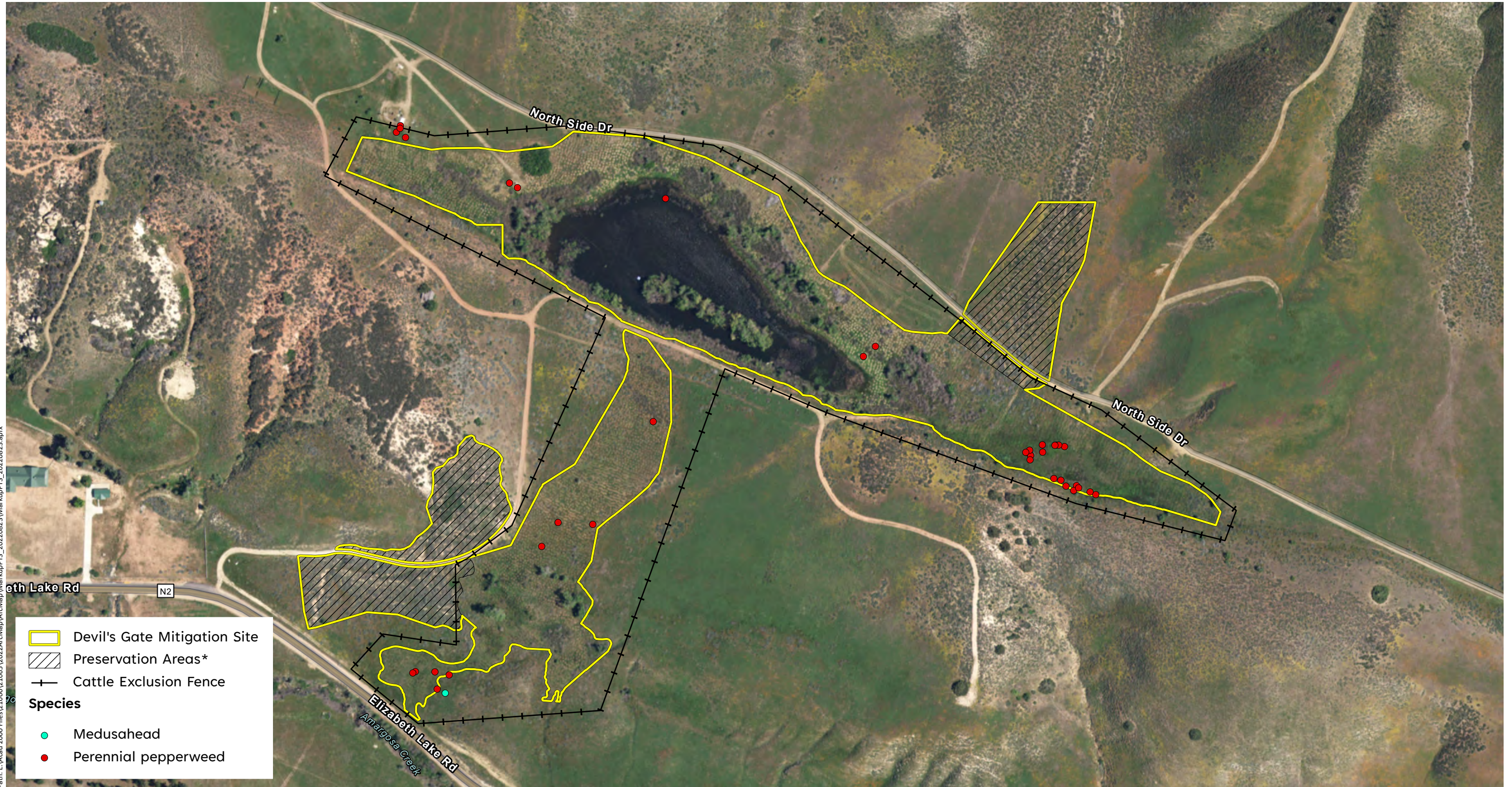
The results of the Year 4 target NNIP species mapping are shown on Figure 6.

In addition to the NNIPs targeted for management, other NNIPs of regional or local concern are also present within the Mitigation Site, including:

- Three Cal-IPC Moderate species: one non-native grass (ripgut brome) and two broad-leaved species (bull thistle [*Cirsium vulgare*] and short-pod mustard [*Hirschfeldia incana*]);
- One Cal-IPC Limited species: horehound (*Marrubium vulgare*); and
- One unrated broad-leaved species: annual yellow sweetclover (*Melilotus indicus*).

Land Veritas staff have been trained on the identification of these species and appropriate control strategies to facilitate rapid weed management efforts upon observation during regular surveys of the Mitigation Site throughout the year.



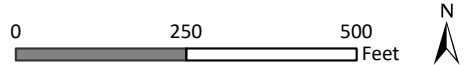
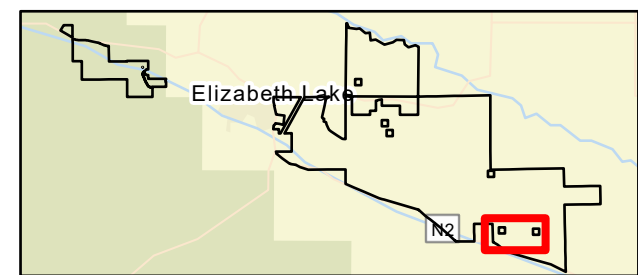


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Sources: USDA NAIP Imagery 2022, WRA | Prepared By: njander, 9/8/2023

**Figure 6. Target Non-Native Invasive Plants within Mitigation Site Planting Areas**

\*Not surveyed for NNIPs.





### 5.2.3 Cattle Exclusion Fencing

Installation of the cattle exclusion fencing and associated gates was completed concurrent with restoration activities in early 2019. The fence remains intact, cattle have been successfully excluded from the Mitigation Site, and no major repairs to the fence have been required.

### 5.2.4 Hydrologic Conditions

Continuous irrigation of the Mitigation Site ended in the Fall of 2022. Maintenance of the irrigation system will continue as needed, which includes system flushes and vegetation management in the immediate vicinity of control mechanisms. Irrigation will not be renewed during the interim management period unless there is major risk of mass mortality among the planted mulefat and willow. During the Long-Term Management Period, irrigation will continue on an as-needed basis.



## 6 SUMMARY AND MANAGEMENT RECOMMENDATIONS

### 6.1 Performance Monitoring Summary

#### 6.1.1 Mulefat and Willows Cover and Survivorship

The Year 4 performance standard states, “The planting areas must contain 40% or more absolute cover of mulefat and willow”. Year 4 annual performance monitoring results indicate that the average combined cover of mulefat and willow is 43% using the monitoring transects (Table 3) and 67% using the UAV multispectral analysis (Table 4), which both surpass the Year 4 performance standard.

Although the Mitigation Site is meeting the Year 4 performance standards, the annual monitoring data indicates relatively low cover of mulefat and willow at transect DG2 and DG4. The likely reason for the relatively low cover at DG2 is prolonged ponding and heavy soils, and DG4 contains heavy soils. Despite the low mulefat and willow cover, these transects are dominated by native wetland species. Year 4 annual monitoring at DG2 revealed the total absolute cover of native species is 101%, with the dominant native species consisting of beardless wild rye (41% absolute cover), mulefat (16% absolute cover), Mexican rush (12% absolute cover), tarragon (9% absolute cover), and red willow (*Salix laevigata*; 8% absolute cover). Year 4 annual monitoring at DG4 revealed the total absolute cover of native species is 77%, with the dominant native species consisting of mulefat (20% absolute cover), field sedge (20% absolute cover), gumweed (*Grindelia camporum*; 14% absolute cover), and Mexican rush (8% absolute cover). While there is relatively low cover of mulefat and willow at these transects, the prevalence of native wetland species and the presence of a mixture of open canopy and closed canopy habitat types is consistent with the objective seeking to improve the riparian habitat structure and increase the riparian habitat diversity (Section 1.2, WRA 2018). As such, no management actions are recommended.

In addition to required transect monitoring, UAV multispectral analysis was conducted to supplement transect monitoring data. The results of this analysis indicate that the absolute cover of native wetland and riparian vegetation within the planting areas is 85%, including 76% native riparian vegetation of which 67% is comprised of mulefat and willow. (Table 4). These results support direct observations that the actual cover of mulefat and willow is higher than the cover observed at the monitoring transects, and that across the planting areas the mitigation actions have resulted in more than 85% cover of native riparian and wetland habitats, which is consistent with the goal of the HMMP. We recommend the use of UAV multispectral analysis for Year 5 performance monitoring. We also recommend that the performance monitoring results for absolute cover of all native wetland and riparian species be included in determining whether the performance standard is being met.

Finally, the primary goal of the Project is to create mitigation areas that could provide suitable habitat for federally and state-listed species, including least Bell’s vireo (*Vireo bellii pusillus*; WRA 2018). The total riparian cover across the entire planting area is 77%, which is greater than the mean riparian vegetation required for least Bell’s vireo habitat as determined by the habitat suitability model developed by the United States Geological Survey Wildlife Program (Preston *et al.* 2021). This includes cover from mulefat (64% absolute cover), willow (3% absolute cover), Fremont cottonwood (8% absolute cover), and desert olive (*Forestiera pubescens*; 1% absolute cover).

**The Mitigation Site is meeting the Year 4 performance standard for absolute cover of mulefat and willow.**



### 6.1.2 Cal-IPC High Broad-Leaved Invasive Species Cover

The Year 4 performance standard for non-native invasive cover at the Mitigation Site is, “Percent cover of Cal-IPC rated High broad-leaved invasive plant species must cover no more than 10% absolute cover of the Mitigation Site”. Year 4 annual monitoring revealed no cover of Cal-IPC High broad-leaved invasive plant species at the monitoring transects (Table 3); however, one Cal-IPC High rated broad-leaved invasive species individual is known to occur at the Mitigation Site, perennial pepperweed. The distribution of perennial pepperweed throughout the Mitigation Site is known and has been documented for multiple years (Figure 6). Treatment for this species is underway; however, some occurrences are more established and will take several years to eradicate.

**The Mitigation Site is meeting the Year 4 performance standard for percent absolute cover of Cal-IPC rated High broad-leaved invasive plant species.**

## 6.2 Management Recommendations

### 6.2.1 Biological Resources

NNIPs surrounding each planted stake are cleared in the spring and managed throughout the growing season. It is recommended that NNIP treatment within the Mitigation Site continue in conjunction with invasive species treatments across the rest of the Bank Property.

Specific NNIP management actions may include:

- Regular qualitative surveys for target NNIP species by Land Veritas staff;
- Implementation of best management practices for individual NNIP species as issues arise;
- Focused eradication efforts of target NNIP species documented in the Mitigation Site, such as perennial pepperweed and medusahead; and
- Regular training of Land Veritas staff on identification of target and other NNIP species of concern.

### 6.2.2 Infrastructure and Facilities

The Mitigation Site’s infrastructure and facilities will be subject to regular standard maintenance to ensure proper function. Land Veritas staff will complete regular and frequent walk-throughs of the Mitigation Site to identify potential maintenance needs, including the condition of the cattle exclusion fencing. Issues will be immediately addressed and repaired. Land Veritas staff will also survey the Mitigation Site for evidence of erosion following large rain events and implement erosion mitigation strategies as appropriate.



## 7 REFERENCES

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- Weih 2009** Weih, M. 2009. Genetic and environmental variation in spring and autumn phenology of biomass willows (*Salix* spp.): effects on shoot growth and nitrogen economy. *Tree Physiology* 29(12):1479-1490. Online at <https://doi.org/10.1093/treephys/tpp081>
- WRA 2013** WRA, Inc. Biological Resources Inventory: Petersen Ranch. Leona Valley, Los Angeles County, California. March 2013.
- WRA 2018** WRA, Inc. 2018. Devil's Gate Off-Site Mitigation Project Habitat Mitigation and Monitoring Plan. Petersen Ranch Mitigation Bank. Los Angeles County, California. October 2018.
- WRA 2019** WRA, Inc. 2019. Devil's Gate Off-Site Project As-Built Report Letter. April 23, 2019.



## APPENDIX A. ANNUAL MONITORING DATA













## APPENDIX B. MITIGATION SITE OBSERVED SPECIES LIST



Scientific Name	Common Name	Origin	Form	Rarity Status <sup>1</sup>	CAL-IPC Status <sup>2</sup>	Wetland Status <sup>3</sup>
<i>Acmispon americanus</i> var. <i>americanus</i>	Spanish lotus	native	annual herb	-	-	UPL
<i>Artemisia dracunculus</i>	Tarragon	native	perennial herb	-	-	FACU
<i>Asclepias fascicularis</i>	Milkweed	native	perennial herb	-	-	FAC
<i>Astragalus douglasii</i>	Douglas's milkvetch	native	perennial herb	-	-	-
<i>Baccharis salicifolia</i> ssp. <i>salicifolia</i>	Mule fat	native	shrub	-	-	FAC
<i>Bromus diandrus</i>	Ripgut brome	non-native (invasive)	annual grass	-	Moderate	-
<i>Bromus hordeaceus</i>	Soft chess	non-native (invasive)	annual grass	-	Limited	FACU
<i>Bromus rubens</i>	Red brome	non-native (invasive)	annual grass	-	High	UPL
<i>Bromus tectorum</i>	Cheat grass	non-native (invasive)	annual grass	-	High	-
<i>Carex praegracilis</i>	Field sedge	native	perennial grasslike herb	-	-	FACW
<i>Castilleja affinis</i> ssp. <i>affinis</i>	Coast Indian paint brush	native	perennial herb	-	-	-
<i>Cirsium vulgare</i>	Bullthistle	non-native (invasive)	perennial herb	-	Moderate	FACU
<i>Corethrogyne filaginifolia</i>	Common sandaster	native	perennial herb	-	-	-
<i>Croton setiger</i>	Turkey-mullein	native	perennial herb	-	-	-

Scientific Name	Common Name	Origin	Form	Rarity Status <sup>1</sup>	CAL-IPC Status <sup>2</sup>	Wetland Status <sup>3</sup>
<i>Cucurbita foetidissima</i>	Missouri gourd	native	perennial herb, vine	-	-	-
<i>Datura wrightii</i>	Jimsonweed	native	perennial herb	-	-	UPL
<i>Descurainia sophia</i>	Herb sophia	non-native (invasive)	annual herb	-	Limited	-
<i>Distichlis spicata</i>	Salt grass	native	perennial grass	-	-	FAC
<i>Elymus triticoides</i>	Beardless wild rye	native	perennial grass	-	-	FAC
<i>Ericameria linearifolia</i>	Interior goldenbush	native	shrub	-	-	-
<i>Ericameria nauseosa</i>	Rubber rabbitbrush	native	shrub	-	-	-
<i>Erigeron canadensis</i>	Canada horseweed	native	annual herb	-	-	FACU
<i>Eriogonum davidsonii</i>	Davidson buckwheat	native	annual herb	-	-	-
<i>Eriogonum elongatum</i> var. <i>elongatum</i>	Long stemmed buckwheat	native	perennial herb	-	-	-
<i>Euthamia occidentalis</i>	Western goldenrod	native	perennial herb	-	-	FACW
<i>Festuca myuros</i>	Rattail sixweeks grass	non-native (invasive)	annual grass	-	Moderate	FACU
<i>Grindelia camporum</i>	Gumweed	native	perennial herb	-	-	FACW
<i>Helianthus annuus</i>	Hairy leaved sunflower	native	annual herb	-	-	FACU

Scientific Name	Common Name	Origin	Form	Rarity Status <sup>1</sup>	CAL-IPC Status <sup>2</sup>	Wetland Status <sup>3</sup>
<i>Heliotropium curassavicum</i> var. <i>oculatum</i>	Seaside heliotrope	native	perennial herb	-	-	FACU
<i>Hirschfeldia incana</i>	Short-podded mustard	non-native (invasive)	perennial herb	-	Moderate	-
<i>Hordeum murinum</i>	Foxtail barley	non-native (invasive)	annual grass	-	Moderate	FACU
<i>Juncus mexicanus</i>	Mexican rush	native	perennial grasslike herb	-	-	FACW
<i>Juncus orthophyllus</i>	Straight leaved rush	native	perennial grasslike herb	-	-	FACW
<i>Lactuca serriola</i>	Prickly lettuce	non-native	annual herb	-	-	FACU
<i>Lepidium appelianum</i>	Hairy whitetop	non-native (invasive)	perennial herb	-	Limited	UPL
<i>Malvella leprosa</i>	Alkali mallow	native	perennial herb	-	-	FACU
<i>Marrubium vulgare</i>	White horehound	non-native (invasive)	perennial herb	-	Limited	FACU
<i>Melilotus albus</i>	White sweetclover	non-native	annual, biennial herb	-	-	-
<i>Melilotus indicus</i>	Annual yellow sweetclover	non-native	annual herb	-	-	FACU
<i>Polypogon monspeliensis</i>	Annual beard grass	non-native (invasive)	annual grass	-	Limited	FACW
<i>Pseudognaphalium californicum</i>	Ladies' tobacco	native	annual, perennial herb	-	-	-

Scientific Name	Common Name	Origin	Form	Rarity Status <sup>1</sup>	CAL-IPC Status <sup>2</sup>	Wetland Status <sup>3</sup>
<i>Rumex crispus</i>	Curly dock	non-native (invasive)	perennial herb	-	Limited	FAC
<i>Salix laevigata</i>	Red willow	native	tree	-	-	FACW
<i>Senecio flaccidus</i>	Shrubby ragwort	native	shrub	-	-	-
<i>Sidalcea malviflora</i>	Wild hollyhock	native	perennial herb	-	-	FACW
<i>Solanum xanti</i>	Nightshade	native	perennial herb, shrub	-	-	-
<i>Sonchus asper</i> ssp. <i>asper</i>	Prickly sow thistle	non-native	annual herb	-	-	FAC
<i>Stachys albens</i>	Cobwebby hedge nettle	native	perennial herb	-	-	OBL
<i>Stipa lepida</i>	Foothill needle grass	native	perennial grass	-	-	-
<i>Stipa pulchra</i>	Purple needle grass	native	perennial grass	-	-	-
<i>Tragopogon dubius</i>	Goat's beard	non-native	perennial herb	-	-	-
<i>Urtica dioica</i>	Stinging nettle	native	perennial herb	-	-	FAC
<i>Verbena lasiostachys</i>	Western vervain	native	perennial herb	-	-	FAC

All species identified using the *Jepson eFlora* [Jepson Flora Project (eds.) 2023]; nomenclature follows *Jepson eFlora* [Jepson Flora Project (eds.) 2023] or Inventory of Rare and Endangered Plants (CNPS 2023). Sp.: "species", intended to indicate that the observer was confident in the identity of the genus but uncertain which species.

<sup>1</sup> **California Native Plant Society. 2019. Inventory of Rare and Endangered Plants (online edition, v9-01 1.5). Sacramento, California. Online at: <http://rareplants.cnps.org/>; most recently accessed: September 2023.**

FE:	Federal Endangered
FT:	Federal Threatened
SE:	State Endangered
ST:	State Threatened
SR:	State Rare
Rank 1A:	Plants presumed extinct in California
Rank 1B:	Plants rare, threatened, or endangered in California and elsewhere
Rank 2:	Plants rare, threatened, or endangered in California, but more common elsewhere
Rank 3:	Plants about which we need more information – a review list
Rank 4:	Plants of limited distribution – a watch list

<sup>2</sup> **California Invasive Plant Council. 2019. California Invasive Plant Inventory Database. California Invasive Plant Council, Berkeley, CA. Online at: <http://www.cal-ipc.org/paf/>; most recently accessed: September 2023.**

High:	Severe ecological impacts; high rates of dispersal and establishment; most are widely distributed ecologically.
Moderate:	Substantial and apparent ecological impacts; moderate-high rates of dispersal, establishment dependent on disturbance; limited-moderate distribution ecologically
Limited:	Minor or not well documented ecological impacts; low-moderate rate of invasiveness; limited distribution ecologically
Assessed:	Assessed by Cal-IPC and determined to not be an existing current threat

<sup>3</sup> **U.S. Army Corps of Engineers. 2020. National Wetland Plant List, version 3.5. Engineer Research and Development Center. Cold Regions Research and Engineering Laboratory, Hanover, NH. Online at: <http://wetland-plants.usace.army.mil/>; most recently accessed: September 2023**

OBL:	Almost always found in wetlands
FACW:	Usually found in wetlands
FAC:	Equally found in wetlands and uplands
FACU:	Usually not found in wetlands
UPL:	Almost never found in wetlands
NL:	Not listed, assumed almost never found in wetlands
NI:	No information; not factored during wetland delineation

## APPENDIX C. PHOTO MONITORING AND TRANSECT PHOTO







Pre-restoration photo of western lobe of Mitigation Site looking to the northwest.



Western lobe of Mitigation Site looking to the northwest. Taken September 10, 2020.



Western lobe of Mitigation Site looking to the northwest. Taken June 24, 2021.



Western lobe of Mitigation Site looking to the northwest. Taken July 29, 2022.



Western lobe of Mitigation Site looking to the northwest. Taken July 26, 2023.



Pre-restoration photo of the northern section of the Mitigation Site looking to the northeast.



Northern section of the Mitigation Site looking to the northeast. Taken September 10, 2020.



Northern section of the Mitigation Site looking to the northeast. Taken June 24, 2021.



Northern section of the Mitigation Site looking to the northeast. Taken July 29, 2022.



Northern section of the Mitigation Site looking to the northeast. Taken July 26, 2023.



Pre-restoration photo of southern section of Mitigation Site looking to the southeast.



Southern section of the Mitigation Site looking to the southeast. Taken September 10, 2020.



Southern section of the Mitigation Site looking to the southeast. Taken June 24, 2021.



Southern section of the Mitigation Site looking to the southeast. Taken July 29, 2022.



Southern section of the Mitigation Site looking to the southeast. Taken July 26, 2023.



Pre restoration photo of the Mitigation Site taken from the northeastern lobe looking to the northwest.



Mitigation Site taken from the northeastern lobe looking to the northwest. Taken September 11, 2020.



Mitigation Site taken from the northeastern lobe looking to the northwest. Taken June 24, 2021.



Mitigation Site taken from the northeastern lobe looking to the northwest. Taken July 29, 2022.



Mitigation Site taken from the northeastern lobe looking to the northwest.  
Taken July 26, 2023.





Transect DG1 Start. Taken July 27, 2023.



Transect DG1 End. Taken July 27, 2023.



Transect DG2 Start. Taken July 26, 2023.



Transect DG2 End. Taken July 26, 2023



Transect DG3 Start. Taken July 26, 2023.



Transect DG3 End. Taken July 26, 2023.



Transect DG4 Start. Taken July 26, 2023.



Transect DG4 End. Taken July 26, 2023.