

# Laguna Creek Restoration and Management Plan

JANUARY 2022



*Prepared by*



*With Technical Assistance from:*

**cbec eco engineering  
H.T. Harvey & Associates  
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# **Laguna Creek Restoration and Management Plan**

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- Attachment A Existing Plant Species
- Attachment B Special-status Species Known to Occur in the Vicinity of the Plan Area
- Attachment C Recommended Plant Palette by Habitat Type
- Attachment D Non-native Vegetation Management Plan

## Acronyms and Abbreviations

°F	degrees Fahrenheit
<b>A</b>	
ANSI	American National Standards Institute
ASTM	American Society for Testing and Materials
<b>B</b>	
bgs	below ground surface
BMP	best management practice
<b>C</b>	
Cal-IPC	California Invasive Plant Council
CDFW	California Department of Fish and Wildlife
CE	categorical exemption
CEAT	contractor environmental awareness training
CEQA	California Environmental Quality Act
CGS	California Geological Survey
City	City of Elk Grove
CNDDB	California Natural Diversity Database
CNPS	California Native Plant Society
CSD	Community Services District
<b>D</b>	
dbh	diameter at breast height
<b>F</b>	
FEMA	Federal Emergency Management Agency
<b>I</b>	
Interim MGs	Interim Maintenance Guidelines
<b>L</b>	
LCWC	Laguna Creek Watershed Council
<b>M</b>	
MND	mitigated negative declaration
msl	mean sea level
<b>N</b>	
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NRCS	Natural Resource Conservation Service
<b>O</b>	
OHWM	ordinary high water mark

**P**

PPE personal protective equipment

**R**

RGP Regional General Permit

RMP Restoration and Management Plan

RSP rock slope protection

**S**

SAA Streambed Alteration Agreement

SDMP Storm Drainage Master Plan

**U**

USACE U.S. Army Corps of Engineers

USFWS U.S. Fish and Wildlife Service

USGS U.S. Geological Survey

**V**

VRP verification request form

**W**

WPA Works Project Administration

WRCC Western Regional Climate Center



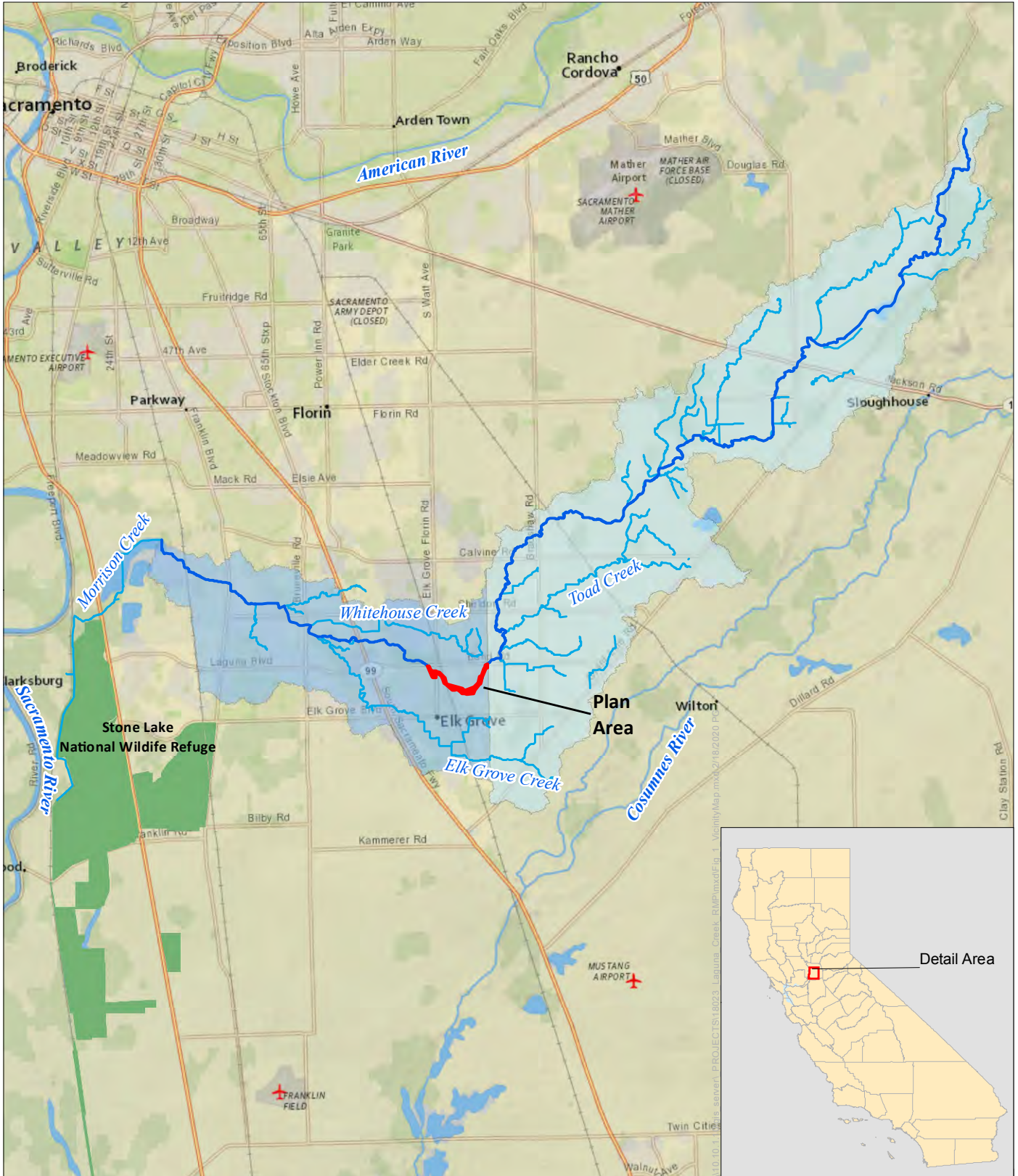
## 1.0 Purpose and Goals of the Laguna Creek Restoration and Management Plan

The City of Elk Grove (City) has developed the Laguna Creek Restoration and Management Plan (RMP) to document routine maintenance activities and identify restoration and management priorities along a 1.75-mile segment of Laguna Creek in Elk Grove. The RMP area encompasses Laguna Creek and its associated riparian corridor from the Bond Road/Waterman Road intersection downstream to the creek crossing downstream of the Bond Road/Elk Grove-Florin Road intersection (see **Figure 1**). To simplify the discussion of various portions of the creek, the RMP area has been divided into four reaches (see **Figure 2**). The RMP would (1) guide routine maintenance activities for Laguna Creek within the RMP area, including vegetation and sediment management activities, methods, and impact avoidance techniques; and (2) identify a vision for ecological restoration and long-term management along this creek segment.

### 1.1 Goals of the Laguna Creek Restoration and Management Plan

The RMP is intended to provide consistent implementation guidance for the City's maintenance program on this portion of Laguna Creek, while also allowing the City flexibility to adapt to manage changing ecosystem conditions over the long term. The overall goals of the RMP are as follows:

- Improve the structural and ecosystem health of the plan area;
- Increase native vegetation throughout the site in all vegetation strata (tree, shrub, and understory);
- Remove or control non-native vegetation consistent with regulatory permitting requirements;
- Reflect stakeholder priorities;
- Engage community volunteers in initial planning efforts and ongoing maintenance activities; and
- Identify best management practices that will assist the City with reducing flood risk.



**Figure 1**  
**Laguna Creek Watershed**

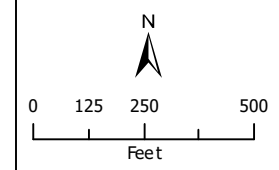
Laguna Creek Restoration and Management Plan

█ Plan Area  
█ Laguna Creek  
█ Other Laguna Creek Watershed Creeks  
█ Upper Laguna Creek Watershed  
█ Lower Laguna Creek Watershed

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**Horizon**  
 WATER AND ENVIRONMENT



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Plan Area  
 LagunaCreek



**Figure 2**  
Laguna Creek Restoration and Management Plan Area

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### 1.1.1 RMP Purpose

Laguna Creek serves two primary roles for the Elk Grove community—stormwater/flood control management and an open space/habitat corridor. To balance Laguna Creek’s dual roles, the RMP balances stormwater management and flood control needs with goals to protect, restore, and enhance natural resources along the creek corridor. The RMP addresses short-term, immediate maintenance issues related to vegetation management, bank stability, and erosion control but also clearly identifies medium-term and longer-term steps and strategies to improve ecologic function while maintaining flood conveyance capacity. Reach-specific guidance has been developed that meets flood management needs while moving toward an improved ecological condition based on a longer-term vision for the creek. This information is intended to provide the City with a roadmap toward improving the ecosystem health of this portion of Laguna Creek, in cooperation with partners such as the Cosumnes Community Services District (CSD) and stakeholders such as the Laguna Creek Watershed Council (LCWC).

## 1.2 Development of the RMP

The RMP includes information from site visits, technical documents developed by the RMP team, and technical documents previously developed by others. The RMP team conducted site visits on April 30, 2018; December 27, 2019; and January 20, 2020. Technical documents developed by the RMP team include the following:

- Preliminary Restoration and Enhancement Recommendations to Accompany the Laguna Creek Restoration and Maintenance Plan (H.T. Harvey 2020); and
- Laguna Creek RMP Site Evaluation Memorandum (cbec 2020).

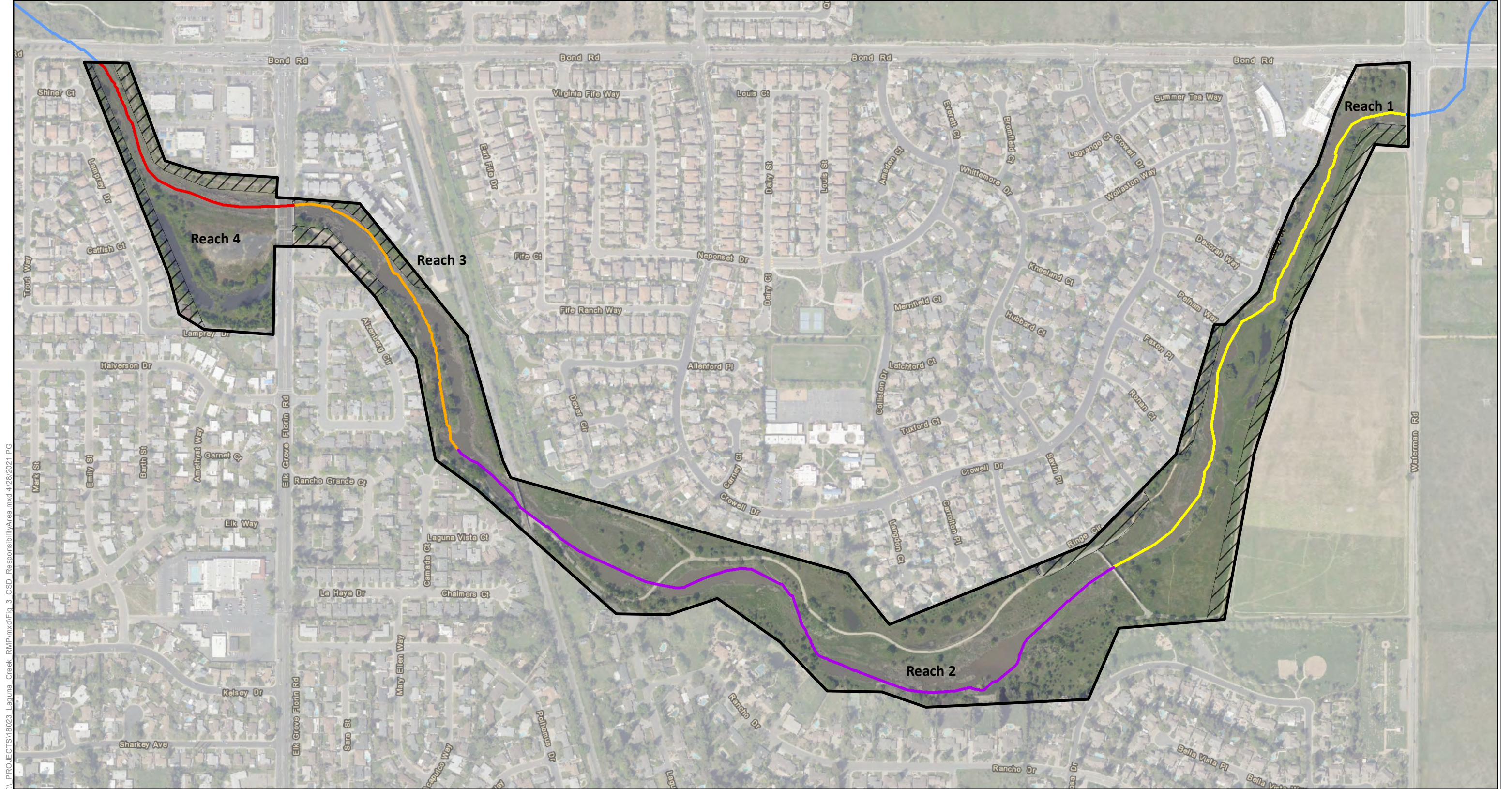
To leverage existing data and to incorporate known stakeholder goals and priorities, previously developed documents were also consulted:

- Laguna Creek Watershed Management Action Plan (CKB Environmental Consulting, Inc et al. 2009);
- Storm Drainage Master Plan (City of Elk Grove 2011, including 2019 Minor Update); and
- Streambed Alteration Agreement 1600-2016-0034-R2.

## 1.3 Implementation of the RMP

The RMP describes maintenance, management, and restoration activities for the stretch of Laguna Creek from the Bond Road/Waterman Road intersection on the east to the Bond Road overcrossing of the creek on the west. Some portions of this area are maintained and managed by the CSD (see **Figure 3**). Following adoption of the RMP, the City and the CSD would jointly conduct routine maintenance activities and accomplish long-term restoration and management goals in accordance with the RMP. More details about RMP implementation and monitoring are provided in Section 8.

Each year, the City would develop a seasonal workplan listing proposed maintenance, restoration, and management activities and locations. The City would identify proposed activities and locations on the basis of current site conditions; the routine maintenance guidelines provided in Section 4 of this RMP; and the restoration and management recommendations identified in Section 5 of this RMP. In conjunction with development of the seasonal workplan and to track the success of various activities, the City would conduct annual monitoring of the channel and bank conditions. Because both the City and the CSD are responsible for portions of the RMP area, the City would coordinate with the CSD regarding proposed activities at sites for which the CSD is responsible (depicted in Figure 3). For identified maintenance activities, the seasonal workplan would include a review of the functional standard or objective for each activity and would identify best management practices (BMPs) to be implemented to avoid and/or minimize potential impacts on natural resources. For restoration and management activities, the seasonal workplan would identify stakeholders and/or implementation partners, funding sources, reach-specific management recommendations that would be addressed, and applicable BMPs.



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**Figure 3**  
Cosumnes CSD Responsibility Area



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## 1.4 Organization of the RMP

The RMP includes the following sections:

**Section 1 – Purpose and Goals of the Laguna Creek Restoration and Management Plan** describes the intended purpose of the RMP and the goals that would be accomplished by its implementation. This section also identifies the agencies and entities that would implement the plan.

**Section 2 – Background of the Laguna Creek RMP** provides a brief history of management activities in the Laguna Creek watershed and describes the planning process that has led to the development of this RMP.

**Section 3 – RMP Setting** describes the physical setting and biological resources in the plan area, to orient the reader regarding the types of conditions and resources that would be targeted by maintenance, restoration, and management activities.

**Section 4 – Routine Maintenance Activities** provides detailed descriptions of routine maintenance activities conducted in the plan area, along with impact avoidance and minimization measures to reduce potential environmental impacts of those activities. This section includes specific triggers and criteria to guide the determination of when maintenance should occur.

**Section 5 – Reach-specific Restoration and Management Recommendations** describes site-specific geographic, hydrologic, and natural resource conditions within each of the four plan reaches. For each reach, the discussion describes the ecological vision, potential constraints and opportunities, and specific recommendations. This section also contains recommendations and a preliminary conceptual plan for restoration of the Old Hatchery Site in Reach 4.

**Section 6 – Summary and Comparison of Restoration and Management Opportunities** provides a summary of the opportunities listed for each reach and identifies their need for CEQA documentation, additional permitting, estimated implementation cost, level of flood risk/damage reduction, and potential for ecological uplift.

**Section 7 – Best Management Practices and Impact Avoidance and Minimization Measures** describes the City’s approach to avoiding or minimizing environmental impacts of maintenance, restoration, and management activities.

**Section 8 – Plan Implementation, Reporting, and Monitoring** identifies plan implementation activities, including monitoring and annual reporting duties.

**Section 9 – References** lists the reference documents and materials used and cited within this RMP.

## 2.0 Background of the Laguna Creek RMP

### 2.1 General Conditions in the Laguna Creek Watershed

Laguna Creek is one of the primary creek corridors in southern Sacramento County. The creek flows approximately 25 miles and passes through Elk Grove in an east-west direction, feeding into Morrison Creek and then into the Stone Lakes National Wildlife Refuge (see Figure 1). The watershed consists of the Upper and Lower Laguna Creek watershed and is fed by several tributaries, including Elk Grove, Whitehouse, and Toad Creeks.

Because of its extent and the fact that it travels from rural southeastern Sacramento County, which is largely undeveloped, through the more developed Elk Grove area, Laguna Creek has consistently been a focus of stormwater and flood management planning for the County and, after incorporation, the City. Historically, the creek was dry much of the year, but agricultural and urban runoff have increasingly caused major sections of the creek to flow year-round. Urbanization has led to issues with minor flooding along the more developed portions of the creek, such as in Reach 2.

### 2.2 Overview of Past Watershed Activities

In 2011, the City, with input from the LCWC, other regional and local agencies, and community organizations, developed the City of Elk Grove Storm Drainage Master Plan (SDMP). Reflective of the collaboration between the City's Department of Public Works and environmental stakeholders, the guiding principles of the SDMP include taking maximum advantage of the natural hydrologic processes of the existing landscape; using alternative storm drainage and flood control management approaches instead of relying solely on engineering solutions; balancing considerations of the environment, cost, property, recreation, and public safety; and minimizing impacts on downstream areas.

Following adoption of the SDMP, the City developed a city-wide routine maintenance program for stream channels and drainage facilities. In 2016, as part of that program, the City entered into a 12-year Streambed Alteration Agreement (SAA) with the California Department of Fish and Wildlife (CDFW) and a Regional General Permit (RGP) with the U.S. Army Corps of Engineers (USACE).

These permits allow the City to conduct routine maintenance activities in improved and unimproved channels and drainage facilities, including:

- annual coverage for debris and obstruction removal up to 30 days;
- up to 10.25 acres of disturbance;
- removal of up to 5,934 cubic yards of debris and sediment; and
- placement of up to 660 square feet (44.1 cubic yards) of fill.

In 2016, the City conducted maintenance activities to address public safety and water quality issues associated with transient encampments along the portion of Laguna Creek near Elk

Grove-Florin Road and from Bond Road to the Union Pacific Railroad tracks. With assistance from local police, the City accomplished the goals of removing trash and debris, addressing transient issues, reducing fire hazards and overgrown vegetation, and maintaining creek capacity. LCWC, with support from local residents, brought to the City's attention that its maintenance procedures had unintended impacts on the character and aesthetic quality of the area with regard to vegetative appearance. As a result of discussions with the LCWC, the City decided to develop an RMP that would formalize ongoing maintenance practices while taking into account the concerns of local stakeholders.

## **2.3 Development of the RMP**

The City developed Interim Maintenance Guidelines (Interim MGs) in 2018. The City used the Interim MGs to guide routine maintenance activities in the RMP area while this full RMP was under development. The Interim MGs and restoration and management recommendations form the basis for the RMP and were developed in collaboration with City and CSD staff responsible for maintenance, restoration, and management activities within the RMP area. Input was also sought from the LCWC, residents and visitors along the creek, and other stakeholders.

As presented in this document, the RMP is consistent with the City's existing 12-year SAA (Notification No. 1600-2016-0034-R2) with CDFW.

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## 3.0 RMP Setting

Information about the existing physical and biological resources in the RMP area was used to inform the development of a sustainable long-term vision and goals for the project area on the Laguna Creek corridor. This information was also used to determine and identify the opportunities and constraints for the RMP area discussed in greater detail in Section 5, and helped to determine how measures can be used to avoid and/or minimize potential environmental effects.

### 3.1 Overview of the Laguna Creek Watershed

The watershed upstream of the RMP area covers 32.8 square miles (U.S. Geological Survey [USGS] 2018), while the entire Laguna Creek watershed covers approximately 65 square miles (CKB Environmental Consulting et al. 2009) (see Figure 1). The upper watershed is largely undeveloped rangeland, which transitions to low-density agricultural-residential development and finally to residential and commercial development in the lower watershed (CKB Environmental Consulting et al. 2009). Watershed land use is gradually becoming more urbanized over time as agricultural areas and grasslands are converted to single-family housing developments.

### 3.2 Geology and Soils

The RMP area is located within the Great Valley Geomorphic Province of California, a relatively flat alluvial plain in the central part of California between the Sierra Nevada to the east and the Coast Ranges to the west (California Geological Survey [CGS] 2002). Alluvium deposition has occurred over this 50-mile-wide by 400-mile-long floodplain almost continuously, with thick sequences of sedimentary deposits dating back approximately 160 million years. Locally, Laguna Creek is underlain by the Laguna Formation (consolidated alluvial deposits) in the headwaters and upper reaches and by Basin deposits (alluvium) in the middle and lower reaches (Wagner et al. 1981).

The RMP area generally contains loamy soils (e.g., Redding gravelly loam, Bruella sandy loam, San Joaquin silt loam) with an indurated or “hardpan” layer approximately 2 to 2.5 feet below the ground surface (bgs) (Natural Resource Conservation Service [NRCS] 2019). These soils are typically deep and well drained with moderate to high runoff and erosion by water.

This understanding of the geologic and soil resources along Laguna Creek provides insight into creek characteristics such as channel stability, erosion processes, and sediment supply, as well as channel bed and bank form and materials.

## 3.3 Climate and Hydrology

### 3.3.1 Climate

The Sacramento-Elk Grove region has a Mediterranean climate with hot, dry summers and cool, rainy winters. Temperatures range from average monthly highs of 93 degrees Fahrenheit (°F) in July to average monthly lows of 38°F in January (Western Regional Climate Center [WRCC] 2018). Average annual precipitation for the RMP area is approximately 17.2 inches, with precipitation occurring in the form of rain falling primarily from October through April (WRCC 2018). During the winter months, dense and persistent low-level fog condenses during periods of high relative humidity (typically after a heavy rain), calm winds, and rapid cooling during the night.

### 3.3.2 Surface Hydrology

The Sacramento-Elk Grove region has relatively flat topography traversed by a network of natural waterways, canals, and sloughs draining to the Sacramento River. The Laguna Creek watershed is a moderately sized, elongated drainage nestled between the American River watershed to the north and the Deer Creek and Cosumnes River watersheds to the south. The headwaters of Laguna Creek drain agricultural areas south of Rancho Cordova, approximately 19 miles northeast of the RMP area, before flowing westward toward the Sacramento River. Laguna Creek has a total flow length of approximately 25 miles from its headwaters to its confluence with Morrison Creek (CKB Environmental Consulting et al. 2009).

Laguna Creek is an ephemeral stream from its headwaters to Blodgett Reservoir and transitions to an intermittent stream from Blodgett Reservoir to approximately 0.5 mile south of Florin Road (CKB Environmental Consulting et al. 2009). The remainder of Laguna Creek is perennial due to water inputs from irrigated and urban lands (CKB Environmental Consulting et al. 2009).

The RMP area is relatively flat with approximate elevations of 62 feet above mean sea level (msl) at the upstream end at Waterman Road and 38 feet above msl at the downstream end at Bond Road).

### 3.3.3 Stormwater

The City maintains a storm drainage and flood control collection system (stormwater system) that consists of approximately 400 miles of underground pipes and 60 miles of constructed and natural channels (City of Elk Grove 2011, including 2019 Minor Update). Within the RMP area, Laguna Creek serves as a conveyance channel for stormwater flows, which affects the hydrology of the creek by increasing flows in the creek compared to historical conditions.

### 3.3.4 Floodplains

The Federal Emergency Management Agency (FEMA) produces flood insurance rate maps that identify special flood hazard areas. The maps further classify these areas into “zones” that broadly characterize the potential risk of an area being inundated by a 100-year or 500-year flood in any given year. According to the applicable FEMA flood insurance rate map (06067C0336H), the Laguna Creek corridor in the RMP area is designated as regulatory floodway, Zone AE with fringe area of 0.2 percent annual chance of flood (i.e., a 500-year floodplain) (FEMA 2012). The floodplain in the RMP area presents several opportunities for enhancement and flood management, as discussed further in the reach-specific guidelines provided in Section 5.

## 3.4 Biological Resources

### 3.4.1 Habitat Communities

This section describes the biological resources that occur in aquatic and terrestrial habitats that are potentially affected by activities covered by the RMP. **Attachment A** includes a species list of plants observed in the RMP area.

#### Perennial Stream

Laguna Creek in the RMP area is a perennial stream with earthen bed and banks; it has high flows during the winter and low flows augmented by irrigation/landscaping runoff water during the summer and fall. The channel varies from unvegetated to areas of dense emergent growth (see “Emergent Marsh” below). Laguna Creek may provide habitat for a variety of benthic invertebrates and fish species (e.g., bass (*Micropterus* spp.) and western mosquito fish [*Gambusia affinis*]) or other aquatic species. Amphibians such as Sierran treefrog (*Pseudacris sierra*) and American bullfrog (*Lithobates catesbeianus*) may also use this habitat. Reptiles that use Laguna Creek include non-native red-eared slider (*Trachemys scripta*) and native special-status species such as western pond turtle (*Emys marmorata*) and possibly giant garter snake (*Thamnophis gigas*). Aquatic mammals, such as river otter (*Lontra canadensis*), common muskrat (*Ondatra zibethicus*), and beaver (*Castor canadensis*), are known to frequent this area.

#### Emergent Marsh

Emergent marsh habitat consists mostly of tall, dense bulrush (*Schoenoplectus* sp.) and cattail (*Typha* sp.). Instream growth of bulrush and cattail varies throughout the creek but generally covers 50 to 95 percent of the channel where present. Rushes (*Juncus* spp.), tall flatsedge (*Cyperus eragrostis*), cocklebur (*Xanthium strumarium*), and curly dock (*Rumex crispus*) are also present but typically at slightly higher elevations on the channel bank that experience shorter periods of inundation. Emergent marsh is present along the channel margins and in some off-channel areas along Laguna Creek. Floating invasive aquatic vegetation such as water primrose (*Ludwigia* sp.) and water hyacinth (*Eichhornia crassipes*) is also present in some areas of the creek, mainly in Reaches 3 and 4.

Bird species such as red-winged blackbird (*Agelaius phoeniceus*) are regularly seen in this reach of the creek. Tricolored blackbird (*Agelaius tricolor*) may nest in bulrush or cattail stands. Waterfowl and wading birds (e.g., mallard [*Anas platyrhynchos*], American coot [*Fulica americana*], great egret [*Ardea alba*], snowy egret [*Egretta thula*], and great blue heron [*Ardea herodias*]) forage in this habitat.

### Seasonal Wetland

Seasonal wetlands are present in the RMP area in Reaches 1 and 2. Seasonal wetlands are inundated during the winter and spring but dry up by the summer months. Hydrology for seasonal wetlands in the RMP area is generally related to flows in Laguna Creek. Vegetation in these habitats includes cocklebur, rushes, and grasses adapted to seasonal inundation such as saltgrass (*Distichlis spicata*). Seasonal wetlands may provide habitat for species such as vernal pool branchiopods.

### Sandbar Willow Thickets

Sandbar willow thickets are dominated by sandbar willows (*Salix exigua*) with other tree species present in low numbers. Understory vegetation may include Himalayan blackberry (*Rubus armeniacus*) and tall flatsedge. In the RMP area, sandbar willow thickets are present in some portions of the creek banks in Reach 4. Beavers may use sandbar willow as browse, and various passerine species forage and/or nest in this habitat. Migratory birds utilize this habitat during seasonal migrations.

### Mixed Oak Woodland

Mixed oak woodland habitat in the RMP area is dominated by valley oak (*Quercus lobata*) and coast live oak (*Quercus agrifolia*). Understory typically includes the species described under “Ruderal/Nonnative Grassland” below but also includes plants such as Himalayan blackberry.

The oak woodland habitat areas along the RMP reaches of Laguna Creek are fragmented by urban and suburban land uses. Nevertheless, they may still support some of the common oak-associated wildlife species in the region. Year-round resident bird species include wild turkey (*Meleagris gallopavo*), ruby-crowned kinglet (*Corthylio calendula*), acorn woodpecker (*Melanerpes formicivorus*), Nuttall’s woodpecker (*Picoides nuttallii*), oak titmouse (*Baeolophus inornatus*), spotted towhee (*Pipilo maculatus*), lesser goldfinch (*Spinus psaltria*), white-crowned sparrow (*Zonotrichia leucophrys*), and Bewick’s wren (*Thryomanes bewickii*), among others.

Reptiles found in adjacent grassland habitats also occur regularly in oak woodland habitats. Mammals such as deer mouse (*Peromyscus maniculatus*), California mouse (*Peromyscus californicus*), and the introduced eastern ~~fox~~ squirrel (*Sciurus carolinensis*) nest and forage in this habitat. Bats may use hollows of large, old oak trees for roosting in open-canopy oak woodland. Larger mammals such as feral cats (*Felis catus*), coyote (*Canis latrans*), and non-native red fox (*Vulpes vulpes*) use the creek channel for foraging and as a movement corridor.



## Ruderal/Non-native Grassland

This habitat is characterized by non-native grasses (including Italian rye [*Festuca perennis*], wild oat [*Avena* sp.], ripgut brome [*Bromus diandrus*], and foxtail barley [*Hordeum murinum*]) and weedy forbs (e.g., Italian thistle [*Carduus pycnocephalus*], black mustard (*Brassica nigra*), and wild radish [*Raphanus sativus*]). Curly dock and prickly lettuce (*Lactuca serriola*) are also commonly occurring species. Some native grass species such as purple needlegrass (*Stipa pulchra*) are also present. Valley oak, coast live oak, and ornamental trees may occasionally occur in this habitat type.

Ruderal/non-native grassland can provide habitat for wildlife such as western fence lizard (*Sceloporus occidentalis*), mice (*Peromyscus* spp.), California ground squirrel (*Spermophilus beecheyi*), raccoons (*Procyon lotor*), striped skunk (*Mephitis mephitis*), and coyote. Bird species may also forage in ruderal/nonnative grassland habitat for seeds, as well as invertebrates and other prey.

### 3.4.2 Special-status Species

Special-status species with the potential to occur in the RMP area are listed in **Table 1** below. A full list of special-status species known to occur in the vicinity of the RMP area and their potential to occur is provided in **Attachment B**.

For the purposes of this RMP, special-status species are those that are listed as rare, species of concern, candidate, threatened, or endangered by the U.S. Fish and Wildlife Service (USFWS), the National Marine Fisheries Service (NMFS), and CDFW. Special-status plant and animal species with the potential to occur in the RMP area were identified through a review of the following resources:

- USFWS list of federally endangered and threatened species that occur within the vicinity of the Plan area (USFWS 2019);
- California Natural Diversity Database (CNDDDB) queries for the nine quadrangles containing and surrounding the Plan area (CDFW 2019); and
- California Native Plant Society's (CNPS's) Inventory of Rare and Endangered Plants of California (CNPS 2019).

The potential for each species to occur in the Plan area was assessed using the criteria outlined below.

**None:** the area contains a complete lack of suitable habitat, the local range for the species is restricted, and/or the species is extirpated in this region.

**Not Expected:** suitable habitat or key habitat elements might be present but might be of poor quality or isolated from the nearest extant occurrences, and/or the species is not known to occur in the area.

**Possible:** presence of suitable habitat or key habitat elements that potentially support the species.

**Present:** the species was either observed directly or its presence was confirmed by field investigations or in previous studies in the area.

**Table 1. Special-status Species with Potential to Occur in the Plan Area**

Name	Listing Status* (Federal/State/CNPS)	Habitat and Flowering Period	Potential to Occur in the Project
<b>Plants</b>			
<i>Downingia pusilla</i> dwarf downingia	- / - / 2B.2	Valley and foothill grassland (mesic sites), vernal pools. Vernal lake and pool margins with a variety of associates. In several types of vernal pools. Elevation 1-490 meters.	<b>Possible.</b> Suitable habitat is present in the seasonal pool in the Plan area.
<i>Gratiola heterosepala</i> Boggs Lake hedge-hyssop	- / SE / 1B.2	Marshes and swamps (freshwater), vernal pools. Clay soils; usually in vernal pools, sometimes on lake margins. 4-2,410 meters.	<b>Possible.</b> Suitable habitat is present in the seasonal pool in the Plan area.
<i>Hibiscus lasiocarpus</i> var. <i>occidentalis</i> woolly rose-mallow	- / - / 1B.2	Marshes and swamps (freshwater). Moist, freshwater-soaked riverbanks and low peat islands in sloughs; can also occur on riprap and levees. In California, known from the delta watershed. 0-155 meters.	<b>Possible.</b> Potentially suitable habitat is present in Laguna Creek in the Plan area.
<i>Legenere limosa</i> legenere	- / - / 1B.1	Vernal pools. In beds of vernal pools. 1-1,005 meters.	<b>Possible.</b> Suitable habitat is present in the seasonal pool in the Plan area.
<i>Sagittaria sanfordii</i> Sanford's arrowhead	- / - / 1B.2	Marshes and swamps. In standing or slow-moving freshwater ponds, marshes, and ditches. 0-605 meters.	<b>Possible.</b> Potentially suitable habitat is present in Laguna Creek in the Plan area.
<b>Invertebrates</b>			
<i>Branchinecta lynchi</i> vernal pool fairy shrimp	FT / -	Endemic to the grasslands of the Central Valley, Central Coast mountains, and South Coast mountains, in astatic rain-filled pools. Inhabit small, clear-water sandstone-depression pools and grassed swale, earth slump, or basalt-flow depression pools.	<b>Possible.</b> Suitable habitat is present in the seasonal pool in the Plan area.
<i>Desmocerus californicus dimorphus</i> valley elderberry longhorn beetle	FT / -	Occurs only in the Central Valley of California, in association with blue elderberry ( <i>Sambucus nigra</i> ssp. <i>caerulea</i> ). Prefers to lay eggs in elderberries 2-8 inches in diameter; some preference shown for "stressed" elderberries.	<b>Possible.</b> Possible if elderberries are present.
<i>Lepidurus packardii</i> vernal pool tadpole shrimp	FE / -	Inhabits vernal pools and swales in the Sacramento Valley containing clear to highly turbid water. Pools commonly found in grass-bottomed swales of unplowed grasslands. Some pools are mud-bottomed and highly turbid.	<b>Possible.</b> Suitable habitat is present in the seasonal pool in the Plan area.

Name	Listing Status* (Federal/ State/CNPS)	Habitat and Flowering Period	Potential to Occur in the Project
<b>Reptiles</b>			
<i>Emys marmorata</i> western pond turtle	– / SSC	A thoroughly aquatic turtle of ponds, marshes, rivers, streams, and irrigation ditches, usually with aquatic vegetation, below 6,000 ft elevation. Need basking sites and suitable (sandy banks or grassy open fields) upland habitat up to 0.5 kilometer from water for egg-laying.	<b>Present.</b> This species was observed within the Plan area (California Natural Diversity Database [CNDDDB] occurrence #532).
<i>Thamnophis gigas</i> giant gartersnake	FT / ST	Prefers freshwater marsh and low gradient streams. Has adapted to drainage canals and irrigation ditches. This is the most aquatic of the gartersnakes in California.	<b>Possible.</b> Potentially suitable habitat is present in the Plan area.
<b>Birds</b>			
<i>Agelaius tricolor</i> tricolored blackbird	– / ST, SSC	Highly colonial species, most numerous in Central Valley and vicinity. Largely endemic to California. Requires open water, protected nesting substrate, and foraging area with insect prey within a few kilometers of the colony.	<b>Possible.</b> Potentially suitable habitat is present in the Plan area.
<i>Buteo swainsoni</i> Swainson’s hawk	– / ST	Breeds in grasslands with scattered trees, juniper-sage flats, riparian areas, savannahs, and agricultural or ranch lands with groves or lines of trees. Requires adjacent suitable foraging areas such as grasslands, or alfalfa or grain fields supporting rodent populations.	<b>Possible.</b> Potentially suitable nesting and foraging habitat is present in the Plan area.
<i>Elanus leucurus</i> white-tailed kite	– / FP	Rolling foothills and valley margins with scattered oaks and river bottomlands or marshes next to deciduous woodlands. Open grasslands, meadows, or marshes for foraging close to isolated, dense-topped trees for nesting and perching.	<b>Present.</b> Observed in the Plan area (ebird 2019).
<i>Melospiza melodia</i> song sparrow (“Modesto” population)	– / SSC	Typically, emergent freshwater marshes dominated by tules ( <i>Scirpus</i> spp.) and cattails ( <i>Typha</i> spp.) as well as riparian willow ( <i>Salix</i> spp.) and valley oak ( <i>Quercus lobata</i> ) (Gardali 2008).	<b>Possible.</b> Potentially suitable habitat is present in the Plan area.
<i>Xanthocephalus</i> yellow-headed blackbird	– / SSC	Nests in freshwater emergent wetlands with dense vegetation and deep water. Often along borders of lakes or ponds. Nests only where large insects such as <i>Odonata</i> are abundant, nesting timed with maximum emergence of aquatic insects.	<b>Possible.</b> Potentially suitable habitat is present in the Plan area.

**\*Federal and State Species Status:**

- FE = Federal endangered
- FT = Federal threatened
- SE = State endangered
- ST = State threatened
- SSC = Species of special concern
- FP = State fully protected
- SR = State rare

**\*CNPS Rare Plant Ranks:**

- 1B = Plants rare, threatened, or endangered in California and elsewhere
  - 2B = Plants rare, threatened, or endangered in California but more common elsewhere
- Threat Ranks:**
- 0.1 = Seriously threatened in California
  - 0.2 = Moderately threatened in California

### 3.4.1 Invasive Species

Invasive plant species in the Plan area include both woody and herbaceous species. Non-native and invasive woody species include Brazilian pepper trees (*Schinus terebinthifolius*), eucalyptus (*Eucalyptus* spp.), catalpa (*Catalpa* sp.), and Chinese tallowtree (*Triadica sebifera*).

Among herbaceous invasive species, plant species with a California Invasive Plant Council (Cal-IPC) ranking of High include Himalayan blackberry, medusahead (*Elymus caput-medusae*), Pampas grass (*Cortaderia selloana*), sweet fennel (*Foeniculum vulgare*), vervain (*Verbena* sp.), water primrose, and water hyacinth. Species with Cal-IPC ranking of Moderate include wild oats, Italian ryegrass, black mustard, ripgut brome, foxtail barley, Bermuda grass (*Cynodon dactylon*), Harding grass (*Phalaris aquatica*), and bull thistle (*Cirsium vulgare*). Species with a Cal-IPC ranking of Limited include calla lily (*Zantedeschia aethiopica*), wild radish, and curly dock.

Invasive wildlife in the Plan area includes red-eared slider, American bullfrog, and feral cats. Red-eared sliders are the primary introduced competitor to the western pond turtle, which is a species of special concern in California (Stebbins and McGinnis 2012). Feral cats are highly visible in Reaches 2 and 3, and homeowners appear to regularly feed them. Both kittens and mature cats were observed, none with ear notches, indicating that they are unlikely to be sterilized and appear to be actively breeding. The Plan area supports diverse and robust songbird populations, and feral cats are known to cause significant wildlife mortality in such populations (Loss et al. 2013).

## 4.0 Routine Maintenance Activities

Consistent with the City's existing SAA with CDFW, the City (or its contractors) is authorized to conduct a variety of routine maintenance activities. This section provides a general description of these ongoing maintenance activities, including when the maintenance activity is conducted, the functional standard or objective for each activity, and BMPs to avoid and/or minimize potential impacts on natural resources. A comprehensive list of BMPs that may be implemented during routine maintenance activities is provided in Section 7. Approved activities, potential thresholds for initiating those activities, and the minimum level of effort or functional standard required to complete each maintenance activity are described below. As described above in Section 1, routine maintenance activities are a key component within the overall RMP that are coordinated with other restoration actions and management priorities.

In addition to following the standards and BMPs identified in this section, proposed maintenance activities must also comply with the City's existing SAA with CDFW, as well as other regulatory or permitting requirements (e.g., Clean Water Act Section 401 water quality certification and monitoring).

### 4.1 Debris or Obstruction Removal

The City may remove debris, trash, rubbish, and flood-deposited woody and herbaceous vegetation debris along the stream corridor. Accumulated debris adversely affects water quality conditions and increases potential flood risks by introducing materials that can clog waterways, become trapped against crossings and bridges, or erosively deflect flows into streambanks. For these reasons, it is important to remove debris and trash from the stream corridor. This work includes annual outfall cleaning, which is typically conducted in the fall.

#### 4.1.1 Possible Causes for Maintenance

This activity is conducted when vegetation or debris is found to, or has the potential to, substantially obstruct water flow, reduce channel capacity, accelerate erosion, degrade water quality, or damage existing assets (e.g., concrete box culverts, metal culverts, or bridge structures). Often, before vegetation management or sediment removal can occur, debris and garbage must first be removed.

#### 4.1.2 Maintenance Standard

Anthropogenic-based (or human-caused) trash, debris, or rubbish should be removed from the riparian corridor and disposed of properly. Excessive organic detritus (dead organic material) is known to reduce water quality by increasing nutrient levels and reducing dissolved oxygen in waterways. Such material may be removed to the extent reasonably achievable by manual or mechanized methods. At a minimum, flood-deposited organic debris should be removed to the level where streamflow is restored and the risk of localized erosion is mitigated.

On the other hand, large woody debris provides ecologic and habitat benefit in the creek. The ability to retain or relocate large woody debris within the channel to enhance wildlife habitat conditions should be considered against the potential risk of flooding, increased erosion, clogging at stream crossings, or other adverse effects due to the transport of large woody debris.

### 4.1.3 Applicable BMPs

Applicable BMPs for this activity include the following (see Section 7 for more information):

- GEN-1, Work Windows
- GEN-2, Minimize Area of Disturbance
- GEN-6, Stream Access<sup>1</sup>
- GEN-7, On-site Hazardous Materials Management
- GEN-8, Spill Prevention and Response
- GEN-9, Existing Hazardous Materials
- GEN-10, Fire Prevention
- GEN-11, Vehicle and Equipment Maintenance
- GEN-12, Vehicle and Equipment Fueling
- GEN-13, Public Safety Measures
- GEN-14, Minimize Noise Disturbances in Residential Areas
- GEN-15, Work Site Housekeeping
- VEG-5, Woody Debris
- BIO-1, Contractor Environmental Awareness Training
- BIO-2, Biological Monitor On-site with Stop Work Authorization
- BIO-3, Minimize Impacts on Nesting Birds
- BIO-4, Protection of Special-status Amphibian and Reptile Species
- BIO-6, Consider Wildlife Habitat Needs

## 4.2 Beaver Dam Removal

The City may remove beaver dams by use of hand tools or heavier equipment, if needed. For purposes of beaver dam removal, a “project” is defined as the removal of one or more beaver dams within 30 days. This does not include the installation of beaver deterrent structures that may substantially alter the bed, bank, or channel within the project area. The presence or expansion of beaver dams can lead to a direct increase in the flood hazard by preventing flow conveyance.

### 4.2.1 Possible Causes for Maintenance

This activity may be initiated when beaver dams and associated debris are found to, or have the potential to, substantially obstruct water flow, reduce channel capacity, increase the risk

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<sup>1</sup> The City does not currently conduct work that would require implementation of this BMP. However, this BMP has been included to guide future work that would require this type of stream access.

of flooding, accelerate erosion, or damage existing assets (e.g., concrete box culverts, metal culverts, or bridge structures).

#### 4.2.2 Maintenance Standard

Beaver dam removal should be limited to the minimum area necessary to facilitate flow conveyance, reduce severe backwatering, and reduce the potential for a sudden release of blocked flows if the beaver dam were to fail. Dam removal may include partial removal (notching or lowering of a specific section) or more extensive dismantling, as needed.

#### 4.2.3 Applicable BMPs

Applicable BMPs for this activity include the following (see Section 7 for more information):

- GEN-2, Minimize Area of Disturbance
- GEN-6, Stream Access<sup>2</sup>
- GEN-7, On-site Hazardous Materials Management
- GEN-8, Spill Prevention and Response
- GEN-9, Existing Hazardous Materials
- GEN-10, Fire Prevention
- GEN-11, Vehicle and Equipment Maintenance
- GEN-12, Vehicle and Equipment Fueling
- GEN-13, Public Safety Measures
- GEN-14, Minimize Noise Disturbances in Residential Areas
- GEN-15, Work Site Housekeeping
- BIO-1, Contractor Environmental Awareness Training
- BIO-2, Biological Monitor On-site with Stop Work Authorization
- BIO-3, Minimize Impacts on Nesting Birds
- BIO-4, Protection of Special-status Amphibian and Reptile Species

### 4.3 Sediment Removal

The City may remove or displace sediment (including silt, sand, or gravel) within the creek or in the immediate vicinity of the creek, facilities, or structures. More specifically, sediment can be removed within 100 feet of natural channels and within 250 feet of unvegetated modified channels, facilities, or structures. Currently, the City does not conduct sediment removal, either mechanically or by hand, because of logistical obstacles; however, such activities would be permitted under the RMP and could be conducted in the future.

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<sup>2</sup> The City does not currently conduct work that would require implementation of this BMP. However, this BMP has been included to guide future work that would require this type of stream access.

### 4.3.1 Possible Causes for Maintenance

This activity is conducted when in-channel deposition is found to, or has the potential to, substantially obstruct water flow, reduce channel capacity, accelerate erosion, increase flooding risk, or damage existing assets (e.g., concrete box culverts, metal culverts, or bridge structures).

### 4.3.2 Maintenance Standard

Sediment removal should be limited to the minimum area necessary to facilitate flow and restore conveyance capacity.

### 4.3.3 Applicable BMPs

Applicable BMPs for this activity include the following (see Section 7 for more information):

- GEN-1, Work Windows
- GEN-2, Minimize Area of Disturbance
- GEN-3, Erosion and Sediment Control
- GEN-4, Dust Management
- GEN-5, Staging and Stockpiling of Materials
- GEN-6, Stream Access<sup>3</sup>
- GEN-7, On-site Hazardous Materials Management
- GEN-8, Spill Prevention and Response
- GEN-9, Existing Hazardous Materials
- GEN-10, Fire Prevention
- GEN-11, Vehicle and Equipment Maintenance
- GEN-12, Vehicle and Equipment Fueling
- GEN-13, Public Safety Measures
- GEN-14, Minimize Noise Disturbances in Residential Areas
- GEN-15, Work Site Housekeeping
- BIO-1, Contractor Environmental Awareness Training
- BIO-2, Biological Monitor On-site with Stop Work Authorization
- BIO-3, Minimize Impacts on Nesting Birds
- BIO-4, Protection of Special-status Amphibian and Reptile Species
- BIO-5, Avoid and/or Minimize Impacts on Special-status Plant Species

## 4.4 Vegetation Control and Removal

The City may cut, mow, burn, or spray herbicides on grasses, shrubs, and woody growth to maintain the designed floodway capacity in the RMP area. The City typically does not spray herbicides within the Laguna Creek channel. Herbicides are typically only applied to active

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<sup>3</sup> The City does not currently conduct work that would require implementation of this BMP. However, this BMP has been included to guide future work that would require this type of stream access.



growth on edges of trails. The City may cut, trim, or remove the lower branches of large trees that have snags, cracks, or limbs separating from the trunk. The City may remove dead or dying trees that impede flood flows, substantially interfere with floodway capacity, obstruct trails, or otherwise pose a hazard. Consideration should be given to retaining dead trees where possible because they provide valuable habitat for tree cavity–nesting birds. Non-native vegetation (e.g., giant reed [*Arundo donax*], Chinese tallowtree [*Triadica sebifera*], red sesbania [*Sesbania punicea*], Spanish broom [*Spartium junceum*], tree-of-heaven [*Ailanthus altissima*], black locust [*Robinia pseudoacacia*], tree tobacco [*Nicotiana glauca*], castor bean [*Ricinus communis*], pampas grass [*Cortaderia* sp.], eucalyptus [*Eucalyptus* sp.], tamarisk [*Tamarix* sp.], water hyacinth, and acacia [*Acacia* sp.]) may be removed where observed.

#### **4.4.1 Possible Causes for Maintenance**

This activity is conducted as needed when vegetative growth or downed trees or branches are found to, or have the potential to, substantially obstruct water flow, reduce channel capacity, accelerate erosion, or damage existing assets (e.g., concrete box culverts, metal culverts, or bridge structures). Tree removal may be considered if dead, dying, or diseased trees are in clear danger of falling near a pathway, trail, or facility. Tree removal is also conducted when vegetation conditions and/or fuel load pose a fire hazard — for instance, when understory vegetation and large woody debris are dense enough to act as ladder fuels, allowing surface fires to develop into crown/canopy fires. See 4.5, Fire Risk Reduction, for related maintenance activities pertaining to fire fuel load reduction.

#### **4.4.2 Maintenance Standard**

Vegetation control and removal should be limited to the minimum extent necessary to conduct safety inspections, reduce fire risks, restore flow, maintain channel capacity, and mitigate the potential for localized erosion. Projects in or immediately adjacent to the stream channel shall not exceed an area of 0.05 acre per project (approximately 50 feet by 50 feet). For projects located at outfalls, culverts, bridges or similar structures, vegetation removal shall not exceed a total of 0.1 acre (0.05 acre upstream and 0.05 acre downstream of the structure). Within the stream channel and immediately adjacent areas, tree branches up to 5 feet above the ground may be pruned. In other areas, such as along trails, tree branches up to 8 feet above the ground may be pruned to allow for bicyclist and maintenance vehicle access. When feasible, branches and limbs extending over the river shall not be pruned to avoid potential impacts on shaded riverine aquatic habitat.

Removal of non-native vegetation may occur wherever observed to maintain channel capacity, prevent the spread of invasive plants, and improve native habitat conditions. Following removal of invasive plants, native plant species may be planted or seeded. Attachment C lists appropriate native plant species.

In areas where mechanical or hand treatments are logistically difficult, targeted grazing may be implemented to reduce biomass fuel build-up, improve ecosystem function, and enhance vegetation management efforts. In areas with limited clearance from private property, mulching may provide an efficient and low-impact method to control invasive plants.

As stated in Section 4.1.2 for debris and obstruction removal, large woody debris is potentially an ecologic and habitat benefit in the creek. The ability to retain vegetation within the channel to enhance wildlife habitat conditions shall be considered against the potential risk of flooding, clogging at stream crossings, or other adverse effects due to the transport of large woody debris. Large wood should be left in place unless a clear risk is identified.

#### 4.4.3 Applicable BMPs

Applicable BMPs for this activity include the following (see Section 7 for more information):

- GEN-1, Work Windows
- GEN-2, Minimize Area of Disturbance
- GEN-3, Erosion and Sediment Control
- GEN-4, Dust Management
- GEN-6, Stream Access<sup>4</sup>
- GEN-7, On-site Hazardous Materials Management
- GEN-8, Spill Prevention and Response
- GEN-10, Fire Prevention
- GEN-11, Vehicle and Equipment Maintenance
- GEN-12, Vehicle and Equipment Fueling
- GEN-13, Public Safety Measures
- GEN-14, Minimize Noise Disturbances in Residential Areas
- GEN-15, Work Site Housekeeping
- VEG-1, In-channel Vegetation Removal
- VEG-2, Routine Pruning
- VEG-4, Removal of Invasive Plants
- VEG-6, Grazing
- VEG-7, Mulching
- BIO-1, Contractor Environmental Awareness Training
- BIO-2, Biological Monitor On-site with Stop Work Authorization
- BIO-3, Minimize Impacts on Nesting Birds
- BIO-4, Protection of Special-status Amphibian and Reptile Species
- BIO-5, Avoid and/or Minimize Impacts on Special-status Plant Species
- BIO-6, Consider Wildlife Habitat Needs

## 4.5 Fire Risk Reduction and Public Safety

The City may manage vegetation to reduce the likelihood of extreme fire behavior by facilitating suppression activities that lower the potential for ignition.

In addition to wildfire risks, vegetation may be managed to reduce other safety concerns where dense, overgrown vegetation may conceal transient encampments or other potential threats to public health and pedestrian usage. The Laguna Creek riparian corridor in the RMP area is in a highly accessible, urbanized area and has been the site of past transient

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<sup>4</sup> The City does not currently conduct work that would require implementation of this BMP. However, this BMP has been included to guide future work that would require this type of stream access.

encampments near Del Meyer Park and Bond Road. Encampments can create a serious public health hazard and public safety concern where unwanted trash and debris become harborage and food sources for vectors and related pathogens, sources of odors, fuel for fires, and a nuisance to the public. Encampments can cause damage to structures and flood control facilities, cause significant ecological degradation, and lower water quality. When located in the floodplain, piles of garbage commonly associated with transient encampments are susceptible to being captured by rising flows. In addition, transient encampments can generate large quantities of trash and hazardous materials (e.g., human waste, hypodermic needles, paints and solvents, batteries, and aerosols) that require specialized hazardous materials training, appropriate personal protective equipment (PPE) and personnel vaccinations, and proper disposal methods.

#### **4.5.1 Possible Causes for Maintenance**

This activity is conducted when overgrown vegetation within the riparian corridor provides a potential fuel source for wildfires or has the ability to conceal encampments.

The City works with local law enforcement to control the establishment of transient encampments within the RMP area. Encampments can be removed year-round and on an as-needed basis to maintain public safety and fire protection.

#### **4.5.2 Maintenance Standard**

Vegetation management for fire risk reduction and public safety should be limited to the minimum extent necessary to reduce fire risks and create a defensible buffer around existing structures and between residential and commercial properties or to ensure adequate public safety. Fire breaks and defensible buffers shall not include wetlands or areas adjacent to the wetted channel.

Removal of non-native vegetation may occur wherever observed to maintain channel capacity, public safety, and fire protection.

In upland (not riparian) areas where mechanical or hand treatments are logistically difficult, targeted grazing may be implemented to reduce biomass fuel build-up. In areas with limited clearance from private property, mulching may provide an efficient and low-impact method to control invasive plants and reduce biomass fuel build-up.

Creation and maintenance of defensible buffers for fire protection may present opportunities for community engagement and public education.

### 4.5.3 Applicable BMPs

Applicable BMPs for this activity include the following (see Section 7 for more information):

- GEN-1, Work Windows
- GEN-2, Minimize Area of Disturbance
- GEN-3, Erosion and Sediment Control
- GEN-4, Dust Management
- GEN-6, Stream Access<sup>5</sup>
- GEN-7, On-site Hazardous Materials Management
- GEN-8, Spill Prevention and Response
- GEN-9, Existing Hazardous Materials
- GEN-10, Fire Prevention
- GEN-11, Vehicle and Equipment Maintenance
- GEN-12, Vehicle and Equipment Fueling
- GEN-13, Public Safety Measures
- GEN-14, Minimize Noise Disturbances in Residential Areas
- GEN-15, Work Site Housekeeping
- VEG-1, In-channel Vegetation Removal
- VEG-2, Routine Pruning
- VEG-6, Grazing
- BIO-1, Contractor Environmental Awareness Training
- BIO-2, Biological Monitor On-site with Stop Work Authorization
- BIO-3, Minimize Impacts on Nesting Birds
- BIO-4, Protection of Special-status Amphibian and Reptile Species
- BIO-5, Avoid and/or Minimize Impacts on Special-status Plant Species
- PUB-2, Incorporate Passive Recreation and Educational Features
- PUB-3, Engage Community Groups

## 4.6 Repair of Previous Erosion Control Work

The City may repair previously implemented erosion control work, including, but not limited to, failed rock, sacked concrete, or gabion sections installed in the past. In some areas, these and other routine maintenance activities may require fill near outfalls, bridges, culverts, basins, and the invert of creeks and channels. Fill materials may be riprap, soil, gravel material, or aggregate base and will be obtained from commercial sources in the local area. Materials may be placed with equipment such as an excavator, backhoe, dump truck, bobcat, or other small construction equipment.

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<sup>5</sup> The City does not currently conduct work that would require implementation of this BMP. However, this BMP has been included to guide future work that would require this type of stream access.

### 4.6.1 Possible Causes for Maintenance

This activity is conducted where previous erosion control work is failing or anticipated to fail. The condition and projected lifespan of previous repair areas shall be evaluated by a qualified professional experienced in assessing these types of facilities and repairs.

### 4.6.2 Maintenance Standard

Repairs of previous erosion control work shall be replaced in-kind and shall not extend more than 20 linear feet beyond the existing erosion control area.

In areas of structural instability, biotechnical treatment approaches such as live-staking, brush-layering, or live fascines may be considered to help stabilize the channel and address bank undercutting.

Erosion repair activities may present opportunities for community engagement and public education.

### 4.6.3 Applicable BMPs

Applicable BMPs for this activity include the following (see Section 7 for more information):

- GEN-1, Work Windows
- GEN-2, Minimize Area of Disturbance
- GEN-3, Erosion and Sediment Control
- GEN-4, Dust Management
- GEN-5, Staging and Stockpiling of Materials
- GEN-6, Stream Access<sup>6</sup>
- GEN-7, On-site Hazardous Materials Management
- GEN-8, Spill Prevention and Response
- GEN-9, Existing Hazardous Materials
- GEN-10, Fire Prevention
- GEN-11, Vehicle and Equipment Maintenance
- GEN-12, Vehicle and Equipment Fueling
- GEN-13, Public Safety Measures
- GEN-14, Minimize Noise Disturbances in Residential Areas
- GEN-15, Work Site Housekeeping
- VEG-8, Biotechnical Treatment Approaches
- BIO-1, Contractor Environmental Awareness Training
- BIO-2, Biological Monitor On-site with Stop Work Authorization
- BIO-3, Minimize Impacts on Nesting Birds
- BIO-4, Protection of Special-status Amphibian and Reptile Species
- BIO-5, Avoid and Minimize Impacts on Special-status Plant Species
- PUB-2, Incorporate Passive Recreation and Educational Features

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<sup>6</sup> The City does not currently conduct work that would require implementation of this BMP. However, this BMP has been included to guide future work that would require this type of stream access.

- PUB-3, Engage Community Groups

## 4.7 Minor Erosion Control Work

The City may slope, place earthen fill, install rocks and gabions, or take other necessary measures to control erosion on previously unrevetted areas. This work would only occur in the portion of Reach 1 upstream of Pelham Way. Actions mandated under the City's SAA and 401 water quality certification/monitoring would be implemented as required.

### 4.7.1 Possible Causes for Maintenance

This activity is conducted when erosion has the potential to threaten bank stability, accelerate erosion, or damage existing assets (e.g., sidewalks, concrete box culverts, metal culverts, or bridge structures).

### 4.7.2 Maintenance Standard

Minor erosion control work shall be limited to the minimum extent necessary to effectively address and stabilize the erosion area. Work areas shall not exceed 40 linear feet in length or 0.1 acre per location per year, whichever is smaller. For the proposed placement of rock slope protection or shot-crete application as bank erosion control, the individual project sites must be separated by a distance of at least 1,500 feet of earthen bank.

In areas of structural instability, biotechnical treatment approaches such as live-staking, brush-layering, or live fascines should be considered to help stabilize the channel and address bank undercutting.

Erosion repair activities may present opportunities for community engagement and public education.

### 4.7.3 Applicable BMPs

Applicable BMPs for this activity include the following (see Section 7 for more information):

- GEN-1, Work Windows
- GEN-2, Minimize Area of Disturbance
- GEN-3, Erosion and Sediment Control
- GEN-4, Dust Management
- GEN-5, Staging and Stockpiling of Materials
- GEN-6, Stream Access
- GEN-7, On-site Hazardous Materials Management
- GEN-13, Public Safety Measures
- GEN-14, Minimize Noise Disturbances in Residential Areas
- GEN-15, Work Site Housekeeping
- VEG-8, Biotechnical Treatment Approaches
- BIO-1, Contractor Environmental Awareness Training
- BIO-2, Biological Monitor On-site with Stop Work Authorization
- BIO-3, Minimize Impacts on Nesting Birds

- GEN-8, Spill Prevention and Response
- GEN-9, Existing Hazardous Materials
- GEN-10, Fire Prevention
- GEN-11, Vehicle and Equipment Maintenance
- GEN-12, Vehicle and Equipment Fueling
- BIO-4, Protection of Special-status Amphibian and Reptile Species
- BIO-5, Avoid and/or Minimize Impacts on Special-status Plant Species
- PUB-2, Incorporate Passive Recreation and Educational Features
- PUB-3, Engage Community Groups

## 4.8 Geotechnical Sampling

The City may undertake drilling of core samples and conduct other minor geotechnical testing in or adjacent to the stream channel. Typically, these types of sampling and testing are conducted in support of the planning and design process for projects undertaken by the City within the RMP area, such as bike trails or bridge construction.

### 4.8.1 Possible Causes for Maintenance

This activity is conducted on an as-needed basis to help support planning and design of maintenance or capital improvement projects in the RMP area.

### 4.8.2 Maintenance Standard

Geotechnical sampling shall be conducted in accordance with accepted American Society for Testing and Materials (ASTM) procedures and technical standards, as well as applicable state and local regulations. In addition, such work shall not adversely affect fish and wildlife resources within the RMP area.

### 4.8.3 Applicable BMPs

Applicable BMPs for this activity include the following (see Section 7 for more information):

- GEN-1, Work Windows
- GEN-2, Minimize Area of Disturbance
- GEN-7, On-site Hazardous Materials Management
- GEN-8, Spill Prevention and Response
- GEN-10, Fire Prevention
- GEN-11, Vehicle and Equipment Maintenance
- GEN-12, Vehicle and Equipment Fueling
- GEN-13, Public Safety Measures
- GEN-14, Minimize Noise Disturbances in Residential Areas
- GEN-15, Work Site Housekeeping

## **4.9 Other Minor Activities**

The City may conduct a variety of minor maintenance activities in or adjacent to the stream channel, such as repairs to fencing, repair or replacement of signage or benches, graffiti removal, or painting of existing facilities. These activities can be conducted on an as-needed basis as long as such work does not adversely affect fish and wildlife resources within the RMP area. Applicable BMPs shall be identified before work begins and shall be implemented as appropriate.

## **4.10 Activities Not Covered in this Plan**

### **4.10.1 Large Capital Improvement Projects**

Routine maintenance does not include projects that would alter (i.e., increase) the designed flood conveyance capacity of a channel. Rather, the RMP focuses on restoring the channel's designed capacity. Large construction projects and capital improvement projects along the creek corridor are not considered routine stream maintenance and are not covered by these guidelines.

### **4.10.2 Emergency Repair Work**

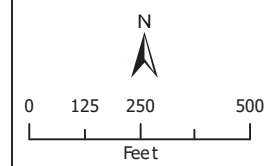
A situation is considered an "emergency" if it is a sudden, unexpected occurrence involving a clear and imminent danger that demands immediate action to prevent or mitigate loss of or damage to life, health, property, or essential public services (Public Resources Code Section 21060.3). Although emergency repair projects are not covered by the SAA or RGP, the City will make every effort to follow the guidance and BMPs provided in this RMP when implementing activities under emergency conditions.



## 5.0 Reach-Specific Restoration and Management Recommendations

This section describes the existing condition, ecological vision, and potential constraints and opportunities (numbered for reference and with relevant BMPs listed) for each reach. For planning purposes, the RMP area has been divided into four reaches. The approximate locations of conceptual cross-sections in each reach of the RMP area are shown in **Figure 4**. Additional figures depict the relevant features of individual reaches, along with representative photographs and cross-sections. In addition, the Old Hatchery Site in Reach 4 is addressed separately, and a preliminary conceptual plan for the site is provided. The vegetation management conditions shown in these conceptual cross-sections would need to also consider potential site-specific hydrologic or hydraulic constraints and the risk for flooding. In such cases where there are greater flooding concerns, the degree to which vegetation is allowed to remain or develop in the channel or along the floodplain may be reduced.

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- Plan Area
- LagunaCreek



**Figure 4**  
Laguna Creek Management Reaches  
with Locations of Conceptual Cross-sections

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## 5.1 Reach 1

Reach 1 extends from Waterman Road downstream to the Laguna Creek Trail pedestrian bridge at Jack E. Hill Park (2,760 linear feet) (see **Figures 5 and 6**). Reach 1 is generally characterized as an engineered, earthen, trapezoidal channel. The channel follows an S-curve shape around the Bond Road/Waterman Road intersection before turning south in a linear, simple plan form for approximately 1,000 feet. This portion of Reach 1 maintains a wetted-channel width of 60-70 feet and top-of-bank width of 180 feet (approximate). Downstream, the channel becomes slightly more sinuous, with the wetted-channel width ranging from 25 to 85 feet. Near the reach midpoint, a low terrace is located on the east side of the channel with a seasonally ponded wetland area along the toe of slope (see Figure 5, photo 2).

A paved pedestrian path traverses the top of the south/east bank, connecting with the pedestrian bridge at the downstream limits of the reach. In the upper half of the reach, a concrete drainage ditch runs parallel to and downslope of the path; this ditch is believed to be associated with the former landfill east of this reach. A second pedestrian path (the Laguna Creek Trail) runs from the cul-de-sac at Pelham Way downstream to the pedestrian bridge; in contrast to the other trail in the reach, this path is largely unpaved.

Laguna Creek in the vicinity of the Bond Road/Waterman Road crossing has been modified both historically and more recently. Historic topographic maps show a few different flow paths in this area (USGS 1909, 1952). The Bond Road/Waterman Road crossing underwent significant modification in 2004 when the single bridge at this location was removed and replaced with a pair of adjacent bridges (at Bond Road and Waterman Road). Installation of the new bridges required reconfiguration of the roadways and relocation of the Laguna Creek channel. The current channel configuration results in a sediment depositional area directly downstream of the Waterman Road crossing. Rock slope protection (RSP) was installed along 80 linear feet on the southeast bank directly downstream of the bridge crossing. This has resulted in undercutting of the northwest bank at the tail end of the S-curve and the outside bend of the channel as it straightens into the linear stretch below the Sacramento County Sheriff Department office.

The wetted portion of the channel is largely unvegetated, with fringe herbaceous wetland vegetation present in a narrow band along the lower portions of the banks in some areas. In-channel emergent vegetation is present at the downstream end of the RSP. Scattered trees are present on both sides of the stream, including coast live oak and Brazilian pepper tree. These trees provide little to no canopy shading of the channel. The understory is dominated by non-native invasive species with very few oak seedlings present.

Ongoing maintenance activities in this reach are limited to mowing for fire breaks. LCWC has expressed interest in partnering with the City on restoration activities in Reach 1, particularly those to increase creek shading and native vegetation on the southeast side of the channel.

### 5.1.1 Ecological Vision for Reach 1

The ecological vision for Reach 1 focuses on increasing creek shading from woody vegetation and increasing native vegetation through the reach in all vegetation strata (tree, shrub, and understory), particularly on the southeast side of the channel (**Figure 7**). A recommended plant palette by habitat type is provided in **Attachment C**. Increasing woody vegetative density provides ecological uplift by increasing canopy cover over the channel, thereby reducing water temperature, increasing plant species diversity and density, augmenting habitat complexity, and providing refugia and roosting habitat for wildlife. The ability to enhance habitat conditions within the channel in accordance with this ecological vision should be considered against the potential risk of flooding.

### 5.1.2 Potential Constraints and Opportunities at Reach 1

#### Constraints



- C.1.a. The simple plan form and relatively narrow riparian corridor noted on the upstream half of Reach 1 limit the possible location and extent of in-channel enhancement opportunities.
- C.1.b. Sediment deposition downstream of the Waterman Road crossing is occurring, and there is currently a lack of viable options for sediment removal at this location. Undercutting of the northwest bank downstream of the Waterman Road crossing, as well as beaver dens along the north bank, may result in bank stability issues.
- C.1.c. No water lines are available on this reach to allow for irrigation of future plantings, with a possible exception at Waterman Road.
- C.1.d. The upland area between the trail parking lot and Waterman Road is owned by Sacramento County, so there may be limitations on what type of improvements could be conducted in this area.

#### Opportunities

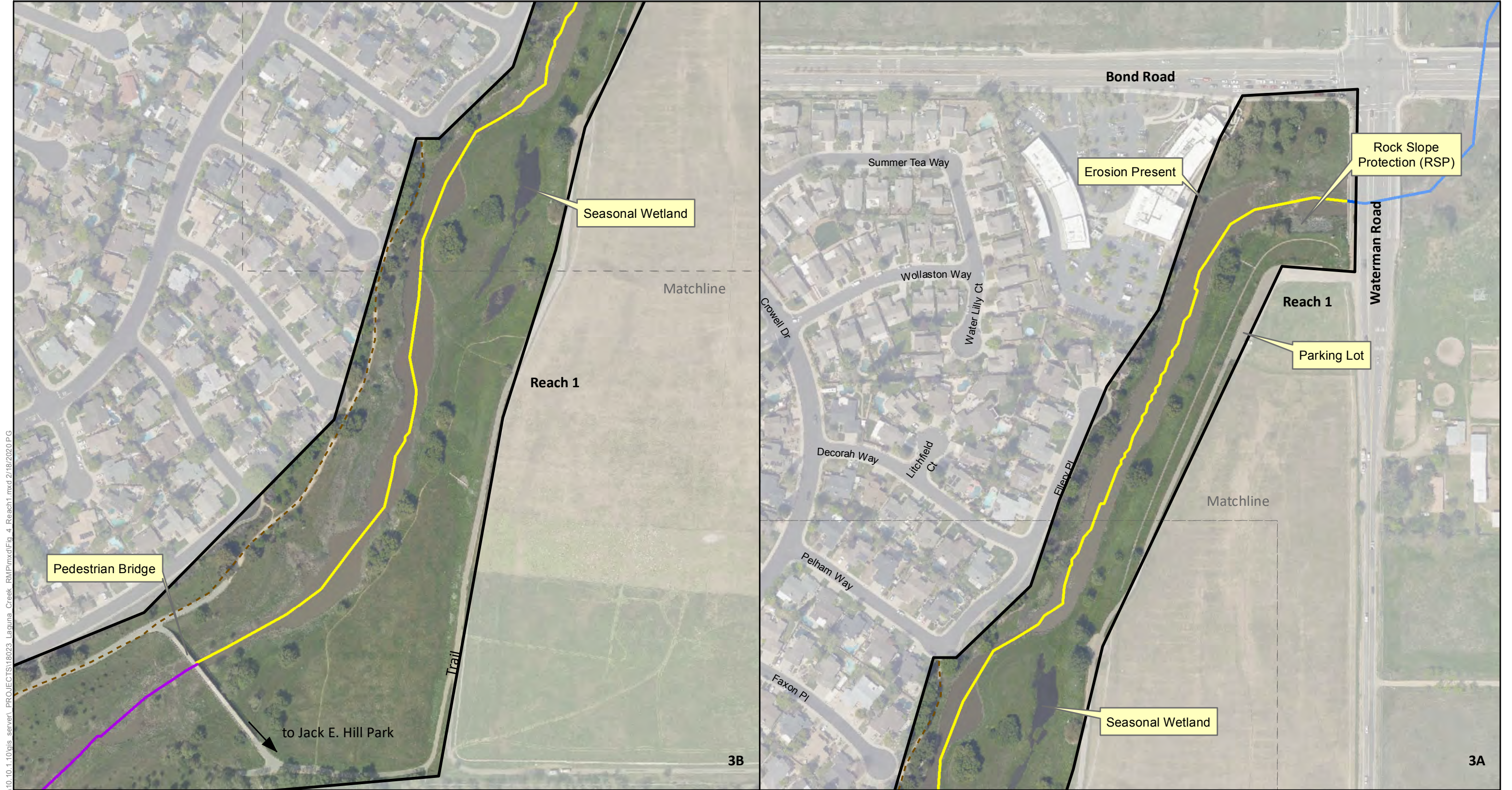
- O.1.a. To improve natural recruitment of trees, existing tree seedlings/saplings can be protected with cages or clearly flagged to prevent loss from grazing, beaver activity, mowing, or other routine maintenance activities. (*VEG-3, Tree Protection*)
- O.1.b. Targeted removal of invasive plants, such as Himalayan blackberry and sweet fennel, followed by planting/seeding of native plant species (**Attachment C**), would enhance native plant communities. Plantings may include both trees and understory species. Similarly, eucalyptus trees growing on the right bank near the upper extent of the reach may be removed and replaced with native tree species. Invasive plant removal activities can occur independently from or in combination with restoration activities. These habitat enhancement activities may be conducted or assisted by volunteer or watershed groups. (*VEG-4, Removal of Invasive Plants; Attachment D, Non-native Vegetation Management Plan*)

- 
- 0.1.c. Improvement of the area near Waterman Road for recreational use (e.g., improvements to the parking area, installation of interpretive signage, benches or seating, and/or additional trash facilities) or with native upland tree plantings. (PUB-3, *Engage Community Groups*)
- 0.1.d. The seasonal wetland habitat on the southeast terrace (see Figure 5, photo 2) would be enhanced by planting native species, such as sandbar willow, common rush (*Juncus effusus*), deergrass (*Muhlenbergia rigens*), tall flatsedge, and cocklebur. Other tree species adapted for more upland conditions, such as oaks, may also be considered.
- 0.1.e. A small ruderal grassland area at the transition between Jack E. Hill Park and Laguna Creek at the west end of the reach is heavily infested with medusahead, which is a highly invasive grass, and a variety of broad-leaf invasive weeds. Medusahead is an annual grass and must produce seeds to survive. Well-timed management actions using mechanical, biological, and chemical methods of control reduce the number of seeds produced, lower the available seedbank, and help prevent its spread into other portions of the RMP area. (VEG-4, *Removal of Invasive Plants*; Attachment D, *Non-native Vegetation Management Plan*)
- 0.1.f. Biotechnical treatment approaches, such as live-staking, brush-layering, or live fascines, may be feasible to help stabilize the channel and address undercutting of the northwest bank downstream of Waterman Road as streamflow is conveyed through the S-curve. This type of approach would likely incorporate live-staking and/or planting of trees and understory vegetation, thereby developing a root system to increase bank stability while also providing shading and habitat for native wildlife. (VEG-8, *Biomechanical Treatment Approaches*)

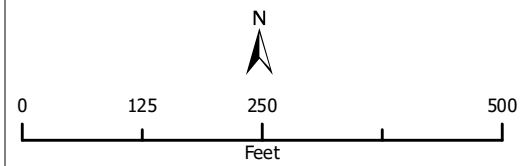
**Figure 5. Reach 1 Representative Photographs**

<p><b>Photo Date:</b> June 2017</p>	
<p><b>Description:</b> Aerial photograph of the upstream portion of Reach 1. Facing south. Rock slope protection is immediately adjacent to Waterman Road, at left.</p>	
<p><b>Photo Date:</b> June 2017</p>	
<p><b>Description:</b> Aerial photograph of the downstream portion of Reach 1. Facing southwest. Seasonal wetland is circled in red.</p>	

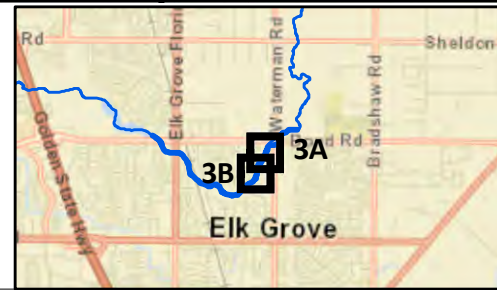




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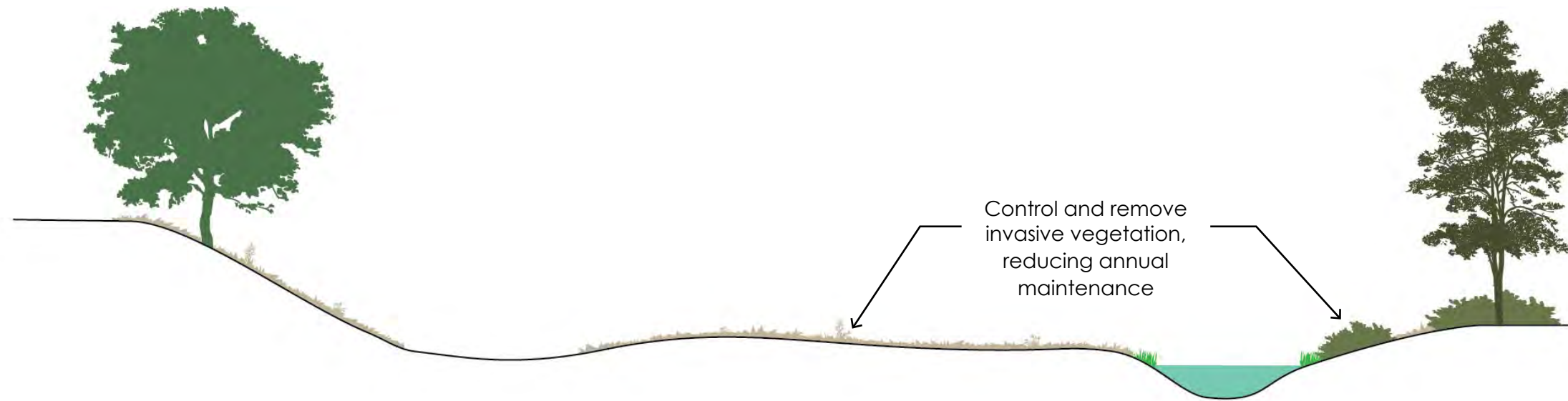
- Plan Area
- Reach 1
- Laguna Creek Trail
- Reach 2
- Laguna Creek



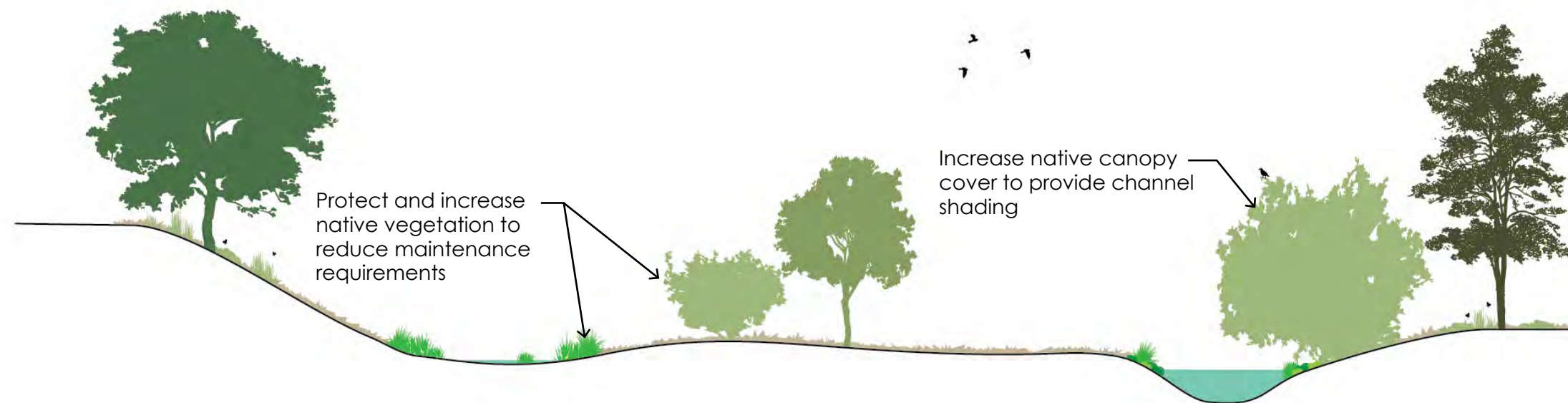
**Figure 6**  
**Laguna Creek RMP Reach 1**

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# Existing Condition



# With BMP Implementation



**Note:** Degree and extent of vegetation growth as depicted in conceptual cross-sections will depend on site-specific conditions and considerations of potential flood risk, conveyance capacity, and increased hydraulic roughness.

**Figure 7**  
**Reach 1 Looking Downstream**

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## 5.2 Reach 2

Reach 2 extends from the Laguna Creek Trail pedestrian bridge at Jack E. Hill Park downstream to Camada Court access (3,680 linear feet) (see **Figures 8 and 9**). Representative cross-sections of Reach 2 under existing conditions and with BMP implementation are provided in **Figure 10**. Reach 2 is generally characterized as a low-gradient earthen channel with a series of wide meanders separated by narrow necks. This reach maintains and is connected to a relatively broad, frequently activated floodplain with setback earthen levees on either bank. Wetted channel widths range from less than 10 feet through the necks and up to 160 feet at meander bends. A pedestrian trail crossing over a set of three culverts is located 2,600 feet downstream from the pedestrian bridge at Jack E. Hill Park. This trail crossing acts as a grade control and hydrologically disconnects streamflow during low-flow periods; the crossing is inundated several times per year during high flows. A small tributary is present to the north of the creek, just upstream of the Union Pacific Railroad bridge crossing. Large woody debris is present in the channel at the very downstream end of this reach in the vicinity of the Union Pacific Railroad bridge crossing.

This reach is heavily visited by recreational users. The Laguna Creek Trail runs along the north side of the creek and then crosses back to the south side at the culverted trail crossing near the cul-de-sac of Laguna Creek Drive. The trail segment on the north side of the creek is prone to flooding during the rainy season. Secondary trails in Reach 2 connect the Laguna Creek Trail on the north side of the creek with access points at Pelham Way, Faxon Place, Ronan Court, Ringe Circle, and Dever Circle. On the south side of the creek in Reach 2, the trail backs up to residential backyards and open space areas.

Emergent wetland vegetation in the creek increases in Reach 2 compared to Reach 1. A band of emergent herbaceous wetland vegetation is present along the margins of the wetted channel and lower portions of the banks, as well as some instream areas. Off-channel wetlands are found on the left floodplain just downstream of the pedestrian bridge. Off-channel wetlands are also present on both sides of the Laguna Creek Trail, starting approximately 600 feet downstream of the pedestrian bridge. A seasonal pool is present approximately 1,400 feet downstream of the pedestrian bridge.

Reach 2 has substantially more trees than Reach 1, although large portions of the creek still have minimal canopy cover. In the upper portion of the reach (i.e., nearer to the culvert crossing), the south floodplain is characterized by a relatively well-developed oak woodland.

Periodically, oaks have been planted north of the creek by the Sacramento Tree Foundation. These trees were planted in dense rows, with the last planting effort occurring around 2008. The upland understory throughout the reach is dominated by non-native invasive species such as Himalayan blackberry, Italian rye grass, vetch, and wild oat; woody understory species are limited.

Ongoing maintenance activities include mowing a 30-foot-wide strip behind homes on the north side of the creek for fire protection. LCWC has expressed interest in partnering with the City on restoration activities in Reach 2, particularly those to increase creek shading,

native canopy, and understory vegetation along the active channel zone, as well as providing assistance in seeking grant funding.

### 5.2.1 Ecological Vision for Reach 2

The ecological vision for Reach 2 focuses on increasing creek shading from woody vegetation and increasing native canopy and understory vegetation to increase structural diversity, pollinator habitat, and food sources for wildlife, particularly along the active channel zone (Figure 10). Increasing native vegetation and reducing non-native species may reduce the need for annual maintenance to suppress growth of flashy fuels. Additionally, planting of woody vegetation along the creek would increase structural complexity and shading of the creek over time, resulting in habitat improvements. The ability to enhance habitat conditions within the channel in accordance with this ecological vision should be considered against the potential risk of flooding.

### 5.2.2 Potential Constraints and Opportunities at Reach 2

#### Constraints

- C.2.a. Upland understory vegetation in Reach 2 is primarily composed of non-native species. Wetted channel widths vary substantially between wide meanders and narrow necks.
- C.2.b. Structural features (e.g., pedestrian bridge, culvert crossing) may exacerbate seasonal variations in flow and may cause or increase the extent of flooding during high-flow periods. It is likely that conveyance of high-frequency events (2-, 5-, and 10-year events) may be impaired by the existing culverted crossing; significant events (25-, 50-, and 100-year events) would be likely to overwhelm the culverts, flowing over the trail and out onto the floodplain such that the culvert would not create a significant flood flow impediment (cbec 2020).
- C.2.c. Large woody debris near the railroad bridge crossing may create additional impediments to flow.
- C.2.d. Heavy recreational use increases wear-and-tear on native vegetation, as well as the visibility and public scrutiny of ongoing maintenance activities on this reach.

#### Opportunities


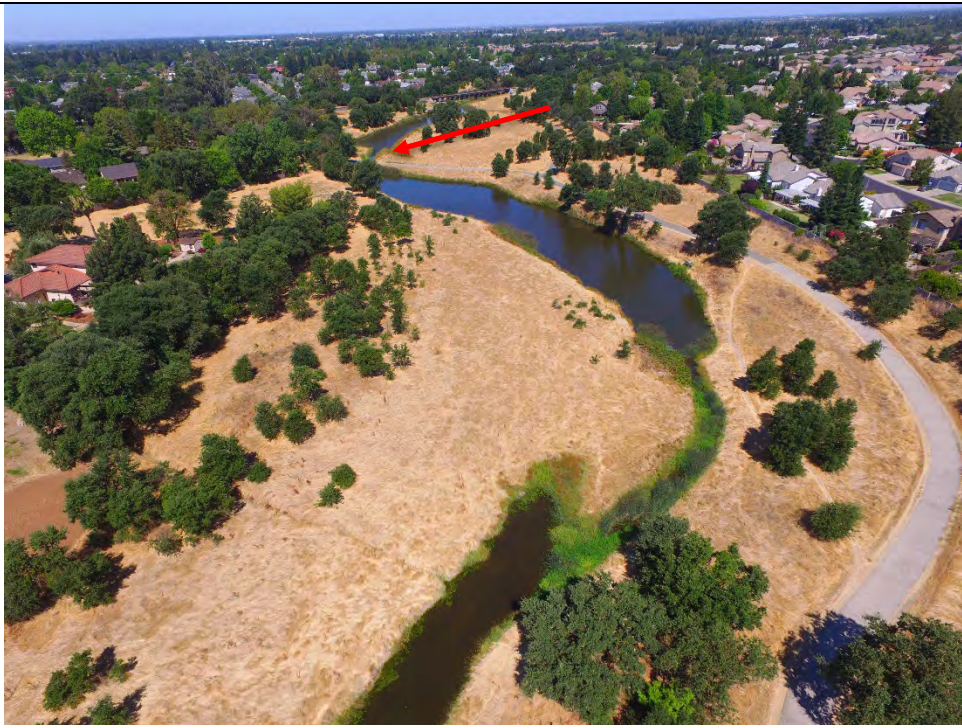
- O.2.a. Several large native trees still have foliage protection cages, which should be removed because the cages are beginning to girdle the trees. Protection cages or flagging should be placed around existing tree seedlings/saplings to prevent loss from grazing, beaver activity, mowing, or other routine maintenance activities. (VEG-3, *Tree Protection*)
- O.2.b. Targeted removal of invasive plants, such as Himalayan blackberry, mustard, sweet fennel, Pampas grass, Chinese tallowtree, and catalpa trees would open up areas for

restoration of native riparian understory vegetation. Invasive vegetation removal activities should be followed by planting/seeding of native plant species. The planting palette shall focus on native plant species that attract songbirds and pollinators and other beneficial insects (Attachment C), including understory species. These habitat enhancement activities may be conducted or assisted by volunteer or watershed groups. An irrigation line is present north of the creek in the vicinity of previous plantings. This existing water line creates opportunities for establishing plantings in this reach. (VEG-4, *Removal of Invasive Plants*; Attachment D, *Non-native Vegetation Management Plan*)

- O.2.c. The high visitor traffic and community group involvement in this reach provides a prime opportunity for the City to work with LCWC and/or other interested stakeholders to develop interpretive signage educating the public about the Laguna Creek corridor and the City's creek maintenance, restoration, and management priorities. The educational program should include the needs for and methods by which local citizens may contribute to efforts to promote ecosystem health and support City restoration and management efforts, such as native plantings, feral cat reduction efforts, and grazing program. (PUB-2, *Incorporate Passive Recreation and Recreational Features*)
- O.2.d. Feral cats are highly visible in this area, and homeowners appear to regularly feed them. Community outreach, including signage, to educate local citizens on the detrimental impacts of feral cats on wildlife would strongly benefit native fauna in this reach. Outreach efforts should be supported by a catch-spay/neuter-rehome (not release) program. (PUB-1, *Feral Cat Reduction*)
- O.2.e. Instream complexity may be increased by re-purposing downed trees and/or other large woody debris or materials within the plan area. Fallen trees can be placed laterally along the banks with smaller riparian trees (e.g., sandbar willow) and shrubs planted behind (downstream) the woody debris. (VEG-5, *Woody Debris*)
- O.2.f. A targeted grazing program should be implemented within Reach 2 (and potentially within Reaches 1 and 3, as feasible), at strategic times of the year to reduce biomass fuel build-up, prevent or reduce seed production from non-native annual grasses, and improve ecosystem function and vegetation control efforts in uplands and along the creek. (VEG-6, *Grazing*)
- O.2.g. Replacement of the culverted trail crossing with a clear span bridge or open-bottomed culvert would improve aquatic species passage and flow conveyance (see Figure 8, photo 2) (cbec 2020, H.T. Harvey 2020). However, if the bridge is tall enough that codes and regulations require handrails, this could significantly affect conveyance of larger events; therefore, this design condition should be avoided (cbec 2020). In addition, increasing the bank setback would expand and enhance wetland and riparian habitat at this location. Installation of a biotechnical approach for grade control may be necessary to prevent a head-cut incision from developing after removal of the culverted trail crossing (cbec 2020, H.T. Harvey 2020). Culvert

performance and improvements may be investigated at a later date, as funding permits.

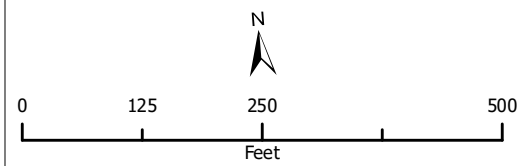
**Figure 8. Reach 2 Representative Photographs**

<p><b>Photo Date:</b> June 2017</p>	
<p><b>Description:</b> Aerial photograph of the upstream portion of Reach 2. Facing northeast (upstream). Recent oak plantings are visible on the left; the pedestrian bridge crossing is in the middle background (red arrow).</p>	
<p><b>Photo Date:</b> June 2017</p>	
<p><b>Description:</b> Aerial photograph of the downstream portion of Reach 2. Facing northwest. Culvert crossing is visible in the middle background (red arrow).</p>	

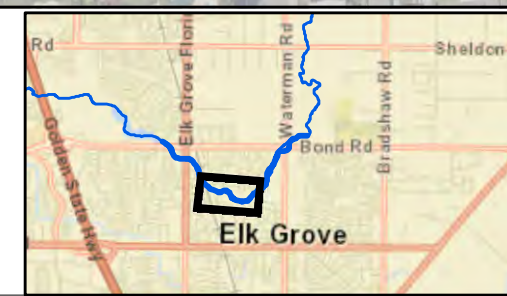




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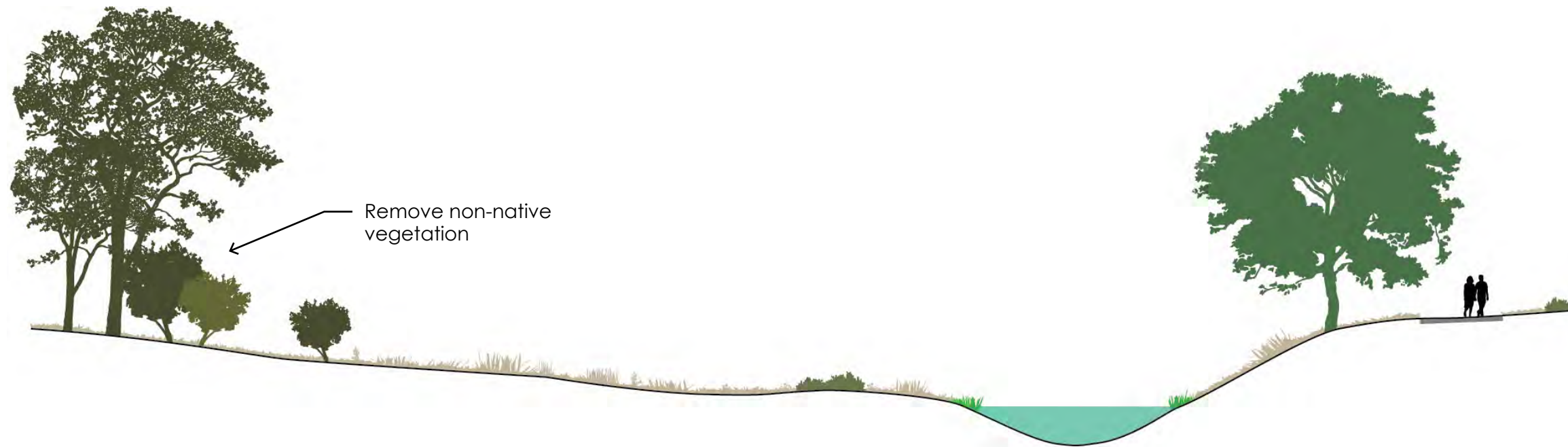
- |                    |         |
|--------------------|---------|
| Plan Area          | Reach 1 |
| Laguna Creek Trail | Reach 2 |
| Laguna Creek       | Reach 3 |



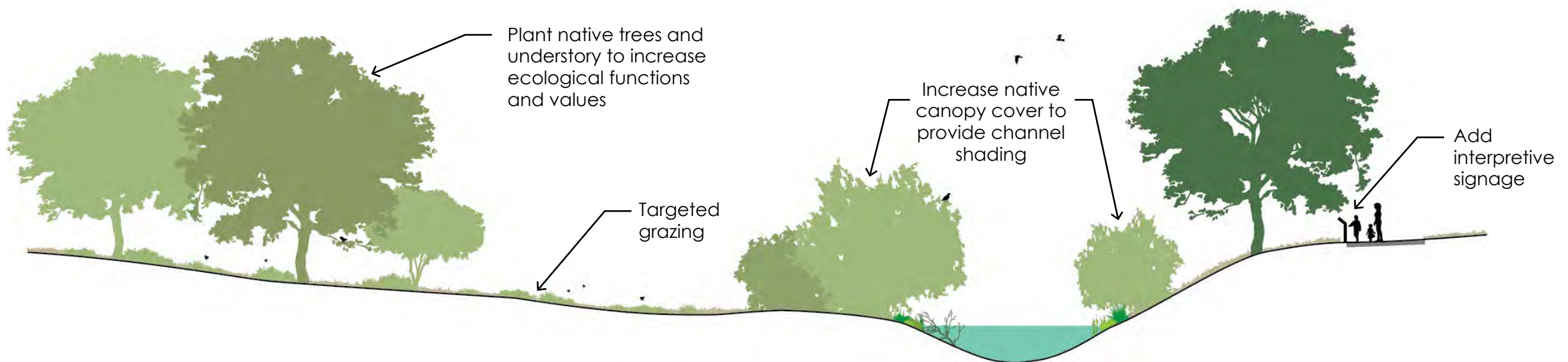
**Figure 9**  
**Laguna Creek RMP Reach 2**

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## Existing Condition



## With BMP Implementation



**Note:** Degree and extent of vegetation growth as depicted in conceptual cross-sections will depend on site-specific conditions and considerations of potential flood risk, conveyance capacity, and increased hydraulic roughness.

Figure 10  
Reach 2 Looking Downstream

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### 5.3 Reach 3

Reach 3 extends from the Camada Court access point downstream to Elk Grove-Florin Road (1,500 linear feet) (see **Figures 11 and 12**). Representative cross-sections of Reach 3 under existing conditions and with BMP implementation are provided in **Figure 13**. The creek narrows substantially in Reach 3 due to residential encroachment, and backyard fences line almost the entire southwestern length of the reach. Reach 3 is generally characterized as an engineered, earthen, two-stage channel. At the upstream end of Reach 3, the channel splits around a 30- to 50-foot-wide, approximately 500-foot-long island. The creek flows northwest before gradually curving west as it approaches the Elk Grove-Florin Road bridge. The floodplain in this reach is significantly narrower compared to the upstream reaches, and residential lots and backyard fencing encroach into the floodplain. The creek is typically stagnant in this reach with low channel activity.

Sediment has accumulated upstream of the Elk Grove-Florin Road bridge. This sediment, as well as emergent vegetation and woody debris, appears to be increasing water surface elevation in this reach. Flooding occurs in low areas but does not overtop levees or escape the creek corridor. Beaver dams are frequently constructed in this reach, especially just upstream of the bridge, and exacerbate flood risk. Currently, the City dismantles beaver dams as needed to reduce the potential for flooding or overtopping of the road.

The Laguna Creek Trail runs parallel to the south side of the creek in Reach 3, having crossed the creek at the culvert crossing in Reach 2, and recreational use of the trail is high. The trailhead adjacent to the parking area at Del Meyer Park has recently been improved with Rotary Club-sponsored benches, a drinking fountain, and LCWC-sponsored interpretive signage. Recent plantings at the trailhead that extend into natural area are non-native plants or landscaping-type plants rather than those typically used in native or native/interface settings. Additional non-native plant species continue to be introduced to natural area due to the proximity of residential backyards, which may over time degrade the habitat value of the vegetation for native wildlife species.

Emergent herbaceous wetland vegetation is present in a band along the lower portions of the banks, with significantly more wetland vegetation present in the downstream portion of the reach. Instream large woody debris is prevalent at the head of the island in the upstream portion of the reach (see Figure 11, photo 1). Near the Elk Grove-Florin Road bridge, emergent wetland vegetation covers most of the channel. Mature oak trees are present along both banks but are denser on the south bank. Scattered trees are also present on the island. Mature trees are being undercut in this reach due to bank erosion. Invasive species such as Himalayan blackberry and non-native annual grasses are dominant in the understory. A large population of red-eared sliders persists in this reach, as well as western pond turtles, and river otters have habitat on the west side of the island. LCWC has expressed interest in partnering with the City on restoration activities in Reach 3, particularly improving habitat conditions on the in-channel island.

### 5.3.1 Ecological Vision for Reach 3

The ecological vision for Reach 3 focuses on replacement of non-native invasive plants with native species that provide pollen and nectar resources for pollinators and other beneficial insects. Another primary goal is to improve the ecological conditions on the in-channel island by increasing native plant species diversity and habitat suitability for native wildlife, specifically western pond turtle and giant garter snake.

Replacing the culverts at the existing trail crossing in Reach 2 with a bridge or open-bottomed culvert would improve passage conditions for aquatic species downstream in Reach 3.

The ability to enhance habitat conditions within the channel in accordance with this ecological vision should be considered against the potential risk of flooding.

### 5.3.2 Potential Constraints and Opportunities at Reach 3

#### Constraints

- C.3a. Lack of available funding sources limits the size and scope of potential improvements in Reach 3 beyond necessary and critical maintenance needs.
- C.3b. High recreational usage and accessibility significantly increase public visibility and scrutiny.

#### Opportunities


- O.3.a. Foliage protection cages shall be removed from large native trees to prevent girdling of the trees. Protection cages or flagging should be placed around existing tree seedlings/saplings to prevent loss from grazing, beaver activity, mowing, or other ongoing maintenance activities. (VEG-3, *Tree Protection*)
- O.3.b. Enhancement of native plant communities could include targeted removal of non-native vegetation, specifically Himalayan blackberry, sharp leaved fluvellin (*Kickxia elatine*), sweet fennel, Pampas grass, and calla lily. Planting of native species could also be done, with a planting palette focused on native plant species that support pollinators and improve habitat for native wildlife, such as Oregon ash (*Fraxinus latifolia*), Fremont cottonwood (*Populus fremontii*), and snowberry (*Symphoricarpos albus*). Other recommended species, including understory species, can be found in Attachment C. (VEG-4, *Removal of Invasive Plants*; Attachment D, *Non-native Vegetation Management Plan*)
- O.3.c. Upland portions of the right (north) bank at the upstream portion of Reach 3 are areas that could be improved by increased native tree planting.
- O.3.d. Providing stream stewardship guidance to neighbors and trail users in this reach would be valuable. Outreach efforts supporting the feral cat management program

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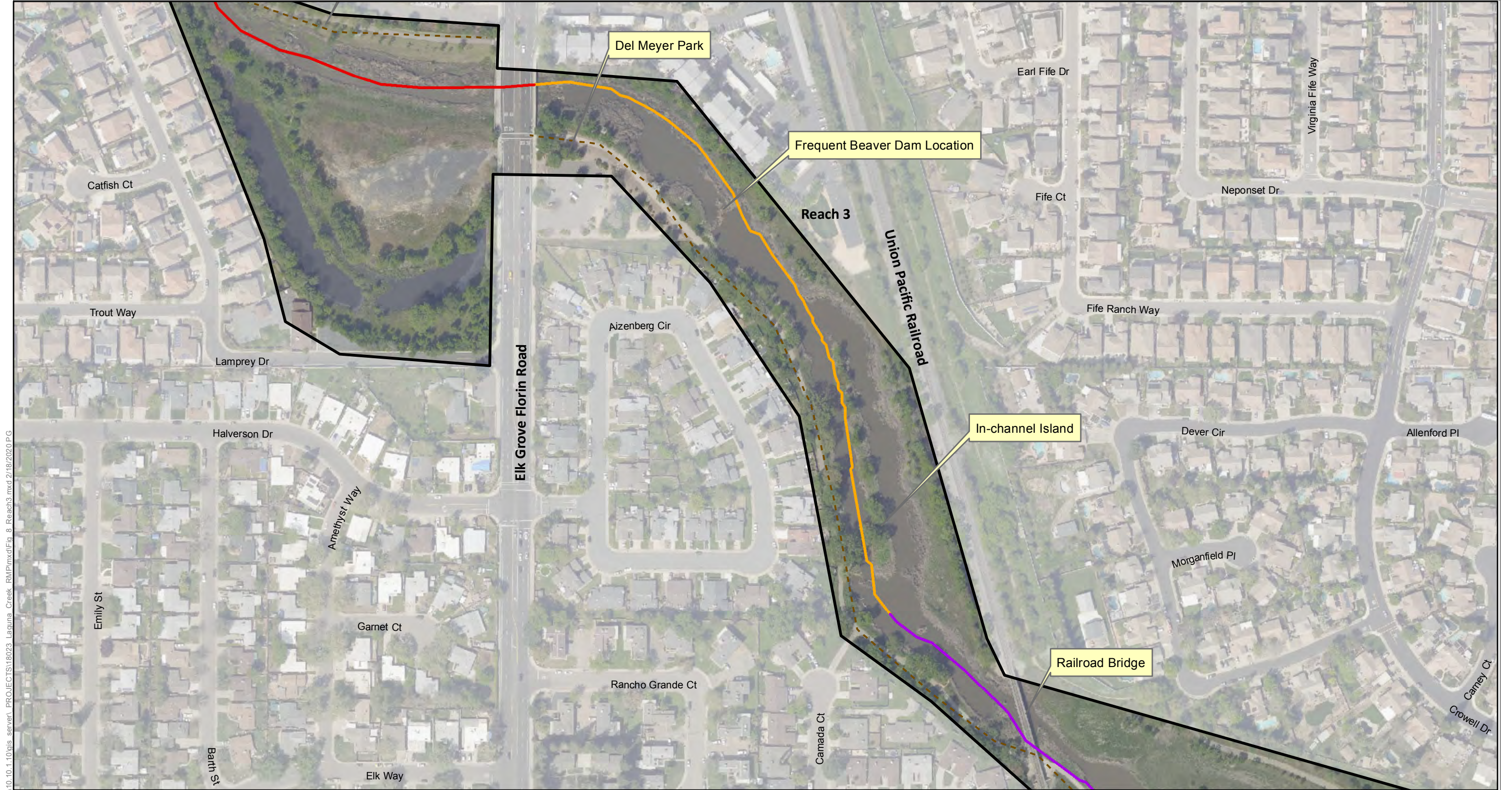
(see 0.2.d above) should extend into Reach 3. (PUB-1, *Feral Cat Removal*; PUB-2, *Incorporate Passive Recreation and Educational Features*)

- 0.3.e. Ecological improvements of the in-channel island may include planting of native plant species, such as California pipevine (*Aristolochia californica*) and California buckeye (*Aesculus californica*), and Oregon ash, with consideration to habitat needs for wildlife, such as maintaining open areas on south facing slopes suitable for western pond turtle nesting. Other improvements may include enhancement of habitat features such as large woody debris or logs that would provide basking/refugia habitat for turtles. (VEG-1, *In-channel Vegetation Removal*; VEG-5, *Woody Debris*; BIO-6, *Consider Wildlife Habitat Needs*)
- 0.3.f. Mulching along the residential fence line on the left (south) bank could reduce non-native growth and ongoing maintenance needs while also meeting objectives such as fire risk reduction, improved visibility, and aesthetics enhancement. (VEG-7, *Mulching*)
- 0.3.g. Localized sediment removal in Laguna Creek to create a low flow path may help to alleviate backwatering and ponding upstream of Elk Grove-Florin Road. Constructing a low flow channel should result in higher velocities during base flow and enhance sediment transport through the sub-reach upstream of Elk Grove-Florin Road to reduce the flood impediment caused by deposition (cbec 2020). The low flow channel should be constructed deep enough to preclude establishment of emergent vegetation (cbec 2020). *Note: Implementing this project would require additional planning, engineering, environmental review, and funding beyond the restoration and routine maintenance activities identified in this RMP.*

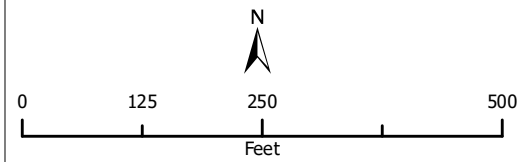
**Figure 11. Reach 3 Representative Photographs**

<p><b>Photo Date:</b> June 2017</p>	 <p>A photograph showing the upstream portion of Reach 3. The water is calm and greenish-brown. A large, fallen tree trunk lies across the water, creating an in-channel island. The banks are lined with dense green trees and tall grasses. The sky is blue with some light clouds.</p>
<p><b>Description:</b> The upstream portion of Reach 3. Facing northwest. The in-channel island is visible at right.</p>	
<p><b>Photo Date:</b> June 2017</p>	 <p>A photograph showing the downstream portion of Reach 3. The water is calm and greenish-brown. The banks are lined with dense green trees and tall grasses. The sky is blue with some light clouds.</p>
<p><b>Description:</b> The downstream portion of Reach 3. Facing northwest. Dense emergent vegetation is visible downstream. Beaver dams are frequently constructed in this area.</p>	

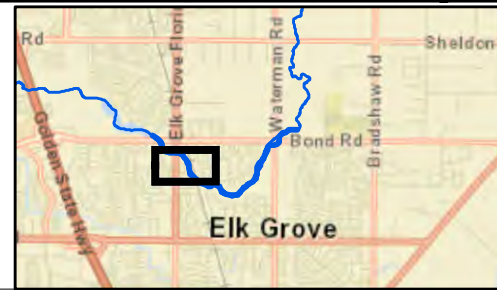




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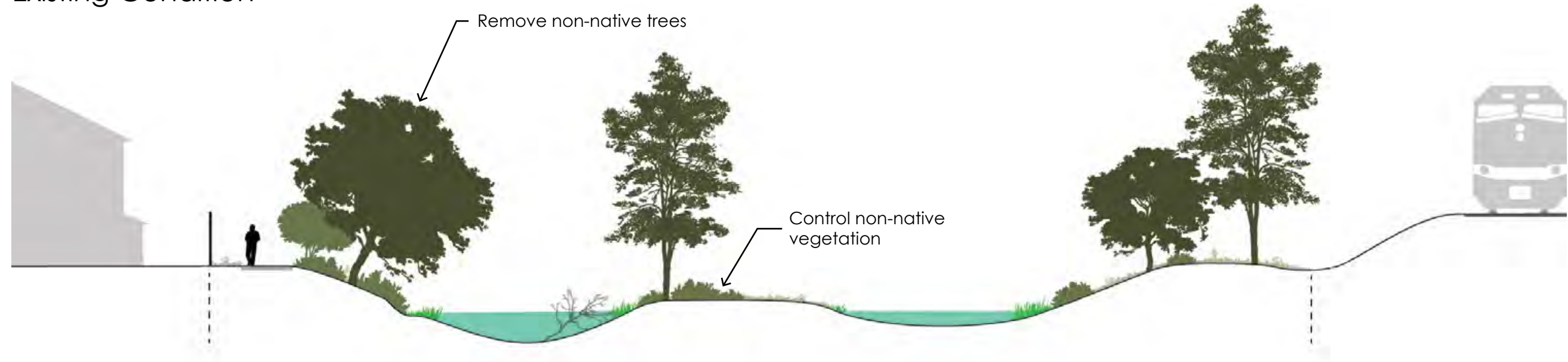
- Plan Area
- Laguna Creek Trail
- Laguna Creek
- Reach 2
- Reach 3
- Reach 4



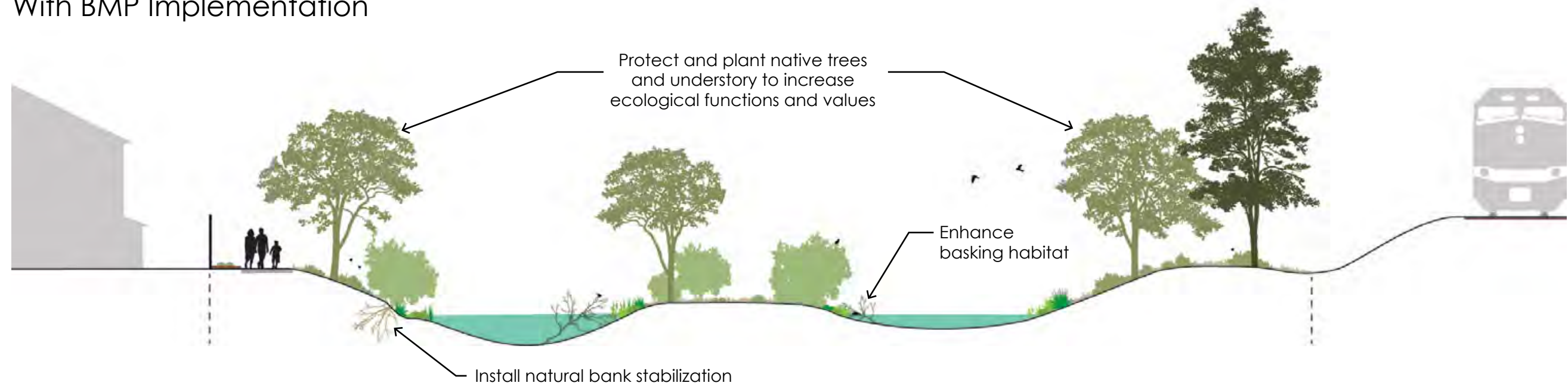
**Figure 12**  
**Laguna Creek RMP Reach 3**

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## Existing Condition



## With BMP Implementation



**Note:** Degree and extent of vegetation growth as depicted in conceptual cross-sections will depend on site-specific conditions and considerations of potential flood risk, conveyance capacity, and increased hydraulic roughness.

Figure 13  
Reach 3 Looking Downstream

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## 5.4 Reach 4

Reach 4 extends from Elk Grove-Florin Road downstream to Bond Road (1,200 linear feet) (see **Figures 14 and 15**). Representative cross-sections of Reach 4 under existing conditions and with BMP implementation are provided in **Figure 16**. Reach 4 is constrained by commercial development, with a greater urban interface than other reaches. This reach of Laguna Creek is an engineered, earthen, linear channel. The wetted portion of the creek is approximately 50 feet wide and maintains relatively uniform shape and dimension through Reach 4. The creek flows west from Elk Grove-Florin Road before curving northwest as it approaches Bond Road. The creek's original path was realigned and straightened prior to 1957 to facilitate construction of a new bridge at Elk Grove-Florin Road, resulting in an oxbow south of the present channel location. This oxbow remains hydrologically connected to the main creek channel on the downstream end of the oxbow via a low earthen rise and high perched culvert but is cut off by Elk Grove-Florin Road on the upstream end. A groundwater well pumps water from Laguna Creek to maintain Camden Lake in the Camden Passage residential subdivision downstream of the RMP area. Flooding is a concern in this reach.

The Laguna Creek Trail runs on the north bank of the creek in this reach. The trail and associated improvements were installed in 2007, along with interpretive signage provided by LCWC. This reach has greater urban interface and higher volume of trail use from nearby businesses during lunchtime hours than the other RMP reaches.

Reach 4 also includes the location of the former Central Valleys Fish Hatchery, which was operated by the Fish and Game Commission from 1937 to 1993. This site, known as the Old Hatchery Site, is addressed separately in Section 5.5 below.

Invasive aquatic vegetation is prevalent in this reach in both Laguna Creek and the oxbow, consisting mainly of water primrose and water hyacinth. Native emergent vegetation (e.g., tules) is also present along Laguna Creek. Dense sandbar willow grows along the channel margins with large non-native catalpa (*Catalpa* sp.) trees on the upper banks and planted trees lining the Laguna Creek Trail. The area between Laguna Creek and the oxbow is largely unvegetated due to the presence of disturbed, compacted soil and gravel left over from the fish hatchery. Oaks are present at the top of bank of the oxbow. Native grasses such as purple needlegrass and other native understory species are present.

No in-channel work is routinely conducted in Reach 4. In fall 2016, the City conducted maintenance activities to address transient encampments in the riparian zone on the south/west bank of the creek near Bond Road. These activities included relatively intensive vegetation removal activities such as mowing of understory herbaceous vegetation and thinning and clearing of woody vegetation, including some trees planted by Sacramento County as part of an earlier project, to increase visibility and reduce public safety risks. Vegetation cover and density have since rebounded, although transient encampments in this area remain an ongoing maintenance and public safety issue.

LCWC has expressed interest in partnering with the City on restoration opportunities in Reach 4, particularly removing non-native species (O.4.b) and planting trees (O.4.d).

### 5.4.1 Ecological Vision for Reach 4

The ecological vision for Reach 4 includes enhancement of the south/west bank downstream of Elk Grove-Florin Road, enhancement of the oxbow, and restoration and enhancement of native plant communities along channel banks and adjacent to the pedestrian trail. The ability to enhance habitat conditions within the channel in accordance with this ecological vision should be considered against the potential risk of flooding.

### 5.4.2 Potential Constraints and Opportunities at Reach 4

#### Constraints

- C.4.a. Flood risk is the highest priority for management in Reach 4.
- C.4.b. Despite persistent attention by the City, transient encampments are frequently established in the south/west bank riparian area upstream of Bond Road.
- C.4.c. Restoration and management considerations in this reach need to balance flood risk and visibility for public safety with competing ecological and aesthetic objectives.
- C.4.d. Available funding limits project size and scope in Reach 4.

#### Opportunities

- O.4.a. Foliage protection cages shall be removed from large native trees to prevent girdling of the trees. Protection cages or flagging should be placed around existing tree seedlings/saplings to prevent loss from grazing, beaver activity, mowing, or other ongoing maintenance activities. (VEG-3, *Tree Protection*)
- O.4.b. Non-native species, such as Himalayan blackberry, sweet fennel, Pampas grass, bull thistle, and catalpa trees, should be removed where they occur in this reach. (VEG-4, *Removal of Invasive Plants*; Attachment D, *Non-native Vegetation Management Plan*)
- O.4.c. Additional interpretive signage about the RMP project and the creek corridor in Reach 4 would be an opportunity to engage the public. (PUB-2, *Incorporate Passive Recreation and Educational Features*)
- O.4.d. The upstream portion of the south/west bank of Laguna Creek currently largely lacks woody vegetation along the 400 feet downstream of Elk Grove-Florin Road, and planting of trees such as oaks and willows would enhance ecological conditions in this area by increasing habitat complexity, available refugia, and nesting substrate. See Attachment C for recommended planting palette. (BIO-6, *Consider Wildlife Habitat Needs*)

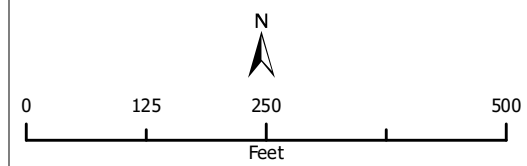
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- 0.4.e. Reestablishment of native grasses and forbs along the Laguna Creek Trail could reduce the need for mowing in upland areas of Reach 4. Native grasses and forbs present in low levels could be protected and reestablished in upland areas along the trail. (VEG-4, *Removal of Invasive Plants; Attachment D, Non-native Vegetation Management Plan*)
- 0.4.f. Modifying the elevation or physical structure of the low earthen rise and high perched culvert at the connection point between the oxbow and the creek's mainstem may potentially improve water quality and habitat within the oxbow channel. The culvert could be lowered or the berm breached to allow water from the main stem to inundate the oxbow as a backwater (cbec 2020). Existing bank cobbles could be removed to soften the banks and allow plants to grow (cbec 2020). This area also may present opportunities to mitigate for other activities in the RMP or on other projects (cbec 2020). (VEG-8, *Biotechnical Treatment Approaches*) *Note: Implementing this project would require additional planning, engineering, environmental review, and funding beyond the restoration and routine maintenance activities identified in this RMP.*

**Figure 14. Reach 4 Representative Photographs**

<p><b>Photo Date:</b> June 2017</p>	
<p><b>Description:</b> Aerial view of Reach 4. Facing southeast. Laguna Creek main channel is shown on the left, with the Old Hatchery Site in the middle and the oxbow to the right. Elk Grove-Florin Road is shown in the background.</p>	
<p><b>Photo Date:</b> June 2017</p>	
<p><b>Description:</b> Reach 4, from the Elk Grove-Florin Road bridge. Facing west. Upland area of the Old Hatchery Site surrounded by the oxbow is at left, with the main creek channel in center.</p>	



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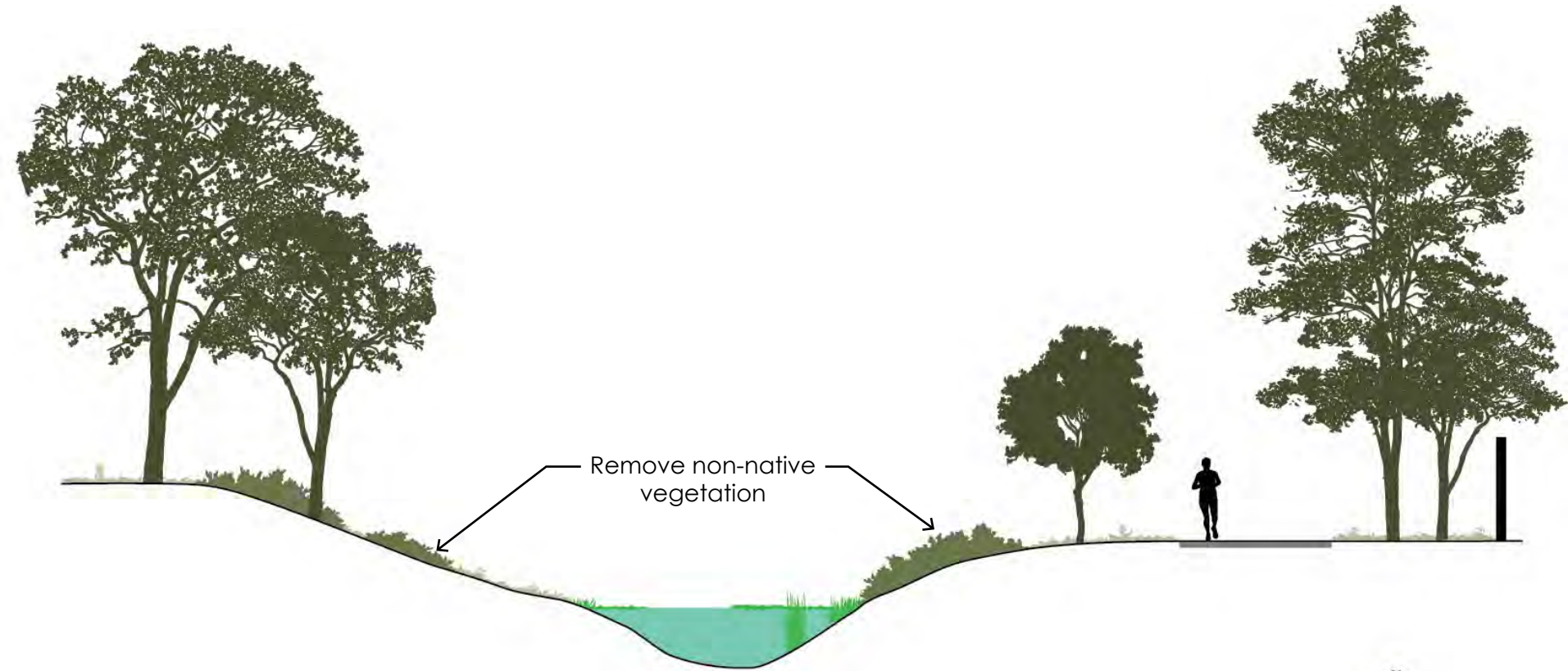
- Plan Area
- Laguna Creek Trail
- Laguna Creek
- Reach 3
- Reach 4



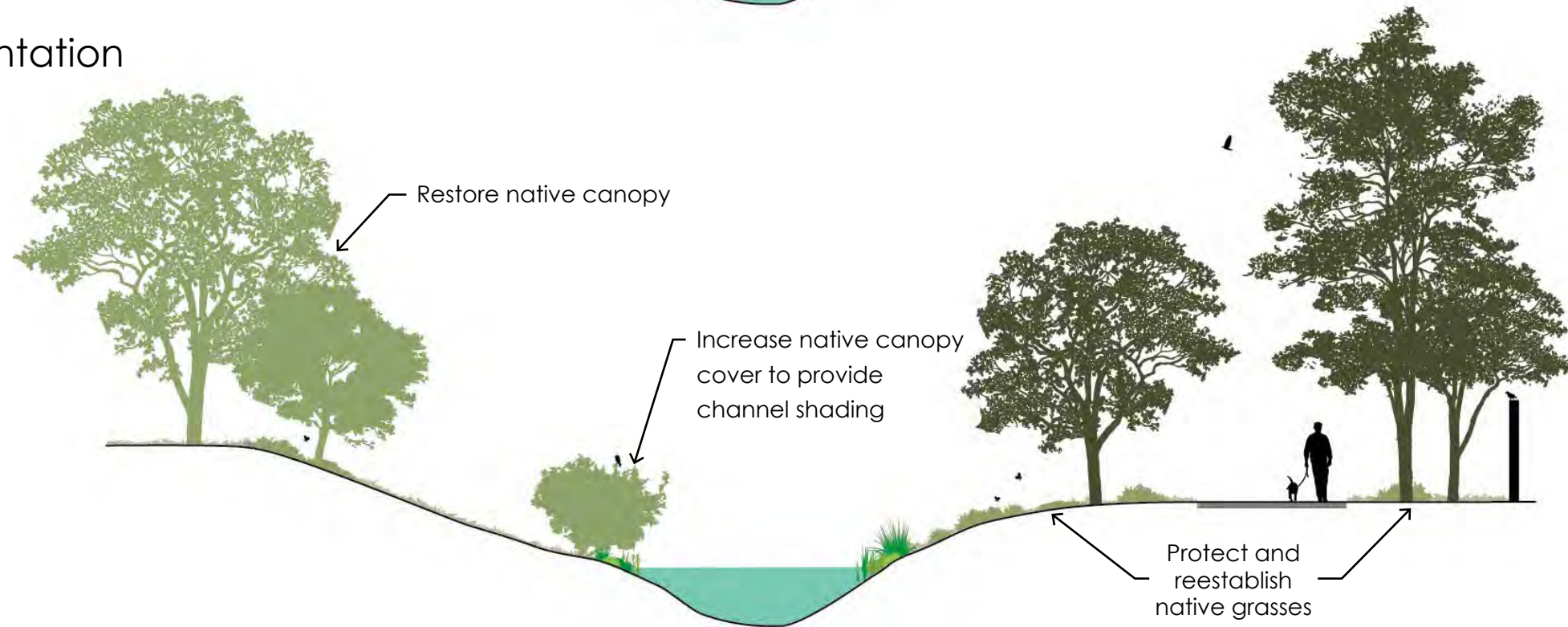
**Figure 15**  
**Laguna Creek RMP Reach 4**

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# Existing Condition



# With BMP Implementation



**Note:** Degree and extent of vegetation growth as depicted in conceptual cross-sections will depend on site-specific conditions and considerations of potential flood risk, conveyance capacity, and increased hydraulic roughness.

Figure 16  
Reach 4 Looking Downstream

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## 5.5 Old Hatchery Site

The Central Valleys Fish Hatchery, located on Elk Grove-Florin Road across from Del Meyer Park, was located in this reach from 1937 to 1993 (Calisphere 2011; see Figures 14 and 15). Representative cross-sections of the Old Hatchery Site under existing conditions and with BMP implementation are provided in **Figure 17**. The Fish and Game Commission purchased a 40-acre parcel in 1936 and constructed a modern warmwater fish hatchery under a federal Works Project Administration (WPA) program. The site included ponds, an office, workshop, and auxiliary outbuildings. The ponds were stocked with adult spotted bass, Sacramento perch, and adult smallmouth bass. Later, aeration equipment was installed and rainbow trout fingerlings were raised at the site. Other species added over the years included white crappie, golden and red shiners, fathead minnows, red-ear sunfish, channel catfish, and threadfin shad. Aquatic plant growth created serious problems in pond management at the hatchery. The hatchery was eventually closed, and structures were removed.

In 1999, a conservation easement for the property was granted to the Wildlife Conservation Board (Conservation Resources, LLC, and Wildlife Conservation Board 1999). The easement deed states:

[T]he purpose of this Conservation Easement is to ensure the property will be retained forever in a natural condition and to prevent any use of the property that will significantly impair or interfere with the conservation values of the property. GRANTOR intends that this Conservation Easement will confine the use of the property to such activities, including without limitation, those involving the preservation and enhancement of native species and their habitat in a manner consistent with the habitat conservation purposes of this Conservation Easement.

The conservation easement contains the following conditions and restrictions:

- (1) No building, billboard, sign, fence or any other structure of any kind shall be erected on the property.
- (2) There shall be no depositing of soil, trash, ashes, garbage, waste or any other material.
- (3) There shall be no excavation, dredging or removal of loam, gravel, soil, rock, sand or other material nor any building of roads nor other change in the general topography of the land, excepting the maintenance of existing foot trails, roads, or for the enhancement of existing wetlands and for the creation of new and additional wetlands approved by the Department of Fish and Game.
- (4) There shall be no removal, destruction or cutting of trees, shrubs or other vegetation except as may be necessary for (a) fire breaks, (b) the maintenance of existing foot trails or roads, (c) the prevention or treatment of disease, or (d) other good husbandry practices approved by STATE.

- (5) No advertising of any kind or nature shall be located on or within the property.
- (6) There shall be no subdivision and no activities, actions or uses detrimental to water conservation, erosion control, soil conservation or fish and wildlife habitat preservation, excepting with the express written consent of the STATE.
- (7) This easement shall allow the general public access to the waterway(s) for the purpose of fishing, at designated areas, wherein such activities will not unreasonably interfere with Grantor's, its assigns' and successors' use of the area.

The Wildlife Conservation Board permits the City access to this area for maintenance and management purposes.

More recently, the hatchery site was recommended for habitat restoration in the *Laguna Creek Watershed Management Action Plan* as Recommended Action No.22 – Creekside Wetland Restoration (CKB Environmental Consulting et al. 2009).

Invasive aquatic vegetation is prevalent in both Laguna Creek and the oxbow, consisting mainly of water primrose and water hyacinth. The area between Laguna Creek and the oxbow is largely unvegetated due to the presence of disturbed, compacted soil and gravel left over from the fish hatchery. Oaks are present at the top of bank of the oxbow. Native grasses such as purple needlegrass and other native understory species are present.

### 5.5.1 Ecological Vision for the Old Hatchery Site

At this time, the City anticipates that management of the Old Hatchery Site would remain unchanged, consisting of routine vegetation control along the oxbow, channel banks, and upland area. City and Operations and Maintenance Division staff and law enforcement would continue to monitor the area for flood control and public safety purposes.

Any proposal for future improvements at the site must comply with the conservation easement and would involve community outreach to identify desired ecological objectives, management goals, and amenities. The long-term ecological vision described here is a preliminary conceptual plan for the area. Additional environmental review may also be required before improvements could be implemented. The ability to enhance habitat conditions within the channel in accordance with this ecological vision should be considered against the potential risk of flooding.

The City's long-term ecological vision for the Old Hatchery Site includes enhancement of the oxbow, improvements to the connection with the main channel to improve water quality, restoration or enhancement of the upland area to an oak woodland, and enhancement of native plant communities along channel banks. Interpretive signage, walking trails, picnic tables, and educational programs may also provide recreational and public stewardship opportunities for Elk Grove residents and visitors. **Figure 18** depicts a preliminary conceptual plan for restoration and management opportunities at the Old Hatchery Site.

## 5.5.2 Potential Constraints and Opportunities at the Old Hatchery Site

### Constraints

- C.5.a. Transient encampments are a concern in the nearby riparian area upstream of Bond Road, and any restoration and management activities at the Old Hatchery Site should provide adequate visibility and access for City and Operations and Maintenance Division staff and law enforcement.
- C.5.b. Maintenance, restoration, and management considerations in this reach need to balance flood risk and visibility for public safety with competing ecological and aesthetic objectives.
- C.5.c. Any activities proposed for the site must comply with the requirements of the conservation easement provided to the City by the Wildlife Conservation Board.
- C.5.d. Available funding limits project size and scope at the Old Hatchery Site.

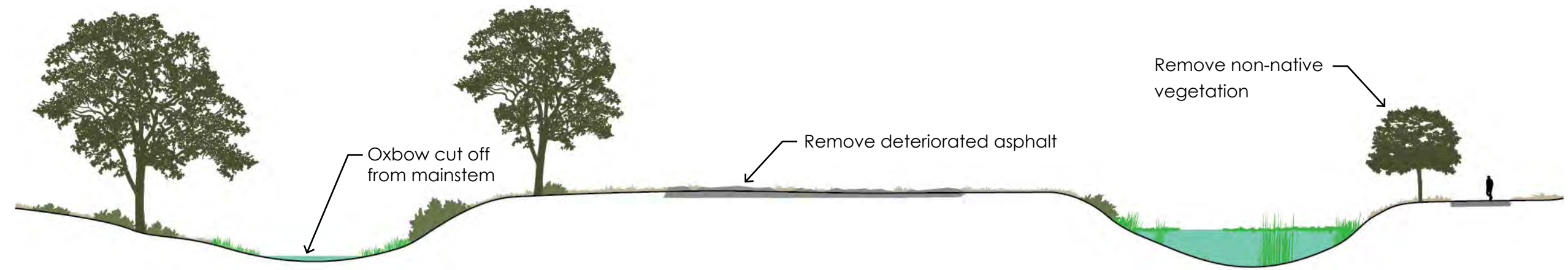
### Opportunities

- O.5.a. The site currently largely lacks woody vegetation, and planting of trees such as oaks and willows would enhance ecological conditions in this area by increasing habitat complexity, available refugia, and nesting substrate. See Attachment C for recommended planting palette. (BIO-6, *Consider Wildlife Habitat Needs*)
- O.5.b. Reestablishment of native grasses and forbs along the Laguna Creek Trail could reduce the need for mowing in upland areas of Reach 4. Native grasses and forbs present in low levels could be protected and reestablished in upland areas along the trail. (VEG-4, *Removal of Invasive Plants*; Attachment D, *Non-native Vegetation Management Plan*)
- O.5.c. Developing a detailed plan for the Old Hatchery Site may provide high-quality ecological improvement, as well as opportunities for long-term public engagement. (PUB-2, *Incorporate Passive Recreation and Educational Features*)
- O.5.d. Potential opportunities to engage community groups in restoration, management, interpretive, and educational activities should be evaluated further. (PUB-3, *Engage Community Groups*)

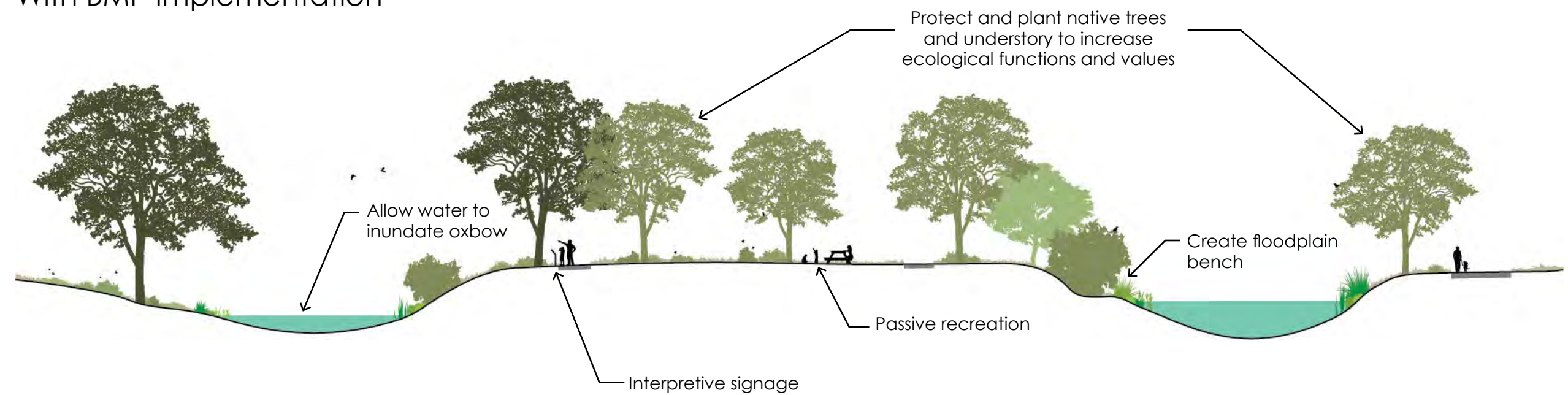
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## Existing Condition



## With BMP Implementation



**Note:** Degree and extent of vegetation growth as depicted in conceptual cross-sections will depend on site-specific conditions and considerations of potential flood risk, conveyance capacity, and increased hydraulic roughness.

**Figure 17**  
Preliminary Concept Plan for the Old Hatchery Site

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**Figure 18**  
**Preliminary Concept Plan for the Old Hatchery Site**

- Trees
- ~
Pedestrian Trail
- Picnic Tables
- Interpretive Panel

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## 6.0 Summary and Comparison of Restoration and Management Opportunities

To aid with the City’s planning for implementation of potential future projects, **Table 2** provides a summary of the opportunities listed for each reach in Section 5. For some opportunities, the appropriate level of environmental review under the California Environmental Quality Act (CEQA) could vary depending on the scale of the proposed activity and its design.

**Table 2. Summary of Restoration and Management Opportunities**

<b>Opportunity No.</b>	<b>Opportunity Description</b>	<b>Anticipated CEQA Documentation*</b>	<b>Additional Permitting Needed</b>	<b>Estimated Implementation Cost</b>	<b>Reduction of Flood Risk or Damage</b>	<b>Ecological Uplift</b>
<b>Reach 1</b>						
O.1.a.	Flag/cage existing tree seedlings/saplings	None	No	Low	Low	Moderate
O.1.b.	Remove invasive plants	None	No	Low	None	Moderate
O.1.c.	Improve recreational use near Waterman Road	None/CE/MND	Yes	Low-Moderate-High	Low	High
O.1.d.	Enhance seasonal wetland habitat	CE/MND	Yes	Moderate-High	Low	High
O.1.e.	Remove/control medusahead near Jack E. Hill Park	None	No	Moderate	None	Moderate
O.1.f.	Implement bank repair	CE/MND	Yes	Moderate-High	Moderate-High	Moderate-High
<b>Reach 2</b>						
O.2.a.	Flag/cage existing tree seedlings/saplings	None	No	Low	Low	Moderate
O.2.b.	Remove invasive plants	None	No	Low	None	Moderate
O.2.c.	Install additional interpretive signage	None	No	Low	None	Low
O.2.d.	Implement feral cat catch-spay/neuter-rehome program	None	No	Moderate	None	High
O.2.e.	Repurpose downed trees and/or large woody debris	None	Yes	Moderate	None	Moderate-High
O.2.f.	Implement targeted grazing program	None	No	Moderate-High	Low-Moderate	Low

Opportunity No.	Opportunity Description	Anticipated CEQA Documentation*	Additional Permitting Needed	Estimated Implementation Cost	Reduction of Flood Risk or Damage	Ecological Uplift
O.2.g.	Replace the culverted trail crossing	MND	Yes	High	High	High
<b>Reach 3</b>						
O.3.a.	Flag/cage existing tree seedlings/saplings	None	No	Low	Low	Moderate
O.3.b.	Remove invasive plants	None	No	Low	None	Moderate
O.3.c.	Plant native trees on right bank	None	No	Low	Low	Moderate
O.3.d.	Public outreach and feral cat management program	None	No	Moderate	None	High
O.3.e.	Improve native habitat on in-channel island	None/CE	Maybe	Moderate	None	Moderate
O.3.f.	Place mulch along left bank fence line	None	No	Low	Low	Low-Moderate
O.3.g.	Localized sediment removal	CE/MND	Yes	Moderate-High	Moderate-High	Moderate-High
<b>Reach 4</b>						
O.4.a.	Flag/cage existing tree seedlings/saplings	None	No	Low	Low	Moderate
O.4.b.	Remove invasive plants	None	No	Low	None	Moderate
O.4.c.	Install additional interpretive signage	None	No	Low	None	Low
O.4.d.	Plant native trees on left bank	None	No	Low	Low	Moderate
O.4.e.	Reestablish native grasses and forbs along trail	None	No	Low	Low	Moderate

Opportunity No.	Opportunity Description	Anticipated CEQA Documentation*	Additional Permitting Needed	Estimated Implementation Cost	Reduction of Flood Risk or Damage	Ecological Uplift
O.4.f.	Modify/remove culvert between oxbow and channel	MND	Yes	Moderate-High	Moderate	Moderate
<b>Old Hatchery Site</b>						
O.5.a.	Plant native trees on left bank	None	No	Low	Low	Moderate
O.5.b.	Reestablish native grasses and forbs	None	No	Low	Low	Moderate
O.5.c.	Enhance/restore former hatchery site	MND	Yes	High	Moderate-High	High
O.5.d.	Engage community groups	None	No	Low	Low	Moderate

\*Anticipated CEQA documentation could vary depending on the scale and design of the proposed project.

Notes: CE = Categorical Exemption; CEQA = California Environmental Quality Act; MND = Mitigated Negative Declaration



## **7.0 Best Management Practices and Impact Avoidance and Minimization Measures**

The City will implement the BMPs described in Table 3 to avoid and minimize potential impacts on natural resources when conducting routine maintenance, restoration, and management activities under this RMP. In addition, these BMPs will be implemented, as applicable, during creek maintenance and management activities elsewhere within the City's jurisdiction.

**Table 3. Best Management Practices for Activities under the Laguna Creek Restoration and Management Plan**

BMP Number	BMP Title	BMP Description
<i>General</i>		
GEN-1	Work Windows	<ul style="list-style-type: none"> <li>▪ Maintenance will generally occur between April 15 and October 15, in accordance with regulatory permit conditions.</li> <li>▪ When maintenance activities will take place within the channel, field personnel shall monitor the National Oceanic and Atmospheric Administration (NOAA) 72-hour forecast for the project area. If the forecast predicts a storm event (i.e., more than a 30% chance of rain), maintenance activities shall cease until all reasonable erosion control measures have been implemented.</li> <li>▪ All ground-disturbing maintenance activities (i.e., tree removal, mechanized vegetation management, bank stabilization, and sediment removal) occurring in the channel will take place between June 15 and October 31. Work within the dry portion of the channel shall be timed with awareness of precipitation forecasts and likely increases in stream level.</li> <li>▪ Hand pruning and hand removal of vegetation may occur year-round, except in areas where wheeled or tracked equipment would be needed to access the site by crossing the creek, ponded area, or secondary channel. In those areas, seasonal work restrictions (April 15 to October 15) will apply.</li> <li>▪ Removal of hazard trees, if routine corrective pruning is not sufficient to address public safety issues, will not occur between February 1 and August 31 to avoid impacts on nesting birds, except after implementation of BMP BIO-3, "Minimize Impacts on Nesting Birds."</li> <li>▪ Modification and removal of large woody debris, such as downed trees, is generally conducted during the dry season, but can occur at any time of the year if imminent danger of a flood threat precludes leaving the wood in place.</li> </ul>
GEN-2	Minimize Area of Disturbance	To minimize impacts on natural resources, ground disturbance shall be limited to the minimum footprint necessary to complete the maintenance operation.
GEN-3	Erosion and Sediment Control	<ul style="list-style-type: none"> <li>▪ Upland soils exposed due to maintenance activities will be seeded and stabilized using erosion control fabric or hydroseeding. The channel bed and areas below the ordinary high water mark (OHWM) are exempt from this BMP.</li> <li>▪ Erosion control fabrics will consist of natural fibers that will biodegrade over time. No plastic or other non-porous material will be used as part of a permanent erosion control approach. Plastic sheeting may be used to protect a slope temporarily from runoff, but only if there are no indications that special-status species would be impacted by the application.</li> </ul>

BMP Number	BMP Title	BMP Description
		<ul style="list-style-type: none"> <li>▪ Erosion control measures will be installed according to manufacturer’s specifications.</li> <li>▪ Appropriate erosion and sediment control measures include, but are not limited to, the following: <ul style="list-style-type: none"> <li>– Silt fences</li> <li>– Straw bale barriers</li> <li>– Brush or rock filters</li> <li>– Storm drain inlet protection</li> <li>– Sediment traps</li> <li>– Sediment basins</li> <li>– Erosion control blankets and mats</li> <li>– Soil stabilization (e.g., tackified straw with seed, jute or geotextile blankets, broadcast seeding and hydro-seeding)</li> </ul> </li> <li>▪ All temporary construction-related erosion control methods (e.g., silt fences) shall be removed at the completion of the maintenance activity.</li> </ul>
GEN-4	Dust Management	<ul style="list-style-type: none"> <li>▪ All exposed surfaces (e.g., parking areas, staging areas, soil piles, graded areas, and unpaved access roads) shall be watered daily.</li> <li>▪ All haul trucks transporting soil, sand, or other loose material off-site shall be covered.</li> <li>▪ All visible mud or dirt track-out onto adjacent public roads shall be removed using wet-power vacuum street sweepers at least once per day. The use of dry-power sweeping is prohibited.</li> <li>▪ All vehicle speeds on unpaved roads shall be limited to 15 mph.</li> <li>▪ Idling times shall be minimized by shutting equipment off when not in use; maximum idling time shall be limited to 5 minutes.</li> <li>▪ All construction equipment shall be maintained and properly tuned in accordance with manufacturer’s specifications. All equipment shall be checked by a certified visible emissions evaluator.</li> </ul>
GEN-5	Staging and Stockpiling of Materials	<ul style="list-style-type: none"> <li>▪ To the extent feasible, staging will occur on access roads, surface streets, or other disturbed areas that are already compacted and support only ruderal vegetation. Similarly, all maintenance equipment and materials (e.g., road rock and project spoil) will be contained within the existing service roads, paved roads, or other predetermined staging areas. Staging areas for equipment, personnel, vehicle parking, and material storage will be sited as far as possible from major roadways.</li> </ul>

BMP Number	BMP Title	BMP Description
		<ul style="list-style-type: none"> <li>▪ To prevent sediment-laden water from being released back into waterways during transport of spoils to disposal locations, truck beds will be lined with an impervious material (e.g., plastic), or tailgates will be blocked with wattles, hay bales, or other appropriate filtration material.</li> <li>▪ Building materials and other maintenance-related materials, including chemicals and sediment, will not be stockpiled or stored where they could spill into water bodies or storm drains.</li> <li>▪ No runoff from the staging areas may be allowed to enter waterways, including the creek channel or storm drains, without being subjected to adequate filtration (e.g., vegetated buffer, hay wattles or bales, silt screens). The discharge of decant water to waterways from any on-site temporary sediment stockpile or storage areas is prohibited.</li> <li>▪ During the dry season, no stockpiled soils will remain exposed and unworked for more than 7 days. During the wet season, no stockpiled soils will remain exposed, unless surrounded by properly installed and maintained silt fencing or other means of erosion control.</li> </ul>
GEN-6*	Stream Access	<ul style="list-style-type: none"> <li>▪ Where feasible, work will be conducted from the top of the bank using an excavator with telescoping arm. If access to the channel is necessary, temporary access points will be constructed in a manner that minimizes impacts on large mature trees, native vegetation, or other significant habitat features, according to the following guidelines:               <ul style="list-style-type: none"> <li>– This activity will be conducted in conjunction with BMPs BIO-1, BIO-2, and BIO-3 to ensure that City staff and contractors comply with applicable BMPs and regulatory permit requirements.</li> <li>– Temporary access points will be constructed as close to the work area as possible to minimize equipment transport.</li> <li>– In considering channel access routes, slopes of greater than 20 percent will be avoided, if possible.</li> <li>– Disturbed areas will be revegetated or filled with compacted soil, seeded, and stabilized with erosion control fabric immediately after the completion of work to prevent future erosion.</li> <li>– Personnel will use the appropriate equipment for the job that minimizes impacts. Appropriately tired vehicles, either tracked or wheeled, will be used depending on the site and maintenance activity.</li> </ul> </li> </ul>

\* The City does not currently conduct work that would require stream access. However, this BMP has been included to guide future work that may require this type of activity.

BMP Number	BMP Title	BMP Description
GEN-7	On-site Hazardous Materials Management	<ul style="list-style-type: none"> <li>▪ An inventory of all hazardous materials used (and/or expected to be used) at the worksite and the end products that are produced (and/or expected to be produced) after their use will be maintained by the worksite manager.</li> <li>▪ As appropriate, containers will be properly labeled with a “Hazardous Waste” label and hazardous waste will be properly recycled or disposed of off-site.</li> <li>▪ Contact of chemicals with precipitation will be minimized by storing chemicals in watertight containers or in a storage shed (completely enclosed), with appropriate secondary containment to prevent any spillage or leakage.</li> <li>▪ Petroleum products, chemicals, cement, lubricants, asphalt, paint or other coatings, non-storm drainage water, and water contaminated with the aforementioned materials will not contact soil and will not be allowed to enter surface waters or the storm drainage system.</li> <li>▪ All toxic materials, including waste disposal containers, will be covered when not in use and located as far away as possible from a direct connection to the storm drainage system or surface water.</li> <li>▪ All trash that is brought to a project site during maintenance activities (e.g., plastic water bottles, plastic lunch bags, cigarettes) will be removed from the site daily.</li> </ul>
GEN-8	Spill Prevention and Response	<ul style="list-style-type: none"> <li>▪ The City will prevent the accidental release of chemicals, fuels, lubricants, and non-storm drainage water into channels by implementing the following measures: <ul style="list-style-type: none"> <li>– Field personnel will be appropriately trained in spill prevention, hazardous material control, and cleanup of accidental spills.</li> <li>– Equipment and materials for cleanup of spills will be available on site and spills and leaks will be cleaned up immediately and disposed of properly.</li> <li>– Field personnel will ensure that hazardous materials are properly handled and natural resources are protected by all reasonable means.</li> <li>– Spill prevention kits will always be in close proximity when using hazardous materials (e.g., at crew trucks and other logical locations). All field personnel will be advised of these locations.</li> </ul> </li> <li>▪ Spill Response Measures: <ul style="list-style-type: none"> <li>– For small spills on impervious surfaces, field personnel will use absorbent materials to remove the spill, rather than hosing it down with water. For small spills on pervious surfaces such as soil, field personnel will excavate the spill and disposed of it properly, rather than burying it. Absorbent materials will be collected and disposed of properly and promptly.</li> </ul> </li> </ul>

BMP Number	BMP Title	BMP Description
GEN-9	Existing Hazardous Materials	If hazardous materials, such as oil, batteries, or paint cans, are encountered at the maintenance sites, the City will carefully remove and dispose of them in an appropriate manner. City staff will wear proper protective gear and store the materials in appropriate hazardous waste containers until they can be disposed of at a hazardous waste facility.
GEN-10	Fire Prevention	<ul style="list-style-type: none"> <li>▪ All earthmoving and portable equipment with internal combustion engines will be equipped with spark arrestors.</li> <li>▪ During the period of high fire danger (April 1–December 1), work crews will: <ul style="list-style-type: none"> <li>– Have appropriate fire suppression equipment available at the work site.</li> <li>– Keep flammable materials, including flammable vegetation slash, at least 10 feet away from any equipment that could produce a spark, fire, or flame.</li> <li>– Not use portable tools powered by gasoline-fueled internal combustion engines within 25 feet of any flammable materials unless a round-point shovel or fire extinguisher is within immediate reach of the work crew (no more than 25 feet away from the work area).</li> </ul> </li> </ul>
GEN-11	Vehicle and Equipment Maintenance	<ul style="list-style-type: none"> <li>▪ All vehicles and equipment will be kept clean. Excessive buildup of oil and grease will be prevented.</li> <li>▪ All equipment used in the creek channel will be inspected for leaks each day prior to initiation of work. Action will be taken to prevent or repair leaks prior to use.</li> <li>▪ Incoming vehicles and equipment (including delivery trucks and employee/subcontractor vehicles) will be checked for leaking oil and fluids. Leaking vehicles or equipment will not be allowed on-site.</li> <li>▪ No heavy equipment will operate in a live stream (see BMP GEN-6, Stream Access).</li> <li>▪ No equipment servicing will be done in the creek channel or immediate floodplain, unless equipment stationed in these locations cannot be readily relocated (i.e., pumps and generators).</li> <li>▪ If necessary, all servicing of equipment done at the job site will be conducted in a designated, protected area to reduce threats to water quality from vehicle fluid spills. Designated areas will not directly connect to surface water or storm drain system. The service area will be clearly designated with berms, sandbags, or other barriers. Secondary containment, such as a drain pan to catch spills or leaks, will be used when removing or changing fluids. Fluids will be stored in appropriate containers with covers and properly recycled or disposed of off-site.</li> <li>▪ If emergency repairs are required in the field, only those repairs necessary to move equipment to a more secure location will be conducted in the channel or floodplain.</li> </ul>

BMP Number	BMP Title	BMP Description
		<ul style="list-style-type: none"> <li>▪ Equipment will be cleaned of any sediment or vegetation before transferring and using in a different watershed to avoid spreading pathogens or exotic/invasive species.</li> <li>▪ Vehicle and equipment washing can occur on-site only as needed to prevent the spread of sediment, pathogens, or exotic/invasive species. No runoff from vehicle or equipment washing is allowed to enter water bodies, including creek channels and storm drains, without being subjected to adequate filtration. Additional vehicle and equipment washing will occur at a City-approved off-site location.</li> </ul>
GEN-12	Vehicle and Equipment Fueling	<ul style="list-style-type: none"> <li>▪ No fueling will be done in the channel (top-of-bank to top-of-bank) or immediate floodplain unless equipment stationed in these locations cannot be readily relocated (e.g., pumps and generators).</li> <li>▪ All off-site fueling sites (i.e., on access roads above the top-of-bank) will be equipped with secondary containment and will avoid a direct connection to soil, surface water, or the storm drainage system.</li> <li>▪ For stationary equipment that must be fueled on-site, secondary containment, such as a drain pan or drop cloth, will be used to prevent accidental spills of fuels from reaching the soil, surface water, or the storm drain system.</li> </ul>
GEN-13	Public Safety Measures	<ul style="list-style-type: none"> <li>▪ The City will implement public safety measures during maintenance as follows: <ul style="list-style-type: none"> <li>– If necessary, construction signs will be posted at work sites warning the public of construction work and recommending caution.</li> <li>– Where work is proposed adjacent to a recreational trail, warning signs will be posted several feet beyond the limits of work. Signs will also be posted if trails will be temporarily closed.</li> <li>– If needed, a travel lane will be closed temporarily to allow trucks to pull into and out of access points to the work site.</li> <li>– Either orange safety fencing or chain-link fencing will be installed above repair sites on bank stabilization projects.</li> <li>– When necessary, City employees or contractors will provide traffic control and site security.</li> <li>– Adequate parking will be provided or designated public parking areas will be used for maintenance-related vehicles not in use through the maintenance period.</li> </ul> </li> </ul>
GEN-14	Minimize Noise Disturbances in Residential Areas	<ul style="list-style-type: none"> <li>▪ The City will implement maintenance practices that minimize disturbances to residential areas surrounding work sites.</li> <li>▪ With the exception of emergencies, work will be conducted during normal working hours (8:00 a.m. – 5:00 p.m.). Maintenance activities in residential areas will not occur on Saturdays, Sundays, or City-</li> </ul>

BMP Number	BMP Title	BMP Description
		<p>observed holidays except during emergencies, or with approval by the City and advance notification of surrounding residents.</p> <ul style="list-style-type: none"> <li>▪ Advanced notification will be provided 1 week prior to the start of construction to adjacent properties within 180 feet of a proposed maintenance site where heavy equipment will be used.</li> <li>▪ Powered equipment (e.g., vehicles, heavy equipment, and hand equipment such as chainsaws) will be equipped with adequate mufflers.</li> <li>▪ Excessive idling of vehicles (i.e., beyond 5 minutes) will be prohibited.</li> </ul>
GEN-15	Work Site Housekeeping	<ul style="list-style-type: none"> <li>▪ City employees and contractors will maintain the work site in neat and orderly conditions on a daily basis, and will leave the site in a neat, clean, and orderly condition when work is complete. Vegetation debris (e.g., slash, sawdust, cuttings) will be removed from the site. As needed, paved access roads and trails will be swept and cleared of any residual vegetation or dirt resulting from the maintenance activity.</li> <li>▪ For activities that last more than one day, materials or equipment left on-site overnight will be stored as inconspicuously as possible and will be neatly arranged.</li> <li>▪ The City’s maintenance crews are responsible for properly removing and disposing of all debris incurred as a result of construction within 72 hours of project completion.</li> </ul>
<b>Vegetation Management</b>		
VEG-1	In-channel Vegetation Removal	<ul style="list-style-type: none"> <li>▪ This activity will be conducted in conjunction with BMPs BIO-1, BIO-2, and BIO-3 to ensure that City staff and contractors comply with applicable BMPs and regulatory permit requirements.</li> <li>▪ Disturbance of vegetation shall not exceed the minimum necessary to complete project-related activities.</li> <li>▪ To minimize the potential effect of localized erosion, the toe of the bank will be protected by leaving vegetation in place to the maximum extent possible.</li> <li>▪ All cleared material and vegetation shall be removed out of the riparian zone and stream channel.</li> </ul> <p>* The City does not currently conduct work that would require in-channel vegetation removal. However, this BMP has been included to guide future work that may require this type of activity.</p>
VEG-2	Routine Pruning	<ul style="list-style-type: none"> <li>▪ Routine corrective pruning may address defects that would eventually result in whole tree failure, such as co-dominant leaders; decayed or diseased limbs; extensive branch dieback; incorrect past pruning; or injury due to storm or mechanical damage. Corrective pruning may occur where a potential hazard exists yet complete removal of a tree is unwarranted. Corrective pruning of lateral branches is also important to reduce the risk of debris trapping in the channel, particularly near the active bankfull channel.</li> </ul>



BMP Number	BMP Title	BMP Description
		<ul style="list-style-type: none"> <li>▪ Pruning activities will follow National ANSI Z133.1-2006 Standards for safe operation of tree care machinery and safety equipment (e.g., carabiners, helmets, and arborist ropes) to ensure the safety of tree climbers.</li> <li>▪ When feasible, branches and limbs extending over the creek shall not be pruned to avoid potential impacts on shaded riverine aquatic habitat.</li> <li>▪ For native trees or woody riparian vegetation split into several trunks close to ground level, a minimum of 50 percent of the total mass of each individual plant shall be preserved where feasible.</li> </ul>
VEG-3	Tree Protection	<ul style="list-style-type: none"> <li>▪ Existing tree seedlings/saplings shall be protected with foliage protection cages to prevent loss or damage from grazing, beaver activity, routine mowing, or other maintenance activities.</li> <li>▪ Foliage protection cages shall be removed after 5 years or when the cage is within ½ inch of the trunk, whichever comes first, to prevent girdling.</li> </ul>
VEG-4	Removal of Invasive Plants	<ul style="list-style-type: none"> <li>▪ Removal and control of invasive plants and trees shall be prioritized to prevent their spread within the RMP area. Where feasible and as funding permits, targeted removal of invasive plants (e.g., Himalayan blackberry, mustard, sweet fennel, eucalyptus, medusahead, Pampas grass, etc.) shall be conducted in accordance with the Non-native Vegetation Management Plan (Attachment D), followed by planting/seeding of native plant species (Attachment C).</li> <li>▪ Replacement plantings may include both trees and understory species and shall focus on native plant species that attract songbirds, pollinators, and other beneficial insects.</li> <li>▪ Invasive plant removal activities can occur independently from or in combination with restoration activities.</li> <li>▪ These habitat enhancement activities may be conducted or assisted by volunteer or watershed groups.</li> </ul>
VEG-5	Woody Debris	<ul style="list-style-type: none"> <li>▪ Downed trees and/or other large woody debris or materials be left in place or repurposed, rather than removed, where appropriate. Fallen trees can be placed laterally along the banks with smaller riparian trees (e.g., sandbar willow) and shrubs planted behind (downstream of) the woody debris.</li> </ul>
VEG-6	Grazing	<ul style="list-style-type: none"> <li>▪ A targeted grazing program shall be implemented, where feasible, at strategic times of the year to reduce biomass fuel build-up, prevent or reduce seed production from non-native annual grasses, and improve ecosystem function and vegetation control efforts in uplands and along the creek.</li> </ul>
VEG-7	Mulching	<ul style="list-style-type: none"> <li>▪ In areas with limited clearance from private property, mulching may provide an efficient and low-impact method to control invasive plants.</li> </ul>

BMP Number	BMP Title	BMP Description
VEG-8	Biotechnical Treatment Approaches	<ul style="list-style-type: none"> <li>▪ Biotechnical treatment approaches, such as live-staking, brush-layering, or live fascines, should be considered in areas of structural instability to help stabilize the channel and address bank undercutting. This type of approach may incorporate live-staking and/or planting of trees and understory vegetation, thereby developing a root system to increase bank stability while also providing shading and habitat for native wildlife.</li> </ul>
<b>Biological Resources</b>		
BIO-1	Contractor Environmental Awareness Training	<p>A qualified biologist shall conduct a contractor environmental awareness training (CEAT) for all persons employed or otherwise working on the project site prior to performing any work on-site and on an annual basis. CEAT shall include a discussion of the biology of the habitats and species present at the site with a focus on any special-status species that may be present; legal protections for those species; penalties for violations; and project-specific protective measures. A sign-in form shall record those who completed CEAT, and attendees will be provided with a copy of the Laguna Creek Maintenance Handbook (in English and Spanish) that contains information about routine maintenance practices, BMPs, and special-status species.</p>
BIO-2	Biological Monitor On-site with Stop Work Authorization	<p>A biological monitor shall be present on-site during the initiation of ground-disturbing maintenance, restoration, or management activities and shall be on call to ensure that BMPs to minimize impacts on fish and wildlife species and habitats are being implemented correctly. The biological monitor shall have the authority to immediately stop any activity that is not in environmental compliance and/or to order any reasonable measure to avoid or minimize impacts on fish and wildlife resources. If any wildlife species are encountered during the conduct of project activity, work shall be halt until the species leaves the work area under its own volition.</p>
BIO-3	Minimize Impacts on Nesting Birds	<ul style="list-style-type: none"> <li>▪ For activities occurring between February 1 and August 31, project areas will be surveyed by a qualified biologist for nesting birds within 15 days prior to starting maintenance work. The survey shall be conducted within a minimum ¼ mile radius of project activities. If a lapse in project-related work of fifteen (15) calendar days or longer occurs, another focused survey may be required before project work can be reinitiated.</li> <li>▪ If nesting birds are found, a buffer will be established around the nest and maintained until the young have fledged. Appropriate buffer widths are 250 feet for raptors, herons, and egrets; 25 feet for ground-nesting non-raptors; and 50 feet for non-raptors nesting on trees, shrubs, and structures. A qualified biologist may identify an alternative buffer based on a site specific-evaluation. No work within the buffer will occur without written approval from a qualified biologist, for as long as the nest is active.</li> <li>▪ The boundary of each buffer zone will be marked with fencing, flagging, or other easily identifiable marking if work will occur immediately outside the buffer zone.</li> </ul>

BMP Number	BMP Title	BMP Description
		<ul style="list-style-type: none"> <li>▪ All protective buffer zones will be maintained until the nest becomes inactive, as determined by a qualified biologist.</li> <li>▪ If monitoring shows that disturbance to actively nesting birds is occurring, buffer widths will be increased until monitoring shows that disturbance is no longer occurring. If this is not possible, work will cease in the area until young have fledged and the nest is no longer active.</li> </ul>
BIO-4	Protection of Special-status Amphibian and Reptile Species	<ul style="list-style-type: none"> <li>▪ A qualified biologist will conduct one daytime survey within a 7-day period preceding the onset of maintenance activities. If no special status amphibian or reptile species are found within the activity area during a pre-activity survey, the work may proceed. If a special status amphibian or reptile, or the eggs or larvae of a special status amphibian or reptile, is found within the survey area during a pre-activity survey or during project activities, the qualified biologist shall notify the City about the special-status species and conduct the following work specific activities:               <ul style="list-style-type: none"> <li>– For minor maintenance activities and for vegetation removal activities that will take less than 1 day, the qualified biologist shall conduct a special-status species survey on the morning of and prior to the scheduled work.</li> <li>– For minor maintenance and vegetation removal activities that will take more than 1 day, the qualified biologist shall conduct a special-status species survey on each morning of and prior to the scheduled work.</li> <li>– If no special-status species is found, the work may proceed.</li> <li>– If eggs of a special-status species are found, a buffer will be established around the location of the eggs and work may proceed outside of the buffer zone. Work within the buffer zone will be rescheduled until eggs have hatched.</li> <li>– If an active western pond turtle nest is detected within the activity area, a 25-foot buffer zone around the nest will be established and maintained during the breeding and nesting season (April 1 – August 31). The buffer zone will remain in place until the young have left the nest, as determined by a qualified biologist.</li> <li>– If adults or juveniles of a special-status species are found, one of the following two procedures will be implemented:                   <ul style="list-style-type: none"> <li>○ If, in the opinion of the qualified biologist, capture and removal of the individual to a safe place outside of the work area is less likely to result in adverse effects than leaving the individual in place and rescheduling the work (e.g., if the species could potentially hide and be missed during a follow-up survey), the individual will be captured and relocated by a qualified biologist (with</li> </ul> </li> </ul> </li> </ul>

BMP Number	BMP Title	BMP Description
		<p>USFWS and/or CDFW approval, depending on the listing status of the species in question), and work may proceed.</p> <ul style="list-style-type: none"> <li>○ If, in the opinion of the qualified biologist, the individual is likely to leave the work area on its own, and work can be feasibly rescheduled, a buffer will be established around the location of the individual(s) and work may proceed outside of the buffer zone. Work within the buffer zone will be rescheduled once the individual has left the work area.</li> </ul>
BIO-5	Avoid and/or Minimize Impacts on Special-status Plant Species	<ul style="list-style-type: none"> <li>▪ A qualified botanist will identify special-status plant species and sensitive natural vegetation communities and clearly map or delineate them as needed to avoid and/or minimize disturbance, using the following protocols: <ul style="list-style-type: none"> <li>– A desktop audit of the California Natural Diversity Database (CNDDDB), vegetation maps, soils maps, and aerial photographs will be conducted to identify if suitable habitats for special-status plants and sensitive natural vegetation communities are potentially located within or near work areas.</li> <li>– Surveys of areas identified as sensitive natural communities or suitable habitat for special-status plant species will be conducted by a qualified botanist prior to commencement of work.</li> <li>– Surveys will be conducted during the appropriate time of year to adequately identify plants.</li> <li>– The qualified botanist will ensure avoidance and minimize of impacts by implementing one or more of the following, as appropriate, per the botanist’s recommendation: <ul style="list-style-type: none"> <li>○ Flag or otherwise delineate in the field the special-status plant populations and/or sensitive natural communities to be protected.</li> <li>○ Allow adequate buffers around plants or habitat; the location of the buffer zone will be shown on the maintenance design drawings and marked in the field with stakes and/or flagging in such a way that exclusion zones are visible to maintenance personnel without excessive disturbance of the sensitive habitat or population itself (e.g., from installation of fencing).</li> <li>○ Time construction or other activities during dormant and/or non-critical life cycle periods.</li> <li>○ Store removed sediment off site.</li> <li>○ Limit the operation of maintenance equipment to established roads whenever possible.</li> </ul> </li> <li>– No herbicides (terrestrial or aquatic) will be used in areas identified as potential habitat for special-status plant species or containing sensitive natural communities until a qualified botanist has surveyed the area and determined the locations of any special-status plant species present.</li> <li>– If special-status plant species are present and maintenance activities cannot avoid impacts on the species, then a qualified botanist will determine the ecologically appropriate minimization measures</li> </ul> </li> </ul>

BMP Number	BMP Title	BMP Description
		<p>for the species. Minimization measures may include transplanting, seed collection, or both, depending on the physiology of the species.</p>
BIO-6	Consider Wildlife Habitat Needs	<ul style="list-style-type: none"> <li>▪ Maintenance and management activities may incorporate consideration of wildlife habitat needs, where feasible and appropriate. Such habitat improvements may include maintaining open areas on south-facing slopes suitable for western pond turtle nesting and enhancement of habitat features, such as large woody debris or logs that would provide basking/refugia habitat for turtles.</li> </ul>
<b>Public Stewardship</b>		
PUB-1	Feral Cat Reduction	<ul style="list-style-type: none"> <li>▪ Community outreach shall be conducted to educate local citizens on the detrimental impacts of feral cats on wildlife. Outreach may include development of on-site signage discouraging the feeding of feral cats. Outreach efforts should be supported by a catch–spay/neuter–rehome (not release) program.</li> </ul>
PUB-2	Incorporate Passive Recreation and Educational Features	<ul style="list-style-type: none"> <li>▪ Seek opportunities to include passive recreational features (e.g., picnic tables, benches, trails) and educational features (e.g., interpretive signage) into large-scale maintenance and vegetation control projects, where feasible and as funding permits.</li> <li>▪ Where possible, seek grant funding for passive recreation and educational features.</li> <li>▪ Educational programs should describe the needs for and methods by which local citizens may contribute to efforts to promote ecosystem health and support City restoration and management efforts, such as plantings, feral cat reduction efforts, and grazing program.</li> </ul>
PUB-3	Engage Community Groups	<ul style="list-style-type: none"> <li>▪ Seek out input from environmental (e.g., LCWC), recreational, and neighborhood-based community groups to assist in planning interpretive and educational displays and programs.</li> <li>▪ Establish a public stewardship program that trains community groups and/or individuals to participate in planting and maintenance activities.</li> <li>▪ Encourage community participation in routine maintenance efforts and ecological enhancement activities.</li> </ul>

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## 8.0 Plan Implementation, Reporting, and Monitoring

In accordance with SAA Administrative Measure 1.6, the City is required to submit a verification request form (VRF) and supporting documentation to CDFW prior to conducting maintenance activities within Laguna Creek. The VRF submittal should describe the proposed activity and include maps, construction drawings, photographs of the location, recent biological surveys, and any other relevant information.

Restoration and management activities implemented by the City under the RMP would be subject to the same notification, work tracking, and reporting requirements as maintenance activities under the City's SAA.

Each year, the City shall develop a seasonal workplan listing proposed maintenance, restoration, and management activities and locations. The seasonal workplan should include the following information for each site:

- approximate location;
- activity type;
- impact area/length;
- estimated duration of activity;
- equipment to be used;
- staging locations (if needed); and
- need for biological surveys and/or monitoring.

The seasonal workplan can also be provided to CDFW in support of VRF submittals. Photographs shall be taken at each location to document pre- and post-activity site conditions. Photographs shall reference the location, date, photo-point location, and directional aspect. As a courtesy, it is recommended that the City provide public notice, including notice to the LCWC and other stakeholder groups, regarding the locations and timing of maintenance activities.

In areas where protected or special-status species may be present, the proposed work areas shall be surveyed by a qualified biologist to determine if work can occur without the possibility of take of a protected species. A memorandum or report summarizing the findings of the biological survey shall accompany the seasonal workplan.

At the end of the work season, the City shall compile a list of the maintenance, restoration, and management activities conducted during that season. At a minimum, the list shall identify the activity, location, impact area/length, and duration of each activity. This list of completed activities shall be compared to the seasonal workplan site list. Differences between the lists (e.g., work that was not conducted or additional work that was not initially included in the seasonal workplan) shall be summarized in an annual report. Supporting materials, such as maps, figures, construction plans, photographs, and other relevant documentation, shall be included with this annual report.

As part of the City's annual assessment process, Operations and Maintenance Division staff shall conduct a visual review of the channel and bank conditions. To provide feedback on the effectiveness of RMP activities, these monitoring efforts shall focus on existing facilities, previous areas of maintenance or bank stabilization, and areas of observed erosion or flooding to identify areas in need of maintenance. This process may be an internal assessment process; any significant observations and recommendations may be included in the annual report and used to guide future maintenance, restoration, and management decisions. The City may also choose to discuss the permitting requirements of identified maintenance, restoration, and management needs with external consultants.



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# Attachment A

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Existing Plant Species



## Attachment A. Existing Plant Species List by Reach

Scientific Name	Common Name	Status in California	Origin	Growth Form	Reach 1	Reach 2	Reach 3	Reach 4	Action	Cal-IPC Rating <sup>1</sup>
<i>Aesculus californica</i>	California buckeye	Native	Native	Tree	X				Keep	
<i>Annual grasses</i>	multiple <sup>2</sup>	Both	Both	Grass	X	X	X	X	Acceptable or Non-target	
<i>Avena species</i>	oats	Naturalized	Non-native	Grass		X	X	X	Acceptable or Non-target	Moderate
<i>Brassica nigra</i>	black mustard	Naturalized	Non-native	Herb		X			Remove	Moderate
<i>Bromus hordeaceus</i>	soft chess	Naturalized	Non-native	Grass	X				Acceptable or Non-target	
<i>Catalpa species</i>	catalpa	Non-native	Non-native	Tree				X	Remove	
<i>Capsella bursa-pastoris</i>	shepherd's purse	Naturalized	Non-native	Herb		X			Acceptable or Non-target	
<i>Carex barbarae</i>	valley sedge	Native	Native	Grass-like plant	X	X	X	X	Keep	
<i>Cichorium intybus</i>	chicory	Naturalized	Non-native	Herb	X	X	X	X	Acceptable or Non-target	
<i>Cirsium vulgare</i>	bull thistle	Naturalized	Non-native	Herb				X	Remove	Moderate
<i>Convolvulus arvensis</i>	field bindweed	Naturalized	Non-native	Herb	X	X	X	X	Acceptable or Non-target	
<i>Cortaderia selloana</i>	Pampas grass	Naturalized	Non-native	Grass	X	X	X	X	Remove	High
<i>Croton setiger</i>	turkey-mullein	Native	Native	Herb	X				Keep	

Scientific Name	Common Name	Status in California	Origin	Growth Form	Reach 1	Reach 2	Reach 3	Reach 4	Action	Cal-IPC Rating <sup>1</sup>
<i>Cynodon dactylon</i>	Bermuda grass	Naturalized	Non-native	Grass	X	X	X	X	Acceptable or Non-target	Moderate
<i>Cyperus eragrostis</i>	tall cyperus	Native	Native	Grass-like plant	X	X	X	X	Keep	
<i>Digitaria species</i>	crabgrass	Naturalized	Non-native	Grass	X	X	X	X	Acceptable or Non-target	
<i>Distichlis spicata</i>	saltgrass	Native	Native	Grass	X	X	X	X	Keep	
<i>Elymus caput-medusae</i>	medusahead	Naturalized	Non-native	Grass	X				Remove	High
<i>Elymus glaucus</i>	blue wild rye	Native	Native	Grass	X	X	X	X	Keep	
<i>Elymus ponticus</i>	tall wheat grass	Non-native	Non-native	Grass	X				Acceptable or Non-target	
<i>Elymus tritichoides</i>	creeping wild rye	Native	Native	Grass	X				Keep	
<i>Epilobium species</i>	willow herbs	Native	Native	Herb	X	X	X	X	Keep	
<i>Erodium species</i>	filarees	Naturalized	Non-native	Herb	X	X	X	X	Acceptable or Non-target	
<i>Eschscholzia californica</i>	California poppy	Native	Native	Herb		X			Keep	
<i>Eucalyptus species</i>	Eucalyptus species	Non-native	Non-native	Tree	X				Remove	Limited
<i>Festuca perennis</i>	Italian rye grass	Naturalized	Non-native	Grass	X				Acceptable or Non-target	
<i>Foeniculum vulgare</i>	sweet fennel	Naturalized	Non-native	Herb	X	X	X	X	Remove	High
<i>Heteromeles arbutifolia</i>	toyon	Native	Native	Tree	X				Keep	



Scientific Name	Common Name	Status in California	Origin	Growth Form	Reach 1	Reach 2	Reach 3	Reach 4	Action	Cal-IPC Rating <sup>1</sup>
<i>Holocarpha virgata</i>	narrow tarplant	Native	Native	Herb	X				Keep	
<i>Juncus species</i> (including <i>J. effusus</i> )	rush species (including bog rush)	Both	Both	Grass-like plant	X	X	X	X	Keep	
<i>Kickxia elatine</i>	sharp leaved fluvellin	Naturalized	Non-native	Herb			X		Remove	
<i>Lactuca species</i>	wild lettuces	Naturalized	Non-native	Herb	X	X	X	X	Acceptable or Non-target	
<i>Marrubium vulgare</i>	white horehound	Naturalized	Non-native	Herb			X		Acceptable or Non-target	Limited
<i>Medicago polymorpha</i>	bur clover	Naturalized	Non-native	Herb	X	X	X	X	Acceptable or Non-target	Limited
<i>Muhlenbergia rigens</i>	deergrass	Native	Native	Grass			X	X	Keep	
<i>Phalaris aquatica</i>	Harding grass	Naturalized	Non-native	Grass	X				Remove	Moderate
<i>Plantago species</i>	plantains	Both	Both	Herb	X	X	X	X	Acceptable or Non-target	
<i>Poa annua</i>	annual blue grass	Naturalized	Non-native	Grass		X			Acceptable or Non-target	
<i>Quercus agrifolia</i>	coast live oak	Native	Native	Tree	X	X	X	X	Keep	
<i>Quercus lobata</i>	valley oak	Native	Native	Tree/Shrub	X	X	X	X	Keep	
<i>Raphanus sativus</i>	jointed charlock	Naturalized	Non-native	Herb	X	X	X	X	Acceptable or Non-target	
<i>Rosa californica</i>	California wild rose	Native	Native	Shrub	X	X	X	X	Keep	
<i>Rubus armeniacus</i>	Himalayan blackberry	Invasive	Non-native	Shrub/Vine	X	X	X	X	Remove	High

Scientific Name	Common Name	Status in California	Origin	Growth Form	Reach 1	Reach 2	Reach 3	Reach 4	Action	Cal-IPC Rating <sup>1</sup>
<i>Rumex crispus</i>	curly dock	Naturalized	Non-native	Herb	X	X	X	X	Acceptable or Non-target	
<i>Salix exigua</i>	sandbar willow	Native	Native	Tree/Shrub	X	X	X	X	Keep	
<i>Salix lasiolepis</i>	Arroyo willow	Native	Native	Tree/Shrub	X	X	X	X	Keep	
<i>Scirpus species</i>	rush species	Both	Both	Grass-like plant	X	X	X	X	Keep	
<i>Sonchus asper</i>	spiny sow thistle	Naturalized	Non-native	Herb	X				Acceptable or Non-target	
<i>Sonchus oleraceus</i>	annual sow thistle	Naturalized	Non-native	Herb	X				Acceptable or Non-target	
<i>Stipa pulchra</i>	purple needlegrass	Native	Native	Grass	X	X	X	X	Keep	
<i>Torilis arvensis</i>	field hedge parsley	Naturalized	Non-native	Herb	X	X	X	X	Acceptable or Non-target	
<i>Tragopogon species</i>	salsify	Naturalized	Non-native	Herb	X				Acceptable or Non-target	
<i>Typha species</i>	cattails	Both	Both	Grass-like plant	X	X	X	X	Keep	
<i>Verbena species</i>	vervain	Both	Both	Herb			X	X	Remove non-native if found	Non-native species = High
<i>Vicia species</i>	annual vetches	Naturalized	Non-native	Herb	X	X	X	X	Acceptable or Non-target	
<i>Xanthium strumarium</i>	rough cocklebur	Native	Native	Herb		X	X		Keep	
<i>Zantedeschia aethiopica</i>	calla lily	Naturalized	Non-native	Grass-like plant			X		Remove	Limited

<sup>1</sup> California Invasive Plant Council (Cal-IPC) ratings refer to the level of negative ecological impact presented by the species. See Cal-IPC (2019) for additional details on these ratings.

<sup>2</sup> Annual grasses include, but are not limited to, soft chess (*Bromus hordeaceus*), red brome (*Bromus madritensis*), oats (*Avena species*), ripgut brome (*Bromus diandrus*), and annual fescues (e.g., *Festuca myuros*). Survey was conducted in December, when most annual grasses have degraded and few are identifiable to species.

# **Attachment B**

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Special-status Species Known to Occur in the  
Vicinity of the Plan Area



The potential for each species to occur in the Plan Area was assessed using the criteria outlined below.

**None:** the area contains a complete lack of suitable habitat, the local range for the species is restricted, and/or the species is extirpated in this region.

**Not Expected:** suitable habitat or key habitat elements might be present but might be of poor quality or isolated from the nearest extant occurrences, and/or the species is not known to occur in the area.

**Possible:** presence of suitable habitat or key habitat elements that potentially support the species.

**Present:** the species was either observed directly or its presence was confirmed by field investigations or in previous studies in the area.

**Table B-1.** Special Status Plants

Name	Listing status* (Federal/State/CNPS)	Habitat and Flowering Period	Potential to Occur in the Plan Area
<i>Brasenia schreberi</i> watershield	- / - / 2B.3	Freshwater marshes and swamps. Aquatic known from water bodies both natural and artificial in California. 1-2180 meters.	<b>Not expected.</b> Potentially suitable habitat is present in the Plan area, but this species is not anticipated due to distance from known occurrences.
<i>Carex comosa</i> bristly sedge	- / - / 2B.1	Marshes and swamps, coastal prairie, valley and foothill grassland. Lake margins, wet places; site below sea level is on a Delta island. -5-1010 meters.	<b>Not expected.</b> Potentially suitable habitat is present in the Plan area, but this species is not anticipated due to distance from known occurrences.
<i>Cicuta maculata</i> var. <i>bolanderi</i> Bolander's water-hemlock	- / - / 2B.1	Marshes and swamps. In fresh or brackish water. 0-20 meters.	<b>Not expected.</b> Potentially suitable habitat is present in the Plan area, but this species is not anticipated due to distance from known occurrences.
<i>Cuscuta obtusiflora</i> var. <i>glandulosa</i> Peruvian dodder	- / - / 2B.2	Marshes and swamps (freshwater). Freshwater marsh. 15-280 meters.	<b>Not expected.</b> Potentially suitable habitat is present in the Plan area, but this species is not anticipated due to

Name	Listing status* (Federal/ State/CNPS)	Habitat and Flowering Period	Potential to Occur in the Plan Area
			distance from known occurrences.
<i>Downingia pusilla</i> dwarf downingia	- / - / 2B.2	Valley and foothill grassland (mesic sites), vernal pools. Vernal lake and pool margins with a variety of associates. In several types of vernal pools. 1-490 meters.	<b>Possible.</b> Suitable habitat is present in the vernal pool in the Plan area.
<i>Gratiola heterosepala</i> Boggs Lake hedge-hyssop	- / SE / 1B.2	Marshes and swamps (freshwater), vernal pools. Clay soils; usually in vernal pools, sometimes on lake margins. 4-2410 meters.	<b>Possible.</b> Suitable habitat is present in the vernal pool in the Plan area.
<i>Hibiscus lasiocarpus</i> var. <i>occidentalis</i> woolly rose-mallow	- / - / 1B.2	Marshes and swamps (freshwater). Moist, freshwater-soaked river banks & low peat islands in sloughs; can also occur on riprap and levees. In California, known from the delta watershed. 0-155 meters.	<b>Possible.</b> Potentially suitable habitat is present in Laguna Creek in the Plan area.
<i>Juncus leiospermus</i> var. <i>ahartii</i> Ahart's dwarf rush	- / - / 1B.2	Valley and foothill grassland. Restricted to the edges of vernal pools in grassland. 30-100 meters.	<b>Not expected.</b> Potentially suitable habitat is present in the Plan area, but this species is not anticipated due to distance from known occurrences.
<i>Lathyrus jepsonii</i> var. <i>jepsonii</i> Delta tule pea	- / - / 1B.2	Marshes and swamps. In freshwater and brackish marshes. Often found with <i>Typha</i> , <i>Aster lentus</i> , <i>Rosa californica</i> , <i>Juncus</i> spp., <i>Scirpus</i> , etc. Usually on marsh and slough edges. 0-5 meters.	<b>None.</b> The Plan area is not within the range of this species.
<i>Legenere limosa</i> legenere	- / - / 1B.1	Vernal pools. In beds of vernal pools. 1-1005 meters.	<b>Possible.</b> Suitable habitat is present in the vernal pool in the Plan area.
<i>Lepidium latipes</i> var. <i>heckardii</i> Heckard's pepper-grass	- / - / 1B.2	Valley and foothill grassland, vernal pools. Grassland, and sometimes vernal pool edges. Alkaline soils. 1-30 meters.	<b>Not expected.</b> Marginally suitable habitat is present in the Project.
<i>Lilaeopsis masonii</i> Mason's lilaeopsis	- / SR / 1B.1	Marshes and swamps, riparian scrub. Tidal zones, in muddy or silty soil formed through river deposition or river bank erosion. In brackish or freshwater. 0-10 meters.	<b>None.</b> Suitable habitat is not present in the Project.
<i>Limosella australis</i> Delta mudwort	- / - / 2B.1	Riparian scrub, marshes and swamps. Usually on mud banks of the Delta in marshy or scrubby riparian associations; often with <i>Lilaeopsis masonii</i> . 0-5 meters.	<b>None.</b> The Project is not within the known range of this species.
<i>Orcuttia tenuis</i> slender Orcutt grass	FT / SE / 1B.1	Vernal pools. Often in gravelly substrate. 25-1755 meters.	<b>Not expected.</b> Potentially suitable habitat is present in the Plan area, but this species is not anticipated due to

Name	Listing status* (Federal/State/CNPS)	Habitat and Flowering Period	Potential to Occur in the Plan Area
			distance from known occurrences.
<i>Orcuttia viscida</i> Sacramento Orcutt grass	FE / SE / 1B.1	Vernal pools. 15-85 meters.	<b>Not expected.</b> Potentially suitable habitat is present in the Plan area, but this species is not anticipated due to distance from known occurrences.
<i>Sagittaria sanfordii</i> Sanford's arrowhead	- / - / 1B.2	Marshes and swamps. In standing or slow-moving freshwater ponds, marshes, and ditches. 0-605 meters.	<b>Possible.</b> Potentially suitable habitat is present in Laguna Creek in the Plan area.
<i>Scutellaria galericulata</i> marsh skullcap	- / - / 2B.2	Marshes and swamps, lower montane coniferous forest, meadows and seeps. Swamps and wet places. 0-1950 meters.	<b>Not expected.</b> Potentially suitable habitat is present in the Plan area, but this species is not anticipated due to distance from known occurrences.
<i>Scutellaria lateriflora</i> side-flowering skullcap	- / - / 2B.2	Meadows and seeps, marshes and swamps. Wet meadows and marshes. In the Delta, often found on logs. 0-500 meters.	<b>Not expected.</b> Potentially suitable habitat is present in the Plan area, but this species is not anticipated due to distance from known occurrences.
<i>Trifolium hydrophilum</i> saline clover	- / - / 1B.2	Marshes and swamps, valley and foothill grassland, vernal pools. Mesic, alkaline sites. 1-335 meters.	<b>Not expected.</b> Marginally suitable habitat is present in the Project.
<p><b>* List of Abbreviations for Federal and State Species Status follow below:</b>  <b>FE = Federal endangered</b>  <b>FT = Federal threatened</b>  <b>SE = State endangered</b>  <b>ST = State threatened</b>  <b>SR = State rare</b></p>			

**Table B-2. Special Status Animal Species**

Scientific name	Listing status* (Federal/ State)	Habitat	Potential to Occur in the Plan Area
<b>Invertebrates</b>			
<i>Branchinecta lynchi</i> vernal pool fairy shrimp	FT/-	Endemic to the grasslands of the Central Valley, Central Coast mountains, and South Coast mountains, in astatic rain-filled pools. Inhabit small, clear-water sandstone-depression pools and grassed swale, earth slump, or basalt-flow depression pools.	<b>Possible.</b> Suitable habitat is present in the vernal pool in the Plan area.
<i>Desmocerus californicus dimorphus</i> valley elderberry longhorn beetle	FT/-	Occurs only in the Central Valley of California, in association with blue elderberry ( <i>Sambucus nigra</i> ssp. <i>caerulea</i> ). Prefers to lay eggs in elderberries 2-8 inches in diameter; some preference shown for "stressed" elderberries.	<b>Possible.</b> Possible if elderberries are present.
<i>Lepidurus packardii</i> vernal pool tadpole shrimp	FE/-	Inhabits vernal pools and swales in the Sacramento Valley containing clear to highly turbid water. Pools commonly found in grass-bottomed swales of unplowed grasslands. Some pools are mud-bottomed and highly turbid.	<b>Possible.</b> Suitable habitat is present in the vernal pool in the Plan area.
<b>Amphibians</b>			
<i>Ambystoma californiense</i> California tiger salamander	FT/ST	Central Valley DPS federally listed as threatened. Santa Barbara and Sonoma counties DPS federally listed as endangered. Need underground refuges, especially ground squirrel burrows, and vernal pools or other seasonal water sources for breeding.	<b>Not expected.</b> Marginally suitable habitat is present in the Plan area.
<i>Rana draytonii</i> California red-legged frog	FT/SSC	Lowlands and foothills in or near permanent sources of deep water with dense, shrubby or emergent riparian vegetation. Requires 11-20 weeks of permanent water for larval development. Must have access to estivation habitat.	<b>None.</b> This species is considered extirpated from the floor of the Central Valley (USFWS 2002).
<i>Spea hammondi</i> western spadefoot	-/SSC	Occurs primarily in grassland habitats, but can be found in valley-foothill hardwood woodlands. Vernal pools are essential for breeding and egg-laying.	<b>Not expected.</b> Marginally suitable habitat is present in the Plan area.
<b>Reptiles</b>			
<i>Emys marmorata</i> western pond turtle	- / SSC	A thoroughly aquatic turtle of ponds, marshes, rivers, streams and irrigation ditches, usually with aquatic vegetation, below 6,000 ft. elevation. Need basking sites and suitable (sandy banks or grassy open fields) upland habitat up to 0.5 km from water for egg-laying.	<b>Present.</b> This species was observed within the Plan area (California Natural Diversity Database [CNDDDB] occurrence #532).



Scientific name	Listing status* (Federal/ State)	Habitat	Potential to Occur in the Plan Area
<i>Thamnophis gigas</i> giant gartersnake	FT/ST	Prefers freshwater marsh and low gradient streams. Has adapted to drainage canals and irrigation ditches. This is the most aquatic of the gartersnakes in California.	<b>Possible.</b> Potentially suitable habitat is present in the Plan area.
<b>Fish</b>			
<i>Hypomesus transpacificus</i> Delta smelt	FT/SE	Sacramento-San Joaquin Delta. Seasonally in Suisun Bay, Carquinez Strait & San Pablo Bay. Seldom found at salinities > 10 ppt. Most often at salinities < 2ppt.	<b>None.</b> The Plan area is not within the range of this species.
<i>Oncorhynchus mykiss irideus</i> steelhead - Central Valley DPS	FT/-	Populations in the Sacramento and San Joaquin rivers and their tributaries.	<b>None.</b> Steelhead not known from the Plan area.
<i>Pogonichthys macrolepidotus</i> Sacramento splittail	-/SSC	Endemic to the lakes and rivers of the Central Valley, but now confined to the Delta, Suisun Bay and associated marshes. Slow moving river sections, dead end sloughs. Requires flooded vegetation for spawning and foraging for young.	<b>None.</b> The Project is not within the known current range of this species (Santos et al. 2014).
<i>Spirinchus thaleichthys</i> longfin smelt	FC/ST	Euryhaline, nektonic & anadromous. Found in open waters of estuaries, mostly in middle or bottom of water column. Prefer salinities of 15-30 ppt, but can be found in completely freshwater to almost pure seawater.	<b>None.</b> Suitable habitat is not present in the Plan area
<b>Birds</b>			
<i>Agelaius tricolor</i> tricolored blackbird	-/ST, SSC	Highly colonial species, most numerous in Central Valley & vicinity. Largely endemic to California. Requires open water, protected nesting substrate, and foraging area with insect prey within a few km of the colony.	<b>Possible.</b> Potentially suitable habitat is present in the Plan area.
<i>Aquila chrysaetos</i> golden eagle	-/FP	Rolling foothills, mountain areas, sage-juniper flats, and desert. Cliff-walled canyons provide nesting habitat in most parts of range; also, large trees in open areas.	<b>None.</b> Suitable habitat is not present in the Plan area
<i>Athene cunicularia</i> burrowing owl	-/SSC	Open, dry annual or perennial grasslands, deserts, and scrublands characterized by low-growing vegetation. Subterranean nester, dependent upon burrowing mammals, most notably, the California ground squirrel.	<b>Not expected.</b> Potentially suitable habitat for wintering individuals but not expected the rest of the year.
<i>Buteo swainsoni</i> Swainson's hawk	-/ST	Breeds in grasslands with scattered trees, juniper-sage flats, riparian areas, savannahs, & agricultural or ranch lands with groves or lines of trees. Requires adjacent suitable foraging areas such as grasslands, or alfalfa or grain fields supporting rodent populations.	<b>Possible.</b> Potentially suitable nesting and foraging

Scientific name	Listing status* (Federal/ State)	Habitat	Potential to Occur in the Plan Area
			habitat is present in the Plan area.
<i>Coccyzus americanus occidentalis</i> western yellow-billed cuckoo	FT/SE	Riparian forest nester, along the broad, lower flood-bottoms of larger river systems. Nests in riparian jungles of willow, often mixed with cottonwoods, with lower story of blackberry, nettles, or wild grape.	<b>Not expected.</b> Marginally suitable habitat is present in the Project.
<i>Elanus leucurus</i> white-tailed kite	-/FP	Rolling foothills and valley margins with scattered oaks & river bottomlands or marshes next to deciduous woodland. Open grasslands, meadows, or marshes for foraging close to isolated, dense-topped trees for nesting and perching.	<b>Present.</b> Observed in the Plan area (ebird 2019).
<i>Laterallus jamaicensis coturniculus</i> California black rail	-/ST, FP	Inhabits freshwater marshes, wet meadows and shallow margins of saltwater marshes bordering larger bays. Needs water depths of about 1 inch that do not fluctuate during the year and dense vegetation for nesting habitat.	<b>None.</b> The Plan area is outside of the range of this species (CDFW 1995)
<i>Melospiza melodia</i> song sparrow ("Modesto" population)	-/SSC	Typically emergent freshwater marshes dominated by tules ( <i>Scirpus</i> spp.) and cattails ( <i>Typha</i> spp.) as well as riparian willow ( <i>Salix</i> spp.) and valley oak ( <i>Quercus lobata</i> ) (Gardali 2008).	<b>Possible.</b> Potentially suitable habitat is present in the Plan area.
<i>Progne subis</i> purple martin	-/SSC	Inhabits woodlands, low elevation coniferous forest of Douglas-fir, ponderosa pine, and Monterey pine. Nests in old woodpecker cavities mostly; also in human-made structures. Nest often located in tall, isolated tree/snag.	<b>Not expected.</b> Marginally suitable habitat is present in the Project.
<i>Riparia riparia</i> bank swallow	-/ST	Colonial nester; nests primarily in riparian and other lowland habitats west of the desert. Requires vertical banks/cliffs with fine-textured/sandy soils near streams, rivers, lakes, ocean to dig nesting hole.	<b>None.</b> Suitable habitat is not present in the Plan area
<i>Xanthocephalus xanthocephalus</i> yellow-headed blackbird	-/SSC	Nests in freshwater emergent wetlands with dense vegetation and deep water. Often along borders of lakes or ponds. Nests only where large insects such as Odonata are abundant, nesting timed with maximum emergence of aquatic insects.	<b>Possible.</b> Potentially suitable habitat is present in the Plan area.
<b>Mammals</b>			
<i>Taxidea taxus</i> American badger	- / SSC	Most abundant in drier open stages of most shrub, forest, and herbaceous habitats, with friable soils. Needs sufficient food, friable soils and open, uncultivated ground. Preys on burrowing rodents. Digs burrows.	<b>None.</b> Suitable habitat is not present in the Project.
<p><b>* List of Abbreviations for Federal and State Species Status follow below:</b>  <b>FE = Federal endangered</b>  <b>FT = Federal threatened</b>  <b>SE = State endangered</b>  <b>ST = State threatened</b>  <b>SSC = Species of special concern</b></p>			

Scientific name	Listing status* (Federal/ State)	Habitat	Potential to Occur in the Plan Area
FP = State fully protected			

**References:**

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# IPaC resource list

This report is an automatically generated list of species and other resources such as critical habitat (collectively referred to as *trust resources*) under the U.S. Fish and Wildlife Service's (USFWS) jurisdiction that are known or expected to be on or near the project area referenced below. The list may also include trust resources that occur outside of the project area, but that could potentially be directly or indirectly affected by activities in the project area. However, determining the likelihood and extent of effects a project may have on trust resources typically requires gathering additional site-specific (e.g., vegetation/species surveys) and project-specific (e.g., magnitude and timing of proposed activities) information.

Below is a summary of the project information you provided and contact information for the USFWS office(s) with jurisdiction in the defined project area. Please read the introduction to each section that follows (Endangered Species, Migratory Birds, USFWS Facilities, and NWI Wetlands) for additional information applicable to the trust resources addressed in that section.

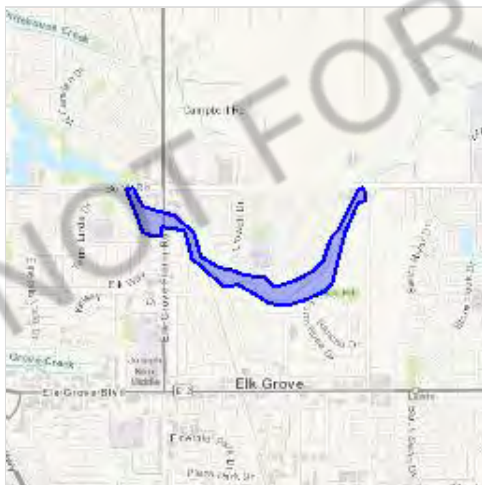
## Project information

### NAME

Laguna Creek Maintenance Plan

### LOCATION

Sacramento County, California



## Local office

Sacramento Fish And Wildlife Office

☎ (916) 414-6600

📅 (916) 414-6713

Federal Building  
2800 Cottage Way, Room W-2605

NOT FOR CONSULTATION

# Endangered species

**This resource list is for informational purposes only and does not constitute an analysis of project level impacts.**

The primary information used to generate this list is the known or expected range of each species. Additional areas of influence (AOI) for species are also considered. An AOI includes areas outside of the species range if the species could be indirectly affected by activities in that area (e.g., placing a dam upstream of a fish population, even if that fish does not occur at the dam site, may indirectly impact the species by reducing or eliminating water flow downstream). Because species can move, and site conditions can change, the species on this list are not guaranteed to be found on or near the project area. To fully determine any potential effects to species, additional site-specific and project-specific information is often required.

Section 7 of the Endangered Species Act **requires** Federal agencies to "request of the Secretary information whether any species which is listed or proposed to be listed may be present in the area of such proposed action" for any project that is conducted, permitted, funded, or licensed by any Federal agency. A letter from the local office and a species list which fulfills this requirement can **only** be obtained by requesting an official species list from either the Regulatory Review section in IPaC (see directions below) or from the local field office directly.

For project evaluations that require USFWS concurrence/review, please return to the IPaC website and request an official species list by doing the following:

1. Log in to IPaC.
2. Go to your My Projects list.
3. Click PROJECT HOME for this project.
4. Click REQUEST SPECIES LIST.

Listed species<sup>1</sup> and their critical habitats are managed by the [Ecological Services Program](#) of the U.S. Fish and Wildlife Service (USFWS) and the fisheries division of the National Oceanic and Atmospheric Administration (NOAA Fisheries<sup>2</sup>).

Species and critical habitats under the sole responsibility of NOAA Fisheries are **not** shown on this list. Please contact [NOAA Fisheries](#) for [species under their jurisdiction](#).

1. Species listed under the [Endangered Species Act](#) are threatened or endangered; IPaC also shows species that are candidates, or proposed, for listing. See the [listing status page](#) for more information.
2. [NOAA Fisheries](#), also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

The following species are potentially affected by activities in this location:

## Reptiles

NAME

STATUS

Giant Garter Snake *Thamnophis gigas* Threatened  
No critical habitat has been designated for this species.  
<https://ecos.fws.gov/ecp/species/4482>

## Amphibians

NAME	STATUS
California Red-legged Frog <i>Rana draytonii</i> There is <b>final</b> critical habitat for this species. Your location is outside the critical habitat. <a href="https://ecos.fws.gov/ecp/species/2891">https://ecos.fws.gov/ecp/species/2891</a>	Threatened
California Tiger Salamander <i>Ambystoma californiense</i> There is <b>final</b> critical habitat for this species. Your location is outside the critical habitat. <a href="https://ecos.fws.gov/ecp/species/2076">https://ecos.fws.gov/ecp/species/2076</a>	Threatened

## Fishes

NAME	STATUS
Delta Smelt <i>Hypomesus transpacificus</i> There is <b>final</b> critical habitat for this species. Your location is outside the critical habitat. <a href="https://ecos.fws.gov/ecp/species/321">https://ecos.fws.gov/ecp/species/321</a>	Threatened

## Insects

NAME	STATUS
Valley Elderberry Longhorn Beetle <i>Desmocerus californicus dimorphus</i> There is <b>final</b> critical habitat for this species. Your location is outside the critical habitat. <a href="https://ecos.fws.gov/ecp/species/7850">https://ecos.fws.gov/ecp/species/7850</a>	Threatened

## Crustaceans

NAME	STATUS
Vernal Pool Fairy Shrimp <i>Branchinecta lynchi</i> There is <b>final</b> critical habitat for this species. Your location is outside the critical habitat. <a href="https://ecos.fws.gov/ecp/species/498">https://ecos.fws.gov/ecp/species/498</a>	Threatened
Vernal Pool Tadpole Shrimp <i>Lepidurus packardii</i> There is <b>final</b> critical habitat for this species. Your location is outside the critical habitat. <a href="https://ecos.fws.gov/ecp/species/2246">https://ecos.fws.gov/ecp/species/2246</a>	Endangered

# Flowering Plants

NAME	STATUS
Sacramento Orcutt Grass <i>Orcuttia viscida</i> There is <b>final</b> critical habitat for this species. Your location is outside the critical habitat. <a href="https://ecos.fws.gov/ecp/species/5507">https://ecos.fws.gov/ecp/species/5507</a>	Endangered
Slender Orcutt Grass <i>Orcuttia tenuis</i> There is <b>final</b> critical habitat for this species. Your location is outside the critical habitat. <a href="https://ecos.fws.gov/ecp/species/1063">https://ecos.fws.gov/ecp/species/1063</a>	Threatened

## Critical habitats

Potential effects to critical habitat(s) in this location must be analyzed along with the endangered species themselves.

THERE ARE NO CRITICAL HABITATS AT THIS LOCATION.

## Migratory birds

Certain birds are protected under the Migratory Bird Treaty Act<sup>1</sup> and the Bald and Golden Eagle Protection Act<sup>2</sup>.

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats should follow appropriate regulations and consider implementing appropriate conservation measures, as described [below](#).

1. The [Migratory Birds Treaty Act](#) of 1918.
2. The [Bald and Golden Eagle Protection Act](#) of 1940.

Additional information can be found using the following links:

- Birds of Conservation Concern <http://www.fws.gov/birds/management/managed-species/birds-of-conservation-concern.php>
- Measures for avoiding and minimizing impacts to birds <http://www.fws.gov/birds/management/project-assessment-tools-and-guidance/conservation-measures.php>
- Nationwide conservation measures for birds <http://www.fws.gov/migratorybirds/pdf/management/nationwidestandardconservationmeasures.pdf>

The birds listed below are birds of particular concern either because they occur on the [USFWS Birds of Conservation Concern](#) (BCC) list or warrant special attention in your project location. To learn more about the levels of concern for birds on your list and how this list is generated, see the FAQ



[below](#). This is not a list of every bird you may find in this location, nor a guarantee that every bird on this list will be found in your project area. To see exact locations of where birders and the general public have sighted birds in and around your project area, visit the [E-bird data mapping tool](#) (Tip: enter your location, desired date range and a species on your list). For projects that occur off the Atlantic Coast, additional maps and models detailing the relative occurrence and abundance of bird species on your list are available. Links to additional information about Atlantic Coast birds, and other important information about your migratory bird list, including how to properly interpret and use your migratory bird report, can be found [below](#).

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON (IF A BREEDING SEASON IS INDICATED FOR A BIRD ON YOUR LIST, THE BIRD MAY BREED IN YOUR PROJECT AREA SOMETIME WITHIN THE TIMEFRAME SPECIFIED, WHICH IS A VERY LIBERAL ESTIMATE OF THE DATES INSIDE WHICH THE BIRD BREEDS ACROSS ITS ENTIRE RANGE. "BREEDS ELSEWHERE" INDICATES THAT THE BIRD DOES NOT LIKELY BREED IN YOUR PROJECT AREA.)
<p>Common Yellowthroat <i>Geothlypis trichas sinuosa</i> This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA <a href="https://ecos.fws.gov/ecp/species/2084">https://ecos.fws.gov/ecp/species/2084</a></p>	Breeds May 20 to Jul 31
<p>Golden Eagle <i>Aquila chrysaetos</i> This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. <a href="https://ecos.fws.gov/ecp/species/1680">https://ecos.fws.gov/ecp/species/1680</a></p>	Breeds Jan 1 to Aug 31
<p>Nuttall's Woodpecker <i>Picoides nuttallii</i> This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA <a href="https://ecos.fws.gov/ecp/species/9410">https://ecos.fws.gov/ecp/species/9410</a></p>	Breeds Apr 1 to Jul 20
<p>Oak Titmouse <i>Baeolophus inornatus</i> This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. <a href="https://ecos.fws.gov/ecp/species/9656">https://ecos.fws.gov/ecp/species/9656</a></p>	Breeds Mar 15 to Jul 15

Rufous Hummingbird *selasphorus rufus*

Breeds elsewhere

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

<https://ecos.fws.gov/ecp/species/8002>

Song Sparrow *Melospiza melodia*

Breeds Feb 20 to Sep 5

This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA

Spotted Towhee *Pipilo maculatus clementae*

Breeds Apr 15 to Jul 20

This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA

<https://ecos.fws.gov/ecp/species/4243>

Tricolored Blackbird *Agelaius tricolor*

Breeds Mar 15 to Aug 10

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

<https://ecos.fws.gov/ecp/species/3910>

Yellow-billed Magpie *Pica nuttalli*

Breeds Apr 1 to Jul 31

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

<https://ecos.fws.gov/ecp/species/9726>

## Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

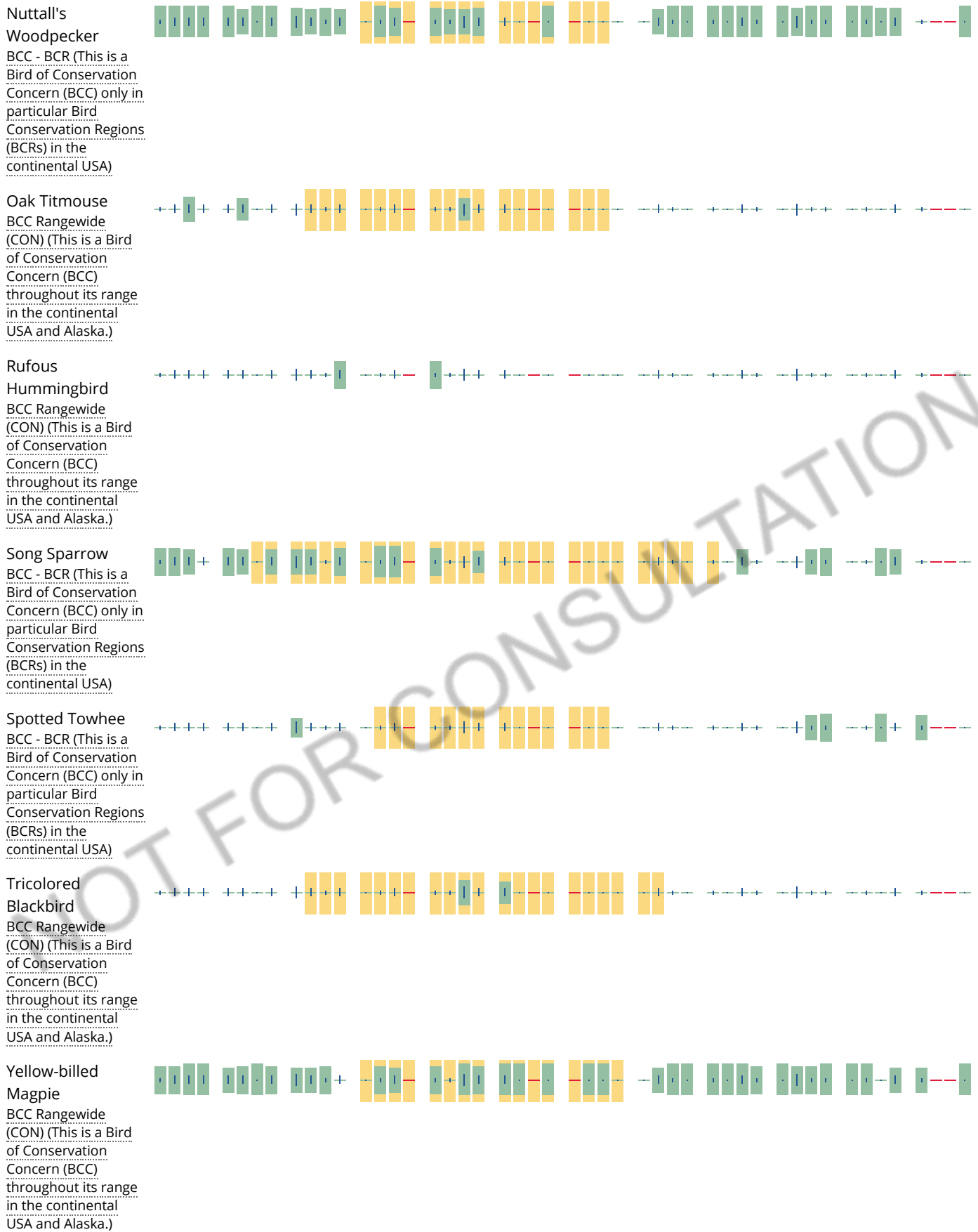
### Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted





Tell me more about conservation measures I can implement to avoid or minimize impacts to migratory birds.

[Nationwide Conservation Measures](#) describes measures that can help avoid and minimize impacts to all birds at any location year round. Implementation of these measures is particularly important when birds are most likely to occur in the project area. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is a very helpful impact minimization measure. To see when birds are most likely to occur and be breeding in your project area, view the Probability of Presence Summary. [Additional measures](#) and/or [permits](#) may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

### **What does IPaC use to generate the migratory birds potentially occurring in my specified location?**

The Migratory Bird Resource List is comprised of USFWS [Birds of Conservation Concern \(BCC\)](#) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the [Avian Knowledge Network \(AKN\)](#). The AKN data is based on a growing collection of [survey, banding, and citizen science datasets](#) and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle ([Eagle Act](#) requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the [AKN Phenology Tool](#).

### **What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?**

The probability of presence graphs associated with your migratory bird list are based on data provided by the [Avian Knowledge Network \(AKN\)](#). This data is derived from a growing collection of [survey, banding, and citizen science datasets](#).

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go to the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

### **How do I know if a bird is breeding, wintering, migrating or present year-round in my project area?**

To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating or year-round), you may refer to the following resources: [The Cornell Lab of Ornithology All About Birds Bird Guide](#), or (if you are unsuccessful in locating the bird of interest there), the [Cornell Lab of Ornithology Neotropical Birds guide](#). If a bird on your migratory bird species list has a breeding season associated with it, if that bird does occur in your project area, there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

### **What are the levels of concern for migratory birds?**

Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are [Birds of Conservation Concern](#) (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the [Eagle Act](#) requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to try to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially eagles and BCC species of rangewide concern. For more information on conservation measures you can implement to help avoid and minimize migratory bird impacts and requirements for eagles, please see the FAQs for these topics.

### **Details about birds that are potentially affected by offshore projects**

For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the [Northeast Ocean Data Portal](#). The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the [NOAA NCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf](#) project webpage.

Bird tracking data can also provide additional details about occurrence and habitat use throughout the year, including migration. Models relying on survey data may not include this information. For additional information on marine bird tracking data, see the [Diving Bird Study](#) and the [nanotag studies](#) or contact [Caleb Spiegel](#) or [Pam Loring](#).

### **What if I have eagles on my list?**

If your project has the potential to disturb or kill eagles, you may need to [obtain a permit](#) to avoid violating the Eagle Act should such impacts occur.

### **Proper Interpretation and Use of Your Migratory Bird Report**

The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated, and see options for identifying what other birds may be in your project area, please see the FAQ "What does IPaC use to generate the migratory birds potentially occurring in my specified location". Please be aware this report provides the "probability of presence" of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please also look carefully at the survey effort (indicated by the black vertical bar) and for the existence of the "no data" indicator (a red horizontal bar). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list helps you know what to look for to confirm presence, and helps guide you in knowing when to implement conservation measures to avoid or minimize potential impacts from your project activities, should presence be confirmed. To learn more about conservation measures, visit the FAQ "Tell me about conservation measures I can implement to avoid or minimize impacts to migratory birds" at the bottom of your migratory bird trust resources page.

## Facilities

### **National Wildlife Refuge lands**

Any activity proposed on lands managed by the [National Wildlife Refuge](#) system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

THERE ARE NO REFUGE LANDS AT THIS LOCATION.

## Fish hatcheries

THERE ARE NO FISH HATCHERIES AT THIS LOCATION.

## Wetlands in the National Wetlands Inventory

Impacts to [NWI wetlands](#) and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local [U.S. Army Corps of Engineers District](#).

Please note that the NWI data being shown may be out of date. We are currently working to update our NWI data set. We recommend you verify these results with a site visit to determine the actual extent of wetlands on site.

This location overlaps the following wetlands:

FRESHWATER EMERGENT WETLAND

[PEM1A](#)

[PEM1C](#)

FRESHWATER POND

[PUBKx](#)

[PUBHh](#)

RIVERINE

[R4SBC](#)

A full description for each wetland code can be found at the [National Wetlands Inventory website](#)

### Data limitations

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

**Data exclusions**

Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tubercid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

**Data precautions**

Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

NOT FOR CONSULTATION





# Selected Elements by Scientific Name

California Department of Fish and Wildlife

California Natural Diversity Database



Query Criteria: Quad (Sacramento East (3812154) OR Carmichael (3812153) OR Buffalo Creek (3812152) OR Florin (3812144) OR Elk Grove (3812143) OR Sloughhouse (3812142) OR Bruceville (3812134) OR Galt (3812133) OR Clay (3812132))

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
<i>Accipiter cooperii</i> Cooper's hawk	ABNKC12040	None	None	G5	S4	WL
<i>Agelaius tricolor</i> tricolored blackbird	ABPBXB0020	None	Threatened	G2G3	S1S2	SSC
<i>Ambystoma californiense</i> California tiger salamander	AAAAA01180	Threatened	Threatened	G2G3	S2S3	WL
<i>Andrena blennospermatis</i> Blennosperma vernal pool andrenid bee	IIHYM35030	None	None	G2	S2	
<i>Aquila chrysaetos</i> golden eagle	ABNKC22010	None	None	G5	S3	FP
<i>Ardea alba</i> great egret	ABNGA04040	None	None	G5	S4	
<i>Ardea herodias</i> great blue heron	ABNGA04010	None	None	G5	S4	
<i>Athene cunicularia</i> burrowing owl	ABNSB10010	None	None	G4	S3	SSC
<i>Branchinecta lynchi</i> vernal pool fairy shrimp	ICBRA03030	Threatened	None	G3	S3	
<i>Branchinecta mesoovallensis</i> midvalley fairy shrimp	ICBRA03150	None	None	G2	S2S3	
<i>Brasenia schreberi</i> watershield	PDCAB01010	None	None	G5	S3	2B.3
<i>Buteo regalis</i> ferruginous hawk	ABNKC19120	None	None	G4	S3S4	WL
<i>Buteo swainsoni</i> Swainson's hawk	ABNKC19070	None	Threatened	G5	S3	
<i>Carex comosa</i> bristly sedge	PMCYP032Y0	None	None	G5	S2	2B.1
<i>Cicuta maculata var. bolanderi</i> Bolander's water-hemlock	PDAP10M051	None	None	G5T4T5	S2?	2B.1
<i>Coastal and Valley Freshwater Marsh</i> Coastal and Valley Freshwater Marsh	CTT52410CA	None	None	G3	S2.1	
<i>Coccyzus americanus occidentalis</i> western yellow-billed cuckoo	ABNRB02022	Threatened	Endangered	G5T2T3	S1	
<i>Cuscuta obtusiflora var. glandulosa</i> Peruvian dodder	PDCUS01111	None	None	G5T4?	SH	2B.2
<i>Desmocerus californicus dimorphus</i> valley elderberry longhorn beetle	IICOL48011	Threatened	None	G3T2	S2	

\*The database used to provide updates to the Online Inventory is under construction. [View updates and changes made since May 2019 here.](#)

## Plant List

24 matches found. *Click on scientific name for details*

### Search Criteria

Found in Quads 3812154, 3812153, 3812152, 3812144, 3812143, 3812142, 3812134 3812133 and 3812132;

[Modify Search Criteria](#) [Export to Excel](#) [Modify Columns](#) [Modify Sort](#) [Display Photos](#)

Scientific Name	Common Name	Family	Lifeform	Blooming Period	CA Rare Plant Rank	State Rank	Global Rank
<a href="#">Brasenia schreberi</a>	watershield	Cabombaceae	perennial rhizomatous herb (aquatic)	Jun-Sep	2B.3	S3	G5
<a href="#">Brodiaea rosea ssp. vallicola</a>	valley brodiaea	Themidaceae	perennial bulbiferous herb	Apr-May(Jun)	4.2	S3	G5T3
<a href="#">Carex comosa</a>	bristly sedge	Cyperaceae	perennial rhizomatous herb	May-Sep	2B.1	S2	G5
<a href="#">Centromadia parryi ssp. rudis</a>	Parry's rough tarplant	Asteraceae	annual herb	May-Oct	4.2	S3	G3T3
<a href="#">Cicuta maculata var. bolanderi</a>	Bolander's water-hemlock	Apiaceae	perennial herb	Jul-Sep	2B.1	S2?	G5T4T5
<a href="#">Cuscuta obtusiflora var. glandulosa</a>	Peruvian dodder	Convolvulaceae	annual vine (parasitic)	Jul-Oct	2B.2	SH	G5T4?
<a href="#">Downingia pusilla</a>	dwarf downingia	Campanulaceae	annual herb	Mar-May	2B.2	S2	GU
<a href="#">Gratiola heterosepala</a>	Boggs Lake hedge-hyssop	Plantaginaceae	annual herb	Apr-Aug	1B.2	S2	G2
<a href="#">Hesperervax caulescens</a>	hogwallow starfish	Asteraceae	annual herb	Mar-Jun	4.2	S3	G3
<a href="#">Hibiscus lasiocarpus var. occidentalis</a>	woolly rose-mallow	Malvaceae	perennial rhizomatous herb (emergent)	Jun-Sep	1B.2	S3	G5T3
<a href="#">Juglans hindsii</a>	Northern California black walnut	Juglandaceae	perennial deciduous tree	Apr-May	1B.1	S1	G1
<a href="#">Juncus leiospermus var. ahartii</a>	Ahart's dwarf rush	Juncaceae	annual herb	Mar-May	1B.2	S1	G2T1
<a href="#">Lasthenia ferrisiae</a>	Ferris' goldfields	Asteraceae	annual herb	Feb-May	4.2	S3	G3
<a href="#">Lathyrus jepsonii var. jepsonii</a>	Delta tule pea	Fabaceae	perennial herb	May-Jul(Aug-Sep)	1B.2	S2	G5T2
<a href="#">Legenere limosa</a>	legenere	Campanulaceae	annual herb	Apr-Jun	1B.1	S2	G2
<a href="#">Lepidium latipes var. heckardii</a>	Heckard's pepper-grass	Brassicaceae	annual herb	Mar-May	1B.2	S1	G4T1

<a href="#"><u>Lilaeopsis masonii</u></a>	Mason's lilaeopsis	Apiaceae	perennial rhizomatous herb	Apr-Nov	1B.1	S2	G2
<a href="#"><u>Navarretia eriocephala</u></a>	hoary navarretia	Polemoniaceae	annual herb	May-Jun	4.3	S4?	G4?
<a href="#"><u>Orcuttia tenuis</u></a>	slender Orcutt grass	Poaceae	annual herb	May-Sep(Oct)	1B.1	S2	G2
<a href="#"><u>Orcuttia viscida</u></a>	Sacramento Orcutt grass	Poaceae	annual herb	Apr-Jul(Sep)	1B.1	S1	G1
<a href="#"><u>Sagittaria sanfordii</u></a>	Sanford's arrowhead	Alismataceae	perennial rhizomatous herb (emergent)	May-Oct(Nov)	1B.2	S3	G3
<a href="#"><u>Scutellaria galericulata</u></a>	marsh skullcap	Lamiaceae	perennial rhizomatous herb	Jun-Sep	2B.2	S2	G5
<a href="#"><u>Scutellaria lateriflora</u></a>	side-flowering skullcap	Lamiaceae	perennial rhizomatous herb	Jul-Sep	2B.2	S2	G5
<a href="#"><u>Trifolium hydrophilum</u></a>	saline clover	Fabaceae	annual herb	Apr-Jun	1B.2	S2	G2

### Suggested Citation

California Native Plant Society, Rare Plant Program. 2019. Inventory of Rare and Endangered Plants of California (online edition, v8-03 0.39). Website <http://www.rareplants.cnps.org> [accessed 22 November 2019].

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#### Questions and Comments

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Selected Elements by Scientific Name  
California Department of Fish and Wildlife  
California Natural Diversity Database



Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
<b><i>Downingia pusilla</i></b> dwarf downingia	PDCAM060C0	None	None	GU	S2	2B.2
<b><i>Dumontia oregonensis</i></b> hairy water flea	ICBRA23010	None	None	G1G3	S1	
<b><i>Elanus leucurus</i></b> white-tailed kite	ABNKC06010	None	None	G5	S3S4	FP
<b><i>Elderberry Savanna</i></b> Elderberry Savanna	CTT63440CA	None	None	G2	S2.1	
<b><i>Emys marmorata</i></b> western pond turtle	ARAAD02030	None	None	G3G4	S3	SSC
<b><i>Falco columbarius</i></b> merlin	ABNKD06030	None	None	G5	S3S4	WL
<b><i>Gratiola heterosepala</i></b> Boggs Lake hedge-hyssop	PDSCR0R060	None	Endangered	G2	S2	1B.2
<b><i>Great Valley Mixed Riparian Forest</i></b> Great Valley Mixed Riparian Forest	CTT61420CA	None	None	G2	S2.2	
<b><i>Great Valley Valley Oak Riparian Forest</i></b> Great Valley Valley Oak Riparian Forest	CTT61430CA	None	None	G1	S1.1	
<b><i>Hibiscus lasiocarpus var. occidentalis</i></b> woolly rose-mallow	PDMAL0H0R3	None	None	G5T3	S3	1B.2
<b><i>Hydrochara rickseckeri</i></b> Ricksecker's water scavenger beetle	IICOL5V010	None	None	G2?	S2?	
<b><i>Juncus leiospermus var. ahartii</i></b> Ahart's dwarf rush	PMJUN011L1	None	None	G2T1	S1	1B.2
<b><i>Laterallus jamaicensis coturniculus</i></b> California black rail	ABNME03041	None	Threatened	G3G4T1	S1	FP
<b><i>Lathyrus jepsonii var. jepsonii</i></b> Delta tule pea	PDFAB250D2	None	None	G5T2	S2	1B.2
<b><i>Legenere limosa</i></b> legenere	PDCAM0C010	None	None	G2	S2	1B.1
<b><i>Lepidium latipes var. heckardii</i></b> Heckard's pepper-grass	PDBRA1M0K1	None	None	G4T1	S1	1B.2
<b><i>Lepidurus packardii</i></b> vernal pool tadpole shrimp	ICBRA10010	Endangered	None	G4	S3S4	
<b><i>Lilaeopsis masonii</i></b> Mason's lilaeopsis	PDAPI19030	None	Rare	G2	S2	1B.1
<b><i>Limosella australis</i></b> Delta mudwort	PDSCR10030	None	None	G4G5	S2	2B.1
<b><i>Linderiella occidentalis</i></b> California linderiella	ICBRA06010	None	None	G2G3	S2S3	
<b><i>Melospiza melodia</i></b> song sparrow ("Modesto" population)	ABPBXA3010	None	None	G5	S3?	SSC



Selected Elements by Scientific Name  
California Department of Fish and Wildlife  
California Natural Diversity Database



Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
<b>Northern Hardpan Vernal Pool</b> Northern Hardpan Vernal Pool	CTT44110CA	None	None	G3	S3.1	
<b>Nycticorax nycticorax</b> black-crowned night heron	ABNGA11010	None	None	G5	S4	
<b>Oncorhynchus mykiss irideus pop. 11</b> steelhead - Central Valley DPS	AFCHA0209K	Threatened	None	G5T2Q	S2	
<b>Orcuttia tenuis</b> slender Orcutt grass	PMPOA4G050	Threatened	Endangered	G2	S2	1B.1
<b>Orcuttia viscida</b> Sacramento Orcutt grass	PMPOA4G070	Endangered	Endangered	G1	S1	1B.1
<b>Phalacrocorax auritus</b> double-crested cormorant	ABNFD01020	None	None	G5	S4	WL
<b>Pogonichthys macrolepidotus</b> Sacramento splittail	AFCJB34020	None	None	GNR	S3	SSC
<b>Progne subis</b> purple martin	ABPAU01010	None	None	G5	S3	SSC
<b>Riparia riparia</b> bank swallow	ABPAU08010	None	Threatened	G5	S2	
<b>Sagittaria sanfordii</b> Sanford's arrowhead	PMALI040Q0	None	None	G3	S3	1B.2
<b>Scutellaria galericulata</b> marsh skullcap	PDLAM1U0J0	None	None	G5	S2	2B.2
<b>Scutellaria lateriflora</b> side-flowering skullcap	PDLAM1U0Q0	None	None	G5	S2	2B.2
<b>Spea hammondii</b> western spadefoot	AAABF02020	None	None	G3	S3	SSC
<b>Spirinchus thaleichthys</b> longfin smelt	AFCHB03010	Candidate	Threatened	G5	S1	
<b>Taxidea taxus</b> American badger	AMAJF04010	None	None	G5	S3	SSC
<b>Thamnophis gigas</b> giant gartersnake	ARADB36150	Threatened	Threatened	G2	S2	
<b>Trifolium hydrophilum</b> saline clover	PDFAB400R5	None	None	G2	S2	1B.2
<b>Valley Oak Woodland</b> Valley Oak Woodland	CTT71130CA	None	None	G3	S2.1	
<b>Xanthocephalus xanthocephalus</b> yellow-headed blackbird	ABPBXB3010	None	None	G5	S3	SSC

Record Count: 59



# **Attachment C**

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## Recommended Plant Palette by Habitat Type





## Attachment C. Recommended Plant Palette by Habitat Type

Habitat Type	Scientific Name	Common Name	Minimum Spacing (ft)	Propagule Type
Riparian Forest (Low Floodplain)	<b>Trees</b>			
	<i>Fraxinus latifolia</i>	Oregon ash	14	Treepot-4
	<i>Populus fremontii</i>	Fremont cottonwood	12	Cutting or treepot-4
	<i>Quercus agrifolia</i> <sup>1</sup>	coast live oak	16	Treepot-4 or acorn
	<i>Quercus lobata</i> <sup>1</sup>	valley oak	16	Treepot-4 or acorn
	<i>Salix exigua</i>	sandbar willow	10	Cutting or treepot-4
	<i>Salix laevigata</i>	red willow	10	Cutting or treepot-4
	<i>Salix lasiolepis</i>	Arroyo willow	10	Cutting or treepot-4
	<i>Symphoricarpos albus</i>	snowberry	10	Cutting, treepot-4, or seed
		<b>Shrubs</b>		<b>Minimum Spacing (ft)</b>
	<i>Baccharis salicifolia</i>	mulefat	12	Cutting
	<i>Rosa californica</i>	California rose	10	Deepot
	<i>Rubus ursinus</i>	California blackberry	10	Deepot or treeband
	<i>Sambucus nigra</i> <i>ssp. caerulea</i>	blue elderberry	12	Treepot-4
	<b>Herbaceous Understory Seed Mix</b>			<b>lbs/acre in seed mix</b>
	<i>Aristolochia californica</i>	California pipevine		0.5
	<i>Artemisia douglasiana</i>	California mugwort		0.5
	<i>Carex barbarae</i>	Valley sedge		3
	<i>Clematis ligusticifolia</i>	Creek clematis		4
	<i>Elymus glaucus</i>	blue wild rye		7
	<i>Elymus triticoides</i>	beardless wild rye		1
	<i>Grindelia camporum</i>	Gumweed		2
	<i>Hordeum brachyantherum</i>	Meadow barley		7
	<i>Muhlenbergia rigens</i>	Deergrass		4

Habitat Type	Scientific Name	Common Name		
	<i>Symphotrichum chilense</i>	Pacific aster		0.5
	<i>Sisyrinchium bellum</i>	blue-eyed grass		0.5
<b>Riparian Woodland (High Floodplain)</b>	<b>Trees</b>		<b>Minimum Spacing (ft)</b>	<b>Propagule Type</b>
	<i>Aesculus californica</i>	California buckeye	16	Treepot-4 or seed
	<i>Fraxinus latifolia</i>	Oregon ash	16	Treepot-4
	<i>Populus fremontii</i>	Fremont cottonwood	20	Cutting or treepot-4
	<i>Quercus agrifolia</i> <sup>1</sup>	coast live oak	16	Treepot-4 or acorn
	<i>Quercus lobata</i> <sup>1</sup>	valley oak	16	Treepot-4 or acorn
	<i>Salix lasiolepis</i>	Arroyo willow	16	Cutting or treepot-4
	<b>Shrubs</b>		<b>Minimum Spacing (ft)</b>	<b>Propagule Type</b>
	<i>Baccharis pilularis</i>	coyote brush	10	Deepot
	<i>Rosa californica</i>	California rose	10	Deepot
	<i>Rubus ursinus</i>	California blackberry	10	Deepot or treeband
	<i>Sambucus nigra</i> ssp. <i>caerulea</i>	blue elderberry	12	Treepot-4
	<i>Heteromeles arbutifolia</i>	toyon	10	Cutting, treepot-4, or seed
	<b>Herbaceous Understory Seed Mix</b>			<b>lbs/acre in seed mix</b>
	<i>Achillea millefolium</i>	yarrow		1
	<i>Bromus carinatus</i>	California brome		10
	<i>Eschscholzia californica</i>	California poppy		1
	<i>Lasthenia californica</i>	goldfields		1
<i>Lupinus bicolor</i>	lupine		3	
<i>Plagiobothrys nothofulvus</i>	rusty haired popcorn flower		2	
<i>Poa secunda</i>	pine bluegrass		2	
<i>Stipa pulchra</i>	purple needle grass		8	
<i>Sisyrinchium bellum</i>	blue-eyed grass		1	
<i>Trifolium willdenovii</i>	tomcat clover		1	

Note: ft = feet; lbs/ac = pounds per acre

<sup>1</sup> Coast live oak and valley oak may will be planted in clusters of three on 20-foot centers. Each cluster may be planted on 50-foot centers measured from the center of each cluster.

# **Attachment D**

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## Non-native Vegetation Management Plan



## 1.0 INTRODUCTION

The City of Elk Grove (City) has developed the Laguna Creek Restoration and Management Plan (RMP) to document routine maintenance activities and identify restoration and management priorities along a 1.75-mile segment of Laguna Creek from the Bond Road/Waterman Road intersection downstream to the creek crossing downstream of the Bond Road/Elk Grove-Florin Road intersection (see Figure 1 in Section 3). This Non-native Vegetation Management Plan describes common approaches to weed management and provides recommendations for management of non-native vegetation species within the RMP area. This document is organized into the following sections:

- Section 1.** Introduction
- Section 2.** Descriptions of High/Medium Priority Species
- Section 3.** Weed Management Strategies and Techniques
- Section 4.** Reach-specific Management Recommendations
- Section 5.** References
- Section 6.** Detailed Management Datasheets

Note that this Non-native Vegetation Management Plan is a summary of commonly followed practices based on sources prepared by experts in the field. The recommendations provided here are not specific instructions for implementation within the Laguna Creek RMP area. Refer to the RMP itself for applicability of these approaches to the project area.

## 2.0 DESCRIPTIONS OF HIGH/MEDIUM PRIORITY SPECIES

This section provides definitions of the priority categories for non-native vegetation management and, more specifically, a general description of the ecology of high-priority and medium-priority target species identified for management within the Laguna Creek RMP area.

### 2.1 Ecological Impact Priorities

The California Invasive Plant Council (Cal-IPC) manages an inventory of non-native vegetation in California (Cal-IPC 2022). Plants are categorized to reflect the level of each species' negative ecological impact in California:

**High:** Species categorized as “high” have severe ecological impacts on physical processes, plant and animal communities, and vegetation structure. They tend to have moderate to high rates of dispersal and establishment. Most are widely distributed ecologically.

**Moderate:** These species have substantial and apparent—but generally not severe—ecological impacts on physical processes, plant and animal communities, and vegetation structure. They have moderate to high rates of dispersal, with establishment generally dependent upon ecological disturbance. Ecological distribution may range from limited to widespread.

**Limited:** These species are invasive but their ecological impacts are minor on a statewide level or there was not enough information to justify a higher score. They have low to moderate rates of invasiveness. Ecological distribution is generally limited, but these species may be locally persistent and problematic.

## 2.2 Target Species

Species with Cal-IPC ratings of “high” should be the first priority, as these species are most likely to spread within the RMP area or other adjacent habitats. Next, species with a Cal-IPC “moderate” rating should be targeted. A ranking of “limited” indicates that species are invasive but their ecological impacts are minor on a statewide level. There are several non-native plants which do not have a Cal-IPC rating and are not considered particularly invasive. Removal of these species should generally be lowest priority. Some invasive grasses that are present within the RMP area, such as Italian ryegrass and wild oats, are not a priority for removal because they are so well established in the RMP area and surrounding areas that removal is infeasible.

**Table 1** shows the priority rating of invasive and non-native plants identified in the project area, based on Cal-IPC rating and threat to the project area. Some species with a limited Cal-IPC rating or no rating (such as catalpa and eucalyptus) are prioritized because their removal would open up habitat for more valuable native species to be planted. Descriptions of non-native vegetation designated as high and medium priority for removal are provided in Section 4. Detailed management datasheets are provided in Section 6.

**Table 1.** Priority Ranking of Non-native Vegetation Species for Removal within the Laguna Creek RMP Area

Scientific Name	Common Name	Cal-IPC rating
<b>High Priority</b>		
<i>Cortaderia selloana</i>	pampas grass	High
<i>Elymus caput-medusae</i>	medusahead	High
<i>Eucalyptus</i> sp.	eucalyptus	Limited
<i>Foeniculum vulgare</i>	sweet fennel	High
<i>Catalpa</i> sp.	catalpa	None
<i>Rubus armeniacus</i>	Himalayan blackberry	High
<b>Medium Priority</b>		
<i>Triadica sebifera</i>	Chinese tallowtree	Moderate
<i>Brassica nigra</i>	black mustard	Moderate
<i>Cirsium vulgare</i>	bull thistle	Moderate
<i>Phalaris aquatica</i>	Harding grass	Moderate
<b>Low Priority</b>		
<i>Kickxia elatine</i>	sharp-leaved fluellin	None
<i>Schinus terebinthifolius</i>	Peruvian pepper tree	Limited
<i>Verbena bonariensis</i>	tall vervain	Watch
<i>Zantedeschia aethiopica</i>	calla lily	Limited

Eradication is generally considered very difficult to accomplish unless the target species is present in very small numbers. Eradication of eucalyptus may be possible, for example, as this species is present in relatively low numbers. Suppression of more established non-native vegetation (such as Himalayan blackberry) is a more achievable goal.

### Pampas grass



Photo 1: Pampasgrass, Krallicus 2020

Pampas grass (*Cortaderia selloana*) is a large densely tufted perennial grass with long basal leaves and tall, showy, plumelike inflorescences (DiTomaso et al. 2013). It has dense fibrous roots that grow from shallow short lateral rhizomes (DiTomaso et al. 2013). It is native to South America, and was introduced as a landscape ornamental and for erosion control, but has since become a noxious weed along the coast of California (DiTomaso et al. 2013). Pampas grass can produce up to 100,000 seeds per seed-bearing plume. The seeds can be dispersed long distances (20 miles) due to having very light seeds (DiTomaso et al. 2013). Mechanical

removal of this species can be very effective, either using hand tools or heavy machinery. The entire crown and top section of the roots should be removed. Application of the herbicide glyphosate in the fall is also effective (DiTomaso et al. 2013).

### Medusahead

Medusahead (*Elymus caput-medusae*) is a noxious rangeland weed and is an ascending to erect winter annual grass to 2 feet tall, with long-awned spikelets (DiTomaso et al. 2013). Native to the Mediterranean region, its range in the United States includes Arizona, California, Idaho, Nebraska, Nevada, Oregon, Utah, Washington and a few locations in the northeastern states. Medusahead displaces vegetation and reduces livestock and wildlife carrying capacity (DiTomaso et al. 2013).



Photo 2: Medusahead,  
Oregon State University 2009

Medusahead spreads primarily by seed, clinging to the feet, fur, and feathers or animals and the shoes and clothing of people (DiTomaso et al. 2013). Medusahead produces fibrous roots in areas that receive at least 9 inches of rain per year. It is unpalatable to livestock, except during the early growth stages, as the stiff awns can cause injury to grazing animals' mouths. Birds and rodents avoid feeding on the seeds (DiTomaso et al. 2013). Implementing multiple types of control methods within one year or across years work best (Becchetti et al. n.d.). On a small scale, pulling or hoeing individual medusahead plants can be effective. This should be done when the plants are large

enough to distinguish themselves from other grasses, but before they set seed (Keyser et al. 2014). In areas where medusahead has built up a heavy thatch, raking or tillage (disking and plowing) is recommended. Tillage must be accomplished prior to seed set (DiTomaso et al. 2013). The timing of herbicide applications is very important. Aminopyralid and glyphosate are the two recommended products (Becchetti et al. n.d.).

### Eucalyptus

Eucalyptus trees (*Eucalyptus* spp.) are native to Australia and surrounding islands. Tasmanian blue gum (*Eucalyptus globulus*) is the most common eucalyptus species in California, and was introduced to North America in the early 1850s as a landscape ornamental. It is a fast-growing tree, and can grow to 180 feet tall, and 4 to 7 feet in diameter (DiTomaso et al. 2013). Eucalyptus trees are a safety hazard due to its flammable plant compounds, dense growth of fine branches, and drop limbs easily. For these reasons, eucalyptus groves are highly combustible and increase the risk of fire. Reproduction is by seed (DiTomaso et al. 2013). Mechanical removal of eucalyptus trees must be followed by stump treatment or removal or resprouting will occur. Stumps can be treated with herbicide (glyphosate is most effective) applied to the cambium, covering the stump with black plastic for one year, or completely removing the stump (DiTomaso et al. 2013).

### Sweet Fennel

Sweet fennel (*Foeniculum vulgare*) is native to southern Europe, and can grow to approximately 10 feet (DiTomaso et al. 2013). It prefers open disturbed areas although can be found in riparian and wetland areas. Fennel is an aromatic perennial with thick taproots (DiTomaso et al. 2013). Vegetative reproduction may occur by the root or crown fragments. It reproduces by seed, which is often spread by animals, human activities, and is particularly a problem in California (DiTomaso et al. 2013). Small infestations can be mechanically removed by hand, but this is labor intensive. Larger infestations can be treated with foliar application of the herbicide triclopyr (DiTomaso et al. 2013).



Photo 3: Fennel, Siaron James 2014



## Catalpa



Photo 4: Catalpa, Wendy Cutler 2010

Catalpa (*Catalpa bignonioides*) is a fast-growing non-native tree species that reaches 40 to 50 feet in height and crown spread (Code 2018). Originally used for wood-based products, and medicinally, currently it is planted as an ornamental shade tree. Native to the Southeastern United States, its distribution range has increased due to human plantings and associated natural seeding (Code 2018). Two to three leaves grow from each node and flowers are slightly fragrant, and 1 to 1.15 inches long and wide. Blooming period occurs from May to June and seeds are naturally shed in late winter (Code 2018). A combination of mechanical removal

and herbicides are effective methods to control this species. In addition to hand removal, a weed wrench may also be used to remove young plants. If a weed wrench is used, soil should be moist, and the whole root removed (DiTomasso et al. 2013). Among the most efficient herbicides are glyphosate, imazapyr, and triclopyr (DiTomasso et al. 2013).

## Himalayan Blackberry

Himalayan blackberry (*Rubus armeniacus*) grows as a vine or shrub, and has canes with stout prickles. This species of blackberry is native to Western Europe, and was introduced to North America in the late 1800s as a crop (Hoshovsky 2000). Birds and animals eat the berries and distribute the seeds (Hoshovsky 2000). Vegetative reproduction by rooting at the cane tips also occurs (Hoshovsky 2000). This species tends to grow in disturbed areas. It is a very competitive plant, and also forms dense thickets which exclude native plants (Hoshovsky 2000). Repeated tilling and/or foliar spray of the herbicides triclopyr or glyphosate may be used to control blackberry (DiTomasso 2010).



Photo 5: Himalayan blackberry, Forest and Kim Starr 2005

## Chinese Tallowtree

Chinese tallowtree (*Sapium sebiferum*) is a fast-growing, extremely invasive, deciduous tree that is found primarily in the southeastern United States and recently has become more problematic in California. (DiTomasso et al. 2013). It inhabits both undisturbed and disturbed bottomlands, fields, riparian areas, and wetlands. It is native to China and Japan and has been cultivated for its seed oil for more than one thousand years (DiTomasso et al. 2013). Chinese tallowtree seed production is prolific, averaging 100,000 seeds annually. Seeds are transported by birds and water primarily (DiTomasso et al. 2013). Small shoots or saplings can be pulled by hand. For larger trees, a combination of mechanical removal and herbicide application is generally effective to control sprouting from the roots and stumps. Application of triclopyr or glyphosate to the cut stump is recommended (DiTomasso et al. 2013).

### Black Mustard

Black mustard (*Brassica nigra*) is native to Europe and was introduced to California by the Spanish as a spice crop (DiTomaso et al. 2013). Black mustard is an erect winter annual to 6 feet tall and with yellow flowers (DiTomaso et al. 2013). This species tends to grow in fields, roadsides, and disturbed waste places. Reproduction is by seed and deeply buried seeds can survive for 50 years or more (DiTomaso et al. 2013). The removal of this species mechanically through hand pulling or use of hand tools is particularly effective in depleting the seedbank if it is done annually (DiTomaso et al. 2013). In the early stages of weed growth, treatment with a postemergence herbicides such as glyphosate is recommended (DiTomaso et al. 2013).



Photo 6: Black mustard, Dana L. Brown 2022

### Bull Thistle



Photo 7: Bull thistle, Matt Lavin 2021

Bull thistle (*Cirsium vulgare*) is native to Europe and found across the United States. Bull thistle tends to outcompete native plants especially in pasture and rangelands where it reduces the forage potential. It is not palatable to livestock, and its leaves resemble a spear (DiTomasso et al. 2013). Bull thistle plants can have spreading branches, and sometimes a single stem growing up to 7 feet in height. (DiTomasso et al. 2013). Bull thistle reproduces and spreads by seed, although the seeds don't travel far with wind due to a feathery pappus that detaches at maturity. (DiTomasso et al. 2013). Mechanical control of bull thistle via tilling, hoeing, and hand pulling (or other method that severs the root) are effective methods to control this species, if done prior to flowering (DiTomasso et al. 2013). Mowing is typically less effective.

### Harding Grass

Harding grass (*Phalaris aquatica*) is native to Mediterranean Europe and was introduced to Australia and the United States to prolong the forage season on pastures and rangelands (DiTomasso et al. 2013). Once established, Harding grass displaces native species by competing for water and space. This perennial grass is coarse with dense, spike like panicles that grow to 5 feet tall (DiTomasso et al. 2013). It has deep and fibrous roots and most reproduction is by seeds (DiTomasso et al. 2013). Control of Harding grass may be accomplished with a combination of physical removal via mowing or grazing, combined with herbicide application to the new growth.

### 3.0 WEED MANAGEMENT STRATEGIES AND TECHNIQUES

This section provides an overview of weed management terminology and techniques commonly used to manage invasive species. The discussion emphasizes techniques that are best suited to the target species and physical conditions in the RMP area. Section 4 provides descriptions of invasive species in the RMP area and, for some species, recommends specific control strategies.

The following terms are commonly used to describe the general approaches to managing invasive species (adapted from Norton 2010):

***Eradicate:*** To completely eliminate an invasive species from within a defined management area.

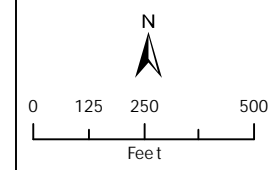
***Suppress:*** To reduce abundance of an invasive species within a defined management area. This is typically measured or estimated in terms of plant cover or density.

***Contain:*** To confine an infestation within a defined management area so that it does not expand, but not necessarily to reduce the area of the infestation.

Weed management techniques are often grouped into the following categories: biological, cultural, mechanical (or physical), and chemical control measures. These control methods can be used independently but are often combined in an Integrated Pest Management (IPM) approach.



\\10.10.1.10\iserver\PROJECTS\18023\_Laguna\_Creek\_RMP\mxd\Fig\_2\_Plan\_location\_mxd.21.8.2020.PG



Plan Area  
 LagunaCreek



**Figure 1**  
Laguna Creek Restoration and Management Plan Area

### 3.1 Biological Control Measures

Biological control of non-native vegetation typically involves using introduced natural enemies of the target species. No biological control measures are recommended for the non-native species present within the Laguna Creek RMP area.

### 3.2 Cultural Control Measures

In some portions of the Laguna Creek RMP area, application of mulch may be an effective way to control non-native herbaceous weeds. This is particularly true in areas with limited clearance from private property. In areas where mechanical or hand treatments are logistically difficult, targeted grazing may be implemented to reduce build-up of biomass and fuels, improve ecosystem function, and enhance vegetation management efforts. The timing of grazing and the type of animals used are important considerations for success in treating non-native vegetation populations.

### 3.3 Mechanical/Physical Control Measures

Mechanical removal of non-native vegetation may involve both heavy equipment and hand tools such as chainsaws and hedge trimmers. The technique used will depend upon equipment access and potential for inadvertent damage to non-target species. Heavy equipment may include a skid steer or tractor with a mastication attachment, an excavator with a bucket modified for tree extraction, or other types of masticating equipment.

Following removal, non-native vegetation biomass should be moved to an appropriate upland disposal area or stacked in upland areas outside of the active floodway. No unmulched material should be left in the active floodway, except in the case where a felled tree may be repurposed to be used as large woody debris along channel banks. Mechanical control is often followed by chemical control measures to reduce the potential for regrowth.

### 3.4 Chemical Control Measures

**Note:** *Herbicides will not be sprayed within the Laguna Creek channel and will only be applied to upland growth along the trails, as described in the RMP.*

Chemical control measures may include both foliar (leaf) and cut-stump application of herbicide to targeted invasive species. Herbicides may include glyphosate, triclopyr, and imazapyr, for both foliar spray and cut-stump application. These herbicides should always be used according to label instructions.

Only formulations approved for aquatic use should be used near water bodies. Trade names of aquatic formulations of herbicides include products such as Habitat® (imazapyr), Garlon 3A® (triclopyr), and Aquamaster® and Rodeo® (glyphosate). Cut-stump treatment of catalpa can use glyphosate, imazapyr, or triclopyr (DiTomaso et al. 2013). For Himalayan blackberry, foliar spray of triclopyr or glyphosate can be used (DiTomaso 2010). Application of glyphosate in the fall is effective at controlling pampas grass (DiTomaso et al. 2013). Large infestations of fennel can be treated with foliar application of triclopyr (DiTomaso et al. 2013). Cut-stump treatment with triclopyr or glyphosate can be used to control Chinese tallow tree (DiTomaso et al. 2013).

## 4.0 REACH-SPECIFIC MANAGEMENT RECOMMENDATIONS

This section provides guidance on non-native vegetation management specific to each maintenance reach, as described in the RMP and shown in **Figure 1**.

### 4.1 Reach 1

Native plant communities may be enhanced through targeted removal of *Himalayan blackberry* and *sweet fennel*, followed by planting/seeding of native plant species. Recommended native plants and revegetation activities are described in **Attachment C** of the RMP, “Recommended Plant Palette by Habitat Type.” *Himalayan blackberry* should be controlled using a combination of mechanical removal and foliar herbicide application using triclopyr or glyphosate. See Section 6 for additional details on control methods. Two years of follow-up with foliar spray herbicide application are recommended to control regrowth and sprouting of this species.

*Eucalyptus* trees growing on the right bank near the upper extent of the reach may be mechanically removed and replaced with native tree species. Mechanical removal of eucalyptus trees must be followed by cut-stump treatment to prevent removal or resprouting. Stumps can be treated with herbicide (glyphosate is most effective) applied to the cambium immediately after cutting, covering the stump with black plastic for one year, or completely removing the stump (DiTomaso et al. 2013).

A small ruderal grassland area at the transition between Jack E. Hill Park and Laguna Creek at the west end of the reach is heavily infested with *medusahead* and a variety of broad-leaf invasive weeds. Medusahead is an annual grass and must produce seeds to survive. Well-timed management actions using mechanical and chemical methods of control will reduce the number of seeds produced, lower the available seedbank, and help prevent its spread into other portions of the RMP area. On a small scale, pulling or hoeing individual medusahead plants can be effective. This should be done when the plants are large enough to distinguish themselves from other grasses, but before they set seed (Keyser et al. 2014). In areas where medusahead has built up a heavy thatch, raking or tillage (disking and plowing) is recommended. Tillage must be accomplished prior to seed set (DiTomaso et al. 2013). An herbicide such as glyphosate may also be used, but the timing of herbicide applications is very important. The goal of using herbicides to control medusahead is to prevent seed production; therefore, if herbicide is used, it should be applied before the plants have gone to seed (Kyser et al. 2014). See Section 4 for details.

### 4.2 Reach 2

Targeted removal of *Himalayan blackberry*, *black mustard*, *sweet fennel*, *pampas grass*, *Chinese tallow tree*, and *catalpa trees* in Reach 2 would open up areas for restoration of native riparian understory vegetation. Removal of invasive vegetation should be followed by planting/seeding of native plant species. Himalayan blackberry treatment is described above in Reach 1. Black mustard, pampas grass, and sweet fennel can be removed mechanically. Chinese tallow tree and catalpa should be removed mechanically and the cut stumps treated with herbicide; triclopyr or glyphosate is recommended for both species (DiTomaso et al. 2013). Imazapyr may also be used for catalpa (DiTomaso et al. 2013).

A targeted grazing program may be implemented in Reach 2 (and potentially within Reaches 1 and 3, as feasible) at strategic times of the year. Targeted grazing will reduce build-up of biomass/fuel, prevent or reduce seed production from invasive annual grasses, and improve ecosystem function and vegetation control efforts in uplands and along the creek. Grazing control of grasses and forbs is most effective when timed to occur as the target plants are leaving the vegetative growth stage and beginning to flower, but prior to seed set. The timing of this optimal period will vary from year to year, based on temperature and precipitation conditions.

#### **4.3 Reach 3**

Target species in Reach 3 include *Himalayan blackberry*, *sharp-leaved fluvellin*, *sweet fennel*, *Pampas grass*, and *calla lily*. Sharp-leaved fluvellin and calla lily can be removed by hand. Treatment recommendations for other species are described for Reaches 1 and 2.

#### **4.4 Reach 4**

*Himalayan blackberry*, *sweet fennel*, *Pampas grass*, *bull thistle*, and *catalpa* trees may be removed where they occur in this reach. Native grasses and forbs present in low levels may be protected and reestablished in upland areas along the trail. Bull thistle can be removed by hand, ideally prior to flowering. See descriptions in Reaches 2 and 3 for treatment recommendations for other species.

#### **4.5 General Maintenance and Monitoring**

Non-native vegetation management typically requires multiple years of follow-up treatment to ensure that treated invasive species do not become re-established. Invasive species may resprout from the root or sprout from the soil seed bank. It is recommended that maintenance staff conduct annual inspections in areas where invasive species have been removed to identify regrowth of target invasive species and provide follow-up treatment using the methods recommended above.

## 5.0 REFERENCES

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**6.0 DETAILED MANAGEMENT DATASHEETS**



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*Cortaderia selloana* (Schultes) Asch. & Graebner;  
pampasgrass  
*Cortaderia jubata* (Lemoine) Stapf; jubatagrass

## Pampasgrass and jubatagrass

**Family:** Poaceae

**Range:** Jubatagrass is found along coastal areas of California and Oregon. Pampasgrass is primarily in coastal areas of California and Oregon, but can also be found inland in both states and Utah.

**Habitat:** Disturbed areas, dunes, bluffs, roadsides, road-cuts, logged forests. Many coastal shrub and grasslands (including serpentine soils) and adjacent inland areas moderated by fog or other maritime influences. Pampasgrass is also found in undisturbed coastal shrubland and marshes, inland riparian areas and other interior sites where sufficient moisture is available (may tolerate standing water for prolonged periods).

**Origin:** Jubatagrass is native to equitable mid-elevation regions of the Andes Mountains in Ecuador, Peru, Bolivia, and northern Argentina, where the climate is similar to that of coastal California. Pampasgrass is native from the mid-elevation Andes slopes of northeastern Chile and northwestern Argentina to the low elevation subtropical grasslands and riparian areas of northern Argentina, Uruguay, and southern Brazil. Jubatagrass and pampasgrass were introduced as landscape ornamentals and for erosion control, but have since escaped cultivation and become noxious weeds in some areas of California, especially along the coast.

**Impacts:** Mature plants of both species are highly competitive with native vegetation and forestry tree seedlings. Jubatagrass produces abundant apomictic seed, and is currently more widespread than pampasgrass in California. Yet pampasgrass may be the more invasive species since it tolerates a wider range of climate variation. Both species are noxious weeds in Australia, Tasmania, and New Zealand.

**Western states listed as Noxious Weed:** *Cortaderia jubata*, California

**California Invasive Plant Council (Cal-IPC) Inventory:** Both species are High Invasiveness

*Cortaderia* species are large, densely tufted perennial grasses with long basal leaves and tall, showy, plume-like inflorescences. The leaves have sharply serrated margins that can easily cut the skin. Pampasgrass tussocks typically grow much larger than those of jubatagrass, and have a more erect, fountain-like appearance. The dense fibrous roots grow from shallow short lateral rhizomes. Ligules consist of a dense ring of hairs mostly 2 to 3 mm long.

Both species produce plumes that are 1 to 3 ft long, although jubatagrass often has a more purplish tinge compared to pampasgrass. Despite the similarity in appearance, the reproductive strategy of pampasgrass and jubatagrass are very different. In jubatagrass, all plants are female and develop seed without fertilization (apomixis). In pampasgrass, plants are functionally male or female. Male plumes are sometimes purplish-tinted.

Unlike jubatagrass, pampasgrass develops seed only when male and female plants are within pollination range of one another. Historically, the plumes on female plants were considered more attractive and were exclusively propagated by division within the nursery trade for ornamental purposes. In more recent years, some nursery stock has been propagated by seed, and both sexes have been widely planted as landscape ornamentals. Weedy populations spread quickly near these ornamental plantings.



*Cortaderia selloana*



*Cortaderia jubata*

Plants of both species reproduce only by seed. Each seed-bearing plume can produce up to 100,000 seeds. The seeds are very light and can disperse long distances with wind (to about 20 miles). Human activity can also disperse plants long distances. Because the seeds are so small, they do not survive long in the soil seedbank. Germination occurs in fall after the first rains, continuing through spring. Seeds typically survive for less than 6 months under field conditions, and a persistent seedbank does not accumulate.

### NON-CHEMICAL CONTROL

<b>Mechanical</b> (pulling, cutting, disking)	Hand-pulling seedlings can help prevent the spread of either species. For removing established clumps, pulaskis, mattocks, or shovels are the safest and most effective tools. To prevent resprouting, it is important to remove the entire crown and top section of the roots. Detached plants left lying on the soil surface may take root and reestablish under moist soil conditions. Some land managers recommend turning the removed clumps upside down so the roots dry out in the air. A large chainsaw or weedeater can expose the base of the plant, allow better access for removal of the crown, and make disposal of the detached plant more manageable. Plumes can also be cut off to avoid seed dispersal. However, plants that have had plumes removed may develop more plumes during the flowering season. Mechanical removal by heavy equipment, including excavators and backhoes, can be very effective and selective. However, these methods are labor- and cost-intensive, and feasibility depends upon site accessibility, size of the infestation, funding, and availability of volunteer support.
<b>Cultural</b>	Heavily mulching bare sites or planting desirable vegetation may prevent or reduce seedling establishment. Burning or grazing are not typically considered effective control strategies for <i>Cortaderia</i> in North America, but cattle have been shown to provide effective control for pampasgrass in commercial forests of New Zealand. Any soil disturbance that creates bare ground, including natural disturbance (fire or landslides) and human-caused disturbance, promotes invasion by jubatagrass or pampasgrass.
<b>Biological</b>	There are no biological control agents available for either of the <i>Cortaderia</i> species.

### CHEMICAL CONTROL

The following specific use information is based on publications and reports by researchers and land managers. Other trade names may be available, and other compounds also are labeled for this weed. Directions for use may vary between brands; see label before use. Herbicides are listed by mode of action and then alphabetically. The order of herbicide listing is not reflective of the order of efficacy or preference.

#### LIPID SYNTHESIS INHIBITORS

Fluazifop <i>Fusilade</i>	<b>Rate:</b> Spot treatment: 2 to 4% v/v solution (0.5 to 1% a.i.). Low volume treatment: 4% v/v solution of product. <b>Timing:</b> Postemergence. Best in late summer or fall, after flowering when translocation of herbicide to base of tillers and rhizomes is at its peak. <b>Remarks:</b> Control of jubatagrass with fluazifop was inconsistent. It has no soil residual activity. Other grass herbicides were not as effective.
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#### AROMATIC AMINO ACID INHIBITORS

Glyphosate <i>Roundup, Accord XRT II, and others</i>	<b>Rate:</b> Broadcast treatment: 2 to 3.3 qt product ( <i>Roundup ProMax</i> )/acre (2.25 to 3.7 lb a.e./acre). High-volume spray-to-wet spot treatment: 2% v/v solution of product. Low-volume treatment: 8 to 10% v/v solution of product. Wiper treatment: 33 to 50% of concentrated product. <b>Timing:</b> Postemergence. Best in late summer or fall, after flowering when translocation of herbicide to base of tillers and rhizomes is at its peak. <b>Remarks:</b> Glyphosate provides the most consistent jubatagrass control with all plant sizes in both fall and early summer. Low volume treatment at 8% and wiper applications at 33% gave the best and most consistent control.
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#### BRANCHED-CHAIN AMINO ACID INHIBITORS

Imazapyr <i>Arsenal, Habitat, Polaris</i>	<b>Rate:</b> 2 to 4% v/v solution of product for spot treatment (0.45 to 0.9% a.e. solution) <b>Timing:</b> Postemergence. Best in late summer or fall, after flowering when translocation of herbicide to base of tillers and rhizomes is at its peak. <b>Remarks:</b> Results were inconsistent from site to site and year to year. Imazapyr is a slow-acting systemic herbicide and may take a year or two to achieve effective control on <i>Cortaderia</i> .
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**RECOMMENDED CITATION:** DiTomaso, J.M., G.B. Kyser et al. 2013. *Weed Control in Natural Areas in the Western United States*. Weed Research and Information Center, University of California. 544 pp.

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*Taeniatherum caput-medusae* (L.) Nevski  
(= *Elymus caput-medusae* L. [Jepson Manual 2012])

## Medusahead

**Family:** Poaceae

**Range:** Arizona, California, Idaho, Nebraska, Nevada, Oregon, Utah, Washington; a few locations in the northeastern states.

**Habitat:** Disturbed sites, grassland, rangeland, openings in chaparral, oak woodlands, and rarely in agronomic fields. Generally in areas that receive at least 9 inches of rain per year, so not common in the low desert. Grows best on clay soils or where deep soil moisture is available late in the growing season.

**Origin:** Native to the Mediterranean region.

**Impact:** Dense stands displace desirable vegetation and reduce livestock and wildlife carrying capacity. Unpalatable to livestock except during the early growth stages. The stiff awns and hard florets can injure eyes, nostrils, and mouths of grazing animals. Birds and rodents usually avoid feeding on the seeds. Senesced plants form a dense layer of thatch that takes a couple of years to decompose. The thatch layer changes the temperature and moisture dynamics of the soil, reduces seed germination of other species, and creates fuel for wildfires.

**Western states listed as Noxious Weed:** California, Colorado, Nevada, Oregon, Utah

**California Invasive Plant Council (Cal-IPC) Inventory:** High Invasiveness



Medusahead is a noxious rangeland weed that is increasing its range in most of the western states. It is an ascending to erect winter annual grass to 2 ft tall, producing spikes of long-awned spikelets. Medusahead matures at least 2 to 4 weeks later in the season than most other annual grasses, and from a distance, the yellowish-green sheen of dense stands is highly visible after other annual grasses turn brown. The mature plant has slender stems, and the leaf surfaces are glabrous or covered with soft, short hairs, and often appear glassy under magnification. Medusahead produces fibrous roots that grow throughout the cool season, depleting upper soil moisture early in the growing season and accessing deep soil moisture later on.

Medusahead flowers in early summer, often after other annual plants have senesced. Its spikes are 0.5 to 2 inches long excluding awns, and the main spike axis does not break apart at maturity. The fertile seeds have long, often twisted, awns 1 to 3 inches long; the seeds and awns are covered with minute, upward-pointing barbs and are rough to the touch. Seed production is usually prolific. Some florets (seeds) can remain attached to spikes long after plants turn brown. This characteristic allows seeds to disperse by clinging to the feet, fur, and feathers of animals and the shoes and clothing of people.

Most seeds germinate in fall after the first rain, but some seeds remain dormant or germinate in winter or spring. Seeds can germinate in dense litter under low moisture conditions. Seedlings remain attached to the long-awned floret. Seedlings can survive desiccation of the primary root and develop adventitious roots when moisture becomes available. Most seed appears to germinate or lose viability within 2 years in the field.

### NON-CHEMICAL CONTROL

**Mechanical**  
(pulling, cutting,  
disking)

There are mixed reports on the effectiveness of mowing. Early-season mowing is likely to be ineffective and may harm other species. Late-season mowing, at the boot to early flowering stage, may help to suppress medusahead. However, mowing after seed set will disperse the seeds.

In areas where medusahead has built up a heavy thatch, removal of the thatch by raking, tillage, or burning

	<p>can reduce dominance by medusahead and can help other plant species to get established.</p> <p>Tillage (disking and plowing) will control existing medusahead plants, as well as burying seed and breaking up deep thatch layers. Tillage should be accomplished before seed set. In rangeland or wildland areas, the increased potential for soil erosion, loss of soil moisture, loss of organic matter, and loss of macrobiotic crusts may outweigh the weed control benefits of tillage. These factors should be considered before applying tillage over a large area.</p>
<b>Cultural</b>	<p>The use of fire has given mixed results for medusahead control. Burning in low-elevation, warm-winter sites (e.g., California's Central Valley and foothills) can be extremely effective. Burns are conducted when medusahead is beginning to head out but before seed drop, when most desirable plants have already dropped seed. Two years of burning can nearly eliminate an infestation. In contrast, burning in high-elevation, cool-winter sites usually fails to control medusahead. It is thought that because of reduced ecosystem productivity and a shorter growing season at these sites, there isn't adequate fuel to carry a fire hot enough to kill medusahead seeds.</p> <p>Because of its high silica content, livestock generally avoid grazing medusahead as it approaches maturity. However, heavy grazing in spring, when medusahead is still palatable, can reduce, but not eliminate, an infestation. To limit seed dispersal, animals should be removed before the plants mature. Spring grazing is especially effective in areas where dried medusahead litter has been previously burned or grazed. Best control is achieved if plants are grazed in the stage of boot to flowerhead emergence. In experimental trials, medusahead populations have been reduced using confined grazing with sheep. In recent trials, fertilizing pastures with nitrogen improved the palatability of medusahead, making it attractive to cattle and resulting in medusahead suppression.</p> <p>As discussed above, thatch removal by raking, tillage, or burning can favor establishment of desirable plants. This can also improve efficacy of subsequent applications of some soil-applied herbicides, particularly imazapic.</p>
<b>Biological</b>	<p>Crown rot fungus (<i>Fusarium culmorum</i>), an endemic fungus of dry soils in the western states, is a potential biocontrol agent. However, there are no studies to show its effectiveness.</p>

**CHEMICAL CONTROL**

The following specific use information is based on published papers and reports by researchers and land managers. Other trade names may be available, and other compounds also are labeled for this weed. Directions for use may vary between brands; see label before use. Herbicides are listed by mode of action and then alphabetically. The order of herbicide listing is not reflective of the order of efficacy or preference.

<b>GROWTH REGULATORS</b>	
Aminopyralid <i>Milestone</i>	<p><b>Rate:</b> 7 to 14 oz product/acre (1.75 to 3.5 oz a.e./acre)</p> <p><b>Timing:</b> Preemergence in fall.</p> <p><b>Remarks:</b> A broadleaf-selective herbicide that is safe on most grasses. There is a 2(ee) Supplemental label for this use in Arizona, California, Colorado, Idaho, Oregon, Washington, Wyoming, and Utah. Research in California's Central Valley showed that 14 oz of <i>Milestone</i> (spot treatment rate)/acre gave ~90% control of medusahead, and 7 oz/acre gave ~60% control.</p>
<b>AROMATIC AMINO ACID INHIBITORS</b>	
Glyphosate <i>Roundup, Accord XRT II</i> , and others	<p><b>Rate:</b> 0.75 to 1 pt product (<i>Roundup ProMax</i>)/acre (0.42 to 0.56 lb a.e./acre) for early-season selective control in shrubland or other perennial systems; 1 to 2 qt product (<i>Roundup ProMax</i>)/acre (1.1 to 2.25 lb a.e./acre) for late-season, nonselective control.</p> <p><b>Timing:</b> For selective control, apply postemergence in spring after all seedlings are up and before heading; the tillering stage is ideal. For late-season, nonselective control, apply to rapidly growing plants before seeds are produced.</p> <p><b>Remarks:</b> Glyphosate is a nonselective herbicide with no soil activity.</p>
<b>BRANCHED-CHAIN AMINO ACID INHIBITORS</b>	
Imazapic <i>Plateau</i>	<p><b>Rate:</b> 4 to 12 oz product/acre (1 to 3 oz a.e./acre)</p> <p><b>Timing:</b> Fall or spring. In warm-winter areas, fall applications may be most effective. In colder climates, spring applications after snow melt are better.</p> <p><b>Remarks:</b> Imazapic has some soil residual activity and mixed selectivity. It tends to favor members of the</p>

	Asteraceae and some grasses. Use a spray adjuvant for postemergence applications. Effects vary depending on soil texture and soil organic matter. Heavy soils and high organic matter may require higher rates. Imazapic also can tie up in litter, and its efficacy is reduced under situations where there is lots of thatch on the soil surface. Not registered for use in California.
Rimsulfuron <i>Matrix</i>	<b>Rate:</b> 4 oz product/acre (1 oz a.i./acre) <b>Timing:</b> Preemergence (fall) to early postemergence (early spring). <b>Remarks:</b> Rimsulfuron controls several annual grasses and broadleaves. Perennial grasses are tolerant to fall applications when established and grown under dryland conditions. Application to rapidly growing or irrigated perennial grasses may result in their injury or death. It provides soil residual control in cool climates but degrades rapidly under warm conditions. Rimsulfuron will not control summer annual weeds when applied in fall or spring. Add a surfactant when applying postemergence.
Sulfometuron <i>Oust</i> and others	<b>Rate:</b> 0.75 to 1.5 oz product/acre (0.56 to 1.13 oz a.i./acre) <b>Timing:</b> Preemergence to early postemergence. Preemergence (fall) applications are generally more effective. <b>Remarks:</b> Sulfometuron is a broad-spectrum herbicide that is fairly safe on native perennial grasses. This can be an advantage in revegetation use. Use lower rates in arid environments, higher rates in wetter areas (> 20 inches rainfall) and on high organic matter soils. It has fairly long soil residual activity.
Sulfometuron + chlorsulfuron <i>Landmark XP</i>	<b>Rate:</b> 1.5 to 2.25 oz product/acre <b>Timing:</b> Preemergence, in fall or after soil thaws in spring. <b>Remarks:</b> See sulfometuron.

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*Eucalyptus globulus* Labill.

## Tasmanian blue gum

**Family:** Myrtaceae

**Range:** Throughout the coastal regions of California and Hawaii.

**Habitat:** Disturbed places, especially in riparian areas and coastal grasslands and forests. Groves can expand into intact adjacent scrub, woodlands, or grasslands. Grows best on deep, well-drained soils where roots can tap deep soil moisture or in areas that receive at least 21 inches of rain per year or moisture from additional sources, such as fog drip. Mature trees tolerate drought and short periods of temperatures as low as 17°F.

**Origin:** Native to southeastern Australia and Tasmania and introduced to the U.S. in the early 1850s as a landscape ornamental. Still widely planted.

**Impacts:** Mature Tasmanian blue gum trees create a safety hazard in public places because they tend to drop limbs. Leaves and branches decompose very slowly. Due to flammable plant compounds, dense growth of fine branches, and leaf and branch litter, groves are highly combustible and increase the risk of fire. Under drought conditions, trees tap into deep soil moisture and continue to transpire freely. The flowers are attractive to native hummingbirds, but the nectar has been implicated in clogging their beaks, causing the birds to starve. Frost dieback can exacerbate accumulation of dry, flammable leaves and branches making fire danger extremely high.

**California Invasive Plant Council (Cal-IPC) Inventory:** Moderate Invasiveness



Tasmanian blue gum is a fast-growing tree that can reach 150 to 180 ft tall and 4 to 7 ft in diameter. It has a straight trunk and well-developed crown with dark, rough persistent bark below and smooth, shedding, yellow-brown bark above. Leaves on older branches are 6 to 8 inches long, glossy, dark green, and leathery; they are narrowly lanceolate, often curved, alternate, and hang vertically. Juvenile leaves are opposite, sessile, broadly oblong, and covered with a gray, waxy bloom which is thicker on the bottom surface. Stems are usually square in cross-section and winged at the corners. Trees can resprout from the base when cut or damaged.

The flowers are white, sessile and solitary in the leaf axils. The fruit is a hard, woody capsule, broadly top-shaped, and often 4-angled. The fruit are 0.75 to 1 inch in diameter and 1 inch long or more, with a distinctive concave ring around the margin. Reproduction is by seed. Most seeds are released from capsules while still attached to the tree. Seeds typically fall within 300 ft from the parent plant, although some may disperse to greater distances with water, soil movement, animals, and human activities. Under favorable conditions, seeds germinate a few weeks after release from capsules, usually late fall through spring, but if conditions are dry, seeds may remain dormant for several years.

### NON-CHEMICAL CONTROL

<b>Mechanical</b> (pulling, cutting, disking)	Hand pulling can remove seedlings and small saplings. For larger saplings and small trees, a weed wrench or other woody weed extractor can be used. Care must be taken to extract the entire root or stump sprouting will occur. Best results are achieved when soil is moist.  Cutting a tree at ground level before it flowers will reduce seed production and deplete the plant's energy reserves. Resprouts are common after treatment. Cutting back regrowth when shoots reach 6 to 7 ft tall for 4 years or more can eventually kill the tree. Covering cut stumps with black plastic and sealing the edges with soil to exclude sunlight also gives good control. Plastic must be kept in place for at least one year. Cutting can
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	also be combined with an herbicide treatment.
<b>Cultural</b>	Grazing is not considered an effective control option as animals seldom browse on seedlings. Burning alone is not an effective method for controlling eucalyptus. Although burning can remove debris, in many cases it can increase the population as it removes competitive vegetation, releases nutrients into the soil, and stimulates the germination of seeds left in the soil. Burning is more effective when followed by an herbicide application, subsequent burnings, and/or revegetation using desirable species. It is important to employ a control strategy following a burn, otherwise the eucalyptus population may increase in subsequent years.
<b>Biological</b>	No biological control agents have been released for the control of eucalyptus. In 1998, the red gum lerp psyllid ( <i>Glycaspis brimblecombei</i> ), an insect native to Australia that causes foliar damage to many eucalyptus species, was found in California. Because eucalyptus is valued as an ornamental and as a commercial forest species, a biological control program was launched for the red gum lerp psyllid. In 2000, the parasitoid <i>Psyllaephagus bliteus</i> was widely released in California to control the red gum lerp psyllid.

### CHEMICAL CONTROL

The following specific use information is based on published papers and reports by researchers and land managers. Other trade names may be available, and other compounds also are labeled for this weed. Directions for use may vary between brands; see label before use. Herbicides are listed by mode of action and then alphabetically. The order of herbicide listing is not reflective of the order of efficacy or preference.

#### GROWTH REGULATORS

Picloram + 2,4-D <i>Tordon 101M</i> , <i>Tordon RTU</i> or <i>Pathway</i>	<b>Rate:</b> Cut stump treatment: undiluted or 50% <i>Tordon 101M</i> in water or undiluted <i>Tordon RTU/Pathway</i> (ready to use). Stem injection treatment: one cut per every 3 inches of stem diameter, and 0.5 ml of undiluted or 1 ml of diluted herbicide added to each cut. <b>Timing:</b> Best when used in late summer to early fall. <b>Remarks:</b> High rates can give long-term soil activity for broadleaves. Picloram is a restricted use herbicide, not registered for use in California. Applications are as described for triclopyr.
Triclopyr <i>Garlon 3A</i> , <i>Garlon 4 Ultra</i> , <i>Pathfinder II</i>	<b>Rate:</b> Foliar spot treatment: 2% v/v solution of <i>Garlon 4 Ultra</i> and water plus 0.5% v/v non-ionic surfactant to thoroughly wet all leaves. Basal cut stump treatment (treat the cut surface and the bark on the sides of the stump): 20 to 25% <i>Garlon 4 Ultra</i> in 75 to 80% oil carrier. Cut stump treatment (apply to cut surface only): 50% <i>Garlon 3A</i> in water. Basal bark treatment: 20 to 25% <i>Garlon 4 Ultra</i> in 75-80% oil carrier, or <i>Pathfinder II</i> (ready-to-use). Stem injection treatment: one cut per every 3 inches of stem diameter, and 1 ml of undiluted <i>Garlon 3A</i> added to each cut. <b>Timing:</b> Foliar treatments best when leaves are fully expanded. Stump and stem treatments can be used any time, but are best if not used when sap is rising in the early spring. <b>Remarks:</b> Broadleaf selective; will not damage desirable grasses growing nearby. Not as effective on eucalyptus as glyphosate. Foliar treatment should only be made on small trees or seedlings. For cut stump, cut stems horizontally near ground level and immediately apply <i>Garlon 3A</i> solution, covering the outer 20% of the cut surface. Suckering may occur after cutting, but the treatment should control most resprouts. For basal cut stump, applications can be made up to 2 weeks after cutting; treat to a height of 12 to 18 inches from the ground. For basal bark, spray the lower trunk, including the root collar, to 12-15 inches from the ground; the spray should wet the lower stem but not to the point of runoff. For stem injection, be sure that each cut goes well into the cambium layer; more effective on smaller trees. Trees should not be cut for at least one month after basal bark or stem injection treatments. A dye can be added to either product.

#### AROMATIC AMINO ACID INHIBITORS

Glyphosate <i>Roundup</i> , <i>Accord XRT II</i> , and others	<b>Rate:</b> Foliar spot treatment: 2% v/v solution ( <i>Roundup ProMax</i> ) glyphosate and water plus 0.5% v/v non-ionic surfactant to thoroughly wet all leaves. Cut stump treatment: undiluted or 50% <i>Roundup</i> (or other trade name) in water. Stem injection treatment: one cut per every 3 inches of stem diameter, and 1 ml of undiluted herbicide added to each cut. <b>Timing:</b> Best when used in late summer to early fall. <b>Remarks:</b> Glyphosate is a nonselective systemic herbicide. Applications are made as described for triclopyr. Glyphosate is considered the most effective herbicide for control of eucalyptus.
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**BRANCHED-CHAIN AMINO ACID INHIBITORS**

Imazapyr

*Arsenal, Habitat,  
Stalker, Chopper,  
Polaris*

**Rate:** Low volume/thinline treatment: 20% v/v solution of *Chopper* plus a 20% v/v ethylated crop oil in water. Cut stump treatment: 20% *Stalker* or *Chopper* formulation v/v in 80% oil carrier or 20% *Arsenal* or *Habitat* v/v in 80% water carrier. Stem injection treatment: one cut per every 3 inches of stem diameter, and 1 ml of undiluted herbicide (*Arsenal* or *Habitat*) added to each cut. Basal bark treatment: 20% *Stalker* or *Chopper* formulation v/v in 80% oil carrier.

**Timing:** Best when used in late summer to early fall.

**Remarks:** Soil residual herbicide; may result in bare ground around trees for some time after treatment. Applications are made as described for triclopyr. Only shown to be effective on smaller eucalyptus trees.

**RECOMMENDED CITATION:** DiTomaso, J.M., G.B. Kyser et al. 2013. *Weed Control in Natural Areas in the Western United States*. Weed Research and Information Center, University of California. 544 pp.

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*Foeniculum vulgare* Mill.

## Fennel

**Family:** Apiaceae

**Range:** Particularly a problem in California, but found throughout many western states including Washington, Oregon, Arizona, Nevada, Utah, New Mexico and Texas.

**Habitat:** Fennel prefers open disturbed areas and has invaded roadsides, slopes, fields, grasslands, coastal scrub, riparian and wetland areas, and other natural communities, particularly in coastal regions.

**Origin:** Native to southern Europe. Birds and rodents consume the seeds, and feral pigs relish the roots.

**Impacts:** Established plants are competitive, and soil disturbance facilitates the development of dense stands, which can exclude native vegetation in some areas. Unlike the weedy form, cultivated varieties are seldom invasive. Fennel is also rated as a noxious weed in some regions of Australia.

**California Invasive Plant Council (Cal-IPC) Inventory:** High Invasiveness



Fennel is an aromatic perennial with a deep thick taproot. Plants can grow to 10 ft tall, with finely dissected leaves divided into numerous thread-like segments. Foliage and seeds have a strong licorice or anise scent, especially when crushed. Different varieties are cultivated as a spice or vegetable, for an essential oil used to flavor foods, and in some countries, for medicinal purposes.

The inflorescence consists of several flat-topped compound umbels of small yellow flowers. Fruits separate into two halves (mericarps) at maturity. Plants reproduce by seed and sometimes vegetatively from root or crown fragments. Seeds are dispersed with water, soil movement, animals, human activities, and as a seed contaminant. Seeds appear to survive several years under field conditions. Fragmentation of roots and crowns may occur during flooding events, mudslides, or agricultural operations. New shoots grow from the crown and lower portions of overwintering stems in mid-winter to early spring.

### NON-CHEMICAL CONTROL

<b>Mechanical</b> (pulling, cutting, disking)	Hand chop small infestations (large fennel plants have a very substantial root, so this labor intensive). Slashing just before flowering may kill the plants, or repeat slashing of regrowth may be needed. Even if plants recover, slashing the stems at flowering will prevent seed set. The use of a mattock to remove the plant can also be successful, but is very labor intensive. Digging out individual plants is also possible, but also labor intensive.  Deep cultivation will also kill the plants but is not practical in most situations.
<b>Cultural</b>	Grazing will not control fennel and often spreads the population. Burning is not effective, as fennel will quickly recover following the fire. However, fall burns followed by herbicide treatment the following two springs reduced fennel cover. Burning can also stimulate the seedbank to germinate, which can reduce the number of years necessary for control.
<b>Biological</b>	Because fennel is the same species as the cultivated fennel, there are no biological control agents available.

### CHEMICAL CONTROL

The following specific use information is based on reports by researchers and land managers. Other trade names may be available, and other compounds also are labeled for this weed. Directions for use may vary

between brands; see label before use. Herbicides are listed by mode of action and then alphabetically. The order of herbicide listing is not reflective of the order of efficacy or preference.

<b>GROWTH REGULATORS</b>	
2,4-D Several names	<p><b>Rate:</b> 0.25 to 0.5% of v/v solution for spot treatment</p> <p><b>Timing:</b> Postemergence to fully developed leaves but before flowering.</p> <p><b>Remarks:</b> 2,4-D will damage other broadleaf species and is not as effective as triclopyr.</p>
Triclopyr <i>Garlon 3A, Garlon 4 Ultra</i>	<p><b>Rate:</b> Broadcast foliar treatment: 1 to 2 qt product/acre (1 to 2 lb a.e./acre). Spot treatment: 0.5 to 1% v/v solution</p> <p><b>Timing:</b> Postemergence to fully developed leaves but before flowering. The best treatment timing is during the wet season from late February to early March. For spot treatment, lower rates can be used early in the season.</p> <p><b>Remarks:</b> Triclopyr is a broadleaf herbicide that is the standard for fennel control. It is very effective and can also be used in combination with glyphosate at 1 lb a.e./acre each.</p>
<b>AROMATIC AMINO ACID INHIBITORS</b>	
Glyphosate <i>Roundup, Accord XRT II, and others</i>	<p><b>Rate:</b> Broadcast foliar treatment: 5 pt product (<i>Roundup ProMax</i>)/acre (2.8 lb a.e./acre). Spot treatment: 2 to 5% v/v solution</p> <p><b>Timing:</b> Postemergence to fully developed leaves but before flowering. Control is less effective once plant has bolted.</p> <p><b>Remarks:</b> Glyphosate is nonselective. It gives very effective control and can also be used in combination with triclopyr at 1 lb a.e./acre each.</p>

**RECOMMENDED CITATION:** DiTomaso, J.M., G.B. Kyser et al. 2013. *Weed Control in Natural Areas in the Western United States*. Weed Research and Information Center, University of California. 544 pp.

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*Catalpa bignonioides*

## Catalpa

**Family:** Bignoniaceae (bignonia)

### NON-CHEMICAL CONTROL

<i>Cultural:</i> grazing	<b>P</b>	
<i>Cultural:</i> prescribed burning		Typically found in riparian areas not conducive to burning
<i>Mechanical:</i> hand removal, weed wrench, cutting	<b>G</b>	weed wrench can be used to remove young plants, soil should be moist, remove entire root
<i>Mechanical:</i> heavy equipment removal	<b>P</b>	generally growing in sensitive areas

### CHEMICAL CONTROL

The following specific use information is based on published papers and reports by researchers and land managers. Other trade names may be available, and other compounds also are labeled for this weed. Directions for use may vary between brands; see label before use.

2,4-D	NIA	
Glyphosate	<b>E</b>	CS, FOL, INJ, Su, Fa
Hexazinone	NIA	
Imazapyr	<b>E</b>	CS, INJ, Su, Fa
Picloram	NIA	
Tebuthiuron	NIA	
Triclopyr	<b>E*</b>	FOL, CS, BB, INJ, Su, Fa

**E** = Excellent control, generally better than 95%

**G** = Good control, 80-95%

**F** = Fair control, 50-80%

**P** = Poor control, below 50%

Control includes effects within the season of treatment.

Control is followed by best timing, if known, when efficacy is **E** or **G**.

**\*** = Likely based on results of observations of related species

#### Possible application methods

BB = basal bark

CS = cut stump

FOL = foliar

INJ = stem injection

FLW = flowering

NIA = No information available

Fa = Fall

Sp = Spring

Su = Summer

**RECOMMENDED CITATION:** DiTomaso, J.M., G.B. Kyser et al. 2013. *Weed Control in Natural Areas in the Western United States*. Weed Research and Information Center, University of California. 544 pp.

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# WILD BLACKBERRIES

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*Integrated Pest Management for Home Gardeners and Landscape Professionals*

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Of the 11 species of *Rubus* in California, four were introduced primarily from Eurasia. Most species of wild blackberry, also called brambles, provide important sources of food and cover for many birds and mammals.

Four species, however, are considered weeds. Two of these are non-natives, cutleaf blackberry (*R. laciniatus*) (Fig. 1) and Himalaya blackberry (*R. discolor* [formerly known as *R. procerus*]) (Fig. 2). In addition, two native species also can be weeds under certain conditions. For example, thimbleberry (*R. parviflorus*) (Fig. 3) competes with conifers during establishment in reforested areas, and California blackberry (*R. ursinus* [formerly known as *R. vitifolius*]) (Fig. 4) can infest areas adjacent to streams and ditches. Of these weedy species, the most common, vigorous, and troublesome is Himalaya blackberry.

## IDENTIFICATION

Of the four weedy wild blackberries, thimbleberry is the only nonvining species. It also lacks prickly stems and has a simple leaf with no leaflets. Both Himalaya and cutleaf blackberry have five-angled stems whereas thimbleberry is rounded in cross section, but Himalaya blackberry is easily distinguishable from the other wild blackberries by its five distinct leaflets, each one toothed and usually oval. By comparison, cutleaf blackberry has five very deeply lobed leaflets, and California blackberry has only three leaflets. Not all wild blackberry leaves are deciduous; many remain evergreen. This is an important feature for chemical control in late fall and winter.

Himalaya blackberry has showy flowers that form in large clusters at the end of shoots. Each flower is about 1

inch across with five white or pink petals. The fruits are black and tasty when ripe. New canes are produced each year from the crown (the base of the plant), replacing those that die naturally. New plants start from crown regrowth, rhizomes (horizontal, underground shoots), and seeds that germinate in fall and spring. Reproduction is similar for the other three species.

## IMPACT

The scrambling habit of Himalaya and the other vining wild blackberries smothers existing plant growth. In addition, the tangled mass of thorny stems blocks access of humans, livestock, equipment, and vehicles to pastures and waterways. In addition, it can host Pierce's disease and serve as a vector to movement of the pathogen to other agricultural and nonagricultural areas, including riparian sites.

In forest areas, timber-logging operations create large open areas that wild blackberries often invade. When grazed, the thorny stems can injure the nasal passages of livestock. Another undesirable aspect of vining blackberry plants is they are a good source of food and shelter for rats.

## BIOLOGY

Many animal species feed on wild blackberries; consequently, seeds spread easily from one area to another in animal droppings. Wild blackberry seeds have a hard seed coat and can remain dormant for an extended period. Once seeds germinate and grow and the plants become established, expansion of the thicket is almost entirely a result of vegetative growth from rhizomes. Over time a single plant can cover a very large area.



Figure 1. Cutleaf blackberry.



Figure 2. Himalaya blackberry.



Figure 3. Thimbleberry.



Figure 4. California blackberry.

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# PEST NOTES

University of California  
Statewide Integrated Pest Management Program  
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Wild blackberry plants can live for 25 years or longer. They produce vines that arise from a central crown or from buds that form along rhizomes (Fig. 5). First-year canes don't produce flowers. In the second year, the canes fruit and die. Tips of first-year canes that contact the ground form roots at the nodes, contributing to the lateral expansion of the plant.

Bumblebees and honey bees are the primary pollinators of wild blackberry flowers. The flowers can be self-pollinated, but cross pollination increases fruit set.

## MANAGEMENT

Wild blackberries are able to regenerate from the crown or rhizomes following mowing, burning, or herbicide treatment. This makes them difficult to control, and control measures often require follow-up treatment. Land managers often rely on a combination of mechanical and chemical control methods followed by a prescribed burn to dispose of vegetative material.

Because of the extensive underground root system, digging out the plants in a home landscape is a difficult undertaking. Home gardeners generally must rely on foliage-applied herbicide treatments to control an infestation of wild blackberries. One nonchemical option in the home landscape is the use of a rototiller to till the ground several times after the canes have been removed.

### Mechanical Control

Because **repeated tillage** easily controls wild blackberries, they aren't a problem in cultivated agricultural systems. A single cultivation, however, can fragment the rhizomes and spread the weed. **Bulldozing** also can cause resprouting and can spread the weed by fragmenting roots and stems.

**Mowing** isn't an effective method for controlling wild blackberries. In many cases it stimulates the formation of suckers from lateral roots and induces branching. Despite the lack of long-

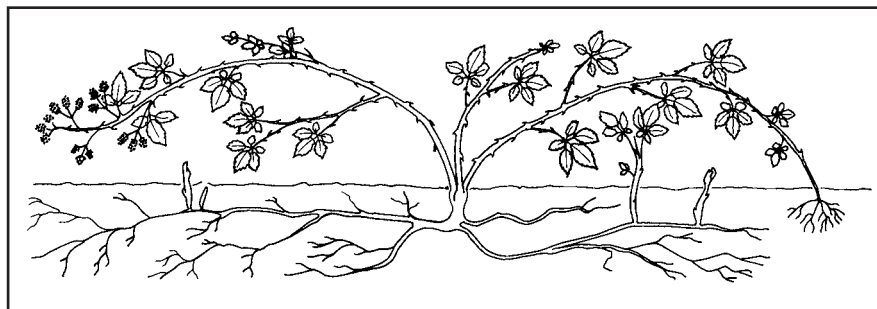


Figure 5. Vegetative growth of a blackberry plant from a central crown.

term control, mowing or chopping can provide short-term canopy reduction that will encourage the growth of grasses and broadleaf plants.

**Burning**, like mowing, isn't an effective long-term strategy, because wild blackberry plants vigorously resprout from rhizomes. However, like mowing, it also provides short-term canopy reduction.

### Biological Control

Because many *Rubus* species are native or of economic importance, biocontrol isn't a practical control method in California. In Australia, however, blackberry leaf rust (*Phragmidium violaceum*) has been released for control of the weed. Thus far this program has not been successful, because the rust hasn't caused significant damage to its host. The rust was discovered in Oregon in the early 2000s and appeared to cause some damage to Himalaya blackberry populations. However, it has not maintained that level of injury and hasn't become widespread in California.

### Chemical Control

Blackberry plants usually regrow following herbicide application; thus, repeated treatments might be necessary for effective long-term control.

**Herbicides applied to the soil.** In noncrop areas, tebuthiuron (Spike) is registered for use by licensed applicators for brush control. Tebuthiuron is a nonselective urea herbicide that is used for total control (i.e., it eliminates other vegetation in the treatment area) of shrubs, trees, and other weeds. It can

be applied in a pelleted formulation at the base of the plant to provide long-term control of wild blackberries.

**Herbicides applied to the plant.** Herbicides can be used in rangeland, pastures, noncrop areas, along roadsides, and in right-of-ways to control actively growing wild blackberry plants.

To effectively control blackberries during the growing season, an herbicide must be transported within the plant to the rhizomes and new growing points. For this to occur, the herbicide must move in the phloem with the plant sugars produced through photosynthesis. In early summer during the rapid extension of canes and expansion of foliar tissue, sugars are transported within the plant from the underground storage tissues to the shoots. After midsummer, new growth is reduced in wild blackberry first-year canes (non-flowering shoots), because these shoots are actively transporting sugars to the rhizomes. These sugars are stored for the following year's growth. In the flowering shoots (second-year canes), movement of sugars from the shoots to the rhizomes occurs later in the season than it does for first-year canes and is most active after completion of fruiting.

Time a foliar herbicide application so that it coincides with the maximum rate of sugar movement to the root system. This will depend upon whether the plants are primarily first-year canes or a combination of both first- and second-year canes. In a situation where only first-year canes are present (for example when plants have been burned or mowed), the most effective time for

optimal herbicide transport to the root system is in late summer. Herbicide application at this time reduces the likelihood of regrowth in subsequent years. Where the bramble infestation consists primarily of second-year canes or a combination of first- and second-year canes, apply an herbicide in early fall, before plants become dormant. Herbicides applied too early generally result in good kill of the top growth but very little movement of the chemical to the root system. Consequently, the plant regrows.

Plants stressed from drought or grazing don't translocate sugars as rapidly as do actively growing plants. Thus, chemical control of wild blackberry plants under stress is difficult and not recommended.

*Foliar-applied herbicides.* Herbicides used to control wild blackberry during the growing season include glyphosate, dicamba, dicamba/2,4-D combinations, and triclopyr. Of these, glyphosate (Roundup and other products containing glyphosate) and triclopyr (Brush-B-Gon, Blackberry and Brush Killer) are registered for use by home gardeners.

- Glyphosate formulated into a product with 41% active ingredient (a.i.) can provide good to excellent control of wild blackberries when applied in a 0.5 to 1.5% solution (i.e., about 0.6 to 2 ounces of product per gallon of water). One product available for use in the home landscape with this concentration of active ingredient is Roundup Super Concentrate. In natural areas, Roundup Pro is commonly used, and in riparian sites near water, the formulations Aquamaster and Rodeo are registered. Glyphosate products that have a lower concentration of active ingredient, such as Roundup Concentrate (18% a.i.), will require a 1.5 to 3.5% solution (i.e., about 2 to 4.5 ounces per gallon of water) for effective control. Late summer or early fall treatments give better control than treatments before or during flowering. To obtain good control, however, complete foliage coverage (spray-to-wet) is essential; spray the plant

until it is thoroughly wet but not to the point of runoff. Burning or mowing 40 to 60 days after spraying with glyphosate increases the level of control and also contributes to good pasture establishment by removing stem debris. Shoots recovering from sublethal glyphosate treatment tend to die more quickly when subjected to heavy grazing. Be sure to wait at least two weeks before grazing after treatment if less than 10% of the area was treated. If more than 10% of the area was treated, animals can't be grazed on the land until eight weeks following treatment.

- Dicamba alone (Banvel, Vanquish) or plus 2,4-D applied in late summer gives good control of wild blackberries. However, 2,4-D alone provides only fair control and will result in resprouting.
- Triclopyr is available to licensed applicators for commercial use in either amine (Garlon 3A) or ester (Garlon 4) formulations. Triclopyr ester (0.75 to 1% solution) is the most effective formulation of triclopyr on thimbleberry and the other three species of wild blackberries. Absorption of the herbicide into the foliage isn't as good with the amine form. Nevertheless, it also provides good control when applied at a 1% solution. The best time to apply either form of the herbicide is midsummer. When air temperatures are higher than 80°F, it is best to use the amine formulation, because the ester form is subject to vaporization. The timing for control of wild blackberries with triclopyr is somewhat earlier than that recommended for glyphosate. Like glyphosate, apply triclopyr spray-to-wet on the foliage. Sometimes glyphosate and triclopyr (1% solution each) are used in combination to achieve better control. Triclopyr is available in retail stores for use in the home landscape in products formulated at a lower concentration than those available to licensed applicators. Carefully read and follow the label of these products (Brush-B-Gon Concentrate, Blackberry and Brush Killer) to apply the correct amount to plants.

*Basal bark treatment.* Concentrated forms of triclopyr (often mixed with commercially available seed oils for better penetration) can be applied to basal regions of wild blackberries with a backpack sprayer using a solid cone, flat fan, or a straight-stream spray nozzle. Thoroughly cover a 6- to 12- inch basal section of the stem with spray but not to the point of runoff. Basal bark applications can be made almost any time of the year, even after leaves have senesced (aged, dried, and fallen from plant). In areas where people frequently harvest the fruit of wild blackberries, a midfall basal bark treatment might be desirable to avoid human contact with the chemical.

*Dormant stem and leaf treatment.* As an alternative to basal bark treatments, a 1% solution of triclopyr ester can be applied to dormant leaves and stems in late fall and winter in a 3% crop oil concentrate mixture; see product labels for the rate to use to obtain the desired concentration. As with other herbicide applications, spray the plant until it is thoroughly wet but not to the point of runoff. Like basal bark treatments, the timing of this technique prevents human contact with the herbicide during berry-picking season.

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To simplify information, trade names of products have been used. No endorsement of named products is intended, nor is criticism implied of similar products that are not mentioned.

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**University of California  
Agriculture and Natural Resources Program**

#### WARNING ON THE USE OF CHEMICALS

Pesticides are poisonous. Always read and carefully follow all precautions and safety recommendations given on the container label. Store all chemicals in the original, labeled containers in a locked cabinet or shed, away from food or feeds, and out of the reach of children, unauthorized persons, pets, and livestock.

Pesticides applied in your home and landscape can move and contaminate creeks, rivers, and oceans. Confine chemicals to the property being treated. Avoid drift onto neighboring properties, especially gardens containing fruits or vegetables ready to be picked.

Do not place containers containing pesticide in the trash or pour pesticides down the sink or toilet. Either use the pesticide according to the label, or take unwanted pesticides to a Household Hazardous Waste Collection site. Contact your county agricultural commissioner for additional information on safe container disposal and for the location of the Household Hazardous Waste Collection site nearest you. Dispose of empty containers by following label directions. Never reuse or burn the containers or dispose of them in such a manner that they may contaminate water supplies or natural waterways.

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*Sapium sebiferum* L.  
(= *Triadica sebifera* (L.) Small)

## Chinese tallowtree



**Family:** Euphorbiaceae

**Range:** Primarily found in the southeastern United States, from North Carolina to Texas. More recently becoming an issue in California.

**Habitat:** Disturbed and undisturbed bottomlands, fields, coastal prairies, riparian areas, and wetlands. Tolerates shade, drought, saline, flooded conditions, and temperatures as low as 5°F. Grows best on well-drained clay-peat soil, but can tolerate a wide range of soil conditions.

**Origin:** Native to China and Japan where it has been cultivated for seed oil production for more than a thousand years. It is thought that Benjamin Franklin introduced Chinese tallowtree into the United States in 1776. Significant planting occurred throughout the Gulf Coast in the early 1900s both as a seed crop and as an ornamental. Since then it has escaped from cultivation, is extremely invasive in much of the lower southeast, and is currently expanding its range.

**Impacts:** Chinese tallowtree can aggressively invade disturbed and undisturbed terrestrial, wetland, and riparian plant communities. The tree is most problematic in the southeastern U.S., where large tracts of coastal prairie have been replaced by stands of Chinese tallowtree. Stands replace native vegetation and can significantly alter the soil nutrient status. The milky sap and unripe fruits are mildly toxic to humans and livestock when ingested.

**California Invasive Plant Council (Cal-IPC) Inventory:** Moderate Invasiveness (Alert)

Chinese tallowtree is a fast-growing deciduous tree that often grows to about 20 ft, but can reach 40 to 50 ft tall. It is freely branching, with an open, airy appearance. The leaves are pendant, diamond shaped, abruptly pointed at the tip, and 2 to 3 inches long. In fall the leaves turn brilliant shades of scarlet, orange, yellow and maroon. Like most members of the spurge family, broken twigs and leaf stems exude a milky latex sap.

The flowers are produced in yellowish-green catkins on the branch tips. The fruits are 3-lobed brown capsules that open to reveal three white, waxy seeds that resemble popcorn. Chinese tallowtree has a tremendous reproductive potential. They reach reproductive age in as little as 3 years and can remain productive for 100 years. A mature tree may annually produce an average of 100,000 seeds that are spread mainly by birds and water. Most seeds survive over a year under field conditions, but little is known of the seedbank longevity. In addition to prolific seed production, Chinese tallowtree resprouts from stumps, and roots readily develop shoots.

### NON-CHEMICAL CONTROL

#### Mechanical (pulling, cutting, disking)

Hand pulling can remove seedlings and small saplings, but this technique is generally not effective or practical for established trees.

Cutting is most effective before flowering to prevent seed production. Because tallowtree spreads by suckering, resprouts are common after treatment. Cutting should be combined with an herbicide treatment or with multiple cuttings over a period of years. Cut trees at ground level with power or manual saws. Trees standing in water may be successfully killed by cutting them below the water line.

Heavy equipment can be effectively used to control tallow trees on canal banks and in areas where soil disturbance and nonselective species removal are not important considerations. Stumps remaining following such treatment will require herbicide application to prevent regrowth.

Girdling can be an effective treatment where the use of herbicides is impractical. Using a hatchet, make a cut through the bark encircling the base of the tree, approximately 6 inches above the ground. Be sure that

	the cut goes well into or below the cambium layer. This method will kill the top of the tree but resprouts are common. Follow-up treatments for many years may be required until roots are exhausted, so this method is not recommended for large populations.
<b>Cultural</b>	Grazing (foliage is toxic to cattle), burning or flooding are not effective management options for controlling Chinese tallowtree.
<b>Biological</b>	No biological control agents have been released for the control of Chinese tallowtree.

**CHEMICAL CONTROL**

The following specific use information is based on published papers and reports by researchers and land managers. Other trade names may be available, and other compounds also are labeled for this weed. Directions for use may vary between brands; see label before use. Herbicides are listed by mode of action and then alphabetically. The order of herbicide listing is not reflective of the order of efficacy or preference.

<b>GROWTH REGULATORS</b>	
Picloram + 2,4-D <i>Tordon 22K</i> + 2,4-D amine	<p><b>Rate:</b> Foliar spot treatment: 1 qt <i>Tordon 22K</i>, plus 4 pt 2,4-D amine (1.9 lb a.e./acre) or 1 pt <i>Remedy Ultra</i>, plus 0.5% v/v surfactant. Apply to thoroughly wet all leaves.</p> <p><b>Timing:</b> Postemergence in spring or fall when conditions are favorable for plant growth.</p>
Picloram + triclopyr <i>Tordon 22K</i> + <i>Remedy Ultra</i>	<p><b>Remarks:</b> High rates of picloram can give long-term soil residual control for broadleaves. <i>Tordon 22K</i> is a federally restricted use pesticide. It is not registered for use in California.</p>
Triclopyr <i>Garlon 3A</i> , <i>Garlon 4 Ultra</i> , <i>Pathfinder II</i>	<p><b>Rate:</b> Low volume foliar treatment: 2% v/v solution of triclopyr and water plus 0.5% surfactant; apply to thoroughly wet all leaves. Cut stump treatment: 20% <i>Garlon 4 Ultra</i> in 80% oil carrier, or 50% <i>Garlon 3A</i> in water. Basal bark treatment: 20 to 30% <i>Garlon 4 Ultra</i> in 70 to 80% oil carrier, or <i>Pathfinder II</i> as a ready to use formulation. Stem injection treatment: one cut per every 3 inches of stem diameter, and 1 ml of undiluted <i>Garlon 3A</i> added to each cut. For clumps, one hack per every 6 inches of total stem diameter. Treat the largest stems. Basal cut stump treatment: 20% <i>Garlon 4 Ultra</i> in 80% oil carrier.</p> <p><b>Timing:</b> Foliar treatments are best when leaves are fully expanded. Cut stump, basal cut stump, basal bark, and stem injection treatments can be applied as long as the ground is not frozen, but are best when used in late summer or early fall, before leaf drop.</p> <p><b>Remarks:</b> Triclopyr is a selective herbicide for broadleaf species and will not damage desirable grasses growing nearby. Cut stump treatment: cut stems horizontally at or near ground level, and immediately apply herbicide solution to cover the outer 20% of the stump face. Suckering from the roots typically occurs after cutting, but the treatment should control most resprouts. Basal bark treatment: spray the lower trunk, including the root collar, to a height of 12 to 15 inches from the ground; the spray should thoroughly wet the lower stem but not to the point of runoff. Stem injection treatment: be sure that each cut goes well into or below the cambium layer. Trees should not be cut for at least one month following basal bark and stem injection treatments. Triclopyr can be used as a premix with aminopyralid (<i>Capstone</i>) at 5 to 8% v/v solution for spot treatments.</p>
<b>AROMATIC AMINO ACID INHIBITORS</b>	
Glyphosate <i>Roundup</i> , <i>Accord XRT II</i> , and others	<p><b>Rate:</b> Foliar treatment: 2% v/v solution of <i>Roundup ProMax</i> (or other trade name with a similar concentration of glyphosate) and water plus 0.5% surfactant to thoroughly wet all leaves. Cut stump treatment: undiluted <i>Roundup</i> (or other trade name) or 50% of herbicide concentrate in water. Stem injection treatment: one cut per every 3 inches of stem diameter, and 1 ml of undiluted herbicide added to each cut. For clumps, one hack per every 6 inches of total stem diameter. Treat the largest stems.</p> <p><b>Timing:</b> Postemergence foliar treatments are best when leaves are fully expanded. Cut stump and stem injection treatments can be applied as long as the ground is not frozen, but is best when used in late summer or early fall, before leaf drop.</p> <p><b>Remarks:</b> Glyphosate is a nonselective systemic herbicide. Cut stump and stem injection applications are as described for triclopyr. Trees should not be cut for at least 4 months after foliar and stem injection treatments.</p>
<b>BRANCHED-CHAIN AMINO ACID INHIBITORS</b>	
Imazapyr <i>Arsenal</i> , <i>Habitat</i> ,	<p><b>Rate:</b> Low volume foliar treatment: 1% v/v solution of <i>Stalker</i> and water plus 0.5% surfactant to thoroughly wet all leaves. Cut stump treatment: 10% <i>Stalker</i> in 90% oil carrier. Basal bark treatment: 20%</p>

<p><i>Stalker, Chopper, Polaris</i></p>	<p>v/v <i>Stalker</i> or <i>Chopper</i> formulation in 80% oil carrier. Stem injection treatment: one cut per every 3 inches of stem diameter, and 1 ml of undiluted herbicide (<i>Arsenal</i> or <i>Habitat</i>) added to each cut. For clumps, one hack per every 6 inches of total stem diameter. Treat the largest stems.</p> <p><b>Timing:</b> Best in late summer to early fall, but before leaf drop. Avoid stem injection between March and April.</p> <p><b>Remarks:</b> Imazapyr is a soil residual herbicide and may result in bare ground around trees for some time after treatment. Cut stump, basal bark and stem injection applications are as described for triclopyr. Trees should not be cut for at least 4 months after foliar, basal bark and stem injection treatments.</p>
<p><b>PHOTOSYNTHETIC INHIBITORS</b></p>	
<p>Hexazinone <i>Velpar L</i></p>	<p><b>Rate:</b> Broadcast soil treatment: 2 to 4 gal/acre (4 to 8 lb a.i./acre). Basal (soil) single stem treatment: undiluted product at a rate of 2 to 4 ml per inch of stem diameter, applied to the soil surface within 3 ft of the stem.</p> <p><b>Timing:</b> Preemergence from late winter through summer.</p> <p><b>Remarks:</b> Hexazinone is a residual herbicide applied as a broadcast or basal-soil treatment for brush control. Basal (soil) single stem treatment: one squirt of spot gun per 1 inch stem diameter. High rates of hexazinone can create bare ground, so only use high rates in spot treatments.</p>
<p>Tebuthiuron <i>Spike</i></p>	<p><b>Rate:</b> Basal (soil) single stem treatment: up to 7.5 lb product (<i>Spike 80DF</i>)/acre (6 lb a.i./acre)</p> <p><b>Timing:</b> Soil treatments can be applied anytime except when the soil is frozen or saturated with moisture. Applications should be made before the start of spring growth or before expected seasonal rainfall.</p> <p><b>Remarks:</b> Tebuthiuron is a surface applied, soil-active product intended for total vegetation control in non-cropland. For best control, do not disturb plants for 2 years after application.</p>

**RECOMMENDED CITATION:** DiTomaso, J.M., G.B. Kyser et al. 2013. *Weed Control in Natural Areas in the Western United States*. Weed Research and Information Center, University of California. 544 pp.

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*Brassica nigra* (L.) Koch

## Black mustard

**Family:** Brassicaceae

**Range:** Throughout the U.S. and in all western states except Wyoming.

**Habitat:** Roadsides, fields, disturbed waste places, and grasslands, especially in coastal areas. Mostly inhabits areas with a mild winter climate in its native range.

**Origin:** Native to Europe. Introduced by the Spanish as a spice crop. The seeds of cultivars are still used to produce mustard oil.

**Impact:** In coastal grasslands, dense stands of black mustard outcompete native vegetation. Black mustard appears to have allelopathic properties. It is adapted to periodic fires and newly burned sites are subject to invasion. The high biomass contributes to increased fuel load and fire frequency. Black mustard contains glucosinolates, sulfur compounds that can irritate the digestive tract and cause thyroid dysfunction when consumed in large quantities over time. Toxicity problems in livestock arise when large quantities of seeds are ingested or when animals are confined to pastures that consist primarily of mustard family species.

**California Invasive Plant Council (Cal-IPC) Inventory:** Moderate Invasiveness



Black mustard is an erect winter annual to 6 ft tall. The basal leaves mostly have 1 to 2 pairs of distinct lateral lobes at the base, with the terminal lobe much larger than the lateral lobes. The upper stem leaves are oblong to linear, the base tapered, and the margins entire to toothed or weakly lobed.

The four petals are bright yellow, 6 to 11 mm long, and plants flower from mid-spring to mid-summer. Mature fruits are linear, 0.5 to 1 inch long, and erect, usually lying close to the stem. Plants reproduce only by seed. Most seeds fall near parent plants when fruits open at maturity. Many mustard species develop a large, persistent seedbank. Deeply buried seeds of black mustard can survive for 50 years or more. Seeds nearer to the soil surface are not as long-lived under field conditions.

### NON-CHEMICAL CONTROL

<b>Mechanical</b> (pulling, cutting, disking)	Plants can be hand pulled or removed by other tools before they produce seed. Yearly manual removal of plants before seeds mature can eventually deplete the seedbank.  Tillage can be used to manage black mustard in the seedling stage. Tillage should be done before black mustard has set seed. Shallow tillage is preferred over deep tillage. Deep tillage can bury weed seeds to depths where they can remain dormant for many years and become a problem at a later date.
<b>Cultural</b>	There is no information on the effectiveness of grazing for the control of black mustard. However, it is speculated that the plants must be readily eaten by livestock because big stands are seldom found on native ranges other than those lightly grazed. In the United States, black mustard is most common on areas protected from grazing. Reports indicate that plants are fairly palatable to sheep and cattle.  Burning and other kinds of disturbance usually favor the increase of mustard species. Seeds on the soil during a grassland fire are not likely to be killed by the heat of the burn.
<b>Biological</b>	Because of the close relationship of black mustard with many important crop plants in the genus <i>Brassica</i> , there are no biological control efforts in the United States.

**CHEMICAL CONTROL**

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<b>GROWTH REGULATORS</b>	
2,4-D Several names	<p><b>Rate:</b> 1 to 2 pt product/acre (0.5 to 1 lb a.e./acre)</p> <p><b>Timing:</b> Postemergence when weeds are small and rapidly growing.</p> <p><b>Remarks:</b> 2,4-D is broadleaf-selective and has no soil activity.</p>
Aminocyclopyrachlor + chlorsulfuron <i>Perspective</i>	<p><b>Rate:</b> 3 to 8 oz product/acre</p> <p><b>Timing:</b> Preemergence or early postemergence when weeds are germinating or actively growing.</p> <p><b>Remarks:</b> <i>Perspective</i> provides broad-spectrum control of many broadleaf species. Although generally safe to grasses, it may suppress or injure certain annual and perennial grass species. Do not treat in the root zone of desirable trees and shrubs. Do not apply more than 11 oz product/acre per year. At this high rate, cool-season grasses will be damaged, including bluebunch wheatgrass. Not yet labeled for grazing lands. Add an adjuvant to the spray solution. This product is not approved for use in California and some counties of Colorado (San Luis Valley).</p>
Dicamba <i>Banvel, Clarity</i>	<p><b>Rate:</b> 0.5 to 1.5 pt product/acre (4 to 12 oz a.e./acre)</p> <p><b>Timing:</b> Postemergence when weeds are small and rapidly growing. Use low rate for small rapidly growing weeds-higher rate for large mustards.</p> <p><b>Remarks:</b> Dicamba is broadleaf-selective with little soil activity.</p> <p>Dicamba is available mixed with diflufenzopyr in a formulation called <i>Overdrive</i>. This has been reported to be effective on some mustards. Diflufenzopyr is an auxin transport inhibitor which causes dicamba to accumulate in shoot and root meristems, increasing its activity. <i>Overdrive</i> is applied postemergence to rapidly growing plants at 4 to 8 oz product/acre. Higher rates should be used on large annuals. Add a non-ionic surfactant to the treatment solution at 0.25% v/v or a methylated seed oil at 1% v/v.</p>
Fluroxypyr <i>Vista XRT</i>	<p><b>Rate:</b> 22 oz product/acre (7.7 oz a.e./acre)</p> <p><b>Timing:</b> Postemergence when weeds are small and rapidly growing.</p> <p><b>Remarks:</b> Only effective when applied postemergence. Gives suppression of mustards. Can also be used in a premix with picloram (<i>Surmount</i>), but this formulation is not registered for use in California.</p>
Triclopyr <i>Garlon 4 Ultra</i>	<p><b>Rate:</b> 1 to 8 qt product/acre (1 to 8 lb a.e./acre)</p> <p><b>Timing:</b> Postemergence when weeds are small and rapidly growing. Higher rates are needed on more mature plants.</p> <p><b>Remarks:</b> Triclopyr is broadleaf-selective and may injure other desirable species. The ester formulation (<i>Garlon 4 Ultra</i>) is more effective compared to the amine formulation. Use rate for mustard should not exceed 4 lb a.e./acre.</p>
<b>AROMATIC AMINO ACID INHIBITORS</b>	
Glyphosate <i>Roundup, Accord XRT II,</i> and others	<p><b>Rate:</b> Spot treatment: 2% v/v solution for spot application</p> <p><b>Timing:</b> Best treated postemergence when plants are small and are growing rapidly, but before flowering.</p> <p><b>Remarks:</b> Some studies show that it only gives fair control on mustards. Best on seedling plants.</p>
<b>BRANCHED-CHAIN AMINO ACID INHIBITORS</b>	
Chlorsulfuron <i>Telar</i>	<p><b>Rate:</b> 1 to 2.6 oz product/acre (0.75 to 1.95 oz a.i./acre)</p> <p><b>Timing:</b> Preemergence or early postemergence, when weeds are germinating or actively growing.</p> <p><b>Remarks:</b> Chlorsulfuron is primarily active on broadleaf species. It gives very effective control of most mustards, except shortpod mustard. It has fairly long residual soil activity. Do not apply more than 1.33 oz product/acre per year in pasture, range, and CRP, or 2.6 oz product/acre per year in noncrop.</p>

<p>Propoxycarbazone-sodium <i>Canter R+P</i></p>	<p><b>Rate:</b> 0.9 to 1.2 oz product/acre (0.63 to 0.84 oz a.i./acre)  <b>Timing:</b> Postemergence to young, rapidly growing plants.  <b>Remarks:</b> Propoxycarbazone is a broad-spectrum herbicide that will control many species, including black mustard. Perennial grass species vary in tolerance. A non-ionic surfactant should be added at 0.25 to 0.5% v/v solution.</p>
<p>Rimsulfuron <i>Matrix</i></p>	<p><b>Rate:</b> 4 oz product/acre (1 oz a.i./acre)  <b>Timing:</b> Preemergence in spring or fall depending on the timing of germination.  <b>Remarks:</b> Controls several annual grasses and broadleaves. Perennial grasses are tolerant to fall applications when established and grown under dryland conditions. Application to rapidly growing or irrigated perennial grasses may result in injury or death of the crop. Provides soil residual control in cool climates but degrades rapidly under warm conditions. Rimsulfuron will not control summer annual weeds when applied in fall or spring. Moisture is necessary for activation and the best results occur when precipitation is within 14 to 21 days of application.</p>
<p>Sulfometuron <i>Oust and others</i></p>	<p><b>Rate:</b> 3 to 5 oz product/acre (2.25 to 3.75 oz a.i./acre)  <b>Timing:</b> Preemergence or early postemergence.  <b>Remarks:</b> Sulfometuron is a broad-spectrum herbicide with long soil residual activity. Provides longer control in areas with 20 inches of annual rainfall or more.</p>

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*Cirsium vulgare* (Savi) Ten.

## Bull thistle

**Family:** Asteraceae

**Range:** Found in every state in the U.S.

**Habitat:** Disturbed areas including rangeland, pastures, forest clearcuts, roadsides and waste areas. Also occurs in foothills, dry meadows and riparian areas.

**Origin:** Native to Europe.

**Impact:** Bull thistle is not palatable to livestock and reduces the forage potential of infested pasture and rangeland. Once established, it can outcompete native plants. Although common, bull thistle is generally not considered as problematic as musk or Scotch thistle.

**Western states listed as Noxious Weed:** California, Colorado, New Mexico, Oregon, Washington

**California Invasive Plant Council (Cal-IPC) Inventory:** Moderate Invasiveness



Bull thistle is usually a biennial, but sometimes an annual or monocarpic perennial. It can grow up to 7 ft in height, but 2 to 6 ft is more common. Rosettes up to 3 ft in diameter form the first year. Leaves are 3 to 12 inches long, deeply lobed with coarse prickly hairs on the top and woolly hairs underneath. Leaves have sharp spines along the midrib and at the tip of the lobes, with the tip resembling a spear. Plants can have spreading branches, and sometimes a single stem. Stem have spiny wings that run down the length of the stem. Bull thistle requires vernalization before bolting.

Plants produce solitary (or sometimes clustered) pink-magenta flowerheads at the end of each stem. They are 1.5 to 2 inches wide and 1 to 2 inches long. Large spiny bracts surround the seedheads. Bull thistle reproduces and spreads entirely from seeds. Under favorable conditions, plants can produce 100 to 300 seeds per flowerhead or more, with 1 to more than 400 flowerheads per plant. Seeds have a feathery pappus that detaches at maturity, so seeds usually do not travel great distances by wind. Most seeds fall within a few feet of the parent plant. Seeds germinate in fall or spring depending on soil moisture. Most seeds either germinate or die within the first year, but seeds buried to about 6 inches or deeper may survive for up to 3 years or more.

### NON-CHEMICAL CONTROL

#### Mechanical (pulling, cutting, disking)

Tillage, hoeing, and hand pulling are effective as long as they are done before flowering to prevent seed production. Any mechanical or physical control measure that severs the root below the soil surface is very effective. The plant must be cut off below the soil surface and no leaves should remain attached, or the plant will recover.

Mowing is only effective when done either immediately before flowering or when plants are just starting to flower. Mowing too early only delays flowering, while mowing too late may allow production of viable seed. Because there can be a wide variation in the maturity of plants, a single mowing is generally insufficient because some seed will still be produced. Repeated mowing throughout the growing season is a more successful approach.

#### Cultural

The ability of thistles to invade pastures can be changed by grazing management, primarily by changing the competitiveness of the desirable pasture species. Sheep, goats, and horses, but not cattle, will eat young plants and can have a significant effect on thistles in the early stages of an infestation. Goats tend to avoid bull thistle foliage but eat the flowerheads, which can completely prevent seed dispersal from mature plants. Light grazing by sheep may selectively reduce competition from neighboring plants, increasing



	seedling survival, growth, flowering and seed production in bull thistle. It is unclear whether fire will completely kill bull thistle. Only mature thistle plants may readily combust and their seed may already be dispersed. Fire can create conditions that favor the establishment of bull thistle, so colonization after a fire may be enhanced. Burning can be used to remove above-ground material once it dries in late summer to fall. This can facilitate subsequent herbicide applications. Burning may also encourage the seedbank to flush, providing an opportunity for seedling control.
<b>Biological</b>	The bull thistle gall fly ( <i>Urophora stylata</i> ) was released as a biocontrol agent in the Pacific Northwest, as was the thistle head weevil, <i>Rhinocyllus conicus</i> . <i>Urophora</i> is not established in California yet and has little impact elsewhere. <i>R. conicus</i> is widely established in the western United States and attacks many thistle species, including some native species. A weevil, <i>Trichosirocalus horridus</i> , was introduced to the U.S. in 1974 to control musk thistle and other thistles. Reports of its effectiveness vary.

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GROWTH REGULATORS	
2,4-D Several names	<b>Rate:</b> 1.6 to 2.1 qt product/acre (1.5 to 2 lb a.e./acre) <b>Timing:</b> Postemergence at rosette stage. Treat seedling rosettes in fall. <b>Remarks:</b> 2,4-D is broadleaf-selective and has no soil activity. It may require repeat applications. 2,4-D is generally not the most effective treatment, but is widely used because of low cost. Use a surfactant. When using the ester formulation do not apply when outside temperatures exceed 80°F.
Aminocyclopyrachlor + chlorsulfuron <i>Perspective</i>	<b>Rate:</b> 4.75 to 8 oz product ( <i>Perspective</i> )/acre <b>Timing:</b> Postemergence and preemergence. Postemergence applications are most effective when applied to plants from the seedling to the bolting stage. <b>Remarks:</b> <i>Perspective</i> provides broad-spectrum control of many broadleaf species. Although generally safe to grasses, it may suppress or injure certain annual and perennial grass species. Do not treat in the root zone of desirable trees and shrubs. Do not apply more than 11 oz product/acre per year. At this high rate, cool-season grasses will be damaged, including bluebunch wheatgrass. Not yet labeled for grazing lands. Add an adjuvant to the spray solution. This product is not approved for use in California and some counties of Colorado (San Luis Valley).
Aminopyralid <i>Milestone</i>	<b>Rate:</b> 3 to 5 oz product/acre (0.75 to 1.25 oz a.e./acre) <b>Timing:</b> Postemergence in spring to early summer when the target plants are in the rosette to bolting stage, or in fall to seedlings. <b>Remarks:</b> Aminopyralid is a broadleaf herbicide similar to picloram, but more selective and generally safe on grasses. Its soil residual activity will kill emerging seedlings. Aminopyralid has a longer soil residual and higher activity than clopyralid. Aminopyralid can also be used in a premix with 2,4-D ( <i>Forefront HL</i> ) at 1.2 to 1.5 pt product/acre for bull thistle control.
Clopyralid <i>Transline</i>	<b>Rate:</b> 0.67 to 1.33 pt product/acre (4 to 8 oz a.e./acre) <b>Timing:</b> Postemergence in spring up to the bud stage. Can also apply to fall regrowth. Results are best if applied to rapidly growing weeds. <b>Remarks:</b> Clopyralid is a broadleaf herbicide like picloram, but more selective. It is very safe on grasses.
Dicamba <i>Banvel, Clarity</i>	<b>Rate:</b> 1 to 2 pt product/acre (0.5 to 1 lb a.e./acre) <b>Timing:</b> Postemergence to rosettes in spring. Fall applications help control seedling rosettes. <b>Remarks:</b> Dicamba is a broadleaf-selective herbicide often combined with other active ingredients. It is also effective when tank-mixed with 2,4-D (0.75 lb a.e./acre of dicamba + 0.25 lb a.e./acre of 2,4-D). Avoid drift to sensitive crops. Do not apply when outside temperatures exceed 80°F. Dicamba is available mixed with diflufenzopyr in a formulation called <i>Overdrive</i> . This has been reported to be effective on bull thistle. Diflufenzopyr is an auxin transport inhibitor which causes

	dicamba to accumulate in shoot and root meristems, increasing its activity. <i>Overdrive</i> is applied postemergence at 4 to 8 oz product/acre on rapidly growing plants. Higher rates should be used on large annuals and biennials. Add a non-ionic surfactant to the treatment solution at 0.25% v/v or a methylated seed oil at 1% v/v solution.
Picloram <i>Tordon 22K</i>	<b>Rate:</b> 0.5 to 0.75 pt product/acre (2 to 3 oz a.e./acre) <b>Timing:</b> Postemergence during active growth before bud stage. <b>Remarks:</b> Picloram is one of the most effective herbicides for bull thistle control. Most broadleaf plants are susceptible, but relatively safe on established grasses. It is also effective when mixed with dicamba or 2,4-D. Picloram has long soil residual activity and has been reported by some to injure young or germinating grasses. Picloram can also be used in a premix with 2,4-D ( <i>Grazon P+D</i> ) to give control of bull thistle. Picloram products are federally restricted use pesticides. Picloram and its formulations are not registered for use in California.
Triclopyr <i>Garlon 3A, Garlon 4 Ultra</i>	<b>Rate:</b> 0.33 to 1.5 gallons <i>Garlon 3A</i> /acre or 0.25 to 1 gallons <i>Garlon 4 Ultra</i> /acre (1 to 4.5 lb a.e./acre) <b>Timing:</b> Postemergence to rapidly growing weeds, up to bud stage. <b>Remarks:</b> Triclopyr is broadleaf-selective and safe on most grasses. It is most effective on smaller plants. <i>Garlon 4 Ultra</i> is formulated as a low volatile ester. However, in warm temperatures, spraying onto hard surfaces such as rocks or pavement can increase the risk of volatilization and off-target damage. Recommended rates are based on those reported for perennial thistles. Triclopyr can also be used in a premix with 2,4-D ( <i>Crossbow</i> ) or clopyralid ( <i>Transline</i> ).
<b>BRANCHED-CHAIN AMINO ACID INHIBITORS</b>	
Chlorsulfuron <i>Telar</i>	<b>Rate:</b> 1 oz product/acre (0.75 oz a.i./acre) <b>Timing:</b> Postemergence to young rapidly growing weeds. <b>Remarks:</b> Chlorsulfuron provides residual control 1 year after treatment. It has mixed selectivity, but is generally safe on grasses. Always use a surfactant. 2,4-D at 1 to 2 pt product/acre can be tank-mixed with chlorsulfuron for quicker burndown.
Imazapyr <i>Arsenal, Habitat, Stalker, Chopper, Polaris</i>	<b>Rate:</b> Broadcast treatment: 4 to 6 pt product/acre (1 to 1.5 lb a.e./acre). Spot treatment: 1% v/v solution <b>Timing:</b> Postemergence at flowering. <b>Remarks:</b> Imazapyr is best used as a spot treatment. It is a nonselective herbicide. It also has long soil residual activity and can leave more bare ground than other treatments, even a year after application. Recommended rates are based on those reported for perennial thistles.
Metsulfuron <i>Escort</i>	<b>Rate:</b> 1.5 to 2 oz product/acre (0.9 to 1.2 oz a.i./acre) <b>Timing:</b> Postemergence to young, rapidly growing weeds in spring before flowering, or in fall to new rosettes. <b>Remarks:</b> Metsulfuron has mixed selectivity, but is generally safe on grasses. Use a surfactant. It can be tank-mixed with 2,4-D or aminopyralid. <i>Opensight</i> is a premix of aminopyralid and metsulfuron; use at 1 to 2.5 oz product/acre. Metsulfuron has some soil residual activity. Recommended rates are based on those reported for perennial thistles. Metsulfuron and its formulations are not registered for use in California.

**RECOMMENDED CITATION:** DiTomaso, J.M., G.B. Kyser et al. 2013. *Weed Control in Natural Areas in the Western United States*. Weed Research and Information Center, University of California. 544 pp.

This WEED REPORT does not constitute a formal recommendation. When using herbicides always read the label, and when in doubt consult your farm advisor or county agent.

This WEED REPORT is an excerpt from the book *Weed Control in Natural Areas in the Western United States* and is available wholesale through the UC Weed Research & Information Center ([wric.ucdavis.edu](http://wric.ucdavis.edu)) or retail through the Western Society of Weed Science ([wsweedscience.org](http://wsweedscience.org)) or the California Invasive Species Council ([cal-ipc.org](http://cal-ipc.org)).

*Phalaris aquatica* L.

## Hardinggrass

**Family:** Poaceae

**Range:** Arizona, California, Montana, Oregon, Texas, and some southeastern states. It is generally more invasive in coastal regions.

**Habitat:** Riparian areas, ditch banks, fields. Tolerates frost and drought.

**Origin:** Native to Mediterranean Europe. Hardinggrass was introduced to Australia and the United States to extend the forage season on pastures and rangeland, but has escaped cultivation in many locations.

**Impacts:** Once established, robust clumps are competitive for water and space, displacing native species. Under drought conditions, hardinggrass may develop toxic levels of alkaloids.

**California Invasive Plant Council (Cal-IPC) Inventory:** Moderate Invasiveness



Hardinggrass is a coarse, tufted perennial grass growing to 5 ft tall, with dense, spike-like panicles. It, like other *Phalaris* species, has pinkish juice when stems are broken at the base. The leaves have delicate, membranous ligules and no auricles. The plant develops fibrous roots, usually deep. Tufts expand around the perimeter by short rhizomes but do not develop clonal patches of new plants from the rhizomes. Under suitable conditions, rhizome fragments can develop into a new plant.

Hardinggrass usually flowers from late spring to the end of summer, producing dense, cylindrical spikes like other canarygrass species. The spikes are 0.5 to 1 inch in diameter and up to 4.5 inches long. Spikes typically remain intact for a period after senescence, but most florets are shed at maturity. Most reproduction is by seeds, which typically fall near the parent plant. The seed soil life is short, generally less than 2 years.

### NON-CHEMICAL CONTROL

<p><b>Mechanical</b> (pulling, cutting, disking)</p>	<p>Hand-pulling is practical only for small stands and requires a large time commitment. It can be effective if done over the entire population 2 to 3 times per year for 5 years.</p> <p>Close mowing late in the season, when plants are still green, can reduce the plants' vigor. Mowing can be used to remove excess biomass, thus enhancing the effectiveness of follow-up herbicide applications. Plants should be allowed to regrow before treating.</p> <p>Cultivation of hardinggrass is usually not effective, because the plant can regenerate both from seed and from pieces of rhizome. Cultivation may be used to control seedlings, and repeated cultivations may eventually exhaust established stands.</p>
<p><b>Cultural</b></p>	<p>Grazing by livestock or geese can be used, similar to mowing, to remove biomass and stimulate new growth that can be treated with an herbicide. Grazing alone will not eradicate hardinggrass, but intensive grazing may help to suppress it.</p> <p>Burning in early spring, when there are large numbers of new shoots, can suppress this species. Burning alone is not an effective control but may facilitate later herbicide application. Plants can be burned first, then the regrowth treated with herbicide. In denser stands, plants can be treated with herbicide first so that their dead foliage provides fuel for a following burn.</p>
<p><b>Biological</b></p>	<p>No effective biocontrol agents are known for hardinggrass.</p>

### CHEMICAL CONTROL

The following specific use information is based on published papers and reports by researchers and land managers. Other trade names may be available, and other compounds also are labeled for this weed. Directions

for use may vary between brands; see label before use. Herbicides are listed by mode of action and then alphabetically. The order of herbicide listing is not reflective of the order of efficacy or preference.

LIPID SYNTHESIS INHIBITORS	
Clethodim <i>Select, Envoy</i>	<p><b>Rate:</b> 16 oz product (<i>Select</i>)/acre (4 oz a.i./acre) for seedlings; 0.5% of product v/v in spot treatment.</p> <p><b>Timing:</b> Postemergence; best before 6 inches tall. Less effective if applied after a mowing.</p> <p><b>Remarks:</b> Clethodim is grass-selective and is safe on broadleaf species. To select in favor of other perennial grasses, apply before they emerge. It has no soil activity. Use a crop oil surfactant. The first treatment may provide only suppression of established plants; retreat as needed. Registered for fallow and non-crop areas, not generally for rangeland/natural areas, but has specific-use supplemental labels. Rates are based on high-end rates reported for annual canarygrass. Note <i>Envoy</i> is 1 lb a.i./gallon, <i>Select</i> is 2 lb a.i./gallon.</p>
Fluazifop <i>Fusilade</i>	<p><b>Rate:</b> 1 to 1.5 pt product/acre (4 to 6 oz a.i./acre); 0.5% product v/v in spot treatment.</p> <p><b>Timing:</b> Postemergence to rapidly growing plants. Best before boot stage.</p> <p><b>Remarks:</b> Fluazifop is grass-selective and is safe on broadleaf species. It has no soil activity. To select in favor of other perennial grasses, apply before they emerge. Use a crop oil surfactant. The first treatment may provide only suppression of established plants; retreat as needed. Registered for fallow and non-crop areas, not for rangeland/natural areas. Rates are based on those reported for reed canarygrass and other perennial grasses.</p>
AROMATIC AMINO ACID INHIBITORS	
Glyphosate <i>Roundup, Rodeo, Aquamaster, and others</i>	<p><b>Rate:</b> 2 to 3 qt product (<i>Roundup ProMax</i>)/acre (2.25 to 3.375 lb a.e./acre); 2% to 5% product v/v in water for spot treatment; 33% to 50% product v/v in water for wiper applications.</p> <p><b>Timing:</b> For selective use, apply in early spring when hardinggrass is just sprouting and before other species germinate. More generally, application to rapidly growing flowering plants provides the best control.</p> <p><b>Remarks:</b> Glyphosate is a nonselective herbicide. It has no soil activity. In addition to foliar sprays it can be applied using a rope wiper. Its effectiveness is increased by addition of ammonium sulfate. Also effective following removal of dead residue by burning, mowing, or grazing. Some formulations, e.g. <i>Rodeo</i> and <i>Aquamaster</i>, are registered for use in or near water. Rates are based on those reported for reed canarygrass.</p>
Glyphosate + imazapyr <i>Rodeo + Habitat</i>	<p><b>Rate:</b> 1 qt <i>Rodeo</i> + 1 pt <i>Habitat</i>/acre</p> <p><b>Timing:</b> Apply in spring to young growth.</p> <p><b>Remarks:</b> Other formulations of each chemical are available; these brands are both registered for aquatic use. Rates are based on those reported for reed canarygrass.</p>
BRANCHED-CHAIN AMINO ACID INHIBITORS	
Imazapic <i>Plateau</i>	<p><b>Rate:</b> 8 to 12 oz product/acre (2 to 3 oz a.e./acre)</p> <p><b>Timing:</b> Preemergence in fall.</p> <p><b>Remarks:</b> Imazapic has mixed selectivity and tends to favor members of the Asteraceae, as well as some grasses. It is safe for most native grasses, but higher rates may suppress seed of some cool-season grasses. Use methylated seed oil surfactant. Imazapic has some residual activity. Rates are based on those reported for reed canarygrass. Not registered for use in California.</p>
Imazapyr <i>Arsenal, Habitat, Chopper, Stalker, Polaris</i>	<p><b>Rate:</b> 1.5 to 4 pt product/acre (6 to 16 oz a.e./acre) broadcast, or spot treatment with 1% product v/v in water.</p> <p><b>Timing:</b> Apply to rapidly growing plants. Use higher rates for larger plants or late-season applications.</p> <p><b>Remarks:</b> Imazapyr has a fairly long soil residual and is nonselective, so may kill desirable competitors. <i>Habitat</i> is registered for aquatic use. Rates are based on those reported for reed canarygrass.</p>
Sulfometuron <i>Oust and others</i>	<p><b>Rate:</b> 1.33 to 2 oz product/acre (1 to 1.5 oz a.i./acre) for areas receiving 20 inches or less annual precipitation; 3 to 5 oz product/acre (2.25 to 3.75 oz a.i./acre) for areas receiving more than 20 inches precipitation.</p> <p><b>Timing:</b> Preemergence or early postemergence, or apply to soil before the beginning of seasonal growth.</p> <p><b>Remarks:</b> Sulfometuron has mixed selectivity. Do not apply to frozen ground. Add non-ionic surfactant for postemergence applications. It has fairly long soil residual activity.</p>

**PHOTOSYNTHETIC INHIBITORS**

Hexazinone	<b>Rate:</b> 1.5 to 3 gal product/acre (3 to 6 lb a.i./acre)
<i>Velpar L</i>	<b>Timing:</b> Spot apply before hardinggrass begins seasonal growth.
	<b>Remarks:</b> Results of efficacy on hardinggrass are from a trial conducted in New Zealand. High rates of hexazinone can create bare ground, so only use high rates in spot treatments.

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