

FINAL TECHNICAL REPORT • OCTOBER 2025

# Biological Resources Evaluation for the Elk River Estuary (Planning Area 1) Restoration Project



P R E P A R E D F O R

California Trout  
1380 9<sup>th</sup> Street  
Arcata, CA 95521

P R E P A R E D B Y

Stillwater Sciences  
850 G Street, Suite K  
Arcata, CA 95521

Suggested citation:

Stillwater Sciences. 2025. Biological Resources Evaluation for the Elk River Estuary (Planning Area 1) Restoration Project. Final Technical Report. Prepared by Stillwater Sciences, Arcata, California for California Trout, Arcata, California.

Cover photos (clockwise from top left): View of a special-status plant *Carex lyngbyei* (Lyngbye's sedge) population along Elk River channel banks; muted tidal drainage in Elk River Wildlife Area South; shore bird evidence within muted tidal marsh plain along Swain Slough; and eelgrass beds, a sensitive natural community, within Swain Slough's main channel.

## Table of Contents

<b>1</b>	<b>INTRODUCTION.....</b>	<b>1</b>
1.1	Report Background.....	1
1.2	Project Location.....	1
1.3	Project Overview.....	3
1.4	Report Purpose.....	5
1.5	Project Avoidance and Minimization Measures.....	5
<b>2</b>	<b>METHODS.....</b>	<b>9</b>
2.1	Vegetation and Special-status Plants.....	9
2.1.1	Database queries.....	9
2.1.2	Pre-field review.....	9
2.1.3	Field surveys.....	10
2.2	Special-status Fish and Wildlife.....	12
2.2.1	Database queries.....	12
2.2.2	Pre-field review.....	13
2.2.3	Additional assessments.....	13
<b>3</b>	<b>RESULTS.....</b>	<b>13</b>
3.1	Vegetation and Land Cover Types.....	13
3.1.1	<i>Zostera</i> Pacific Aquatic Herbaceous Alliance.....	17
3.2	Special-status Plants.....	19
3.2.1	<i>Angelica lucida</i> .....	22
3.2.2	<i>Carex lyngbyei</i> .....	22
3.2.3	<i>Castilleja ambigua</i> var. <i>humboldtiensis</i> .....	23
3.2.4	<i>Chrysosplenium glechomifolium</i> .....	24
3.2.5	<i>Spergularia canadensis</i> var. <i>occidentalis</i> .....	25
3.3	Target Invasive Plants.....	25
3.4	Special-status Fish and Wildlife.....	28
<b>4</b>	<b>REFERENCES.....</b>	<b>37</b>

**Tables**

Table 3-1. Vegetation and land cover types within Planning Area 1. .... 14  
Table 3-2. Special-status plant species documented<sup>1</sup> within Planning Area 1. .... 20  
Table 3-3. Invasive plants documented within Planning Area 1. .... 26  
Table 3-4. Special-status fish and wildlife with the potential to occur within Planning  
Area 1. .... 29

**Figures**

Figure 1-1. Vicinity map of Planning Area 1 and overview of the Elk River Stewardship  
Program area. .... 2  
Figure 1-2. Overview of Planning Area 1 design enhancement actions. .... 4  
Figure 3-1. Vegetation cover types classified within Planning Area 1. .... 18  
Figure 3-2. Special-status plant occurrences within Planning Area 1. .... 21  
Figure 3-3. Invasive plant occurrences documented within Planning Area 1. .... 27

**Appendices**

Appendix A. Database Query Results for Special-status Species and Sensitive Natural  
Communities Previously Documented in the Project Vicinity  
Appendix B. Comprehensive Plant Species List  
Appendix C. Fish Utilization and Habitat Characterization  
Appendix D. Bat Habitat Assessment

# 1 INTRODUCTION

## 1.1 Report Background

The Elk River Planning Area 1 (PA 1) Restoration Project (Project) is focused on one of four planning areas described in the Elk River Recovery Plan (CalTrout et al. 2022) as part of the Elk River Stewardship Program. In 2023, the Elk River Estuary Recovery design team (California Trout [CalTrout], Northern Hydrology and Engineering [NHE], Stillwater Sciences, and GHD) produced the *Elk River Planning Area 1 10% Design Report* that presented an initial biological resource and baseline condition assessment within Elk River’s PA 1 to inform on early design development (i.e., reach-specific goals and objectives, identify opportunities and constraints, and develop habitat enhancement design concepts). Initial studies summarized in the 10% design report included: geomorphology, hydrology and water quality, fish utilization and habitat characterization, vegetation, wetlands, and land use (CalTrout et al. 2023). The PA 1 restoration design has since progressed towards 65% design and restoration actions have been further refined and developed as presented in the *Elk River Estuary (Planning Area 1) Restoration Project: Project Description* (CalTrout et al. 2025).

## 1.2 Project Location

Elk River’s PA 1 encompasses the lower-most reaches of the Elk River mainstem at the downstream end of the Elk River valley (Figure 1-1). PA 1 includes 5.3 miles of channel length including Elk River and Swain Slough and spans 857 acres (ac) of former tidal and brackish wetlands, riparian forest, and prairie grasslands; it was historically interspersed with mixed conifer forest stands. The western edge of PA 1 is bordered by US Highway 101 (Hwy 101), although this is an artificial boundary; there are additional tidal wetlands on the west side of Hwy 101 owned by the City of Eureka that were hydraulically interconnected with PA 1 but are currently separated by Hwy 101. City of Eureka tidal wetlands north of PA 1 have undergone restoration and the construction of the Elk River Hikshari’ Trail and are not part of the Stewardship Program. PA 1 is generally bounded to the south-west by the Elk River itself and to the north-east by Swain Slough and Elk River Road. The Elk River – Swain Slough confluence is at the downstream end of PA 1, just upstream of Hwy 101 at Station 7800; PA 1 extends up the sinuous Elk River to Showers Road. The total length of the channel, including Elk River and Swain Slough is 20,500 feet [ft] or 3.8 miles. Martin Slough branches off Swain Slough but is not considered part of the Stewardship Program.

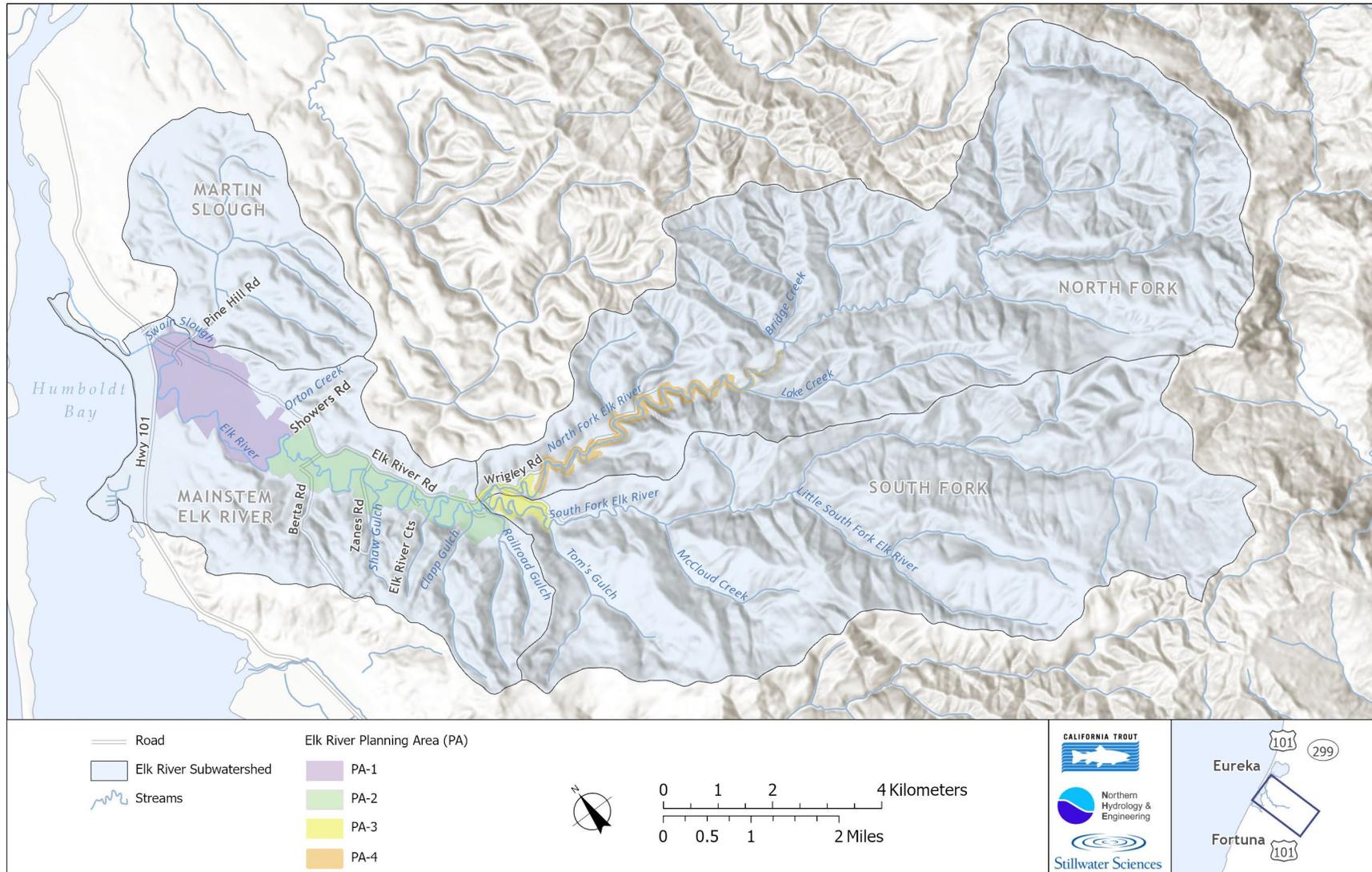


Figure 1-1. Vicinity map of Planning Area 1 and overview of the Elk River Stewardship Program area.

### 1.3 Project Overview

The Project Team has developed engineering designs to restore natural tidal and fluvial drainage patterns within the 857-acre planning area. PA 1 has eleven distinct subareas as presented in Figure 1-2. These subareas general align with former designations labeled Areas of Interest A–H that have been used to describe hydraulic conditions in earlier Project reports. The Project restoration scope includes the following elements:

- Remove and/or upgrade drainage infrastructure;
- Reduce or remove levees;
- Breach an abandoned railroad grade;
- Restore tidal sloughs and tidal creek channels and their connectivity to mainstem channels;
- Create backwater features for seasonal waterfowl and winter salmonid rearing habitat (primarily for federally listed coho salmon);
- Manage invasive vegetation;
- Expand native plant communities;
- Recontour portions of the floodplain to guide winter flood-flows across the floodplain and back into the slough channel network toward suitable aquatic habitat; and
- Public access facilities

The PA 1 site will provide a large area of highly productive slough-like habitat; fish will be able to move into tidal channels during higher tides, finding refugia and rearing in slower moving water and feeding on abundant food at the edges of tidal channels or entrained in water leaving the marsh plain. Reconnection of Orton Creek to Swain Slough in a subsequent construction phase that will enhance migratory pathways to this Project’s restored habitats and provide stream-estuary ecotone habitat for juvenile salmonid winter rearing. A restored marsh will also provide habitat and food resources for other focal species, including longfin smelt, tidewater goby, and an abundance of marine species. Finally, this Project would connect other recently restored Elk Estuary habitats, including restoration completed in Martin Slough (funded in part by NOAA Restoration Center and California Coastal Conservancy) and the City of Eureka in lower Elk River (funded by United States Fish and Wildlife Service, National Fish and Wildlife Foundation, and the State Coastal Conservancy). The expected benefits to Elk River ecosystems would be substantial, including expansion and enhancement of fish rearing habitat in Swain Slough and increased longevity of salt marsh habitats through increased resilience to sea level rise.

Restoration actions will establish a full tidal prism in large portions PA 1 that will promote the recovery of estuarine sensitive natural communities. Constructed tidal channel networks throughout PA 1 will expand suitable habitat for the sensitive *Zostera marina* Association (eelgrass beds) observed in Swain Slough. Expansion of Orton Creek and revegetation within the Elk River floodplain will create perennial waters and sensitive aquatic and riparian habitats, as well as enhance existing brackish and freshwater marsh and coastal grassland communities that collectively form a functional stream to estuary ecotone beneficial to fish and wildlife. Riparian and coastal scrub planting will further enhance and expand existing forest and shrubland plant communities throughout PA 1 that will improve riparian function and generate more diverse wildlife habitat along the wetland to upland ecotone. Measures that will be implemented to avoid and minimize impact on sensitive biological resources within PA 1 during Project activities are detailed in Section 1.5.

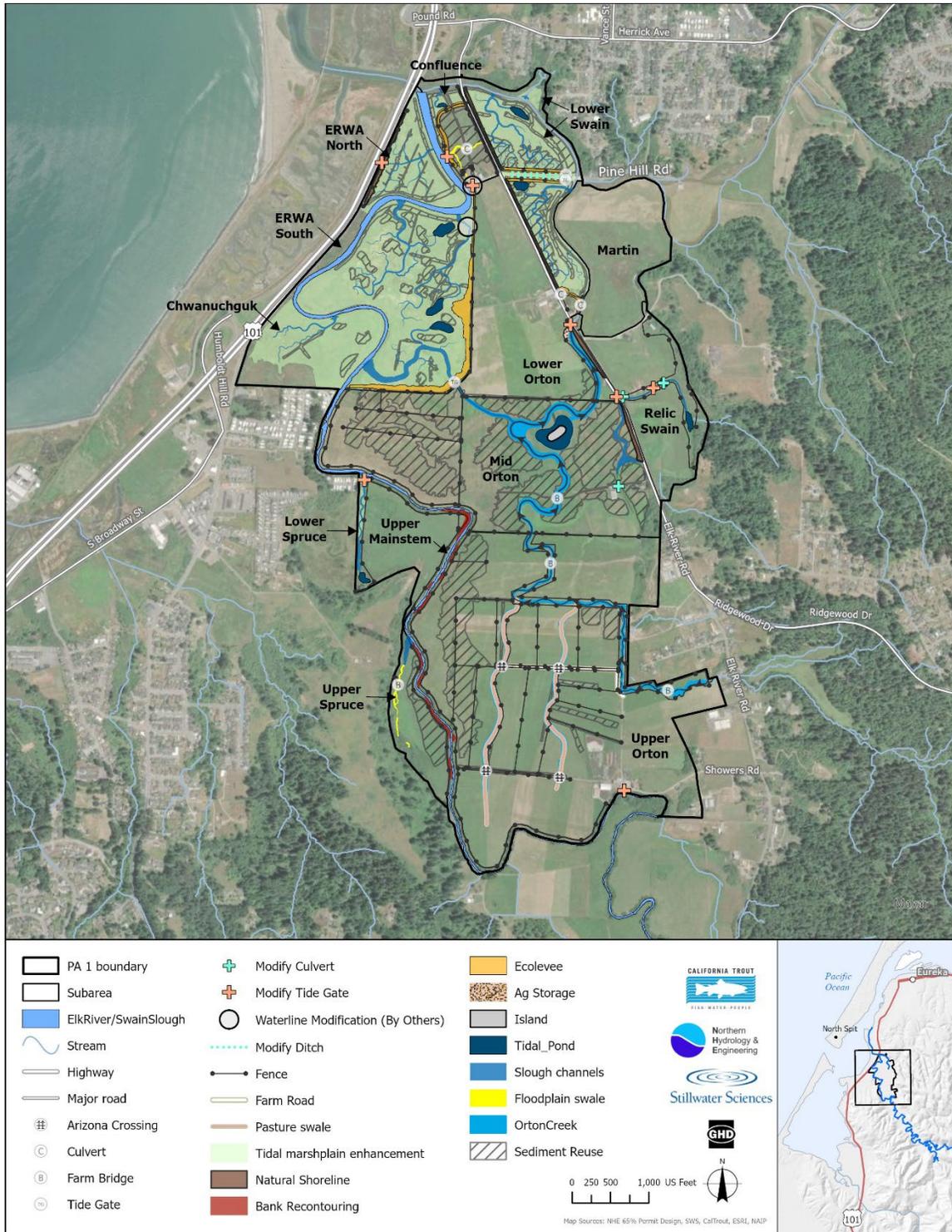


Figure 1-2. Overview of Planning Area 1 design enhancement actions.

## 1.4 Report Purpose

The purpose of this report is to present the latest results of the biological resource desktop assessments and field surveys which were conducted to characterize biological resources that occur or may occur within the Elk River PA 1; these results will inform design opportunities and constraints and provide baseline information for the regulatory review process. It presents the following: (1) vegetation characterization and floristic survey results documenting the presence of any special-status plant species<sup>1</sup> or sensitive natural communities<sup>2</sup> within PA 1, (2) potential for habitat recorded in PA 1 to support special-status wildlife, and/or fish species<sup>3</sup>, and (3) avoidance and minimization measures to reduce potential adverse impacts on biological resources in PA 1 by restoration activities. A separate report, *Preliminary Aquatic Resources Delineation Report for the Elk River Estuary (Planning Area 1) Restoration Project* (Stillwater Sciences 2025a), describes the preliminary jurisdictional Waters of the U.S and State.

## 1.5 Project Avoidance and Minimization Measures

Avoidance and minimization measures will be employed during Project construction activities (i.e., site preparation, invasive plant management, grading and earthwork, revegetation) to protect biological resources including special-status plant species, sensitive natural communities, and special-status fish and wildlife as follows:

- **BOT-1: Special-status Plants.** All special-status plant species documented with the graded construction footprint will be salvaged and/or its seed harvested. The planting contractor will reseed and/or translocate salvaged plant material to designated areas determined to provide suitable site conditions for the species as directed by a qualified botanist. All other occurrences will be flagged by a qualified botanist and avoided to the extent possible.
- **BOT-2: Sensitive Natural Communities/Native Vegetation.** Ground disturbance and vegetation clearing and/or trimming will be confined to the minimum amount necessary to facilitate Project implementation. If possible, viable native plants within the Project design footprint will be salvaged for reuse and relocated at suitable elevation grades during the revegetation stage of construction.
- **BOT-3: Invasive Plant Control.**
  - Measures to prevent the spread of invasive weeds and pathogens will be taken, including, where appropriate, inspecting equipment for soil, seeds, and vegetative matter; cleaning equipment; utilizing weed-free materials and native seed mixes for revegetation; and disposing properly of soil and vegetation.

---

<sup>1</sup> Special-status plant species are defined as those species listed, proposed, or under review as endangered or threatened under the federal Endangered Species Act (ESA) or the California Endangered Species Act (CESA); listed as rare under the California Native Plant Protection Act; and/or included on California Department of Fish and Wildlife's (CDFW) most recent *Special Vascular Plants, Bryophytes, and Lichens List* with a California Rare Plant Rank (CRPR) of 1, 2, 3, or 4 (CDFW 2025c).

<sup>2</sup> Sensitive natural communities are defined as those natural community types with a state ranking of S1 (critically imperiled), S2 (imperiled), or S3 (vulnerable) as listed in the most recent *California Sensitive Natural Community List* (CDFW 2025d).

<sup>3</sup> Special-status wildlife and fish species are defined as species: listed, proposed, or under review as endangered or threatened under ESA or CESA; designated as a species of special concern by CDFW; designated as Fully Protected under the California Fish and Game Code (Sections 3511, 4700, 5050, and 5515); and/or protected under the federal Bald and Golden Eagle Protection Act.

- Invasive plant material from Project construction activities will be disposed of as described in the *Elk River Estuary (Planning Area 1) Restoration Project: Invasive Plant Management Plan (PA 1 Invasive Plant Management Plan)* (Stillwater Sciences 2025b).
- Any imported fill material, soil amendments, gravel, or other material required for construction or restoration activities that will be placed within the upper 12 inches of the ground surface will be certified free of weed seeds and plant material.
- To minimize the spread of plant pathogens that can reduce plant establishment success, nursery stock procured for revegetation efforts will be sourced from plant nurseries that follow best management practices to produce clean nursery stock free of Phytophthora and other soilborne disease. Standard BMPs are available online at: <http://phytosphere.com/BMPsnursery/Index.htm>
- **AQU-1: Aquatic eelgrass bed.**
  - Disturbance in and adjacent to eelgrass beds may be required to connect new tidal channels to the mainstem Elk River or Swain Slough and removal of channel adjacent berms. Disturbance will be limited to the minimum necessary.
  - If used during construction, a barge positioned in open water will avoid grounding or anchoring in eelgrass habitat if feasible.
  - Construction activities will avoid shading established eelgrass beds for long periods of time (i.e., greater than 12 hours daily).
  - If necessary, a floating surface boom will be positioned to capture any floating surface debris in open waters.
- **AQU-2: Work window for fish.** To protect the most vulnerable life stages of special-status fish species with the potential to occur within PA 1, all in-channel work will be restricted to the permitted in-water work period between **June 15 and October 15**. Work extensions may be requested from regulatory agencies through October 31, pending weather. This seasonal work window correlates to the period of the year when special-status fish species are least likely to occur within PA 1.
- **AQU-3: Fish.** Measures to protect all special-status fish during construction activities will comply with the NMFS Biological Opinion and USFWS Statewide Restoration Programmatic Biological Opinion.
- **WIL-1: Wildlife**
  - Injured wildlife will be transported to the nearest wildlife rehabilitation facility (Humboldt Wildlife Care Center near Arcata, California), at the discretion of the monitoring biologist.
  - All trash and waste items (including microtrash) generated by Project activities will be properly contained and removed from the work area at the end of each workday to prevent attracting wildlife.
  - Trenches, holes, or open ends of pipes will be covered, equipped with escape ramps, or elevated to a minimum of three feet above the ground if left overnight. Open trenches or holes will be inspected for trapped wildlife every morning prior to work. If any wildlife species are documented, and have the potential to be affected, the qualified wildlife biologist will be notified immediately.
- **WIL-2: Amphibians/Reptiles**
  - **Northwestern pond turtle:** Measures will comply with the USFWS Programmatic Biological Opinion.

- **Work window and pre-construction surveys for northern red-legged frog.** Modification of waterways and wetlands with standing water that have the potential to support northern red-legged frog breeding will be limited to the period of the year between **June 15 and October 31** to avoid disturbance to breeding northern red-legged frogs, **or a biologist will surveys suitable habitat** prior to disturbance to confirm no individuals and egg masses are present during the initiation of Project construction or, if present, relocate individuals and egg masses to nearby suitable habitat and/or implement a no-disturbance buffer until the threat on the species has lifted. For construction activities within suitable habitat **outside of the breeding period (November 1 through June 14) will also be surveyed** in a similar manner. If Project construction activities at a given location cease for more than seven consecutive days, and there is potential for special-status species to reoccupy habitat at that site, the biologist will resurvey the area prior to resuming construction.
- **WIL-3: Birds**
  - **Pre-construction bird nesting survey.** For areas where ground disturbance, vegetation removal, and/or structure modification/removal occurs during the **bird breeding season (March 15–August 15)** a pre-construction bird nest survey will be conducted. Surveys will occur within 7 days of the activity, and if construction activities at a given location cease for more than **7 days** during the breeding season, and there is potential for special-status species to reoccupy habitat at that site, the biologist will **resurvey** the area prior to resuming construction activities. If active nests (nests containing eggs or young) protected by the Migratory Bird Treaty Act are identified, a no-disturbance buffer zone will be established around the nest using flagging, fencing, and/or signage as appropriate. The buffer will be determined by a qualified biologist in coordination with CDFW based on site-specific topography, ambient conditions, and sensitivity of the bird, typically ranging from 50 to 500 feet, depending on the species. No construction activities will occur within the buffer zone until a qualified biologist has determined that the young have fledged or that construction activities within the buffer zone are not disturbing the nesting birds.
- **WIL-4: Bats**
  - **Tree removal.**
    - Prior to tree removal, a bat biologist will conduct a **bat habitat assessment** to identify trees with high-quality crevice-roosting habitat (e.g., tree cavities, basal hollows, loose or peeling bark, larger snags) to be retained, when feasible.
    - **If a high-quality roost tree will be removed during the maternity season (May 1 through August 31) and/or torpor season (November 1 through March 31),** a biologist will assess the potential for a day roost through visual inspection or emergence survey. If a colony is documented, then the tree will not be felled until the colony has left. If a survey or inspection is infeasible due to existing site conditions, a biologist will recommend site-specific means to modify and disturb the habitat to allow bats, if present, to wake and leave the roost prior to tree felling. These disturbances may include (1) modifying habitat conditions such as removing smaller non-habitat trees at least a day prior to removing habitat trees; (2) creating a vibrational disturbance over the course of a few minutes with a chainsaw, knocking the tree with a sledgehammer, using equipment to shake the tree, or removing the tree in pieces (sections or limbs) over the course of a few days; (3) changing the structure of the potential roost by lifting bark to modify temperature, wind, light, and precipitation; and/or (4) using ultrasound deterrents.

- **If a *high-quality roost tree* is removed outside of the sensitive maternity and/or torpor season**, then a contractor will create a vibrational disturbance over the course of a few minutes prior to removing the tree (as described above) to allow individuals to leave, if present.
- **Structure removal.** If a structure is to be removed during the maternity season (May 1 through August 31) and/or torpor season (November 1 through March 31), a qualified bat biologist will examine the structure through appropriate day inspection and/or evening emergence survey to confirm no day-roosting bats are present.
- **BIO-1: Environmental Awareness Training.** Prior to the initiation of Project construction activities, a qualified biologist will provide all contractors and equipment operators a worker environmental awareness training to educate them on the environmental resources of the Project. Training will include information about environmental permits for the Project and the consequences of noncompliance. Personnel will be informed regarding the identification, life history, habitat requirements, and avoidance and minimization measures for all special-status species and sensitive natural communities with the potential to occur within or immediately adjacent to the construction footprint. Training will also include information on state and federal laws protecting biological resources. Personnel will be informed of the procedures to follow should special-status species be encountered or disturbed. This training will be conducted prior to construction and provided to any new staff/contractors added during implementation of the Project.
- **BIO-2: Site Practices**
  - Heavy equipment and vehicles will be restricted to existing and designated access roads and staging areas to the extent possible.
  - Construction materials will be stored in designated staging areas.
  - Erosion control measures will be implemented where necessary to reduce sedimentation in wetland areas and waterways. Modifications, repairs, and improvements to erosion control measures will be made as needed to protect water quality. Only non-monofilament, wildlife-safe fabrics will be used.
  - All machinery or heavy equipment that will be entering the wetland areas and waterways will be cleaned of materials deleterious to aquatic life including oil, lubricants, coolants, hydraulic fluid, soil, and other debris. Cleaning of equipment will take place outside of the wetland areas and waterways.
  - Refueling of machinery or heavy equipment, or adding or draining oil, lubricants, coolants, or hydraulic fluids will not take place within waterways, with the exception of portable generators. Generators will be equipped with appropriately sized secondary spill containment devices at all times. Heavy equipment used or stored within wetland areas and waterways will use drip pans or other devices (i.e., absorbent blankets, sheet barriers or other materials) as needed to prevent soil and water contamination. Absorbent pads and spill cleanup kits will be onsite during all refueling activities.
- **BIO-3: A Spill Communication Plan** will be developed by the implementation contractor(s) and implemented if construction activities cause any material hazardous or toxic to aquatic life to enter wetland areas and waterways. Agencies will be consulted regarding clean-up procedures.

## 2 METHODS

### 2.1 Vegetation and Special-status Plants

#### 2.1.1 Database queries

A list of special-status plants and sensitive natural communities with the potential to occur within PA 1 was developed by querying the following resources:

- The U.S. Fish and Wildlife Service (USFWS) online *Information for Planning and Consultation* (IPaC) (includes the official species list) (USFWS 2025);
- The California Native Plant Society's (CNPS) online *Inventory of Rare and Endangered Vascular Plants of California* (CNPS 2025b); and
- California Department of Fish and Wildlife's (CDFW) California Natural Diversity Database (CNDDDB) including Biogeographic Information and Observation System (BIOS) (CDFW 2025a, 2025b).<sup>4</sup>

The CNPS and CNDDDB database queries were each based on a search of the USGS 7.5-minute quadrangles in which PA 1 is located (Fields Landing and Eureka), and the surrounding California quadrangles (Tyee City, Arcata North, Arcata South, McWhinney Creek, Hydesville, Fortuna, Ferndale, and Cannibal Island); hereinafter referred to as the Project vicinity. The USFWS query was based on the boundaries of PA 1. Appendix Table A-1 summarizes query results.

#### 2.1.2 Pre-field review

Prior to the field, results of the special-status plant database query (Appendix Table A-1) and sensitive natural community database query (Appendix Table A-2) were reviewed. The following categories were assigned to the special-status plant database query to compile a targeted list of species with potential to occur in PA 1:

- **None:** PA 1 is outside the species' current distributional or elevation range and/or the species' required habitat is lacking from PA 1 (e.g., cismontane woodland).
- **Low:** the species' known distribution and elevation range overlaps with PA 1; however, the species' required habitat is of very low quality or quantity in PA 1.
- **Moderate:** the species' known distribution, elevation range, and required habitat overlap PA 1 and documented occurrences are within five<sup>4</sup> miles of PA 1.
- **High:** the species' known distribution, elevation range, and required habitat overlap PA 1 and documented occurrences are in, or within one mile of, PA 1.

The results of this assessment are presented in Appendix Table A-1. Subsequently the following steps were taken:

---

<sup>4</sup> BIOS provides a visualization of data in CNDDDB plus unprocessed data that has not been incorporated into CNDDDB. Sensitive natural communities in CNDDDB are legacy data only based on the Holland (1986) classification scheme which has been superseded by the *Manual of California* (MCV; CNPS 2025a) classification scheme. Vegetation mapping data based on MCV is sometimes included in BIOS for visualization with source information on how to obtain the data.

- Key identifying characteristics<sup>5</sup> and life history stages (e.g., bloom time) of the targeted special-status plant species and sensitive natural communities PA 1 were reviewed.
- Survey periods that would coincide with the phenological stage (e.g., flowering or fruiting) during which the special-status plant species are most easily identifiable in the field determined; and
- Field maps of known locations of targeted special-status plants and sensitive natural communities within PA 1 were created.

### 2.1.3 Field surveys

Vegetation characterization and protocol-level surveys for special-status plant species and sensitive natural communities were conducted on May 12–14, 2021, and July 12–14, 2021. Additional surveys were conducted in 2021 (August 11, October 28, November 19), 2024 (March 7, April 24, May 2, 14, 16, and 20), and 2025 (January 24, February 27, May 12 and 26) to update information on special-status plant occurrences and vegetation communities.

Surveys were conducted by qualified botanists with: (1) experience conducting floristic surveys; (2) knowledge of plant taxonomy and plant community ecology and classification; (3) familiarity with the plant species of the area; (4) familiarity with appropriate state and federal statutes related to plants and plant collecting; and (5) experience with analyzing impacts of a project on native plant species and natural communities. The survey followed the methods of the *Guidelines for Conducting and Reporting Botanical Inventories for Federally Listed, Proposed and Candidate Plants* (USFWS 1996) and *Protocols for Surveying and Evaluating Impacts to Special-Status Native Plant Populations and Sensitive Natural Communities* (CDFW 2018).

#### 2.1.3.1 Vegetation mapping

Vegetation community types are distinct plant assemblages with a characteristic appearance (size, shape, spacing) based on their interaction with the landscape (e.g., topography, soils, hydrology, geology, climate, slope, exposure, disturbance, substrate) (CNPS 2025a). These distinct patterns form the basis for habitat classification and description. For this survey effort, vegetation types were defined to the alliance<sup>6</sup>- or more fine-scale associate-level<sup>7</sup> as described in the online edition of *A Manual of California Vegetation* (CNPS 2025a). This standardized vegetation classification follows established protocols that conform with the State of California standard vegetation classification system. Classification was taken to the association level, as opposed to the alliance level, where necessary to verify the presence of sensitive natural communities. Semi-natural stands or alliances characterize a vegetation type that is dominated by invasive, non-native

---

<sup>5</sup> To familiarize surveyors with key characteristics and natural variation of those characteristics of each special-status plant species, information was obtained through a review of: (1) CNPS (2025b) and CDFW (2025a) data; (2) photographs on CalPhotos (University of California, Berkeley 2025); (3) key characteristics using the online Jepson eFlora (Jepson Flora Project 2025), and (4) documented occurrence information in CNDDB (CDFW 2025a), Consortium of California Herbaria (CCH 2025) Manual of California Vegetation (MCV) (CNPS 2025a), and CalFlora (2025).

<sup>6</sup> A classification unit of vegetation, containing one or more associations and defined by one or more diagnostic species, often of high cover, in the uppermost layer or the layer with the highest canopy cover. Alliances reflect physiognomy as well as regional to subregional climates, substrates, hydrology, and disturbance regimes (Jennings et al. 2006, FGDC 2008 as cited in CNPS 2025a)

<sup>7</sup> A vegetation classification unit defined by a diagnostic species, a characteristic range of species composition, physiognomy, and distinctive habitat conditions that also reflect local topo-edaphic climates, substrates, hydrology, and disturbance regimes (Jennings et al. 2006, CNPS 2025a)

vegetation (CNPS 2025a). Provisional alliances were created for distinct species assemblages that were frequently observed in similar landform position within PA 1; this data will be shared with the Vegetation Classification and Mapping Program (VegCAMP).

Available regional vegetation datasets (i.e., CALVEG, FRAP) were reviewed and compared against available aerial photography (i.e., high-resolution [1.5-in pixel] orthorectified aerial photography created for the City of Eureka collected on July 24, 2019 [Office of Coastal Management 2020] and UAS-flown imagery collected on October 13, 2021, by Stillwater Sciences). Aerial photography captured both low and high tide stages in PA 1. As such, the full extent of vegetation polygons was captured within the regularly flooded intertidal zone. Preliminary boundaries of vegetation communities were digitized using photo-interpretive techniques and verification points were collected during the 2021 floristic surveys using the ArcGIS Collector application on handheld tablets (Samsung Galaxy Tablet, Apple iPad). Data collected were used to support the interpretation of vegetation community signatures in aerial photos, verify dominant vegetation signatures, and refine vegetation type boundaries. The initial 2021 vegetation map was revised in 2025 using PA 1 refined topographic Existing Ground (EG) surface (CalTrout et al. 2023), updated 2024 and 2025 field verification surveys, and from review of the latest available imagery (NAIP 2024, ESRI World Imagery). Alliance/association boundaries were mapped to canopy extent; therefore, mapped vegetation alliance/association boundaries may include overstory canopy over open water or herbaceous communities.

### 2.1.3.2 Special-status plant surveys

Special-status plant surveys were comprehensive for vascular plants such that “every plant taxon that occurs in the Project area is identified to the taxonomic level necessary to determine rarity and listing status” (CDFW 2018) following the taxonomy of the *Jepson eFlora* (Jepson Flora Project 2025). If identification was not possible in the field, the plants were collected for identification in the laboratory (using the “1 in 20” rule, Wagner 1991) or, if potentially a special-status plant, according to the botanists’ current CDFW plant voucher collection permit guidelines (e.g., not more than 5 individuals or 2% of the population, whichever is less, for one voucher sheet).

The location and population boundaries of any identified special-status species were recorded in the field using a handheld GPS unit and a CNDDDB form was completed for each occurrence. Information collected for each special-status population included the following:

- numbers of individuals;
- phenology;
- habitat description (e.g., surrounding plant communities, dominant species, associated species, substrates/soils, aspects/slopes);
- relative condition of the population (i.e., a qualitative assessment of site quality and occurrence viability [excellent, good, fair, or poor]); and
- recognizable risk factors.

In addition, photographs were taken to document diagnostic floral characteristics, growth forms, and habitat characteristics of special-status species. The GPS data were post-processed and corrected, then incorporated into a GIS database.

### 2.1.3.3 Target Invasive Plant Inventory

Invasive plant species are known to have severe or substantial ecological impacts on physical processes, plant and animal communities, and vegetation structure. When present, they often displace native species, reducing native species recruitment and overall species richness. For the purposes of this report, target invasive plant species are defined as species rated by the California Invasive Plant Council (Cal-IPC) as high or moderate and listed as invasive in *Invasive Weeds of Humboldt County* (Humboldt County Weed Management Area 2010), and/or those species which are known to the region as having invasive tendencies and can be detrimental to the successful establishment of restored native plant communities.

All target invasive plant species will be targeted for control during restoration efforts. Stand-level occurrences characterized by invasive plants are anticipated to require a high intensity approach for control and management (e.g., mechanical excavation or scraping of topsoil). Documented individual or patch size target invasive plant occurrences will require targeted treatments prior to or concurrent with construction activities. Recommended management and control of invasive plants are described in the *PA 1 Invasive Plant Management Plan* (Stillwater Sciences 2025b).

Concurrent with the floristic and vegetation mapping surveys, any target invasive plant occurrence that was not depicted by a vegetation stand type, was mapped to inform vegetation management during design implementation.

## 2.2 Special-status Fish and Wildlife

### 2.2.1 Database queries

A list of special-status fish and wildlife with the potential to occur within PA 1 was developed by querying the following resources:

- U.S. Fish and Wildlife Service’s (USFWS’s) *Information for Planning and Conservation* (IPaC) portal (USFWS 2025);
- CDFW’s CNDDDB (CDFW 2025a); and
- National Marine Fisheries Service’s (NMFS) *California Species List Tools* database (NMFS 2022).

The USFWS query was based on the location of PA 1. The CDFW and NMFS database queries were each based on a search of the USGS 7.5-minute quadrangles in which PA 1 is located (Fields Landing and Eureka), and the surrounding California quadrangles (Tyee City, Arcata North, Arcata South, McWhinney Creek, Hydesville, Fortuna, Ferndale, and Cannibal Island).

The following resources were also utilized to inform evaluations of special-status wildlife species with potential to occur within PA 1:

- CDFW’s CNDDDB Spotted Owl Observation Database (CDFW 2025e),
- eBird (eBird 2025),
- North American Bat Acoustic Monitoring Portal (Conservation Biology Institute and USFS 2025) (closest grid cells 88752, 130175, and 938, located between about 1–13 miles from PA 1), and
- Western Milkweed Monarch Mapper (Western Monarch and Milkweed Occurrence Database 2025).

### 2.2.2 Pre-field review

Special-status fish and wildlife species were evaluated to determine the likelihood for each species, as identified from the database queries, to occur within PA 1 based on species habitat requirements, known distribution, location and date of recorded observations, and professional judgement (Appendix A; Table A-3). The likelihood of occurrence was rated as one of the following:

- None: The habitat required to support the species is not present within PA 1 or the area is outside the current or historical distribution.
- Low: The habitat is of very low quality or quantity within PA 1; suitable key habitat or habitat elements may be present but may be of poor quality or isolated from the nearest extant occurrences.
- Moderate: The habitat required to support the species is present within PA 1.
- High: The species has been documented within and/or adjacent to PA 1 and/or required habitat components are present and are high quality.

### 2.2.3 Additional assessments

The following additional assessments were developed and supported the evaluation of the potential for special-status fish and wildlife to be present within PA 1.

- ***Fish Utilization and Habitat Characterization:*** presents the known seasonal distribution and life history characteristics of focal fish species that includes most of the special-status species identified in this report. It characterizes existing fish habitat conditions in PA 1. This summary is provided in Appendix C.
- ***Bat Habitat Assessment:*** summarizes the results of a February 2025 site evaluation to assess the potential for existing structures within PA 1 to support bats and recommendations to enhance structures and trees to promote bat roosting opportunities. This summary is provided in Appendix D.

## 3 RESULTS

### 3.1 Vegetation and Land Cover Types

The vegetation map of PA 1 includes five native and two nonnative forest associations, four native and one nonnative shrubland associations, and 24 native and 10 nonnative herbaceous alliances/associations as presented in Table 3-1 and Figure 3-1. Other cover types include developed/disturbed and open waters. Development and disturbed areas were associated with agricultural land use (e.g., barns, access roads), paved roadways, private residential, and utilities (i.e., substation, former railroad grade). Since vegetation was mapped based on areal extent of vegetative canopy, open waters in the vegetation map are associated with waterways that lacked an overstory canopy including narrow drainages throughout the Elk River floodplain. Extent of potential jurisdictional waters and wetlands within PA 1 are provided in *Preliminary Aquatic Resources Delineation Report for the Elk River Estuary (Planning Area 1) Restoration Project* (Stillwater Sciences 2025a).

Most of the Elk River valley bottom was occupied by nonnative grassland associations related to active agricultural land use, primarily grazing pasture for dairy cows, steer, and hay production (Table 3-1, Figure 31). Nonnative grassland communities totaled 539 ac (63%) of PA 1.

Additional native coastal grassland communities were observed in the estuarine marsh-upland ecotone and within depressions and drainages in agriculture pastures that formed an additional 2% of PA 1 (or 17 ac) (Table 3-1). Leaky tide gates and degraded earthen berms along Elk River and Swain Slough have returned tidal influence back onto historical tidelands in and adjacent to Elk River Wildlife Area (ERWA) and some parcels along Swain Slough. These tidally influenced locations are no longer managed for agriculture land use and thereby contain most of the native and naturalized herbaceous vegetation types documented within PA 1. Tidal regimes in reclaimed tidelands of Elk River and Swain Slough formed intertidal coastal salt marsh and brackish marsh communities (see estuarine cover types in Table 3-1, Figure 3-1). In PA 1, the Elk River riparian corridor was narrowed by land use and composed mostly of willow species (*Salix hookeriana*, *Salix lasiolepis*, *Salix lucida* [coast, arroyo, and Pacific willow; respectively]), although a small stand of intact evergreen conifers (*Picea sitchensis* [Sitka spruce]) was observed within the ERWA South enhancement area (Figure 3-1). Lowland swales and drainages throughout the valley bottom were composed of hydrophytic herbaceous species like *Potentilla anserina* subsp. *pacifica* (silverleaf cinquefoil), *Eleocharis macrostachya* (pale spikerush), *Juncus effusus* (Pacific rush) and *Scirpus microcarpus* (small-fruited bulrush) that formed freshwater and brackish marsh communities often surrounded by pasture (Figure 3-1). Levee crests and upland earthen berms were composed of species assemblages associated with coastal scrub habitat including upland shrub species *Baccharis pilularis* (coyote bush).

Sensitive natural communities total 163-acres or approximately 19% of PA 1 and include three forest, two shrubland, and nineteen herbaceous cover types (associations or alliances) (see bold text in Table 3-1, Figure 3-1). Cover types include riparian, coastal scrub, estuarine, freshwater and brackish marsh, and coastal grassland communities (Table 3-1). Disturbances within these sensitive natural communities included: (1) presence by invasive plants, (2) codominant cover by naturalized nonnative species, (3) agriculture land use disturbance, (4) impaired drainage, and/or (5) a muted tidal regime.

**Table 3-1.** Vegetation and land cover types within Planning Area 1.

Alliance and cover types	Association	State rank <sup>1</sup>	Area (ac)
<b><i>Coastal and Agricultural Grasslands</i></b>			
<b><i>Alopecurus geniculatus</i> Provisional Herbaceous Alliance (Water foxtail meadows)</b>	–	S3?	2.4
<b><i>Deschampsia cespitosa - Hordeum brachyantherum - Danthonia californica</i> Herbaceous Alliance (Coastal tufted hair grass - Meadow barley - California oatgrass meadow)</b>	<b><i>Deschampsia (cespitosa, holciformis)</i> Association</b>	S3	0.7
	<b><i>Deschampsia cespitosa/Rosa nutkana</i> Association</b>	S3	2.4
	<b><i>Hordeum brachyantherum</i> Lowland Association</b>	S3	10.4
<b><i>Glyceria declinata</i> Provisional Alliance</b>	–	–	2.8
<b><i>Holcus lanatus - Anthoxanthum odoratum</i> Herbaceous Semi-Natural Alliance (Common velvet grass - sweet vernal grass meadows)</b>	<b><i>Holcus lanatus</i> Association</b>	SNA	54.1
<b><i>Leymus cinereus – Leymus triticoides</i> Herbaceous Alliance (Ashy ryegrass – Creeping wildrye turfs)</b>	<b><i>Leymus triticoides</i> Association</b>	S3	1.0

Alliance and cover types	Association	State rank <sup>1</sup>	Area (ac)
<i>Lolium perenne</i> Herbaceous Semi-Natural Alliance (Perennial rye grass fields)	<i>Lolium perenne</i> Association	SNA	169.7
	<i>Lolium perenne</i> - <i>Festuca arundinacea</i> Association	SNA	133.7
<i>Phalaris aquatica</i> - <i>Phalaris arundinacea</i> Herbaceous Semi-Natural Alliance (Harding grass - Reed Canary grass swards)	<i>Phalaris arundinacea</i> Association	SNA	7.3
<i>Poa pratensis</i> - <i>Agrostis gigantea</i> - <i>Agrostis stolonifera</i> Herbaceous Semi-Natural Alliance (Kentucky bluegrass - Redtop - Creeping bentgrass meadows)	<i>Agrostis (gigantea, stolonifera)</i> Association	SNA	19.5
	<i>Agrostis stolonifera</i> - <i>Festuca arundinacea</i> Association	SNA	87.8
	<i>Poa pratensis</i> Association	SNA	64.1
<b>Coastal Scrub</b>			
<i>Baccharis pilularis</i> Shrubland Alliance (Coyote brush scrub)	<i>Baccharis pilularis</i> Association	S5	8.0
<i>Gaultheria shallon</i> - <i>Rubus (ursinus)</i> Shrubland Alliance (Salal - berry brambles)	<b><i>Rubus ursinus</i> Association</b>	S3?	17.7
<i>Rubus armeniacus</i> - <i>Sesbania punicea</i> - <i>Ficus carica</i> Shrubland Semi-Natural Alliance (Himalayan blackberry - rattlebox - edible fig riparian scrub)	<i>Rubus armeniacus</i> Association	SNA	8.8
<b>Estuarine</b>			
<i>Atriplex prostrata</i> - <i>Cotula coronopifolia</i> Herbaceous Semi-Natural Alliance (Fields of fat hen and brass buttons <sup>3</sup> )	<i>Cotula coronopifolia</i> Association	SNA	0.4
<b><i>Carex lyngbyei</i> Provisional Herbaceous Alliance (Lyngbye's sedge swathes)</b>	–	<b>S1</b>	<b>6.2</b>
<i>Distichlis spicata</i> - <i>Frankenia salina</i> Coastal Herbaceous Alliance (Saltgrass - Alkali heath Coastal)	<i>Distichlis spicata</i> - <i>Parapholis strigosa</i> Association	S4	4.3
	<b><i>Distichlis spicata</i> - <i>Sarcocornia pacifica</i> Association</b>	<b>S3</b>	<b>12.3</b>
	<i>Distichlis spicata</i> Coastal Association	S4	1.1
	<b><i>Grindelia stricta</i> Association</b>	<b>S3</b>	<b>0.3</b>
	<b><i>Juncus (lescurii)</i> - <i>Distichlis spicata</i> Association</b>	<b>S3</b>	<b>2.3</b>
<b><i>Sarcocornia pacifica</i> (<i>Salicornia depressa</i>) Herbaceous Alliance (Pickleweed mats)</b>	<b><i>Sarcocornia pacifica</i> - <i>Distichlis spicata</i> Association</b>	<b>S3</b>	<b>16.5</b>
	<b><i>Sarcocornia pacifica</i> - <i>Distichlis spicata</i> Association*<sup>2</sup></b>	<b>S3/SNA<sup>2</sup></b>	<b>35.2</b>
	<b><i>Triglochin maritima</i> Provisional Association</b>	<b>S3</b>	<b>8.6</b>
<i>Spartina (alterniflora, densiflora)</i> Herbaceous Semi-Natural Alliance Smooth or Chilean cordgrass marshes	<i>Spartina densiflora</i> Association	SNA	2.1
<b><i>Zostera (marina, pacifica)</i> Pacific Aquatic Herbaceous Alliance (Eelgrass beds)</b>	<b><i>Zostera marina</i> Association</b>	<b>S3</b>	<b>0.5</b>
<b>Freshwater and Brackish Marsh</b>			
<b><i>Juncus (effusus, patens)</i> - <i>Carex (pansa, praegracilis)</i> Herbaceous Alliance (Soft and western rush - Sedge marshes)</b>	<b><i>Eleocharis macrostachya</i> Lowland Association</b>	<b>S3S4</b>	<b>0.9</b>
	<i>Juncus effusus</i> Association	S4?	21.7

Alliance and cover types	Association	State rank <sup>1</sup>	Area (ac)
<b>Carex obnupta - Oenanthe sarmentosa - Scirpus microcarpus Herbaceous Alliance (Slough sedge - Water-parsley - Small-fruited bulrush marsh)</b>	<b>Argentina egedii Association</b>	S3	37.5
	<b>Argentina egedii - Eleocharis macrostachya Association</b>	S3	1.1
	<b>Juncus lescurii Association</b>	S3	6.8
	<b>Oenanthe sarmentosa Association</b>	S3	0.03
	<b>Scirpus microcarpus Pacific Coast Association</b>	S3	5.9
<b>Carex obnupta Association</b>	S3	0.2	
<i>Typha (angustifolia, domingensis, latifolia)</i> Herbaceous Alliance (Cattail marshes)	<i>Typha (latifolia, angustifolia)</i> Association	S5	1.5
<b>Riparian</b>			
<i>Alnus rubra</i> Forest Alliance (Red alder forest)	–	S4	5.2
<i>Hesperocyparis macrocarpa - Pinus radiata</i> Forest & Woodland Semi-Natural Alliance (Monterey cypress - Monterey pine stands)	<i>Hesperocyparis macrocarpa</i> Ruderal Association	SNA	0.5
	<i>Pinus radiata</i> Association	SNA	0.1
<b>Picea sitchensis Forest &amp; Woodland Alliance (Sitka spruce forest and woodland)</b>	–	S2	1.5
<b>Salix hookeriana - Salix sitchensis - Spiraea douglasii Shrubland Alliance (Coastal dune willow – Sitka willow-Douglas spiraea thickets)</b>	<b>Salix hookeriana Association</b>	S3	7.8
<i>Salix lasiolepis</i> Shrubland Alliance (Arroyo willow thickets)	–	S4	22.9
<b>Salix lucida ssp. lasiandra Forest &amp; Woodland Alliance (Shining willow groves)</b>	<b>Salix lucida subsp. lasiandra / Urtica urens – Urtica dioica Association</b>	S3	1.9
	<b>Salix lucida subsp. lasiandra Association</b>	S3	2.2
<b>Sequoia sempervirens Forest &amp; Woodland Alliance (Redwood forest and woodland)</b>	<b>Sequoia sempervirens Association<sup>3</sup></b>	S3	0.04
<b>Other</b>			
Developed/Disturbed	–	N/A	31.8
Open water	–	N/A	28.5

<sup>1</sup> State Rank (MCV, NatureServe 2025)

SNA No rating was provided where the eponymous species of an alliance/association was classified by a nonnative species (semi-natural alliances).

S1 Critically imperiled statewide

S2 Imperiled statewide

S3 Vulnerable statewide

S4 Apparently secure statewide

S5 Secure statewide

0.2 Threatened

(?) Denotes an inexact numeric rank because of insufficient samples over the full expected range of the type, but existing information points to this rank.

<sup>2</sup> The cover type “*Sarcocornia pacifica - Distichlis spicata*” has inclusions of the *Atriplex prostrata - Cotula coronopifolia* Herbaceous Semi-Natural Alliance (Fields of fat hen and brass buttons, SNA). This mixed cover type was mapped within the dynamic estuarine tidal marsh that had shifting patterns by these two vegetation alliances throughout the survey period (2021 to present [2025]).

<sup>3</sup> This cover type captures a single occurrence of a coast redwood adjacent to a private residence on the Elk River floodplain.

### 3.1.1 *Zostera (marina, pacifica)* Pacific Aquatic Herbaceous Alliance (eelgrass beds)

One sensitive natural community in PA 1, *Zostera (marina, pacifica)* Pacific Aquatic Herbaceous Alliance (eelgrass beds), is also a listed special aquatic site under 404(b)(1) guidelines of the Clean Water Act (40 C.F.R. § 230.43) and is a designated essential fish habitat (EFH) habitat area of particular concern (HAPC) for various federally-managed fish species within the Pacific Coast Groundfish Fishery Management Plan (PFMC 2008) pursuant to the Magnuson Stevens Fishery Conservation and Management Act.



Patchy distribution of eelgrass was detected within Swain Slough from the confluence with Elk River near HWY 101 bridge to approximately 600 ft upstream of the Elk River Road crossing (Figure 3-1). Areal extent was mapped from UAV-collected imagery and survey data points collected in June 2021 and totaled 0.5 ac in PA 1 (Table 3-1). The Project's recovered tidal slough channels will connect to Elk River and Swain Slough and increase suitable habitat for eelgrass recruitment.

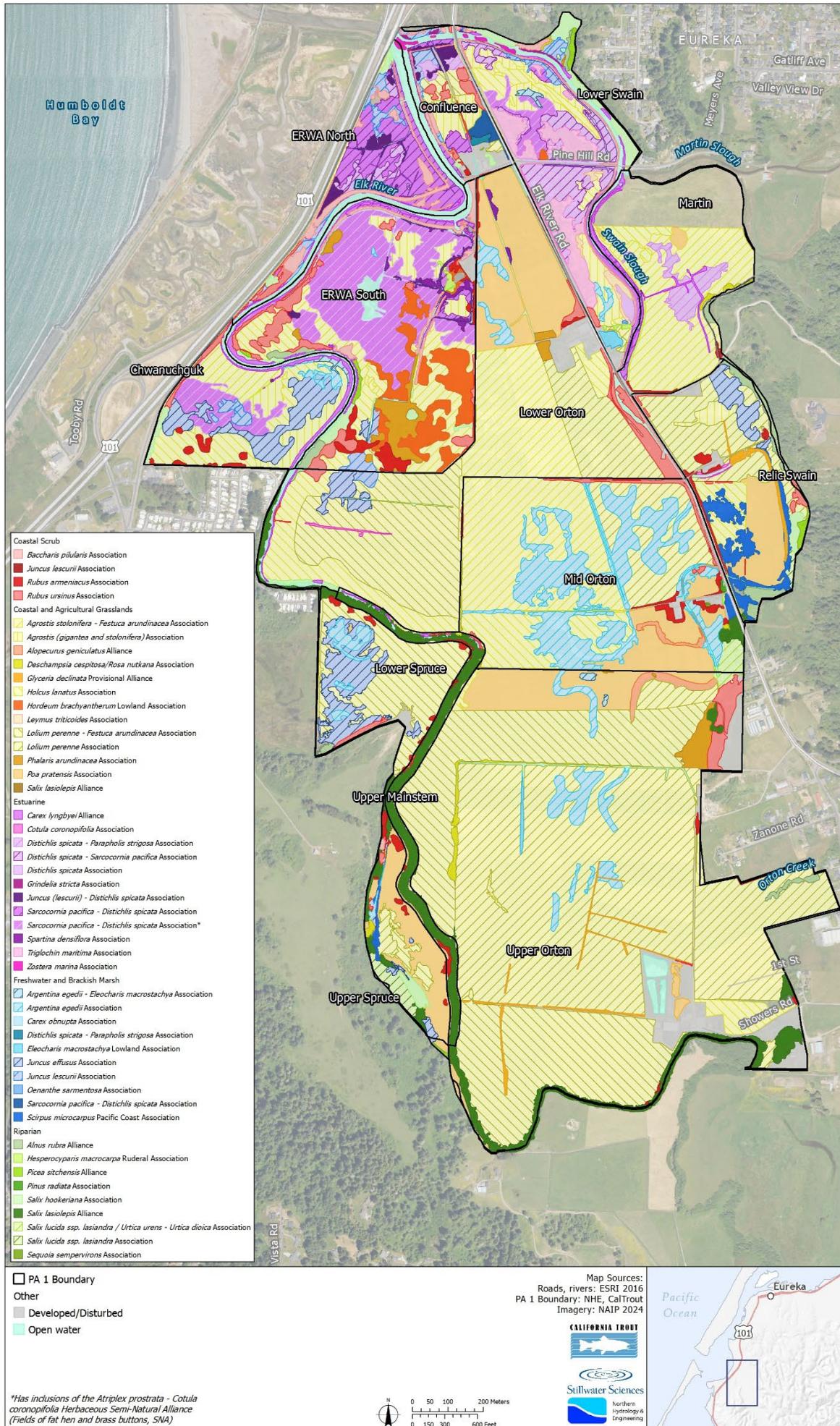


Figure 3-1. Vegetation cover types classified within Planning Area 1.

### 3.2 Special-status Plants

Five special-status plant species were documented within PA 1 (Table 3-2). A comprehensive list of all species observed within PA 1 is provided in Appendix B. Characteristics of each special-status plant species documented on site and information regarding occurrences within PA 1 is provided below. The conservation strategy for all special-status plant species is described in Section 1.5 (see BOT-01). Revegetation activities will promote the expansion of existing special-status plant populations by restoring suitable special-status plant habitat (e.g., fully tidal marsh communities) and seeding or planting special-status plants into suitable planting zones.

In late 2024, one new occurrence of special-status plant *Chloropyron maritimum* subsp. *palustre* (Point Reyes bird's-beak) was documented just outside of PA 1, along Elk River (Figure 3-2). Approximately 20 individuals, occurring in two patches, were observed in the restored City of Eureka's Hikshari' Trail Project, approximately 0.5 miles downstream of PA 1 (CHMAR 001 (Figure 3-2). This occurrence was documented within the high coastal salt marsh adjacent to Elk River just within the high tide line. Associated species included pickleweed and San Francisco rush. Although outside of PA 1, this new finding is a positive indicator for Point Reyes bird's-beak's potential expansion and recovery within Elk River's restored estuarine wetlands.

**Table 3-2. Special-status plant species documented<sup>1</sup> within Planning Area 1.**

Species name (common name)	Status <sup>1</sup> (Federal/ State/CRPR)	Existing CNDDB occurrence?	Occurrence label	Population size
<i>Angelica lucida</i> (sea-watch)	-/-/4.2	No	ANLUC 001	22 patches (1,954 m <sup>2</sup> )
			ANLUC 002	45 patches (1,170 m <sup>2</sup> )
<i>Carex lyngbyei</i> (Lyngbye’s sedge)	-/-/2B.2	Yes, Occurrence 9	CALYN 001	20 patches (1,681 m <sup>2</sup> )
			CALYN 002	32 patches (11,417 m <sup>2</sup> )
			CALYN 003	10 patches (9,338 m <sup>2</sup> )
			CALYN 004	7 patches (1,452 m <sup>2</sup> )
			CALYN 005	16 patches (178 m <sup>2</sup> )
<i>Castilleja ambigua</i> subsp. <i>humboldtiensis</i> (Humboldt Bay owl’s-clover)	-/-/1B.2	Yes, Occurrence 13	CAAMB 001	19 patches (1,490 m <sup>2</sup> )
			CAAMB 002	3 patches (733 m <sup>2</sup> )
			CAAMB 003	6 patches (2,498 m <sup>2</sup> )
			CAAMB 004	75 patches (3,297 m <sup>2</sup> )
<i>Chrysosplenium glechomifolium</i> (Pacific golden saxifrage)	-/-/4.3	No	CHGLE 001	1 patch (29 m <sup>2</sup> )
<i>Spergularia canadensis</i> var. <i>occidentalis</i> (western sand-spurrey)	-/-/2B.1	No	SPCAN 001	1 patch (67 m <sup>2</sup> )

<sup>1</sup> Floristic surveys conducted on May 12–14, 2021, and July 12–14, 2021 and supplemental survey work conducted in 2021 (August 11, October 28, November 19), 2024 (March 7, April 24, May 2, 14, 16, and 20), and 2025 (January 24, February 27, May 12, 26).

<sup>2</sup> Status:

**California Rare Plant Rank**

- List 1B Plants rare, threatened, or endangered in California and elsewhere
- List 2B Plants rare, threatened, or endangered in California, but more common elsewhere
- List 4 Plants of limited distribution, a watch list

**CNPS Threat Ranks:**

- 0.1 Seriously threatened in California (high degree/immediacy of threat)
- 0.2 Fairly threatened in California (moderate degree/immediacy of threat)
- 0.3 Not very threatened in California (low degree/immediacy of threats or no current threats known)

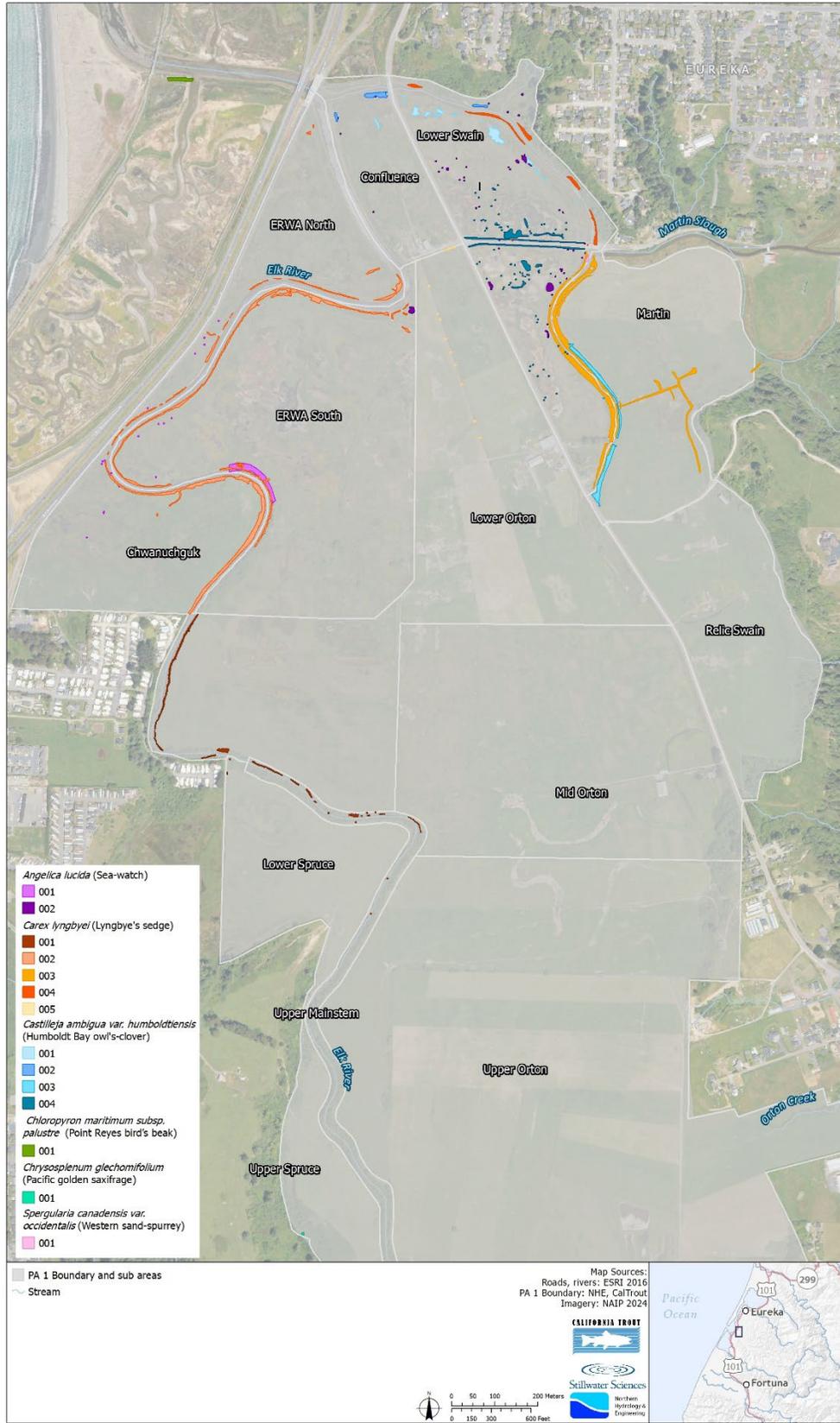


Figure 3-2. Special-status plant occurrences within Planning Area 1.

### 3.2.1 *Angelica lucida* (sea-watch)

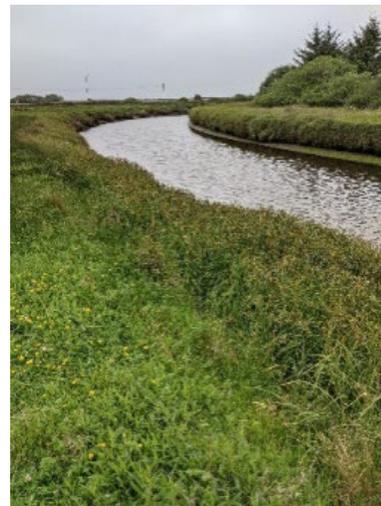
*Angelica lucida* (sea-watch) is a native perennial herb in the Apiaceae family with a CRPR of 4.2 (i.e., plants of limited distribution; fairly threatened in California). It is limited to the North Coast, specifically Humboldt, Mendocino, and Del Norte counties, from 0 to 164 ft above sea level. Sea-watch typically occurs in coastal bluff scrub, coastal dunes, coastal scrub, and coastal salt marshes and blooms from May to September. Populations of sea watch are threatened by non-native plants (CNPS 2025b, Jepson Flora Project 2025).



Three large populations of sea-watch were documented within PA 1 mostly in transitions from marsh to coastal scrub habitats along Elk River and Swain Slough, typically near or on levees and earthen berms (Figure 3-2, Table 3-2). One population (ANLUC 001) was documented in scrub habitats along Elk River. Another population (ANLUC 002) was documented within Swain Slough's wetland to upland ecotone. The third, more interior, population (ANLUC 003) was documented in scattered patches in transitional estuarine wetlands and adjacent to roadsides (Figure 3-2). Plant associates included woody shrubs and vines common to coastal scrublands *Lonicera involucrata* (coast twinberry), *Rubus ursinus* (California blackberry), coyote brush, and the invasive *Rubus armeniacus* (Himalayan blackberry). Associated herbaceous plants included *Juncus lescurii* (San Francisco rush), *Symphotrichum chilense* (Pacific aster), silverweed cinquefoil, *Triglochin maritima* (common arrow-grass), *Deschampsia cespitosa* (tufted hair grass), *Achillea millefolium* (common yarrow), *Atriplex prostrata* (fat-hen), *Scrophularia californica* (California bee plant), *Conium maculatum* (poison hemlock), and *Lotus corniculatus* (bird's foot trefoil). Potential site-specific threats include competition by non-native plants, bank erosion, and sea-level rise.

### 3.2.2 *Carex lyngbyei* (Lyngbye's sedge)

*Carex lyngbyei* (Lyngbye's sedge) is a perennial rhizomatous herb in the Cyperaceae family with a California Rare Plant Rank (CRPR) of 2B.2 (i.e., plants rare, threatened, or endangered in California, but more common elsewhere; fairly threatened in California). In California, it is known to occur in Del Norte, Humboldt, Mendocino, Marin, and Napa counties and is limited to the North and Central coast at 0 to 33 ft elevation. It occurs in brackish and freshwater marshes, swamps, and riverbanks and blooms from April through August. Threats to Lyngbye's sedge include grazing, non-native plants, and habitat disturbance (CNPS 2025b, Jepson Flora Project 2025).



During the 2021 surveys, Lyngbye's sedge was frequently documented in dense stands along the tidally influenced channels of Elk River and Swain Slough and their adjoining drainages (Figure 3-2). These populations were associated with the CDFW reported CNDDDB occurrence 9 (Table 3-2); however, the CNDDDB documented occurrence did not capture the full

extent of this species. Thousands of Lyngbye’s sedge individuals were documented within five populations distinguished by geographic locale, associated waterbody, habitat, unique threats and disturbances, and overall occurrence quality (Table 3-2). Two occurrences (CALYN 001 and 002) were documented along the lower intertidal banks of Elk River. The largest occurrence (CALYN 002, pictured above) consists of intertidal, dense, monotypic bands of vegetation along both sides of Elk River. The upstream occurrence in Elk River (CALYN 001), was restricted to openings within the otherwise forested riparian corridor. Similarly, along Swain Slough, occurrence CALYN 004 was composed of several patches growing within openings of a partially forested riparian corridor. The upstream Swain Slough occurrence (CALYN 003) represented another healthy Lyngbye’s sedge stand. This occurrence formed a dense, monotypic band growing in the intertidal zone along both banks of the slough. These four occurrences along Elk River and Swain Slough showed little signs of disturbance and appeared to be in excellent condition. Potential site-specific threats include competition by *Spartina densiflora* (dense-flowered cord grass) along the upper marsh elevation extent, bank erosion, and sea-level rise. Finally, a fifth occurrence (CALYN 005) was documented along the sides of shallow drainages within an actively grazed agricultural field east of Swain Slough. These drainages were subject to tidal influence from a leaky tide gate upstream of Martin Slough. This population was sparse and patchy with signs of herbivory where livestock had access.

In general, Lyngbye’s sedge populations were immediately bordered by mixed salt marsh communities including associations to the *Sarcocornia pacifica* (*Salicornia depressa*) Herbaceous Alliance (pickleweed mats) as well as the *Juncus lescurii* Association (high marsh community) and patches of dense-flowered cord grass. Herbaceous plants observed along the intertidal channel benches adjacent to Lyngbye’s sedge populations included San Francisco rush, Pacific aster, silverweed cinquefoil, common arrow-grass, *Distichlis spicata* (salt grass), tufted hair grass, and *Salicornia pacifica* (pickleweed). Shrubs associated with the species included coastal willow and *Sambucus racemosa* (red elderberry).

### 3.2.3 *Castilleja ambigua* var. *humboldtiensis* (Humboldt bay owl’s clover)

*Castilleja ambigua* var. *humboldtiensis* (Humboldt Bay owl’s clover) is a hemi-parasitic annual herb in the Orobanchaceae family with a CRPR of 1B.2 (i.e., plants rare, threatened, or endangered in California and elsewhere; fairly threatened in California). It is limited to the north and Central Coast specifically Humboldt, Mendocino, and Marin counties, at 0 to 10 ft elevation. It occurs in coastal salt marshes and swamps and blooms from April through August. Populations of Humboldt Bay owl’s clover are threatened by habitat disturbance and development (CNPS 2025b, Jepson Flora Project 2025).



Three populations of Humboldt Bay owl’s-clover were initially observed within PA 1 during the 2021 botanical surveys. This species was previously documented along lower Elk River and Swain Slough at the downstream end of PA 1 (CDFW 2025a). Although upstream of the CNDDDB documented occurrence (occurrence # 13), these sightings were attributed to this population (Table 3-2). In May 2024 and May 2025 anew population was documented within the high marsh adjacent to the roadside drainages of Pine Hill Road (Figure 3-2). This population was attributed to 2023 revegetation activities for the County of Humboldt Department of Public Works Pine Hill Road over Swain

Slough Bridge project. Similar to Lyngbye’s sedge characterization, the Humboldt Bay owl’s clover occurrences within PA 1 were grouped based on geographic connectivity, habitat, unique threats and disturbances, and overall occurrence quality. Two populations, CAAMB 002 and CAAMB 003, were attributed to salt marsh habitat on intertidal benches along Swain Slough. A third population was located along muted tidelands interior of existing levees along Swain Slough (CAAMB 001). This location was historically converted to agricultural fields; however, over the last several decades, it has been reintroduced to tidal influence and is transitioning back to estuarine wetlands (Figure 3-2). The fourth population (CAAMB 004) was located in 2024 along Pine Hill Road within gravelly drainages subject to tidal inundation and flooding during winter conditions and later in 2025 spreading further into the adjacent tidal marsh (Figure 3-2).

Associated plants observed among populations of Humboldt Bay owl’s-clover were tufted hairgrass, salt grass, pickleweed, brass-buttons, San Francisco rush, *Spergularia marina* (saltmarsh sand-spurrey), common arrow-grass, and dense-flowered cord grass.

Three populations appeared to be in excellent condition with minimal disturbances or threats observed. Plant associates included pickleweed, *Jaumea carnosa* (marsh jaumea), salt grass, San Francisco rush, common arrow-grass, silverweed cinquefoil, brass-buttons, and dense-flowered cord grass. Threats to populations of Humboldt Bay owl’s-clover included encroachment by invasive plants, dense-flowered cord grass and common brass buttons, and potential ground disturbance from agriculture; yet these threats seemed of little impact to current populations. The population along Pine Hill Road, appeared healthy but had high disturbance from road maintenance activities, nonnative plant encroachment, pedestrian traffic, and roadway debris.

#### 3.2.4 *Chrysosplenium glechomifolium* (Pacific golden saxifrage)

*Chrysosplenium glechomifolium* (Pacific golden saxifrage) is a perennial stoloniferous herb in the Saxifragaceae family with a CRPR of 4.3 (i.e., plants of limited distribution; not very threatened in California). In California, this species is known to occur only in Mendocino, Humboldt, and Del Norte County at 35 to 1,770 ft elevation within seeps and along streambanks in North Coast coniferous and riparian forests and blooms February through June (CNPS 2025b, Jepson Flora Project 2025). The primary threat to this obligate wetland species includes the alteration to pre-existing hydrology or water flow.



One new occurrence of Pacific golden saxifrage (CHGLE 001) was documented within PA 1 within a riparian forest, adjacent to a seep leading to a freshwater marsh, and consisted of approximately 50 individuals (Figure 3-2, Table 3-2). The dominant tree species in the riparian forest were arroyo willow and Pacific willow, which formed dense cover in the overstory (70–85% canopy cover). Associated herbaceous plants included *Ranunculus repens* (creeping buttercup), *Oenanthe sarmentosa* (water parsley), *Tolmiea diplomenziesii* (pigaback plant), California blackberry, *Urtica dioica* (stinging nettle), and small-fruited bulrush. Potential threats to occurrences within PA 1 include competition by nonnative plants (e.g., creeping buttercup), hydrological alterations, and cattle grazing and trampling.

### 3.2.5 *Spergularia canadensis* var. *occidentalis* (western sand-spurrey)

*Spergularia canadensis* var. *occidentalis* (western sand-spurrey) is an annual herb in the Carophyllaceae family with a CRPR of 2B.1 (i.e., plants rare, threatened, or endangered in California, but more common elsewhere; seriously threatened in California). In California, this species is known to occur only in Humboldt County at 0 to 10 ft elevation within coastal salt marsh and swamp habitats and blooms from June through August. Threats to western sand spurrey include habitat disturbance and non-native plants (CNPS 2025b, Jepson Flora Project 2025).



During the 2021 surveys, one new occurrence of western sand-spurrey, SPCAN 001, was documented within PA 1 consisting of approximately 100 individuals. It was observed in a lower intertidal mudflat location in the Swain Slough channel that was exposed during low tide events (Figure 3-2). Vegetative cover at this location was sparse with western sand-spurrey providing the highest cover (~15% absolute cover). In addition, some dense-flowered cord grass and brass-buttons were documented, each with less than 5% absolute cover. The high inundation times between low tide events in the Swain Slough seem to maintain control of both nonnative plant associates. Other potential site-specific threats to this occurrence include mudflat erosion and sea-level rise. The western sand-spurrey population will be avoided during all Project activities due to its limited presence.

### 3.3 Target Invasive Plants

Invasive weeds within PA 1 occur in a range of patterns, from large stands to discrete patches or single individuals within native vegetation communities. Invasive plants that formed documented stand-level occurrences with PA 1 included: *Phalaris arundinacea* (reed canary grass), dense-flowered cord grass, *Rubus armeniacus* (Himalayan blackberry), and *Glyceria declinata* (low manna grass) (Tables 3-1 and 3-3). These species occupy various habitats within PA 1 including estuarine, freshwater wetland, and riparian areas (Tables 3-1 and 3-3; Figures 3-1 and 3-3).

Other invasive plants that were observed as single or small patch-size occurrences within PA 1 are summarized in Table 3-3.

**Table 3-3. Invasive plants documented within Planning Area 1.**

Scientific name	Common name	Cal-IPC rating <sup>1</sup>	Regionally listed <sup>2</sup>
<i>Cirsium arvense</i>	Canada thistle	Moderate	Yes
<i>Cirsium vulgare</i>	Bull thistle	Moderate	Yes
<i>Conium maculatum</i>	Poison hemlock	Moderate	Yes
<i>Cortaderia jubata</i>	purple pampas grass	High	Yes
<i>Cotoneaster</i> spp.	Cotoneaster	Moderate	Yes
<i>Cytisus scoparius</i>	Scotch broom	High	Yes
<i>Dipsacus fullonum</i>	wild teasel	Moderate	Yes
<i>Erica lusitanica</i>	heather	Limited	Yes
<i>Foeniculum vulgare</i>	fennel	Moderate	Yes
<i>Genista monspessulana</i>	French broom	High	Yes
<i>Glyceria declinata</i>	low manna grass	Moderate	No
<i>Hedera helix</i>	English ivy	High	Yes
<i>Ilex aquifolium</i>	English holly	Limited	Yes
<i>Phalaris arundinacea</i>	reed canary grass	None <sup>3</sup>	Yes <sup>3</sup>
<i>Rubus armeniacus</i>	Himalayan blackberry	High	Yes
<i>Spartina densiflora</i>	dense-flowered cord grass	High	Yes
<i>Vinca major</i>	periwinkle	Moderate	Yes

<sup>1</sup> **Cal-IPC rankings**

**High** – These species have severe ecological impacts on physical processes, plant and animal communities, and vegetation structure. Their reproductive biology and other attributes are conducive to 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. Their reproductive biology and other attributes are conducive to moderate to high rates of dispersal, though establishment is generally dependent upon ecological disturbance. Ecological amplitude and 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. Their reproductive biology and other attributes result in low to moderate rates of invasiveness. Ecological amplitude and distribution are generally limited, but these species may be locally persistent and problematic.

**None** – No rating listed.

<sup>2</sup> Species listed as invasive to Humboldt County, California (Humboldt County Weed Management Area 2010)

<sup>3</sup> Known to the region as having invasive tendencies and can be detrimental to the successful establishment of restored native plant communities (Humboldt County Resource Conservation District 2024).

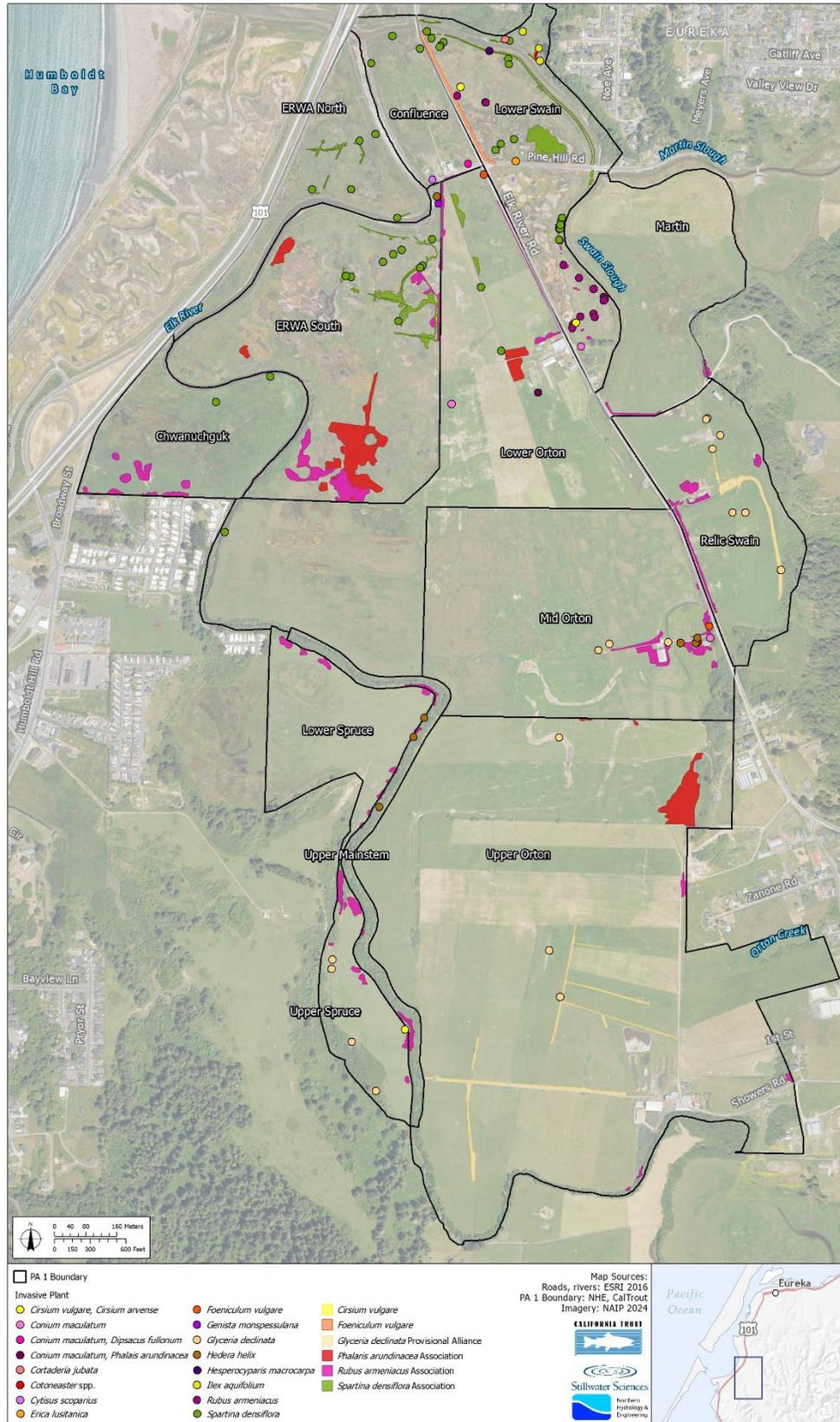


Figure 3-3. Invasive plant occurrences documented within Planning Area 1.

### **3.4 Special-status Fish and Wildlife**

The special-status wildlife (i.e., invertebrate, fish, amphibian, reptile, bird, and mammal) species identified from the database queries are presented in Appendix A, Table A-3. Species with either a low or no potential to occur were eliminated from further consideration. The special-status wildlife species with a moderate or high potential to occur within PA 1 are summarized in Table 3-4.

Table 3-4. Special-status fish and wildlife with the potential to occur within Planning Area 1.

Common name Scientific name	Query sources	Status <sup>a</sup> Federal/ State	Distribution in California	Habitat association	Likelihood to occur within Planning Area 1	Sensitive life history timing <sup>b</sup>
<b>Invertebrates</b>						
Monarch butterfly (California overwintering population) <i>Danaus plexippus plexippus</i>	USFWS	FC/-	Range includes most of California; it breeds throughout California and overwinters in suitable groves along the California coast	Adults forage on a variety of flowering plants during breeding and migration; larva (caterpillars) require milkweed ( <i>Asclepias</i> spp.) as a host plant. Overwinter roosts include eucalyptus ( <i>Eucalyptus</i> spp.), Monterey pines ( <i>Pinus radiata</i> ), and Monterey cypress ( <i>Hesperocyparis macrocarpa</i> ) trees or groves.	<p><b>Moderate (foraging only):</b> No breeding habitat (milkweed species) were observed during the comprehensive botanical surveys in 2021 (Appendix B) while foraging habitat (flowering plants) is present within PA 1.</p> <p>An occurrence of an adult monarch was observed within 0.5 miles of PA 1 in 2022 and an adult monarch and eggs were documented on milkweed within two miles of PA 1 in 2024 (Western Monarch Milkweed Occurrence Database 2025).</p> <p>Critical habitat has been proposed for this species and is not present within PA 1.</p>	<p>Breeding season: March through October</p> <p>Overwintering season: November through February</p>
<b>Fish</b>						
Pacific lamprey <i>Entosphenus tridentatus</i>	CDFW	-/SSC	Most coastal flowing watersheds between Mexico and Oregon.	<p>Anadromous species that spawns and rears in freshwater before emigrating to the ocean to feed and grow. Generally distributed wherever salmon and steelhead occur.</p> <p>Adult spawning: coarse gravel or small cobble in pool tails or low-gradient riffles.</p> <p>Larval rearing: Mostly freshwater (below 12 parts per thousand [ppt] salinity) and low-velocity areas where they burrow into fine silt and sand substrates that often contain organic matter. Water temperatures less than approximately 22°C.</p>	<p><b>High:</b> While no spawning habitat is present within PA 1, adults will move through the lower portion of PA 1 via the Elk River and Swain Slough as they migrate upstream to freshwater spawning areas as will juveniles (macrophthalmia) as they out-migrate to the bay and/or ocean. Larve (ammocoetes) are not expected to be present in the lowermost portion of PA 1 due to the high salinities resulting from the direct connection to Humboldt Bay, but are likely to be present in the middle and uppermost portions.</p> <p>Pacific lamprey have been documented within the Elk River watershed (Stillwater Sciences 2016) and neighboring Humboldt Bay tributaries such as Freshwater Creek (Anderson 2020), Fay Slough, and Freshwater Slough (CDFW 2025a).</p> <p>Adult and juveniles have been documented in the North Fork Elk River 4 miles upstream of PA 1 from 2014 (CDFW 2025a).</p>	<p>Adult migration: late winter to early summer</p> <p>Spawning: March through July</p> <p>Egg hatching: 15 days after eggs deposited into the redd</p> <p>Emergence: 15 days following hatching</p> <p>Juvenile rearing: 4–10 years</p> <p>Outmigration: fall to spring</p> <p>Ocean period: 18–40 months</p>

Common name <i>Scientific name</i>	Query sources	Status <sup>a</sup> Federal/ State	Distribution in California	Habitat association	Likelihood to occur within Planning Area 1	Sensitive life history timing <sup>b</sup>
Western brook lamprey <i>Lampetra richardsoni</i>	CDFW	-/SSC	Coastal and Central Valley rivers and streams	Non-migratory species that remains in fresh water for its entire life cycle. Spawns in small gravel substrates in cool water streams; requires habitats with low water velocity and fine sediment for ammocoete rearing.	<b>Moderate:</b> While Western brook lamprey have been documented in the Elk River watershed (Stillwater Sciences 2016) and neighboring Humboldt Bay tributaries such as Freshwater Creek (Anderson 2020), Fay Slough, and Freshwater Slough (CDFW 2025a), the species is not expected to occur in waters with the higher salinities present in the lower portion of PA 1. In the upper portions of PA 1, larval rearing for the species may occur.  Ammocoetes have been documented in the South Fork Elk River, 3 miles upstream of PA 1 in 2013 (CDFW 2025a).	Spawning: March through June  Eggs hatching: approximately 15 days after fertilization and deposition in redd  Larval emergence: approximately 15 days following hatching  Larval rearing: 3–4 years
Longfin smelt <i>Spirinchus thaleichthys</i>	CDFW	-/ST	San Francisco estuary from Rio Vista or Medford Island in the Delta as far downstream as South Bay; concentrated in Suisun, San Pablo, and North San Francisco bays; historical populations in Humboldt Bay, Eel River estuary, and Klamath River estuary	Adults associated with nearshore coastal areas, large bays, and estuaries, and migrate into lower portions of freshwater streams and rivers to spawn over sandy/gravel substrates, rocks, and aquatic plants; juveniles and adults rear in estuarine habitats, with smolts preferring deep-water channels.	<b>High:</b> Spawning habitat is present in the upstream area of PA 1, and rearing habitat is present throughout PA 1, due to the close proximity to Humboldt Bay and the Elk River estuary.  Present throughout Humboldt Bay including PA 1 (i.e., Elk River) in addition to other Humboldt Bay tributaries (Garwood 2017, Anderson 2023a). Species has been documented throughout Humboldt Bay, less than a mile from PA 1 in 2005 (CDFW 2025a). Additional information is provided in Appendix C.	Spawning: November through May (peak in February–April)  Fry hatching and larval dispersal downstream to estuaries: 40 days following spawning (March through June)  Larval rearing: 3 months following hatching (June through September)
Eulachon, southern DPS <i>Thaleichthys pacificus</i>	CDFW/ NMFS	FT/SSC	Skeena River in British Columbia (inclusive) south to Humboldt Bay and in smaller numbers south to Fort Brag in Northern California	An anadromous fish that generally spawns in freshwater rivers with eggs fertilized in the water column and sinking to the river bottom, typically in areas of gravel and coarse sand. Uses estuaries for migrating between the ocean and freshwater; spends approximately three years in the ocean.	<b>Moderate:</b> Adults and larvae have a moderate potential of migrating through PA 1; adults on their way upstream to spawn and larvae as they out-migrate to the bay and ocean.  Adult eulachon have been documented in a tidally influenced area of Freshwater Creek, about 6 miles northeast of PA 1, in March 2023 (Anderson 2023b), which is a tributary to Humboldt Bay similar to Elk River. Historical accounts also include central and north Humboldt Bay, less than a mile from PA 1, in 1977 (CDFW 2025a).  Critical habitat has been designated for this species and is not present within PA 1; critical habitat is located 12 miles north on the Mad River.	Adult migration: December through March  Spawning: mid-March into May  Fry emergence and larval outmigration: 30–40 days following spawning (mid-April through June)

Common name <i>Scientific name</i>	Query sources	Status <sup>a</sup> Federal/ State	Distribution in California	Habitat association	Likelihood to occur within Planning Area 1	Sensitive life history timing <sup>b</sup>
Coho salmon, southern Oregon/northern California Coast Evolutionary Significant Unit (ESU) <i>Oncorhynchus kisutch</i>	NMFS, CDFW	FT/ST	Range includes Punta Gorda north to the Oregon border	<p>Low-gradient portions of coastal draining streams with sufficiently cool water temperatures.</p> <p>Adult spawning: fine to coarse gravel in pool tailouts or low-gradient riffles with nearby cover or deep pools.</p> <p>Juvenile rearing: instream pool habitats often associated with large wood or off-channel features that provide low-velocity protection from high flows and cover from predation and water temperatures less than approximately 17°C.</p>	<p><b>High:</b> PA 1 is mostly inclusive of estuarine habitat that supports migratory habitat during adult upstream migration, juvenile downstream outmigration, and juvenile rearing. No spawning habitat is present.</p> <p>The species has been documented throughout the Elk River watershed in 2005, including PA 1, with Age-0 fish present April through December and Age-1 fish present January through August (Wallace and Allen 2009, CDFW 2025a). Additional information is provided in Appendix C.</p> <p>Critical habitat has been designated for this species and is present within PA 1.</p>	<p>Adult migration: fall and winter</p> <p>Spawning: few weeks following migration (December–February)</p> <p>Fry emergence: 3–4 months after spawning</p> <p>Juvenile rearing: year round</p> <p>Emigration from streams to mainstem: March–May</p> <p>Out-migration: April and May, peak in early May</p>
Chinook salmon, California Coastal ESU <i>Oncorhynchus tshawytscha</i>	NMFS	FT/–	Range includes Russian River (Sonoma County) north to Redwood Creek (Humboldt County)	<p>Coastal draining streams.</p> <p>Adult spawning: medium gravel to small cobble in pool tails or low-gradient riffles with nearby cover or deep pools.</p> <p>Juvenile rearing: fry utilize shallow stream margins and juveniles utilize pool or deep run habitats with instream cover from winter flows and predation, often associated with large cobble, boulders, or large wood in water temperatures less than approximately 19°C.</p>	<p><b>High:</b> PA 1 is mostly inclusive of estuarine habitat that supports migratory habitat during adult upstream migration and juvenile downstream out-migration. No spawning habitat is present.</p> <p>Species documented within PA 1, with Age-0 fish present between May and September (Wallace and Allen 2009). Additional information is provided in Appendix C.</p> <p>Critical habitat has been designated for this species and is present within PA 1.</p>	<p>Adult migration: fall and winter (September–early November)</p> <p>Spawning: few weeks following freshwater entry (November–January, peak in December)</p> <p>Fry emergence: March–May</p> <p>Juvenile rearing: May to September</p> <p>Out-migration: summer–fall</p>
Steelhead, northern California DPS winter-run <i>Oncorhynchus mykiss irideus</i>	NMFS, CDFW	FT/–	Range includes Coastal streams from the Russian River (exclusive) north to Redwood Creek (Humboldt County)	<p>Rivers and streams with cold water, clean gravel of appropriate size for spawning, and suitable rearing habitat.</p> <p>Adult spawning: medium to coarse gravel in pool tails or low-gradient riffles with nearby cover or deep pools.</p> <p>Juvenile rearing: pool or deep run habitats with instream cover from winter flows and predation, often associated with large cobble, boulders, or large wood in water temperatures less than approximately 22°C. Juveniles typically rear in fresh water for 1 or more years before migrating to the ocean.</p>	<p><b>High:</b> PA 1 is mostly inclusive of estuarine habitat that supports migratory habitat during adult upstream migration and juvenile downstream outmigration. Rearing habitat may be present in the upper portion of PA 1. No spawning habitat is present.</p> <p>Species documented within PA 1 with Age 1+ fish documented between February–October and December (Wallace and Allen 2009). Species has been documented throughout the Elk River watershed including PA 1 in 2022 (CDFW 2025a). Additional information is provided in Appendix C.</p> <p>Critical habitat has been designated for this species and is present within PA 1 (i.e., Elk River, Swain Slough and Martin Slough).</p>	<p>Adult migration: October through March</p> <p>Spawning: late February through April</p> <p>Fry emergence: 6 weeks following hatching (April–June)</p> <p>Juvenile rearing: year-round</p> <p>Outmigration: late-winter and spring (February–June [peak in March and April] and October–November)</p>

Common name <i>Scientific name</i>	Query sources	Status <sup>a</sup> Federal/ State	Distribution in California	Habitat association	Likelihood to occur within Planning Area 1	Sensitive life history timing <sup>b</sup>
Coast cutthroat trout <i>Oncorhynchus clarkii clarkii</i>	CDFW	-/SSC	Small, low-gradient coastal streams and estuaries from northern Oregon to the Eel River, California	Shaded streams with water temperatures below 18°C and small gravel for spawning; have diverse life histories, including potadromous (migratory within freshwater portions of the river system), stream-resident, and anadromy, which includes rearing in freshwater and foraging in estuaries.	<p><b>High:</b> PA 1 is mostly inclusive of estuarine habitat that supports migratory and foraging habitat during adult upstream migration and juvenile downstream outmigration. Rearing habitat is present within PA 1. No spawning habitat is present.</p> <p>Species documented within PA 1 (Wallace and Allen 2009) with Age 1+ fish present in January and between April–December (Wallace and Allen 2009). Additional information is provided in Appendix C.</p> <p>Species has been documented throughout the Elk River watershed including PA 1 in 2014 (CDFW 2025a).</p>	<p>Adult spawning migration: August–November, with peak in January</p> <p>Fry emergence: 6 weeks following hatching (March–June)</p> <p>Juvenile rearing: year-round</p> <p>Juvenile outmigration: March–June, with peak in April</p>
Tidewater goby <i>Eucyclogobius newberryi</i>	CDFW, USFWS	FE/-	Range includes San Diego County north to the mouth of the Smith River in Del Norte County	Typically in shallow waters of coastal lagoons and the uppermost zone of brackish large estuaries; prefer sandy substrate for spawning, but can be found on silt, mud, or rocky substrates; typically in shallow water, but can occur in water up to 15 feet in lagoons and within a wide range of salinity (0–42 ppt).	<p><b>High:</b> Suitable habitat is present within PA 1 for all life stages of the tidewater goby.</p> <p>Species was documented within PA 1 in 2010 along the lower, northwestern portion of PA 1 near the confluence of Elk River and Swain Slough (CDFW 2025a). Additional information is provided in Appendix C.</p> <p>Critical habitat has been designated for this species and is present within PA 1.</p>	<p>Breeding (egg laying and larval emergence): late April to July (peak), while can continue through December</p> <p>Larval rearing: one month following breeding (late May through August [peak], while can continue through January)</p>
<b>Amphibians</b>						
Southern torrent salamander <i>Rhyacotriton variegatus</i>	CDFW	-/SSC	Coastal drainages from near Point Arena in Mendocino County to the Oregon border	In and adjacent to cold, permanent, well-shaded mountain springs, waterfalls, and seeps with rocky substrate in redwood ( <i>Sequoia sempervirens</i> ), Douglas-fir ( <i>Pseudotsuga menziesii</i> ), mixed conifer, montane riparian and montane hardwood-conifer habitats. Elevational range extends from near sea level to about 3,940 ft.	<p><b>Moderate:</b> Suitable habitat is present within PA 1 (seeps and springs along the valley walls) but is of low quantity.</p> <p>The most recent occurrence is about seven miles north of PA 1 from 2013. Other observations in the vicinity include an observation within seven miles of PA 1 along Freshwater Creek from 1994, an occurrence along Salmon Creek near Headwaters Forest Reserve from 1995, and an occurrence in Kneeland about ten miles from PA 1 from 2010 (CDFW 2025a).</p>	<p>Breeding: may occur year-round, while peak oviposition period is in August and September</p> <p>Egg hatching: about 8 months following egg laying; peak egg hatching occurs in the spring</p> <p>Larval metamorphosis: 2–2.5 years following hatching</p>

Common name <i>Scientific name</i>	Query sources	Status <sup>a</sup> Federal/ State	Distribution in California	Habitat association	Likelihood to occur within Planning Area 1	Sensitive life history timing <sup>b</sup>
Northern red-legged frog <i>Rana aurora</i>	CDFW	-/SSC	Ranges from Mills Creek in Mendocino County to Oregon border	Breeds in still or slow-moving water with emergent and overhanging vegetation, including wetlands, wet meadows, ponds, lakes, and low-gradient, slow moving stream reaches with permanent pools; uses adjacent uplands for dispersal and summer retreat.	<b>High:</b> Suitable aquatic habitat for breeding and terrestrial habitat for cover and dispersal is present within PA 1.  Egg masses were observed within PA 1 during a site visit in January 2025 in the Western Off-Channel Habitat Upstream (M2-FP-3.9) (Draeger, B., NHE, and Dusek, L., Stillwater Sciences pers. comm., January 2025). Additional CNDDDB occurrences include one within PA 1 at the Elk River Wildlife Area from 2009 (ERWA), an occurrence 0.5 miles from PA 1 in King Salmon from 2024, and an observation within 0.25 miles of PA 1 from 2003 (CDFW 2025a).	Active period: year-round Egg laying: November to April Egg hatching: about 4 weeks following egg laying Tadpole metamorphosis: 4–7 months following hatching Upland dispersal period: post-tadpole metamorphosis
<b>Reptiles</b>						
Northwestern pond turtle <i>Actinemys marmorata</i>	USFWS, CDFW	FPT/SSC	Range is from the Oregon border along the coast ranges to the Mexican border, and west of the crest of the Cascades and Sierras	Permanent, slow-moving fresh or brackish water with available basking sites and adjacent open habitats or forest for nesting.	<b>Moderate:</b> Suitable basking and breeding habitat is present within PA 1, and suitability is likely to increase in areas with a higher proportion of freshwater inflow.  The nearest CNDDDB occurrences are about 0.5 miles away from 2013 in the neighboring Martin Slough with six additional occurrences within about 5 miles of PA 1 in 2006, 2011, and 2017; two of these occurrences were on Elk River upstream of PA 1 (CDFW 2025a).  Critical habitat has not been designated for this species.	General active period: February through November Mating: April–May Nesting: April–August Egg incubation: while unknown, laboratory hatching occurred in 73–81 days Hatchling emergence: late-summer or fall, but some may overwinter and emerge the following spring Hibernation: winter in either aquatic or terrestrial habitat Aestivation: summer in aquatic habitat

Common name <i>Scientific name</i>	Query sources	Status <sup>a</sup> Federal/ State	Distribution in California	Habitat association	Likelihood to occur within Planning Area 1	Sensitive life history timing <sup>b</sup>
<b>Birds</b>						
Numerous bird species protected under the Migratory Bird Treaty Act (MBTA)	USFWS	MBTA	Range encompasses California	Variable including, but not limited to, grasses, shrubs, and trees.	<b>High:</b> Suitable nesting trees, shrubs, grasses, and agriculture fields provide nesting and foraging habitat for MBTA-protected birds including those documented within PA 1 such as Allen's hummingbird ( <i>Selasphorus sasin</i> ), lesser yellowlegs ( <i>Tringa flavipes</i> ), chestnut-backed chickadee ( <i>Poecile rufescens</i> ), and wrentit ( <i>Chamaea fasciata</i> ) (eBird 2025). Inactive barn swallow nests were observed at structures during a site visit to PA 1 in February 2025 (L. Dusek, Stillwater Sciences, pers. comm., February 2025); see Appendix D for additional information.	Nesting bird season: typically ranges from mid- March through mid-August
Marbled murrelet <i>Brachyramphus marmoratus</i>	CDFW, USFWS	FT/SE	Nesting birds mostly concentrated near coastal waters in Del Norte and Humboldt counties, and in lesser numbers near San Mateo and Santa Cruz counties; species winters throughout the nesting range and in small numbers in southern California	Most time spent on the ocean; nests inland in large areas of old-growth conifers with suitable platforms, especially redwood or Douglas-fir forests near coastal areas.	<b>Moderate (flyover only):</b> No suitable nesting habitat within PA 1, although may be present in adjacent, forested habitat. There is a high potential for individuals to be flying over PA 1 during daily migrations to forage at the ocean.  The nearest CNDDDB occurrence is about seven miles from PA 1 in Headwaters Forest Reserve in 1995 (CDFW 2025a).  Critical habitat has been designated for this species and occurs 4.5 miles from PA 1.	Nesting initiated: May, while as late as July  Egg laying: variable occurring between March through August  Incubation period: 28–30 days following egg laying  Nestling period: 30 days following hatching
White-tailed kite <i>Elanus leucurus</i>	CDFW	–/SFP	Year-round resident; found in nearly all lowlands of California west of the Sierra Nevada mountains and the southeast deserts	Lowland grasslands and wetlands with open areas; nests in trees near open foraging area	<b>High.</b> Suitable foraging and nesting habitat is present within PA 1. A foraging white-tailed kite was observed during a site visit in February 2025 (L. Dusek, Stillwater Sciences, pers. comm., February 2025).  The nearest CNDDDB occurrences include an observation less than a mile away from PA 1 from 2014, and another about one mile away from 2015 (CDFW 2025a).	Breeding: February–October, with peak breeding in May–August  Incubation period: 30–32 days following egg laying  Nestling period: 35–38 days following hatching
Golden eagle <i>Aquila chrysaetos</i>	USFWS	BGECP/ SFP	Species is an uncommon permanent resident and migrant throughout California, except center of Central Valley	Open woodlands and oak savannahs, grasslands, chaparral, sagebrush flats; nests on steep cliffs or medium to tall trees	<b>Moderate (flyovers and possibly foraging):</b> Suitable foraging habitat is present in grasslands within PA 1. While preferred nesting habitat of cliffs is lacking within PA 1, medium to tall trees are present in adjacent forested areas.  Multiple occurrences are from within six miles of PA 1 at the nearby Humboldt Bay National Wildlife Refuge, Hookton Slough, and Fay Slough Wildlife Area (2009–2012 and 2016–2021) (eBird 2025). The nearest CNDDDB occurrence is about 12 miles away from 2006 (CDFW 2025a).	General breeding season: late January through August  Nesting initiated: late January  Egg laying: typically, in March, while may occur 1–3 months after nest is constructed  Incubation period: 41–45 days following egg laying  Nestling period: 45–81 days following hatching

Common name <i>Scientific name</i>	Query sources	Status <sup>a</sup> Federal/ State	Distribution in California	Habitat association	Likelihood to occur within Planning Area 1	Sensitive life history timing <sup>b</sup>
Northern harrier <i>Circus hudsonius</i>	CDFW	-/SSC	Summer resident in eastern Sierra Nevada in Mono County.	Coastal scrub, Great Basin grasslands, Valley & foothill grasslands, wetlands, marshes & swamps, coastal salt and freshwater marsh, and riparian scrub. Nest and forage in grasslands, from salt grass in desert sink to mountain cienagas. Nests on the ground in shrubby vegetation, usually at marsh edge; nest built of a large mound of sticks in wet areas.	<b>High:</b> Suitable foraging and nesting habitat is present in upland grassland and agricultural areas within PA 1.  Numerous occurrences within PA 1 (eBird 2025).	Breeding: April–September with peak breeding during June and July.  Roosting: The breeding pair and juveniles roost communally until the following spring.
Bald eagle <i>Haliaeetus leucocephalus</i>	CDFW, USFWS	BGECP/ SE, SFP	Species is a permanent resident and uncommon winter migrant, found nesting primarily in Butte, Lake, Lassen, Modoc, Plumas, Shasta, Siskiyou, and Trinity counties	Large bodies of water or rivers with abundant fish, uses snags or other perches; nests in advanced-successional conifer forest near open water	<b>Moderate (flyovers and possibly foraging):</b> No suitable nesting trees are present within PA 1, while suitable nesting habitat may be present in adjacent forests. Eagles typically nest near foraging habitat, and while the most suitable foraging habitat in the area is Humboldt Bay, which is about 0.25 miles from PA 1, the lower estuary habitat within PA 1 may also support foraging habitat.  An eagle was observed within PA 1 in 2018 and there have been numerous other occurrences spanning multiple years within one mile of PA 1 (eBird 2025). The nearest CNDDDB occurrence is within three miles of PA 1 in 2005, and the most recent is six miles from PA 1 from 2022 (CDFW 2025a).	Breeding season: February through August  Nest building: typically, 1 to 3 months before egg-laying
Bank swallow <i>Riparia riparia</i>	CDFW	-/ST	Summer resident; occurs along the Sacramento River from Tehama County to Sacramento County, along the Feather and lower American rivers; and in the plains east of the Cascade Range in Modoc, Lassen, and northern Siskiyou counties; small populations near the coast from San Francisco County to Monterey County	Nests in vertical bluffs or banks, usually adjacent to water, where the soil consists of sand or sandy loam	<b>Moderate (foraging only):</b> Suitable nesting habitat does not exist within PA 1, but foraging habitat is present in grasslands, agricultural fields, and riparian areas.  One occurrence within 0.25 miles of PA 1 in 2022 and multiple 2024 occurrences in the Project vicinity (Arcata Marsh, Humboldt Bay National Wildlife Refuge, north and south spits of Humboldt Bay) (eBird 2025). The most recent CNDDDB occurrence is about 12 miles from PA 1 from 2012 (CDFW 2025a).	Not applicable
Grasshopper sparrow <i>Ammodramus savannarum</i>	CDFW	-/SSC	Summer resident; nests in Humboldt, Mendocino, Trinity, and Tehama counties south, west of the Cascade–Sierra Nevada axis and southeastern deserts, to San Diego County	Typically found in moderately open grasslands with scattered shrubs	<b>Moderate:</b> Suitable nesting and foraging habitat exists within PA 1.  One CNDDDB occurrence is documented near the Eel River in 2017 (CDFW 2025a). The nearest eBird occurrence is 1.5 miles away from PA 1 in Humboldt Hill from 2014, and there have been many occurrences at the Arcata Marsh, Table Bluff Ecological Reserve, and Humboldt Bay National Wildlife Refuge from 2020–2024 (eBird 2025).	Breeding season: mid-March to August  Incubation Period: 11–13 days  Nestling Period: 6–9 days

Common name <i>Scientific name</i>	Query sources	Status <sup>a</sup> Federal/ State	Distribution in California	Habitat association	Likelihood to occur within Planning Area 1	Sensitive life history timing <sup>b</sup>
<b>Mammals</b>						
Townsend's big-eared bat <i>Corynorhinus townsendii</i>	CDFW	-/SSC	Throughout California, found in all but subalpine and alpine habitats, details of distribution not well known	Roosts in cavities, most often in tunnels, caves, mines, and buildings, but also rock shelters, preferentially close to water. Most abundant in mesic habitats, also found in oak woodlands, desert, vegetated drainages, caves or cave-like structures (including basal hollows in large trees, mines, tunnels, and buildings).	<b>Moderate:</b> While preferred roosting habitat is lacking (caves and mines), species have been known to roost in buildings, which are present within PA 1 (Appendix D, Bat Habitat Assessment). It is unlikely that trees within PA 1 support large basal hollows for roosting. Suitable foraging habitat present in upland open areas of PA 1.  Species documented acoustically about 8 miles northeast at the closest grid cell to PA 1 in July and August 2019 and July 2020 (Conservation Biology Institute and USFS 2025). The nearest CNDDDB occurrence is about three miles from PA 1 in 1949 and the most recent CNDDDB occurrence is about six miles away in Eureka in 1998 (CDFW 2025a).	Maternity season: May 1 through August 31  Torpor season: November 1 through March 31
Pallid bat <i>Antrozous pallidus</i>	CDFW	-/SSC	Throughout California except for elevations greater than 3,000 m in the Sierra Nevada	Roosts in rock crevices, cavities in live or dead trees hollows, mines, caves, and a variety of vacant and occupied buildings; feeds in a variety of open woodland habitats and most frequently in riparian zone, in open oak savannah, and open mixed deciduous forest.	<b>Moderate:</b> Buildings and trees with cavities may provide roosting habitat (Appendix D, Bat Habitat Assessment). Upland foraging habitat is present within PA 1.  The only CNDDDB occurrence near PA 1 is about ten miles south from 1924 (CDFW 2025a). The species was not documented acoustically at the closest grid cell to PA 1, located about 8 miles northeast (Conservation Biology Institute and USFS 2025).	Maternity season: May 1 through August 31  Torpor season: November 1 through March 31

Notes: CDFW = California Department Fish and Wildlife; CNDDDB = California Natural Diversity Database; ppt = parts per thousand; USFWS = U.S. Fish and Wildlife Service

<sup>a</sup> Status codes:

Federal

FE Listed as endangered under the federal Endangered Species Act  
 FT Listed as threatened under the federal Endangered Species Act  
 FC Federal candidate species  
 FPT Federally proposed for listing as threatened  
 BGECP Protected under the Bald and Golden Eagle Protection Act  
 MBTA Protected under the Migratory Bird Treaty Act

State

SE Listed as Endangered under the California Endangered Species Act  
 ST Listed as Threatened under the California Endangered Species Act  
 SSC CDFW Species of Special Concern  
 SFP State Fully Protected  
 - No state status

<sup>b</sup> Sensitive life history timing was identified for species with a moderate to high potential to occur within the Planning Area.

## 4 REFERENCES

Allen, M. B., R. O. Engle, J. S. Zendt, F. C. Shrier, J. T. Wilson, and P. J. Connolly. 2016. Salmon and steelhead in the White Salmon River after the removal of condit dam-planning efforts and recolonization results. *Fisheries* 41: 190–203.

Anderson, C. 2020. Results of Freshwater Creek Salmonid Life Cycle Monitoring Station 2019–2020. Scientific Report Prepared in Partial Fulfillment of Fisheries Restoration Grant Project No: P1610508. Prepared by Anderson and Humboldt State University, Department of Fisheries Biology, Arcata, California for California Department of Fish and Wildlife, Sacramento, California.

Anderson, C. 2023a. Recent longfin smelt captures Northern California. Unpublished data.

Anderson, C. 2023b. Recent eulachon captures Northern California. Unpublished data.

Barnhart, R. A. 1991. Steelhead (*Oncorhynchus mykiss*). Pages 324–336 in J. Stolz and J. Schnell, editors. Trout. Stackpole Books, Harrisburg, Pennsylvania.

Beck, M. W., K. L. Heck, K. W. Able, D. L. Childers, D. B. Eggleston, B. M. Gillanders, B. Haplern, C. G. Hays, K. Hoshino, T. J. Minello, R. J. Orth, P. F. Sheridan, m. P. Weinstein. 2001. The identification, conservation, and management of estuarine and marine nurseries for fish and invertebrates: a better understanding of the habitats that serve as nurseries for marine species and the factors that create site-specific variability in nursery quality will improve conservation and management of these areas. *Bioscience* 51: 633–641.

Bond, M. H. 2006. Importance of estuarine rearing to Central California steelhead (*Oncorhynchus mykiss*) growth and marine survival. Master's thesis. University of California, Santa Cruz, California.

Bond, M. H., S. A. Hayes, C. V. Hanson, and R. B. MacFarlane. 2008. Marine survival of steelhead (*Oncorhynchus mykiss*) enhanced by a seasonally closed estuary. *Canadian Journal of Fisheries and Aquatic Sciences* 65: 2,242–2,252.

Bottom, D. L., K. K. Jones, T. J. Cornwell, A. Gray, and C. A., Simenstad. 2005. Patterns of Chinook salmon migration and residency in the Salmon River Estuary (Oregon). *Estuarine Coastal and Shelf Science* 64: 79–93.

Bourret, S. L., C. C. Caudill, and M. L. Keefer. 2016. Diversity of juvenile Chinook salmon life history pathways. *Reviews in Fish Biology and Fisheries* 26: 375–403.  
Calflora. 2025. Calflora. Website. <https://www.calflora.org/> [Accessed December 2024–January 2025]. Prepared by Calflora, Berkeley, California.

Cal-IPC (California Invasive Plant Council). 2025. The Cal-IPC inventory. <https://www.cal-ipc.org/>

California Trout, Stillwater Sciences, and Northern Hydrology and Engineering. 2019. Elk River Recovery Assessment: Recovery Framework. Prepared by California Trout, Arcata, California;

Stillwater Sciences, Arcata, California; and Northern Hydrology and Engineering, McKinleyville, California for North Coast Regional Water Quality Control Board, Santa Rosa, California.

California Trout, Stillwater Sciences, Northern Hydrology & Engineering, and GHD. 2022. Elk River Watershed Stewardship Program: Sediment Remediation and Habitat Rehabilitation Recovery Plan. Prepared by California Trout, Arcata, California; Stillwater Sciences, Arcata, California; Northern Hydrology & Engineering, McKinleyville, California; and GHD, Eureka California, for the North Coast Regional Water Quality Control Board, Santa Rosa, California.

California Trout, Northern Hydrology and Engineering, and Stillwater Sciences. 2023. Elk River Planning Area 1 10% Design Report. Draft. Prepared by California Trout, Arcata, California; Northern Hydrology and Engineering, McKinleyville, California; and Stillwater Sciences, Arcata, California.

California Trout, Northern Hydrology and Engineering, Stillwater Sciences, and GHD. 2025. Elk River Planning Area 1 Project Description. Draft. Prepared by California Trout, Arcata, California; Northern Hydrology and Engineering, McKinleyville, California; Stillwater Sciences, Arcata, California; and GHD, Eureka, California.

CCH (Consortium of California Herbaria). 2024. Specimen data from CCH contributing herbaria. Website. <https://www.calflora.org/> [Accessed December 2024].

CDFW (California Department of Fish and Wildlife). 2018. Protocols for surveying and evaluating impacts to special-status native plant populations and sensitive natural communities.

CDFW. 2025a. California Natural Diversity Database (CNDDB), Version 5.3.0. Website. <https://map.dfg.ca.gov/rarefind/view/RareFind.aspx> [Accessed December 2024–January 2025]. Prepared by California Department of Fish and Wildlife, Sacramento, California.

CDFW. 2025b. CNDDB QuickView Tool. Biogeographic Information and Observation System (BIOS) (Version 6.24.071). California Department of Fish and Wildlife. Available at: <https://wildlife.ca.gov/Data/BIOS>.

CDFW. 2025c. Special Vascular Plants, Bryophytes, and Lichens List. California Department of Fish and Wildlife. Sacramento, CA.

CDFW. 2025d. California Sensitive Natural Communities List. Prepared by CDFW, Vegetation Classification and Mapping Program, Sacramento, California. Available at: <https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=153398&inlinehttps://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=153398&inline>.

CDFW. 2025e. Spotted owl observations database. Website. <https://apps.wildlife.ca.gov/bios6/?bookmark=327>. [Accessed January 2025].

Chamberlain, C. D. 2006. Environmental variables of northern California lagoons and estuaries and the distribution of tidewater goby (*Eucyclogobius newberryi*). Draft technical report No. TR 2006-04. U. S. Fish and Wildlife Service, Arcata Fish and Wildlife Office, Arcata, California.

CNPS (California Native Plant Society). 2025a. A manual of California vegetation, online edition. Website. <http://www.cnps.org/cnps/vegetation/> [Accessed December 2024–January 2025]. Prepared by CNPS, Sacramento, California.

CNPS. 2025b. Inventory of Rare and Endangered Plants of California (online edition, v9.5). <https://www.rareplants.cnps.org> [Accessed December 2024–January 2025]. Prepared by CNPS, Sacramento, California.

Conservation Biology Institute and USFS (U.S. Department of Agriculture Forest Service). 2025. Bat Acoustic Monitoring Visualization Tool. <https://visualize.batamp.databasin.org/> [Accessed January 2025].

eBird. 2025. eBird: An online database of bird distribution and abundance. Website. <http://www.ebird.org>. [Accessed: December 2024]. eBird, Cornell Lab of Ornithology, Ithaca, New York.

FGDC (Federal Geographic Data Committee). 2008. National Vegetation Classification Standard, Version 2. FGDC-STD-005-2008, Federal Geographic Data Committee, FGDC Secretariat, U.S. Geological Survey, Reston, Virginia. Available: [http://www.fgdc.gov/standards/standards\\_publications/index.htm](http://www.fgdc.gov/standards/standards_publications/index.htm)

Flitcroft, R. L., S. L. Lewis, I. Arismendi, R. LovellFord, M. V. Santelmann, M. Safeeq, and G. Grant. 2016. Linking hydroclimate to fish phenology and habitat use with ichthyographs. PLoS ONE 11: e0168831. doi:10.1371/journal.pone.0168831.

Garwood. R. S., 2017. Historic and contemporary distribution of Longfin Smelt (*Spirinchus thaleichthys*) along the California coast. California Fish and Game 103: 96–117.

Hayes, S. A., M. H. Bond, C. V. Hanson, E. V. Freund, J. J. Smith, E. C. Anderson, A. J. Ammann, and R. B. MacFarlane. 2008. Steelhead growth in a small central California watershed: upstream and estuarine rearing patterns. Transactions of the American Fisheries Society 137: 114–128.

HBWAC (Humboldt Bay Watershed Advisory Committee). 2005. Humboldt Bay Watershed Salmon and Steelhead Conservation Plan. Available at: <http://www.nrscaa.org/nrs/projcurr/pdfs/EnhancePlanComplete.pdf>.

Healey M. C. 1982. Catch, escapement and stock-recruitment for British Columbia Chinook salmon since 1951. Can Tech Rep Fish Aquat Sci 1107: 1–77

Healey, M. C. 1991. Life history of Chinook salmon (*Oncorhynchus tshawytscha*). Pages 311–393 in C. Groot and L. Margolis, editors. Pacific salmon life histories. University of British Columbia Press, Vancouver, British Columbia.

Hering, D. K., D. L. Bottom, E. F. Prentice, K. K. Jones, and I. A. Fleming. 2010. Tidal movements and residency of subyearling Chinook salmon (*Oncorhynchus tshawytscha*) in an Oregon salt marsh channel. Canadian Journal of Fisheries and Aquatic Sciences 67: 524–533.

Humboldt County Resource Conservation District. 2024. Salt River Ecosystem Restoration Project habitat mitigation and monitoring plan: monitoring report 2023. Prepared by Humboldt County Resource Conservation District, Eureka, California.

Jepson Flora Project, editors. 2025. Jepson eFlora. Available at: <http://ucjeps.berkeley.edu/eflora/>.

Jennings, M. D., D. Faber-Langendoen, R. K. Peet, O. L. Loucks, D. C. Glenn-Lewin, A. Damman, M. G. Barbour, R. Pfister, D. H. Grossman, D. Roberts, D. Tart, M. Walker, S. S. Talbot, J. Walker, G. S. Hartshorn, G. Waggoner, M. D. Abrams, A. Hill, and M. Rejmanek. 2006. Description, documentation, and evaluation of associations and alliances within the U.S. National Vegetation Classification, Version 4.5. Vegetation Classification Panel, The Ecological Society of America, Washington, D.C.

Jones, K. K., T. J. Cornwell, D. L. Bottom, L. A. Campbell, and S. Stein. 2014. The contribution of estuary-resident life histories to the return of adult *Onchorynchus kisutch*. *Journal of Fish Biology* 85: 52–80.

Koski, K. V. 2009. The fate of coho salmon nomads: the story of an estuarine-rearing strategy promoting resilience. *Ecology and Society* 14: 4.

Lafferty, K. D., C. C. Swift, and R. F. Ambrose. 1999a. Extirpation and decolonization in a metapopulation of an endangered fish, the tidewater goby. *Conservation Biology* 13: 1,447–1,453.

Lafferty, K. D., C. C. Swift, and R. F. Ambrose. 1999b. Postflood persistence and recolonization of endangered tidewater goby populations. *North American Journal of Fisheries Management* 19: 618–622.

Levy, D. A., T. G. Northcote, and G. J. Birch. 1979. Juvenile salmon utilization of tidal channels in the Fraser River estuary, British Columbia. West-water Res. Cent. Univ. Br. Col. Tech. Rep. 23.

Miller, B. A., and S. Sadro. 2003. Residence time and seasonal movements of juvenile coho salmon in the ecotone and lower estuary of Winchester Creek, South Slough, Oregon. *Transactions of the American Fisheries Society* 132: 546–559.

Moyle, P. B. 2002. *Inland Fishes of California*. University of California Press, Berkeley.

Moyle, P. B., R. M. Quiñones, J. V. Katz and J. Weaver. 2015. *Fish Species of Special Concern in California*. Sacramento: California Department of Fish and Wildlife.

NAIP (National Agriculture Imagery Program). 2024. Humboldt County NAIP imagery. USDA Farm Production and Conservation Business Center (FPAC-BC) Geospatial Enterprise Operations (GEO) Branch.

Natural Resources Services. 2022. Martin Slough Enhancement Project 2021 Monitoring Report March 2022 Prepared by Natural Resources Services, a division of Redwood Community Action Agency, Eureka, California.

NatureServe. 2025. Definitions of NatureServe Conservation Status Ranks. Website. [https://help.natureserve.org/biotics/content/record\\_management/Element\\_Files/Element\\_Tracking/ETRACK\\_Definitions\\_of\\_Heritage\\_Conservation\\_Status\\_Ranks.htm#National](https://help.natureserve.org/biotics/content/record_management/Element_Files/Element_Tracking/ETRACK_Definitions_of_Heritage_Conservation_Status_Ranks.htm#National) [Accessed April 2025].

NMFS (National Marine Fisheries Service). 2014. Final Recovery Plan for the Southern Oregon/Northern California Coast Evolutionarily Significant Unit of Coho Salmon (*Oncorhynchus kisutch*). National Marine Fisheries Service. Arcata, California.

NMFS. 2016. Coastal Multispecies Final Recovery Plan: California Coastal Chinook Salmon ESU, Northern California Steelhead DPS and Central California Coast Steelhead DPS. West Coast Region, Santa Rosa, California. October.

NMFS. 2022. California Species List Tools database. Available at:  
<https://www.fisheries.noaa.gov/resource/map/protected-resources-app>.

Office of Coastal Management. 2020. Aerial photography (1.5-inch pixel) orthorectified aerial photography. Collected on July 24, 2019. Prepared for the City of Eureka.

Otto, R. G. 1971. Effects of salinity on the survival and growth of pre-smolt coho salmon (*Oncorhynchus kisutch*). Journal of the Fisheries Research Board of Canada 28: 343–349.

PFMC (Pacific Fishery Management Council). 2008. Pacific Coast Groundfish Fishery Management Plan for the California, Oregon, and Washington Groundfish Fishery as Amended Through Amendment 19.

Reimers, P. E. 1971. The length of residence of juvenile fall Chinook salmon in Sixes River, Oregon. Doctoral dissertation. Oregon State University, Corvallis.

Ricker, S. J., D. Ward, and C. W. Anderson. 2014. Results of Freshwater Creek Salmonid Life Cycle Monitoring Station 2010–2013. California Department of Fish and Game, Anadromous Fisheries Resource Assessment and Monitoring Program, 50 Ericson Ct., Arcata, CA 95521.

Rosenfield, J. A. 2010. Life history conceptual model and sub-models for longfin smelt, San Francisco Estuary Population. Prepared for Delta Regional Ecosystem Restoration Implementation Plan.

Shapovalov, L., and A. C. Taft. 1954. The life histories of the steelhead rainbow trout (*Salmo gairdneri gairdneri*) and silver salmon (*Oncorhynchus kisutch*) with special reference to Waddell Creek, California, and recommendations regarding their management. Fisheries Bulletin No. 98. Prepared by California Department of Fish and Game, Sacramento, California.

Shuford, W. D., and T. Gardali, editors. 2008. California bird species of special concern: A ranked assessment of species, subspecies, and distinct populations of birds of immediate conservation concern in California. Studies of Western Birds 1. Western Field Ornithologists, Camarillo, California, and California Department of Fish and Game, Sacramento.

Stillwater Sciences. 2006. Guidelines to evaluate, modify, and develop estuarine restoration projects for tidewater goby habitat. Prepared by Stillwater Sciences, Arcata, California for US Fish and Wildlife Service, Arcata, California.

Stillwater Sciences. 2016. Pacific lamprey in Humboldt Bay tributaries: a summary of information and identification of research needs. Prepared by Stillwater Sciences, Arcata, California for Wiyot Tribe, Loleta, California.

Stillwater Sciences. 2025a. Preliminary Aquatic Resources Delineation Report for the Elk River Estuary (Planning Area 1) Restoration Project. Prepared by Stillwater Sciences, Arcata, California.

Stillwater Sciences. 2025b. Elk River Estuary (Planning Area 1) Restoration Project: Invasive Plant Management Plan. Prepared by Stillwater Sciences, Arcata, California.

Swift, C. C., J. L. Nelson, C. Maslow, and T. Stein. 1989. Biology and distribution of the tidewater goby, *Eucyclogobius newberri* (Pisces: Gobiidae) of California. *Contributions in Science* 404: 1–19.

Tetra Tech, Inc. 2000. Final report intensive habitat survey for Lake Earl and Lake Talawa, Del Norte County, California. Prepared by Tetra Tech, Inc., San Francisco, California for US Army Corps of Engineers, San Francisco District, San Francisco, California.

Tschaplinski, P. J. 1987. The use of estuaries as rearing habitats by juvenile coho salmon. Pages 123–142 in T. W. Chamberlain, editor. *Proceedings of the workshop: applying 15 years of Carnation Creek results*. Department of Fisheries and Oceans Canada, Pacific Biological Station, Nanaimo, British Columbia, Canada.

University of California, Berkeley. 2025. CalPhotos: plants. Biodiversity Sciences Technology Group (BSCIT), University of California, Berkeley, California. Available at: <http://calphotos.berkeley.edu/flora/>

USFWS (U.S. Fish and Wildlife Service). 1996. Guidelines for conducting and reporting botanical inventories for federally listed, proposed and candidate plants.

USFWS. 2025. Information for Planning and Consultation (IPaC): online project planning tool. <https://ecos.fws.gov/ipac/> [Accessed December 2024].

Wallace, M., and S. Allan. 2009. Juvenile Salmonid Use of the Tidal Portions of Selected Tributaries to Humboldt Bay, California, 2007-2009. Prepared by Michael Wallace, Natural Stocks Assessment Project, California Department of Fish and Game and Stan Allen, Pacific States Marine Fisheries Commission.

Wallace, M., S. Ricker, J. Garwood, A. Frimodig, and S. Allen. 2015. Importance of the stream-estuary ecotone to juvenile Coho Salmon (*Oncorhynchus kisutch*) in Humboldt Bay, California. *California Fish and Game* 101: 241–266.

Wallace, M., E. Ojerholm, A. Scheiff, and S. Allen. 2018. Juvenile salmonid use and restoration assessment of the tidal portions of selected tributaries to Humboldt Bay, California, 2015–2017. Fisheries Restoration Grant Program Final Report for Grant P1310520. Available at: <https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=159379>

Western Monarch and Milkweed Occurrence Database. 2025. Data accessed from the Western Monarch Milkweed Mapper. Website. [www.monarchmilkweedmapper.org](http://www.monarchmilkweedmapper.org) [Accessed January 2025]. Prepared by the Xerces Society, U.S. Fish and Wildlife Service, Idaho Department of Fish and Game, and Washington Department of Fish and Wildlife.

---

## **Appendices**

---

---

## **Appendix A**

### **Database Query Results for Special-status Species and Sensitive Natural Communities Previously Documented in the Project Vicinity**

---

**Table A-1.** Database query results for special-status plant species documented within the Project vicinity.

Scientific name (Common name)	Family	Lifeform	Status (Federal, State, CRPR) <sup>1</sup>	Habitat association, elevation range, and blooming period <sup>2</sup>	Pre-field assessment of potential to occur
<i>Angelica lucida</i> (sea-watch) <sup>3</sup>	Apiaceae	perennial herb	-/-/4.2	Coastal bluff scrub, coastal dunes, coastal scrub, coastal salt marshes and swamps; 0–490 ft. Blooming period: May–September	<b>High:</b> the species’ known distribution, elevation range, and required habitat overlap with PA 1 and populations were documented within one mile of PA 1.
<i>Astragalus pycnostachyus</i> var. <i>pycnostachyus</i> (coastal marsh milk- vetch)	Fabaceae	perennial herb	-/-/1B.2	Mesic coastal dunes, coastal scrub, and coastal salt and streamside marshes and swamps; 0–100 ft. Blooming period: (April) June–October	<b>Low:</b> suitable habitat is present within PA 1; however, the two occurrences within the Project vicinity are both over 100 years old (CDFW 2025a).
<i>Cardamine angulata</i> (seaside bittercress)	Brassicaceae	perennial herb	-/-/2B.2	Wet areas and streambanks in Lower montane coniferous forest, and North Coast coniferous forest; 80–3,000 ft. Blooming period: (January) March–July	<b>Low:</b> suitable habitat is present within PA 1; however, the nearest occurrence is from 1964 (CDFW 2025a).
<i>Carex arcta</i> (northern clustered sedge)	Cyperaceae	perennial herb	-/-/2B.2	Bogs and fens, and North Coast coniferous forest (mesic); 195–4595 ft. Blooming period: June–September	<b>Low:</b> suitable habitat is present within PA 1; however, PA 1 is slightly under the species’ elevation range. The nearest occurrence is over fifteen miles away in 2007 (CDFW 2025a).
<i>Carex leptalea</i> (bristle-stalked sedge)	Cyperaceae	perennial rhizomatous herb	-/-/2B.2	Bogs and fens, mesic meadows and seeps, and marshes and swamps; 0–2,295 ft. Blooming period: March–July	<b>Low:</b> suitable habitat is present within PA 1; however, nearest occurrence is known from a 1926 Tracy collection occurring in a mossy bog along a north slope (CDFW 2025a).
<i>Carex lyngbyei</i> (Lyngbye’s sedge) <sup>3</sup>	Cyperaceae	perennial rhizomatous herb	-/-/2B.2	Brackish or freshwater marshes and swamps; 0–35 ft. Blooming period: April–August	<b>High:</b> the species’ known distribution, elevation range, and required habitat overlap with PA 1 and populations were documented within PA 1 (CDFW 2025a).

Scientific name (Common name)	Family	Lifeform	Status (Federal, State, CRPR) <sup>1</sup>	Habitat association, elevation range, and blooming period <sup>2</sup>	Pre-field assessment of potential to occur
<i>Carex praticola</i> (northern meadow sedge)	Cyperaceae	perennial herb	-/-/2B.2	Mesic meadows and seeps; 0–10,500 ft. Blooming period: May–July	<b>Low:</b> suitable habitat is present within PA 1; however, the nearest documented occurrence within 10 miles of PA 1 is known from a 1914 and 1915 Tracy collection attributed to the Ryan Slough region (CDFW 2025a).
<i>Castilleja ambigua</i> var. <i>humboldtensis</i> (Humboldt Bay owl's- clover) <sup>3</sup>	Orobanchaceae	annual herb (hemiparasit ic)	-/-/1B.2	Coastal salt marshes and swamps; 0–10 ft. Blooming period: April–August	<b>High:</b> the species' known distribution, elevation range, and required habitat overlap with PA 1 and populations were documented within PA 1 (CDFW 2025a).
<i>Chloropyron maritimum</i> subsp. <i>palustre</i> (Point Reyes bird's-beak) <sup>3</sup>	Orobanchaceae	annual herb (hemiparasit ic)	-/-/1B.2	Coastal salt marshes and swamps; 0–35 ft. Blooming period: June–October	<b>High:</b> suitable habitat is present within PA 1 and an occurrence was documented just downstream (0.25 mi) of PA 1 in 2024 (Stillwater Sciences, field obs., 2024).
<i>Chrysosplenium glechomifolium</i> (Pacific golden saxifrage) <sup>3</sup>	Saxifragaceae	perennial herb	-/-/4.3	Streambanks, sometimes seeps, sometimes roadsides in North Coast coniferous forest and riparian forest; 30–2,100 ft. Blooming period: February–June (July)	<b>High:</b> the species' known distribution, elevation range, and required habitat overlap with PA 1 and populations were observed within one-mile of PA 1 (Stillwater Sciences, field obs., 2023).
<i>Eleocharis parvula</i> (small spikerush)	Cyperaceae	perennial herb	-/-/4.3	Marshes and swamps; 5–9,910 ft. Blooming period: (April)June-August (September)	<b>Low:</b> suitable habitat is present within PA 1; however, few occurrences within ten miles of PA 1. The most recent occurrence is from 2019 within the Arcata South quadrangle (CalFlora 2025).
<i>Fissidens pauperculus</i> (minute pocket moss)	Fissidentaceae	moss	-/-/1B.2	North Coast coniferous forest (damp coastal soil); 30–3,360 ft. Blooming period: N/A	<b>Low:</b> the species' known distribution and elevation range overlaps with PA 1 and the species' required habitat is of very low quality or quantity.

Scientific name (Common name)	Family	Lifeform	Status (Federal, State, CRPR) <sup>1</sup>	Habitat association, elevation range, and blooming period <sup>2</sup>	Pre-field assessment of potential to occur
<i>Gilia capitata</i> subsp. <i>pacifica</i> (Pacific gilia)	Polemoniaceae	annual herb	-/-/1B.2	Coastal bluff scrub, chaparral (openings), coastal prairie, valley and foothill grassland; 15–5,465 ft. Blooming period: April–August	<b>Low:</b> suitable habitat is of low quantity and quality within PA 1. The only documented occurrence within 10 miles of PA 1 is known from a 1905 Tracy collection located in a sandy field near Bucksport (Eureka) (CDFW 2025a).
<i>Hosackia gracilis</i> (harlequin lotus)	Fabaceae	perennial rhizomatous herb	-/-/4.2	Generally in mesic areas of Broadleafed upland forest, mixed coniferous forest, Cismontane woodland, Closed-cone coniferous forest, Coastal bluff scrub, Coastal prairie, Coastal scrub, Marshes and swamps, Meadows and seeps, North Coast coniferous forest, Valley and foothill grassland. Sometimes on roadsides; 0–2,295 ft. Blooming period: March–July	<b>Low:</b> suitable habitat is of low quantity and quality within PA 1. The nearest occurrence within the last decade is about seven miles PA 1 in Table Bluff (CDFW 2025a).
<i>Lasthenia californica</i> subsp. <i>macrantha</i> (perennial goldfields)	Asteraceae	perennial herb	-/-/1B.2	Coastal bluff scrub, coastal dunes, and coastal scrub; 15–1,705 ft. Blooming period: January–November	<b>Low:</b> suitable habitat is of low quantity and quality within PA 1. The only known occurrence within 10 miles of PA 1 is known from 1913 Hutchinson collection in the Eureka area (CDFW 2025a).
<i>Lathyrus palustris</i> (marsh pea)	Fabaceae	perennial herb	-/-/2B.2	Mesic in bogs and fens, coastal prairie, coastal scrub, lower montane coniferous forest, marshes and swamps, and North Coast coniferous forest; 0–330 ft. Blooming period: March–August	<b>Moderate:</b> suitable habitat is present and a single occurrence near PA 1 was documented in a marsh north of Elk River Slough in 2003 (CDFW 2025a).

Scientific name (Common name)	Family	Lifeform	Status (Federal, State, CRPR) <sup>1</sup>	Habitat association, elevation range, and blooming period <sup>2</sup>	Pre-field assessment of potential to occur
<i>Lilium occidentale</i> (western lily)	Liliaceae	perennial bulbiferous herb	FE/SE/1B. 1	Bogs and fens, coastal bluff scrub, coastal prairie, coastal scrub, marshes and swamps (freshwater), and North Coast coniferous forest (openings); 5–605 ft. Blooming period: June–July	<b>Low:</b> nearby occurrences are under CDFW management in the Table Bluff Ecological Reserve and are not known to occur within PA 1.
<i>Mitellastrum caulescens</i> (leafy-stemmed mitrewort)	Saxifragaceae	perennial rhizomatous herb	–/–/4.2	Mesic, sometimes roadsides in broadleaved upland forest, lower montane coniferous forest, meadows and seeps, and North Coast coniferous forest; 15–5,575 ft. Blooming period: (March) April–October	<b>Low:</b> the species’ known distribution and elevation range overlaps with PA 1 and the species’ required habitat is of very low quality or quantity within PA 1. The most recent occurrence is from 2021 in the Arcata Community Forest (CalFlora 2025).
<i>Monotropa uniflora</i> (ghost-pipe)	Ericaceae	perennial herb (achlorophyl lous)	–/–/2B.2	Broadleaved upland forest and North Coast coniferous forest; 30–1,805 ft. Blooming period: June–August (September)	<b>Low:</b> the species’ known distribution and elevation range overlaps with PA 1 the species’ required habitat is of very low quality or quantity.
<i>Montia howellii</i> (Howell's montia)	Montiaceae	annual herb	–/–/2B.2	Vernally mesic, sometimes roadsides in meadows and seeps, North Coast coniferous forest, and vernal pools; 0–2,740 ft. Blooming period: (January–February) March–May	<b>Low:</b> the species’ known distribution and elevation range overlaps with PA 1 and the species’ required habitat is of very low quality or quantity.
<i>Packera bolanderi</i> var. <i>bolanderi</i> (seacoast ragwort)	Asteraceae	perennial rhizomatous herb	–/–/2B.2	Sometimes roadsides in coastal scrub, and North Coast coniferous forest; 95–2,135 ft. Blooming period: (January–April) May–July (August)	<b>Low:</b> the species’ known distribution and elevation range overlaps with PA 1 and the species’ required habitat is of very low quality or quantity.

Scientific name (Common name)	Family	Lifeform	Status (Federal, State, CRPR) <sup>1</sup>	Habitat association, elevation range, and blooming period <sup>2</sup>	Pre-field assessment of potential to occur
<i>Pityopus californicus</i> (California pinefoot)	Ericaceae	perennial herb (achlorophyl- lous)	-/-/4.2	Mesic areas in broadleafed upland forest, lower montane coniferous forest, North Coast coniferous forest, and upper montane coniferous forest; 45–7,300 ft. Blooming period: (March–April) May–August	<b>Low:</b> the species’ known distribution and elevation range overlaps with PA 1 and the species’ required habitat is of very low quality or quantity.
<i>Pleuropogon refractus</i> (nodding semaphore grass)	Poaceae	perennial rhizomatous herb	-/-/4.2	Mesic areas in lower montane coniferous forest, meadows and seeps, North Coast coniferous forest, and riparian forest; 0–5,250 ft. Blooming period: (March) April–August	<b>Low:</b> the species’ known distribution and elevation range overlaps with PA 1 and the species’ required habitat is of very low quality or quantity.
<i>Polemonium carneum</i> (Oregon polemonium)	Polemoniaceae	perennial herb	-/-/2B.2	Coastal prairie, coastal scrub, and lower montane coniferous forest; 0–6,005 ft. Blooming period: April–September	<b>Low:</b> the species’ known distribution and elevation range overlaps with PA 1 and the species’ required habitat is of very low quality or quantity.
<i>Puccinellia pumila</i> (dwarf alkali grass)	Poaceae	perennial herb	-/-/2B.2	Coastal salt marshes and swamps; 0–35 ft. Blooming period: July	<b>Low:</b> suitable habitat is present within PA 1 however only known occurrence within 10-miles of PA 1 is from a 1938 Tracy collection near the Eel River mouth (CDFW 2025a).
<i>Ribes laxiflorum</i> (trailing black currant)	Grossulariaceae	perennial deciduous shrub	-/-/4.3	North Coast coniferous forest (sometimes roadsides); 15–4,575 ft. Blooming period: March–July (August)	<b>Low:</b> the species’ known distribution and elevation range overlaps with PA 1 and the species’ required habitat is of very low quality or quantity.

Scientific name (Common name)	Family	Lifeform	Status (Federal, State, CRPR) <sup>1</sup>	Habitat association, elevation range, and blooming period <sup>2</sup>	Pre-field assessment of potential to occur
<i>Sidalcea malachroides</i> (maple-leaved checkerbloom)	Malvaceae	perennial herb	-/-/4.2	Often in disturbed areas in broadleaved upland forest, coastal prairie, coastal scrub, North Coast coniferous forest, and riparian woodland; 0–2395 ft. Blooming period: (March) April–August	<b>Moderate:</b> the species' known distribution and elevation range overlaps with PA 1 and the species' required habitat is present within PA 1. The nearest occurrence (2001) is within two miles of PA 1 in a mesic redwood forest (CDFW 2025a).
<i>Sidalcea malviflora</i> subsp. <i>patula</i> (Siskiyou checkerbloom)	Malvaceae	perennial rhizomatous herb	-/-/1B.2	Often roadcuts in coastal bluff scrub, coastal prairie, and North Coast coniferous forest; 45–2,885 ft. Blooming period: (April) May–August	<b>Low:</b> suitable habitat is present within PA 1; however, known occurrences within 10- miles of PA 1 are from pre-1950 Tracy collections in Eureka and Table Bluff (CDFW 2025a).
<i>Sidalcea oregana</i> subsp. <i>eximia</i> (coast checkerbloom)	Malvaceae	perennial herb	-/-/1B.2	Lower montane coniferous forest, meadows and seeps, and North Coast coniferous forest; 15–4,395 ft. Blooming period: June–August	<b>Moderate:</b> suitable habitat is present within PA 1. A single occurrence within PA 1 was documented from a 1907 Tracy collection along a ditch in the Elk River (CDFW 2025a).
<i>Silene scouleri</i> subsp. <i>scouleri</i> (Scouler's catchfly)	Caryophyllaceae	perennial herb	-/-/2B.2	Coastal bluff scrub, coastal prairie, and valley and foothill grassland; 0–1,970 ft. Blooming period: (March–May) June– August (September)	<b>Low:</b> suitable habitat is present within PA 1 however, known occurrences within 10- miles of PA 1 are from a 1904 Tracy Collection near Bucksport (Eureka) (CDFW 2025a).
<i>Spergularia canadensis</i> var. <i>occidentalis</i> (western sand-spurrey) <sup>1</sup>	Caryophyllaceae	annual herb	-/-/2B.1	Coastal salt marshes and swamps; 0–10 ft. Blooming period: June–August	<b>High:</b> the species' known distribution, elevation range, and required habitat overlap with PA 1 and populations were documented within PA 1 during botanical surveys in 2021.

Scientific name (Common name)	Family	Lifeform	Status (Federal, State, CRPR) <sup>1</sup>	Habitat association, elevation range, and blooming period <sup>2</sup>	Pre-field assessment of potential to occur
<i>Sulcaria spiralifera</i> (twisted horsehair lichen)	Parmeliaceae	fruticose lichen (epiphytic)	-/-/1B.2	Usually on conifers in Coastal dunes (SLO Co.), North Coast coniferous forest (immediate coast); 0–295 ft. Blooming period: N/A	<b>Low:</b> the species’ known distribution and elevation range overlaps with PA 1 and the species’ required habitat is of very low quality or quantity.
<i>Viola palustris</i> (alpine marsh violet)	Violaceae	perennial rhizomatous herb	-/-/2B.2	Bogs and fens (coastal) and coastal scrub (mesic); 0–490 ft. Blooming period: March–August	<b>Low:</b> the species’ known distribution and elevation range overlaps with PA 1 and the species’ required habitat is of very low quality or quantity.

Table Source: CNPS 2025b, CDFW 2025a

<sup>1</sup> Status:

**Federal**

- None No federal status
- FE Federally Endangered

**State**

- None No state status
- SE State Endangered

**California Rare Plant Rank**

- List 1B Plants rare, threatened, or endangered in California and elsewhere
- List 2B Plants rare, threatened, or endangered in California, but more common elsewhere
- List 4 Plants of limited distribution, a watch list

**CNPS Threat Ranks:**

- 0.1 Seriously threatened in California (high degree/immediacy of threat)
- 0.2 Fairly threatened in California (moderate degree/immediacy of threat)
- 0.3 Not very threatened in California (low degree/immediacy of threats or no current threats known)

<sup>2</sup> Months within parentheses are uncommon; N/A = Not applicable (CNPS 2025b)

<sup>3</sup> Observed in PA 1 during floristic surveys conducted between 2021–2025.

**Table A-2.** Database query results for sensitive natural communities documented within the Project vicinity.

Holland type	Corresponding MCV Alliances/Associations that are sensitive natural communities	Common name	State status <sup>1</sup>	Corresponding CWHR type	Documented within PA 1?
Northern Coastal Salt Marsh	<i>Arthrocnemum subterminale</i> Herbaceous Alliance	Parish’s glasswort patches	S2	Saline emergent wetland	No
	<i>Carex obnupta</i> - <i>Oenanthe sarmentosa</i> - <i>Scirpus microcarpus</i> Herbaceous Alliance	slough sedge - water-parsley - small-fruited bulrush marsh	S3	Fresh emergent wetland, saline emergent wetland	Yes
	<i>Deschampsia cespitosa</i> - <i>Festuca rubra</i> Brackish Salt Marsh Provisional Herbaceous Alliance	tufted hairgrass - red fescue brackish salt marsh	S2	Saline emergent wetland	No
	<i>Frankenia salina</i> Herbaceous Alliance	alkali heath marsh	S3	Saline emergent wetland	No
	<i>Grindelia (stricta)</i> Provisional Herbaceous Alliance	gum plant patches	S2S3	Saline emergent wetland	Yes
	<i>Sarcocornia pacifica (Salicornia depressa)</i> Herbaceous Alliance	pickleweed mats	S3	Saline emergent wetland	Yes
	<i>Sesuvium verrucosum</i> Herbaceous Alliance	Western sea-purslane marshes	S2.2?	Saline emergent wetland	No
	<i>Spartina foliosa</i> Herbaceous Alliance	California cordgrass marsh	S3.2	Saline emergent wetland	No
Coastal Terrace Prairie	<i>Calamagrostis nutkaensis</i> Herbaceous Alliance	Pacific reed grass meadows	S2	Perennial grassland	No
	<i>Deschampsia cespitosa</i> - <i>Hordeum brachyantherum</i> - <i>Danthonia californica</i> Herbaceous Alliance	Coastal tufted hair grass - meadow barley - California oatgrass meadow	S3	Fresh emergent wetland, perennial grassland, wet meadow	Yes
	<i>Festuca idahoensis</i> - <i>Danthonia californica</i> Herbaceous Alliance	Idaho fescue - California oatgrass grassland	S3	Perennial grassland	No
Sitka Spruce Forest	<i>Abies grandis</i> Forest Alliance	Grand fir forest	S2.1	Redwood	No
	<i>Picea sitchensis</i> Forest & Woodland Alliance	Sitka spruce forest and woodland	S2	Redwood	Yes

Table Source: CDFW 2025a, CNPS 2025a

<sup>1</sup> State status: S2: Imperiled statewide – At high risk of extirpation in the state due to restricted range, few populations or occurrences, steep declines, severe threats, or other factors.  
 S3: Vulnerable statewide – At moderate risk of extirpation in the state due to a fairly restricted range, relatively few populations or occurrences, recent and widespread declines, threats, or other factors.  
 0.1: Very threatened  
 0.2: Threatened  
 ?: Inexact or uncertain numeric rank.

**Table A-3.** Database query results of special-status fish and wildlife species documented in the Project Vicinity.

Common name <i>Scientific name</i>	Query sources	Status <sup>a</sup> Federal/ State	Distribution in California	Habitat association	Likelihood to occur within Planning Area 1
<i>Invertebrates</i>					
Western bumble bee <i>Bombus occidentalis</i>	CDFW	–/SCE	Current range includes northern California and northern Sierra Nevada Mountains	<p>Forages on flowering plants in chaparral, scrub, mountain meadows, forested openings, open grassy areas, and urban parks and gardens.</p> <p>Host plant genera include, but are not limited to, <i>Ceanothus</i>, <i>Centaurea</i>, <i>Chrysothamnus</i>, <i>Cirsium</i>, <i>Eriogonum</i>, <i>Geranium</i>, <i>Grindellia</i>, <i>Lupinus</i>, <i>Melilotus</i>, <i>Monardella</i>, <i>Rubus</i>, <i>Solidago</i>, and <i>Trifolium</i>.</p> <p>Nests underground in pre-existing cavities (abandoned small mammal burrows) but can also nest above ground in thatched grass, brush piles, fallen logs, and human-made structures.</p>	<p><b>Low:</b> While foraging habitat and potential nesting sites occur within PA 1, it is located in the southern portion of the species’ current range, where observations have been sparse in the last few decades, which include 3.7 miles from PA 1 in 1993, 1.4 miles in 1976, and 26 miles in 2015 (CDFW 2025a).</p>
Monarch butterfly (California overwintering population) <i>Danaus plexippus plexippus</i>	USFWS	FC/–	Range includes most of California; it breeds throughout California and overwinters in suitable groves along the California coast	<p>Adults forage on a variety of flowering plants during breeding and migration; larva (caterpillars) require milkweed (<i>Asclepias</i> spp.) as a host plant. Overwinter roosts include eucalyptus (<i>Eucalyptus</i> sp.), Monterey pines (<i>Pinus radiata</i>), and Monterey cypress (<i>Hesperocyparis macrocarpa</i>) trees or groves.</p>	<p><b>Moderate (foraging only):</b> See Section 3.4.</p>

Common name <i>Scientific name</i>	Query sources	Status <sup>a</sup> Federal/ State	Distribution in California	Habitat association	Likelihood to occur within Planning Area 1
<i>Fish</i>					
Pacific lamprey <i>Entosphenus tridentatus</i>	CDFW	-/SSC	Most coastal flowing watersheds between Mexico and Oregon.	<p>Anadromous species that spawns and rears in freshwater before emigrating to the ocean to feed and grow. Generally distributed wherever salmon and steelhead occur.</p> <p>Adult spawning: coarse gravel or small cobble in pool tails or low-gradient riffles.</p> <p>Larval rearing: Mostly freshwater (below 12 parts per thousand [ppt] salinity) and low-velocity areas where they burrow into fine silt and sand substrates that often contain organic matter. Water temperatures less than approximately 22°C.</p>	<b>High:</b> See Section 3.4.
Western brook lamprey <i>Lampetra richardsoni</i>	CDFW	-/SSC	Coastal and Central Valley rivers and streams	Non-migratory species that remains in fresh water for its entire life cycle. Spawns in small gravel substrates in cool water streams; requires habitats with low water velocity and fine sediment for ammocoete rearing.	<b>Moderate:</b> See Section 3.4.

Common name <i>Scientific name</i>	Query sources	Status <sup>a</sup> Federal/ State	Distribution in California	Habitat association	Likelihood to occur within Planning Area 1
<p>Green sturgeon – southern distinct population segment (DPS) <i>Acipenser medirostris pop. 1</i></p>	<p>CDFW/NMFS</p>	<p>FT/SSC</p>	<p>Present in estuaries such as San Francisco, San Pablo, Suisun, and Humboldt bays and Sacramento-San Joaquin Delta; spawn in the Sacramento and San Joaquin rivers, including the Sacramento, Feather, and Yuba rivers</p>	<p>Spawns in large river mainstem pools with cool water and cobble, clean sand, or bedrock substrate; in San Francisco Bay adults tend to utilize water depths less than 10 m (33 ft) to swim near the surface or forage along the sea floor.</p>	<p><b>Low:</b> Subadults and adults are known to feed in the North Humboldt Bay (area of the bay north of the harbor entrance). While they are unlikely to venture into or inhabit the shallow channels within PA 1, critical habitat has been designated in the lower portion; therefore, subadults and adults may access these areas to feed. No breeding or juvenile rearing habitat is present in Humboldt Bay or tributaries, including Elk River and PA 1.</p> <p>Species has been documented throughout Humboldt Bay, less than a mile from PA 1 in 2020 (CDFW 2025a).</p> <p>Critical habitat has been designated for this species and is present in the western portion of PA 1 (i.e. Lower Elk River and Swain Slough).</p>

Common name <i>Scientific name</i>	Query sources	Status <sup>a</sup> Federal/ State	Distribution in California	Habitat association	Likelihood to occur within Planning Area 1
Longfin smelt <i>Spirinchus thaleichthys</i>	CDFW	-/ST	San Francisco estuary from Rio Vista or Medford Island in the Delta as far downstream as South Bay; concentrated in Suisun, San Pablo, and North San Francisco bays; historical populations in Humboldt Bay, Eel River estuary, and Klamath River estuary	Adults associated with nearshore coastal areas, large bays, and estuaries, and migrate into lower portions of freshwater streams and rivers to spawn over sandy/gravel substrates, rocks, and aquatic plants; juveniles and adults rear in estuarine habitats, with smolts preferring deep-water channels	<b>High:</b> See Section 3.4.
Eulachon, southern DPS <i>Thaleichthys pacificus</i>	CDFW, NMFS	FT/SSC	Skeena River in British Columbia (inclusive) south to Humboldt Bay and in smaller numbers south to Fort Brag in Northern California	An anadromous fish that generally spawns in freshwater rivers with eggs fertilized in the water column and sinking to the river bottom, typically in areas of gravel and coarse sand. Uses estuaries for migrating between the ocean and freshwater; spends approximately three years in the ocean.	<b>Moderate:</b> See Section 3.4.

Common name <i>Scientific name</i>	Query sources	Status <sup>a</sup> Federal/ State	Distribution in California	Habitat association	Likelihood to occur within Planning Area 1
Coho salmon, southern Oregon/northern California Coast Evolutionary Significant Unit (ESU) <i>Oncorhynchus kisutch</i>	NMFS, CDFW	FT/ST	Range includes Punta Gorda north to the Oregon border	<p>Low-gradient portions of coastal draining streams with sufficiently cool water temperatures.</p> <p>Adult spawning: fine to coarse gravel in pool tailouts or low-gradient riffles with nearby cover or deep pools.</p> <p>Juvenile rearing: instream pool habitats often associated with large wood or off-channel features that provide low-velocity protection from high flows and cover from predation and water temperatures less than approximately 17°C.</p>	<b>High:</b> See Section 3.4.
Chinook salmon, California Coastal ESU <i>Oncorhynchus tshawytscha</i>	NMFS	FT/-	Range includes Russian River (Sonoma County) north to Redwood Creek (Humboldt County)	<p>Coastal draining streams.</p> <p>Adult spawning: medium gravel to small cobble in pool tails or low-gradient riffles with nearby cover or deep pools.</p> <p>Juvenile rearing: fry utilize shallow stream margins and juveniles utilize pool or deep run habitats with instream cover from winter flows and predation, often associated with large cobble, boulders, or large wood in water temperatures less than approximately 19°C.</p>	<b>High:</b> See Section 3.4.

Common name <i>Scientific name</i>	Query sources	Status <sup>a</sup> Federal/ State	Distribution in California	Habitat association	Likelihood to occur within Planning Area 1
Steelhead, northern California DPS winter-run <i>Oncorhynchus mykiss irideus</i>	NMFS, CDFW	FT/-	Range includes Coastal streams from the Russian River (exclusive) north to Redwood Creek (Humboldt County)	<p>Rivers and streams with cold water, clean gravel of appropriate size for spawning, and suitable rearing habitat.</p> <p>Adult spawning: medium to coarse gravel in pool tails or low-gradient riffles with nearby cover or deep pools.</p> <p>Juvenile rearing: pool or deep run habitats with instream cover from winter flows and predation, often associated with large cobble, boulders, or large wood in water temperatures less than approximately 22°C. Juveniles typically rear in fresh water for 1 or more years before migrating to the ocean.</p>	<b>High:</b> See Section 3.4.

Common name <i>Scientific name</i>	Query sources	Status <sup>a</sup> Federal/ State	Distribution in California	Habitat association	Likelihood to occur within Planning Area 1
Steelhead, northern California DPS summer-run <i>Oncorhynchus mykiss irideus</i>	CDFW	FT/SE	Range includes portions of Redwood Creek (Humboldt County) and the Mad, Eel, and Mattole River basins	Rivers and streams with cold water, clean gravel of appropriate size for spawning, and suitable rearing habitat; juveniles typically rear in fresh water for 1 or more years before migrating to the ocean. Adults require suitable pools for holding prior to spawning and tend to spawn in smaller, higher-gradient streams than winter-run steelhead. Adults are capable of spawning upstream of partial barriers to movement, which are only passable at intermediate stream flows.	<b>None:</b> No adult habitat within the Humboldt Bay tributaries; therefore, no adults or juveniles would be present. The closest rivers where present include the Eel River 8 miles to the south and Mad River 12 miles to the north.
Coast cutthroat trout <i>Oncorhynchus clarkii clarkii</i>	CDFW	-/SSC	Small, low-gradient coastal streams and estuaries from northern Oregon to the Eel River, California	Shaded streams with water temperatures below 18°C and small gravel for spawning; have diverse life histories, including potadromous (migratory within freshwater portions of the river system), stream-resident, and anadromy, which includes rearing in freshwater and foraging in estuaries.	<b>High:</b> See Section 3.4.

Common name <i>Scientific name</i>	Query sources	Status <sup>a</sup> Federal/ State	Distribution in California	Habitat association	Likelihood to occur within Planning Area 1
Tidewater goby <i>Eucyclogobius newberryi</i>	CDFW, USFWS	FE/-	Range includes San Diego County north to the mouth of the Smith River in Del Norte County	Typically in shallow waters of coastal lagoons and the uppermost zone of brackish large estuaries; prefer sandy substrate for spawning, but can be found on silt, mud, or rocky substrates; typically in shallow water, but can occur in water up to 15 feet in lagoons and within a wide range of salinity (0–42 ppt).	<b>High:</b> See Section 3.4.
<b>Amphibians</b>					
Southern torrent salamander <i>Rhyacotriton variegatus</i>	CDFW	-/SSC	Coastal drainages from near Point Arena in Mendocino County to the Oregon border	In and adjacent to cold, permanent, well-shaded mountain springs, waterfalls, and seeps with rocky substrate in redwood, Douglas fir, mixed conifer, montane riparian and montane hardwood-conifer habitats. Elevational range extends from near sea level to about 3,940 ft.	<b>Moderate:</b> See Section 3.4.

Common name <i>Scientific name</i>	Query sources	Status <sup>a</sup> Federal/ State	Distribution in California	Habitat association	Likelihood to occur within Planning Area 1
Pacific tailed frog (also known as coastal-tailed frog) <i>Ascaphus truei</i>	CDFW	-/SSC	Coastal Mendocino County north to the Oregon border, with an isolated population in Shasta region	Occurs in montane hardwood-conifer, redwood, Douglas-fir and ponderosa pine habitats. Restricted to perennial montane streams. In and adjacent to cold, clear, moderate- to fast-flowing, perennial montane streams. Tadpoles require water below 15°C. Elevation 0–8,400 feet.	<b>Low:</b> Suitable habitat is not present within PA 1 (e.g., the substrate in Orton Creek does not provide rocky substrate). Suitable habitat is present upstream of PA 1.  CNDDB occurrences include an observation within seven miles of PA 1 in the North Fork Elk River from 2004, an occurrence about 11 miles from PA 1 in Salmon Creek from 2017, and an observation within six miles of PA 1 in Little South Fork Elk River from 1994 (CDFW 2025a).
Northern red-legged frog <i>Rana aurora</i>	CDFW	-/SSC	Ranges from Mills Creek in Mendocino County to Oregon border	Breeds in still or slow-moving water with emergent and overhanging vegetation, including wetlands, wet meadows, ponds, lakes, and low-gradient, slow moving stream reaches with permanent pools; uses adjacent uplands for dispersal and summer retreat	<b>High:</b> See Section 3.4.

Common name <i>Scientific name</i>	Query sources	Status <sup>a</sup> Federal/ State	Distribution in California	Habitat association	Likelihood to occur within Planning Area 1
Foothill yellow-legged frog, North Coast clade <i>Rana boylei</i>	CDFW	–/SSC	North of San Francisco Bay through the Coast Range and Klamath Mountains	Shallow tributaries and mainstems of perennial streams and rivers, typically associated with cobble or boulder substrate	<p><b>Low:</b> Breeding habitat is not present within PA 1; therefore, it is unlikely that individuals would be present. Suitable habitat is present upstream of PA 1.</p> <p>While there is a CNDDDB observation from 2014 in similar habitat as PA 1 (Humboldt National Wildlife Refuge, 3 miles away), the species is not typically found in estuarine habitats, but rather in upstream freshwater with cobble or boulder substrates, as noted by an occurrence in the North Fork Elk River from 2001 and multiple recent occurrences 13 miles north along the Mad River from 2018 (CDFW 2025a).</p>
Leatherback Sea Turtle <i>Dermochelys coriacea</i>	NMFS	FE/SCE	Temperate and cool waters of the Pacific coast; most sightings in California are from boats out at sea; have been observed in open ocean near San Diego, Santa Barbara, Ventura, San Mateo, and Santa Cruz counties; does not nest in California	Pelagic, though also forages near coastal waters	<p><b>None:</b> No suitable habitat is present within PA 1.</p> <p>Critical habitat has been designated for this species and is not present within PA 1.</p>

Common name <i>Scientific name</i>	Query sources	Status <sup>a</sup> Federal/ State	Distribution in California	Habitat association	Likelihood to occur within Planning Area 1
Green Sea Turtle <i>Chelonia mydas</i>	USFWS/NMFS	FT/-	Channel Islands south; does not nest in California	Uses convergence zones in the open ocean and benthic feeding grounds in coastal areas; nests on sandy ocean beaches	<b>None:</b> No suitable habitat is present within PA 1.  Critical habitat has not been designated for this species.
Olive Ridley Sea Turtle <i>Lepidochelys olivacea</i>	NMFS	FT/-	Warm waters of the Pacific coast, primarily from southern California south; does not nest in California	Well out to sea in pelagic zone as well as coastal areas, including bays and estuaries; nests on sandy ocean beaches	<b>None:</b> No suitable habitat is present within PA 1.  Critical habitat has not been designated for this species.
Northwestern pond turtle <i>Actinemys marmorata</i>	USFWS, CDFW	FPT/SSC	Range is from the Oregon border along the coast ranges to the Mexican border, and west of the crest of the Cascades and Sierras	Permanent, slow-moving fresh or brackish water with available basking sites and adjacent open habitats or forest for nesting	<b>Moderate:</b> See Section 3.4.
Numerous bird species protected under the Migratory Bird Treaty Act (MBTA)	USFWS	MBTA	Range encompasses California	Variable including, but not limited to, grasses, shrubs, and trees	<b>High:</b> See Section 3.4.

Common name <i>Scientific name</i>	Query sources	Status <sup>a</sup> Federal/ State	Distribution in California	Habitat association	Likelihood to occur within Planning Area 1
Yellow-billed cuckoo, western DPS <i>Coccyzus americanus</i>	CDFW, USFWS	FT/SE	Species breeds in limited portions of the Sacramento River and the South Fork Kern River; small populations may nest in Butte, Yuba, Sutter, San Bernardino, Riverside, Inyo, Los Angeles, and Imperial counties	Summer resident of valley foothill and desert riparian habitats; nests in open woodland with clearings and low, dense, scrubby vegetation.	<p><b>Low:</b> While suitable habitat is present within PA 1, Humboldt County is outside of the known and preferred species' range.</p> <p>Occurrences in the area are rare and yellow-billed cuckoos are not known to breed nor overwinter in the area. Two CNDDDB occurrences have been documented near PA 1—a 2010 observation on Cock Robin Island and a 2013 observation along the Salt River near Ferndale (CDFW 2025a). eBird occurrences include a 2015 observation at the Arcata Marsh, a 2015 observation at the Humboldt Bay Wildlife Sanctuary, and a 2013 observation along the north spit of Humboldt Bay (eBird 2025).</p> <p>Critical habitat has been designated for this species and is not present within PA 1.</p>
California Ridgway's rail <i>Rallus obsoletus obsoletus</i>	CDFW	FE/SE, SFP	Salt water and brackish marshes traversed by tidal sloughs in the vicinity of San Francisco Bay.	Associated with abundant growths of pickleweed, but feeds away from cover on invertebrates from mud-bottomed sloughs	<p><b>None:</b> Outside of the species' current range.</p> <p>There has been one historical occurrence four miles from PA 1 in 1932.</p>

Common name <i>Scientific name</i>	Query sources	Status <sup>a</sup> Federal/ State	Distribution in California	Habitat association	Likelihood to occur within Planning Area 1
Yellow rail <i>Coturnicops noveboracensis</i>	CDFW	-/SSC	Occurs year round in California, but in two primary seasonal roles: currently as a very local breeder in the northeastern interior and as a winter visitor (early Oct to mid-Apr) on the coast and in the Suisun Marsh region	Densely vegetated wetlands such as marshes and meadows. In summer, favors large wet meadows or shallow marshes dominated by sedges and grasses. In winter mostly in coastal salt marsh	<b>Low (overwintering only):</b> While suitable year-round habitat is present, Humboldt County is outside of the known current range.  Only two observations of this species have been during the winter months (indicating winter presence only) including one from 1987 (CDFW 2025a) and one about four miles from PA 1 in the Eureka Slough from 2013 (eBird 2025). The lack of observations may be due to the elusive habit of this species (Shuford and Gardali 2008).

Common name <i>Scientific name</i>	Query sources	Status <sup>a</sup> Federal/ State	Distribution in California	Habitat association	Likelihood to occur within Planning Area 1
Mountain plover <i>Charadrius montanus</i>	CDFW	-/SSC	Breeds in the high plains east of the Rocky Mountains from Montana to New Mexico and in western Texas and western Oklahoma south to central Mexico. Winters in central and southern California, southern Arizona, southern Texas, and northern Mexico; primary wintering areas are the Central and Imperial valleys of California.	Short grasslands, freshly plowed fields, newly sprouting grain fields, and sometimes sod farms. Areas with short vegetation, bare ground, and flat topography. Prefers grazed areas and areas with burrowing rodents.	<b>Low (overwintering only):</b> While suitable wintering habitat is present within PA 1, Humboldt County is outside of species current known and preferred range.  Two CNDDDB occurrences are documented within the vicinity of PA 1: at the Humboldt Bay south spit about 1.5 miles from PA 1 from 2017 and in the Arcata bottoms about seven miles from PA 1 from 2012 (CDFW 2025a). While there are numerous eBird occurrences (2007, 2009, 2010–2012, 2015, 2017, 2020–2023) along coastal Humboldt County, these observations are from winter months and likely represent stray migrants (eBird 2025).

Common name <i>Scientific name</i>	Query sources	Status <sup>a</sup> Federal/ State	Distribution in California	Habitat association	Likelihood to occur within Planning Area 1
Western snowy plover <i>Charadrius nivosus nivosus</i>	CDFW, USFWS	FT/SSC	Species nests in locations along the California coast, including the Eel River in Humboldt County; nests in the interior of the state in the Central Valley, Klamath Basin, Modoc Plateau, and Great Basin, Mojave, and Colorado deserts; winters primarily along coast	Barren to sparsely vegetated beaches, barrier beaches, salt- evaporation pond levees, and shores of alkali lakes; also nests on gravel bars in rivers with wide flood plains; needs sandy, gravelly, or friable soils for nesting	<b>Low (flyover only):</b> Nesting habitat (coastal dunes and beaches) is not present within PA 1.  The nearest and most recent occurrences are from coastal dunes of the north and south spits of Humboldt Bay from 2014 (CDFW 2025a).  Critical habitat has been designated for this species and occurs about 1.5 miles from PA 1 along the north spit of Humboldt Bay.
Marbled murrelet <i>Brachyramphus marmoratus</i>	CDFW, USFWS	FT/SE	Nesting birds mostly concentrated near coastal waters in Del Norte and Humboldt counties, and in lesser numbers near San Mateo and Santa Cruz counties; species winters throughout the nesting range and in small numbers in southern California	Most time spent on the ocean; nests inland in large areas of old-growth conifers with suitable platforms, especially redwood or Douglas-fir forests near coastal areas	<b>Moderate (flyover only):</b> See Section 3.4.
White-tailed kite <i>Elanus leucurus</i>	CDFW	-/SFP	Year-round resident; found in nearly all lowlands of California west of the Sierra Nevada mountains and the southeast deserts	Lowland grasslands and wetlands with open areas; nests in trees near open foraging area	<b>High.</b> See Section 3.4.

Common name <i>Scientific name</i>	Query sources	Status <sup>a</sup> Federal/ State	Distribution in California	Habitat association	Likelihood to occur within Planning Area 1
Golden eagle <i>Aquila chrysaetos</i>	USFWS	BGECP/ SFP	Species is an uncommon permanent resident and migrant throughout California, except center of Central Valley	Open woodlands and oak savannahs, grasslands, chaparral, sagebrush flats; nests on steep cliffs or medium to tall trees	<b>Moderate (flyovers and possibly foraging):</b> See Section 3.4.
Northern harrier <i>Circus hudsonius</i>	CDFW	-/SSC	Summer resident in eastern Sierra Nevada in Mono County.	Coastal scrub, Great Basin grasslands, Valley & foothill grasslands, wetlands, marshes & swamps, coastal salt and freshwater marsh, and riparian scrub. Nest and forage in grasslands, from salt grass in desert sink to mountain cienagas. Nests on the ground in shrubby vegetation, usually at marsh edge; nest built of a large mound of sticks in wet areas.	<b>High:</b> See Section 3.4.
Bald eagle <i>Haliaeetus leucocephalus</i>	CDFW, USFWS	BGECP/ SE, SFP	Species is a permanent resident and uncommon winter migrant, found nesting primarily in Butte, Lake, Lassen, Modoc, Plumas, Shasta, Siskiyou, and Trinity counties	Large bodies of water or rivers with abundant fish, uses snags or other perches; nests in advanced-successional conifer forest near open water	<b>Moderate (flyovers and possibly foraging):</b> See Section 3.4.

Common name <i>Scientific name</i>	Query sources	Status <sup>a</sup> Federal/ State	Distribution in California	Habitat association	Likelihood to occur within Planning Area 1
Northern spotted owl <i>Strix occidentalis caurina</i>	USFWS, CDFW	FT/SSC	Range includes Northwestern California south to Marin County, and southeast to the Pit River area of Shasta County	Typically found in older forested habitats; nests in complex stands dominated by conifers, especially coastal redwood, with hardwood understories; some open areas are important for foraging.	<p><b>Low:</b> Suitable nesting, roosting, and/or foraging habitat is not present within PA 1. Suitable habitat is present in the dense coniferous forest adjacent to PA 1, which may support older, more suitable nesting stands.</p> <p>The closest nesting owl location (activity center, HUM0550) is about 0.8 miles from PA 1 and the closest positive detections are 0.6 and 0.8 miles from PA 1 from 2018 and 2019, respectively (CDFW 2025e).</p> <p>Designated critical habitat has been designated for this species and is located about 14 miles away.</p>
Bank swallow <i>Riparia riparia</i>	CDFW	-/ST	Summer resident; occurs along the Sacramento River from Tehama County to Sacramento County, along the Feather and lower American rivers; and in the plains east of the Cascade Range in Modoc, Lassen, and northern Siskiyou counties; small populations near the coast from San Francisco County to Monterey County	Nests in vertical bluffs or banks, usually adjacent to water, where the soil consists of sand or sandy loam	<p><b>Moderate (foraging only):</b> See Section 3.4.</p>

Common name <i>Scientific name</i>	Query sources	Status <sup>a</sup> Federal/ State	Distribution in California	Habitat association	Likelihood to occur within Planning Area 1
Grasshopper sparrow <i>Ammodramus savannarum</i>	CDFW	-/SSC	Summer resident; nests in Humboldt, Mendocino, Trinity, and Tehama counties south, west of the Cascade-Sierra Nevada axis and southeastern deserts, to San Diego County	Typically found in moderately open grasslands with scattered shrubs	<b>Moderate:</b> See Section 3.4.
Tricolored blackbird <i>Agelaius tricolor</i>	CDFW	-/ST, SSC	Permanent resident in California, but makes extensive migrations both in breeding season and winter; common locally throughout Central Valley and in coastal areas in and south of Sonoma County	Generally found in freshwater marshes, swamps, and wetlands. Highly colonial species that requires open water, protected nesting substrate, and foraging area with insect prey within a few kilometers of the colony. Often found in agricultural areas.	<b>Low:</b> Preferred breeding habitat (cattail marshes) is limited within PA 1 and Humboldt County is outside of the preferred range of the species.  The only CNDDDB occurrence within the vicinity of PA 1 is about 12 miles away near Fortuna and documents 32 birds nesting in blackberry/coyote brush patches in 1997 (CDFW 2025a). Two eBird occurrences have been documented within PA 1 in 2018 (Pine Hill Road) and 2021 (Elk River Wildlife Area) There have been multiple observations over numerous years at the Arcata Marsh and Wildlife Sanctuary and surrounding wetland areas (eBird 2025)

Common name <i>Scientific name</i>	Query sources	Status <sup>a</sup> Federal/ State	Distribution in California	Habitat association	Likelihood to occur within Planning Area 1
Sonoma tree vole <i>Arborimus pomo</i>	CDFW	-/SSC	Along the North Coast from Sonoma County north to the Oregon border, generally along the fog belt	Primarily nests in old-growth or partially harvested old-growth stands, while also present in young stands. Associated with Douglas-fir, redwood, grand fir, and montane hardwood-conifer habitats in the fog belt. Feeds almost exclusively on Douglas fir needles.	<b>Low:</b> Suitable habitat is not present within PA 1 but may be present in adjacent forested areas.  The nearest CNDDDB occurrence is 2.5 miles from PA 1 in 1988 (CDFW 2025a).
Townsend’s big-eared bat <i>Corynorhinus townsendii</i>	CDFW	-/SSC	Throughout California, found in all but subalpine and alpine habitats, details of distribution not well known	Roosts in cavities, most often in tunnels, caves, mines, and buildings, but also rock shelters, preferentially close to water. Most abundant in mesic habitats, also found in oak woodlands, desert, vegetated drainages, caves or cave-like structures (including basal hollows in large trees, mines, tunnels, and buildings).	<b>High:</b> See Section 3.4.
Pallid bat <i>Antrozous pallidus</i>	CDFW	-/SSC	Throughout California except for elevations greater than 3,000 m in the Sierra Nevada	Roosts in rock crevices, cavities in live or dead trees hollows, mines, caves, and a variety of vacant and occupied buildings; feeds in a variety of open woodland habitats and most frequently in riparian zone, in open oak savannah, and open mixed deciduous forest.	<b>Moderate:</b> See Section 3.4.

Common name <i>Scientific name</i>	Query sources	Status <sup>a</sup> Federal/ State	Distribution in California	Habitat association	Likelihood to occur within Planning Area 1
Humboldt marten, coastal DPS <i>Martes caurina humboldtensis</i>	CDFW	-/SSC	Occurs only in the coastal redwood zone from the Oregon border south to Sonoma County.	Mid- to advanced-successional stands of conifers with complex structure near the ground and dense canopy closure.	<b>Low:</b> Suitable habitat is not present within PA 1 but may be present in adjacent forested areas.  The nearest CNDDDB occurrence is eight miles from PA 1 (Headwaters Forest Reserve) from 2002 (CDFW 2025a).
Fisher, Northern California/Southern Oregon DPS <i>Pekania pennanti</i>	CDFW	-/SSC	The northern Coast Range, including the Trinity and Klamath forests	Dense (greater than 50% canopy cover), advanced-successional conifer forests, with complex forest structure; den in hollow trees and snags.	<b>Low:</b> Dense, advanced-successional conifer forests are lacking within PA 1, but may be used as a corridor to adjacent forests outside of PA 1, which may provide higher-quality later-successional forests.  The most recent CNDDDB occurrence is about ten miles from PA 1 from 2017 in the Arcata Community Forest and the nearest about ten miles from PA 1 in Headwaters Forest Reserve in 2009 (CDFW 2025a).
North Pacific Right Whale <i>Eubalaena glacialis</i>	NMFS	FE/SFP	Pacific Ocean	Deep ocean waters	<b>None:</b> No suitable habitat is present within PA 1.  Critical habitat has been designated for this species and is not present within PA 1.

Common name <i>Scientific name</i>	Query sources	Status <sup>a</sup> Federal/ State	Distribution in California	Habitat association	Likelihood to occur within Planning Area 1
Sei Whale <i>Balaenoptera borealis</i>	NMFS	FE/-	Pacific Ocean	Deep ocean waters far from the coastline	<b>None:</b> No suitable habitat is present within PA 1.  Critical habitat has not been designated for this species.
Blue Whale <i>Balaenoptera musculus</i>	NMFS	FE/-	Pacific Ocean	Deep ocean waters; also can be found in coastal waters	<b>None:</b> No suitable habitat is present within PA 1.  Critical habitat has not been designated for this species.
Fin Whale <i>Balaenoptera physalus</i>	NMFS	FE/-	Pacific Ocean	Deep ocean waters	<b>None:</b> No suitable habitat is present within PA 1.  Critical habitat has not been designated for this species.
Humpback Whale <i>Megaptera novaengliae</i>	NMFS	FE/-	Pacific Ocean	Deep ocean waters	<b>None:</b> No suitable habitat is present within PA 1.  Critical habitat has been designated for this species and is not present within PA 1.
Killer Whale Southern Resident DPS <i>Orcinus orca</i>	NMFS	FE/-	Pacific Ocean	Coastal habitats of temperate waters, including bays	<b>None:</b> No suitable habitat is present within PA 1.  Critical habitat has been designated for this species and is not present within PA 1.

Common name <i>Scientific name</i>	Query sources	Status <sup>a</sup> Federal/ State	Distribution in California	Habitat association	Likelihood to occur within Planning Area 1
Sperm Whale <i>Physeter macrocephalus</i>	NMFS	FE/-	Pacific Ocean	Deep ocean waters	<b>None:</b> No suitable habitat is present within PA 1.  Critical habitat has not been designated for this species.

Table Source: CDFW 2025a, USFWS 2005, NMFS 2022

Notes: CDFW = California Department Fish and Wildlife; CNDDDB = California Natural Diversity Database; ppt = parts per thousand; USFWS = U.S. Fish and Wildlife Service

<sup>a</sup> Status codes:

Federal

- FE Listed as endangered under the federal Endangered Species Act
- FT Listed as threatened under the federal Endangered Species Act
- FC Federal candidate species
- FPT Federally proposed for listing as threatened
- BGECP Protected under the Bald and Golden Eagle Protection Act
- MBTA Protected under the Migratory Bird Treaty Act

State

- SE Listed as Endangered under the California Endangered Species Act
- ST Listed as Threatened under the California Endangered Species Act
- SCE State Candidate Endangered
- SSC CDFW Species of Special Concern
- SFP State Fully-Protected
- No state status

---

**Appendix B**

**Comprehensive Plant Species List**

---

Table B-1. Comprehensive list of plant species documented<sup>1</sup> in the Elk River.

Scientific name	Common name	Family	Nativity	Cal-IPC Rating <sup>2</sup>	Wetland indicator status <sup>3</sup> (WMVC)
<i>Abies grandis</i>	grand fir	Pinaceae	Native	N/A	FACU
<i>Achillea millefolium</i>	common yarrow	Asteraceae	Native	N/A	FACU
<i>Acmispon americanus</i> var. <i>americanus</i>	American bird's-foot trefoil	Fabaceae	Native	N/A	FACU
<i>Agrostis capillaris</i>	colonial bent grass	Poaceae	Naturalized	None	FAC
<i>Agrostis stolonifera</i>	creeping bent grass	Poaceae	Naturalized	Limited	FAC
<i>Aira caryophylla</i>	silver hair grass	Poaceae	Naturalized	None	FACU
<i>Allium triquetrum</i>	three corner leek	Alliaceae	Naturalized	None	NL/UPL
<i>Alnus rubra</i>	red alder	Betulaceae	Native	N/A	FAC
<i>Alopecurus geniculatus</i>	water foxtail	Poaceae	Native	N/A	OBL
<i>Alopecurus pratensis</i>	meadow foxtail	Poaceae	Naturalized	Watch	FAC
<i>Angelica lucida</i>	sea watch	Apiaceae	Native	N/A	FAC
<i>Anthemis cotula</i>	stinking chamomile	Asteraceae	Naturalized	None	FACU
<i>Anthoxanthum odoratum</i>	sweet vernal grass	Poaceae	Naturalized	Limited	FACU
<i>Artemisia douglasiana</i>	mugwort	Asteraceae	Native	N/A	FACW
<i>Athyrium filix-femina</i> var. <i>cyclosum</i>	subarctic ladyfern	Athyriaceae	Native	N/A	FAC
<i>Atriplex prostrata</i>	fat hen	Chenopodiaceae	Naturalized	None	FAC
<i>Avena fatua</i>	wild oat	Poaceae	Naturalized	Moderate	NL/UPL
<i>Baccharis pilularis</i>	coyote brush	Asteraceae	Native	N/A	NL/UPL
<i>Bellis perennis</i>	English daisy	Asteraceae	Naturalized	None	NL/UPL
<i>Bolboschoenus maritimus</i> subsp. <i>paludosus</i>	saltmarsh bulrush	Cyperaceae	Native	N/A	OBL
<i>Bolboschoenus robustus</i>	seacoast bulrush	Cyperaceae	Native	N/A	OBL
<i>Brassica nigra</i>	black mustard	Brassicaceae	Naturalized	Moderate	NL/UPL
<i>Brassica rapa</i>	field mustard	Brassicaceae	Naturalized	Limited	FACU
<i>Briza maxima</i>	rattlesnake grass	Poaceae	Naturalized	Limited	NL/UPL
<i>Briza minor</i>	little quakinggrass	Poaceae	Naturalized	None	FAC

Scientific name	Common name	Family	Nativity	Cal-IPC Rating <sup>2</sup>	Wetland indicator status <sup>3</sup> (WMVC)
<i>Bromus diandrus</i>	ripgut brome	Poaceae	Naturalized	Moderate	NL/UPL
<i>Bromus hordeaceus</i>	soft brome	Poaceae	Naturalized	Limited	FACU
<i>Bromus sitchensis</i> var. <i>carinatus</i>	California brome	Poaceae	Native	N/A	NL/UPL
<i>Callitriche heterophylla</i>	twoheaded water-starwort	Plantaginaceae	Native	N/A	OBL
<i>Capsella bursa-pastoris</i>	shepherd's purse	Brassicaceae	Naturalized	None	FACU
<i>Cardamine oligosperma</i>	little western bittercress	Brassicaceae	Native	N/A	FAC
<i>Carduus pycnocephalus</i> subsp. <i>pycnocephalus</i>	Italian thistle	Asteraceae	Naturalized	Moderate	NL/UPL
<i>Carex lyngbyei</i>	Lyngbye's sedge	Cyperaceae	Native	N/A	OBL
<i>Carex obnupta</i>	slough sedge	Cyperaceae	Native	N/A	OBL
<i>Carex pachystachya</i>	starry broomsedge	Cyperaceae	Native	N/A	FAC
<i>Carex praegracilis</i>	freeway sedge	Cyperaceae	Native	N/A	FACW
<i>Castilleja ambigua</i> subsp. <i>humboldtiensis</i>	Humboldt Bay owl's-clover	Orobanchaceae	Native	N/A	FACW
<i>Cerastium fontanum</i> subsp. <i>vulgare</i>	common mouse-ear chickweed	Caryophyllaceae	Naturalized	None	FACU
<i>Chamerion angustifolium</i> subsp. <i>circumvagum</i>	fireweed	Onagraceae	Native	N/A	FACU
<i>Chloropyron maritimum</i> subsp. <i>palustre</i>	Pt. Reyes bird's-beak	Orobanchaceae	Native	N/A	OBL
<i>Chrysosplenium glechomifolium</i>	Pacific golden saxifrage	Saxifragaceae	Native	N/A	OBL
<i>Cichorium intybus</i>	chicory	Asteraceae	Naturalized	None	FACU
<i>Cirsium arvense</i>	Canada thistle	Asteraceae	Naturalized	Moderate	FAC
<i>Cirsium vulgare</i>	bull thistle	Asteraceae	Naturalized	Moderate	FACU
<i>Claytonia perfoliata</i>	miner's lettuce	Montiaceae	Native	N/A	FAC
<i>Conium maculatum</i>	poison hemlock	Apiaceae	Naturalized	Moderate	FAC
<i>Convolvulus arvensis</i>	field bindweed	Convolvulaceae	Naturalized	None	NL/UPL
<i>Cortaderia jubata</i>	purple pampas grass	Poaceae	Naturalized	High	FACU
<i>Cotoneaster franchetii</i>	orange cotoneaster	Rosaceae	Naturalized	Moderate	NL/UPL
<i>Cotula coronopifolia</i>	common brassbuttons	Asteraceae	Naturalized	Limited	OBL
<i>Crataegus monogyna</i>	oneseed hawthorn	Rosaceae	Naturalized	Limited	FAC
<i>Crocsmia x crocosmiiiflora</i>	montbretia	Iridaceae	Naturalized	Limited	FAC
<i>Cuscuta pacifica</i> var. <i>pacifica</i>	dodder	Convolvulaceae	Native	N/A	NL/UPL

Scientific name	Common name	Family	Nativity	Cal-IPC Rating <sup>2</sup>	Wetland indicator status <sup>3</sup> (WMVC)
<i>Cyperus eragrostis</i>	tall flatsedge	Cyperaceae	Native	N/A	FACW
<i>Cytisus scoparius</i>	Scotch broom	Fabaceae	Naturalized	High	NL/UPL
<i>Dactylis glomerata</i>	orchardgrass	Poaceae	Naturalized	Limited	FACU
<i>Danthonia californica</i>	California oatgrass	Poaceae	Native	N/A	FAC
<i>Daucus carota</i>	Queen Anne's lace	Apiaceae	Naturalized	None	FACU
<i>Deschampsia cespitosa</i>	tufted hairgrass	Poaceae	Native	N/A	FACW
<i>Dipsacus fullonum</i>	wild teasel	Dipsacaceae	Naturalized	Moderate	FAC
<i>Distichlis spicata</i>	saltgrass	Poaceae	Native	N/A	FACW
<i>Dryopteris arguta</i>	coastal woodfern	Dryopteridaceae	Native	N/A	NL/UPL
<i>Dryopteris expansa</i>	spreading woodfern	Dryopteridaceae	Native	N/A	FACW
<i>Eleocharis macrostachya</i>	pale spikerush	Cyperaceae	Native	N/A	OBL
<i>Elymus triticoides</i>	beardless wildrye	Poaceae	Native	N/A	FAC
<i>Epilobium ciliatum</i>	fringed willowherb	Onagraceae	Native	N/A	FACW
<i>Epilobium ciliatum</i> subsp. <i>ciliatum</i>	fringed willowherb	Onagraceae	Native	N/A	FACW
<i>Equisetum arvense</i>	field horsetail	Equisetaceae	Native	N/A	FAC
<i>Erica lusitanica</i>	Spanish heath	Ericaceae	Naturalized	Limited	NL/UPL
<i>Erodium cicutarium</i>	redstem stork's bill	Geraniaceae	Naturalized	Limited	NL/UPL
<i>Erythranthe dentata</i>	coastal monkeyflower	Phrymaceae	Native	N/A	OBL
<i>Festuca arundinacea</i>	tall fescue	Poaceae	Naturalized	Moderate	FAC
<i>Festuca bromoides</i>	brome fescue	Poaceae	Naturalized	None	FAC
<i>Festuca microstachys</i>	desert fescue	Poaceae	Native	N/A	NL/UPL
<i>Festuca myuros</i>	rattail sixweeks grass	Poaceae	Naturalized	Moderate	FACU
<i>Festuca perennis</i>	Italian ryegrass	Poaceae	Naturalized	Moderate	FAC
<i>Foeniculum vulgare</i>	sweet fennel	Apiaceae	Naturalized	Moderate	NL/UPL
<i>Frangula purshiana</i>	Cascara buckthorn	Rhamnaceae	Native	N/A	FAC
<i>Galium aparine</i>	stickywilly	Rubiaceae	Native	N/A	FACU
<i>Genista monspessulana</i>	French broom	Fabaceae	Naturalized	High	NL/UPL
<i>Geranium dissectum</i>	cutleaf geranium	Geraniaceae	Naturalized	Limited	NL/UPL

Scientific name	Common name	Family	Nativity	Cal-IPC Rating <sup>2</sup>	Wetland indicator status <sup>3</sup> (WMVC)
<i>Glyceria ×occidentalis</i>	western manna grass	Poaceae	Naturalized	None	OBL
<i>Glyceria declinata</i>	low manna grass	Poaceae	Naturalized	Moderate	FACW
<i>Grindelia stricta</i>	Oregon gumweed	Asteraceae	Native	N/A	FACW
<i>Hedera helix</i>	English ivy	Araliaceae	Naturalized	High	FACU
<i>Helminthotheca echioides</i>	bristly ox-tongue	Asteraceae	Naturalized	Limited	FAC
<i>Heracleum maximum</i>	cow parsnip	Apiaceae	Native	N/A	FAC
<i>Hesperocyparis macrocarpa</i>	Monterey cypress	Cupressaceae	Native	N/A	NL/UPL
<i>Hirschfeldia incana</i>	shortpod mustard	Brassicaceae	Naturalized	Moderate	NL/UPL
<i>Holcus lanatus</i>	common velvet grass	Poaceae	Naturalized	Moderate	FAC
<i>Hordeum brachyantherum</i>	meadow barley	Poaceae	Native	N/A	FACW
<i>Hordeum jubatum</i> subsp. <i>jubatum</i>	foxtail barley	Poaceae	Native	N/A	FAC
<i>Hordeum murinum</i>	wall barley	Poaceae	Naturalized	Moderate	FAC
<i>Hydrocotyle ranunculoides</i>	floating marshpennywort	Araliaceae	Native	N/A	OBL
<i>Hypochaeris glabra</i>	smooth cat's ear	Asteraceae	Naturalized	Limited	NL/UPL
<i>Hypochaeris radicata</i>	rough cat's-ear	Asteraceae	Naturalized	Moderate	FACU
<i>Ilex aquafolium</i>	holly	Aquifoliaceae	Naturalized	Limited	FACU
<i>Iris douglasiana</i>	Douglas iris	Iridaceae	Native	N/A	NL/UPL
<i>Isolepis cernua</i>	low bulrush	Cyperaceae	Native	N/A	OBL
<i>Jaumea carnosa</i>	marsh jaumea	Asteraceae	Native	N/A	OBL
<i>Juncus balticus</i> subsp. <i>ater</i>	baltic rush	Juncaceae	Native	N/A	FACW
<i>Juncus bolanderi</i>	Bolander's rush	Juncaceae	Native	N/A	OBL
<i>Juncus breweri</i>	Brewer's rush	Juncaceae	Native	N/A	FACW
<i>Juncus bufonius</i>	toad rush	Juncaceae	Native	N/A	FACW
<i>Juncus effusus</i> subsp. <i>pacificus</i>	Pacific rush	Juncaceae	Native	N/A	FACW
<i>Juncus ensifolius</i>	swordleaf rush	Juncaceae	Native	N/A	FACW
<i>Juncus hesperius</i>	coast rush	Juncaceae	Native	N/A	FACW
<i>Juncus lescurii</i>	San Francisco rush	Juncaceae	Native	N/A	FACW
<i>Juncus patens</i>	spreading rush	Juncaceae	Native	N/A	FACW

Scientific name	Common name	Family	Nativity	Cal-IPC Rating <sup>2</sup>	Wetland indicator status <sup>3</sup> (WMVC)
<i>Juncus xiphioides</i>	iris-leaved rush	Juncaceae	Native	N/A	OBL
<i>Lathyrus latifolius</i>	perennial sweet pea	Fabaceae	Naturalized	None	NL/UPL
<i>Lemna minor</i>	common duckweed	Araceae	Native	N/A	OBL
<i>Leontodon saxatilis</i>	lesser hawkbit	Asteraceae	Naturalized	None	FACU
<i>Lepidium didymum</i>	lesser swinecress	Brassicaceae	Naturalized	None	NL/UPL
<i>Leucanthemum vulgare</i>	ox-eye daisy	Asteraceae	Naturalized	Moderate	FACU
<i>Linum bienne</i>	pale flax	Linaceae	Naturalized	None	NL/UPL
<i>Lonicera involucrata</i>	twinberry	Caprifoliaceae	Native	N/A	FAC
<i>Lotus corniculatus</i>	bird's-foot trefoil	Fabaceae	Naturalized	None	FAC
<i>Lotus uliginosus</i>	big trefoil	Fabaceae	Naturalized	None	FAC
<i>Lupinus bicolor</i>	miniature lupine	Fabaceae	Native	N/A	NL/UPL
<i>Lupinus rivularis</i>	riverbank lupine	Fabaceae	Native	N/A	FAC
<i>Lysichiton americanus</i>	yellow skunk-cabbage	Araceae	Native	N/A	OBL
<i>Lysimachia arvensis</i>	scarlet pimpernel	Myrsinaceae	Naturalized	None	FAC
<i>Madia gracilis</i>	grassy tarweed	Asteraceae	Native	N/A	NL/UPL
<i>Madia sativa</i>	coast tarweed	Asteraceae	Native	N/A	NL/UPL
<i>Malus sp.</i>	apple cultivar	Rosaceae	Naturalized	None	NL/UPL
<i>Malva neglecta</i>	common mallow	Malvaceae	Naturalized	None	NL/UPL
<i>Malva parviflora</i>	cheeseweed	Malvaceae	Naturalized	None	NL/UPL
<i>Marah oregana</i>	coastal manroot	Cucurbitaceae	Native	N/A	NL/UPL
<i>Matricaria discoidea</i>	pineapple weed	Asteraceae	Native	N/A	FACU
<i>Medicago polymorpha</i>	california burclover	Fabaceae	Naturalized	Limited	FACU
<i>Melilotus albus</i>	white sweetclover	Fabaceae	Naturalized	None	NL/UPL
<i>Melilotus officinalis</i>	yellow sweetclover	Fabaceae	Naturalized	None	FACU
<i>Mentha spicata</i>	spearmint	Lamiaceae	Naturalized	None	FACW
<i>Modiola caroliniana</i>	modiola	Malvaceae	Naturalized	None	FACU
<i>Morella californica</i>	wax myrtle	Myricaceae	Native	N/A	FACW
<i>Narcissus pseudonarcissus</i>	daffodil	Amaryllidaceae	Naturalized	None	NL/UPL

Scientific name	Common name	Family	Nativity	Cal-IPC Rating <sup>2</sup>	Wetland indicator status <sup>3</sup> (WMVC)
<i>Nasturtium officinale</i>	water cress	Brassicaceae	Native	N/A	OBL
<i>Navarretia squarrosa</i>	skunkweed	Polemoniaceae	Native	N/A	FACU
<i>Oenanthe sarmentosa</i>	water parsley	Apiaceae	Native	N/A	OBL
<i>Opuntia ficus-indica</i>	mission prickly-pear	Cactaceae	Naturalized	None	NL/UPL
<i>Oxalis purpurea</i>	purple wood-sorrel	Oxalidaceae	Naturalized	None	NL/UPL
<i>Parapholis strigosa</i>	strigose sicklegrass	Poaceae	Naturalized	None	OBL
<i>Parentucellia viscosa</i>	yellow glandweed	Orobanchaceae	Naturalized	Limited	FAC
<i>Persicaria maculosa</i>	lady's thumb	Polygonaceae	Naturalized	None	FACW
<i>Phalaris arundinacea</i>	reed canarygrass	Poaceae	Naturalized	None <sup>4</sup>	FACW
<i>Phleum pratense</i>	cultivated timothy	Poaceae	Naturalized	None	FAC
<i>Picea sitchensis</i>	Sitka spruce	Pinaceae	Native	N/A	FAC
<i>Pinus contorta</i> subsp. <i>contorta</i>	shore pine	Pinaceae	Native	N/A	FAC
<i>Pinus radiata</i>	Monterey pine	Pinaceae	Native	N/A	NL/UPL
<i>Plantago coronopus</i>	buckhorn plantain	Plantaginaceae	Naturalized	None	FAC
<i>Plantago lanceolata</i>	English plantain	Plantaginaceae	Naturalized	Limited	FACU
<i>Plantago major</i>	common plantain	Plantaginaceae	Naturalized	None	FAC
<i>Plectritis congesta</i>	shortspur seablush	Valerianaceae	Native	N/A	FACU
<i>Poa annua</i>	annual blue grass	Poaceae	Naturalized	None	FAC
<i>Poa palustris</i>	fowl blue grass	Poaceae	Naturalized	None	FAC
<i>Poa pratensis</i> subsp. <i>pratensis</i>	Kentucky blue grass	Poaceae	Naturalized	Limited	FAC
<i>Polygonum aviculare</i>	knotweed	Polygonaceae	Naturalized	None	FAC
<i>Polypogon australis</i>	Chilean beard grass	Poaceae	Naturalized	None	FACW
<i>Polypogon monspeliensis</i>	annual beard grass	Poaceae	Naturalized	Limited	FACW
<i>Polystichum munitum</i>	western swordfern	Dryopteridaceae	Native	N/A	FACU
<i>Potentilla anserina</i>	silverweed cinquefoil	Rosaceae	Native	N/A	OBL
<i>Prunella vulgaris</i>	common selfheal	Lamiaceae	Native	N/A	FACU
<i>Pteridium aquilinum</i> var. <i>pubescens</i>	hairy brackenfern	Dennstaedtiaceae	Native	N/A	FACU
<i>Ranunculus occidentalis</i>	western buttercup	Ranunculaceae	Native	N/A	FACW

Scientific name	Common name	Family	Nativity	Cal-IPC Rating <sup>2</sup>	Wetland indicator status <sup>3</sup> (WMVC)
<i>Ranunculus repens</i>	creeping buttercup	Ranunculaceae	Naturalized	Limited	FAC
<i>Raphanus raphanistrum</i>	wild radish	Brassicaceae	Naturalized	None	NL/UPL
<i>Raphanus sativus</i>	cultivated radish	Brassicaceae	Naturalized	Limited	NL/UPL
<i>Ribes divaricatum</i>	spreading gooseberry	Grossulariaceae	Native	N/A	FAC
<i>Ribes sanguineum</i>	red-flowering currant	Grossulariaceae	Native	N/A	FACU
<i>Rosa nutkana</i> subsp. <i>nutkana</i>	Nootka rose	Rosaceae	Native	N/A	FAC
<i>Rubus armeniacus</i>	Himalayan blackberry	Rosaceae	Naturalized	High	FAC
<i>Rubus leucodermis</i>	whitebark raspberry	Rosaceae	Native	N/A	FACU
<i>Rubus parviflorus</i>	thimbleberry	Rosaceae	Native	N/A	FACU
<i>Rubus spectabilis</i>	salmonberry	Rosaceae	Native	N/A	FAC
<i>Rubus ursinus</i>	California blackberry	Rosaceae	Native	N/A	FACU
<i>Rumex acetosella</i>	sheep sorrel	Polygonaceae	Naturalized	Moderate	FACU
<i>Rumex conglomeratus</i>	clustered dock	Polygonaceae	Naturalized	None	FACW
<i>Rumex crispus</i>	curly dock	Polygonaceae	Naturalized	Limited	FAC
<i>Rumex pulcher</i>	fiddle dock	Polygonaceae	Naturalized	None	FAC
<i>Salicornia pacifica</i>	Pacific swampfire	Chenopodiaceae	Native	N/A	OBL
<i>Salix hookeriana</i>	coastal willow	Salicaceae	Native	N/A	FACW
<i>Salix lasiandra</i>	Pacific willow	Salicaceae	Native	N/A	FACW
<i>Salix scouleriana</i>	Scouler's willow	Salicaceae	Native	N/A	FAC
<i>Salix sitchensis</i>	Sitka willow	Salicaceae	Native	N/A	FACW
<i>Sambucus racemosa</i>	red elderberry	Adoxaceae	Native	N/A	FACU
<i>Sanguisorba minor</i> subsp. <i>balearica</i>	small burnet	Rosaceae	Native	N/A	FACW
<i>Sanicula crassicaulis</i>	Pacific blacksnakeroot	Apiaceae	Native	N/A	NL/UPL
<i>Schoenoplectus acutus</i> var. <i>occidentalis</i>	common tule	Cyperaceae	Native	N/A	OBL
<i>Schoenoplectus pungens</i> var. <i>longispicatus</i>	common three-square bulrush	Cyperaceae	Native	N/A	OBL
<i>Scirpus microcarpus</i>	paniced bulrush	Cyperaceae	Native	N/A	OBL
<i>Scrophularia californica</i>	California figwort	Scrophulariaceae	Native	N/A	FAC
<i>Senecio jacobaea</i>	tansy ragwort	Asteraceae	Naturalized	Limited	FACU

Scientific name	Common name	Family	Nativity	Cal-IPC Rating <sup>2</sup>	Wetland indicator status <sup>3</sup> (WMVC)
<i>Senecio minimus</i>	coastal burnweed	Asteraceae	Naturalized	None	FACU
<i>Sequoia sempervirens</i>	redwood	Cupressaceae	Native	N/A	NL/UPL
<i>Silybum marianum</i>	blessed milkthistle	Asteraceae	Naturalized	Limited	NL/UPL
<i>Sisymbrium officinale</i>	hedge mustard	Brassicaceae	Naturalized	None	NL/UPL
<i>Solanum americanum</i>	American black nightshade	Solanaceae	Native	N/A	FACU
<i>Sonchus asper</i> subsp. <i>asper</i>	prickly sow thistle	Asteraceae	Naturalized	None	FACU
<i>Sonchus oleraceus</i>	common sow thistle	Asteraceae	Naturalized	None	UPL
<i>Sparganium emersum</i>	European bur-reed	Typhaceae	Native	N/A	OBL
<i>Spartina densiflora</i>	dense-flowered cord grass	Poaceae	Naturalized	High	OBL
<i>Spergula arvensis</i>	stickwort	Caryophyllaceae	Naturalized	None	NL/UPL
<i>Spergularia canadensis</i> var. <i>occidentalis</i>	western sand-spurrey	Caryophyllaceae	Native	N/A	FACW
<i>Spergularia macrotheca</i> var. <i>macrotheca</i>	sticky sand-spurry	Caryophyllaceae	Native	N/A	FAC
<i>Spergularia marina</i>	saltmarsh sand-spurrey	Caryophyllaceae	Native	N/A	OBL
<i>Spergularia rubra</i>	red sand-spurrey	Caryophyllaceae	Naturalized	None	FAC
<i>Stachys chamissonis</i>	coastal hedgenettle	Lamiaceae	Native	N/A	FACW
<i>Stachys mexicana</i>	Mexican hedgenettle	Lamiaceae	Native	N/A	FACW
<i>Stellaria media</i>	common chickweed	Caryophyllaceae	Naturalized	None	FACU
<i>Symphyotrichum chilense</i>	Pacific aster	Asteraceae	Native	N/A	FAC
<i>Taraxacum officinale</i>	common dandelion	Asteraceae	Naturalized	None	FACU
<i>Tolmiea diplomenziesii</i>	pig-a-back plant	Saxifragaceae	Native	N/A	FACW
<i>Toxicodendron diversilobum</i>	poison oak	Anacardiaceae	Native	N/A	FAC
<i>Trifolium angustifolium</i>	narrow-leaved clover	Fabaceae	Naturalized	None	NL/UPL
<i>Trifolium arvense</i>	rabbitfoot clover	Fabaceae	Naturalized	None	NL/UPL
<i>Trifolium dubium</i>	little hop clover	Fabaceae	Naturalized	None	FACU
<i>Trifolium fragiferum</i>	strawberry clover	Fabaceae	Naturalized	None	FACU
<i>Trifolium pratense</i>	red clover	Fabaceae	Naturalized	None	FACU
<i>Trifolium repens</i>	white clover	Fabaceae	Naturalized	None	FAC
<i>Trifolium subterraneum</i>	subterranean clover	Fabaceae	Naturalized	None	NL/UPL
<i>Trifolium wormskioldii</i>	cow clover	Fabaceae	Native	N/A	FACW
<i>Triglochin maritima</i>	common arrow-grass	Juncaginaceae	Native	N/A	OBL

Scientific name	Common name	Family	Nativity	Cal-IPC Rating <sup>2</sup>	Wetland indicator status <sup>3</sup> (WMVC)
<i>Triglochin striata</i>	three-ribbed arrow-grass	Juncaginaceae	Native	N/A	OBL
<i>Tropaeolum majus</i>	garden nasturtium	Tropaeolaceae	Naturalized	None	UPL
<i>Typha latifolia</i>	broad-leaved cattail	Typhaceae	Native	N/A	OBL
<i>Urtica dioica</i>	stinging nettle	Urticaceae	Native	N/A	FAC
<i>Urtica urens</i>	dwarf nettle	Urticaceae	Naturalized	None	NL/UPL
<i>Veronica americana</i>	American speedwell	Plantaginaceae	Native	N/A	OBL
<i>Vicia gigantea</i>	giant vetch	Fabaceae	Native	N/A	NL/UPL
<i>Vicia hirsuta</i>	tiny vetch	Fabaceae	Naturalized	None	NL/UPL
<i>Vicia sativa</i>	garden vetch	Fabaceae	Naturalized	None	UPL
<i>Vicia tetrasperma</i>	sparrow vetch	Fabaceae	Naturalized	None	NL/UPL
<i>Vinca major</i>	greater periwinkle	Apocynaceae	Naturalized	Moderate	FACU
<i>Woodwardia fimbriata</i>	giant chain fern	Blechnaceae	Native	N/A	FACW
<i>Zantedeschia aethiopica</i>	calla-lily	Araceae	Naturalized	Limited	OBL
<i>Zostera marina</i>	eelgrass	Zosteraceae	Native	N/A	OBL

<sup>1</sup> Floristic surveys conducted on May 12–14, 2021, and July 12–14, 2021 and supplemental survey work conducted in 2021 (August 11, October 28, November 19), 2024 (March 7, April 24, May 2, 14, 16, and 20), and 2025 (January 24, February 27).

<sup>2</sup> **Cal-IPC rating**

High – These species have severe ecological impacts on physical processes, plant and animal communities, and vegetation structure. Their reproductive biology and other attributes are conducive to 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. Their reproductive biology and other attributes are conducive to moderate to high rates of dispersal, though establishment is generally dependent upon ecological disturbance. Ecological amplitude and 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. Their reproductive biology and other attributes result in low to moderate rates of invasiveness. Ecological amplitude and distribution are generally limited, but these species may be locally persistent and problematic.

Watch – These species have been assessed as posing a high risk of becoming invasive in the future in California.

None – No Cal-IPC rating listed for the nonnative species.

N/A – Not applicable, native species to California.

<sup>3</sup> **Wetland indicator status (Western Mountains, Valleys, and Coast Regional Supplement)**

OBL – Obligate. Almost always occur in wetlands

FACW – Facultative Wetland. Usually occur in wetlands but may occur in non-wetlands

FAC – Facultative. Occur in wetlands and non-wetlands

FACU – Facultative Upland. Usually occur in non-wetlands but may occur in wetlands

NL/UPL – Not Listed/Upland. Almost always occur in non-wetlands

<sup>4</sup> Known to the region as having invasive tendencies and can be detrimental to the successful establishment of restored native plant communities (Humboldt County Resource Conservation District 2024).

---

## **Appendix C**

### **Fish Utilization and Habitat Characterization**

---

## FISH UTILIZATION AND HABITAT

The lower reaches of coastal watersheds where streams transition into estuaries are particularly valuable for habitat restoration and recovery of anadromous salmonids (Jones et al. 2014, Wallace et al. 2015, Flitcroft et al. 2016), as well as the federally listed Tidewater Goby and state listed Longfin Smelt (Stillwater Sciences 2006, Garwood 2017). In addition to providing unique and productive habitats that promote life history diversity within a population, these reaches play an outsized role in influencing growth, survival, and population dynamics of anadromous species since the entire population of the watershed must pass through them (Koski 2009, Jones et al. 2014, Wallace et al. 2015).

Healey (1982) proposed the concept of “estuarine dependence” in which tidal marshes are considered a requisite rearing habitat for juvenile salmonids. Numerous studies have shown that favorable growth conditions in estuaries may enable juvenile salmonids to recruit disproportionately to the adult population compared to fish that rear in upstream habitats, because larger individuals have higher ocean survival rates (Beck et al. 2001, Miller and Sadro 2003, Bond 2006, Ricker et al. 2014, Wallace et al. 2015). For example, the life-cycle monitoring station on Freshwater Creek operated by CDFW found that approximately 40% of the Coho Salmon smolts produced from the basin reared in the stream-estuary ecotone, and juveniles that reared in the stream-estuary ecotone were larger than those rearing in stream habitat upstream (Wallace et al. 2015)<sup>8</sup>. Factors hypothesized to contribute to the disproportionate success of estuarine reared fish include higher growth rates resulting from abundant invertebrate food and favorable water temperatures, suppressed predation resulting from high turbidity and deeper channels, and a favorable transition area for smoltification.

The amount and quality of fish habitat in PA 1 has been significantly reduced by conversion of former tidelands to agricultural land uses. Much of the historically extensive tidal marshlands in lower Elk River are currently used for cattle and dairy ranching. Remaining habitat is impaired by sediment aggradation, flood control levees, and tide gates that reduce the tidal prism and impair fish movement into and out of sloughs and other off-channel areas. Elk River east of US Highway 101 is constricted by levees and the Northwestern Pacific railroad grade and lacks access to off-channel rearing habitats due to floodplain disconnection. Habitat in the stream-estuary ecotone has been further simplified by removal or modification of streamside riparian vegetation. The impairment and loss of productive tidal marsh and estuarine rearing habitat has likely contributed to the acute decline of salmonid population abundance in the Elk River watershed (HBWAC 2005; NMFS 2014, 2016).

For this reason, restoring fish habitats in PA 1 (the stream-estuary ecotone) is a key component of the overall strategy for recovering fish populations in the Elk River watershed. In this section, the known seasonal distribution and life history characteristics of focal fish species are summarized (Section 2.3.1) and characterize existing fish habitat conditions in PA 1 (Section 2.3.2).

---

<sup>8</sup> An ecotone is a region of transition between two biological communities; ecotones between two habitats are often richer in species than surrounding communities. The “stream-estuary ecotone” is the zone from the margin of Humboldt Bay where channels become surrounded by mudflats, upstream to the upper limit of tidal influence, at approximately the upper boundary of MSR 2.

**Focal Fish Species**

To support interpretation of the fish habitat assessment, a summary of observed seasonal utilization in lower Elk River, general estuarine life history, and preferred habitat characteristics are provided for each focal species in the sections that follow. The focus of the habitat assessment is on juvenile salmonids, but other special status species are also included. Focal species include Coho Salmon (*Oncorhynchus kisutch*), Chinook Salmon (*Oncorhynchus tshawytscha*), steelhead *Oncorhynchus mykiss*, Coastal Cutthroat Trout (*Oncorhynchus clarkii clarkii*), Tidewater Goby (*Eucyclogobius newberryi*), and Longfin Smelt (*Spirinchus thaleichthys*).

In addition to these focal species, the Elk River tidal estuary provides habitat for numerous other species of native fish, amphibians, and invertebrates whose habitats have been diminished in the Elk River, and which could benefit from habitat restoration and enhancement. Over 30 species of fish have been documented in brackish portions of lower Elk River (M. Wallace, CDFW, unpub. data, 2005–2009).

**Salmonids**

Seasonal utilization of the lower (MSR1) and upper (MSR2) portions of the mainstem Elk River by juvenile salmonids is summarized in Table C-1 based on monthly sampling conducted by Wallace and Allen (2009) during 2007 and 2008.

**Table C-1.** Observed seasonal presence of juvenile salmonids in lower and upper portions of PA 1. Based on seining and minnow trapping conducted by Wallace and Allen (2009).

Reach <sup>1</sup>	Species life stage <sup>2</sup>	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Lower (MSR1)	Chinook Age-0												
	Coho Age-0												
	Coho Age-1												
	Steelhead Age-1+												
	Cutthroat Age-1+												
Upper (MSR2)	Chinook Age-0												
	Coho Age-0												
	Coho Age-1												
	Steelhead Age-1+												
	Cutthroat Age-1+												

<sup>1</sup> The “Lower” and “Upper” reaches sampled by Wallace and Allen (2009) loosely coincide with MSR1 and MSR2, respectively.

<sup>2</sup> Age class designations are based on fish length data provided by Wallace and Allen (2009).

## Coho Salmon

Based on multi-year sampling of Humboldt Bay tributaries, including lower Elk River, Wallace et al. (2015) described three life history strategies employed by juvenile Coho Salmon in the stream-estuary ecotone, including (1) young-of-year (age-0) fish that arrive in the spring soon after emergence and reside primarily in the upper portion of the stream-estuary ecotone during the summer and early fall; (2) age-0 juvenile coho that migrate to the stream-estuary ecotone in the fall as stream flows rise and rear in adjacent off-channel and tributary habitats during the winter and following spring; and (3) age-1 smolt that emigrate through the stream-estuary ecotone in spring after rearing primarily in upstream riverine reaches. These findings are consistent with timing of Coho Salmon utilization observed during intensive monthly sampling conducted in lower Elk River (Wallace and Allen 2009; Table 1-1). Variations of these life history strategies, including overwintering in adjacent non-natal streams or moving upstream out of the lower mainstem reaches to overwinter, may also occur (Miller and Sadro 2003, Koski 2009, Jones et al. 2014).

Recent monitoring in Martin Slough—where no Coho Salmon spawning habitat is thought to exist—indicates significant numbers of juvenile Coho Salmon from Elk River pass through lower Elk River and Swain Slough before rearing in Martin Slough during winter rearing and spring (Allen et al. 2016, Wallace et al. 2018, Natural Resources Services 2022). Juvenile Coho Salmon were documented in these habitats during every month of monitoring, which was conducted from November through May, but were most abundant from February through April (Natural Resources Services 2022). Notably, some juvenile Coho Salmon from other Humboldt Bay tributaries move into lower Elk River on their way to the ocean. In late-May 2008, Wallace and Allen (2009) captured two age-1 Coho Salmon that were tagged in Freshwater Creek, one in early April and one in early May. Restoration of more diverse and connected tidal wetlands and off-channel habitats in the stream-estuary ecotone may also promote additional life history diversity, as has been observed following large scale estuarine restoration (Flitcroft et al. 2016).

The physical habitat characteristics preferred by Coho Salmon in the stream-estuary ecotone are generally the same as in upstream fluvial reaches, with most individuals inhabiting areas with low-velocity habitats with escape cover. For example, in an intensive study of coho salmon estuarine habitat use, Tschaplinski (1987) found that at low tide the largest number of age-0 coho in locations with water velocity <1 ft/s (but on average 0.3 ft/s), pools with depths ranging from about 1.5–7 ft, and escape cover provided by large logs and rootwads or undercut banks, often containing overhanging vegetation.

Salinity is also expected to be a primary factor driving seasonal utilization and distribution patterns of Coho Salmon and other fish in PA 1 and other stream-estuary ecotones (Otto 1971, Wallace and Allen 2009, Koski 2009, Flitcroft et al. 2016). Pre-smolt juvenile Coho Salmon in the lower reaches of Humboldt Bay tributaries have primarily been documented rearing in habitats <5 ppt (Wallace and Allen 2009). However, laboratory studies of Coho Salmon indicate salinity tolerance increases substantially after being acclimated to dilute salinities and increases with size, with juvenile coho surviving (near 100% survival) salinities of approximately 20 ppt during the spring through fall and 25 ppt in the winter (Otto 1971). Despite the ability to tolerate these higher salinities, in these lab studies, growth was inhibited at values greater than about 10 ppt (Otto 1971). Various other studies indicate that Coho Salmon can survive and grow rapidly in estuarine areas prior to undergoing transformation to the smolt stage (Tschaplinski 1987, Koski 2009).

## Chinook Salmon

As with Coho Salmon, Chinook Salmon have been shown to display a wide range of juvenile life history strategies (Bouret et al. 2016), but most fall Chinook Salmon rearing in coastal California streams primarily display the ocean-type life history where juveniles migrate to the estuary within weeks or months of emergence from redd gravels (Reimers 1971, Healey 1991). Fall Chinook Salmon fry generally emerge from redd gravels from March to May and spend several weeks or months in freshwater before outmigrating to the estuary (Reimers 1971, Healey 1991). The species is largely dependent on estuarine and tidal marsh habitats, where they typically feed and grow for extended periods before migrating to sea (Reimers 1971, Healey 1991, NMFS 2016). In the Elk River, Wallace and Allen (2009) documented juvenile Chinook Salmon in the stream-estuary ecotone from May–September, with August and September observations occurring only in MSR1 (Table 1-1). A small number of juvenile Chinook Salmon were documented in Martin Slough in May 2017 during regular monthly sampling (Wallace et al. 2018); however, no individuals were captured during similar sampling conducted from 2014–2016 (Allen et al. 2016 and Wallace et al. 2018) and 2020–2021 (Natural Resources Services 2022). No Chinook Salmon spawning habitat exists in Martin Slough, which means any individuals rearing there originated in Elk River and passed through lower Elk River and Swain Slough to reach Martin Slough.

In the Salmon River estuary of Oregon, Bottom et al. (2005) identified a range of juvenile Chinook Salmon migration strategies, including (1) individuals that entered the estuary and tidal marsh habitats in the early spring, soon after emergence; (2) juveniles that reside in fresh water for several months, enter the estuary in June or July and remain for several weeks to several months before entering the ocean; and (3) juveniles that enter the estuary in the fall after and reading primarily in upstream freshwater reaches. This long-term study found that estuarine wetland restoration increased variation in estuarine rearing strategies, enhancing overall life history diversity and resilience of Chinook Salmon in the watershed (Bottom et al. 2005).

Characteristics of preferred estuarine rearing habitats for Chinook Salmon have not been well described, but the species appears to utilize salt marshes, tidal sloughs, and mainstem portions of the estuary (Reimers 1971, Bottom et al 2005, Hering et al. 2010). Reimers (1971) found that in early spring most juvenile Chinook Salmon in the Sixes River estuary in Oregon were near shore and associated with logs and debris, but by June, they were more widespread throughout the estuary (not just near shore). Levy et al. (1979, as cited in Healy 1991) found that in that juvenile Chinook Salmon were more abundant in tidal channels that had lower banks and provided cover during low tide. Hering et al. (2010) documented extensive movement of juvenile Chinook Salmon between large tidal slough and a smaller tidal channel leading to tidally flooded salt marsh habitat. Movement into the smaller channel generally peaked during mid- to late flood tides (i.e., 1–2 h before high tide) and movement out of the channel peaked late during ebb tides (i.e., 3–4 h after high tide). Little movement occurred when water depth was less than approximately 1.3 ft. This study indicates that juvenile Chinook Salmon in the estuary move frequently in response to tidally driven habitat conditions. In general, Chinook Salmon fry can initially tolerate salinities less than 20 ppt and osmoregulatory capabilities increase rapidly as individuals are exposed to brackish water (Healey 1991).

## Steelhead

Like Coho and Chinook salmon, steelhead display diverse juvenile life history strategies and have been shown to extensively utilize habitats in stream-estuary ecotone (Shapovalov and Taft 1954, Barnhart 1991, Bond et al. 2008, Hayes et al. 2008). Steelhead can grow rapidly in the estuary, and the component of the population rearing in these habitats can contribute disproportionately to

the returning adult population (Bond et al. 2008, Hayes et al. 2008). Depending partly on growing conditions, steelhead may migrate downstream to estuaries as age 0+ juveniles or may rear in streams for two or more years before outmigrating to the estuary and ocean (Shapovalov and Taft 1954). Steelhead migrating downstream as juveniles may rear for one month to a year in the estuary before entering the ocean (Shapovalov and Taft 1954, Barnhart 1991). In lower Elk River Wallace and Allen (2009) documented age 1+ juvenile steelhead in all months except November but captures in MSR1 were concentrated in the spring (Table C-1). Small numbers of juvenile steelhead have been documented in Martin Slough during recent intensive sampling, but only in 2 of 6 years sampled (Allen et al. 2016, Wallace et al. 2018, Natural Resources Services 2022). These individuals were captured in April and May. Due to the lack of steelhead spawning habitat in Martin Slough, these individuals likely originated in Elk River and had to pass through Swain Slough to reach Martin Slough.

Characteristics of preferred estuarine rearing habitats for steelhead have not been well described, but are presumably similar to other salmonids in that they require sufficient escape cover and velocity refugia during higher flows. Recent research shows that juvenile steelhead can exhibit diel movements within estuaries in response to temperature and dissolved oxygen patterns, with movement to upper estuary habitats at dawn and movement to lower estuary habitats at dusk (Bond et al. 2021).

### **Coastal Cutthroat Trout**

Coastal Cutthroat Trout display a wide array of life history strategies, with significant variation in migratory behavior between and among populations (Moyle et al. 2015). In rivers, this life history diversity can loosely be divided into three main groups: (1) anadromous (sea-run) life history, (3) potadromous (migratory within freshwater portions of the river system), and (4) stream-resident. The various life history forms require a wide diversity of marine, estuarine and freshwater habitats to exploit food and survive. Sea-run cutthroat trout migrate upstream to spawn in freshwater, but they are not strictly anadromous because they can make numerous movements back and forth between fresh and salt water to feed. For this reason, they are heavily reliant on estuaries and can spend prolonged periods (months) there, often moving in and out of fresh water, likely in response to feeding opportunities and rearing habitats (Moyle et al. 2015). Coastal Cutthroat trout have similar habitat requirements to those of resident Rainbow Trout and steelhead.

Because of their diverse life histories and frequent movements, Coastal Cutthroat Trout can be found in the in estuaries and the lower reaches of streams throughout the year. In Elk River, Wallace and Allen (2009) captured the species in MSR2 in all months except February and March, but in MSR1 they only captured them from May through July (Table C-1). All individuals captured ranged in length from about 130 millimeter (mm) (5 in) to >300 mm (12 in), indicating that they were age 1 or older. Small numbers of Coastal Cutthroat Trout have also been captured during all seasons of sampling of Martin Slough (Allen et al. 2016, Wallace et al. 2018, Natural Resources Services 2022).

### **Non-salmonid focal species**

#### **Tidewater Goby**

Tidewater Goby are a small, short-lived (generally 1 year), estuarine-adapted fish that can tolerate large temperature and salinity ranges (Swift et al. 1989, Tetra Tech, Inc. 2000). The species generally requires stable lagoon or off-channel habitats, particularly during their relatively short

larval stage (Lafferty et al. 1999a, Chamberlain 2006). Tidewater Goby are highly susceptible to predation by piscivorous fish and amphibians, especially introduced species (Stillwater Sciences 2006).

Tidewater Goby utilize the stream-estuary ecotone throughout their life cycle. During the juvenile and adult life stages, preferred habitat consists of low-velocity (but not stagnant), shallow water in seasonally disconnected or tidally muted lagoons, estuaries, and sloughs. Juveniles and adults can be found year-round, although they are most abundant in summer and fall. Tidewater Goby can be flushed downstream during high flow events, but can persist in low-velocity refugia habitat, which generally consists of off-channel sloughs and wetlands (Lafferty et al. 1999b). Substrate preference for juvenile and adult rearing is sand, mud, gravel, and silt, particularly associated with submerged vegetation. Which is likely used for cover (Stillwater Sciences 2006). Juvenile and adult Tidewater Goby are reported to prefer water temperatures of 12–24°C (54–75°F) within a range of 6–25°C (42–77°F) (Stillwater Sciences 2006). Juveniles and adults generally prefer salinities <15 ppt, but have been documented in waters ranging from 0–51 ppt (Stillwater Sciences 2006). Juvenile and adult Tidewater Goby appear to prefer shallow depths (< 1 m [3 ft]) near emergent vegetation, possibly to avoid predation by wading birds and piscivorous fish (Moyle 2002).

Reproduction and spawning typically occur during spring and summer in shallow, slack waters of seasonally disconnected or tidally muted lagoons, estuaries, and sloughs. Males dig burrows and guard eggs, most commonly in early spring and late summer in some areas (Stillwater Sciences 2006). Larvae, eggs, and males in burrows are likely less tolerant of floods, lagoon breaching, or strong tidal exchange. Preferred water temperatures during reproduction are 15–24°C (59–75°F), with a range of 2–27°C (36–81°F) (Stillwater Sciences 2006). Preferred salinities during spawning are generally <15 ppt, but range from 5–25 ppt (Stillwater Sciences 2006). Preferred depths for reproduction range from approximately 0.2 m to 1 m (0.7–3.3 ft) and preferred substrates appear to be sand, coarse sand, and sand/silt (Stillwater Sciences 2006).

Although Tidewater Goby are tolerant of a wide range of habitat conditions, they are generally most abundant and persist in habitats with a narrower range in habitat parameters during specific life stages (Stillwater Sciences 2006). Physical structure and location of Tidewater Goby habitat may be more important to their survival and persistence than specific water quality parameters (Chamberlain 2006). Persistence of Tidewater Goby populations is greatest in large wetlands and distance between extirpated habitats and larger wetland source populations affects dispersal and potential for recolonization (Lafferty et al. 1999a,b). Flood and breaching events can result in dispersal between disconnected estuarine habitats, although low survival likely limits dispersal (Stillwater Sciences 2006).

Seasonal distribution and relative abundance of Tidewater Goby in lower Elk River and Swain Slough is not well described. No Tidewater Goby were captured, during multiple years of seining at several sites in MSR1 and the lower portion of MSR2 (M. Wallace, CDFW, unpubl. data, 2005–2009). However, large numbers of Tidewater Goby were captured during in restored habitats in Martin Slough during monthly sampling conducted in fall, winter, and spring (Natural Resources Services 2022).

### **Longfin Smelt**

Longfin Smelt (LFS) were listed as threatened under the California Endangered Species Act in 2009 (CDFG 2009). This euryhaline, anadromous species exhibits complex life history patterns, using a variety of habitats during its approximately 2-year life cycle, from nearshore waters to

estuaries and the stream-estuary ecotone (Rosenfield 2010, Garwood 2017). LFS live along the Pacific Coast of North America from Prince William Sound, Alaska to the San Francisco Estuary (Rosenfield 2010). In Humboldt Bay, LFS have been documented in all the major tributaries including Mad River Slough, Jacoby Creek, Freshwater Slough, Elk River, and Salmon Creek (Garwood 2017). In lower Elk River, the species was documented in MSR1 from January–March 2016 (M. Wallace, CDFW, unpubl. data, 2006; Garwood 2017). The life stage of these individuals was not reported. LFS were not reported from other recent monitoring efforts in lower Elk River and Martin Slough (Wallace and Allen 2009, Allen et. al 2016, Wallace et al. 2018), but juvenile smelt of unknown species were reported in Martin Slough from late fall through spring (Natural Resources Services 2022).

Except for an unpublished larval LFS study conducted by CDFW between 2016–2018, information on the life history of the species in the Humboldt Bay region is limited relative to the San Francisco Estuary where it has been well studied (Rosenfield 2010, Garwood 2017). For this reason, the life history description presented draws heavily on information from the San Francisco Estuary (including the Sacramento-San Joaquin Delta) synthesized by Moyle (2002) and Rosenfield (2010).

LFS, which are semelparous, are thought to spawn in or near the mixing zone between fresh and brackish water in the upper portions of the estuary. Evidence from the Sacramento-San Joaquin Delta suggests spawning locations likely shift depending on freshwater inflow entering the stream-estuary ecotone (Rosenfield 2010). LFS eggs are adhesive and are thought to be deposited on sandy and gravel substrates. Eggs are deposited from late-fall to early spring, and generally incubate at water temperatures of about 7–15°C (Moyle 2002). LFS were not captured in Elk River during 2016–2018 sampling of Humboldt Bay tributaries, but based on capture of larvae in nearby Freshwater Creek, spawning likely occurred from late December through February or early March in those years (J. Ray, CDFW, pers. comm., 10 August 2022). In Freshwater Creek, based on larval capture locations, spawning likely occurred in fresh water near the upper extent of tidal influence (J. Ray, CDFW, pers. comm., 10 August 2022).

The embryo incubation period for LFS is thought to be from about 4–6 weeks, depending on water temperature (Moyle 2002). Salinity requirements for developing eggs are not well described, but the distribution of sexually mature adults in or close to fresh water suggests lower salinities are required for egg development (Moyle 2002, Rosenfield 2010). After hatching from eggs, the small (5–8 mm) larvae are buoyant and generally distributed near the surface of the water column in fresh and brackish waters (Moyle 2002, Rosenfield 2010). Larval LFS have a relatively low salinity tolerance and are most closely associated with salinities of 2 ppt. Upper salinity tolerance is not well described, but larval abundance rapidly declines with increasing salinities up to 15 ppt (Moyle 2002, Rosenfield 2010). Larvae can be detected over a protracted period, but they are most common in the winter and spring. In lower mainstem Freshwater Creek, in 2016 and 2017, recently hatched (6–7 mm) larval LFS were captured from mid-January through mid- to late March, with peak capture in late January and early February (J. Ray, CDFW, pers. comm., 10 August 2022). Larvae are weak swimmers and susceptible to transport to locations with unsuitable environmental conditions (e.g., high salinities) by stream flows and tidal currents (Moyle 2002, Rosenfield 2010).

Metamorphosis from the larval to juvenile form, which is strongly influenced by water temperature, may begin as quickly as 15 days post-hatch but more commonly requires 3 months. Juvenile and pre-spawning adult LFS are widely distributed throughout the year in brackish and marine environments. Juveniles and pre-spawning adults can be found across a wide range of salinities, from fresh water to pure sea water, but they generally prefer salinities from 15–30 ppt.

During the summer, they can inhabit water as warm as 20°C (68°F), but generally select 16–18°C (60.8–64.4°F). In the Sacramento-San Joaquin Delta, both juveniles and adults are typically found at greater densities in deeper habitats (>7 m) relative to shallower habitats. Juveniles and adults appear to migrate seasonally, downstream during summer months and upstream in the late-fall and winter. Adults are thought to become sexually mature as they migrate towards spawning locations.

### **Fish Habitat Characterization**

This section describes existing fish habitat conditions in PA 1, with an emphasis on characterizing juvenile salmonid rearing habitat. The assessment focuses on juvenile summer and winter salmonid rearing habitats since spawning habitat is not present in the low gradient and fine sediment dominated channels of the stream-estuary ecotone. Field assessments of physical habitat conditions for salmonids were conducted during both the dry (summer habitat) and wet (winter habitat) seasons to help understand habitat factors limiting salmonid population productivity and identify opportunities for and constraints to restoring fish habitat. Results from salinity and water temperature monitoring (Section 2.2.2 of the *Elk River PA 1 10% Design Report*; CalTrout et al. 2023) are also summarized as they relate to water quality constraints on fish utilization in PA 1.

In most of PA 1, clear geomorphic habitat units could not be identified due to the channelized, tidally influenced, and relatively homogeneous nature of the channel (uniform width, depth, and substrate). For this reason, traditional mesohabitat typing (e.g., pool, riffle, flatwater) was not feasible. Thus, for the purposes of characterizing and describing fish habitat conditions, the main channels of lower Elk River (MSR1 and MSR2) and Swain Slough (SS) were delineated into channel segments based on tributary and off-channel habitat junctures, unique geomorphic or riparian characteristics, or other notable changes in channel conditions (Figure 1-1). These segments ranged in length from approximately 400 ft to 2,500 ft. Primary off-channel features connected to the main channels of Elk River and Swain Slough were also identified and characterized and are shown in Figure C-1.



Figure C-1. Channel segment used to characterize fish habitat within Planning Area 1.

Summer rearing habitat for salmonids was assessed from September 28 through October 1, 2021, when stream flow was representative of typical late-summer and early fall habitat conditions. A mix of boat and bank surveys were used to access channels in PA 1 in both summer and winter. The summer habitat assessment focused on describing relative quantity of escape cover for juvenile salmonids and other fish in each channel segment provided by water depth, overhanging terrestrial vegetation, aquatic vegetation, large wood, small woody debris, and other cover elements. Observations and notes on relative level of canopy cover, presence and relative quantity of large wood, water velocity, tidal influence, and other fish habitat characteristics were also collected. Notes on anthropogenic disturbances and restoration opportunities and constraints were also recorded. GPS coordinates were collected at the downstream boundary of each channel segment and representative photographs of channel characteristics and physical habitat conditions were taken.

Salmonid winter rearing habitat was assessed from January 12–14, 2022, during a relatively dry period with a relatively low winter base flow (Section 2.2.2.1 of the *Elk River PA 1 10% Design Report*; CalTrout et al. 2023). The winter assessment focused on characterizing relative quantity and quality of low-velocity winter rearing habitat for juvenile Coho Salmon and other salmonids, including: (1) availability of in-channel low-velocity habitat; and (2) level of connectivity with off-channel features such as alcoves, side channels, and adjacent tidal marshes and floodplains. The degree of off-channel habitat connectivity was qualitatively characterized at representative locations by observing inundation of off-channel features at the surveyed flow and tidal stage and by assessing potential for inundation at higher streamflows and tides. Information from geomorphic and surface water assessments were also used to help characterize off-channel winter habitat conditions in the planning reach and ascertain restoration potential.

For summarizing fish habitat conditions herein, river and slough channels and adjacent off-channel habitats within PA 1 were subdivided into the following areas, each of which is characterized in the sections that follow:

- MSR1 – the lowest reach of mainstem Elk River that is dominated by saline or brackish water. The assessed portion of MSR1 includes main channel segments ER1–ER9.
- MSR2 – the reach of mainstem Elk River upstream of MSR1 that is tidally influenced but dominated by fresh water and includes main channel segments ER10–ER13.
- Swain Slough – the primary slough channel that enters the Elk River estuary at the HWY 101 bridge and includes main channel segments SS1–SS6 and other ditches or off-channel features draining into Swain Slough.
- Other – other assessed off-channel features and tributaries.

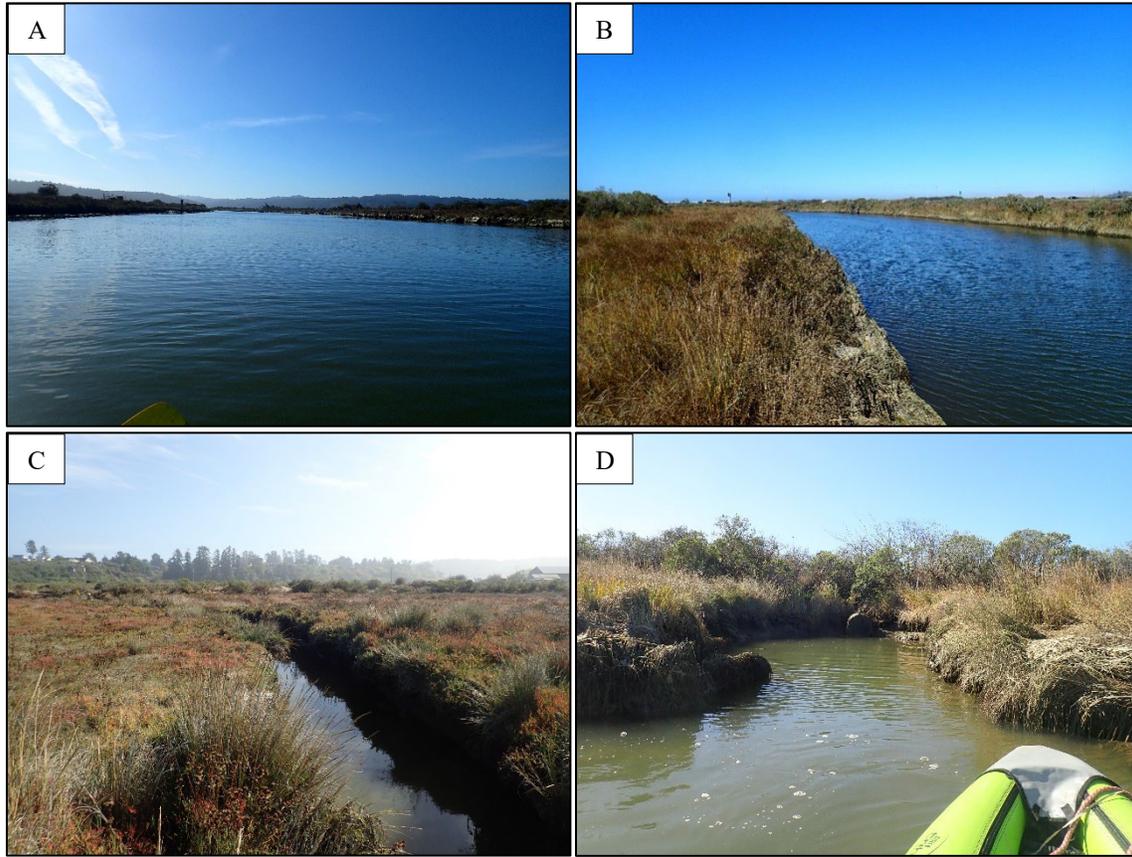
## MSR1

Approximately 2 miles of mainstem Elk River were assessed within MSR1, from the HWY 101 bridge upstream to the MSR2 boundary (Figure 2-24). In general, MSR1 is characterized by a broad, homogenous tidal slough channel with a high width-to-depth ratio, silt-dominated bed substrate, and near vertical banks associated with constructed levees along significant portions of the reach (Section 2.6, Appendix A of the *Elk River PA 1 10% Design Report*; CalTrout et al. 2023). Throughout much of MSR1, the channel is confined by these levees, limiting natural channel processes and connectivity with relic slough channels, tidal marshes, and other off-channel habitats. Wetted borrow ditches run along most of the levees on the side opposite from the main channel. These ditches are channelized and have infrequent connections with the main channel, but in some places may function like tidal slough channels (e.g., ER1.1). Channel width

in MSR1 gradually decreases in the upstream direction, ranging from approximately 150 ft in ER1 to 40 ft in ER9. MSR1 can experience daily tidal fluctuations of 4–8 ft (Section 2.2.2 of the *Elk River PA 1 10% Design Report*; CalTrout et al. 2023), which has significant bearing on habitat conditions and fish utilization patterns in the reach. For example, many of the higher quality rearing habitats that provide low velocities, escape cover, and feeding opportunities are associated with channel margins, alcoves, inset benches, and tidal sloughs, and these habitats may become dewatered or too shallow to support salmonid rearing during lower tidal stages. Because of tide-driven temporal shifts in habitat characteristics, fish are likely to move to find suitable rearing habitats at different tidal stages. The area of suitable salmonid rearing habitat in MSR1 is generally expected to be greatest at higher tidal stages and diminish at lower stages. Studies in other estuaries indicate that available habitat during low tides likely limits fish carrying capacity (Tschaplinski 1987). For this reason, providing rearing habitat and cover at lower tides is an important consideration for habitat restoration in MSR1.

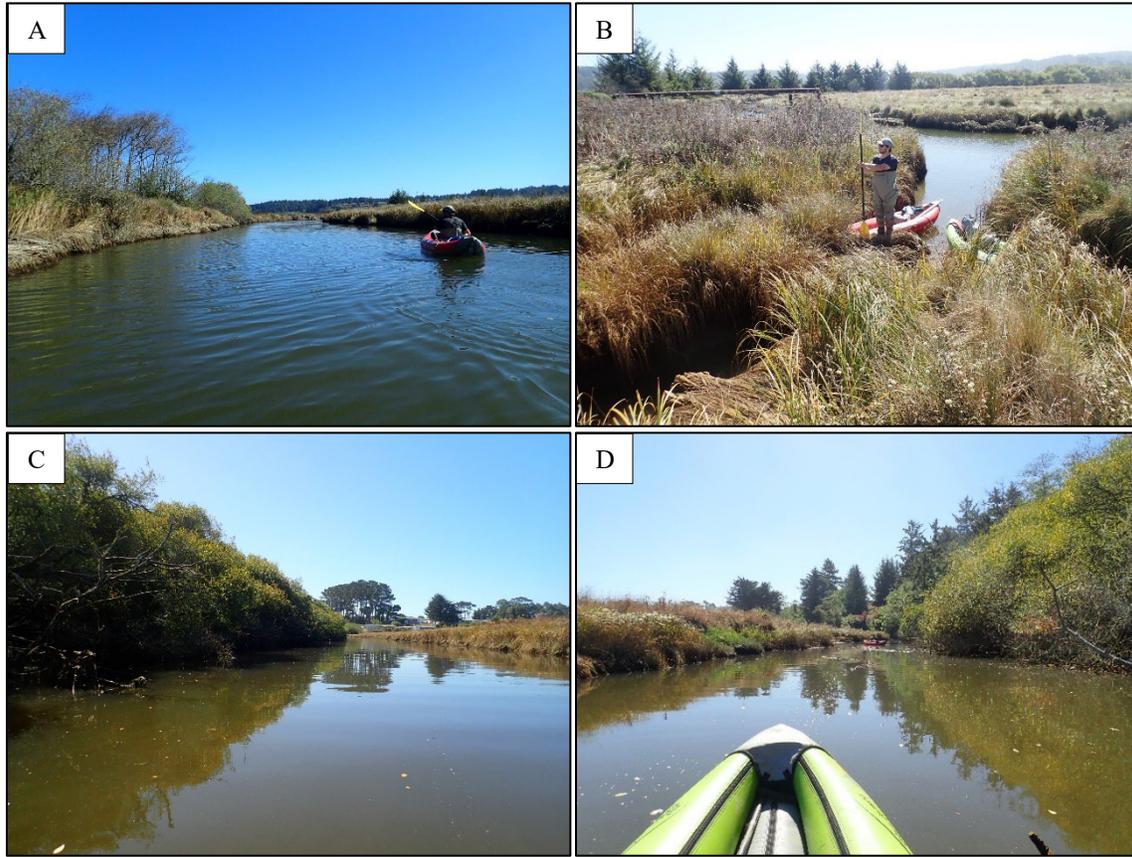
### Summer habitat

In channel segments ER1–ER4 (the lower 4,720 ft of the assessed portion of MSR1), quality of physical summer rearing habitat for salmonids, Tidewater Goby, and other fish is, in general, relatively poor due to the homogenous and straight channel, steep banks, limited hydraulic and depth complexity, and lack of in-channel and riparian cover (Figure C-2). In ER1–ER4, other than some shallow, grassy margins and small bank indentations along the main channel that are wetted during higher tides, the primary habitats with escape cover and lower velocities are associated with the ER.1 ditch network, alcove-like features present where drainage ditches enter the channel (e.g., ER2.1, ER2.2, ER3.1, ER4.1), and a single, small island at the upstream end of ER3. A network of partially wetted drainage ditches, relic slough channels, and depressions occurs throughout the ERWA adjacent to MSR1. These channels connect to the Elk River via tide gates at ER2.1, ER2.2, and ER3.1, but tidal exchange and fish access to these features are limited by dilapidated tide gates and low habitat complexity along with high salinities would limit juvenile salmonid rearing in these ditches during the summer (Section 2.2.2; Table 2-12 and Table 2-13 in the *Elk River PA 1 10% Design Report*; CalTrout et al. 2023). It was not possible to view the entire channel at the surveyed tide due to depth and turbidity, but except for a few pieces of submerged large wood observed in ER4, very little in-channel cover was observed in channel segments ER1–ER4. Additionally, no canopy cover or significant escape cover from riparian trees was observed. Because of the simplified channel and minimal off-channel habitat connectivity, high water velocities during higher ebb and flood tides may limit overall capacity of the channel to support juvenile Coho Salmon and other fish during the summer.



**Figure C-2.** Photos from September 2021 showing representative main-channel summer fish habitat conditions in ER1 (A) and ER4 (B) and examples of accessible off-channel habitat features in ER1.1 (C) and ER3.1(D). Note: tidal stage was relatively high when these photos were taken.

In channel segments ER5–ER7, overall fish habitat quantity and quality continues to be limited by the simplified, straight channel bordered by relatively steep banks and limited off-channel habitat. Main-channel salmonid summer rearing habitat quality improves somewhat relative to ER1–ER4 due to long patches of continuous riparian trees with overhanging branches on the right bank of ER5 and ER6 and on the left bank of ER7. These branches provide both overhead and in-channel escape cover for juvenile fish (Figure C-3). Based on observations during the winter survey, which was conducted at a lower tidal stage than the summer survey, the area of suitable salmonid rearing habitat provided by these overhanging branches is expected to be greatest at higher tidal stages, when they and the few gradually sloping banks become more inundated. It was difficult to fully assess in-channel cover at the surveyed tide due to depth and turbidity, but other than several pieces of submerged large wood in ER7, most cover was associated with channel margins (branches from live trees and grasses).

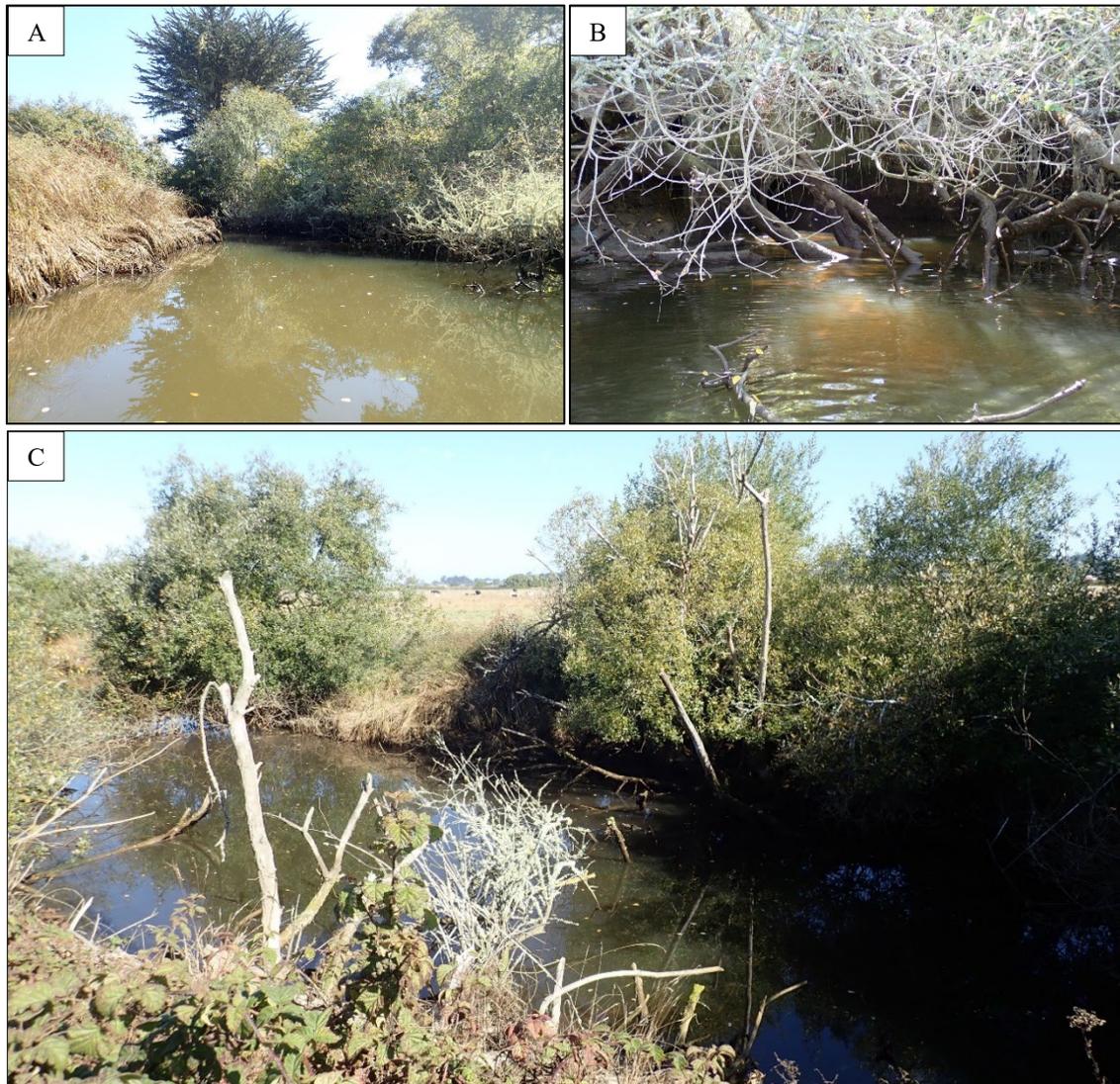


**Figure C-3.** Photos from September 2021 showing representative main-channel summer fish habitat conditions in ER5 (A), an alcove habitat associated with a tide gate at ER5.1 (B), and examples of overhanging riparian cover in ER6 (C) and ER7 (D). Note: tidal stage was relatively high when these photos were taken.

In channel segments ER8–ER9 (the upper 2,260 ft of MSR1), overall quality of summer rearing habitat for salmonids increases substantially due the presence of thick riparian trees with complex overhanging and in-channel branches on one or both banks (Figure C-4). Additionally, several pieces of in-channel large wood that provide high quality habitat were observed in both ER8 and ER9. The channel in these segments is still relatively homogeneous, with steep banks on both sides and is narrower and deeper relative to downstream segments. In many places, overhanging branches provide shade and escape cover for fish across much of the narrow channel. However, in several sections of the right bank of both ER8 and ER9, the riparian zone is interrupted by several long areas of grassy bank with few trees and little fish cover. No connected alcoves, tidal sloughs, or other features that provide flow refugia or off-channel rearing opportunities were documented in ER8 or ER9. A seasonally wetted drainage ditch, ER9.1, enters Elk River at the ER8/ER9 boundary via a tide gate, but is not currently accessible to fish. This location, which historically had a connected tidal slough channel, is fed by springs/seeps draining the hillslope. As described below, if restored, it has potential to provide high quality off-channel rearing habitat.

Overall, suitable habitat for Tidewater Goby is limited in MSR1 because the species requires relatively stable and shallow low-velocity habitats in connected off-channel sloughs and wetlands. The primary habitats with potential to support Tidewater Goby under existing

conditions are associated with the ER.1 ditch network and alcove-like features present where drainage ditches enter the channel (e.g., ER2.1, ER2.2, ER3.1, ER4.1, ER5.1, ER6.1). Additionally, many existing, but largely disconnected, ditches and relic slough channels in the ERWA have potential to provide high quality goby habitat if restored. The drainage ditch and relic slough associated with ER9.1 also has potential to provide goby habitat if reconnected.



**Figure C-4.** Photos from September 2021 showing a steep, grassy bank on the right bank of ER8 and overhanging riparian branches on the left bank (A) complex overhanging and in-channel tree branches on a near-vertical bank in ER8 (B), and section of ER9 with patchy riparian on both banks (C).

#### Winter habitat

The same channel characteristics that limit summer rearing habitat quality for salmonids and other fish in much of MSR1 (homogenous and straight channel, steep banks, limited hydraulic and depth complexity, lack of in-channel cover) also limit winter rearing habitat quality. MSR1

has minimal in-channel velocity refugia, limited escape cover, and lack of connected off-channel rearing habitat.

At the relatively low stream flow and moderate tidal currents surveyed, small areas of relatively low-velocity habitat (<1.0 ft per second) were observed along the channel margins and the few alcove-like habitats present in MSR1. However, because of the straight channel, with relatively steep banks, and very little large wood, even moderate winter and spring high-flow events are expected to produce in-channel water velocities that exceed values needed by Coho Salmon for rearing (<0.6 ft per second ft/s; Beecher et al. 2002). Lack of in-channel cover and velocity refugia is also expected to restrict suitable habitat area for other fish species in the reach during higher flows.

The primary areas with potential to provide velocity refugia during higher stream flows include (1) the ER.1 ditch network, the alcove-like features present where drainage ditches enter the channel (e.g., ER2.1, ER2.2, ER3.1, ER4.1, ER5.1, and ER6.1) (2) small areas in ER6, ER7, ER8, and ER9 that have both relatively gradual slopes and complex, overhanging, in-channel riparian branches or large wood along the bank, and (3) the few pieces of in-channel large wood big enough to potentially provide small areas of low velocity habitat (Figure C-3). A series of 20–40 ft wide “inset benches” (bounded by levees) located along the right bank in ER3 and ER5 have gradual bank slopes (after an initial step up from the active channel). These sites may also provide velocity refugia when they are flooded during higher flows (Figure C-5).

The network of drainage ditches, relic slough channels, and depressions in the ERWA have potential to provide large areas of high-quality winter refugia and rearing habitat depending on flow and tidal stage, but the current habitat is generally in poor condition. Additionally, as described above, ER9.1 is not currently accessible to fish, but if restored, has potential to provide a large area of high-quality, off-channel salmonid winter rearing habitat. During the relatively dry winter period, a significant amount of fresh water was observed entering the ditch via the adjacent hillslope, which would help maintain water quality at the site if it were made accessible to fish (Figure C-6).



**Figure C-5.** Examples of locations in MSR1 that have potential to provide high flow refugia for fish in MSR1, including connected borrow ditch at ER1.1 (A), large algal cover associated with ER2.2 (B), large wood along both channel margins in ER7 (C), relatively gradually sloped bank with in-channel willow branches in ER9 (D), and inset bench on right bank in ER5 (E).



Figure C-6. Photo from January 2022 showing the lower portion of the drainage ditch at ER9.1.

### Water quality

Despite the presence of suitable physical habitat for juvenile salmonid rearing in MSR1, utilization of this reach is likely seasonally limited by high salinities and water temperatures. Continuous water temperature and salinity data collected in MSR1 in 2021 and 2022 (Section 2.2.2) provide an indication of seasonal suitability for salmonids and other fish species. MSR1 is characterized by brackish water, with channel bottom salinities varying from about 20–30 ppt during the dry season and ranging from about 0–26 ppt during wetter periods, with lower values associated with higher flows during lower tides. In general, high salinities are expected to inhibit most rearing by non-smolt juvenile salmonids during much of the dry season. Results of fish monitoring conducted in the reach confirm that few rearing juvenile salmonids use MSR1 during the summer and early fall, except for Chinook and Coho smolt, which have higher salinity tolerances than fry and parr (Wallace and Allen 2009; Table C-1).

During wetter periods in the winter and spring, salinities in MSR1 can be low enough to support juvenile salmon rearing and it is likely that some individuals move in and out of this reach in response to fluctuating salinities resulting from variable flows and tides. Additionally, during both wet and dry seasons, significant salinity stratification can occur, with the surface layer having considerably lower salinities relative to the channel bottom (where the continuous data were collected). For example, at the water quality monitoring site ER-2 (channel segment ER6), spot-measured salinity in September 2021 was 13.7 ppt near the surface and 27 ppt near the

bottom. At the same site, in both February and late-May 2022, salinity was about 3 ppt near the surface and 27 ppt near the bottom. It is likely that the presence of less saline surface layers allows juvenile salmonids to acclimate to higher salinities and rear in or move through the reach prior to undergoing smoltification.

Water temperatures in MSR1 generally remain below levels tolerated by juvenile Coho Salmon and other salmonids (approximately 18°C), but in 2021, daily mean temperatures exceeded 20°C and daily maximums exceeded 22–24°C at monitoring sites ER-1 and ER-2 during June and July. Additional temperature monitoring in the reach would be valuable to understand whether these higher values occur in other water years. Limited depth stratified spot measurements indicate thermal stratification can occur in MSR1 during some periods, with surface values from 2–4°C cooler than bottom values during some (but not all) measurements.

## MSR2

Approximately 1 mile of mainstem Elk River and adjacent off-channel features were assessed for fish habitat in MSR2 (Figure 2-21 of the *Elk River PA 1 10% Design Report*; CalTrout et al. 2023). In general, MSR2 is considered the upper part of the stream-estuary ecotone and is tidally influenced at stages greater than about 4 ft but dominated by fresh water. Similar to upstream reaches, MSR2, which is dominated by homogeneous silt-sand substrates, has been impacted by channel and habitat simplification resulting from agricultural land uses, large wood removal, and sediment aggradation. The channel is relatively narrow (20–50 ft) with steep banks and is entrenched by 6–8 ft relative to the adjacent pastures throughout much of MSR2, limiting floodplain connectivity. The riparian corridor is constrained to a narrow strip, primarily composed of willow and alder on the stream bank and, in many places encroaching on the channel. Stream banks are degraded by cattle grazing in places. In general, salinities and water temperatures remain sufficiently low to support year-round rearing by juvenile salmonids. More detailed observations of summer and winter habitat for juvenile salmonids are provided in the sections that follow.

### Summer habitat

Despite the anthropogenically impacted and simplified channel, suitable summer rearing habitat for juvenile salmonids is abundant and widespread in MSR2 relative to MSR1. Large areas of summer rearing habitat with sufficient depth and extensive escape cover are present and ample riparian shading was observed throughout the reach (Figure C-7). A comprehensive large wood survey could not be conducted due to the extremely dense riparian that choked the channel in much of the reach, but very few pieces of functional large wood and no channel spanning wood jams were observed.

Channel segment ER10 is characterized by a straight, homogenous channel bounded by cattle pasture on both sides and contains an extremely dense willow-dominated riparian zone that overhangs the entire wetted channel in most areas. In many places, thick willow branches interacted with the low-flow channel. These branches provide a high amount of overhead and in-channel escape cover for rearing juvenile salmonids. While very few pieces of large wood were observed, some larger willows growing along the bank may function like large wood. At the outgoing tidal stage of about 4 ft when ER10 was assessed, some short riffle-like features and shallow, hydraulic control points separating habitats were observed, suggesting minimal tidal influence at that stage.

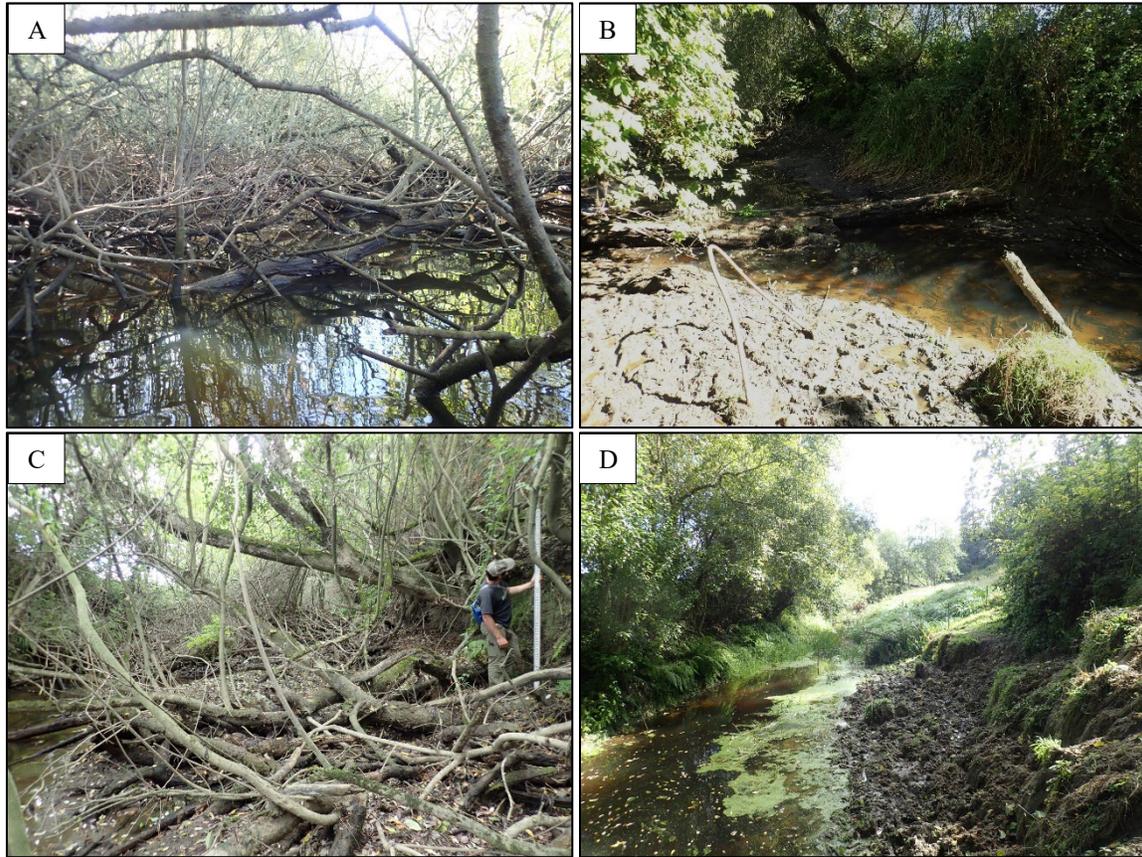
In channel segment ER11 the hillslope impinges along the left bank of the channel. The riparian zone is still relatively dense and contiguous in ER11 but has more diversity and the understory and channel are more open relative to ER10. Several pieces of functional large wood were observed, creating some local scour and fish cover. Significant erosion resulting from cattle was observed in portions of ER11, from the left bank hillslope, extending into the channel, creating local silt inputs, and potentially impairing water quality.

The dense riparian vegetation in channel segment ER12 is similar to that observed in ER10: the channel is choked with live willow that interacts with the fine-sediment dominated channel. Overall, summer rearing habitat for salmonids in ER12 is abundant and relatively high quality, except for several relatively long (50–100 ft) and homogeneous sections of shallow (<0.5 ft) and flowing flatwater habitat. ER12.1 is a significant off-channel drainage fed by springs draining the adjacent hillslopes that enters ER12 via a culvert and tide gate that excludes fish. As detailed below, this site has significant potential for fish habitat restoration, particularly for winter off-channel habitat. A ditch draining the adjacent cattle pasture enters ER12 through a long culvert (without a tide gate) on the right bank at ER12.2.

Channel segment ER13 runs along the base of the hillslope on the left bank, with continued flat cattle pasture on the right bank. Portions of the segment have extensive escape cover and sufficient water depth to support summer rearing habitat for salmonids, however, several very shallow and apparently stagnant sections with unsuitable salmonid habitat were observed in ER13. Several shallow locations had thick aquatic vegetation, which in one place spanned the channel and appeared to obstruct fish movement. In general, the channel in ER13 is more open with larger and less dense riparian trees relative to downstream segments. The channel is still entrenched, but portions of the bank have failed, creating small inset benches and increasing channel complexity in places. While the bed substrate is still silt-dominated, patches of sand and small gravel were observed in the upper portion of ER13. A significant spring/drainage was observed flowing off the left bank hillslope and entering the channel at the downstream end of ER13.

Despite the generally abundant and high-quality summer rearing habitat observed for salmonids, restoration actions that increase the depth and complexity of pools and mitigate for in-channel cattle impacts would be valuable in portions of MSR2. Implementing restoration actions that improve winter rearing habitat—such as through the addition of large wood—will also improve summer habitat.

Overall, suitable habitat for Tidewater Goby is limited in MSR2 because the species requires relatively stable and shallow low-velocity habitats in off-channel sloughs and connected wetlands, which are rare in the reach. The drainage ditch and relic channel associated with ER12.1 has potential to provide goby habitat if restored.



**Figure C-7.** Representative summer rearing habitat in MSR2. Dense willow branches and small woody debris covering much of the channel in ER10 (A), a more open section in ER11 with some functional large wood and cattle impacts in the channel (B), dense in-channel branches and entrenched channel in ER12 (C), and shallow, stagnant section of ER13 with in cattle impacts (D).

### Winter habitat

Overall, quality of winter habitat in MSR2 is relatively poor, with minimal in-channel flow refugia due to low large wood densities, essentially no connected off-channel habitat features, and severely restricted connectivity with adjacent floodplains. During the winter habitat assessment conducted in January 2022 at a moderate winter baseflow, small areas of relatively low-velocity habitat (<1.0 ft per second) were observed along the channel margins in a few locations where banks were more gradually sloped and dense willow branches or large wood were present (Figure C-8). However, because of the entrenched channel and limited functional large wood, even moderate high-flow events are expected to produce water velocities that exceed values preferred by Coho Salmon for rearing (approximately 0.6 ft per second ft/s; Beecher et al. 2002) throughout much of the reach. In some locations, it is possible that the extremely dense in-channel willow trunks and instream branches create low-velocity refugia along the channel margins or slow upstream water velocities through backwatering. Several groups of large wood pieces that were observed also likely create some in-channel flow refugia at higher flows.



**Figure C-8.** Examples of low-velocity in-channel habitat in MSR2 observed during the January 2022 survey conducted at a moderate winter base flow. Dense in-channel branches and small wood pieces in ER10 (A) and a piece of large wood creating alcove-like habitat at the observed flow in ER11 (B).

No alcoves, side channels, or other off-channel winter habitat features accessible to fish were observed in MSR2. The primary opportunity to restore off-channel fish habitat in MSR2 involves re-connecting the existing low-elevation drainage present at ER12.1, which runs along the hillslope west of ER12 for approximately 1,300 ft before entering the channel via a culvert and tide gate (Figure C-9). During the January 2022 assessment, during a relatively dry winter period, the entire length of this drainage was wetted and significant flow was observed at both at the upstream/south end of the feature and where it entered the culvert through a shallow riffle at the south end. Additionally, a large (~30 x 200 ft) and relatively deep (max depth = 1.5 ft) ponded area was documented at the south end of the feature. Simply removing or modifying the existing tide gate to allow fish access to the existing low elevation feature fed by freshwater would provide a large area of high-quality off-channel winter rearing habitat in a reach where little is present.



**Figure C-9.** Large area of existing off-channel habitat at ER12.1 that is inaccessible to fish due to a tide gate.

### Water quality

Continuous water temperature and salinity data collected at site ER-3 near the ER11/ER12 boundary in MSR2 (Section 2.2.2) indicate that, although water levels rise and fall with the tide, the site is freshwater dominated in the winter and spring when stream flows limit the upstream extent of saltwater influence. However, during summer and fall low flow conditions, the site becomes brackish during higher tidal stages (typically greater than about 6.5 ft). In 2021, daily

maximum bottom salinities ranged from near 0 ppt during days with lower high tides to 21 ppt at higher tides (Figure 2-18, Figure 2-19 of the *Elk River PA 1 10% Design Report*; CalTrout et al. 2023). High densities of age-0 Coho Salmon documented in MSR2, suggests salinity does not prevent fish utilization of the reach during the low flow period (Wallace and Allen 2009; Table C-1). While salinity stratification was not documented by limited spot measurements in 2021 and 2022 (Table 2-8 in CalTrout et al. 2023; note measurements only conducted during lower tides or higher flows), it is likely that a significant freshwater surface layer is present in much of MSR2 during high tides, allow juvenile salmonids to persist. Fish may also move upstream during high tides to avoid high salinities. Water temperatures in MSR2 remain below levels that can be stressful to salmonids and are substantially cooler than measured in MSR1, with daily mean temperatures at the ER-3 monitoring site never exceeding 16°C during 2021 and 2021.

Although water quality information is limited in these reaches, winter water quality is known to be significantly impaired by high suspended sediment concentration and turbidity (CalTrout et al. 2019).

### **Swain Slough downstream of Elk River Road tide gate**

Approximately 0.9 miles of mainstem Swain Slough and adjacent off-channel habitats within PA 1 were assessed for fish habitat, from its confluence with Elk River upstream to the tide gate at Elk River Road (SS1–SS6; Figure C-1).

In general, mainstem Swain Slough is characterized by a relatively broad, homogenous tidal slough channel with steep banks confined by constructed levees along significant portions of the reach (Figure 2-40 of the *Elk River PA 1 10% Design Report*; CalTrout et al. 2023). As with lower Elk River, the channel is confined by these levees, limiting natural channel processes and connectivity with relic slough channels, tidal marshes, and other off-channel habitats. Wetted borrow ditches run along most of the levees. These features are channelized and have infrequent connections with the main channel (either thorough small gaps in the levees or during high tide). Channel width in Swain Slough gradually decreases in the upstream direction, ranging from approximately 60 ft in SS1 to 20 ft in SS6. Swain Slough tidal patterns and water levels closely tracks those recorded at the ER-1 monitoring site, except during high flow events with significant freshwater inflows from Martin Slough (Section 2.2.2). Daily tidal fluctuations of 4–8 ft are expected to have significant influence on habitat conditions in Swain Slough, with a greater area of habitat with high-quality cover on the channel margins available at higher tidal stages. As with MSR1, available habitat during low tides is expected to limit overall fish carrying capacity. Observations of summer and winter fish habitat, focused on juvenile salmonid rearing, and the likely influence of salinity and water temperature on fish utilization in Swain Slough are summarized below.

#### **Summer habitat**

As with MSR1, because of high salinities, utilization of Swain Slough habitats by salmonids during the summer is expected to be primarily limited to the smolt life stage as they transition to Humboldt Bay and the ocean. At relatively high tidal stages, including during the September 2021 survey, there is a significant amount of juvenile fish escape cover and low velocity habitat along much of the margins Swain Slough. High quality fish cover is provided by extensive overhanging and in-channel riparian tree branches present along much of the right bank in SS2 and SS3 (Figure C-10). Additional cover is provided by flood grasses and other vegetation that occur along much of the channel, including some relatively large inset benches with gradual slopes and small alcove-like features in SS4, SS5, and SS6 that provide large areas of 1–2 ft deep,

lower velocity habitats with cover during higher tides. Little connected off-channel habitat is currently present in Swain Slough due to the levees that run along the channel. A relatively large salt marsh that contains an off-channel pond is present at SS3.1. Tidal connectivity and fish access to this site appears to be severely limited by an old tide gate and drainage ditch running through the marsh. As detailed under winter habitat below, this site has potential to provide a large area of high-quality fish rearing habitat. The borrow ditches that run along much of Swain Slough appear to be connected to the main channel only at high tidal stages, but there are a few locations, such the left bank of SS4 where the levees have partially failed, allowing more frequent tidal inundation and potentially providing fish off-channel fish habitat at more moderate tidal stages.

At lower tidal stages, many of these margin habitats become dewatered and fish would need to move to find cover provided by in-channel features. Observations from a relatively low tidal stage during the January 2022 winter habitat survey indicate that the low-flow channel in much of Swain Slough is relatively shallow during low tides and contains very little in-channel escape cover or hydraulic diversity. In SS1 and SS2, some fish cover is provided by mid-channel patches of eelgrass (Section 2.4). Except for two large logs in SS3 that create some scour and fish cover, no large wood was observed in the low-flow channel.

Overall, suitable habitat for Tidewater Goby is currently limited in Swain Slough because the species requires relatively stable and shallow low-velocity habitats in connected off-channel sloughs and wetlands. The primary habitats with potential to support Tidewater Goby under existing conditions include the large alcove at SS4.1 and locations with levee failures where borrow ditches are connected. Some of the smaller alcove life features that occur along the margins SS4 and SS5 may also provide some habitat, but most of these features likely go dry during low tides.



**Figure C-10.** Photos from September 2021 showing representative main-channel summer fish habitat conditions in Swain Slough. Looking upstream at straight channel in SS2 confined by a levees on the left bank and more gradual bank with riparian cover on the right bank (A), looking downstream at overhanging riparian cover along both banks in SS3 (B), looking upstream at flooded vegetation along the margins of SS5 during a relatively high tidal stage (C), and looking downstream from the tide gate at the end of SS6 (D).

### Winter habitat

During wetter periods of winter and spring with more freshwater influence, like MSR1, Swain Slough has potential to support rearing age-0 juvenile salmonids and other freshwater-dependent or brackish species (Table C-1). Winter habitat complexity and fish escape cover in the Swain Slough channel during moderate winter flows is similar to that described for summer habitat: relatively large areas of high-quality habitat are accessible along the channel margins during higher tidal stages and minimal in-channel habitat is available during lower tides (Figure C-10 and Figure C-11). During high winter flows, when significant freshwater enters Swain Slough via Martin Slough and upstream drainages, water velocities in much of the channel may become too high to support juvenile salmonid rearing. As described above, access to off-channel and floodplain habitats that provide velocity refugia is limited by the levees that run along much of Swain Slough. During high flow conditions, some high-flow refugia habitat appears to be present along the more natural bank margins that occur along the right bank of SS2 and SS3, which has sections with relatively gradual slopes (up to the base of the adjacent hillslope) with thick overhanging tree branches and some bankside large wood (Figure C-11). Fish may also find

velocity refugia where the levees have failed, and they can access the network of borrow ditches and adjacent lower elevation floodplains. However, fish stranding could be an issue when flows recede and the ditches become disconnected.



**Figure C-11.** Photos of from the January 2022 fish habitat assessment of Swain Slough. Examples of potential high flow refugia habitat, including large wood located on the relatively gradually sloping right bank of SS3 (A) and an alcove at SS4.1 (B) and representative area with shallow water and low in-channel habitat complexity that occurs during lower tidal stages in SS4 (C).

The salt marsh that occurs east of the SS2/SS3 boundary (SS3.1), is currently largely disconnected; however, it has high potential to provide a large area of high-quality fish habitat adjacent to lower Swain Slough (Figure C-12). The approximately 1-ac marsh is fed by a small drainage originating in the adjacent wooded hillslopes that provide significant freshwater inputs to the site during the wet season. Most of this water appears to drain into a narrow (2 ft) and very entrenched (3–5 ft deep) drainage ditch that runs across the meadow before terminating in Swain Slough through a small tide gate at the base of a channel-side levee. An existing, small (40x40 ft) brackish pond is present on the eastern edge of the marsh. It does not have an obvious inlet or outlet channels but appears to be tidally connected at some tidal stages (was brackish during September site visit) and likely receives some freshwater from the adjacent hillslopes. The site appears to become inundated at the highest tidal stages that flood the berm that runs along this channel/marsh margin (Figure 2-1 of the *Elk River PA 1 10% Design Report*; CalTrout et al.

2023). However, field observations suggest the marsh is inaccessible to fish at most tidal stages. It is unclear how frequently the site floods during winter flow events but appears to be disconnected by the relatively high elevation berm at most flows. This site has significant potential for restoration of high quality and valuable fish habitat since it is an undeveloped low-elevation salt marsh habitat with an off-channel pond in the lower estuary that could be fed by significant freshwater. If restored, this site could provide high flow refugia habitat during flood events and persistent off-channel rearing habitat for salmonids and other fish during the winter and spring.



**Figure C-12.** Photos of disconnected off-channel salt marsh (A), associated pond (B), small tributary flowing into marsh (C), and old tide gate that enters Swain Slough (D).

## Water quality

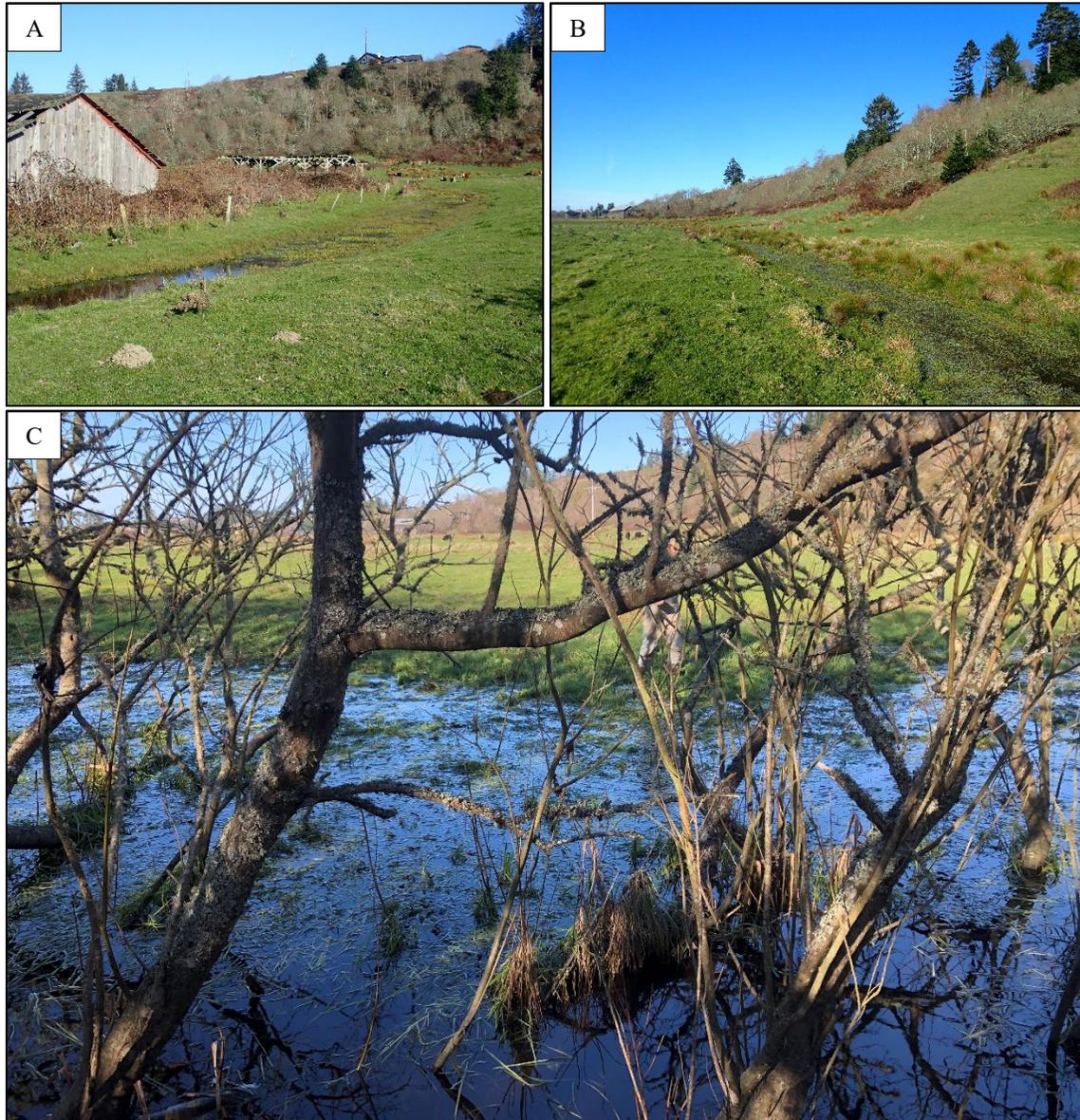
As with MSR1, during the summer and early fall, high salinities (>20 ppt) in Swain Slough are expected to limit fish use to species and life stages (i.e., smolt) than can tolerate salt water (Section 2.2.2 of the *Elk River PA 1 10% Design Report*; CalTrout et al. 2023). During wetter periods in the winter and spring, salinities in Swain Slough can be significantly lower especially at the SS-2 monitoring station (channel segment SS6), where daily values fluctuating between a low of near zero and a high of 6–10 ppt during periods with higher flows during lower tides. During these periods, Swain Slough may support age-0 and pre-smolt juvenile salmon rearing; though it is likely that some individuals move in and out of this reach in response to fluctuating salinities resulting from variable flows and tides. Additionally, the duration that Swain Slough provides suitable salinities is expected to be significantly longer during wet winters relative to the dry winter of 2021–2022 when water quality monitoring was conducted. Restoration efforts that reconnect freshwater sources to Swain Slough and provide fish access to nearby freshwater dominated habitats are expected to extend the duration of salmonid rearing. Additionally, significant salinity stratification may also allow salmonids to persist in the reach during some periods when bottom salinities are high. However, in contrast to MSR1, limited depth-stratified sampling in 2021 and 2022 suggests minimal thermal stratification in Swain Slough (Section 2.2.2.1 of the *Elk River PA 1 10% Design Report*; CalTrout et al. 2023).

Water temperatures recorded at Swain Slough monitoring sites (SS-1 and SS-2) were similar to those recorded at MSR1 monitoring sites (ER-1 and ER-2). Daily mean water temperatures at both sites remained above 18°C for much of the summer 2021, with temperatures at SS-2 being higher than at SS-1 (Section 2.2.2.2 of the *Elk River PA 1 10% Design Report*; CalTrout et al. 2023). Limited depth-stratified measurements showed essentially no thermal stratification at the Swain Slough monitoring sites.

## Other locations assessed

### Eastern off-channel habitat

A disconnected relic slough feature that is fed by two small tributaries (T1 and T2) and borders cattle pasture on the east side of Elk River Road, was also assessed due to its potential for fish habitat restoration (Figure C-1; Figure C-13). This site consists of two channel-like depressions that are mostly dry in the summer but appear to remain wetted for much of the winter and spring. The northern channel, T1, is fed by a seasonal drainage from the north, a small tributary, and at least one spring entering from hillslope to the east of the channel. The T1 channel is approximately 1,900 ft long and flows north and west before passing through a culvert under Elk River Road and entering a drainage ditch (SS7) that flows into Swain Slough (Figure C-1, Section 2.6, Appendix A). The southern channel, T2, is fed primarily by a tributary flowing from the southeast hillslope that enters a depression along the southern edge of the cattle pasture before passing through a culvert under Elk River Road and eventually flowing into Swain Slough via a drainage ditch that follows the west side of Elk River Road (Figure C-1, Section 2.6, Appendix A of the *Elk River PA 1 10% Design Report*; CalTrout et al. 2023). This feature includes about 400 ft of ponded habitat on the edge of the cattle field, including a relatively deep (1 ft) section partially within the adjacent riparian forest (Figure C-13). Neither of these relic channels are currently accessible to fish but contribute valuable freshwater to Swain Slough and have potential to provide high quality winter rearing habitat for salmonids if reconnected.



**Figure C-13.** Relic Swain Slough channel complex east of Elk River Road. T1 channel near Elk River Road(A) and along hillslope (B) and deep depression along riparian forest associated with T2.

### Orton Creek

Orton Creek is a small perennial tributary draining an area of approximately 1.5 square kilometers ( $\text{km}^2$ ) (0.6 square miles [ $\text{mi}^2$ ]) (Figure C-1) east of Elk River Road. After crossing Elk River Road through a culvert that is a barrier to fish movement just east of PA 1, the stream flows west for approximately 900 ft before entering a culvert that routes it southwest for approximately 1,400 ft to Elk River near the end of Showers Road. Historical aerial photographs and terrain analyses indicate that the stream likely flowed into Swain Slough before being re-routed (Figure 2-3 of the *Elk River PA 1 10% Design Report*; CalTrout et al. 2023). Although the contributing drainage area and stream channel are relatively small (approximately 3–4 ft wetted width in

January), Orton Creek delivers a significant amount of fresh water to PA 1. Notably, the stream was wetted and had detectable flow during a site visit in August 2021, following a historically dry winter. During the winter habitat assessment on January 14, 2022, following a relatively dry period (7 days without rain), stream flow measured near the culvert inlet was near 0.4 cfs. The portion of the channel in PA 1 that is above ground currently has a relatively small area of suitable salmonid rearing habitat due to its small size. The channel is narrow and has limited connectivity with the flood plain since it is generally entrenched by 3–6 ft relative to the adjacent pasture. The channel consists of alternating short riffles and pools with depths generally <1 ft during January. Bed substrate includes a mix of silt, sand, and small gravels. Water temperature in Orton Creek was 12.5°C on at 12:40pm on October 1, 2021, and 8°C at 12:14 pm on January 14, 2022. Despite limited existing physical habitat for fish, reconnecting freshwater flows from Orton Creek to a relic Swain Slough channel would have high value by lowering salinities and helping to maintain water quality in restored channels. Additionally, if the channel were restored, Orton Creek could provide some high-flow refugia for salmonids and provide quality spawning habitat for Coastal Cutthroat trout and potentially other salmonids.



**Figure C-14.** Photos of Orton Creek and the culvert connecting it with Elk River. Riparian zone near culvert inlet (A), wetted channel during January 2022 flow measurement near culvert inlet (B) culvert inlet during August 2021 site visit (C) and culvert outlet and flow into Elk River during September 2021 habitat assessment.

---

**Appendix D**

**Bat Habitat Assessment**

---

## BAT HABITAT ASSESSMENT

### Methods

A bat habitat field assessment was conducted to provide existing information for permitting and design considerations. The bat habitat assessment was conducted on February 25, 2025, by Stillwater biologist Lauren Dusek, with support from Emmalien Craydon. The assessment included Areas 1–4 and involved visual inspection of existing structures and an assessment of mature tree stands that may be modified by the Project (Figure D-1).

A structure survey was conducted at structures that may be removed or possibly considered for modification to benefit bats. The building within Elk River Wildlife Area (ERWA) South that is managed by California Department of Fish and Wildlife was not surveyed (Figure D-1). The survey assessed if the structure had the potential for supporting roosting bats and documented any evidence of a previous roost (e.g., guano or urine staining). While all structures had the potential to support a night roost (used by an individual or smaller number of bats in the evening between feeding bouts), the focus of the survey was to identify the potential for the structure to support a maternity roost. Maternity roosts are locations where pregnant females gather in a warm, safe place to have their young. Structure modification has the potential to disturb maternity roosts and result in injury or mortality to adults and non-volant young (young unable to fly) if timed during the maternity season (May 1 through August 31).

A tree inventory was conducted at Area 4 to inspect the established *Hesperocyparis macrocarpa* (Monterey cypress) stand along Swain Slough in PA 1 to provide recommendations for tree retainment or removal based on each individual tree's potential to support wildlife and its potential impacts on adjacent planting areas (e.g., shade). The following was assessed for each individual:

- current tree condition (health and vigor, visible decomposition condition) and its potential to contribute to long-term structure;
- length of shade generated that could inhibit native plant establishment in adjacent recovery areas;
- trunk surface area with solar exposures ideal for bat use;
- cracks, crevices, and peeling bark to provide roosting habitat for bats;
- perching/nesting habitat for birds; and
- anticipated impacts based on the latest design plans for PA 1 (Figure 1-2).

The tree inventory was guided by a desktop solar assessment that determined the zone within PA 1 with the greatest morning sun in early June (Figure D-1). This parameter covers the period when bats are rearing their pups.

Survey results for Areas 1–4 are provided below.

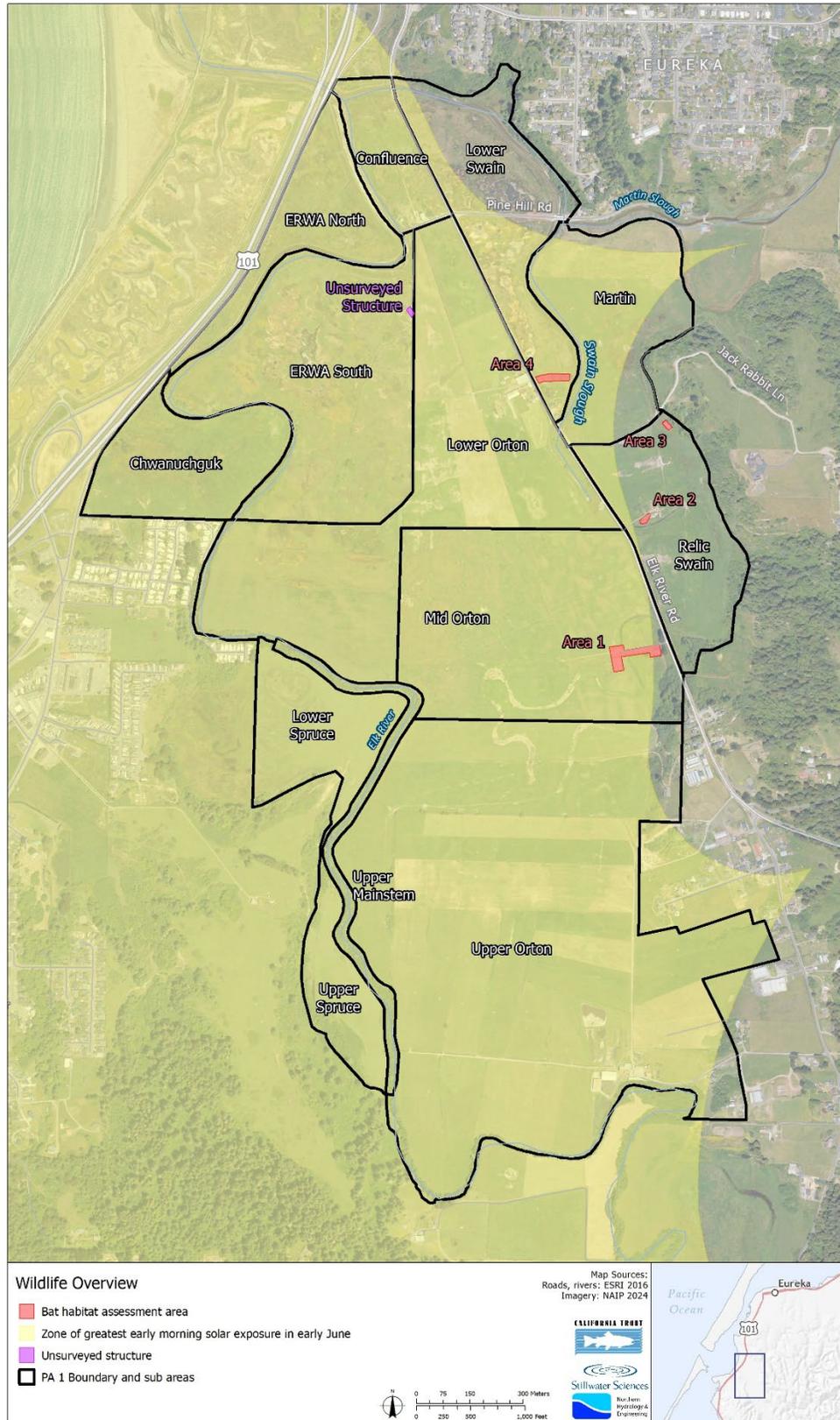
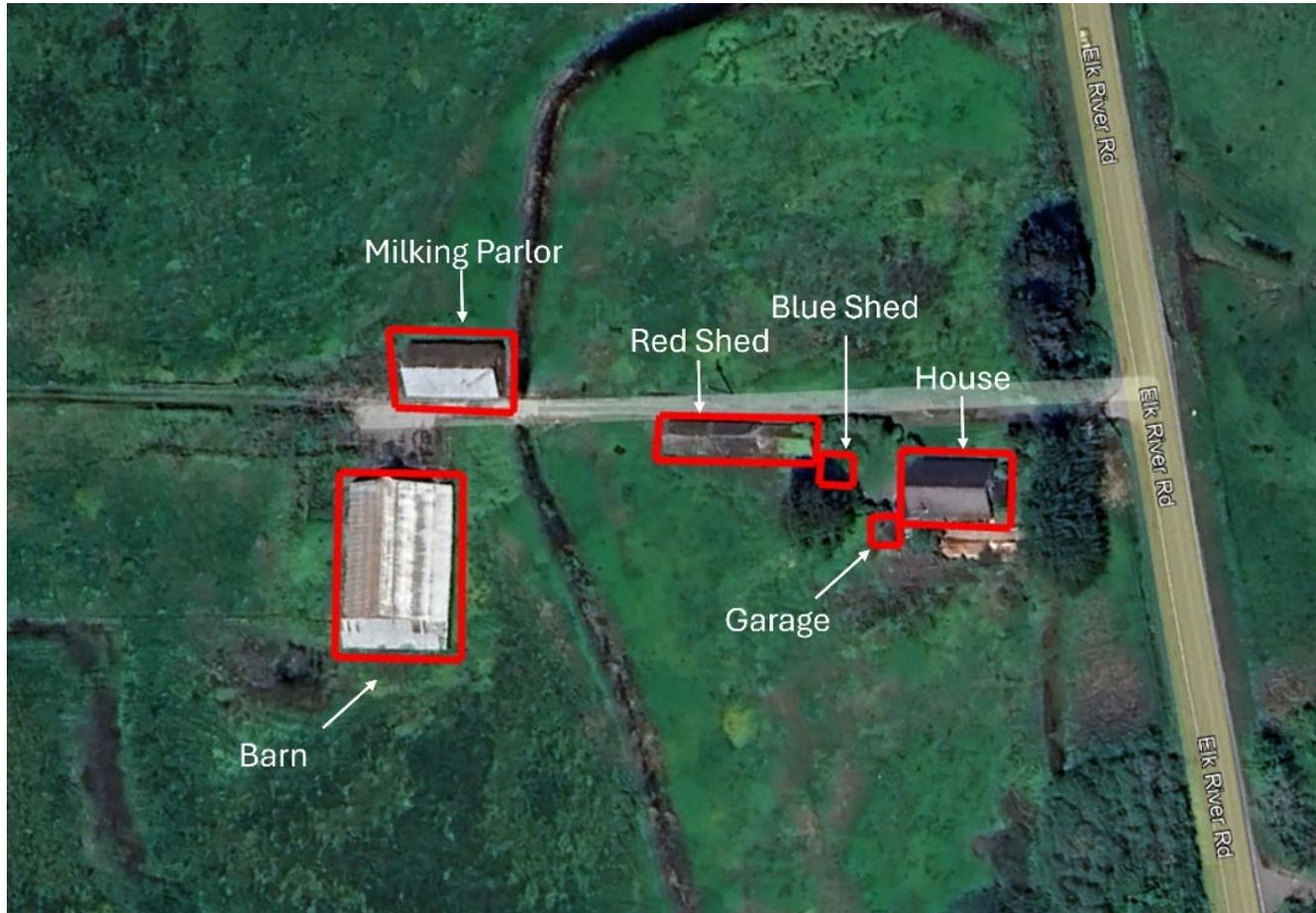


Figure D-1. Bat habitat assessment areas (Areas 1-4) and the zone of greatest early morning solar exposure in early June within Planning Area 1.

**Area 1 (Mid Orton)**

The bat habitat assessment within Area 1 included the review of six structures (Figure D-2).



**Figure D-2.** Area 1 structures assessed for bat habitat.

## Milking Parlor

### Results:

The current Project design will remove the milking parlor. The structure consists of wood siding and a roof made of either corrugated metal or wood (the latter observed over the attic). It consists of one large room with a few smaller adjoining rooms; all with moderate deteriorated conditions (Figure D-3). The attic was not accessible during the survey.

There was no evidence of bats. About a dozen pre-existing barn swallow nests were observed. While the structure provides bat roosting habitat, there is a **low to moderate likelihood** for this structure (particularly the attic) to support a maternity roost due to the open nature of the building.



Figure D-3. Area 1 milking parlor; photos on the right show attic access locations.

## Barn

### Results:

The current design will retain the barn structure. The barn is comprised of wood siding and a corrugated metal roof (Figure D-4). The structure is a single open room. There was no evidence of bats, and limited maternity roosting opportunities. Several barn swallow nests from a prior season and one active rat nest were present. While the structure provides bat roosting habitat, there is a **low likelihood** for the barn to support a maternity roost due to the lack of crevices present.



Figure D-4. View of Area 1 barn's southerly exposed exterior (left) and view of the barn interior (right).

## Red Shed

### Results:

The current design will remove the red shed. The red shed is composed of wood siding and a wooden and composite shingle roof (Figure D-5). While the inside of the red shed was not thoroughly inspected due to safety concerns, portions of the highly degraded structure allowed significant airflow which reduces the suitability of the structure to support maternity roosting habitat. Roosting habitat may be present in the gap between the roof, as shown in Figure D-5. Overall, there is a **moderate likelihood** for this shed to support a maternity roost due to the gap along the roof.



Figure D-5. Area 1 red shed exterior view (top left), view of the interior (right), and potential bat roosting habitat at the roof (bottom left).

## Blue Shed

### Results:

The current design will remove the blue shed. The blue shed is comprised of wood siding and a composite shingle and wooden roof (Figure D-6). This structure was fully boarded (doors and windows) and the interior was not accessible to survey. While the structure appeared well sealed from the outside, there was one hole on the east side of the attic which may provide access to the attic. There was no evidence of bats. Several barn swallow nests from a prior season were documented on the underside of the overhanging eaves. While the blue shed provides access to the roof for roosting habitat, there is a **low likelihood** for this structure to support a maternity roost as the structure was well sealed.



**Figure D-6.** Area 1 blue shed view from the east side (top left) with access hole to the attic (top right) and prior years barn swallow nests (bottom).

## Garage

### Results:

The current design will remove the garage. The garage is composed of wood siding and a wooden and composite shingle roof (Figure D-7). The interior and exterior of this structure were thoroughly inspected and there was no indication of bat use. Besides the garage door being open, the garage was well sealed on the outside. While the structure provides bat roosting habitat, there is a **low likelihood** for this structure to support a maternity roost due to the lack of crevices.



Figure D-7. Exterior view of the Area 1 garage structure.

## House

### Results:

The current design will remove the house. The house is composed of wood siding, a brick chimney, and a wooden and composite shingle roof (Figure D-8). The interior of the house was not accessible. The exterior of the structure looked well sealed except for a hole on the back side of the house, where bird droppings were observed. There was also a gap between the chimney and the side of the house; however, there was no indication of guano. The structure may support roosting habitat, particularly in the attic and gap between chimney and wall, as shown in Figure D-8. Overall, there is a **moderate likelihood** for this structure to support a maternity roost due to the presence of crevices and attic openings.



**Figure D-8.** Area 1 house view from the exterior with gap between the chimney and the house (top right) and access to the attic (bottom right).

## Area 2 (Relic Swain)

The bat habitat assessment within Area 2 included the review of two structures—a barn and a shed. One additional structure was not evaluated as it was not included within PA 1 design enhancement areas (Figure D-1).

### Barn

#### Results:

The current design will remove the barn. The barn is composed of wood siding and wooden roof shingles (Figure D-9). The structure is a single open room. While the inside of the barn was not thoroughly inspected due to safety concerns, portions of the structure (gaps along the degraded roof and siding) allowed airflow which reduces the suitability of the structure to support maternity roosting habitat. While the structure provides bat roosting habitat, there is a **low likelihood** for this barn to support a maternity roost due to the airflow.



Figure D-9. Area 2 barn view from the exterior (top) and interior (bottom left and right).

## Shed

### Results:

The current design will retain the shed. The shed is composed of cinder block and corrugated metal siding, corrugated metal roof, and a wooden door (Figure D-10). The structure formed a single room. While the interior of the shed was not thoroughly inspected due to safety concerns, the **structure does not provide suitable habitat for bats** as there were no suitable crevices.



Figure D-10. Area 2 shed view from the exterior.

### Area 3 (Relic Swain)

The bat habitat assessment within Area 3 included review of a single barn structure (Figure D-1).

#### Barn

The current design will remove the barn. The barn is composed of wood and was partially collapsed (Figure D-11). While the inside of the barn was not thoroughly inspected due to safety concerns, portions of the highly degraded structure allowed significant airflow which reduces the suitability of the structure to support maternity roosting habitat. While the structure provides bat roosting habitat, there is a **low likelihood** for this structure to support a maternity roost due to the existing airflow.



Figure D-11. Area 3 barn and view from the exterior (left) and interior (right).

## Area 4 (Lower Swain)

The bat habitat assessment within Area 4 included the review of the single maintained barn structure and an established stand of Monterey cypress.

### Barn

The current design will retain the barn. The barn is composed of wood siding and a corrugated metal roof that overlays a wooden roof (Figure D-12). The interior of the barn was not accessible. From the exterior, the structure appeared well sealed with one hole on the easterly facing second-story. There was no evidence of bats. The structure provides bat roosting habitat, particularly in gaps present along the wooden roof but there is a **low likelihood** for this structure to support a maternity roost

While this structure is in an ideal location to enhance bat roosting habitat as it is located within the zone of greatest morning sun between late May and early June, when bats are rearing their pups (Figure 1), the preferred second story easterly wall does not provide sufficient height (about 9 feet) above a roofline for bats to drop and take flight from a roost.



Figure D-12. Area 1 barn view from the outside and access hole (right)

## Monterey Cypress Stand

The Monterey cypress stand near Swain Slough consists of 20 trees and is within the zone of greatest morning sun between late May and early June, when bats are rearing their pups (Figure D-1). Thus, this location is an ideal area to incorporate bat habitat enhancements in intact trees to support roosting bats. Some of these trees have peeling bark, which is suitable for roosting bats. The trees support nesting habitat for birds and the broken tops and vertical limbs provide perch sites while foraging in adjacent grasslands and agricultural fields (Figure D-13). Although these features represent ideal habitat conditions for wildlife, they also represent a decline in tree health. An arborist may be able to assess disease susceptibility and existing lifespan of living trees planned for habitat enhancements.



**Figure D-13.** Area 4 Monterey cypress stand (Trees 1-20).

Results of the tree inventory assessment:

- Tree 1 (down snag, adjacent to barn): Low habitat suitability for nesting birds/roosting bats as existing crevices are shallow and peeled bark is on the underside and would collect water forming undesirable conditions for bats.
- Tree 2 (snag): Moderate habitat suitability for perching birds on a horizontal limb.
- Tree 3 (decadent tree with broken top): Low habitat suitability as this tree has active decay and insect damage and is leaning towards the south-east side of the property, creating shade.
- Tree 4 (living): Moderate habitat suitability and potential for enhancement by adding bat crevices and removing lower branches.
- Tree 5 (living): Moderate habitat suitability and potential for enhancement by removing lower limbs.
- Tree 6 (snag): Low habitat suitability; adjacent trees provide similar habitat.
- Tree 7 (snag): Moderate habitat suitability.
- Tree 8 (live): Moderate habitat suitability and potential for enhancement by removing lower limbs to reduce shade onto adjacent planting area.
- Tree 9 (snag): Low habitat suitability as it is younger and lower limbs currently shade adjacent planting area.
- Tree 10 (snag): Moderate habitat suitability with crown top and horizontal limbs for perching.

- Trees 11 and 12 (living): Moderate habitat suitability and potential for enhancement by adding bat crevices.
- Tree 13 (decadent tree): Low habitat suitability due to active decay and broken lower limbs, which are shading adjacent planting area.
- Tree 14 (decadent tree): Low habitat suitability with a potential for enhancement by adding bat crevices.
- Tree 15 (snag): Moderate habitat suitability due to peeling bark on easterly-side, which may provide natural bat roosting habitat.
- Tree 16 (snag): Moderate habitat suitability for perching birds on limbs.
- Trees 17 through 19 (living): Moderate habitat suitability for bird nesting.
- 20 (down snag): Low habitat suitability.