

Off-Channel Salmonid Habitat Design for Freshwater Creek: Phase Two

2020

Introduction:

The Redwood Community Action Agency (Permittee) through this project will develop final engineering plans to build a self-maintaining off-channel rearing habitat for juvenile salmonids along Freshwater Creek. Freshwater Creek has limited high-quality suitable habitat for salmonid juveniles attributable to over a century of anthropogenic activities: such as gravel extraction, forestry, agriculture, hydroelectric projects, and urban sprawl. The design development project is the first step in creating additional optimal habitat for salmonid species. This project addresses the task above by resulting in design plans that, once implemented, will create winter rearing habitat and refugia for salmonid juveniles.

The Permittee shall not proceed with on the ground implementation until all necessary permits, consultations, and/or Notice to Proceed are secured. All habitat improvement(s) will follow techniques in the *California Salmonid Stream Habitat Restoration* (<https://www.wildlife.ca.gov/Grants/FRGP/Guidance>).

Objective(s):

The project will result in a final design plan to create off-channel winter rearing habitat and refugia for juvenile salmonids in Freshwater Creek. The site will be assessed and restoration design plans will be developed to construct a self-maintaining off-channel pond.

Project Description:

Location:

The project area is located in the middle reach of Freshwater Creek watershed, east of Humboldt Bay, and four miles east of Eureka, California (See Freshwater Project Watershed Map). The site is located approximately 7.3-miles upstream from the confluence with Humboldt Bay, 2.2-miles upstream from Myrtle Avenue at Freshwater Corners (a.k.a. Three Corners), and 0.35-miles downstream from Howard Heights Bridge. The town of Freshwater is 0.67-miles southeast of the project area. Project coordinates are: 40.76593 North Latitude, -124.06997 West Longitude.

Project Set Up:

The project development will be completed by a multidisciplinary team consisting of the Permittee, Michael Love & Associates, Inc. (MLA), and Pacific Watershed Associates (PWA). Permittee will be the fiscal agent and the Project Manager will be responsible for grant management, contracting with consultants, landowner coordination and reviewing and submitting invoices, quarterly progress updates, and the final report. Permittee Division Director will facilitate communications between NRS and the fiscal department and assist the project manager as

necessary. Permittee Administrative Coordinator will assist with the preparation of invoicing and processing purchase orders. Permittee Project Ecologist will evaluate the riparian and aquatic ecology of the site for current and potential habitat conditions for the target (coho salmon) and other riparian species. Project Ecologist will prepare the revegetation plan and project monitoring plan with assistance from Permittee Planner. The Project Ecologist will develop a wetland species list and assign locations depending on the site and on the elevations of the proposed off-channel pond. The appropriate seed mixture for the pond and pasture locations will be selected. The Project Ecologist will also prepare the project monitoring plan when the final design report is completed. Project Ecologist will complete the Wetland delineation and provide a report. MLA will lead the topographic survey, water level and water quality monitoring effort, hydrologic and hydraulic analyses, scoping of conceptual options, and development of preliminary (30%) through final (100%) engineering designs and implementation cost estimate for the project. MLA will write the Basis of Design Report and prepare the final plans specifications and estimate. MLA will work collaboratively with the Project Ecologist to support development of a project planting plan, and assist with calculations of metrics needed for evaluating the project impacts and identifying permitting pathways. MLA will also assist with authoring sections of the Project Monitoring Plan. The MLA Principal Engineer will oversee all aspects of the project for MLA and lead in identification of options and design development, participate in stakeholder meetings, assist with installation of gaging equipment, and author sections of the project reports. The MLA Project Engineer will be the MLA lead for survey, will prepare the project basemap, identify and develop project layout, develop earthworks, lead the preparation of plan sheets for each submittal, oversee processing of water level and water quality data and will be the MLA lead for developing the off channel design and oversee the hydraulic modeling of the channel. The MLA Engineering Geomorphologist will provide oversight for the wood force-balance calculations, provide quality control for the hydraulic modeling and assist with development of alternatives, and author sections of the project report. The Associate Engineer will assist with surveying, drafting, developing hydraulic models, processing of collected data, preparation of figures, and hydrologic calculations. The MLA Senior Project Engineer will provide design review in a quality control roll and provide technical assistance during design development. The Permittee Field Crew will remove brush, as necessary, to facilitate access to key project areas. Pacific Watershed Associates (PWA) will lead the engineering geologic investigations with four staff geologists in support of engineering designs for the Off-Channel Salmonid Habitat Design for Freshwater Creek: Phase Two. PWA will attend the kick-off and scoping meetings, and will be available for one additional Technical Advisory Committee (TAC) stakeholder meeting. In addition, PWA will provide review consultation during the development of the preliminary (35%) and intermediate (65%) design levels. Understanding the site's geomorphic and geological limitations, including soil and groundwater conditions,

will be essential to designing and developing a successful off-channel rearing habitat restoration project. The proposed engineering geologic investigation includes characterizing the geology and geomorphology, shallow stratigraphic and hydrogeologic conditions, and physical soil characteristics. PWA Staff will investigate substrate suitability for a culvert, type and stratification of subsurface materials, and installation of groundwater monitoring wells.

Materials:

MLA will supply five water level loggers (one to record atmospheric pressure) to the project for a 12 month period, and will purchase miscellaneous materials to construct for housing and mounting for the loggers, including PVC pipes and caps, paracord, eye bolts, t-post, zip ties, staff plates, and lumber. MLA will lease a Trimble robotic total station for use during cross section and longitudinal profile surveys and to mark elevations. PWA will rent coring/sampling equipment and purchase sampling materials to complete the engineering geologic investigations. PWA will also purchase report supplies to present final results. Permittee will also purchase office supplies required for general tasks such as invoicing, printing plans and reporting. Permittee, PWA, and MLA will all require transportation to the site for site investigations and therefore will purchase gas for vehicles. The Permittee Field Crew will use a field truck so they can transport the tools required to clear brush from the site; use of the field truck requires a daily use fee.

Tasks & Deliverables:

Task 1: Project Management and Administration:

Description of Activities: The permittee's Susannah Manning will be taking the lead on project management and administration with assistance from the Permittee Planner. This includes doing the invoicing, quarterly reporting, final reporting, contracting, scheduling, and landowner communications. Permittee staff will be in constant communication with subcontractors and stakeholders throughout the duration of the project. MLA and PWA will prepare invoices and provide progress reports, along with updates to the project schedule and coordinate with other project team members.

Deliverables: Monthly invoices, quarterly reports, final reports, and contracting all in electronic PDF format.

Start Date: 04/01/2021

End Date: 04/30/2023

Task 2.1: Stakeholder Coordination and Meetings: Kickoff Meeting:

Description of Activities: The project will have a minimum of three in-person meetings with the stakeholders, and budgeted for additional coordination meetings with stakeholders, including the landowner.

Off-Channel Salmonid Habitat Design for Freshwater Creek: Phase Two

2020

Meeting 1 - On-site kick-off with stakeholders. The meeting will be used to introduce the project, discuss project goals, objectives, and constraints, and discuss in detail the project surveys and site characterization efforts and how findings from these efforts support the preliminary project design. This meeting is envisioned to take a half-day and occur at the project site.

Deliverables: Meeting summaries (PDF format).

Start Date: 04/01/2021

End Date: 05/15/2021

Task 2.2: Stakeholder Coordination and Meetings: 30% Design Review Meeting:

Description of Activities: Meeting 2 - A 30% design review meeting with project stakeholders. The project team will present the considered options and preliminary design, answer questions, and receive comments and guidance from stakeholders. The meeting will include a presentation of findings and potential options for project layout. It is anticipated this will be a two-hour meeting with potential for a site visit if warranted.

Deliverables: Meeting summaries (PDF format).

Start Date: 04/01/2021

End Date: 05/30/2022

Task 2.3: Stakeholder Coordination and Meetings: 65% Design Review Meeting:

Description of Activities: Meeting 3 - A conference call and/or site visit will be held to discuss comments received on the 65% design drawings and Basis of Design Report. The meeting will also be used to discuss regulatory pathways for securing coverage for CEQA and permits, and for pursuing funding for implementation.

Additional Stakeholder Coordination- Additional meetings with the landowner, Permittee, CDFW, and other potential stakeholders will be held as needed during project development. For budgeting purposes, a total of four, two-hour meetings are assumed.

Deliverables: Meeting summaries (PDF format).

Start Date: 06/15/2022

End Date: 08/31/2022

Task 3.1: Site Characterization: Topographic Survey:

Description of Activities: This task focuses on characterizing the existing site from geologic, geomorphic, hydrologic, water quality, vegetative, and fisheries aspects. It involves various field surveys and mapping, soil sampling, hydrologic and water quality monitoring, and fisheries sampling. The Permittee Field Crew

will remove brush, as necessary, to facilitate access to key project areas. The information gained through these Activities will guide development of the project design and be essential for securing CEQA coverage and permits. As much as practical, the data collected for the recently completed "Phase I" Freshwater Creek Off-Channel Habitat project will be used to inform design of this "Phase II" off-channel habitat project.

Topography and Basemap Preparation (MLA): A project basemap will be prepared by MLA in AutoCAD Civil3D. LiDAR coverage and elevation control will be researched and incorporated into the basemap as applicable. The topographic survey of the new side-channel/pond site will capture the confluence with Freshwater Creek, the topography of Freshwater Creek at least 50-feet upstream and downstream of the confluence, and the adjacent floodplain, including significant trees, observable utilities, and infrastructure. Survey of these areas will be conducted with sufficient detail to produce a basemap with one-foot contour intervals.

A longitudinal and cross-sectional survey will be conducted with assistance from the Permittee Project Ecologist and/or Planner. The Permittee Field Crew will clear vegetation from the site to facilitate completion of the surveys and access to all relevant areas of the project site. This survey will extend from the recently completed Lower Pond outfall culvert, extending upstream, and will support the hydraulic analysis. At least 10 cross sections will be surveyed across Freshwater Creek between the Lower Pond outfall culvert and the upstream end of the meander, upstream the project area. These data will assist in determining the frequency and magnitude of overbank flows and the patterns of floodplain flow returning to Freshwater Creek in the vicinity of the proposed off-channel feature. Installed water level (stage) recording equipment (Task 3) will be surveyed to establish the gage datum.

Other layers will be incorporated into the basemap, including parcel lines and aerial photographs. The basemap will be provided as a PDF and used in subsequent site characterization activities, hydraulic analysis, and project design.

Deliverables: Basemap in PDF format.

Start Date: 06/15/2021

End Date: 10/15/2021

Task 3.2 Site Characterization: Hydrology:

Description of Activities: Water Level Monitoring: Understanding water levels and hydraulic gradients for both surface and groundwater are necessary to develop the project, analyze proposed flow patterns, set planting zones, and evaluate potential risk for the crossing design near the mouth of the proposed off-channel feature. Water level loggers will be installed by MLA at approximately four (4) locations throughout the project area. The installation is planned for summer of

Off-Channel Salmonid Habitat Design for Freshwater Creek: Phase Two

2020

2021 and will be operated for a 12-month period. The downstream most location will be in the mainstem of Freshwater Creek at the confluence of the proposed off-channel feature. The upstream most installation will be at the head of the meander that bounds the floodplain where the project area is located. Two of the loggers will be placed in shallow monitoring wells, near the head and middle of the off-channel feature, installed by PWA as part of their soils investigation. MLA will consult with the Permittee Project Ecologist to ensure water level measurements will also be useful for informing elevations of wetland soils/vegetation within the project area. Data will be downloaded every four to six weeks by Permittee with support from MLA and processed by MLA. All water levels will be referenced to the project vertical datum.

This information will be used to assess degree water levels in Freshwater Creek would influence water levels in the proposed feature, determine if a shallow groundwater gradient would create emerging flow from the head of the off-channel feature, provide data for calibration of the hydraulic model, and to evaluate the frequency and duration that the off-channel feature would be connected to Freshwater Creek during low flows given different design options.

Water Quality Field Measurements: Water quality parameters will be measured in the stream channel and wells at each of the water monitoring locations to assist in evaluating seasonal salmonid habitat suitability for the project. Parameters to be measured include water temperature and dissolved oxygen. Water level loggers will record water temperatures continuously and a hand-held meter will be used to measure water temperatures and dissolved oxygen at each monitoring location when downloading data. The measurements will be made at varying depths in the water column to determine the degree of stratification occurring during different hydrologic conditions. A minimum of 10 samples will be taken at each site between early fall and late spring.

Water Level and Water Quality Data Processing and Interpretation:

Water level data will be converted to the project datum and plotted, with a focus on water surface gradients across the meander and through the proposed off-channel feature. Stage-duration curves will be constructed for each season. All water quality spot measurements and data collected with the loggers will be post-processed and compiled by MLA in tables and plots. They will also be correlated with the water level data and patterns will be characterized for use in project development. The methods and results will be provided in the project Basis of Design Report.

Deliverables: Methods and results will be provided in the Basis of Design Report.

Start Date: 06/15/2021

End Date: 07/31/2021

Task 3.3 Site Characterizations: Geologic Investigations:

Description of Activities: PWA will lead the geologic investigation at the site to identify and characterize underlying floodplain/channel sediments in order to determine if the geologic substrate is suitable for culvert placement. PWA will also install a groundwater monitoring well at the proposed project site. PWA will oversee the investigation type and stratification of subsurface materials. Exact core locations will be determined during a field visit with the project engineer so that the data will best support their requirements.

Background Studies: Where available, LiDAR and historic stereo aerial photographs will be analyzed to characterize the local geomorphology and identify land management modifications that have affected site conditions. These may include road, channel and valley bottom modifications, and land disturbance/construction history and methods. In addition, all available design-related studies, documents and plans will be analyzed prior to finalizing the location of actual sites and sampling areas for surface and subsurface investigations.

Site Geologic Characterization: PWA will conduct a geologic site characterization including local and regional geologic and geomorphic setting, faulting, and seismicity, and estimated peak ground accelerations in the project area. This will include a description of associated geologic risks and potential constraints to the project design alternatives.

Subsurface Characterization and Monitoring Well Installation: To support geologic site characterization and groundwater monitoring efforts, a limited number of hand excavated test pits and/or hand-augured borings will be completed to characterize the in-situ subsurface stratigraphy and existing groundwater conditions along or adjacent to potential preferred off-channel design alignments. Where appropriate, groundwater monitoring wells will be installed in boreholes so that near surface hydrogeologic conditions can be observed and monitored throughout at least one winter period. For the purposes of this study, a minimum of four (4) hand-augured and/or test pit borings will be excavated at strategic locations in coordination with the Project Engineer. In addition, a minimum of two (2) shallow (7-13 ft). British Geological Survey (BGS) monitoring wells will be installed where appropriate and as field conditions dictate.

Evaluation of Soil Conditions: PWA will collect soil samples during the subsurface investigation using either a 2- or 3-inch diameter core-barrel sampler (semi-undisturbed), if appropriate, or grab samples (disturbed) to be used for laboratory analysis. A one-inch diameter gouge core will be utilized where saturated, fine-grained soils inhibit retrieval using standard hand-auguring techniques. A field penetrometer will be driven at various locations to qualitatively evaluate penetration resistance and compressive strength of soil types. Field

penetrometer measurements will be used to estimate soil compressive strength as a supplement to hand auger and gouge core sampling for field-based characterization of soils. Laboratory testing of selected samples will be conducted as necessary to identify soil material engineering properties such as grain size distribution, Atterberg Limits, and moisture density tests for compaction.

Engineering Geologic Technical Memorandum: The background studies, site geologic characterization, subsurface investigation, and soil conditions analysis will be summarized in a brief engineering geologic technical memorandum that includes the methods, findings, constraints and recommendations for design and construction of the proposed project. This will be used by the project engineers to develop technical specifications and identify and address potential project constraints for the proposed designs. The draft engineering geologic report will be submitted to the stakeholders (TAC) and finalized upon addressing written comments received by the group.

Investigation findings and recommendations will include, at a minimum:

1. Review of historical aerial photos, LiDAR data, maps, and studies
2. Geologic and geomorphic setting
3. Soil and sediment boring logs
4. Characterization and interpretation of subsurface stratigraphy
5. Stratified textural classifications of soils using the Unified Soil Classification System
6. Location and descriptions of all soils encountered
7. Soil materials properties and laboratory testing results
8. Interpretation of local, shallow groundwater conditions and soil permeability properties
9. Recommendations for on-site soil reuse and grading for channels, ponds, and planting mounds
10. OSHA soil type determination for trenching and shoring Potential project constraints and geologic hazards
11. Constructability review (equipment access guidance, nuisance water, handling of spoils, etc.) and recommendations.

Deliverables: Results will be provided in the Design Report.

Start Date: 06/15/2021

End Date: 02/28/2022

Task 3.4 Site Characterization: Site Ecology and Wetland Delineation:

Description of Activities: RCAA Ecologist will evaluate the riparian and aquatic ecology of the site for current and potential habitat conditions for the target (coho salmon) and other riparian species. RCAA Ecologist will complete the wetland delineation at the project site. A narrative will be prepared to discuss the

availability and benefits of off-channel habitat in Freshwater Creek and the imperative for the project.

Assessment of current conditions will include description of present micro-ecosystems on-site (including migratory and resident species utilizing project site), the effects of land use on aquatic and riparian habitat, and site limitations for target and other aquatic species. Desired habitat conditions relative to the target species and life stages will be discussed with the context of the site. Installation of an in-channel structure and riparian revegetation will be recommended to achieve desired habitat conditions and incorporated into the final design plans.

Deliverables: Wetland Delineation and Site Ecology report will be in PDF format.
Start Date: 05/01/2021
End Date: 04/30/2022

Task 4: Hydrologic & Hydraulic Analysis:

Description of Activities: The data collected in Task 3 will be used to perform hydraulic and hydrologic analysis to evaluate and select design options for the project site and for design development of the project. The analysis and results will be summarized in the draft and final Basis of Design Report (BODR).

Freshwater Creek Hydrology (MLA): MLA will calculate the contributing drainage area for adjacent Freshwater Creek, and estimate return period flows from 1.1-year to at least 10-year using a minimum of two standard methods. Flows in Freshwater Creek will be used to analyze overbank flooding patterns associated with the various return periods. The methods and results will be provided in the project BODR.

Existing and Design Condition Hydraulic Analysis (MLA): Numerical modeling of the existing hydraulic conditions will be conducted by MLA using a combination of HEC-RAS 1D and 2D (1D for in-channel and 2D for overbank flows). The model will be developed using the DEM from the project basemap. The model focus will be on overbank flood flows from Freshwater Creek, and how they are currently routed across the floodplain and return to the mainstem. Numerous return period flows will be analyzed to determine the frequency and extent of the overbank flooding and flow patterns will be useful for understanding the existing topography and for layout of the proposed project.

For the design conditions, a hydraulic analysis will be conducted to estimate:

1. Water velocities and water surface elevations at the mouth of the off-channel feature,
2. The magnitude and depth of overbank flows at the upstream end of the off-channel feature and across the floodplain from upstream to downstream of the project site, and

3. Headwater depths, head loss, and water velocities through, and over the top of, the proposed culvert and the backwater effects into the off-channel feature associated with overbank flows entering from upstream.

A two-dimensional model will be developed for the project by modifying the existing conditions model for the design condition. Figures of model results will be made in GIS showing flow patterns and inundation extents for review by the stakeholders and for inclusion in the project BODR.

Deliverables: Results will be provided in the BODR.

Start Date: 06/15/2021

End Date: 02/28/2022

Task 5: Preliminary (30%) Design Development:

Description of Activities: Initial findings from site characterization and hydraulic analysis will guide development of potential design options. Consideration will be given to various factors, such as quantity and quality of habitat to be created, geomorphic self- sustainability, risk analysis of a new crossing, and overall project cost.

Scoping Project Layout: As part of the initial project scoping process, MLA will prepare schematic plan maps in GIS and/or CAD of different options for review and input from the landowner. These options will be different configurations/layouts of the off-channel feature and will attempt to balance habitat objectives with landowner needs. These will be included as options considered in the project BODR.

Design Development: Based on the outcome of the scoping, the project will be further developed and refined. Off-channel feature dimensions and profile will be developed, and grading of the proposed design will be developed using AutoCAD Civil3D. Preliminary culvert sizing will be determined at this stage. Elevations establishing various planting zones will be incorporated into the grading-based input from the project ecologist. An iterative approach to design of the project will be used, based on results from the hydraulic analysis.

Proposed Conditions Hydraulic Analysis: A proposed-condition hydraulic model will be prepared by MLA in HEC-RAS 1D and 2D. Various scenarios will be analyzed, including low-flow periods and overbank flooding from Freshwater Creek. Results will be used to refine the project grading, evaluate project impacts, and size a culvert crossing near the mouth of the off-channel feature. A preliminary risk assessment for the culvert crossing will be conducted that evaluates the frequency of overtopping the culvert soffit and fill prism on top of the culvert, the velocities associated with overtopping, flow conditions assuming the culvert becomes plugged, and potential scour associated with these events. This evaluation will identify geomorphic/hydraulic hazards associated with the

crossing and inform the amount of fill-armoring needed and potential maintenance requirements.

Preliminary Design Plans: Preliminary design plans will be prepared by MLA in AutoCAD Civil3D and will include:

1. Cover sheet
2. Existing plan overview
3. Project footprint
4. Channel profile
5. Typical channel sections.

Draft BODR: A BODR will be prepared that provides an overview of the project setting and findings from the site characterization activities along with a description of the options considered, and the proposed project selected for development. The BODR will provide a project description, basis of design decision, and summarize the anticipated performance of the project. The report will include as attachments the various data and analysis prepared as part of the different surveys conducted under the Site Characterization task. The BODR will also include the project plan set as an attachment.

The BODR will be submitted to the Stakeholders for review and comment and will be presented at Meeting No. 3. A minimum of 30 days will be provided for review. Both oral and written comments will be compiled and addressed as part of the 65% design.

Deliverables: 30% Planset (11x17 PDF format) and Draft Basis of Design Report (PDF format).

Start Date: 06/15/2021

End Date: 04/30/2022

Task 6: Intermediate (65%) Design Development:

Description of Activities: Intermediate design development includes developing layout and grading, developing project details and performing additional hydraulic analysis. Comments on the preliminary (30%) design will be addressed and incorporated into the intermediate design development. The project will continue to be refined based on guidance and additional details received by the stakeholders. These details will be added to the plans and may include:

1. Large wood placement location and anchoring details
2. Detailed cross-sections
3. Additional grading details
4. Crossing structure details
5. Construction access and staging locations and BMPs
6. Locations for spoils placement
7. General notes
8. Erosion control and water management typical and notes

9. Developing a revegetation plan.

Prepare Opinion of Probable Construction Cost (OPCC): Areas of impact and quantities will be developed by MLA for the entire project, as presented in the 65% design plans. Based on the developed project, and engineer's opinion of OPCC will be prepared, and will include a 20% contingency given the level of uncertainty associated with project elements yet to be developed, as well as unanticipated conditions during construction and price volatility. Escalation will also be added based on the anticipated year of construction.

Prepare Final BODR: The draft BODR (from Task 5) will be updated based on comments and changes made to the preliminary design submittal.

The 65% design plans along with the OPCC, and BODR will be provided as a submittal to the stakeholders. A 30-day comment period will be provided for submission of written comments. Upon receipt of comments a conference call may be held to discuss comment resolution.

Deliverables: 65% Planset (11x17 PDF format), Final Basis of Design Report (PDF format), Opinion of Probable Construction Cost (PDF format).

Start Date: 05/01/2022

End Date: 07/31/2022

Task 7: Develop Draft-Final (90%) and Final (100%) Engineering Designs:

Description of Activities: Comments received on the 65% design submittal will be addressed by MLA and the engineering designs will be finalized. A draft-final (90%) version of the complete plan set will be prepared for final review.

In preparation of the 90% plan set, a planting plan and planting pallet will be finalized by RCAA. This will involve planting sheets showing location for application of various planting pallets based in part on anticipated seasonal water levels and results of vegetation monitoring at the Phase I sites.

Additions to the plans set are anticipated to include:

1. Site layout geometry tables
2. Grading cross sections
3. Planting overview and details
4. Additional specifications as notes on plans.

It is assumed that comments on the 90% submittal will be minor, and not involve redesign. A 30-day period will be provided for review. As part of the 90% submittal, the OPCC will be updated. This effort may include engaging potential contractors to better assess the most cost-effective means and methods for constructing the project. The OPCC will include a contingency of 15% to account for uncertainty and volatility in the cost of labor and materials. Escalation may

Off-Channel Salmonid Habitat Design for Freshwater Creek: Phase Two

2020

also be included. Once comments are received on the 90% submittal, the plan set will be finalized and signed and sealed by a California registered civil engineer and the OPCC will be finalized as 100% Engineering Designs.

Deliverables: 90% Plan set submittal 11/15/2022 (11x17 PDF format), Final (100%) Plan set Signed and Sealed by CA Registered Civil Engineer 02/28/2023 (11x17 PDF format), Final Opinion of Probable Construction Cost (PDF format).
Start Date: 07/31/2022
End Date: 02/28/2023

Task 8: Project Monitoring Plan:

Description of Activities: To support the pursuit of implementation funds and securing of project permits, a draft project monitoring plan will be prepared. This plan will follow NOAA's and CDFW's monitoring protocols and provide the necessary components required to measure project effectiveness and allow for adaptive management. It is anticipated to include both physical and biological monitoring, including hydrology, water quality, topography, fisheries, and vegetation. A draft of the plan will be circulated among the stakeholders and will be refined and finalized following written feedback. A 30-day comment period will be provided for review of the draft.

Deliverables: Draft Project Monitoring Plan (PDF format) by 01/15/2023, Final Project Monitoring Plan (PDF format) by 03/15/2023.
Start Date: 04/01/2021
End Date: 03/15/2023

Additional Requirements:

The Permittee will not proceed with on the ground implementation until all necessary permits and consultations are secured. Work in flowing streams is restricted per the United States Army Corp of Engineers (USACE) Regional General Permit. Actual project start and end dates, within this timeframe, are at the discretion of the California Department of Fish and Wildlife (CDFW).

No equipment maintenance will be performed within or near the stream channel where pollutants (such as petroleum products) from the equipment may enter the channel via rainfall or runoff. Appropriate spill containment devices (e.g., oil absorbent pads, tarpaulins) will be used when refueling equipment. All equipment will be removed from the streambed and flood plain areas at the end of each workday.

All equipment and gear will be brushed with a stiff brush prior to leaving each stretch of stream to avoid the transport of aquatic invasive species (AIS). When transporting traps out of the area, each numbered trap will be bagged in its own bag to avoid cross contamination during transport in and out of the work area. All

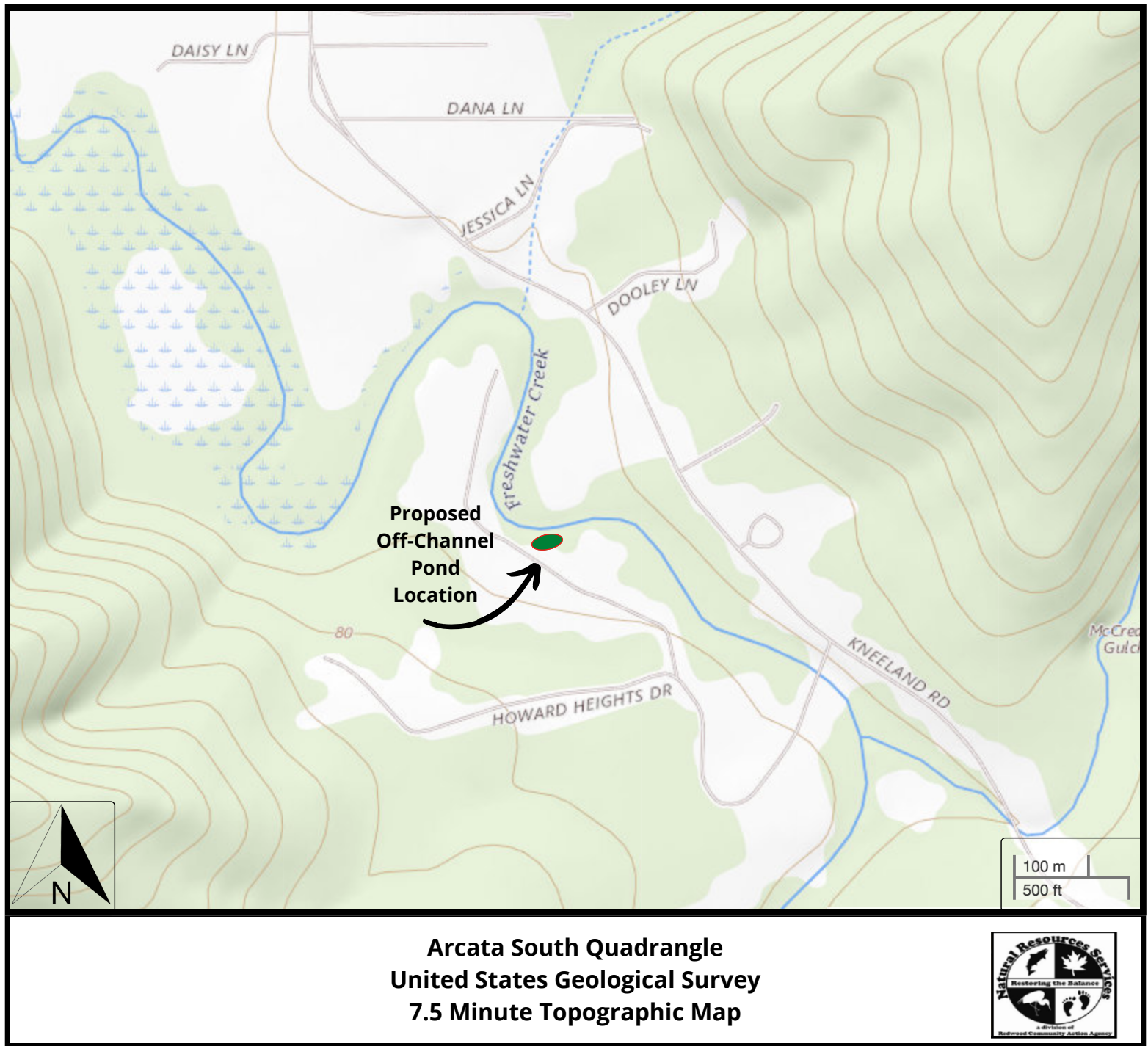
crew members will decontaminate equipment and shoes for AIS according to the standards detailed in the CDFW *Aquatic Invasive Species Decontamination Protocol*.

During project activities, all trash that may attract predators will be properly contained, removed from the work site, and disposed of regularly. Following construction, all trash and construction debris will be removed from work areas.

All habitat improvements will follow techniques described in the *California Salmonid Stream Habitat Restoration Manual*, Volume I and Volume II.

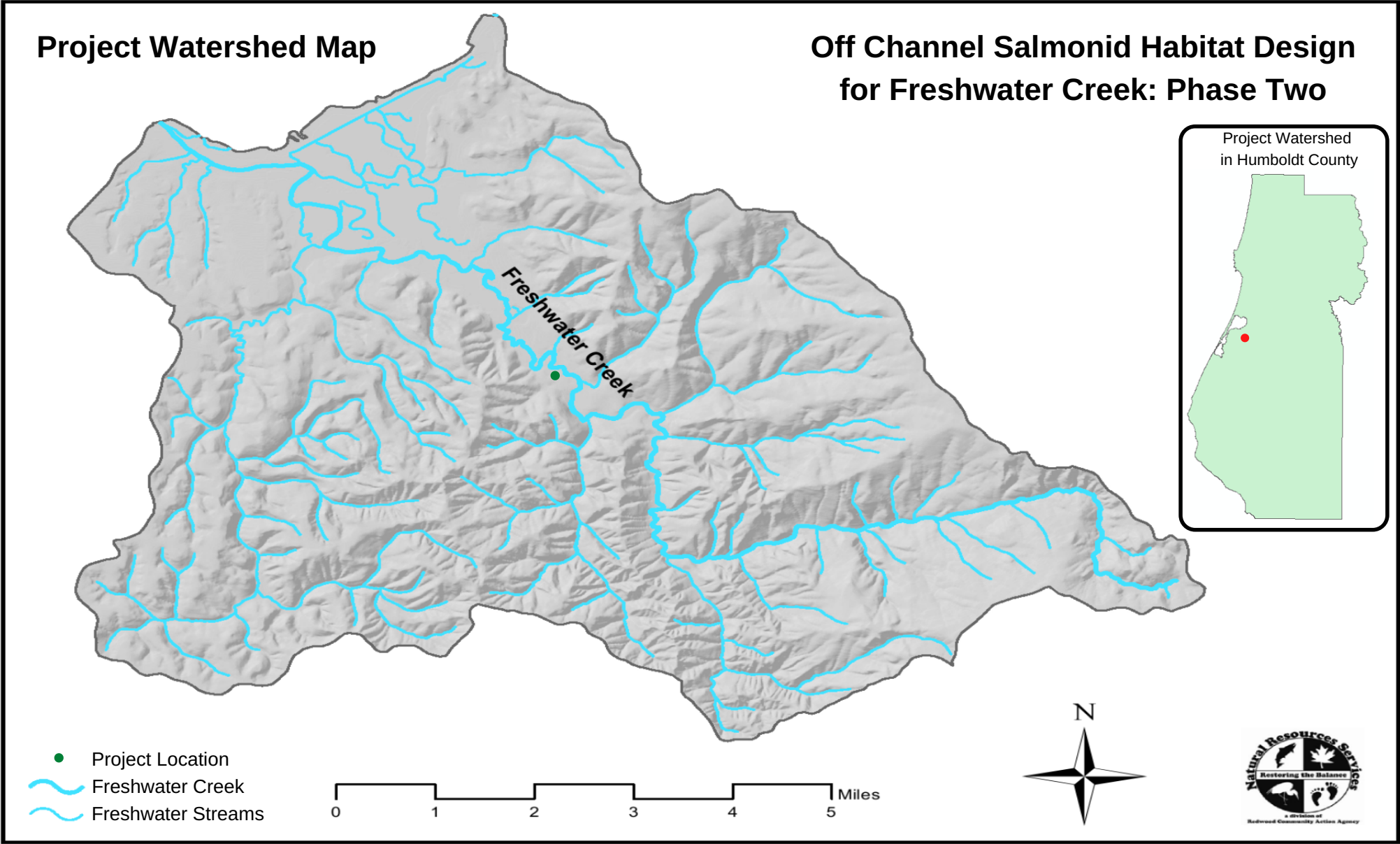
Project Location Topographic Map

Off-Channel Salmonid Habitat Design: Phase Two



Project Watershed Map

**Off Channel Salmonid Habitat Design
for Freshwater Creek: Phase Two**





Selected Elements by Scientific Name

California Department of Fish and Wildlife

California Natural Diversity Database



Query Criteria: Quad IS (Arcata South (4012471) OR McWhinney Creek (4012461) OR Fields Landing (4012462) OR Eureka (4012472) OR Tyee City (4012482) OR Arcata North (4012481) OR Blue Lake (4012388) OR Korbel (4012378) OR Laqua Buttes (4012368))

Possible species within the Arcata South and surrounding quads for 1723401 - Off-Channel Salmonid Habitat Design for Freshwater Creek: Phase Two, Humboldt County

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
<i>Abronia umbellata</i> var. <i>breviflora</i> pink sand-verbena	PDNYC010N4	None	None	G4G5T2	S2	1B.1
<i>Accipiter cooperii</i> Cooper's hawk	ABNKC12040	None	None	G5	S4	WL
<i>Accipiter striatus</i> sharp-shinned hawk	ABNKC12020	None	None	G5	S4	WL
<i>Acipenser medirostris</i> green sturgeon	AFCAA01030	Threatened	None	G3	S1S2	SSC
<i>Anodonta californiensis</i> California floater	IMBIV04020	None	None	G3Q	S2?	
<i>Aplodontia rufa humboldtiana</i> Humboldt mountain beaver	AMAF01017	None	None	G5TNR	SNR	
<i>Aquila chrysaetos</i> golden eagle	ABNKC22010	None	None	G5	S3	FP
<i>Arborimus albipes</i> white-footed vole	AMAFF23010	None	None	G3G4	S2	SSC
<i>Arborimus pomo</i> Sonoma tree vole	AMAFF23030	None	None	G3	S3	SSC
<i>Ardea alba</i> great egret	ABNGA04040	None	None	G5	S4	
<i>Ardea herodias</i> great blue heron	ABNGA04010	None	None	G5	S4	
<i>Ascaphus truei</i> Pacific tailed frog	AAABA01010	None	None	G4	S3S4	SSC
<i>Astragalus pycnostachyus</i> var. <i>pycnostachyus</i> coastal marsh milk-vetch	PDFAB0F7B2	None	None	G2T2	S2	1B.2
<i>Bombus caliginosus</i> obscure bumble bee	IIHYM24380	None	None	G4?	S1S2	
<i>Bombus occidentalis</i> western bumble bee	IIHYM24250	None	Candidate Endangered	G2G3	S1	
<i>Brachyramphus marmoratus</i> marbled murrelet	ABNNN06010	Threatened	Endangered	G3G4	S1	
<i>Bryoria spiralifera</i> twisted horsehair lichen	NLTEST5460	None	None	G1G2	S1S2	1B.1
<i>Cardamine angulata</i> seaside bittercress	PDBRA0K010	None	None	G4G5	S3	2B.1



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



Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Carex arcta northern clustered sedge	PMCYP030X0	None	None	G5	S1	2B.2
Carex leptalea bristle-stalked sedge	PMCYP037E0	None	None	G5	S1	2B.2
Carex lyngbyei Lyngbye's sedge	PMCYP037Y0	None	None	G5	S3	2B.2
Carex praticola northern meadow sedge	PMCYP03B20	None	None	G5	S2	2B.2
Castilleja ambigua var. humboldtiensis Humboldt Bay owl's-clover	PDSCR0D402	None	None	G4T2	S2	1B.2
Castilleja litoralis Oregon coast paintbrush	PDSCR0D012	None	None	G3	S3	2B.2
Charadrius alexandrinus nivosus western snowy plover	ABNNB03031	Threatened	None	G3T3	S2S3	SSC
Charadrius montanus mountain plover	ABNNB03100	None	None	G3	S2S3	SSC
Chloropyron maritimum ssp. palustre Point Reyes salty bird's-beak	PDSCR0J0C3	None	None	G4?T2	S2	1B.2
Cicindela hirticollis gravida sandy beach tiger beetle	IICOL02101	None	None	G5T2	S2	
Circus hudsonius northern harrier	ABNKC11011	None	None	G5	S3	SSC
Collinsia corymbosa round-headed Chinese-houses	PDSCR0H060	None	None	G1	S1	1B.2
Coptis laciniata Oregon goldthread	PDRAN0A020	None	None	G4?	S3?	4.2
Corynorhinus townsendii Townsend's big-eared bat	AMACC08010	None	None	G3G4	S2	SSC
Coturnicops noveboracensis yellow rail	ABNME01010	None	None	G4	S1S2	SSC
Egretta thula snowy egret	ABNGA06030	None	None	G5	S4	
Elanus leucurus white-tailed kite	ABNKC06010	None	None	G5	S3S4	FP
Emys marmorata western pond turtle	ARAAD02030	None	None	G3G4	S3	SSC
Entosphenus tridentatus Pacific lamprey	AFBAA02100	None	None	G4	S4	SSC
Erethizon dorsatum North American porcupine	AMAFJ01010	None	None	G5	S3	
Erysimum menziesii Menzies' wallflower	PDBRA160R0	Endangered	Endangered	G1	S1	1B.1



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



Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
<i>Erythronium oregonum</i> giant fawn lily	PMLIL0U0C0	None	None	G4G5	S2	2B.2
<i>Erythronium revolutum</i> coast fawn lily	PMLIL0U0F0	None	None	G4G5	S3	2B.2
<i>Eucyclogobius newberryi</i> tidewater goby	AFCQN04010	Endangered	None	G3	S3	SSC
<i>Fissidens pauperculus</i> minute pocket moss	NBMUS2W0U0	None	None	G3?	S2	1B.2
<i>Gilia capitata ssp. pacifica</i> Pacific gilia	PDPLM040B6	None	None	G5T3	S2	1B.2
<i>Gilia millefoliata</i> dark-eyed gilia	PDPLM04130	None	None	G2	S2	1B.2
<i>Haliaeetus leucocephalus</i> bald eagle	ABNKC10010	Delisted	Endangered	G5	S3	FP
<i>Hesperervax sparsiflora var. brevifolia</i> short-leaved evax	PDASTE5011	None	None	G4T3	S3	1B.2
<i>Iliamna latibracteata</i> California globe mallow	PDMAL0K040	None	None	G2G3	S2	1B.2
<i>Lampetra richardsoni</i> western brook lamprey	AFBAA02090	None	None	G4G5	S3S4	SSC
<i>Lasthenia californica ssp. macrantha</i> perennial goldfields	PDAST5L0C5	None	None	G3T2	S2	1B.2
<i>Lathyrus japonicus</i> seaside pea	PDFAB250C0	None	None	G5	S2	2B.1
<i>Lathyrus palustris</i> marsh pea	PDFAB250P0	None	None	G5	S2	2B.2
<i>Layia carnosa</i> beach layia	PDAST5N010	Endangered	Endangered	G2	S2	1B.1
<i>Lilium occidentale</i> western lily	PMLIL1A0G0	Endangered	Endangered	G1	S1	1B.1
<i>Lycopodium clavatum</i> running-pine	PPLYC01080	None	None	G5	S3	4.1
<i>Margaritifera falcata</i> western pearlshell	IMBIV27020	None	None	G4G5	S1S2	
<i>Martes caurina humboldtensis</i> Humboldt marten	AMAJF01012	Proposed Threatened	Endangered	G5T1	S1	SSC
<i>Mitellastra caulescens</i> leafy-stemmed mitrewort	PDSAX0N020	None	None	G5	S4	4.2
<i>Monotropa uniflora</i> ghost-pipe	PDMON03030	None	None	G5	S2	2B.2
<i>Montia howellii</i> Howell's montia	PDPOR05070	None	None	G3G4	S2	2B.2



Selected Elements by Scientific Name

California Department of Fish and Wildlife

California Natural Diversity Database



Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
<i>Myotis evotis</i> long-eared myotis	AMACC01070	None	None	G5	S3	
<i>Noccaea fendleri ssp. californica</i> Kneeland Prairie pennycress	PDBRA2P041	Endangered	None	G5?T1	S1	1B.1
<i>Northern Coastal Salt Marsh</i> Northern Coastal Salt Marsh	CTT52110CA	None	None	G3	S3.2	
<i>Northern Foredune Grassland</i> Northern Foredune Grassland	CTT21211CA	None	None	G1	S1.1	
<i>Nycticorax nycticorax</i> black-crowned night heron	ABNGA11010	None	None	G5	S4	
<i>Oenothera wolffii</i> Wolf's evening-primrose	PDONA0C1K0	None	None	G2	S1	1B.1
<i>Oncorhynchus clarkii clarkii</i> coast cutthroat trout	AFCHA0208A	None	None	G4T4	S3	SSC
<i>Oncorhynchus kisutch pop. 2</i> coho salmon - southern Oregon / northern California ESU	AFCHA02032	Threatened	Threatened	G4T2Q	S2?	
<i>Oncorhynchus mykiss irideus pop. 16</i> steelhead - northern California DPS	AFCHA0209Q	Threatened	None	G5T2T3Q	S2S3	
<i>Oncorhynchus mykiss irideus pop. 36</i> summer-run steelhead trout	AFCHA0213B	None	Candidate Endangered	G5T4Q	S2	SSC
<i>Packera bolanderi var. bolanderi</i> seacoast ragwort	PDAST8H0H1	None	None	G4T4	S2S3	2B.2
<i>Pandion haliaetus</i> osprey	ABNKC01010	None	None	G5	S4	WL
<i>Pekania pennanti</i> fisher - West Coast DPS	AMAJF01021	Endangered	Threatened	G5T2T3Q	S2S3	SSC
<i>Phalacrocorax auritus</i> double-crested cormorant	ABNFD01020	None	None	G5	S4	WL
<i>Piperia candida</i> white-flowered rein orchid	PMORC1X050	None	None	G3	S3	1B.2
<i>Plethodon elongatus</i> Del Norte salamander	AAAAD12050	None	None	G4	S3	WL
<i>Rallus obsoletus obsoletus</i> California Ridgway's rail	ABNME05011	Endangered	Endangered	G5T1	S1	FP
<i>Rana aurora</i> northern red-legged frog	AAABH01021	None	None	G4	S3	SSC
<i>Rana boylei</i> foothill yellow-legged frog	AAABH01050	None	Endangered	G3	S3	SSC
<i>Rhyacotriton variegatus</i> southern torrent salamander	AAAAJ01020	None	None	G3G4	S2S3	SSC
<i>Riparia riparia</i> bank swallow	ABPAU08010	None	Threatened	G5	S2	



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



Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
<i>Sidalcea malachroides</i> maple-leaved checkerbloom	PDMAL110E0	None	None	G3	S3	4.2
<i>Sidalcea malviflora ssp. patula</i> Siskiyou checkerbloom	PDMAL110F9	None	None	G5T2	S2	1B.2
<i>Sidalcea oregana ssp. eximia</i> coast checkerbloom	PDMAL110K9	None	None	G5T1	S1	1B.2
<i>Silene scouleri ssp. scouleri</i> Scouler's catchfly	PDCAR0U1MC	None	None	G5T4T5	S2S3	2B.2
<i>Spergularia canadensis var. occidentalis</i> western sand-spurrey	PDCAR0W032	None	None	G5T4	S1	2B.1
<i>Spirinchus thaleichthys</i> longfin smelt	AFCHB03010	Candidate	Threatened	G5	S1	
<i>Thaleichthys pacificus</i> eulachon	AFCHB04010	Threatened	None	G5	S3	
<i>Trichodon cylindricus</i> cylindrical trichodon	NBMUS7N020	None	None	G4G5	S2	2B.2
<i>Upland Douglas Fir Forest</i> Upland Douglas Fir Forest	CTT82420CA	None	None	G4	S3.1	
<i>Usnea longissima</i> Methuselah's beard lichen	NLLEC5P420	None	None	G4	S4	4.2
<i>Viola palustris</i> alpine marsh violet	PDVIO041G0	None	None	G5	S1S2	2B.2

Record Count: 92