APPLICATION FOR NEW LICENSE
MAJOR PROJECT – EXISTING DAM

VOLUME II: EXHIBIT E

TRANSMITTAL LETTER
EXHIBIT E – ENVIRONMENTAL REPORT

CAMP FAR WEST HYDROELECTRIC PROJECT
FERC Project No. 2997

SECURITY LEVEL: PUBLIC

Prepared by:
South Sutter Water District
2464 Pacific Ave.
Trowbridge, CA 95659

June 2019

COVER SHEET

a. Title: Application for New License – Major Project- Existing Dam, Camp Far West Hydroelectric Project, FERC Project No. 2997

b. Subject: Exhibit E, Environmental Report of Final License Application

c. Lead Agency: Federal Energy Regulatory Commission

d. Abstract:

On or about June 30, 2019, South Sutter Water District (SSWD) filed with the Federal Energy Regulatory Commission (FERC or Commission) a final application for a new license for SSWD's Camp Far West Hydroelectric Project (P-2997). The Project is located on the main stem of the Bear River in Nevada, Yuba and Placer counties, California.

The existing Project occupies 2,863.7 acres of land, none of which is federal lands or Indian tribal lands. The Project does not use any United States-owned facilities.

SSWD proposes to continue to operate the Project as it has been operated historically, with the addition of the 5 foot pool raise of Camp Far West Reservoir and certain modifications and additional measures.

e. Contacts:

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f. Transmittal: This Exhibit E to relicense the Camp Far West Hydroelectric Project is made available to federal, state and local agencies, Native American tribes, non-governmental organizations, and members of the public on or about June 30, 2019, as required by Part 18 of the Code of Federal Regulations, Section 4.50.

FOREWORD

The Federal Energy Regulatory Commission (FERC or Commission), pursuant to the Federal Power Act (FPA)[1] and the United States Department of Energy Organization Act[2] is authorized to issue licenses for up to 50 years for the construction and operation of non-federal hydroelectric development subject to its jurisdiction, on the necessary conditions:

> That the project… shall be such as in the judgment of the Commission will be adapted to a comprehensive plan for improving or developing a waterway or waterways for the use or benefit of interstate or foreign commerce, for the improvement and utilization of water-power development, for the adequate protection, mitigation, and enhancement of fish and wildlife (including related spawning grounds and habitat), and for other beneficial public uses, including irrigation, flood control, water supply, and recreational and other purposes referred to in section 4(e).[3]

The Commission may require such other conditions not inconsistent with the FPA as may be found necessary to provide for the various public interests to be served by the project.[4] Compliance with such conditions during the licensing period is required. The Commission's Rules of Practice and Procedure allow any person objecting to a licensee's compliance or noncompliance with such conditions to file a complaint noting the basis for such objection for the Commission's consideration.[5]

[1] 16 U.S.C. § 791(a)-825r, as amended by the Electric Consumers Protection Act of 1986, P.L. 99-495 (1986) and the Energy Policy Act of 1992, P.L. 102-486 (1992).
[2] P. L. 95-91, 91 Stat. 556 (1977).
[3] 16 U.S.C. § 803(a).
[4] 16 U.S.C. § 803(g).
[5] 18 CFR § 385.206 (1987).

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Glossary - Definitions of Terms, Acronyms and Abbreviations

Term	Definition
0-9	
7DADM	7-day averages of the daily maxima
A	
ac	acre
ac-ft	acre-feet or acre-foot; the amount of water needed to cover one acre to a depth of one foot (43,560 cubic feet or 325,900 gallons)
ACHP	the Advisory Council on Historic Preservation
ADA	Americans with Disabilities Act
AIS	Aquatic Invasive Species
APE	Area of Potential Effect, as pertaining to Section 106 of the National Historic Preservation Act
B	
BA	Biological Assessment
BAF	Bioaccumulation factors
Basin Plan	Water Quality Control Plan for the Sacramento and San Joaquin Rivers
Bay-Delta	the San Francisco Bay/Sacramento-San Joaquin Delta Estuary
BGEPA	the Bald and Golden Eagle Protect Act
BLM	United States Department of the Interior, Bureau of Land Management
BMI	benthic macroinvertebrate
BO	Biological Opinion
C	
°C	Degrees Celsius
CALFED	CALFED Bay-Delta Program; state and federal interagency committee with management and regulatory responsibility for the Bay-Delta Estuary, now California's Delta Stewardship Council
Cal-IPC	California Invasive Plant Council
CDEC	California Data Exchange Center
CDFA	California Department of Food and Agriculture
CDFG	California Department of Fish and Game
CDFW	California Department of Fish and Wildlife
CDPR	California Department of Parks and Recreation
CEC	California Energy Commission
CEII	Critical Energy Infrastructure Information
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
C.F.R.	Code of Federal Regulations
cfs	cubic feet per second. One cfs equals approximately 1.98 acre-feet per day.
CFWID	Camp Far West Irrigation District
CHART	Critical Habitat Review Team
CNDDB	California Natural Diversity Data Base
CNPPA	The California Native Plant Protection Act
Commission	see FERC
CRLF	California red-legged frog
CSCI	California Stream Condition Index
cu ft	cubic feet
cu yd	cubic yards
CV	Central Valley
CVHJV	The California Central Valley Habitat Joint Venture
CVRWQCB	Central Valley Regional Water Quality Control Board
CWA	Federal Clean Water Act

Glossary. (continued)

Term	Definition
CWHR	California Wildlife Habitat Relationships System
CZMA	Coastal Zone Management Act
D	
DBOW	California State Parks Division of Boating and Waterways
DCU	Deer Conservation Units
DLA	Draft License Application
DO	dissolved oxygen
DPS	distinct population segment
DWR	California Department of Water Resources
E	
EA	Environmental Assessment
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
El.	elevation
EPA	United States Environmental Protection Agency
EPT	Ephemeroptera
ESA	Federal Endangered Species Act
F	
°F	Degrees Fahrenheit
FE	Federally Endangered
FEIS	Final Environmental Impact Statement
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission; also referred to as Commission
F.G.C.	California Fish and Game Code
Forest Service	United States Department of the Interior, Forest Service
FP	Fully Protected
FPA	Federal Power Act
ft	foot or feet
FT	Fully Threatened
FWN	Foothills Water Network
FYLF	Foothill yellow-legged frog
G	
g	grams
GIS	Geographic Information System
GPS	Global Positioning System
GUI	graphical user interface
H	
HPMP	Historic Properties Management Plan
HSC	Habitat Suitability Criteria
HU	Hydrologic unit, numbers assigned by California's Regional Water Quality Control Boards
HUC	Hydrologic unit codes developed by the Water Resources Council corresponding to hierarchal classification of hydrologic drainage basins in the United States. Each hydrologic unit is identified by a unique HUC
I	
ILP	Integrated Licensing Process
in.	inch
IPaC	Information, Planning, and Conservation System
J	
None	

Glossary. (continued)

Term	Definition
K	
kW	kilowatt: 1,000 watts
L	
LFAC	Low Flow Active Channel
Licensee	South Sutter Water District
LOP	Limited Operating Period
LWM	large woody material
M	
MBTA	The Migratory Bird Treaty Act of 1918
mg/L	milligrams per liter
mi	miles
mm	millimeter
MMI	multi-metric index
MSA Act	Magnuson-Stevens Fishery Conservation and Management Act
MWh	Megawatt hours: 1,000 kilowatt hours
N	
NAAQS	National Ambient Air Quality Standards
NAWMP	The North American Waterfowl Management Plan
NCIC	North Central Information Center
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NID	Nevada Irrigation District
NMFS	United States Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service
NMWSE	Normal maximum water surface elevation (applies to reservoirs and impoundments)
NNIP	Non-Native Invasive Plant
NOAA	National Oceanic and Atmospheric Association
NRHP	National Register of Historical Places
NRI	Nationwide Rivers Inventory
NSRA	North Shore Recreation Area
NWI	National Wetlands Inventory
O	
O&M	operation and maintenance
O/E	observed-to-expected
OHP	the California State Office of Historic Preservation
P	
PAD	Pre-Application Document
PAOT	people at one time
PG&E	Pacific Gas and Electric Company
PM&E	Protection, Mitigation & Enhancement
Project	SSWD's Camp Far West Hydroelectric Project, FERC Project No. 2997. Specifically, the Project facilities and features identified in the existing FERC license
Project Area	The area within and immediately adjacent to the existing FERC Project Boundary, and the Bear River downstream of the Project.
Project Boundary	All lands necessary for the safe operations and maintenance of the Project and other purposes, such as recreation, shoreline control, and protection of environmental resources
PUB	Palustrine Unconsolidated Bottom

Glossary. (continued)

Term	Definition
Q	
QA/QC	Quality Assurance/Quality Control
R	
RD	Recreation Day, which equals a visit by a person to a site for recreation purposes during any portion of a 24-hour period
Reclamation	United States Department of Interior, Bureau of Reclamation
Relicensing Participants	Any agency, Indian tribe non-governmental organization (NGO) or member of the public that actively participates in the Camp Far West Hydroelectric Project relicensing.
RM	River Mile, as measured along the river course, from downstream to upstream, often beginning at a downstream confluence with another river reach
RV	recreational vehicle
S	
§ or §§	section or sections
SCORP	California Department of Parks and Recreation's Statewide California Outdoor Recreation Plan
SE	State Endangered
SHPO	California Department of Parks and Recreation, Office of Historic Preservation, State Historic Preservation Officer
SIP	State Implementation Plans
SMUD	Sacramento Municipal Utility District
sq ft	square feet
sq mi	square mile
sq m	square meter
SSC	Species of special concern
SSRA	South Shore Recreation Area
SSWD	South State Water District
SWAMP	SWRCB's Surface Water Ambient Monitoring Program
SWRCB	State Water Resources Control Board
T	
TCP	Traditional Cultural Property
TMDL	total maximum daily load
U	
U.S.	United States
U.S.C.	United States Code
USACE	United States Department of Defense, Army Corps of Engineers
USDOC	United States Department of Commerce
USDOI	United States Department of Interior
USFWS	United States Department of the Interior, Fish and Wildlife Service
USGS	United States Geological Survey
V	
VAOT	Vehicles-at-one-time
VegCAMP	Vegetation Classification and Mapping Program
W	
WPT	western pond turtle
WSRA	Wild and Scenic Rivers Act
WUA	Weighted Usable Area
WY(s)	Water Years: Time period from October 1 of one year through September 31 of the next

Glossary. (continued)

Term	Definition
X	
None	
Y	
yr	year
Z	
None	

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SECTION 1.0 INTRODUCTION

1.1 SSWD's Application for a New License

The South Sutter Water District (SSWD or Licensee) has prepared this Exhibit E, Environmental Report, as part of its Application for a New License Major Project – Existing Dam (Application for New License of FLA) from the Federal Energy Regulatory Commission (FERC or Commission) for the Camp Far West Hydroelectric Project, FERC Project Number 2997 (Project). This exhibit is prepared in conformance with Title 18 of the Code of Federal Regulations (C.F.R.), Subchapter B (Regulations under the Federal Power Act), Part 4 (traditional licensing process). In particular, this exhibit conforms to the regulations in 18 C.F.R. Section 4.51(f). The initial license for the Project was issued by FERC to SSWD on July 2, 1981, effective on July 1, 1981, for a period of 40 yrs (yr).

1.1.1 The South Sutter Water District

Established in 1954, SSWD, located in Trowbridge, California, is a State of California public agency formed under California Water District Law, California Water Code Section 34000 et seq. to develop, store, and distribute surface water supplies for irrigation uses in SSWD's service area. In addition, Section 34000 et seq. authorizes SSWD to develop hydroelectric power in connection with SSWD's projects. SSWD is governed by a Board of Directors, whose seven members are elected by landowners within SSWD's service area.

SSWD's service area encompasses a total gross area of 63,972 acres (ac), of which 6,960 ac are excluded, for a net area of 57,012 ac. Approximately 40,107 ac are in Sutter County and 16,905 ac are in Placer County (Figure 1.1-1). In a normal year, over 35,500 ac within SSWD's service area are under irrigation, with approximately 29,110 ac (82%) in rice production, 3,905 ac (11%) in orchards, 2,130 ac (6%) in irrigated pastures, and 355 ac (1%) in miscellaneous row and field crops.

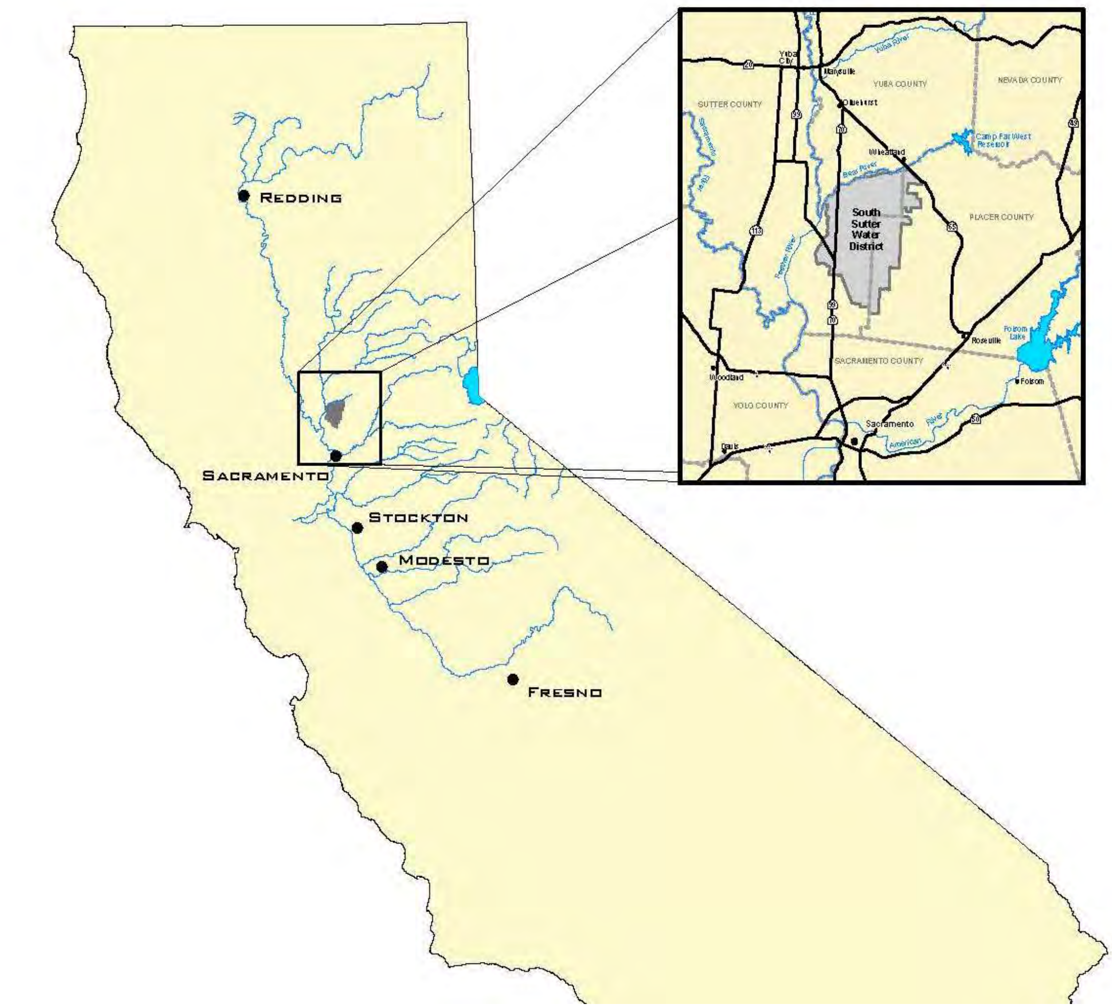

Figure 1.1-1. South Sutter Water District's service area.

One of the first acts by SSWD when it was formed was to enlarge the existing Camp Far West Dam and Reservoir and to develop a distribution system to augment and provide alternatives to a declining groundwater table that was being tapped by private agricultural wells within SSWD's service area.

Today, the annual available water supply in the enlarged Camp Far West Reservoir is totally allocated each yr, but still represents only a portion of SSWD's users' demands. Up to 510 cubic feet per second (cfs) of the water released from Camp Far West Reservoir is re-diverted from the Bear River during the irrigation season (i.e., typically, from mid-April through mid-October) at a non-Project 38-feet (ft) high overflow diversion dam[1] located approximately 1.3 miles (mi) downstream from Camp Far West Dam. Up to approximately 40 cfs is diverted into Camp Far West Irrigation District's (CFWID) South Canal, 435 cfs into SSWD's Main Canal, and 35 cfs into CFWID's North Canal. SSWD's Main Canal, which is located on the south bank and runs predominately north to south along the higher eastern border of SSWD's service area.[2] The intake for CFWID's South Canal is on SSWD's Main Canal a few hundred feet downstream of the diversion, and the intake for CFWID's North Canal is located on the north bank at the diversion dam across from SSWD's Main Canal intake. Typically, water deliveries begin low in mid-April, peak in July, and then gradually decrease through mid-October. Through turnouts and head gates, water is directed from SSWD's Main Canal into improved canals, one pipeline, and natural channels running from east to west, and distributed to water users. Depending upon the anticipated reservoir yield, the water user's allocations may range from 0.5 acre-feet (ac-ft) per ac of irrigated land during a drought year to as much as 2.5 ac-ft per ac during a wet yr. Perennial crops such as orchards and pasture receive a higher priority of allocation over seasonal crops, with rice growers receiving the lowest priority. Water deliveries are initiated when SSWD installs flashboards on the diversion dam (i.e., in accordance with the California Division of Safety of Dam, the flashboards cannot be in place from November 1 to April 1), which provides the head for the diversions into the canals. Water is released from the non-Project diversion dam into the Bear River through a fish release valve, and higher flows spill over the diversion dam.

1.1.2 Brief Description of the Project

The Project ranges in elevation (E1.) from 150 ft to 320 ft[3] and is located on the main stem of the Bear River in Nevada, Yuba and Placer counties, California. The Project includes a single development whose principal facilities and features consist of: the 170-ft high Camp Far West Dam; the 93,740 ac-ft Camp Far West Reservoir; the 6.8 megawatt (MW) Camp Far West Powerhouse at the base of the Camp Far West Dam; and two recreation areas on Camp Far West Reservoir. The existing FERC Project Boundary includes 2,863.7 ac of land. SSWD owns over 95 percent (2,710.5 ac) of the land within the boundary, and the remaining 5 percent (153.2 ac) of the land is owned by private parties – no federal or state land occurs within or adjacent to the FERC Project boundary or on the Bear River downstream of the Project. The Project does not include any open water conveyance facilities, transmission lines,[4] or active borrow or spoil areas. Figure 1.1-2 illustrates the general regional location of the Bear River watershed. Figure 1.1-3 shows the Project Vicinity,[5] Project facilities, and the existing FERC Project Boundary. Refer to Exhibit A of the Draft License Application (DLA) for a detailed description of the Project.

[1] The diversion dam was constructed in 1924-1925 and is owned and operated by SSWD. It is not part of SSWD's Camp Far West Hydroelectric Project, it is not used or useful for operations of the Camp Far West Hydroelectric Project, and it does not have any hydropower production facilities otherwise associated with the dam.

[2] CFWID is not part of SSWD.

[3] In this exhibit, all E1. data are in United States Department of Commerce (USDOC), National Oceanic and Atmospheric Association (NOAA), National Geodetic Survey Vertical Datum of 1929 (NGVD 29), unless otherwise stated.

[4] The original license for the Project included a short 60 kilovolt transmission line, however, on April 2, 1991, the transmission line was removed from the Project FERC license and added to Pacific Gas & Electric Camp Far West Transmission Line project (FERC Project No. 10821.

[5] In this exhibit, "Project Vicinity" refers to the area surrounding the Project on the order of USGS 1:24,000 scale topographic quadrangle.

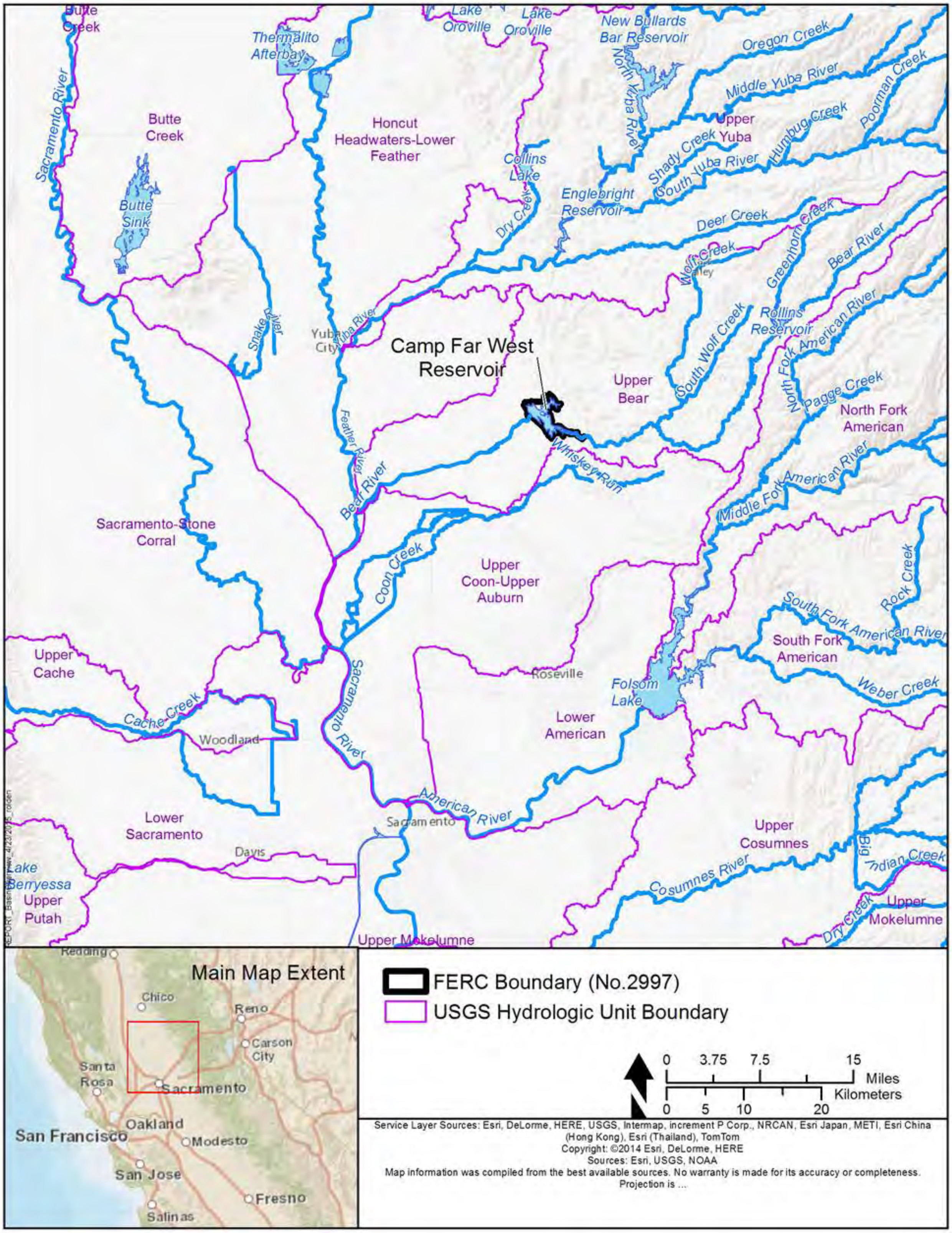

Figure 1.1-2. Bear River watershed in relation to the Feather River and other tributaries to the Sacramento River.

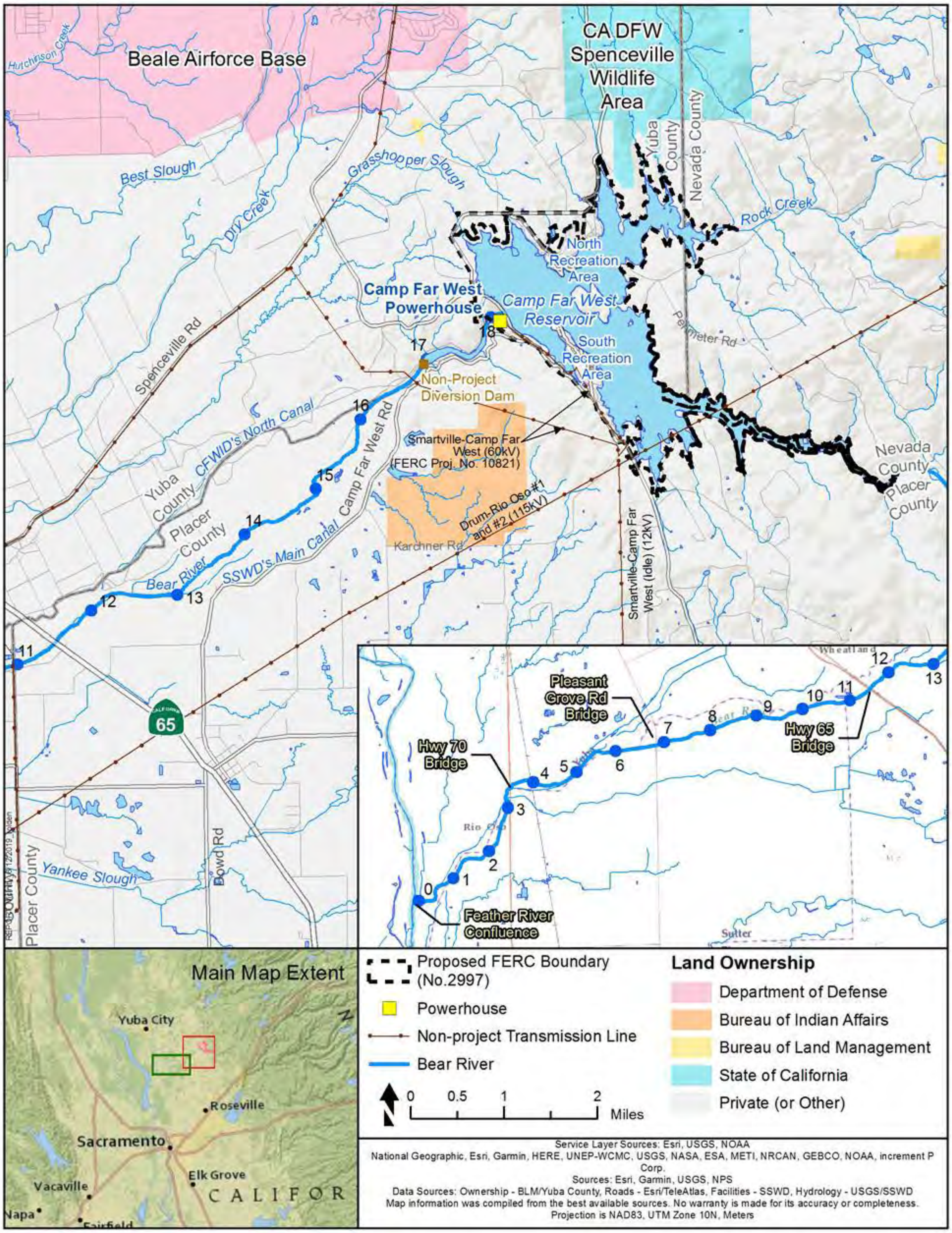

Figure 1.1-3. SSWD's Camp Far West Hydroelectric Project and Proposed Project Vicinity.

The Project is operated primarily to provide irrigation water to growers in SSWD's and the Camp Far West Irrigation District's (CFWID) service districts. However, SSWD also operates the Project to meet Bear River flow requirements and to generate power. Although the specific water availability can vary widely, normal Project operation is to fill Camp Far West Reservoir as early in the season as sufficient water becomes available and to then spill the excess flows over the Camp Far West Dam ungated spillway. Because the reservoir is primarily fed by rainfall-produced runoff and releases from upstream water projects, it is difficult to predict the amount of inflow anticipated before the end of the season; therefore, SSWD retains within the reservoir all of the inflow except releases for requirements for fisheries until the beginning of the irrigation season. Since the reservoir is operated as a fill-and-spill system, its effect on downstream flood flows is erratic, as it may range from complete control to only minor surcharge regulation. Camp Far West Reservoir does not have any dedicated flood control space or associated flood control rules. Because of the Camp Far West Powerhouse generating unit's operating characteristics, power can only be generated when the elevation of the Camp Far West Reservoir water surface is at or above 236 ft and when reservoir outflow is greater than 130 cfs. This condition normally occurs each yr starting in September and continuing into the fall until such time that surplus inflows are available to be passed through the powerhouse. During the irrigation season, up to a maximum of 530 cfs passes through the powerhouse in conformance with downstream irrigation and instream requirements. However, during the heavy runoff period, when spilling from the reservoir occurs, a greater quantity of water is routed through the powerhouse up to its maximum limit of 725 cfs.

SSWD proposes to modify the Project.[6] SSWD proposes two changes to existing Project facilities: 1) raising the normal maximum water surface elevation (NMWSE) of Camp Far West Reservoir by 5 feet (ft) from an E1. of 300 ft to an E1. of 305 ft (pool raise); and 2) modifying Project recreation facilities at Camp Far West Reservoir. In addition, SSWD proposes to modify the existing FERC Project Boundary.

In general, SSWD proposes to continue to operate the Project as it has operated historically, with the addition of a number of operation and management activities to: 1) protect or mitigate impacts from continued operation and maintenance (O&M) of the Project; and 2) enhance resources affected by continued Project O&M. These activities are collectively referred to as protection, mitigation and enhancement (PM&E) measures.

SSWD's Proposed Project would be able to continue to provide reliable surface water supplies under SSWD's water right permits. The Proposed Project would also continue to provide substantial protection and enhancement for anadromous salmonids in the Bear River downstream of the Project.

SSWD anticipates that its Proposed Project would generate an average of about 21,200 megawatt-hours (MWh) of energy annually, which represents a gross annual power value of $743,908. Annual costs under the Proposed Project would be $1,808,798. Shortfalls are met through periodic and unpredictable water sales and acquisition of federal and State grants.

[6] In this exhibit, "SSWD's Proposed Project" refers to the Project as proposed by SSWD in this Application or New License.

1.2 Purpose of Action and Need for Power

1.2.1 Purpose of Actions

The Commission must decide whether to issue a license to SSWD for the Project and what conditions should be placed in the license, if issued. In deciding whether to issue a license for the Project, the Commission must determine that the Project will be best adapted to a comprehensive plan for improving or developing the waterway. In addition to the power and developmental purposes for which licenses are issued (e.g., irrigation and water supply), the Commission must give equal consideration to the purposes of energy conservation; the Protection, Mitigation and Enhancement (PM&E) of fish and wildlife, including related spawning grounds and habitat; the provision of recreational opportunities; and the preservation of other aspects of environmental quality.

Issuing a new license for the Project would allow SSWD to continue to generate electricity at the Project for the term of the new license, making electric power from a renewable resource available for transmission to its customers. SSWD would continue to provide irrigation water to the local communities.

This Exhibit E was prepared in general conformance with the Commission's *Preparing Environmental Assessments: Guidelines for Applicants, Contractors and Staff* (FERC 2008). In addition, this Exhibit E was prepared in accordance with the National Environmental Policy Act of 1969 (NEPA), and assesses the effects associated with the operation of SSWD's Proposed Project and the No Action Alternative.[7] This Exhibit E includes measures proposed by SSWD for the PM&E of resources that would potentially be affected by SSWD's Proposed Project.

1.2.2 Need for Power

The Project is located in the California-Mexico Power area of the Western Electricity Coordination Council (WECC). According to the California Energy Commission (CEC), electricity consumption statewide is projected to grow at an annual average compounded rate of 1.2 percent from 2010 through 2020 (CEC 2009). SSWD's Proposed Project would continue to meet part of existing load requirements within the system, which is in need of resources.

Power from the Project could help to meet a need for power in the WECC region in both the short-term and long-term. The Project would provide low-cost power that may displace non-renewable, fossil-fired generation and contribute to a diversified generation mix. Displacing the operation of fossil-fired facilities avoids some power plant emissions and creates an environmental benefit.

[7] The "No Action Alternative" is defined as the condition under which the existing Project as currently configured (e.g., no changes to generation facilities) would continue to operate into the future as it operates today. All Project alternatives, including SSWD's Proposed Project, are compared to the No Action Alternative.

In August 1991, SSWD and Sacramento Municipal Utility District (SMUD) entered into a Contract for the Sale and Purchase of Electricity of the power generated at the Camp Far West Powerhouse. Under the contract, SMUD reimbursed SSWD for the construction of the Camp Far West Powerhouse and associated power facilities, SMUD operates the powerhouse under a lease, and SMUD receives all the power from the powerhouse paying for the power at a fixed rate. SSWD will continue to lease the Camp Far West Powerhouse to SMUD through 2032, when the existing SSWD/SMUD Contract expires on July 1, 2031. Upon termination of the existing SSWD/SMUD Contract, SSWD plans to negotiate a new lease/power purchase contract or multiple contracts with, at this time, an unknown third-party, which could be SMUD, or parties, and assumes the third party(ies) will sell the Project power into the California Independent System Operator (CAISO) daily and real-time energy markets.

1.3 Statutory and Regulatory Requirements

Issuing a new license for the Project is subject to numerous requirements under the Federal Power Act (FPA) and other applicable statutes. The major acts and related requirements are summarized in Table 1.3-1 and described below in chronological order based on date of enactment. The current status of actions undertaken by SSWD or the agency with jurisdiction related to each requirement are briefly described.

Table 1.3-1. Summary of statutory and regulatory requirements and status.

Requirement	Agency with Jurisdiction	Status
Migratory Bird Treaty Act of 1918	USFWS	The USFWS has not formally specified measures to protect birds protected under the Migratory Bird Treaty Act at this time.
Section 10(a) of the Federal Power Act of 1920	Park Service, NMFS, USFWS, SWRCB and CDFW	The agencies have not formally provided Section 10(a) recommendations at this time.
Section 10(j) of the Federal Power Act of 1920	USFWS, NMFS and CDFW	The agencies have not formally provided Section 10(j) recommendations at this time.
Section 18 of the Federal Power Act of 1920	NMFS and USFWS	NMFS and USFWS have not formally prescribed Section 18 fishway prescriptions at this time.
Energy Policy Act of 2005	USDOC	At this time, parties have not requested trial-type hearings or recommended alternatives to FPA Section 18 fishway prescriptions.
Bald and Golden Eagle Protection Act of 1940	USFWS	The USFWS has not formally specified measures to protect bald and golden eagles at this time.
California Fully Protected Species Act (1957)	CDFW	SSWD has consulted with CDFW regarding Fully Protected species. CDFW has not issued a formal determination at this time.
National Historic Preservation Act of 1966	Advisory Council, State Historic Preservation Officer, Park Service and Native American Tribes	SSWD has consulted with the Forest Service, State Historic Preservation Officer and Native American tribes, and included a Historic Properties Management Plan in the Application for New License.
Wild and Scenic Rivers Act of 1968	Park Service	The agency has not provided formal comments regarding designated, or proposed for designation Wild and Scenic Rivers at this time.
Clean Air Act of 1970	EPA and Air Quality Control Boards	The agencies have not provided formal comments regarding air quality at this time.

Table 1.3-1. (continued)

Requirement	Agency with Jurisdiction	Status
Section 401 of the Clean Water Act (added by the Water Pollution Control Act Amendments of 1972)	SWRCB	SSWD will file with the SWRCB a formal request for a CWA Section 401 Water Quality Certification within 60 days of the date that FERC issues its Ready for Environmental Analysis Notice.
Coastal Zone Management Act of 1972	California Coastal Zone Commission	Not applicable; the Project is not within the Coastal Zone.
California Environmental Quality Act of 1970	SSWD, SWRCB and CDFW	SSWD plans to be the Lead Agency for CEQA (SWRCB expected to be Responsible Agency), and will initiate CEQA at the appropriate time in the relicensing proceeding.
California Wild and Scenic Rivers Act of 1972	CDPR	The agency has not provided formal comments regarding designated, or proposed for designation California Wild and Scenic Rivers at this time.
Endangered Species Act of 1973	USFWS and NMFS	SSWD has consulted with USFWS and NMFS. The agencies have not provided formal comments regarding Section 7 consultation.
Magnuson-Stevens Fishery Conservation and Management Act of 1976	NMFS	SSWD has consulted with NMFS. The agency has not provided formal comments regarding the act.
Pacific Northwest Electric Power Planning and Conservation Act of 1980	Pacific Northwest Power and Conservation Planning Council	Not applicable; the Project is not within the Pacific Northwest Power and Conservation Planning area (i.e., the Columbia River Basin).
Wilderness Act of 1984	Park Service	The agency has not provided formal comments regarding designated, or proposed for designation Wilderness Areas at this time.
California Endangered Species Act of 1984	CDFW	SSWD has consulted with CDFW regarding CESA-listed species. CDFW has not issued a formal determination at this time.
Americans with Disabilities Act of 2010, and Accessibility Standards	United States Department of Justice	SSWD has assessed recreation facilities on private land owned by SSWD using these standards, and addressed ADA access in the Application for New License. Consultation is not required.

1.3.1 Migratory Bird Treaty Act of 1918

The Migratory Bird Treaty Act (MBTA) of 1918, as amended (16 U.S.C. §§ 703-712), implemented the 1916 Convention between the United States (U.S.) and Great Britain, on behalf of Canada, for the protection of migratory birds. The MBTA was later amended to address treaties between the U.S. and Mexico, the U.S. and Japan, and the U.S. and the Soviet Union, now Russia. The act provides that, unless and except as permitted by regulations made under the act, it is unlawful

> …to pursue, hunt, take, capture, kill, attempt to take, capture or kill, possess, offer for sale, sell, offer to barter, barter, offer to purchase, purchase, deliver for shipment, ship, export, import, cause to be shipped, exported, or imported, deliver for transportation, transport or cause to be transported, carry, or cause to be carried, or receive for shipment, transportation, carriage, or export, any migratory bird, any part, nest, or

> egg of any such bird, or any product, whether or not manufactured, which consists, or is composed in whole or part, of any such bird or any part, nest, or egg thereof…

that is included in terms of one or more of these treaties. (16 U.S.C. § 703)

Executive Order 13186 (66 FR 3853) defines the responsibilities of federal agencies for the protection of migratory birds. Each federal agency taking actions that have, or are likely to have, measurable negative effect on migratory bird populations are directed to develop and implement, within 2 yrs, a Memorandum of Understanding (MOU) with the United States Department of the Interior (USDOI), Fish and Wildlife Service (USFWS), the lead agency for migratory birds, that shall promote the conservation of migratory bird populations.

SSWD has had ongoing discussions with the USFWS during the relicensing regarding potential Project effects on migratory bird species potentially affected by the Project.

At this time, the USFWS has not proposed any recommendations for potentially-affected migratory birds. SSWD expects that the USFWS will initiate discussion on migratory birds at the appropriate time in the relicensing proceeding.

1.3.2 Federal Power Act of 1920

1.3.2.1 Section 10(a) Recommendations

Section 10(a)(1) of the FPA (16 U.S.C. § 806(a)(1)) provides that the Project adopted by the Commission:

> …shall be such as in the judgment of the Commission will be best adapted to a comprehensive plan for improving or developing a waterway or waterways for the use or benefit of interstate or foreign commerce, for the improvement and utilization of water-power development, for the adequate protection, mitigation, and enhancement of fish and wildlife (including related spawning grounds and habitat), and for other beneficial public uses, including irrigation, flood control, water supply, and recreation and other purposes referred to in…

FPA section 4(e).

SSWD has had ongoing discussions with federal, State and local agencies regarding potential Project effects.

At this time, federal and State agencies that have filed with FERC comprehensive plans for the development of the waterway have not proposed any FPA Section 10(a) recommendations. SSWD expects that these agencies will exercise their FPA Section 10(a) authorities at the appropriate time in the relicensing proceeding.

Refer to Section 5.4 of this Exhibit E for a discussion of the Project's consistency with comprehensive plans that have been filed with FERC (i.e., Qualifying Plans).

1.3.2.2 Section 10(j) Recommendations

Under Section 10(j) of the FPA (16 U.S.C. § 803(j)), each hydroelectric license issued by the Commission must include conditions for the PM&E of fish and wildlife that are affected by the project and are based on recommendations that federal and State fish and wildlife agencies provide to the Commission, unless the Commission determines that the proposed PM&E recommendations are inconsistent with the purposes and requirements of the FPA or other applicable law. Before rejecting or modifying any such agency recommendation, the Commission must attempt to resolve any such inconsistency with the agency making the recommendation, giving due weight to the recommendations, expertise, and statutory responsibilities of such agency.

SSWD has had ongoing discussions with federal, State and local fish and wildlife agencies regarding potential Project effects on fish and wildlife.

At this time, federal and State and local fish and wildlife agencies have not proposed any FPA Section 10(j) recommendations for potentially-affected fish and wildlife resources. SSWD expects that these agencies will exercise their FPA Section 10(j) authorities at the appropriate time in the relicensing proceeding.

1.3.2.3 Section 18 Fishway Prescriptions

Section 18 of the FPA (16 U.S.C. § 811) provides that the Commission shall require the construction and O&M by a licensee at its own expense of such fishways as may be prescribed by the Secretary of Commerce or the Secretary of the Interior.

Pursuant to FERC's regulations at 18 C.F.R. Section 5.22(a)(4), FERC will solicit preliminary FPA Section 18 prescriptions in its notice that SSWD's license application is ready for environmental analysis. After the USDOC, NOAA, National Marine Fisheries Service (NMFS) and USFWS have proposed their preliminary FPA Section 18 prescriptions, parties to a relicensing proceeding may request a trial-type hearing on any disputed issues of material fact with respect to such preliminary prescriptions (16 U.S.C. § 811). Requests for trial-type hearing must be filed with the relevant agency within 30 days of the agency's deadline for filing the preliminary condition with FERC (50 C.F.R. § 221.21(a)(2)).

In addition, pursuant to Section 33 of the FPA, which was added by Section 241 of the Energy Policy Act of 2005 (16 U.S.C. § 823d(b)), parties to a relicensing proceeding may propose alternative Section 18 prescriptions. The Secretary of relevant agency must accept the alternative in lieu of its own proposal if it determines, based on substantial evidence, that the alternative prescription:

(A) will be no less protective than the fishway initially prescribed by the Secretary; and

(B) will either, as compared to the fishway initially prescribed by the Secretary –

(i) cost significantly less to implement; or

(ii) result in improved operation of the project works for electricity production.

Alternative FPA Section 18 prescriptions must be filed within 30 days of the agency's deadline for filing the preliminary Section 18 prescription with FERC (50 C.F.R. § 221.71(a)(2)).

SSWD has had ongoing discussions with NMFS and USFWS regarding potential Project effects on fish passage.

At this time, the Secretaries of Commerce and Interior have not provided any formal fishway prescriptions. SSWD expects that the Secretaries will exercise or reserve their FPA Section 18 authorities at the appropriate time in the relicensing proceeding.

1.3.3 Bald and Golden Eagle Protection Act of 1940

Section 1 of the Bald and Golden Eagle Protect Act (BGEPA) of 1940 (16 U.S.C. § 668), prohibits the take, possession, sale, purchase, barter, offer to sell, purchase or barter, transport, export or import of any bald or golden eagles, or any part, nest or egg thereof, unless otherwise permitted by the Secretary of the Interior. Section 4 of the Act (16 U.S.C. § 668c) defines "take" to include to "*pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb*." A USFWS regulation (50 C.F.R. § 22.3) defines "disturb" as

> …to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available, 1) injury to an eagle, 2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or 3) nest abandonment, by substantially interfering with normal breeding, feeding or sheltering behavior.

SSWD has observed bald eagles (*Haliaeetus leucocephalus*) and golden eagles (*Aquila chrysaetos*) in the Project Area.[8]

SSWD has had ongoing discussions with the USFWS regarding the potential effect of the Project on bald eagles and golden eagles. SSWD, CDFW and USFWS are working collaboratively to develop a Bald Eagle Management Plan. The collaborative process between SSWD and the agencies is described in Section 1.4.2.4 and Exhibit E2 in Exhibit E of this FLA.

[8] For the purposes of this document, "Project Area" is defined as the area within the FERC Project Boundary and the land immediately surrounding the FERC Project Boundary (i.e., within about 0.25-mi of the FERC Project Boundary) and includes he Bear River to its confluence with the Feather River.

1.3.4 California Fully Protected Species Statutes (1957)

In 1957, California adopted statutes providing for the full protection of specified birds, mammals, amphibians and reptiles and fish (California Fish and Game Code [F.G.C.] §§ 3511, 4700, 5050, 5515). These statutes provide that no provision of the Fish and Game Code or any other provision of law shall be construed to authorize the issuance of permits or licenses to take any member of one of these Fully Protected (CFP) species, except that the California Department of Fish and Wildlife (CDFW)[9] may authorize the taking of members of these species "*for necessary scientific research, including efforts to recover fully protected, threatened, or endangered species*," and may authorize the live capture and relocation of members of the listed bird species pursuant to a permit for the protection of livestock.

Today, 13 bird species, 9 mammal species, 5 reptile and amphibian species, and 10 fish species are designated as CFP under California state law.

Through consultation with CDFW, SSWD has identified six CFP species that have a reasonable potential to be affected by the Project: five birds and one mammal. These include:

- State of California Fully Protected Species:
  - Bald eagle
  - Golden eagle
  - American peregrine falcon (*Falco peregrinus anatum*)
  - California black rail (*Laterallus jamaicensis coturniculus*)
  - White-tailed kite (*Elanus leucurus*)
  - Ringtail (*Bassariscus astutus*)

The bald eagle is also listed as an endangered species under the California Endangered Species Act (CESA), and both the bald eagle and the golden eagle are protected under the MBTA and BGEPA. In addition, the bald eagle, golden eagle and American peregrine falcon are protected under F.G.C. Sections 3503, 3503.5, and 3513, which make it unlawful to take, possess, or needlessly destroy birds' nests or eggs; take, possess, or destroy raptors and their eggs and nests; and take or possess any migratory nongame bird, or part thereof, designated in the MBTA, respectively. None of the CFP species are listed as threatened or endangered species under the Endangered Species Act (ESA).

SSWD has had ongoing discussions with CDFW regarding the potential effect of the Project, including on CFP species. SSWD, CDFW and USFWS are working collaboratively to develop a Bald Eagle Management Plan, which includes incidental observations of other nesting raptors

[9] In January 2013, the California Natural Resources Agency changed the name of the California Department of Fish and Game (CDFG) to the California Department of Fish and Wildlife (CDFW).

such as golden eagles and osprey. The collaborative process between SSWD and the agencies is described in Section 1.4.2.4 and Exhibit E2 in Exhibit E of this FLA.

1.3.5 National Historic Preservation Act of 1966

Section 106 of the National Historic Preservation Act (NHPA) of 1966 (16 U.S.C. § 470f), requires any federal agency having direct or indirect jurisdiction over a proposed federal or federally assisted undertaking to "*take into account the effects of the undertaking on any district, site, building, structure, or object that is included in or eligible for inclusion in*" the National Register of Historic Places (NRHP) that the Secretary of the Interior is authorized to expand and maintain under Section 101(a)(1)(A) of the NHPA (16 U.S.C. § 470a(a)(1)(A)). The regulations implementing the NHPA are in 36 C.F.R. Part 800. Section 800.4(a)(1) of 36 C.F.R. requires the federal agency whose proposed undertaking is subject to the NHPA must determine and document the "area of potential effects" (APE) and 36 C.F.R. Section 800.16(d) defines this area as "*the geographic area within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist*." This regulation also provides that the "*area of potential effects is influenced by the scale and nature of an undertaking and may be different for different kinds of effects caused by the undertaking*." 36 C.F.R. Section 800.16(y) defines "undertaking" as "*a project, activity, or program funded in whole or in part under the direct or indirect jurisdiction of a Federal agency, including those carried out by or on behalf of a Federal agency; those carried out with Federal financial assistance; and those requiring a Federal permit, license or approval*." In this case, the undertaking is FERC's issuance of a new license to SSWD for the Project.

Historic properties are any prehistoric or historic district, site, building, structure, object, or traditional cultural property included in or eligible for inclusion in the NRHP maintained by the Secretary of the Interior (36 C.F.R. § 800.16(l)(1)). In most cases, cultural resources less than 50 yrs old are not considered eligible for the NRHP; however, a property achieving significance within the past 50 yrs is eligible if it is of exceptional importance. Cultural resources also must retain their integrities (i.e., the ability to convey their significance) to qualify for listing in the NRHP. For example, dilapidated structures or heavily disturbed archaeological sites may not retain enough integrity to relay information relative to the context in which the resource is considered to be important and, therefore, may not be eligible for listing on the NRHP.

As part of the NHPA Section 106 process, federal agencies and their representatives are required to participate in consultation on any findings and determinations regarding an undertaking's effect on historic properties (36 C.F.R. § 800.2(a)(4)). Consulting parties include: 1) the State Historic Preservation Officer (SHPO); 2) Indian tribes; 3) local governments; and 4) individuals and organizations with a demonstrated interest in the Project. Section 106 requires that federal agencies seek concurrence from the SHPO on any determinations of NRHP eligibility and findings of effect to historic properties, and notify the Advisory Council on Historic Preservation (Council) on any finding of adverse effects. Additionally, federal agencies must make a reasonable and good faith effort to identify Indian tribes and other consulting parties that might attach religious and cultural significance to historic properties that may be affected by the undertaking (36 C.F.R. § 800.3(f)(2)), and gather information to assist in the identification of such properties (36 C.F.R. § 800.4(a)(3),(4)).

On May 13, 2016, FERC initiated consultation with SHPO pursuant to 36 C.F.R. Section 800.3(c)(3), and designated SSWD as its non-federal representative for the purposes of informal Section 106 consultation with regards to the relicensing. FERC also contacted Native American tribes in the area informing them of the beginning of consultation and soliciting their interest in participating in the process.

FERC typically requires, as a license condition, that an applicant for a new license develop and implement a Historic Properties Management Plan (HPMP) that considers and manages effects to historic properties throughout the term of the license. SSWD has completed cultural resources studies to identify historic properties within the APE. Study reports were completed for these studies and filed with FERC on June 7, 2019 (FERC Accession No.: 201906075078, 201906075079). These study reports include consultation with consulting parties, as described above. The data from these studies have been used to develop the HPMP that outlines the procedures and protocols for managing historic properties within the APE under the new FERC license. A draft HPMP was provided to Indian tribes on March 28, 2019 for review; no comments were received. The draft HPMP was provided to SHPO for review on June 7, 2019. A draft HPMP is provided in Volume III of SSWD's FLA. SSWD anticipates that FERC will enter into a programmatic agreement (PA) that will formally implement the HPMP under the new license for the Project. The PA generally concludes FERC's NHPA Section 106 responsibilities for the relicensing.

1.3.6 Wild and Scenic Rivers Act of 1968

Under the Wild and Scenic Rivers Act of 1968, as amended (16 U.S.C. §§ 1271-1287), various rivers and river segments are designated as components of the national wild and scenic rivers system for their "*outstandingly remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural or other similar values*" (16 U.S.C. §1271). The purpose of the act is to preserve these rivers in their free-flowing conditions, and to protect them and their immediate environments for the benefit and enjoyment of present and future generations. There are no designated federal Wild and Scenic Rivers in the Project Vicinity or downstream of the Project, nor are there any river segments recommended for designation as federal Wild and Scenic Rivers in the Project Vicinity or downstream of the Project.

At this time, the USDOI, National Park Service (NPS) have not formally commented on SSWD's Proposed Project in relation to the Wild and Scenic Rivers Act. SSWD expects that the agencies will comment at the appropriate time in the relicensing proceeding, as necessary.

1.3.7 National Environmental Policy Act of 1969

The National Environmental Policy Act of 1969 (42 U.S.C. §§ 4321-437h) (NEPA) requires all federal agencies involved in the permitting of activities affecting the environment, such as the issuance of a new FPA license for the Project, to evaluate the environmental impacts of the proposed action and the significance of these impacts.

Under NEPA, it is the continuing responsibility of the federal government

> …to use all practical means consistent with other essential considerations of national policy, to improve and coordinate Federal plans, functions, programs, and resources to the end that the Nation may-- (1) fulfill the responsibilities of each generation as trustee of the environment for succeeding generations; (2) assure for all Americans safe, healthful, productive, and esthetically and culturally pleasing surroundings; (3) attain the widest range of beneficial uses of the environment without degradation, risk to health or safety, or other undesirable and unintended consequences; (4) preserve important historic, cultural, and natural aspects of our national heritage, and maintain, wherever possible, an environment which supports diversity and variety of individual choice; (5) achieve a balance between population and resource use which will permit high standards of living and a wide sharing of life's amenities; and (6) enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources. (42 U.S.C. §4331(b))

NEPA requires federal action agencies to prepare an Environmental Assessment (EA) or environmental impact statements (EIS) that describe: 1) the environmental impacts of the proposed action; 2) any adverse environmental effects which cannot be avoided should the proposal be implemented; 3) alternatives to the proposed action; 4) the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity; and 5) any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented. (42 U.S.C. § 4332(2)(C)).

The EA or EIS acts as a disclosure or guidance document in which FERC describes the effects of proposed actions and possible PM&E measures; assesses the environmental effects of relicensing the project; and concludes that relicensing the project is: 1) not a major federal action significantly affecting the quality of the human environment; or 2) a major federal action significantly affecting the quality of the human environment.

SSWD anticipates that FERC will initiate NEPA after SSWD files its Application for New License.

1.3.8 Clean Air Act of 1970

The Clean Air Act (42 U.S.C. §§ 7401-7671q) and the Conformity Rules require federal agencies to conform to State Implementation Plans (SIPs). The United States Environmental Protection Agency (EPA) has established requirements and procedures to ensure that federally sponsored or approved actions will comply with the National Ambient Air Quality Standards (NAAQS), and conform to the appropriate SIPs. The conformity rules apply to designated non-attainment or maintenance areas for criteria pollutants regulated under NAAQS. The SIPs are the approved State air quality regulations that provide policies, requirements, and goals for the implementation, maintenance, and enforcement of the NAAQS. SIPs include emission limitations and control measures to attain and maintain the NAAQS. The EPA has developed two conformity regulations: one for transportation projects and one for non-transportation projects. Non-transportation projects are governed by the "general conformity" regulations (40 C.F.R. Parts 6, 51 and 93) described in the final rule for Determining Conformity of General Federal Actions to State or Federal Implementation Plans.

Because the Project is a non-transportation project, the general conformity rule applies.

At this time, the EPA and local Air Quality Control Boards have not formally commented on the Project with regards to air quality. SSWD expects that these agencies will comment at the appropriate time in the relicensing proceeding, as necessary.

1.3.9 Federal Water Pollution Control Act of 1970

Waters of the U.S. are those that are regulated under the Federal Water Pollution Control Act of 1970, as amended (33 U.S.C. § 1313),[10] and include waters which are currently used, were used in the past, or may be susceptible to use in interstate or foreign commerce; their tributaries; and adjacent waters, including wetlands, ponds, lakes, impoundments and similar waters (40 C.F.R. § 230.3). For rivers and streams, including those that are non-vegetated, the limit of jurisdiction is determined by the ordinary high water mark, which is typically delineated in the field by evaluating field indicators. Evaluation of hydrological data also can provide additional information to assist in determination of the ordinary high water mark. Riparian areas that are not located within waters of the U.S. are not regulated under the Federal Clean Water Act (CWA). Man-made water bodies may or may not be considered jurisdictional under the CWA. The jurisdictional determination of these features is typically made by considering wetland characteristics and hydrological connections to other waterways or wetlands. The U.S. Army Corps of Engineers (USACE) ultimately makes the final determination of jurisdictional status.

Section 303 of the CWA authorizes states to adopt water quality standards applicable to intrastate waters and to submit them to the EPA for review and approval. The SWRCB and the State's nine Regional Water Quality Control Boards (RWQCB) adopt such water quality standards through their adoption of water quality control plans, which also are known as "Basin Plans," pursuant to Water Code Sections 13240-13248. The region of the Central Valley Regional Water Quality Control Board (CVRWQCB) includes the Project and the Bear River watershed.

CWA Section 303(c)(2)(A) (33 U.S.C. § 1313(c)(2)(A) provides that water quality standards shall "*consist of the designated uses of the navigable waters involved and the water quality criteria for such waters based upon such uses*." In California, water quality control plans contain water quality objectives, which consist of "*limits or levels of water quality constituents or characteristics which are established for the reasonable protection of beneficial uses of water or the prevention and correction of water pollution and nuisance*" and programs of implementation to achieve the objectives (Water Code §§ 13050(h), 13241-13242.) The

[10] For the purpose of this PAD, the Federal Water Pollution Control Act is referred to as the "Clean Water Act" or "CWA," which is the name commonly used when referring to the Federal Water Pollution Control Act.

RWQCBs must consider various factors, including: 1) past, present and probable future beneficial uses of water; 2) environmental characteristics of the hydro unit (HU) under consideration, including the quality of water available thereto; 3) water quality conditions that could reasonably be achieved through the coordinated control of all factors that affect water quality in the area; 4) economic considerations; 5) the need for developing housing within the region; and 6) the need to develop and use recycled water (Water Code § 13241).

The SWRCB's management goals are set forth in the *Water Quality Control Plan (Basin Plan) for the Sacramento and San Joaquin Rivers*, the fourth edition of which was initially adopted in 1998 and most recently revised in 2016 (CVRWQCB 1998). This Basin Plan formally specifies designated existing and potential beneficial uses and water quality objectives for the Bear River. The various water quality objectives specified in the Basin Plan are in numeric and narrative form, and some apply to the whole basin while others apply only to specified water bodies.

The Basin Plan includes the Bear River in one HU: 1) HU 515.1, which includes the Bear River and its tributaries from its origin to the Feather River. Table 1.3-2 lists designated existing and potential beneficial uses for this HU.

Table 1.3-2. Designated beneficial uses of surface waters within the Camp Far West Hydroelectric Project Vicinity by HU in the Basin Plan.

Designated Beneficial Use Description from Basin Plan, Section II		**Designated Beneficial Use by HU in the Basin Plan, Table II-1**	**Bear River from Headwaters to Feather River**
		Use	**HU 515.1**
Municipal and Domestic Supply (MUN)	Uses of water for community, military, or individual water supply systems including, but not limited to, drinking water supply.	Municipal and Domestic Supply	Existing
Agricultural Supply (AGR)	Uses of water for farming, horticulture, or ranching including, but not limited to, irrigation (including leaching of salts), stock watering, or support of vegetation for range grazing.	Irrigation	Existing
		Stock Watering	Existing
Industrial Process Supply (PRO)	Uses of water for industrial activities that depend primarily on water quality.	Process	--
Industrial Service Supply (IND)	Uses of water for industrial activities that do not depend primarily on water quality including, but not limited to, mining, cooling water supply, hydraulic conveyance, gravel washing, fire protection, or oil well re-pressurization.	Service Supply	--
		Power	Existing
Water Contact Recreation (REC-1)	Uses of water for recreational activities involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, swimming, wading, water skiing, skin and scuba diving, surfing, white water activities, fishing, or use of natural hot springs.	Contact	Existing
		Canoeing and Rafting	Existing

Table 1.3-2. (continued)

Designated Beneficial Use Description from Basin Plan, Section II		Designated Beneficial Use by HU in the Basin Plan, Table II-1	Bear River from Headwaters to Feather River
		Use	HU 515.1
Non-Contact Water Recreation (REC-2)	Uses of water for recreational activities involving proximity to water, but where there is generally no body contact with water, nor any likelihood of ingestion of water. These uses include, but are not limited to, picnicking, sunbathing, hiking, beach-combing, camping, boating, tide-pool and marine life study, hunting, sightseeing, or aesthetic enjoyment in conjunction with the above activities.	Other Non-Contact	Existing
Warm Freshwater Habitat (WARM)	Uses of water that support warm water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates.	Warm[1]	Existing
Cold Freshwater Habitat (COLD)	Uses of water that support cold water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates.	Cold[1]	Existing
Migration of Aquatic Organisms (MGR)	Uses of water that support habitats necessary for migration or other temporary activities by aquatic organisms, such as anadromous fish.	Warm[2]	Potential
		Cold[3]	Potential
Spawning (SPWN)	Uses of water that support high quality aquatic habitats suitable for reproduction and early development of fish.	Warm[2]	Potential
		Cold[3]	Potential
Wildlife Habitat (WILD)	Uses of water that support terrestrial or wetland ecosystems including, but not limited to, preservation or enhancement of terrestrial habitats or wetlands, vegetation, wildlife (e.g., mammals, birds, reptiles, amphibians, or invertebrates), or wildlife water and food sources.	Wildlife Habitat	Existing
Navigation (NAV)	--	--	--

Source: CVRWQCB 1998

[1] Resident does not include anadromous. Any hydrologic unit with both WARM and COLD beneficial use designations is considered COLD water body by the SWRCB for the application of water quality objectives.

[2] Striped bass, sturgeon, and shad.

[3] Salmon and steelhead.

CWA Section 303(d) (33 U.S.C. § 1313(d)) requires that each state identify the waters within the state for which effluent limitations under CWA Section 301(b)(1)(A) and (B) (33 U.S.C. § 1311(b)(1)(A) & (B)) are not stringent enough to implement any water quality standard applicable to such waters. The SWRCB and CVRWQCB work together to research and update this list for Central Valley Region. This list and its associated Total Maximum Daily Load (TMDL) Priority Schedule indicate that, in the Project Area, the surface waters listed in Table 1.3-3 have been identified by the SWRCB as impaired under CWA Section 303(d) (SWRCB 2010).[11]

[11] The proposed 2012 update of the CWA Section 303(d) List is limited to waterbodies of the North Coast, Lahontan, and Colorado River regions and is not expected to modify the 303(d) List in the Project Area. http://www.waterboards.ca.gov/northcoast/water_issues/programs/tmdls/303d/pdf/150115/SB_Notice.pdf

Table 1.3-3. Section 303(d) List of Water Quality Limited Segments for the Camp Far West Hydroelectric Project and downstream of the Project.

Waterbody Segment	Pollutant / Stressor	Potential Sources	SWRCB's Expected TMDL Plan Completion Date
CAMP FAR WEST RESERVOIR			
Camp Far West Reservoir	Mercury	Resource Extraction	2015[1]
BEAR RIVER			
Downstream of Camp Far West Reservoir	Chlorpyrifos	Agriculture	2021[2]
	Mercury	Resource Extraction	2015[1]
	Diazinon	Agriculture	2010[2]
	Copper	Unknown	2021

1 Mercury TMDLs are being addressed through the SWRCB's process to develop a statewide water quality control program for mercury that consists of a mercury water quality objectives based on fish tissue concentrations and a Statewide Reservoir Mercury Control Program and TMDL. The SWRCB has completed the scoping phase of the California Environmental Quality Act, and is currently gathering more information.[12, 13]

2 On March 7, 2017, the SWRCB adopted the CVRWQCB *Amendment to the Water Quality Control Plan for the Sacramento River and San Joaquin River Basins for The Control of Diazinon and Chlorpyrifos Discharges*, and approving the supporting Substitute Environmental Documentation and Staff Report. The EPA adopted the amendment on August 16, 2017. The diazinon and chlorpyrifos TMDLs are being addressed through this SWRCB initiative.[14]

A TMDL may apply to a single water body and pollutant, or a combination of multiple water bodies and pollutant listings. There are currently no approved TMDL plans specific to the Bear River.

CWA Section 401 (33 U.S.C. § 1341) requires that an applicant for a federal license or permit seek certifications from the appropriate State agency that the Project will comply with several listed sections of the CWA, including CWA Section 303. CWA Section 401(d) (33 U.S.C. § 1341(d)) provides that any such certification

> …shall set forth any effluent limitations and other limitations and monitoring requirements necessary to assure that any applicant for a Federal license or permit will comply with any applicable effluent limitations and other limitations under [33 U.S.C. § 1311 or 1312] standard of performance under [33 U.S.C. § 1316] or prohibition, effluent standard, or pretreatment standard under [33 U.S.C. § 1317], and with any other appropriate requirement of State law set forth in such certification, and shall become a condition on any Federal license or permit subject to the provisions of this section.

The SWRCB issues CWA Section 401 certifications for hydroelectric power projects in California.

A CWA Section 401 water quality certificate was not issued for the current FERC license for the existing Project because FERC issued the Project license before enactment of the CWA.

12 http://www.waterboards.ca.gov/water_issues/programs/mercury/reservoirs/
13 http://www.swrcb.ca.gov/water_issues/programs/mercury/
14 http://www.waterboards.ca.gov/rwqcb5/water_issues/tmdl/central_valley_projects/central_valley_pesticides/

SSWD intends to file with the SWRCB a request for a CWA Section 401 Water Quality Certificate.

1.3.10 California Environmental Quality Act of 1970

The California Environmental Quality Act (CEQA) (Pub. Res. Code §§21000-21189.3) requires State and local government agencies to follow specified procedures to identify any significant environmental impacts of their proposed actions and to avoid or mitigate those impacts whenever feasible. CEQA applies to all discretionary activities proposed to be undertaken or approved by California state agencies, such as the SWRCB and CDFW, or local government agencies, such as SSWD.

Under CEQA, an environmental impact report (EIR) must be prepared for any Project that may have a significant effect on the environment. (Pub. Res. Code §21100, subd. (a).) An EIR is the public document that analyzes and describes the significant environmental effects of a Proposed Project, identifies and describes alternatives, and describes potential measures to reduce or avoid potential environmental impacts. A CEQA guideline states that when federal review of a Project under NEPA also is required, State agencies should cooperate with federal agencies to the fullest extent possible to reduce duplication between CEQA and NEPA. (Cal. Code Regs., tit. 14, § 15226.)

One CEQA requirement for which there is no corresponding NEPA requirement is the need for CEQA lead agencies to adopt a program for monitoring or reporting on mitigation measures that were adopted for the Project. (Cal. Code Regs., tit. 14, § 15097.) The monitoring or reporting program must ensure compliance with mitigation measures during Project implementation. The program may also provide information on the effectiveness of mitigation measures. Although discussion of the mitigation reporting or monitoring program can be deferred until the final EIR or, in some cases, after Project approval, it is often included in the draft EIR, so that the public may review it and comment on it.

Another analysis required for EIR under CEQA that is not required by NEPA is a description of any growth-inducing effects that the Proposed Project may cause. (Cal. Code Regs., tit. 14, § 15126.2(d).)

1.3.11 Coastal Zone Management Act of 1972

Under Section 307(c)(3)(A) of the Coastal Zone Management Act of 1972, as amended, (CZMA), (16 U.S.C. § 1456(c)(3)(A)), the Commission may not issue a license for a Project within or affecting a state's coastal zone unless the state's CZMA agency concurs with the license applicant's certification of consistency with the state's CZMA program, or the agency's concurrence is conclusively presumed by its failure to act within 180 days of its receipt of the applicant's certification.

SSWD determined the Project is not located within the coastal zone boundary, which extends from a few city blocks to 5 mi inland from the sea, and will not affect any resources located within the boundary of the coastal zone. The California Coastal Commission concurred with

SSWD's determination in a letter dated March 13, 2018, which is included in this Exhibit E as Attachment 1.0A.

1.3.12 California Wild and Scenic Rivers Act of 1972

The California Wild and Scenic Rivers Act (WSRA) (Pub. Res. Code §§ 5093.50-5093.70) was enacted in 1972 to preserve in their free-flowing states designated rivers possessing extraordinary scenic, recreation, fishery, or wildlife values. (See Pub. Res. Code § 5093.50.) The WSRA prohibits the construction of dams, reservoirs, diversions and other water impoundment facilities, other than permitted temporary flood storage facilities, on any designated river and segment unless the Secretary of the California Resources Agency (Resources Agency) determines that the facility is needed to supply domestic water to local residents and that the facility will not adversely affect the free-flowing condition and natural character of the river and segment. (Pub. Res. Code § 5093.55.) The WSRA requires the Resources Agency to coordinate the activities of State agencies whose activities affect designated rivers with the activities of other State, local and federal agencies with jurisdiction over matters that may affect the rivers, and it requires State and local agencies and departments to exercise their powers in manners that are consistent with the WSRA and its policy. (Pub. Res. Code §§ 5093.60, 5093.61.). Initially, the WSRA required the implementation of a management plan for each river or river segment designated as wild and scenic, but the amendments of 1982 eliminated this requirement. (See former Pub. Res. Code § 5093.59.) State designated rivers may be added to the federal system upon the request of the Governor of California and the approval of the Secretary of the Interior. (See 16 U.S.C. § 1275(c).)

The Project Vicinity does not include any sections of river designated or proposed for designation under the WSRA.

At this time, California Department of Parks and Recreation (CDPR) have not formally commented on SSWD's Proposed Project in relation to the WSRA. SSWD expects that CDPR will comment at the appropriate time in the relicensing proceeding, as necessary.

1.3.13 Endangered Species Act of 1973

The ESA of 1973, as amended, (16 U.S.C. § 1531 - 1544) was enacted to conserve endangered and threatened species and the ecosystems upon which they depend. (See 16 U.S.C. § 1531(b) & (c)(1)). The ESA defines an "endangered" species as "*any species which is in danger of extinction throughout all or a significant portion of its range…*and a "threatened" species as, "*any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range*." (16 U.S.C. § 1532(6) & (20)). A species may be listed under the ESA as an endangered species or as a threatened species. (16 U.S.C. § 1533.) The ESA is administered by the Secretary of the Interior through USFWS for most species, and by the Secretary of Commerce through NMFS for marine and anadromous species. (See 16 U.S.C. § 1532(15).)

Section 7 of the ESA (16 U.S.C. § 1536) requires federal agencies to consult with the USFWS or NMFS to ensure that any action that they authorize, fund, or carry out is not likely to jeopardize the continued existence of any threatened or endangered species, or result in the destruction or adverse modification of critical habitat[15] for these listed species. A proposed action may jeopardize the continued existence of a listed species if it would "*reduce appreciably the likelihood of both the survival and recovery of a listed species...*" (50 C.F.R. § 402.02).

An ESA Section 7 consultation begins with requests to the USFWS and NMFS for inventories of the threatened and endangered species that may be affected by the Proposed Project. For hydroelectric power project relicensings, FERC then prepares a Biological Assessment (BA) that discusses whether or not any listed species or critical habitat is likely to be adversely affected by the federal action, and therefore requires formal consultation. At the end of the consultation process, the USFWS or NMFS may issue a Biological Opinion (BO) that specifies whether the proposed action will jeopardize the continued existence of any threatened or endangered species, or result in the destruction or adverse modification of any designated critical habitat. (16 U.S.C. § 1536(b).) If jeopardy or adverse modification is found, then the USFWS or NMFS must suggest a reasonable and prudent alternative, or alternatives, to the proposed action that the USFWS or NMFS believes would not cause such jeopardy or adverse modification and which can be taken by the federal agency or applicant in implementing the Proposed Project. (16 U.S.C. § 1536(b)(3)(A).) A non-jeopardy opinion may be accompanied by an incidental take statement that specifies potential impacts of the taking of individuals of a listed species or their habitat, mitigation measures, and terms and conditions for implementation of reasonable and prudent mitigation measures. (16 U.S.C. § 1536(b)(4).)

On May 13, 2016, the Commission initiated informal consultation with USFWS and NMFS as required under Section 7 of the ESA and the interagency cooperation regulations in 50 C.F.R. Part 402, and designated SSWD as FERC's non-federal representative for purposes of informal consultation.

Through informal consultation with the USFWS and NMFS, SSWD has identified 11 species - two endangered species and nine threatened species – that could potentially be affected by continued Project O&M and associated recreation. No candidate or proposed for listing species are potentially affected. These species include one plant, four invertebrates, one amphibian, one reptile, three fishes, and one bird. These species are:

[15] Critical habitat is defined in Section 3(5)(A) of the ESA (16 U.S.C. § 1532(5)(A)) as the specific areas within the geographical area occupied by the species where there are physical or biological features that are essential to the conservation of the species or that may require special management considerations or protection. (16 U.S.C. § 1532(5)(A)(i).) Specific areas outside of the geographical area occupied by the species may also be included in designations of critical habitat, if such areas are determined to be essential for the conservation of the species. (16 U.S.C. § 1532(5)(A)(ii).)

- ESA Endangered Species:
  - Hartweg's golden sunburst (*Pseudobahia bahiifolia*)
  - Vernal pool tadpole shrimp (*Lepidurus packardi*)
- ESA Threatened Species:
  - Valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*)
  - California red-legged frog (*Rana draytonii*)
  - Conservancy fairy shrimp (*Branchinecta conservatio*)
  - Vernal pool fairy shrimp (*B. lynchi*)
  - Giant garter snake (*Thamnophis gigas*)
  - Central Valley spring-run Chinook salmon (*Oncorhynchus tshawytscha*) Evolutionarily Significant Unit (ESU) and Critical Habitat[16]
  - Steelhead, California Central Valley Distinct Population Segment (DPS) (*O. mykiss)* and Critical Habitat[17]
  - North American green sturgeon, Southern DPS (*Acipenser medirostris*) and Critical Habitat[18]
  - Yellow-billed cuckoo, Western DPS[19] (*Coccyzus americanus*)

Hartweg's golden sunburst and the western yellow-billed cuckoo are also listed as endangered species under the CESA; and giant garter snake and Central Valley spring-run Chinook salmon are also listed as threatened under the CESA, which is discussed below. None of the ESA-listed species are CFP species.

[16] The ESU for Central Valley spring-run Chinook salmon is defined as all naturally-spawned populations of spring-run Chinook salmon in the Sacramento River and its tributaries, including the Feather River Fish Hatchery population. In the Bear River, NMFS designates CV spring-run Chinook salmon critical habitat to include the area defined in the CALWATER Marysville HU 5515, Lower Yuba River Hydrologic Sub-area 551510. Outlet(s) = Bear River (Lat 38.9398, Long-121.5790) upstream to endpoint(s) in: Bear River (38.9783,-121.5166), which means the upstream extent is approximately to RM 5 in the Bear River (70 FR 52488).

[17] The DPS for Central Valley steelhead includes all naturally-spawned populations of steelhead below natural and human-made impassable barriers in the Sacramento and San Joaquin rivers and their tributaries, excluding steelhead from San Francisco and San Pablo bays and their tributaries. In the Bear River, NMFS designates CV steelhead critical habitat to include the area defined in the CALWATER Marysville Hydrologic Unit 5515 (i) Lower Bear River Hydrologic Sub-area 551510. Outlet(s) = Bear River (Lat 39.9398, Long –121.5790) upstream to endpoint(s) in Bear River (39.0421, –121.3319), which means the upstream extent is at the non-Project diversion dam (70 FR 52488).

[18] The Southern DPS of North American green sturgeon includes the green sturgeon population spawning in the Sacramento River and utilizing the Sacramento-San Joaquin River Delta and San Francisco Estuary. NMFS has not designated any critical habitat for North American green sturgeon, Southern DPS, in the Bear River.

[19] The Western DPS for yellow billed-cuckoo is defined as that portion of the species that nests west of the Continental Divide in the states of Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Texas, Utah, Washington, and Wyoming, as well as in southwestern British Columbia, Canada, and in parts of western Mexico. This DPS also corresponds to the subspecies, western yellow-billed cuckoo (*C. americanus occidentalis*), which is generally, but not universally accepted as a valid taxon. Critical habitat was proposed in 2014, but a Final Rule has not been published. The nearest critical habitat unit is located in the Sutter National Wildlife Refuge.

SSWD has had ongoing discussions with NMFS and USFWS regarding the potential effects of the Project on ESA-listed species.

The process used to address Project effects on ESA-listed species and their critical habitats and a summary of anticipated environmental effects on the species are included in Section 3.3.5.

On February 1, 2019, USFWS filed a letter with FERC requested ESA Section 7 consultation regarding California red-legged frog and vernal pool fair shrimp. SSWD anticipates that FERC will consult with NMFS and USFWS at the appropriate time in the relicensing proceeding.

1.3.14 Magnuson-Stevens Fishery Conservation and Management Act of 1976

One purpose of the Magnuson-Stevens Fishery Conservation and Management Act of 1976 (MSA Act), as amended (16 U.S.C. §§ 1801-1891d) (MSA) is to conserve and manage anadromous fishery resources of the U.S. (16 U.S.C. § 1801(b)(1).) The MSA establishes eight Regional Fisheries Management Councils and authorizes them to prepare, monitor and revise fishery management plans in ways that will achieve and maintain the optimum yield from each fishery. (16 U.S.C. §1852.) The Pacific Fisheries Management Council is responsible for implementing the MSA in California. (16 U.S.C. § 1852(a)(1)(F).) The Secretary of Commerce has oversight authority. (See 16 U.S.C. § 1854.)

The MSA was amended in 1996 to establish a new requirement to describe and identify "Essential Fish Habitat" (EFH) in each fishery management plan. (16 U.S.C. § 1855(b).) EFH is defined in the MSA regulations as "*those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity*." (50 C.F.R. § 600.10.) For Pacific salmon, EFH "*includes all those water bodies occupied or historically accessible*" in specified hydrologic units. (50 C.F.R. § 600.412.) For the purpose of EFH, NMFS uses fourth field hydrologic unit codes developed by the United States Geological Survey (USGS) as defined in the USGS publication; HU Maps, Water Supply Paper 2294, 1987.[20]

The MSA requires that all federal agencies consult with NMFS on all actions and proposed actions, that are or will be permitted, funded, or undertaken by the agency (the lead agency), and that may adversely affect any EFH (16 U.S.C. § 1855(b)(2).). Comments from NMFS following consultation are advisory only; however, the lead agency must provide a written explanation to NMFS if the lead agency does not agree with NMFS' recommendations regarding EFH. (See 16 U.S.C. § 1855(b)(4)(B).)

Within the Project affected basin, the Pacific Fisheries Management Council has designated freshwater EFH for Pacific salmon (50 C.F.R. § 660.412). The designation does not identify specific Chinook salmon races (e.g., spring-run or fall-run) but instead is for "Pacific salmon."

[20] The geographic extent of HUs range is from the first field, which is the largest geographic extent, to the sixth field, which is the smallest geographic extent. Fourth field HU Codes divide the landscape into distinct geographic areas that are identified by eight numbers unique to that HU.

As discussed above, Pacific salmon EFH "*includes all water bodies occupied or historically accessible*" in designated hydrologic units (50 C.F.R. § 660.412), and the Upper Bear River hydrologic unit (USGS Hydrologic unit code [HUC] 18020126)[21] is one of these designated hydrologic units (50 C.F.R., pt. 660, subpt. H, table 1.) Although in some cases, EFH can extend beyond impassable dams, within HUC 18029126 on the Bear River, the upstream extent of Pacific salmon EFH is the Camp Far West Dam (PFMC 2014).

On May 13, 2016, FERC designate SSWD as FERC's non-federal representative for purposes of MSA consultation.

SSWD has had ongoing discussions with NMFS regarding the potential effect of the Project.

SSWD anticipates that FERC will consult with NMFS under the MSA at the appropriate time in the relicensing proceeding.

1.3.15 California Native Plant Protection Act of 1977

The California Native Plant Protection Act (CNPPA) (F.G.C. §§ 1900 - 1913) was enacted in 1977 and authorizes the California Fish and Wildlife Commission to designate native plants within the State as rare or endangered (F.G.C. § 1904). Currently, 64 species, including some with the potential to occur on the Project, are listed under the CNPPA. Take of these plant species is prohibited, with the exception of certain exempted activities, including some agriculture and nursery operations, emergencies and proper notification of CDFW for vegetation removal from canals, roads, etc., and changes in land use.

No CNPPA-listed plant species were located in the Project Area during SSWD's relicensing studies. If any plants listed on the CNPPA are found to be located on the Project, then SSWD will comply with the CNPPA.

1.3.16 Pacific Northwest Electric Power Planning and Conservation Act of 1980

The provisions of the Pacific Northwest Electric Power Planning and Conservation Act of 1980, as amended (16 U.S.C. §§ 839 - 839h) do not apply to the Project because the Project is not located within the Pacific Northwest Electric Power Planning and Conservation Area (i.e., the Columbia River Basin).

[21] Historically, the HUC8 basin data set from USGS called the basin from the Feather River to the Camp Far West Dam on the Bear River, the "Lower Bear" (HUC #18020108) and the basin upstream of Camp Far West Dam the "Upper Bear" (HUC #18020126). The new and current USGS Watershed Boundary Dataset combines the two basins and calls it the "Upper Bear" (HUC #18020126), eliminating the "Lower Bear" designation. However, this does not affect the EFH area.

1.3.17 Wilderness Act of 1984

The Project Vicinity does not include any areas that have been included in or are proposed for inclusion in the National Wilderness Preservation System under Wilderness Act of 1984, as amended (16 U.S.C. §§ 1131 - 1136).

At this time, agencies have not formally commented on the Proposed Project with regards to Wilderness Areas. SSWD expects that agencies will comment at the appropriate time in the relicensing proceeding, if necessary.

1.3.18 California Endangered Species Act of 1984

Under the CESA (F.G.C. §§ 2050 – 2069), the California Fish and Wildlife Commission may, after following specified procedures, list native bird, mammal, fish, amphibian, reptile or plant species as endangered species or threatened species (F.G.C. §§ 2062, 2067, 2070 - 2079).[22]

CESA prohibits any person from importing, exporting, taking, possessing, purchasing or selling within California any species or product thereof that is listed as an endangered species or a threatened species under CESA (F.G.C. § 2080). However, CDFW may issue permits for the incidental take of CESA-listed species if the impacts of the authorized take are minimized and fully mitigated and other applicable statutory requirements are satisfied (F.G.C. § 2081(b)). But no such permit may be issued if its issuance would jeopardize the continued existence of the species (F.G.C. § 2081(c)).

If a species is listed as an endangered species or threatened species under the ESA, and if the USFWS or NMFS has authorized incidental take of the species under ESA Section 7 (16 U.S.C. § 1536) or ESA section 10 (16 U.S.C. § 1539), then such incidental take also is authorized by CESA if CDFW follows the statutory procedures and issues a determination that such incidental take is consistent with CESA (F.G.C. § 2080.1).

Through consultation with CDFW, SSWD has identified eight species listed as threatened or endangered species under CESA and one candidate species (i.e., proposed for listing) that have reasonable potential to be affected by the Project: one plant, one amphibian, one fish, and five birds. These species are:

- <u>CESA Endangered Species</u>:
  - Hartweg's golden sunburst
  - Western yellow-billed cuckoo
  - Bald eagle

[22] CDFW, pursuant to its goal of maintaining viable populations of all native species, also designates "species of special concern" when in CDFW's opinion, declining population levels, limited ranges, and/or continuing threats have made them vulnerable to extinction. The State's species of concern designation is an administrative term and has no legal status.

- CESA Threatened Species:
  - Central Valley Spring-run Chinook salmon
  - California black rail
  - Swainson's hawk (*Buteo swainsoni*)
  - Bank swallow (*Riparia riparia*)
- CESA Candidate Species:
  - Foothill yellow-legged frog (*Rana boylii*)

Hartweg's golden sunburst is also listed as an endangered species under the ESA, and CV spring-run Chinook salmon and western yellow-billed cuckoo, also known as the Western DPS of yellow-billed cuckoo, are also listed as threatened species under the ESA. Bald eagle is also protected under the MBTA and F.G.C. Sections 3503, 3503.5, and 3513, and under the BGEPA. Bald eagle and California black rail are CFP species.

SSWD has had ongoing discussions with CDFW regarding the potential effects of the Project on fish and wildlife.

At this time, CDFW has not formally commented on the Proposed Project with regards to CESA, other than regarding bald eagle, which is discussed above. SSWD expects that CDFW will formally comment at the appropriate time in the relicensing proceeding, if necessary.

1.3.19 Americans with Disabilities Act of 2010

Public recreation facilities must comply with the Americans with Disabilities Act of 2010 as amended (ADA) (42 U.S.C. §§ 12101 - 12213) on private land. FERC, however, has no statutory role in implementing or enforcing the ADA as it applies to its licenses. A licensee's obligation to comply with the ADA exists independent of its FERC Project license.

All Project recreation facilities are on private land owned by SSWD.

1.4 Consultation Documentation

The Commission's regulations (18 C.F.R. § 16.8) require that an applicant consult with appropriate federal and State agencies, local governments, Indian tribes, non-governmental organizations, businesses and unaffiliated members of the public that may be interested in the proceeding before filing an application for a license. This consultation is the first step in complying with ESA, NHPA, and other federal statutes. Pre-application filing consultation must be completed and documented according to the Commission's regulations.

On March 14, 2016, SSWD filed with FERC a request to use FERC's traditional licensing process (TLP) to relicense the Project. FERC granted SSWD's request in a letter dated May 13, 2016.

The TLP includes three stages of consultation. SSWD's consultation efforts by consultation stage is described below.

If a document mentioned in this section has already been filed with FERC in the Camp Far West Hydroelectric Project relicensing docket, to reduce redundancy the document is not attached to this Application for New License, but the accession number in FERC's ELibrary is noted and the document is included in this Application for New License by reference. SSWD assumes documents on FERC's ELibrary, excluding Privileged or Critical Energy Infrastructure Information (CEII), are accessible by all interested parties. However, if a party would like a copy of a specific document referenced below and that party is unable to access the document on FERC's ELibrary, the party may contact SSWD who will provide the document.

1.4.1 First Stage Consultation

First Stage Consultation begins when an applicant for a new license files its Notice of Intent (NOI) to file an application for a new license (NOI) and its Pre-Application Document (PAD) (18 C.F.R. §4.38(b)(1)), and ends after all participating agencies and Indian tribes provide written comments on the applicant's NOI and PAD (18 C.F.R. § 4.38(b)(7)).

1.4.1.1 Filing of NOI and PAD

On March 13, 2016, SSWD filed with FERC its NOI[23] and PAD.[24] The PAD included 15 detailed study plans (Table 1.4-1) that SSWD proposed to conduct to supplement existing, relevant and reasonably available information regarding the Project and potentially affected resources. In addition, the PAD included a Water Balance/Operations Model for the Project. The 15 proposed studies were:

Table 1.4-1. Studies proposed by SSWD in its March 2016 PAD.

Study Designation in PAD	Study Name in PAD
2.1	Water Temperature Monitoring
2.2	Water Temperature Modeling
2.3	Water Quality
3.1	Salmonid Redd
3.2	Stream Fish Populations
3.3	Instream Flow
4.1	Special-status Plants and Non-native Invasive Plants
4.2	Special-status Wildlife – Raptors
4.3	Special-status Wildlife – Bats
5.1	ESA-listed Plants
5.2	ESA-listed Wildlife – Valley Elderberry Longhorn Beetle
5.3	ESA-listed Amphibians – California Red-legged Frog
6.1	Recreation Use and Visitor Survey Study
10.1	Cultural Resources
11.1	Tribal Interests
Total	**15 Studies**

[23] FERC Accession No: 20160311-5262.
[24] FERC Accession No: 20160311-5263.

1.4.1.2 FERC Notice

On May 13, 2016, FERC issued a NOI to File License Application, Filing of Pre-Application Document, and Approving Use of Traditional Licensing Process. In its notice, FERC initiated informal consultation with USFWS and with NMFS under Section 7 of the ESA, with NMFS under Section 305(b) of the MSFMCA, and with SHPO under section 106 of the NHPA. In addition, FERC designated SSWD as its non-federal representative for informal consultation for ESA and MSA Act and with SHPO for consultation for NHPA.

1.4.1.3 Site Visit and Joint Meeting and Initial Indian Tribe Consultation during First Stage Consultation

On June 10, 2016, SSWD filed with FERC and provided to agencies a letter advising that SSWD had coordinated with agencies, Indian tribes and members of the public to schedule a site visit and joint agency/public meeting.[25] The letter included an agenda for the joint meeting.

On June 9 and 10, 2016, SSWD placed notices of the joint meeting in three newspapers, one in each county in which the Project is located.

The site visit occurred on June 27, 2016, and, besides SSWD representatives, eight agency representatives participated: three from USFWS; four from the CDFW; and one from the SWRCB.

The joint meeting occurred on June 27, 2016. The purpose of the meeting was to provide agencies, Indian tribes and members of the public an opportunity to discuss the information in the PAD, discuss data and studies to be developed by SSWD, and express their views regarding resource issues that should be addressed in SSWD's application for new license. Besides SSWD representatives, the facilitator and the transcriber, 16 people attended the joint meeting: three from the USFWS; one from the NMFS; three from the CDFW; two from the SWRCB; one from the California State Office of Historic Preservation (OHP); one from the United Auburn Indian Community (UAIC); one from the California Sport Fishing Alliance (CSPA); one from the Foothill Water Network (FWN)/Sierra Club (SC); two from the Sierra Streams Institute; and one from the SMUD.

On August 2, 2016, SSWD filed with FERC documentation of SSWD's site visit and joint meeting, the later including a meeting transcript and proof of publication of the joint meeting public notices.[26]

On June 29, 2016, under Section 106 of the NHPA, SSWD offered a site visit to interested Indian tribes and held an initial Section 106 meeting. Besides SSWD representatives, the site visit was attended by three UAIC representatives and two Nevada City Rancheria representatives; and the meeting was attended by one OHP representative, three UAIC

[25] FERC Accession No: 20160610-5251.
[26] FERC Accession No: 20160802-5106.

representatives and two Nevada City Rancheria representatives. FERC participated in the meeting by telephone.

In addition, during this period, FERC staff reached out to potentially interested Indian tribes and documented its consultation with memos to the docket. These include:

- May 11 and 13, 2016 Memorandum.[27] Mechoopda Indian Tribe of Chico Rancheria advised FERC that the tribe "would refer consultations and comments to the other Indian tribes involved with this relicensing."
- May 11 and 17, 2016 Memorandum.[28] Shingle Springs Rancheria advised FERC that the tribe "would defer to the United Auburn Indian Community involving tribal consultation with this relicensing."
- May 20, 2016 Memorandum.[29] Washoe Tribe of Nevada and California advised FERC that the tribe "would defer to the other Indian tribes (e.g., United Auburn Indian Community) who would be participating with this relicensing."
- June 1, 2016 Memorandum.[30] FERC staff noted it had left messages with the Tribal Chairman with the Mooretown Rancheria to see if the tribe would like to consult with FERC on the relicensing, but had not heard back from any representative from the Mooretown Rancheria.
- June 16, 2016 Memorandum.[31] FERC staff contacted the Chair of the Greenville Rancheria to see if the tribe would like to consult with FERC on the relicensing. The memo says that, initially, the Chair said he would be interested, and asked that FERC staff leave a time and date on his telephone answering machine the following week to discuss this further. The memo notes that FERC staff have not heard back since then.

1.4.1.4 Comments on NOI and PAD

In a letter to FERC dated August 25, 2016, the USFWS requested a 60-day extension from the NOI/PAD comment filing deadline of August 27, 2016.[32]

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[27] FERC Accession No: 20160516-4022.
[28] FERC Accession No: 20160517-4008.
[29] FERC Accession No: 20160523-4002.
[30] FERC Accession No: 20160601-4005.
[31] FERC Accession No: 20160615-4001.
[32] FERC Accession No: 20160825-5100.

Seven parties filed comments on SSWD's PAD: NMFS,[33] CDFW,[34] SWRCB,[35] OHP,[36] FWN,[37] USFWS[38] and UAIC[39] (Table 1.4-2).

Table 1.4-2. Parties that filed with FERC comments on SSWD's March 2016 PAD.

Commenter	Date of Comment Letter
UAIC	April 27, 2016
OHP	August 25, 2016
NMFS	August 25, 2016
CDFW	August 25, 2016
SWRCB	August 26, 2016
FWN	August 26, 2016
USFWS	September 7, 2016
Total	**7 Comment Letters**

SSWD careful reviewed the seven comment letters, and identified 63 individual requests[40] for modifications to eight of SSWD's proposed studies, and requests for 10 studies not proposed by SSWD (i.e., new studies). Table 1.4-3 shows the number of SSWD-identified requested study modifications by commenter and the number of SSWD-identified requested new studies by commenter.

Table 1.4-3. Requested study modifications and new studies.

Study Proposed in SSWD's PAD		Commenter						
Designation	**Name**	**NMFS**	**CDFW**	**SWRCB**	**OHP**	**FWN**	**USFWS**	**UAIC**
REQUESTED STUDY MODIFICATIONS								
2.1	Water Temperature Monitoring	1	1	1			1	
2.2	Water Temperature Modeling		1				1	
2.3	Water Quality							
3.1	Salmonid Redd	3	3	1			2	
3.2	Stream Fish Populations	6	5			1	5	
3.3	Instream Flow		5	1			4	
4.1	Special-status Plants and Non-native Invasive Plants		1					
4.2	Special-status Wildlife – Raptors		8				4	
4.3	Special-status Wildlife – Bats		8					
5.1	ESA-listed Plants							

[33] FERC Accession No: 20160825-5156.
[34] FERC Accession No: 20160826-5029.
[35] FERC Accession No: 20160829-5064.
[36] FERC Accession No: 20160825-5094 and 20160906-5224.
[37] FWN's letter was signed by 13 parties that included FWN, CSPA, Trout Unlimited, Nevada City Rancheria Tribal Council, American Whitewater, American Rivers, Sierra Club – Mother Lode Chapter, Federation of Fly Fishers, Northern California Federation of Fly Fishers, Friends of the River, Dry Creek Conservancy, Friends of Spenceville, and Sierra Streams Institute.
[38] FERC Accession No: 20160908-5223.
[39] FERC Accession No: 20160425-0068. Note: This correspondence is Privileged and not available on FERC's eLibrary.
[40] SSWD found that approximately 25 percent of the 63 individual requested study modifications were identical or very similar to each other. SSWD considered each of these duplicate requests separately.

Table 1.4-3. (continued)

Study Proposed in SSWD's PAD		Commenter						
Designation	**Name**	**NMFS**	**CDFW**	**SWRCB**	**OHP**	**FWN**	**USFWS**	**UAIC**
REQUESTED STUDY MODIFICATIONS (cont'd)								
5.2	ESA-listed Wildlife – Valley Elderberry Longhorn Beetle							
5.3	ESA-listed Amphibians – California Red-legged Frog							
6.1	Recreation Use and Visitor Survey Study							
10.1	Cultural Resources							
11.1	Tribal Interests							
	Subtotal	*10*	*32*	*3*	*0*	*1*	*17*	*0*
	Total	**Requested Study Modifications: 63 Modifications to 8 Studies**						
REQUESTED NEW STUDIES								
New	Effects of Camp Far West Project and Related Facilities on Fluvial Process and Channel Morphology for Anadromous Fish	1						
New	Effects of Camp Far West Project and Related Facilities on Coldwater Delivery Feasibility for Anadromous Fish	1						
New	Vegetation Mapping		1					
New	Sturgeon		1				1	
New	Benthic Marcroinvertebrates		1				1	
New	Algal Growth			1				
New	Evaluation of Migration and Use of the Lower Bear River by Juvenile Chinook Salmon and Other Anadromous Fish Using Two Rotary Screw Traps					1		
New	California Red-legged Frog						1	
New	Juvenile Chinook Salmon Survival						1	
New	Large Woody Material and Sediment Transport						2	
	Subtotal	*2*	*3*	*1*	*0*	*1*	*5*	*0*
	Total	**Requested New Studies: 12 Requests for 10 New Studies**						

1.4.1.5 Resolution of Study Disagreements

Upon careful consideration, SSWD adopted without modification 14 of the requested study modifications, adopted with modification 26 of the requested study modifications, and did not adopt 23 of the requested study modifications in commenters' letters regarding SSWD's PAD. SSWD adopted some elements of five of the requested new studies into its proposed studies, and did not adopt eight of the requested new studies (Tables 1.4-4 and 1.4-5, respectively). In addition, SSWD withdrew one study that had been proposed in the PAD - Study 4.3, Special-Status Wildlife – Bats - because SSWD planned to include in its Application for New License a

Bat Management Plan that would require SSWD to inspect all Project facilities for bats in the first full calendar yr after license issuance and to install and maintain bat exclusion devices where bats are found.

Table 1.4-4. Number of requested modifications that SSWD adopted without modification, adopted with modification and did not adopt by study.

SSWD Proposed Study	Adopted Without Modification	Adopted With Modification	Not Adopted	Total
2.1, *Water Temperature Monitoring*	2	2		4
2.2, *Water Temperature Modeling*	2			2
3.1, *Salmonid Redd Survey*		7	2	9
3.2, *Stream Fish Populations*	4	8	5	17
3.3, *Instream Flow*		8	2	10
4.1, *Special-Status Plants and Non-Native Invasive Plants*			1	1
4.2, *Special-Status Wildlife – Raptors*	6	1	5	12
4.3, *Special-Status Wildlife – Bats*			8	8
Total	**14**	**26**	**23**	**63**

Table 1.4-5. Elements of requested new studies that SSWD adopted.

Requested New Study	Adopted Elements
Effects of Camp Far West Project and Related Facilities on Fluvial Process and Channel Morphology for Anadromous Fish	LWM count in Bear River downstream of non-Project diversion dam, course sediment evaluation and gravel permeability in Bear River downstream of non-Project diversion dam adopted into SSWD's proposed Study 3.3, Instream Flow
Effects of Camp Far West Project and Related Facilities on Coldwater Delivery Feasibility for Anadromous Fish	User defined downstream release water temperature targets adopted into SSWD's proposed Study 2.2, Water Temperature Modeling
Vegetation Mapping	None
Sturgeon	eDNA, snorkel surveys and beach seining in the Bear River downstream of the non-Project diversion dam adopted into SSWD's proposed Study 3.2, Stream Fish Populations
Benthic Marcroinvertebrates	None
Algal Growth	None
Evaluation of Migration and Use of the Lower Bear River by Juvenile Chinook Salmon and Other Anadromous Fish Using Two Rotary Screw Traps	None
California Red-legged Frog	Additional survey time to monitor for American bullfrog and two additional site visits adopted into SSWD's proposed Study 5.3, ESA-listed Amphibians – California Red-legged Frog
Juvenile Chinook Salmon Survival	None
Large Woody Material and Sediment Transport	Sediment accumulation in Camp Far West Reservoir adopted into SSWD's proposed Study 3.3, Instream Flow

On October 12, 2016, SSWD filed with FERC a letter that provided: 1) SSWD's rationale for adopting, adopting with modification, or not adopting each requested study modification and new study; and 2) detailed plans for each of the 14 studies that SSWD now proposed to conduct.[41]

On November 17, 2016, CDFW filed with FERC a letter to SSWD responding to SSWD's October 12, 2016 letter, which included additional CDFW study requests as well as reiteration of various points from its PAD comment letter.[42]

In an effort to reach agreement on studies, on November 21, 2016, SSWD met with representatives from the CDFW, USFWS, SWRCB; CSPA; 5) FWN; and 6) Sierra Streams Institute. At the conclusion of the meeting, SSWD agreed to modify its October 12, 2016, study plans, as described in Table 1.4-6. In addition, SSWD agreed to perform two new studies: 1) Benthic Macroinvertebrates; and 2) Special Status Wildlife – Bats; and to provide to interested stakeholders in early 2017 an upstream hydrology model and a modified Water Balance/Operations Model that SSWD included in its PAD.

Table 1.4-6. Summary of changes made based on November 21, 2016 Relicensing Participants[43] Meeting.

Study Proposed in SSWD's October 12, 2016 Letter		Study Proposed in SSWD's PAD
Designation	**Designation**	**Modification**
2.2	Water Temperature Modeling	Develop hydrology for Dry Creek (also include in updated Water Balance/Operations Model)
3.1	Salmonid Redd Surveys	Add physical redd measurements to sampling beginning in December 2016
3.2	Stream Fish Populations	Change location and timing of eDNA sampling
4.2	Special Status Wildlife – Raptors	Modify study plan to reflect language regarding intent to survey 0.25 mile from FERC boundary
All Study Plans		Add elderberry bushes to list of incidental observation species

SSWD understood that these agreements resolved any outstanding study disagreements with those parties that attend the November 21 meeting. SSWD considered that these studies, and no others, are reasonable and necessary for an informed decision but the Commission on the merits of SSWD's Application or New License, and the use of the use of the methods for conducting each study are generally accepted practices.

On December 20, 2016, NMFS filed a letter with FERC commenting on SSWD's October 12, 2016, letter and requesting a meeting with FERC "to discuss ESA consultation procedures including developing a shared understanding of the environmental baseline, including related structures such as CFW diversion dam in the analysis of the Project's effects."[44] SSWD commented on NMFS's letter in its January 9, 2017 filing. On January 24, 2017, FERC responded to NMFS's letter stating that FERC does not participate in pre-filing activities under

[41] FERC Accession No: 20161014-5144.
[42] FERC Accession No: 20161117-5158.
[43] In this exhibit, "Relicensing Participants" mean any agency, Indian tribe non-governmental organization (NGO) or member of the public that actively participates in the Camp Far West Hydroelectric Project relicensing.
[44] FERC Accession No: 20161220-5206.

the TLP, and that NMFS may file formal dispute regarding SSWD's proposed studies if NMFS "sees fit to do so."[45]

On January 9, 2017, SSWD filed a letter with FERC with each of the 16 study plans, including those agreed to at the November 21, 2016 meeting, and advised FERC that SSWD was undertaking these studies to support the relicensing.[46] Each study plan is posted on SSWD's Camp Far West Relicensing Website at www.sswdrelicensing.com, and for clarity, the studies are listed in Table 1.4-7.

Table 1.4-7. Studies provided in SSWD's January 9, 2017 letter to FERC and undertaken by SSWD in support of the Camp Far West Hydroelectric Project relicensing.

Study Designation	Study Name
2.1	Water Temperature Monitoring
2.2	Water Temperature Modeling
2.3	Water Quality
3.1	Salmonid Redd
3.2	Stream Fish Populations
3.3	Instream Flow
3.4	Benthic Macroinvertebrates
4.1	Special-status Plants and Non-native Invasive Plants
4.2	Special-status Wildlife – Raptors
4.3	Special-status Wildlife – Bats
5.1	ESA-listed Plants
5.2	ESA-listed Wildlife – Valley Elderberry Longhorn Beetle
5.3	ESA-listed Amphibians – California Red-legged Frog
6.1	Recreation Use and Visitor Survey Study
10.1	Cultural Resources
11.1	Tribal Interests
Total	**16 Studies**

In its January 9, 2017 letter, SSWD advised FERC that it was commencing the studies described in its letter.

1.4.2 Second Stage Consultation

Second Stage Consultation begins when an applicant commences all reasonable studies (18 C.F.R. §4.38(c)(1)), and ends after the applicant holds the last joint meeting to resolve any substantive disagreements with the applicant's conclusions in its draft application regarding resource impacts or its proposed PM&E measures (18 C.F.R. § 4.38(c)(10)).

Each month during study performance, SSWD posted to its Camp Far West Hydroelectric Project relicensing website and e-mailed to Relicensing Participants SSWD's planed fieldwork schedule for the upcoming month in case any agency wished to observe the fieldwork.

[45] FERC Accession No: 20170124-3052.
[46] FERC Accession No: 20170109-5327.

1.4.2.1 Formal Requests for FERC to Resolve a Study Disagreement

To SSWD's knowledge, during Second Stage Consultation, neither NMFS nor any other party filed with FERC a formal request, as provided in 18 C.F.R. Section (c)(2), for FERC to resolve a dispute regarding a disagreement as to any matter arising during First Stage Consultation or the need for SSWD to conduct a study or gather information.

1.4.2.2 Study Status

At the time SSWD files its FLA, all studies have been completed.

1.4.2.3 Availability of Study Results

Beginning in April 2018, SSWD made the data and results of the 16 relicensing studies available on SSWD's relicensing website at https://sswdrelicensing.com/home/study-results/. As new study results became available, SSWD alerted agencies and other interested parties of the new information via email. The results of these studies are also discussed in the appropriate Exhibit E sections of this Application for New License and any specific products (e.g., models and reports) are provided as attachments to Exhibit E. Data collected as part of SSWD's relicensing studies are provided as Appendix E1 to this FLA.

1.4.2.4 Distribution of Draft Application for New License

On December 28, 2018, SSWD provided to interested agencies, Indian tribes and members of the public a copy of its draft Application for New License for 90-day review. The draft: 1) indicated the type of application SSWD expects to file with FERC; 2) responded to written comments and recommendations made by resource agencies and Indian tribes during First Stage Consultation or up to the time SSWD distributed the draft; 3) the results of studies and information gathering conducted by SSWD; 4) SSWD's proposed PM&E measures; and 5) a request for review and written comments regarding the draft within the 90-day review period. In addition, SSWD filed a copy of the draft with FERC.

1.4.2.5 Comments on Draft Application for New License

Six parties submitted written comments to SSWD regarding SSWD's DLA: FERC, USFWS, SWRCB, CDFW, NMFS and FWN (Table 1.4-8). The SWRCB's August 25, 2019, e-mail stated the SWRCB did not have any written comments on the DLA. No written comment letters on the DLA were received from Indian tribes. Each written comment is provided in Appendix E3.

Table 1.4-8. Parties that submitted written comments to SSWD on SSWD's December 29, 2019, DLA.

Commenter	Date of Comment Letter or E-Mail
FERC	March 29, 2019
USFWS	August 25, 2016
SWRCB	August 25, 2016
CDFW	August 25, 2016

Table 1.4-8. (continued)

Commenter	Date of Comment Letter or E-Mail
NMFS	August 26, 2016
FWN	August 26, 2016
Total	**6 Written Comments**

SSWD carefully reviewed each comment letter. Attachment E4 to this Exhibit E contains SSWD's replies to USFWS's, CDFW's NMFS's and FWN's written comments. Attachment E5 to this Exhibit E contains SSWD's replies to FERC's written comments.

1.4.2.6 Attempt to Resolve Disagreements Regarding PM&E Plan

Upon review of the DLA comment letters from USFWS, CDFW, NMFS and FWN, SSWD found that USFWS, NMFS, CDFW and FWN did not suggest specific PM&E measures related to water year types, minimum flows, pulse flows, ramping rates and bald eagles, but encouraged SSWD to continue to collaborate with the agencies regarding these measures. SSWD has continued this collaboration, as described in Section 1.4.2.8 in Exhibit E. SSWD found the comment letters included the following seven substantive disagreements regarding PM&E measures included in SSWD's DLA:

1. USFWS and CDFW suggested SSWD include in its FLA a Camp Far West Reservoir aquatic invasive species management plan PM&E measure.
2. USFWS and CDFW suggested SSWD include in its FLA an integrated pest management plan regarding use of rodenticide PM&E measure.
3. USFWS and CDFW suggested SSWD include in its FLA a PM&E measure to implement a 0.25-mile-wide limited operating period buffer at the existing great blue heron rookery on the south shore of Camp Far West Reservoir from March 15 to July 31 each year.
4. USFWS suggested USFWS be included in the planning of using exclusion devices for bats. CDFW suggested SSWD add language to Condition TR2 in its DLA regarding inspections and avoidance of bat winter hibernacula.
5. CDFW and FWN suggested SSWD modify its Recreation Facilities Plan in the DLA to include the South Shore Recreation Area (SSRA) be open longer and the SSRA Boat Ramp be improved. CDFW also suggested including a permanent fish cleaning station and replacement of existing trash receptacles with wildlife-resistant trash receptacles.
6. CDFW suggested SSWD include in its FLA a lower Bear River aquatic monitoring plan for stream fish, benthic macroinvertebrates (BMI), water temperature and water quality. USFWS and FWN suggested monitoring for salmonids.
7. NMFS suggested SSWD include in its FLA a PM&E measure to augment large wood and sediment in the lower Bear River, and to monitor for effectiveness.

After consulting with agencies and providing to FERC and Relicensing Participants on April 29, 2019, a notice and agenda, SSWD held a meeting with USFWS, NMFS, CDFW, SWRCB and FWN to discuss and attempt to reach agreement on SSWD's proposed PM&E measures to be included in the FLA. Attachment E6 to this Exhibit E documents the meeting, and any remaining disagreements regarding PM&E measures are discussed in the appropriate resource sections in this Exhibit E.

1.4.2.7 Collaborative Development of PM&E Measures

SSWD and Relicensing Participants held 19 meetings to collaboratively develop and agree upon PM&E measures that SSWD would include in its FLA and that Relicensing Participants would support. These meetings were open to all Relicensing Participants, and the following Relicensing Participants participated in one or more of the meetings: NMFS, USFWS, NPS, CDFW, SWRCB and FWN. At the June 5, July 16, July 23, September 20, October 18, November 15, 2018, January 25, February 12, March 1, March 12, March 29, April 9, April 26, May 6, May 24, and June 4, 2019 meetings, Relicensing Participants discussed relicensing study results, Project operations, water temperature and instream flow models, lower Bear River aquatic resources, and potential measures. Relicensing Participants discussed vegetation management, wildlife, recreation, and potential measures at the August 16, November 9, 2018, March 1, March 29, April 26, and May 24 2019 meetings. In addition, SSWD held a PM&E Measures Resolution Meeting on May 13, 2019, which is summarized in Appendix E6 of this Exhibit E. Some, but not all, issues that were raised during these meetings included: 1) ramping rates; 2) extending spring flows coming off Camp Far West Dam spill; 3) augmenting gravel and large woody material (LWM) in the lower Bear River; 4) monitoring; 5) bald eagle; 6) bats; 7) black rail; 8) vegetation; 9) erosion; 10) recreation; and 11) CRLF.

As a result of these collaborative meetings, SSWD and Relicensing Participants have reached agreement, or are working towards reaching agreement, on a number of PM&E measures. The status of each measure proposed by SSWD in its Application for New License is described in Table 1.4-8, for which a detailed PM&E measure is in included in Appendix E2 in this Exhibit E. SSWD and the Relicensing Participants that agree to a PM&E measure as shown in Table 1.4-9 will take the following actions for that measure assuming there is no additional information discovered or changes in Project conditions that affect the measure:

- SSWD will include the agreed-upon PM&E measure unchanged in its FLA, and SSWD will propose no other measures in the FLA related to the issue.
- USFWS and CDFW will include the PM&E measure unchanged and will propose no other measures related to the issue in their respective FPA Section 10(j) and/or FPA Section 10(a) recommendations.
- FWN will propose the PM&E measure unchanged and no other measures related to the issue in its comments on SSWD's FLA.

Table 1.4-9. PM&E measures on which SSWD and Relicensing Participants reached agreement, indicated by an "X" in the respective cell.

PM&E Measure Included in Appendix E2 of this Exhibit E	SSWD and Relicensing Participants that Support SSWD's Proposed PM&E Measure[1]					Explanation
	NMFS	USFWS	NPS	CDFW	FWN	
WR1. Implement Water Year Types		X		X	X	SSWD and the indicated parties have reached agreement on this measure. For the purpose of this FLA, this agreed-on measure is included as SSWD's Proposed Measure in SSWD's FLA
AR1. Implement Minimum Streamflows		X		X	X	SSWD and the indicated parties have reached agreement on this measure. For the purpose of this FLA, this agreed-on measure is included as SSWD's Proposed Measure in SSWD's FLA. As a separate measure, agencies would like SSWD to provide flow data on a real-time basis. SSWD and the agencies will continue to discuss that measure.
AR2. Implement Fall and Spring Pulse Flows		X		X	X	SSWD and the indicated parties have reached agreement on this measure. For the purpose of this FLA, this agreed-on measure is included as SSWD's Proposed Measure in SSWD's FLA
AR3. Implement Ramping Rates						SSWD and the indicated parties have had very productive discussions regarding this measure and are continuing to collaborate on this measure. SSWD and the parties anticipate intend to reach agreement and provide a consensus measure to FERC by the end of September 2019, at which time SSWD will amend its FLA to include the agreed-on detailed measure. SSWD has included in this FLA its measure as proposed at this time.
TR1. Implement a Bald Eagle Management Plan						SSWD and the indicated parties have had very productive discussions regarding this measure and are continuing to collaborate on this measure. SSWD and the parties anticipate intend to reach agreement and provide a consensus measure to FERC by the end of September 2019, at which time SSWD will amend its FLA to include the agreed-on detailed measure. SSWD has included in this FLA its measure as proposed at this time.
TR2. Implement Blue Heron Rookery Management		X		X	X	SSWD and the indicated parties have reached agreement on this measure. For the purpose of this FLA, this agreed-on measure is included as SSWD's Proposed Measure in SSWD's FLA.
Agreed-agreed-on RR1. Implement Recreation Facilities Plan						SSWD and relicensing participants are in substantial agreement on this measure. Outstanding items are the period when SSRA would be open. SSWD and the indicated parties are continuing to collaborate on this issue and will provide a consensus measure to FERC by the end of September 2019, at which time SSWD will amend its FLA to include the agreed-upon detailed measure. SSWD has included in this FLA its proposed measure at this time.

Table 1.4.9. (continued)

PM&E Measure Included in Appendix E2 of this Exhibit E	SSWD and Relicensing Participants that Support SSWD's Proposed PM&E Measure[1]					Explanation
CR1. Implement Historic Properties Management Plan						Under Section 106 of the NHPA, SSWD has consulted with SHPO and UAIC regarding this measure. Refer to the HPMP for a discussion of consultation. NMFS, USFWS, CDFW, NPS and FWN defer to these agencies on this measure.
Subtotal	*0*	*4*	*0*	*4*	*4*	--
Total	**8**					--

[1] The SWRCB participated in the collaboration meetings, but stated that it cannot agree to or take a position on the merits of any PM&E measures at this time.

SSWD and Relicensing Participants have scheduled four meetings in July and August 2019 to resolve differences and come to agreement on Measures AR3 (Ramping Rates), TR1 (Bald Eagle Plan) and RR1 (Recreation Plan). By the end of September 2019, SSWD plans to file with FERC these final agreed-on measures.

Prior to issuance of the FLA, this section was provided to the Relicensing Participants listed in Table 1.4-9 for review and comment, and SSWD understands that each Relicensing Participant listed in Table 1.4-9 agrees that this section accurately presents its current position on the PM&E measures listed in Table 1.4-9.

1.4.2.8 Filing of Final Application for New License

In late June 2019, SSWD filed with FERC and made available to interested agencies, Indian tribes and members of the public a copy of its final Application for New License. SSWD published a notice of the availability of its FLA twice within 14 days of the date it was filed with FERC in the local newspapers of general circulation.

1.4.3 Third Stage Consultation

Third Stage Consultation begins when an applicant files it application, and includes the actions FERC will take to process the application.

1.5 List of Attachments

Attachment 1.0A	The California Coastal Commission's March 13, 2018 Concurrence Letter

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Attachment 1.0A
The California Coastal Commission's
March 13, 2018, Concurrence Letter

STATE OF CALIFORNIA – NATURAL RESOURCES AGENCY

EDMUND G. BROWN, JR., GOVERNOR

CALIFORNIA COASTAL COMMISSION

45 FREMONT, SUITE 2000
SAN FRANCISCO, CA 94105-2219
VOICE (415) 904-5200
FAX (415) 904-5400
TDD (415) 597-5885

March 13, 2018

James Lynch
Senior Vice President
Hydropower Services HDR
2379 Gateway Oaks Drive, Suite 200
Sacramento, CA 95833

Subject: Camp Far West Hydroelectric Project Relicensing

Dear Mr. Lynch:

The Coastal Commission staff reviewed your determination that the South Sutter Water District's proposed relicensing of the Camp Far West Hydroelectric Project (FERC Project No. 2997), located in Yuba, Nevada, and Placer counties, would not affect coastal resources. The Commission staff concurs with your determination. Please contact me should you have any questions regarding this matter.

Sincerely,

Larry Simon

Larry Simon
Federal Consistency Coordinator

SECTION 2.0 PROPOSED ACTION AND ALTERNATIVES

This section describes the existing Project (i.e., No Action Alternative) and SSWD's proposed changes to the existing Project (i.e., SSWD's Proposed Project). Section 2.1 describes the No Action Alternative, the baseline from which to compare all action alternatives. Section 2.2 describes SSWD's Proposed Project. Section 2.3 describes alternatives considered but not analyzed in detail in this document.

2.1 No Action Alternative

Under the No Action Alternative, the Project would continue to operate into the future as it has historically operated (i.e., for the past 5 years) but with planned modification to the Camp Far West Dam Spillway as described below, and no new environmental PM&E measures would be implemented. Provided below is a description of: 1) existing Project facilities (Section 2.1.1); 2) existing Project Boundary (Section 2.1.2); 3) Project safety (Section 2.1.3); 4) current Project operations (Section 2.1.4); 5) conditions in the existing FERC license and other agreements and contracts that affect existing Project operations (Section 2.1.5), and facility maintenance (Section 2.1.6).

2.1.1 Existing Project Facilities and Features

The existing Project includes one development – Camp Far West. Figure 1.1-2 shows the Project in relation to the Bear and Feather River watersheds, and Figure 1.1-2 shows existing Project facilities and features.

The Project does not include any open water conveyance facilities, transmission lines, active borrow or spoil areas, the diversion dam located downstream from Camp Far West Dam, SSWD's Conveyance Canal, CFWID's Camp Far West Canal, or the intake structures to these water delivery canals.

Table 2.1-1 and Table 2.1-2 summarize key information for the Project's powerhouse and reservoir, respectively.

Table 2.1-1. Key information regarding the Camp Far West Hydroelectric Project's powerhouse.

Powerhouse	Unit	Turbine Type	Rated Head (ft)	Rated Hydraulic Capacity (cfs)		Generation Capacity (kW)		Average Annual Energy (MWh/yr)[3]
				Minimum	Maximum	Nameplate Rating[1]	Dependable[2]	
Camp Far West	1	Francis	143	200	725	6,800	3,750	26,900

[1] Manufacturer's stated turbine and/or generator capacity, as shown on equipment nameplate.
[2] Defined as the average available capacity during the period of highest demand within the driest recent historical period, which for this purpose is July and August 1977.
[3] Megawatt hours: 1,000 kilowatt hours.

Table 2.1-2. Key morphological information regarding the Camp Far West Hydroelectric Project's reservoir.

Project Reservoir	NMWSE (ft)	Gross Storage[1] (ac-ft)	Usable Storage[2] (ac-ft)	Surface Area[3] (ac)	Maximum Depth[3] (ft)	Shoreline Length[3] (mi)	Drainage Area At Dam (sq mi)
Camp Far West	300	93,737	91,327	1,886	155	29	284

Key: NMWSE = normal maximum water surface elevation; ft =feet; ac-ft = acre-feet; ac = acres; mi = miles; and sq mi = square miles
[1] Defined as the reservoir storage between the NMWSE and the bottom of the reservoir.
[2] Defined as the reservoir storage between the NMWSE and the invert of the 72-inch hollow jet valve level outlet (i.e., 175 ft), below which there is 2,500 ac-ft of reservoir storage that is not available for release (i.e., dead storage).
[3] At NMWSE.

Existing Project facilities and features are described below.

2.1.1.1 Main Dam and Auxiliary Dams

2.1.1.1.1 Main Dam

The first Camp Far West Dam was a 50-ft high concrete gravity structure built by the CFWID in 1927. Construction on the current dam was completed in January1964 by SSWD as part of the California State Water Plan to enhance water supply in California's Central Valley. Camp Far West Dam and Reservoir are not part of California's State Water Project.

The main embankment of the existing dam is a zoned earthfill structure, which is 185 ft high, 40 ft wide at the crest and 2,070 ft long. The dam has variable 2 to 1, 2.5 to 1, and 3 to 1 upstream slopes, with a 60-ft wide beam at an elevation of 200 ft, and a 2 to 1 downstream slope. The certified crest of the dam is at an elevation of 320 ft and has an additional 2.2 to 3.1 ft of camber resulting from roadway construction along the dam crest.

The central impervious core of the main embankment is comprised of compacted silts, clays, and gravels. Upstream from the core is a compacted shell of sand, gravel, and cobbles. Downstream and separated from the core by an inclined chimney drain is a shell of compacted clays and silts, which is further overlain by a shell of compacted rock with soil fines. Underlying the center portion of the embankment over the original river channel and extending from the 12-ft thick inclined chimney drain to the downstream toe is a 6-ft-thick, 100-ft-wide horizontal drain blanket. Both upstream and downstream slopes of the embankment are covered with a layer of riprap having a maximum diameter of 3 ft.

Figure 2.1-1 shows the Camp Far West Dam.

Figure 2.1-1. Photograph of some Camp Far West Hydroelectric Project facilities and features.

2.1.1.1.2 North and South Wing Dams

Adjacent to the left abutment of the main embankment is the south wing dam constructed of earthfill with a maximum height of 45 ft, a crest width of 20 ft, and length of 1,060 ft. Constructed to the north of the main embankment opposite the spillway is the north earthfill wing dam that is 25 ft in height, 20 ft in width at the crest, and 1,460 ft in length. The upstream slopes of the south and north wing dams are 2.5 to 1 and 3 to 1, respectively. The downstream slopes of both wing dams are 2.5 to 1. The north and south wing dams are constructed of compacted clays and silts. The upstream outside slope of the two wing dams is covered with 3 ft of riprap underlain by an 18-in. layer of gravel bedding. The downstream slope of the south wing dam is protected by a layer of riprap with a minimum thickness of 3 ft.

2.1.1.1.3 North Dike

The Project includes an earthfill dike constructed to the north of the north wing dam, and referred to as the north dike. The north dike is 15-ft-high, has a crest length of 1,450 ft, and a crest width of 20 ft. The nominal elevation at the top of the dike is 320 ft.

2.1.1.2 Camp Far West Reservoir

When the main dam was built, the reservoir had a surface area of 2,020 ac and storage volume of 104,000 acre-feet (ac-ft) at the Normal Maximum Water Surface Elevation (NMWSE) of 300 ft. Based on recent SSWD topographic and bathymetric surveys, the current reservoir surface area is 1,886 ac with a gross storage capacity of approximately 93,737 ac-ft at the NMWSE of 300 ft. The reservoir contains 1,307 ac-ft and has a surface area of about 74 ac at its minimum operating elevation of 175 ft, below which the reservoir storage is not available for release (i.e., dead storage). Maximum reservoir depth is approximately 155 ft, relative to the NMWSE. Figure 2.1-2 shows Camp Far West Reservoir.

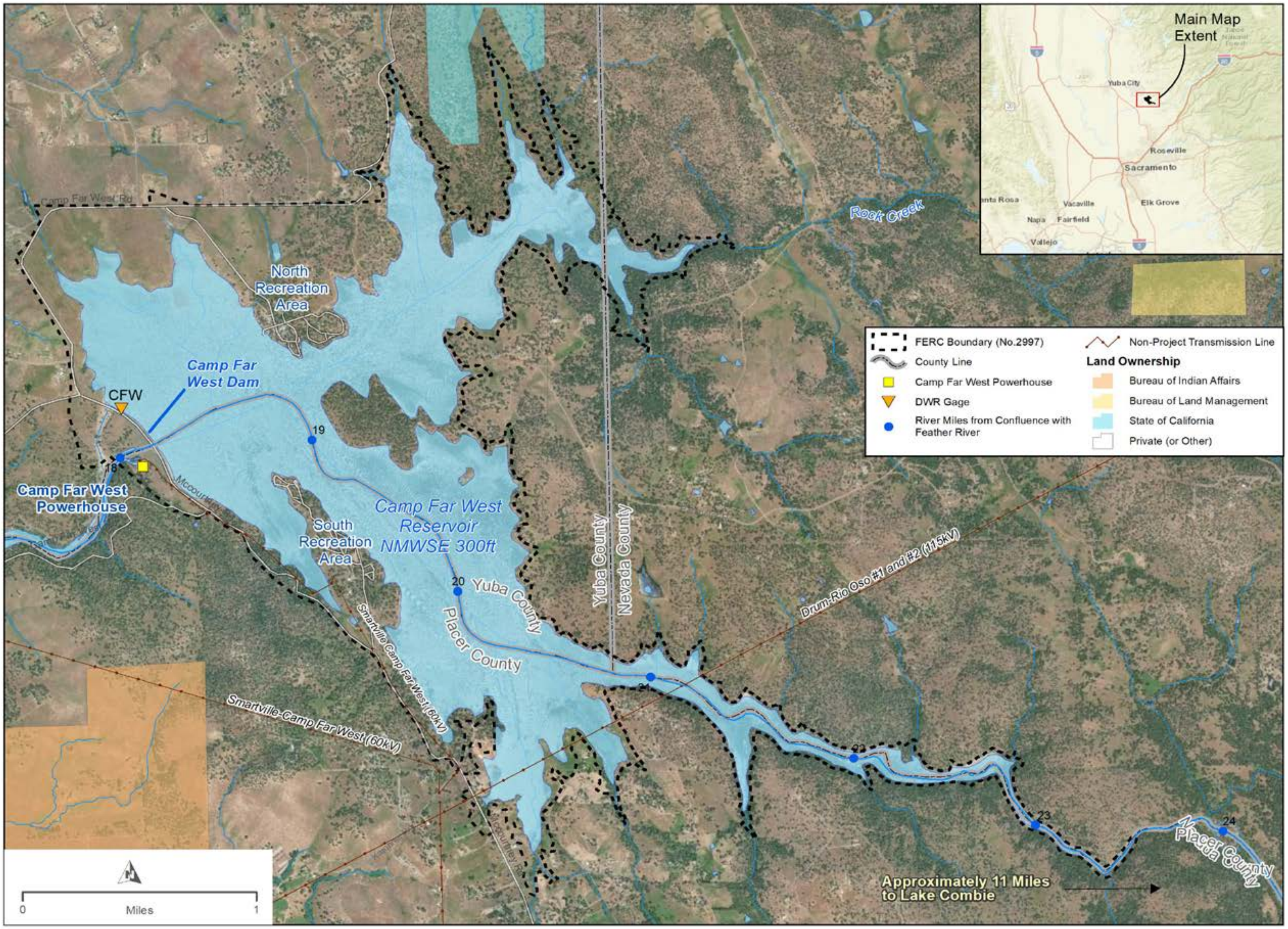

Figure 2.1-2. Camp Far West Reservoir and associated facilities and features.

2.1.1.3 Camp Far West Spillway

2.1.1.3.1 Existing Spillway

An overflow spillway is located adjacent to the right abutment of the Camp Far West main dam. The spillway structure consists of a 15-ft-wide reinforced concrete approach apron with the invert at 290 ft, an ungated, ogee-type reinforced concrete structure with a crest length of 300 ft, and a 77-ft long downstream reinforced concrete chute with vertical reinforced concrete counterforted sidewalls. The spillway crest elevation is 300 ft. The channel downstream of the spillway terminates in a chute excavated in solid rock. This unlined channel then joins the Bear River approximately 1,200 ft below the main dam. A 302.5-ft single-span, steel-truss bridge across the spillway crest provides access across the dam. The spillway has a maximum design capacity of 106,500 cubic feet per second (cfs) at a reservoir elevation of 320 ft. Figure 2.1-1 shows the existing Camp Far West Dam Spillway.

2.1.1.3.2 Ongoing Spillway Modification to Meet Probable Maximum Flood

In 2005, the probable maximum flood (PMF) was recalculated for the Camp Far West Hydroelectric Project resulting in a Camp Far West Dam spillway capacity of less than the PMF and consequently inadequate spillway capacity. Since the existing spillway capacity at NMWSE (i.e., 106,500 cfs) is less than the recalculated peak outflow during the PMF (i.e., approximately 126,600 cfs [NHC 2006]), FERC directed SSWD to increase the spillway capacity to accommodate passage of the revised PMF and avoid overtopping the dam at a reservoir elevation of 320 ft. Similarly, the California Division of Safety of Dams (DSOD) directed SSWD to increase the spillway capacity to ensure passage of the revised PMF with 1.0 ft of freeboard at the dam. The modification is needed to assure that the Camp Far West Dam spillway could accommodate the PMF wherein water would flow over the spillway rather than overtop the dam embankment thereby avoiding the risk of dam failure along with sudden and significant downstream flooding. SSWD is coordinating with FERC and DSOD to modify the spillway, as directed.

At the time this Application for New License is filed, the spillway modification, which has been agreed to by FERC,[1] includes the following:

- New Auxiliary Spillway Structure. The proposed new auxiliary spillway structure would be an ogee-type weir, horizontally concaved, with a crest length of 300 ft. The spillway would be constructed of reinforced concrete and be of similar design to the existing, adjacent spillway structure. Although the auxiliary spillway is being constructed to elevation 305 ft, it will not affect the existing Camp Far West Reservoir NMWSE because the reservoir will still spill over the existing elevation 300 ft spillway: the auxiliary spillway would only be activated at higher inflows.

[1] FERC approved the spillway modification in a memo filed on July 3, 2007 (Accession No. 200170709-0225).

- New Inlet Channel. A new unlined spillway inlet channel would be excavated upstream of the auxiliary spillway structure, within the Camp Far West Reservoir area, to divert water to the new auxiliary spillway. The width of the new auxiliary inlet channel would be a minimum of 300 ft at its narrowest, and the bottom elevation of the channel would be a constant 290 ft elevation. The side slopes of the channel would be constructed at 1:1 slopes where moderately weathered or un-weathered rock is encountered and 2:1 slopes for all other material types.
- New Outlet Channel. A new unlined auxiliary spillway outlet channel would be constructed downstream of the new auxiliary spillway structure to convey water back to the existing spillway channel. The channel would be approximately 805 ft long with a slope varying from -3 percent to -5.6 percent. The side slopes of the channel would be constructed at 1:1 slopes where moderately weathered or un-weathered rock is encountered and 2:1 slopes for all other material types.
- New Bridge. A new approximately 300-ft-long bridge would be constructed for the new auxiliary spillway to provide continuity and allow vehicular traffic to pass over the dam and along Blackford Road. The bridge would be constructed of precast concrete girders, and consist of side concrete barriers and a paved road surface. Guardrails would be placed at the ends of the bridge for transition from the road to the bridge. The bridge would be supported by concrete abutments at each end and two additional piers, evenly spaced.
- Grading and Raising Existing Blackford Road. Construction of the new bridge to a top-of-paved-surface-elevation of 325 ft would require the existing Blackford Road to be raised approximately 15 ft at the west end of the proposed new bridge to accommodate the approach to the bridge over the new auxiliary spillway. The new bridge would ramp back down to the existing road grade on the east end. Fill would be required on the west end of the bridge in order to accommodate the approach to the new spillway bridge. Maximum grade would be approximately 6 percent, similar to existing maximum grade. The road width would be 24 ft along Blackford Road and 20 ft along Camp Far West Road. Fill side slopes would be constructed at 2:1.
- Relocation of Existing Powerline. A segment of an existing distribution powerline, which is located just south of the proposed new auxiliary spillway and owned and operated by Pacific Gas and Electric (PG&E), would be relocated. The line serves only as a distribution line from the Camp Far West Powerhouse switchyard to the main grid and would not disrupt power distribution to other users.

SSWD anticipates that the auxiliary spillway would be constructed in the course of 3 months in fall 2020 and 5 months in spring-summer 2021.

When the spillway modification is complete, the auxiliary spillway in combination with the existing spillway will have a combined capacity of 134,600 cfs at a water surface elevation of 318.5 ft.

For the purposes of this Application for New License, SSWD assumes the spillway modification is fully implemented under the existing license and is in place when FERC issues a new license for the Project.

2.1.1.4 Water Intakes and Water Conveyance Systems

2.1.1.4.1 Intakes

There are two intake structures associated with the Camp Far West Dam; the power intake that was constructed when hydropower was added to the dam, and the intake structure for the outlet works. Both structures are submerged for most of the year and are located at the upstream toe of the main dam.

The power intake structure consists of a reinforced concrete ungated vertical intake tower 22-ft-high, with openings on three sides; two 10-ft-wide by 14-ft-high and one 10-ft-wide by 10-ft-high. The openings are protected by steel trashracks on 6-in. centers. A concrete bulkhead enables positive closure and the sill elevation measures 197.0 ft.

The intake for the outlet works consists of a reinforced concrete ungated vertical intake tower 25-ft-4 in. high, with openings on three sides – each 7-ft-wide by 8-ft-high. The openings are protected by steel trashracks on 6-in. centers and the sill elevation measures 175.0 ft.

2.2.2.4.2 Water Conveyance Systems

There are three main conveyance systems associated with the Camp Far West Dam. The overflow spillway discussed above flows into an unlined rock conveyance channel that carries the spill back into the Bear River downstream of the dam.

The power intake structure described above connects to a 760-ft-long, 8-ft diameter concrete tunnel through the left abutment of Camp Far West Dam that conveys water directly to the Camp Far West Powerhouse, which discharges to the Bear River at the base of Camp Far West Dam.

A 350-ft-long 48-in. diameter steel pipe connects the intake structure for the outlet works described above to a valve chamber, and a 400 ft long, 7.5-ft diameter concrete-lined horseshoe tunnel connects the valve chamber to a 48-in. diameter Howell Bunger outlet valve on the downstream face of Camp Far West Dam. The valve has a release capacity of 500 cfs at NMWSE and discharges directly into the Bear River.

Each facility is shown on Figure 2.1-1.

2.1.1.5 Camp Far West Powerhouse

The powerhouse was constructed in conjunction with the addition of hydropower licensed in 1981 after Camp Far West Dam was built and in operation. The powerhouse is an above-ground, steel reinforced concrete structure that houses a single vertical-shaft Francis-type turbine. The turbine-generator unit is rated at 6,800 kilowatts (kW) under a rated head of 143 ft and a rated flow of 725 cfs. The unit includes a synchronous three-phase, 13.6 kilovolt (kV) generator with a capability of 6,800 kW. The intake is submerged in the reservoir. Figure 2.1-1 shows the Camp Far West Powerhouse.

2.1.1.6 Camp Far West Switchyard

The Camp Far West Switchyard is a fenced switchyard adjacent to the Camp Far West Powerhouse containing a 6/8 NVA, OH/FA, three phase, 13.8 kV – 60 kV, delta-ground wye power step-up transformer; a 60 KV, 31, 60 Marts, 600 ampere, 1,000 MVA short circuit bulk oil circuit breaker; and appropriate disconnect switches. The switchyard also contains PG&E electrical equipment facilities that are not part of the Project. Figures 3.1-1 shows the Camp Far West Switchyard.

2.1.1.7 Camp Far West Reservoir Recreation Facilities

There are two developed recreational areas on the Camp Far West Reservoir, both of which are owned by SSWD and leased to a private concessionaire to operate. The North Shore Recreation Area (NSRA) is located off of Camp Far West Road in Wheatland, CA. This campground is currently open year-round. The South Shore Recreation Area (SSRA) is located off of McCourtney Road (Placer Co. C6037) in unincorporated Lincoln, CA, and is only open from mid-May until September. The boat launching facility at the NSRA was reconstructed in 2003-2004. Table 2.1-3 provides details of the recreation facilities at the NSRA and the SSRA. Figure 2.1-2 shows the locations of the NSRA and SSRA.

Table 2.1-3. Camp Far West Hydroelectric Project recreation facilities.

Facility	Amenity	North Shore Recreation Area	South Shore Recreation Area
Family Campgrounds	No. Sites (standard)	70	67
	Sites (RV with hookups)	10	none
	Parking Spurs	1 spur per site	1 spur per site
	Overflow Parking Spaces	None	18 single
	Restrooms	2 flush	1 flush, 2 vault
Group Campgrounds	Sites	2, 25-person group sites, 1, 50-person horse camp site	1, 50-person group site
	Parking Spaces	None[1]	10
	Restrooms	4 portable chemical toilets	None[2]
Day Use Areas	Picnic Sites	20	33
	Swim Beaches	1	1
	Parking Spaces	None[3]	44
	Restrooms	1 flush	None[4]
Boat Ramps	Number	1, 4-lane concrete ramp	1, 2-lane concrete ramp
	Parking Spaces	82 single, 73 vehicle with trailer	52 vehicle with trailer
	Restrooms	1 flush	1 flush
Dispersed Use Areas[5]	Sites	2	2
	Restrooms	6 portable chemical toilets	6 portable chemical toilets

Table 2.1-3. (continued)

Facility	Amenity	North Shore Recreation Area	South Shore Recreation Area
Other Facilities	Entrance Station	1	1
	Store	1	1
	RV Dump Station & Holding Pond	1	1
	Concessionaire Trailers	2	1
	Water Treatment Plant	1	None[6]
	Water Storage Tank	1, 60,000-gallon tank	None[6]

[1] The group campsites use the adjoining family campground restroom building.
[2] Parking is available in open areas adjacent to the group sites, but is not designated or defined.
[3] The day use area (picnic area and swim beach) uses the adjoining boat ramp parking area for parking.
[4] The picnic area uses the adjoining boat ramp restroom building.
[5] The dispersed use areas provide day use and overnight opportunities with minimal facilities (roads, portable chemical toilets and trash cans).
[6] Water is piped under the reservoir to South Shore Recreation Area from the North Shore Recreation Area treatment plant and storage tank.

A recreational water system source is Camp Far West Reservoir, where two pumps in the reservoir deliver water at 70 gallons/minute (5,000,000 gallons or 15.3 ac-ft per year) uphill via underground piping to the water treatment facility in the NSRA. After being treated, the water is piped nearby to a 60,000-gallon storage tank constructed of belted steel and recently installed in 2011. From the storage tank, underground distribution piping sends the water throughout the NSRA and SSRA. The SSRA facilities are connected via two pipes under the reservoir that sends the water from the NSRA to the SSRA.

Both NSRA and SSRA have a sewage holding pond with an aerator to handle the sanitary needs of the flush restroom buildings and the RV dump stations at each recreation area. The NSRA and SSRA ponds have surface areas of approximately 1.5 and 0.5 ac, respectively. The NSRA sewage system uses a gravity-feed operation and is supplemented by a pump to get the sewage up to the holding pond. The SSRA sewage system is a gravity-fed system. SSWD maintains the sewage ponds in conformance with a permit issued by the Central Valley Regional Water Quality Control Board.

2.1.1.8 Gages

Flow data for the Project comes from four gages, data for two of which are published by the USGS (Table 2.1-4). SSWD also measures spill through the Camp Far West Dam spillway by indirect stage method.

Table 2.1-4. Streamflow and other gages in the Camp Far West Hydroelectric Project Vicinity.

United States Geological Survey (USGS) Identifier	California Data Exchange Center (CDEC) Identifier[1]	Gage Name	Measures
--	--	Camp Far West Dam Low-Level Outlet Flowmeter[2]	Low-level outlet discharge
--	--	Camp Far West Powerhouse Flowmeter[2]	Powerhouse discharge
11423700[3]	CFW[4]	Bear River at Camp Far West Dam (Camp Far West Reservoir)	Reservoir Stage and Storage

Table 2.1-4. (continued)

United States Geological Survey (USGS) Identifier	California Data Exchange Center (CDEC) Identifier[1]	Gage Name	Measures
11423800[5]	CFW[6]	Bear River Fish Release below Camp Far West Reservoir	Compliance with flow requirements in Existing FERC License

[1] Unlike USGS data which are reviewed for quality by USGS prior to publishing the data, CDEC data are not reviewed by CDEC before being made available.
[2] Flowmeters below Camp Far West Dam at low-level outlet and powerhouse are currently maintained by the Sacramento Municipal Utility District (SMUD) and data are not reported publicly.
[3] USGS gage 11423700 measured Camp Far West Reservoir storage, but has not been reported by USGS since September 30, 1983.
[4] CDEC gage CFW, maintained by DWR Flood Management, reports real-time Camp Far West Reservoir stage and end-of-month Camp Far West Reservoir storage-.
[5] USGS Gage 11423800, maintained by USGS, reports river flow below the non-Project diversion dam for compliance with the FERC license. It is not a full flow gage.
[6] CDEC gage CFW reported computed flow downstream from Camp Far West Dam, but is inactive as of June 1, 2018.

Figure 2.1-3 shows the fish release valve in the non-Project diversion dam. Water is released through a slide gate into a concrete structure on the south-side of the non-Project diversion dam. The structure includes a rectangular notch and weir plate. The water level is measured to determine the depth of flow over the weir and calculate flow.

Figure 2.1-3. Camp Far West Hydroelectric Project minimum flow compliance gage (USGS Gage 11423800, Bear River Fish Release below Camp Far West Reservoir.

Seven gages exist downstream of the Project. One gage is a stage gage that measures the stage of the pool formed by the non-Project diversion dam, and the other six are flow gages. One flow gage is located on CFWID's North Canal to measure diversions into the canal from the Bear River. Two flow gages are located on SSWD's Main Canal: one gage measures diversions from SSWD's Main Canal into CFWID's South Canal, and the second gage is located further along the Main Canal and measures flow in the Main Canal past the CFWID's South Canal withdrawal.[2] The fourth flow gage is USGS Gage 11424000, *Bear River near Wheatland*, reported by California Data Exchange Center (CDEC) as BRW, *Bear River near Wheatland*, located 6.5 mi downstream from Camp Far West Dam, 200 ft downstream of the State Highway 65 bridge crossing, which is a full-flow gage and is maintained by USGS and DWR. The last flow gage is CDEC Gage BPG, *Bear River at Pleasant Grove Road*, a full-flow gage maintained by DWR and located 10.5 mi downstream from Camp Far West Dam. Figure 2.1-4 shows the location of the gages.

[2] SSWD Main and Canal and CFWID South Canal and North Canal diversions are measured and reported in compliance with CA SWRCB Surface Water Measurement and Reporting Regulations (California Code of Regulations, Title 23, Chapters 2.7 and 2.8). Beginning January 1, 2020, hourly diversion data will be reported weekly, and will be publicly available.

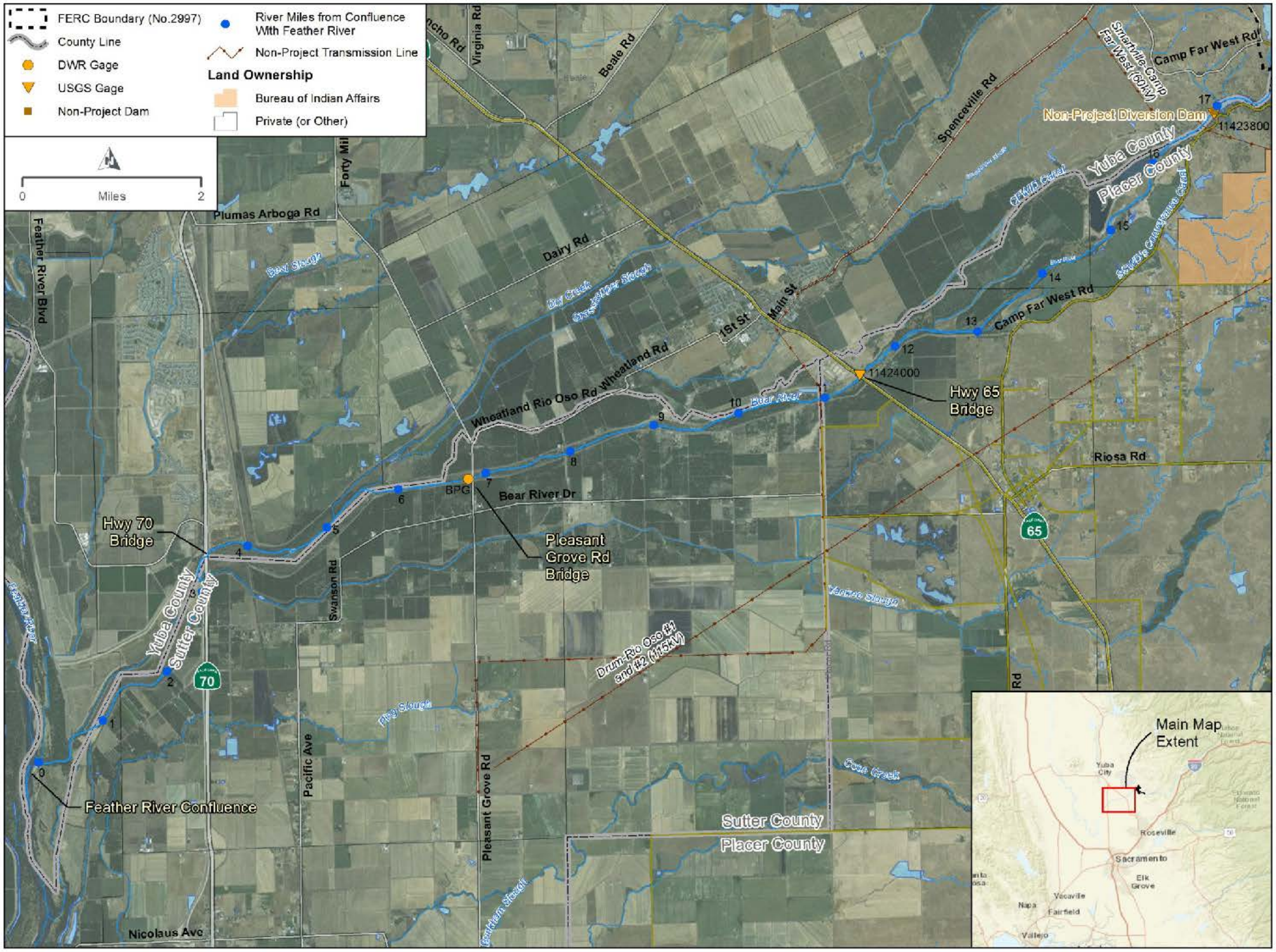

Figure 2.1-4. Location of downstream flow streamflow gages.

2.1.1.9 Primary Project Roads and Trails

There are no Primary Project Roads or Trails included explicitly in the existing FERC-licensed Project facilities.

2.1.2 Existing Project Boundary

The FERC Project Boundary is intended to consist of all lands necessary for the safe operations and maintenance of the Project and other purposes, such as recreation, shoreline control, and protection of environmental resources. For the Camp Far West Hydroelectric Project, the existing FERC Project Boundary encompasses 2,863.7 ac of land. SSWD owns over 95 percent (2,710.5 ac) of the land within the boundary, and the remaining 5 percent (153.2 ac) of the land is owned by private parties – no federal or state land occurs within or adjacent to the FERC Project Boundary or along the Bear River downstream of the Project. The boundary generally follows the 320 ft elevation contour around Camp Far West Reservoir with the exception of the additional lands included at the northwest end of the reservoir that include the NSRA and additional lands included at the southwest end of the reservoir that include the SSRA.

2.1.3 Existing Project Safety

The Project has been operating for more than 35 years under the existing license and during this time, FERC staff has conducted operational inspections focusing on the continued safety of the structure, identification of unauthorized modifications, efficiency and safety of operations, compliance with the terms of the license, and proper maintenance. In addition, the Project has been inspected and evaluated every 5 years by an independent consultant and a consultant's safety report has been submitted for FERC's review. SSWD has a strong commitment to employee and public safety, which is reflected in its safety procedures and training program, and its safety record.

2.1.4 Operations

2.1.4.1 Use of SSWD's Water Balance/Operations Model

SSWD has operated the Project since 1984. However, Project operations have changed through time. Therefore, historical operations information (e.g., flows, storage and generation) may not provide the best picture of current existing conditions. To describe better existing operations of Camp Far West Reservoir and associated hydropower and irrigation facilities over a range of hydrologic conditions, SSWD developed the Camp Far West Hydroelectric Project Water Balance/Operations Model (Ops Model).

The Ops Model is a tool to examine water supply and hydropower generation under a variety of hydrologic and operational conditions, and addresses operational decisions including: stream flow requirements, water supply, recreation, and hydropower generation. The Ops Model simulates operations subject to the physical constraints of the Project, including maximum and minimum reservoir elevations, reservoir outlet and powerhouse capacities, and the existing configuration of the Camp Far West Dam Spillway. Ops Model logic focuses on operations of Camp Far West Reservoir and the downstream non-Project diversion dam, which includes simulated diversions into SSWD's Main Canal and CFWID's North Canal and South Canal. Irrigation diversions are based on estimated agricultural demands, Camp Far West Reservoir storage and anticipated releases and diversions from upstream water storage projects. The Ops Model contains data for historical water transfers but does not include water transfers in its simulation of operations. The Ops Model also includes a representation of the Bear River downstream of the diversion dam to the confluence of the Bear River with the Feather River, including tributary inflow from Dry Creek at river mile (R.M.)[3] 5.1. Three additional stream nodes are located downstream of the diversion dam: Bear River at Wheatland; Bear River at Pleasant Grove Road; and the Bear River at the confluence with the Feather River. Table 2.1-5 provides a summary of output available from the Ops Model and Figure 2.1-5 is an overview of the Project, SSWD and CFWID service territories, and Ops Model nodes.

Table 2.1-5. Summary of Ops Model nodes and outputs.

Model Node	Model Output
NODES WITHIN PROJECT	
Camp Far West Reservoir	Storage and elevation
Camp Far West Powerhouse	Generation and release through turbine
Camp Far West Dam	Release from low-level outlet and spillway
NODES DOWNSTREAM OF PROJECT	
CFWID North Canal	Diversion into canal
CFWID South Canal	Diversion into canal
SSWD Main Canal	Diversion into canal
Non-Project Diversion Dam	Estimated flow below diversion dam
Bear River at Wheatland	Estimated flow in river
Bear River at Pleasant Grove Road	Estimated flow in river
Bear River at Feather River	Estimated flow in river

[3] In this exhibit, river miles are estimated using SSWD's relicensing Geographic Information System (GIS) of the Bear River basin moving from downstream to upstream in the Bear River with R.M. 0.0 designating the confluence of the Bear River with the Feather River.

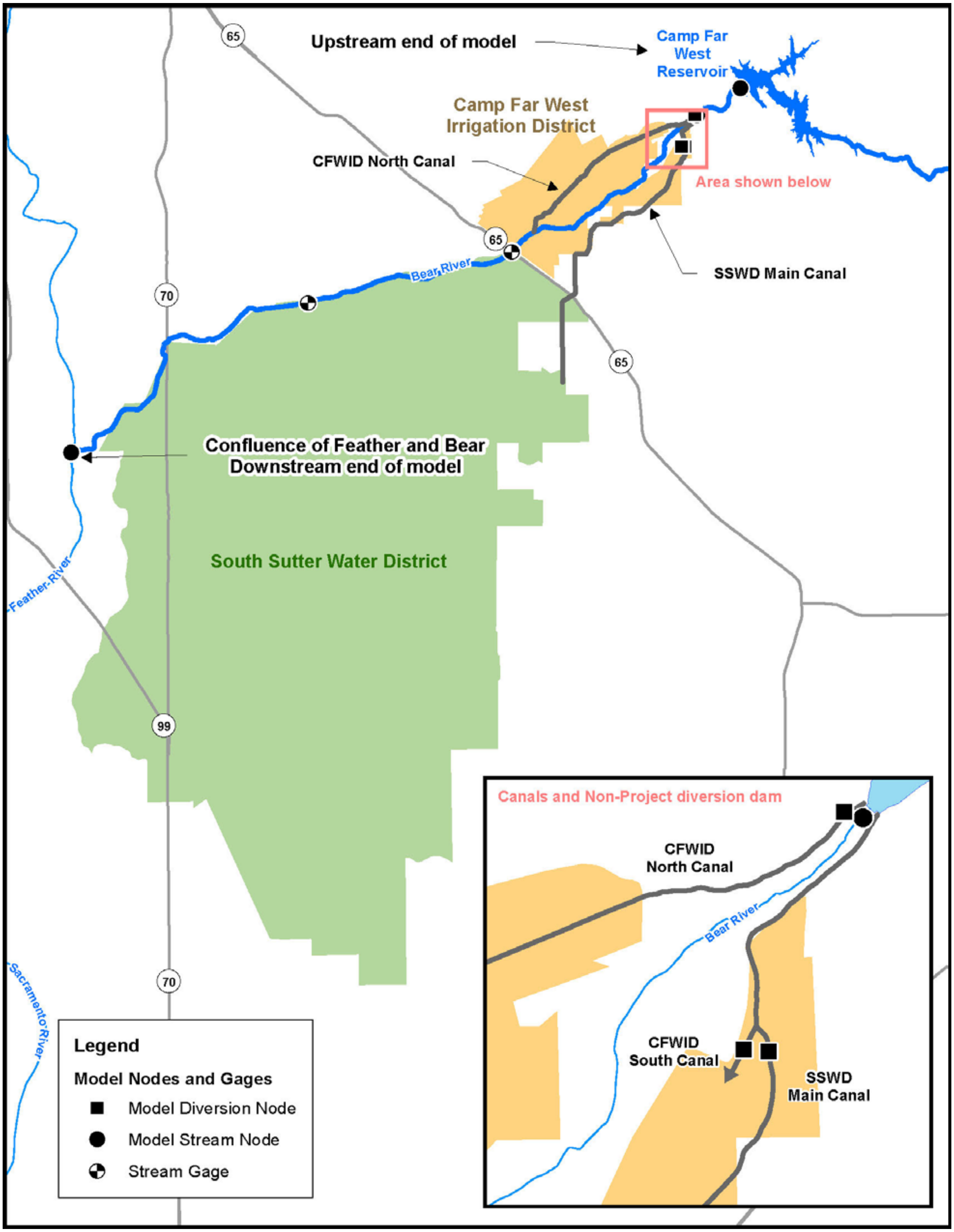

Figure 2.1-5. Camp Far West Hydroelectric Project, SSWD and CFWID service territories, and Ops Model nodes.

The Ops Model simulates operations on a daily time-step for 39 years of historical hydrology from Water Year (WY) 1976 through WY 2014. This period covers a range of hydrologic conditions and includes both the driest (1977) and wettest (1983) years on record, based on total annual inflow to Camp Far West Reservoir. The period also includes three multi-year periods of below average inflow: WYs 1976 through 1977; WYs 1987 through 1992; and WYs 2012 through 2014.

The Ops Model is a Microsoft Excel spreadsheet. SSWD selected Microsoft Excel as the Ops Model platform for several reasons including: availability to Relicensing Participants;[4] transparency of Ops Model logic and operations; flexibility in developing operational rules; and existing familiarity with spreadsheets for most Relicensing Participants. The Ops Model allows user-defined variables to be changed and different operations to be evaluated. Ops Model operational logic is transparent and editable.

The Ops Model includes preliminary WY types based on five WY types proposed for the upstream Nevada Irrigation District's (NID) Yuba-Bear Project (FERC Project No. 2266) and Pacific Gas and Electric's (PG&E) Drum-Spaulding Project (FERC Project No. 2310), collectively, the Yuba-Bear Drum Spaulding (YB/DS) Projects. The YB/DS Projects' WY types are used in the Ops Model for reporting model results and to evaluate potential operational decisions. The existing Project license includes only two WY types.

The Ops Model was developed and validated with inputs designed to represent historical operations and historical inflow.

Then, the Ops Model was used to develop a Baseline scenario, assuming YB/DS Projects near-term operations with assumed new YB/DS FERC license requirements based on the FERC-issued Final Environmental Impact Statement (FEIS) for both projects and the current level of development upstream. The YB/DS Projects are currently in the process of relicensing. Therefore, upstream operations are expected to change in the near future and those changes will affect inflow into Camp Far West Reservoir and SSWD's operations. Inflow into Camp Far West was provided by HDR Inc., a consultant to NID and PG&E for the YB/DS relicensing, based on a model of the YB/DS Projects. The Baseline scenario includes Camp Far West operations representative of how SSWD currently operates the Project, and includes all current physical, regulatory, and contractual constraints.

The Ops Model was then used to develop two separate Proposed Project simulations. The first scenario, Proposed Project (Near-Term Condition), assumes YB/DS Projects operations with assumed new YB/DS FERC license requirements based on the FERC-FEIS for both projects, the current level of development upstream, and SSWD's Proposed Project. The second scenario, (Future Condition), assumes YB/DS Projects operations with assumed new FERC license requirements, a future level of development upstream, and SSWD's Proposed Project.

[4] In this exhibit, "Relicensing Participants" includes SSWD, federal and State agencies, local agencies, non-governmental organizations (NGO), businesses and members of the public that routinely and actively take part (i.e., attend meetings/workshops and make filings) in the Camp Far West Project relicensing.

Inflow hydrology for Dry Creek was developed as part of SSWD's relicensing Study 2.2 *Water Temperature Modeling*, by gage reconstruction. Dry Creek was gaged from WY 1947 to 1962, capturing 87 percent (99.9 square miles, or sq mi) of the total Dry Creek drainage basin. The analysis was a flow gage reconstruction for the desired WYs (1976 through 2014), and not an estimate of the total Dry Creek flow at the Bear River. Statistical regression relationships were developed to relate the Dry Creek gage to other flow gages in Northern California as summarized in Table 2.1-6. Due to the lack of overlapping periods of record, regressions of Laguna Creek near Elk Grove and Dry Creek near Roseville to South Honcut Creek were developed to first synthesize South Honcut Creek, which is then used to synthesize Dry Creek near Wheatland. The resulting time series was used for both the Near-Term and Future Conditions scenarios.

Table 2.1-6. Flow gages used in analysis.

Flow Gage	Gage Identification	WYs Available	Mean Elevation (ft)	Watershed Area (mi²)	Dry Creek Synthesis Periods
Dry Creek near Wheatland	11424500	1947-1962	920	99.9	--
South Honcut Creek near Bangor	11407500, *A05775*	1951-1986, *2006-2014*	1640	30.6	1975-1986
Dry Creek near Roseville	11447293	2000-2012	450	80.1	2000-2005
Laguna Creek near Elk Grove	11336585	1996-2014	120	31.9	1996-1999
Napa River near St. Helena	11456000	1947-1995, 2000-2014	1020	78.8	1987-1995

Note: Italicized data from DWR Water Data Library, all other data from USGS.

The Ops Model was validated by comparison with observed data from WY 1995 through WY 2014. Recent years are used for validation because SSWD operations have changed during the 39-year simulation period, most notably in 2000. For this reason, a separate simulation was used for model validation. The validation model also includes limited water transfers that occurred during the validation period.

The Ops Model Validation Report and the Ops Model itself is included in Appendix E1 of Exhibit E.

2.1.4.2 Relicensing Hydrology Datasets

SSWD developed six hydrology datasets (mean daily values for flows and daily values for reservoir elevation and storage) to support the Camp Far West Project relicensing. These datasets are:

1. Historical Hydrology. This dataset is composed of publicly available, empirical, gaged reservoir and flow data in the Project Area, and covers the period from WY 1928 through WY 2014. The WY 1928 through 1964 period covers the period prior to the development of Camp Far West Dam;[5] the WY 1967 through 1984 covers the period

[5] This period starts after the first Camp Far West Dam, which was a 50-ft high concrete gravity structure was built by the CFWID in 1927. The dam was enlarged in 1964 by SSWD as part of the California State Water Plan to enhance water supply in California's Central Valley. Camp Far West Dam and Reservoir are not part of California's State Water Project.

from when the dam was in place but prior to the development of Camp Far West Powerhouse; and the WY 1985 through 2014 period covers the period from when both the dam and powerhouse were in place. The Ops Model includes calculated, historical inflow to Camp Far Water Reservoir based on historical gage records for the modeling period of record, which is from WY 1976 through WY 2014.

2. Unimpaired Hydrology. This dataset is an estimation of flows that would have occurred in the basin during the modeling period of record if no Project or non-Project facilities were present.[6]

3. Environmental Baseline. This dataset is the No Action Alternative, and is an estimation of inflow to Camp Far West Reservoir, operations, and flows that would have occurred in the basin during the modeling period of record if the Project and all non-Project facilities were present and operating under expected, near-term conditions. This dataset is used throughout SSWD's Application for New License to represent environmental baseline reservoir and flow conditions. SSWD uses this dataset instead of the Historical Hydrology dataset to represent near-term environmental baseline conditions because using historical data would be misleading given changes in Project and non-Project operations over time. This hydrology dataset is a product of the Ops Model, and is sometimes referred to in this Application for New License as the No Action Alternative. Near-Term Conditions assume YB/DS Project operations with assumed new FERC license requirements based on the FERC-issued FEIS for both YB-DS Projects and the current level of development upstream.

4. Proposed Project (Near-Term Condition). This dataset is SSWD's Proposed Project under near-term conditions. Near-Term conditions assume YB/DS Project YB/DS Projects operations with assumed new FERC license requirements based on the FERC-issued FEIS for both YB-DS Projects and the current level of development upstream.

5. Proposed Project (Future Condition). This dataset is SSWD's Proposed Project under future conditions. Future conditions assume YB/DS Project operations with assumed new FERC license requirements based on the FERC-issued FEIS for both YB-DS Projects and the future (WY 2062) level of development upstream.

Each hydrology dataset as well as SSWD's methods used to estimate each flow condition are provided in Appendix E1 of Exhibit E of SSWD's Application for New License. Specifically, for the modeling period of record the attachment includes: 1) mean daily releases from the Project powerhouse; 2) total mean daily flow below Camp Far West Dam (i.e., the sum of the powerhouse discharge, dam spill and low-level outlet release); 3) mean daily fish release flow immediately downstream of the non-Project diversion dam, the flow compliance location in the existing Project license; 4) daily Camp Far West Reservoir water surface elevation (WSE) and storage; and 5) other hydrologic information. Data are provided in the United States Army Corps of Engineers' (USACE) Hydrologic Engineering Center's (HEC) Data Storage System

[6] Unlike other tributaries to the Feather River, the California Department of Water Resources (DWR) does not forecast or estimate unimpaired flow in the Bear River.

(DSS) format and in Microsoft™ Excel format, and monthly duration curves are provided for flow.

2.1.4.3 Typical Operations

The Project is operated primarily to provide irrigation water to growers in SSWD's and CFWID's service districts. However, SSWD also operates the Project to meet Bear River flow requirements and to generate power. SSWD leases the power generating facilities to SMUD, which operates the Camp Far West Powerhouse and switchyard.

Although the specific water availability can vary widely, normal Project operation is to fill the reservoir as early in the season as sufficient water becomes available and to then spill the excess flows over the ungated spillway. Because the reservoir is primarily fed by rainfall-produced runoff, it is difficult to predict the amount of inflow anticipated before the end of the season; therefore, SSWD retains within the reservoir all of the inflow except releases for requirements for fisheries until the beginning of the irrigation season. Since the reservoir is operated as a fill-and-spill system, its effect on downstream flood flows is erratic, as it may range from complete control to only minor surcharge regulation.

Camp Far West Reservoir does not have any dedicated flood control space or associated flood control rules.

In most years, the reservoir reaches NMWSE in January when the basin produces its heaviest runoff, and then starts to decline in April or May as releases for irrigation increase. The reservoir reaches its lowest point in the mid-October period when irrigation deliveries are no longer made.

Power is produced at Camp Far West Powerhouse during the winter/early spring months when the reservoir is spilling and during the spring and summer months when releases are being made for irrigation and to meet instream flow requirements. Because of the generating unit's operating characteristics, power can only be generated when the elevation of the reservoir water surface is at or above 236 ft and when reservoir outflow is greater than 130 cfs. If these two criteria cannot be met, water is released through the low-level outlet. This condition normally occurs each year starting in September and continuing into the fall until such time that surplus inflows are available to be passed through the powerhouse.

During the irrigation season, up to a maximum of 530 cfs passes through the powerhouse in conformance with downstream irrigation and instream requirements. However, during the heavy runoff period when spilling from the reservoir occurs, a greater quantity of water is routed through the powerhouse up to its maximum limit of 725 cfs.

When the reservoir water surface is high enough to send flows over the spillway, all flows up to approximately the physical capacity of the turbine are diverted through the power tunnel. The balance of any flows greater than turbine capacity are passed over the uncontrolled spillway.

During normal reservoir releases for furnishing irrigation water, all releases are utilized for power production except under those conditions as described above when the combination of head and flow are outside the operating characteristics of the turbine. During dry periods outside of the irrigation season, reservoir releases can be limited to minimum instream flow requirements, which are at times controlled by inflow per the existing license (see Article 29). Inflow from the Bear River is measured during the low-flow season by SSWD in the Bear River immediately upstream of Camp Far West Reservoir.

Operation of the powerhouse is automatic except for start-up, which is done manually. A powerhouse shutdown activates an alarm at SMUD's dispatch center, which requires sending trained personnel to the site to determine the problem and re-start the powerhouse.

SMUD receives Renewable Energy Credits (REC) for power generated at Camp Far West Powerhouse through the CEC. The powerhouse is registered under CEC Plant ID H0083.

To demonstrate normal operations, SSWD selected 1995, 2003, and 2001 as representative Wet, Normal, and Dry WYs, respectively, because these years approximate the 10, 50, and 90 percent exceedance intervals, respectively, for annual flow volume as measured at USGS Gage 11424000 (*Bear River near Wheatland*). This gage was selected because it is the nearest full-flow gage to Camp Far West Dam. Figures 2.1-6 through 2.1-8 show for each representative WY: 1) daily water storage in Camp Far West Reservoir based on exiting reservoir storage curves; 2) mean daily water releases from Camp Far West Dam and Powerhouse (i.e., releases through the powerhouse, low-level outlet and over the spillway); and 3) mean daily flows at USGS Gage 11424000 located about 6.5 mi downstream from Camp Far West Dam near Wheatland.

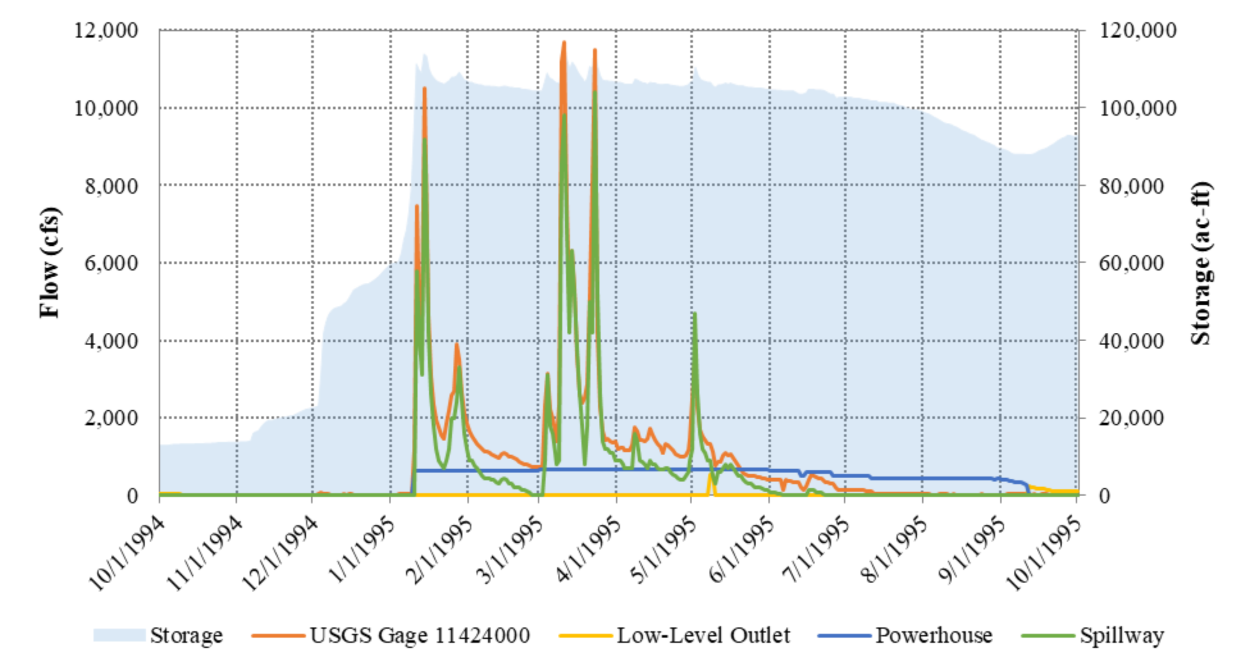

Figure 2.1-6. Camp Far West Hydroelectric Project releases and storage in a representative Wet Water Year – 1995 (Historical Hydrology).

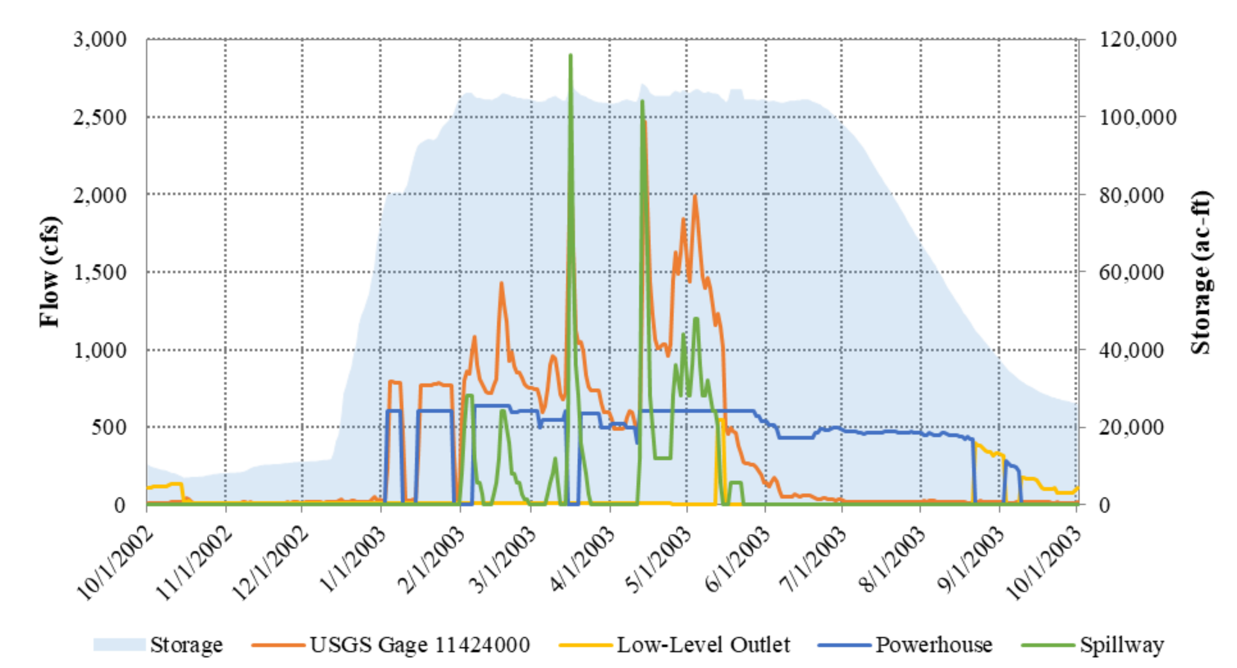

Figure 2.1-7. Camp Far West Hydroelectric Project releases and storage in a representative Normal Water Year – 2003 (Historical Hydrology).

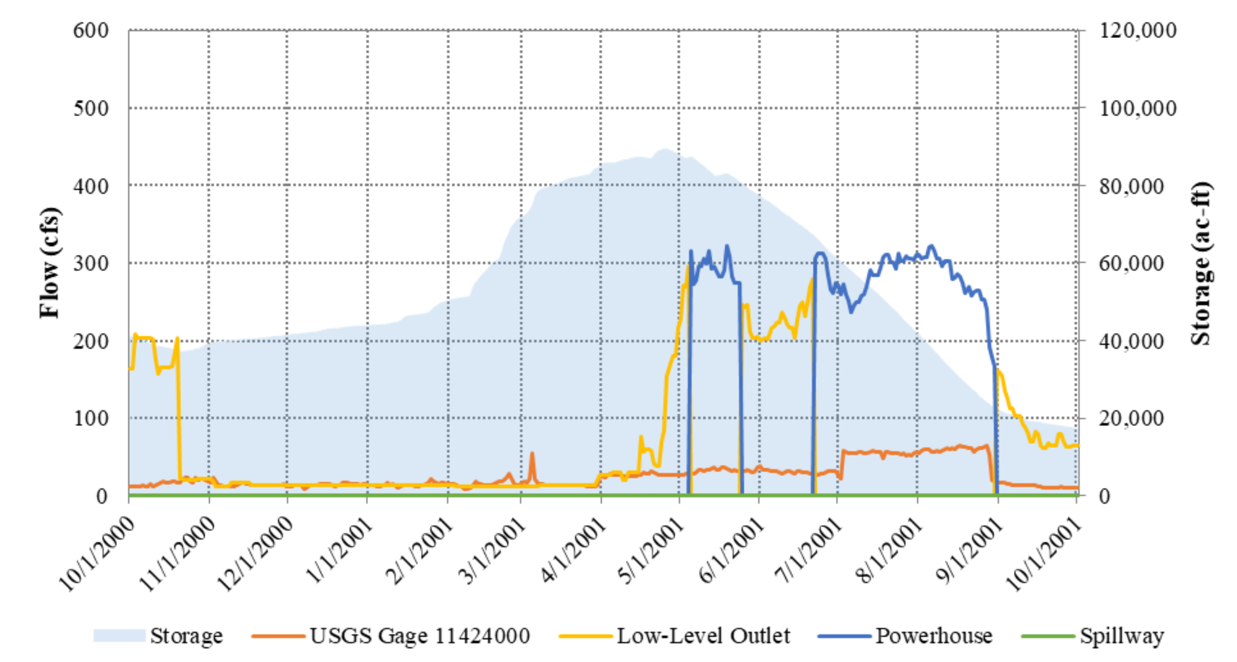

Figure 2.1-8. Camp Far West Hydroelectric Project releases and storage in a representative Dry Water Year – 2001 (Historical Hydrology).

2.1.5 Existing Environmental Measures

This section discusses operating constraints, including conditions in the existing FERC license, measures in other existing licenses, agreements and contracts that affect Project operations.

2.1.5.1 Conditions in Current FERC License

The initial license included 33 articles numbered 1 through 33, which have not changed since the license was issued. Of these, SSWD considers six articles (i.e., articles 24, 25, 26, 27, 28 and 32) "expired" or "out of date," because each pertains to a construction activity that has been completed, a filing related to a construction activity that has been completed, or another activity that has been completed. As a result, the existing license contains 27 "active" articles. The general topic that each of the 27 active articles is provided in Table 2.1-7.

Table 2.1-7. List of active requirements in the existing FERC license for the Camp Far West Hydroelectric Project.

Article(s)	Description	Article(s)	Description
1	General - Compliance	15	Construction of fish and wildlife protective devices and structures by Licensee
2 & 3	FERC approval of changes	16	Construction of fish handling facilities by U.S.
4	FERC inspection and supervision	17	Recreation facilities
5	Obtain any needed land rights	18	Allow public access to Project lands and waters
6	Federal takeover	19	Soil erosion and sedimentation control
7	Project costs and depreciation	20	Clearing

Table 2.1-7. (continued)

Article(s)	Description	Article(s)	Description
8	Gaging and stream gaging	21	Implied surrender provisions
9	Install additional capacity if order by FERC	22	Termination of license
10	Coordinate with others if ordered by FERC	23	Terms and conditions of FPA
11	Headwater benefits	29	Minimum flows
12	Operation as ordered by FERC to protect life, health property or for other benefits	30	Consult with resource agencies on impacts to fish and wildlife during construction and operation of project.
13	Non-project use of project lands	31	Annual Charges
14	Public safety related to safety of transmission lines, telephone lines, etc.	33	Standard Land Use Article

Of these, Article 29 is more germane to Project operations than the other 27 articles. Provided below as Article 29 as it appears in the existing FERC License.

> **Article 29.** The licensee shall maintain a continuous minimum flow of 25 cfs from April 1 through June 30 and 10 cfs from July 1 through March 31 or inflow to the project reservoir, whichever is less, as measured immediately below the Camp Far West diversion dam to protect and enhance the fishery resources in Bear Creek. The flows may be temporarily modified if required by operating emergencies beyond the control of the licensee, or for short periods for fishery management purposes, upon mutual agreement between the licensee and the California Department of Fish and Game. Gaging facilities shall be constructed according to the recommendations of the Geological Survey and shall be operational by April 15, 1989.[7]

2.1.5.2 Measures in Other Existing Licenses, Agreements and Contracts that Affect Project Operations

2.1.5.2.1 SSWD's Water Rights for Power (No Expiration Date)

SSWD holds a post-1914 appropriative water right for the purposes of operating the Project for hydroelectric power generation. Table 2.1-8 provides SWRCB designations and the key terms of the post-1914 appropriative water-right permit held by SSWD for power use.

[7] Article 29 in the initial license was amended in 46 FERC ¶62,088, Order Amending License, issued by FERC on January 26, 1989 to read as shown above.

Table 2.1-8. Water right permit held by SSWD for operation of the Camp Far West Hydroelectric Project for power generation.[1]

Priority (date)	SWRCB Designation (application)	SWRCB Designation (permit)	SWRCB Designation (license)	Source (Waterbody)	Rate, Amount & Season	Point of Diversion (powerhouse)
1/4/80	26162	18360	Not Issued Yet	Bear River	725 cfs Direct Diversion from 1/1 – 12/31	Camp Far West Dam Powerhouse
					103,100 ac-ft Storage from 10/1 – 6/30	

[1] SSWD's water rights include a Bay-Delta flow component as described in Section 5.2.3.

For the protection of fish and wildlife, SSWD's Permit 18360 identifies a minimum required release of 25 cfs during April 1 through June 30 and 10 cfs from July 1 through March 31. If the total inflow to Camp Far West Reservoir is less than the designated amount for a given period, SSWD shall bypass that quantity.

The time to complete beneficial use for Permit 18360 expired on December 1, 1995. SSWD submitted a request for licensing of Permit 18360 to the SWRCB Division of Water Rights on September 9, 1997, which is still pending.

SSWD operates the Project consistent with the terms and conditions of the above water right.

2.1.5.2.2 Water Supply Deliveries from the Bear River to SSWD's Service Area (No Expiration Date)

SSWD makes water deliveries from the Bear River and several small tributaries to its members within its service area consistent with SSWD's consumptive use water rights. Table 2.1-9 lists SSWD's post-1914 appropriative water-right licenses and permit for irrigation and domestic uses.

Table 2.1-9. Water rights held by SSWD for delivery to SSWD's members within its service area for irrigation and domestic uses.

Priority (date)	SWRCB Designation (application)	SWRCB Designation (license)	Source (Waterbody)	Purpose of Use	Rate & Amount	Season (period)	Place of Beneficial Use
6/13/41	10221	11120	Bear River	Irrigation, Domestic and Incidental Power [2]	250 cfs Direct Diversion	from 3/1 – 6/30 and from 9/1 – 10/31	59,000 ac within SSWD and 4,180 ac within CFWID
					40,000 ac-ft Storage	from 10/1 – 6/30	
5/12/52[1]	14804	11118	Bear River	Irrigation, Domestic and Incidental Power	330 cfs Direct Diversion	from 5/1 – 9/1	59,000 ac within SSWD and 4,180 ac within CFWID
					58,370 ac-ft Storage	from 10/1 – 6/30	
8/16/51	14430	4653	Coon Creek	Irrigation	2 cfs Direct Diversion	from about 4/1 – about 11/1	80 ac
4/12/65	22102	11121	East Side Canal, Coon Creek, Markham Ravine, and Auburn Ravine	Irrigation	40.3 cfs Direct Diversion 4,769 ac-ft per annum	from 4/1 – 6/15 and 9/1 – 10/31	4,000 ac

Table 2.1-9. (continued)

Priority (date)	SWRCB Designation (application)	SWRCB Designation (license)	Source (Waterbody)	Purpose of Use	Rate & Amount	Season (period)	Place of Beneficial Use
8/11/71	23838	12587	Yankee Slough	Irrigation	1.35 cfs Direct Diversion 143 ac-ft per annum	from 4/1 – 6/30 and 9/1 – 9/30	235 ac

[1] SSWD received a release from priority from Applications 5633 and 5634 for Application 14804.
[2] Incidental Power is identified as a purpose of use for Applications 10221 and 14804. The powerhouse listed in the place of use for these applications is a hydroelectric facility located along SSWD's main canal.

SSWD delivers this water from the Bear River via its Main Canal, which is located on the Bear River about 1.2 mi downstream of Camp Far West Dam (Figure 2.1-5).

Identical to the required fish release for SSWD's power permit, Applications 10221 and 14804 identify minimum required releases of 25 cfs during April 1 through June 30 and 10 cfs from July 1 through March 31. If the total inflow to Camp Far West Reservoir is less than the designated amount for a given period, SSWD shall bypass that quantity. These required fish releases are not additive.

2.1.5.2.3 Bay-Delta Bear River Voluntary Agreement (Expires December 31, 2035)

In February 2000, after prolonged negotiations, SSWD, DWR and the CFWID entered into the Bear River Settlement Agreement (DWR, SSWD and CFWID 2000) with the objective of settling the responsibilities of SSWD, CFWID, and all other Bear River water rights, to implement the standards in the SWRCB's May 22, 1995 *Water Quality Control Plan for the San Francisco Bay/ Sacramento-San Joaquin Delta Estuary*.

To incorporate this settlement agreement into SSWD's water rights, in July 2000, the SWRCB issued Order 2000-10 that amended SSWD's Water Right Licenses 11120 and 11118 to provide that:

> During releases of water in connection with the change of purpose of use and place of use of up to 4,400 acre-feet transferred to DWR during dry and critical years,[8] Licensee shall increase flows in the lower Bear River by no more than 37 cfs from July through September. To avoid stranding impacts to anadromous fish in the Bear River below Camp Far West Reservoir, Licensee shall, by the end of a release period from the reservoir in connection with said change, ramp down flows from the reservoir at a rate not to exceed 25 cfs over a 24-hour period.

[8] The Bear River Settlement Agreement and SWRCB Order 2000-10 state: *"Dry and critical years are defined, for purposes of this order, as set forth on page 23 of the Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary (Adopted by the SWRCB in May, 1995), except that such years do not include a year in which water storage in Camp Far West Reservoir on April 1 is at or below 33,255 acre-feet ("extreme critical year")."*

The required flow volume is in addition to the minimum flow requirement in the Project license, and is measured immediately downstream of the diversion dam as spill over the diversion dam (i.e., SSWD installs notched boards on the diversion dam and controls the elevation of the diversion dam impoundment to provide the required flow).

As shown in Table 2.1-10, SSWD has met the requirements in the Bear River Settlement Agreement and in its amended water rights in each "Dry" and "Critically Dry Year", as defined in the agreement. Transfers are not required in non-"Dry" and "Critically Dry" years. In each transfer year, DWR compensated SSWD for the amount of water transferred.

Table 2.1-10. Years in which SSWD has met the requirements in the Bear River Settlement Agreement and in its amended water rights.

Year	Was Year "Dry" or "Critically Dry" Based on the Bear River Settlement Agreement[1]	Amount of Water Transferred to DWR in "Dry" and Critically Dry" Years in Accordance with the Bear River Settlement Agreement[2]
2000	No	Transfer Not Required
2001	Yes	4,137
2002	Yes	3,882
2003	No	Transfer Not Required
2004	No	Transfer Not Required
2005	No	Transfer Not Required
2006	No	Transfer Not Required
2007	Yes	4,644
2008	Yes	4,425
2009	Yes	4,423
2010	No	Transfer Not Required
2011	No	Transfer Not Required
2012	No	Transfer Not Required
2013	Yes	4,402
2014	Yes	4,400
2015	Yes	4,471
2016	No	Transfer Not Required
2017	No	Transfer Not Required
2018	No	Transfer Not Required

1 The SSWD/SWRCB/DWR Bear River Settlement Agreement and SSWD's amended water rights define "Dry" and "Critically Dry" years as determined by the Sacramento Valley 40-30-30 Index.

2 The SSWD/SWRCB/DWR Bear River Settlement Agreement and SSWD's amended water rights stipulate that SSWD will transfer up to 4,400 ac-ft of water to DWR in "Dry" and "Critically Dry" years, and DWR will compensate SSWD for the volume of the transfer at an agreed upon cost per ac-ft.

SWRCB's Order 2000-10 states that this arrangement would terminate upon the termination of the Bear River Settlement Agreement on December 31, 2035, or sooner if the agreement is terminated sooner.

2.1.5.2.4 Water Supply Contracts (No Expiration Date)

SSWD and CFWID entered into an Agreement in 1957 and a Supplemental Agreement in 1973, relative to the construction and subsequent enlargement of Camp Far West Reservoir. Under the Agreement, SSWD provides CFWID the first 13,000 ac-ft of water from the Reservoir each year to satisfy CFWID's senior water rights along the Bear River. A summary of CFWID's water rights are provided in Table 2.1-11. No other active water rights[9] are identified downstream of Camp Far West Dam along the Bear River.

Table 2.1-11. Water rights held by CFWID, downstream of Camp Far West Dam.

Priority (date)	SWRCB Designation (application)	SWRCB Designation (license)	Source (Waterbody)	Purpose of Use	Amount & Place of Diversion or Storage (amount & place)	Season (period)	Place of Beneficial Use
4/1/1918	959	385	Bear River	Agricultural Use	13.24 cfs Direct Diversion	from 4/1 to 10/1	A net irrigable area of 4,445 acres within a gross area of 5,045 acres consisting of 4,732 acres within the boundaries of CFWID and 313 acres outside of CFWID
6/13/1922	2881	2266	Bear River	Irrigation	5,000 ac-ft Storage per annum[1]	from 3/1 to 5/1	
2/11/1924	3843	2267	Bear River	Irrigation	11.76 cfs Direct Diversion	from 5/1 to 10/1	
4/28/1941	10190	2740	Bear River	Irrigation	5,000 ac-ft Storage per annum[1]	from 5/1 to 6/1	

[1] The maximum annual quantity diverted under Licenses 2740 and 2266 shall not exceed 5,000 ac-ft per annum.

2.1.5.2.5 Water Transfers

In recent years, SSWD has participated in water transfers of water held in storage in Camp Far West Reservoir. Transfers have occurred in 2008, 2009, 2010, 2014, 2015, and 2018. Table 2.1-12 summarizes the approximate volumes of water released for transfer in each of these years. In each year, transfer water was released from Camp Far West Dam in the months of July, August, and September. Transfer water flowed over the non-Project diversion dam and down the Bear River, was conveyed across the Sacramento-San Joaquin River Delta, and was subsequently pumped out of the southern Delta at facilities owned and operated by the State Water Project (SWP) or the Central Valley Project (CVP). The decision on whether to participate in voluntary water transfers is made each year, when there are potential buyers, by the SSWD Board of Directors. It is unknown whether SSWD will participate in future water transfers.

Table 2.1-12. Annual SSWD water transfers in recent years.

Water Year	Total Volume Released for Transfer (ac-ft)
2008	7,100
2009	10,000
2010	10,000
2014	10,000
2015	6,000
2018	10,590

[9] An Initial Statement of Water Diversion and Use was filed in 1978 in support of a riparian and pre-1914 water right claim; however, the SWRCB currently lists Statement S009549 as inactive.

2.1.5.2.6 SMUD Power Purchase Contract (Expires July 1, 2031)

In August 1991, SSWD and SMUD entered into a Contract for the Sale and Purchase of Electricity of the power generated at the Camp Far West Powerhouse. Under the contract, SMUD reimburses SSWD for the construction of the Camp Far West Powerhouse and associated power facilities, SMUD operates the powerhouse under a lease, and SMUD receives all the power from the powerhouse by paying for the power at a fixed rate. The contract expires on July 1, 2031.

SMUD receives Renewable Energy Credits for power generated at Camp Far West Powerhouse through the California Energy Commission. The powerhouse is registered under California Energy Commission Plant ID H0083.

2.1.6 Facility Maintenance

2.1.6.1 Camp Far West Powerhouse Maintenance

SMUD conducts annual mechanical and electrical inspections and maintenance at the Camp Far West Powerhouse to verify the structural and/or functional integrity of the facilities and to identify conditions that might disrupt operations. The Camp Far West Powerhouse unit is offline to support planned outages for approximately 2-3 weeks in the September/October period. During an unplanned outage, such as when the unit trips offline, water flows to the low-level outlet. Depending on maintenance work needed on the tunnel and penstock, it can be dewatered by closing the intake gates.

2.1.6.2 Other Facility Maintenance

Routine maintenance activities conducted in the vicinity of Project Facilities include vegetation management, pest management, road and trail maintenance, maintenance of communication facilities, debris management, and facility painting. Each of these activities is described below.

2.1.6.2.1 Vegetation Maintenance

Vegetation management, manually using hand tools and chemically by the use of herbicides, is implemented by SSWD at Project Facilities. Vegetation management is completed throughout the Project Area as necessary to reduce fire hazard, to provide for adequate Project Facility access and inspection, to protect Project Facilities, and to provide for worker and public health and safety. In general, vegetation management is implemented within about 75 ft of the powerhouse and switchyard; within about 15 ft on either side of roads and trails to Project Facilities; and within recreation areas.

Vegetation management occurs both by hand trimming and herbicides. Hand trimming includes trimming grasses and forbs using string trimmers, and removal or trimming of overhanging shrubs and tree limbs using a chain saw or other handheld saw or clippers. These management activities are conducted as needed in conjunction with facility inspections.

Herbicides, in combination with surfactants, are used in combination with hand trimming vegetation management activities on an annual basis at Project Facilities located on SSWD-owned property. All herbicide applications are supervised by a Qualified Applicator with direction of a licensed Pest Control Advisor (PCA). The PCA prepares Pest Control Recommendations (PCR) consistent with the specific herbicide label(s) for each site prescribing specific application direction and associated precautions that must be strictly followed. All-terrain vehicles, other vehicles (pick-up trucks), backpack sprayers, or small hand-held sprayers are used to apply herbicides. Herbicide application occurs, at a minimum, twice annually. These applications occur between December 1 and March 31, as determined by the PCA for pre-emergent plants, and seasonally dependent, typically occurring between April 1 and June 30. This cycle is for follow-up visits to apply post-emergent herbicide application and/or additional treatments as needed. A third cycle, if required, is completed between July 1 and October 14.

2.1.6.2.2 Hazard Trees

Hazard trees, generally defined as dead or dying trees or trees with defects that may result in failure and have the potential to cause property damage, personal injury, or death, are removed as needed. Removal is conducted with a chainsaw, handheld saw, or other equipment. Smaller diameter debris from felled hazard trees is either chipped or lopped and scattered. Downed logs are typically left onsite and only moved if needed for safety. If moving logs is necessary, it may be completed by hand or machine depending on the situation.

2.1.6.2.3 Vertebrate Pest Management

SSWD implements rodent control as needed in facility interiors using an integrated pest management approach that includes sanitation and exclusion. General use of rodenticides, applied in accordance with the label instruction, may be used when necessary.

2.1.6.2.4 Road Maintenance

Regular inspection of the Project access roads occurs during the course of day-to-day Project activities. Road maintenance on Project and shared roads occurs as needed. Maintenance generally includes, but is not limited to, the following types of activities: debris removal; filling potholes; grading, sealing, and surfacing; maintenance or replacement of erosion control features (e.g., culverts, drains, ditches, and water bars); repair, replacement, or installation of access control structures such as posts, cables, rails, gates, and barrier rock; and repair and replacement of signage. Vegetation management may be conducted concurrently with road maintenance.

2.1.6.2.5 Facility Painting

SSWD paints the exterior of Project Facilities, including the powerhouse and ancillary facilities as needed.

2.1.6.2.6 Recreation Facilities Maintenance

SSWD, through a concessionaire, routinely maintains the Project recreation facilities at the North and South Shore recreation areas. Typical routine maintenance activities include litter and trash collection, lowering/raising the boat launch docks as the water level changes, fire pit cleaning and ash removal, cleaning and maintaining restroom buildings, gate and traffic control maintenance, keeping roadways and parking areas clear of debris, and public signage maintenance. In addition, SSWD routinely maintains and tests the water supply system and sewage treatment ponds with aerators that serve the flush restroom buildings and RV sanitary dump stations at both recreation areas.

2.2 Proposed Changes to the Existing Project

2.2.1 Changes to Existing Project Facilities and Features

SSWD proposes three general changes to existing Project facilities: 1) raising the NMWSE of Camp Far West Reservoir by 5 ft from an elevation of 300 ft to an elevation of 305 ft;[10] 2) modifications to Project recreation facilities at Camp Far West Reservoir; and, 3) addition of a single Primary Project Road. In addition, SSWD proposes a slight modification to the existing FERC Project Boundary. Each of these is discussed below.

2.2.1.1 Camp Far West Reservoir Pool Raise

Recent aerial surveying and topographic mapping shows that Camp Far West Reservoir stores 93,737 ac-ft of water at its existing Camp Far West Reservoir NMWSE of 300 ft. This is roughly 10 percent less than anticipated when the dam was enlarged in 1964, and the amount authorized in SSWD's water rights. Therefore, SSWD proposes to raise the NMWSE of Camp Far West Reservoir by 5 ft to an elevation of 305 ft. The Pool Raise would increase Camp Far West Reservoir storage by 9,836 ac-ft to a capacity of 103,573 ac-ft at Camp Far West Reservoir's new NMWSE of 305 ft. When the Pool Raise is complete, the auxiliary spillway in combination with the modified existing spillway will have a combined capacity of 126,600 cfs at a water surface elevation of 318.5 ft.

2.2.1.1.1 Anticipated Facilities

The Pool Raise would involve demolition of the concrete cap on the existing Camp Far West Dam spillway, the addition of approximately 1,730 cy of concrete to raise the existing spillway crest from an elevation of 300 ft to an elevation 305 ft, and anchoring of the new concrete with steel dowels. The spillway design would not change from its existing reinforced concrete, ungated, ogee-type weir and the existing 300-ft crest length will not change. In addition, no changes would be required to the ongoing spillway modification. Figure 2.2.-1 is a general conceptual-level plan showing the details of the Pool Raise. Figures 2.2-2 and 2.2-3 show

[10] For the purpose of this exhibit, this is referred to as the "Pool Raise."

profiles of the existing spillway and Blackford Road profiles. Figure 2.2-4 shows additional typical sections of the existing spillway. When the Pool Raise is complete, the auxiliary spillway in combination with the modified existing spillway will have a combined capacity of 126,600 cfs at a water surface elevation of 318.5 ft.

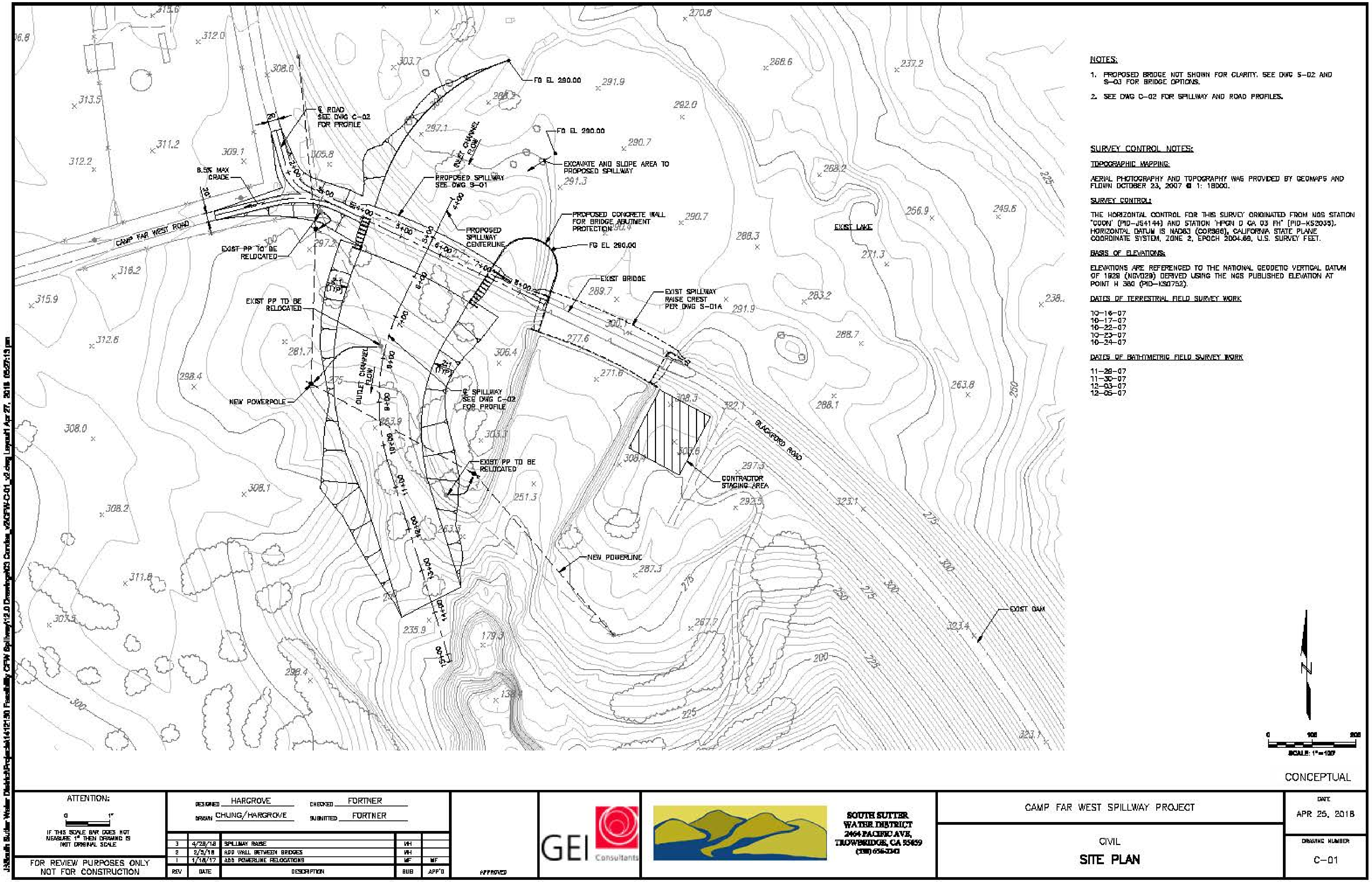

Figure 2.2-1. Conceptual level plan for Camp Far West Reservoir Pool Raise – general plan.

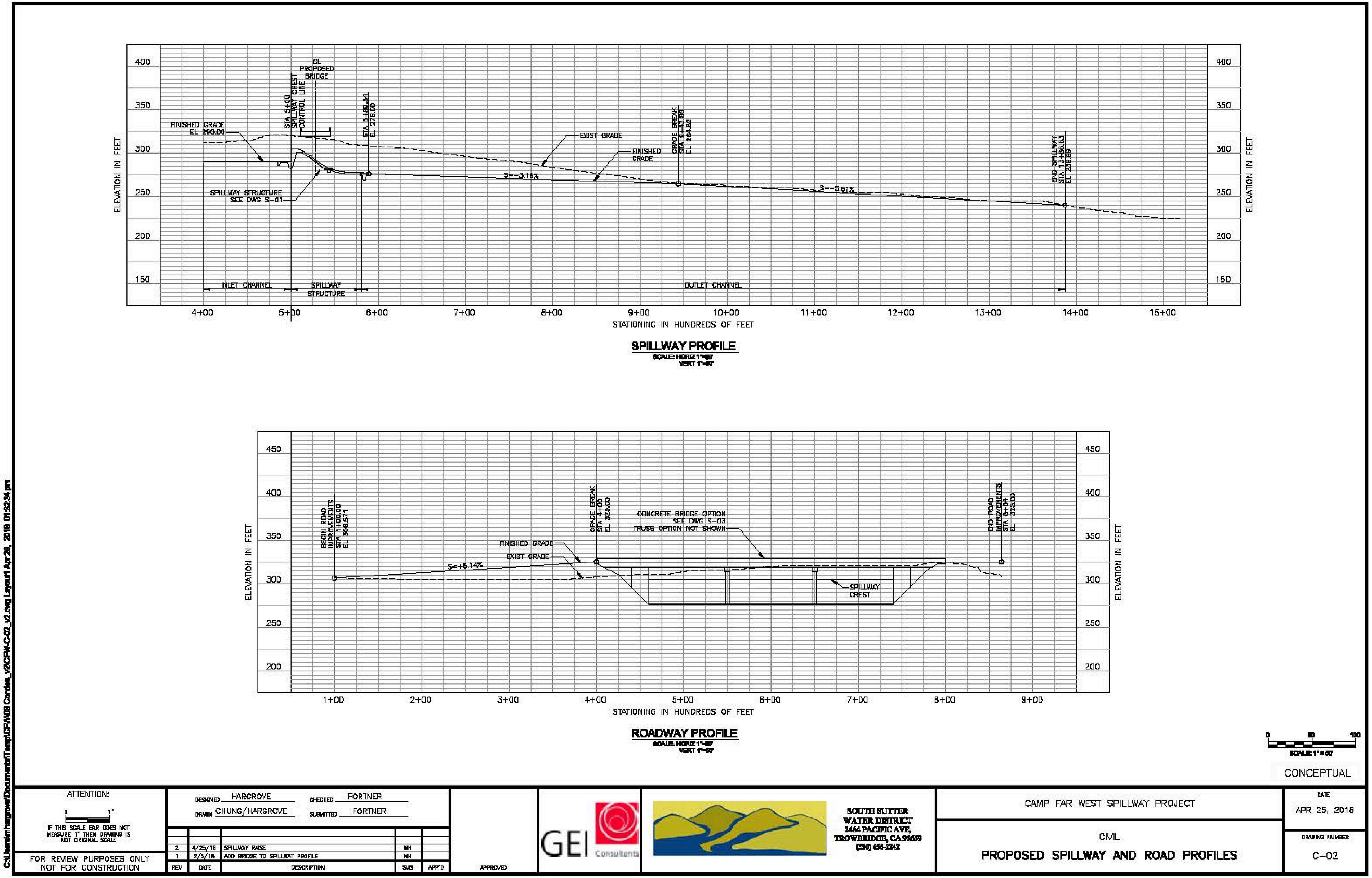

Figure 2.2-2. Conceptual level plan for Camp Far West Reservoir Pool Raise – spillway and road profiles.

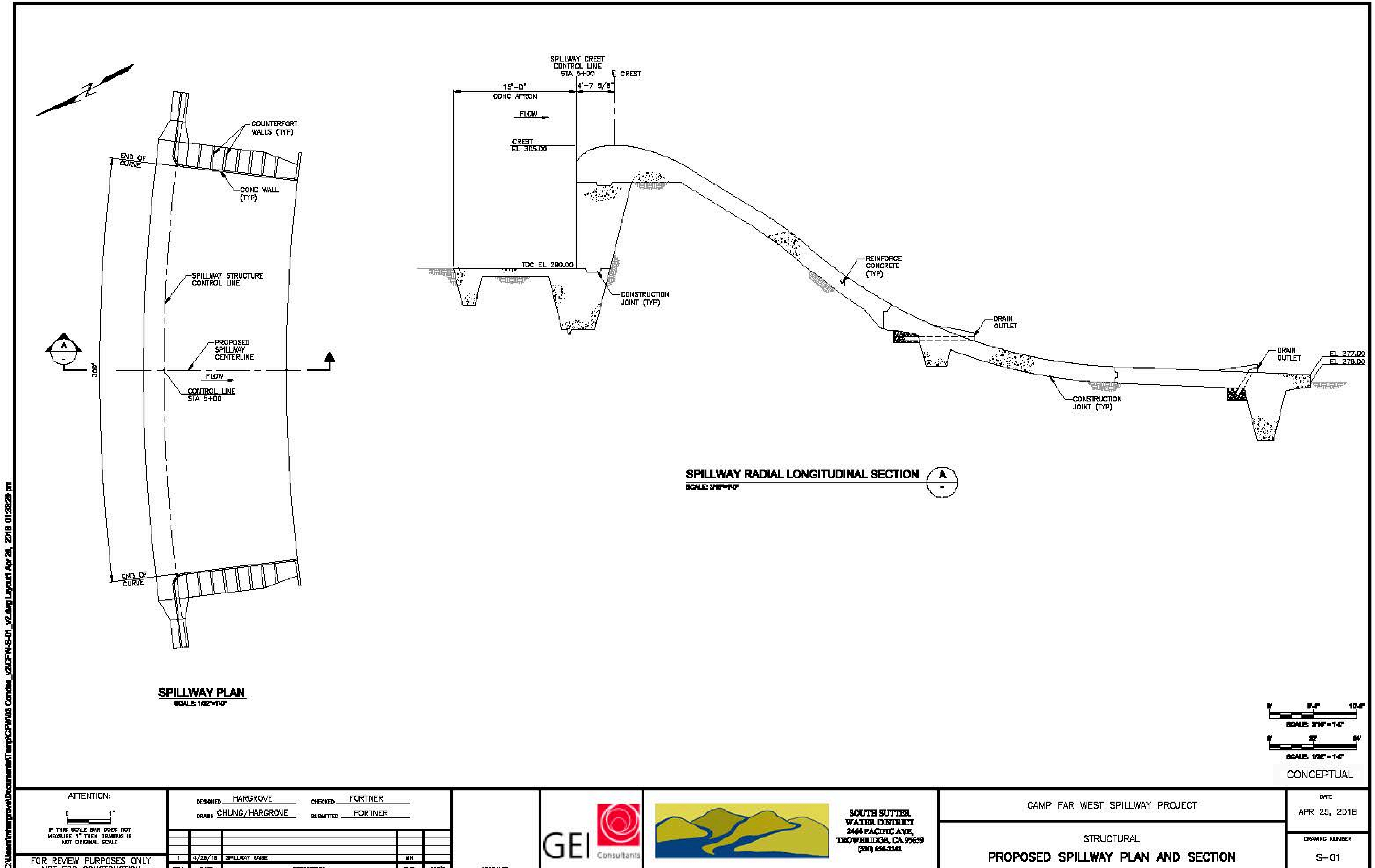

Figure 2.2-3. Conceptual level plan for Camp Far West Reservoir Pool Raise – spillway and road typical sections.

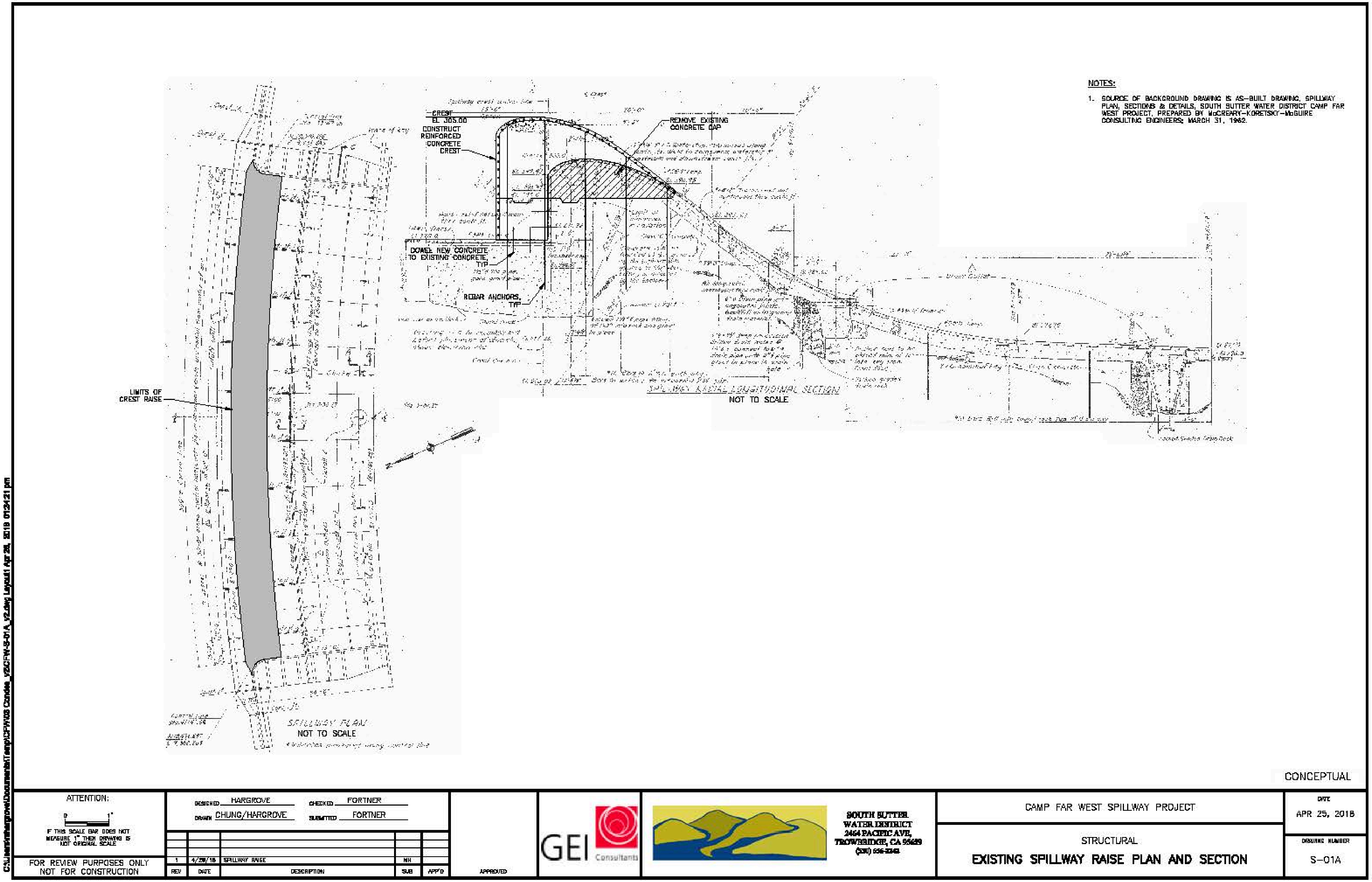

Figure 2.2-4. Conceptual level plan for Camp Far West Reservoir Pool Raise - spillway typical section.

2.2.1.1.2 Anticipated Construction

The existing spillway crest modifications to facilitate the pool raise would involve demolition of the existing concrete cap, the addition of 1,730 cu yd of concrete to raise the spillway crest from an elevation of 300 ft to an elevation 305 ft, and anchoring of the new concrete with steel dowels. The spillway design would not change from its existing reinforced concrete, ungated, ogee-type weir and the existing 300-ft crest length will not change.

Construction Laydown and Staging Areas

A contractor staging area would be located south of Blackford Road, immediately adjacent to the auxiliary spillway. Activities at the staging area would include parking for concrete trucks and other construction vehicles, temporary storing of material (e.g., rebar for new concrete crest and demolished concrete), and meetings. At this time, SSWD anticipates the staging area will encompass 3.71 ac (Figure 2.2-5).

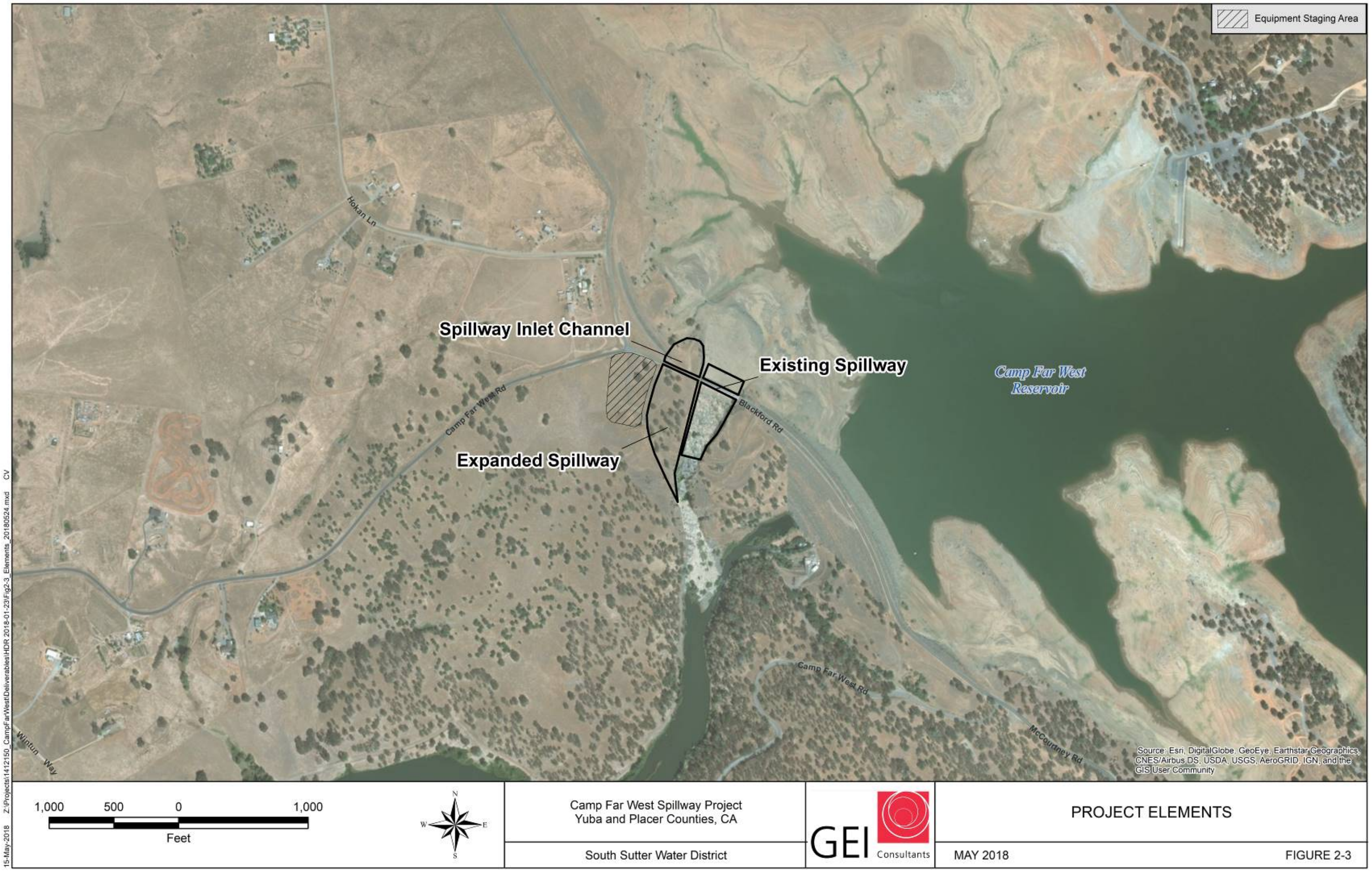

Figure 2.2-5. Anticipated construction laydown area and staging area for the Pool Raise.

Construction Borrow and Disposal Areas

Concrete would be brought from offsite (within 100 miles) thus there will be no on-site borrow areas associated with the Pool Raise. Steel needed for pool raise would be transported from Sacramento, CA. The approximately 550 cy of demolished concrete, rebar, and any other material from the spillway cap removal would be disposed of at an approved off-site facility that accepts construction waste, such as at the Western Regional Sanitary Landfill in Placer County, CA, which is permitted to receive construction waste in the quantities anticipated and is located within 50 miles of the Project (WPWMA 2018). Location and disposal of hazardous waste materials is not expected to occur for the Pool Raise.

Construction Roads and Traffic Considerations

Construction-related traffic would be spread over the duration of the Pool Raise work. During this period, the existing bridge over the spillway would likely be closed to through-traffic and detours around the dam may be required. During construction and the bridge closure, local residents would use McCourtney Road and then Riosa Road to access Highway 65 for north-south travel to Wheatland and the Sacramento areas (Figure 2.2-6). Closures and detours would be coordinated with Yuba County. The bridge would be permanently reopened following completion of the Pool Raise. There would be no work within the reservoir or the construction of any additional haul routes for the existing spillway modifications for the Pool Raise.

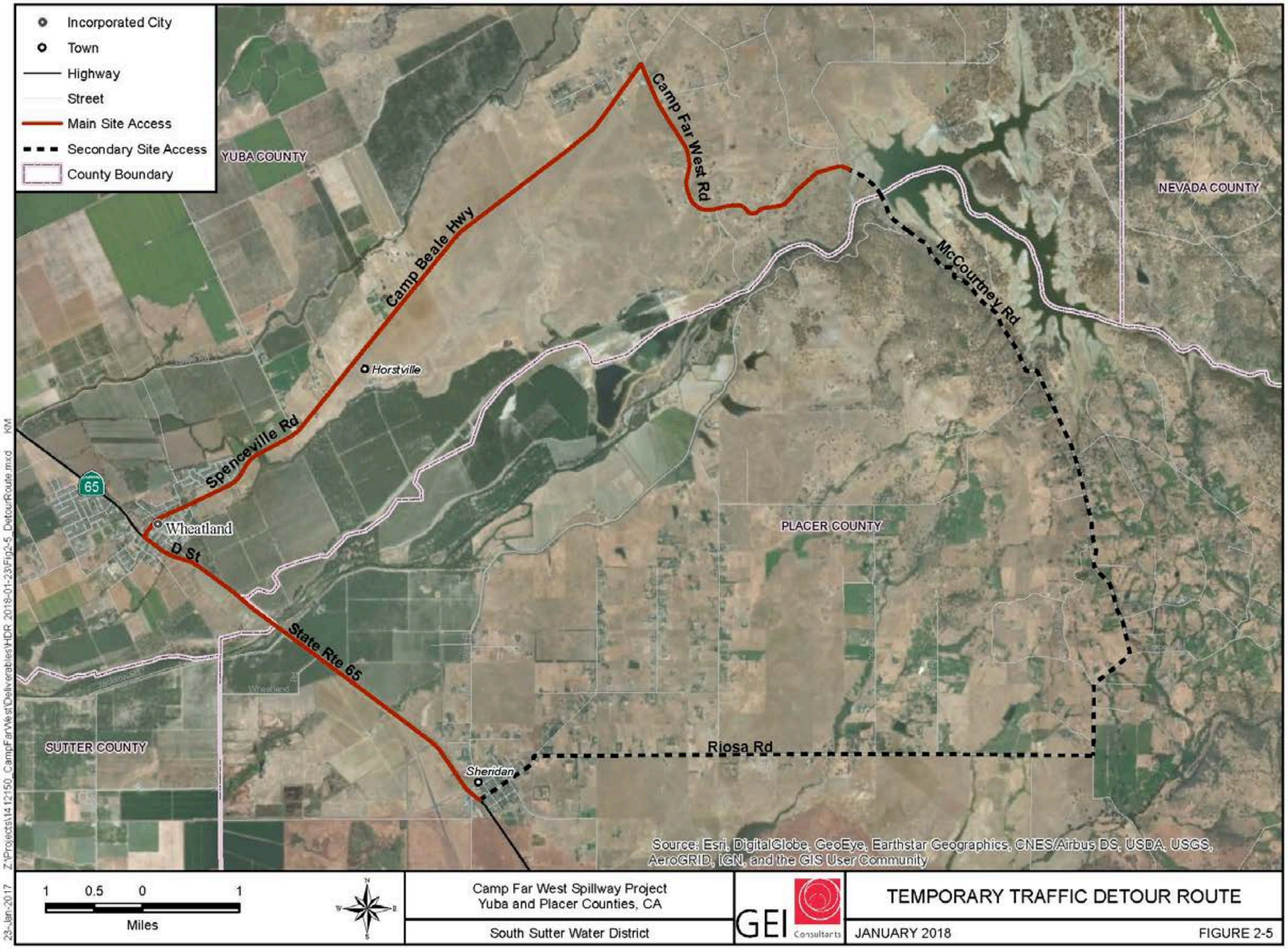

Figure 2.2-6. Anticipated traffic detour route during construction of the Pool Raise.

Construction Sequences and Schedule

At this time, SSWD anticipates that planning, design, and construction would take approximately 2 years to complete. The typical construction sequence and duration for this type of work is shown in Table 2.2-1. The major activities are discussed below.

Table 2.2-1. Draft preliminary schedule for construction of the Pool Raise.

Task #	Task Name	Duration
1	**Complete Pool Raise Design**	**585 days**
1.1	Seismological Investigation	45 days
1.2	Geotechnical Investigation	90 days
1.3	Geotechnical Data Evaluation	45 days
1.4	Agency Consultation on Engineering Evaluation	60 days
1.5	Preliminary (30%) Design & Specifications	120 days
1.6	Draft 60% Design & Specifications	90 days
1.7	Draft 90% Design & Specifications	90 days
1.8	Final (100%) Design & Specifications	45 days
2	**Complete Environmental Permitting and Obtain Regulatory Approvals**	**150 days**
2.1	Notify adjacent landowners of upcoming pool raise	1 day
3	**Onsite Kickoff Meeting**	**1 day**
4	**Site Preparation**	**126 days**
4.1	Pre-Construction Meeting	2 days
4.2	Prepare Site for Demolition and Set Traffic Control	3 days
4.3	Demolishing and Removal of Waste	7 days
4.4	Prepare Foundation for New Concrete	5 days
4.5	Construct Forms for New Concrete	7 days
4.6	Install Rebar and Pour New Concrete	97 days
4.7	Relocate Inundated Recreation Facilities	90 days
5	**Site Cleanup and Restoration**	**1 day**
5.1	Site Cleanup and Restoration	1 day
	Total	**863 days**

[1] All work related to the recreation facilities relocation and described below in Section 3.1.5.9 will take 90 days overall. However, the work will occur in phases throughout 1 full calendar year to minimize any impacts to the recreation area visitors and experiences -- mostly outside the peak recreation season (i.e., Memorial Day through Labor Day holiday weekends). Refer to Section 3.3.6.2.1 in Exhibit E of this Application for New License for additional details.

<u>Seismological Investigation</u>

Seismological data would be to provide estimates on strong ground motion and seismic design parameters for the existing spillway. A review of surface-fault rupture hazard would be performed using existing California Geological Survey and USGS reports on active faults in the vicinity of the planned structure. SSWD would develop a database of historical and recent seismicity in the region to assess the controlling seismic source(s) for deterministic ground motion assessment. The evaluation of site seismicity would include the following critical parameters:

- The distance to the closest seismic source
- The specific geometry of the seismic source in the Project area
- The maximum expected earthquake magnitude
- Deterministic and probabilistic response spectra

SSWD would prepare a detailed Subsurface Exploration Work Plan for geotechnical investigations. The investigations would focus on exploring the thickness of overburden, depth to competent bedrock, and engineering characteristics of the soil and rock beneath the existing spillway and bridge abutments. The work plan would describe locations of geotechnical explorations, samplings details, and other field exploration activities. A laboratory testing plan would be included in the work plan detailing the types and numbers of laboratory tests to be performed during subsurface investigations. The work plan would include any permits or access approvals needed to conduct the investigations, and methods for restoration of all areas disturbed by the field investigation.

The investigation program would consist of borings and test pits. Exploration locations and depths may be adjusted based on conditions encountered during the subsurface investigations. Access constraints and logistics would be further evaluated during preparation of the work plan. Site terrain may require track-mounted drilling equipment. The work plan would include the use of drilling and sampling equipment suitable for the site constraints, thus minimizing the need for access improvements.

All soil and rock samples collected from the borings and test pits would be carefully logged, labeled, and photographed. Exploratory borings would be continuously logged, describing the types and characteristics of the material encountered. Soils would be described in accordance with American Society for Testing and Materials (ASTM) D2487 Classification of Soils for Engineering Purposes and ASTM D2488 Description and Identification of Soils. Rock core samples would be identified and described based on standards developed by the International Society of Rock Mechanics (ISRM 1981) and Bureau of Reclamation (2001). The borehole logs would include complete descriptions of materials encountered, including the frequency and orientation of fractures and joints, as well as additional relevant field information, such as fluid loss or penetration rates. Additionally, Core Recovery (REC) Rock Quality Designation (RQD) would be recorded and presented on boring logs based on procedures described in Deere and Deere (1989). The remaining samples and cores would be stored until completion of construction. Field logs would be prepared by the field logger, which would be reviewed by a senior geologist and input into a gINT log format for finalization.

Drill cuttings and fluid from the borings would be collected in 55-gallon drums or roll-away bins for testing and disposal. The cuttings would be hauled off-site for disposal after completion of laboratory testing. It is assumed that the cuttings would not contain hazardous or toxic material. All drilling and sampling activities would be performed at the direction of a qualified geologist licensed in the State of California. A field engineer or geologist would supervise all drilling and sampling, and will log the soil and rock in accordance with ASTM standards.

The laboratory testing program would be finalized during implementation of the subsurface exploration program. It is assumed that index testing would include sieve analysis, Atterberg Limits, specific gravity, and bulk density to be performed on samples collected from the site. Additionally, unconfined compression tests would be performed on bedrock samples collected from within the preliminary footprint of the concrete spillway and bridge abutments.

<u>Geotechnical Investigation</u>

A geotechnical evaluation would be prepared to support the Pool Raise design. The evaluation would cover the methods and results of the necessary work needed to perform for the investigation, provide key graphics, and summarize the findings, conclusions, and recommendations. The evaluation would include the following:

- Detailed site map showing all investigations
- Boring logs, test pit logs, and laboratory results
- Updated site geologic map and two preliminary geologic cross sections oriented normal and parallel to the spillway alignment.
- Evaluation of design parameters

Design

SSWD would coordinate with FERC and DSOD at the 30 percent, 60 percent, 90 percent and final design milestones. SSWD would prepare a Final Design Report that would include detailed hydraulic, geotechnical and design evaluation. The final design documents would be submitted to FERC and DSOD for final approval/acceptance. A 60 percent design (draft of the final design) would be provided to FERC and the California Division of Safety of Dams (DSOD) for review and approval. Following approval of the 60 percent design, SSWD would advertise the work for bid and contractor selection.

Obtain Permits and Approvals

SSWD would consult with FERC, federal, state and local agencies to discuss the Pool Raise's permitting/approval needs, including any necessary ground-disturbing investigations. Table 2.2-2 list permits and approvals that may be required.

Table 2.2-2. Anticipated permits and approvals that may be needed for the Pool Raise.

Permit/Approval	Issuing Body
Approval for inclusion in the License	FERC, including SWRCB's issuance of Clean Water Act Section 401 Water Quality Certification for FERC's issuance of the new license. Compliance with both NEPA and CEQA would be required. It is assume d SSWD would be the lead agency for CEQA compliance.
Clean Water Act Section 404 Permit	U.S. Army Corps of Engineers – Nationwide Permit (NWP) #3 [Maintenance] and #7 [Outfall Structures & Associated Intake Structures]
Clean Water Act Section 401 Water Quality Certification for Construction	Central Valley Regional Water Quality Control Board or State Water Quality Control Board
Section 1600 Streambed Alteration Agreement	California Department of Fish and Wildlife
Endangered Species Act – Section 7 Consultation	U.S. Fish and Wildlife Service. FERC or the USACE would be the lead agency for consultation. A biological opinion may be needed.
Endangered Species Act Incidental Take Permit	California Department of Fish and Wildlife
National Historic Preservation Act, Section 106	State Historic Preservation Office and Native Americans. FERC or the USACE would be the lead agency for consultation.
Endangered Species Act Incidental Take Permit	California Department of Fish and Wildlife
Grading permits	Counties of Sutter, Yuba and Nevada
Clean Water Act Section 402 (National Pollution Discharge Elimination System)	Central Valley Regional Water Quality Control Board
Stormwater Pollution Prevention Plan	Central Valley Regional Water Quality Control Board
Other Approvals	California Division of Safety of Dams, FERC

On-Site Kick Off Meeting to Discuss Logistics, Work Sequence and Safety

A pre-construction meeting will be held with the construction contractor to discuss construction related activities including schedule, work sequencing, environmental requirements, temporary facilities, staging areas, parking, site access, traffic control, and various other items.

Prepare Site for Demolition, including Traffic Control

The following activities are expected to be performed to prepare for demolition work required for the existing weir:

- Set-up project notification and warning signs in accordance with Caltrans Unified Traffic Control Devices Manual Devices (MUTCD) and Yuba County standards at locations along the east and west approaches of Blackford Road to notify on-coming traffic of construction being conducted at the site.
- Provide traffic control as needed for deliveries and hauling of materials to and from the site.
- Set-up staging areas, including staging area near southeast side of existing bridge on Blackford Road.
- Set-up all environmental and safety controls.
- Construct access ramps to existing spillway.
- Move demolition tools and equipment to the existing weir area and set-up.

Demolition of Existing Weir, and Removal of Waste

The following activities are expected to be performed for the removal of the existing weir:

- Sawcut a minimum of 12" existing weir at elevation 295 on the vertical upstream face of the weir at elevation 295.71 on sloped downstream face of the weir. Sawcuts shall be perpendicular to the face of the weir.
- Stop sawcuts a minimum of 6-inches from longitudinal joints. Chip out concrete around waterstop and protect and preserve a minimum of 6-inches of the waterstop in the joints.
- The remaining concrete on the weir may be removed by hydroblasting or hydrodemolition. Removing concrete by hammering or percussion means shall not be allowed.
- All concrete removal by hydrodemolition and water used shall be contained and disposed of off-site.

Prepare Foundation for New Concrete

The following activities are expected to be performed for the preparation of the foundation for the new concrete:

- Surfaces of all existing concrete against which new concrete will be placed shall be roughened to a minimum of 0.25 inch amplitude.
- Within 48 hours prior to placement of new concrete, use low-pressure water jetting to remove all loose materials and rust at existing reinforcement.

- Protect exposed existing waterstops from sun exposure and damage during reinforcement installation procedures.
- Protect reinforcement after removal of existing concrete to preclude rust forming on the ends of exposed reinforcement.

Construct Forms for New Concrete

The following activities are expected to be performed for constructing forms for the concrete:

- Formwork shall be designed by an engineer licensed in the state of California and shall support all concrete placement loads.
- Formwork may consist of wood or steel; aluminum formwork or accessories shall not be allowed.
- Formwork shall be designed for placement of concrete in 2 lifts.

Install Rebar and Pour New Concrete

The following activities are expected to be performed for the installation of the new rebar and concrete:

- All reinforcement shall consist of 60 ksi reinforcement.
- Vertical anchor dowels shall consist of #10 bars and shall be placed in 2-inch diameter grouted holes with a minimum embedment as shown on the drawings and shall be located at 6-feet on-center each way in each section of the crest.
- Edge distance from joint to vertical anchors shall be a minimum of 6-inches and shall not exceed 12-inches.
- Vertical anchor dowels may be mechanically coupled above the surface of the concrete removal and above the existing apron with Engineer approved mechanical couplers.
- Anchor dowels shall have a 135-degree hook that connects with the reinforcement mat to be placed at the surface of the new structure.
- Dowels placed between new and existing concrete shall consist of #5 bars and shall be placed in 1-1/2-inch diameter holes with a minimum embedment of 8-inches and shall be located at 12-inches on center each-way in each structure.
- Place #5 dowels as shown to match existing longitudinal reinforcement.
- Edge distance from joint to dowels shall be a minimum of 6-inches and shall not exceed 12-inches.
- Roughen hole surfaces by means of a wire brush and remove loose materials prior to grouting all dowels.
- Place 9-inch waterstops per manufacturer's requirements at each contraction joint to match existing waterstops. Weld new waterstops to existing waterstops per manufacturer recommendations.

- Place new #5 vertical longitudinal bars in first concrete lift to elevation 295 and allow for Type A lap with vertical bars from second and final lift in accordance with ACI 318.
- Horizontal #4 bars at 12-inches on-center shall be lapped as needed in crest sections and shall not extend through contraction joints.
- Minimum cover for all reinforcement shall be a minimum of 3-inches.
- Concrete shall be placed in 2 lifts the first lift to elevation 295 and the second lift to complete crest structure.
- Concrete mix design:
  - Minimum 28-day strength of 4,000 psi
  - Shall have a maximum aggregate size of 0.75
  - All aggregate shall be proven to conform to ASTM C1567 for alkali reactivity
  - Type II/V low alkali cement shall be used
  - Class F Fly Ash may be used up to a 20 percent replacement of cementitious materials to reduce heat of hydration in concrete
  - Air entrainment shall be a minimum of 6 percent
  - Maximum water/cement ratio of 0.45
  - All admixtures shall be compatible and shall not contain any chlorides
  - Maximum slump of concrete shall not exceed 3-inches.
- Roughen surface of first lift to be in contact with second lift to a 0.25 inch amplitude and remove all laitance and loose materials prior to placement of final concrete lift.
- All concrete placement work shall conform to ACI 305R and 306R hot and cold weather placements of concrete.
- Both lifts are categorized as mass concrete placements and shall be placed in accordance with ACI 207.1 to prevent thermal cracking.

Recreation Facilities Relocation

As a result of the Pool Raise, 104 recreational facilities or site features would be impacted along the shoreline at the NSRA and SSRA. Most of the impacted features (i.e., 59%) would be directly impacted by the pool raise by either partially or fully inundating the features. In these instances, the inundated features would be relocated, re-routed or re-aligned to avoid inundation. The remaining impacted features (i.e., 41%) would be indirectly impacted, whereby the Pool Raise would not inundate the feature, but would closely abut the feature likely resulting in flooding and/or erosion impacts to the features due to wind, wave or high flow events. In a few instances, a feature would be indirectly impacted and require relocation because an inundated segment of a circulation road would likely be re-aligned through these features. The construction work to relocate, re-route or realign the impacted features would be completed in one calendar year. Overall, the majority of the construction would occur outside the peak recreation season (i.e., Memorial Day through Labor Day holiday weekends). In instances where construction would be necessary during the peak season, the work would be restricted to select areas and conducted during low-use periods (i.e., weekdays) to minimize any impacts to the recreation facilities and visitor experiences.

At NSRA, 57 site features would be impacted, including 21 campsite living spaces (i.e., table and/or grill area), 19 campsite vehicle spurs, 13 circulation road segments (i.e., 2,410 ft of dirt roads and 480 ft of paved roads), 2 boat ramp and parking area segments, 1 picnic site, and 1 water hydrant. The majority of the impacted recreational site features at NSRA would be at the family campground (i.e., 43 impacted features) followed by the dispersed use areas (i.e., 6 impacted features – all dirt roads), group campground (i.e., 4 impacted features), and the day use area and boat launch facilities (i.e., each with 2 impacted features). At the family campground, most of the impacted features would be campsite living spaces and vehicle spurs (i.e., each with 19 impacted sites) with a five impacted road (dirt surface) segments. At the group campground, one of the two group campsites would be fully inundated. At the dispersed use areas, all of the impacted features would be the dirt roads (i.e., 1,410 ft) that provide shoreline access. Overall, most of the impacted features at NSRA (i.e., 61%) would be directly impacted by the pool raise and the remaining impacted features would be indirectly impacted (i.e., features abutting the 305 ft NMWSE).

At SSRA, 47 site features would be impacted, including 15 circulation road segments (i.e., 3,720 ft of dirt roads and 1,140 ft of paved roads), 11 campsite living spaces (i.e., table and/or grill area), 9 picnic sites, 7 campsite vehicle spurs, 1 boat ramp turnaround area, 1 parking area, 1 swim beach, 1 water hydrant, and 1 stage. The majority of the impacted recreational site features at SSRA would be at the family campground (i.e., 22 impacted features) followed by the day use area (i.e., 14 impacted features), dispersed use areas (i.e., 9 impacted features – all dirt road segments), the swim beach (i.e., 2 impacted features), and the boat launch (i.e., 1 impacted feature). At the family campground, most of the impacted features would be campsite living spaces (i.e., 11 sites), vehicle spurs (i.e., 7 sites) and road segments (i.e., 3 segments). At the dispersed use areas, all of the impacted features would be the dirt roads (i.e., 2,710 ft) that provide shoreline access. The entire swim beach would be inundated. Overall, most of the impacted features at SSRA (i.e., 55%) would be directly impacted by the Pool Raise and the remaining impacted features would be indirectly impacted (i.e., features abutting the 305 ft NMWSE). Notably, at five campsites in the family campground, the campsite living space and vehicle spurs would be indirectly impacted and require relocation because an inundated segment of the campground circulation road would likely be re-aligned through these campsites.

<u>Clean-Up and Site Restoration</u>

During construction daily clean-up activities will take place to keep construction and staging areas clean. After construction is completed the disturbed areas, including areas where temporary access or staging has taken place, will be restored to similar conditions prior to construction. Equipment, material, temporary facilities, temporary controls, etc. will be removed from the site. A final clean-up and walk-thru will be conducted to make sure site clean-up and restoration has been completed.

2.2.1.2 Other Changes to Existing Recreation Facilities

Beyond the replacement of inundated recreation facilities, while the Project RAs are able to meet the current and future recreational demand, some of the recreation facilities are in need of replacement or rehabilitation to maintain the proper functioning condition of the facility. Nearly all of the facilities will require replacement or rehabilitation during the term of the new license to maintain the facilities in proper functioning condition; and, particularly the restrooms, potable water system and the circulation roads, which will need near-term rehabilitation in order to provide facilities in a safe and proper functioning condition. When constructing or rehabilitating Project recreation facilities, SSWD will obtain all necessary permits and approval for survey work, facility design and on-site resource evaluations.

2.2.1.3 Changes to Primary Project Roads and Trails

SSWD proposes to add to the new license as a Primary Project Road an existing road that accesses the Camp Far West Powerhouse. The existing road is within the proposed and existing FERC Project boundaries. The road extends approximately 0.25 miles from an existing SSWD locked gate at Camp Far West Road to the Camp Far West Powerhouse and Switchyard. The existing road is not open to the public for safety reasons, is used and maintained solely by SSWD to access the Camp Far West Powerhouse and Switchyard, and has an asphalt-paved surface approximately 20 ft wide and shoulder width of approximately two feet. While the road was constructed when Camp Far West Powerhouse and Switchyard were constructed and is SSWD's only vehicular access route to Camp Far West Powerhouse and Switchyard, the road is not identified in the existing license as a Project facility. Figure 2.1-1 in this Exhibit as well as Attachment G-1 in Exhibit G of the FLA shows the location of the existing road. Roads associated with recreation facilities are considered in SSWD’s proposed Recreation Facilities Plan.

2.2.1.4 Changes to Project Gages

SSWD does not propose any changes to Project gages described in Section 2.1.1.8.

2.2.2 Change to Existing FERC Project Boundary

SSWD proposes several changes to the existing FERC Project Boundary in order to more accurately define lands necessary for the safe operation and maintenance of the Project and other purposes, such as recreation, shoreline control, and protection of environmental resources. There are two categories of Proposed Project Boundary changes:

- Proposed addition of lands to the existing FERC Project Boundary that are currently utilized with a preponderance of use related to the Project operation and maintenance, and proposed removal of lands from the Project Boundary that do not have Project facilities and are not used or necessary for Project O&M. These proposed changes are essentially making corrections to the existing FERC Project Boundary.

- Proposed changes to the existing FERC Project Boundary around the Project reservoir and impoundments from surveyed coordinates to a contour located above the 300' elevation NMWSE or to a distance of 200 ft from the 300-ft elevation NMWSE. These changes are proposed as these are the preferred methods of defining project boundaries as outlined in the FERC Drawing Guide (FERC 2012), provide a minimum of 15 ft of dry shore for all locations around the reservoir and are a better representation of lands required for Project O&M around the Project reservoir.

Proposed changes are discussed below. All proposed changes are described in detail in Section 2.0 of Exhibit G.

SSWD proposes the following changes under the category of corrections to the existing FERC Project Boundary:

- The addition of the areas that encompass rights-of-way for road access to the Camp Far West Powerhouse used to access and maintain the dam outlet and powerhouse. Land in this proposed addition is owned by a private land owner (Placer County Assessor's Parcel Number 018-020-015-000).
- The removal of the land owned by SSWD to the west of the dam spillway (Yuba County Assessor's Parcel Number 015-370-016-000). These lands are not used or needed for Project O&M. Note that the area of the new Spillway Modification to the Bear River is retained in the Proposed Project Boundary with a 15 ft buffer.
- The removal of the area in the existing Project Boundary bounded on the north and west by Camp Far West Road, extending to a boundary established at 200' from the NMWSE. This land is not used for Project O&M. Land in this proposed removal is owned by SSWD (Yuba County Assessor's Parcel Numbers 015840021000, 015840020000, 015370016000).
- The removal of the area in the existing Project Boundary bounded on the north by Camp Far West Road, extending to the northern use limit of the North Recreation Area. This land is not used as part of the recreation facility or for Project O&M. Land in this proposed removal is owned by SSWD (Yuba County Assessor's Parcel Number 015840022000).

SSWD proposes the following changes under the category of a contour 20 ft above the 300-ft NMWSE or proximity of 200 horizontal ft from the 300 ft NMWSE:

- The addition and removal of land such that the Project Boundary around Camp Far West Reservoir where the Project Boundary is not encompassing Project facilities is defined by the lesser (closer to reservoir NMWSE) of either the topographic contour of 320 ft, which is 20 ft above the 300-ft NMWSE, or 200 horizontal ft from the 300 ft NMWSE. Lands in this proposed change are a combination of lands owned by private land owners and SSWD. The corrections consist of many small additions and subtractions from the existing FERC boundary based on higher accuracy elevation data made available since the creation of the original boundary geometry. Areas of significant change are limited to the upland reaches of tributary canyons of unnamed creeks where the existing FERC Boundary extends beyond 200 ft horizontally from the 300 ft NMWSE. All of the upland canyon changes are removal of lands included in the existing FERC boundary.

Table 2.2-3 summaries SSWD's proposed changes to the existing FERC Project Boundary.

Table 2.2-3. Summary of proposed changes to the existing FERC Project Boundary.

Owner and Action	Added to Include Primary Project Roads (ac)	Beyond 200 ft from the 300-ft NMWSE (ac)	Correction to 320 ft contour (ac)	Not Used for Project O&M (ac)	Added to include recreation area (ac)	Total (ac)
EXISTING FERC PROJECT BOUNDARY						
Private Lands	--	--	--	--	--	139.6
SSWD Lands	--	--	--	--	--	2,724.1
Total	--	--	--	--	--	**2,863.7**
PROPOSED CHANGES TO EXISTING FERC PROJECT BOUNDARY						
Changes to Private Lands						
addition	+0.7	--	+7.2	--	--	+7.9
subtraction	--	-0.4	-0.4	--	--	-0.8
Subtotal	*+0.7*	*-0.4*	*+6.8*	*0.0*	--	*+7.1*
addition	0	--	+7.7	--	+6.7	+14.4
subtraction	--	-87.6	-2.0	-121.6	--	-211.2
Subtotal	*0*	*-87.6*	*+5.7*	*-121.6*	*+6.7*	*-196.8*
Total	**+0.7**	**-88.0**	**+12.5**	**-121.6**	**+6.7**	**-189.7**
PROPOSED FERC PROJECT BOUNDARY						
Private Lands	--	--	--	--	--	146.7
SSWD Lands	--	--	--	--	--	2,527.3
Total	--	--	--	--	--	**2,674.0**

Where SSWD proposes to add private lands to the FERC Project Boundary, SSWD has notified the land owner of this proposal.

Neither the existing FERC Project Boundary nor the Proposed FERC Project Boundary includes federal lands or tribal reservation lands.

2.2.3 Changes to Existing Project Operations

The Proposed Project would create additional storage space in Camp Far West Reservoir, which allows for more water to be stored when Camp Far West Reservoir fills and spills. The additional stored water may be delivered for water supply in the year when it is stored, or carried over for water supply and downstream demand in future years. Some of the changes to the No Action Alternative with the Proposed Project include:

- Increase in average annual water supply deliveries to SSWD of 1,600 ac-ft over the period of record modeled, ranging from an increase of 4,800 ac-ft in Below Normal WYs to 400 ac-ft in Wet WYs. A decrease of 300 ac-ft occurs in Critical WYs.
- Increase in average annual carryover storage in Camp Far West Reservoir of 4,700 ac-ft over the period of record modeled, ranging from an increase of 8,300 ac-ft in Wet WYs

to 5,800 in Below Normal WYs. Decreases of 400 and 900 ac occur in Dry and Critical WYs, respectively.

- Increase in average annual energy production at Camp Far West Powerhouse of 443 MWhrs over the period of record modeled, ranging from an increase of 1,174 MWhrs in Wet WYs to 10 MWhrs in Critical WYs. A decrease of 121 MWhs occurs in Dry WYs. About 60 percent of the overall increase occurs in off-peak energy and 40 percent in peak energy.
- Increase of two years (i.e., 1987 and 2001) over the period of record modeled when Bay-Delta Settlement Agreement releases would be made, and decrease in one year (i.e., 1991).
- Decrease in average annual flow below the non-Project diversion dam of 2 cfs over the period of record modeled, ranging from a decrease of 12 cfs in Below Normal WYs to 8 in Above Normal WYs. Increases of 6, 2 and 3 cfs occur in Wet, Dry and Critical WYs. No substantial difference in the Bear River downstream occurs due to accretion.

2.2.4 Changes to Conditions in the FERC License and Other Agreements

2.2.4.1 SSWD's Proposed Conditions in the FERC license

SSWD developed Proposed Conditions, including associated implementation plans, for the new licenses. These conditions are:

- SSWD Proposed Condition WR1, Implement Water Year Types. SSWD shall determine the WY types in this condition, and shall use the determinations to implement articles and conditions of the license that are dependent on WY type.
- SSWD Proposed Conditions AR1, Implement Minimum Streamflows. SSWD shall maintain the minimum streamflows in the Bear River downstream of the Project as described in this condition.
- SSWD Proposed Condition AR2, Implement Fall and Spring Pulse Flows. SSWD shall provide fall and spring pulse flows in the Bear River downstream of the Project described in this condition.
- SSWD Proposed Condition AR3, Implement Ramping Rates. SSWD shall make a good-faith effort to adhere to the target ramping rates in the Bear River downstream of the Project described in this condition.
- SSWD Proposed Condition TR1, Implement a Bald Eagle Management Plan. SSWD shall implement the Bald Eagle Management Plan included in Appendix E2 in Exhibit E of this Application for New License.
- SSWD proposed Condition TR2, Implement Blue Heron Rookery Management. SSWD shall implement a Limited Operating Period within a buffer of any great blue heron (*Ardea herodias*) rookeries located on Camp Far West Reservoir.

- SSWD Proposed Condition RR1, Implement Recreation Facilities Plan. SSWD shall implement the Recreation Facilities Plan included in Appendix E2 in Exhibit E of this Application for New License.
- SSWD Proposed Condition CR1, Implement Historic Properties Management Plan. SSWD shall implement the Historic Properties Management Plan included in Volume 3 of SSWD's Application for New License.

Refer to Appendix E2 in Exhibit E for the full text of each measure.

SSWD does not propose to include the requirements of the Bear River Settlement Agreement in the new license for the following reasons. First, no participant to the relicensing has suggested the requirements be included in the new license. Second, the requirements in the agreement resulted from prolonged negotiations to resolve a water rights issue, which is outside FERC's jurisdiction under Section 27 of the Federal Power Act. The agreement resulted in a paid water transfer and is not appropriately characterized as a PM&E measure, except for the down ramp restriction to avoid fish stranding resulting from the water transfer. The release of the water in "dry" and "critically dry" years as required by the agreement provides little, if any, benefit to aquatic resources in the Bear River because the water is provided in the July through September period when releases are too warm to be of any benefit; and providing benefits to aquatic resources in the Bear River is not the purpose of the Settlement Agreement. Third, the Settlement Agreement terminates on December 31, 2035, or sooner if agreed to by SSWD, SWRCB and DWR. The Settlement Agreement does not contemplate, nor did the parties bargain for, the need to go through a FERC license amendment process to terminate the benefits and obligations of the Settlement Agreement.

2.2.4.2 Changes to Measures in Other Licenses, Agreements and Contracts that Affect Operations

Section 2.1.5.2 describes other licenses (i.e., not the FERC license), agreements and contracts that affect current Project operations. When FERC issues its new license, SSWD would apply to the SWRCB to modify any water rights, if necessary, to make them consistent with the new license. SSWD does not anticipate any changes will be needed to SSWD's water delivery contracts. Upon termination of the existing SSWD/SMUD Contract, SSWD plans to negotiate a new lease/power purchase contract or multiple contracts with, at this time, an unknown third party, which could be SMUD, or other parties. SSWD may continue to make water transfers, when possible, and will abide by the requirements, which are unknown at this time, in a new power purchase contract. SSWD would continue to make releases to meet its Bear River Settlement Agreement requirements, though as described in Section 2.2.4.1 in this Exhibit E, those requirements may change as the SWRCB updates the Bay-Delta Plan.

2.2.5 Changes to Existing Facility Maintenance

Section 2.1.6 describes SSWD's existing facility maintenance. SSWD does not propose any changes to maintenance, except as regards to implementation of SSWD's Proposed PM&E measures.

2.3 Alternatives Considered But Eliminated From Further Analysis

SSWD considered but eliminated from further analysis the following alternatives:

- Retire the Project
- Issue a Non-Power License
- Federal Agency Takeover of the Project
- Alternatives Proposed by FWN in its DLA Comments

Each of these alternatives and the consideration of factors through which the alternative was eliminated from further analysis are described below.

2.3.1 Retire the Project

Project retirement could be accomplished with or without removal of the Project dam. No Relicensing Participant has proposed that removal of the Project dam would be appropriate in this case and, besides providing for hydroelectric power generation, the dam also provides critical water-supply functions, as well as important environmental and recreational opportunities. For these reasons, there is little practical basis for recommending removal of the Project dam, and dam removal is not a reasonably foreseeable alternative to relicensing the Project with appropriate resource management measures.

The second Project retirement alternative would involve retaining the Project dam and disabling or removing equipment used to generate power. Project works would remain in place and would be used for historical consumptive-use, environmental and recreational water management, or other purposes. No Relicensing Participant has advocated this alternative and there is no basis for recommending it. Because the power supplied by the Project is needed, replacement power from some other source, without adding air pollutants, would have to be provided. For these reasons, removal of the electric generating equipment is not a reasonably foreseeable alternative.

2.3.2 Issue a Non-Power License

A non-power license is a temporary license that FERC would issue when it determines that a governmental agency, other than SSWD in this case, would assume regulatory authority and supervision over the lands and facilities covered by the non-power license. At this point, no agency has suggested a willingness or ability to do this. No party has sought a non-power license and there is no basis for concluding that the Project should no longer be used to produce power. As stated above, if the power facilities were removed, a source of replacement power would have to be identified. Thus, a non-power license is not a realistic alternative to relicensing in this circumstance.

2.3.3 Federal Agency Takeover of the Project

Federal takeover of the Project is not a reasonably foreseeable alternative. Federal takeover and operation of the Project would require Congressional approval. While that fact alone would not preclude further consideration of this alternative, there is no evidence to indicate that federal takeover should be recommended to Congress. No Relicensing Participant or other party has suggested federal takeover would be appropriate, and no federal agency has expressed an interest in operating the Project. So, federal takeover of the Project is not a reasonably foreseeable alternative.

2.4 List of Attachments

None.

SECTION 3.0
ENVIRONMENTAL ANALYSIS

This section has four components. Section 3.1 provides a general description of the river basin in which the Project occurs, including existing water projects. Section 3.2 provides the temporal and geographic scope of the cumulative effects analysis in this Exhibit E, and describes past, present and reasonably foreseeable future actions considered in the analysis. Section 3.3 explains the effects of SSWD's Proposed Project on environmental resources using the information included in SSWD's PAD, information developed through SSWD's studies, and other information otherwise developed or obtained by SSWD.[1]

3.1 General Description of the River Basin

3.1.1 Existing Water Projects in the Bear River Basin

Four existing water projects, all of which are under FERC's jurisdiction, occur in the Bear River Basin. Together, these four projects have a combined FERC-authorized capacity of 277.95 MW, of which the Camp Far West Project represents approximately 2.4 percent of the total capacity. Each of these water projects is described briefly below.

3.1.1.1 Drum-Spaulding Project

PG&E's 190-MW Drum-Spaulding Project, FERC Project No. 2310, is located on the South Yuba River, Bear River, North Fork of the North Fork American River and tributaries to the Sacramento River Basin in Nevada and Placer counties, California. Major project reservoirs include Lake Spaulding (74,773 ac-ft) on the South Yuba River and Fordyce Lake (49,903 ac-ft) on Fordyce Creek. In addition, the Drum-Spaulding Project includes numerous smaller reservoirs on tributaries to the South Yuba River, and diversions from the South Yuba River to Deer Creek via the South Yuba and Chalk Bluff Canals (maximum capacity of 107 cfs) and to the Bear River via the Drum Canal (840 cfs). In anticipation of the expiration of the initial license on April 30, 2013, PG&E filed with FERC an application for a new license on April 12, 2011. In that application, PG&E requested FERC split the existing license into three separate licenses, one each for the Upper Drum-Spaulding Project, Lower Drum-Spaulding Project and Deer Creek Project. Since the initial license expired, PG&E has operated the Project under annual licenses from FERC and is expected to continue to do so until a new license is issued.

[1] Because a voluminous amount of information exists or has otherwise been developed for many resource areas, SSWD has made a good faith effort to bring forward the most important and relevant information into Section 3.3. However, if readers want a more comprehensive understanding of the totality of available information, data and study results, readers should review other relicensing materials, including SSWD's PAD and the data summaries available on SSWD's relicensing website at www.sswdrelicensing.com.

3.1.1.2 Yuba-Bear Hydroelectric Project

NID's 79.3-MW Yuba-Bear Hydroelectric Project, FERC Project No. 2266, is a water supply/power project constructed in the 1960s, though some project facilities were initially constructed in the late 1800s. The project includes a storage reservoir on the Middle Yuba River (i.e., Jackson Meadows Reservoir) with a gross storage capacity of 69,205 ac-ft, five storage reservoirs on Canyon Creek (i.e., Jackson, French, Faucherie, Sawmill and Bowman) with a combined gross storage capacity of 90,790 ac-ft, and a storage reservoir on the Bear River (Rollins Reservoir) with a gross storage capacity of 58,682 ac-ft. The Project also includes a diversion with a maximum capacity of about 450 cfs via the Milton-Bowman Diversion Dam from the Middle Yuba River to Bowman Lake on Canyon Creek, and a diversion with a maximum capacity of about 300 cfs via the Bowman-Spaulding Canal from Bowman Lake on Canyon Creek to PG&E's Lake Spaulding on the South Yuba River. In anticipation of the expiration of the initial license on April 30, 2013, NID filed with FERC an application for a new license on April 15, 2011. Since the initial license expired, NID has operated the Project under annual licenses from FERC and is expected to continue to do so until a new license is issued.

3.1.1.3 Lake Combie/Combie North Aqueduct Projects

The 1.5-MW Lake Combie Project, FERC Project No. 2981, along with the 0.35-MW Combie North Aqueduct Project, FERC Project No. 7731, are FERC-exempt power projects constructed in the 1980s at NID's Van Geisen Dam, that forms Lake Combie, on the Bear River. The dam was originally constructed in 1928. Lake Combie has a gross storage capacity of 5,555 ac-ft.

3.1.1.4 Camp Far West Hydroelectric Project

The existing Camp Far West Hydroelectric Project is described in Exhibit A of this Application for New License.

3.1.2 The River Basin

Provided below is a description of the general setting of the Project Vicinity. The discussion focuses primarily on the Project Area. A general description of the Feather River downstream of the Bear River confluence and the Sacramento River is also provided for reference.

Figure 3.1-1 is a streambed gradient profile of the Bear River and its tributaries from and including Camp Far West Reservoir, the most upstream Project facility, to the Bear River's confluence with the Feather River. Figure 3.1-2 shows Bear River drainage sub-basins.

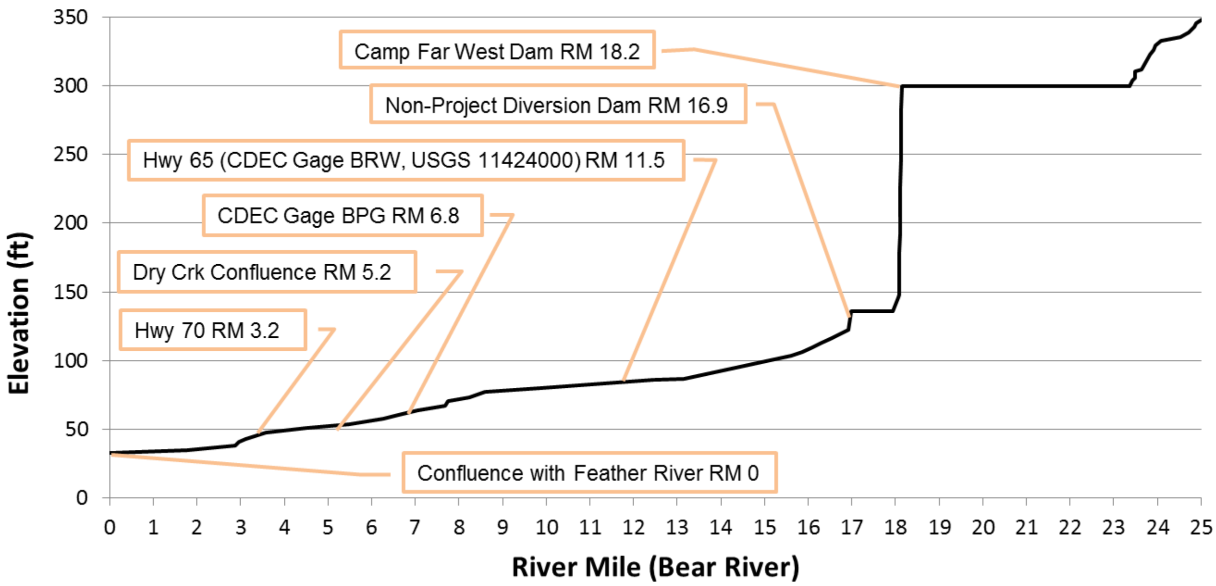

Figure 3.1-1. Streambed gradient of the Bear River from Camp Far West Reservoir, the most upstream Project facility, to the Bear River's confluence with the Feather River.

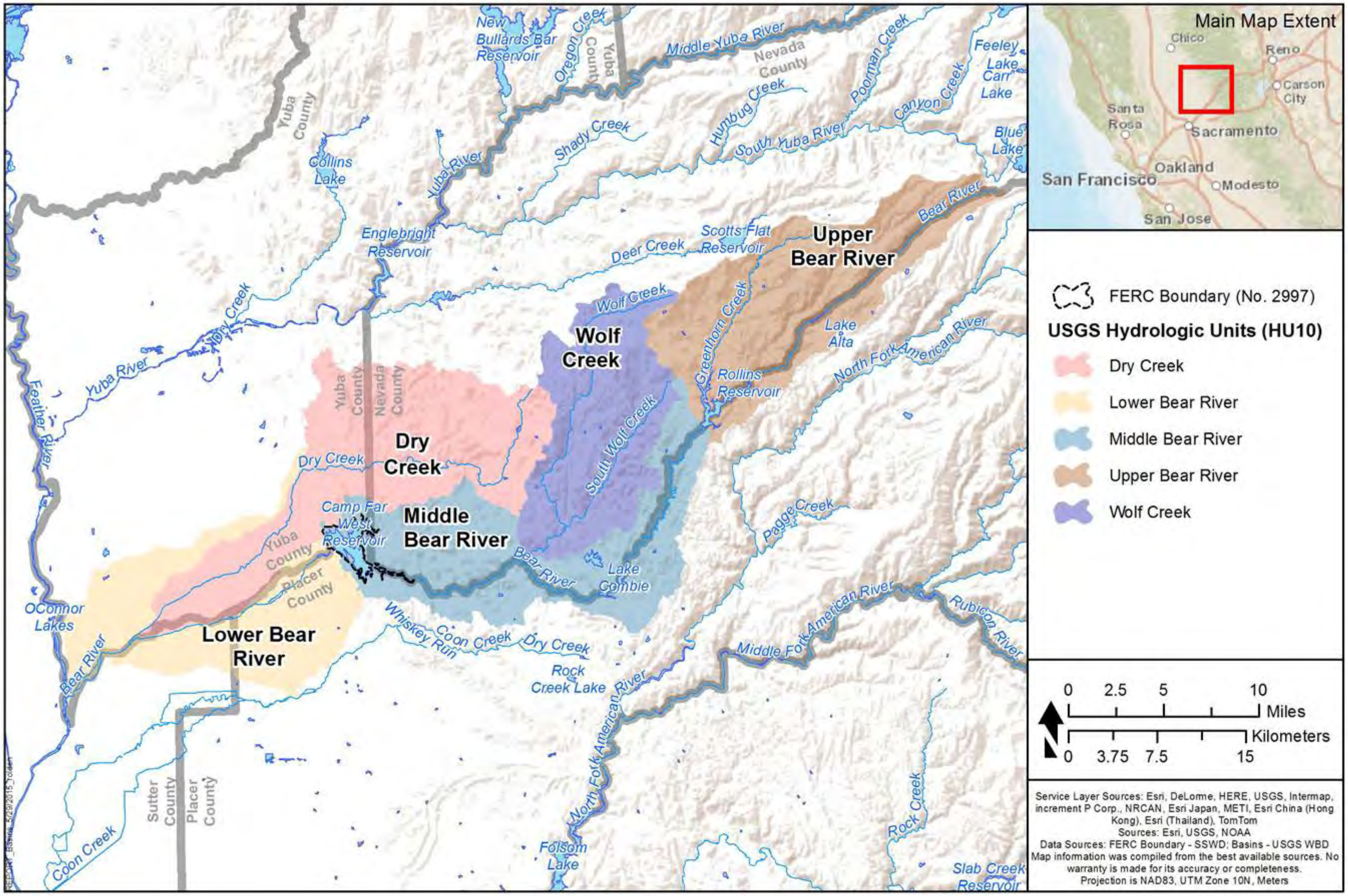

Figure 3.1-2. Bear River drainage sub-basins.

3.1.2.1 Bear River Basin

The Bear River basin is on the western slope of the Sierra Nevada and is bounded by the Yuba River basin to the north, the American River basin to the south, and the Feather River basin to the west. The Bear River originates near Emigrant Gap in Nevada County in Township 17 North, Range 12 East at an elevation of approximately 4,900 ft and then flows southwesterly for approximately 75 mi to its confluence with the Feather River northeast of the town of East Nicolaus, CA, at an elevation of about 50 ft. The Bear River drains approximately 400 sq mi in Yuba, Nevada, Sutter, and Placer counties. The average annual flow of the Bear River from WY 1975 to WY 2014 as measured at the USGS Gage 11424000, *Bear River at Wheatland*, at RM 11.5 is 376 cfs, and the annual flow has ranged from a maximum of approximately 1,191 cfs in WY 1983 to a minimum of approximately 3 cfs in WY 1977.

Upstream of Camp Far West Reservoir at RM 74.5, PG&E's Drum-Spaulding Project Drum Canal can add up to 840 cfs of water to the natural flow in the Bear River at PG&E Drum Forebay, which is at elevation (El.) 4,756 ft and has a gross storage capacity of 621 ac-ft. Other small impoundments in the Bear River include PG&E's Drum Afterbay at RM 65.9, which is at El. 3,383 ft, and NID's Dutch Flat Afterbay at RM 60.5, which is at El. 2,740 ft and has a gross storage capacity of 1,397 ac-ft. Major storage reservoirs in the Bear River occur at RM 50.4 (NID's Rollins Reservoir at El. 2,171 ft with a gross storage capacity of 58,682 ac-ft) and at RM 37.2 (NID's Lake Combie at El. 1,600 ft with a gross storage capacity of 5,555 ac-ft). Out-of-basin diversions occur at RM 50.3 (PG&E's Bear River Canal with a maximum capacity of 470 cfs) and at RM 37.2 (NID's Combie Phase I Canal with a maximum diversion of 200 cfs).

From the Van Giesen Dam, the Bear River flows another 13.8 mi until it reaches the NMWSE (i.e., El. 300 ft) of Camp Far West Reservoir at RM 23.4.

Camp Far West Reservoir is relatively shallow and has an average retention time of about 4 months. The reservoir has two main arms. The longer arm extends approximately 5.2 mi upstream of the dam into the Bear River, and the shorter arm extends upstream about 2.4 mi into Rock Creek, a small tributary to the Bear River. The lower portion of the Bear Creek arm is the widest portion of the reservoir at about 1-mi wide. Most of the land surrounding Camp Far West Reservoir is undeveloped (i.e., no roads or residential communities), with the exception of the recreation areas.

Based on recent bathymetric surveys, the Camp Far West Reservoir has a gross storage capacity of 93,740 ac-ft, which results in a surface area is 1,886 ac and a shoreline length of 29 mi. At the minimum operating pool (El. 175 ft),[2] the reservoir has a gross storage of 1,310 ac-ft and a surface area of 55 ac.

Similar to the other reservoirs in the Bear River Basin, the normal operation for Camp Far West Reservoir is to fill as early in the season as sufficient water becomes available and to then spill

[2] Minimum operating pool is the sill elevation of the low level intake structure, whereby no additional releases can be made from the reservoir.

the excess flows over the ungated spillway. Because the reservoir is primarily fed by rainfall-produced runoff and releases from upstream reservoirs, it is difficult to predict the amount of inflow anticipated before the end of the season. Therefore, SSWD retains within the reservoir all of the inflow except for instream flow requirements until the beginning of the irrigation season. Since the reservoir is operated as a fill-and-spill system, its effect on downstream flood flows is erratic, as it may range from complete control to only minor surcharge regulation.

The reservoir normally reaches its maximum level in January when the basin produces its heaviest runoff. The water level starts to decline in mid-April, at the beginning of the irrigation season, and reaches its lowest point (usually around El. 178 ft) in mid-October when irrigation deliveries are no longer made.

Power is produced at Camp Far West Powerhouse during the winter/early spring months when the reservoir is spilling and during the spring and summer months when releases are being made for irrigation and to meet instream flow requirements. Because of the generating unit's operating characteristics, power can only be generated when the elevation of the reservoir water surface is at or above 235 ft and when the flow is greater than 270 cfs. If these two criteria cannot be met, water is released through the low-level outlet. This condition normally occurs each year starting in September and continuing into the fall until such time that surplus flows are available to be passed through the powerhouse.

During the irrigation season, up to a maximum of 530 cfs passes through the turbine in conformance with downstream irrigation and instream flow requirements. However, during the heavy runoff period, when spilling from the reservoir occurs, a greater quantity of water is routed through the powerhouse to its maximum limit of 725 cfs.

The existing Camp Far West Dam is the second dam built at this location. The original dam was a 50-ft high concrete gravity structure, built by the CFWID in 1927.

The drainage area at Camp Far West Dam is 281.8 sq mi, approximately 70 percent of the total Bear River drainage area.

From Camp Far West Dam, the Bear River flows southwest another 1.3 mi to a 38-ft high non-Project diversion dam where up to 475 cfs of Bear River water is diverted into SSWD's Conveyance Canal. Approximately 40 cfs of that water is re-diverted from the first 0.5-mi of the canal to the CFWID, with the remaining water going to SSWD's customers. In addition, up to 35 cfs of Bear River water is diverted at the non-Project diversion dam into CFWID Camp Far West Canal on the north bank.

From the non-Project diversion dam, the Bear River flows another 16.9 mi to where it empties into the Feather River.

3.1.2.2 Feather River, Sacramento River and Delta

The Bear River discharges into the Feather River, whose basin encompasses a broad variety of terrain, climate, historic use, and flora and fauna. Over 80 percent of the upper Feather River watershed is federally-owned land managed by the U.S. Department of Agriculture, Forest Service as part of the Plumas National Forest. Approximately 11 percent of the upper Feather River watershed is alluvial valleys that are predominantly privately-owned and used for livestock grazing. The rest of the land is used for other agricultural purposes, urban development and wildlife habitat.

Water originating from the Feather River drainages provides significant amounts of water to California's SWP, which provides water to meet urban and agricultural demands. The Feather River Basin also produces significant forest and agricultural outputs. Flow in the lower Feather River is controlled mainly by releases from Lake Oroville, the second largest reservoir in the Sacramento River basin and part of DWR's Oroville Project (FERC Project No. 2100), and by flows from the Yuba and Bear rivers. As with many Sierra Nevada foothill streams and rivers, the Feather River Basin has historically been influenced by large-scale gold mining operations. To a lesser degree, gold mining operations still continue within the western slope watersheds.

The Feather River drains into the Sacramento River, which provides water for municipal, agricultural, recreational, and environmental purposes throughout northern and southern California. The Sacramento River is the largest river system in California, yielding 35 percent of the state's water supply. Most of the Sacramento River flow is controlled by the United States Department of Interior, Bureau of Reclamation (Reclamation's) Shasta Dam and Reservoir, and river flow is augmented by imports of Trinity River water through Clear and Spring Creek tunnels to the Reclamation's Keswick Reservoir. Immediately below Keswick Dam, the river is deeply incised in bedrock with very limited riparian vegetation.

The upper Sacramento River is often defined as the portion of the river from Princeton (i.e., RM 163; downstream extent of salmonid spawning in the Sacramento River) to Keswick Dam (i.e., the upstream extent of anadromous fish migration and spawning). The Sacramento River is an important corridor for anadromous fishes moving between the ocean and the Delta and upstream river and tributary spawning and rearing habitats. The upper Sacramento River is differentiated from the river's "headwaters," which lie upstream of Shasta Reservoir. The upper Sacramento River provides a diversity of aquatic habitats, including fast-water riffles and shallow glides, slow-water deep glides and pools, and off-channel backwater habitats (Reclamation 2004).

The lower Sacramento River is generally defined as the portion of the river from Princeton, CA, to the Delta at approximately Chipps Island near Pittsburg, California. The lower Sacramento River is predominantly channelized, leveed and bordered by agricultural lands. Aquatic habitat in the lower Sacramento River is characterized primarily by slow water glides and pools, is depositional in nature, and has lower water clarity and habitat diversity, relative to the upper portion of the river.

The Delta is a vast, low-lying inland region located east of the San Francisco Bay area, at the confluence of the Sacramento and San Joaquin rivers. Geographically, this region forms the eastern portion of the San Francisco estuary, which includes San Francisco, San Pablo and Suisun bays. An interconnected network of water channels and man-made islands, the Delta stretches nearly 50 mi from Sacramento south to the City of Tracy, and spans almost 25 mi from Antioch east to Stockton (Public Policy Institute of California 2007). The Delta is a complex area for both anadromous fisheries production and distribution of California water resources for numerous beneficial uses. Approximately 42 percent of the state's annual runoff flows through the Delta's maze of channels and sloughs, which surround 57 major reclaimed islands and nearly 800 un-leveed islands (WEF Website 2006). The Delta also includes the federal Central Valley Project Jones Pumping Plant and the SWP's Banks Pumping Plant (i.e., export pumps) in the south Delta. Water withdrawn from the Delta provides for much of California's water needs, including both drinking water and water for agricultural irrigation purposes.

3.1.2.3 Potentially-Affected Bear River Stream Reaches

Table 3.1-1 provides a description of stream reaches in the Bear River Basin potentially affected by continued Project operations.

Table 3.1-1. Stream reaches in the Bear River Basin potentially affected by continued Project operations.

River	Reach Name in PAD	Description
Bear River (1.3 mi)	Camp Far West Reach	Approximately 1.3 mi of the Bear River from Camp Far West Dam at RM 18.2 to the non-Project Diversion Dam at RM 16.9.
Bear River (16.9 mi)	Lower Bear River	Approximately 16.9 mi of the Bear River from the non-Project diversion dam at RM 16.9 to the confluence of the Bear River and the Feather River at RM 0.0.

3.1.2.4 Bear River Basin Streams and Tributaries

Table 3.1-2 provides a list of named tributaries and named secondary tributaries to the Bear River. Some of the tributaries are intermittent or ephemeral in nature and contribute water to the Bear River during only part of the year.

Table 3.1-2. Streams and tributaries to the Bear River.

Tributary	Secondary Tributaries
UPSTREAM OF THE PROJECT	
Wolf Creek, Steephollow Creek, Greenhorn Creek, Little Bear Creek	Numerous
WITHIN THE PROJECT	
Rock Creek, Long Ravine	--
DOWNSTREAM OF THE PROJECT	
Dry Creek	Best Slough

Source: USGS, National Hydrology Dataset.

3.1.2.5 Bear River Basin Dams

There are approximately 11 major dams and diversions in the Bear River Basin, with a combined storage capacity of approximately 155,940 ac-ft of water (Table 3.1-3). All of the dams except one are upstream of the Project and account for about 40 percent of the total storage capacity. The Project accounts for the other 60 percent of storage.

Table 3.1-3. Owners and capacities of dams and diversions in the Bear River Basin.

Owner	FERC Project No.	River / Tributary	Dam / Diversion	Reservoir Gross Storage Capacity (ac-ft)
PG&E	2310	Bear River	Drum Afterbay Dam	150.4
PG&E	2310	Off Channel	Alta Forebay Dam	19.4
PCWA	NA	Off Channel	Lower Boardman Canal Diversion Dam	Negligible
NID	2266	Off Channel	Dutch Flat No. 2 Forebay Dam	159.8
NID	2266	Bear River	Dutch Flat Afterbay Dam	1,359.2
NID	2266	Off Channel	Chicago Park Forebay Dam	103
NID	2266	Bear River	Rollins Dam	54,453
PG&E	2310	Bear River	Bear River Diversion Dam	Negligible
NID	2981 (Exempt)	Bear River	Van Geisen Dam (Lake Combie)	5,555
SSWD	2997	Bear River	Camp Far West Dam	93,740
SSWD	7580 (Exempt)	Bear River	Camp Far West Diversion Dam	Negligible
Total	**4 Projects**	--	**11 Dams/Diversions**	**155,539.8 ac-ft**

Key:
PG&E – Pacific Gas and Electric Company
PCWA – Placer County Water Agency
NID – Nevada Irrigation District
SSWD – South Sutter Water District

Figure 3.1-3 depicts the general location of each of the dams in Table 3.1-3.

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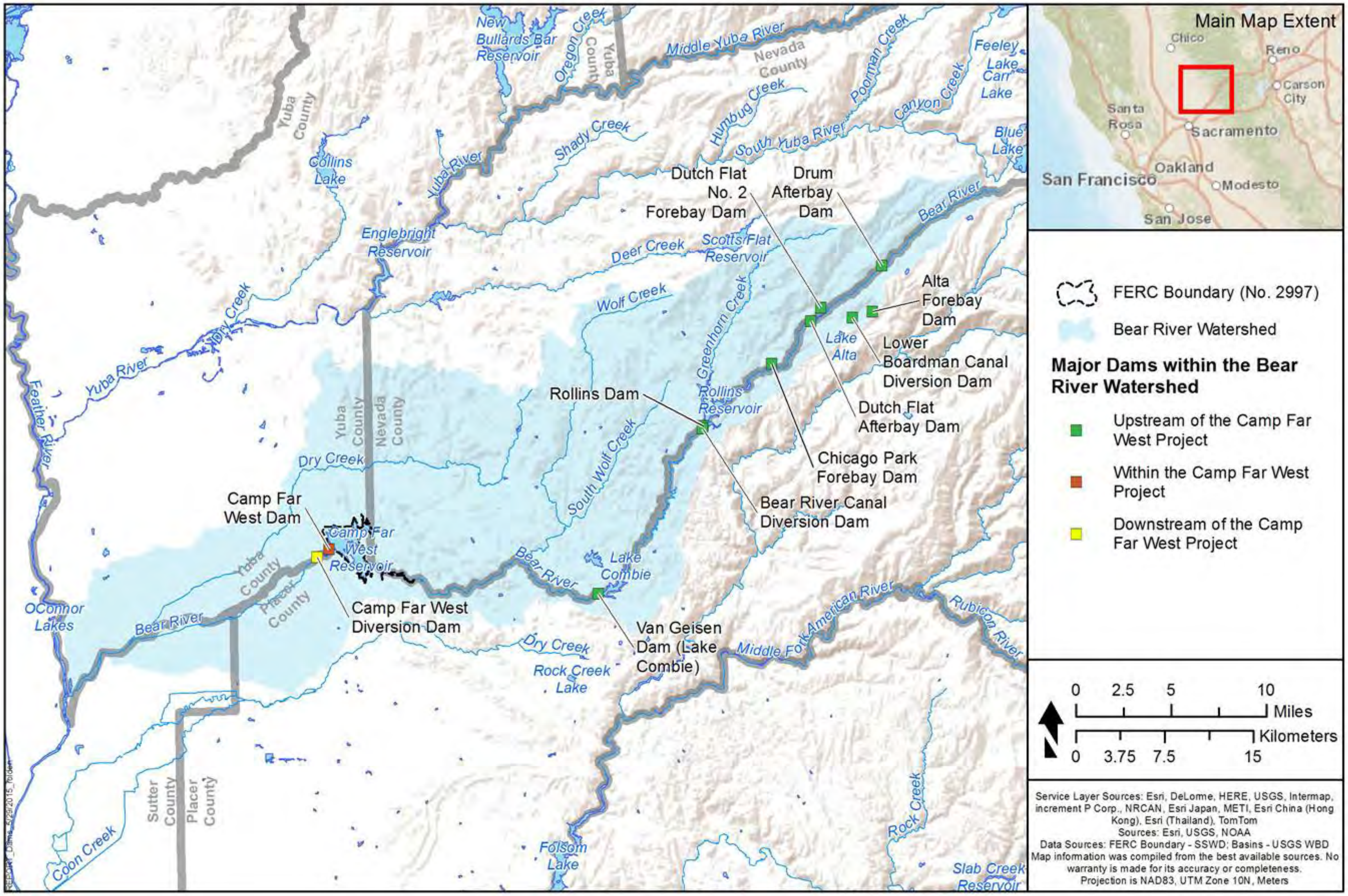

Figure 3.1-3. General location of dams within the Bear River watershed.

3.1.3 Climate

The Project Region,[3] which includes the sub-basins, excluding the Upper Bear River sub-basin, shown in Figure 3.1.2, experience hot, dry summers and cool winters with substantial rainfall, but no appreciable snowfall. The National Weather Service monitoring station Number 045385 at Marysville, at an elevation of approximately 75 ft, provides a climate history representative of the Project Region. These areas occupy the eastern Central Valley and rolling, western Sierra foothills, and can experience high summer temperatures, mostly unmitigated by the "Delta breezes" that are present further south and west in California's Central Valley. July air temperatures at Marysville, California, average a high of 96.4 degrees Fahrenheit (°F), and a low of 62.0°F. Average January high and low temperatures are 54.1°F and 38.0°F, respectively. Annual average precipitation totals 21.59 in., and falls exclusively as rain, with 67 percent falling during the winter months from December through March. June through August precipitation averages only 0.25-in., generally resulting from rare summer thunderstorms (WRCC 2009).

3.1.4 Major Land Uses

The topography around Camp Far West Reservoir consists of rolling hills and many oak trees with elevations from 150 to 320 ft. Slopes range from 2 to 30 percent and rock outcrops are common.

The area immediately adjacent to the reservoir is owned by SSWD and accessible to the public. Beyond that, land in the vicinity is rural in nature with large parcel (e.g., 20 ac or larger) homesteads and cattle ranching. Beale Air Force Base is located approximately 11 mi northwest of the dam.

Hydraulic mining for gold was prevalent in the Bear River and other watersheds in the Sierra Nevada during the latter half of the 19th century. Underground mining of hardrock (i.e., lode) gold-quartz vein deposits also was important in the Bear River watershed.

The Dairy Farm Mine, located in Placer County on the southeast side of the reservoir, produced copper, zinc, and gold from a deposit along the south shore of Camp Far West Reservoir, part of the Foothill Copper-Zinc Belt. Open pit mining was used at the Dairy Farm Mine during the 1920s and 1930s. When the water level in the reservoir is high, the pit is inundated by the reservoir, whereas at lower water levels, the pit is hydraulically isolated (Alpers et al. 2008).

The counties are the primary agencies for establishing land use policies for private land within the river basins and sub-basins. The county general plans provide the land use policies for each county. The Yuba County General Plan was adopted in 1996, and is currently being revised. Nevada County and Sierra County also adopted their general plans in 1996.

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3 In this Exhibit E, "*Project Region*" is defined as the area surrounding the Project on the order of a county.

3.1.5 Major Water Uses

The CVRWQCB, in its Basin Plan (CVRWQCB 1998) identifies existing beneficial uses of the waters in the Project Area as Municipal and Domestic Supply, Agricultural Supply, Power, Contact Recreation, Non-contact Recreation, Warm Freshwater Habitat, Cold Freshwater Habitat and Wildlife Habitat. The Basin Plan identifies potential beneficial uses of the water as Migration of Aquatic Organisms and Spawning.

3.2 Scope of Cumulative Effects Analysis

Council on Environmental Quality regulations require that EIS's describe direct and indirect effects of the proposed action (40 C.F.R. § 1502.16(a) & (b)). These regulations define "effects" to include cumulative effects (40 C.F.R. § 1508.8). These regulations state that a "*Cumulative impact is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.*" (40 C.F.R. §1508.7.) Note that cumulative effects under ESA are defined differently.

Based on information in this Application for New License, SSWD concludes that the following resources have the potential to be cumulatively affected by the continued O&M of the Project as proposed in this Application for New License:

- water resources
- aquatic resources, including Pacific salmon EFH
- ESA-listed anadromous salmonids and their designated critical habitat

Provided below are the geographic and temporal scopes of the cumulative effects analysis for these resources, and the past, present, and reasonably foreseeable future actions considered in the analysis.

3.2.1 Geographic Scope for Analysis of Cumulatively Affected Resources

The geographic scope of the cumulative effects analysis defines the physical limits or boundaries of the Proposed Action's effect on the resources. Based on information in this Application for New License, SSWD defines the geographic scope for water resources, aquatic resources, and ESA-listed anadromous salmonids and their critical habitats as follows:

- from the NMWSE of Camp Far West Reservoir downstream in the Bear River to the Bear River's confluence with the Feather River

3.2.2 Temporal Scope for Analysis of Cumulatively Affected Resources

The temporal scope of the cumulative effects analysis includes a discussion of past, present, and future actions and their effects on each resource that could be cumulatively affected. For any resource identified as potentially having cumulative effects, the temporal scope will look 30 to 50 years into the future, based on the potential term of a new license, concentrating on the effect on the resource from reasonable foreseeable future actions. The historical discussion will, by necessity, be limited to the amount of available information for each resource.

3.2.3 Past, Present and Reasonably Foreseeable Future Actions Considered for Analysis of Cumulatively Affected Resources

Following FERC Guidelines on Preparing Environmental Documents, the application should include a brief discussion of past, present, and future actions, and their effects on resources based on the new license term (30 to 50 years). Further, the guidance from FERC notes the need to highlight the effect on the cumulatively affected resources from reasonably foreseeable future actions. The past actions' effects on a resource are normally outlined in the Affected Environment section.

Each of these actions is discussed below without consideration of the added effects, if any, of the Proposed Project. Incremental effects of the Proposed Project, when taken in combination with these actions, are discussed in the appropriate resource sections of this Exhibit E.

3.2.3.1 Past and Present Actions

Past and present actions contribute to the current condition of the resources, and are intrinsically embedded in the baseline (i.e., existing conditions), and are discussed where appropriate in the specific resource sections of this Exhibit E. These activities include harvesting, grazing, mining, and operation of upstream and downstream water projects. These activities affect the resources identified for cumulative effects analysis, and are outside the Commission's authority to regulate under a new license for the Camp Far West Project.

Timber harvesting and grazing affect water resources (i.e., both water quantity and water quality, including temperature), which in turn affect aquatic resources and ESA-listed anadromous fishes.

Mining affects water quality, especially the metal contaminant concentrations. The Dairy Farm Mine, which predates the Project, can affect water quality. Most notably, hydraulic mining has had drastic effects on geology and soils in the Bear River, especially with regards to channel morphology, substrate and riparian vegetation.

The most significant past and present actions in the Project area is the construction and operation of the various water projects on the Bear River, all of which went into operation prior to the Project. As described in Sections 3.1.2.1 and 3.1.2.5, upstream water projects in the Bear River import large amounts of water from the Yuba and American rivers, store the imported water as well as the natural flow in the Bear River, and divert large amounts of water. The result is that inflow into the Project is controlled by these upstream water projects, is somewhat unreliable since the upstream projects are operated for the benefit of their owners, and is not akin to the hydrology in an unimpaired system. For instance, in wet years, the upstream project may store and divert much of the runoff so that the Project inflow is more typical of a drier water year. In addition, the upstream projects capture large amounts of sediment and wood that would otherwise flow into the Project. Because of these upstream projects, releases from the Project do not reflect the natural hydrograph and can be unpredictable, especially in spring, which affects aquatic habitat and ESA-listed anadromous fishes.

In addition, flows in the lower Bear River for most of the spring and summer are mostly controlled by diversions at the non-Project diversion dam below Camp Far West Dam. As described in Section 3.1.2.1, approximately 510 cfs of water is diverted at the dam. These diversions can affect water quality, aquatic resources and habitat for ESA-listed fishes in the lower Bear River by reducing flow. Further, the non-Project diversion dam is a complete physical barrier to the upstream movement of anadromous fishes.

Water projects in the Feather River, such as DWR's Oroville Project, also have significant environmental effects in the Bear River. The releases from these projects along with the natural flow in the Feather River are often many magnitudes of order greater than Bear River flows, which result in backwatering in the lower Bear River, sometimes for over a mile.

While not as significant as the upstream and downstream water projects, the introduction and proliferation of giant cane grass in the lower Bear River, which predates the Project, has a significant effect on habitat for aquatic resources and ESA-listed fishes.

3.2.3.2 Reasonably Foreseeable Future Actions

The past and present actions described above are likely to continue in the future, though the magnitudes of particular actions may change. Timber harvesting and grazing are declining. Hydraulic mining was prohibited in the watershed in the late 1800's, but other forms of mining continue, and past mining activities continue to have environmental effects. Annual water demands in the region may increase significantly. NID projects that its annual demand will increase to 201,000 ac-ft by 2062 and PCWA projects that its demand will increase to 118,000 ac-ft by 2062.

SSWD has not included in its cumulative effects analysis under reasonably foreseeable future actions (i) actions arising from the SWRCB's ongoing process to update the Water Quality Control Plan for the San Francisco Bay-Delta Estuary (Bay-Delta Plan); (ii) actions associated with the implementation of voluntary agreements related to the Bay-Delta Plan; or (iii) the California Department of Water Resources' proposed Eco Restore program. While the SWRCB adopted amendments to the Bay-Delta Plan for the Lower San Joaquin River pursuant to Resolution No. 2018-0059 adopted December 12, 2018, the SWRCB has taken no formal action at this juncture to propose specific elements of a proposed Bay-Delta Plan for the Sacramento River watershed, which includes the Bear River. The three processes identified above have not proceeded far enough for SSWD or the Commission to know what environmental effects or amendments to this plan may be adopted in the future.

In addition, SSWD has not included in its cumulative effects analysis under reasonably foreseeable future actions the California WaterFix Project. California WaterFix is a controversial $15,000,000,000 plan proposed by former Governor Edmond G. Brown Jr. and DWR to build two large, 40-foot diameter tunnels to carry fresh water from the Sacramento River under the Delta toward the intake stations for the SWP and the CVP. Current Governor Gavin Newsom has stated that his administration will not support a dual tunnel project and it is unclear, at this juncture, whether the California WaterFix Project will be implemented. SSWD has not included any potential changes in Project operations that may occur because of the California WaterFix Project because it is not possible at this time to know whether the California WaterFix Project will be implemented, or, if it is implemented, how its implementation might affect Project operations.

In their written comments on the DLA, CDFW and FWN requested SSWD include in its analysis of potential Project effects NID's upstream Centennial Reservoir Project. SSWD has not included NID's Centennial Reservoir Project in SSWD's cumulative effects analysis because it is not reasonably foreseeable. NID's Centennial Reservoir Project has not undergone either state or federal environmental review (i.e., CEQA or NEPA); NID has not obtained necessary permits to construct, maintain or operate the project; NID has not funded the project; and NID has not put forward sufficient engineering or operations details of the project that would allow for an environmental review, let alone allow SSWD to evaluate how the project would affect SSWD's Camp Far West Hydroelectric Project.

SSWD is unaware of any other reasonably foreseeable future actions for consideration in this cumulative effects analysis.

3.3 Existing Environment and Effects

Section 3.3 is further divided into subsections, by major resource areas:

- Geology and Soils (Section 3.3.1)
- Water Resources (Section 3.3.2)
- Aquatic Resources (Section 3.3.3)
- Terrestrial Resources (Section 3.3.4)
- Threatened and Endangered Species (Section 3.3.5)
- Recreation Resources (Section 3.3.6)
- Land Use (Section 3.3.7)
- Aesthetic Resources (Section 3.3.8)
- Socioeconomic Resources (Section 3.3.9)
- Cultural Resources (Section 3.3.10)
- Tribal Resources (Section 3.3.11)

Excluding Section 3.3.5,[4] each of the above resource areas is divided into the following three subsections:

- Affected Environment. This subsection uses existing, relevant and reasonably available information included in the PAD and available since the PAD was filed and the results of SSWD's studies to describe the condition of the environment under the existing Project. In general, the affected environment discussion is divided into major areas of interest within each resource area.
- Environmental Effects. This subsection describes the beneficial and adverse direct and indirect effects of SSWD's Proposed Project, which includes SSWD's proposed environmental measures. This section describes how each of SSWD's proposed measures are expected to protect or enhance the existing environment, including, where possible, a non-monetary quantification of the anticipated environmental benefits of the measure.
- Unavoidable Adverse Effects. This subsection describes any adverse environmental effects under SSWD's Proposed Project that cannot be mitigated, including whether the effect is short- or long-term, minor or major, and cumulative or site-specific.
- Measures or Studies Recommended by Agencies and Not Adopted by SSWD. This subsection describes any recommended measures or studies written comments SSWD received by agencies, Indian tribes or the public after SSWD distributed its DLA, and not adopted and SSWD's reasons for not adopting the recommendation.

3.4 List of Attachments

None.

[4] Although Section 3.3.5 discusses SSWD's studies and includes analysis of both the affected environment and potential environmental effects, Section 3.3.5 is organized by ESA-listed species.

3.3.1 Geology and Soils

The discussion of geology and soils is divided into four sections. The affected environment is discussed in Section 3.3.1.1, environmental effects of the Project are discussed in Section 3.3.1.2, unavoidable adverse effects are addressed in Section 3.3.1.3, and geology and soils-related measures or studies recommended by agencies but not adopted by SSWD are discussed in Section 3.3.6.4.

SSWD augmented existing, relevant, and reasonably available information regarding geology and soils by conducting one study: Study 3.3, *Instream Flow Study*. This study included habitat mapping, channel topography, substrate and cover type mapping and large woody material (LWM) observations that address aspects of channel morphology in the lower Bear River. The results of Study 3.3 are discussed throughout this section and all field data is provided in Appendix E1.

3.3.1.1 Affected Environment

This section describes existing geology and soils within the Project Area. Geology and soil conditions are summarized in the following sections: 1) geologic setting, 2) tectonic history, faulting and seismicity, 3) mineral resources, 4) soils, 5) physiography, 6) sedimentation, and 7) existing information.

3.3.1.1.1 Geologic Setting

The Project is located within the Sierra Nevada physiographic and geologic provinces. The geology within the region has evolved through many complex interactions within and beneath the earth's crust. These processes include plate tectonics, where continents are created and transferred by various mechanisms. Other smaller-scale local processes, such as mass wasting, weathering, erosion, and sedimentation also constantly change the landscape.

The geologic history of the region spans the period from the mid-Paleozoic, approximately 300-400 million yrs ago (Mya), to the present day. The deepest basement rocks were emplaced about 225 Mya. However, the deepest basement rocks are actually younger than many of the overlying metamorphic, volcanic, and sedimentary rocks exposed in the region. The basement rock and overlying rocks began to move westward with the formation of a subduction boundary on what was then the western margin of the North American land mass (Schweickert et al. 1984), located east of the present day Sierra Nevada.

Paleozoic and Mesozoic terrains were both accreted upon and subducted beneath the continent. Accretion occurred along the continental margin in long, linear strips, striking roughly parallel to the present day Sierra crest. The subduction zone supplied the mantle with new rock to a depth great enough for the subducting plate to melt. The resulting magma eventually rose as both surface volcanic rock and as subsurface granitic plutons. The granitic plutons compose much of the core of the current Sierra Nevada. Concurrent with the development of the plutons, the hot magma intruded into the folded sedimentary rocks, resulting in metamorphism and the creation of the famous Sierra Nevada gold deposits in the fractures (Forest Service 2002).

The middle Tertiary was a time of volcanic eruptions that deposited lava, mudflows, pyroclastic flows, and ash throughout the Yuba and upper Bear River basin. These deposits filled many preexisting drainages such as the ancestral Bear River, as well as emplacing a cap of volcanic rock and volcanic debris on both the plutonic rocks and the eroded and intruded remnants of the preexisting early Mesozoic rocks. From 14 to 4 Mya, these tuffs were in turn buried by andesites, andesitic mudflows, and associated volcanic sedimentary rocks (PG&E, Piedmont 2003).

Subsequent to this latest orogeny of eruptions and mudflows, three late Quaternary glacial stages, each with multiple stages, occurred in the northwestern Sierra Nevada (James 2003, James et al. 2002). Glacial till and associated moraines extend west into the upper Bear River near the town of Alta (PG&E, Piedmont 2003).

Uplift along the eastern margin of the Sierra produced erosion through the beginning of the Tertiary Period (65 Mya), exposing the gold veins that had been created during the Mesozoic. These gold veins were eroded and the gold-laden sediments re-deposited throughout the ancestral Yuba River drainage, which ran approximately north to south. The "Tertiary River Gravels" are the source for much of the gold mined during the 19th century in the Yuba River drainage (Forest Service 2002), which also includes the Bear River. The ancestral headwaters of the Bear River were captured by the Yuba River (James 1995), yet were once a part of the Yuba. Because of the gold-laden gravels deposited, uplifted and subsequently exposed, the Bear River was one of the most heavily mined and modified drainages in the Sierra (James 2004).

Specifically within the Project Area, downstream of the Camp Far West Reservoir, valley sediments are dominated by Quaternary alluvium (Figure 3.3.1-1), which comprises 64.9 percent of the Project Area (Table 3.3.1-1). Bedrock geology near the Reservoir is composed of Jurassic volcanic rocks, quartz diorite, and massive diabase of the Smartville Complex, and is the second-most common material at 22.4 percent. The Bear River arm of the Camp Far West Reservoir has an intrusive mafic dyke that strikes northwest across both the Bear River and Wolf Creek (Alpers et al. 2008).

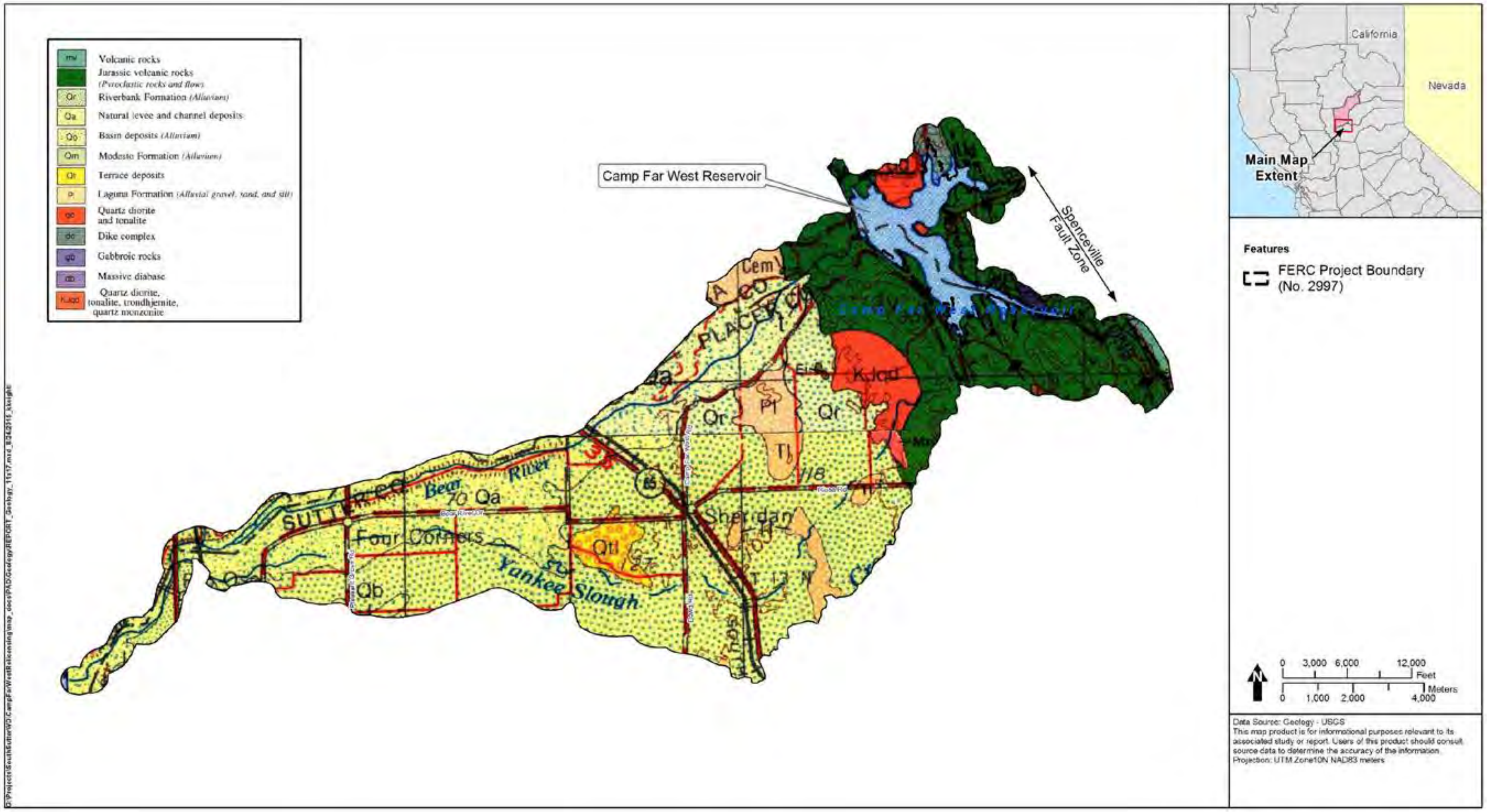

Figure 3.3.1-1. Generalized geologic map of the Project Vicinity.

Table 3.3.1-1. Description of generalized geologic rock types in the Project Vicinity.

Rock Type[1]	Area (acres)	Percent (%)	Description	Age
Quaternary Alluvium (Qr, Qb, Qa, Qt, Pl)	27,102	64.9%	Poorly consolidated gravels, sands and clays along river courses, levees, river banks, terraces adjacent to and within Dry Creek and Bear River downstream of the Project Area.	Quaternary – Pleistocene and Holocene
Laguna Formation	1,935	4.6%	Consolidated Alluvium – gravel sand and silt	Pliocene
Tailings	68	0.2%	Hydraulic and placer mining tailings	Recent, historical
Smartville Complex (Jv, qd, dc, gb)	9,352	22.4%	Pyroclastic rocks and flows, quartz diorite and tonalite, dike complex and gabbro that surround Camp Far West Reservoir.	Jurassic
Volcanic Rocks (mv)	1,432	3.4%	Undifferentiated rocks of the Smartville complex upstream of Camp Far West and dominate Wolf and Bear Creek drainages to Lake Combie.	Jurassic
Ultramafic and metasedimentary rocks	98	0.2%	Folded and faulted rocks near the Wolf Creek fault zone at the upper end of Wolf and Little Wolf Creeks.	Triassic
Water	1,775	4.3%	--	--
Total	**41,762**	**100%**	**--**	**--**

[1] Refer to Figure 3.3.1-1 for a description of each rock type.

3.3.1.1.2 Tectonic History, Faulting, and Seismicity

Uplift of the Sierra Nevada began approximately 3 to 5 Mya (Unruh 1991; Wakabayashi and Sawyer 2001; Henry and Perkins 2001), which is approximately synchronous with the uplift of the Carson Range, bordering the Tahoe basin on the east, at 3 Mya (Surpless et al. 2000). The uplift was accompanied by westward tilting of the range, stream incision, and downwarping of the Central Valley.

Most faults resulted from late Paleozoic and Mesozoic tectonic collisions. Faults that were reactivated in the late-Cenozoic are predominantly high-angle, northwest-trending, east-dipping, normal faults resulting from extensional stresses (Schwartz et al. 1977). Deformation is pronounced in bands of weak, ultramafic rock (Bennett 1983), as with the formations associated with the Wolf Creek Fault at the upper end of Wolf and Little Wolf Creeks.

The Spenceville Fault Zone trends northwest-southeast and occurs just to the east of Camp Far West Reservoir. The Wolf Creek Fault Zone bisects Wolf and Little Wolf creeks, and the Bear River downstream of Lake Combie, and several miles upstream of the Camp Far West Reservoir. The Wolf Creek Fault in the Bear River Basin is also known as the Highway 49 Lineament (Bennett 1983) and recognized as a southern extension of the Big Bend Fault (Rogers and Williams 1974). A historic seismicity map, prepared by NID for its proposed project site of the Centennial Reservoir upstream of Lake Combie on the Bear River (NID 2017) includes the Camp Far West Project area, reproduced as Figure 3.3.1-2.

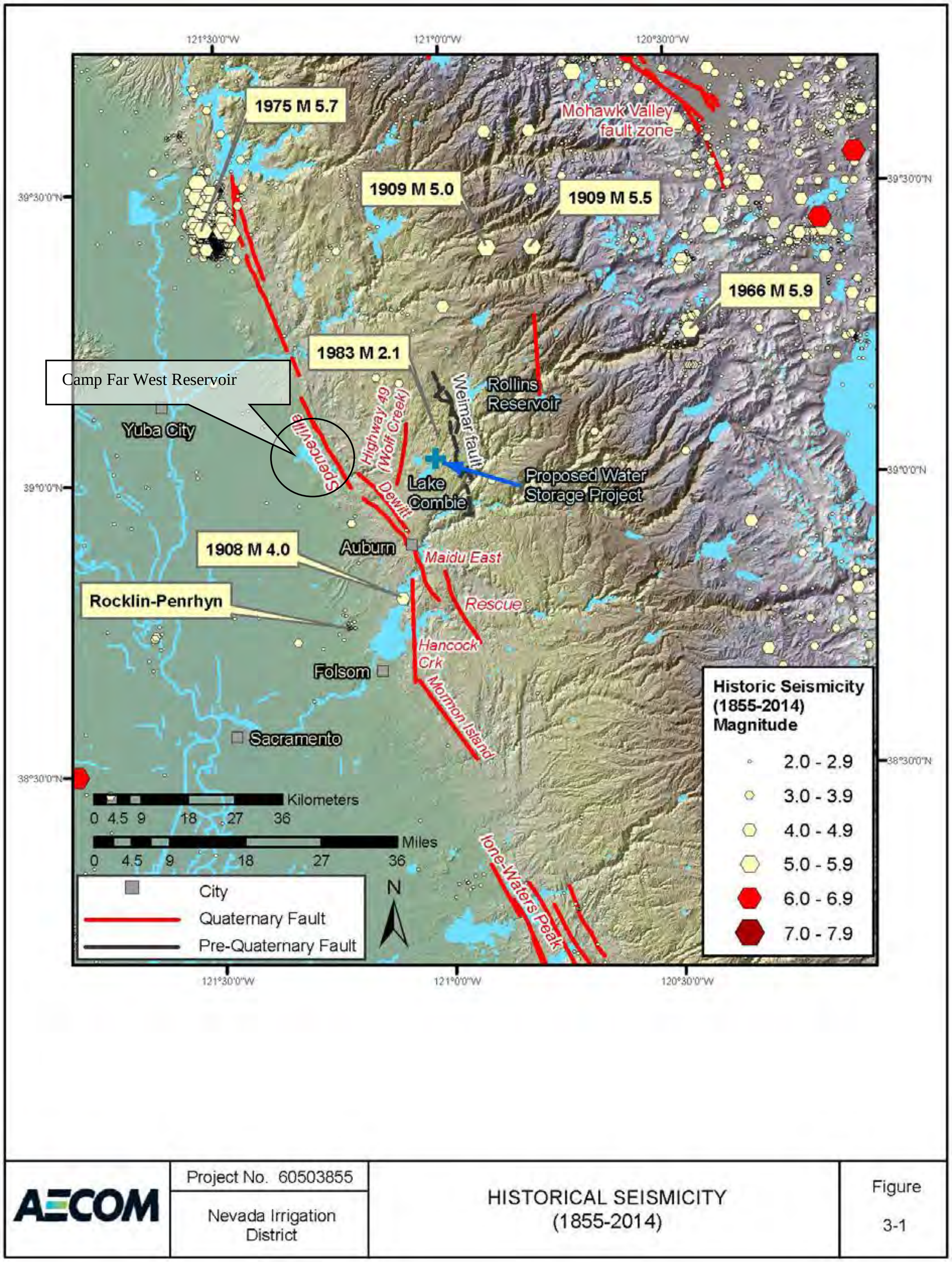

Figure 3.3.1-2. Historical seismicity in the surrounding area of the Project. Reproduced from NID Centennial Reservoir Project Geotechnical Engineering Report (NID 2017).

3.3.1.1.3 Mineral Resources

Six mines were found in the Project Vicinity, most of which were gold and copper mines, as shown in Figure 3.3.1-3 and Table 3.3.1-2.

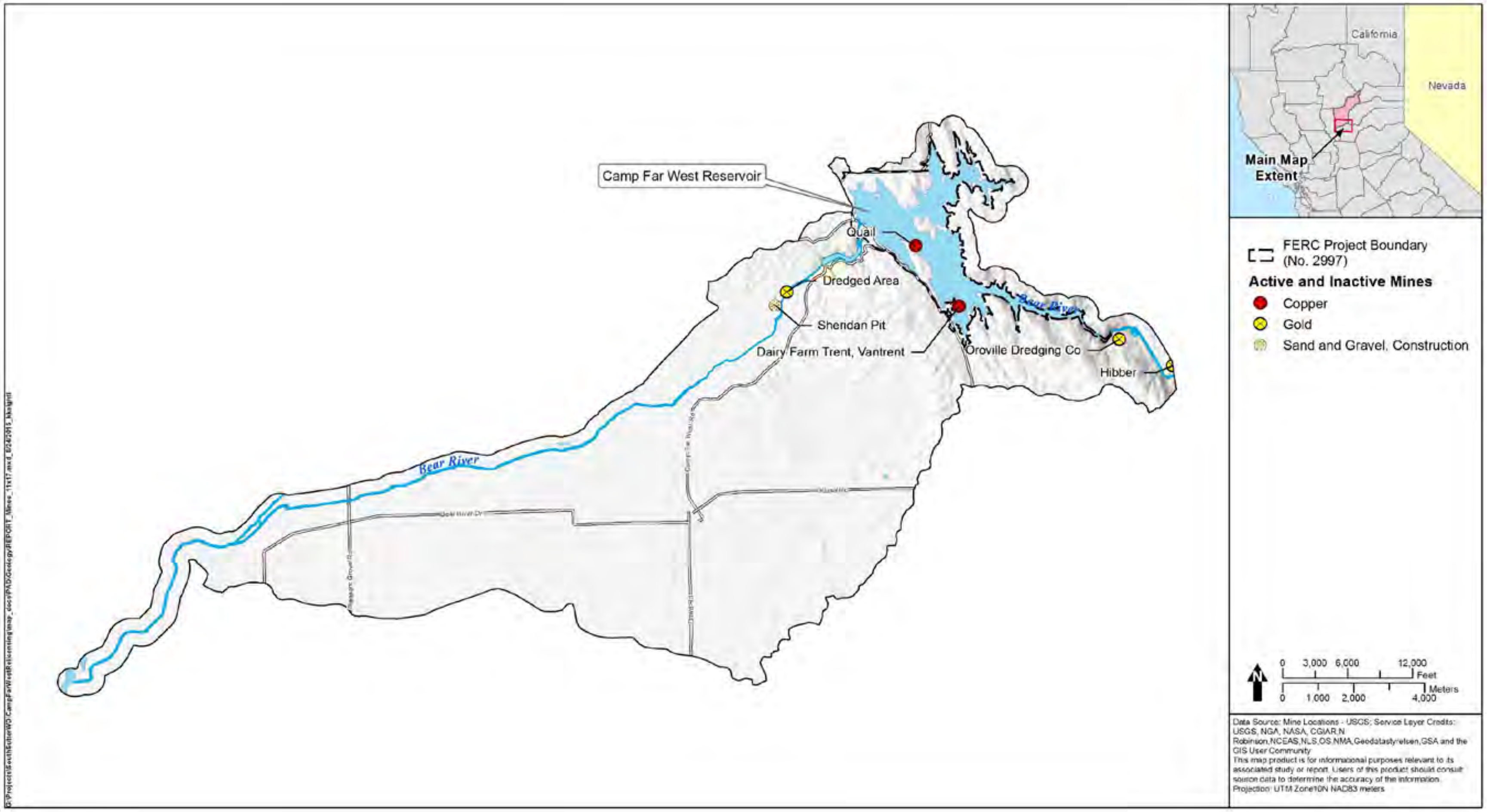

Figure 3.3.1-3. Active and inactive mines in the Project Vicinity.

Table 3.3.1-2. Mines in the Project Vicinity.

Site Name	Major	Minor	Operation	Status	Previous Name
Dairy Farm (Trent, Vantrent)	Copper, Gold	Silver	Unknown	Past Producer	--
Hibber	Gold	Copper	Unknown	Past Producer	--
Dredged Area	Gold	--	Placer	Unknown	--
Oroville Dredging Company	Gold	--	Placer	Unknown	--
Quail	Copper	Silver (trace)[1]	Unknown	Occurrence	--
Sheridan Pit	Sand and gravel	--	Surface	Producer	Sheridan Plant

[1] Not specifically defined in the database, but is assumed to be less than a "minor" component.

One of the main mines near Camp Far West Reservoir and within the FERC Project Boundary is the inactive Dairy Farm Mine (Trent Mine and Vantrent Mine). The deposit from which copper, zinc, and gold were derived is part of the Foothill Copper-Zinc Belt, which extends along the western slope of the Sierra Nevada in eastern California (Heyl 1948). Open pit and underground mining began during the 1860s and continued in the early 1900s and 1930s. The pit created during the 1920s and 1930s extends more than 150 ft below the surface, which is inundated by the Camp Far West Reservoir during high levels, yet is hydraulically isolated at low pool elevation (Alpers et al. 2008). Underground mining followed the massive-sulfide deposit to a total depth of at least 500 ft; the deposit was 10 to 60 ft thick and more than 600 ft long. In 1915, 350 tons of ore were mined per day (Waring 1919). A cyanide plant with a capacity of 100 tons per day was active on the site prior to 1915. In the 1930s, gold was recovered from the oxidized portion of the deposit (Clark 1963).

The Quail Mine is also located within the FERC Project Boundary on the shores of the Camp Far West Reservoir. It is listed as a "site" with an occurrence (i.e., presence or concentration) of copper (primary) and silver (tertiary). The USGS Mineral Resources Data System has no information as the operation type, mining method or yrs of production. It is a non-significant deposit (USGS MRDS, information downloaded April 2018)

The auriferous gravels of the Bear River were mined extensively by hydraulic mining methods in the mid to late 1800s. In addition, there was underground mining of lode gold-quartz vein deposits in the Grass Valley mining district, which drains into Wolf Creek (Alpers et al. 2008) upstream of the Project Area. Much of the fluvial deposits of hydraulic mine waste in the Bear River watershed remain to this day (James 1991, 1993, 1999).

The dredging industry was an important aspect of placer mining in the early 1900s. A small district was worked for some time near Camp Far West on the Bear River above Wheatland. However, the gravels were too low grade and operations were suspended (Lindgren 1911).

There is one active quarry site downstream of the Project Area on the Bear River, the Sheridan Pit that is mined for sand and gravel along the Bear River in both Placer and Yuba counties. Cemex Construction is expanding the existing Patterson Sand and Gravel Mine operation over a 38-year span (Placer County 2015). Currently, the company is permitted through 2028 to operate the mining operation on 326 ac at 8705 Camp Far West Road. The 448-ac proposed expansion is immediately south and west of the existing operation on the Bear River floodplain (Foster 2005).

3.3.1.1.4 Soils

Soil associations in the Project Area are shown in Table 3.3.1-3 and Figure 3.3.1-4.

Table 3.3.1-3. Soil associations in the Project Vicinity.

Soil No.	Soil Association	Acres	Percent of Total
s855	Sycamore-Shanghai-Nueva-Columbia	11,552	28
s840	Sobrante-Rock outcrop-Auburn	9,088	22
s870	Tisdale-Kilaga-Conejo	13	<1
s825	San Joaquin	6,799	16
s8369	Water	2,071	5
s821	Redding-Corning	8,533	20
s839	Xerofluvents-Ramona-Kilaga-Cometa	1,912	5
s817	Sierra-Caperton-Andregg)	1,794	4
Total	**8**	**41,762**	**100%**

Source: NRCS 2018.

The Project Vicinity soil distribution coincides with the underlying bedrock and geomorphic location. Table 3.3.1-4 provides a summary of the soil series characteristics including parent material, geomorphic position, slope, elevation range, average precipitation, mean annual temperature, and drainage. Soil descriptions have been summarized from the Natural Resources Conservation Service's "Official Soil Series Descriptions and Series Classifications" website (NRCS 2018) for each of the series.

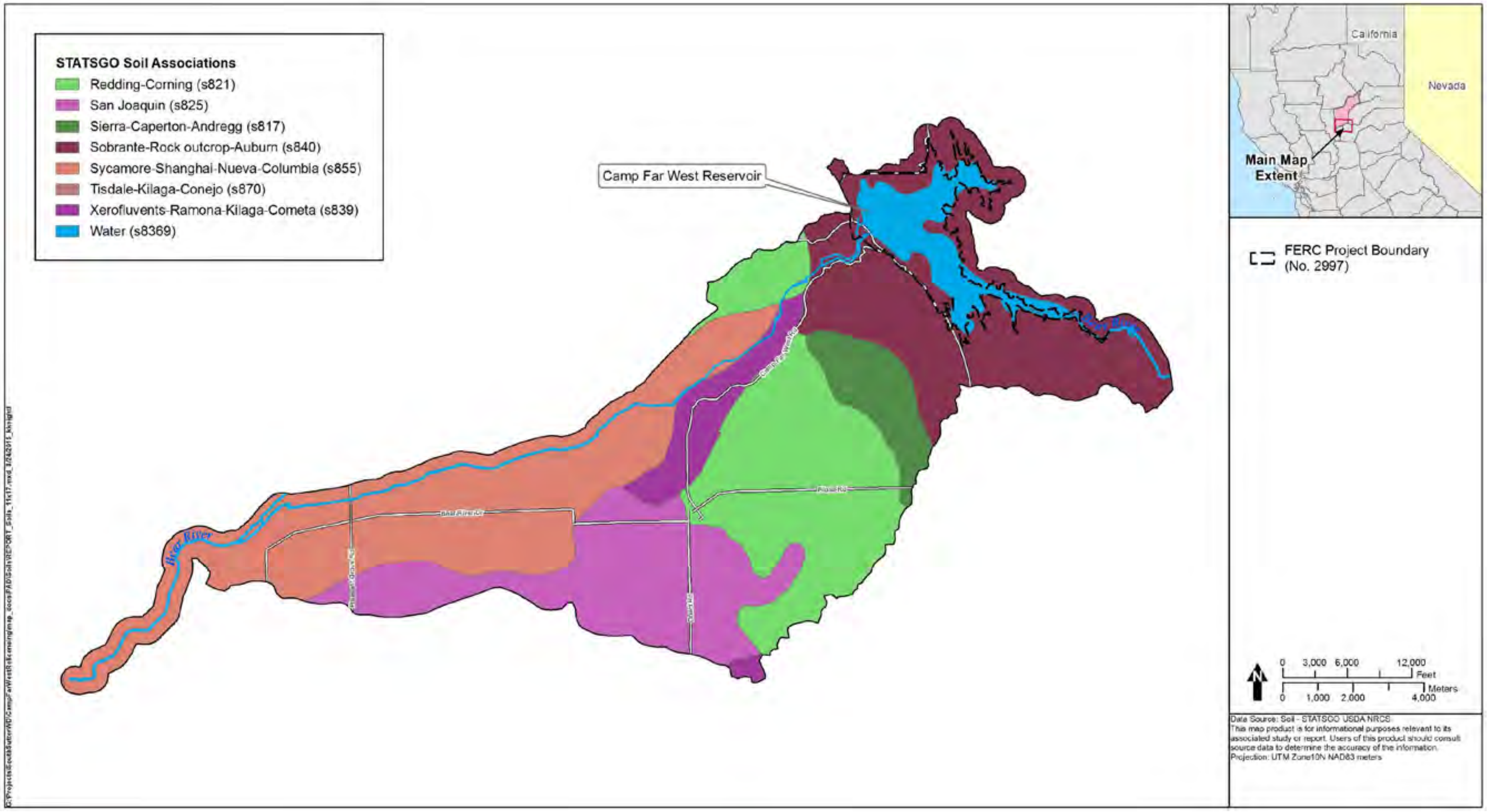

Figure 3.3.1-4. Soil associations in the Project Vicinity.

Table 3.3.1-4. Soil series and order summary description in the Project Vicinity.

Series	Parent Material	Geomorphic Position	Slope (%)	Elevation (ft)	Avg. Annual Precipitation (in.)	Mean Annual Temperature (°F)	Drainage
Andregg	Weathered granitic	Undulating to steep slopes on foothills	2-75	200-1,500	27	60°	Well-drained
Auburn	Amphibolite schist	Foothills	2-75	125-3,000	24	60°	Shallow to moderately deep, well drained
Caperton	Weathered granitic	Uplands	2-50	200-1,500	27	60°	Shallow, somewhat excessively drained
Columbia	Alluvium	Flood plains and natural levees	0-8	10-155	12-25	61°	Very deep, mod well drained
Cometa	Granitic	Gently sloping, slightly dissected older stream terraces	0-15	200-600	16	62°	Moderately well or well-drained
Conejo	Alluvium from basic igneous or sedimentary rocks	Alluvial fans/stream terraces	0-9	30-2,000	20	62°	Very deep, well drained
Corning	Gravelly alluvium	High terraces with mound, intermound relief	0-30	75-1,300	23	62°	Very deep, well or moderately well drained
Kilaga	Alluvium from mixed sources	Terraces	0-9	50-200	20	62°	Deep and very deep, well drained
Nueva	Alluvium from mixed sources	Floodplains	0-2	20-80	16	62°	Very deep, somewhat poorly drained
Ramona	Alluvium from granitic rocks	Terraces and fans	Nearly level to mod steep	25-3,500	15	63°	Well-drained
Redding	Alluvium	High terraces	0-30	40-2,000	22	61°	Moderately deep to duripan, well or mod well drained
San Joaquin	Alluvium from predom. Granitic source	Undulating low terraces	0-9	20-500	15	61°	Mod deep to duripan, well and mod well drained
Shanghai	Alluvium from mixed sources	Floodplains	0-2	20-150	18	62°	Very deep, somewhat poorly drained
Sierra	Acid igneous	Foothills	Gently sloping to steep	200-3,500	20-38	59° - 62°	Deep, well drained
Sobrante	Basic igneous and metamorphic	Foothills	2-75	125-3,500	32	60°	Mod deep well drained
Sycamore	Mixed sedimentary alluvium	Floodplains	Nearly level	10-100	15-20	60° - 62°	Poorly drained
Tisdale	Alluvium from mixed sources	Low terraces	0-2	20-80	18	62°	Mod deep, well drained
Xerofluvents	Young soils not differentiated enough to separate from soil suborder. Shallow, developed in Mediterranean climate, slopes of less than 25% and mean annual soil temperature above freezing and Holocene-age carbon; associated with low-gradient alluvial material adjacent to the lower Bear River corridor.						
Total	**18 Soil Series**						

Erosion hazard within a soil series is often strongly dependent upon slope. In general, the steeper the slope, the more erosive the soil, although erosion potential on steeper slopes may be moderated by coarse, well drained soils, such as those derived from granitic parent material.

3.3.1.1.5 Physiography

The current Bear River basin drains the northwestern Sierra Nevada via a series of deep canyons cut by mountain channels, separated by high, steep sided ridges and a parallel drainage network.

In the upper section of the Bear River above Lake Combie, downcutting, through the relatively soft Paleozoic metamorphic rock (Shoo Fly Complex) has created a deep, v-shaped canyon where short, steep-sided tributary drainages are typical (Geomatrix 1997). However, in the lower Bear River downstream of Camp Far West Dam, the river flows through alluvial material and constructed levees. According to Sacramento River Watershed Program's report on the Bear River, a high volume of mining sediment along with the levees restricting lateral movement that have caused the lower Bear River to become incised (SRWP 2010); Foothills Water Network (FWN) (2015) also cites this condition yet neither have provided data nor sources. During habitat mapping of the lower Bear River in 2015, SSWD found numerous locations where the channel is bounded by near vertical slopes between levees and vegetated, stable terraces. There are also inset floodplains, and low, semi-active terraces that are adjacent to the low flow (e.g., 25 cfs) channel.

3.3.1.1.6 Sedimentation

There are no known excessive sources of erosion that would lead to sedimentation within the Project Area. In 2008, a bathymetry study was done on Camp Far West Reservoir and compared against 1968 bathymetry. The 1968 reservoir storage volume was estimated at 104,000 ac-ft and in 2008 at 93,740 ac-ft, a reservoir capacity loss of 10,260 ac-ft[1] over 40 yrs (Mead and Hunt 2012). Based on an average specific weight of 70 pounds/cubic feet (cu ft), as estimated by Dendy and Champion (1978) for Lake Combie, this volume of sediment deposition in the reservoir indicates 16 million tons of sediment have been deposited, or 321,000 tons/yr, which translates to 2,188 tons/mi^2/yr. Accumulation rates for other reservoirs in the area are shown on Table 3.3.1-5.

Table 3.3.1-5. Accumulation rates in nearby reservoirs.

Stream	Reservoir (River Mile (RM) at Dam)	Rate of Deposition (ac-ft/mi/yr)
Bear River	Rollins Reservoir (RM 50.4)	2.1
	Lake Combie (RM 37.2)	0.75[1]
	Camp Far West (RM 18.2)	1.4
Yuba River	Englebright Reservoir (RM 24.3)	0.6

[1] Estimated by Dendy and Champion (1978).

Though sediment supply is high in the lower Bear River due to continued movement and availability of hydraulic mining debris, downstream of some dams, the channel can respond either with coarsening of the bed, or there may be no change if the downstream channel was originally transport-dominated (e.g., bedrock control with little storage of sediment). Construction of Camp Far West Dam and Lake Combie Dam (aka Van Geisen Dam) in 1928 halted downstream transport of most mining sediment (James 1988). Downstream channel responses to Van Geisen Dam were negligible in the middle Bear River because channels are dominated by bedrock. There was significant accumulation of sediment in the early 1900s at the Van Trent Gage, which was inundated by the Camp Far West Reservoir, which was attributed to historic mining sediment (James 1999).

[1] Calculated volume: 10,530 ac-ft*43,560 ft^2= 458,686,800 ft^3, multiplied by 70lbs/ft^3 = 3.2x10^{10} lbs = 16 million (m) tons/50 year = 321,000 tons/year. Camp Far West Dam drains an area of 146.7 mi^2.

Hillslopes in the Project Vicinity, shown in Figure 3.3.1-5, are generally less than 25 percent. (Table 3.3.1-6). Within the Bear River arm (the arm that comes into the Reservoir from the southeast), slopes are often greater than 50 percent, especially where it narrows upstream of the main reservoir body. However, it appears that these steeper slopes are dominated by bedrock, judging from aerial photographs and the soil survey that identifies the soil association as Sobrante-Rock Outcrop Auburn (Figure 3.3.1-4 and Table 3.3.1-4), and are likely resistant to erosion. The spillway just below the dam is also in the 25-50 percent hillslope range. However, the spillway flows over bedrock.

Table 3.3.1-6. Summary of slope classes within the Project Vicinity.

Slope Class (%)	Acres	Percent of Project Vicinity
0-25	661,664	93.6%
25-50	41,154	5.8%
50-75	3,723	0.5%
75+	389	0.1%
Total	**706,930**	**100.0%**

Excluding recreation-related roads, the Proposed Project includes one road: a short, paved road segment that accesses the Camp Far West Powerhouse. However, there are unsealed roads on the western side of the reservoir that may be contributing fine sediment. Slopes are steepest in the Bear River arm of the reservoir. However, there are few roads close to the water and the river appears to be bounded by resistant parent rock (i.e., there is no evidence of channel or hillslope instability that adds coarse or fine sediment) within the Project.

The inactive Dairy Farm Mine occupies a low terrace within the FERC Project Boundary that extends into the reservoir. Significant parts of the historic mine are within the drawdown zone and are currently being eroded. The Dairy Farm arm receives acidic, metal-rich drainage seasonally from the mined area (Alpers 2008). In the 1980s, several acres were reclaimed by removing pyrite-bearing waste rock and mill tailings to reduce the acidic runoff and pool soil quality (G. Vaughn, California Regional Water Quality Control Board-Central Valley Region, oral communication, 2001 as cited in Alpers 2008).

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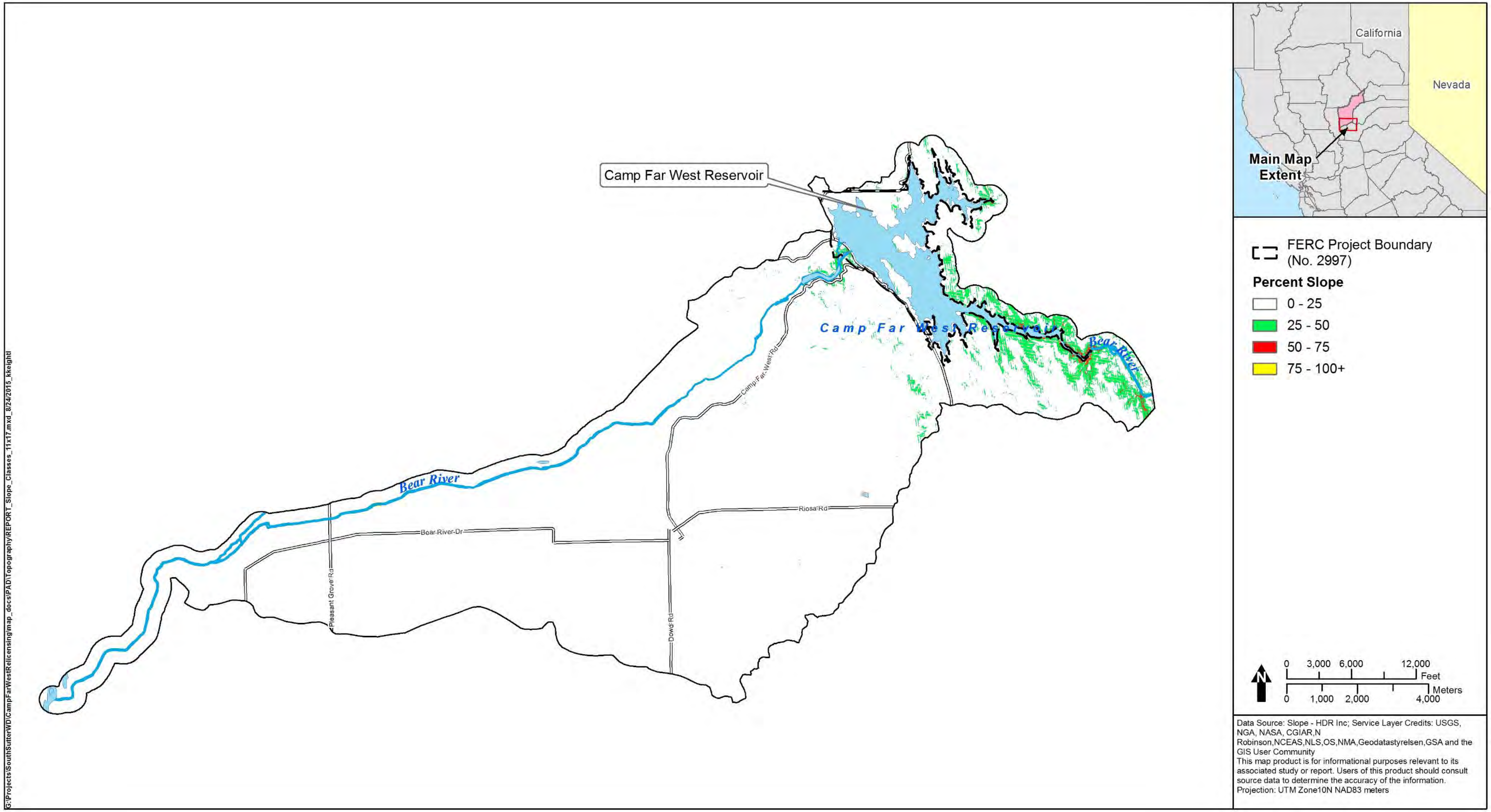

Figure 3.3.1-5. Slopes in the Project Vicinity.

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3.3.1.1.7 Existing Reach Information

This section presents existing information to describe channel setting and processes in the following reaches: 1) upstream of the Project; 2) within the Project; and 3) downstream of the Project.

Upstream of the Project

In reviewing aerial imagery (Google EarthPro 2015®), the Bear River flows through bedrock and boulder and there are substantial sections of bedrock gorge, which (James 1999) characterized as a "steep gorge". (James 1999) reported that there has been little sediment production and storage between Lake Combie and Camp Far West Reservoir due to the steep gorge, and there are no major obstacles to sediment transport. A rough estimate of average gradient for this reach, based on change in elevation of 1,200 ft over 13.8 mi, is 1.6 percent.

NID owns and operates the Combie development. Lake Combie has little water storage capacity and the reservoir fills with each storm event. Dredging to maintain water storage capacity has occurred over the past 40 yrs, and was halted in 2002 due to high mercury levels. While monitoring and studying the effects on water quality and biota, a sediment and mercury removal project was approved to extract mercury from dredged sediments, initially estimated to be about 150,000 to 200,000 tons of accumulated sediment. The project is estimated to take 3-5 yrs to complete, with on-going maintenance to remove the annual sediment accumulation, estimated to be 50,000 tons/yr (NID 2012). Initially, 804 milligrams of elemental mercury was removed from 944 kilograms of material from Lake Combie (NID 2012). In June 2018, NID agreed to move forward with a pilot project to remove and clean approximately 80,000 cu yd of sediment from Combie Reservoir (NID 2018).

At the request of NID, reach assessments were conducted within an approximately 5.5 mi section of the Bear River from Lake Combie to Wolf Creek (ECORP 2014). One response reach within the Bear River was selected for an instream flow and sediment study. Three potential study sites were identified and an 844-ft section of the Bear River, known as the Laursen Reach, was selected by interested parties and found to be representative of habitat types and composition. Generally, the river is controlled by bedrock and large boulders with little vegetative cover. The complete results are found in the ECORP documentation. However, the general findings were:

- Average width was 35.5 ft for the Bear River location, and 34 ft within the study area, and widths within the study area ranged from 12 to 69 ft, and depth from 1 to 23 ft.
- Mid-channel pools composed over 50 percent of the habitat type, with riffles next (25 %) and then run/glide habitat (22 %).
- Cover provided by vegetation is less than 10 percent; cover from undercut banks is about 1 percent; large boulders provide 15 percent; surface turbulence and depth provided an average of 15 percent.
- Trout spawning habitat is less than 1 percent. Sediment typically ideal for trout spawning are scarce or armored below larger imbricated cobbles.

- LWD is largely absent in the entire 5.5 mi section.
- Bear River is largely bedrock-controlled. Specifically within the Laursen Reach substrate ranged from coarse sand to bedrock, yet is dominated by 20-60 percent boulders and 10-65 percent bedrock.
- Very little sediment is present, most of which was located on point bars, behind boulders, and underneath or behind LWD. In the Laursen Reach, if sediments did exist, it was mostly gravels and to a lesser extent cobbles. Very little sediment was available for sampling.
- Bankfull discharge is estimated to be about 60-80 cfs.
- Roughly half of the available sediments between 20-43 millimeters (mm) in diameter would be entrained at flows up to 15 cfs within most of the habitat units.
- Minimum annual peak flow from 2001 to 2011 was 823 cfs.
- Flows capable of mobilizing and transporting large sediments likely occur every year. Bear River appears to be highly competent to transport 15 to 35 percent of the gravel materials at flows under 10 cfs, which makes this river unsuitable for gravel augmentation.

Channel reaches within the Bear River mining districts remain dominated by mining tailings after more than 100 yrs (James 1991). Much of the sediment produced by incision into mining tailing deposits was deposited near the aggrading confluences of Steephollow and Greenhorn creeks with the Bear River and currently forms deltas in Rollins Reservoir (James 2004). Detention of down-valley sediment deliveries by dams created a sediment-starved environment dominated by channel erosion in the lower Bear River valley below Rollins, Van Giesen, and Camp Far West dams. Channel incision below these dams reflects lowered sediment loads and effects of altered flow regime have exacerbated incision (James 1988). Anthropogenic changes due to mining changed the Bear River from a supply-limited system to a transport-limited system, and a change in geomorphic processes away from long-term drainage evolution dominated by ingrown meanders.

Within the Project

Camp Far West Reservoir may receive acidic, metal-rich drainage seasonally from the inactive Dairy Farm Mine. This mine, located within the FERC Project Boundary, is discussed in Section 3.3.1.1.3. Removal of pyrite-bearing waste rock and mill tailings in the 1980s reduced some of the acidic runoff and poor soil quality. However, the pit remains a likely source of trace metals, sulfate, and acidity to Camp Far West Reservoir and the lower Bear River. Elevated concentrations of total mercury in the water of Camp Far West Reservoir and in the biological taxa over a range of trophic levels were observed in fall and winter from October 2001 through August 2003 (Alpers et al. 2008). Alpers et al. (2008) reported mercury bioaccumulation factors are high compared to other reservoirs in northern California, which indicates relatively efficient biomagnification (Alpers et al. 2008). In contrast, SSWD's relicensing *Water Quality Study* found total mercury concentrations ranged between 2 nanograms per liter (ng/L) and 33.8 ng/L during three sampling events near Camp Far West Dam. Five of the six samples collected for mercury were less than 6 ng/L and the sixth sample (33.8 ng/L) was taken near the bottom of the reservoir in November 2017. All six samples SSWD collected and analyzed for total mercury were below the Basin Plan Water Quality Benchmark of 50 ng/L (EPA 2000). Regarding total and dissolved methyl mercury, five of the six samples were a "non-detection" and the sixth sample measured 0.1 ng/L (Table 3.3.3.2-9). These mercury concentrations were similar to those observed in the Bear River upstream of Camp Far West Reservoir where total mercury ranged between 2.4 ng/L and 11.3 ng/L over three sampling events and total and dissolved methyl mercury was a "non-detection" for two of the three samples and the third sample was 0.5 ng/L (Table 3.3.2.8). Additional discussion of mercury in Camp Far West Reservoir is in Section 3.3.2.1.2.4 of this Exhibit E.

The Bear River had a waterfall that barred upstream salmon movement in the vicinity of the Camp Far West Reservoir. The waterfall was submerged or built upon during construction of the dam (Wildland Resources Center 1996).

On the section of the Bear River, now inundated by the Camp Far West Reservoir, was the Van Trent stream flow gage that operated from 1905 to 1928. It was reported by Keyes (1878) that there was three meters (m) of aggradation that occurred in the 1870s. Channel instability and rating-curve changes were noted between 1907 and 1927. Large volumes of sediment were produced in the Bear River Basin from 1913-1914 and from 1918-1921; hydraulic mining provided sediment to the channel and high flows transported and redistributed the material downstream. These sediment volumes correspond to high flows recorded at the Van Trent gage (James 1991). Rating curve changes were noted in most years from 1914 to 1927, and in 1909, were specifically attributed to the movement of "mining debris" (James 1999).

The Camp Far West Dam existing spillway terminates in a chute excavated into solid rock. This unlined channel then joins the Bear River approximately 1,200 ft below the dam. Material eroded from the spillway channel has been deposited as an alluvial fan at the junction with the Bear River. The fan is approximately 450 ft long by 300 ft wide, and is composed of fairly coarse, stable material (Figure 3.3.1-6). The distal end of the alluvial fan, located about 700 ft downstream of the dam face, restricts the mainstem channel width from 70 ft to 23 ft, then the channel width increases downstream of the fan to over 200 ft. The alluvial fan material is stored within the backwater area of the diversion dam impoundment. There are no obvious additional failures or excessive sediment sources on the slopes or banks of the SSWD diversion dam impoundment below the reservoir.

Figure 3.3.1-6. Camp Far West Dam and Spillway Channel on the Bear River at RM 16.9. The red circle indicates the alluvial fan.

In most years, SSWD collects no LWM from the surface of Camp Far West Reservoir. Very little LWM enters the reservoir from upstream and the reservoir shoreline has very little LWM.

SSWD is unaware of any reservoir shoreline stability issues. In general, the shoreline is gently sloping and stable. At the Dairy Mine site, the historic tailings pile is creating acid mine drainage (Alpers 2008). There is a two-track road that begins in the Project Area on the historic tailings pile and continues southeast onto private property. There is an eroded mound of dirt and gravel that is yellow and full of sulfur that was likely bulldozed into the location during mine destruction as trees are undisturbed; it is unclear if the material can be directly transported to the reservoir. Most of the Dairy Mine is on private property.

Downstream of the Project

The lower Bear River is described below based on information developed by Allan James, the FWN, the Sacramento Watershed Program, and SSWD.

The lower Bear River was an anastomosing channel with a series of sloughs and with two terrace sets described by early settlers, the lowest terrace remains in-filled by deposition of mining sediments (James 1988). James estimated 164 million cu yd was stored in the lower Bear River during maximum aggradation. In the lower Bear River, incision processes dominated from 1905 to 1928. Between 1930 and 1955, the channel was relatively stable as pre-mining alluvial gravel armored the bed. The channel began to incise again in 1955 after a large flood penetrated the coarse gravel layer. Incision was unaffected by construction and enlargement of Camp Far West Dam, which suggests that changes in flow regime and sediment loads caused by the dam were much less important than penetration of the channel armor layer prior to dam construction (James 1988).

There is little urban development along the corridor. However, agricultural uses and levees influence floodplain development, water distribution, and riparian environments. In 2004, the Environmental Defense Fund, FWN and their partners reported in *Assessing Flow Improvement Needs and Opportunities in Northern California's Bear River Problemshed* various flow needs and flow-related challenges in the lower Bear River (FWN Bear River *Awakening* webpage 2015). Among the issues identified, due to past accumulation of mining sediments and presence of restricting levees, the channel has become narrow and incised, that downstream gravel recruitment had been limited for many yrs and would need to be supplemented to improve habitat, and that invasive Giant Arundo (i.e., giant cane, or *Arundo donax*) should be eradicated. They did not indicate there were data to support these identified issues. Figure 3.3.1-7 shows active and prolific sediment additions from near the CEMEX property above Highway 65 (~ RM 12) with giant cane in the active channel that had been stabilizing gravel bars. Much of the giant cane was removed by the very high flows in 2017.

Figure 3.3.1-7. An example of bank erosion, gravel bar formation, and giant cane concentration in the lower Bear River (RM 13).

The USFWS was to develop competitive Request for Proposals for studies to evaluate baseline conditions as well as fishery restoration needs and opportunities on the lower Bear River below Camp Far West Reservoir (Yardas and Eberhart 2005). As of 2013, no projects have been conducted, nor is there information for the watershed (USFWS 2013).

Between 2005 and 2009, the Bear River Setback levee was designed and constructed by the Three Rivers Levee Improvement Authority to replace an existing levee. The improved levee was approximately 9,600 ft long and replaced levee portions at the junction of the Feather and Bear rivers. The setback levee was designed to provide a 200-year flood protection level. In addition, 1 million shrubs and trees were planted in the setback area to prevent erosion and to benefit threatened and endangered species in the expanded floodway (SRWP 2015).

There are significant quantities of gravel in the lower Bear River, much of which may be derived from hydraulically mined sediments. It was estimated previously that 160 million cu yd of mining sediment are stored in the lower Bear River (FWN 2015a). The high volume of mining sediment, in combination with restricting levees, has caused the lower Bear River to change from wide and shallow to deeply incised, according to the FWN. However, no data have been collected to support this claim. The Sheridan Pit gravel and aggregate mine (now part of the CEMEX sand and gravel mining and processing operation) is testament to the high volumes of sand and gravel present in and near the Bear River. Additional discussion of gravel availability as it relates to fisheries is provided in Section 3.3.3.1.3.

Further characterization of stream channel characteristics downstream of the Project is described below with respect to channel form, large woody material, and instream habitat.

Channel Form

To characterize sediment storage within the lower Bear River channel, a hillslope shading map was developed by SSWD (2010) using LiDAR to delineate floodplains and terraces adjacent to the lower Bear River (Attachment 3.3.1A). These maps were used to quantify channel sediment into sediment storage types (i.e., Active, Semi-Active, Inactive, and Stable), as defined in Table 3.3.1-7. The area used to quantify the aerial extent within each stability class was limited to between the constructed levees or stream-adjacent roads that would limit lateral channel movement. If no artificial limit to lateral movement was obvious but the channel was bounded by the Stable stability class (i.e., greater than 20 ft above the water surface during low-flow), approximately 100 ft on each side of the channel was used to quantify such areas. LiDAR data were not available for the area from the non-Project diversion dam to the Camp Far West Dam so this assessment was not performed for that area.

Sediment storage volume was assessed as part of the Study 3.3, *Instream Flow*, as shown in Table 3.3.1-7. Volume was estimated using average thalweg depth assessed during the *Instream Flow Study* at the upstream (between RM 14.2 to 15.1) and downstream (between RM 7.7 to 8.3) modeling sites, then converted to tons using Dendy and Champion (1978) formula. The greatest area of stored sediment is within the semi-active classification, while the lowest is within the active channel.

Table 3.3.1-7. Estimate of sediment stored within four stability classes within and adjacent to the lower Bear River.

Stability Class	Description[1]	Height above low-flow water surface elevation (ft)[2]	Area (million ft^2)	Volume (m ft^3)[3]	Quantity (m tons)[4]
Active	Moves at least once every few years	0-6	5.7	31	1.1
Semi-Active	Susceptible to revegetation and moved every 5-20 years	6-15	19.5	254	8.8
Inactive	Moves only during extreme events every 20-100 years and becomes well-vegetated in the interim	15-20	15.3	306	10.7
Stable	Deposits are not accumulating under present climate or channel regime, yet may be susceptible to cutbank erosion	20+	8.7	217	7.6

1 After Curtis et al. 2005 and Kelsey et al. 1987
2 Estimated from 2015 LiDAR; low flow discharge ~25 cfs
3 Using average/median thalweg depth and midpoint of stability class height times area
4 Based on an average specific weight of 70 pounds/cubic feet (cu ft), as estimated by Dendy and Champion (1978)

The stability classes were quantified within sub-reaches that were defined for habitat mapping and the quantification of LWM (Table 3.3.1-8, Figure 3.3.1-8).

Table 3.3.1-8. Area within stability class by sub-reach of the lower Bear River between the Feather River and the non-Project diversion dam.

Sub-Reach Name	Location and Length	Stability Class (million ft^2)			
		Active	Semi-Active	Inactive	Stable
Feather River to Highway 70	RM 0 to 3.5 (3.5 mi)	0..6	1.1	2.2	1.1
Highway 70 to Pleasant Grove Rd	RM 3.5 to 6.8 (3.3 mi)	1.0	9.9	7.1	1.0
Pleasant Grove Rd to Highway 65	RM 6.8 to 11.5 (4.7 mi)	1.5	3.9	3.7	8.3
Highway 65 to SSWD Diversion	RM 11.5 to RM 16.9 (5.3 mi)	2.6	4.5	2.4	1.7
Highway 65 to CEMEX	RM 11.5 to 14.2 (2.7 mi)	1.0	1.8	1.3	1.1
CEMEX to non-Project diversion dam	RM 14.2 to RM 16.8 (2.6 mi)	1.6	2.7	1.1	0.6

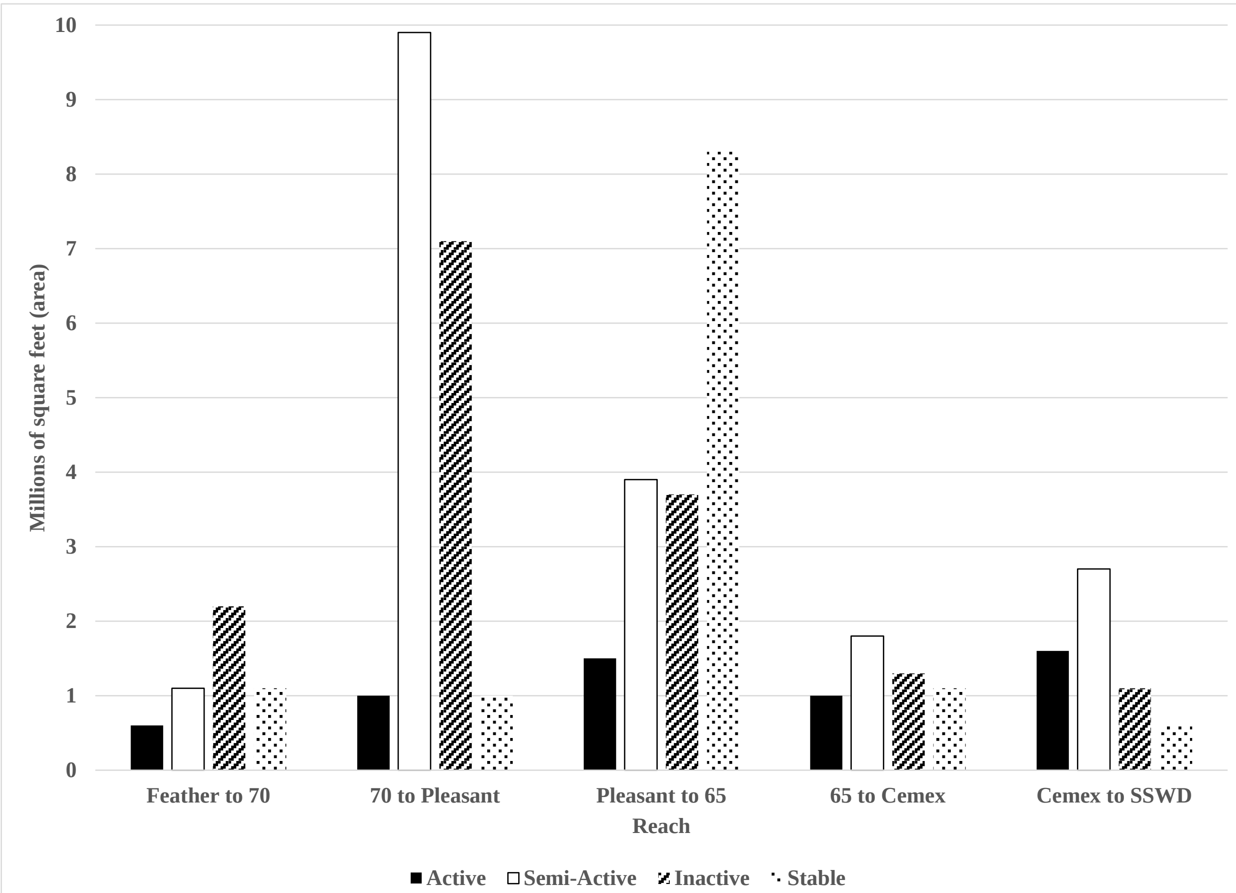


Figure 3.3.1-8. Area for each stability class within sub-reaches of the lower Bear River between the Feather River to the non-Project diversion dam.

The extent of channel confinement types was also quantified in terms of extent and location in the lower Bear River (Table 3.3.1-9). Seventy percent of the channel is defined as confined and 30 percent unconfined in the lower Bear River.

As defined above, the Active Stability class is considered the channel area within 6 ft of the low flow (~25 cfs) water surface elevation and is generally consistent with the 1.5 yr return frequency. The 1.5 yr return frequency stage height was estimated using instantaneous peak flows recorded at USGS Gage Station 11424000 on the Bear River near Wheatland at RM 11.5 along with the gage height/discharge relationship (Figures 3.3.1-9 and 3.3.1-10). Generally the river channel within a 1.5 yr return frequency is a floodplain under construction and flooded frequently at a relatively consistent recurrence interval and is important in geomorphic analysis (Dunne and Leopold 1978).

Table 3.3.1-9. Channel confinement types, extent and location in the lower Bear River between the Feather River (RM 0) and non-Project Diversion (RM 16.9).

Channel Type	River Mile		Distance (miles)	
	Start	End	Confined	Unconfined
Confined	0	3.1	3.1	--
Unconfined	3.1	3.5	--	0.4
Confined	3.5	3.9	0.4	--
Unconfined	3.9	4	--	0.1
Confined	4	4.35	0.35	--
Unconfined	4.35	4.6	--	0.25
Confined	4.6	5.6	1	--
Unconfined	5.6	6.5	--	0.9
Confined	6.5	6.7	0.2	--
Unconfined	6.7	7.4	--	0.7
Confined	7.4	9.1	1.7	--
Unconfined	9.1	10.2	--	1.1
Confined	10.2	10.9	0.7	--
Unconfined	10.9	11.3	--	0.4
Confined	11.3	11.6	0.3	--
Unconfined	11.6	11.7	--	0.1
Confined	11.7	14	2.3	--
Unconfined	14	14.4	--	0.4
Confined	14.4	15	0.6	--
Unconfined	15	15.8	--	0.8
Confined	15.8	16.9	1.1	--
		Total Miles	**11.75**	**5.15**
		Percent Total Reach	**70%**	**30%**

The Inactive Stability class is composed of the stable, vegetated terraces and levees located approximately 15-20 ft above the low flow 25 cfs water surface elevation. Sediment stored within the Semi-Active Stability class, typically accessed during high flow events, was often found to be composed of cohesive material that enhances lateral stability of the mainstem, in some cases including vertical slopes that resist lateral channel movement.

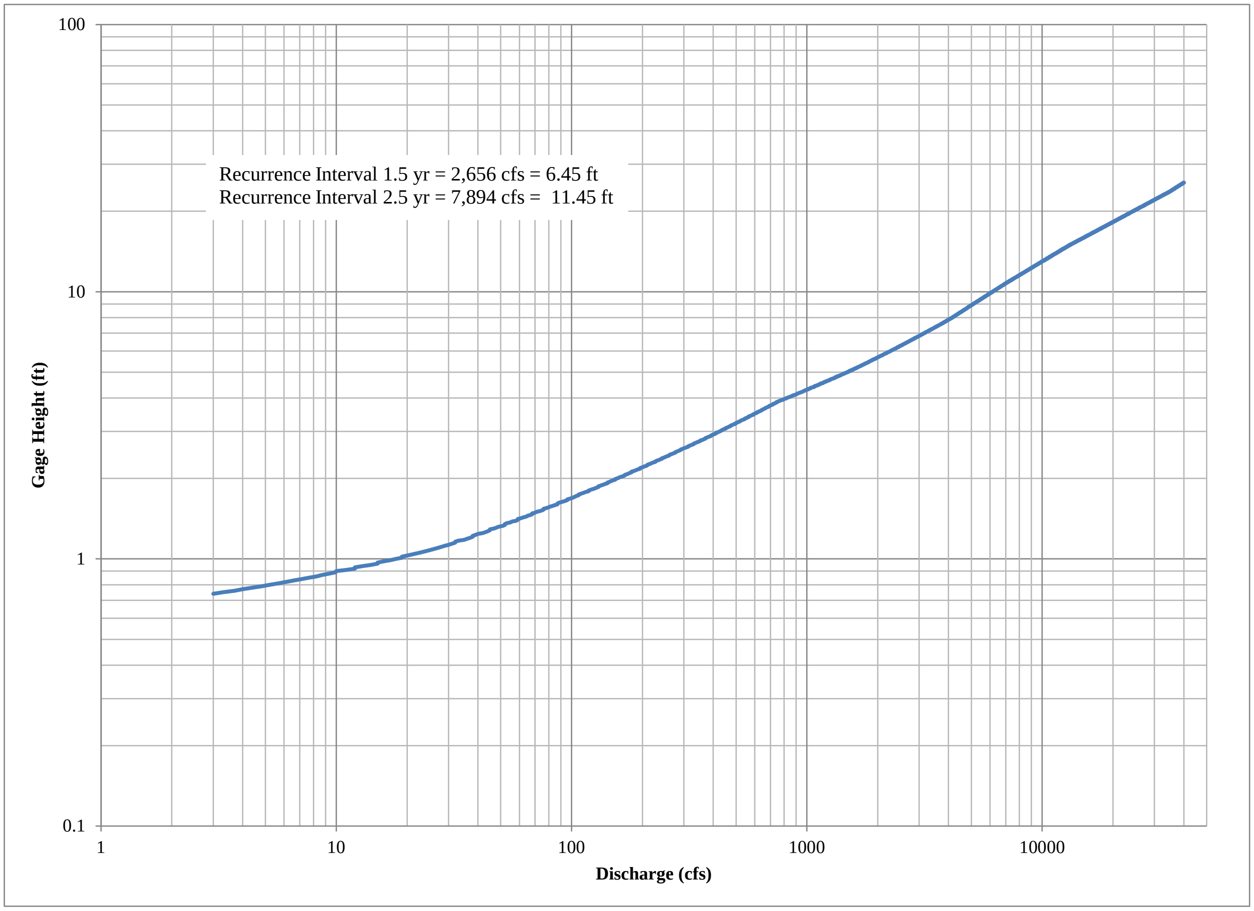
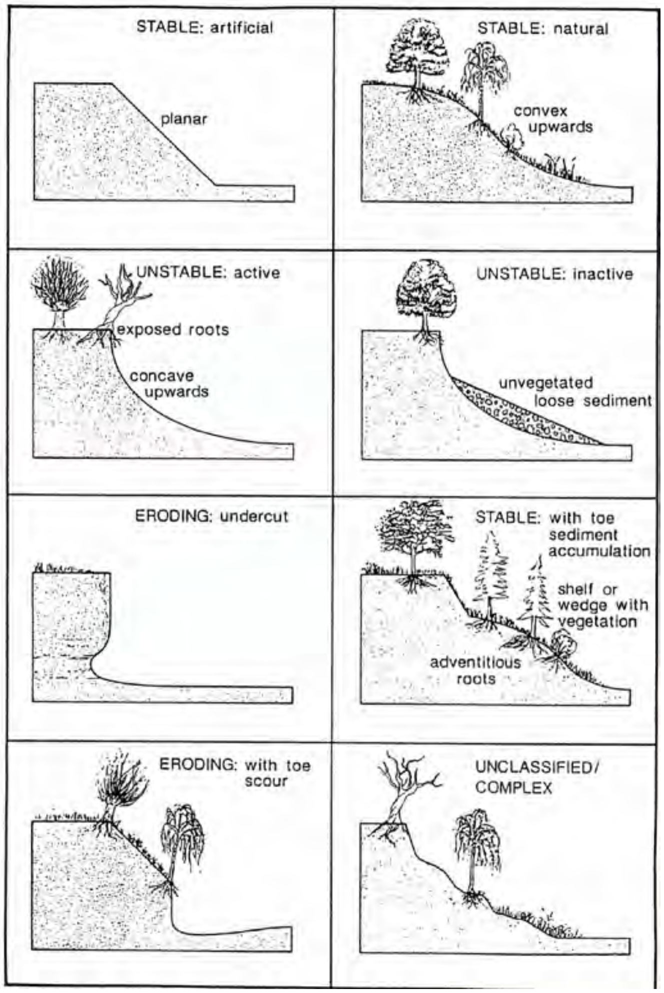


Figure 3.3.1-9. Rating curve for the Bear River at Wheatland USGS Gage 11424000 at Hwy 65 (RM 11.5) based on Instantaneous Peaks 1964 to 2015.

Figure 3.3.1-10. Determining the elevation of 1.5 yr frequency flow (2,656 cfs) for the Bear River at Hwy 65 (RM 11.5) based on instantaneous peaks 1964 to 2015 at USGS Gage station 11424000.

Channel confinement in the lower Bear River occurs between reinforced, vegetated levees or stable vegetated terraces, and also where the banks are vertical and eroding. About 50 percent of the mapped meso-habitat units were experiencing active bank erosion. Some of this erosion may be due to incision into the deposited historical mining sediments, and because levees restrict lateral channel movement. To further understand the bank types and mechanisms of erosion, the *Instream Flow Study* quantified the area (height and length) of bank types (Figure 3.3.1-11) within ten randomly selected sections of the lower Bear River, five within confined channels and five within unconfined channels (Table 3.3.1-10). Stability, for the purposes of the bank analysis exercise, refers specifically to bank erosion, and is a different type of stability than that defined for the broader sediment "Stability Classes" as above in Table 3.3.1-7.



Additional Stable Bank Types:

STABLE: Top unstable, base stable

STABLE: Toe undercut

Figure 3.3.1-11. Bank types classified in the lower Bear River at 10 random sites between the SSWD Diversion and the Feather River. From: *Figure 19. Classification and morphological interpretation of typical bank profiles* (Thorne 1998).

Table 3.3.1-10. Summary of bank erosion quantified by channel type at 10 random sites in the lower Bear River between the non-Project Diversion and the Feather River.

Site (RM)	Channel Type	Extent of Bank Erosion Area (sq ft)	
		Stable	Unstable
2.57	Confined	-0-	33,944
3.33	Unconfined	6,953	19,336
5.83	Unconfined	9,444	8,278
6.11	Unconfined	1,348	21,336
6.35	Unconfined	5,919	17,563
8.56	Confined	21,753	8,612
9.64	Unconfined	3,046	11,678
10.56	Confined	203	12,262
11.80	Confined	5,506	18,904
14.77	Confined	2,352	30,692

In general, confinement was not particularly relevant to extent or type of bank erosion. Most of the banks are exposed and actively eroding. The base of the banks are often undermined and undercut (i.e., Eroding – with toe scour [36%], Eroding – undercut [12%]), as described in Table 3.3.1-11. LWM is periodically added to the channel from these vertical banks wherein the entire tree, including the root mass is added to the channel often creating areas of bed scour and bank protection. The banks maintain a vertical profile due to fine-grained and cohesive bank material. The dominant material is composed of sand and finer, as shown in Table 3.3.1-12. The less cohesive cobble and gravel banks are associated with the extensive gravel and floodplain deposits; (refer to the hillslope shading map [Attachment 3.3.1A] where the 0-6 ft stability class occupies a larger fraction of the area between the levees, e.g., above RM 14.1). Near the toe of these coarse-grained deposits (e.g., stream-adjacent within the low flow active channel), the gravel bars have fairly resilient and resistant bank protection provided by sedges, rushes and hydrophytic vegetation within the low flow active channel. Boulders were not found except where artificially placed to stabilize the bank from lateral erosion.

Table 3.3.1-11. Area (height and length) of bank types quantified within 10 sites (20 channel widths in length) in the lower Bear River between the Feather River and the non-Project Diversion Dam.

Bank Type	Area (sq ft)	Percent Area	Stable
Eroding - with toe scour	84,943	36%	
Unstable - active	40,613	17%	
Eroding - undercut	28,185	12%	
Stable - with toe sediment accumulation	26,671	11%	x
Unclassified - complex	18,752	8%	
Stable - toe undercut	13,526	6%	x
Unstable -inactive	12,437	5%	
Stable - natural	7,250	3%	x
Stable - artificial	4,834	2%	x
Top unstable, base stable	1,917	1%	x

Table 3.3.1-12. Area (square feet) of dominant substrate of bank types quantified within 10 sites (20 channel widths in length) in the lower Bear River between the Feather River and the non-Project Diversion Dam.

Bank	Dominant Substrate (square feet)				
Type	Boulder	Cobble	Gravel	Sand	Silt and Finer
Unstable - active	0	260	1,303	26,967	12,083
Unstable -inactive	0	1,221	6,103	5,113	0
Eroding - undercut	0	1,087	1,737	10,043	15,319
Eroding - with toe scour	0	4,400	7,817	31,982	40,744
Stable - with toe sediment accumulation	0	0	4,623	7,753	14,295
Unclassified - complex	0	2,033	1,718	5,434	9,568
Top unstable, base stable	0	0	1,917	0	0
Stable - artificial	4,834	0	0	0	0
Stable - natural	0	1,356	286	0	5,608
Stable - toe undercut	0	5,964	0	720	6,843
Total	**4,834**	**16,321**	**25,504**	**88,012**	**104,460**

Large Woody Material

LWM was quantified during the habitat mapping effort. All pieces within the active channel (1.5 yr frequency elevation) that were larger than 4-in diameter at the large end, and longer than 3 ft were tallied (Table 3.3.1-13). LWM concentration ranged between 18 and 65 pieces per mile (1.1 to 4.0 pieces/100 m), and most of the pieces were within the wetted channel. The highest concentration of LWM was located between Highway 70 and Pleasant Grove bridges, and the lowest concentration was between Highway 65 (RM 11.5) and the CEMEX gravel operation (RM 14.2). The riparian area of the lower Bear River is heavily modified by levees and agricultural modifications so the recruitment potential is very low and outside of the control of Project operations. Key pieces of LWM were defined as pieces either longer than 0.5 times the low flow active channel (LFAC), or are deposited in a manner that alters channel morphology and aquatic habitat (e.g., trapping sediment or altering flow patterns). Table 3.3.1-14 summarizes the key pieces found during the habitat mapping effort in 2016. Based on incidental observations by SSWD during other field efforts, some of these pieces moved during the 2016/2017 high flows. However, new pieces were added due to bank failures.

Table 3.3.1-13. Summary of LWM count by diameter and length class within the lower Bear River between the Feather River and the non-Project diversion dam.

Reach	Diameter (in)	Length (ft)				Total Number of Pieces	Number of Pieces Within Wetted Channel	Pieces / Mile	Pieces / 100 m
		3-25	26-50	51-75	>75				
Feather River to Hwy 70	4-12	67	11	--	--	--	--	--	--
	13-24	29	12	--	1	--	--	--	--
	25-36	4	7	2	--	--	--	--	--
	>36	1	--	--	--	--	--	--	--
	SUM	**101**	**30**	**2**	**1**	**134**	**92**	**38**	**2.4**
Hwy 70 to Pleasant Grove	4-12	118	18	1	--	--	--	--	--
	13-24	25	19	5	--	--	--	--	--
	25-36	10	8	7	1	--	--	--	--
	>36	--	--	1	--	--	--	--	--
	SUM	**153**	**45**	**14**	**1**	**213**	**161**	**65**	**4**
Pleasant Grove to Hwy 65	4-12	100	16	--	--	--	--	--	--
	13-24	26	17	3	--	--	--	--	--
	25-36	4	7	3	1	--	--	--	--
	>36	--	--	2	1	--	--	--	--
	SUM	**130**	**40**	**8**	**2**	**180**	**90**	**38**	**2.4**
Hwy 65 to Cemex	4-12	26	3	--	--	--	--	--	--
	13-24	7	8	--	--	--	--	--	--
	25-36	1	4	--	--	--	--	--	--
	>36	--	--	--	--	--	--	--	--
	SUM	**34**	**15**	**0**	**0**	**49**	**43**	**18**	**1.1**
Cemex to non-Project Diversion Dam	4-12	41	2	--	--	--	--	--	--
	13-24	12	1	--	--	--	--	--	--
	25-36	5	1	--	--	--	--	--	--
	>36	--	--	--	--	--	--	--	--
	SUM	**58**	**4**	**0**	**0**	**62**	**55**	**23**	**1.4**

Table 3.3.1-14. Summary of key pieces of LWM within the lower Bear River between SSWD's non-Project Diversion Dam and Feather River.

Reach	Diameter (in)	Length (ft)				Function Provided	
		3-25	25-50	50-75	>75	Type	Percent of Function[1]
Feather River to Hwy 70	4-12	--	3	--	--	Cover Bank Protection Scour Sediment Storage No geomorphic function Vegetation trapping	40 10 15 5 25 5
	13-24	--	7	1	--		
	25-36	--	5	1	1		
	>36	--	--	--	--		
	SUM	--	15	2	1		
Hwy 70 to Pleasant Grove	4-12	6	5	--	--	Cover Bank Protection Scour Sediment Storage No geomorphic function Vegetation trapping Dam	30 20 26 8 13 2 1
	13-24	1	14	9	1		
	25-36	2	10	7	--		
	>36	1	2	1	--		
	SUM	10	31	17	1		
Pleasant Grove to Hwy 65	4-12	2	1	--	--	Cover Bank Protection Scour No geomorphic function	47 23 12 18
	13-24	--	--	1	--		
	25-36	4	2	--	--		
	>36	2	5	--	--		
	SUM	8	8	1	--		
Hwy 65 to Cemex	4-12	2	1	--	--	Cover Bank Protection Scour Sediment Storage No geomorphic function	28 28 34 7 3
	13-24	2	7	--	--		
	25-36	--	2	--	--		
	>36	--		--	--		
	SUM	4	10	--	--		
Cemex to non-Project Diversion Dam	4-12	1	--	--	--	Cover Bank Protection Scour	50 25 25
	13-24	1	--	--	--		
	25-36	--	--	1	--		
	>36	--	--	--	--		
	SUM	2	--	1	--		

[1] Some pieces have more than one function.

There was no real difference in the amount, size, species, or function of the LWM (including key pieces) found within the downstream instream flow modeling site (Tables 3.3.1-15 and 3.3.1-16) from that quantified in the lower Bear River as a whole (Table 3.3.1-14). There was no LWM in the upstream modeling site that met the minimum size criteria.

Table 3.3.1-15. LWM found in Bear River downstream instream flow study site (RM 7.7 to 8.3).

Location	Diameter (in)	Length (ft)				Total Number of Pieces	Number of Pieces Within Wetted Channel
		3-25	25-50	50-75	>75		
Downstream Instream Flow Study Site	4-12	16	2	1	--	--	--
	13-24	5	6	5	--	--	--
	25-36	--	--	1	--	--	--
	>36	--	--	--	--	--	--
	SUM	**21**	**8**	**7**	**0**	**36**	**19**

Table 3.3.1-16. Key piece characteristics within the downstream instream flow study site (RM 7.7 to 8.3).

Piece ID Number	Total Length (ft)	Diameter (in)	Orientation	Function	Root Wad Attached?
1	28	8	downstream	Bank protection	Yes
2	50	12	downstream	Bank protection	Yes
3	65	12	downstream	Bank protection	Yes
4	50	18	downstream	Bank protection	Yes
5	60	12	downstream	Bank protection	Yes
6	40	12	downstream	Scour	Yes
7	70	15	downstream	Bank protection	Yes
8	38	20	downstream	Bank protection, scour	Yes
9	64	36	downstream	None	No

Instream Habitats

In June 2015, October 2016 and August 2017 (following high flows during the winter of 2016/2017), SSWD evaluated the Bear River between Camp Far West Dam and the Feather River for habitat features and channel characteristics. The mapping consisted of assessing length of meso-habitat types and other channel features such as bank erosion and floodplain/terrace development. As part of these measurements, the LFAC was measured as a surrogate for bankfull width. The LFAC was defined as the area where vegetation was still hydrologically connected when flow was at a minimum instream flow (~10 – 25 cfs) and was identifiable in the field. Each meso-habitat had the length, LFAC width, and substrate recorded, along with a photograph. Maximum and average pool depth were also recorded for pools. In some units (a sub-set of the reach), more details were collected such as bank erosion and cover.

Meso-habitat types were dominated by pools, short riffles, runs, and long glides. The average gradient of the Bear River is generally less than 0.5 percent, with few falls, cascades, chutes, rapids, step runs, pocket water, or sheet flow habitat types. Habitat types in the Bear River are summarized in Figure 3.3.1-12. There is one exception near Highway 70 where the Bear River flows over a bedrock control and falls, rapids, and a plunge pool occur. The substrate of the mapped units in the majority of the channel is dominated by gravel with mostly cobble sub-dominant (Table 3.3.1-17). Sand is a minor component though is often the subdominant substrate present. Increasing amounts of exposed bedrock and cobble substrates occur closer to the non-Project diversion dam. The coarsening of material in the upstream direction is likely due to both a change in parent material (i.e., alluvium to volcanics) and a decrease in available sediment due to storage in Camp Far West Reservoir. Additional mudstone bedrock is exposed in the channel above HWY 65 at about RM 12.4 and upstream of Pleasant Grove Road at RM 6.7. Very little silt occurs in the active channel, though the banks are often composed of finer, sandy/silty material. There was not much in-channel cover observed and most of it was from giant cane concentrations that lined and often extended across the channel (Figure 3.3.1-13). The giant cane is fairly resistant to removal from higher flows, and served to scour pools and develop some areas of spawning gravel. While the giant cane populations were reduced during the winter 2016/2017 high flows, resistant roots were observed indicating that the cane will re-sprout and re-inhabit the channel.

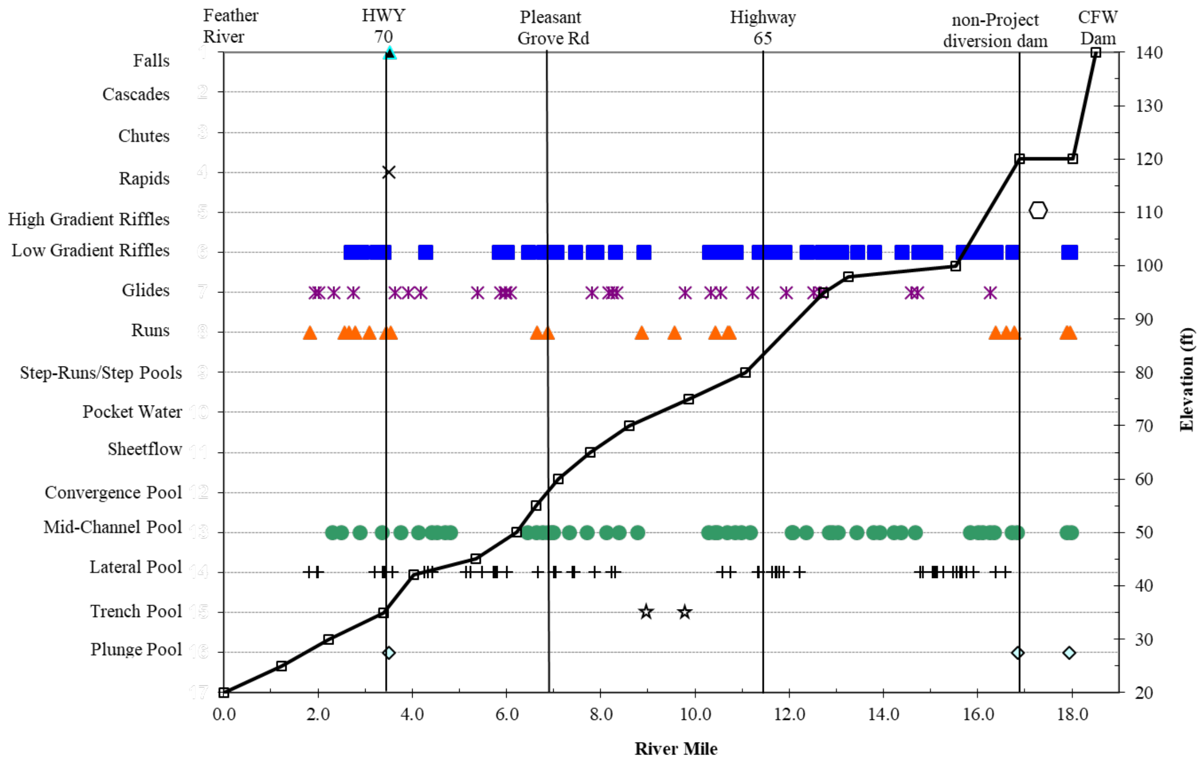


Figure 3.3.1-12. Longitudinal profile and habitat types mapped in the lower Bear River.

Table 3.3.1-17. Dominant, subdominant and bank substrate total length and frequency in the Bear River.

Substrate Type	Dominant Substrate		Subdominant Substrate		Bank Substrate	
	Total Length (ft)	Frequency (%)	Total Length (ft)	Frequency (%)	Total Length (ft)	Frequency (%)
Bedrock	696	4	603	4	872	7
Boulder	538	3	0	0	538	4
Cobble	4,893	27	4,577	29	1,257	10
Gravel	10,179	56	5,496	35	3,269	27
Sand	1,753	10	3,849	24	2,996	24
Silt	0	0	1,282	8	3,478	28
Total	**18,059**	**100**	**15,807**	**100**	**12,410**	**100**

Figure 3.3.1-13. Effects of introduced giant cane in providing cover, pool formation, gravel bar deposition and scour, and sorting of spawning-size gravels (pre-2016-17 high flows).

High flows during the winter of 2016/2017 (Figure 3.3.1-14) caused some changes to instream habitats due to scour and deposition based on observations made by SSWD before and after the high flows. SSWD observed that low gradient riffles increased in frequency and length in 2017 due to increased deposition and in areas where patches of giant cane were removed. Glides also increased in length and frequency due to deposition of gravel into areas that were previously runs or shallow pools. Some pools had enhanced scour if there were elements such as bedrock, boulder or large woody material forcing three-dimensional flow patterns (Table 3.3.1-18).

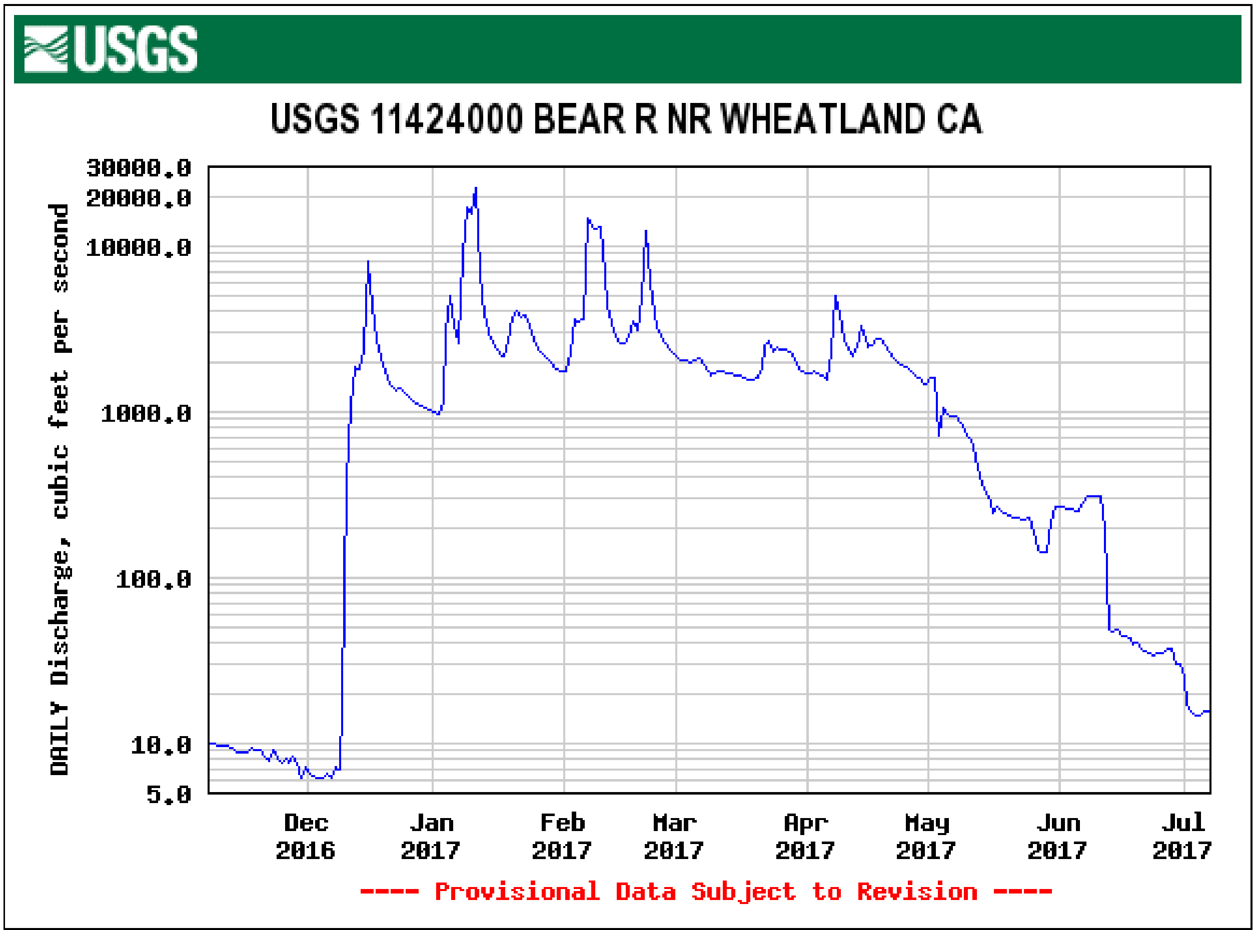


Figure 3.3.1-14. Data from USGS Gage 11324000 of Bear River near Wheatland California showing the high flows of late 2016 and early 2017. (Source: waterdata.usgs.gov. Accessed 2/8/18).

Table 3.3.1-18. 2017 Habitat type, length and frequency, and 2016 pre-flood relative frequency of habitats in the lower Bear River.

Unit Type	2016 Percent of Total Length (%)	2017 Percent of Total Length (%)	Change (%)
Mid-Channel Pool	35.9	35.1	-0.8
Lateral Scour Pool	19.5	18.7	-0.8
Glide	11.2	12.1	0.9
Backwater	10.2	10.1	-0.1
Trench Pool	6.1	5.1	-1.0
Reservoir[1]	5.3	5.3	0.0
Low Gradient Riffle	5.1	6.6	1.5
Run	4.3	4.3	0.0
Split	1.8	2.1	0.3
Rapid	0.2	0.2	0.0
Plunge Pool	0.2	0.2	0.0
Fall	0.1	0.1	0.0
High Gradient Riffle	0.1	0.1	0.0

1 Reservoir habitat is created by the non-Project diversion dam and extends approximately 5,000 ft upstream towards Camp Far West Dam.

3.3.1.2 Environmental Effects

This section discusses the potential environmental effects of SSWD's Proposed Project, as described in Section 2.2 of this Exhibit E. As part of the Project relicensing, SSWD proposes a Pool Raise of 5 ft, modifications of existing recreation facilities, and modification of the existing Project boundary.

3.3.1.2.1 Effects of Construction-Related Activities

To mitigate effects to geology and soils resources from the Pool Raise construction, SSWD will obtain and implement all permits required for construction, which may include mitigation measures related to erosion. Construction related to the Pool Raise would have short-term and local effects on geology and soils, and with implementation of all permits and approvals required for construction the effects would be less-than-significant.

3.3.1.2.2 Effects of the Pool Raise

The current effects of shoreline erosion along Camp Far West Reservoir are minor due to the lack of erodible strata. The amount of deposition in Camp Far West Reservoir since the Project was developed is fairly low as a percentage of the total volume (approximately 10% of original volume, or about 0.2% per yr). SSWD does not propose to remove sediment from Camp Far West Reservoir as part of its Proposed Project, and SSWD does not propose any activities that may increase shoreline erosion or deposition of sediment besides the Pool Raise.

Lower gradient slopes will likely experience wave action and sediment suspension initially that will diminish as the water interface develops more of an armor layer as fines are removed, leaving a surface of coarser and more resistant material. In the steeper slopes, which are largely stable bedrock, there may be increased rock fall and small local failures due to wave action and saturation of toe slopes. These failures are not expected to be extensive, given the stability of the igneous and metamorphic bedrock associated with the steeper shorelines. Table 3.3.1-19 shows the amount of area based on slope that will be inundated by the Pool Raise, most of which are less than 25 percent. The steepest slopes that will be inundated occur within the approximately 3,000 ft of additional backwatering up the Bear River that the Pool Raise will cause.

Table 3.3.1-19. Slopes inundated by the Pool Raise.

Slope Class (%)	Number of Acres Inundated by Pool Raise
0-25%	148
25-50%	9.2
50-75%	1
>75%	0.1

The inactive Dairy Mine in the Bear River Arm of the Reservoir may experience more surface erosion and sediment suspension due to the Pool Raise since approximately 1.3 ac will become newly inundated seasonally (Figure 3.3.1-15). Erosion from the Dairy Mine deposits may be rejuvenated due to wave action within the newly inundated shoreline at full pool elevation. Effects of the Pool Raise on geology and soils would be short-term and less-than-significant due to a lack of erodible strata within the additional 5-ft inundation zone, and the removal of available fines would temporary and decreasing over time as the additionally inundated shoreline would subsequently become more resistant to wave action. Potential water quality effects are discussed in Section 3.3.2.2.2.

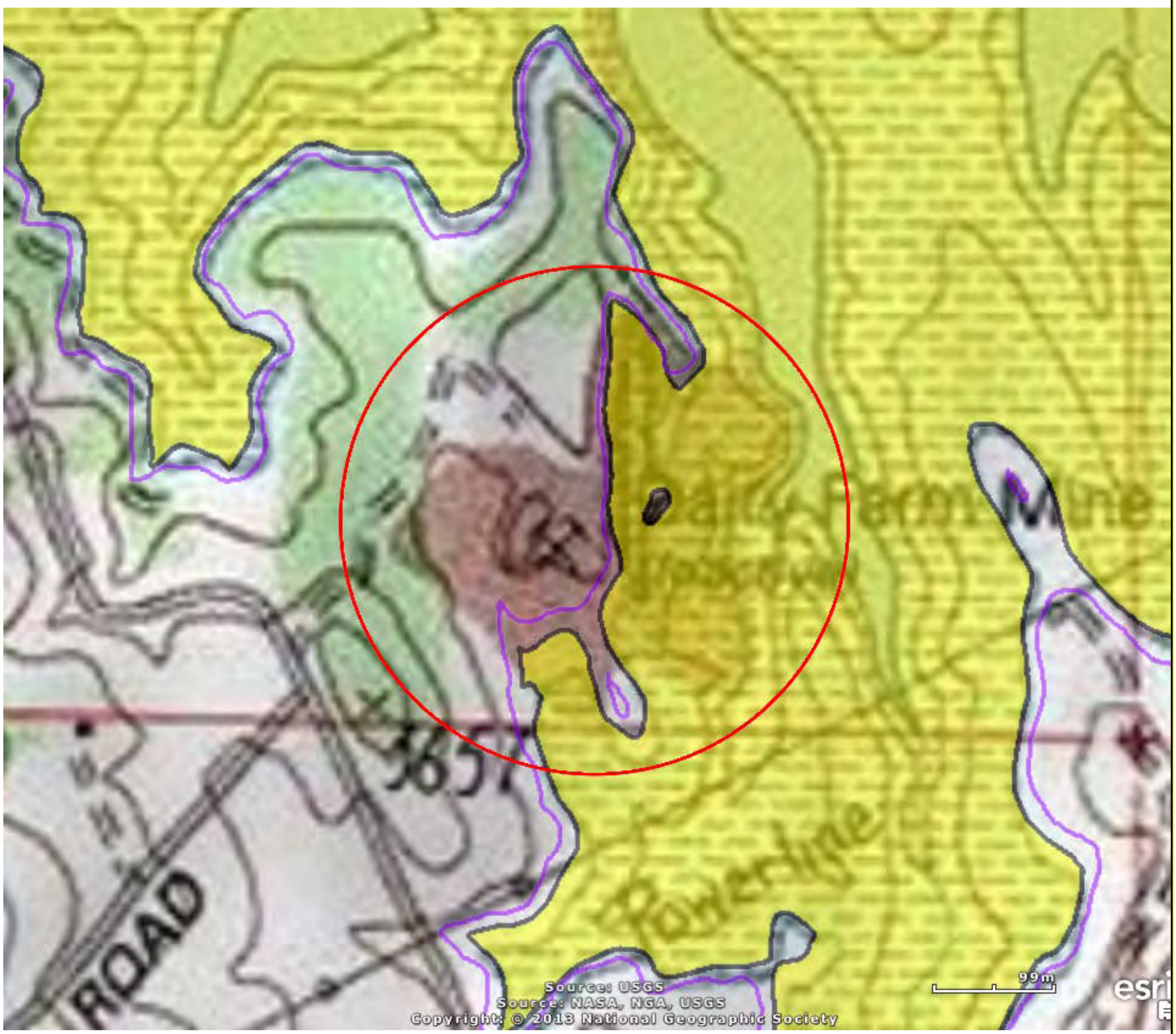


Figure 3.3.1-15. Dairy Farm Mine location adjacent to Camp Far West Reservoir. Yellow shading represents current NMWSE (300 ft) and purple line represents the estimated Pool Raise NMWSE (305 ft).

3.3.1.2.3 Effects of Proposed Project Operations and Maintenance

SSWD's Proposed Project does not include any significant changes in operations other than management of the Pool Raise which has been addressed in Section 3.3.1.2.2 regarding Camp Far West Reservoir. The Pool Raise will also slightly alter the timing and magnitude of spill events downstream of Camp Far West Dam, which could affect sediment and LWM transport in the lower Bear River. However, as discussed below, these effects are should be minimal. Flows in the Bear River downstream of the non-Project diversion dam are anticipated to decrease by approximately 4 cfs, on average, resulting from changes in the timing and magnitude of spill from Camp Far West Reservoir. Additional details regarding Project flows and reservoir storage under the Proposed Project is provided in Section 3.3.2.2.2 of this Exhibit E. Overall effects on geology and soils resources by the continued O&M of the Project will be less than significant.

SSWD considered proposing a condition to enhance sediment, especially for anadromous salmonid spawning, in the lower Bear River. However, the condition is not needed because, under existing conditions, there are adequate quantities of sediment in the lower Bear River, with estimates as high as 160 million cu yd, mostly from mining tailings (FWN 2015a). The Sheridan Pit gravel and aggregate mine, now part of the CEMEX sand and gravel mining and processing operation, is testament to the high volumes of gravel present in and near the lower Bear River. Furthermore, SSWD found suitable quantity and quality of gravel for anadromous salmonid spawning during its recent investigation. Additional discussion of gravel availability as it relates to fisheries is provided in Section 3.3.3.1. 3 of this Exhibit E.

In addition, SSWD considered proposing a condition to enhance LWM in the lower Bear River. However, the condition is not needed because there are adequate quantities of LWM in the lower Bear River. Existing conditions show that LWM concentration range between 18 and 65 pieces per mile (1.1 to 4.0 pieces/100 m), and most of the pieces were within the low-flow, wetted channel. Furthermore, based on incidental observations by SSWD during other field efforts, some LWM moved during the 2016/2017 high flows. However, new pieces were also added due to bank failures. The lower Bear River is also not dependent exclusively on LWM to provide habitat for fish or to assist in channel forming because of beaver dams and the presence of giant cane patches that also provide these channel morphology functions.

SSWD also considered proposing a condition related to spring flows to mobilize sediment and LWM in the lower Bear River. However, the condition was not needed. Considering the amount of gravel and LWM present in the lower Bear River and SSWD's observations of how gravel and LWM were moved during 2016/2017 high flows, no additional measures are necessary to provide flows to mobilize gravel or LWM. Spill events at Camp Far West Reservoir are also largely out of the control of SSWD because of upstream water projects that capture most of the run-off in the Bear River watershed. The Pool Raise will only slightly affect the timing and magnitude of spills.

Lastly, SSWD has not proposed a measure related to erosion control because during construction of the Pool Raise, including the relocation of recreation facilities, SSWD will implement all required permit measures which will include specific mitigation for erosion. Any other O&M activities that SSWD conducts that could cause erosion (e.g., future construction and) would likely have similar measures included in applicable permits. The Pool Raise will have some short-term effects on erosion locally around Camp Far West Reservoir, as described above, yet does not warrant a specific measure. Finally, erosion in the lower Bear River is caused during high flow events that are not under the control of SSWD because they occur through the ungated spillway. Erosion in the lower Bear River is also heavily influenced by the levees that exist from the non-Project diversion dam to the Feather River confluence, which confines high flows and promotes erosions between them.

3.3.1.3 Unavoidable Adverse Effects

The Project is expected to continue to store water in the spring and as it is released from upstream water projects, and capture sediment and LWM that would otherwise be available in the lower Bear River. However, the presence of several upstream dams on the Bear River already limits the amount water, sediment and LWM transported into Camp Far West Reservoir. During spill events, sediment and LWM may be passed below Camp Far West Dam and SSWD's studies have shown that sediment (especially gravel appropriate for anadromus salmonid spawning) and LWM are present in the lower Bear River. Therefore, these effects are expected to be minor.

Project and recreation roads will continue to erode during runoff events, which is a long-term, minor effect. Under existing conditions, there appear to be no significant effects due to sedimentation from Project and recreation roads. SSWD's proposed recreation measure would maintain recreation roads in good condition. The one, short Primary Project road is paved and regularly maintained, so erosion should be minor, if at all.

Replacement of Project recreation facilities could result in site-specific erosion problems. However, the effects would be short-term and minor with implementation of required permits and mitigation measures.

3.3.1.4 Measures or Studies Recommended by Agencies and Not Adopted by SSWD

As described in Appendix E4 in this Exhibit E, USFWS, NMFS, CDFW, SWRCB and FWN each submitted written comments on SSWD's December 29, 2018, DLA. Only NMFS's comment letter recommended a measure related to geology and soils, and none of the comment letters recommended a study related to geology and soils.

In NMFS' April 15, 2019 letter commenting on the DLA, it stated:

> The Project effects on the recruitment of large woody material and spawning gravel should be mitigated for based on the length of the license. Even though these resources are available now, the Project will continue to inhibit the addition of new materials; future sediment/LWM surveys and new substrate augmentation are likely to be needed. This Project effect should be acknowledged and long-term mitigation measures should be developed.

This items was on the agenda for the PM&E Resolution Meeting (see summary in Appendix E2 in this Exhibit E), but NMFS said it was not ready to discuss the item in detail. SSWD has not included NMFS's recommendation in its FLA a PM&E measure for three reasons. First, NMFS does not provide an adequate description of the rationale, scope, or estimated cost for the suggested monitoring and augmentation so that SSWD can respond in detail to NMFS's request.

Without these details, SSWD can only evaluate and reply to NMFS's suggestion in general terms. Second, and in general terms, the need for monitoring is unclear, because the best available science shows that adequate quantities of these resources currently exist and continue to persist in the lower Bear River, and because NMFS does not provide adequate description of a mechanism by which these resources would become depleted in the future. Third, and also in general terms, the use of monitoring data and utility of LWM and gravel augmentation is unclear. Specifically, NMFS does not describe a mechanism to isolate in monitoring data Project-related effects from non-Project-related effects on these resources, and does not describe how monitoring data would be used to inform and guide augmentation activities.

3.3.1.5 List of Attachments

Attachment 3.3.1A Channel Form and Large Woody Material Maps

Attachment 3.3.1A

Channel Form and Large Woody Material Maps

LEGEND

- Bank Erosion Site
- Key LWM Piece
- Major River Mile
- River Mile Tenth

Stability Class: Elevation Above Water Surface

- 0 - 6
- 6 - 15
- 15 - 20
- 20 - 25
- >25

DATA SOURCES: Key Piece, Bank Erosion Site, Giant Cane - HDR Inc. Service Layer Credits: Content may not reflect National Geographic's current map policy. Sources: National Geographic, Esri, Garmin, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp., Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

DISCLAIMER: Map information was compiled from the best available sources. No warranty is made for its accuracy or completeness. Map projection is UTM Zone 10 North.

ATTACHMENT E3.3.1A CHANNEL FORM AND LARGE WOODY MATERIAL KEY PIECES

CAMP FAR WEST HYDROELECTRIC PROJECT FERC NO. 2997

N

0 1,500

FEET

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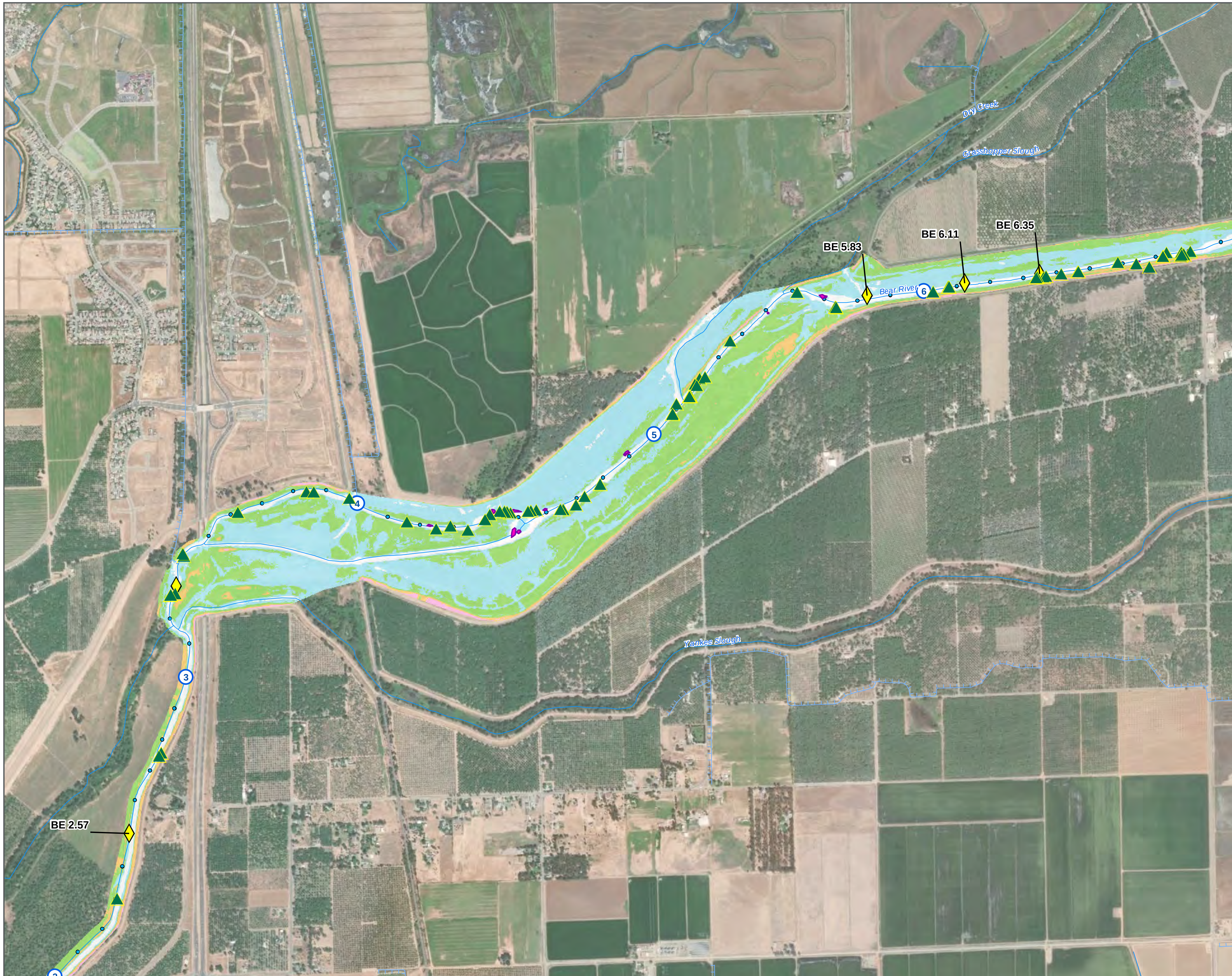

LEGEND

- Bank Erosion Site
- Key LWM Piece
- Major River Mile
- River Mile Tenth
- Giant Cane *(Arundo donax)*

Stability Class: Elevation Above Water Surface

- 0 - 6
- 6 - 15
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ATTACHMENT E3.3.1A CHANNEL FORM AND LARGE WOODY MATERIAL KEY PIECES

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LEGEND

- Bank Erosion Site
- Key LWM Piece
- Major River Mile
- River Mile Tenth
- Giant Cane *(Arundo donax)*

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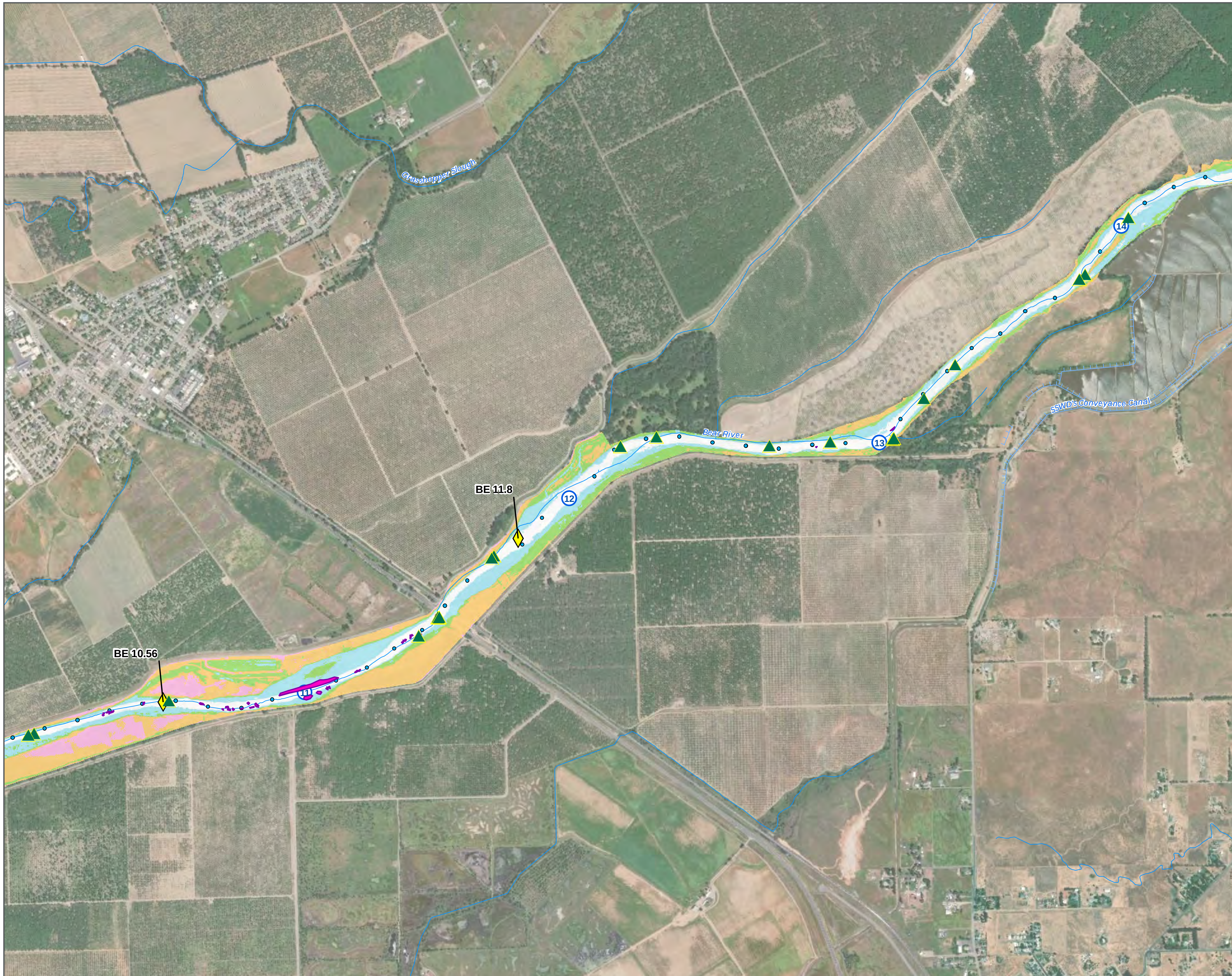

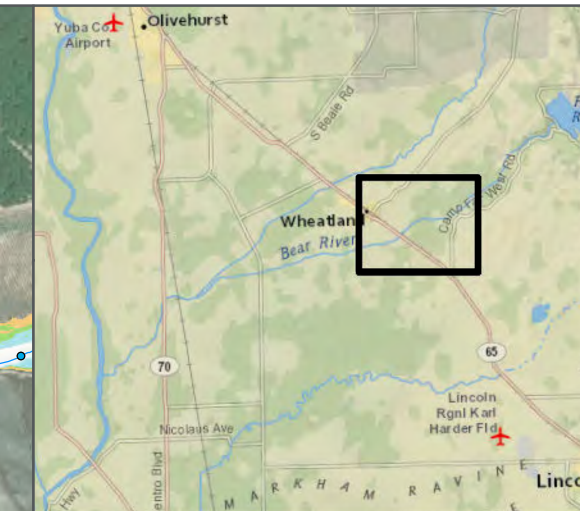

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ATTACHMENT E3.3.1A CHANNEL FORM AND LARGE WOODY MATERIAL KEY PIECES

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ATTACHMENT E3.3.1A CHANNEL FORM AND LARGE WOODY MATERIAL KEY PIECES

CAMP FAR WEST HYDROELECTRIC PROJECT FERC NO. 2997

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3.3.2 Water Resources

The discussion of water resources is divided into five sections. The affected environment is discussed in Section 3.3.2.1, environmental effects of the Project are discussed in Section 3.3.2.2, cumulative effects are described in Section 3.3.2.3, unavoidable adverse effects are addressed in Section 3.3.2.4., and proposed measures recommended by agencies or other Relicensing Participants in written comments on the DLA that were not adopted by SSWD are discussed in Section 3.3.2.5.

SSWD augmented existing, relevant, and reasonably available information on water resources by conducting three studies: 1) Study 2.1, *Water Temperature Monitoring*; 2) Study 2.2, *Water Temperature Modeling*; and 3) Study 2.3, *Water Quality*. The results of these studies are discussed throughout this section and data are provided in Appendix E1.

3.3.2.1 Affected Environment

This section describes existing water resources conditions (environmental baseline) in two general areas – water quantity and water quality – for waters affected by the Project.[1, 2]

3.3.2.1.1 Water Quantity

This section describes: 1) the development of Project hydrologic datasets; 2) the Project's storage and flows; 3) the existing and proposed uses of Project waters; and 4) existing and proposed water rights that might affect or be affected by the Project.

Hydrologic Datasets

As described in Section 4.1 of Exhibit B of this Application for New License, SSWD developed five hydrology datasets, each of which covers WYs 1976 through 2014 and are provided in Exhibit E, Appendix E1, of this Application for New License. These datasets are: 1) Historical Hydrology; 2) Unimpaired Hydrology; 3) Baseline; 4) Near-Term Condition – Proposed Project; 5) Future Condition – Proposed Project. The first dataset is composed of gaged flow data, while the other five datasets are products of SSWD's Ops Model. The model run of the Baseline is the No Action Alternative, and is used throughout SSWD's Application for New License to represent baseline reservoir and flow conditions. SSWD uses this dataset instead of the Historical Hydrology dataset to represent operations under current conditions because using historical data would be misleading given changes in Project operations overtime. The Ops Model run of the Near-Term Condition – Proposed Project is also used throughout SSWD's Application for New License to represent reservoir and flow conditions under SSWD's Proposed Project as described in this Application for New License under near-term conditions. The Ops

[1] Refer to Section 3.1.2 of this Exhibit E for a description of the Bear River basin from its headwaters to the confluence with the Feather River, a description of the Feather River basin from the Yuba River to the Sacramento River.
[2] Refer to Table 2.1-2 of this Exhibit E for information regarding the volume, surface area, depth and shoreline length of Camp Far West Reservoir.

Model run of the SSWD's Future Condition – Proposed Project is used in Exhibit E Sections 3.3.2.3, which address water resources and aquatic resources cumulative effects, respectively. Each Ops Model run is provided in Exhibit E, Appendix E1.

Project Flows and Storage

SSWD currently operates the Project to provide irrigation water to growers in SSWD's and CFWID's service districts. A schematic of these service districts is shown in Figure 3.0-1 of Exhibit B. Water supply deliveries to SSWD's Service Area is described in Section 5.2.2 of Exhibit B. Water supply deliveries to CFWID's Service Area is described in Section 5.2.4 of Exhibit B. SSWD also operates the Project to meet Bear River flow requirements and to generate power. A complete description of the existing Project operations is provided in Exhibit E Section 2, and a description of SSWD's Ops Model's representation of Project operations under the No Action Alternative can be found in Exhibit E, Appendix E1, *Operations Model Documentation and Validation* report.

Table 3.3.2-1 provides inflows to the Project and Project flows and storage for the 0 percent (i.e., maximum), 10 percent (i.e., wet conditions), 50 percent (i.e., median), 90 percent (i.e., dry conditions) and 100 percent (i.e., minimum) exceedance values at critical locations for the No Action Alternative model run. Long-term averages are also provided in the table.

Table 3.3.2-1. No Action Alternative flows and storage by month from Baseline dataset.

Value	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
INFLOW INTO CAMP FAR WEST RESERVOIR (cfs)												
0%	578	8,306	27,304	45,966	29,243	13,609	11,836	4,741	1,183	669	290	219
10%	98	406	1,213	1,817	2,347	2,574	1,711	1,125	645	284	101	56
50%	15	21	46	130	431	703	586	536	71	13	9	12
90%	7	11	14	20	40	85	61	27	10	7	6	6
100%	6	7	10	10	10	17	14	11	6	6	6	6
Average	*36*	*169*	*540*	*788*	*1,005*	*1,073*	*767*	*561*	*245*	*99*	*36*	*24*
CAMP FAR WEST RESERVOIR STORAGE (ac-ft)												
0%	69,015	94,174	94,251	94,272	94,288	94,280	94,290	94,294	94,284	94,279	86,883	71,366
10%	55,986	60,784	85,815	93,910	94,125	94,199	94,220	94,224	94,132	87,796	70,030	55,217
50%	17,159	17,795	22,445	38,861	76,726	93,737	93,859	93,917	85,076	59,539	33,685	18,638
90%	3,010	3,553	4,594	6,625	10,707	21,350	33,188	37,943	37,094	25,932	10,874	3,676
100%	2,500	2,500	2,729	3,723	3,897	8,913	13,157	12,000	8,376	4,833	2,500	2,500
Average	*21,576*	*24,378*	*33,860*	*47,745*	*62,420*	*74,162*	*79,408*	*79,529*	*74,379*	*58,235*	*37,685*	*23,243*
CAMP FAR WEST RESERVOIR WATER-SURFACE ELEVATION (ft)												
0%	286	300	300	300	300	300	300	300	300	300	296	287
10%	277	280	296	300	300	300	300	300	300	297	286	276
50%	235	236	243	262	290	300	300	300	295	279	257	237
90%	192	195	201	209	221	241	256	261	260	248	222	196
100%	188	188	190	196	197	217	227	224	215	202	188	188
Average	*231*	*234*	*246*	*261*	*274*	*285*	*289*	*289*	*286*	*275*	*255*	*236*
BEAR RIVER FLOW BELOW CAMP FAR WEST RESERVOIR FLOW (RM 12.6) (cfs)												
0%	114	8,367	27,379	46,031	29,394	13,736	11,925	4,737	1,215	680	521	399
10%	104	13	10	1,510	2,230	2,563	1,717	1,120	630	495	489	281
50%	17	11	10	10	12	510	531	494	453	476	431	110
90%	14	10	10	10	11	10	29	123	144	133	125	22
100%	5	8	10	10	10	10	26	42	47	38	4	4
Average	*40*	*63*	*370*	*504*	*803*	*916*	*733*	*575*	*415*	*391*	*366*	*135*
DIVERSION INTO CFWID'S NORTH CANAL (cfs)												
0%	3	1	0	1	2	2	7	18	25	29	28	17
10%	2	1	0	0	2	2	6	18	25	29	27	12
50%	2	1	0	0	2	1	4	15	23	27	26	5
90%	1	0	0	0	1	0	1	9	21	23	22	3
100%	0	0	0	0	0	0	0	4	11	13	0	0
Average	*2*	*1*	*0*	*0*	*1*	*1*	*4*	*14*	*23*	*26*	*25*	*7*
DIVERSION INTO CFWID'S SOUTH CANAL (cfs)												
0%	7	2	0	0	0	1	21	22	26	25	23	12
10%	7	1	0	0	0	0	21	22	25	25	22	10
50%	5	0	0	0	0	0	5	21	24	25	20	7
90%	3	0	0	0	0	0	1	19	19	23	12	5
100%	0	0	0	0	0	0	0	11	11	14	0	0
Average	*5*	*0*	*0*	*0*	*0*	*0*	*9*	*21*	*23*	*24*	*18*	*7*

Table 3.3.2-1. (continued)

Value	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
DIVERSION INTO SSWD'S MAIN CANAL (cfs)												
0%	96	0	0	0	0	0	396	446	438	434	433	361
10%	86	0	0	0	0	0	174	396	422	431	430	244
50%	0	0	0	0	0	0	10	301	354	415	369	84
90%	0	0	0	0	0	0	0	63	70	70	67	0
100%	0	0	0	0	0	0	0	0	0	0	0	0
Average	*24*	*0*	*0*	*0*	*0*	*0*	*53*	*264*	*296*	*322*	*300*	*106*
BEAR RIVER BELOW THE NON-PROJECT DIVERSION DAM (RM 16.9) (cfs)												
0%	10	8,366	27,379	46,031	29,392	13,735	11,923	4,502	825	210	47	47
10%	10	10	10	1,510	2,229	2,562	1,663	725	225	47	47	47
50%	10	10	10	10	10	510	425	95	25	10	10	10
90%	10	10	10	10	10	10	25	25	25	10	10	10
100%	5	8	10	10	10	10	25	25	25	10	4	4
Average	*10*	*62*	*370*	*504*	*802*	*915*	*669*	*278*	*73*	*18*	*22*	*15*
BEAR RIVER FLOW AT WHEATLAND (RM 11.5) (cfs)												
0%	14	8,369	27,384	46,036	29,396	13,739	11,927	4,508	830	216	54	52
10%	14	14	15	1,515	2,232	2,566	1,667	731	230	53	54	52
50%	14	14	15	15	14	514	430	101	30	16	17	15
90%	14	14	15	15	14	14	30	31	30	16	17	15
100%	9	12	15	15	14	14	30	31	30	16	11	9
Average	*14*	*66*	*375*	*509*	*806*	*919*	*674*	*284*	*79*	*25*	*29*	*20*
BEAR RIVER FLOW AT PLEASANT GROVE ROAD (RM 7.1) (cfs)												
0%	14	8,369	27,384	46,036	29,396	13,739	11,927	4,508	830	216	54	52
10%	14	14	15	1,515	2,232	2,566	1,667	731	230	53	54	52
50%	14	14	15	15	14	514	430	101	30	16	17	15
90%	14	14	15	15	14	14	30	31	30	16	17	15
100%	9	12	15	15	14	14	30	31	30	16	11	9
Average	*14*	*66*	*375*	*509*	*806*	*919*	*674*	*284*	*79*	*25*	*29*	*20*
BEAR RIVER FLOW AT FEATHER RIVER CONFLUENCE (RM 0.0) (cfs)												
0%	398	10,035	32,792	51,938	35,166	15,880	15,191	4,731	869	223	66	58
10%	18	33	849	1,719	2,478	2,787	1,731	778	231	54	54	52
50%	14	15	21	50	110	557	467	109	34	18	18	15
90%	14	14	16	17	18	24	35	34	31	17	17	15
100%	9	12	15	15	14	17	32	31	30	16	11	10
Average	*16*	*85*	*465*	*639*	*965*	*1,037*	*719*	*300*	*83*	*26*	*30*	*21*

Refer to Section 2.1.4.3 in Exhibit E and Exhibit B of this Application for new License for a more detailed description of water quantity under the Environmental Baseline.

Existing Designated Beneficial Uses

As described in Section 1.3.9 of Exhibit E, Basin Plan water quality standards "consist of the designated uses of the navigable waters involved and the water quality criteria for such waters based upon such uses." [33 USC § 1313(C) (2) (A)]. Section 1.3.9 of Exhibit E describes existing designated Beneficial Uses of water in the Project Vicinity, which include: 1) Municipal and Domestic Supply; 2) Agricultural Supply (Irrigation); 3) Industrial Process Supply (Power Generation); 4) Industrial Services Supply; 5) Water Contact Recreation; 6) Non-Water Contact Recreation; 7) Warm Freshwater Habitat; 8) Cold Freshwater Habitat; and 9) Wildlife Habitat. The Basin Plan identifies potential designated Beneficial Uses of water in the Project Vicinity as Migration of Aquatic Organisms and Spawning. Refer to Section 1.3.9 for a definition of each Beneficial Use.

Existing and Proposed Water Rights Potentially Affecting or Affected by the Project

This section provides a list of water rights held by SSWD and other existing or proposed water rights potentially affecting or affected by the Project.

<u>Water Rights Upstream of the Project Area That Affect the Project</u>

Numerous water rights holders divert and store waters upstream of the Project Area. The upstream projects with significant impacts on inflows to the Project include PG&E's Drum-Spaulding Project, NID's Yuba-Bear Hydroelectric Project and NID's Lake Combie. Details regarding PG&E's Drum-Spaulding Hydroelectric Project water rights in the Bear River are provided in Table 3.3.2-2. Details on NID's Yuba-Bear Hydroelectric Project water rights in the Bear River are provided in Table 3.3.2-3. Details regarding NID's water rights at Lake Combie in the Bear River drainage are provided in Table 3.3.2-4.

Table 3.3.2-2. Summary of water rights held by PG&E related to the Drum-Spaulding Hydroelectric Project (FERC project number 2310) in the Bear River.

Priority Date	SWRCB Designation		Source	Amount		Place of Storage or Diversion	Season of		Beneficial Use
	Application	Permit or License Number		cfs	ac-ft		Diversion	Storage	
7/5/1928	5970	8888	Bear River	525	--	Dutch Flat 1 Intake	1/1-12/31	--	Power
2/9/1922	2753	987	Bear River	100	--	Bear River Canal Intake	1/1-12/31	--	Power
6/19/1929	6332	1375	Bear River	120	--	Bear River Canal Intake	1/1-12/31	--	Power
1852	--	957	Bear River	475	--	Bear River Canal Intake	1/1-12/31	--	Power, Irrigation, Domestic, Public Service
1864	--	--	Little Bear River	60	--	Boardman Canal below Alta PH	1/1-12/31	--	Irrigation and Domestic

Table 3.3.2-3. Summary of water rights held by NID related to the Yuba-Bear Hydroelectric Project (FERC project number 2266) in the Bear River.

Priority Date	SWRCB Designation			Source	Amount		Place of Storage or Diversion	Season of		Beneficial Use
	Application	Permit	License		cfs	ac-ft		Diversion	Storage	
2/5/1963	21151	14799	9903 (4/19/72)	Bear River	1,056	--	Chicago Park Flume	1/1-12/31	--	Power
2/5/1963	21152	14800	9902 (4/19/72)	Bear River	550	-	Dutch Flat Flume	1/1-12/31	--	Power
1/9/1976	24983	16953	In Progress	Bear River	700	62,080	Rollins Reservoir	1/1-12/31	11/30-6/1	Power
1853	S14354	--	Pre-1914 Right	Bear River	--	--	Rollins	--	--	--
1853	S14355	--	Pre-1914 Right	Bear River	--	--	Bear River Canal	--	--	--

Table 3.3.2-4. Summary of non-consumptive water rights held by NID for the purpose of power generation and irrigation.

Priority Date	SWRCB Designation			Source	Amount		Place of Storage or Diversion	Season of		Beneficial Use
	Application	Permit	License		cfs	ac-ft		Diversion	Storage	
11/22/1921	2652A	5803	10350	Bear River	--	5,555	Combie Reservoir	--	11/30-6/1	Irrigation
6/3/1981	26866	18757	--	Bear River	1,000	--	Combie Reservoir	1/1-12/31	--	Power

NID also holds senior pre-1914 water rights to the Bear River. In August 2015, NID filed an application with the SWRCB for the annual appropriation of 222,000 ac-ft of water from the Bear River, related to the development of a proposed water storage project (i.e., Centennial ;) immediately upstream of Combie Reservoir.[3] Refer to Section 3.2.3.2 for additional discussion regarding NID's Proposed Project.

Water Rights within the Project Area

SSWD operates the Project consistent with the terms and conditions of each of the water rights and agreements listed below.

SSWD's Water Right for Power (No Expiration Date)

Refer to Section 2.1.5.2.1 in Exhibit E for a description of SSWD's water rights related to power.

Water Rights Downstream of the Project Affected by the Project

Water Supply Deliveries from the Bear River to SSWD's Service Area (No Expiration Date)

Refer to Section 2.1.5.2.2 in Exhibit E for a description of water rights related to SSWD's water supply deliveries from the Bear River to SSWD's Service Area.

[3] Details on NID's proposed water storage project can be found at https://centennial.nidwater.com.

Water Supply Deliveries from the Bear River to CFWID (No Expiration Date)

Refer to Section 2.1.5.2.4 in Exhibit E for a description of water SSWD provides to CFWID.

Water Deliveries to Satisfy Bay-Delta Bear River Voluntary Agreement (Expires December 31, 2035)

Refer to Section 2.1.5.2.3 in Exhibit E for a description of water SSWD supplies to CDFW and DWR to settle the responsibilities of SSWD, CFWID, and all other Bear River water rights to implement the objectives in the *Water Quality Control Plan for the San Francisco Bay/ Sacramento-San Joaquin Delta Estuary* adopted May 22, 1995 (1995 Bay-Delta Plan).

Other Water Deliveries

No other active water rights than those listed above[4] are identified downstream of Camp Far West Dam along the Bear River.

3.3.2.1.2 Water Quality

This section first describes the regulatory context of water quality in the basin, and then describes existing water quality conditions in five areas: 1) general water quality, including results of synoptic dissolved oxygen (DO) sampling; 2) water temperature and DO conditions in reservoirs; 3) water temperature conditions in streams; 4) SSWD's relicensing water temperature model; and 5) the CWA Section 303(d) constituent mercury and existing conditions regarding mercury bioaccumulation in fish.

Existing Water Quality Objectives

Table 3.3.2-5 lists Water Quality Objectives described in the Basin Plan related to the designated Beneficial Uses.

Table 3.3.2-5. Basin Plan Water Quality Objectives to support designated Beneficial Uses in the Project Vicinity.

Water Quality Objective	Description
Bacteria	In terms of fecal coliform. Less than a geometric average of 200/100 ml on five samples collected in any 30-day period and less than 400/100 ml on ten percent of all samples taken in a 30-day period.
Biostimulatory Substances	Water shall not contain biostimulatory substances that promote aquatic growth in concentrations that cause nuisance or adversely affect beneficial uses.

[4] An Initial Statement of Water Diversion and Use was filed in 1978 in support of a riparian and pre-1914 water right claim; however, the SWRCB currently lists Statement S009549 as inactive.

Table 3.3.2-5. (continued)

Water Quality Objective	Description
Chemical Constituents	Waters shall not contain chemical constituents in concentrations that adversely affect beneficial uses. Specific trace element levels are given for certain surface waters, none of which include the waters in the vicinity of the Project. Electrical conductivity (at 77 ºF) shall not exceed 150 micromhos (µmhos)/cm (90 percentile) in well-mixed waters of the Feather River from the Fish Barrier Dam at Oroville to Sacramento River. Other limits for organic, inorganic and trace metals are provided for surface waters that are designated for domestic or municipal water supply. In addition, waters designated for municipal or domestic use must comply with portions of Title 22 of the California Code of Regulations. For protection of aquatic life, surface water in California must also comply with the California Toxics Rule (40 C.F.R. Part 131).
Color	Water shall be free of discoloration that causes a nuisance or adversely affects beneficial uses.
Dissolved Oxygen (DO)	Monthly median of the average daily dissolved oxygen concentration shall not fall below 85 percent of saturation in the main water mass, and the 95 percent concentration shall not fall below 75 percent of saturation. Minimum level of 7 mg/L. Specific DO water quality objectives below Oroville dam are 8.0 mg/L from September 1 to May 31 for Feather River from Fish Barrier Dam at Oroville to Honcut Creek (surface water body #40). When natural conditions lower dissolved oxygen below this level, the concentrations shall be maintained at or above 95 percent of saturation.
Floating Material	Water shall not contain floating material in amounts that cause a nuisance or adversely affect beneficial uses.
Oil and Grease	Water shall not contain oils, greases, waxes or other material in concentrations that cause a nuisance, result in visible film or coating on the surface of the water or on objects in the water, or otherwise adversely affect beneficial uses.
PH	The pH of surface waters will remain between 6.5 and 8.5, and cause changes of less than 0.5 in receiving water bodies.
Pesticides	Waters shall not contain pesticides or a combination of pesticides in concentrations that adversely affect beneficial uses. Other limits established as well.
Radioactivity	Radionuclides shall not be present in concentrations that are harmful to human, plant, animal or aquatic life, nor that result in the accumulation of radionuclides in the food web to an extent that presents a hazard to human, plant, animal or aquatic life.
Sediment	The suspended sediment load and suspended-sediment discharge rate of surface waters shall not be altered in such a manner as to cause a nuisance or adversely affect beneficial uses.
Settleable Material	Waters shall not contain substances in concentrations that result in the deposition of material that causes a nuisance or adversely affects beneficial uses.
Suspended Material	Waters shall not contain suspended material in concentrations that cause a nuisance or adversely affect beneficial uses.
Tastes and Odor	Water shall not contain taste- or odor-producing substances in concentrations that impart undesirable tastes and odors to domestic or municipal water supplies or to fish flesh or other edible products of aquatic origin, or that cause nuisance, or otherwise adversely affect beneficial uses.
Temperature	The natural receiving water temperature of interstate waters shall not be altered unless it can be demonstrated to the satisfaction of the Regional Water Quality Control Board that such alteration in temperature does not adversely affect beneficial uses. Increases in water temperatures must be less than 5 ºF above natural receiving-water temperature.
Toxicity	All waters shall be maintained free of toxic substances in concentrations that produce detrimental physiological responses in human, plant, animal, or aquatic life. Compliance with this objective will be determined by analyses of indicator organisms, species diversity, population density, growth anomalies, and biotoxicity tests as specified by the CVRWQCB.
Turbidity	In terms of changes in turbidity (NTU) in the receiving water body where natural turbidity is 0 to 5 NTUs, increases shall not exceed 1 NTU; where 5 to 50 NTUs, increases shall not exceed 20 percent; where 50 to 100 NTUs, increases shall not exceed 10 NTUs; and where natural turbidity is greater than 100 NTUs, increase shall not exceed 10 percent.

Source: CVRWQCB 1998.

Section 303(d) of the CWA requires that each State submit to EPA a list of rivers, lakes and reservoirs in the State for which pollution control or requirements have failed to provide for water quality every 2 years. The CVRWQCB and SWRCB work together to research and update the list for the Central Valley region of California. Based on a review of this list and its associated TMDL Priority Schedule in the Project Vicinity, the Bear River from Combie Lake to Camp Far West Reservoir has been identified by the SWRCB as CWA Section 303(d) State Impaired for mercury. Downstream of the Project, the Bear River has been listed as CWA

Section 303(d) State Impaired for mercury, copper, and chlorpyrifos (SWRCB 2016). The Project does not use or introduce to the Bear River mercury, copper, or chlorpyrifos.

General Water Quality

Water quality parameters discussed in this section include all parameters except water temperature and mercury, which are discussed in subsequent sections. Conditions upstream of the Project, within the Project, and below the Project in the lower Bear River are presented.

Upstream of the Project

Water quality was measured at one location in the Bear River as part of the SWRCB's Surface Water Ambient Monitoring Program (SWAMP) Statewide Perennial Stream Assessment (SWRCB 2013); in 2013 upstream of the Little Wolf Creek confluence (RM 24). Table 3.3.2-6 provides the results of that sampling event.

Table 3.3.2-6. Water quality results from the SWAMP Perennial Streams Assessment.

Analyte	Units	Bear River above Little Wolf Creek
Nitrogen, Total, Total	mg/L	0.223
Phosphorus as P, Total	mg/L	0.0139
Silica as SiO2, Dissolved	mg/L	8.9
Ammonia as N, Total	mg/L	0.0078
OrthoPhosphate as P, Dissolved	mg/L	0.0393
AFDM_Algae, Particulate	g/m2	2.45
Chlorophyll a, Particulate	mg/m2	4.05
Total Suspended Solids, Particulate	mg/L	1.4
Sulfate, Dissolved	mg/L	2.83
Chloride, Dissolved	mg/L	8.55
Hardness as CaCO3, Total	mg/L	42.8
Dissolved Organic Carbon, Dissolved	mg/L	2.65
pH	units	7.78
Turbidity, Total	NTU	0.68
Alkalinity as CaCO3, Total	mg/L	55
Oxygen, Dissolved, Total	mg/L	9.06
Specific Conductivity, Total	uS/cm	124.2
Temperature	°C	25.2

Source: SWRCB 2013

In 2017, SSWD completed a relicensing water quality study which included one sampling location upstream of the Camp Far West Reservoir NMWSE. Results of the sampling are similar to those observed from SWRCB's 2013 sampling and are provided in Table 3.3.2-7.The data from SSWD's 2017 water quality study are also provided in Appendix E1. Alkalinity was the only parameter that was inconsistent with the identified benchmark (20 mg/L) with two of the three samples only slightly higher.

Table 3.3.2-7. Water quality results from SSWD's 2017 study at the Bear River upstream of Camp Far West Reservoir.

Analyte	Benchmark	Sample Location	Bear River above CFW Reservoir		
		Sample ID	10051111-1		
		Sample Depth	1 ft		
		Date	6/14/2017	8/29/2017	11/21/2017
IN SITU MEASUREMENTS					
Temperature	--	°C	15.01	25.59	13.04
Specific Conductance	900	µSiemens/cm	60	124	NS

Table 3.3.2-7. (continued)

Analyte	Benchmark	Sample Location	Bear River above CFW Reservoir		
		Sample ID	10051111-1		
		Sample Depth	1 ft		
		Date	6/14/2017	8/29/2017	11/21/2017
IN SITU MEASUREMENTS (cont'd)					
pH	6.5-8.5	pH units	7.12	8.06	NS
Dissolved Oxygen	> 7 mg/L	mg/L	10.14	8.27	NS
Turbidity	--	NTU	1.8	2	NS
BASIC WATER QUALITY					
Alkalinity, Total (as CaCO3)	20	mg/L	23	49	22
Ammonia (as N)	Temp & pH Dep't	mg/L	ND	0.117	ND
Calcium	--	mg/L	5.29	11.5	4.68
Carbon, Dissolved Organic	--	mg/L	1.59	3.17	1.54
Carbon, Total Organic	--	mg/L	1.46	2.53	1.54
Chloride	250	mg/L	3.26	6.5	2.19
Hardness, Total	--	mg/L	22	47.5	18.7
Magnesium	--	mg/L	2.14	4.55	1.71
Nitrate+Nitrite (as N)	10	mg/L	ND	ND	0.16
o-Phosphate (as P)	--	mg/L	0.014	ND	ND
Phosphorus, Total	--	mg/L	0.255	ND	0.018
Potassium	--	mg/L	0.4	0.71	0.59
Sodium	20	mg/L	3.17	5.25	2.12
Solids, Total Dissolved	500	mg/L	58.7	88.3	33
Solids, Total Suspended	--	mg/L	ND	ND	ND
Sulfate	250	mg/L	2.31	3.59	3.43
Sulfide, Total	--	mg/L	ND	ND	ND
Total Kjeldahl Nitrogen	--	mg/L	0.38	0.55	2.26
TOTAL METALS CONCENTRATIONS					
Aluminum	87	µg/L	32.2	8.6	66.9
Arsenic	10	µg/L	0.68	2.09	0.55
Cadmium	5	µg/L	ND	ND	ND
Chromium	50	µg/L	ND	ND	0.25
Copper	1000	µg/L	0.64	1.14	1.08
Iron	300	µg/L	117	63.5	135
Lead	15	µg/L	0.056	0.027	0.133
Nickel	100	µg/L	0.92	1.07	1.11
Selenium	50	µg/L	ND	ND	ND
Silver	100	µg/L	ND	ND	ND
Zinc	5000	µg/L	ND	2	ND
Mercury	50	ng/L	4.9	2.4	11.3
Methyl Mercury	--	ng/L	ND	0.5	ND
DISSOLVED METALS CONCENTRATIONS					
Aluminum	--	µg/L	9.2	4.1	74.9
Arsenic	--	µg/L	0.54	1.99	0.54
Cadmium	Hardness Dep't	µg/L	ND	ND	ND
Chromium	Hardness Dep't	µg/L	ND	ND	0.28
Copper	Hardness Dep't	µg/L	1.16	1.32	0.98
Iron	Hardness Dep't	µg/L	49.4	31.5	125
Lead	Hardness Dep't	µg/L	0.038	ND	0.108
Nickel	Hardness Dep't	µg/L	1.03	0.93	1.08
Silver	Hardness Dep't	µg/L	ND	ND	ND

Table 3.3.2-7. (continued)

Analyte	Benchmark	Sample Location	Bear River above CFW Reservoir		
		Sample ID	10051111-1		
		Sample Depth	1 ft		
		Date	6/14/2017	8/29/2017	11/21/2017
DISSOLVED METALS CONCENTRATIONS (cont'd)					
Zinc	Hardness Dep't	µg/L	ND	ND	ND
Methyl Mercury	--	ng/L	NS	0.3	ND
PESTICIDES					
Diazinon	1.2	µg/L	ND	ND	ND
Chlorpyrifos	2	µg/L	ND	ND	ND

NS = not sampled
ND = not detected based on the method detection limit

Camp Far West Reservoir

SSWD collected water quality data at one location in Camp Far West Reservoir near the dam as part of its 2017 water quality study on three occasions. Samples were collected at two depths: near the surface and below the thermocline at a depth of about 80 ft (Table 3.3.2-8). Four parameters were inconsistent with identified benchmarks during at least one sampling event; dissolved oxygen (three of six samples, all at depth), alkalinity (six of six samples), aluminum (one sample), and iron (one of six samples). DO concentrations below 7 mg/L are expected at depth in a reservoir and are discussed more below. Alkalinity concentrations in the reservoir were consistent with values both upstream and downstream, all of which were above the Basin Plan benchmark of 20 mg/L.

Table 3.3.2-8. Water quality results from SSWD's 2017 study at Camp Far West Reservoir near the dam.

Analyte	Benchmark	Sample Location	Camp Far West Reservoir near dam, surface			Camp Far West Reservoir near dam, near bottom		
		Sample ID	10051111-2			10051111-3		
		Sample Depth	1 ft			80 ft		
		Date	6/15/2017	8/31/2017	11/21/2017	6/15/2017	8/31/2017	11/21/2017
IN SITU MEASUREMENTS								
Temperature	--	°C	23.15	27.34	14.85	11.06	12.38	13.22
Specific Conductance	900	µSiemens/cm	77	80	77	71	98	54
pH	6.5-8.5	pH units	8.03	8.63	7.5	6.72	6.88	7.34
Dissolved Oxygen	> 7 mg/L	mg/L	8.93	8.25	9.39	6.45	0	0
Turbidity	--	NTU	2.9	5.3	14	8.9	8.6	30
BASIC WATER QUALITY								
Alkalinity, Total (as CaCO3)	20	mg/L	31	31	32	31	31	43
Ammonia (as N)	Temp & pH Dep't	mg/L	ND	0.082	ND	ND	0.087	0.324
Calcium	--	mg/L	6.68	6.72	7.43	6.18	6.57	8.91
Carbon, Dissolved Organic	--	mg/L	2.89	1.81	1.39	2.05	1.71	1.87
Carbon, Total Organic	--	mg/L	1.72	1.89	1.36	1.36	1.62	1.48
Chloride	250	mg/L	3.83	3.75	3.6	4.1	3.37	3.42
Hardness, Total	--	mg/L	29.4	29.1	31.7	26.8	28.3	37.2
Magnesium	--	mg/L	3.09	3	3.19	2.75	2.88	3.63
Nitrate+Nitrite (as N)	10	mg/L	ND	ND	0.055	ND	ND	ND
o-Phosphate (as P)	--	mg/L	ND	ND	ND	ND	0.01	ND
Phosphorus, Total	--	mg/L	ND	0.014	ND	0.09	0.011	0.067
Potassium	--	mg/L	0.86	0.64	0.79	0.59	0.67	1.06

Table 3.3.2-8. (continued)

Analyte	Benchmark	Sample Location	Camp Far West Reservoir near dam, surface			Camp Far West Reservoir near dam, near bottom		
		Sample ID	10051111-2			10051111-3		
		Sample Depth	1 ft			80 ft		
		Date	6/15/2017	8/31/2017	11/21/2017	6/15/2017	8/31/2017	11/21/2017
BASIC WATER QUALITY (cont'd)								
Sodium	20	mg/L	3.82	3.68	3.87	3.59	3.53	3.69
Solids, Total Dissolved	500	mg/L	68.7	63.3	56	55.5	61.5	67.5
Solids, Total Suspended	--	mg/L	ND	5	ND	ND	28.5	31.5
Sulfate	250	mg/L	3.85	3.37	4.18	4.02	3.74	3.59
Sulfide, Total	--	mg/L	ND	ND	ND	ND	ND	0.071
Total Kjeldahl Nitrogen	--	mg/L	0.58	0.66	0.24	0.51	0.7	0.58
TOTAL METALS CONCENTRATIONS								
Aluminum	87	µg/L	17.2	64.8	55.4	34.7	64.2	684
Arsenic	10	µg/L	0.71	0.96	0.82	0.74	1	1.74
Cadmium	5	µg/L	0.025	ND	ND	ND	ND	0.034
Chromium	50	µg/L	ND	0.36	ND	0.21	ND	1.98
Copper	1000	µg/L	1.16	1.23	1.63	1.1	1.19	3.64
Iron	300	µg/L	21.6	50.7	74.7	63.8	61	1450
Lead	15	µg/L	0.033	0.058	0.06	0.194	0.059	0.91
Nickel	100	µg/L	0.69	0.43	0.76	1.01	0.39	4.37
Selenium	50	µg/L	ND	ND	ND	ND	ND	ND
Silver	100	µg/L	ND	ND	ND	ND	ND	ND
Zinc	5000	µg/L	44.7	2.1	ND	8.5	ND	8.3
Mercury	50	ng/L	2	6	2.8	5.6	3.5	33.8
Methyl Mercury	--	ng/L	ND	0.2	ND	ND	0.1	ND
DISSOLVED METALS CONCENTRATIONS								
Aluminum	--	µg/L	5.2	13.8	41.1	ND	16.3	396
Arsenic	--	µg/L	0.67	0.81	0.79	0.66	0.84	1.25
Cadmium	Hardness Dep't	µg/L	0.07	ND	ND	ND	ND	0.037
Chromium	Hardness Dep't	µg/L	ND	ND	ND	ND	ND	1.06
Copper	Hardness Dep't	µg/L	1.82	1.18	1.64	1.3	1.32	2.83
Iron	Hardness Dep't	µg/L	5.4	3.5	38.1	9.5	12.9	760
Lead	Hardness Dep't	µg/L	0.035	ND	0.03	0.023	ND	0.503
Nickel	Hardness Dep't	µg/L	0.71	0.28	0.61	0.93	0.36	3.62
Silver	Hardness Dep't	µg/L	ND	ND	ND	ND	ND	ND
Zinc	Hardness Dep't	µg/L	7.1	ND	ND	15.7	ND	19.7
Methyl Mercury	--	ng/L	ND	ND	ND	ND	ND	0.1
PESTICIDES								
Diazinon	1.2	µg/L	ND	ND	ND	ND	ND	ND
Chlorpyrifos	2	µg/L	ND	ND	ND	ND	ND	ND

Source: SSWD 2017
ND = not detected based on the method detection limit

SSWD collected monthly water quality profiles at three locations in Camp Far West Reservoir from May 2015 to December 2017 (Table 3.3.2-9). Water temperature, DO, specific conductivity and pH were recorded at approximately 10-ft intervals at each monitoring location.

Table 3.3.2-9. SSWD reservoir water quality profile locations at Camp Far West.

Location	First Profile Date	Last Profile Date	Latitude	Longitude
Near Camp Far West Dam	4/9/2015	1/30/2018	39.05140	-121.31237
Rock Creek Arm of Reservoir	4/9/2015	1/30/2018	39.05972	-121.29323
Bear River Arm of Reservoir	4/9/2015	1/30/2018	39.03301	-121.27238

DO profiles in Camp Far West Reservoir between April and August 2017 were generally a negative heterograde curve indicating a metalimnetic oxygen minimum. DO concentrations decreased sharply in the first 50 ft below the surface before beginning to increase. Profiles taken near the dam saw DO values decrease again near the bottom. DO concentrations on the surface were usually 7 mg/L or greater, whereas DO concentrations in the metalimnion were less than 1.0 mg/L. The cause of the metalimnion minimum is unknown, yet similar curves occur in other reservoirs. In some cases, the reason is oxidizable material that is either produced in the reservoir's epilimnion (e.g., autochthonous material, such as phytoplankton), or oxidizable material that enters the reservoir from outside sources (e.g., allochthonous material, such as leaves, twigs and insects). The material sinks in the reservoir, and the rate of sinking slows down as it encounters the more dense metalimnetic water. Here, the material has more time under more conducive (i.e., warmer) water temperatures than deeper in the reservoir, to decompose. As a result, more readily oxidizable material is decomposed in the metalimnion with a concomitant consumption of oxygen by bacterial respiration. Another potential cause of the metalimnetic oxygen minimum is very high concentrations of zooplankton microcrustaceans in the metalimnion, which due to respiratory consumption, lower DO concentrations. DO profiles for 2017 are presented in Figures 3.3.2-1 through 3.3.2-3, as examples of present conditions.

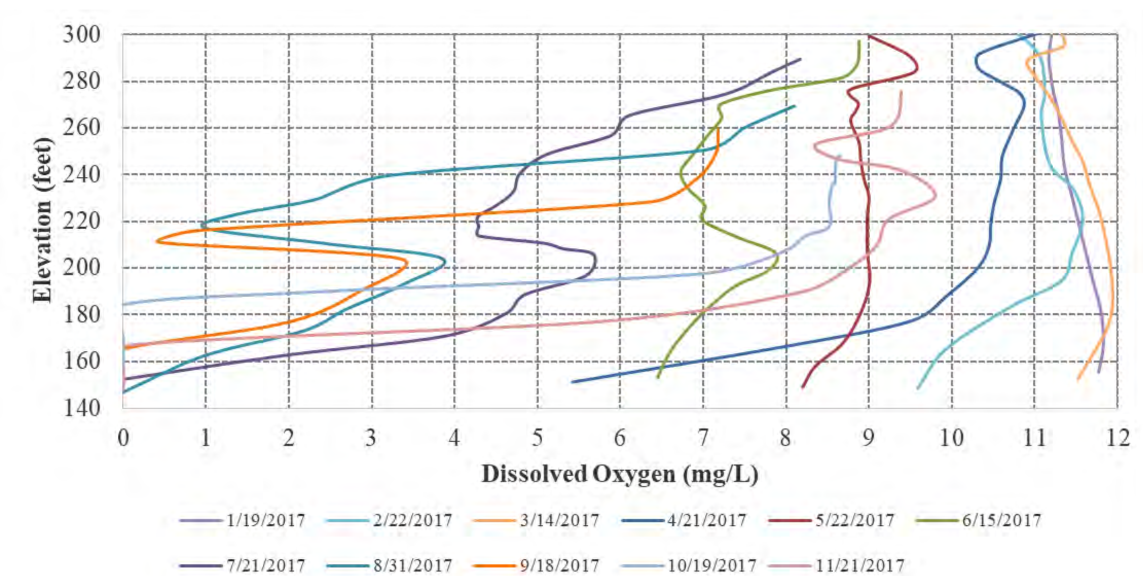


Figure 3.3.2-1. Reservoir dissolved oxygen profiles near the Camp Far West Dam.

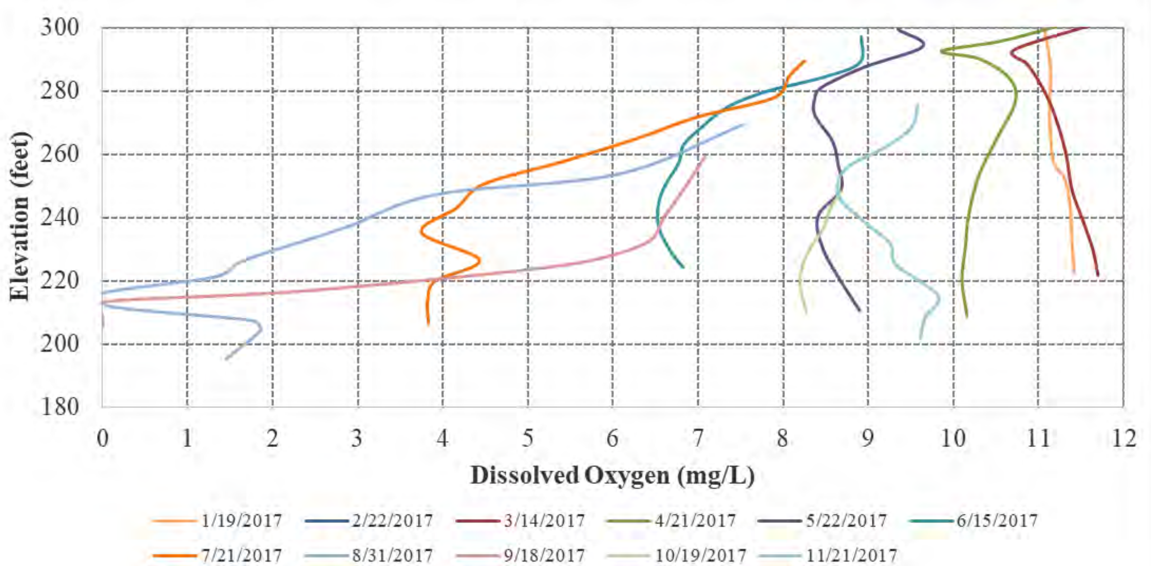


Figure 3.3.2-2. Reservoir dissolved oxygen profiles in the Rock Creek Arm of Camp Far West Reservoir.

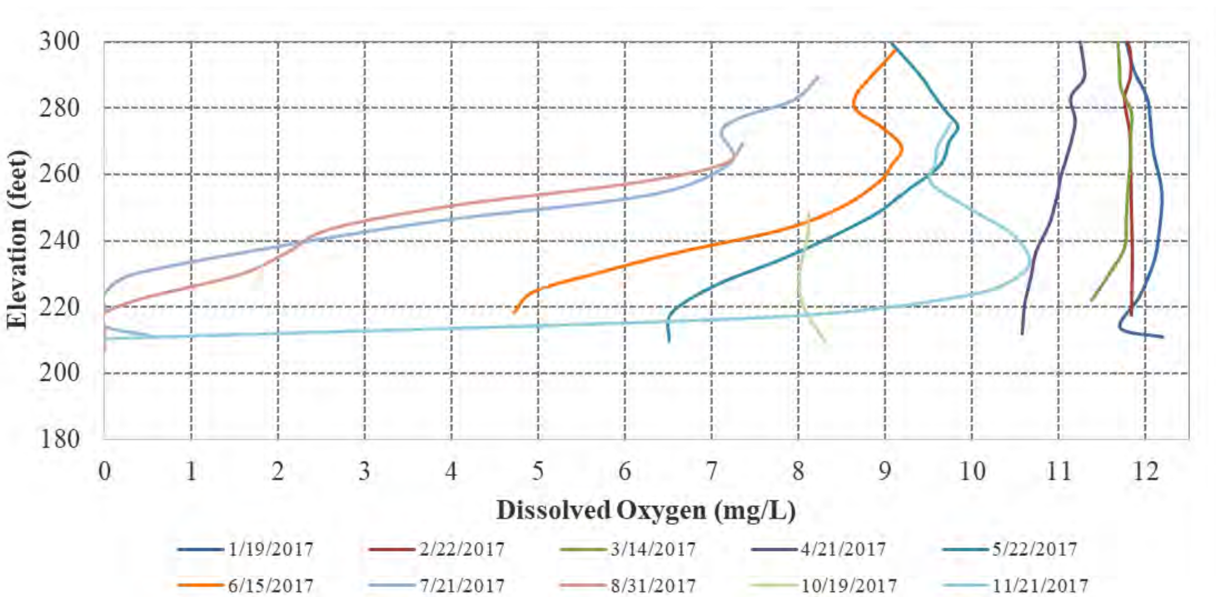


Figure 3.3.2-3. Reservoir dissolved oxygen profiles in the Bear River Arm of Camp Far West Reservoir.

Specific conductivity ranged from 11 µS/cm to 315 µS/cm during the monitoring period and tended to decrease with depth. Specific conductivity values increased as water temperatures increased during the year, particularly near the surface. Levels of pH ranged from 5.7 to 9.2 units during the monitoring period and were highest near the surface (Table 3.3.2-10). The most variation in values for specific conductivity and pH occurred at the sampling location near the dam due to the depth of water sampled.

Table 3.3.2-10. Conductivity and pH values for three monitoring locations at Camp Far West reservoir.

	Specific Conductivity (µS/cm)			pH (pH units)		
	Near Dam	Rock Creek Arm	Bear River Arm	Near Dam	Rock Creek Arm	Bear River Arm
MONTHLY RANGE						
January	52-68	53-71	37-64	6.8-7.5	7.3-7.5	7.2-7.5
February	54-275	58-79	55-120	7.1-7.6	7.4-7.6	7.5-7.6
March	59-86	59-81	60-80	6.8-8.0	7-8.1	7.3-7.6
April	11-93	65-93	66-111	6.5-8.5	6.7-8.5	6.8-7.8
May	66-189	60-103	60-112	6.5-8.5	6.8-8.6	6.7-8.6
June	62-79	62-81	48-75	6.3-8.7	6.8-9.0	6.7- 8.4
July	55-80	57-80	50-81	5.7-9.2	6.1-9.1	6-8.8
August	57-121	60-125	63-150	6.3-7.6	6.6-8.6	6.3-8.31
September	69-99	76-88	87-100	6.4-7.6	6.7-7.5	6.8-7.4
October	82-137	84-128	85-140	6.6-7.6	7.1-7.5	6.7-7.36
November	63-315	59-141	54-145	6.7-7.6	6.9-7.6	7.3-7.7
December	66-79	70-93	58-62	7.2-7.5	7.4-7.6	7.3-7.6
OVERALL STATISTICS						
Minimum	11	53	37	5.7	6.1	6
Average	78.4	76	75.7	7.1	7.3	7.2
Maximum	315	141	150	9.2	9.1	8.8

Alpers et al. (2008) reported on water quality samples collected from October 2001 through August 2003 in order to develop bioaccumulation factors (BAF) for reservoir dwelling biota. Water quality sampling sites were focused along the reservoir thalweg as well as sampling in the Rock Creek and Dairy Farm arms of the reservoir. Water quality samples were collected at approximately 3-month intervals during the duration of the Alpers et al. study for a total of eight samples. The results for six field measured parameters are provided in Figure 3.3.2-4. The data collected for temperature, DO, pH and specific conductance were similar to those observed by SSWD in 2015.

	Temperature (°C)	Dissolved oxygen (mg/L)	pH	Specific conductance (µS/cm)	Total suspended solids (mg/L)	Suspended silt plus clay (mg/L)
All samples						
Mean	14.6	8.1	7.0	164	9.8	8.4
Standard error of mean	0.78	0.44	0.13	32	1.0	0.9
Standard deviation	6.5	3.7	1.1	267	7.9	7.1
Minimum	7.0	0.0	3.0	69	0	0
25th percentile	9.6	6.6	6.8	84	5	3
Median	11.4	8.7	7.3	90	7.5	6
75th percentile	17.6	10.3	7.7	127	11	10
Maximum	27.5	14.6	8.4	1,660	30	30
n	69	69	71	71	68	68

Figure 3.3.2-4. Statistical data for field measurements and suspended solids concentrations.
From: Alpers et. al. 2008. Figure 8.

Bear River between Camp Far West Reservoir and the non-Project Diversion Dam

The only sources of water quality data for this reach were those collected during SSWD's 2017 relicensing water quality study. Samples were collected at one location downstream of the powerhouse and low-level outlet releases at three dates (Table 3.3.2-11). Four parameters were inconsistent with the Basin Plan during at least one sampling event: DO (one sample), alkalinity (three samples), aluminum (two samples), and iron (one sample).

Table 3.3.2-11. Water quality results from SSWD's 2017 study at the Bear River downstream of the Camp Far West Powerhouse.

Analyte	Benchmark	Sample Location	Bear River downstream of Powerhouse		
		Sample ID	10051111-4		
		Sample Depth	1 ft		
		Date	6/14/2017	8/29/2017	11/21/2017
IN SITU MEASUREMENTS					
Temperature	--	°C	14.92	24.46	13.43
Specific Conductance	900	µSiemens/cm	71	59	66
pH	6.5-8.5	pH units	6.76	6.65	7.56
Dissolved Oxygen	> 7 mg/L	mg/L	7.92	4.57	10.43
Turbidity	--	NTU	5.1	7.1	14.4
BASIC WATER QUALITY					
Alkalinity, Total (as CaCO3)	20	mg/L	29	24	27
Ammonia (as N)	Temp & pH Dep't	mg/L	ND	0.052	0.077
Calcium	--	mg/L	6.36	5.28	6.08
Carbon, Dissolved Organic	--	mg/L	1.47	1.33	2.15
Carbon, Total Organic	--	mg/L	1.47	1.23	1.88
Chloride	250	mg/L	3.74	2.54	2.84
Hardness, Total	--	mg/L	27.4	22	25.1
Magnesium	--	mg/L	2.79	2.13	2.42
Nitrate+Nitrite (as N)	10	mg/L	ND	ND	0.267
o-Phosphate (as P)	--	mg/L	0.016	ND	ND
Phosphorus, Total	--	mg/L	0.011	0.012	0.033
Potassium	--	mg/L	0.61	0.53	0.84
Sodium	20	mg/L	3.58	2.71	2.82
Solids, Total Dissolved	500	mg/L	70.5	58.7	48
Solids, Total Suspended	--	mg/L	ND	ND	11
Sulfate	250	mg/L	3.2	2.63	3.9
Sulfide, Total	--	mg/L	ND	ND	ND
Total Kjeldahl Nitrogen	--	mg/L	0.35	0.47	0.83
TOTAL METALS CONCENTRATIONS					
Aluminum	87	µg/L	61.1	95	259
Arsenic	10	µg/L	0.72	0.85	1.04
Cadmium	5	µg/L	ND	ND	0.027
Chromium	50	µg/L	0.26	0.28	0.77
Copper	1000	µg/L	1.12	1.42	2.5
Iron	300	µg/L	112	123	486
Lead	15	µg/L	0.102	0.114	0.398
Nickel	100	µg/L	1.23	0.79	2.04
Selenium	50	µg/L	ND	ND	ND
Silver	100	µg/L	ND	ND	ND
Zinc	5000	µg/L	4.7	ND	3.1
Mercury	50	ng/L	9.1	5.5	13.9
Methyl Mercury	--	ng/L	ND	ND	0.1
DISSOLVED METALS CONCENTRATIONS					
Aluminum	--	µg/L	13.9	62.1	57.8
Arsenic	--	µg/L	0.59	0.9	0.79
Cadmium	Hardness Dep't	µg/L	ND	ND	ND
Chromium	Hardness Dep't	µg/L	0.21	ND	0.29
Copper	Hardness Dep't	µg/L	1.17	1.53	1.41
Iron	Hardness Dep't	µg/L	33.3	75.4	121

Table 3.3.2-11. (continued)

Analyte	Benchmark	Sample Location	Bear River downstream of Powerhouse		
		Sample ID	10051111-4		
		Sample Depth	1 ft		
DISSOLVED METALS CONCENTRATIONS (cont'd)					
Lead	Hardness Dep't	µg/L	0.027	0.068	0.106
Nickel	Hardness Dep't	µg/L	0.98	0.59	1.44
Silver	Hardness Dep't	µg/L	ND	ND	ND
Zinc	Hardness Dep't	µg/L	ND	ND	3.1
Methyl Mercury	--	ng/L	ND	ND	ND
PESTICIDES					
Diazinon	1.2	µg/L	ND	ND	ND
Chlorpyrifos	2	µg/L	ND	ND	ND

Source: SSWD 2017
ND = not detected based on the method detection limit

In addition, SSWD monitored dissolved oxygen concentrations over two periods in 2017 at a location downstream of the powerhouse and low-level outlet. One sampling period was during powerhouse operations (Figure 3.3.2-5) and the second was when water was released from the low-level outlet (Figure 3.3.2-6). During the September monitoring event, DO concentrations were inconsistent with the Basin Plan Objective (greater than 7.0 mg/L) for the entire sampling period likely due to high water temperatures in Camp Far West Reservoir. During the November sampling period, DO concentrations were consistent with the Basin Plan throughout the sampling.

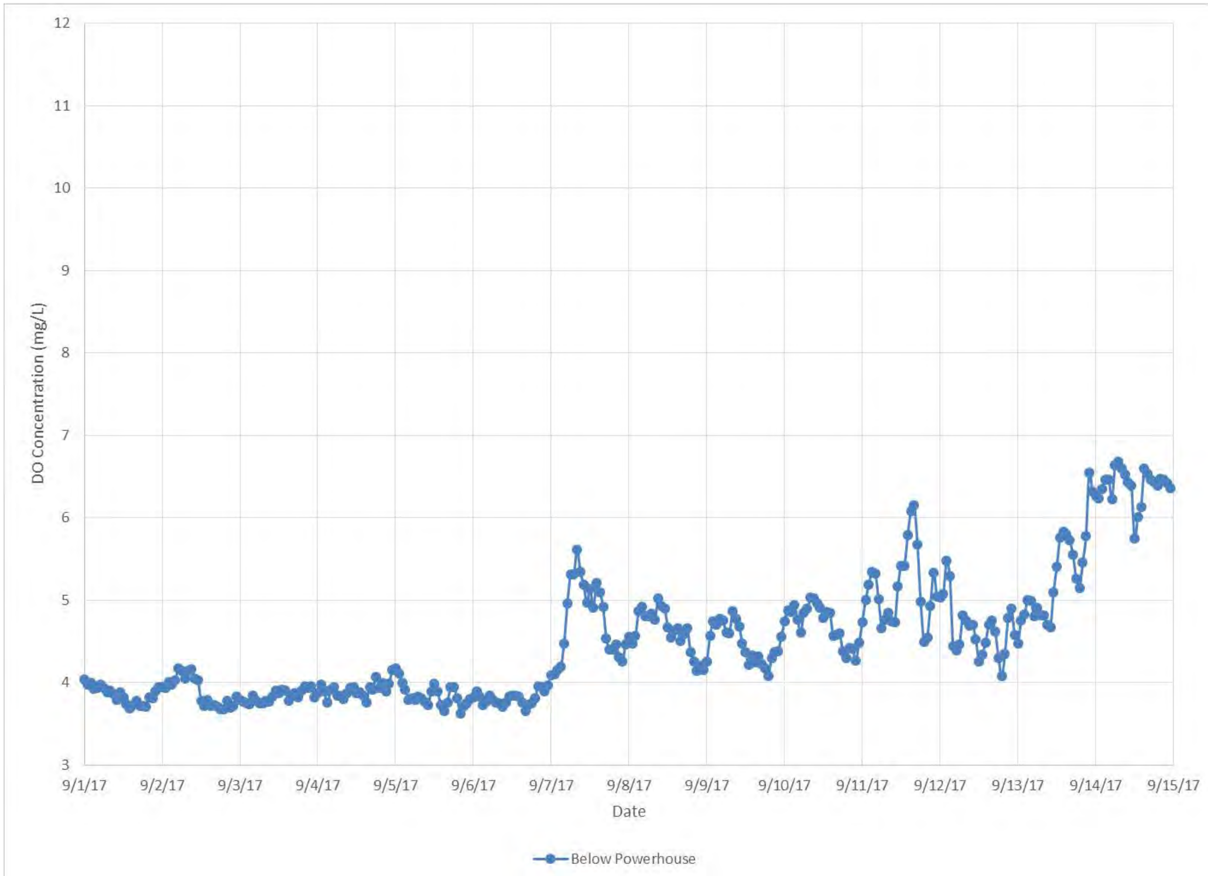


Figure 3.3.2-5. Hourly DO concentrations (mg/L) with Camp Far West Powerhouse operating (249-390 cfs), diversions occurring (199-381 cfs), and flows at Wheatland Gage (13-31 cfs).

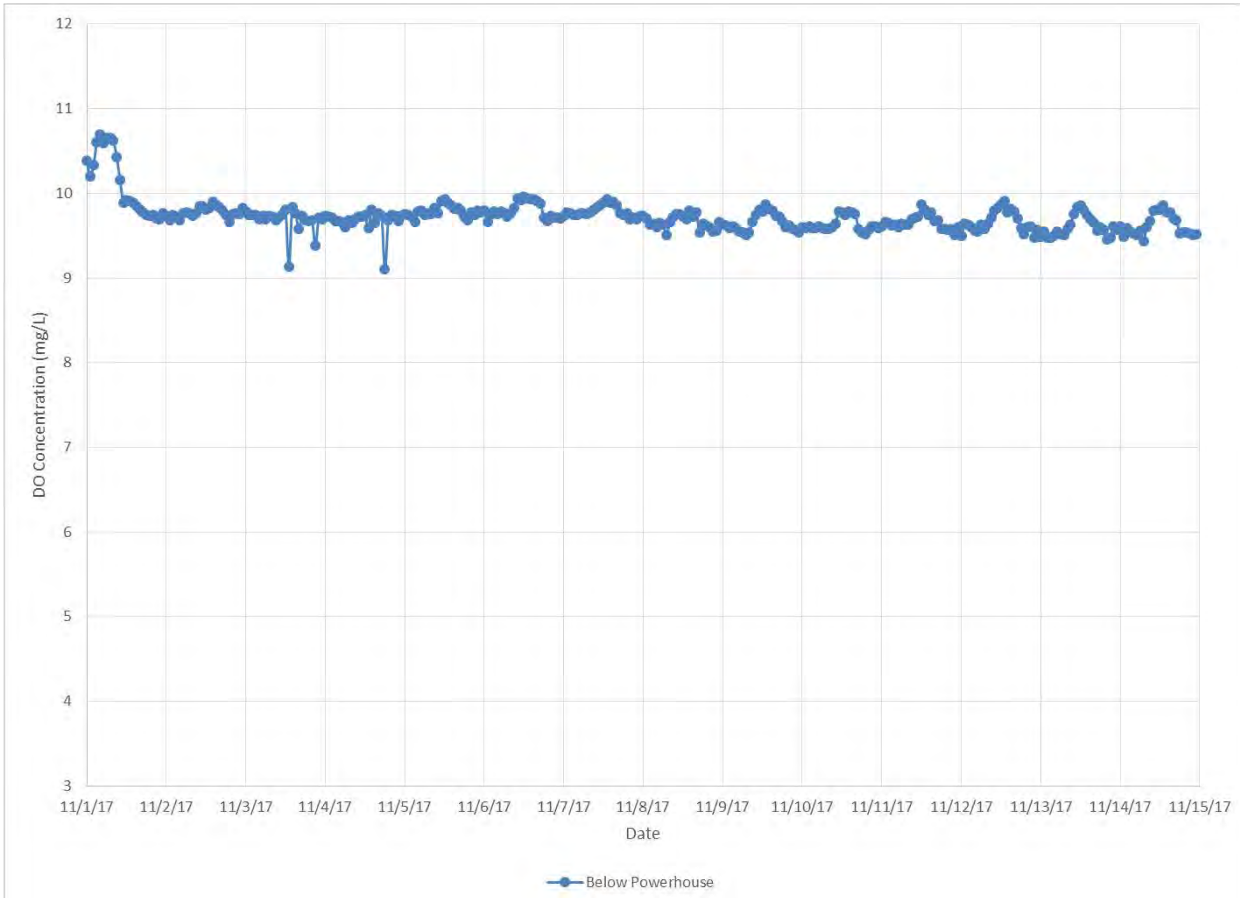


Figure 3.3.2-6. Hourly DO concentrations (mg/L) with Camp Far West Powerhouse not operating, no diversions occurring, and flows at Wheatland Gage (15-26 cfs).

Lower Bear River

SSWD found four sources of water quality data in the lower Bear River.

Water quality was measured at two locations in the lower Bear River as part of the SWAMP Statewide Perennial Stream Assessment (SWRCB 2013); in 2011 upstream of the Pleasant Grove Bridge (RM 7.1) and in 2013 upstream of the Highway 65 Bridge (RM 11.8). Table 3.3.2-12 provides the results of those sampling events.

Table 3.3.2-12. Water quality measurements from the SWAMP Perennial Streams Assessment.

Analyte	Units	Sampling Location	
		Upstream of Pleasant Grove (9/7/11)	Upstream of Highway 65 (6/10/13)
Ammonia as N, Total	mg/L	--	0.0042
Chlorophyll a, Particulate	mg/m2	21.88	21.1
OrthoPhosphate as P, Dissolved	mg/L	0.0134	0.0166
Sulfate, Dissolved	mg/L	3.26	4.46
Silica as SiO2, Dissolved	mg/L	14.2	9.55
Nitrogen, Total, Total	mg/L	0.104	0.242

Table 3.3.2-12. (continued)

Analyte	Units	Sampling Location: Upstream of Pleasant Grove (9/7/11)	Sampling Location: Upstream of Highway 65 (6/10/13)
Total Suspended Solids, Particulate	mg/L	1	2.8
Chloride, Dissolved	mg/L	4.18	4.12
Dissolved Organic Carbon, Dissolved	mg/L	1.38	2.44
AFDM_Algae, Particulate	g/m2	9.76	4.76
Phosphorus as P, Total	mg/L	0.0092	0.0072
Hardness as CaCO3, Total	mg/L	32.8	34.3
Oxygen, Dissolved, Total	mg/L	8.72	9.92
pH	none	9.1	7.1
Alkalinity as CaCO3, Total	mg/L	41	40
Specific Conductivity, Total	uS/cm	88.6	92
Temperature	Deg C	25.9	21
Turbidity, Total	NTU	0.67	1.36

Source: SWRCB 2013

As part of DWR's Oroville Facilities relicensing, DWR completed an extensive water quality study, which included one location in the Bear River near its confluence with the Feather River. Figures 3.3.2-7 through 3.3.2-9 provide summaries of the data collected. During sampling, only turbidity and phosphorus levels exceeded the identified Water Quality Objective.

Bear R near Mouth (A6-5010.50)

	Dissolved Oxygen (ppm)	pH units	Conductivity (field) umhos/cm	Conductivity (lab) umhos/cm	Alkalinity mg/L	Turbidity NTU
Maximum detected	13.4	7.5	236	233	81	58
Minimum detected	6.7	6.8	84	83	31	2.2
Number of samples	28	29	28	29	28	29

Figure 3.3.2-7. Field measurements taken in the Bear River near the Feather River confluence.
From: DWR 2004. Appendix 2c.

Bear R near Mouth (A6-5010.50)

	Ammonia T	Ammonia D	Nitrate + Nitrite D	Ortho-phosphate D	Phosphorus T	Organic Carbon T	Organic Carbon D
Maximum detected	0.2	0.08	0.58	0.07	0.28	14.3	9.2
Minimum detected	<0.02	<0.01	<0.01	<0.01	0.03	2	2
Number of samples	29	28	28	29	29	28	28

Figure 3.3.2-8. Nutrient measurements taken in the Bear River near the Feather River confluence. T = total, D = dissolved.
From: DWR 2004. Appendix 3a-3.

Bear R near Mouth (A6-5010.50)

	Calcium		Magnesium		Sodium	Potassium	Sulfate	Chloride	Boron	Hardness	
	T	D	T	D	D	D	D	D	D	T	D
Maximum detected	13	17	8	10	16	7.0	8	21	<0.1	84	84
Minimum detected	7	6	4	3	4	0.7	3	<1.0	<0.1	30	27
Number of samples	16	29	16	29	29	29	29	29	29	29	29

Figure 3.3.2-9. Mineral measurements taken in the Bear River near the Feather River confluence. T = total, D = dissolved.
From: DWR 2004. Appendix 3b-3.

Total and fecal coliform samples were collected by DWR at this monitoring location 36 times between March 2002 and April 2004. Total coliform counts per 100 mL ranged from 0 to 231 and fecal coliform counts per 100 mL ranged from 0 to 168 (DWR 2004). None of the values exceeded SWRCB criteria.

Total suspended solids and settleable solids were sampled 29 times during the study. Total suspended solids concentrations ranged from less than 1 mg/L to 57 mg/L and settleable solids ranged from undetectable to 0.2 mL/L (DWR 2004).

Metals were also sampled at this location, and DWR determined six metals exceeded identified water quality criterion established by the California Environmental Protection Agency (Cal/EPA), EPA or the SWRCB during at least one sampling event: aluminum, arsenic, copper, iron, manganese and lead (Figure 3.3.2-10).

Bear R near Mouth (A6-5010.50)

	Aluminum		Arsenic		Cadmium		Chromium		Copper		Iron		Mercury	Methyl Mercury	Manganese		Nickel		Lead		Selenium		Silver		Zinc	
	T	D	T	D	T	D	T	D	T	D	T	D	T	T	T	D	T	D	T	D	T	D	T	D	T	D
Maximum detected	1504	1203	1.57	1.320	0.034	0.009	3.46	2.22	8.36	5.82	2880	1768	0.04070	0.000934	390	284	5.40	3.73	1.57	1.01	0.33	0.370	0.55	0.035	8.11	4.23
Minimum detected	53	5.5	0.39	0.282	<0.004	<0.004	0.23	<0.02	1.52	1.12	224	35.6	0.00205	0.000056	13.2	0.33	0.51	0.38	0.070	<0.011	<0.04	<0.04	<0.006	<0.001	0.38	0.19
Number of samples	29	29	29	29	29	29	29	29	29	29	29	29	29	28	29	29	29	29	29	29	29	29	14	14	29	29
Number of samples exceeding criteria or																										
Public Health Goal[1]	9	-	-	-	0	-	-	-	0	-	-	-	0	-	0	-	0	-	0	-	-	-	-	-	-	-
Primary MCL[2]	3	-	0	-	0	-	0	-	0	-	-	-	0	-	-	-	0	-	0	-	0	-	-	-	-	-
Secondary MCL[2]	30	-	0	-	-	-	-	-	0	-	25	-	-	-	14	-	-	-	-	-	-	-	0	-	0	-
Agricultural Goal[3]	0	-	0	-	0	-	0	-	0	-	0	-	-	-	2	-	0	-	0	-	0	-	-	-	0	-
Cal/EPA Cancer Potency Factor[4]	-	-	29	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CTR[5] Humans	-	-	-	-	-	-	-	-	0	-	-	-	0	-	-	-	0	-	-	-	-	-	-	-	-	-
CTR[5] Aquatic Life	-	-	-	0	0	0	-	0	15[9]	2[9],1[10]	-	-	-	-	-	-	-	0	1[9]	1[9]	-	-	0	0	0	0
NTR[6]	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	-
NAWQC[7] Humans	-	-	29	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NAWQC[7] Aquatic Life	28[9], 4[10]	-	-	-	-	-	-	-	-	-	8	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-
USEPA IRIS Reference Dose[8]	-	-	-	-	-	-	0	-	-	-	-	-	-	0	-	-	-	-	-	-	0	-	0	-	0	-

Figure 3.3.2-10. Metals measurements taken in the Bear River near the Feather River confluence. T = total, D = dissolved.

Source: From DWR 2004, Appendix 3c-3.

Footnotes:

1 California Environmental Protection Agency (Cal/EPA), Office of Environmental Health Hazard Assessment, *Public Health Goals for Chemicals in Drinking Water*

2 California Department of Health Services, California Code of Regulations, Title 22, Division 4, Chapter 15, Domestic Water Quality and Monitoring

3 Food and Agriculture Organization of the United Nations, 1985. Water Quality for Agriculture

4 Cal/EPA, Office of Environmental Health Hazard Assessment, Cal/EPA Toxicity Criteria Database

5 California State Water Resources Control Board, Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California (2 March 2003)

6 U.S. Environmental Protection Agency, Federal Register, Volume 64, No. 216 (Tuesday, 9 November 1999) [National Toxics Rule revisions]

7 U.S. Environmental Protection Agency, Quality Criteria for Water, 1986 (May 1986) [The Gold Book] plus updates (various dates)

8 U.S. Environmental Protection Agency, Integrated Risk Information System [IRIS] database

9 Chronic (4 day average)

10 Acute (1 hr average)

The Irrigated Lands Regulatory Program (SWRCB 2005) regulates agricultural discharges into receiving waters through waste discharge requirements or waivers. The program had a single monitoring location on the Bear River near Pleasant Grove Road (RM 6.8) where four samples were taken in June and July 2005 (Table 3.3.2-13). None of the parameters sampled during the four events exceeded the identified water quality criteria established by SWRCB (2016), EPA (2000) or the CVRWQCB (1998).

Table 3.3.2-13. Water quality data collected near Pleasant Grove Bridge as part of the Irrigated Lands Regulatory Program.

Analyte	Units	Sampling Dates			
		6/14/05	6/27/05	7/11/05	7/25/05
Boron, Total	mg/L	0.0046	--	0.0034	--
Arsenic, Total	ug/L	0.51	0.28	0.29	0.71
Zinc, Total	ug/L	0.63	0.32	0.15	0.5
Lead, Total	ug/L	0.06	0.05	0.05	0.04
Nickel, Total	ug/L	1.05	--	0.69	--
Copper, Total	ug/L	1.39	--	1.18	1.71
Ortho Phosphate as P, Dissolved	mg/L	0.0084	--	0.0076	0.0078
Total Organic Carbon, Total	mg/L	2.256	--	1.559	1.8
Nitrate + Nitrite as N, Dissolved	mg/L	0.0601	0.0217	--	0.0091
Ammonia as N, Total	mg/L	0.042	--	--	0.095
Phosphorus as P, Total	ug/L	--	2.47	--	2.84
Total Dissolved Solids, Dissolved	mg/L	53	53	39	63
Hardness as CaCO3, Total	mg/L	28.3	25.2	25.2	--
Specific Conductivity, Total	uS/cm	83.1	80.6	77.8	107.2
Temperature	°C	17.6	19.4	22.2	32.4
Discharge	cfs	238	217.7	146	--
Oxygen, Dissolved, Total	mg/L	7.4	9.1	9.1	7.4
pH	units	7.55	7.49	7.56	8.31
Turbidity, Total	NTU	2.1	1.5	1.7	1.2

Source: SWRCB 2005

In 2017, SSWD collected water quality data at three locations in the lower Bear River as part of the water quality study; 1) downstream of the non-Project diversion dam, 2) at the Pleasant Grove Bridge, and 3) below the Highway 70 Bridge (Table 3.3.2-14). Two parameters were inconsistent with the Basin Plan Objectives for at least one sample at the location downstream of the non-Project diversion dam: alkalinity (3 of 3 samples) and aluminum (1 of 3 samples). One parameter was inconsistent with the Basin Plan Objective at the sampling location upstream of Pleasant Grove Bridge: alkalinity (3 of 3 samples). Four parameters were inconsistent with Basin Plan Water Quality Objectives at the sampling location downstream of the Highway 70 Bridge: dissolved oxygen (1 of 3 samples); alkalinity (3 of 3 samples); aluminum (2 of 3 samples); and iron (3 of 3 samples).

Table 3.3.2-14. Water quality results for SSWD's 2017 study at three locations in the lower Bear River.

Analyte	Benchmark	Sample Location	Bear River downstream of non-Project Diversion			Bear River upstream of Pleasant Grove Bridge			Bear River downstream of Highway 70 Bridge		
		Sample ID	10051111-5			10051111-6			10051111-7		
		Sample Depth	1 ft			1 ft			1 ft		
		Date	6/14/2017	8/29/2017	11/21/2017	6/14/2017	8/29/2017	11/21/2017	6/14/2017	8/31/2017	11/21/2017
IN SITU MEASUREMENTS											
Temperature	--	°C	16.42	24.54	13.44	24.93	29.52	12.9	24.5	24.03	12.18
Specific Conductance	900	µSiemens/cm	71	61	87	90	88	110	102	180	147
pH	6.5-8.5	stnd units	7.21	6.99	7.56	7.92	7.53	7.55	7.24	7.06	7
Dissolved Oxygen	> 7 mg/L	mg/L	10.18	8.19	10.38	9.48	7.83	9.99	7.69	6.83	8.63
Turbidity	--	NTU	3.7	5.1	6.9	2.3	2.2	2	35.1	9.5	19.6
BASIC WATER QUALITY											
Alkalinity, Total (as CaCO3)	20	mg/L	30	24	37	33	38	46	48	66	50
Ammonia (as N)	Temp & pH Dep't	mg/L	ND	ND	0.076	ND	0.108	ND	ND	0.088	0.051
Calcium	--	mg/L	6.28	5.51	8.22	7.82	7.47	9.85	10.6	13.7	11.5
Carbon, Dissolved Organic	--	mg/L	1.59	1.26	1.88	2.35	1.57	1.78	3.99	3.95	5.4
Carbon, Total Organic	--	mg/L	1.45	1.19	1.34	2.12	1.53	1.97	3.95	3.84	5.43
Chloride	250	mg/L	3.63	2.6	3.64	4.38	3.21	4.49	5.41	13.6	11.1
Hardness, Total	--	mg/L	27.3	23.1	34.2	34.3	33.8	43.3	48	64.3	52
Magnesium	--	mg/L	2.81	2.26	3.31	3.59	3.67	4.54	5.22	7.3	5.65
Nitrate+Nitrite (as N)	10	mg/L	ND	ND	0.183	0.068	ND	0.099	0.052	ND	0.147
o-Phosphate (as P)	--	mg/L	0.016	0.015	ND	0.015	ND	ND	0.021	0.054	0.047
Phosphorus, Total	--	mg/L	ND	0.011	0.02	0.176	ND	ND	0.092	0.098	0.108
Potassium	--	mg/L	0.61	0.57	0.9	0.72	0.78	0.87	1.28	1.81	3.87
Sodium	20	mg/L	3.57	2.83	3.58	4.08	3.7	4.5	5.1	9.43	7.62
Solids, Total Dissolved	500	mg/L	69.5	57.8	58.7	80	72.5	62	90.3	118	96.2
Solids, Total Suspended	--	mg/L	ND	ND	5	ND	ND	5.5	44	14	20
Sulfate	250	mg/L	3.21	2.75	4.09	4.95	3.47	5.3	5.81	2.67	9.05
Sulfide, Total	--	mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total Kjeldahl Nitrogen	--	mg/L	0.63	0.7	0.93	0.54	0.52	1.54	0.84	0.68	1.09
TOTAL METALS CONCENTRATIONS											
Aluminum	87	µg/L	65.8	105	79.5	55.1	62.7	24.3	68.6	218	331
Arsenic	10	µg/L	0.81	0.91	0.84	0.82	0.64	ND	1.31	1.32	0.95
Cadmium	5	µg/L	ND	0.033	0.222	ND	ND	ND	0.022	ND	0.035
Chromium	50	µg/L	0.3	0.29	0.31	0.28	ND	ND	2.06	0.67	1.13
Copper	1000	µg/L	1.16	1.32	1.74	1.59	1.22	1.06	4.97	2.03	3.87
Iron	300	µg/L	125	132	158	150	85.6	73.4	1730	821	1400
Lead	15	µg/L	0.166	0.119	0.175	0.12	0.047	0.032	1.04	0.364	0.501
Nickel	100	µg/L	1.13	0.75	1.41	1.19	0.65	0.72	3.3	2	2.76
Selenium	50	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND
Silver	100	µg/L	ND	ND	ND	ND	ND	ND	0.023	ND	0.022

Table 3.3.2-14. (continued)

Analyte	Benchmark	Sample Location	Bear River downstream of non-Project Diversion			Bear River upstream of Pleasant Grove Bridge			Bear River downstream of Highway 70 Bridge		
		Sample ID	10051111-5			10051111-6			10051111-7		
		Sample Depth	1 ft			1 ft			1 ft		
		Date	6/14/2017	8/29/2017	11/21/2017	6/14/2017	8/29/2017	11/21/2017	6/14/2017	8/31/2017	11/21/2017
TOTAL METALS CONCENTRATIONS (cont'd)											
Zinc	5000	µg/L	ND	4.5	2.5	ND	ND	ND	5.1	ND	2.8
Mercury	50	ng/L	7.10	5.0	6.40	5.2	5.5	2.3	15.3	3.8	3.7
Methyl Mercury	--	ng/L	ND	ND	0.1	0.2	0.2	0.1	0.2	0.1	0.1
DISSOLVED METALS CONCENTRATIONS											
Aluminum	--	µg/L	6.2	19.3	39	12.6	ND	15.2	206	21.1	23.3
Arsenic	--	µg/L	0.64	0.74	0.72	0.75	0.57	ND	0.9	1.03	0.57
Cadmium	Hardness Dep't	µg/L	ND	ND	ND	0.05	ND	ND	0.021	ND	ND
Chromium	Hardness Dep't	µg/L	ND	ND	0.24	ND	ND	ND	0.75	ND	0.27
Copper	Hardness Dep't	µg/L	0.74	1.34	1.8	1.68	1.24	1.43	3.44	1.39	2.52
Iron	Hardness Dep't	µg/L	19.2	20.5	72	65.7	15	42.2	609	73.8	136
Lead	Hardness Dep't	µg/L	ND	ND	0.064	0.037	ND	0.028	0.311	0.033	0.039
Nickel	Hardness Dep't	µg/L	0.94	0.51	1.28	0.99	0.39	0.77	2.16	1.46	1.87
Silver	Hardness Dep't	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND
Zinc	Hardness Dep't	µg/L	ND	ND	6.6	ND	2.6	ND	3.6	ND	ND
Methyl Mercury	--	ng/L	ND	0.1	0.1	ND	ND	ND	ND	0.1	ND
PESTICIDES											
Diazinon	1.2	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chlorpyrifos	2	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND

Source: SSWD 2017.
ND = not detected based on the method detection limit

SSWD also monitored dissolved oxygen at two locations in the lower Bear River as part of its 2017 water quality study; the first location was downstream of the non-Project diversion dam and the second was downstream of the Highway 65 Bridge. One sampling period was during powerhouse operations and diversions (Figure 3.3.2-11) and the second was when water was released from the low-level outlet and SSWD was not diverting at the non-Project diversion dam (Figure 3.3.2-12). DO concentrations downstream of the non-Project diversion dam were consistent with the Basin Plan during both sampling periods and ranged between 8 mg/L and 10 mg/L. DO concentrations downstream of Highway 65 were inconsistent with the Bain Plan for some of the period during September 2017. The hourly DO concentrations showed a consistent diurnal fluctuation with concentrations ranging between about 6.5 mg/L and 9.5 mg/L (Figure 3.3.2-13). During the September 2017 sampling period, 116 of the 360 total readings were below the 7.0 mg/L objective (32%).

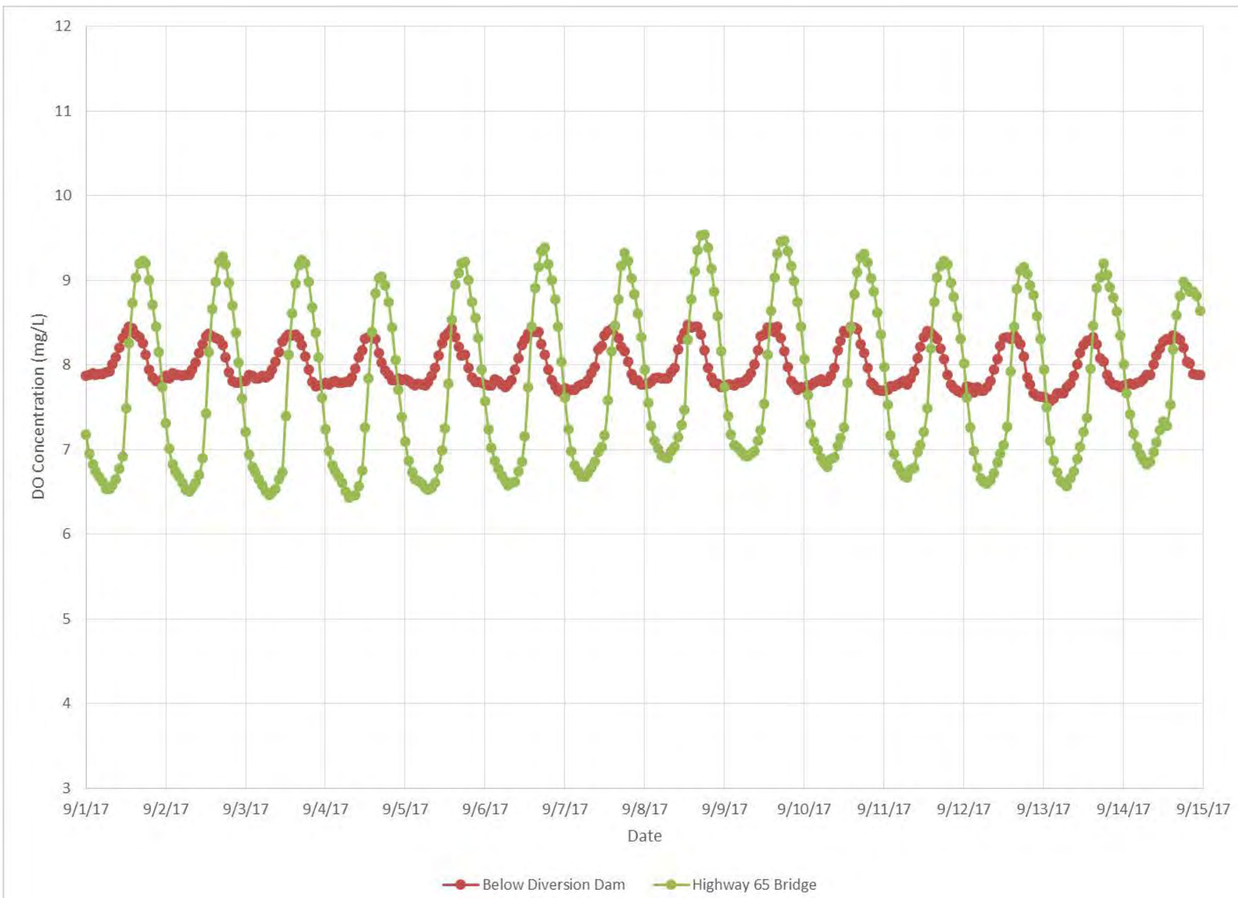


Figure 3.3.2-11. Hourly DO concentrations (mg/L) with Camp Far West Powerhouse operating (249-390 cfs), diversions occurring (199-381 cfs), and flows at Wheatland Gage (13-31 cfs) in September 2017.

Figure 3.3.2-12. Hourly DO concentrations (mg/L) with Camp Far West Powerhouse not operating, no diversions occurring, and flows at Wheatland Gage (15-26 cfs) in November 2017.

Water Temperature

Data collected by SSWD since 2015 is the most comprehensive water temperature data available in Camp Far West Reservoir and in the Bear River upstream and downstream of the Project. Other water temperature sources described below are spot measurements or short-term recordings.

In 2015, SSWD installed a series of water temperature recorders as part of relicensing Study 2.1 to better understand conditions upstream, within, and downstream of the Project (Table 3.3.2-15). In addition, SSWD began collecting monthly reservoir profiles at three locations (Table 3.3.2-9) in April 2015 to monitor reservoir water temperatures. Monitoring continued through 2018 (Table 3.3.2-15).

Table 3.3.2-15. SSWD water temperature monitoring locations in the Bear River.

Location	Bear River Mile	Installation Date	Removal Date[1]	Latitude	Longitude
UPSTREAM OF PROJECT AREA					
Bear River above Camp Far West Reservoir	25.1	4/10/15	7/3/18	39.011685	-121.220506
Rock Creek above Camp Far West Reservoir	--	8/6/15	7/2/18	39.063471	-121.263205
DOWNSTREAM OF PROJECT AREA					
Bear River below Powerhouse Outflow	18.0	4/10/15	9/12/18	39.04898	-121.31841
Bear River below CFW Spillway Channel	17.9	9/29/15	10/25/17	39.04719	-121.31969
Bear River below Diversion Dam	16.9	4/10/15	9/12/18	39.04163	-121.33235
Bear River at BRW gage, Highway 65 Crossing	11.4	4/10/15	9/12/18	38.99901	-121.40810
Bear River at BPG gage, Pleasant Grove Bridge	7.1	5/1/15	9/12/18	38.98561	-121.48329
Dry Creek above Bear River	--	12/1/15	9/12/18	38.99596	-121.49121
Bear River near Highway 70 Crossing	3.5	5/1/15	9/12/18	38.97249	-121.54343
Bear River above Feather River Confluence	0.1	5/1/15	9/12/18	38.93906	-121.57831
Feather River above Bear River Confluence	--	8/6/15	9/12/18	38.94277	-121.57928
Feather River below Bear River Confluence	--	5/1/15	9/12/18	38.93802	-121.58038

[1] This is the date the logger was removed. In some cases there are large data gaps due to vandalism, high flows, or logger malfunction.

Upstream of the Project

SSWD monitored water temperature at two locations upstream of the Project: in Rock Creek and the Bear River upstream of Camp Far West Reservoir (Table 3.3.2-14). Water temperatures in Rock Creek were fairly consistent during the monitoring period with temperatures ranging between approximately 5 degrees Celsius (°C) and 25°C (Figure 3.3.2-13). Water temperatures in the Bear River above Camp Far West Reservoir (RM 25.1) followed the pattern expected for a lower elevation river with water temperatures ranging between approximately 5°C and over 30°C (Figure 3.3.2-14). Both locations showed similar trends across all years of monitoring.

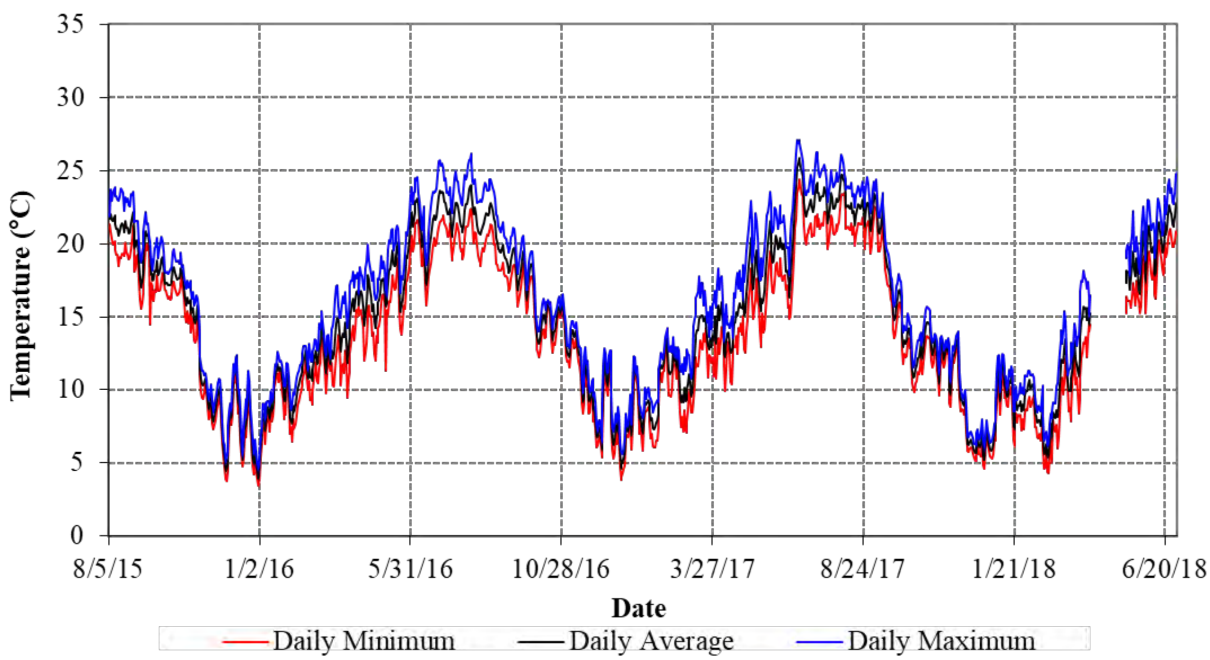


Figure 3.3.2-13. Daily minimum, average and maximum water temperature in Rock Creek upstream of Camp Far West Reservoir.

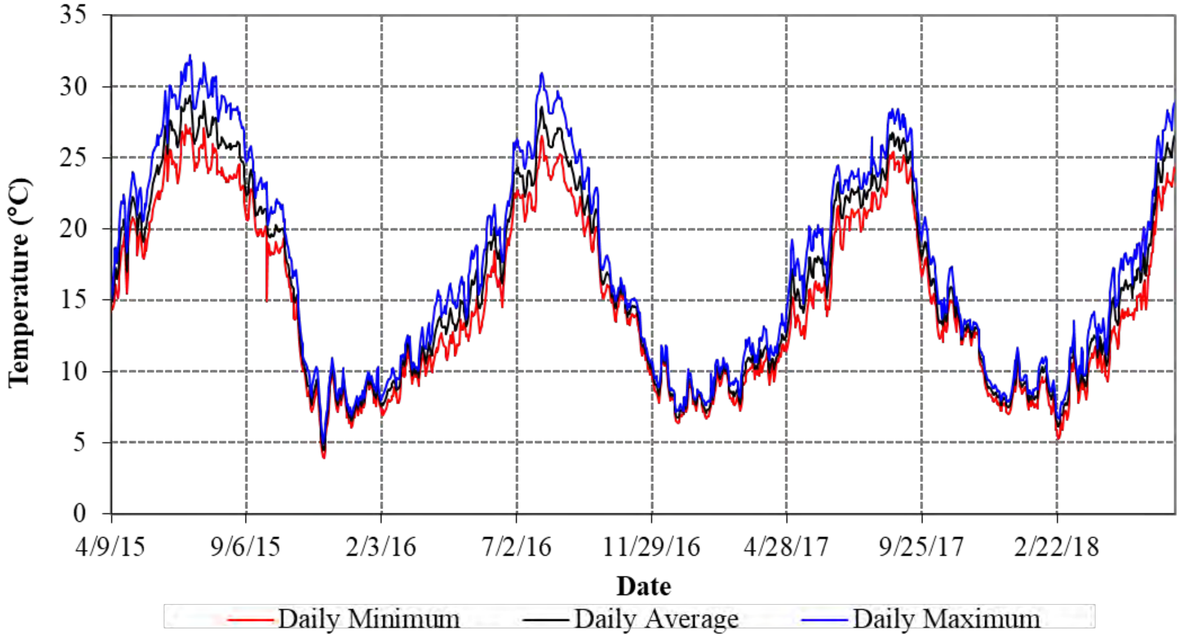


Figure 3.3.2-14. Daily minimum, average and maximum water temperature in the Bear River upstream of Camp Far West Reservoir (RM 25.1).

SSWD found no other information regarding water temperatures immediately upstream of Camp Far West Reservoir.

Camp Far West Reservoir

SSWD collected monthly water temperature profiles at three locations in Camp Far West Reservoir (Table 3.3.2-15) from April 2015 to November 2017. Reservoir profiles for 2017 are provided as an example of the variation seen throughout the year at each location (Figures 3.3.2-15 through 3.3.2-17)

Water temperatures in Camp Far West Reservoir followed the expected patterns for a reservoir of its size and depth. Surface water temperatures warmed through the spring and summer as air temperatures increased while temperatures near the bottom remained cooler, especially in the deeper areas near the dam. Colder water (i.e. less than 20°C) generally persisted for the entire monitoring period near the dam. However, the amount of cold water was greatly reduced between the April and October sampling events (Figure 3.3.2-15). The Rock Creek arm generally showed minimal vertical mixing from in the spring and summer until reservoir levels in the arm became low enough that water temperatures became almost vertically uniform (Figure 3.3.2-16). Water temperature profiles in the Bear River arm also showed minimal vertical mixing in the spring and summer until temperatures reached equilibrium with the Bear River inflow usually in the fall (Figure 3.3.2-17) and the vertical water temperatures became fully mixed.

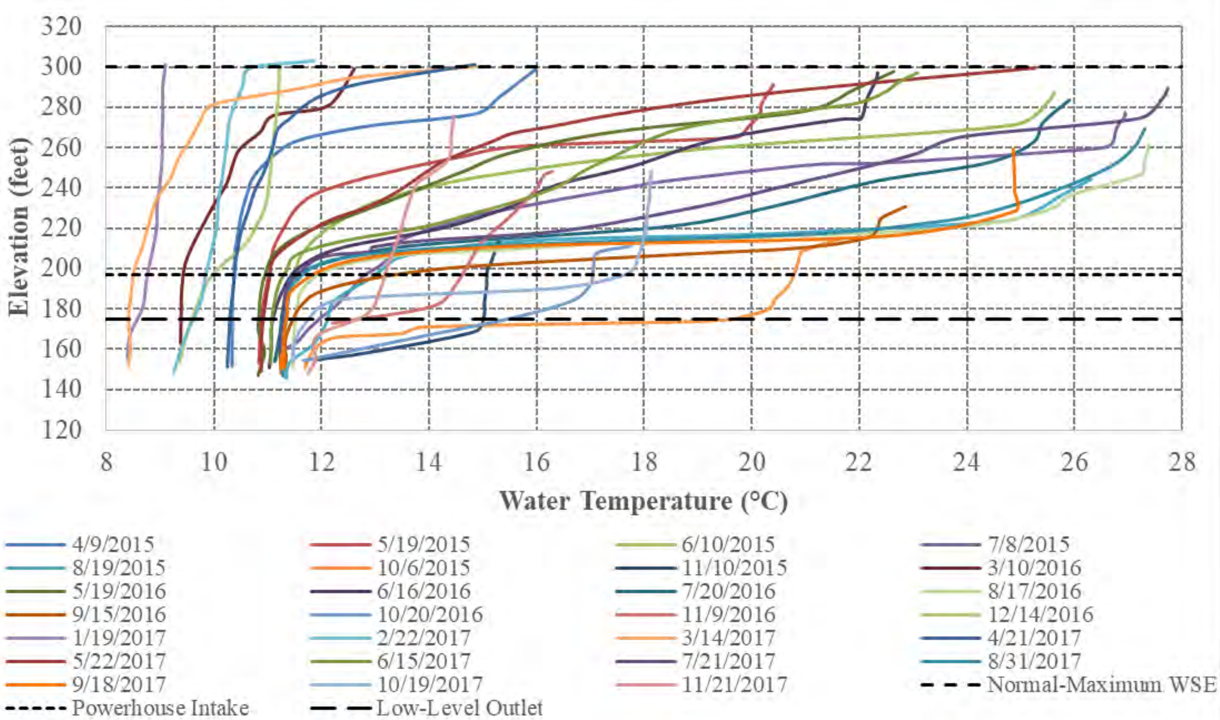


Figure 3.3.2-15. Reservoir water temperature profiles near the Camp Far West Dam.

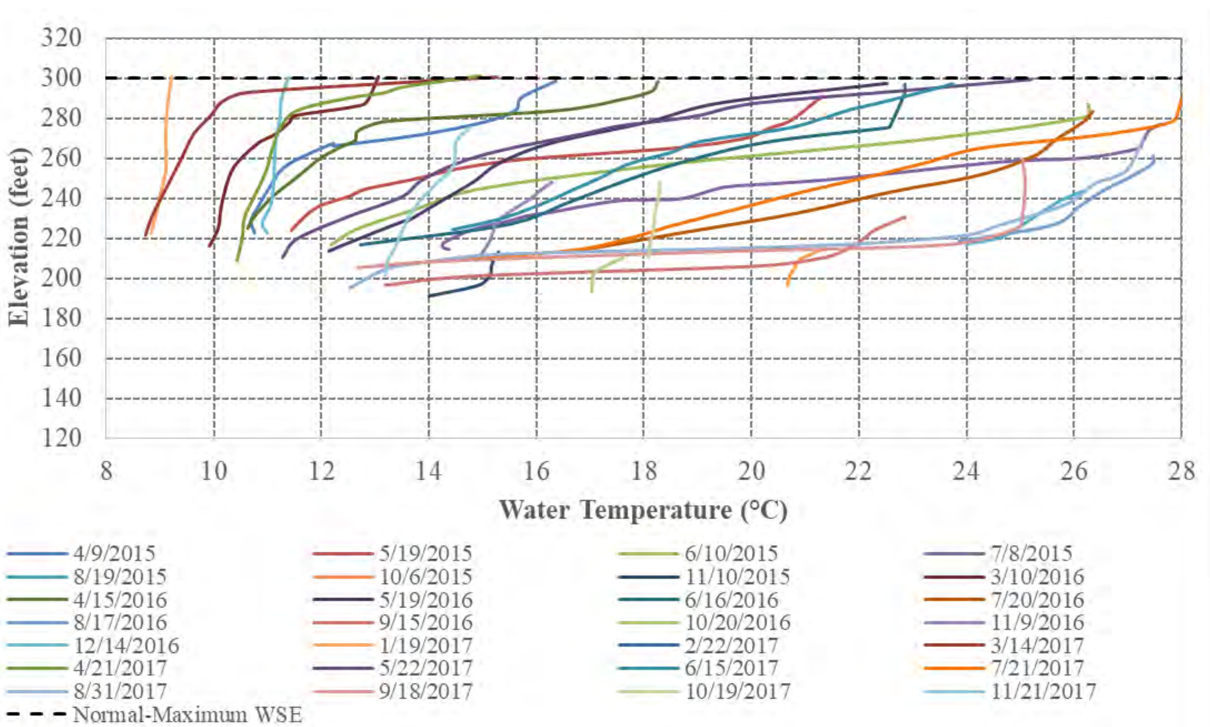


Figure 3.3.2-16. Reservoir water temperature profiles in the Rock Creek Arm of Camp Far West Reservoir.

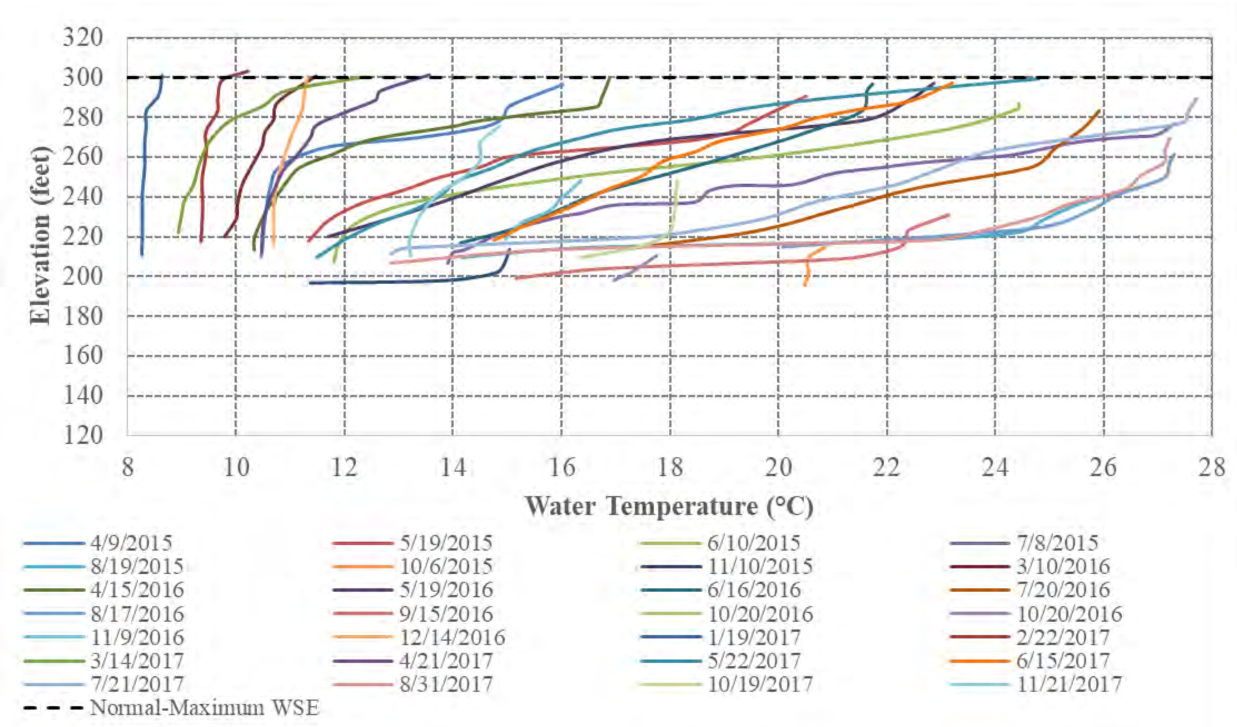


Figure 3.3.2-17. Reservoir water temperature profiles in the Bear River Arm of Camp Far West Reservoir.

Alpers et al. (2008) collected water temperature profile data in Camp Far West Reservoir at multiple locations from 2001 to 2003 during their study of environmental factors affecting mercury in the reservoir. Table 3.3.2-16 provides the minimum and maximum water temperatures observed by Alpers et al. during their sampling at three of the locations: 1) near the dam; 2) in the Bear River arm of the reservoir; and 3) in the Rock Creek arm of the reservoir. These locations are similar to where SSWD collected profiles in 2015. These three locations provide an overall picture of reservoir temperatures during the Alpers et al. study. In general, water temperatures observed by Alpers et al. are similar to those recorded by SSWD.

Table 3.3.2-16. Minimum and maximum water temperatures recorded at three locations in Camp Far West Reservoir by Alpers et al. (2008).

Date	Near Dam (Site No. 2)		Bear River Arm (Site No. 5)		Rock Creek Arm (Site No. 7)	
	Minimum Temperature (°C)	Maximum Temperature (°C)	Minimum Temperature (°C)	Maximum Temperature (°C)	Minimum Temperature (°C)	Maximum Temperature (°C)
11/01/2001	11.2	17.3	11.2	13.0	--	--
11/28/2001	11.2	13.3	--	--	--	--
1/2/2002	8.4	10.2	--	--	--	--
2/12/2002	6.7	9.5	--	--	--	--
4/22/2002	9.1	18.4	10.0	16.6	--	--
6/18/2002	10.3	25.8	11.4	26.1	--	--
8/7/2002	10.5	26.0	12.9	27.0	25.3	26.9
9/6/2002	11.3	23.4	--	--	--	--
11/4/2002	11.0	15.1	--	--	--	--
11/6/2002	11.0	14.0	--	--	--	--
11/21/2002	12.3	13.6	--	--	--	--
12/4/2002	11.5	12.2	--	--	--	--

Table 3.3.2-16. (continued)

Date	Near Dam (Site No. 2)		Bear River Arm (Site No. 5)		Rock Creek Arm (Site No. 7)	
	Minimum Temperature (°C)	Maximum Temperature (°C)	Minimum Temperature (°C)	Maximum Temperature (°C)	Minimum Temperature (°C)	Maximum Temperature (°C)
12/23/2002	8.6	9.9	8.9	9.9	--	--
1/17/2003	8.1	9.6	8.2	9.1	--	--
1/28/2003	8.1	12.0	8.2	11.0	--	--
3/7/2003	8.4	12.5	8.4	11.2	--	--
4/16/2003	9.6	15.7	10.0	15.5	10.6	17.0
7/7/2003	10.9	26.4	12.5	26.0	--	--
10/10/2013	11.2	21.8	20.5	21.9	--	--

Source: Alpers et al. 2008.
-- = No data collected

Bear River between Camp Far West Dam and the non-Project Diversion Dam

SSWD monitored water temperature at two locations in the reach between Camp Far West Dam and the non-Project Diversion Dam; downstream of the powerhouse and low-level outlet channel and downstream of the spillway channel.

Water temperatures in the Bear River downstream of Camp Far West Dam (RM 18.0) and upstream of the non-Project diversion dam pool generally ranged from 5°C to 25°C for the monitoring period. Fluctuations in water temperature were influenced by two factors: 1) water temperatures in Camp Far West Reservoir; and 2) where SSWD was drawing water from the reservoir (i.e. powerhouse intake or low-level outlet intake) (Figure 3.3.2-18). Abrupt changes in the water temperature below the dam were usually during an operational change. Water temperatures observed downstream of where the Camp Far West spillway delivers flow to the Bear River were similar to those of the upstream logger. There was limited data for this location due to the nature of flows at the installation.

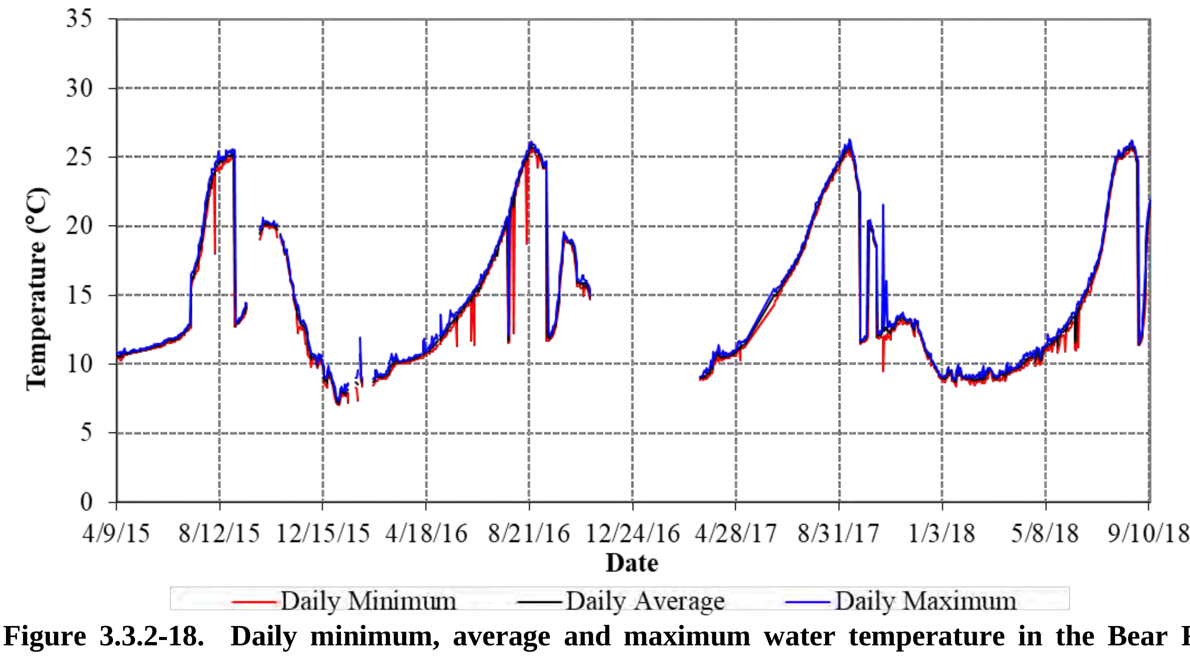


Figure 3.3.2-18. Daily minimum, average and maximum water temperature in the Bear River downstream of the Camp Far West Dam (RM 18.0).

SSWD found no other water temperature data for the Bear River between Camp Far West Dam and the non-Project diversion dam.

Lower Bear River

SSWD monitored water temperature at eight locations downstream of the non-Project Diversion Dam: five in the Bear River; one in Dry Creek; and two in the Feather River (Table 3.3.2-14).

Water temperatures in the Bear River downstream of the non-Project diversion dam (RM 16.9) ranged from approximately 6°C to 27°C during the monitoring period and were influenced by operations at Camp Far West Dam (Figure 3.3.2-19). Water temperatures followed similar trends to those observed immediately downstream of the powerhouse and low-level outlet (Figure 3.3.2-19, above).

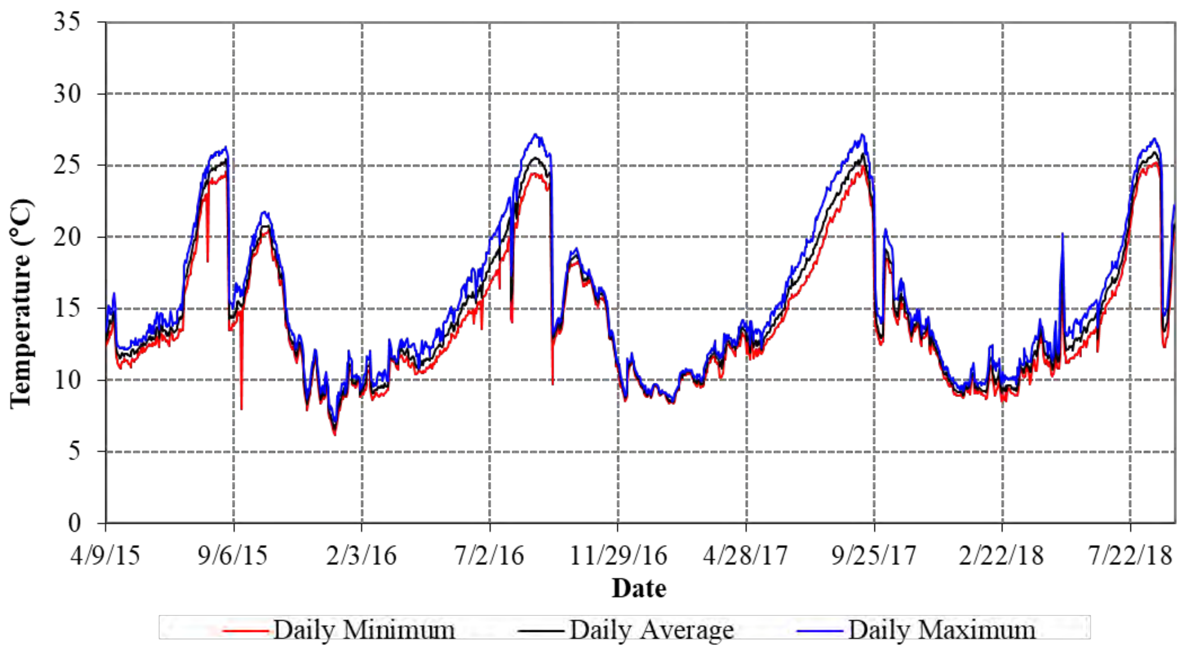


Figure 3.3.2-19. Daily minimum, average and maximum water temperature in the Bear River downstream of the SSWD Non-Project Diversion Dam (RM 16.9).

Water temperatures in the Bear River showed similar patterns and ranges at the four locations between Highway 65 (RM 11.4) and the Feather River confluence (RM 0.1) (Figures 3.3.2-20 through 3.3.2-23). The warmest summer temperatures were observed near the Pleasant Grove bright location, which was about five miles downstream of the non-Project diversion dam but just upstream of the Dry Creek confluence, which added both flow and slightly cooler water temperature to the Bear River.

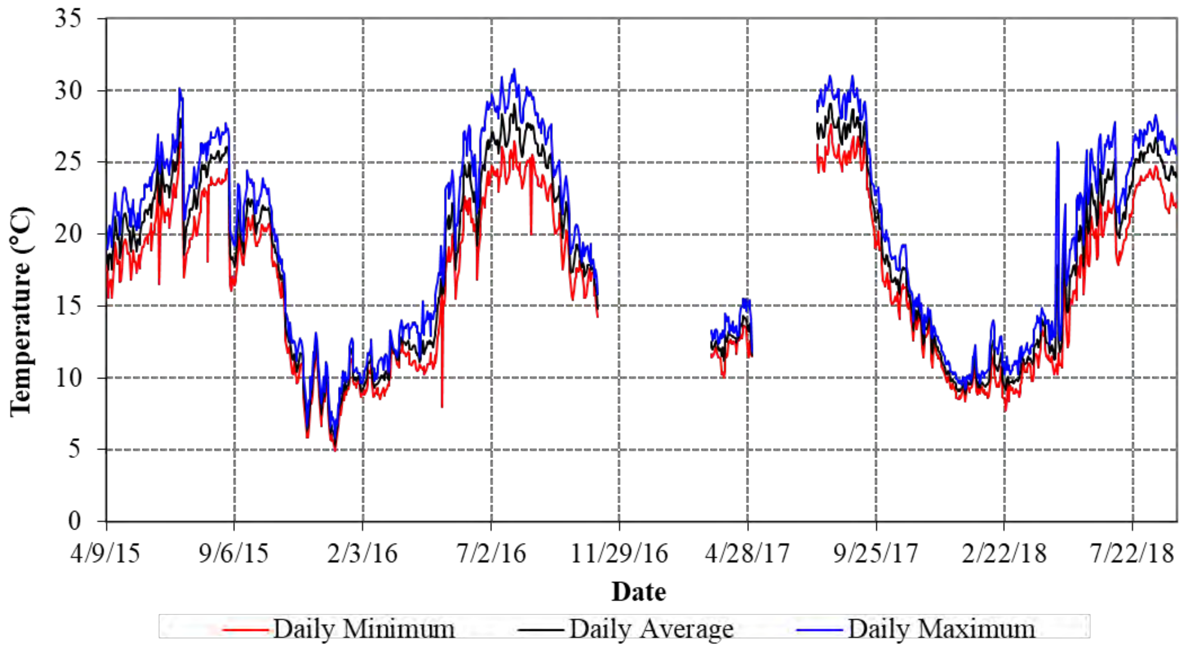


Figure 3.3.2-20. Daily minimum, average and maximum water temperature in the Bear River downstream of the Highway 65 Bridge (RM 11.4).

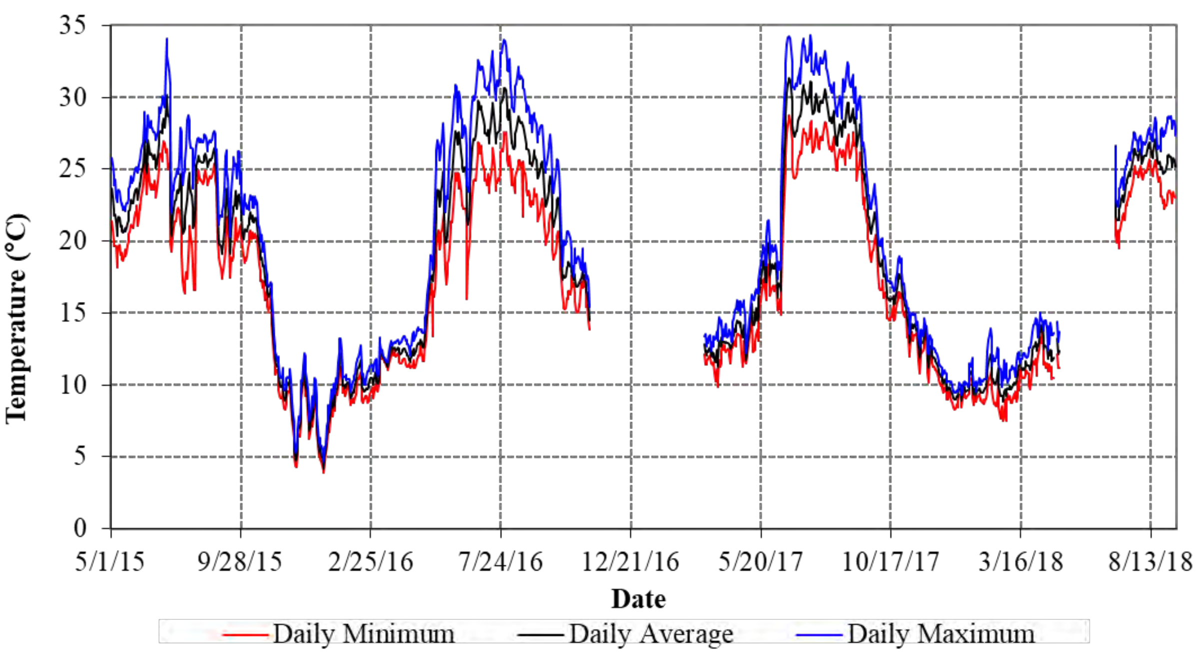


Figure 3.3.2-21. Daily minimum, average and maximum water temperature in the Bear River upstream of the Pleasant Grove Rd. Bridge (RM 7.4)

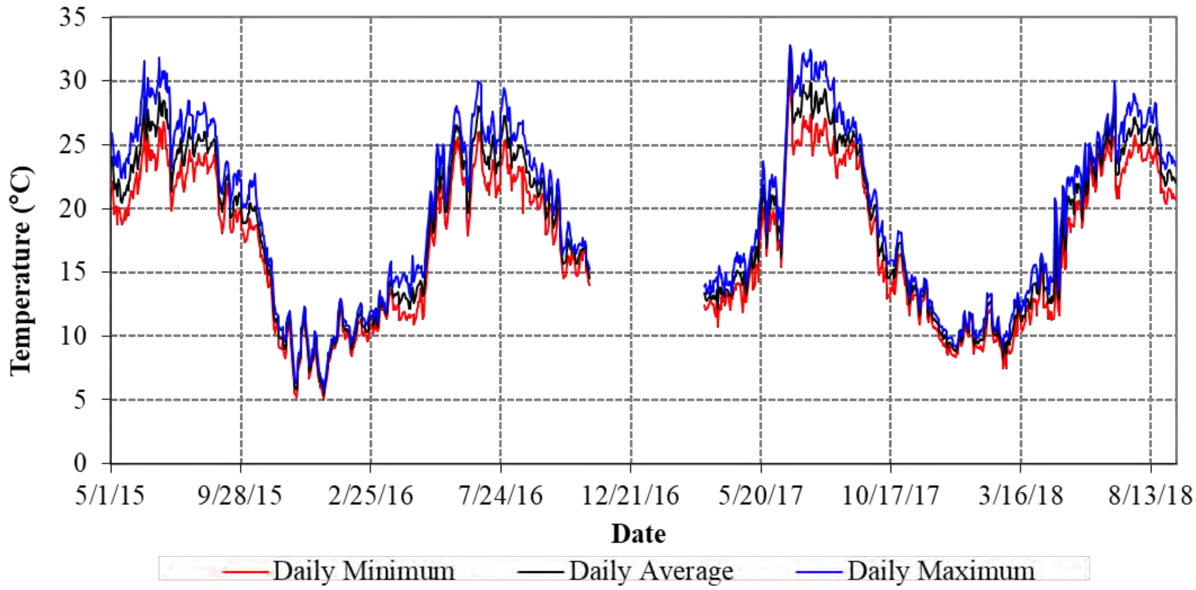


Figure 3.3.2-22. Daily minimum, average and maximum water temperature in the Bear River downstream of the Highway 70 Bridge (RM 3.5).

Water temperatures measured in the Bear River upstream of the Feather River confluence showed less diurnal variation and also lower maximum temperatures compared to the next upstream location near Highway 70, which SSWD believes is due to mixing of tributary inflow from Dry Creek.

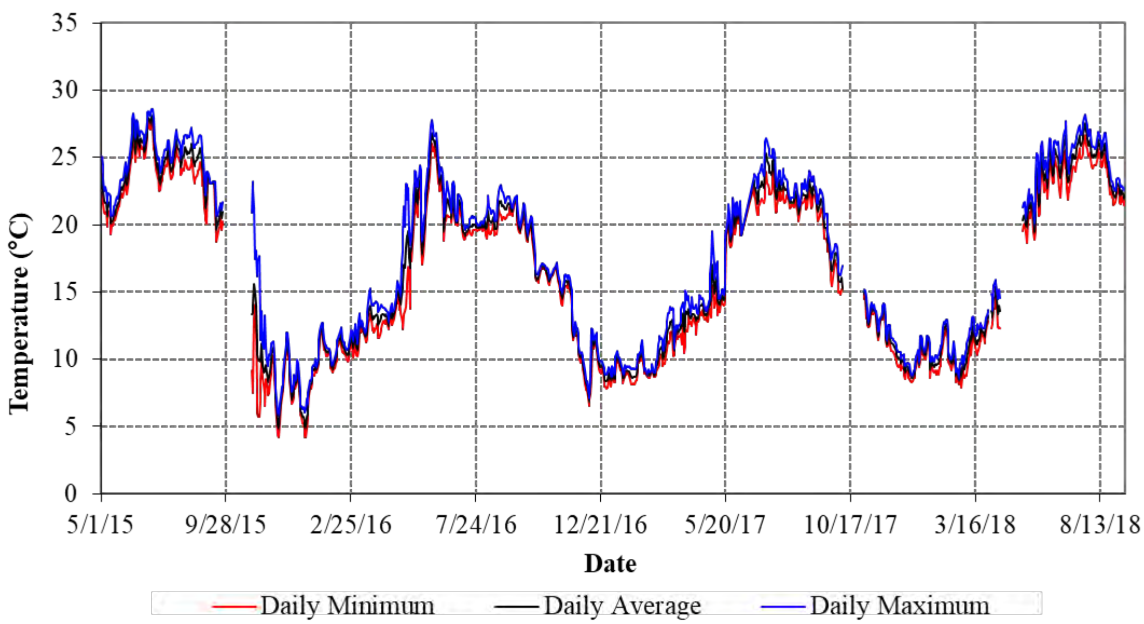


Figure 3.3.2-23. Daily minimum, average and maximum water temperature in the Bear River upstream of the Feather River confluence (RM 0.1)

SSWD also monitored water temperature in Dry Creek, which is the only major tributary in the lower Bear River and the confluence is between the Pleasant Grove and Highway 70 bridges. Due to access issues and variable flows during the monitoring period, only about 1 year of reliable data was collected. In general, water temperatures were slightly cooler in the summer compared to the Bear River but showed a similar seasonal pattern (Figure 3.3.2-24).

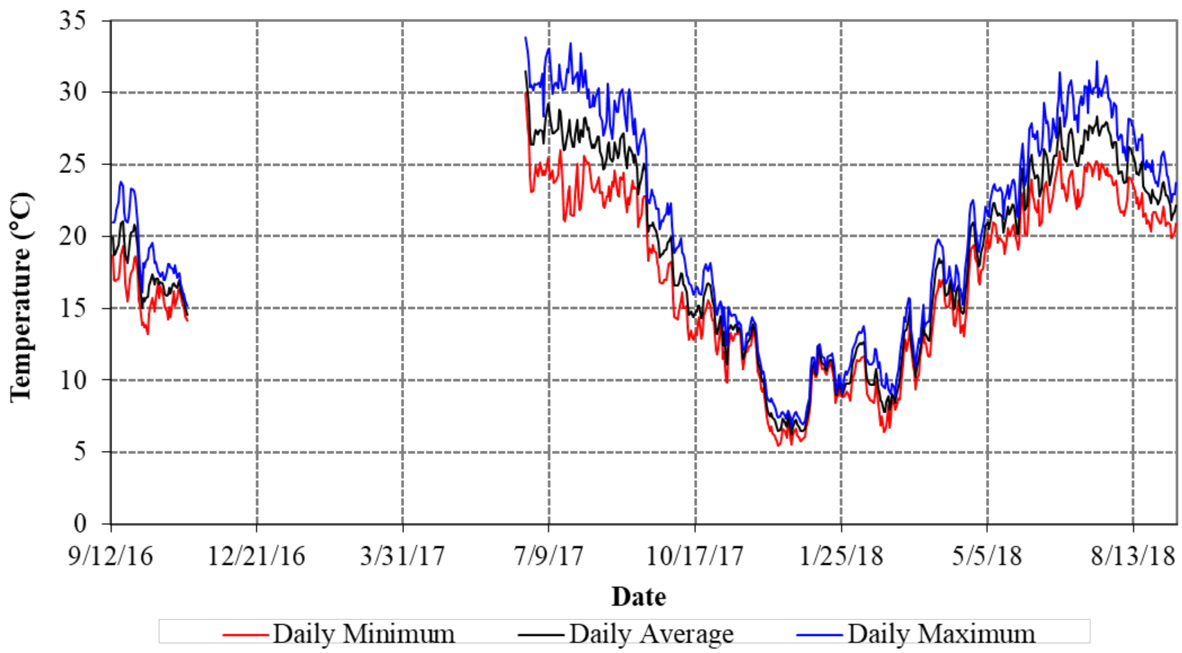


Figure 3.3.2-24. Daily minimum, average and maximum water temperature in Dry Creek upstream of the Bear River confluence.

SSWD also monitored water temperatures in the Feather River upstream and downstream of the Bear River confluence (Figures 3.3.2-25 and 3.3.2-26, respectively). The Feather River upstream of the Bear River confluence was generally cooler in the summer and warmer in the winter compared to the Bear River. The Feather River below the Bear River confluence was warmer compared to the upstream location, yet still generally cooler versus the Bear River. The water temperature at each Feather River location showed less diurnal variability (e.g., daily minimum and maximum) compared to the Bear River locations likely due to the higher flows and water depth and velocity at the installation points.

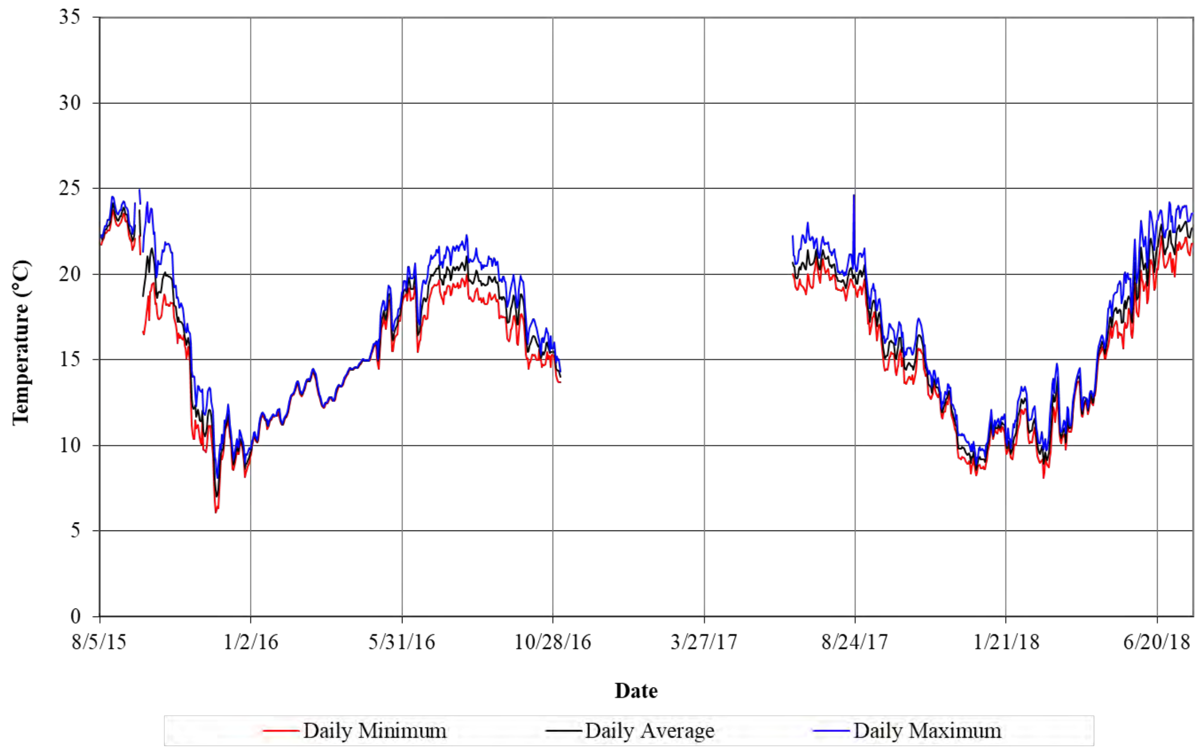


Figure 3.3.2-25. Daily minimum, average and maximum water temperature in the Feather River upstream of the Bear River confluence.

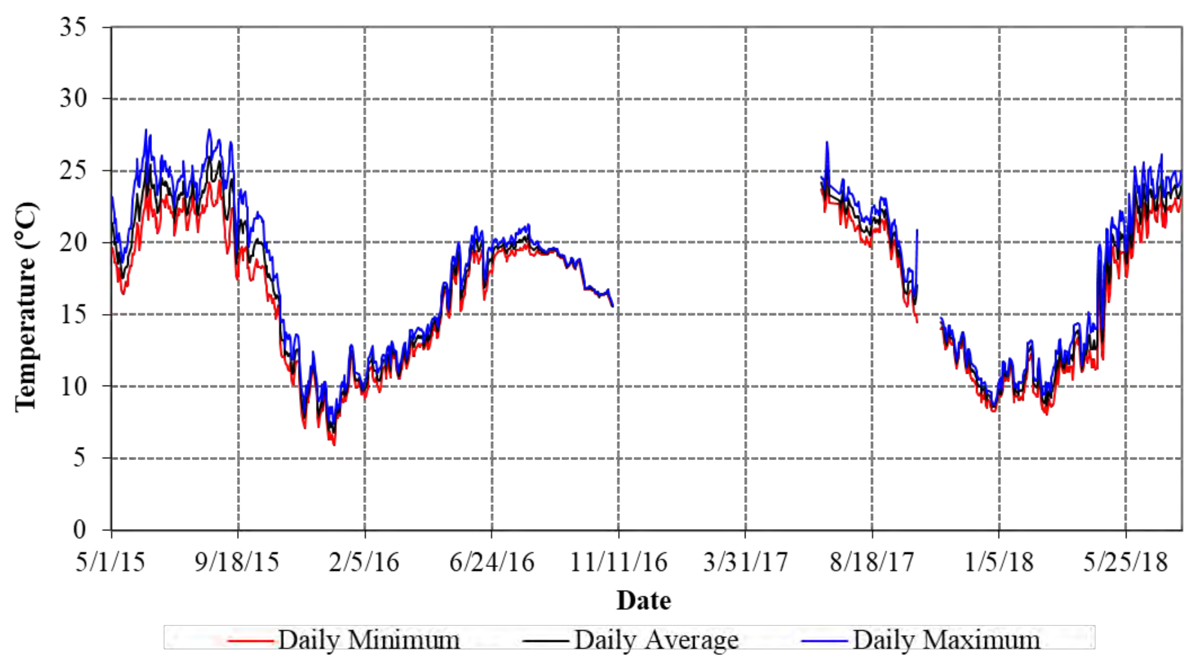


Figure 3.3.2-26. Daily minimum, average and maximum water temperature in the Feather River downstream of the Bear River confluence.

One source of long-term water temperature data available downstream of the Project was collected by DWR staff during monthly sampling from 1964 to 1987 near Wheatland, CA. While these data include only spot (i.e., once-monthly) recordings, they do show general trends in water temperature over a 24-year period (Table 3.3.2-17). These data are consistent with those collected by SSWD at a similar location.

Table 3.3.2-17. Minimum, mean and maximum monthly water temperatures in the Bear River near Wheatland. Collected once monthly by California Department of Water Resources for WY 1964 through WY 1987.

Temperatures (°C)	Month											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep
Minimum	12	11	7	6	6	7	9	12	16	21	22	17
Mean	18	14	11	9	9	11	15	19	24	26	26	22
Maximum	23	16	13	11	16	16	28	31	33	33	31	29
# of Readings	17	15	19	19	20	22	22	20	19	18	17	19

Source: CDFG 1991.

In addition, Bailey (2003) monitored water temperature at two locations near the Patterson Sand and Gravel operation: one approximately 2,000 ft downstream of the non-Project diversion dam (RM 16.5) and the second at the downstream end of the gravel operation (RM 15.0) (Figures 3.3.2-27 and 3.3.2-28). These data are also consistent with those collected by SSWD at a similar location.

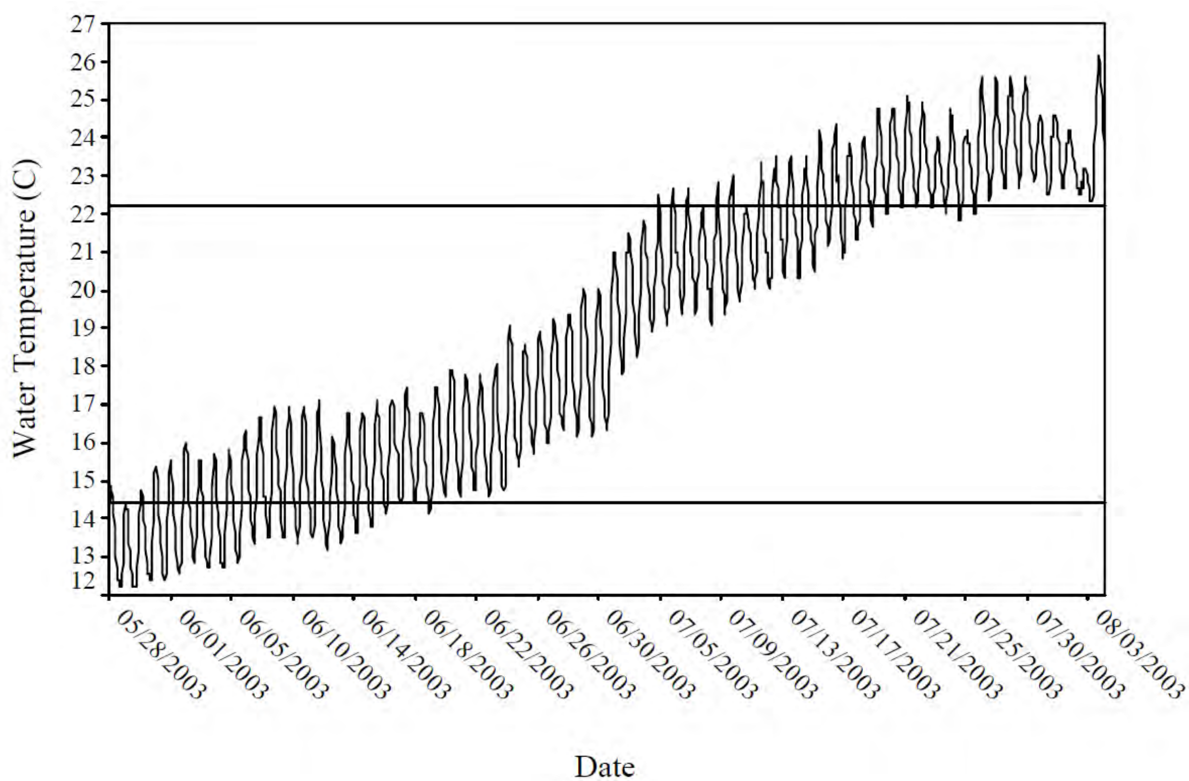


Figure 3.3.2-27. Water temperature time series from the upper Patterson Sand and Gravel site for the period of May 28 to August 4, 2003.
From: Bailey 2003, Figure 1.

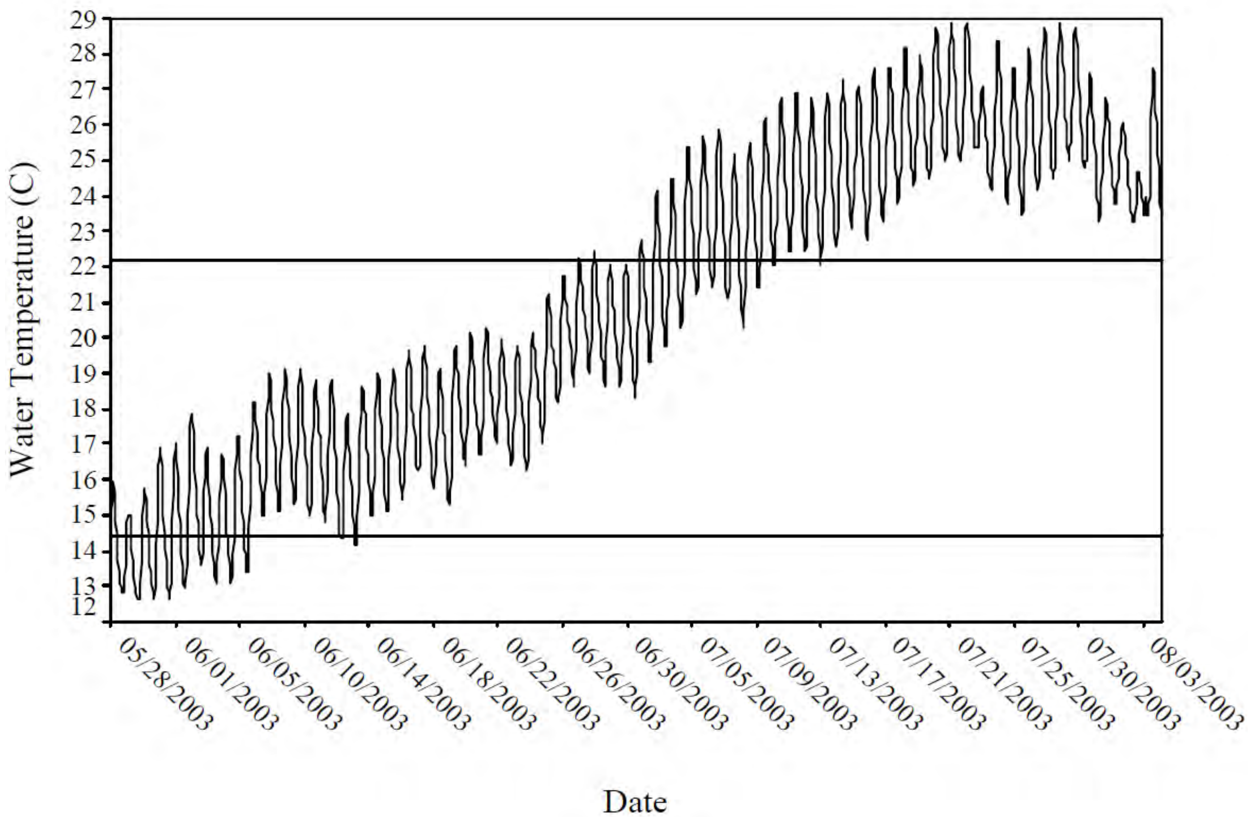


Figure 3.3.2-28. Water temperature time series from the lower Patterson Sand and Gravel site for the period of May 28 to August 4, 2003.
From: Bailey 2003, Figure 2.

A water temperature model of Dry Creek was developed by USFWS as part of the Dry Creek/Best Slough Baseline Habitat Assessment (USFWS 2016). The model simulated water temperatures at three locations in Dry Creek, including one location immediately upstream of the Bear River using the Stream Network Temperature Model (SNTEMP) modeling platform (Payne and Associates 2005). Model validation focused on a period of observed data collected from October 6, 2015 to September 29, 2016. Validation results are shown in Figure 3.3.2-29. Observed data in this figure are consistent with temperature data collected by SSWD at a similar location.

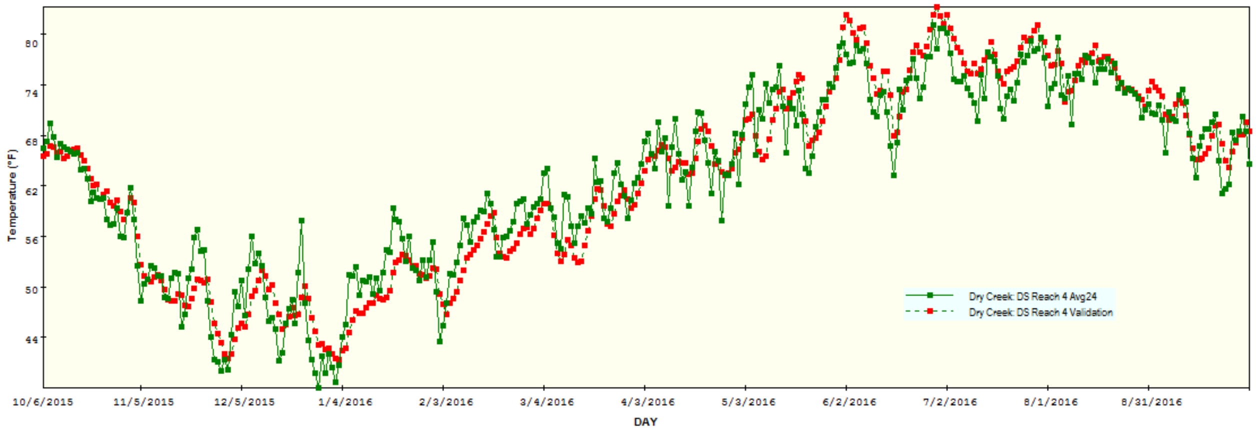


Figure 3.3.2-29. Results of water temperature model validation in Dry Creek upstream of the Bear River for the period of October 6, 2015 to September 29, 2016. Daily average simulated water temperature are red, daily average observed water temperatures are green.
From: USFWS 2016, Appendix E, Figure 3.

Relicensing Water Temperature Model

While a substantial quantity of water temperature data has been collected throughout the Project Area, available data are limited to a few years, and are generally collected from readily accessible locations and regulatory compliance points. Analysis of potential Project effects is greatly enhanced through the examination of a longer period-of-record of data than was historically available, representing a wide range of hydrologic and meteorological conditions. Accordingly, SSWD developed a water temperature model with the capability of simulating water temperatures throughout the Project Area for a period of record matching that of the Ops Model, WYs 1976 through 2014. SSWD relicensing Technical Memorandum 2-2, *Water Temperature Model Documentation, Calibration and Validation*, in Exhibit E, Appendix E1 provides a detailed description of the model platform used in the development of the water temperature model, which is summarized below.

SSWD elected to use a single model platform, CE-QUAL-W2 (Version 4.1), to develop three water temperature models that are run in series to simulate water temperatures from upstream to downstream. CE-QUAL-W2, by the Waterways Experiment Station of the U.S. Army Corps of Engineers (USACE), is a two-dimensional, laterally averaged, hydrodynamic water quality model for rivers, estuaries, lakes, reservoirs, and river basin systems (Cole and Wells 2017). The three models simulate: 1) Camp Far West Reservoir; 2) the non-Project diversion dam; and 3) the lower Bear River. Each model is summarized below.

Camp Far West Reservoir

This Temp Model uses CE-QUAL-W2 to simulate water temperature conditions in Camp Far West Reservoir. The model uses hydrologic output from the Ops Model; a historically-based synthetic time series for water temperatures in the Bear River upstream of Camp Far West Reservoir; a historically-based synthetic time series of water temperatures in Rock Creek above Camp Far West Reservoir; and historically-based synthetic meteorological conditions to simulate Project effects on Camp Far West Reservoir water temperatures. The model provides a two-dimensional (2D) representation of Camp Far West Reservoir, and includes releases from the powerhouse, low-level outlet and spillway at Englebright Dam.

Non-Project Diversion Dam

This Temp Model uses CE-QUAL-W2 to simulate water temperature conditions in the non-Project diversion dam, located immediately downstream of Camp Far West Reservoir. The model uses hydrologic output from the Ops Model, simulated water temperatures in the Bear River below Camp Far West Reservoir from the upstream model; and historically-based synthetic meteorological conditions to simulate Project effects on non-Project diversion dam water temperatures. The model provides a 2D representation of the diversion dam impoundment, including releases to the CFWID North Canal, the SSWD Conveyance Canal, and the Bear River.

Lower Bear River

This Temp Model uses CE-QUAL-W2 to simulate water temperatures in the Bear River from the non-Project diversion dam to the Bear River's confluence with the Feather River. The model uses hydrologic output from the Ops Model, simulated water temperatures in the Bear River below the non-project diversion dam from the upstream model; a historically-based synthetic time series of water temperatures in Dry Creek upstream of the Bear; and historically-based synthetic meteorological conditions to simulate Project effects on Bear River water temperatures. The model provides a 2D representation of lower Bear River, including inflows from the non-Project diversion dam and Dry Creek. The model is unable to simulate backwater effects from the Feather River.

The three Temp Models were developed using available physical information such as reservoir bathymetry and LiDAR. Historically-measured water temperature data described above were used to calibrate each water temperature model. The Camp Far West Reservoir and non-Project diversion dam temperature models calibrated well-below targeted error thresholds. The lower Bear River did not calibrate as well, yet still provides adequate representation of reach water temperature conditions. There are many possible reasons for the Bear River calibration challenges, including inadequate representation of accretion flows and accretion temperatures throughout the reach, and the lack of channel morphology data to develop the lower Bear River model grid. After calibration, each model was validated using a different period of hydrology than was used for the calibration. Validation results were similar to calibration results. For both calibration and validation, simulated water temperature output was compared to historical data when and where available. Model results were able to reasonably match observed water temperature data, and were sensitive to changes in flow meteorological conditions.

Once Temp Model development was complete, the three models were setup to run in series to simulate the full period of record, WYs 1976 through 2014. A graphical user interface (GUI) was developed in Microsoft™ Excel to streamline the process of taking hydrologic output from the Ops Model, converting it to input for the Temp Models, and then running the three models in series. The GUI was used to make three runs of the water temperature model in support of FERC license application: 1) the No Action Alternative, 2) the Proposed Project-near term scenario, and 3) the Proposed Project-future scenario. The GUI and the No Action Alternative are described in the *Water Temperature Model Documentation Calibration and Validation* report located in Exhibit E, Appendix E1. All three Temp Model runs use the same meteorological and water temperature boundary conditions. Hydrologic boundary conditions for each scenario come from their respective Ops Model run.

Standard water temperature model output includes mean- and maximum-daily water temperature, and seven day average daily maximum water temperature for WYs 1976 through 2014 for the following Bear River locations:

- Below Camp Far West Reservoir (RM 18.0)
- Below the non-project diversion dam (RM 16.9)
- At Highway 65 (RM 11.4)
- At Pleasant Grove Bridge (RM 7.1)
- At Highway 70 (RM 3.5)

Below Highway 70, the Bear River is affected by backwater effects from the Feather River, which is not simulated by the water temperature model. Therefore, results downstream below Highway 70 are not included as standard model output.

Figures 3.3.2-30, 3.3.2-31, and 3.3.2-32 show simulated mean-daily water temperatures under the No Action Alternative (i.e., existing conditions) for three representative WYs: 1995 (wet hydrology); 2003 (normal hydrology); and 2001 (dry hydrology). To demonstrate how simulated water temperature changes longitudinally along the Bear River, each figure shows mean-daily water temperatures for each WY at several locations. In all three representative WYs, water temperatures throughout the reach exceed 20°C for most of the June through September period. In each year, simulated water temperatures were very similar at all locations below Highway 65, indicating that water temperatures were at equilibrium with the ambient environment. Warming does occur at the head of the reach below Camp Far West Reservoir to Highway 65 from late spring through summer; cooling occurs at the head of the reach in the fall. Water Temperatures at Highway 70 are impacted by inflows from Dry Creek, which are slightly cooler than the Bear River in summer and fall months, and slightly warmer than the Bear River in spring months.

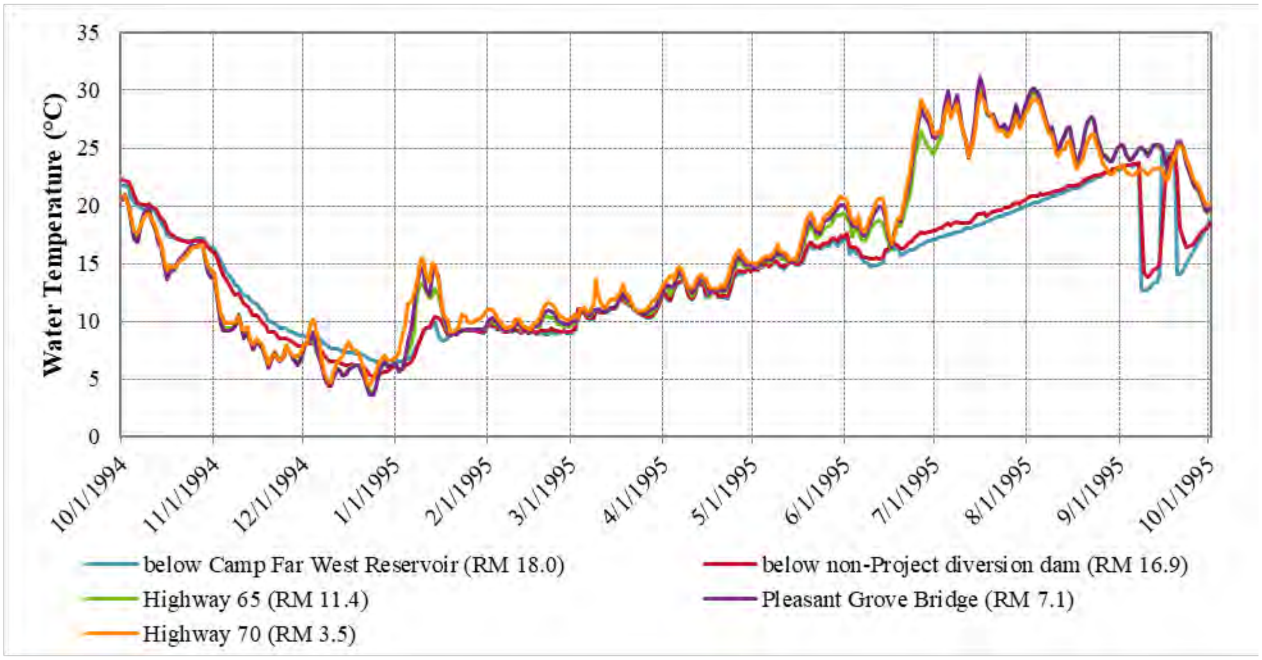


Figure 3.3.2-30. Simulated daily average water temperatures for a representative wet WY (1995) at various locations in the Bear River downstream of the non-Project diversion dam.

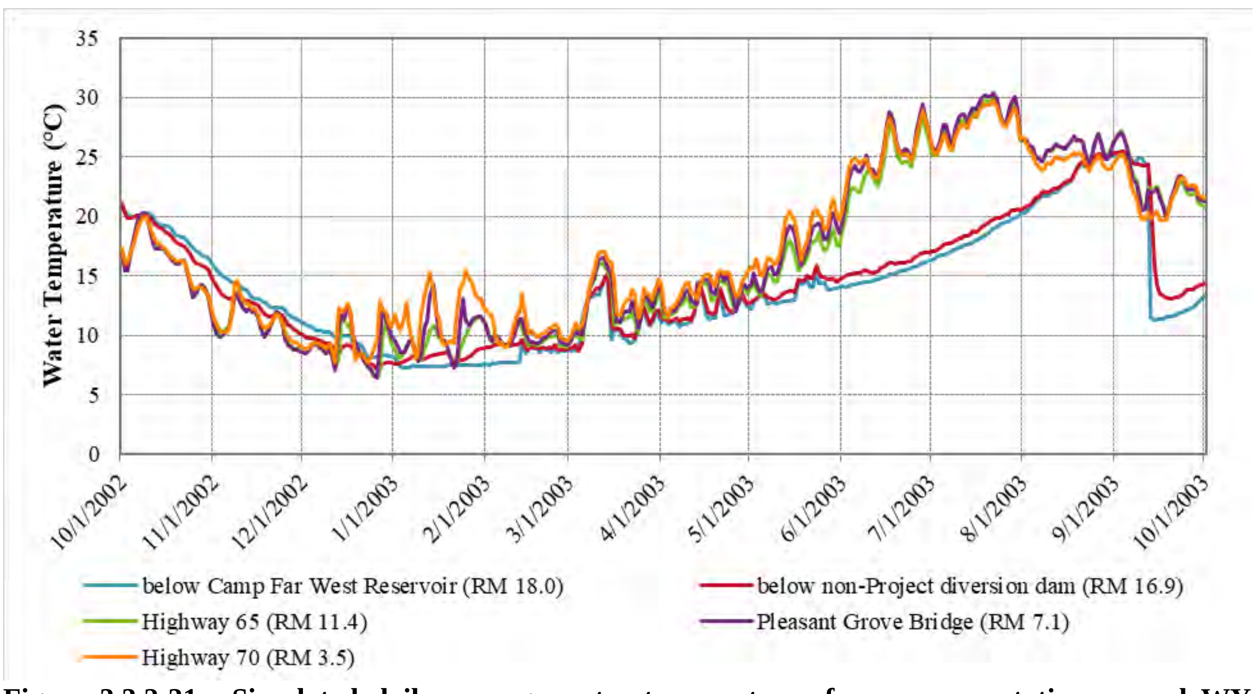


Figure 3.3.2-31. Simulated daily average water temperatures for a representative normal WY (2003) at various locations in the Bear River downstream of the non-Project diversion dam.

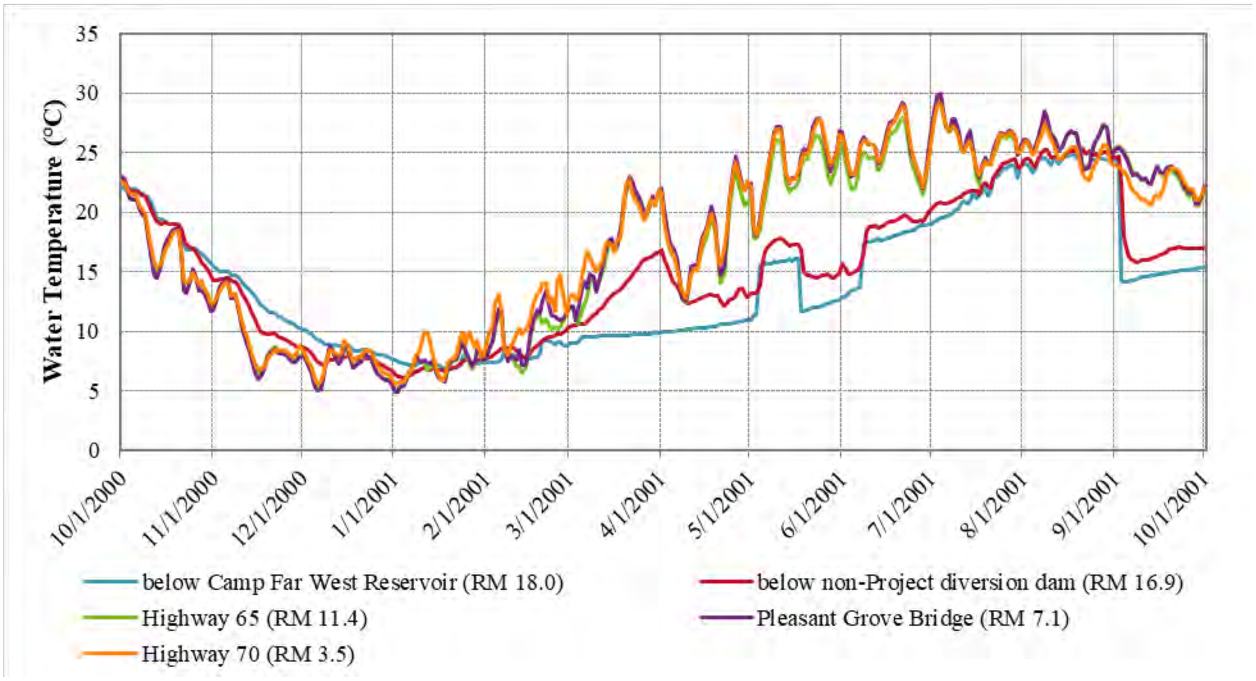


Figure 3.3.2-32. Simulated daily water temperatures for a representative dry WY (2001) at various locations in the Bear River downstream of the non-Project diversion dam.

Mercury

Mercury contamination is common in California aquatic food webs, affecting both the fishing and aquatic life, and beneficial uses in many areas of the state with long-term trends, indicating little change over the past few decades (Davis et al. 2007). In the Bear River watersheds, local sources of mercury, and hence of methylmercury, are a legacy of historic gold mining practices on the river, which used mercury amalgamation in the gold recovery process. Much of the mercury used was lost to the environment (Alpers et al. 2005; Hunerlach et al. 1999; May et al. 2000; Slotton et al. 1995 as cited in May et al. 2000). Regional and global atmospheric sources of mercury also substantially contribute to mercury impacts to the Sacramento–San Joaquin River system (Davis et al. 2009).

As described in Section 3.3.2.1.2, the SWRCB has identified Camp Far West Reservoir and the lower Bear River as CWA Section 303(d) State Impaired for mercury, citing fish tissue concentrations and surface water concentrations, to support their listing (SWRCB 2012).

SSWD has not and does not now introduce mercury into Project waters, nor perform any Project O&M activity associated with the release or mobilization of mercury. SSWD voluntarily participates in the SWRCB and Regional Water Board's Owner and Operators Committee to develop a California-wide water quality control program for mercury (Statewide Mercury Program or Program) that will include: 1) mercury control program for reservoirs; and 2) mercury water quality objectives. It is expected that research performed on Camp Far West Reservoir will inform the TMDL development process.

Mercury has been comprehensively studied in Camp Far West Reservoir fish tissue, surface water and sediment. A brief description of recent studies related to mercury is provided below.

Camp Far West Reservoir

SSWD found five sources of information related to mercury within the Project. The first, Saiki et al. (2010), reported on fish collected by USGS in August 2002 and August 2003 from three locations: the Bear River arm (inflow); the Rock Creek arm; and near the dam. Total mercury (reported as dry weight concentrations) in whole fish was highest in spotted bass (mean, 0.93 ppm; range, 0.16 to 4.41 ppm) and lower in bluegill (mean, 0.45 ppm; range, 0.22 to 1.96 ppm) and threadfin shad (0.44 ppm; range, 0.21 to 1.34 ppm). Spatial patterns for mercury in fish indicated high concentrations upstream in the Bear River arm and generally lower concentrations elsewhere, including downstream near the dam. These findings coincided with patterns exhibited by methylmercury in water and sediment, and the source of mercury to Camp Far Reservoir is Bear River inflows.

Davis et al. (2009) reported on fish collected by CDFW in September 2007 from two locations, the Bear River arm of the reservoir and near the dam. A total of 23 sample composites were generated from two species: spotted bass (21) and channel catfish (2). Mercury in spotted bass ranged from 0.205 to 1.55 ppm, while mercury in catfish ranged from 0.318 to 0.44 ppm.

Alpers et al. (2008) reported on water quality samples collected from October 2001 through August 2003, and developed mercury Bioaccumulation Factors (BAFs) for reservoir dwelling biota. Water quality sampling was done at approximately 3-month intervals on eight occasions at several stations in the reservoir, including a group of three stations along a flow path in the reservoir. Concentrations of total mercury (filtered and unfiltered water) were highest during fall and winter; these concentrations decreased at most stations during spring and summer. Anoxic conditions developed in deep parts of the reservoir during summer and fall in association with thermal stratification. The highest concentrations of methylmercury in unfiltered water were observed in samples collected during summer from deep-water stations in the anoxic hypolimnion. In the shallow (i.e., ≤14 m depth) oxic epilimnion, concentrations of methylmercury in unfiltered water were highest during the spring and lowest during the fall. The ratio of methylmercury to total mercury increased systematically from winter to spring to summer, largely in response to the progressive seasonal decrease in total mercury concentrations, and also to some extent because of increases in methylmercury concentrations during summer.

Alpers et al. (2008) computed mercury BAFs in Camp Far West Reservoir using data from linked studies of biota spanning a range of trophic positions: zooplankton; midge larvae; mayfly nymphs; crayfish; threadfin shad; bluegill; and spotted bass. Significant increases in total mercury in tissue with increasing organism size were observed for all three fish species and for crayfish. The BAF values were computed using the average methylmercury concentration (wet) in biota divided by the arithmetic mean concentration of methylmercury in filtered water (0.04 nanograms per liter). As expected, the BAF values increased systematically with increasing trophic position. Values of BAF were 190,000 for zooplankton; 470,000 to 930,000 for three taxa of invertebrates; 2.7 million for threadfin shad (whole body); 4.2 million for bluegill (fillet); and 10 million for spotted bass (fillet).

Kuwabara et al. (2003) conducted field and laboratory studies in April and November 2002 to provide the first direct measurements of the benthic flux of dissolved mercury species (total and methylated forms) between the bottom sediment and water column at three sampling locations within Camp Far West Reservoir: one near the Bear River inlet to the reservoir; a second at a mid-reservoir site of comparable depth to the inlet site; and the third at the deepest position in the reservoir near the dam. Results were reported in molar quantities and are not reproduced here. Kuwarbara et al. (2003) observed seasonal and spatial variation in benthic flux, and suggested the information can inform reservoir management to minimize methylmercury production.

The California Office of Environmental Health and Hazard Assessment (OEHHA 2009) implemented the following safe eating guidelines for fish in Camp Far West Reservoir based on mercury:

- Women between ages 18 to 45 and children between ages 1 to 17 should not consume more than one serving per week of bluegill or other sunfish species. OEHHA recommended that this group not consume any black bass or catfish species from the reservoir.
- Men over age 17 and women over age 45 should not consume more than three servings per week of bluegill or other sunfish. OEHHA recommended that this group not consume more than one serving per week of black bass or catfish species from the reservoir.

SSWD analyzed water samples for mercury as part of its 2017 study at one location in Camp Far West Reservoir, near the dam. Mercury concentrations ranged from 2.0 µg/L to 6.0 µg/L near the surface and between 3.5 µg/L and 33.8 µg/L near the bottom over three sampling events (Table 3.3.2-8).

<u>Lower Bear River</u>

SSWD found two sources of information related to mercury in the lower Bear River. DWR's Oroville Facilities relicensing (DWR 2004) included collection of a total of 29 water samples at one location in the Bear River downstream of Camp Far West Reservoir, representing sixteen 30-day average samples. The total recoverable mercury concentrations in water ranged from 2.6 ng/l to 20.8 ng/l with an average of 0.84 ng/l for the sixteen 30-day average samples. None of the sixteen 30-day average samples exceeded the EPA (California Toxics Rule) mercury-based numeric criterion for human health.

Grenier et al. (2007) collected fish samples from various Sacramento-San Joaquin rivers and streams, including the lower Bear River. Fish were sampled for tissue analysis at one location from this reach, near Highway 70. A total of 5 out of 21 samples exceeded the EPA fish tissue criterion for human health. The average wet weight mercury concentration in fish tissue was 0.21 ppm for all 21 samples collected. The number of fish collected per sample, the measured mercury concentrations in fish tissue, and the number of exceedances are, by species: redear sunfish–10 samples, 0.07-0.42 ppm (average 0.14 ppm), 1 exceedance; Sacramento pikeminnow – 4 samples, 0.30-0.51 ppm (average 0.40 ppm), 4 exceedances; Sacramento sucker – 4 samples, 0.06-0.25 ppm (average 0.14 ppm), no exceedances; spotted bass – 3 samples, 0.25-0.27 ppm (average 0.26 ppm), no exceedances. All 21 samples were collected from fish with total lengths greater than 150 mm, which represent fish most commonly caught and consumed by sport fishers and their families.

SSWD analyzed water samples for mercury as part of its 2017 study at four locations in the Bear River downstream of Camp Far West Reservoir; 1) downstream of the Camp Far West Dam, 2) downstream of the non-Project diversion dam, 3) near Pleasant Grove Road Bridge, and 4) near highway 70 Bridge. Mercury concentrations ranged from 2.3 µg/L to 15.3 µg/L near the bottom over three sampling events at all locations (Table 3.3.2-14).

3.3.2.2 Environmental Effects

This section discusses the potential environmental effects of SSWD's Proposed Project, as described in Section 2.2 of this Exhibit E. As part of the Project relicensing, SSWD proposes a Pool Raise, modifications of existing recreation facilities, and modification of the existing Project Boundary. Besides the Pool Raise itself, SSWD proposes four license measures that will affect water resources: 1) WR1, Implement Water Year Types; 2) AR1, Implement Minimum Streamflows; 3) AR2, Implement Fall and Spring Pulse Flows; and 4) Implement Ramping Rates. Refer to Appendix E 2 in Exhibit E for the full text of each measure.

The remainder of this section is divided into the following areas: 1) effects of construction-related activities; and 2) effects of continued Project O&M, especially with regards to a) effects on water quantity and use, b) effects on water quality, and c) effects on CWA Section 303(d) constituent – mercury.

3.3.2.2.1 Effects of Construction-Related Activities

SSWD anticipates there to be little-to-no effect from the construction of the Pool Raise, as described in Section 2.2.1.1.2 in Exhibit E, on water quantity or quality under the construction sequence and schedule proposed by SSWD. Construction is anticipated to last a total of 126 days (Task 4, Table 2.2-1), which can be completed in one summer season after the preceding winter spills have ended typically by the end of June, and before the subsequent winter spills have begun typically in the month of December (Exhibit B, Figure 6.3-1). Construction activities will not impact SSWD's ability to make dam releases from either the powerhouse or the low-level outlet. SSWD will obtain all necessary permits and approvals for the Pool Raise construction and related activities, and SSWD anticipates the permits and approvals will contain conditons for the protection and mitigation of any potential impacts to water quality.

3.3.2.2.2 Effects of Proposed Project Operations and Maintenance

Effects on Water Quantity and Use

Under SSWD's Proposed Project, water quantity and use would change, as compared to the No Action Alternative. This section discusses effects of SSWD's Proposed Project on: 1) Project flows and reservoir storage; 2) water supply; and 3) water rights. The Project is described in Exhibit B, Section 2.0.

Project Flows and Reservoir Storage

Project flows and storage would be directly affected by a number of proposed Measures. Five WY types, defined in SSWD's Proposed Measure WR1, would determine the minimum flows described in proposed Measure AR1 and seasonal pulse flows described in proposed Measure AR2. Proposed Measure AR1 would require increased releases from Camp Far West Dam from approximately mid-October through mid-May in all WYs when flows would otherwise have been stored in Camp Far West Reservoir. Proposed Measure AR1 would require decreased releases from April through mid-June in Dry and Critically Dry WYs. Pulse flows and ramping rates in proposed Measures AR2 and AR3, respectively, would have a minor effect on flows and storage as compared to the No Action Alternative.

Project flows and storage are directly affected by the Pool Raise. The Pool Raise would create additional storage space in Camp Far West Reservoir, which allows for more water to be stored when Camp Far West Reservoir fills and spills. On average, carryover storage in Camp Far West Reservoir is anticipated to increase in Wet, Above Normal and Below Normal WYs and decrease in Dry and Critically Dry WYs, when additional water would be required to be released to meet increased minimum streamflow requirements. Average carryover store would be 4,700 ac-ft higher under to Proposed Project than it would be under the No Action Alternative across all years of the period of record.

The difference in flow downstream of the non-Project diversion dam between the two alternatives would be substantial given the change in minimum streamflow and the pulse flows under SSWD's Proposed Project, and the delay in spills resulting from the increased storage capability under the Proposed Project (Near-Term Condition). Flows between the two alternatives would be most often different in the fall months of most years, and in the spring of Dry WYs. Flows would be frequently higher under the Proposed Project, but can be lower for shorter periods of time. Simulated daily flows for the Bear River below the non-Project diversion dam are presented in Figures 3.3.2-33 through 3.3.2-35 for the No Action Alternative and SSWD's Proposed Project (Near-Term) for representative wet, dry and normal WYs, respectively. In Figure 3.3.2-35, flows in August and September include Bay-Delta Settlement Agreement releases. Differences in settlement agreement releases between the Proposed Project and the No Action Alternative are the result of differences in carryover storage from the previous year (shown in Figure 3.3.2-36).

Figure 3.3.2-33. Simulated daily flows for the Bear River below the non-Project diversion dam for the No Action Alternative and SSWD's Proposed Project for a representative wet WY (1995). Flow is plotted in logarithmic scale to better show both high and low values.

Figure 3.3.2-34. Simulated daily flows for the Bear River below the non-Project diversion dam for the No Action Alternative and SSWD's Proposed Project for a representative normal WY (2003). Flow is plotted in logarithmic scale to better show both high and low values.

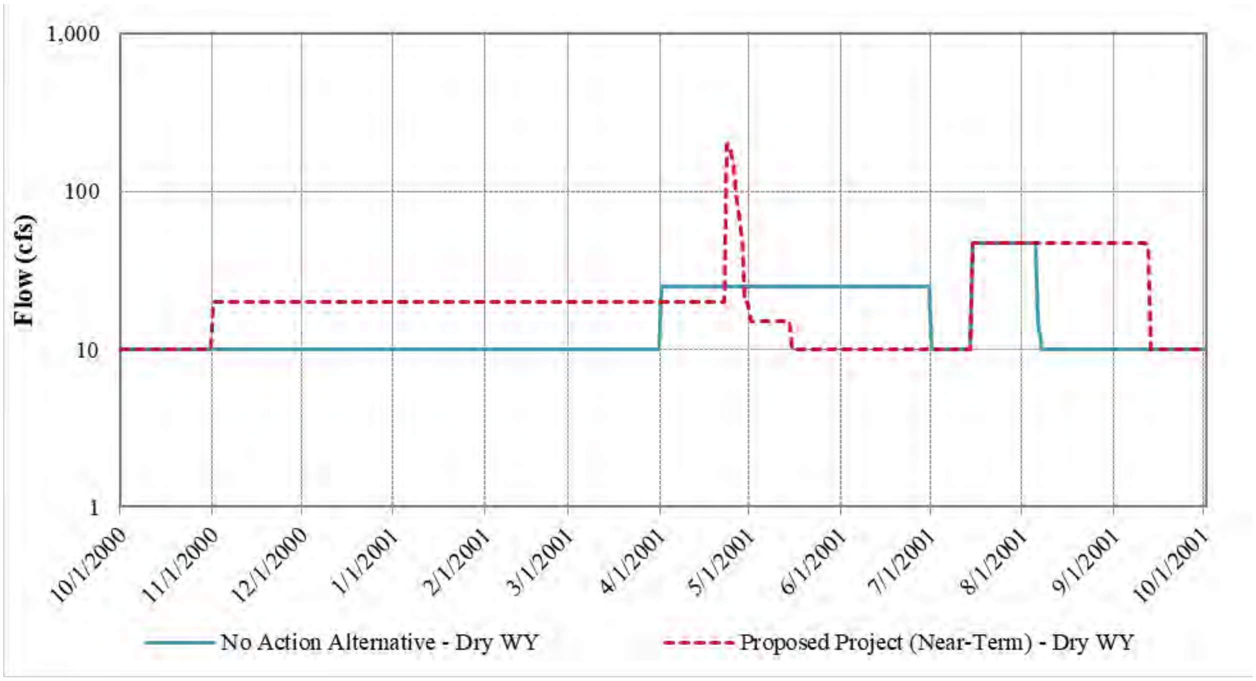


Figure 3.3.2-35. Simulated daily flows for the Bear River below the non-project diversion dam for the No Action Alternative and SSWD's Proposed Project for a representative dry WY (2001). Flow is plotted in logarithmic scale to better show both high and low values.

Typical reservoir operations would be largely unaffected by the increase in available storage under the Proposed Project (Near-Term Condition). Reservoir storage would be often higher, although the reservoir often fills slightly later in the year given the increased minimum flow requirements in the fall under the new license. However, the reservoir's fill and drawdown pattern is essentially identical to the No Action Alternative. Simulated daily Camp Far West Reservoir storages are presented in Figure 3.3.2-36 for the No Action Alternative and SSWD's Proposed Project (Near-Term) for representative wet, dry and normal WYs. Simulated daily Camp Far West Reservoir water-surface elevations are presented in Figure 3.3.2-37 for the No Action Alternative and SSWD's Proposed Project (Near-Term) for representative wet, normal and dry WYs.

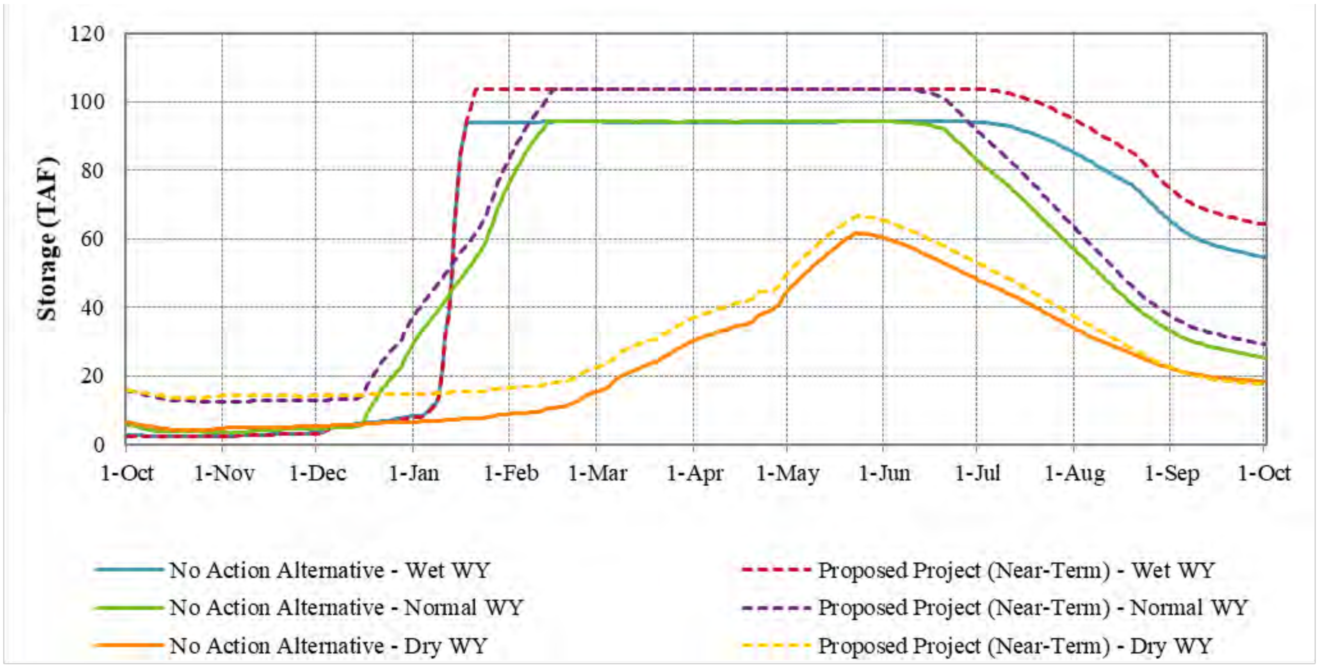


Figure 3.3.2-36. Simulated daily Camp Far West Reservoir storage for the No Action Alternative and SSWD's Proposed Project for representative wet (1995), normal (2003) and dry (2001) WYs.

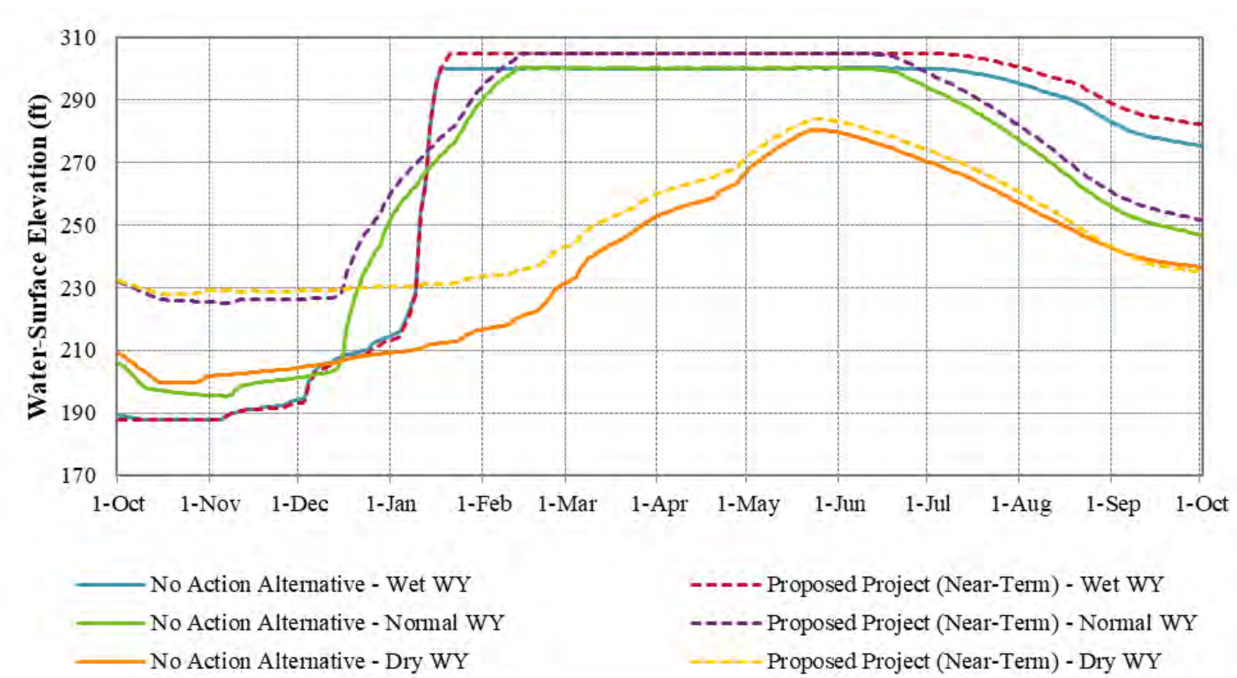


Figure 3.3.2-37. Simulated daily Camp Far West Reservoir water-surface elevation for the No Action Alternative and SSWD's Proposed Project for representative wet (1995), normal (2003) and dry (2001) WYs.

Table 3.3.2-18 provides Project flows and storages exceedance values for the Proposed Project (Near-Term) similar to those provided in Table 3.3.2-1 for the No Action Alternative. Averages are also provided in the table.

Table 3.3.2-18. Proposed Project flows and storage by month from SSWD's Near-Term Condition dataset.

Value	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
CAMP FAR WEST RESERVOIR STORAGE (ac-ft)												
0%	77,131	103,573	103,573	103,573	103,573	103,573	103,573	103,573	103,573	103,573	96,515	80,918
10%	63,862	64,759	88,541	103,573	103,573	103,573	103,573	103,573	103,573	97,636	79,721	64,673
50%	18,853	18,472	21,888	40,004	69,965	103,573	103,573	103,573	94,598	67,817	38,980	21,185
90%	3,680	3,416	5,552	9,636	12,331	21,925	32,742	35,853	34,735	24,223	12,091	4,095
100%	2,500	2,500	2,560	3,854	4,174	7,845	8,653	8,574	7,355	4,133	2,500	2,500
Average	*26,421*	*27,992*	*36,123*	*49,547*	*64,862*	*78,139*	*84,737*	*84,964*	*80,137*	*64,000*	*43,169*	*28,500*
CAMP FAR WEST RESERVOIR WATER-SURFACE ELEVATION (ft)												
0%	291	305	305	305	305	305	305	305	305	305	301	293
10%	282	283	297	305	305	305	305	305	305	302	292	283
50%	237	237	242	263	286	305	305	305	300	285	262	241
90%	196	195	205	219	225	242	256	259	258	245	225	198
100%	188	188	188	197	199	213	216	216	212	199	188	188
Average	*239*	*240*	*249*	*262*	*275*	*287*	*292*	*292*	*289*	*278*	*260*	*243*
BEAR RIVER FLOW BELOW CAMP FAR WEST RESERVOIR FLOW (RM 12.6) (cfs)												
0%	144	7,472	27,385	46,035	29,405	13,745	11,931	4,737	1,195	678	521	399
10%	107	103	175	1,359	2,229	2,505	1,707	1,111	628	495	490	287
50%	32	22	20	30	62	235	518	487	449	478	436	114
90%	14	13	15	15	17	17	24	124	143	168	143	34
100%	5	8	15	15	15	15	16	26	27	31	4	4
Average	*50*	*92*	*381*	*504*	*796*	*877*	*727*	*572*	*409*	*396*	*368*	*139*
DIVERSION INTO CFWID NORTH CANAL (cfs)												
0%	3	1	0	1	2	2	7	18	25	29	28	17
10%	2	1	0	0	2	2	6	18	25	29	27	12
50%	2	1	0	0	2	1	4	15	23	27	26	5
90%	1	0	0	0	1	0	1	9	21	23	21	3
100%	0	0	0	0	0	0	0	3	9	10	0	0
Average	*2*	*1*	*0*	*0*	*1*	*1*	*3*	*14*	*23*	*26*	*25*	*6*
DIVERSION INTO CFWID SOUTH CANAL (cfs)												
0%	7	2	0	0	0	1	21	22	26	25	23	12
10%	7	1	0	0	0	0	21	22	25	25	22	10
50%	5	0	0	0	0	0	5	21	24	25	20	7
90%	3	0	0	0	0	0	1	19	19	23	12	5
100%	0	0	0	0	0	0	0	8	8	11	0	0
Average	*5*	*0*	*0*	*0*	*0*	*0*	*8*	*20*	*23*	*24*	*18*	*7*
DIVERSION INTO SSWD MAIN CANAL (cfs)												
0%	96	0	0	0	0	0	396	446	438	434	433	361
10%	88	0	0	0	0	0	172	396	424	431	430	245
50%	0	0	0	0	0	0	11	311	365	418	380	87
90%	0	0	0	0	0	0	0	77	88	89	79	0
100%	0	0	0	0	0	0	0	0	0	0	0	0
Average	*28*	*0*	*0*	*0*	*0*	*0*	*54*	*267*	*300*	*327*	*303*	*111*

Table 3.3.2-18. (continued)

Value	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
BEAR RIVER BELOW THE NON-PROJECT DIVERSION DAM (RM 16.9) (cfs)												
0%	50	7,472	27,385	46,035	29,403	13,744	11,929	4,502	810	208	47	47
10%	25	100	175	1,359	2,227	2,504	1,659	745	203	47	47	47
50%	10	20	20	30	60	234	442	94	15	10	10	10
90%	10	10	15	15	15	15	20	10	10	10	10	10
100%	5	8	15	15	15	15	15	10	10	10	4	4
Average	*15*	*91*	*381*	*504*	*794*	*876*	*662*	*270*	*63*	*18*	*22*	*15*
BEAR RIVER FLOW AT WHEATLAND (RM 11.5) (cfs)												
0%	54	7,476	27,389	46,040	29,407	13,748	11,933	4,508	815	214	54	52
10%	29	104	180	1,364	2,231	2,508	1,664	751	209	53	54	52
50%	14	24	25	35	64	239	447	100	20	16	17	15
90%	14	14	20	20	19	19	25	16	15	16	17	15
100%	9	12	20	20	19	19	20	16	15	16	11	9
Average	*19*	*95*	*385*	*509*	*798*	*881*	*667*	*276*	*68*	*25*	*29*	*19*
BEAR RIVER FLOW AT PLEASANT GROVE ROAD (RM 7.1) (cfs)												
0%	54	7,476	27,389	46,040	29,407	13,748	11,933	4,508	815	214	54	52
10%	29	104	180	1,364	2,231	2,508	1,664	751	209	53	54	52
50%	14	24	25	35	64	239	447	100	20	16	17	15
90%	14	14	20	20	19	19	25	16	15	16	17	15
100%	9	12	20	20	19	19	20	16	15	16	11	9
Average	*19*	*95*	*385*	*509*	*798*	*881*	*667*	*276*	*68*	*25*	*29*	*19*
BEAR RIVER FLOW AT FEATHER RIVER CONFLUENCE (RM 0.0) (cfs)												
0%	438	9,044	32,797	51,942	35,176	15,888	15,200	4,734	854	221	66	58
10%	34	129	864	1,609	2,477	2,741	1,687	787	217	54	54	52
50%	15	35	67	89	134	453	472	106	24	18	18	15
90%	14	19	24	27	29	36	31	20	16	17	17	15
100%	9	12	20	21	19	22	22	17	15	16	11	9
Average	*22*	*114*	*475*	*639*	*957*	*998*	*712*	*292*	*72*	*26*	*30*	*21*

The primary differences in flows between the Proposed Project (Near-Term) and the No Action Alternative are changes in minimum instream flow requirements, pulse flows and differences in the timing of spills at Camp Far West Dam resulting from the proposed Pool Raise. The Pool Raise would provide additional storage to capture reservoir inflows from the Bear River and Rock Creek. The additional storage created by the Pool Raise would offset the water supply impacts created by the proposed minimum streamflows and pulse flow requirements. Table 3.3.2-19 shows: 1) the differences in Project flows and storages for the same locations and exceedance values shown in Tables 3.3.2-1 and 3.3.2-18 resulting from: 1) the Proposed Project (Near-Term) less No Action Alternative; and 2) the percent change, shown in parentheses.

Table 3.3.2-19. Changes in Project flows and storage from No Action Alternative to SSWD's Proposed Project (Near-Term).

Value	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
CAMP FAR WEST RESERVOIR STORAGE (ac-ft)												
0%	8,116 (11.8%)	9,399 (10.0%)	9,322 (9.9%)	9,301 (9.9%)	9,285 (9.8%)	9,293 (9.9%)	9,283 (9.8%)	9,279 (9.8%)	9,289 (9.9%)	9,294 (9.9%)	9,632 (11.1%)	9,552 (13.4%)
10%	7,876 (14.1%)	3,975 (6.5%)	2,726 (3.2%)	9,663 (10.3%)	9,448 (10.0%)	9,374 (10.0%)	9,353 (9.9%)	9,349 (9.9%)	9,441 (10.0%)	9,840 (11.2%)	9,691 (13.8%)	9,456 (17.1%)
50%	1,694 (9.9%)	677 (3.8%)	-557 (-2.5%)	1,143 (2.9%)	-6,761 (-8.8%)	9,836 (10.5%)	9,714 (10.3%)	9,656 (10.3%)	9,522 (11.2%)	8,278 (13.9%)	5,295 (15.7%)	2,547 (13.7%)
90%	670 (22.3%)	-137 (-3.9%)	958 (20.9%)	3,011 (45.4%)	1,624 (15.2%)	575 (2.7%)	-446 (-1.3%)	-2,090 (-5.5%)	-2,359 (-6.4%)	-1,709 (-6.6%)	1,217 (11.2%)	419 (11.4%)
100%	0 (0.0%)	0 (0.0%)	-169 (-6.2%)	131 (3.5%)	277 (7.1%)	-1,068 (-12.0%)	-4,504 (-34.2%)	-3,426 (-28.6%)	-1,021 (-12.2%)	-700 (-14.5%)	0 (0.0%)	0 (0.0%)
Average	*4,845* *(22.5%)*	*3,614* *(14.8%)*	*2,263* *(6.7%)*	*1,802* *(3.8%)*	*2,442* *(3.9%)*	*3,977* *(5.4%)*	*5,329* *(6.7%)*	*5,435* *(6.8%)*	*5,758* *(7.7%)*	*5,765* *(9.9%)*	*5,484* *(14.6%)*	*5,257* *(22.6%)*
CAMP FAR WEST RESERVOIR WATER-SURFACE ELEVATION (ft)												
0%	5 (1.7%)	5 (1.7%)	5 (1.7%)	5 (1.7%)	5 (1.7%)	5 (1.7%)	5 (1.7%)	5 (1.7%)	5 (1.7%)	5 (1.7%)	5 (1.7%)	6 (2.1%)
10%	5 (1.8%)	3 (1.1%)	1 (0.3%)	5 (1.7%)	5 (1.7%)	5 (1.7%)	5 (1.7%)	5 (1.7%)	5 (1.7%)	5 (1.7%)	6 (2.1%)	7 (2.5%)
50%	2 (0.9%)	1 (0.4%)	-1 (-0.4%)	1 (0.4%)	-4 (-1.4%)	5 (1.7%)	5 (1.7%)	5 (1.7%)	5 (1.7%)	6 (2.2%)	5 (1.9%)	4 (1.7%)
90%	4 (2.1%)	0 (0.0%)	4 (2.0%)	10 (4.8%)	4 (1.8%)	1 (0.4%)	0 (0.0%)	-2 (-0.8%)	-2 (-0.8%)	-3 (-1.2%)	3 (1.4%)	2 (1.0%)
100%	0 (0.0%)	0 (0.0%)	-2 (-1.1%)	1 (0.5%)	2 (1.0%)	-4 (-1.8%)	-11 (-4.8%)	-8 (-3.6%)	-3 (-1.4%)	-3 (-1.5%)	0 (0.0%)	0 (0.0%)
Average	*8* *(3.5%)*	*6* *(2.6%)*	*3* *(1.2%)*	*1* *(0.4%)*	*1* *(0.4%)*	*2* *(0.7%)*	*3* *(1.0%)*	*3* *(1.0%)*	*3* *(1.0%)*	*3* *(1.1%)*	*5* *(2.0%)*	*7* *(3.0%)*
BEAR RIVER FLOW BELOW CAMP FAR WEST RESERVOIR FLOW (RM 12.6) (cfs)												
0%	30 (26.3%)	-895 (-10.7%)	6 (0.0%)	4 (0.0%)	11 (0.0%)	9 (0.1%)	6 (0.1%)	0 (0.0%)	-20 (-1.6%)	-2 (-0.3%)	0 (0.0%)	0 (0.0%)
10%	3 (2.9%)	90 (692.3%)	165 (1650.0%)	-151 (-10.0%)	-1 (0.0%)	-58 (-2.3%)	-10 (-0.6%)	-9 (-0.8%)	-2 (-0.3%)	0 (0.0%)	1 (0.2%)	6 (2.1%)
50%	15 (88.2%)	11 (100.0%)	10 (100.0%)	20 (200.0%)	50 (416.7%)	-275 (-53.9%)	-13 (-2.4%)	-7 (-1.4%)	-4 (-0.9%)	2 (0.4%)	5 (1.2%)	4 (3.6%)
90%	0 (0.0%)	3 (30.0%)	5 (50.0%)	5 (50.0%)	6 (54.5%)	7 (70.0%)	-5 (-17.2%)	1 (0.8%)	-1 (-0.7%)	35 (26.3%)	18 (14.4%)	12 (54.5%)
100%	0 (0.0%)	0 (0.0%)	5 (50.0%)	5 (50.0%)	5 (50.0%)	5 (50.0%)	-10 (-38.5%)	-16 (-38.1%)	-20 (-42.6%)	-7 (-18.4%)	0 (0.0%)	0 (0.0%)
Average	*10* *(25.0%)*	*29* *(46.0%)*	*11* *(3.0%)*	*0* *(0.0%)*	*-7* *(-0.9%)*	*-39* *(-4.3%)*	*-6* *(-0.8%)*	*-3* *(-0.5%)*	*-6* *(-1.4%)*	*5* *(1.3%)*	*2* *(0.5%)*	*4* *(3.0%)*
DIVERSION INTO CFWID NORTH CANAL (cfs)												
0%	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
10%	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)

Table 3.3.2-19. (continued)

Value	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
DIVERSION INTO CFWID NORTH CANAL (cfs) (continued)												
50%	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
90%	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	-1 (-4.5%)	0 (0.0%)
100%	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	-1 (-25.0%)	-2 (-18.2%)	-3 (-23.1%)	0 (0.0%)	0 (0.0%)
Average	*0 (0.0%)*	*0 (0.0%)*	*0 (0.0%)*	*0 (0.0%)*	*0 (0.0%)*	*0 (0.0%)*	*-1 (-25.0%)*	*0 (0.0%)*	*0 (0.0%)*	*0 (0.0%)*	*0 (0.0%)*	*-1 (-14.3%)*
DIVERSION INTO CFWID SOUTH CANAL (cfs)												
0%	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
10%	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
50%	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
90%	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
100%	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	-3 (-27.3%)	-3 (-27.3%)	-3 (-21.4%)	0 (0.0%)	0 (0.0%)
Average	*0 (0.0%)*	*0 (0.0%)*	*0 (0.0%)*	*0 (0.0%)*	*0 (0.0%)*	*0 (0.0%)*	*-1 (-11.1%)*	*-1 (-4.8%)*	*0 (0.0%)*	*0 (0.0%)*	*0 (0.0%)*	*0 (0.0%)*
DIVERSION INTO SSWD MAIN CANAL (cfs)												
0%	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
10%	2 (2.3%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	-2 (-1.1%)	0 (0.0%)	2 (0.5%)	0 (0.0%)	0 (0.0%)	1 (0.4%)
50%	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (10.0%)	10 (3.3%)	11 (3.1%)	3 (0.7%)	11 (3.0%)	3 (3.6%)
90%	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	14 (22.2%)	18 (25.7%)	19 (27.1%)	12 (17.9%)	0 (0.0%)
100%	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Average	*4 (16.7%)*	*0 (0.0%)*	*0 (0.0%)*	*0 (0.0%)*	*0 (0.0%)*	*0 (0.0%)*	*1 (1.9%)*	*3 (1.1%)*	*4 (1.4%)*	*5 (1.6%)*	*3 (1.0%)*	*5 (4.7%)*
BEAR RIVER BELOW THE NON-PROJECT DIVERSION DAM (RM 16.9) (cfs)												
0%	40 (400.0%)	-894 (-10.7%)	6 (0.0%)	4 (0.0%)	11 (0.0%)	9 (0.1%)	6 (0.1%)	0 (0.0%)	-15 (-1.8%)	-2 (-1.0%)	0 (0.0%)	0 (0.0%)
10%	15 (150.0%)	90 (900.0%)	165 (1650.0%)	-151 (-10.0%)	-2 (-0.1%)	-58 (-2.3%)	-4 (-0.2%)	20 (2.8%)	-22 (-9.8%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
50%	0 (0.0%)	10 (100.0%)	10 (100.0%)	20 (200.0%)	50 (500.0%)	-276 (-54.1%)	17 (4.0%)	-1 (-1.1%)	-10 (-40.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)

Table 3.3.2-19. (continued)

Value	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
BEAR RIVER BELOW THE NON-PROJECT DIVERSION DAM (RM 16.9) (cfs) (continued)												
90%	0 (0.0%)	0 (0.0%)	5 (50.0%)	5 (50.0%)	5 (50.0%)	5 (50.0%)	-5 (-20.0%)	-15 (-60.0%)	-15 (-60.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
100%	0 (0.0%)	0 (0.0%)	5 (50.0%)	5 (50.0%)	5 (50.0%)	5 (50.0%)	-10 (-40.0%)	-15 (-60.0%)	-15 (-60.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Average	*5 (50.0%)*	*29 (46.8%)*	*11 (3.0%)*	*0 (0.0%)*	*-8 (-1.0%)*	*-39 (-4.3%)*	*-7 (-1.0%)*	*-8 (-2.9%)*	*-10 (-13.7%)*	*0 (0.0%)*	*0 (0.0%)*	*0 (0.0%)*
BEAR RIVER FLOW AT WHEATLAND (RM 11.5) (cfs)												
0%	40 (285.7%)	-893 (-10.7%)	5 (0.0%)	4 (0.0%)	11 (0.0%)	9 (0.1%)	6 (0.1%)	0 (0.0%)	-15 (-1.8%)	-2 (-0.9%)	0 (0.0%)	0 (0.0%)
10%	15 (107.1%)	90 (642.9%)	165 (1100.0%)	-151 (-10.0%)	-1 (0.0%)	-58 (-2.3%)	-3 (-0.2%)	20 (2.7%)	-21 (-9.1%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
50%	0 (0.0%)	10 (71.4%)	10 (66.7%)	20 (133.3%)	50 (357.1%)	-275 (-53.5%)	17 (4.0%)	-1 (-1.0%)	-10 (-33.3%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
90%	0 (0.0%)	0 (0.0%)	5 (33.3%)	5 (33.3%)	5 (35.7%)	5 (35.7%)	-5 (-16.7%)	-15 (-48.4%)	-15 (-50.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
100%	0 (0.0%)	0 (0.0%)	5 (33.3%)	5 (33.3%)	5 (35.7%)	5 (35.7%)	-10 (-33.3%)	-15 (-48.4%)	-15 (-50.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Average	*5 (35.7%)*	*29 (43.9%)*	*10 (2.7%)*	*0 (0.0%)*	*-8 (-1.0%)*	*-38 (-4.1%)*	*-7 (-1.0%)*	*-8 (-2.8%)*	*-11 (-13.9%)*	*0 (0.0%)*	*0 (0.0%)*	*-1 (-5.0%)*
BEAR RIVER FLOW AT PLEASANT GROVE ROAD (RM 7.1) (cfs)												
0%	40 (285.7%)	-893 (-10.7%)	5 (0.0%)	4 (0.0%)	11 (0.0%)	9 (0.1%)	6 (0.1%)	0 (0.0%)	-15 (-1.8%)	-2 (-0.9%)	0 (0.0%)	0 (0.0%)
10%	15 (107.1%)	90 (642.9%)	165 (1100.0%)	-151 (-10.0%)	-1 (0.0%)	-58 (-2.3%)	-3 (-0.2%)	20 (2.7%)	-21 (-9.1%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
50%	0 (0.0%)	10 (71.4%)	10 (66.7%)	20 (133.3%)	50 (357.1%)	-275 (-53.5%)	17 (4.0%)	-1 (-1.0%)	-10 (-33.3%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
90%	0 (0.0%)	0 (0.0%)	5 (33.3%)	5 (33.3%)	5 (35.7%)	5 (35.7%)	-5 (-16.7%)	-15 (-48.4%)	-15 (-50.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
100%	0 (0.0%)	0 (0.0%)	5 (33.3%)	5 (33.3%)	5 (35.7%)	5 (35.7%)	-10 (-33.3%)	-15 (-48.4%)	-15 (-50.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Average	*5 (35.7%)*	*29 (43.9%)*	*10 (2.7%)*	*0 (0.0%)*	*-8 (-1.0%)*	*-38 (-4.1%)*	*-7 (-1.0%)*	*-8 (-2.8%)*	*-11 (-13.9%)*	*0 (0.0%)*	*0 (0.0%)*	*-1 (-5.0%)*
BEAR RIVER FLOW AT FEATHER RIVER CONFLUENCE (RM 0.0) (cfs)												
0%	40 (10.1%)	-991 (-9.9%)	5 (0.0%)	4 (0.0%)	10 (0.0%)	8 (0.1%)	9 (0.1%)	3 (0.1%)	-15 (-1.7%)	-2 (-0.9%)	0 (0.0%)	0 (0.0%)
10%	16 (88.9%)	96 (290.9%)	15 (1.8%)	-110 (-6.4%)	-1 (0.0%)	-46 (-1.7%)	-44 (-2.5%)	9 (1.2%)	-14 (-6.1%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
50%	1 (7.1%)	20 (133.3%)	46 (219.0%)	39 (78.0%)	24 (21.8%)	-104 (-18.7%)	5 (1.1%)	-3 (-2.8%)	-10 (-29.4%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
90%	0 (0.0%)	5 (35.7%)	8 (50.0%)	10 (58.8%)	11 (61.1%)	12 (50.0%)	-4 (-11.4%)	-14 (-41.2%)	-15 (-48.4%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
100%	0 (0.0%)	0 (0.0%)	5 (33.3%)	6 (40.0%)	5 (35.7%)	5 (29.4%)	-10 (-31.3%)	-14 (-45.2%)	-15 (-50.0%)	0 (0.0%)	0 (0.0%)	-1 (-10.0%)

Table 3.3.2-19. (continued)

Value	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
BEAR RIVER FLOW AT FEATHER RIVER CONFLUENCE (RM 0.0) (cfs) (continued)												
Average	*6 (37.5%)*	*29 (34.1%)*	*10 (2.2%)*	*0 (0.0%)*	*-8 (-0.8%)*	*-39 (-3.8%)*	*-7 (-1.0%)*	*-8 (-2.7%)*	*-11 (-13.3%)*	*0 (0.0%)*	*0 (0.0%)*	*0 (0.0%)*

Water Supply

Under SSWD's Proposed Project (Near-Term), average annual irrigation diversions would increase in all but Critically Dry WYs relative to the No Action Alternative. Average annual water supply diversions would increase by approximately 1,600 ac-ft per year, or by 1.2 percent, with an increase of 4,800 ac-ft in Below Normal WYs, 1,000 ac-ft per year in Above Normal WYs, 1,000 ac-ft/yr in Dry WYs, and 400 ac-ft per WY in Wet WYs. In Critical WYs, average annual water supply diversions would decrease by approximately by 1,000 ac-ft per year, 300 ac-ft per year for SSWD and by 650 ac-ft per year for CFWID. A comparison of existing irrigation diversions under the No Action Alternative and SSWD's Proposed Project (Near-Term) is presented in Figure 3.3.2-38.

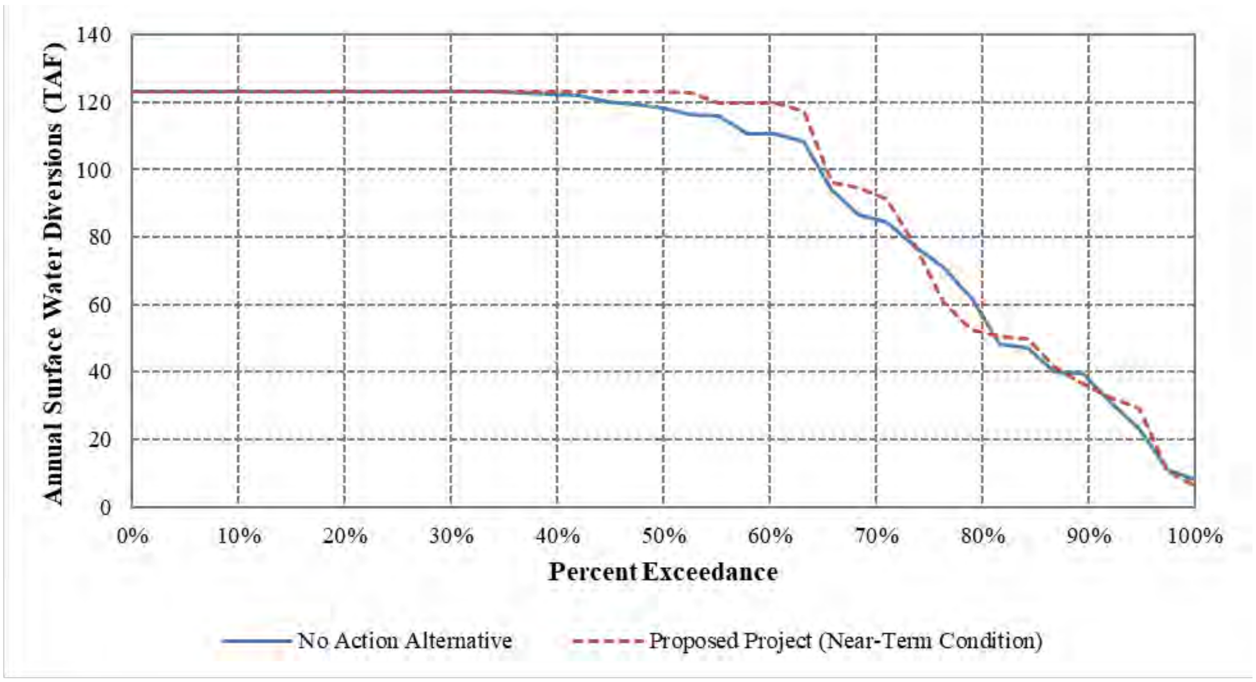


Figure 3.3.2-38. Exceedance curves of modeled annual irrigation diversions to SSWD and CFWID customers for the No Action Alternative and SSWD's Proposed Project for WYs 1976 through 2014.

Water Rights

CFWID has senior water rights to the Bear River downstream of the Project, and SSWD provides CFWID water under terms of a 1973 agreement. Diversions to CFWID would only be reduced if Camp Far West Reservoir is at deadpool and is only releasing what is flowing into the reservoir. As shown in Table 3.3.2-19, there would be a small reduction in diversions to CFWID under the Proposed Project (Near-Term) relative to the No Action Alternative. Impacts to CFWID would be limited to two Critical WYs and a Dry WY following a Critical WY, relative to No Action Alternative. A comparison of existing irrigation diversions under the No Action Alternative and SSWD's Proposed Project (Near-Term) is presented in Figure 3.3.2-39.

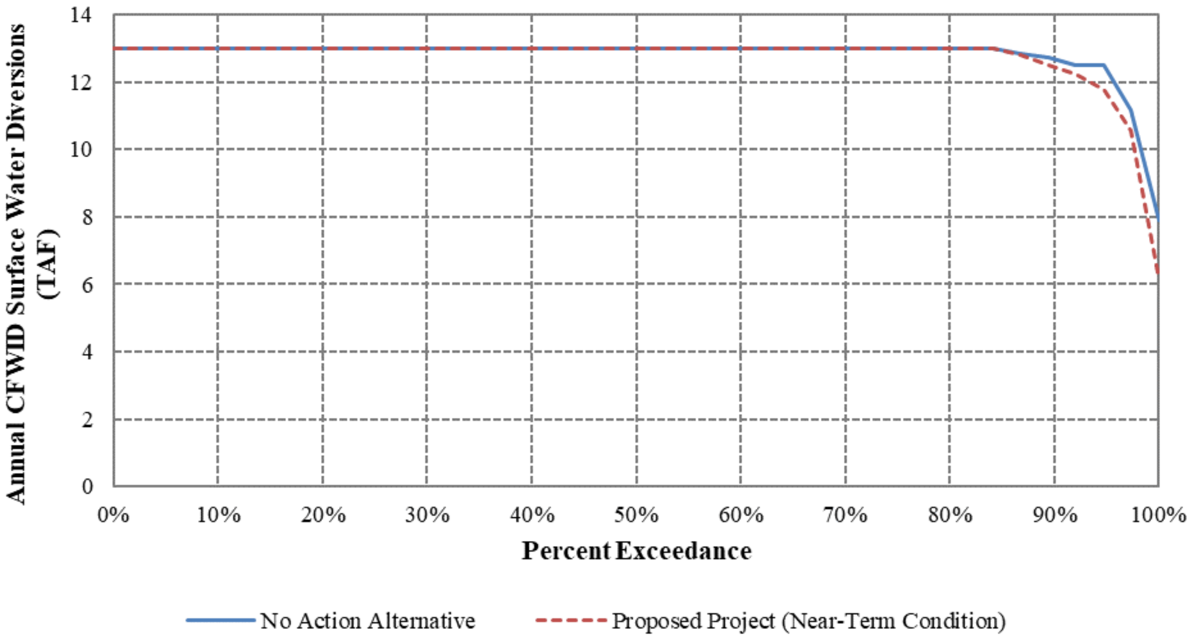


Figure 3.3.2-39. Exceedance curves of modeled annual irrigation diversions to CFWID customers for the No Action Alternative and SSWD's Proposed Project (Near-Term) for WYs 1976 through 2014.

Effects on Water Quality

Camp Far West Reservoir

SSWD's Proposed Project would have very little effect on water quality in Camp Far West Reservoir. Considering that the Pool Raise would increase water-surface elevations and overall storage, some water quality parameters may decrease as constituents (e.g., metals and nutrients) are further diluted by the increase in water. Regarding DO, this reservoir change would not substantially alter the size or stability of the epilimnion or hypolimnion. The current DO conditions are expected to continue to occur with SSWD's Proposed Project; however, the Proposed Project is not expected to cause DO concentrations to be lower than under existing conditions.

Under existing conditions, reservoir water temperatures typically exceed 20°C during May through September at depths of up to 50 ft below the Camp Far West Reservoir surface (2015-2017, Figure 3.3.2-15). Reservoir release temperatures through the powerhouse intake regularly exceed 20°C beginning in late July and continue to exceed 20°C through the end of the irrigation season, typically in mid-October, or until reservoir water levels are too low to run water through the powerhouse (Figure 3.3.2-18). A small coldwater pool is accessible to the low-level outlet that is not accessible to the powerhouse intake, but it is typically exhausted in a few weeks (Figure 3.3.2-18).

Under SSWD's Proposed Project, the Pool Raise would provide additional storage in Camp Far West Reservoir to capture addition relatively cool runoff from winter storms. Table 3.3.2-20 depicts thermal conditions in Camp Far West Reservoir under the No Action Alternative and

SSWD's Proposed Project. There would be a very small increase in usable cold water as a result of the Pool Raise.

Table 3.3.2-20. Average usable storage in Camp Far West Reservoir at the 10°C and 15°C isotherms for the modeled period of record (WYs 1976 through 2014) based on Ops Model and Temp Model results.

Operations Scenario	Average Usable Storage below 15°C Isotherm (ac-ft)		Average Usable Storage below 10°C Isotherm (ac-ft)	
	July 1	October 15	July 1	October 15
No Action Alternative	8,939	832	540	15
Proposed Project (Near-Term)	10,079	974	676	17

Figure 3.3.2-40 presents results of the Proposed Project Temp Model run compared to the No Action Alternative for the Bear River below Camp Far West Reservoir. Table 3.3.2-21 presents a comparison of simulated monthly water temperatures for the same location. Simulated mean-daily Camp Far West Reservoir release temperatures exceeds 20°C in August under both the No Action Alternative and Proposed Project (Near-Term) conditions (Table 3.3.2-21).

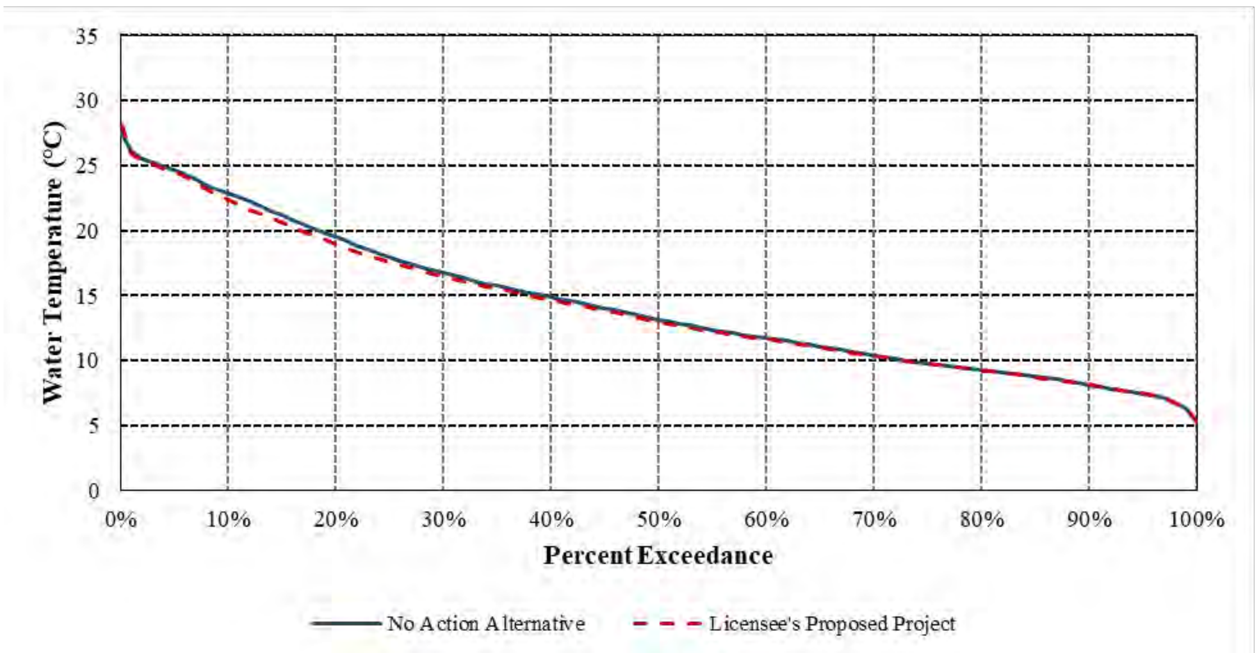


Figure 3.3.2-40. Exceedance curves of modeled mean daily water temperatures in the Bear River downstream of Camp Far West Reservoir for the No Action Alternative and Proposed Project (Near-Term) for WYs 1976 through 2014.

Table 3.3.2-21. Comparison of simulated mean monthly Camp Far West Reservoir release water temperatures for the No Action Alternative and Proposed Project (Near-Term) for WYs 1976 through 2014.

Month	No Action Alternative			Proposed Project (Near-Term)			Change		
	Min (°C)	Mean (°C)	Max (°C)	Min (°C)	Mean (°C)	Max (°C)	Min (°C)	Mean (°C)	Max (°C)
October	11.6	18.0	24.1	11.1	17.7	22.5	-0.5	-0.3	-1.6
November	8.7	14.8	20.7	8.7	15.1	20.7	0.0	0.3	0.0
December	5.3	10.1	15.6	5.4	10.2	15.7	0.1	0.1	0.1
January	5.3	7.9	11.1	5.2	7.9	11.3	-0.1	0.0	0.2
February	6.0	8.5	12.0	6.1	8.5	11.9	0.1	0.0	-0.1
March	6.3	10.0	16.6	6.5	9.9	15.7	0.2	-0.1	-0.9
April	6.8	11.4	18.8	6.8	11.3	17.3	0.0	-0.1	-1.5
May	9.0	13.1	19.1	8.9	12.9	18.8	-0.1	-0.2	-0.3
June	10.4	15.4	22.8	10.5	15.2	26.3	0.1	-0.2	3.5
July	10.4	19.7	27.2	11.1	19.0	28.4	0.7	-0.7	1.2
August	8.5	22.9	27.6	8.7	22.7	28.1	0.2	-0.2	0.5
September	10.4	19.5	27.0	9.3	18.6	26.7	-1.1	-0.9	-0.3

<u>Bear River</u>

The Proposed Project would have minimal effects to water quality in the Bear River downstream of the Project. In SSWD's Proposed Measure AR1, minimum flows in the Bear River below the non-Project diversion dam would not change from July 1 through October 14. Higher flows are proposed in the fall and winter when water quality, primarily water temperature, is less of a concern. Given the minor changes in flows (Figures 3.3.2-32 through 3.3.2-34) between the current and Proposed Project, SSWD does not expect any changes to water quality downstream. As discussed above, water quality downstream of the Project usually meets or exceeds Basin Plan Water Quality Objectives.

Figures 3.3.2-41 through 3.3.2-49 show simulated water temperatures along the Bear River downstream of the non-Project diversion dam for three representative WYs. Figures 3.3.2-41, 3.3.2-44, and 3.3.2-47 show water temperatures increasing from upstream to downstream, particularly in the spring and summer. In summer months, Proposed Project water temperatures would be slightly cooler during the No Action Alternative in the Bear River immediately downstream of the non-Project diversion dam (Figures 3.3.2-41, 3.3.2-46, and 3.3.2-47). By Highway 65, there would be very little difference between the No Action Alternative and Proposed Project water temperatures. Similarly, there would be little difference between the No Action Alternative and Proposed Project water temperatures at Pleasant Grove Bridge (Figure 3.3.2-43, 3.3.2-46, 3.3.2-48), or at Highway 70 (Figure 3.3.2-41, 3.3.2-46, 3.3.2-49).

Figure 3.3.2-41. Simulated daily water temperatures for a representative wet WY (1995) at various locations in the Bear River downstream of the non-Project diversion dam.

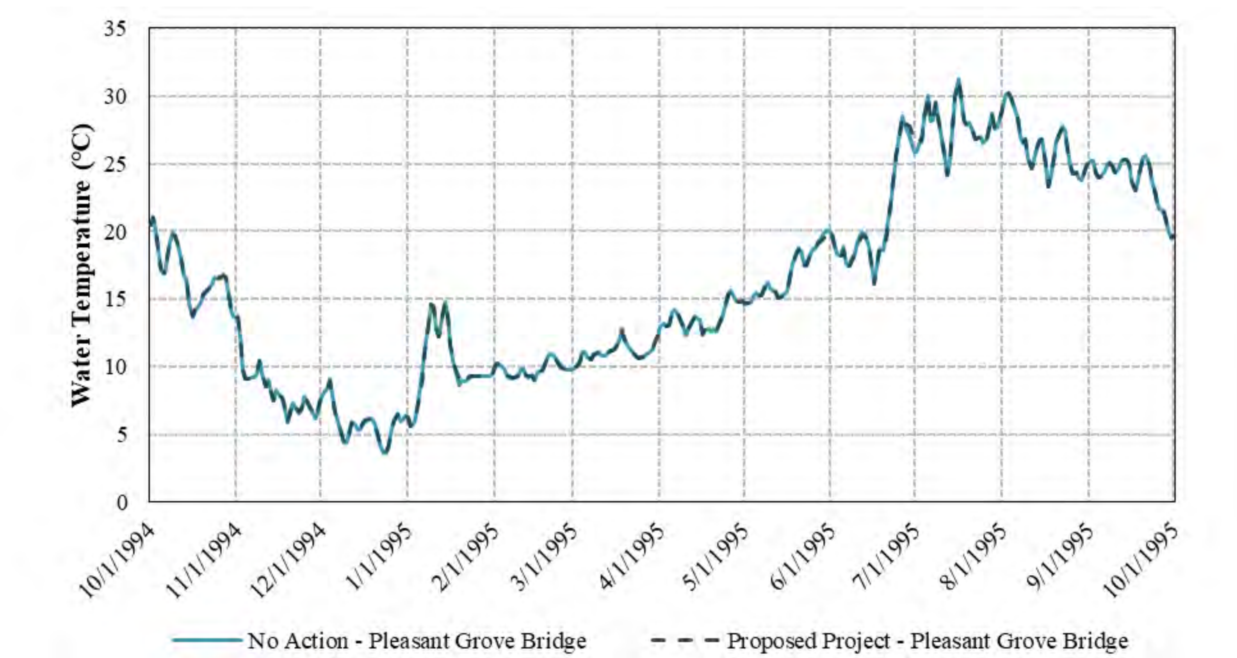


Figure 3.3.2-42. Simulated daily water temperatures for a representative wet WY (1995) at Pleasant Grove Bridge in the Bear River downstream of the non-Project diversion dam.

Figure 3.3.2-43. Simulated daily water temperatures for a representative wet WY (1995) at Highway 70 in the Bear River downstream of the non-Project diversion dam.

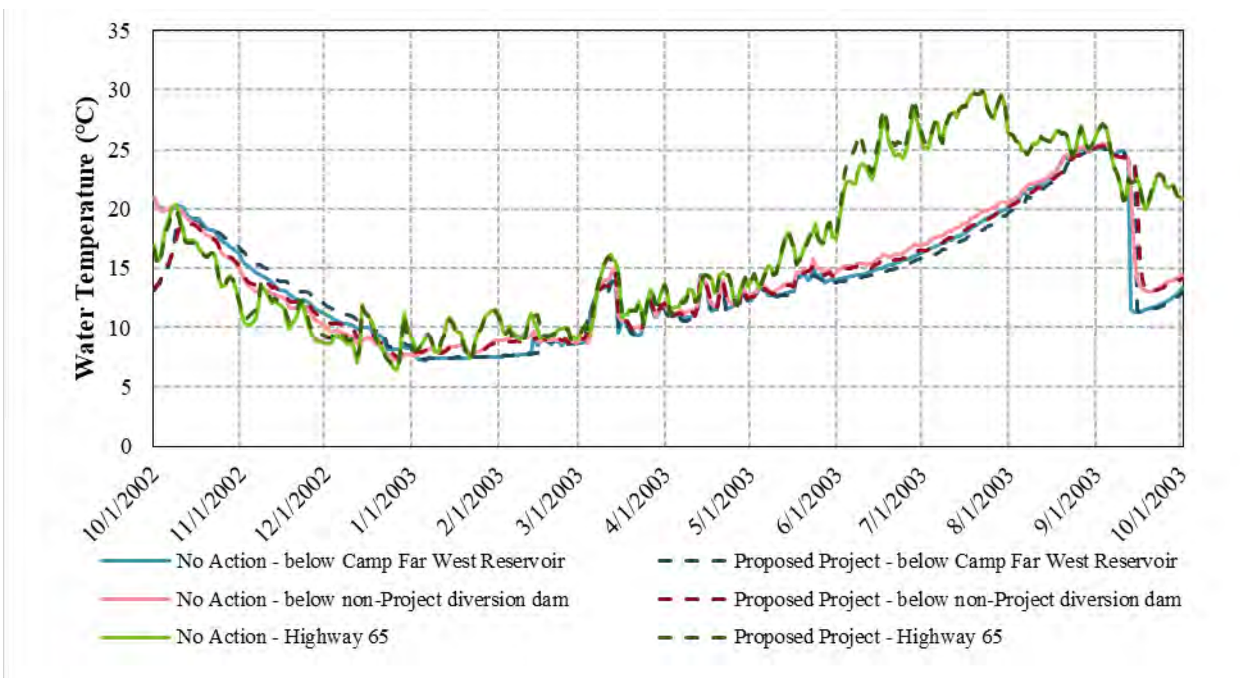


Figure 3.3.2-44. Simulated daily water temperatures for a representative normal WY (2003) at various locations in the Bear River downstream of the non-Project diversion dam.

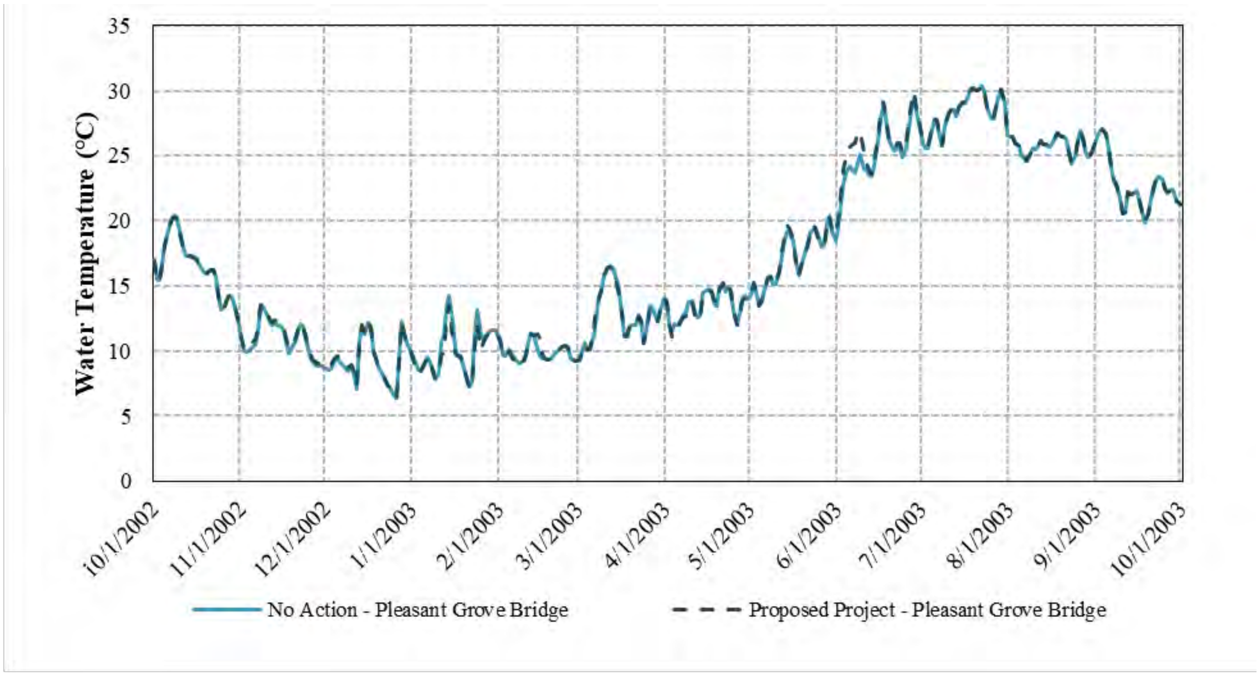


Figure 3.3.2-45. Simulated daily water temperatures for a representative normal WY (2003) at Pleasant Grove Bridge in the Bear River downstream of the non-Project diversion dam.

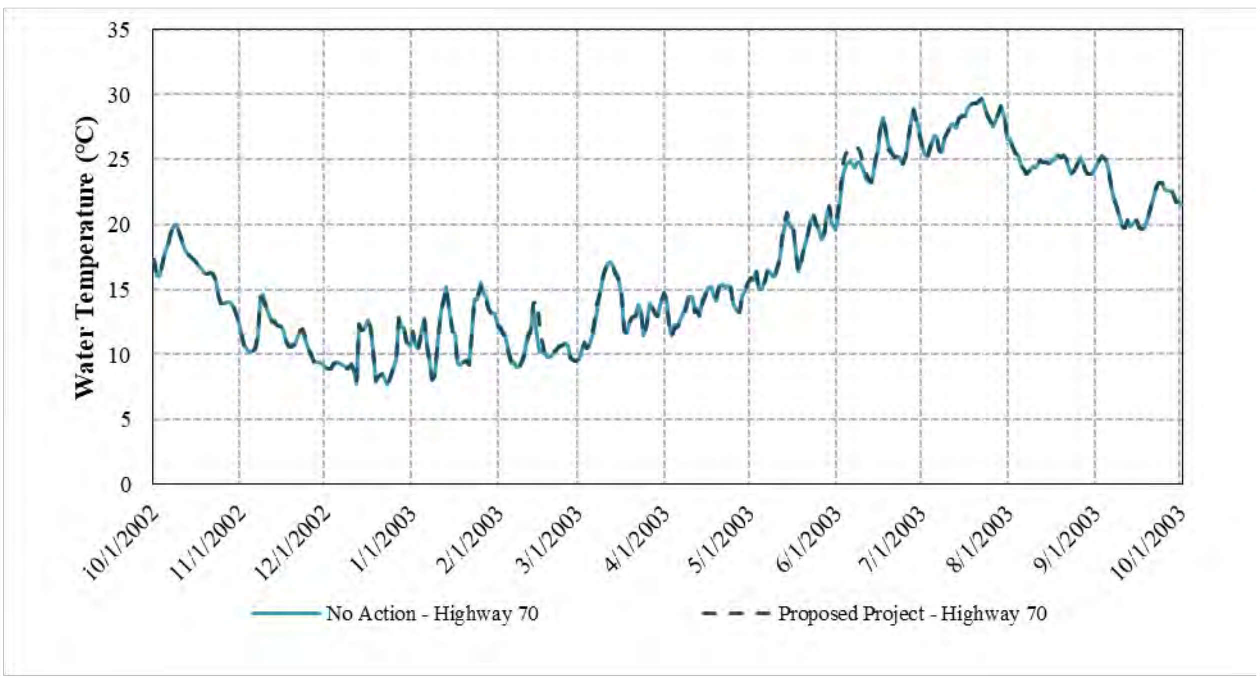


Figure 3.3.2-46. Simulated daily water temperatures for a representative normal WY (2003) at Highway 70 in the Bear River downstream of the non-Project diversion dam.

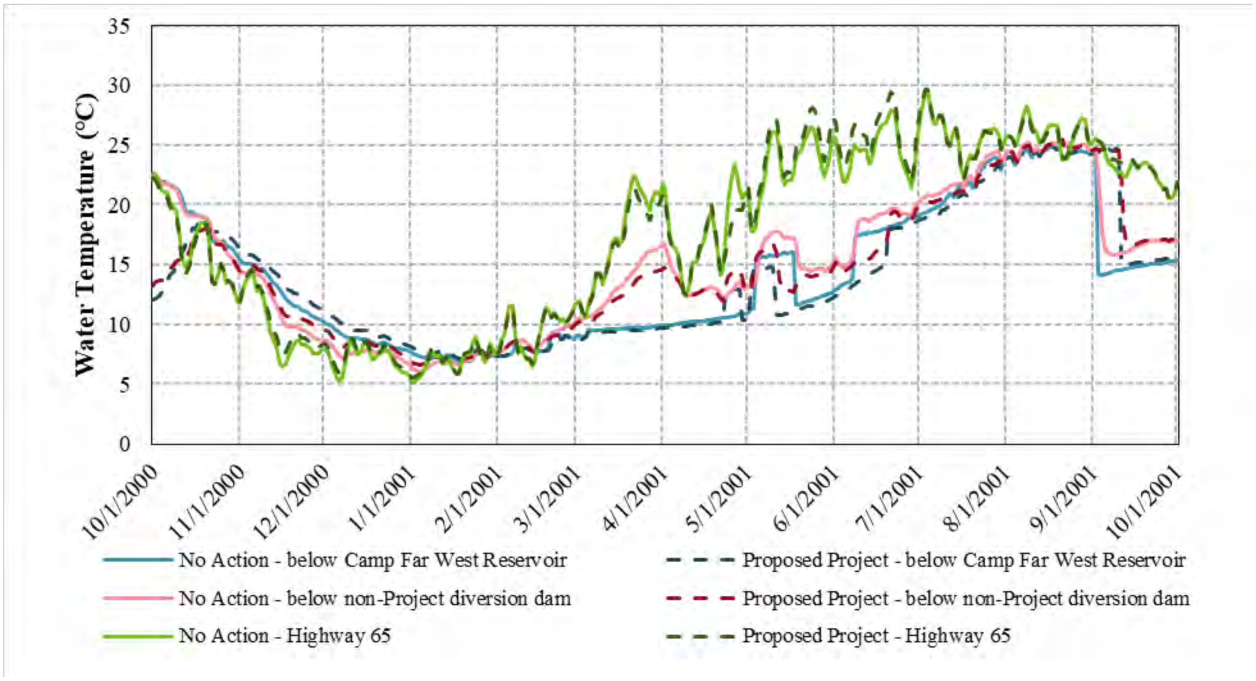


Figure 3.3.2-47. Simulated daily water temperatures for a representative dry WY (2001) at various locations in the Bear River downstream of the non-Project diversion dam.

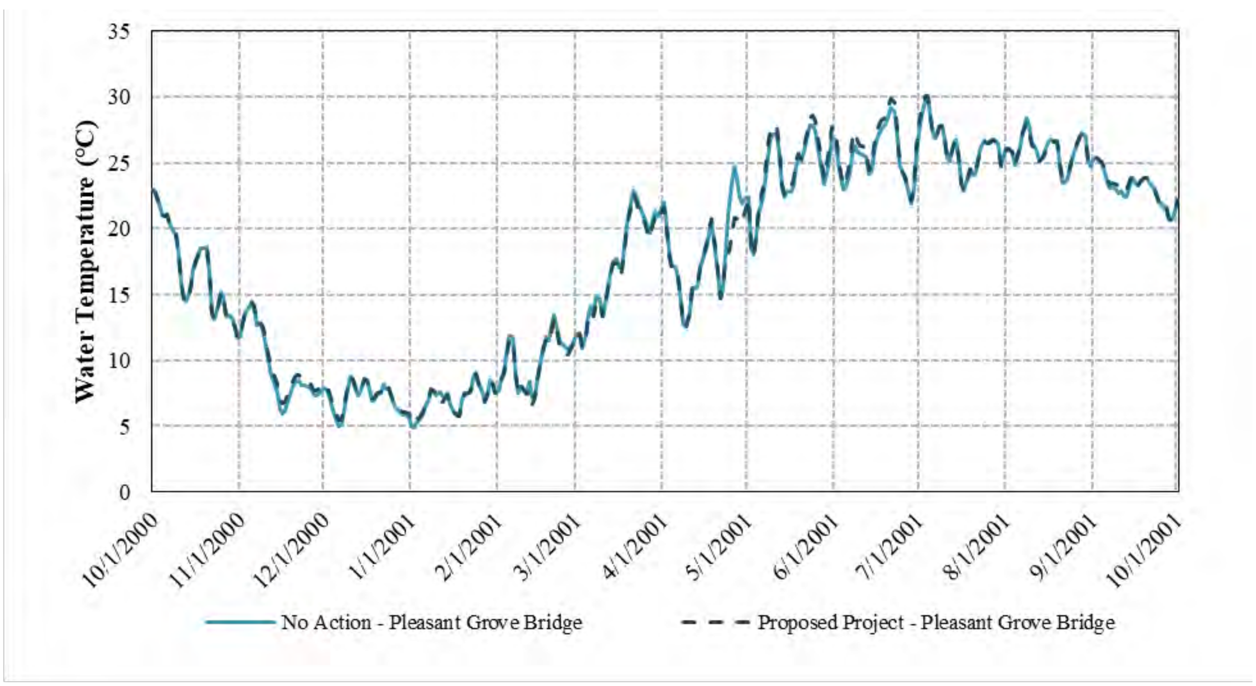


Figure 3.3.2-48. Simulated daily water temperatures for a representative dry WY (2001) at Pleasant Grove Bridge in the Bear River downstream of the non-Project diversion dam.

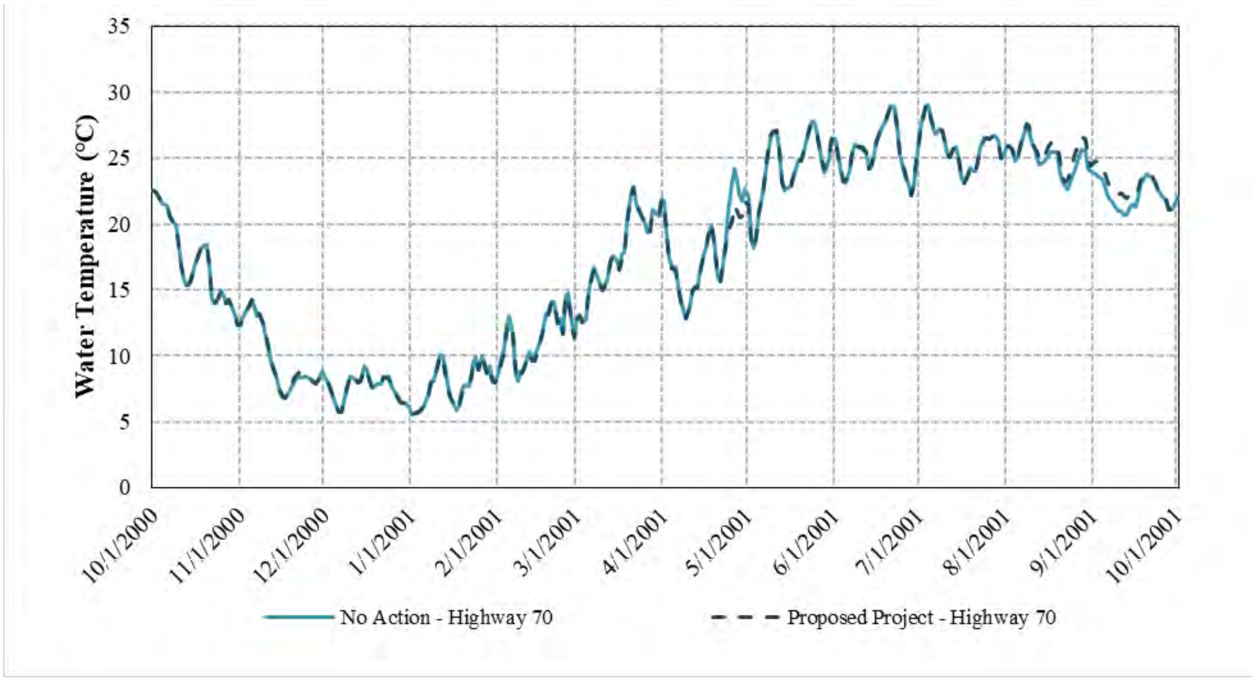


Figure 3.3.2-49. Simulated daily water temperatures for a representative dry WY (2001) at Highway 70 in the Bear River downstream of the non-Project diversion dam.

In the following sections, simulated water temperatures in the Bear River downstream of Camp Far West Reservoir are statistically presented for the full period of record (WYs 1976 through 2014). Temp Model results are presented only as far downstream as Highway 70 because of backwater effects from the Feather River that are not represented in the Temp Model.

Bear River below the Non-Project Diversion Dam

Figure 3.3.2-50 presents exceedance curves of mean-daily water temperatures for the Proposed Project water temperature model run compared to the No Action Alternative for the Bear River downstream of the non-Project diversion dam. Table 3.3.2-22 presents a comparison of simulated monthly water temperatures for the same location.

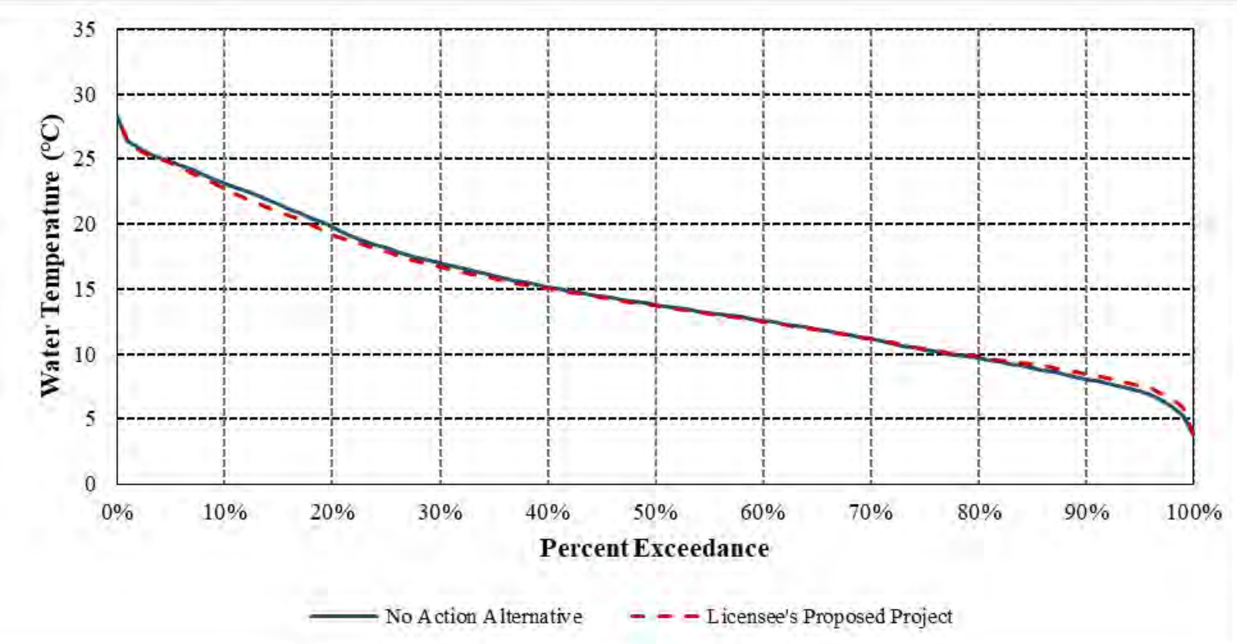


Figure 3.3.2-50. Exceedance curves of modeled mean daily water temperatures in the Bear River downstream of the non-Project diversion dam for the No Action Alternative and Proposed Project (Near-Term) for WYs 1976 through 2014.

Table 3.3.2-22. Comparison of simulated mean monthly water temperatures in the Bear River downstream of the non-Project diversion dam for the No Action Alternative and Proposed Project (Near-Term) for WYs 1976 through 2014.

Month	No Action Alternative			Proposed Project (Near-Term)			Change		
	Min (°C)	Mean (°C)	Max (°C)	Min (°C)	Mean (°C)	Max (°C)	Min (°C)	Mean (°C)	Max (°C)
October	12.6	17.8	24.0	12.6	17.5	22.9	0.0	-0.3	-1.1
November	7.0	13.3	19.3	7.9	14.1	20.0	0.9	0.8	0.7
December	3.8	8.5	13.3	3.8	9.4	15.4	0.0	0.9	2.1
January	4.0	7.4	10.9	4.2	7.8	10.7	0.2	0.4	-0.2
February	5.2	9.4	13.6	5.8	9.2	13.1	0.6	-0.2	-0.5
March	7.7	11.6	16.6	7.9	11.2	16.2	0.2	-0.4	-0.4
April	8.0	12.7	17.8	8.2	12.6	17.9	0.2	-0.1	0.1
May	9.7	14.0	19.2	9.6	13.8	19.8	-0.1	-0.2	0.6
June	11.9	16.3	23.7	12.0	16.2	26.4	0.1	-0.1	2.7
July	12.8	20.4	28.0	13.2	19.7	28.3	0.4	-0.7	0.3
August	9.4	23.3	27.8	9.9	23.1	28.1	0.5	-0.2	0.3
September	12.1	20.3	28.2	10.4	19.6	28.3	-1.7	-0.7	0.1

Bear River at Highway 65 (Wheatland)

Figure 3.3.2-51 presents exceedance curves of mean daily water temperatures for the Proposed Project (Near-Term) water temperature model run compared to the No Action Alternative for the Bear River at Highway 65. Table 3.3.2-23 presents a comparison of simulated monthly water temperatures for the same location.

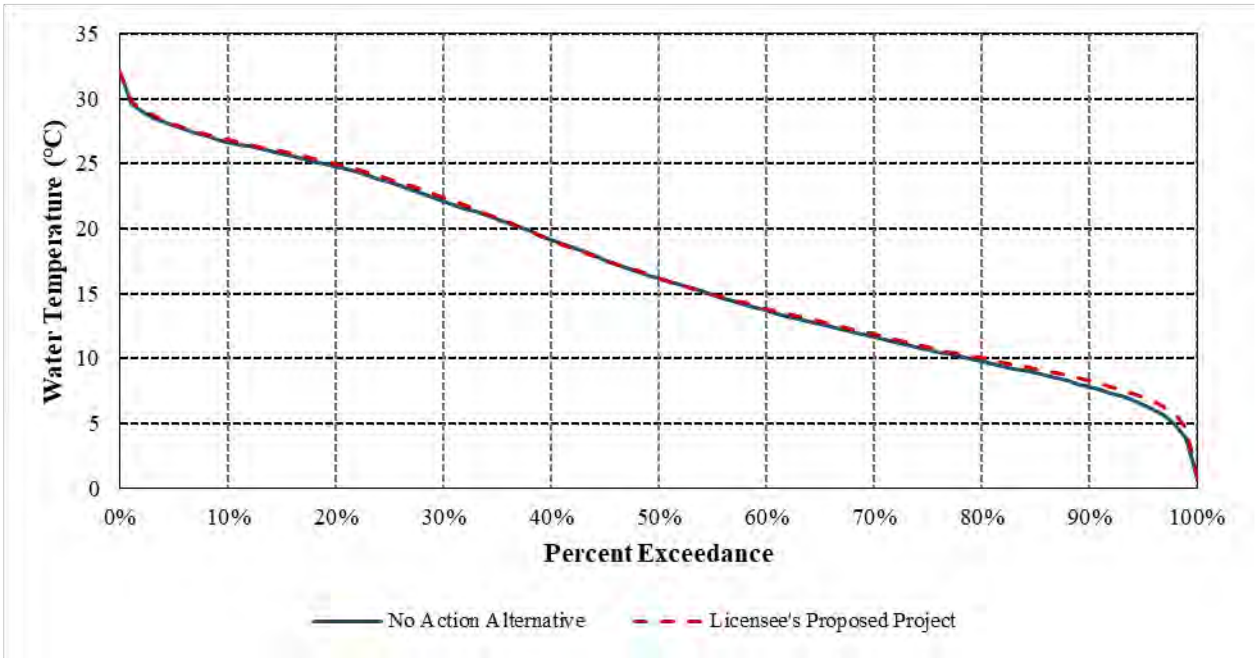


Figure 3.3.2-51. Exceedance curves of modeled mean daily water temperatures in the Bear River at Highway 65 for the No Action Alternative and Proposed Project for WYs 1976 through 2014.

Table 3.3.2-23. Comparison of simulated mean monthly water temperatures in the Bear River at Highway 65 for the No Action Alternative and Proposed Project (Near-Term) for WYs 1976 through 2014.

Month	No Action Alternative			Proposed Project (Near-Term)			Change		
	Min (°C)	Mean (°C)	Max (°C)	Min (°C)	Mean (°C)	Max (°C)	Min (°C)	Mean (°C)	Max (°C)
October	10.5	17.6	24.0	10.5	17.7	23.9	0.0	0.1	-0.1
November	4.0	11.5	17.5	5.1	12.4	18.9	1.1	0.9	1.4
December	0.7	7.4	15.0	0.8	8.2	15.0	0.1	0.8	0.0
January	1.9	7.8	14.8	2.7	8.0	14.5	0.8	0.2	-0.3
February	3.3	10.7	18.2	3.5	10.4	18.0	0.2	-0.3	-0.2
March	8.2	13.1	22.5	8.1	13.1	21.4	-0.1	0.0	-1.1
April	9.9	15.2	23.9	10.2	15.2	24.4	0.3	0.0	0.5
May	12.4	19.0	27.4	12.3	19.4	29.0	-0.1	0.4	1.6
June	14.7	23.8	29.9	14.5	24.3	30.8	-0.2	0.5	0.9
July	20.1	27.2	32.1	20.3	27.2	32.1	0.2	0.0	0.0
August	19.0	26.1	31.3	18.8	26.1	31.2	-0.2	0.0	-0.1
September	15.4	22.9	29.4	15.4	22.8	29.4	0.0	-0.1	0.0

Bear River at Pleasant Grove Road

Figure 3.3.2-52 presents exceedance curves of mean daily water temperatures for the Proposed Project (Near-Term) water temperature model run compared to the No Action Alternative for the Bear River at Pleasant Grove Road. Table 3.3.2-24 presents a comparison of simulated monthly water temperatures for the same location.

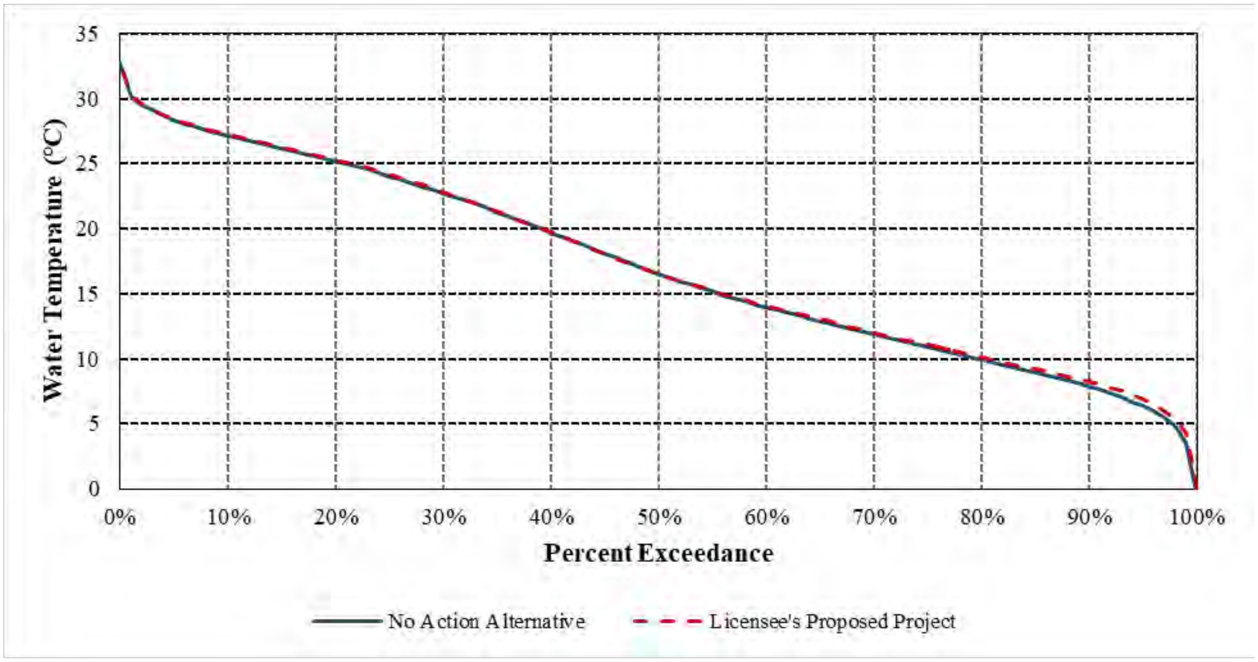


Figure 3.3.2-52. Exceedance curves of modeled mean daily water temperatures in the Bear River at Pleasant Grove Road for the No Action Alternative and Proposed Project for WYs 1976 through 2014.

Table 3.3.2-24. Comparison of simulated mean monthly water temperatures in the Bear River at Pleasant Grove Road for the No Action Alternative and Proposed Project (Near-Term) for WYs 1976 through 2014.

Month	No Action Alternative			Proposed Project (Near-Term)			Change		
	Min (°C)	Mean (°C)	Max (°C)	Min (°C)	Mean (°C)	Max (°C)	Min (°C)	Mean (°C)	Max (°C)
October	10.1	17.7	24.6	10.1	17.7	24.6	0.0	0.0	0.0
November	3.5	11.4	17.7	4.3	12.1	18.6	0.8	0.7	0.9
December	-0.8	7.4	16.2	0.0	8.0	15.3	0.8	0.6	-0.9
January	1.2	7.9	16.1	2.4	8.1	16.0	1.2	0.2	-0.1
February	3.0	10.9	18.5	3.1	10.7	18.4	0.1	-0.2	-0.1
March	8.0	13.4	22.9	8.2	13.5	22.6	0.2	0.1	-0.3
April	10.1	15.8	25.3	10.1	15.8	25.5	0.0	0.0	0.2
May	12.6	20.0	28.7	12.5	20.1	29.5	-0.1	0.1	0.8
June	15.6	24.7	30.9	15.4	25.0	31.3	-0.2	0.3	0.4
July	20.8	27.6	32.8	20.8	27.7	32.8	0.0	0.1	0.0
August	21.1	26.2	31.5	21.2	26.2	31.5	0.1	0.0	0.0
September	15.3	23.0	29.4	15.3	22.9	29.4	0.0	-0.1	0.0

Bear River at Highway 70

Figure 3.3.2-53 presents exceedance curves of mean daily water temperatures for the Proposed Project (Near-Term) water temperature model run compared to the No Action Alternative for the Bear River at Highway 70. Table 3.3.2-25 presents a comparison of simulated monthly water temperatures for the same location.

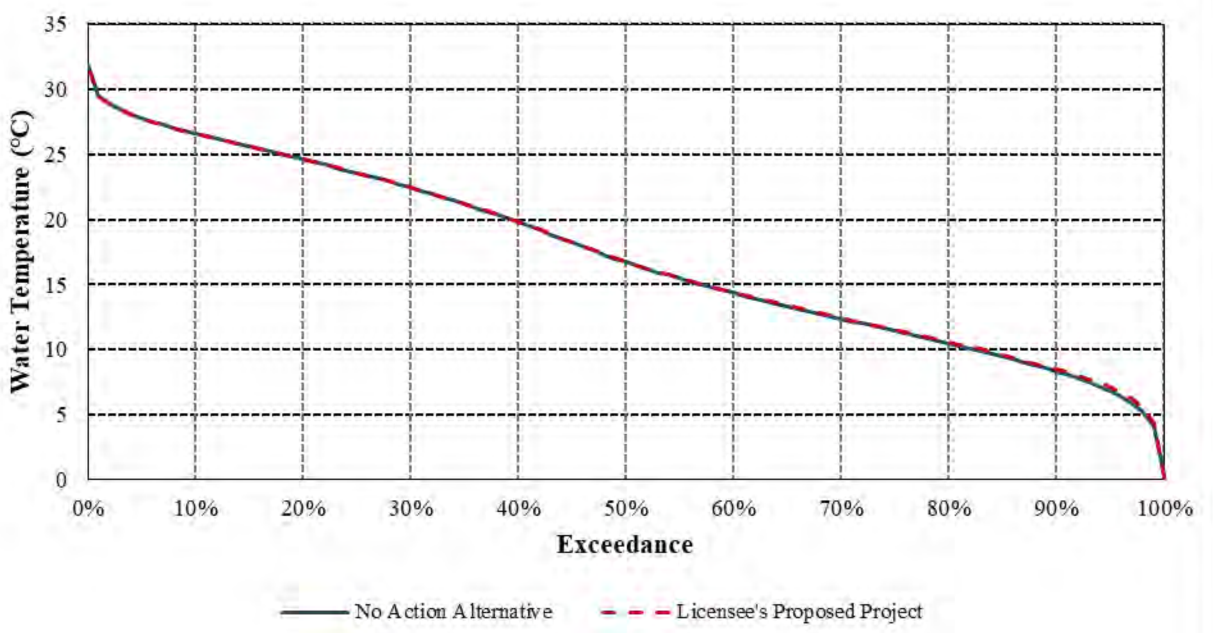


Figure 3.3.2-53. Exceedance curves of modeled mean daily water temperatures in the Bear River at Highway 70 for the No Action Alternative and Proposed Project for WYs 1976 through 2014.

Table 3.3.2-25. Comparison of simulated mean monthly water temperatures in the Bear River at Highway 70 for the No Action Alternative and Proposed Project (Near-Term) for WYs 1976 through 2014.

Month	No Action Alternative			Proposed Project (Near-Term)			Change		
	Min (°C)	Mean (°C)	Max (°C)	Min (°C)	Mean (°C)	Max (°C)	Min (°C)	Mean (°C)	Max (°C)
October	10.9	17.8	24.5	11.3	17.8	24.5	0.4	0.0	0.0
November	3.9	11.6	17.8	4.4	12.0	18.2	0.5	0.4	0.4
December	0.3	7.9	16.9	0.1	8.2	16.8	-0.2	0.3	-0.1
January	1.8	8.6	16.6	2.6	8.6	16.6	0.8	0.0	0.0
February	3.8	11.4	18.0	3.6	11.3	18.1	-0.2	-0.1	0.1
March	8.0	13.7	22.8	8.5	13.8	22.7	0.5	0.1	-0.1
April	10.4	16.0	25.1	10.4	16.0	25.2	0.0	0.0	0.1
May	13.1	20.3	28.4	13.1	20.3	28.5	0.0	0.0	0.1
June	16.0	24.7	30.4	15.9	24.7	30.4	-0.1	0.0	0.0
July	21.1	27.2	31.9	21.0	27.2	31.9	-0.1	0.0	0.0
August	20.4	25.5	30.5	20.4	25.5	30.5	0.0	0.0	0.0
September	16.4	22.3	27.8	16.3	22.3	27.6	-0.1	0.0	-0.2

Effects on CWA Section 303(d) Constituent

Mercury

As pointed out above, based on data collected before 2012, the SWRCB identified the lower Bear River as CWA Section 303(d) State Impaired for mercury, citing fish tissue concentrations, water samples, and sediment samples to support their listing (SWRCB 2018).

SSWD has not and does not plan to perform any Project O&M activities associated with the release or mobilization of mercury.

3.3.2.3 Cumulative Effects

Cumulative effects resulting from past, present, and reasonably foreseeable future actions, including the Proposed Project, have the potential to affect water quantity and water quality in Camp Far West Reservoir and the lower Bear River. As described in Section 3.3.2 of this Exhibit E, these activities include timber harvesting, livestock grazing, mining, and operation of upstream and downstream water projects.

Discussed below are the cumulative effects on water quantity and water quality of the Proposed Project in combination with these past, present and future actions from the NMWSE of Camp Far West Reservoir downstream in the Bear River to the Bear River's confluence with the Feather River.

3.3.2.3.1 Cumulative Effects on Water Quantity

Upstream water projects in the Bear River, described in Section 3.1.2.1 and 3.1.2.5, control inflow into the Project. Projected increases in upstream water demands by NID and PCWA will reduce inflow into Camp Far West Reservoir by approximately 28,500 ac-ft per year by 2062, a 9 percent reduction relative to near-term average inflow. The Proposed Project creates additional storage space in Camp Far West Reservoir, which allows the reservoir to compensate for the decrease in available water supply to SSWD caused by reduced reservoir inflow. Section 7.2.2 of Exhibit B describes impacts on flows in the lower Bear River under future Proposed Project conditions. These changes are summarized in Table 3.3.2-26.

Table 3.3.2-26. Average annual results from WY 1976 through WY 2014 for the No Action Alternative (Baseline Condition) and the Proposed Project (Future Condition), and the difference between the two.

Water Year Type[1]	SSWD Diversions for Water Supply (ac-ft)	Camp Far West Reservoir Carryover Storage[2] (ac-ft)	Peak Project Energy Generation (MWhr)	Off-Peak Project Energy Generation (MWhr)	Total Project Energy Generation (MWhr)	Mean Flow Downstream of Non-Project Diversion Dam (cfs)
NO ACTION ALTERNATIVE (BASELINE CONDITION)						
Wet	109,600	39,700	14,375	22,780	37,155	826
Above Normal	109,000	23,600	11,722	18,584	30,306	365
Below Normal	100,500	14,500	8,321	13,164	21,485	178
Dry	53,700	13,000	2,138	3,378	5,515	42
Critical	19,200	5,400	412	650	1,062	15
All	**82,900**	**20,800**	**7,888**	**12,493**	**20,381**	**309**
PROPOSED PROJECT (FUTURE CONDITION)						
Wet	109,600	34,600	14,348	22,738	37,086	782
Above Normal	109,400	21,200	11,049	17,518	28,567	316
Below Normal	103,100	17,000	7,169	11,341	18,510	120
Dry	39,300	6,300	1,237	1,954	3,191	32
Critical	15,100	4,200	344	543	887	18
All	**79,700**	**18,100**	**7,278**	**11,529**	**18,807**	**274**
DIFFERENCE BETWEEN THE PROPOSED PROJECT FUTURE CONDITIONS AND NO ACTION ALTERNATIVE						
Wet	0	-5,100	-27	-42	-69	-44
Above Normal	400	-2,400	-673	-1,066	-1,739	-49
Below Normal	2,600	2,500	-1,152	-1,823	-2,975	-58
Dry	-14,400	-6,700	-901	-1,424	-2,324	-10

Table 3.3.2-26. (continued)

Water Year Type[1]	SSWD Diversions for Water Supply (ac-ft)	Camp Far West Reservoir Carryover Storage[2] (ac-ft)	Peak Project Energy Generation (MWhr)	Off-Peak Project Energy Generation (MWhr)	Total Project Energy Generation (MWhr)	Mean Flow Downstream of Non-Project Diversion Dam (cfs)
DIFFERENCE BETWEEN THE PROPOSED PROJECT FUTURE CONDITIONS AND NO ACTION ALTERNATIVE (CONT'D)						
Critical	-4,100	-1,200	-68	-107	-175	3
All	**-3,200**	**-2,700**	**-610**	**-964**	**-1,574**	**-35**

[1] For this summary, SSWD used the WY types in FERC's FEIS for the YB/DS Projects. Simulated WY types were as described in SSWD Proposed Condition WR1 in Appendix E2 in Exhibit E of SSWD's Application for New License.
[2] Carryover storage is reservoir storage on October 31, carried over into the following year.

The additional storage space created by the Proposed Project would create marginal effects to annual water supply diversion in Above and Below Normal WYs. However, average annual water supply would be reduced by 3,200 ac-ft, largely a result of reduced inflow in Dry and Critical WYs, the increase in required minimum flows, and the addition of pulse flows downstream of the non-Project diversion dam in most WY types under the new license.

Water diversions downstream of the Project have a major effect on flow in the lower Bear River. From approximately April 15 through October 15, flows up to 510 cfs are diverted at the non-Project diversion dam to meet downstream agricultural water demands during this period. Figure 3.3.2-54 illustrates the difference in Project releases below Camp Far West Dam and flows in the Bear River downstream of the non-Project diversion dam for the agricultural diversion period under the No Action Alternative and the Proposed Project (Near-Term). The difference in flow between these two locations is the result of agricultural diversions at the non-Project diversion dam. The Project provides water to CFWID and SSWD, but the Project itself does not include any in-basin or out-of-basin diversions. Diversions downstream of the project will continue with or without the continued operation of the Project.

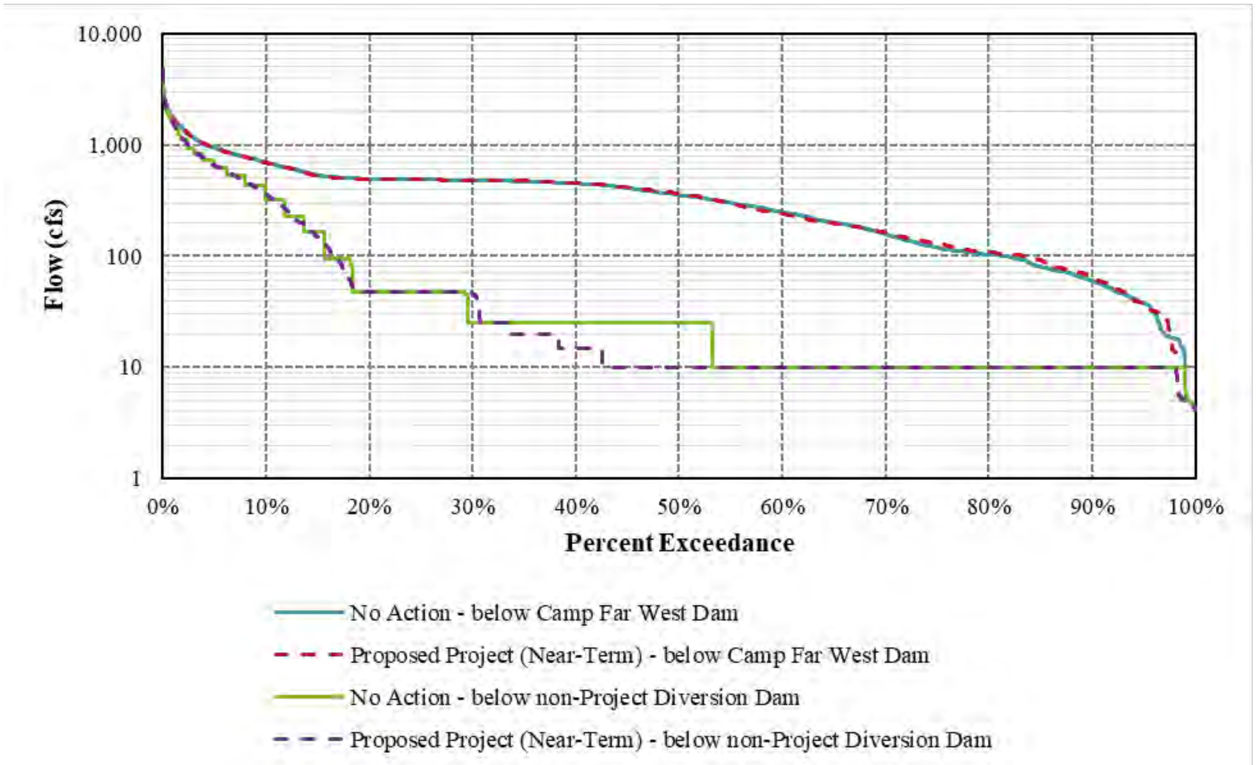


Figure 3.3.2-54. Exceedance curves of modeled mean daily flows below Camp Far West Dam and the non-Project Diversion Dam for the No Action Alternative and Proposed Project for WYs 1976 through 2014, limited to April 15 through October 15.

In addition to downstream diversions and upstream inflow, the presence of historical mining debris upstream of the Project impacts flows in the lower Bear River. Hydraulic mining debris located in streambeds upstream of the Project are mobilized during high flow events and deposited in Camp Far West Reservoir, resulting in a gradual loss of reservoir storage capacity through time. As storage capacity is lost, the ability of the reservoir to capture inflows during high flow events is reduced. As a result, Camp Far West Reservoir will spill sooner, and will have less ability to store water for subsequent reservoir releases. While reservoir sedimentation does not affect the quantity of water in the lower Bear River, it does affect the timing and magnitude of river flows. SSWD estimated a loss of approximately 10 percent of storage due to sedimentation based on the results of bathymetry surveys in 1968 and 2008, however some of this difference is likely attributed to advances in survey technology. Additional discussion of sedimentation in Camp Far West Reservoir is provided in Section 3.3.1.1.6 of this Exhibit E.

Timber harvesting and grazing also affect water quantity. Timber harvesting and grazing has occurred historically within the watershed, although it is on the decline. A decrease in timber harvesting would result in less inflow to Camp Far West Reservoir and less flow in the lower Bear River from water uptake by trees located upstream of the Project. Conversely, a decrease in grazing would result in more inflow to Camp Far West Reservoir and more flow in the lower Bear River. Overall, impacts from timber harvesting and grazing are minor.

3.3.2.3.2 Cumulative Effects on Water Quality

Impoundment of water by the Project and upstream water projects, downstream diversions, historical mining, timber harvesting, and grazing each cumulatively affect water quality and water temperature in Camp Far West Reservoir and in the lower Bear River.

Water Quality

Generally, water quality in Camp Far West Reservoir and in the lower Bear River is good and meets Basin Plan Water Quality Objectives for the majority of constituents. During SSWD's relicensing study, one constituent, alkalinity, exceeded the Water Quality Objective for samples upstream of Camp Far West Reservoir, in the reservoir, and downstream of Camp Far West Reservoir. Aluminum and iron concentrations exceeded Water Quality Objectives in Camp Far West Reservoir and downstream of the Project. Elevated metals are likely the result of legacy mining that happened throughout the Bear River watershed. The Proposed Project does not include any actions to introduce metals into Camp Far West Reservoir or the lower Bear River. If the Proposed Project was removed, trace metals from historic mining would still be present and transported downstream in the Bear River.

The presence of mercury, also a legacy from the long history of mining, has led to concerns regarding mercury concentrations in edible fish (Section 3.3.2.1.2). However, these concerns occur throughout the watershed, as they do in most California streams where gold mining occurred, and the potential to bioaccumulate mercury in fish is not exacerbated by the Proposed Project. OEHHA, the California agency responsible for advising the public of health concerns, has issued fish ingestion advisories for Camp Far West Reservoir. Further, with the except of rainbow trout, the fish in Camp Far West Reservoir that OEHHA has issued advisories for (e.g. bass and bluegill) are not native and were stock by resource agencies or the public, not SSWD. Mercury concentrations do not exceed the Water Quality Objective based on SSWD's study and, with the exception of one sample collected near the bottom of Camp Far West Reservoir, were similar upstream, within, and downstream of the Project. The Proposed Project does not include any actions to introduce mercury into Camp Far West Reservoir or the lower Bear River. If the Proposed Project were removed, mercury from historic mining would still be present and transported downstream in the Bear River.

Water Temperature

SSWD's Proposed Project, in combination with upstream projects and downstream diversions, affect water temperature in the lower Bear River. As discussed in 3.3.2.3.2, water diversions downstream of the Project have a major effect on flow in the lower Bear River. Consequently, water diversions also have a major effect on water temperature. With less water in the river, water temperature reaches ambient equilibrium quicker. Temp Model results showed that ambient conditions are present in the lower Bear River from approximately Highway 65 to the confluence with Dry Creek for much of the year (Figures 3.3.2-30 through 3.3.2-32).

Proposed Project Camp Far West Reservoir releases are cooler in summer months than Bear River inflow temperatures under Near-Term and Future conditions as shown in Figure 3.3.2-55 for a representative wet WY (1995), in Figure 3.3.2-56 for a representative normal WY (2003), and in Figure 3.3.2-57 for a representative dry WY (2001). Approximately 5 miles downstream of the non-Project diversion dam, near Highway 65, Bear River water temperatures reach ambient equilibrium and are similar to water temperatures in the Bear River upstream of the Project.

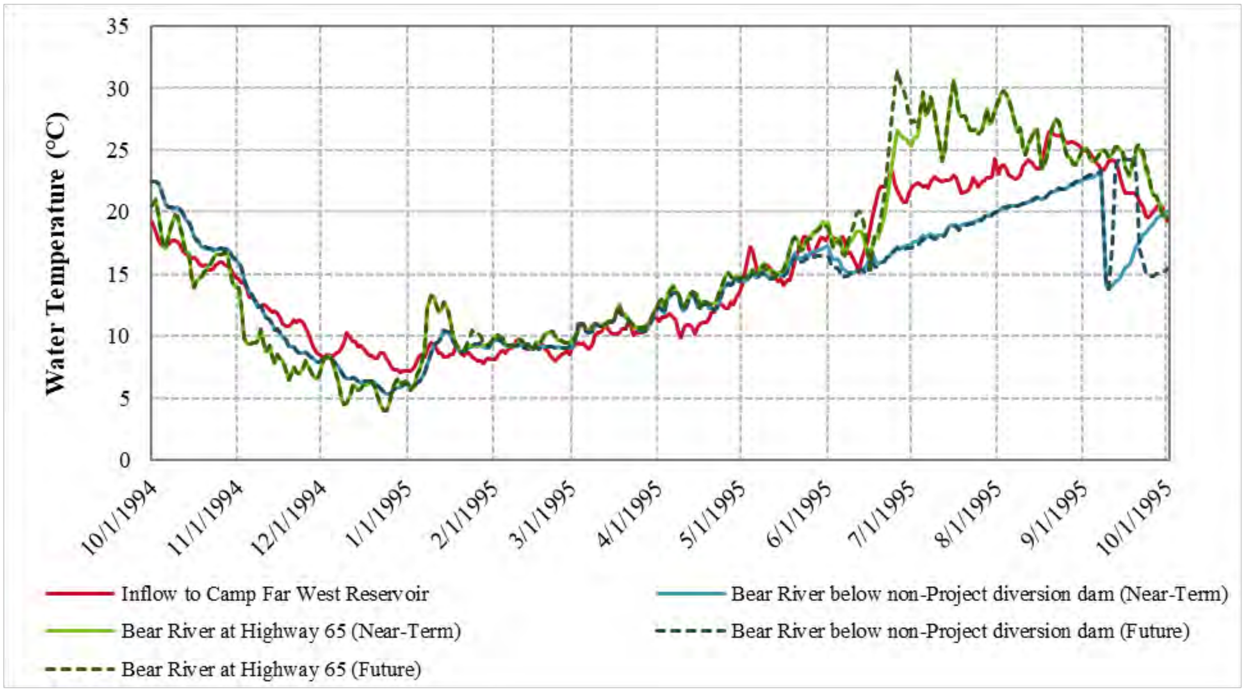


Figure 3.3.2-55. Simulated daily average water temperatures for a representative wet WY (1995) at various locations Bear River downstream of the non-Project diversion dam for the Proposed Project (Near-Term and Future) relative to reservoir inflow temperature.

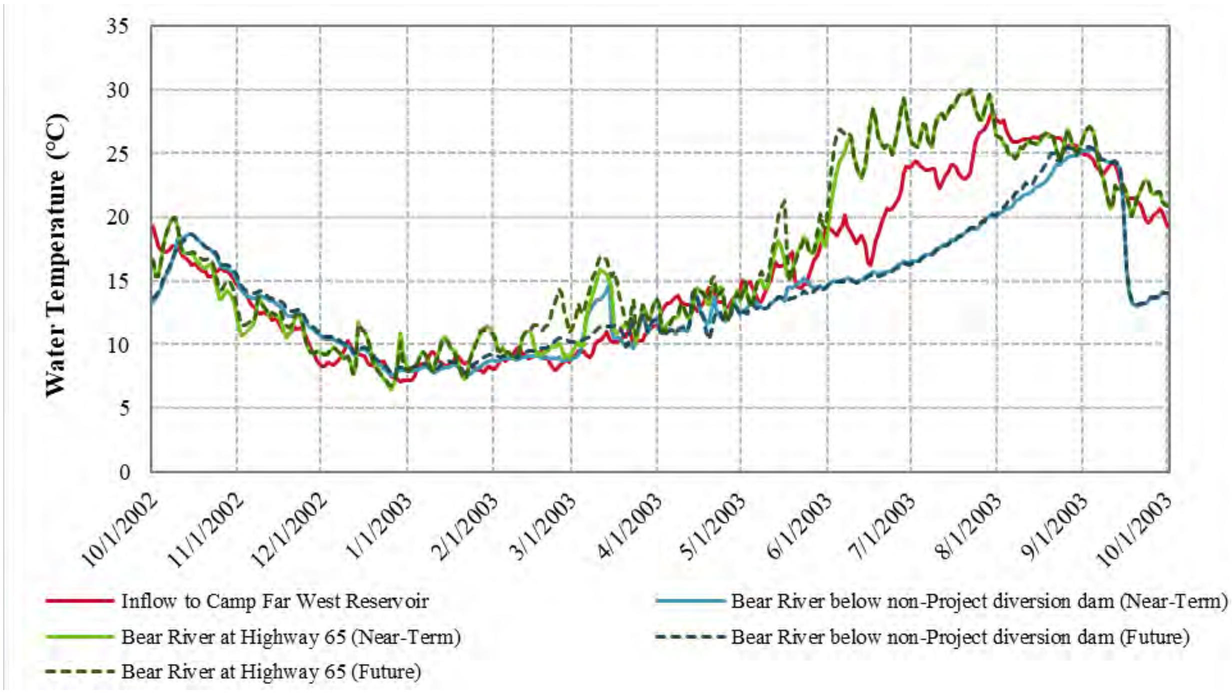


Figure 3.3.2-56. Simulated daily average water temperatures for a representative normal WY (2003) at various locations Bear River downstream of the non-Project diversion dam for the Proposed Project (Near-Term and Future) relative to reservoir inflow temperature.

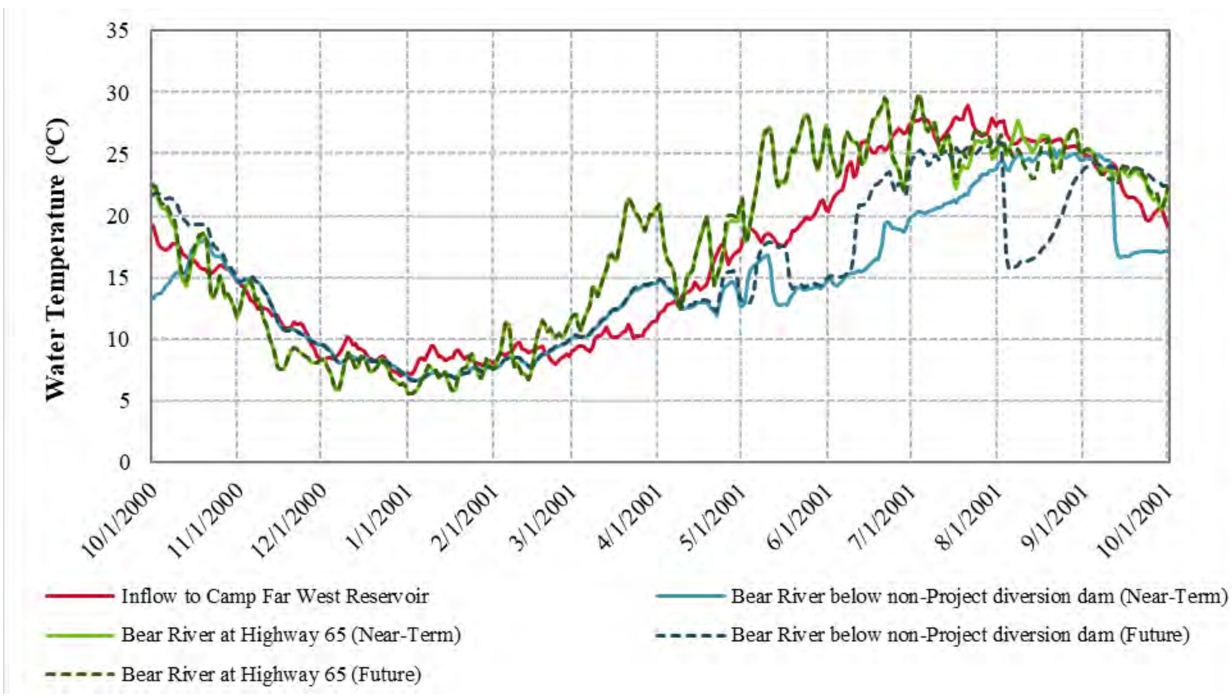


Figure 3.3.2-57. Simulated daily average water temperatures for a representative dry WY (2001) at various locations Bear River downstream of the non-Project diversion dam for the Proposed Project (Near-Term and Future) relative to reservoir inflow temperature.

As discussed in Section 3.3.2.3.1, Bear River inflow to Camp Far West Reservoir from upstream projects is projected to decrease because of changes in upstream project operations and increased water demands. Wet season spills from upstream reservoirs will occur less, as upstream reservoirs will capture more of the watershed runoff. This will impact the volume of available coldwater in Camp Far West Reservoir.

With decreased inflow, Camp Far West Reservoir water levels will be lower in Below Normal, Dry, and Critically Dry WYs. As a result the powerhouse intake is closer to the surface of the reservoir, making releases from higher in the metalimnion layer. This is seen in Figure 3.3.2-57 from mid-June through July. Camp Far West Reservoir releases temperatures are warmer under the Future condition relative to the Near-Term condition.

3.3.2.4 Unavoidable Adverse Effects

Operating and maintaining the Project consistent with SSWD's proposed conditions would not create any significant or unavoidable adverse effects. Camp Far West Reservoir will continue to truncate high flows that enter Camp Far West Reservoir and augment low summertime and fall flows, which will affect water quantity. However, storage in Camp Far West Reservoir would occur with or without the Project since it is necessary to meet CFWID and SSWD irrigation demands now and into the future. For that reason, long-term Project effects on water quantity are considered minor and cumulative.

Camp Far West Reservoir will continue to trap sediment contaminated with mercury, a legacy of hydraulic mining which historically occurred upstream of the Project. However, sediment would be trapped in Camp Far West Reservoir with or without the Project since it is necessary to meet CFWID and SSWD irrigation demands now and into the future. For that reason, long-term Project effects on water quantity are considered minor and cumulative.

Water temperatures in the Bear River downstream of the Project exceed 20°C in every year in both the Proposed Project and No Action Alternative (Tables 3.3.2-22 through 3.3.2-25). Cold water is limited in the Bear River because the watershed is relatively low in elevation (i.e., <5,000 ft) and experiences precipitation as rainfall rather than snowfall. As shown in Table 3.3.2-23, there is a small increase in usable cold water pool volumes below 10°C and 15°C in the Proposed Project compared to the No Action Alternative. However, even if Camp Far West Reservoir releases were made entirely from the low-level outlet, located approximately 46 ft below the powerhouse intake, there is not enough coldwater pool to maintain colder water temperatures in the Bear River below the Project. For that reason, long-term Project effects on water quantity and quality are considered minor and cumulative.

3.3.2.5 PM&E Measures Not Adopted by SSWD

As described in Appendix E4, five comment letters or emails (provided in Appendix E3) were submitted regarding SSWD's DLA. SSWD reviewed each letter or email and, with regards to Water Resources, no proposals or comments to modify a SSWD proposed measure or add a new measure were identified.

3.3.2.6 List of Attachments

None.

3.3.3 Aquatic Resources

The discussion of aquatic resources is divided into five sections. The affected environment is discussed in Section 3.3.3.1, environmental effects of the Proposed Project are discussed in Section 3.3.3.2, cumulative effects are described in Section 3.3.3.3, unavoidable adverse effects are addressed in Section 3.3.3.4, and measures recommended by agencies and other interested parties in written comments on SSWD's DLA that were not adopted by SSWD are discussed in Section 3.3.3.5.

SSWD augmented existing, relevant, and reasonably available information with four relicensing studies: 1) Study 3.1, *Salmonid Redd Study*; 2) Study 3.2, *Stream Fish Populations Study;* 3) Study 3.3, *Instream Flow Study;* and 4) Study 3.4, *Benthic Macroinvertebrate Study*. The studies are complete, and information on the study results can be found in this Application for New License. Additionally, data related to each study are located in Appendix E1 in Exhibit E of this Application for New License.

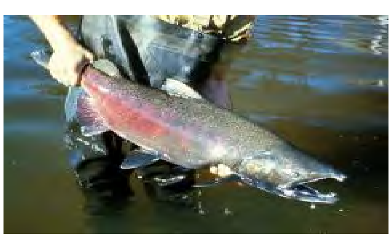
3.3.3.1 Affected Environment

This section describes the condition of existing aquatic resources in three general areas: 1) special-status aquatic species, 2) aquatic invasive species, and 3) aquatic resources of the Bear River.

3.3.3.1.1 Special-Status Aquatic Species

Four special-status aquatic species occur or have been reported to occur recently in the Project Area. These are: 1) Central Valley (CV) fall-run Chinook salmon Evolutionarily Significant Unit (ESU) (NMFS-S, CSC); 2) white sturgeon (CSC); 3) Sacramento-San Joaquin roach (CSC); and 4) Western (or northwestern) pond turtle (*Actinemys marmorata*) (CSC). Two other species - hardhead (CSC) and Sacramento splittail (*Pogonichthys macrolepidotus*) (CSC) – have been reported in the area, but have not been documented in recent times. A seventh species - foothill yellow-legged frog (*Rana boylii*) (CSC, CESA Candidate Species) - has never been reported to occur in the Project area and is found above elevations of 600 feet, but it is included here because it is a Candidate for listing under CESA and known extirpated populations once occurred at elevations below 300 ft in some areas (Moyle 1973; Seltenrich and Pool 2002; ECORP 2005). A description of each of these seven species, including its nearest known occurrence to Project facilities and features, is provided below.

Central Valley fall-run Chinook salmon ESU (NMFS-S, CSC)[1]



Four principal life history variants of Chinook salmon are recognized in the California Central Valley and are named for the timing of their spawning runs: fall-run, late fall-run, winter-run, and spring-run.

[1] Photo source: http://www.usgs.gov/features/lewisandclark/images/Chinook_Salmon.jpg

Seventeen distinct groups, or ESUs, of naturally-spawned Chinook salmon occur from southern California to the Canadian border and east to the Rocky Mountains; five of these groups occur in California (Myers et al. 1998). Four groups occur in the Project Vicinity (NMFS 2008), but only the CV fall-run ESU has been documented in the lower Bear River. NMFS listed CV fall-run Chinook salmon ESU as a Species of Concern in 2004 due to concerns about population size and hatchery influence (NMFS 2009). Little information exists regarding the life history of CV Chinook salmon ESU in the lower Bear River. Therefore, much of the information in this section is based on the life history of CV fall-run Chinook salmon ESU in the lower Yuba and Feather rivers. The Bear and Yuba rivers are both tributaries to the Feather River. Therefore, it is anticipated that the life history and timing of CV fall-run Chinook salmon ESU in the Bear River are similar to that seen of the Feather and Yuba rivers.

Although it is an important commercial and recreational fish species, declines in populations resulted in harvest management restrictions throughout California. In April 2009, the Pacific Fishery Management Council and NMFS adopted a closure of all commercial ocean salmon fishing through April 30, 2010, and placed restrictions on inland salmon fisheries over the same time frame (CDFG 2009a). Currently the Bear River from the non-Project diversion dam to Highway 65 is only subject to sport fishing regulations, which is annually open from the fourth Saturday in May through October 15.

The generalized life history of Pacific salmon (*Oncorhynchus* sp.) involves spawning, incubation, hatching, emergence, and rearing in freshwater, migration to the ocean, and subsequent initiation of maturation and return to freshwater for completion of the life-cycle (Myers et al. 1998).

Chinook salmon is the largest salmonid, with adults often exceeding 40 pounds, and individuals over 120 pounds reported (NMFS 2008). Adult Chinook salmon migrate from the ocean into the freshwater streams and rivers of their birth to mate (i.e., anadromy) and, following a single spawning event, they die (i.e., semelparity). Adult CV fall-run Chinook salmon ESU generally begin migrating upstream in the Feather River annually in June, with immigration continuing through December (Moyle 2002; NMFS 2008). In the Central Valley, immigration generally peaks in November and, typically, greater than 90 percent of the run has entered their natal river by the end of November (Moyle et al. 2008).

The timing of adult Chinook salmon spawning activity is influenced by water temperatures. In general, when mean daily water temperatures decrease to approximately 60°F, female Chinook salmon begin to construct nests, which are known as redds, into which their eggs are eventually released and simultaneously fertilized by males (Moyle 2002; NMFS 2008). Chinook salmon require gravel and cobble areas, primarily at the heads of riffles, with water flow through the substrate for spawning. Gravel and cobble sizes can range from 0.1 to 6 in in diameter. Fall-run Chinook salmon spawning and embryo incubation period generally extends from October through March, but may occur earlier if temperature conditions fall below 60°F (Moyle 2002; NMFS 2008). Based on life history periodicities in the Feather and Yuba rivers, CV fall-run Chinook salmon ESU fry emergence is expected to typically occur from late December through March within the Project Vicinity (Moyle 2002). Growth rates are largely influenced by water temperature, and the optimal range of juvenile rearing temperatures is 55° through 65°F. Young

Chinook salmon will survive and grow within the range of 41°F through 66°F, but steady temperatures above 75°F are lethal (UC Davis 2018).

Table 3.3.3-1 shows the CV fall-run Chinook salmon ESU lifestage periodicity developed by the Lower Yuba River Accord Management Team for the lower Yuba River (RMT 2013). SSWD expects that the lower Yuba River and lower Bear River CV fall-run Chinook salmon ESU periodicities are generally similar. The lower Yuba River is a larger basin than the Bear River, so select areas may extend beyond the suitable periods of the lower Bear River.

Table 3.3.3-1. Life stage-specific periodicities for CV fall-run Chinook salmon ESU in the Yuba River. Reproduced from Lower Yuba River Accord River Management Team (2013). Gray shading is assumed presence.

Life Stage	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
Adult Immigration & Staging													■	■	■	■	■	■	■	■	■	■	■	■
Spawning	■	■																	■	■	■	■	■	■
Embryo Incubation	■	■	■	■	■	■													■	■	■	■	■	■
Fry Rearing	■	■	■	■	■	■	■	■																■
Juvenile Rearing		■	■	■	■	■	■	■	■	■	■	■												
Juvenile Downstream Movement	■	■	■	■	■	■	■	■	■	■	■	■												■

In addition, water temperature is very important for the support of CV fall-run Chinook salmon ESU in the lower Bear River. In 1991, using multiple sources of information, CDFG (1991) opined ranges of preferred water temperatures for each life stage of CV fall-run Chinook salmon ESU. Table 3.3.3-2 provides the CDFG preferred water temperature by life stages, including the sources cited by CDFG.

Table 3.3.3-2. CDFG 1991 water temperatures for CV fall-run Chinook salmon life stages.

CV Fall-Run Chinook Salmon Life Stage	Preferred Water Temperature Range (°C)	Sources Cited by CDFW
Upstream Migration	6.7° to 14.2°C	Bell 1986, Rich 1987
Spawning	5.0° to 13.9°C	Reiser and Bjornn 1979, Rich 1987, and Chambers 1956
Egg Incubation through Fry Emergence	5.0° to 14.4°C	Reiser and Bjornn 1979, and Rich 1987
Fry Rearing	7.0° to 14.0°C	Raleigh et al. 1986 and Rich 1987
Juvenile Rearing	7.3° to 14.6°C	Reiser and Bjornn 1979, and Rich 1987

In its 1991 report, CDFG stated that warm water temperatures near the confluence of the lower Bear and Feather rivers during September and October could delay CV fall-run Chinook salmon ESU upstream migration into the Bear River. The report concluded that the preferred water temperature range for spawning was exceeded at Wheatland until early November, thereby shortening the period for spawning that is normally October through January. CDFG also concluded that during the incubation period of October through February, water temperatures generally exceed the optimum only during October and that the temperature range for juvenile rearing was exceeded during the entire rearing period of April through June.

More recently, CDFW and other federal and state agencies have expressed a reliance on salmon and steelhead life history water temperature guidelines developed by the United States Environmental Protection Agency (EPA 2003). These guidelines are 7-day averages of the daily maxima (7DADM) water temperatures that the EPA claims will maintain protection of anadromous salmonids. The EPA-developed guidelines are based on a review of literature describing water temperature-related effects on various species of anadromous salmonids. The EPA did not develop guidelines based on local testing and some guidelines were applied to multiple species of salmonids (e.g., *O. mykiss* and Chinook salmon). Further, the EPA (2003) does not distinguish between ESUs or DPS' of conspecific anadromous salmonids (e.g., spring-run and fall-run Chinook salmon), and the EPA water temperature guidelines do not align directly with the Chinook salmon periodicities in Table 3.3.3-1. Table 3.3.3-3 shows the EPA guidelines for the anadromous salmonid lifestages.

Table 3.3.3-3. EPA water temperature guidelines (EPA 2003) for protection of anadromous salmonids by life stage.

Salmonid Life History Phase Terminology	7-Day Average of the Daily Maxima Guideline (°C)	Intended Period of Protection
Adult and Juvenile Migration	≤18°C	Salmon and steelhead migration
Spawning and Egg Incubation	≤13°C	Salmon and steelhead spawning, egg incubation and fry emergence
Juvenile Rearing	≤16°C for "core" juvenile rearing;[1]	Salmon and steelhead rearing and
Smoltification	≤14°C	Composite criteria for salmon and steelhead smoltification[2]

[1] The EPA recommends that for areas of degraded habitat, "*core juvenile rearing*" use cover the downstream extent of low density rearing that currently occurs during the period of maximum summer temperatures (EPA 2003).

[2] The EPA establishes a guideline of ≤15°C for salmon smoltification and a guideline of less than or equal to 14°C for steelhead smoltification; but for a composite guideline for both species, the steelhead guideline of less than or equal to 14°C is applied.

The EPA recommends its guidelines because they "*describe the maximum temperatures in a stream, but is not overly influenced by the maximum temperature of a single day*." The EPA states that, because this metric uses daily maximum water temperatures, the guidelines can be used to protect against acute water temperature effects (EPA 2003). The EPA also states that its guidelines can be used to protect against sub-lethal or chronic effects, but the cumulative thermal exposure of fish over the course of a week or more needs to be considered when selecting a 7DADM value to protect against these effects (EPA 2003). Based on studies of fluctuating water temperature regimes, the EPA concludes that:

> ...fluctuating temperatures increase juvenile growth rates when mean temperatures are colder than the optimal growth temperature derived from constant temperature studies, but will reduce growth when the mean temperature exceeds the optimal growth temperature. When the mean temperature is above the optimal growth temperature, the "mid-point" temperature between the mean and maximum is the "equivalent" constant temperature. This "equivalent" constant temperature then can be directly compared to laboratory studies done at constant temperatures. For example, a river with a 7DADM value of 18°C and a 15°C weekly mean temperature (i.e., diurnal variation +/- 3°C) will be roughly equivalent to a constant laboratory study temperature of 16.5°C (mid-point between 15°C and 18°C). Thus, both maximum and mean temperatures are important when determining a 7DADM value that is protective against sub-lethal/chronic effects.

Because the 7DADM water temperature guideline is reportedly about 3°C higher than the weekly mean water temperature in many rivers in the Pacific Northwest (Dunham et al. 2001 and Chapman 2002, both as cited in EPA 2003), EPA (2003) said it first started with the constant temperatures that scientific studies indicate would be protective against chronic effects, and then added 1-2°C to develop 7DADM temperatures that would protect against chronic effects.

Table 3.3.3-4 provides a crosswalk between the Yuba River Chinook salmon periodicities and the EPA water temperature guidelines.

Table 3.3.3-4. Life history events for Yuba River Periodicity, EPA (2003) temperature guidelines, and instream flow life history variables merged into a single 12-month calendar for comparative reference.

Yuba River Periodicity[1]	EPA (2003) Water Temp[2]	Instream Flow[3]	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Adult Immigration & Staging	Adult Migration	Spawning												
Spawning	Spawning and Egg Incubation													
Embryo Incubation														
Fry Rearing	Juvenile Rearing	Fry Rearing												
Juvenile Rearing		Juvenile Rearing												
Juvenile Downstream Movement	Smoltification													

1 As provided in Table 3.3.3-1 of this Exhibit E.
2 As provided in Table 3.3.3-3 of this Exhibit E.
3 As discussed in Section 3.3.1.3 of this Exhibit E.

In the Central Valley, fall-run Chinook salmon ESU are the most numerous of the four salmon runs and are the principal run raised in hatcheries (Moyle 2002). Throughout the Central Valley, the number of Chinook salmon returning in the fall to spawn has exhibited a declining trend in recent years based on data reported in GrandTab.[2] Little is known about the historical run size, but it has been reported to be highly variable from year to year depending on fall flow conditions.

Fall-run Chinook salmon are raised at five major Central Valley hatcheries that release more than 32 million smolts each year into California water bodies (CDFG 2007). Chinook salmon fry stocking occurred in the Bear River in 1981, 1983, 1985, 1986, and 1987. Stocking typically occurred at Patterson's Gravel Plant (RM 16). Each year roughly 100,000 Feather River or Nimbus Hatchery fall-run fry were released into the river. No known plantings of Chinook salmon fry in the lower Bear River have occurred since 1987. Recently, Chinook salmon have been released in the Feather River at the Hatchery and near Live Oak (RMIS 2015).

While hatchery programs can increase overall returns to the fishery, Lindley et al. (2007) concluded that hatchery programs have negative effects on wild populations of Chinook salmon

2 GrandTab is a compilation of annual population estimates for Chinook salmon, *Oncorhynchus tshawytscha*, in the Sacramento and San Joaquin River systems. GrandTab is available for download at: http://www.calfish.org/IndependentDatasets/CDFGFisheriesBranch/tabid/157/Default.aspx

due to competition by hatchery fish with wild juveniles, and straying of hatchery fish both within and between basins and resultant introgression of hatchery stocks with native populations.

Unlike spring-run Chinook salmon, adult fall-run Chinook salmon does not exhibit an extended over-summer holding period. Rather, it stages for a relatively short period of time prior to spawning. Adult CV fall-run Chinook salmon ESU immigration and staging has been reported to generally occur in the nearby lower Yuba River from August through November (CALFED and YCWA 2005).

Fall-run Chinook salmon embryo incubation extends from the time of egg deposition through alevin emergence from the gravel. The CV fall-run Chinook salmon ESU embryo incubation period has been reported to extend from October through March in the lower Yuba River (YCWA et al. 2007).

In the Central Valley, fall-run Chinook salmon ESU fry emergence generally occurs from late-December through March (Moyle 2002). CV fall-run Chinook salmon ESU juvenile rearing and outmigration in the lower Yuba River has been reported to primarily occur from December through June (CALFED and YCWA 2005; SWRI 2002). In the lower Yuba River, most CV fall-run Chinook salmon ESU exhibit downstream movement as fry shortly after emergence from gravels, although some individuals rear in the river for a period of up to several months and move downstream as juveniles. Thus, the fry rearing lifestage is considered to extend from December through April, and the juvenile rearing lifestage from January through June.

The Bear River has historically contained a single run of fall-run Chinook salmon (Yoshiyama et al. 2001). Adult salmon historically ascended as far as a barrier waterfall in the immediate vicinity of Camp Far West Dam (Yoshiyama et al. 2001). No waterfall currently exists in the area so it has presumably been inundated by the construction of the dam and formation of the reservoir (Yoshiyama et al. 2001). There are no known accounts of anadromous fishes of any kind upstream of the original barrier waterfall. Yoshiyama et al. (2001) estimates that less than 1 RM of salmon habitat was lost due to the creation of Camp Far West Dam. USFWS (1998) states:

> Historically, the Bear River never supported substantial runs of salmon and steelhead as a consequence of its naturally intermittent hydrology and the occurrence of a natural rock barrier located a short distance upstream from Camp Far West Reservoir. This barrier prevented salmon and steelhead from ascending the Bear River to higher elevations where streamflows and water temperatures were more suitable. Thus, fish were restricted to the Sacramento Valley floor where environmental conditions were not always favorable. In years with favorable flows, the Bear River probably supported small runs of fall-run Chinook salmon and steelhead, although run size estimates are not available.

Reports issued in 1991 and 1993 by CDFG (1991) and Reynolds et al. (1993) respectively, stated that fall flows, specifically October and November, in the lower Bear River appeared to influence the CV fall-run Chinook salmon ESU run size. During years of high water in October and November, CDFG reports runs as high as 300 CV fall-run Chinook salmon ESU in 1984 and none in 1985 (CDFG 1991, Table 3.3.3-5). However, CDFG (1991) concludes that the monthly impaired flow pattern and quantity of water closely resembled the unimpaired flow with approximately 90 percent of the unimpaired flow released annually downstream of Camp Far West, indicating that flow was not the limiting factor influencing fall-run Chinook salmon ESU production.

Table 3.3.3-5. Estimates of spawning CV fall-run Chinook salmon ESU in the lower Bear River.[1]

Year	Number of Chinook Salmon Adult Spawners	Instantaneous Flow Range (cfs)[2]		Highest Observed Instantaneous Flow in October & November (cfs)
		October	November	
1978	0	1.6 - 8.7	<1 - 14	14
1980	0	2.1 - 9.2	5 - 29	29
1982	<100	6.8 - 37	28 - 7,170	7,170
1983	>200[3]	37 - 55	484 - 4,360	4,360
1984	300	19 - 47	24 - 1,430	1,430
1985	0	4.4 - 33	10 - 28	28
1986	1	9.5 - 20	15 - 34	34

From: CDFG 1991
[1] CDFG Region 2, Rancho Cordova, file data for Bear River-Placer, Sutter, and Yuba counties, as cited in CDFG 1991.
[2] USGS Water Resources Data, California, Volume 4, various years, gage 11424000, Bear River near Wheatland, CA.
[3] Estimate of angler catch from Dry Creek.

The Central Valley Project Improvement Act (CVPIA) directed the Secretary of DOI to develop and implement a program that makes all reasonable efforts to double natural production of anadromous fish in California Central Valley streams (Section 3406(b)(1)). The program is known as the Anadromous Fish Restoration Program (AFRP). The 2001 plan was released by USFWS as a revised draft on May 30, 1997 and adopted as final on January 9, 2001 (USFWS 2001). The plan identifies restoration actions that may increase natural production of anadromous fish in Central Valley streams. The CVPIA target for natural production of Chinook salmon in the Bear River is 450 adults, though this target was established using a combination of the limited and low-quality abundance data presented in Table 3.3.3-5, above, and a "professional judgment" estimate of freshwater harvest. The CVPIA doubling goal and associated restoration and management actions identified to meet the goal are discussed in detail in Section 5.4.20 of this Exhibit E.

A more detailed discussion regarding CV fall-run Chinook salmon ESU in the lower Bear River is provided in Section 3.3.3.1.3.

White Sturgeon (CSC)[3]

White sturgeon is listed as a CSC due to a lack of abundance data, concerns regarding availability of spawning and rearing habitats, and the continued recreational importance of the species. Moyle (2002) states that the number of adults fluctuates annually and appears to be the result of highly variable juvenile production; the population is dominated by a few strong year classes associated with high spring

[3] Photo source - https://www.dfw.state.or.us/RR/images/fish/sturgeon/4803_white_sturgeon_swart_odfw.jpg

outflows. White sturgeon reside in estuaries of large rivers for much of their lives and tend to move around bays or estuaries to find optimal brackish water areas (Kohlhorst et al. 1991; USBR 2017a).

Data show that adult white sturgeon initiate their upstream migration into the lower Sacramento River from the Delta during late fall and winter (Kohlhorst and Cech 2001). The migration is believed to be triggered by photoperiod (Doroshov et al. 1997) and increases in river flow (Schaffter 1997). Mature adult white sturgeon have been documented moving up the Sacramento River until they are concentrated near Colusa from March through May (Kohlhorst et al. 1991 as cited in Kohlhorst and Cech 2001).

Onset of sexual maturity for males and females varies with photoperiod and temperature; however, male sturgeon reach maturity before females. Males are sexually mature as early as 3 to 4 years. Females mature as early as 5 years (Wang 2010). Only a small percentage of the adult population spawns in a given season. Males may spawn every 1 to 2 years, and females may spawn every 2 to 4 years. Limited data exists on preferential spawning habitat but biologists believe that white sturgeon pick deep swift water areas, such as riffles or pools with rock and gravel substrate, to spawn. Female sturgeon produce many eggs, with white sturgeon in the Sacramento River producing an average of 5,648 eggs per kilogram of body weight (Moyle 2002). Male sturgeon fertilize the eggs, giving them a tacky property that allows the eggs to stick to the substrate until the larvae emerge four to 12 days later (Wang 2010; USBR 2017a).

According to Moyle (2002), white sturgeon spawning typically occurs between February and June when water temperatures are 46° to 66°F. Biologists believe that adults broadcast spawn in the water column in areas with swift current. Fertilized eggs sink and attach to the gravel bottom, where they hatch. Eggs reportedly hatch after 4 days at 61°F (Beer 1981), but can take up to 2 weeks at lower water temperatures (PSMFC 1992). Exact white sturgeon spawning locations in the Sacramento River have not been documented, although it is likely white sturgeon spawn between Knights Landing (RM 90) and Colusa (RM 143) (CDFG 2002 and Schaffter 1997, both as cited in Beamesderfer et al. 2004; Kohlhorst 1976), or several miles upstream of Colusa (Kohlhorst 1976, and Schaffter 1997, all as cited in Israel et al. 2011). Vogel (2008) sampled adult sturgeons for a telemetry study on the Sacramento River near the Glenn-Colusa Irrigation District’s diversion between 2003 and 2006 and sampled white sturgeons as far upstream as RM 165.

After hatching, larvae begin swimming around in a vertical position as they are suspended by a yolk sac, making them more susceptible to be carried down to the estuary in the current (Wang 2010). Larvae begin to swim freely and feed through their mouths once the yolk sac has been consumed (Moyle 2002; USBR 2017a). Juvenile rearing and downstream movement can occur year-round.

Little information is available regarding white sturgeon use of the lower Bear River for spawning and rearing habitat. Recent studies conducted by DWR and utilizing Dual Frequency Identification Sonar (DIDSON) documented sturgeon presence in the lower 1 mi of the Bear River, but DWR was unable to determine species (A. Seesholtz, pers. comm., 2018). On March 28, 2017, DWR biologists reported detecting 24 adult sturgeon while conducting DIDSON surveys in the lower 1 mile of the Bear River. During that same time period, DWR staff reported they received anecdotal reports of anglers landing sturgeon in Wheatland just above the Highway 65 Bridge. On March 19, 2018, DWR repeated the DIDSON survey in the lower Bear River and reported detecting a total of 37 adult sturgeon within 1 mile of the Feather River confluence. During the survey, DWR staff reported watching an angler hook and land four white sturgeon approximately 0.5 mi upstream from the confluence with the Feather River. Additionally, DWR staff reported that a friend of a DWR biologist hooked and landed an adult white sturgeon on the Bear River on March 18, 2018.

CDFW deployed egg mats to investigate sturgeon spawning on the lower Bear River at eight sites in 2017 and at two sites in 2018 (CDFW 2018a and 2018b). Prior to deployment of the egg mats, CDFW conducted reconnaissance surveys with DIDSON cameras to identify potential spawning or holding locations on the Bear River. After identifying suitable locations, two egg mats were deployed at each sampling site. Sampling took place from March 7 through May 9, 2017, and March 27 through May 11, 2018. During the 2018 surveys, a logjam approximately 2.5 mi upstream from the confluence with the Feather River prevented access to six sites where mats were deployed in 2017. CDFW staff checked egg mats 3 to 4 times during the 2017 survey period, depending on accessibility due to flow conditions, and 4 times during the 2018 survey period. No sturgeon eggs were collected or observed on the egg mats and no sturgeon were observed during the DIDSON reconnaissance surveys in 2017 or 2018.

Hardhead (CSC)[4]

Hardhead has been reported to occur in the upper Yuba River, the lower Bear, Feather, and Yuba rivers and the Honcut Creek headwaters (UC Davis 2018). The report did not provide specific population counts for the lower Bear River.

Hardhead is a large cyprinid species that can reach lengths of over 23 in., and generally occurs in large, undisturbed, low- to mid-elevation, cool- to warm-water rivers and streams (Moyle 2002). Hardhead was designated CSC by CDFW in 1995, and is listed by CDFW as a Class 3 Watch List species, meaning that it occupies much of its native range but was formerly more widespread or abundant within that range (CDFG 2009a,b). Historically, hardhead was considered a widespread and locally abundant species in California, but its specialized habitat requirements, widespread alteration of downstream habitats, and predation by smallmouth bass (*Micropterus dolomieu*) have resulted in population declines and isolation of populations (Moyle 2002).

Most reservoir populations of hardhead have proved to be temporary; presumably the result of colonization of the reservoir by juvenile hardhead before introduced predators became established. Brown and Moyle (1993) observed that hardhead disappeared from the upper Kings River when the reach was invaded by bass.

Hardhead mature following their second year. Spawning migrations, which occur in the spring into smaller tributary streams, are common. The spawning season may extend into August in the foothill streams of the Sacramento and San Joaquin river basins. Spawning behavior has not

4 Photo source - http://calfish.ucdavis.edu/calfish/Hardhead.html

been documented, but hardhead is believed to elicit mass spawning in gravel riffles (Moyle 2002). Little is known about life stage specific temperature requirements of hardhead; however, temperatures ranging from approximately 65° to 75°F are believed to be suitable (Moyle 2002).

In 1980, CDFG reported hardhead to be present in Camp Far West Reservoir. However, in 2012, CDFG conducted boat electrofishing surveys at nine sites in the reservoir and did not report any hardhead to be present. SSWD found no records of hardhead in the lower Bear River, and did not find any hardhead during its relicensing studies.

Sacramento Splittail (CSC)[5]

The Sacramento splittail, a minnow, was listed as threatened under the ESA on February 8, 1999, and delisted on September 22, 2003 (USFWS 2003a, b). Sacramento splittail is designated as a CSC (CDFW 2018c, CDFW2015b). Sacramento splittail is a large cyprinid, growing in excess of 12 in., and is adapted to living in freshwater and estuarine habitats as well as alkaline lakes and sloughs (Moyle 2002).

Historically, Sacramento splittail inhabited sloughs, lakes, and rivers of the Central Valley with populations extending upstream to Redding in the Sacramento River, to the vicinity of Colusa-Sacramento River State Recreation Area, in Butte Creek/Sutter Bypass, to Oroville in the Feather River, to Folsom in the American River, and to Friant in the San Joaquin River (Moyle et al. 2004, USFWS 2003b). Currently, the species is known to migrate up the Sacramento River to Red Bluff Diversion Dam and up the San Joaquin River to Salt Slough in wet years as well as into the lower reaches of the Feather and American rivers (USFWS 2003b).

Sacramento splittail has been documented only in the lower Feather River (UC Davis 2018) and, according to Moyle, evidence of self-sustaining populations of Sacramento splittail occurring outside of these areas is weak (Moyle et al. 2004). SSWD did not find any historic records of Sacramento splittail in the lower Bear River, and did not observe the species during its relicensing studies.

Sacramento-San Joaquin Roach (CSC)[6]

The Sacramento-San Joaquin roach, a CSC, is part of the California roach complex, which is composed of various subspecies. The Sacramento-San Joaquin roach is found in the Sacramento and San Joaquin River drainages, except the Pit River, and in other tributaries to San Francisco Bay. There is little quantitative information available on the abundance of Sacramento-San Joaquin roach. Assuming this widely distributed form is indeed just one subspecies, it appears to be abundant in a large number of streams. However, it is now absent from many streams and stream reaches where it once occurred (Leidy 1984).

Sacramento-San Joaquin roach is generally found in small, warm intermittent streams, and is

[5] Photo source http://swr.nmfs.noaa.gov/overview/sroffice/2Dredge_species_list.html
[6] Photo source - http://calfish.ucdavis.edu/calfish/CaliforniaRoach.htm

most abundant in mid-elevation streams in the Sierra foothills and in the lower reaches of some coastal streams (Moyle 2002; Moyle et al. 1982). Assuming that the Sacramento-San Joaquin roach is indeed a single taxon, it is abundant in a large number of streams although it is now extirpated from a number of streams and stream reaches where it once occurred (Moyle 2002). Roach are tolerant of relatively high temperatures of 86° to 95°F and low oxygen levels of 1 to 2 mg/L (Taylor et al. 1982). However, it is a habitat generalist, also found in cold, well-aerated clear "trout" streams (Taylor et al. 1982), in human-modified habitats (Moyle 2002; Moyle et al. 1982) and in the main channels of rivers.

Reproduction occurs from March through early July, depending on water temperature (Moyle 2002). Murphy (1943) in CDFG 2008 states that spawning is determined by water temperature, which must be approximately 60°F for spawning to be initiated. During the spawning season, schools of fish move into shallow areas with moderate flow and gravel/rubble substrate (Moyle 2002). Females deposit adhesive eggs in the substrate interstices and the eggs are fertilized by attendant males. Typically, 250-900 eggs are produced by a female and the eggs hatch within two to three days. Fry remain in the substrate interstices until they are free-swimming.

Sacramento-San Joaquin roach have been reported to occur in the upper Yuba River, the lower Bear and Feather rivers, the Middle Fork of the Feather River, and the Honcut Creek headwaters (UC Davis 2018). SSWD did not find any Sacramento-San Joaquin roach during its relicensing studies in the lower Bear River.

Foothill Yellow-Legged Frog (CSC, CESA Candidate Species)[7]

The foothill yellow-legged frog (FYLF) is currently a candidate for listing as threatened under the CESA. On June 21, 2017, the California Fish and Game Commission accepted for consideration a petition from the Center for Biological Diversity to list FYLF as a threatened species, with a finding by CDFW (2017a) that the petitioned action may be warranted. Based on this finding and acceptance of the petition, the Fish and Game Commission advanced the FYLF to a candidate species under the CESA. As a candidate species, FYLF receives all the protections of a CESA-listed species for 1 year from the date it was accepted for consideration while the Fish and Game Commission and CDFW staff decide whether to provide permanent protection to FYLF as a listed species under CESA. This 1 year period has elapsed with no action by the California Fish and Game Commission, so FYLF's status as a CESA Candidate species is uncertain. Nevertheless, FYLF remains a CSC, so it is treated as an aquatic special status species in this Exhibit E.

FYLF is a stream-adapted species, usually associated with shallow, flowing streams with backwater habitats and coarse cobble-sized substrates (Jennings and Hayes 1994). Known extant populations, particularly in the Sierra Nevada, are concentrated between about 600 to 5,000 ft elevation, although populations since extirpated once occurred at elevations below 300 ft in some areas (Moyle 1973; Seltenrich and Pool 2002; ECORP 2005). The species has declined range wide, most severely in southern California, where it evidently no longer occurs (CDFW 2017c).

[7] Photo source: Stephen Nyman, PhD

Within the Central/Northern Sierra Nevada region, populations persist on some portions of previously occupied drainages (NatureServe© 2018), but many of these populations are smaller and more fragmented than historically (CDFW 2017c). FYLF populations may require both mainstem and tributary habitats for long-term persistence. Streams too small to provide breeding habitat for this species may be critical as seasonal habitats (e.g., in winter and during the hottest part of the summer) (VanWagner 1996; Seltenrich and Pool 2002), and there is evidence that habitat use by young-of-the-year, sub-adult, and adult frogs differs by age-class and changes seasonally (Randall 1997). Adult migrations appear to be limited to modest movements along stream corridors (Ashton et al. 1998), but the magnitude of such movements, any seasonal component, and differences between sexes remains largely unknown. FYLF is infrequent in habitats where introduced fish and bullfrogs are present (Jennings and Hayes 1994).

Breeding tends to occur in spring or early summer and eggs are laid in areas of shallow, slow-moving waters near the shore. Timing and duration of breeding activity may vary geographically and across populations. In California, egg masses have been found between April 22 and July 6, with an average of May 3 (Ashton et al. 1998). Kupferberg (1996a, b) reports an approximate breeding period of 1 month beginning late April to late May. Rainfall during a given breeding season has the potential to delay oviposition (Kupferberg 1996a, b).

Egg masses vary in size and in the number of eggs/mass. The size of an egg mass after it has absorbed water (usually a few hours after oviposition) is 5 to 10 cm in diameter and "*resembles a cluster of grapes*" (Stebbins 1985). The number of eggs in a mass can range from 300 to 2,000 (Zweifel 1955), with an average of about 900 eggs (Ashton et al., 1998). Eggs generally hatch within 5 to 37 days (Zweifel 1955; Ashton et al. 1998). Hatching rates are influenced by temperature, with faster developmental times in warmer waters, up to the critical thermal maximum temperature of about 26˚C (Zweifel 1955; Duellman and Trueb 1986). Tadpoles move away from their egg mass after hatching (Ashton et al. 1998) and typically metamorphose 3 to 4 months after hatching.

FYLF is known to occur at higher elevations within the Bear River watershed, but occurrences at the low elevations of the Project (i.e., below 320 ft) are unlikely because the Project is below the accepted elevation range of 600 ft for the species. A search of the CNDDB for the USGS 1:24,000 quadrangles of Camp Far West, Nicolaus, Sheridan, Wheatland, and Wolf found no known occurrences of FYLF (CDFW 2018c). Through a search of the literature, no other studies or known occurrences of FYLF in the Project Area were found, and SSWD did not observe FYLF during its relicensing studies in the lower Bear River.

Western Pond Turtle (CSC)[8]

The western, or northwestern, pond turtle (WPT) occurs in a wide variety of aquatic habitats up to a 6,000 ft elevation, particularly permanent ponds, lakes, side channels, backwaters, and pools of streams, but is uncommon in high-gradient streams (Jennings and Hayes 1994). Western pond turtle has declined due to loss of habitat, introduced species, and historical over-collection (Jennings

[8] Photo source: http://sfbaywildlife.info/species/pacific_pond_turtle.htm

and Hayes 1994), and has been designated as CSC. Isolated occurrences of WPT in lakes and reservoirs sometimes occur from deliberate releases of pets.

Although highly aquatic, WPT often overwinters in forested habitats and eggs are laid in shallow nests in sandy or loamy soil in summer at upland sites as much as 1,200 ft from aquatic habitats (Jennings and Hayes 1994). Hatchlings do not typically emerge from the covered nests until the following spring. Reese and Welsh (1997) documented WPT away from aquatic habitats for as much as 7 months in a year and suggested that terrestrial habitat use was at least in part a response to seasonal high flows. Basking sites are an important habitat element (Jennings and Hayes 1994) and basking occurs on substrates include rocks, logs, banks, emergent vegetation, root masses, and tree limbs (Reese undated). Terrestrial activities include basking, overwintering, nesting, and moving between ephemeral sources of water (Holland 1991). During the terrestrial period, Reese and Welsh (1997) found that radio-tracked WPT were burrowed in leaf litter.

Breeding activity may occur year-round in California, but egg-laying tends to peak in June and July in colder climates, when females begin to search for suitable nesting sites upslope from water. Adult WPTs have been documented traveling long distances from perennial watercourses for both aestivation and nesting, with long-range movements to aestivation sites averaging about 820 ft, and nesting movements averaging about 295 ft (Rathbun et al. 2002). Introduced species of turtles (e.g., red-eared sliders [*Trachemys scripta elegans*]) are likely to compete with western pond turtle for basking sites, while bullfrogs and predatory fish species may prey on hatchling western pond turtles. Major factors cited as limiting WPT populations include loss of aquatic habitats, elevated nest and hatchling predation, reduced availability of nest habitat, and road mortality (BLM and USFWS 2009).

CDFW (2018a) reports six occurrences of WPT in the Project Vicinity, none of which are in Camp Far West Reservoir or the mainstem of the lower Bear River. The occurrences were: 1) in Dry Creek about 2.5 mi west of Wheatland, approximately 8.5 mi from Camp Far West Dam; 2) the south end of Wood Duck Slough, 2 mi north of Nicolaus, approximately 16.7 mi from Camp Far West Dam; 3) the upper end of Best Slough, South of Beale Air Force Base, approximately 4.3 mi from Camp Far West Dam; 4) along Dry Creek, approximately 1-mi east of the junction of Spenceville Road and Waldo Road in the Spenceville Wildlife Area, approximately 4.3 mi from Camp Far West Dam; 5) along Dry Creek, approximately 1.3 mi east of the junction of Spenceville Road and Waldo Road in the Spenceville Wildlife Area, approximately 4.4 mi from Camp Far West Dam; and 6) along the north bank of Dry Creek about 0.25 west/southwest of Shingle Falls and 1.6 miles northeast of Spenceville Rd at Nichols Rd within the Spenceville Wildlife Area, approximately 4.2 miles from Camp Far West Dam. No incidental observations of western pond turtle were recorded during relicensing studies. Through a search of the literature, no other studies or known occurrences of WPT were found in Camp Far West Reservoir or the lower Bear River.

3.3.3.1.2 Aquatic Invasive Species

The USFWS Fisheries Program defines aquatic invasive species (AIS) as "aquatic organisms that invade ecosystems beyond their natural, historic range and may harm native ecosystems or commercial, agricultural, or recreational activities."[9] Although most AIS are nonindigenous (i.e., exotic or non-native in origin), also included in this category are native species that grow out of control in their natural habitats due to excessive nutrients, warmer waters, or other factors. The USGS maintains a list of AIS, including reported geographical locations (USGS 2018a). Based on a search of the USGS Non-indigenous Aquatic Animals database (USGS 2018a) and the CalWeedMapper database (Cal-IPC 2018a) and other information, two AIS occur in Camp Far West Reservoir and one in the sewage ponds in the recreation areas. These are: 1) Asian clam (*Corbicula fluminea*); 2) floating water primrose (*Ludwigia peploides* ssp. *montevidensis*); and 3) American bullfrog (*Lithobates catesbeianus*). Eight other AIS are known to occur with 100 mi of Camp Far West Reservoir. These are: 1) New Zealand mudsnail (*Potamopyrgus antipodarum*): 2) Carolina fanwort (*Cabomba caroliniana*); 3) Brazilian waterweed (*Egeria densa*); 4) water hyacinth (*Eichhornia crassipes*); 5) hydrilla (*Hydrilla verticillata*); 6) parrot's feather milfoil (*Myriophyllum aquaticum*); 7) Eurasian watermilfoil (*Myriophyllum spicatum*) and 8) curly leaf pondweed (*Potamogeton crispus*). Table 3.3.3-6 lists these two mollusks (snails and bivalves), eight aquatic plants and one amphibian, and provides information, including listing status, on each.

Table 3.3.3-6. Aquatic invasive species known or with the potential to occur in the Project Vicinity.

Common Name/ Scientific Name	Status	Habitat Requirements	Located Within Project Vicinity
AIS KNOWN TO OCCUR IN CAMP FAR WEST RESERVOIR			
Asian clam *Corbicula fluminea*	None[1]	Freshwater lakes, reservoirs and streams, and often bury themselves in sandy, bottom sediments	Yes. In 2014, Asian clams were reported in Camp Far West Reservoir at NSRA and SSRA boat launches (USGS 2018c)
Floating water primrose *Ludwigia peploides ssp. montevidensis*	Cal-IPC 'high' species	Shallow, stagnant, nutrient-rich water such as flood control channels, irrigation ditches, and holding ponds	Yes. The species was located during SSWD's relicensing Botanical Resources Study at the NSRA and SSRA in Camp Far West Reservoir.
American bullfrog *Lithobates catesbeianus*	None[1]	Quiet waters of ponds, lakes, reservoirs, irrigation ditches, streams, and marshes	Yes. The species was located at multiple locations adjacent to Camp Far West Reservoir, but not within the Reservoir, during SSWD's relicensing studies, including at both recreation area sewage ponds. Also observed during surveys for the 2013 Biological Assessment (specific locations not indicated) (ESA 2013).
Subtotal	*4*		
AIS THAT DO NOT OCCUR WITHIN CAMP FAR WEST RESERVOIR, BUT ARE KNONW TO OCCUR WITHIN 100 MILES OF THE RESERVOIR			
New Zealand mudsnail *Potamopyrgus antipodarum*	C.C.R. 14 Section 671(c)(10), Restricted Species	Freshwater and brackish lakes, reservoirs and streams	No. Closest known occurrence is on the Yuba River below the Highway 20 bridge, approximately 10 mi from the Project (USGS 2018h).
Carolina fanwort *Cabomba caroliniana*	CDFA Q-rated	Mud of stagnant to slow-flowing water, including streams and smaller rivers	No. The closest occurrence to the Project is in Snodgrass Slough in Sacramento County, approximately 70 mi away (Cal-IPC 2018b).
Brazilian waterweed *Egeria densa*	Cal-IPC 'high' species	Slowly moving non-turbid shallow waters of lakes, springs, ponds, streams, and sloughs	No, this species was reported in the Camp Far West quad, but without specific location Cal-IPC 2018b).

[9] Available online: https://www.fws.gov/fisheries/ans/index.html

Table 3.3.3-6. (continued)

Common Name/ Scientific Name	Status	Habitat Requirements	Located Within Project Vicinity
AIS THAT DO NOT OCCUR WITHIN CAMP FAR WEST RESERVOIR, BUT ARE KNONW TO OCCUR WITHIN 100 MILES OF THE RESERVOIR (cont'd)			
Water hyacinth *Eichhornia crassipes*	Cal-IPC 'high' species CDFA C-rated	Both natural and man-made freshwater systems (e.g., ponds, sloughs and rivers)	No. The nearest occurrences of water hyacinth is just north of Mount Vernon Road in the neighboring Lincoln quadrangle, about 15 mi southeast of Camp Far West Reservoir (Cal-IPC 2018b).
Hydrilla *Hydrilla verticillata*	C.C.R. 3 Section 3962(a)(1) Cal-IPC 'high' species CDFA A-rated	Freshwater lakes, ponds, and slow-moving waters	No, the closest occurrence of hydrilla to the Project is in Placer County (Wolf quadrangle), south of Fenton Ravine, approximately 1 mi south and downstream of Camp Far West Reservoir (Cal-IPC 2018b).
Parrot's feather milfoil *Myriophyllum aquaticum*	Cal-IPC 'high' species	Ponds, lakes, rivers, streams, canals, and ditches, usually in still or slow-moving water, but occasionally in faster-moving water of streams and rivers	No. The species has been reported to be located 3.5 mi northwest of Camp Far West Reservoir, within the Beale Air Force Base (USGS 2018k).
Eurasian watermilfoil *Myriophyllum spicatum*	Cal-IPC 'high' species CDFA C-rated	Surface of freshwater lakes, ponds, and slow-moving waters	Yes. The species has been reported to be located 0.5 mi northwest of Camp Far West Reservoir just outside the NSRA (Cal-IPC 2018b).
Curly leaf pondweed *Potamogeton crispus*	Cal-IPC 'moderate' species	Quiet waters, especially brackish, alkaline, or eutrophic waters of ponds, lakes, and streams	No. Curly leaf pondweed has been located about 12 mi south of the Project in Placer County (in neighboring Wolf quadrangle), but has not been documented from Camp Far West Reservoir (Cal-IPC 2018b).
Subtotal	*7*		
Total	**11**		

Key:
[1] Although not formally listed, these species are invasive and of interest to natural resource agencies, including the CDFW and USFWS, for their impacts on native species.
Cal-IPC Inventory (Cal_IPC 2018a):
High: Species with severe ecological impacts; high rates of dispersal; ecologically widely-distributed
Moderate: Species with substantial and apparent ecological impacts; moderate to high rates of dispersal; ecologically limited to widespread
California Department of Food and Agriculture
A: Those organisms of known economic importance subject to state enforced action (i.e., eradication, quarantine regulation, containment, rejection or other holding action)
Q: Those organisms requiring temporary "A" action
C: Those organisms subject to no state-enforced action outside of nurseries except to retard spread OR no state-enforced action except to provide for pest cleanliness in nurseries.
Sources: Cal-IPC 2018a; CDFA 2018; USGS 2018a

Two other AIS - zebra mussel (*Dreissena polymorpha*) and quagga mussel (*Dreissena rostriformis bugensis*) - do not occur within 200 mi of the Project, but are included here because of the serious concern for these species in California.

Each of the AIS listed in Table 3.3.3-6 and zebra and quagga mussels is described below.

AIS Known to Occur in Camp Far West Reservoir

<u>Asian Clam</u>

Asian clam is a small (around 0.2-in.), freshwater mollusk, native to temperate and tropical southern Asia, eastern Mediterranean and the Southeast Asian islands to Australia. This species was first located in the U.S. in 1938 in the Columbia River and is believed to have been brought by Chinese immigrants as food. People have spread the species through bait buckets, aquaculture and intentional introductions for consumption (USGS 2018b).

In California, Asian clams are also known in the Sacramento and San Joaquin drainages, Santa Barbara County south to San Diego County, the Salton Sea and the San Francisco Bay (USGS 2018b).

Asian clams can inhabit freshwater lakes, reservoirs and streams, and often bury themselves in sandy, bottom sediments. These clams can foul complex power and water systems and have temporarily closed down nuclear power plants and weakened concrete structures in the U.S. An inhibiting factor for the species is temperature, as they have a low tolerance to cold temperatures, which can cause their populations to fluctuate (USGS 2018c). Nonetheless, Asian clams are well-established in Lake Tahoe, an area with winter time freezing temperatures, at depths from 5 ft to 250 ft, though the individuals are smaller than those in warmer waters (TERC 2015). The species is also sensitive to salinity, drying, low pH and siltation (USGS 2018b).

Management methods for Asian clam include mechanical (e.g., scraping colonies off substrate), bottom barriers, suction removal and chemical and temperature alteration, though some of these techniques cannot be used in many water bodies (USGS 2018b).

In 2014, an unspecified number of Asian clam specimens were collected in Camp Far West Reservoir at the NSRA and SSRA boat launches (USGS 2018c).

<u>Floating Water Primrose</u>

Several native and non-native water primrose species are found in California. Native species include floating water primrose (*Ludwigia peploides peploides*). Non-native species include Uruguay water-primrose (*L. hexapetala*) and creeping water primrose (*L. peploides* ssp. *montevidensis*), among others. Water primrose is part of the aquatic plant Subfamily Ludwigioideae (Family Onagraceae), of which most species are native to South America. Water primroses are floating to emergent perennials with stems up to 10 ft long. Flowers have five petals and are bright yellow (DiTomaso et al. 2013). Stems from dense mats in waterways, reaching above and below the water surface (Cal-IPC 2018b).

Water primrose is found throughout the central and northern Central Valley, especially in Sacramento, Yuba, and Sutter counties and the Sacramento-San Joaquin Delta.

Water primrose reproduces vegetatively (roots, rhizomes, and plant fragments) and by seed, although seedlings are rarely encountered (DiTomaso et al. 2013). Water primrose establishes in areas with disturbed hydrology, high nutrient loading and flooding. The species favors areas of shallow, stagnant, nutrient-rich water such as flood control channels, irrigation ditches, and holding ponds. It is a freshwater aquatic vascular plant that is able to persist in both wet and dry transitional zones, such as lakes, ponds, reservoirs, rivers, stream, canals, bogs, marshes, riparian and bottomland habitats (Cal-IPC 2018b).

Water primrose's main mode of dispersal is by flowing water when floating mats or shoots break off, however water primrose fragments can catch onto boats and other watercraft which spreads plants to new areas. The species has also been documented to be consumed and possibly transported by ducks and other waterfowl. It is a common ornamental plant and believed to be widely-spread by humans. Since it thrives in nutrient-rich waters, its spread may be facilitated by nursery cultivation/commercial use and animals (Cal-IPC 2018b).

Water primrose is rated as a "high" level invasive by the Cal-IPC, meaning "*the species has severe ecological impacts on physical processes, plant and animal communities, and vegetation structure*" (Cal-IPC 2018b).

Incidental sightings of floating water primrose were found in ponds within the Camp Far West Reservoir off of the NSRA and SSRA during SSWD's Botanical Resources Study.

American Bullfrog

The American bullfrog is a large frog with an average snout to vent length ranging between 3.5 and 8 in. Its color varies, with most individuals being light green to dark olive green, with dark spots and blotches. Adult American bullfrogs are opportunistic feeders taking insects, worms, crustaceans, birds, bats, rodents, lizards, snakes, turtles, newts, and other frogs and tadpoles (Nafis 2018; CDFW 2017a).

American bullfrogs occur near permanent or semi-permanent water throughout California, including the quiet waters of ponds, lakes, reservoirs, irrigation ditches, streams, and marshes.

In California, breeding and egg-laying occur from March to July (CDFW 2017a). Reproduction begins when the air temperature reaches a certain level (measured at one location in Kansas at 70°F [Nafis 2018]). Females deposit 10,000 to 20,000 eggs in disk-shaped masses about 1 egg thick and 1 ft to 5 ft in diameter. Eggs are deposited among aquatic plants or brush growing on the bottom. In some localities, they may produce more than one clutch per season. Tadpoles use shallow waters near shore while completing development, which can take up to 6 months. Individuals in many populations overwinter as tadpoles and transform during their second year (CDFW 2017a).

As demonstrated by their diet and high tadpole survival rates, bullfrogs are adaptable. In addition, they are not as sensitive to temperature and pollution as California's native frogs. Bullfrogs are found at elevation ranges from sea level to 6000 ft (Zeiner et al. 1988). In desert regions, they occur along the Mojave and Colorado rivers and in areas where irrigation creates suitable habitat. Bullfrogs can travel great distances, especially during wet periods (CDFW 2017a).

Native to central and eastern North America, American bullfrogs were introduced to California and the West for their meat (legs), as biological controls for insects, and accidentally during fish stocking. Most fish appear to be averse to eating American bullfrog tadpoles because of their undesirable taste and, other than people, the adult American bullfrog has few predators. Nevertheless, American bullfrog tadpoles, and some adults, are preyed upon by aquatic insects, fish, garter snakes, wading birds, and probably a few nocturnal mammals (CDFW 2017a).

As a result of their feeding behaviors and adaptability to natural and manmade aquatic environments, larval and post-metamorphic lifestages of American bullfrogs prey upon and are able to out-compete native frogs and other aquatic species. Additionally, American bullfrogs are a known carrier of chytrid fungus, which causes the potentially fatal skin disease in frogs called chytridiomycosis. Chytridomycosis is believed to be a leading cause of the decline of native amphibian populations all over the world and responsible for the extinction of over 100 species since the 1970s (CDFW 2017a).

Management methods for American bullfrogs are limited to localized populations, as eradicating bullfrogs from large waterbodies is currently infeasible. Currently, there are only a few methods for managing bullfrogs, including chemical control, bullfrog-specific traps and hunting. Prevention remains the best means of management (Snow and Witmer 2010).

American bullfrogs were located at multiple locations north and south of Camp Far West Reservoir during SSWD's relicensing studies at Camp Far West Reservoir in 2016 and 2017, including in sewage ponds at both recreation areas.

AIS Within 100 Miles of Camp Far West Reservoir

New Zealand Mudsnail

New Zealand mudsnail is a small (around 0.16 to 0.24 in.), freshwater mollusk, native to the lakes and streams in New Zealand and nearby small islands. Ballast water discharge from commercial cargo ships into the Great Lakes is most likely responsible for their introduction into the U.S. Since then, recreationists and recreational and commercial boating have facilitated their spread westward (USGS 2018g).

New Zealand mudsnails can inhabit freshwater and brackish lakes, reservoirs and streams. They can tolerate siltation and benefit from disturbance and high nutrient flows. These snails can compete with other grazers and cause decreases in species richness. Reduction in algal production can rapidly reduce food resources for native species. An inhibiting factor for the species is temperature, as it cannot tolerate temperatures below freezing or above 93°F (USGS 2018g).

There are a couple of potential management strategies for New Zealand mudsnails, mostly for small waterbodies that can be isolated from the rest of a system. Methods include chemical control and draining water to allow substrate to heat and freeze. CDFW has suggested methods for decontaminating equipment and boats after using them in known infested waters (CDFW 2015a).

Under C.C.R. 14 § 671(c)(9)(A), New Zealand mudsnails are listed as a Restricted Species, which means it is "*unlawful to import, transport, or possess live (New Zealand mudsnail)…except under permit issued by the department.*" Additionally, pursuant to this regulation, New Zealand mudsnails are termed "detrimental," which means they pose a threat to native wildlife, the agricultural interests of the state, or to public health or safety.

The closest known location of New Zealand mudsnails to the Project is on the Yuba River downstream of the Highway 20 Bridge. The species is fairly widespread in California (USGS 2018h).

Carolina Fanwort

Carolina fanwort or fanwort is a submersed, sometimes floating, but often rooted, freshwater perennial plant. Its shoots are grass green to olive green or sometimes reddish brown. The leaves are of two types: submersed and floating. The submersed leaves are finely divided and arranged in pairs on the stem. The floating leaves, when present, are linear and inconspicuous, with an alternate arrangement. They are less than 0.5-in. long and narrow (i.e., less than 0.25-in.) (DiTomaso 2010). Flowers are on stalks rising from the tips of stems and are white to pink to purplish and about 0.5-in. across (DiTomaso et al. 2013)

Fanwort grows rooted in the mud of stagnant-to slow flowing water, including streams and smaller rivers. The plants flower from May to September. Although seeds are produced, there is little known about seed viability or soil longevity. Like most aquatic plants, fanwort reproduces vegetatively from small fragments. In the late summer, fanwort stems become brittle, which causes the plant to break apart, facilitating its distribution and invasion of new water bodies (DiTomaso 2010).

In California, there have been sightings of fanwort in Contra Costa, Sacramento, and San Joaquin counties, and it is present in the Sacramento-San Joaquin Delta. The species is native to the eastern U.S., but has spread beyond its range both in North America and on other continents (DiTomaso 2010).

Mechanical control can contribute to the spread of fanwort since it easily fragments, however a venture dredge, which acts like a giant vacuum cleaner, can minimize fragmentation and extract the rootball. Draining a waterbody can provide temporary control of fanwort; growth can be suppressed if areas are dewatered in high temperatures and allowed to dry or dewatered during hard freezes. Potential biological control agents have been identified and are currently being investigated in the laboratory in Argentina, but no successful field releases have been made. Some of the same herbicides used to control Brazilian waterweed and water hyacinth can be used to control fanwort (DiTomaso et al. 2013).

The closest occurrence to the Project is in Snodgrass Slough in Sacramento County, approximately 70 mi away (USGS 2018i).

Brazilian Waterweed

Brazilian waterweed[10] is a fast-growing, shallow-water perennial aquatic plant that grows rooted in mud, submerged or floating, with stems up to 15 ft long and 1/8-in. thick. Its leaves are small, smooth, spear-shaped, 1 to 2.5 in. long, 0.06 to 0.12-in. wide, arranged in whorls of three to six leaves, with many whorls along stem. It displays prominent white flowers extending 1.5 in. above the water surface on long, thread-like flower tubes attached to stems (SFEI 2014; DiTomaso et al. 2013).

All populations of Brazilian waterweed in the western U.S. reproduce vegetatively by stolon and stem fragments as all plants are male and no fruit is produced. Although similar in appearance to hydrilla, Brazilian waterweed does not produce tubers or turions. Plants easily break into free-floating fragments and disperse to new areas by water flow, waterfowl, and human activities

[10] Also known as "*Egeria elodea*" or "Brazilian elodea."

such as fishing and boating. However, only fragments with a double node can develop into new plants (DiTomaso et al. 2013).

Native to South America, Brazilian waterweed was introduced to California more than 30 years ago and now infests approximately 12,000 ac of the 61,619 surface ac of the Sacramento-San Joaquin Delta. Commonly sold as aquarium decor, it may have been introduced to the Delta when dumped by an aquarium owner (DBOW 2012). Brazilian waterweed is found throughout the California Central Valley, especially between Stockton and Butte counties, and in the Sacramento-San Joaquin Delta and tributaries.

Brazilian waterweed prefers slowly moving non-turbid shallow waters of lakes, springs, ponds, streams, and sloughs, rarely establishing itself greater than 20 ft below the surface. Brazilian waterweed's growth is affected by nutrient status, light intensity, day length, temperature, turbidity, salinity, and rate of water flow. The plant inhabits acidic to alkaline waters and is highly susceptible to iron deficiencies and salinity. In the Delta, plants grow year-round with maximum growth occurring in the spring. Ideal temperatures range between 50°F and 80°F, but in climates with colder temperatures, Brazilian waterweed senesces in winter (SFEI 2014).

Mechanical control and herbicides are effective methods of control. However, Brazilian waterweed can propagate from small sections of stem, so repeated treatments are often necessary for full control (Cal-IPC 2018b). Triploid grass carp may be a good option for control, as Brazilian waterweed is one of its most preferred diets, although a permit is required from CDFW for possession and use of this species. DBOW conducts annual treatments for Brazilian waterweed and is the only agency in California authorized to use herbicides in the Delta and its tributaries. In 2016, DBOW conducted herbicide treatments from March through November, including in the Sacramento area, on 1,529 surface water acres (DBOW 2017).

Brazilian waterweed is given a "high" invasive plant rating by the Cal-IPC, meaning "*the species has severe ecological impacts on physical processes, plant and animal communities, and vegetation structure*" (Cal-IPC 2018a).

The nearest known Brazilian waterweed occurrence to the Project is a record within the Camp Far West quadrangle (i.e., not in or adjacent to the reservoir) in 2011 (Cal-IPC 2018a). The population within the quadrangle was noted as high in abundance, but not spreading due to a saturated ecological niche according to CalWeedMapper (Cal-IPC 2018a). Brazilian waterweed is currently not under management in this quadrangle (Cal-IPC 2018a).

<u>Water Hyacinth</u>

Water hyacinth is a free-floating perennial. It has bushy, fibrous roots and is often found in large mats on the water surface measuring tens or hundreds of feet in diameter. Seedlings are most often rooted in mud along shorelines or on floating mats. Leaves are round or oval and shiny green and 3 to 8 in. across. Buoyant bulbs are present at the base of the leaf stalks an attached to a thick erect stem which can grow up to 2 ft tall (DiTomaso et al. 2013; Cal-IPC 2018b). Water hyacinth flowers are pale blue, purple to whitish with six petals (Cal-IPC 2018b).

Water hyacinth can be found in both natural and man-made freshwater systems (e.g., ponds, sloughs and rivers). It cannot tolerate brackish or saline water with salinity levels above 1.8

percent. Water hyacinth obtains nutrients directly from the water and can double its size every ten days in hot weather. Water hyacinth's transpiration rate is calculated to be almost eight times the evaporation rate of open water. It alters water quality beneath the mats by lowering pH, dissolved oxygen and light levels, and increasing carbon dioxide and turbidity (Cal-IPC 2018b).

Vegetative reproduction occurs from late spring through fall. Water hyacinth reproduces primarily from pieces of runners, and in as little as a week, the number of individuals can double. Plant fragments can spread via a number of mechanisms, "daughter" plants break off and float downstream, or the stout leaves act like sails and float downstream en masse. Water hyacinth also reproduces by seed which can spread by water flow and clinging to the feet or feathers of birds. Seeds require warm, shallow water and high light intensity for germination. Seeds can remain viable in sediment for 15 to 20 years (Cal-IPC 2018b; DiTomaso et al. 2013).

Native to Central and South America, water hyacinth was introduced into the U.S. in 1884 as an ornamental plant for water gardens. By 1904, water hyacinth had made its way into Yolo County, California. In California, water hyacinth typically is found below 660 ft elevation in the Central Valley, San Francisco Bay Area, and South Coast (Cal-IPC 2018b). The Sacramento-San Joaquin Delta and several of the rivers draining into the Delta are heavily infested.

At present, aquatic herbicides remain the primary tools available to control water hyacinth. Two weevils and a moth have been introduced as biological controls, but have not demonstrated much success. Most animals, except rabbits, do not readily eat the plant, possibly because its leaves are 95 percent water and have a high tannin content (Cal-IPC 2018b). The DBOW conducts annual treatments for water hyacinth and is the only agency in California currently authorized to use herbicides in the Delta and tributaries. In 2014, DBOW treated 4,445 surface acres of water hyacinth with herbicides and an additional 4,100 surface acres mechanically (DBOW 2017).

Cal-IPC gives water hyacinth a "high" invasive plant rating, meaning 'the species has severe ecological impacts on physical processes, plant and animal communities, and vegetation structure' (Cal-IPC 2018b).

The nearest occurrences of water hyacinth to the Project Area is north of Mount Vernon Road, in the neighboring Lincoln quadrangle, about 15 miles southeast of Camp Far West Reservoir (Cal-IPC 2018a).

<u>Hydrilla</u>

The submerged aquatic perennial hydrilla has small spear-shaped leaves up to 1-in. long and 1 to 4 mm-wide, with toothed edges, arranged in whorls of usually 5 to 8 leaves, with many whorls along each stem. Typically, it is found in shallow (i.e., less than 11.5 ft) water, but if the water is clear enough it may be found growing to depths of 48 ft (DiTomaso et al. 2013; Cal-IPC 2018b).

Hydrilla grows rapidly in spring and summer, creating dense mats in freshwater lakes, ponds, and slow-moving waters. In spring, when water temperatures exceed 60°F, hydrilla begins to grow, producing large amounts of biomass by late summer and early fall. It can tolerate some salinity and is sometimes found in upper estuaries. It grows better on mud than on sand. Growth is enhanced in water with agricultural runoff that raises nutrient levels. Dieback of above-ground portions of the plant usually occurs in late fall and winter (Cal-IPC 2018b).

Hydrilla can reproduce by fragmentation of stems, rhizomes, root crowns, and by the production of tubers and turions. The plant is most likely to spread when fragments are carried into new waterbodies by recreational watercraft or water dispersal. Once established, it produces a bank of tubers and turions in the soil that may remain viable for three to five years (Cal-IPC 2018b).

Hydrilla was imported into the U.S. from Asia in the late 1950s for aquarium use. In California, hydrilla was first found in Yuba County in 1976 (Cal-IPC 2018b) and has since been found in 17 of California's 58 counties. The California Department of Food and Agriculture (CDFA) implements and eradication program specifically for hydrilla. The CDFA has successfully eradicated hydrilla from fourteen counties and currently conducts hydrilla eradication efforts in four counties throughout California integrating various methods of control, though the last posted report is from 2013 (CDFA 2018). The closest occurrence of hydrilla to the Project is in Placer County about 4 miles away in a pond (USGS 2018j).

Manual removal of hydrilla can be used for small infestations, but herbicides are usually necessary for large infestations. Sterile triploid grass carp (*Ctenopharyngodon idella*) are approved for hydrilla control in the Imperial Irrigation District drainage system in southeastern California by permit issued by CDFW (Cal-IPC 2018b, SFEI 2014).

Hydrilla is listed by the CDFA as an A-rated noxious weed, which means "*a pest of known economic or environmental detriment and is either not known to be established in California or it is present in a limited distribution that allows for the possibility of eradication or successful containment* (and is) *subject to state enforced action involving eradication, quarantine regulation, containment, rejection, or other holding action*" (CDFA 2015). CDFA implements an ongoing program to eradicate hydrilla from California. Yuba and Nevada counties are designated hydrilla eradication areas pursuant to C.C.R. 3 § 3962(a)(1). Cal-IPC gives hydrilla an invasive plant rating of "high," meaning "*the species has severe ecological impacts on physical processes, plant and animal communities, and vegetation structure*" (Cal-IPC 2018b).

The closest occurrence of hydrilla to the Project is in Placer County (Wolf quadrangle), south of Fenton Ravine, approximately 1 mile south and downstream of Camp Far West Reservoir (Cal-IPC 2018a).

<u>Parrot's Feather Milfoil</u>

Parrot's feather milfoil is a stout aquatic perennial that forms dense mats of intertwined brownish rhizomes in water (CDFA 2016). Stems are mostly submerged and can grow up to 16 ft in length. Submersed leaves are arranged in whorls of three to six per node; emergent leaves are similar in appearance but are slightly thicker. Additionally, emerged leaves are light gray-green and resemble a bottlebrush. The bottlebrush appearance results from the fact that the leaves appear in whorls of four to six at each node and each leaf is feather-like, the blade divided into twenty-four to thirty-six thread-like segments. Unlike other milfoils (*Myriophyllum* spp.), parrot's feather stems may grow as much as 8 in. above the water surface (DiTomaso et al. 2013).

Parrot's feather milfoil occurs in ponds, lakes, rivers, streams, canals, and ditches, usually in still or slow-moving water, but occasionally in faster-moving water of streams and rivers. It tolerates soft to very hard water and a pH range of 5.5 to 9.0. It does not tolerate brackish water and requires high light conditions (USGS 2018k). In north and central California, it is wide spread through the Central Valley and North Coast, especially in Mendocino, Butte, Yuba, and Sutter counties, with occurrences also in Nevada and Placer counties.

Introduced from South America as an aquarium plant and pond ornamental in the late 1800s to early 1900s, parrot's feather milfoil grows best in tropical regions and can survive freezing by becoming dormant. In California, parrot's feather milfoil grows most rapidly from March until September. In spring, shoots begin to grow rapidly from overwintering rhizomes as water temperature increases. Underwater leaves tend to senesce as the season advances. Plants usually flower in the spring, but may also flower in the fall (CDFA 2016).

With its tough rhizomes, parrot's feather milfoil can be transported long distances on boat trailers. Any rhizome or stem sections with at least one node, even as small as 0.2-in. long, can root and establish new plants. Rhizomes stored under moist conditions in a refrigerator survived for one year. Once rooted, these new plants produce rhizomes that spread through sediments and stems that grow until they reach the water surface (CDFA 2016). Most plants in its introduced range are female, thus only populations within its native range develop seed (DiTomaso et al. 2013).

Biological, mechanical, and chemical controls have all been attempted by researchers. Of the available methods, chemical control seems to hold the most promise for control of this milfoil. Biological control is largely ineffective, with many typical aquatic herbivores finding the plant unpalatable. Mechanical control is difficult because of the species' ability to regenerate from a small fragment of the original plant and its rapid growth rate, requiring many repeated treatments to control an infestation. There are several chemical treatments that have shown promise, but many do not specifically target milfoil and may damage native aquatic species as well (Cal-IPC 2018).

Parrot's feather milfoil is listed by the CDFA as a C-rated noxious weed, which means "*A pest of known economic or environmental detriment and, if present in California, it is usually widespread. If found in the state, they are subject to regulations designed to retard spread or to suppress at the discretion of the individual county agricultural commissioner. There is no state enforced action other than providing for pest cleanliness*" (CDFA 2016).

Parrot's feather milfoil is given a "high" invasive plant rating by the Cal-IPC, meaning "*the species has severe ecological impacts on physical processes, plant and animal communities, and vegetation structure*" (Cal-IPC 2018a).

The species was reported to be located 3 mi northwest outside of Camp Far West Reservoir, within Beale Air Force Base (USGS 2018k). The population within the Camp Far West quadrangle is being managed and decreasing (Cal-IPC 2018b).

<u>Eurasian Watermilfoil</u>
Eurasian watermilfoil grows submerged, rooted in mud or sand, with branching stems 12 to 20 ft long that widen towards the root. Its leaves are finely divided, feather-like, 0.5 to 1.5 in. long and whorled in groups of 3 to 6 (commonly 4) around the stem. Its spike of flowers, 1.5 to 3.0 in. long, extends up from water surface, typically pink (DiTomaso et al. 2013).

Watermilfoil grows rapidly in spring (March-April), creating dense mats on the surface of freshwater lakes, ponds, and slow-moving waters (Cal-IPC 2018b). In the early 1990s, it was present, but uncommon, in San Francisco Bay Area's ditches and lake margins, as well as in the Sacramento-San Joaquin Delta (SFEI 2014). The University of Reno reports that in 2002, Eurasian watermilfoil covered over 160 ac of Lake Tahoe (Donaldson and Johnson 2002). Watermilfoil is now widespread throughout California, especially through the Central Valley in the Sacramento River Watershed, its tributaries, and the Delta.

The key factor for the establishment of Eurasian watermilfoil is still water (Donaldson and Johnson 2002). Eurasian watermilfoil reproduction is primarily vegetative via rhizomes, stem fragments, and axillary buds. Some populations produce seeds, although seed reproduction appears to be insignificant (DiTomaso et al. 2013). Watermilfoil can tolerate a wide range of environmental conditions, including low light levels, high or low nutrient waters, and freezing water temperatures. In waters where temperatures do not drop below 50°F, there is little seasonal die-back; high temperatures promote multiple periods of flowering and fragmentation. Eurasian watermilfoil also creates its own habitat by trapping sediment and initiating a favorable environment for further establishment. It is an opportunistic species that prefers disturbed substrates with much nutrient runoff (Cal-IPC 2018b). This watermilfoil can grow on sandy, silty, or rocky substrates, but grows best in fertile, fine-textured, inorganic sediments. The plant will thrive in brackish waters with a salinity of up to 10 parts per thousand. As the plant is easily spread by vegetative fragments, transport on boating equipment plays the largest role in contaminating new water bodies. A single stem fragment hitching a ride on a boat or trailer can spread the plant from lake to lake (Donaldson and Johnson 2002).

Efforts are underway to identify insects which are native to Nevada or California that prey on the plant and help control Eurasian watermilfoil. A North American native milfoil weevil (*Euhrychiopsis lecontei*) has been identified in several studies in other states and Canada as a possible control species. Triploid grass carp may also be an effective biocontrol mechanism; however, grass carp prefer other submerged plants, including native species, to watermilfoil (DiTomaso et al. 2013). Other control techniques for this species includes mechanical removal, herbicide treatment, benthic barriers (such as mats to prevent establishment), and tillage (Cal-IPC 2018b). Mechanical removal can help remove stem densities, but escaped stem fragments can drift to other areas and develop into new plants (DiTomaso et al. 2013). The most effective technique is to prevent its spread to and establishment in new waterbodies.

Eurasian watermilfoil is given a "high" invasive plant rating by the Cal-IPC, meaning "*the species has severe ecological impacts on physical processes, plant and animal communities, and vegetation structure*" (Cal-IPC 2018a).

The species has been reported to be located 0.5 mi northwest outside of Camp Far West Reservoir(Cal-IPC 2018b). The population within the Camp Far West quadrangle is being managed and decreasing (Cal-IPC 2018b).

<u>Curly Leaf Pondweed</u>

The genus *Potamogeton* contains many widespread, variable species that are difficult to tell apart (Cal-IPC 2018b). All are native to California, except curly leaf pondweed, whose distinguishing characteristic is very wavy (undulate) leaves. Native to Eurasia, Africa and Australia, curly leaf pondweed can grow up to 0.8-in. in length and be found in water as deep as 4.7 in. (DiTomaso et al. 2013).

Most pondweeds reproduce vegetatively from rhizomes or stem fragments. Curly leaf pondweed is unusual as it both flowers and fruits in late spring and early summer, at which time it also produces turions, a wintering bud resembling brown pinecones, that becomes detached and remains dormant at the bottom of the water body it inhabits (Cal-IPC 2018b; DiTomaso et al. 2013). Turions can survive unfavorable conditions. The plants become dormant over the summer and decay, contributing to eutrophic conditions, leaving only their fruits and turions in the waterbody. The turions germinate in late summer or fall, and the plants overwinter as small plants only a few centimeters in size. Growth then continues as the water begins warming in the spring (DiTomaso et al. 2013).

Curly leaf pondweed is widely distributed throughout California, and is found throughout the Central Valley and northern Sierra foothills. The plant's production of both seed and turions makes it resistant to disturbance such as dredging. Their small size allows them to be easily transported attached to waterfowl, boats, or fishing gear (Cal-IPC 2018b).

Laboratory and field studies have found that germination is generally controlled by temperature, light intensity, photoperiod, and anoxic conditions. It grows in the fine substrates and quiet (standing or slow moving) calcium-rich waters of lakes, reservoirs, ponds, rivers, streams, springs, small ponds and ditches and is tolerant of a wide-range of water quality conditions. It can grow in clear to turbid and polluted waters, and in alkaline or brackish waters; and it is tolerant of significant nutrient pollution. The species is shade intolerant (Cal-IPC 2018b).

Effective control of curly leaf pondweed is difficult because of its vegetative reproduction. Mechanical removal can help remove stem densities, but escaped stem fragments can drift to other areas and develop into new plants. Bottom barriers can be used to cover and smother pondweed infestations. Dredging can be used to remove infestations in canals and other waterbodies. Pond drawdowns or canal detwatering may be used to suppress growth of pondweed, but plants can still resprout from rhizomes in moist, cool bottom sediments (DiTomaso et al. 2013). Triploid grass carp (*Ctenopharyngodon idella*) have also been used as a biological control mechanism, however these fish do not selectively feed on non-native plants and a permit is required by CDFW for possession and use of these fish in California. Broadcast chemical control has proved to be effective, but can damage native species (Cal-IPC 2018b).

Curly leaf pondweed is rated as a "moderate" invasive plant by the California Invasive Plant Council (Cal-IPC), which means the "*species has substantial and apparent - but generally not severe - ecological impacts on physical processes, plant and animal communities, and vegetation structure*" (Cal-IPC 2018b).

Curly leaf pondweed has been located about 12 miles south of the Project in in Nevada Placer County and (in neighboring Wolf quadrangle), but has not been documented from Camp Far West Reservoir (Cal-IPC 2018a).

Zebra and Quaaga Mussels

Zebra Mussel

Zebra mussel is a small (around 0.2-in.), freshwater mollusk, native to the Black, Caspian and Azov seas. Ballast water discharge from a single commercial cargo ship into the Great Lakes in 1988 is responsible for their introduction into the U.S. Since then, larval drift and recreational and commercial boating have facilitated their spread (USGS 2018d).

Zebra mussel can inhabit freshwater lakes, reservoirs and streams and colonize any stable substrate. It can also settle on submerged plants and be transported with them on bait buckets, fishing gear or boats. The mussel can cause damage to hydroelectric facilities and ecosystems once they invade a system. It clogs water intakes and fish screens, as well as impede recreation opportunities by growing on recreation facilities (Forest Service 2016).

In addition, zebra mussel consume large quantities of microscopic plants and animals, which are the basis of native communities, and thus, lead to the disturbance of the natural ecosystem, harming plants and wildlife (USFWS 2011). A single female can lay 40,000 eggs in a single reproductive cycle and up to one million in a spawning season (USGS 2018d).

Zebra mussel can tolerate only very low salinity (USGS 2018d). Currently, the best scientific data indicates that if calcium levels are low (i.e., less than 12 mg/L), introduced adult zebra mussels will not survive and veligers will not develop (Claudi and Prescott 2011). Additionally, marginal sites can be determined for their ability to support zebra mussels by the concentration of calcite. A minimum calcite value of ~0.9 is necessary for supporting zebra mussels long-term (Prescott et al. 2014). There are other water quality parameters that appear to also limit the ability of zebra mussel adults to survive and veligers to successfully develop, including pH, hardness and water temperature. Calcium carbonate solubility increases as pH decreases. In spite of adequate calcium, if the pH is low (i.e., less than 7.3 units) shells will become thin as they lose calcium to the external environment (Claudi and Prescott 2011). However, initial introduction can occur under a broader range of conditions.

Extensive research is currently being conducted on the management of zebra mussel once it has invaded a waterbody and although there are promising leads; prevention is the only effective management strategy (USGS 2018d). Research on natural enemies, both in Europe and North America, has focused on predators, particularly birds (i.e., 36 species) and fish (i.e., 53 species that eat veligers and attached mussels). The vast majority of the organisms that are natural enemies in Europe are not present in North America. Ecologically similar species do exist; however, they have not been observed preying on zebra mussel at levels that limit populations. In California, native and non-native species predators include redear sunfish (*Lepomis microlophus*), smallmouth bass (*Micropterus dolomieu*) diving ducks and crayfish (Hoddle 2011). At the San Justo Reservoir, the United States Department of the Interior, Bureau of Reclamation is conducting an experiment to eradicate the zebra mussel infestation using muriate of potash. As of December 2017, an experiment had been conducted to determine the response of the mussel to different doses. Future plans include treating all of San Justo Reservoir when funding is available (USBR 2017b).

The Federal Lacey Act (18 U.S.C. 42) lists zebra mussel as injurious wildlife, whose importation, possession, and shipment within the U.S. is prohibited. If found, any zebra mussel brought into the U.S. will be promptly destroyed or exported by the USFWS at the cost of the importer.

Under C.C.R. 14 § 671(c)(10), zebra mussel is listed as a Restricted Species, which means it is "unlawful to import, transport, or possess (zebra mussels)…except under permit issued by the department." Additionally, pursuant to this regulation, all species of *Dreissena* are termed "detrimental," which means they pose a threat to native wildlife, the agricultural interests of the state, or to public health or safety.

In addition, F.G.C. §§ 2301 and 2302 provide specific regulations on dreissenid mussels, including zebra mussel. F.G.C. § 2301 states that nobody shall: "possess, import, ship, or transport in the state, or place, plant, or cause to be placed or planted in any water within the state, dreissenid mussels." This law gives the director of CDFW, or his or her designee, the right to conduct inspections of conveyances, order conveyances to be drained, impound or quarantine conveyances, and close or restrict access to conveyances to prevent the importation, shipment, or transport of dreissenid mussels. Additionally, F.G.C. § 2301 requires a public or private agency that operates a water supply to prepare and implement a plan to control or eradicate dreissenid mussels if detected in their water system. This law also requires any entity which discovers dreissenid mussels to immediately report the finding to CDFW.

Pursuant to F.G.C. § 2302, any person, or Federal, state, or local agency, district, or authority that owns or manages a reservoir where recreational, boating, or fishing activities are permitted, shall: 1) assess the vulnerability of the reservoir for introduction of dreissenid mussels; and 2) develop and implement a program designed to prevent the introduction of dreissenid mussels. At a minimum, the prevention program shall include: public education, monitoring, and management of the recreational, boating, and fishing activities that are permitted. As of 2017, the CDFW has developed a Guidance for Developing a Dreissenid Mussel Prevention Program to include all the requisite pieces of the program (CDFW 2017b). Per the regulations, SSWD drafted a Dreissenid Mussel Vulnerability Assessment in May 2019 for submission to the CDFW. This document includes a prevention program, which features public education and a monitoring program for the dreissenid mussels. The prevention program will include posted signs and pamphlets, which will describe how to clean boats and not to use boats between different waterbodies without cleaning and/or completely drying them out. As the prime vector for the introduction and spread of AIS, this will help prevention the introduction and spread of more than just zebra mussel. This document has been submitted to the CDFW.

The closest current known location of zebra mussel to the Project Area is the currently-closed San Justo Reservoir in California, approximately 200 mi south of the Project (USBR 2017b). There are no other known zebra mussel occurrences in California or Nevada (USGS 2018e).

<u>Quagga Mussel</u>

Quagga mussel is a small (up to 1.6 in.) freshwater mollusk, native to the Dnieper River drainage of Ukraine and Ponto-Caspian Sea. Ballast water discharge from transoceanic liners carried the mussel to North America, and larval drift and recreational and commercial boating have facilitated their spread. Quagga mussel was first found in the U.S. in 1989 in the Great Lakes and have since moved west (USGS 2017).

Quagga mussel can inhabit freshwater lakes, reservoirs and streams and colonize soft and hard substrates. Like zebra mussel, quagga mussel can cause tremendous damage to hydro facilities and aquatic ecosystems once they invade a system. It clogs water intakes and fish screens, as well as impede recreation opportunities by growing on recreation facilities (USGS 2017). Quagga mussels, like zebra mussels, consume large quantities of microscopic plants and animals, which are the basis of native communities, and thus, lead to the disturbance of the natural ecosystem, harming plants and wildlife (USFWS 2011); and they cannot survive in water with salinity over 5 parts per thousand (USGS 2017). Management of quagga mussel is similar to that described above for zebra mussel.

Like zebra mussel, quagga mussel is listed as Restricted under C.C.R. 14 Section 671 (c)(10), regulated under F.G.C. Sections 2301 and 2302. SSWD's May 2019 draft Dreissenid Mussel Vulnerability Assessment covers both zebra and quagga mussels.

In California, quagga mussels are in Southern California, with the closest occurrence to the Project approximately 500 mi south (USGS 2018f).

3.3.3.1.3 Aquatic Resources of the Bear River Area

Information regarding aquatic resources in the Project Vicinity is provided below by: 1) immediately upstream of the Project (NID's Lake Combie to Camp Far West Reservoir); 2) within Camp Far West Reservoir; and 3) from Camp Far West Dam to the Feather River (i.e., lower Bear River). Information regarding mercury in fish, including fish ingestion advisories is discussed in Section 3.3.2.1.4 of this Exhibit E.

Upstream of the Project

Fish

Table 3.3.3-7 lists 12 fishes that are known or suspected to occur in the Bear River upstream of Camp Far Reservoir. For the most part, the fish assemblage is composed of native warmwater species.

Table 3.3.3-7. Fish species know to occur or with the potential to occur upstream, within, and downstream of the Project in alphabetical order.

Common Name	Scientific Name	Status	Native / Introduced	Upstream of Camp Far West Reservoir	In Camp Far West Reservoir	Downstream of Camp Far West Reservoir
American shad	*Alosa sapidissima*	--	I	NR	O	P
Black bullhead	*Ameriurus melas*	--	I	NR	O	NR
Black crappie	*Pomoxis nigromaculatus*	--	I	NR	O	NR
Bluegill	*Lepomis macrochirus*	--	I	NR	O	O
Brown bullhead	*Ameriurus nudbulosus*	--	I	NR	O	NR
Brown trout	*Salmo trutta*	--	I	NR	O	NR
Channel catfish	*Ictalurus punctatus*	--	I	NR	O	O
Chinook salmon	*Oncorynchus tshawytscha*	NMFS-S, CSC	N	NA	NA	O
Common carp	*Cyprinus carpio*	--	I	NR	O	O
Common shiner	*Luxilus cornutus*	--	I	NR	NR	O

Table 3.3.3-7. (continued)

Common Name	Scientific Name	Status	Native / Introduced	Upstream of Camp Far West Reservoir	In Camp Far West Reservoir	Downstream of Camp Far West Reservoir
Goldfish	*Carassius auratus*	--	I	NR	O	O
Green sturgeon	*Acipenser medirostris*	FT	N	NA	NA	P
Green sunfish	*Lepomis cyanellus*	--	I	NR	O	O
Hardhead	*Mylopharodon conocephalus*	CSC	N	P	O	P
Inland silverside	*Menidia beryllina*	--	I	NR	O	O
Largemouth bass	*Micropterus salmoides*	--	I	NR	O	O
Steelhead / Rainbow trout	*Oncorynchus mykiss*	FT[1]	N	O	P	O
Mosquitofish	*Gambusia affinis*	--	I	NR	NR	O
Pacific lamprey	*Entosphenus tridentatus*	--	N	NA	NA	O
Prickly sculpin	*Cottus asper*	--	N	P	P	O
Pumpkinseed	*Lepomis gibbosus*	--	I	NR	NR	O
Redear sunfish	*Lepomis microlophus*	--	I	NR	O	O
Riffle sculpin	*Cottus gulosus*	--	N	P	P	O
Sacramento hitch	*Lavinia exilicauda*	--	N	P	O	P
Sacramento perch	*Archoplites interruptus*	--	N	P	O	P
Sacramento pikeminnow	*Ptychocheilus grandis*	--	N	O	O	O
Sacramento splittail	*Pogonichthys macrolepidotus*	CSC	N	NA	NA	P
Sacramento sucker	*Catostomus occidentalis*	--	N	O	O	O
Sacramento-San Joaquin roach	*Lavinia s. symmetricus*	CSC	N	P	P	P
Smallmouth bass	*Micropterus dolomieu*	--	I	O	O	O
Speckled dace	*Rhinichthys osculus ssp.*	--	N	P	P	P
Spotted bass	*Micropterus punctulatus*	--	I	O	O	O
Striped bass	*Morone saxitilis*	--	I	NR	O	P
Threadfin shad	*Dorosoma petenense*	--	I	NR	O	NR
White sturgeon	*Acipenser transmontanous*	CSC	N	NA	NA	P
White catfish	*Ameiurus catus*	--	I	NR	O	O
White crappie	*Pomoxis annularis*	--	I	NR	O	O
	Subtotal	*7*	--	*12 – 10 Native, 2 Introduced*	*29 – 10 Native, 19 Introduced*	*33 – 15 Native, 18 Introduced*
	Total	**37 Species**				

Sources: CDFW 2012b, ECORP 2014, CDFW unpublished data

Key: O = observed, P = potential to occur (based on available information), NR = no record, NA = outside of historic range; N = Native; I = Introduced, NMFS-S = NMFS Species of Concern, CSC = California Species of Special Concern, FT = Threatened under ESA

[1] The anadromous form of *O. mykiss* is federally threatened, although the resident form is not recognized under this listing.

Yardas and Eberhart (2005) identified flow-related improvement needs and opportunities along with identifying key challenges in the reach between Camp Far West Reservoir and NID's Lake Combie. They concluded that contemporary conditions in this section of the Bear River are such that ecological justifications for improved flows are limited, especially when compared to the lower Bear River or the various foothill streams that continue to support anadromous fish. The authors state that colder water temperatures due to improved summer/fall flows may help to reduce the potential for mercury methylation in this reach and Camp Far West Reservoir, but could also lead to potential conflicts with non-native fisheries. Yardas and Eberhart also noted that any change to flows would require the development of multiple agreements and understandings with various agencies, companies, districts, and private water rights holders.

In addition, Yardas and Eberhart (2005) cite John Hiscox (CDFW biologist, retired) who states that the reach between Lake Combie and Camp Far West Reservoir is reputed to be a renowned area for bass fishing. He surmises during high flow events, game fish likely wash into the river from stocked ponds on private property. Mr. Hiscox states this reach is predominantly located in a deep canyon such that improved flows would likely provide few riparian benefits, and that the reach is predominantly private land holdings and provides few opportunities for public access. Mr. Hiscox speculated that flow improvements below Combie Dam may result in both operational and structural improvement needs.

The North Central Region (NCR) (CDFW 2012a) conducted fish community surveys in October 2011 including two locations in the Bear River: 1) upstream of Camp Far West Reservoir (BR 1); and 2) downstream of Lake Combie (BR 2). The fish community surveys focused on collecting reconnaissance level fish community data utilizing single or multiple pass depletion electrofishing methods. Data relative to species composition, temporal and spatial distribution, and presence or absence of species were collected.

At the sampling location upstream of Camp Far West Reservoir (BR1), a total of 54 fish representing four species was collected during the survey. Species collected were represented by smallmouth bass (n=26, 48.1%), Sacramento sucker (n=21, 38.9%), Sacramento pikeminnow (n=5, 9.3%) and rainbow trout (n=2, 3.7%). Only six smallmouth bass were collected at the sampling location downstream of Lake Combie Dam (BR2).

At the request of NID, ECORP Consulting, Inc. (ECORP) (ECORP 2014) conducted reach assessments within an approximately 5.5 mi section of the Bear River from Lake Combie to Wolf Creek to define and understand the aquatic and sediment resources. A total of 50 smallmouth bass and two spotted bass (*Micropterus punctulatus*) were observed in mid-channel pool and flatwater habitats. Most (78%) of the smallmouth bass were young-of-year and the two spotted bass were in the 1+ age class.

Benthic Macroinvertebrates

As part of ECORP's (2014) study, benthic macroinvertebrate (BMI) samples were collected and identified. In general, Ephemeroptera (EPT) taxa (mayflies, stoneflies, caddisflies), which are important prey items for fish, were present in relatively low quantity. There was also a greater abundance of tolerant species (e.g. blackflies) than intolerant species (e.g. midges), indicating the Bear River is a warm-water system with more environmental stressors. When compared with other area rivers (South Fork American River, North Fork Mokelumne River, and Middle Fork Yuba River), the Bear River in the area examined by ECORP had the lowest species diversity (i.e. taxa richness) and the lowest quantity of EPT taxa.

In 2013, one sample collection was conducted in the Bear River upstream of Camp Far West Reservoir, near Little Wolf Creek (RM 24.0), as part of the Surface Water Ambient Monitoring Program (SWAMP) Statewide Perennial Streams Assessment (SWRCB 2013). While the data provided did not include any BMI metric calculations, the 14 orders and 30 families identified during sampling suggest a diverse assemblage of BMIs (Table 3.3.3-8). However, only seven of the 30 families found were from the EPT taxa suggesting a more stressed warm-water system.

Table 3.3.3-8. Orders and families of aquatic macroinvertebrates that were found at one location in the Bear River (upstream of the Project).

Order	Amphipoda (scuds)	Basommatophora (snails)	Coleoptera (aquatic beetles)	Odonata (dramsel and dragonflies)	Trombidiformes (mites)	Hemiptera (true bugs)
Family	Hyalellidae	Planorbidae	Elmidae	Coenagrionidae	Hygrobatidae	Naucoridae
	Crangonyctidae	Physidae	Psephenidae	--	Torrenticolidae	--

Table 3.3.3-8. (continued)

Order	Ephemeroptera (mayflies)	Veneroida (clams)	Rhynchobdellida (leeches)	Lepidoptera (aquatic moths)	Megaloptera (hellgrammites)	Hoplonemertea (worms)
Family	Caenidae	Corbiculidae	Glossiphoniidae	Pyralidae	Corydalidae	Tetrastemmatidae
	Baetidae	--	--	--	--	--
	Leptohyphidae	--	--	--	--	--
Order	**Diptera (true flies)**	**Trichoptera (caddisflies)**	--	--	--	--
Family	Ceratopogonidae	Helicopsychidae	--	--	--	--
	Chironomidae	Hydroptilidae	--	--	--	--
	Ceratopogonidae	Hydropsychidae	--	--	--	--
	Simuliidae	Philopotamidae	--	--	--	--
	Empididae	Leptoceridae	--	--	--	--

Source: SWRCB 2013.

Camp Far West Reservoir

Fish

Camp Far West Reservoir supports a warmwater fishery, primarily for bass. Table 3.3.3-7 lists 29 fishes that are known or suspected to occur in Camp Far West Reservoir, two-thirds of which are introduced species.

Since Camp Far West Reservoir's enlargement in 1963, stocking of warmwater game fish species by CDFW has occurred. Largemouth bass (*Micropterus salmoides*), smallmouth bass, redear sunfish, white crappie (*Pomoxis annularis*), and channel catfish (*Ictalurus punctatus*) were the first species stocked in the reservoir by CDFG. In 1965, CDFG decided to create a striped bass (*Morone saxatilis*) sport fishery in Camp Far West Reservoir. Stocking records and memoranda between CDFG employees indicated that the striped bass fishery never took hold in the reservoir. In the late 1960s, CDFG's stocking of striped bass ceased and CDFG's efforts shifted to focus on improving the smallmouth bass fishery. Limited available data documented fish survey and stocking records from 1964 through 1985, with some missing years, were obtained from CDFW and are summarized in Table 3.3.3-9 (CDFG unpublished data). There is currently no stocking in Camp Far West Reservoir by SSWD or any Resource Agency.

Table 3.3.3-9. Camp Far West Reservoir stocking records summary from 1964 to 1985, with missing years excluded from row entries.

Year	Common Name	Scientific Name	Lifestage	Quantity (pounds)
1964	Largemouth bass	*Micropterus salmoides*	NA[1]	60,734
	Smallmouth bass	*Micropterus dolomieu*	NA	8,098
	Redear sunfish	*Lepomis microlophus*	NA	12,000
	White crappie	*Pomoxis annularis*	NA	249
	Channel catfish	*Ictalurus punctatus*	NA	10,000
1966	Smallmouth bass	*Micropterus dolomieu*	Fry	18,500
	Striped bass	*Morone saxitilis*	NA	18,707
1967	Smallmouth bass	*Micropterus dolomieu*	Fry, Fingerlings	24,000
	Striped bass	*Morone saxitilis*	NA	23,835
1973	Smallmouth bass	*Micropterus dolomieu*	Fry	1,500,000
1976	Smallmouth bass	*Micropterus dolomieu*	Yearlings	5,050
1978	Smallmouth bass	*Micropterus dolomieu*	Yearlings	5,050
1979	Smallmouth bass	*Micropterus dolomieu*	NA	430
	Channel catfish	*Ictalurus punctatus*	NA	4,030

Table 3.3.3-9. (continued)

Year	Common Name	Scientific Name	Lifestage	Quantity (pounds)
1980	Smallmouth bass	*Micropterus dolomieu*	NA	4,300
1985	Spotted bass	*Micropterus punctulatus*	Adults	40
Total				7 Species 1,659,023 Pounds

Source: CDFG unpublished data.
[1] Information not available from CDFW.

In addition to the species listed in Table 3.3.3-9, CDFW records indicated that white catfish (*Ameiurus catus*) and threadfin shad (*Dorosoma petenense*) were stocked prior to 1980, but no additional details were available (CDFW unpublished data).

Internal memoranda between CDFG staff in the 1970s and 1980s also indicated the presence of 11 fishes in Camp Far West Reservoir, not stocked by CDFW, including: 1) bluegill; 2) green sunfish (*L. cyanellus*); 3) Sacramento perch; 4) brown bullhead (*Ameiurus nebulosus*); 5) black bullhead (*A. melas*); 6) common carp (*Cyprinus carpio*); 7) Sacramento hitch; 8) hardhead; 9) Sacramento sucker; 10) American shad (*Alosa sapidissima*) and; 11) Sacramento pikeminnow.
More recently, in April 2012, CDFG (CDFG 2012b) conducted boat electrofishing surveys at nine sites in Camp Far West Reservoir. The total numbers of individuals for each species are summarized is Table 3.3.3-10, but no other information was available.

Table 3.3.3-10. CDFG 2012 Camp Far West Reservoir boat electrofishing summary of capture in descending order of abundance.

Common Name	Scientific Name	Individuals Captured
Spotted bass	*Micropterus punctulatus*	446
Bluegill	*Lepomis macrochirus*	65
Sacramento sucker	*Catostomus occidentalis*	51
White catfish	*Ameiurus catus*	20
Channel catfish	*Ictalurus punctatus*	13
Inland silverside	*Menidia beryllina*	10
Green sunfish	*Lepomis cyanellus*	8
Largemouth bass	*Micropterus salmoides*	8
Common carp	*Cyprinus carpio*	7
Smallmouth bass	*Micropterus dolomieu*	6
Redear sunfish	*Lepomis microlophus*	5
Threadfin shad	*Dorosoma petenense*	4
Goldfish	*Carassius auratus*	3
Black crappie	*Pomoxis nigromaculatus*	2
Sacramento perch	*Archoplites interruptus*	1
Brown trout	*Salmo trutta*	1
Total Catch	**--**	**650**
Total Species	**--**	**16**

Source: CDFG 2012b

Lower Bear River

As context for this discussion, in June 2015, October 2016 and August 2017, SSWD evaluated the Bear River between Camp Far West Dam and the Feather River for habitat features and channel characteristics. Meso-habitat types are dominated by pools, short riffles, runs, and long glides. The average gradient of the Bear River is generally less than 0.5 percent, with few falls, cascades, chutes, rapids, step runs, pocket water, or sheet flow habitat types. The substrate of the mapped units in the majority of the channel is dominated by gravel with mostly cobble subdominant. Sand is a minor component though is often the subdominant substrate present. Increasing amounts of exposed bedrock and cobble substrates occur closer to the non-Project diversion dam. Very little silt occurs in the active channel, though the banks are often composed of finer, sandy/silty material. Figure 3.3.3-1 and Table 3.3.3-11 provide the results of this mapping exercise. Additional discussion regarding habitat mapping is provided in Section 3.3.1 of this Exhibit E.

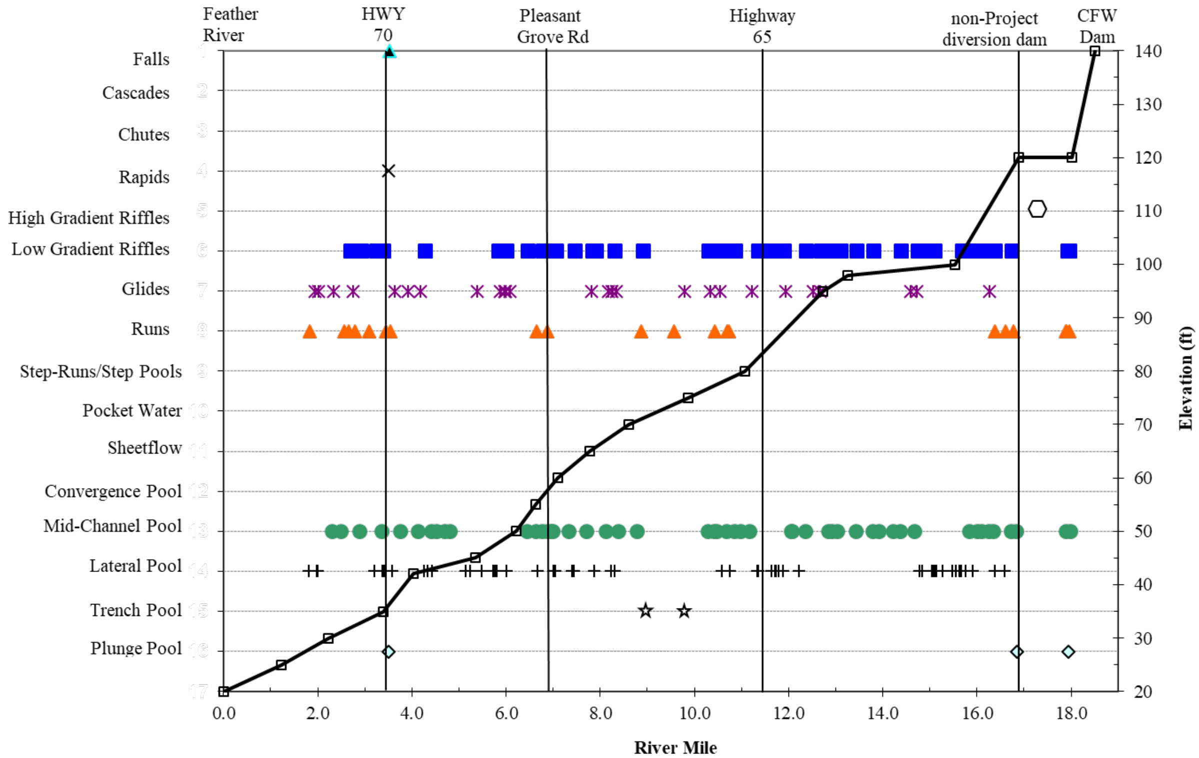


Figure 3.3.3-1. Longitudinal profile and habitat types mapped in the lower Bear River.

Table 3.3.3-11. Dominant, subdominant and bank substrate total length and frequency in the Bear River where measurements could be taken in a safe manner.

Substrate Type	Dominant Substrate		Subdominant Substrate		Bank Substrate	
	Total Length (ft)	Frequency (%)	Total Length (ft)	Frequency (%)	Total Length (ft)	Frequency (%)
Bedrock	696	4	603	4	872	7
Boulder	538	3	0	0	538	4
Cobble	4,893	27	4,577	29	1,257	10
Gravel	10,179	56	5,496	35	3,269	27
Sand	1,753	10	3,849	24	2,996	24
Silt	0	0	1,282	8	3,478	28
Total	**18,059**	**100**	**15,807**	**100**	**12,410**	**100**

LWM was quantified during SSWD's habitat mapping effort. All pieces within the active channel (1.5 yr frequency elevation) that were larger than 4-in diameter at the large end, and longer than 3 ft were tallied. LWM concentration ranged between 18 and 65 pieces per mile (1.1

to 4.0 pieces/100 m), and most of the pieces were within the wetted channel. The highest concentration of LWM was located between Highway 70 and Pleasant Grove bridges, and the lowest concentration was between Highway 65 (RM 11.5) and the CEMEX gravel operation (RM 14.2). The riparian area of the lower Bear River is heavily modified by levees and agricultural modifications, so the LWM recruitment potential is very low and outside of the control of Project operations. Additional discussion of LWM is provided in Section 3.3.1 of this Exhibit E.

Fishes

Table 3.3.3-7 lists 33 fishes that are known or suspected to occur in the lower Bear River, which for the most part are introduced and native warmwater species, with some anadromous salmonids. The most abundant species are centrarchids, occupying all reaches of the lower Bear River. Native species observed included Pacific lamprey, prickly sculpin, Sacramento sucker, Sacramento pikeminnow, and riffle sculpin. Adult Chinook salmon were observed during SSWD's redd surveys and juveniles were observed during the fish population surveys. No adult *O. mykiss* were observed, although a small number of *O. mykiss* parr were observed during the fish population surveys. SSWD did not observe any sturgeon in the lower Bear River during its studies.

SSWD's Fish Population Surveys

As part of its relicensing studies, SSWD partitioned the Bear River into five reaches: 1) Camp Far West Dam to the non-Project diversion dam; 2) the non-Project diversion dam to the Highway 65 Bridge; 3) Highway 65 Bridge to the Pleasant Grove Bridge; 4) the Pleasant Grove Bridge to the Highway 70 Bridge; and 5) Highway 70 Bridge to the Feather River (Table 3.3.3-12).

Table 3.3.3-12. Bear River reach designations.

Reach	Upstream Location	Upstream River Mile	Downstream Location	Downstream River Mile	Distance (River Miles)
1	Camp Far West Dam	18.1	Non-Project Diversion Dam	16.9	1.2
2	Non-Project Diversion Dam	16.9	Highway 65 Bridge	11.4	5.5
3	Highway 65 Bridge	11.4	Pleasant Grove Road Bridge	6.8	4.6
4	Pleasant Grove Road Bridge	6.8	Highway 70 Bridge	3.5	3.3
5	Highway 70 Bridge	3.5	Feather River Confluence	0.0	3.5
				Total	**18.1**

Table 3.3.3-13 provides the specific locations at which SSWD conducted backpack and boat electrofishing, composite snorkel and seine surveys, and eDNA sampling.

Table 3.3.3-13. Methods, dates, and locations of sampling events for Study 3.2.

Reach	Survey Type	River Mile	Date of Survey(s)	Latitude	Longitude
Reach 1	Backpack Electrofishing	17.8	10/27/2017	39.0484111	121.3192528
Reach 1	Boat Electrofishing	17.0	9/10/2018	39.042564	121.330631
Reach 2	eDNA	16.9	2/22/2017, 3/8/2017	39.0417222	121.3322222
Reach 2	eDNA	16.7	2/22/2017, 3/8/2017	39.0394444	121.3347500
Reach 2	Snorkel/Seine	15.0	10/25/2017	39.0233500	121.3544417
Reach 2	Snorkel/Seine	15.0	4/24/2018	39.02234	121.35386
Reach 2	Snorkel/Seine	15.0	5/21/2018	39.02242	121.35387
Reach 2	Snorkel/Seine	15.0	6/21/2018	39.02239	121.35389
Reach 3	eDNA	11.4	2/23/2017, 3/8/2017	38.9996667	121.4072222

Table 3.3.3-13. (continued)

Reach	Survey Type	River Mile	Date of Survey(s)	Latitude	Longitude
Reach 3	Snorkel/Seine	7.8	10/24/2017	38.9879889	121.4692667
Reach 3	Snorkel/Seine	7.8	4/25/2018	38.98764	121.47198
Reach 3	Snorkel/Seine	7.8	5/22/2018	38.98765	121.471918
Reach 3	Snorkel/Seine	7.8	6/20/2018	38.98775	121.472000
Reach 4	eDNA	5.1	3/1/2017, 3/15/2017	38.9783056	121.5166389
Reach 4	Snorkel/Seine	4.5	10/26/2017	38.9736389	121.5244111
Reach 4	Snorkel/Seine	4.5	4/26/2018	38.97362	121.52636
Reach 4	Snorkel/Seine	4.5	5/23/2018	38.960045	121.527953
Reach 4	Snorkel/Seine	4.5	6/19/2018	38.973611	121.526333
Reach 4	eDNA	4.0	3/1/2017, 3/15/2017	38.9740833	121.5349167
Reach 5	eDNA	0.6	2/28/2017, 3/15/2017	38.9434722	121.5709444

Figure 3.3.3-2 through Figure 3.3.3-4 show the locations and detections of fishes where SSWD conducted backpack and boat electrofishing, composite snorkel and seine surveys).

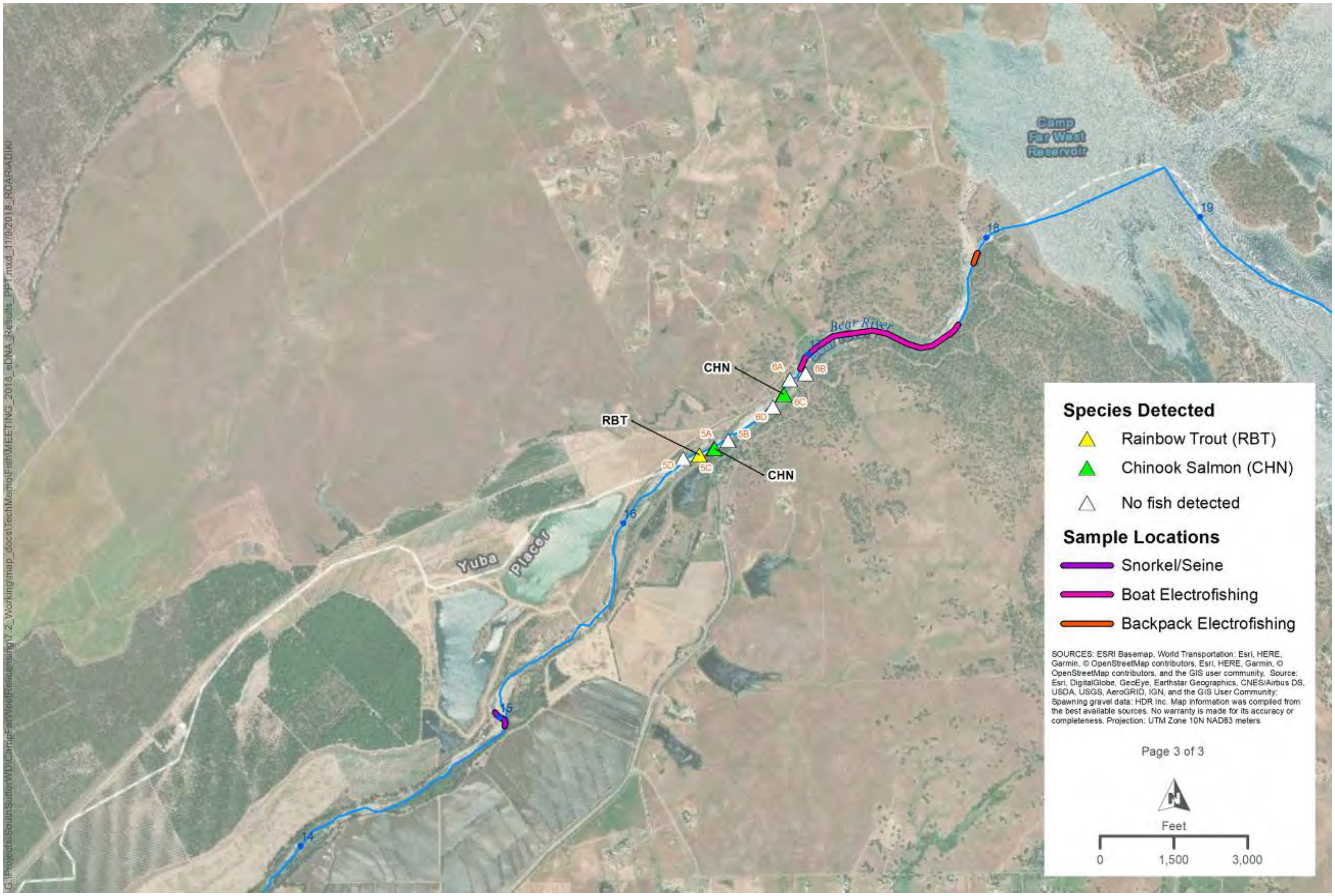


Figure 3.3.3-2. Lower Bear River Reaches 1 and 2 boat electrofishing, backpack electrofishing and snorkeling and seining sampling sites and eDNA detections.

Figure 3.3.3-3. Lower Bear River Reach 3 snorkeling and seining sampling sites and eDNA detections.

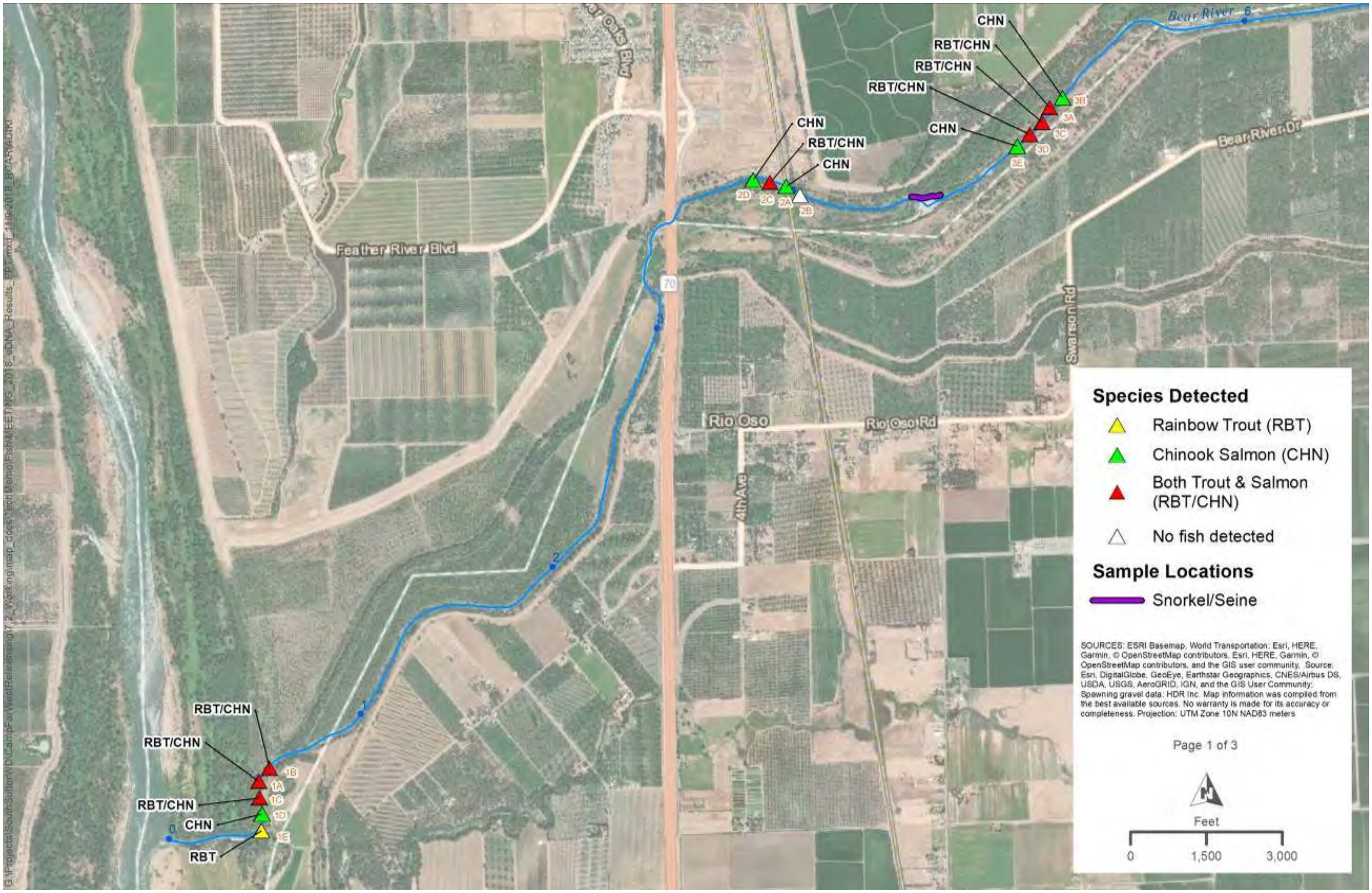


Figure 3.3.3-4. Lower Bear River Reach 4 snorkeling and seining sampling site and eDNA detections in Reaches 4 and 5.

Fish Population Surveys - Reach 1

SSWD found 14 warmwater, non-native fishes and Sacramento sucker, a native coldwater species, in Reach 1 (Table 3.3.3-14). Detailed results are provided below. In addition, 2018 summer observations made in Reaches 2 through 4 as part of water transfer fish surveys on July 24-26 and August 29-31 validated many of the general species guilds with observations of bass/sunfish, suckers, carp, and catfish. Chinook salmon and sturgeon were not observed during the summer survey period.

Table 3.3.3-14. Fishes, in alphabetical order, found in Reaches 1 through 4 during SSWD's relicensing fish population surveys.

Common Name	Scientific Name	Reach 1	Reach 2	Reach 3	Reach 4
Bluegill	*Lepomis macrochirus*	Be, Bo	Sn, Se	Sn	Sn, Se
Centrachid sp. (unknown)	--	--	--	--	Sn
Channel catfish	*Ictalurus punctatus*	Be, Bo	--	--	Sn
Chinook salmon	*Oncorynchus tshawytscha*		Sn, Se, eDNA, R	Sn, Se, eDNA, R	Sn, Se, eDNA, R
Common carp	*Cyprinus carpio*	Bo	--	--	--
Goldfish	*Carassius auratus*	Bo	--	--	--
Green sunfish	*Lepomis cyanellus*	Be, Bo	Se	Sn	Sn, Se
Inland silverside	*Menidia beryllina*	Bo	Se	--	--
Lamprey (ammocete)	*Entosphenus* spp.		Se	--	--
Largemouth bass	*Micropterus salmoides*	Bo	--	--	--
Minnow sp. (unknown)	--	--	Sn	Sn	Sn
Mosquitofish	*Gambusia affinis*	Be	Sn, Se	Sn	Sn, Se
Prickly sculpin	*Cottus asper*	--	Sn	--	--
Pumpkinseed	*Lepomis gibbosus*	--	Se	--	Se
Rainbow trout	*Oncorynchus mykiss*	--	eDNA	Sn, Se, eDNA	eDNA
Redear sunfish	*Lepomis microlophus*	Bo	--		Sn
Rifle sculpin	*Cottus gulosus*	--	--		Se
Sacramento pikeminnow	*Ptychocheilus grandis*	--	Sn, Se	Sn	Sn
Sacramento sucker	*Catostomus occidentalis*	Bo	Sn, Se	Sn	Sn, Se
Shiner spp. (unknown)		Be	--		--
Smallmouth bass	*Micropterus dolomieu*	--	--	Sn	Sn
Spotted bass	*Micropterus punctulatus*	Be, Bo	Sn, Se	Sn, Se	Sn, Se
Sculpin sp. (unknown)		--	Sn		--
White catfish	*Ameiurus catus*	Bo	--		Sn
White crappie	*Pomoxis annularis*	Be	--		--
	Subtotal	*14*	*14*	*10*	*16*
	Total	**25**			

Key: Sn = snorkeling; Be = backpack electrofishing; Bo = boat electrofishing; Se = seining; WT = observed during SSWD's visual surveys related to a 2018 water transfer; eDNA = eDNA sampling targeted Chinook salmon; *O. mykiss*; green sturgeon; and 4) white sturgeon; R = Chinook salmon redd observed.

As observed during the fish population survey, the stream fish population sample site in Reach 1 was represented by a series of riffle, pool, and glide habitat units. The channel and substrate was visibly composed of bedrock with moderate amounts of cobble. Depth was minimal and averaged 0.2 m (Table 3.3.3-15). Few locations in Reach 1 are suitable for backpack electrofishing, since most of this reach is below the inundation elevation of the non-Project diversion impoundment. The site sampled using backpack electrofishing was representative of the short, riverine portion of Reach 1.

Table 3.3.3-15. Habitat characteristics for Reach 1 backpack electrofishing site.

Habitat Characteristics		Reach 1
Timing	Sample date	October 27, 2017
Water Quality	Air temp. (C)	16.0
	Water temp. (C)	12.9
	Dissolved oxygen (mg/l)	9.8
	Conductivity (μS)	88.7
Site Characteristics	Elevation (m msl)	41.1
	Rivermile	17.8
	Site length (m)	83.8
	Average site width (m)	7.2
	Average depth (m)	0.2
	Average Maximum depth (m)	1.0
	Estimated Flow	16 cfs
Habitat Characteristics	Dominant substrate	Bedrock/Cobble
	Sub-dominant substrate	Gravel
	Number of Large Woody Debris Pieces	0
	Suitable spawning gravel (sq ft)	0
	Low-gradient riffle	38%
	% Glide	15%
	% Mid-channel Pool	45%
	% Chute	3%

In the backpack electrofishing site, multi-pass depletion sampling was conducted using two Smith Root LR-24 backpack electrofishers in October 2017. Sampling resulted in the capture of 176 individuals representing seven warmwater, non-native species. Green sunfish and spotted bass were more abundant (n=86 and n=53, respectively). Mosquitofish also represented a large proportion of the catch (24%). Spotted bass showed the broadest range of size classes (Fork Length, FL: 49 to 167mm) and represented the highest biomass (6.7 lbs/ac). Fulton's condition for spotted bass averaged above 1.0, which is considered good. Relative condition was variable with broad ranges for most species (Table 3.3.3-16 and Figure 3.3.3-5).

Table 3.3.3-16. Population summary of backpack electrofishing site in Reach 1.

Summary Metrics		Species						
		Green Sunfish	Spotted Bass	Mosquitofish	Bluegill	Channel Catfish	Shiner spp.	White Crappie
Abundance	No. captured by pass (total)	43-30-13 (86)	42-6-5 (53)	9-11-4 (24)	6-2-2 (10)	0-1-0 (1)	0-1-0 (1)	0-1-0 (1)
	Estimated abundance	104	53	33	10	1	1	1
	95% CI	83-125	51-55	11-55	7-13	1-1	1-1	1-1
	Fish/100m[1]	124.1	63.2	39.4	11.9	1.2	1.2	1.2
	Fish/mi[1]	1,996.8	1,017.6	633.6	192.0	19.2	19.2	19.2
Length (mm)	Range (Average)	32-98 (63)	49-167 (85)	21-50 (36)	52-103 (79)	112	55	56
Weight (g)	Total	396.1	498.1	13	70.1	7.3	1.5	1.3
	Range (Average)	0.4-17.1 (4.6)	1.2-53.7 (9.4)	0.1-1.3 (0.5)	2.1-15.0 (7.0)	7.3	1.5	1.3
	Total estimated weight (g)	479.0	498.1	17.9	70.0	7.3	1.5	1.3
	Weight (g)/100m	472.6	594.2	15.5	83.6	8.7	1.8	1.6
	lbs/ac	6.5	6.7	0.2	0.9	0.1	<0.1	<0.1
	kg/ha	8.0	8.3	0.3	1.2	0.1	0.03	0.02
Condition Factor	Relative – range[1]	0.67-1.42	0.73-1.89	0.51-1.83	0.44-1.22	N/A	N/A	N/A
	Fulton's – range (average)[2]	N/A	0.86-2.21 (1.17)	N/A	N/A	0.52	N/A	N/A

[1] Relative condition factor not calculated for species when n=1.
[2] Fulton's condition factor not calculated for species without a fusiform body shape, non-game species, or when n=1.

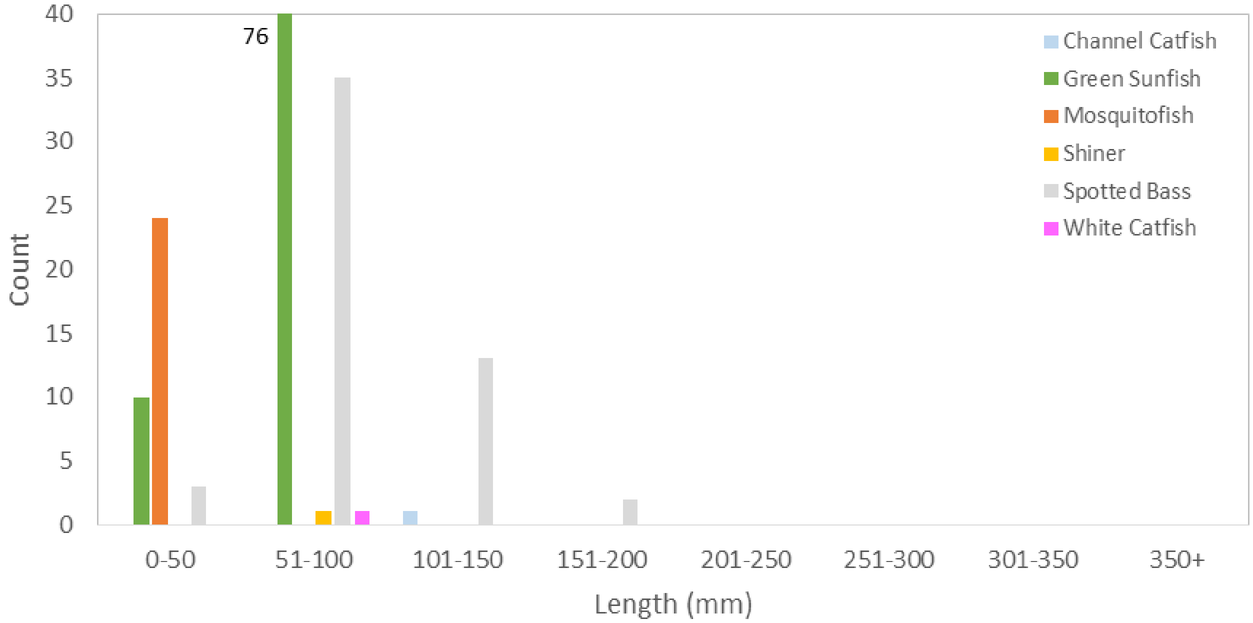


Figure 3.3.3-5. Length-frequency of fishes collected during electrofishing in Reach 1.

The impounded portion of Reach 1 was also sampled in September 2018 by boat electrofishing using a Smith Root 5.0 GPP system. The effort was divided into five unique habitat units defined by their dominant characteristics: 1) shoal and dam; 2) emergent and overhanging vegetation; 3) shoal with artificial structure; 4) drop off and overhanging vegetation; 5) and mid-channel (Figure 3.3.3-6). Average sampled depths ranged from 1.5 to 6 ft, with a maximum encountered depth of 14 ft. Boat electrofishing was completed in all areas where conditions allowed; areas of shallow water, large rocks, or heavy aquatic vegetation were not always suitable for sampling.

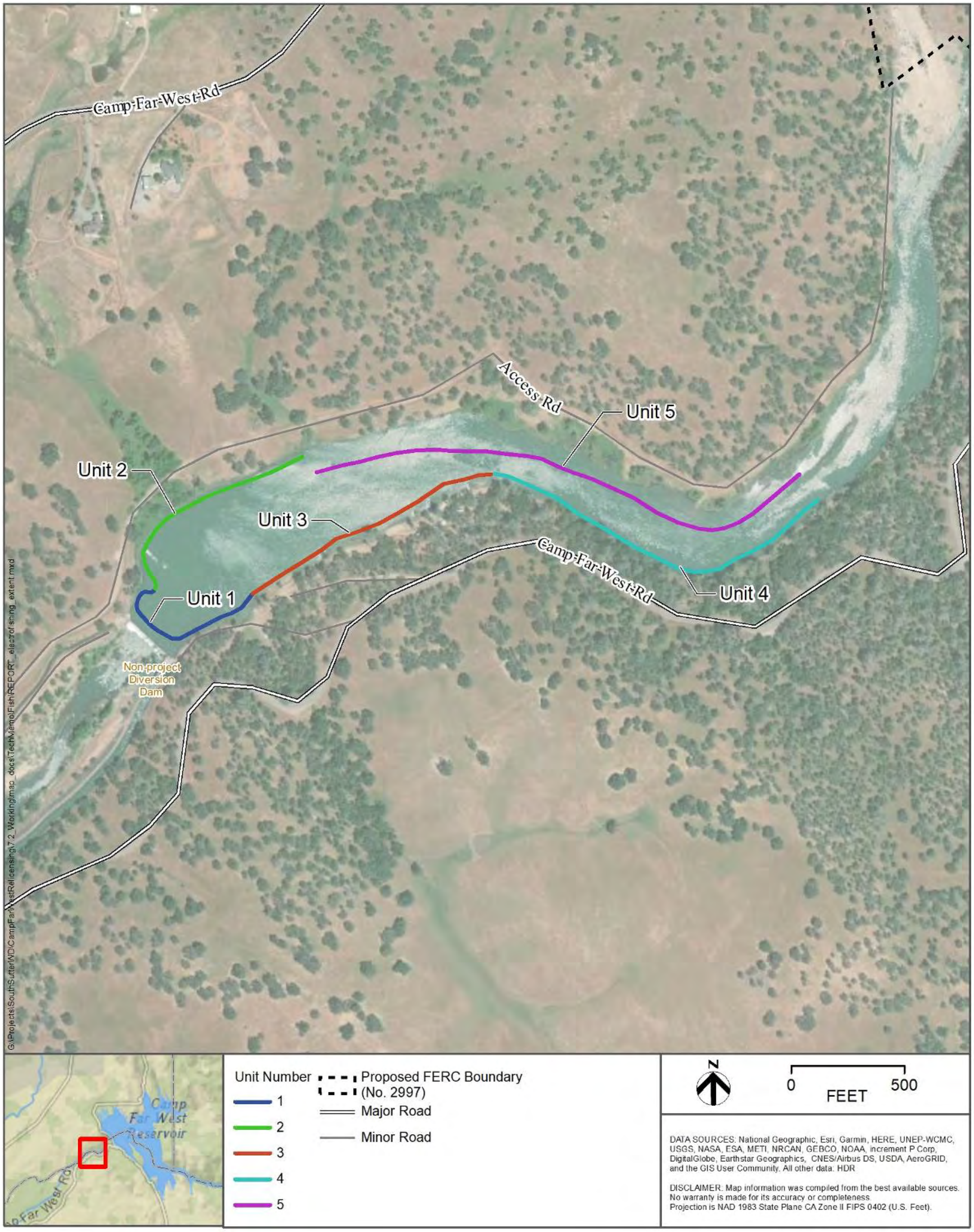


Figure 3.3.3-6. Locations of habitat units sampled during boat electrofishing.

A total of 285 individuals was captured. Bluegill (n=105), spotted bass (n=58), and Sacramento sucker (n=49) were the three more abundant species, respectively. Catch per unit effort (CPUE) (#/min) ranged from 0.8 to 5.39 per unit with an average of 2.8 over all units. Bluegill had the highest capture rate with a CPUE of 1.03 fish per minute (Table 3.3.3-17 and Figure 3.3.3-7). Units 2 and 3 yielded the highest numbers of fishes with 75 and 123 individuals captured, respectively. These units also produced the greatest number of species with 9 each (Table 3.3.3-18 and Figure 3.3.3-8).

Table 3.3.3-17. Population summary of boat electrofished habitat in Reach 1.

Common Name	Scientific Name	# Captured	Length (mm)		Weight (g)		Percent Composition	CPUE (#/min)
			Range	Mean	Range	Mean		
Bluegill	*Lepomis macrochirus*	105	62-162	109	3.7-96.9	28.5	36.8%	1.03
Spotted bass	*Micropterus punctulatus*	58	44-260	137	1.7-230.5	40.5	20.4%	0.57
Sacramento sucker	*Catostomus occidentalis*	49	76-495	412	4.2-1,540.0	913.4	17.2%	0.48
Green sunfish	*Lepomis cyanellus*	34	53-128	82	2.2-42.5	12.9	11.9%	0.33
Readear sunfish	*Lepomis microlophus*	19	70-179	128	16.0-114.9	43.6	6.7%	0.19
Silverside	*Menidia beryllina*	7	36-110	76	1.5-9.0	3.9	2.5%	0.07
Largemouth bass	*Micropterus salmoides*	5	147-400	230	38.0-890.0	279.2	1.8%	0.05
Common carp	*Cyprinus carpio*	4	507-571	539	2,170-3,450	2,670	1.4%	0.04
Goldfish	*Carassius auratus*	2	192-260	226	130-360	245	0.7%	0.02
Channel catfish	*Ictalurus punctatus*	1	482	482	1,160	1,160	0.4%	0.01
White catfish	*Ameiurus catus*	1	147	147	40.0	40.0	0.4%	0.01
Total	**11**	**285**	**--**	**--**	**--**	**--**	**100.0%**	**2.80**

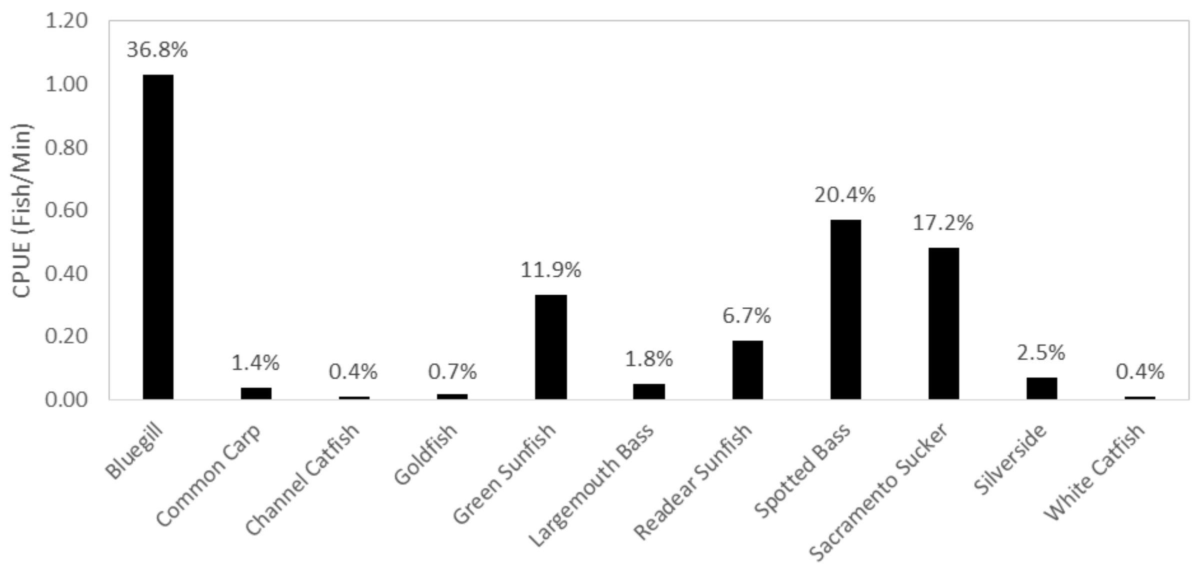


Figure 3.3.3-7. Overall CPUE (fish/min) with composition of species collected during boat electrofishing in Reach 1.

Table 3.3.3-18. Overall catch per unit effort (CPUE in fish/min) by habitat unit during boat electrofishing in Reach 1.

Species	Total Catch	Overall CPUE	Unit 1		Unit 2		Unit 3		Unit 4		Unit 5	
			Catch	CPUE	Catch	CPUE	Catch	CPUE	Catch	CPUE	Catch	CPUE
Bluegill	105	1.03	15	1.43	35	1.93	51	2.23	1	0.03	3	0.21
Spotted Bass	58	0.57	13	1.24	14	0.77	13	0.57	14	0.39	4	0.28
Sacramento Sucker	49	0.48	2	0.19	10	0.55	20	0.88	12	0.33	5	0.35
Green Sunfish	34	0.33	10	0.96	8	0.44	16	0.70	0	0.00	0	0.00
Readear Sunfish	19	0.19	1	0.10	3	0.17	15	0.66	0	0.00	0	0.00
Silverside	7	0.07	1	0.10	2	0.11	2	0.09	2	0.06	0	0.00
Largemouth Bass	5	0.05	0	0.00	1	0.06	4	0.18	0	0.00	0	0.00
Common Carp	4	0.04	1	0.10	0	0.00	1	0.04	0	0.00	2	0.14
Goldfish	2	0.02	0	0.00	1	0.06	1	0.04	0	0.00	0	0.00
Channel Catfish	1	0.01	0	0.00	1	0.06	0	0.00	0	0.00	0	0.00
White Catfish	1	0.01	0	0.00	0	0.00	0	0.00	0	0.00	1	0.07
Total Catch	**285**		**43**		**75**		**123**		**29**		**15**	
Overall #/min	**2.8**		**4.11**		**4.13**		**5.39**		**0.8**		**1.06**	

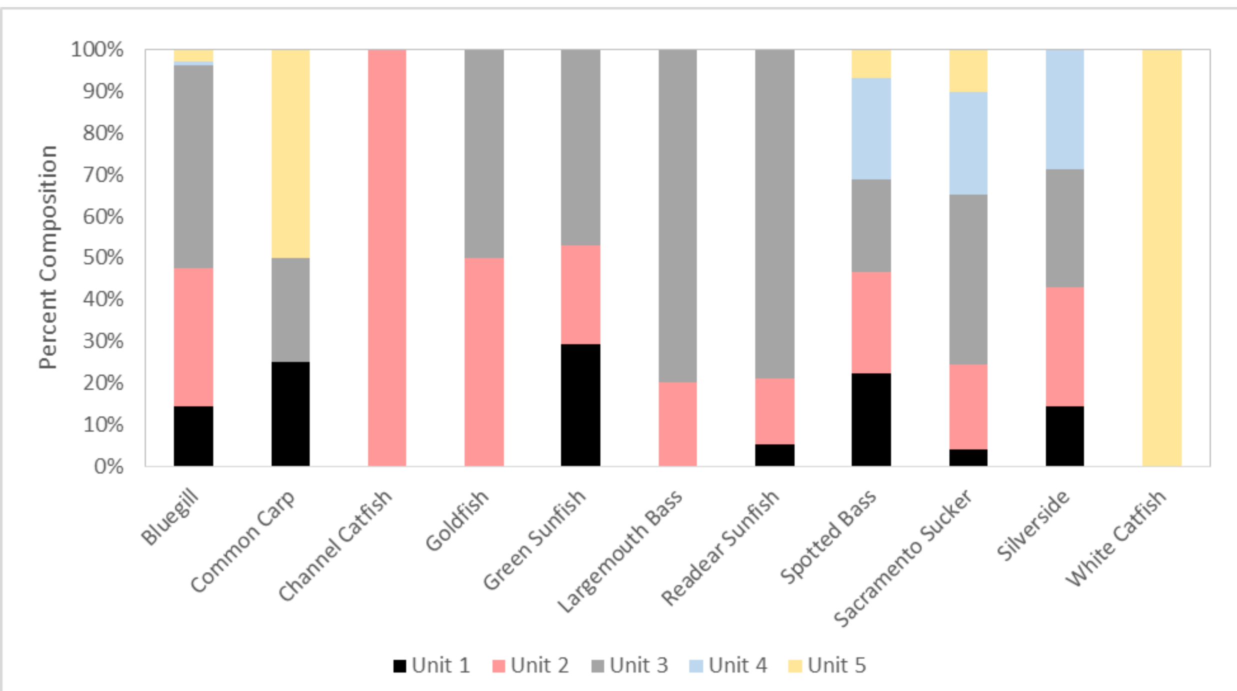


Figure 3.3.3-8. Percent composition by habitat unit during boat electrofishing in Reach 1.

Fish Population Surveys - Reaches 2 through 4

SSWD found 14, 10 and 16 fishes in Reaches 2, 3 and 4, respectively (Table 3.3.3-14). Most of the species were warmwater, introduced species. Detailed results by reach are provided below.

In accordance with Study 3.2, SSWD conducted snorkeling, seining, and eDNA sampling in Reaches 2 through 4. Fish population sample site selection prioritized representing available habitat within the selected reach and considered logistical feasibility. Sites in Reaches 2 and 3 were co-located with the Instream Flow Study sites for data comparability. The site in Reach 4 was located approximately 1 mi upstream of the Highway 70 Bridge where access was available and represented typical habitat. Table 3.3.3-19 describes habitat characteristics as observed during the fish population survey for these sites.

Table 3.3.3-19. Habitat characteristics for snorkel and seine sampling sites in Reaches 2 through 4.

Habitat Characteristics		Reach 2	Reach 3	Reach 4
Timing	Sample date	October 25, 2017 April 24, May 21, June 21, 2018	October 24, 2017 April 25, May 22, June 20, 2018	October 26, 2017 April 26, May 23, June 19, 2018
Water Quality[1]	Air temp. (C)	24.1-28.3 (26.6)	19.7-33.9 (26.1)	20.7-32.2 (26.9)
	Water temp. (C)	12.3-17.1 (15)	14.0-24.5 (19.6)	18.0-25.2 (21.1)
	Dissolved oxygen (mg/l)	9.08-10.70 (10.16)	7.79-10.40 (9.24)	7.40-10.50 (8.49)
	Conductivity (µS)	73.0-86.2 (77.1)	79.0-85.0 (82.7)	113.0-146.0 (130.7)
Site Characteristics[2]	Elevation (m msl)	29.3	21.3	20.1
	Rivermile	15	7.8	4.5
	Site length (m)[3]	139.4	265.6	170.5
	Average site width (m)	12.6	12.3	11.3
	Average depth (m)	0.5	0.3	0.6
	Average Maximum depth (m)	1.4	1.0	1.4
	Estimated Flow Range	16-246 cfs	16-37 cfs[4]	16-36 cfs[4]
Habitat Characteristics	Dominant substrate	Cobble	Gravel	Gravel
	Sub-dominant substrate	Gravel	Sand	Sand
	Fish passage impediments present	No	No	No
	Number of Large Woody Debris Pieces	0	0	0
	Suitable spawning gravel (sq ft)[5]	0-500	3,400-11,270	900-3,440
	% Low-gradient riffle	21	26	4
	% Run	11	6	7
	% Glide	8	15	26
	% Lateral Pool	27	14	0
	% Mid-channel Pool	33	38	47
	% Chute	0	2	>0
	% Trench Pool	0	0	15

[1] Water quality parameters for reaches 2 through 4 are presented as a range and (average).
[2] Site characteristics averaged overall all sampling events.
[3] Site length fluctuated with changes in habitat and flows and is averaged over all sampling events.
[4] Flows not available for the April sampling event.
[5] Spawning gravel presented as a range through all sampling events.

A three-pass composite snorkel survey and three standardized 10 m seine hauls were completed once at each site in October 2017, and April, May, and June 2018. Seining was not completed in May for Reach 4 and in June for Reaches 3 and 4, because temperatures exceeded 21°C, the maximum allowed under SSWD's CDFW scientific collecting permit. October sampling yielded an assemblage of centrarchids, sculpin, Sacramento pikeminnow, and Sacramento sucker. The spring surveys showed similar species with the addition of salmonids. Sampling results are presented in Table 3.3.3-20 for snorkeling and Table 3.3.3-21 for seining.

Table 3.3.3-20. Population summary of snorkeled habitat units in Reaches 2 through 4.

Species	Abundance						Fork length (mm)	
	# Counted by Pass (Total)	% of Total Fish Counted	Estimated abundance	95% CI	Fish/100 m	Fish/mi	Min (bin)	Max (bin)
OCTOBER 2017								
SNORKELED REACH 2 - 145.4 Meters								
Mosquitofish	131-114-102 (347)	51.8%	116	113-118	80	1,280	0-50	0-50
Spotted Bass	71-76-83 (230)	34.3%	77	75-78	53	849	0-50	151-200
Sacramento Sucker	30-10-8 (48)	7.2%	16	10-22	11	177	0-50	151-200
Sacramento Pikeminnow	13-8-7 (28)	4.2%	9	7-11	6	103	51-100	151-200
Bluegill	4-9-4 (17)	2.5%	6	3-8	4	63	0-50	51-100
SNORKELED REACH 3 - 271.3 Meters								
Spotted Bass	127-162-181 (470)	57.7%	157	152-161	58	929	0-50	251-300
Mosquitofish	77-115-130 (322)	39.6%	107	102-113	40	637	0-50	0-50
Bluegill	7-3-6 (16)	2.0%	5	4-7	2	32	0-50	101-150
Sacramento Pikeminnow	2-2-2 (6)	0.7%	2	2	1	12	151-200	251-300
SNORKELED REACH 4 - 176.8 Meters								
Sunfish species.	45-66-83 (194)	49.6%	65	60-69	37	589	0-50	201-250
Spotted Bass	40-36-30 (106)	27.1%	35	34-37	20	321	0-50	301-350
Mosquitofish	30-30-30 (90)	23.0%	30	30	17	273	0-50	0-50
Sacramento Pikeminnow	0-1-0 (1)	1.0%	1	1.0	1	9	101-150	101-150
APRIL 2018								
SNORKELED REACH 2 - 140.21 Meters								
Chinook Salmon	99-100-76 (275)	98.92%	92	89-95	65	1,052	0-50	51-100
Spotted Bass	0-0-2 (2)	0.72%	1	2	1	8	0-50	51-100
Mosquito Fish	1-0-0 (1)	0.36%	1	1	<1	4	0-50	0-50
SNORKELED REACH 3 - 270.97 Meters								
Chinook Salmon	198-270-282 (750)	75.53%	250	244-256	92	1,485	0-50	101-150
Unknown Minnow	155-0-0 (155)	15.61%	52	27-76	19	307	0-50	0-50
Bluegill	5-9-21 (35)	3.52%	12	7-17	4	69	0-50	151-200
Spotted Bass	6-11-15 (32)	3.22%	11	8-14	4	63	0-50	301-350
Rainbow Trout	10-1-6 (17)	1.71%	6	2-10	2	34	0-50	51-100
Smallmouth Bass	1-0-1 (2)	0.20%	1	1.0	<1	4	>350	>350
Sacramento Pikeminnow	1-1-0 (2)	0.20%	1	1	<1	4	51-100	101-150

Table 3.3.3-20. (continued)

Species	Abundance						Fork length (mm)	
	# Counted by Pass (Total)	% of Total Fish Counted	Estimated abundance	95% CI	Fish/100 m	Fish/mi	Min (bin)	Max (bin)
APRIL 2018 (cont'd)								
SNORKELED REACH 4 - 174.80 Meters								
Chinook Salmon	16-11-7 (34)	75.56%	11	9-14	7	104	0-50	51-100
Bluegill	0-1-7 (8)	17.78%	3	0-8	2	25	0-50	151-200
Spotted Bass	0-0-3 (3)	6.67%	1	0-4	1	9	51-100	101-150
MAY 2018								
SNORKELED REACH 2 - 119.48 Meters								
Unknown Minnow	5-35-35 (75)	45.18%	25	18-32	21	337	0-50	0-50
Chinook Salmon	3-36-33 (72)	43.37%	24	17-31	20	323	51-100	151-200
Spotted Bass	1-1-10 (12)	7.23%	4	0-9	3	54	51-100	301-350
Sacramento Pikeminnow	3-1-0 (4)	2.41%	1	0-4	1	18	51-100	151-200
Bluegill	1-0-1 (2)	1.20%	1	1	1	9	151-200	151-200
Unknown Sculpin	0-1-0 (1)	0.60%	1	1	<1	5	51-100	51-100
SNORKELED REACH 3 - 283.16 Meters								
Unknown Minnow	720-1,000-1,000 (2,720)	87.26%	907	896-917	320	5,153	0-50	0-50
Chinook Salmon	71-62-61 (194)	6.22%	65	63-66	23	368	51-100	151-200
Spotted Bass	46-36-51 (133)	4.27%	44	42-47	16	252	51-100	251-300
Bluegill	8-30-29 (67)	2.15%	22	17-28	8	127	51-100	151-200
Rainbow Trout	0-2-0 (2)	0.06%	1	2	<1	4	101-150	101-150
Smallmouth Bass	0-1-0 (1)	0.03%	1	1	<1	2	101-150	101-150
SNORKELED REACH 4 - 174.80 Meters								
Unknown Minnow	50-0-0 (50)	78.13%	17	3-31	10	153	0-50	0-50
Bluegill	2-6-5 (13)	20.31%	4	2-6	3	40	51-100	51-100
Spotted Bass	0-0-1 (1)	1.56%	1	1	<1	3	51-100	51-100
JUNE 2018								
SNORKELED REACH 2 - 119.48 Meters								
Sacramento Sucker	833-778-833 (2,444)	76.90%	815	813-817	535	8,603	0-50	0-50
Unknown Minnow	50-465-200 (715)	22.50%	238	164-313	156	2,517	0-50	0-50
Spotted Bass	5-7-5 (17)	0.53%	6	5-7	4	60	51-100	>350
Prickly Sculpin	0-1-1 (2)	0.06%	1	1	<1	7	101-150	101-150
SNORKELED REACH 3 - 237.13 Meters								
Spotted Bass	586-539-563 (1,688)	56.95%	563	561-565	237	3,819	0-50	251-300
Unknown Minnow	200-200-125 (525)	17.71%	175	169-181	74	1,188	0-50	0-50
Sacramento Pikeminnow	80-133-186 (399)	13.46%	133	124-142	56	903	0-50	0-50
Bluegill	54-49-66 (169)	5.70%	56	54-59	24	382	0-50	101-150
Sacramento Sucker	13-5-62 (80)	2.70%	27	15-39	11	181	0-50	51-100
Green Sunfish	18-19-15 (52)	1.75%	17	16-18	7	118	51-100	101-150

Table 3.3.3-20. (continued)

Species	Abundance						Fork length (mm)	
	# Counted by Pass (Total)	% of Total Fish Counted	Estimated abundance	95% CI	Fish/100 m	Fish/mi	Min (bin)	Max (bin)
JUNE 2018 (cont'd)								
SNORKELED REACH 3 - 237.13 Meters (continued)								
Smallmouth Bass	8-9-11 (28)	0.94%	9	8-10	4	63	0-50	151-200
Mosquito Fish	10-7-6 (23)	0.78%	8	6-9	3	52	0-50	0-50
SNORKELED REACH 4 - 237.13 Meters								
Unknown Minnow	420-425-300 (1,145)	75.23%	382	375-389	226	3,641	0-50	0-50
Spotted Bass	54-77-70 (201)	13.21%	67	64-70	40	639	0-50	>350
Bluegill	45-47-48 (140)	9.20%	47	46-47	28	445	51-100	151-200
White Catfish	2-3-3 (8)	0.53%	3	2-4	2	25	>350	>350
Sacramento Sucker	2-4-1 (7)	0.46%	2	0-5	1	22	0-50	51-100
Channel Catfish	2-3-0 (5)	0.33%	2	0-5	1	16	251-300	>350
Sacramento Pikeminnow	1-3-1 (5)	0.33%	2	0-4	1	16	0-50	151-200
Redear Sunfish	0-1-3 (4)	0.26%	1	0-4	1	13	51-100	51-100
Smallmouth Bass	0-0-4 (4)	0.26%	1	0-6	1	13	101-150	101-150
Green Sunfish	0-1-1 (2)	0.13%	1	1	<1	6	51-100	101-150
Unknown Centrachid	1-0-0 (1)	0.07%	1	1	<1	3	101-150	101-150

Table 3.3.3-21. Population summary of 10 m standardized seine hauls in Reaches 2 through 4.

Species	Abundance			Fork length (mm)	Weight (g)	Condition Factor	
	# By Pass (Total)	% of Total Fish	CPUE (catch by pass)	Min-Max (Avg)	Min-Max (Avg)	Relative – range	Fulton's – range (average)
OCTOBER 2017							
REACH 2 SEINE (n=47)							
Spotted Bass	0-23-10 (33)	70.2%	11.0	45-152 (61)	1.1-43.9 (3.7)	0.79-0.87	0.86-2.22 (1.22)
Bluegill	0-5-0 (5)	10.6%	1.7	50-58 (54)	1.6-2.4 (1.9)	0.8-1.32	N/A[1]
Green Sunfish	0-3-0 (3)	6.4%	1.0	44-61 (52)	1.6-3.8 (2.5)	1.08-1.17	N/A[1]
Mosquito Fish	0-3-0 (3)	6.4%	1.0	30-41 (35)	0.4-0.6 (0.5)	0.89-1.38	N/A[1]
Sacramento Pikeminnow	2-0-0 (2)	4.3%	0.7	84-88 (86)	5.9-6.1 (6.0)	0.73-1.81	0.90-1.00 (0.95)
Pumpkinseed	0-1-0 (1)	2.1%	0.3	72 (72)	5.1 (5.1)	N/A[1]	N/A[1]
REACH 3 SEINE (n=6)							
Spotted Bass	5-0-1 (6)	100.0%	2.0	125-150 (136)	19.4-37.7 (28.3)	0.85-1.38	0.92-1.49 (1.10)

Table 3.3.3-21. (continued)

Species	Abundance			Fork length (mm)	Weight (g)	Condition Factor	
	# By Pass (Total)	% of Total Fish	CPUE (catch by pass)	Min-Max (Avg)	Min-Max (Avg)	Relative – range	Fulton's – range (average)
OCTOBER 2017 (cont'd)							
REACH 4 SEINE (n=60)							
Mosquitofish	0-43-0 (43)	71.7%	14.3	12-52 (27)	N/A[2]	N/A[1]	N/A[1]
Bluegill	0-3-9 (12)	20.0%	4.0	26-117 (54)	0.3-21.5 (3.3)	0.84-1.23	N/A[1]
Riffle Sculpin	0-1-3 (4)	6.7%	1.3	15-110 (63)	2.0-18.0 (6.7)	N/A[1]	N/A[1]
Spotted Bass	0-0-1 (1)	1.7%	0.3	153 (153)	37.1 (37.1)	0.97[3]	1.04
APRIL 2018							
REACH 2 SEINE[4] (n=140)							
Chinook Salmon	3-42-3-78-11 (137)	97.9%	27.4	30-74 (55.8)	0.3-4.3 (2.2)	0.5-3.2	0.58-4.46 (1.25)
Lamprey Ammocete	0-0-2-0-0	1.4%	0.4	N/A[2]	N/A[2]	N/A[1]	N/A[1]
Inland Silverside	0-0-0-1-0	0.7%	0.2	33 (33)	0.3 (0.3)	N/A[1]	N/A[1]
REACH 3 SEINE (n=183)							
Chinook Salmon	0-0-7-29-147 (183)	100.0%	36.6	45-95 (64.5)	0.9-10.3 (3.6)	0.7-1.6	0.99-1.96 (1.25)
REACH 4 SEINE (n=139)							
Chinook Salmon	0-3-6-70-17 (96)	69.1%	19.2	38-71 (55.2)	0.4-4.4 (2.0)	0.5-1.5	0.61-2.19 (1.11)
Bluegill	0-0-0-1-38 (39)	28.1%	7.8	43-80 (54.1)	1.2-7.1 (2.7)	0.8-1.6	N/A[1]
Mosquitofish	0-0-0-1-2 (3)	2.2%	0.6	36-46 (41.0)	0.3-0.6 (0.5)	0.7-1.0	N/A[1]
Spotted Bass	0-1-0-0-0 (1)	0.7%	0.2	126 (126)	25.5 (25.5)	1.2	1.27
MAY 2018							
REACH 2 SEINE (n=55)							
Chinook Salmon	1-0-49 (50)	90.9%	16.7	58-101 (82.4)	1.8-8.6 (4.7)	0.5-0.9	0.59-0.98 (0.80)
Sacramento Pikeminnow	0-0-3 (3)	5.5%	1.0	109-129 (118.7)	11.0-15.8 (14.0)	0.9-1.1	0.74-0.92 (0.83)
Sacramento Sucker	2-0-0 (2)	3.6%	0.7	76-93 (84.5)	7.0-9.1 (8.1)	1.4-1.9	1.13-1.59 (1.36)
REACH 3 SEINE (n=4)							
Chinook Salmon	0-2-0 (2)	50.0%	0.7	59-67 (63.0)	2.4-3.8 (3.1)	0.9-1.0	1.17-1.26 (1.22)
Rainbow Trout	0-1-0 (1)	25.0%	0.3	74 (74.0)	5.7 (5.7)	N/A[1]	1.41
Spotted Bass	1-0-0 (1)	25.0%	0.3	96 (96.0)	7.1 (7.1)	0.7	0.80
REACH 4 SEINE (n=0)							
No seining conducted per CDFW scientific collecting permit requirements; water temperature was above 21°C							
JUNE 2018							
REACH 2 SEINE (n=147)							
Sacramento Sucker	144-0-0 (144)	98.0%	48.0	17-34 (25.5)	1.1-2.2 (1.7)	0.6-1.9	0.56-2.24 (1.11)
Pumpkinseed	0-1-0 (1)	0.7%	0.3	46 (46.0)	0.6 (0.6)	N/A[1]	N/A[1]
Spotted Bass	0-0-1 (1)	0.7%	0.3	82 (82.0)	4.3 (4.3)	0.7	0.78
Green Sunfish	0-0-1 (1)	0.7%	0.3	76 (76.0)	5.8 (5.8)	1.0	N/A[1]

Table 3.3.3-21. (continued)

Species	Abundance			Fork length (mm)	Weight (g)	Condition Factor	
	# By Pass (Total)	% of Total Fish	CPUE (catch by pass)	Min-Max (Avg)	Min-Max (Avg)	Relative – range	Fulton's – range (average)
June 2018 (cont'd)							
REACH 3 SEINE (n=0)							
No seining conducted per CDFW scientific collecting permit requirements; water temperature was above 21°C							
REACH 3 SEINE (n=0)							
No seining conducted per CDFW scientific collecting permit requirements; water temperature was above 21°C							

[1] Condition factor could not be calculated for single individuals, because lengths and weights were not collected, or body shape was not fusiform.
[2] Lengths and weights were not collected for some species due to concerns of fish health.
[3] Condition factor for spotted bass calculated with fish pooled from all reaches and sampling occasions.
[4] Five seine hauls were completed during April 2018 due to lower visibility and higher flows at the sampling locations.

Figure 3.3.3-9. *O. mykiss* captured in Reach 3 during the May sampling event.

Chinook salmon parr were observed in Reaches 2, 3, and 4 during snorkeling events in April and May 2018. They were also captured during the April and May 2018 seine sampling in the same reaches, except for Reach 4 in May. A total of 416 Chinook salmon parr was captured in April and 52 in May. The lack of Chinook salmon during the June sampling period suggested that rearing fish had migrated downstream. The relative condition of the captured Chinook salmon over all sampling events ranged from 0.5 to 3.2. The Fulton's condition of these fish ranged from 0.58 to 4.46 with averages ranging from 0.80 to 1.25 over all sampling events. *O. mykiss* parr were observed in Reach 3 in April and May 2018. Only one *O. mykiss* parr was captured during the May seine event and is shown in Figure 3.3.3-9.

SSWD's Relicensing eDNA Sampling

SSWD's eDNA sampling targeted four species: 1) Chinook salmon; 2) *O. mykiss*; 3) green sturgeon (*Acipenser medirostris*); and 4) white sturgeon (*Acipenser transmontanous*). Sampling occurred between February 22 and March 1, 2017, and was followed by a second survey that occurred on March 8, 2017 and March 15, 2017 (Table 3.3.3-22). Samples were collected during high flows in the Bear River in accordance with the study plan. Flows ranged from 1,523 to 5,659 cfs throughout sampling events (Table 3.3.3-22). As a result of the high flows, turbidity was also high, which severely limited the volume of water that could be filtered for each sample. Suspended sediment clogged the filter quickly. As a result, the field team used five filters for each sample and recorded the volume of water filtered by each filter. On average, this was approximately 1 liter (total of five filters) for each sample, with filtered amounts ranging from 0.5 L to 1 L across all sites. Discussions with the analysis lab determined that the decreased filtration volumes would not adversely affect the results, given the replication of sites within sampling areas and number of filters used per sample (S. Blankenship [Genidaqs], pers. comm., June 2019). SSWD originally anticipated for the use of one filter per sample location and increased the overall effort to ensure a sufficient volume of water was filtered.

DNA from all samples and controls were extracted using PowerWater Sterivex™ DNA Isolation Kit (Mo Bio Laboratories, Inc.) following the manufacturer's recommended guidelines. A DNA extraction negative control was processed in parallel to ensure sample integrity throughout extraction procedure. DNA extraction controls were processed using the same equipment utilized to extract DNA from all samples. Each sample and all controls were analyzed in triplicate for the presence of the GGS CytB mitochondrial gene using the qPCR primer and probe designed previously. DNA extracted from each sample was analyzed in triplicate with each qPCR replicate consisting of a 10 µl reaction volume. Each 10 µl qPCR reaction was composed of 2x Applied Biosystems TaqMan Universal PCR Master Mix, No AmpErase UNG (Thermo Fisher ABI), 500-900 nM initial primer concentration, 2.5-10 uM initial probe concentration, and 4 µl DNA template. Thermocycling was performed using a Bio-Rad CFX 96 Real time System (Bio-ad Laboratories, Inc.) with the following profile: 10 min at 95°C, 40 cycles of 15 second denaturation at 95°C and 1 min extension at 60°C. Six template control (NTC) reactions were run on the plate with the control sample templates consisting of 4 µl of ultrapure water replacing DNA template within reaction volume. Three positive control reactions consisting of 20 ng/µl target species genomic DNA template were also tested in parallel to ensure consistent PCR performance. All PCR master mixes were made inside an ultraviolet (UV) PCR enclosed workstation. A DNA template was added to the master mix outside of the UV PCR workstation on a dedicated PCR set up workbench. All PCR reactions were conducted on instruments located outside of the main lab in a separate portion of the building. Results of the qPCR reactions were analyzed using BioRad CFX manager v3.1 (Bio-Rad Laboratories, Inc.). A sample was considered positive for the presence of target DNA if any one of the three replicates showed logarithmic amplification within 40 cycles.

Fifty eDNA samples were collected over the two sampling events. Chinook salmon had 17 positive detections throughout all reaches and *O. mykiss* 11 positive detections throughout all reaches (Table 3.3.3-22 and Figures 3.3.3-10 through 3.3.3-12). No green or white sturgeons were detected during either sampling event.

Table 3.3.3-22. Environmental DNA results through both sampling events for *O. mykiss*, Chinook salmon, green sturgeon, and white sturgeon.

Sample Event	Flow (cfs)[1]	Total Samples	Detection by Target Species			
			O. mykiss	**Chinook Salmon**	**Green Sturgeon**	**White Sturgeon**
REACH 2						
1	5,659	7	0	2	0	0
2	1,640	7	1	0	0	0
REACH 3						
1	3,775	4	1	1	0	0
2	1,640	4	1	0	0	0
REACH 4						
1	1,588 to 2,120[2]	9	2	1	0	0
2	1,523	9	2	7	0	0
REACH 5						
1	1,588 to 2,120[2]	5	2	3	0	0
2	1,523	5	2	3	0	0
Total	**--**	**50**	**11**	**17**	**0**	**0**

[1] Flow recorded at USGS gauging station 1142400 – Bear River at Wheatland

[2] Sampling completed over 2 days due to accessibility issues.

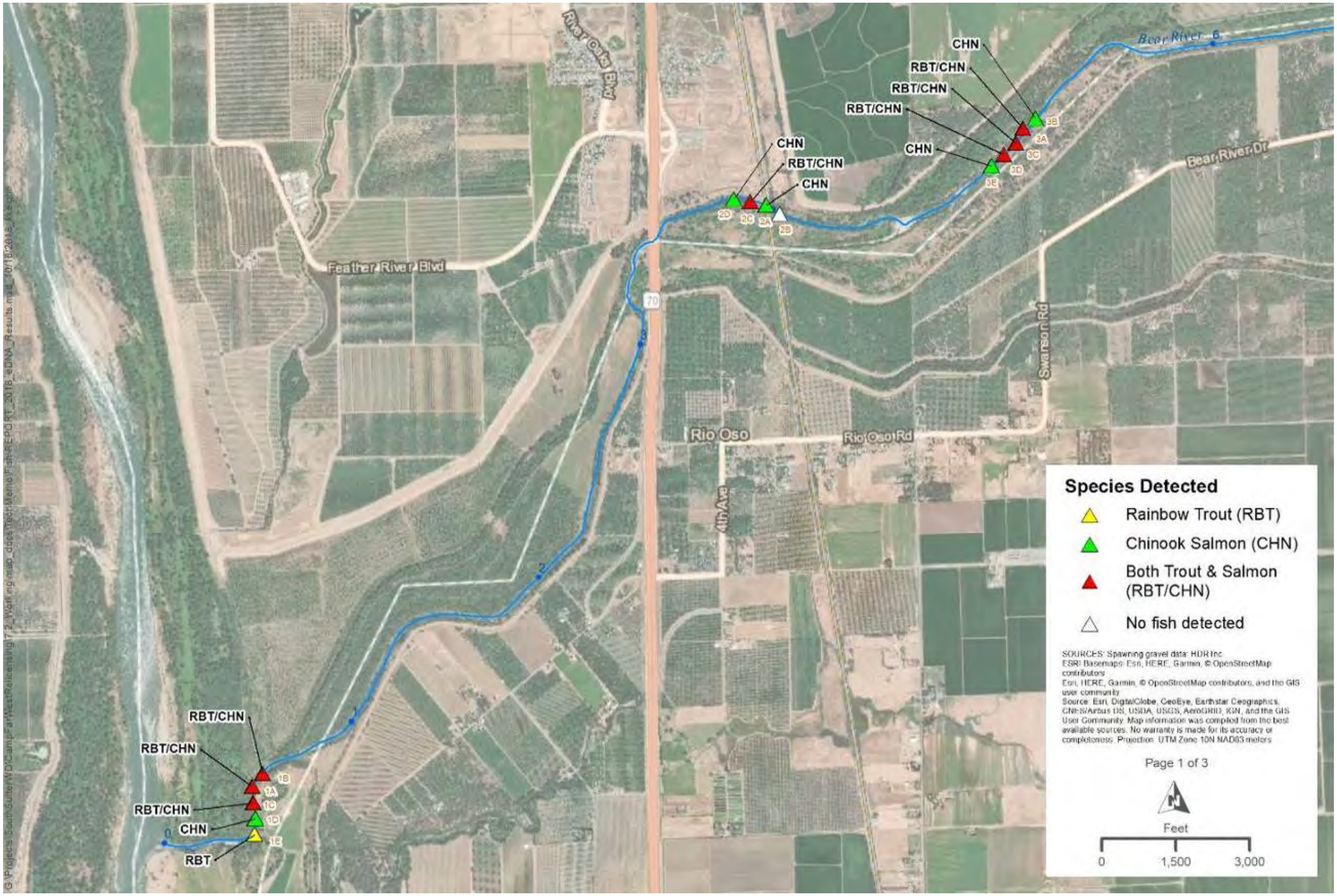


Figure 3.3.3-10. eDNA sampling locations and species detected (Reach 2).

Figure 3.3.3-11. eDNA sampling location and species detected (Reach 3).

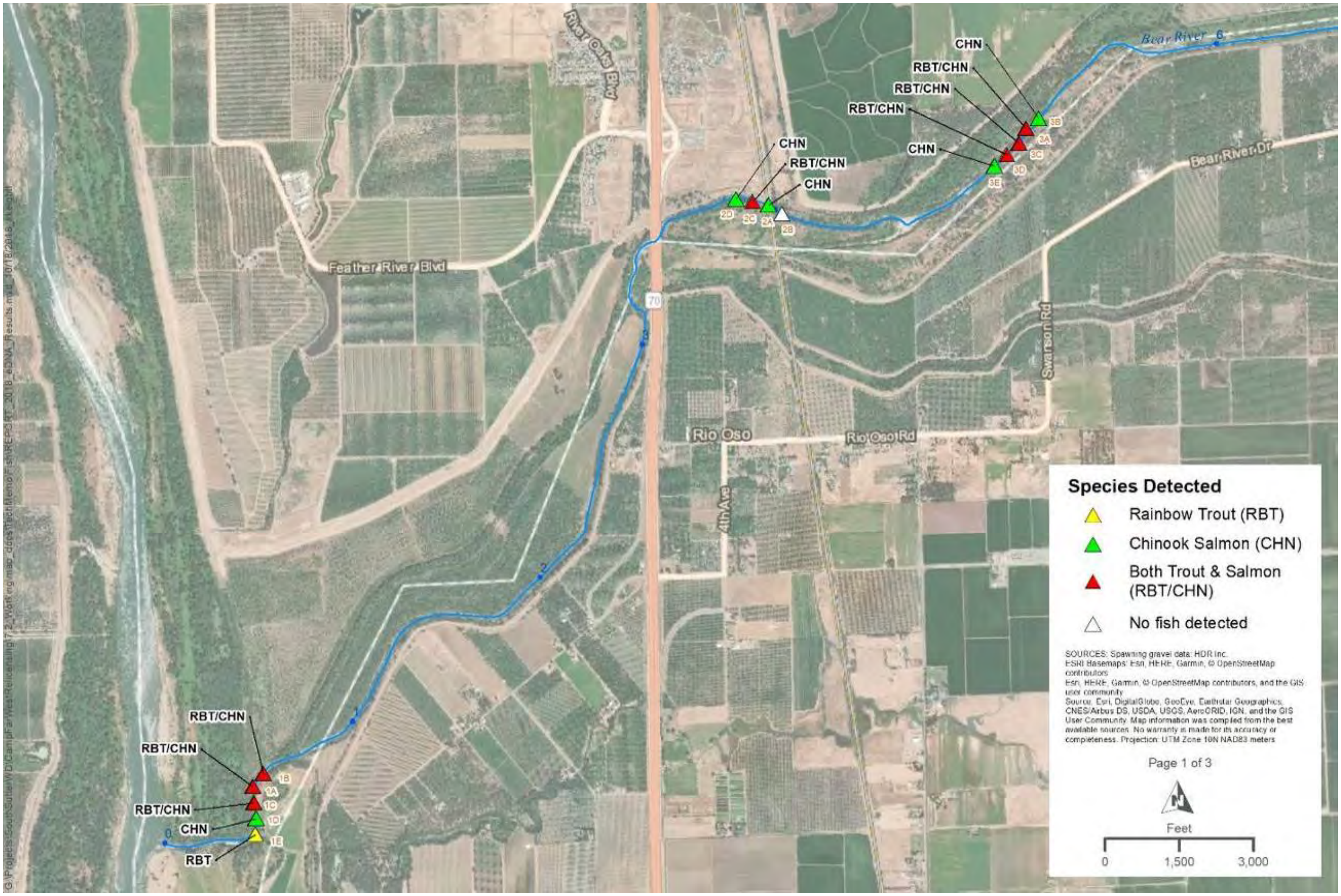


Figure 3.3.3-12. eDNA sampling locations and species detected (Reaches 4 and 5).

SSWD's Relicensing Salmonid Redd Surveys

Sporadic salmon surveys on the Bear River were documented from 1982 to 1986 by CDFG (CDFG unpublished data). Salmon numbers and redd observations depended on flows and water temperature. Salmon surveys by CDFG employees indicated the presences of roughly 100 adult salmon and steelhead strays in the Bear River in 1982. Salmon surveys were conducted from the non-Project diversion dam to Highway 70, occurred on November 16 and November 19, 1984. On November 16, 1984, CDFG employees reported seven salmon (four males and three females) were on redds and one additional unattended redd from the diversion dam to Patterson's Sand and Gravel plant (~RM 15). Also, On November 16, 1984, CDFG employees canoed from Highway 65 to Hudson Road and found five fresh carcasses (two male, two female and one jack), one carcass, six live fish and 15 redds. On November 19, 1984, CDFG employees canoed from Hudson Road to Highway 70. From Hudson Road to Pleasant Grove Road, CDFG reported finding one male carcass, one live female, and 35 redds. From Pleasant Grove Road to Highway 70, CDFG observed three skeletons (two male and one female), one pair of salmon spawning and six unattended redds. CDFG employees conducted salmon redd surveys in December of 1986 and observed only one male carcass.

SSWD conducted salmon redd surveys from October 17 through December 8, 2016. Redds were first documented on November 7, 2016 (Figure 3.3.3-13). Surveys ceased on December 8, 2016, due to high flows and low visibility (Figure 3.3.3-14). River conditions were monitored approximately every two weeks to determine if redd surveys could be resumed during the monitoring period. Secchi depths ranged from 0.2 to 0.6 m, which is less than the generally accepted minimum visibility for redd surveys of 1.2 m (PSMFC 2017). Flows ranged from 1,388 to 4,851 cfs during the periodic checks, causing visibility and safety concerns. The maximum flow during the potential survey period in the Bear River, measured at the Wheatland gage, was 34,900 cfs in January 2017. Due to these conditions, no further redd surveys were conducted during the remainder of the 2016/2017 period, which ended on March 31, 2017.

Figure 3.3.3-13. Typical Chinook salmon redd on the lower Bear River, photo taken during November 7, 2016 redd survey.

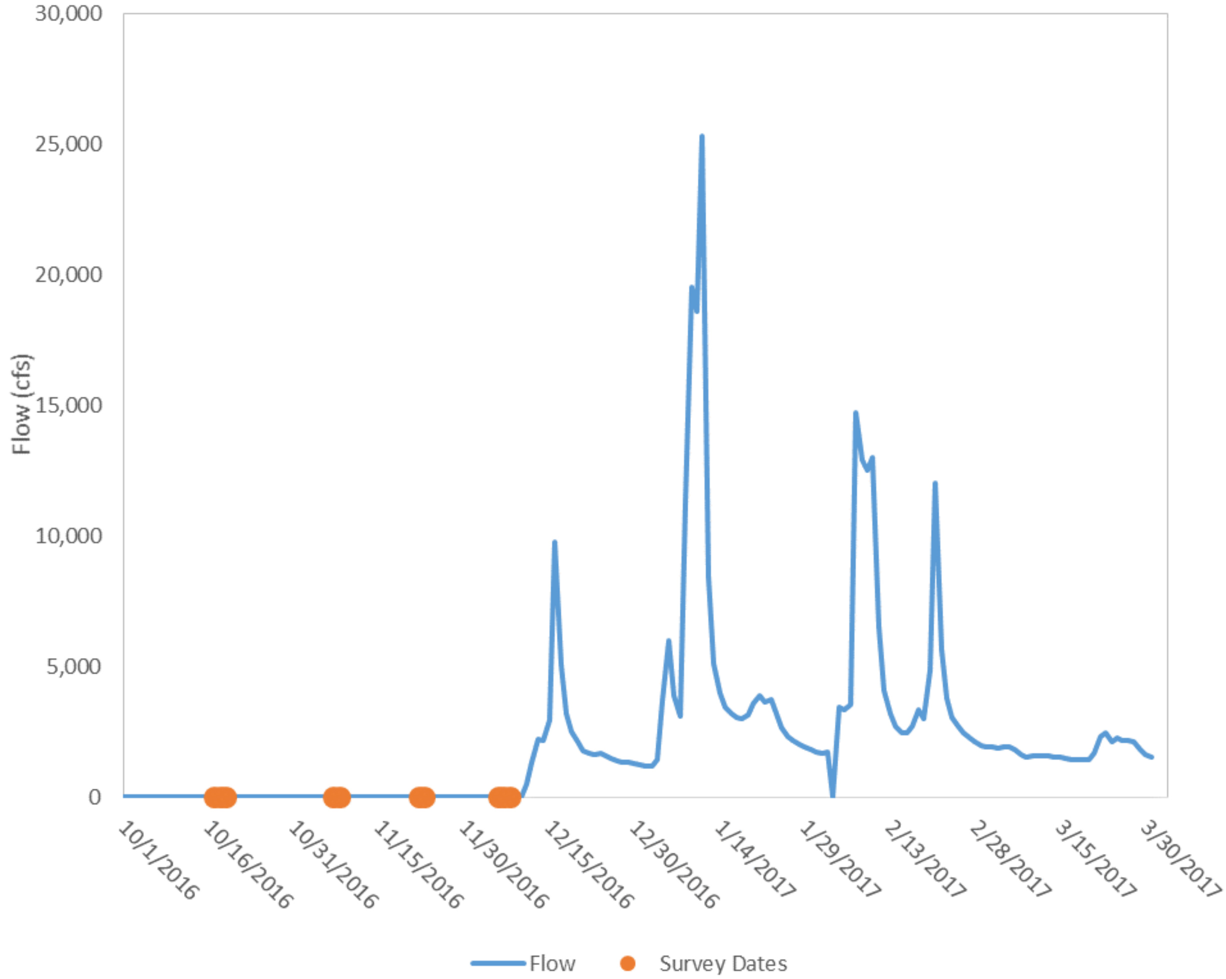


Figure 3.3.3-14. Discharge in the lower Bear River (measured at USGS Wheatland gage) during the 2016-17 redd survey season (October 1, 2016 through March 30, 2017).

The four surveys conducted in 2016 resulted in the documentation of 23 redds, four adult CV fall-run Chinook salmon ESU, and three Chinook salmon carcasses. Of the 23 redds documented in 2016, none were recorded in Reach 2; 20 in Reach 3; and 3 in Reach 4. No Chinook salmon were observed actively spawning. New redds were observed during surveys on November 7 and 8, November 22 and 23, and December 7 and 8, 2016. Estimated pot (i.e., the depression formed by the excavation of gravels by female salmon during redd construction), areas ranged from 0.29 to 8.75 square meters (sq m), and total redd area ranged from 1.27 to 36.73 sq m. Pot depths were not estimated because visual estimation of depth can be highly variable depending on water clarity, lighting conditions, and velocity.

SSWD conducted four additional salmon redd surveys between January and March 2018 to gather additional data on salmonid spawning. The first surveys were conducted from January 15 through 17, 2018, during a break in high winter flows (Figure 3.3.3-15). During this event, SSWD identified a total of 78 Chinook salmon redds, 10 adult Chinook salmon, and six Chinook salmon carcasses. Out of the 78 redds identified, 35 were found in Reach 2; 23 in Reach 3; and

20 in Reach 4 (Figures 3.3.3-16 through 3.3.3-20). Redd age was difficult to determine due to the late date of the spawning surveys, and the presence of periphyton that had begun to regrow on most redds. No new redds were identified in the later three redd surveys in 2018.

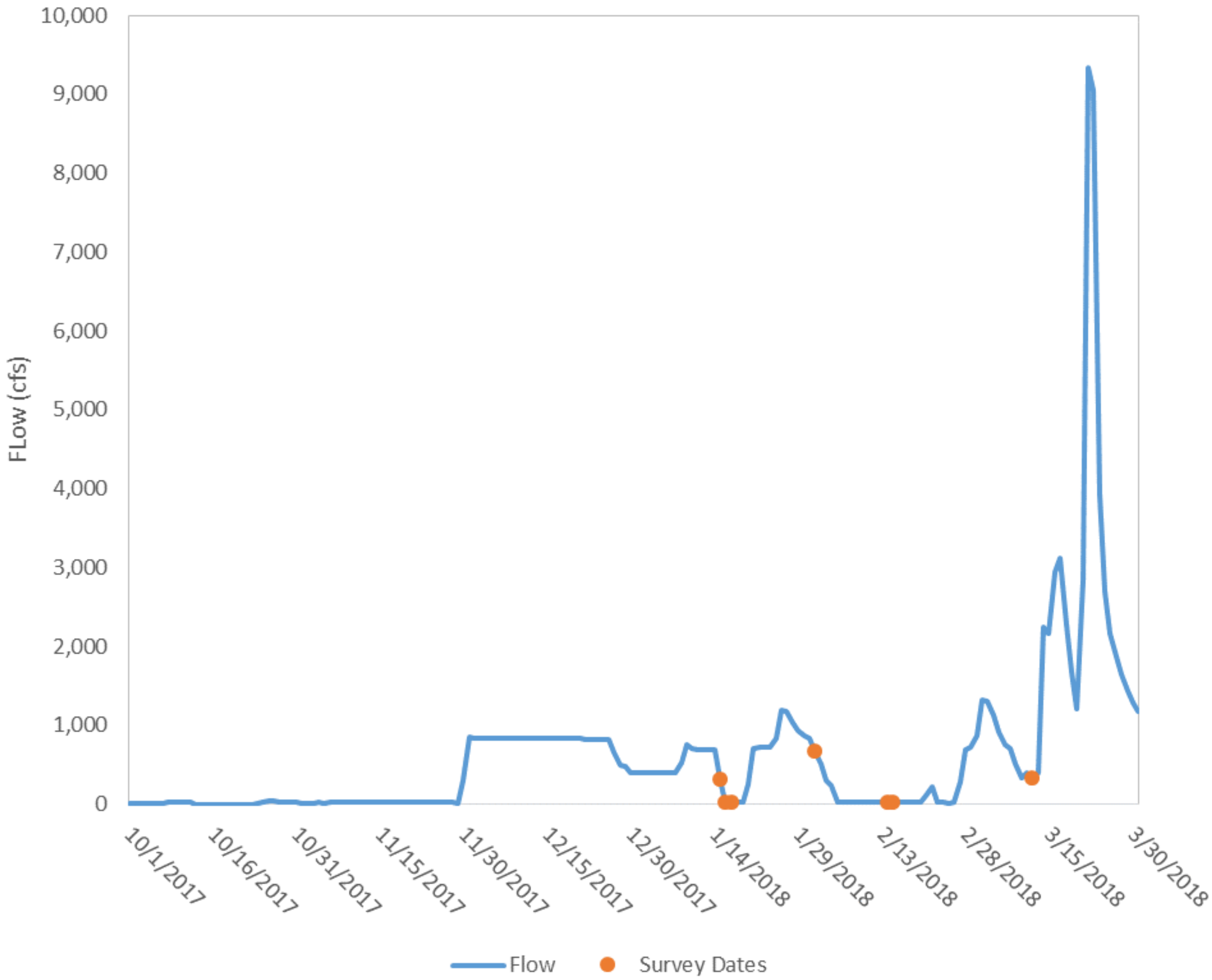


Figure 3.3.3-15. Discharge in the lower Bear River during the 2017-18 redd survey season (October 1, 2017 through March 30, 2018).

Redd area ranged from 0.36 to 39.26 sq m in 2018. Pot substrate was variable, ranging from sand to cobble, and tailspill substrate was typically one size class smaller than the associated pot substrate (Table 3.3.3-23).

Table 3.3.3-23. Minimum, maximum, and average values for redd area, pot depth and velocity, and substrate.

Range	Area (square meters)			Pot Depth (meters)	Pot Velocity (meters per second)	Substrate	
	Pot	**Tail Spill**	**Total**			**Pot**	**Tailspill**
Minimum[1]	0.22	0.13	0.36	0.1	0	sand	sand
Maximum[1]	13.37	29.64	39.26	0.6	0.7	cobble	cobble
Average[1]	2.77	4.84	7.61	0.3	0.2	cobble	coarse gravel

[1] n = 78.

Figure 3.3.3-16. Locations of redds observed during surveys in Reach 2 in 2016 and 2018.

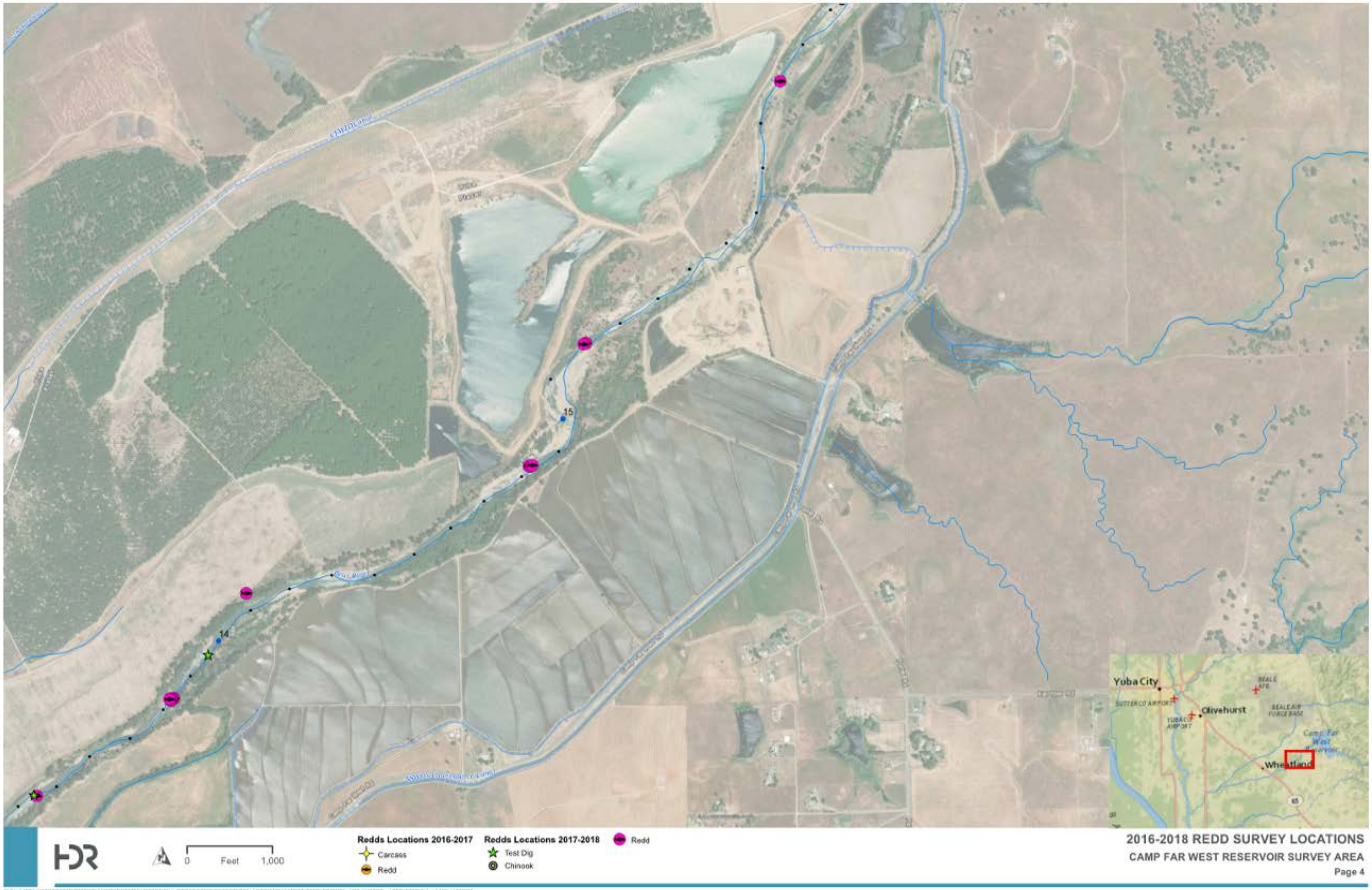


Figure 3.3.3-17. Locations of redds observed during surveys in Reach 2 in 2016 and 2018.

Figure 3.3.3-18. Locations of redds observed during surveys in Reaches 2 and 3 in 2016 and 2018.

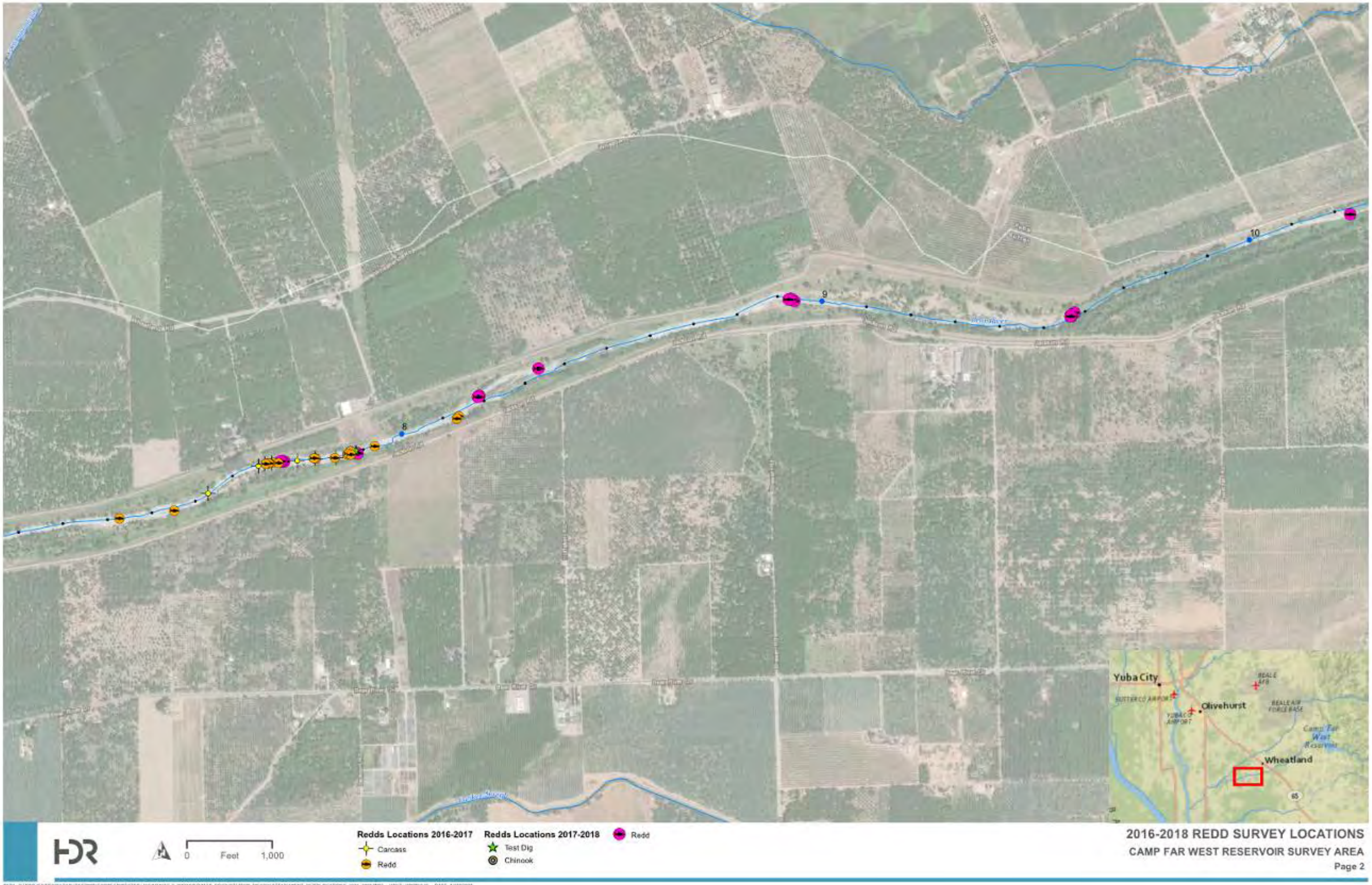


Figure 3.3.3-19. Locations of redds observed during surveys in Reach 3 in 2016 and 2018.

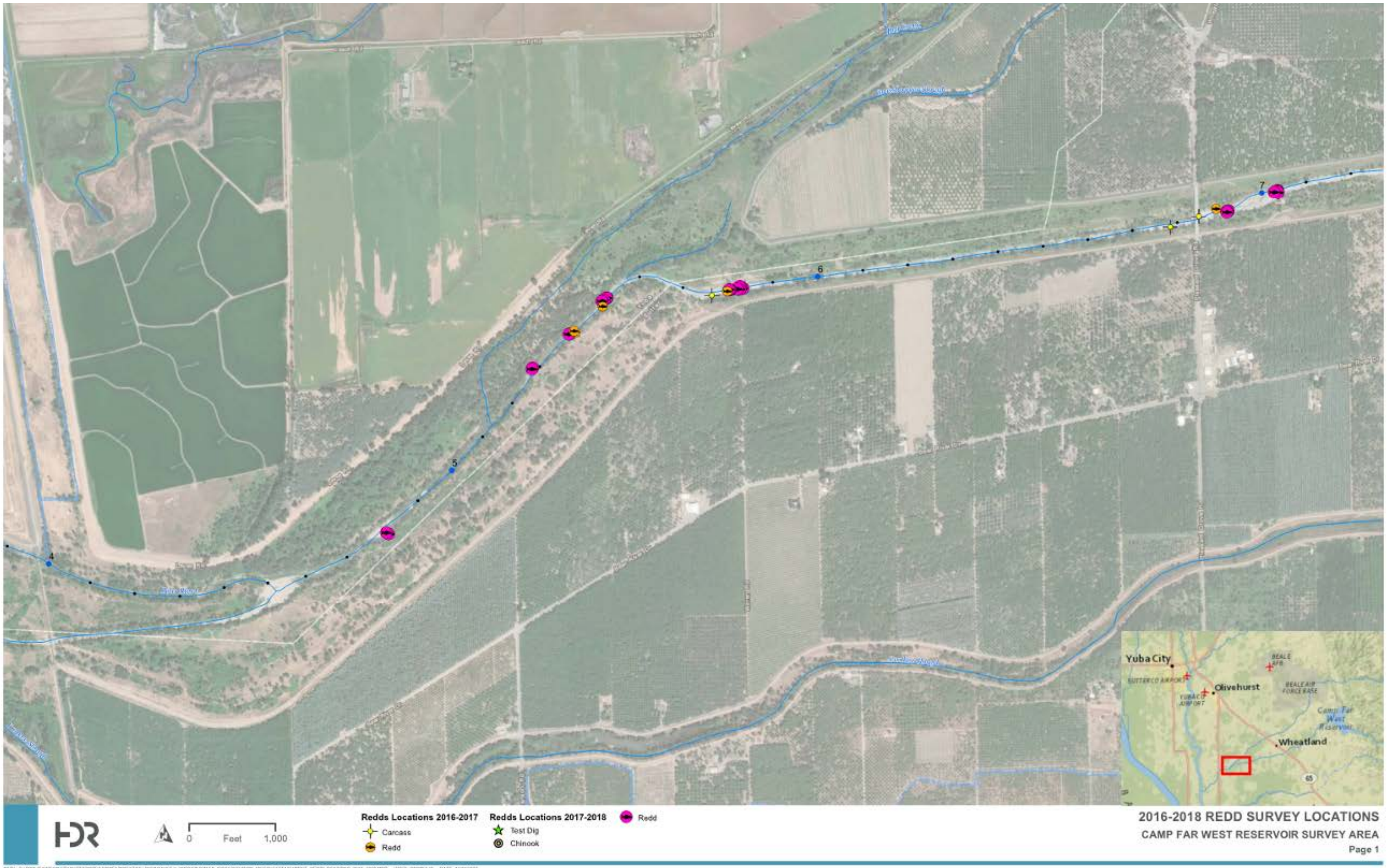


Figure 3.3.3-20. Locations of redds observed during surveys in Reach 4 in 2016 and 2018.

SSWD's Relicensing Salmonid Spawning Gravels Surveys

SSWD conducted a salmonid spawning gravel assessment survey of the lower Bear River in June 2018 as part of Study 3.2 and found that gravel conditions are suitable for anadromous salmonid spawning. Due to the extensive distribution of gravel in the D_{50} diameter of 0.11 to 5.9 in. (2.8-150 mm), a two-tiered classification system was devised to provide higher resolution to the study results. Areas that were identified in the Low Flow Active Channel (LFAC, i.e. the wetted channel) were classified as primary spawning gravel. These were areas that adult Chinook salmon could use to spawn under minimum flows requirements in the existing license. All other gravels falling within the D_{50} of 0.11 to 5.9 in. that were identified outside the LFAC, but within the bank full channel, were classified as secondary spawning gravel. Deep pools with little potential for use as spawning habitat were included in the surveys due to the systematic sampling design employed, but were accounted for separately in the calculations. Velocity transects and pebble counts were collected at areas of primary spawning gravel, but not secondary.

Representative areas surveyed at 250 m intervals showed that spawning gravels were present throughout the majority of the lower Bear River, with significant deposits in RMs 5 to 8 and 14. The primary concentration of gravel was within Reach 3 (RM 6.8-11.5), where the majority of spawning activity was noted between surveys in 2016 and 2018 (n=20 and 23, respectively). In primary habitats of surveyed areas (i.e. LFAC), suitable spawning gravels comprised an average of 24.1 percent of sampled non-pool habitats (i.e. riffle, run, or glide) by RM (minimum 0.0%, maximum 56.8%; Table 3.3.3-24), and an average of 6.9 percent of sampled pool habitats by river mile (minimum 0%, maximum 32.2%). Much of pool habitat is not considered spawning habitat due to depth, but the tailouts of pools offered suitable deposits. While deposits were concentrated in Reach 3, 9 of 16 RMs had deposits greater than 20 percent of the sampled area, offering a broad spatial range for spawning opportunities. In secondary habitats that were surveyed (i.e. outside of the wetted channel, but within bank full width), spawning gravels comprised an average of 26.8 percent of sampled habitats by river mile (minimum 0%, maximum 70.5%). Reach 4 had the highest individual maximum deposit of surveyed areas, but Reach 3 again had the greatest average overall.

Where spawning gravels were present in primary habitats, pebble counts were conducted. The average median particle size, or D_{50}, was approximately 0.98 in. (25 mm, Figure 3.3.3-21), a value that corresponds with coarse gravels. The range of D_{50} particle sizes that is commonly accepted to comprise suitable spawning gravels for Chinook salmon and steelhead is 0.11 to 5.9 in.; all but one sample site had D_{50} values within that range. The one site that had a D_{50} value of approximately 0.06 in. (1.6mm) had a subdominant substrate component of silt/clay. Velocities were also measured where primary spawning gravels were identified. Velocities ranged from 0.03 ft/s to 5.48 ft/s, and the average median velocity (averaged across all sites) was 1.86 ft/s (Figure 3.3.3-23).

Table 3.3.3-24. Spawning gravel availability for primary (i.e. within the low-flow active channel) and secondary habitats that were surveyed, presented as the average percent of available habitat comprised by spawning gravels and shown by river mile. Primary habitats are further partitioned into non-pool (i.e. riffle/run/glide) and pool habitats.

General Reach Boundary	River Mile	Average Percent of Primary Spawning		Proportion of Non-Pool Habitats (%)	Average Percent of Secondary Spawning Gravels (%)
		Non-Pool Habitats (Riffle/Run/Glide)	Pool Habitats		
4	3	5.0	0.0	0.33	12.0
	4	16.2	8.9	0.25	27.1
	5	32.8	6.7	0.33	32.4
	6	30.0	0.0	0.25	0.0
3	7	56.8	20.4	0.57	62.1
	8	49.0	32.2	0.71	48.4
	9	20.0	0.9	0.14	45.7
	10	20.7	1.7	0.43	26.5
	11	21.6	12.2	0.50	23.0
2	12	26.9	8.2	0.43	70.5
	13	19.4	3.1	0.29	19.0
	14	32.5	2.1	0.57	8.6
	15	0.0	0.7	0.17	0.0
	16	7.0	0.0	0.57	0.3
Average		**24.1**	**6.9**	**0.40**	**26.8**

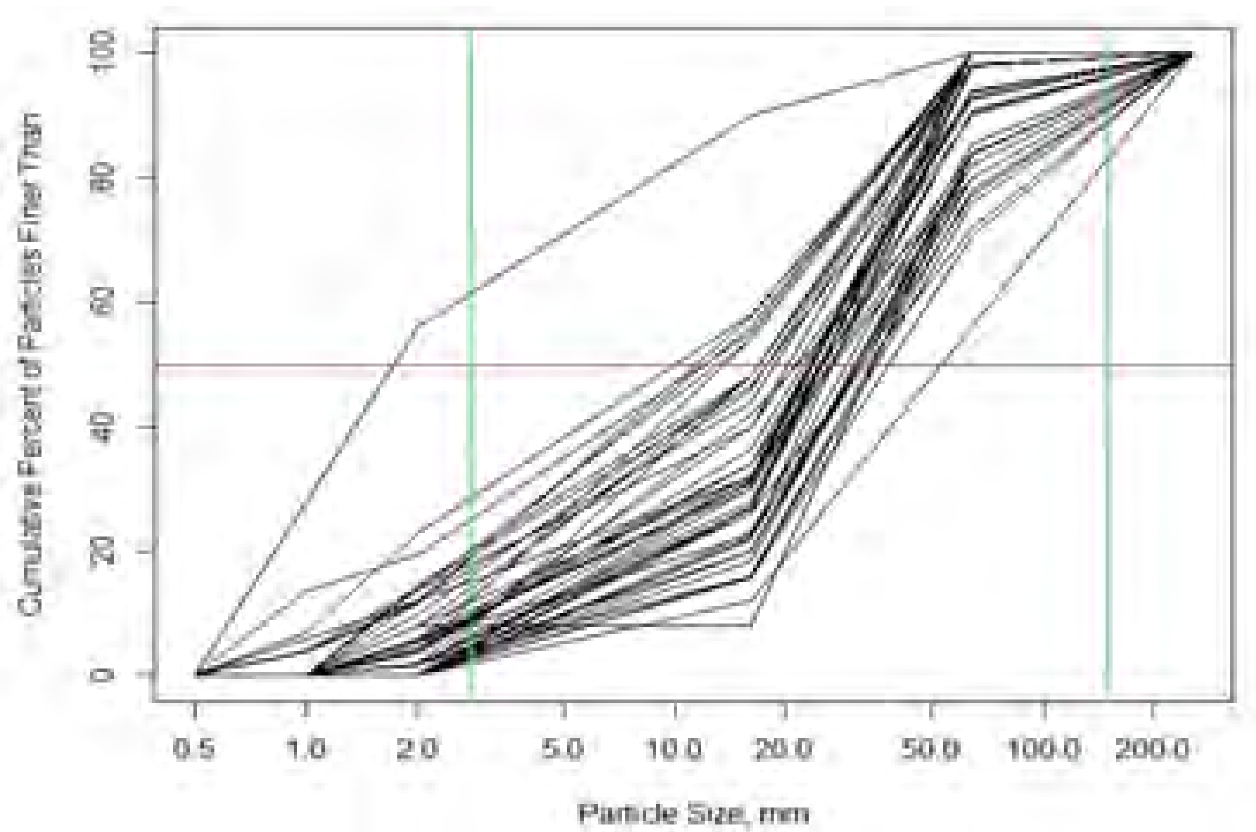


Figure 3.3.3-21. Cumulative size distribution of gravels at sites in the lower Bear River deemed to be suitable for salmonid spawning. Each black line represents a distribution of substrate sizes at a single site. The horizontal red line indicates the location of the 50th percentile of particle diameters, or D50 value. The vertical green lines indicate the lower and upper threshold diameters of gravel particle sizes that are commonly deemed suitable for salmonid spawning (0.11-5.9 in., or 2.8-150 mm).

SSWD's Relicensing Instream Flow Study for Target Species

CDFG (1991) found that fall flows in the lower Bear River are not usually high enough to attract salmon to migrate up and spawn. During years where the October and November flows are high, CDFG estimated adult spawning runs as high as 300 fish (Table 3.3.3-2). Based on the evaluation of Chinook salmon life stage periodicities and analysis of WUA/streamflow indices, CDFG developed a set of instream flow recommendations. In 1991, CDFG recommended the following flows in the lower Bear River, as measured at the Wheatland gage (Gage 11424000) to optimize CV fall-run Chinook salmon ESU habitat:

- 100 cfs from October 1 to 14 to provide ample depth and attraction for upstream adult migration and early spawning of fall-run Chinook salmon
- 250 cfs from October 15 to December 31 to provide maximum spawning habitat for fall-run Chinook salmon, when the majority of spawning occurs
- 190 cfs from January through March to prevent dewatering of fall-run Chinook salmon redds, alevins, and/or stranding of fry
- 100 cfs from April through June to provide maximum fall-run Chinook salmon juvenile salmon rearing habitat and facilitate their downstream movement
- 10 cfs from July through September for fall-run Chinook salmon juveniles' migration to the ocean by June

CDFG noted that its recommended flows may provide habitat and water temperatures favorable to CV fall-run Chinook salmon ESU, but would likely not meet the requirements for steelhead. CDFG also acknowledged that water diversions and operations upstream of Camp Far West Reservoir may limit the ability to deliver the recommended flows and subsequent improvements to habitat and water temperature. Recommendations for future studies included increased upstream analysis, steelhead-specific studies, and consideration of dry year criteria. CDFG's flow recommendations were not implemented.

Jones & Stokes (2005) stated that the Bear River historically experienced high winter flows and low summer flows, but present-day flow timing and volume is highly regulated by storage reservoir releases and diversions. The exportation of water diverted from the Bear River watershed is made through the conveyance facilities of NID and PG&E. The flow is diverted for irrigation, power generation, and domestic supply uses in the Auburn area. The report stated that upstream diversions from the Bear River basin have depleted the streamflow downstream of the non-Project diversion dam. Jones and Stokes stated that minimum flow releases are 25 cfs in the spring and 10 cfs during the rest of the year and that flows in the Bear River below the diversion dam range between zero and 40 cfs from June to December. Its report found that current winter flows during wet years are similar to unimpeded flows, averaging 2,500 to 5,200 cfs, and that summer flows are currently 30 to 50 percent less than the unimpaired flows.

During a water transfer in 2018, SSWD recorded velocities in the Bear and Feather rivers using an acoustic Doppler current profiler (ADCP). During this period, flows in the Feather River ranged from approximately 2,500 to 6,000 cfs measured at Star Bend (CDEC – FSB) during the transfer and the Bear River flows ranged from approximately 125 to 150 cfs measured at

Pleasant Grove (CDEC – BPG) (Figure 3.3.3-22). On average, flows in the Feather River were 20 to 50 times greater than in the Bear River. The higher flows in the Feather River resulted in a reduction to the velocity signature of Bear River flows at the confluence, as indicated by velocity measurements recorded by SSWD. Velocities in the Feather River at the confluence ranged from approximately 1.5 to 4 fps, while in the Bear River at the confluence, velocities ranged from approximately 0 to 0.8 fps (Figure 3.3.3-23). This demonstrates a backwatering effect of the Feather River up the Bear River, which was found to extend approximately 1 mi upstream of the confluence, and denotes a lack of attraction flow from the Bear River even when Bear River flows are greater than the existing minimum instream flows during the summer months.

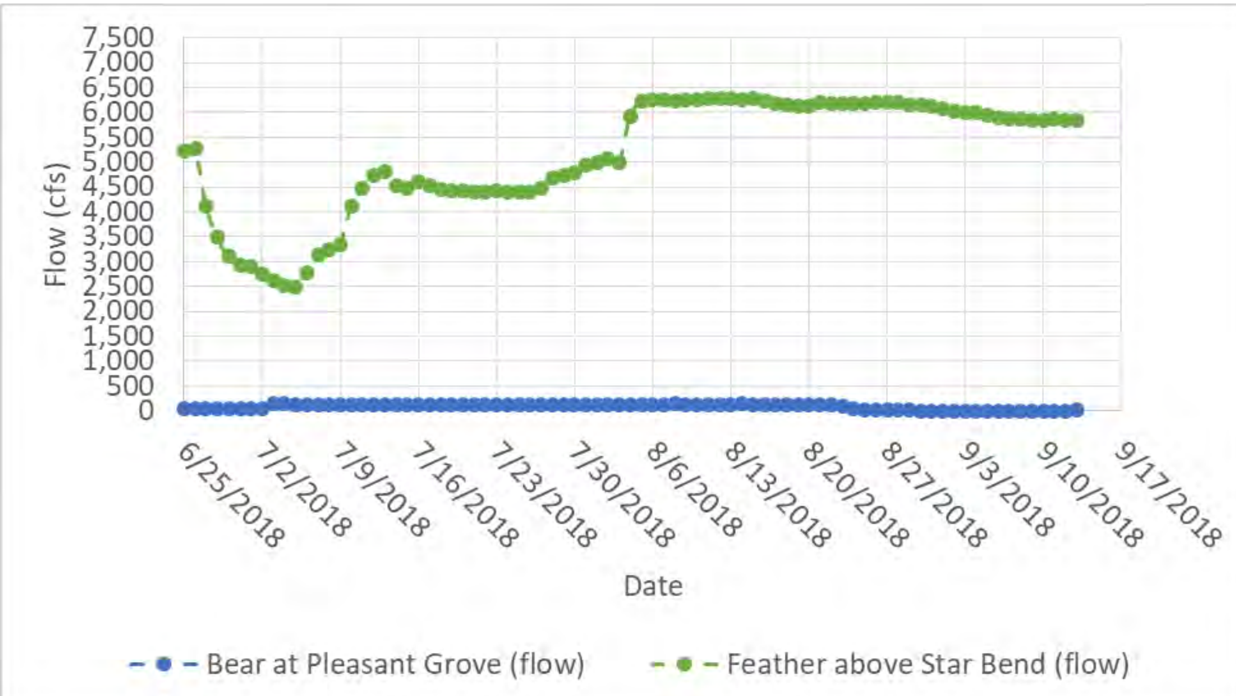


Figure 3.3.3-22. Flows in the Bear and Feather Rivers during the 2018 SSWD water transfer.

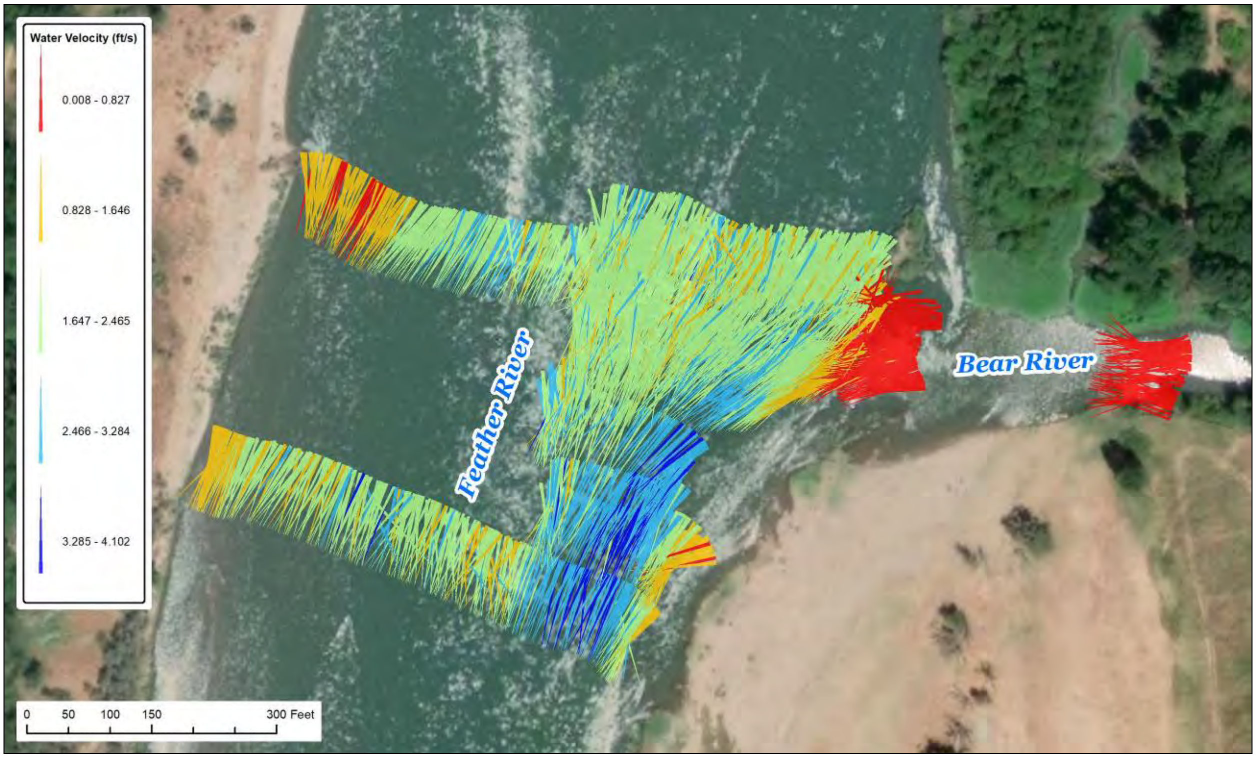


Figure 3.3.3-23. Measured velocities at the confluence of the Bear and Feather rivers during the 2018 SSWD water transfer. Red indicated little to no velocity and green and blue represents higher velocities.

SSWD performed an Instream Flow Study using River 2D (i.e., 2 dimensional) habitat modeling to simulate the relationship for stream flows to fish habitat suitability – defined by water depth and velocity, and substrate availability – at two study sites downstream of the non-Project diversion dam at locations where fish spawning and breading are known to occur. The two sites, named 'Upstream' and 'Downstream' in the relicensing Instream Flow Study, were selected in collaboration with Relicensing Participants in August 2017. Habitat types and lengths from habitat mapping completed in 2017 were used to assess reach-wide habitat composition to habitat composition within each site. One site was in Reach 2 and extended from RM 14.2 to RM 15.05. The second site was located in the Reach 3 and extended from approximately RM 7.7 to RM 8.3. (Figure 3.3.3-24.) SSWD collected topographic data at both sites from levee to levee. A comparison of reach habitat frequency and study site habitat frequencies is provided in Table 3.3.3-25.

Figure 3.3.3-24. Location of instream flow 2-D sampling sites.

Table 3.3.3-25. Reach wide and Instream Flow Study site habitat frequency.

Unit Type	Length Frequency	Number of Units	Number of Units Frequency	Unit Length Frequency	Number of Units Frequency
UPSTREAM SITE (REACH 2)					
Glide	11.6%	6	7.7%	29.6%	12.5%
Lateral Pool	32.9%	18	23.1%	35.4%	37.5%
Low Gradient Riffle	7.1%	26	33.3%	10.4%	37.5%
Mid-channel Pool	45.4%	20	25.6%	24.6%	12.5%
Run	1.1%	5	6.4%	0.0%	0.0%
Totals[1]	**98.1%**	**75**	**96.2%**	**100.0%**	**100.0%**
DOWNSTREAM SITE (REACH 3)					
Glide	17.4%	12	19.0%	35.4%	28.6%
Lateral Pool	10.9%	12	19.0%	12.3%	14.3%
Low Gradient Riffle	8.3%	17	27.0%	13.6%	35.7%
Mid-channel Pool	32.0%	14	22.2%	36.3%	14.3%
Run	4.4%	4	6.3%	2.4%	7.1%
Trench Pool	24.4%	2	3.2%	0.0%	0.0%
Totals[2]	**97.5%**	**61**	**96.8%**	**100.0%**	**100.0%**

[1] Reach 2 frequencies do not include one 144 foot plunge pool and two split channels totaling 400 ft.
[2] Reach 3 frequencies do not include two split channels totaling 511 ft.

A third site was selected by USFWS in Reach 4 and was surveyed and modeled by USFWS in 2017 and 2018 independently of the SSWD data collection and modeling efforts. The USFWS Site maintained habitat frequencies similar to reach-wide composition and extended from approximately RM 4.2 to RM 4.8 (Figure 3.3.3-24). Results from the USFWS modeling effort are provided as a supplement to results generated by SSWD models. Specific details on the USFWS effort are provided where available.

SSWD collected the majority of field data, including topographic data and hydraulic calibration measurements between October 2017 and February 2018. Additional hydraulic calibration measurements were collected in July 2018 near the target calibration flow of 100 cfs. A summary of flows and calibration data obtained at the study sites is provided in Table 3.3.3-26. At the Upstream Site a total of 52,455 topographic data points were collected. At the Downstream Site a total of 27,083 topographic data points were collected.

Table 3.3.3-26. Calibration data collection summary for SSWD Instream Flow Study sites.

Location	Date	Measured Discharge (cfs)[1]	Wheatland Gage (cfs)[2]	Obtained Calibration Criteria[3]
Upstream Study Site	12/14/17	674.1	827	Boundary conditions
	01/19/18	17.0	23	Boundary conditions and 46 calibration nodes
	02/20/18	15.9	16.9	Boundary Conditions
	02/21/18	332.9	300	Boundary conditions and 21 calibration nodes
	07/19/18	127.2	120	Boundary conditions and 50 calibration nodes

Table 3.3.3-26. (continued)

Location	Date	Measured Discharge (cfs)[1]	Wheatland Gage (cfs)[2]	Obtained Calibration Criteria[3]
Downstream Study Site	12/14/17	734.5	827	Boundary Conditions
	01/18/18	15.6	22.3	Boundary conditions and 49 calibration nodes
	02/19/18	12.9	17.5	Boundary Conditions
	02/22/18	319.7	300	Boundary conditions and 49 calibration nodes
	07/18/18	125.0	116	Boundary conditions and 52 calibration nodes

[1] Measured discharges above 200 cfs are an average of three or more individual discharge measurements utilizing an ADCP. Measured discharges below 200 cfs were measured manually utilizing a recently calibrated Swoffer current velocity meter and USGS top setting wading rod.

[2] Wheatland gage flows are approximate and showed minor variation from the values.

[3] Boundary conditions include water surface elevations at the upstream and downstream model boundaries. Calibration nodes are random and discrete locations within each modeling site where water surface, depth and mean column velocity were measured.

In addition to field data collection for hydraulic and habitat model development, four level loggers were installed to measure stage change in the Bear River downstream of the non-Project diversion dam in November of 2017. Level loggers were installed immediately upstream of the modeling site in Reach 2, approximately 1,000 ft downstream of the Highway 65 bridge, approximately 1,200 ft upstream of the Pleasant Grove Road bridge, and 2,000 ft downstream of the Highway 70 bridge. Loggers at all locations were recovered unfixed from their original deployment location after high flows in December 2017 and were redeployed in January 2018. Complete stage information for a full calendar year is not yet available.

Topographic data for the Upstream and Downstream sites were post processed and verified in Trimble Business Center and Microsoft™ Excel to ensure that there were no obvious elevation errors in the survey data. Once initial quality control measures were completed, topographic data were entered into ArcGIS for the development of a Triangulated Irregular Network (TIN). The TIN was then imported to ArcScene for a visual verification of the topographic data. After visual verification field collected topographic data were integrated with publically available LiDAR data to fully characterize channel topography from Levee to levee.

Hydraulic modeling for each study site was completed using River2D (Steffler and Balckburn 2002). Verified and reviewed channel topography was further assessed in River2D Bed to look for areas with data gaps and bed files were modified in some locations to produce bed contours and channel features more representative of observed conditions. Most modifications were made in areas where dense vegetation, overhead canopy cover, or terrain characteristics made field collection of accurate topography data difficult.

Once bed files were completed, a computational mesh for each study site was developed. Mesh development followed procedures outlined in the River2D mesh User manual, 2002 (Waddle and Steffler 2002). Each mesh was developed in four steps: uniform fill at 5.0 meters, wet refine at 1,500 cfs, region refinement, quality index (QI) improvement. Region refinement is the most intensive step in mesh development and reconciled high elevation differences remaining between the bed file and the mesh after the two preceding steps. The River 2D Mesh program pinpoints mesh triangles with elevation differences exceeding a specified threshold by highlighting them yellow. Region refinement was completed by further densifying the mesh in locations with yellow triangles with the elevation threshold set to 0.2 meters. Region refinement was considered complete when yellow triangles were eliminated or where the resulting size would have limited to no effect on model results. Comparison of mesh generated contours to bed file contours at 0.2 meter intervals was performed concurrently with yellow triangle reduction and elimination as part of the region refinement step. During each step in mesh development the QI is monitored. After completion of region refinement small changes were made to specific mesh node locations throughout each mesh to improve QI. One base mesh for each study site was used for all simulation runs, representing the model domain. Minor changes to the mesh were made in each simulation to improve model run time errors and improve model characterization at especially low flows. A summary of mesh metrics for the Upstream and Downstream Sites is provided in Table 3.3.3-27. Mesh metrics from the USFWS Site are also provided in Table 3.3.3-27 but the development process may have varied slightly from that used for the two SSWD sites.

Table 3.3.3-27. Mesh development metrics for SSWD and USFWS sites.

Location	Mesh Nodes	Mesh Elements	Quality Index (QI)
Upstream Site	32,294	64,546	0.349
Downstream Site	32,316	64,610	0.382
USFWS Site	35,146	70,258	0.299

For each hydraulic model, initial hydraulic calibration tests were conducted using the surveyed calibration data collected at each modeling site, summarized in Table 3.3.3-27. Hydraulic calibration data measured in January and February 2018 were the primary datasets used for calibration. The data measured in July 2018 were not used given the hydraulic control changes measured at each site after flows of in excess of 14,000 cfs in March 2018. Six iterations of bed roughness (Ks) modifications were made to match WSEs measured in the field. WSE, velocity and depth model predictions were compared to measured field data to evaluate the effects of changes made to channel roughness. A summary of the absolute mean error between modeled and measured WSE, depth and velocity for the final selected bed roughness values at the Upstream and Downstream sites is provided in Table 3.3.3-28. Examples of final model files, including topographic contours and water depth at 25 cfs are presented in Figures 3.3.3-25 through Figure 3.3.3-27.

Table 3.3.3-28. Summary of absolute mean error for final bed files.

Location	Calibration Type	Discharge (cfs)	Calibration Nodes	Absolute Mean Error (ft)		
				Water Surface Elevation (ft)	Velocity (ft/sec)	Depth (ft)
Upstream Site	High Flow	332.9	21	0.074	0.394	0.330
	Low Flow	17.0	46	0.061	0.217	0.204
Downstream Site	High Flow	319.7	49	0.089	0.413	0.164
	Low Flow	15.6	49	0.034	0.158	0.204

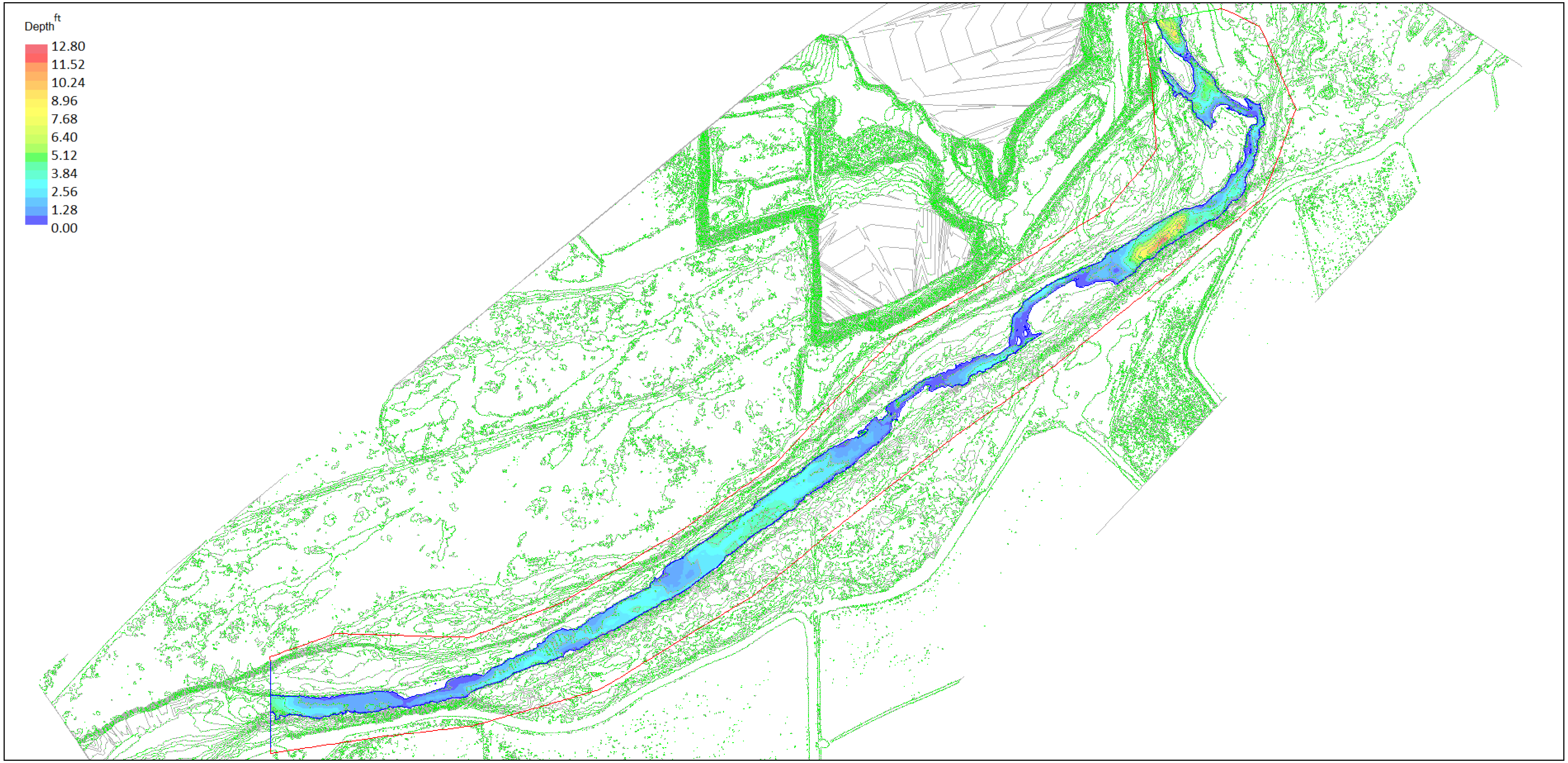


Figure 3.3.3-25. SSWD Upstream Site topographic contours and depth at 25 cfs.

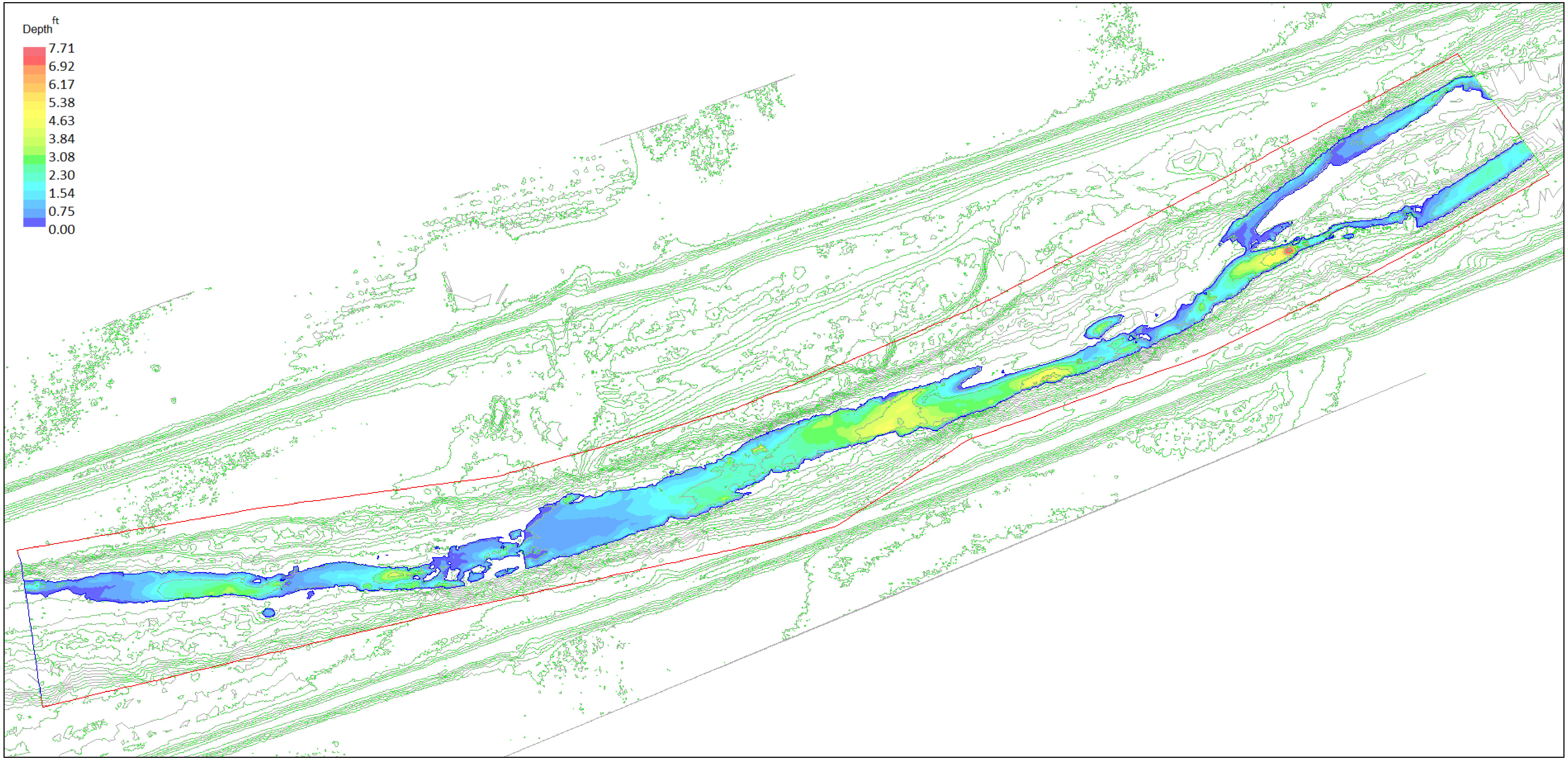


Figure 3.3.3-26. SSWD Downstream Site topographic contours and depth at 25 cfs.

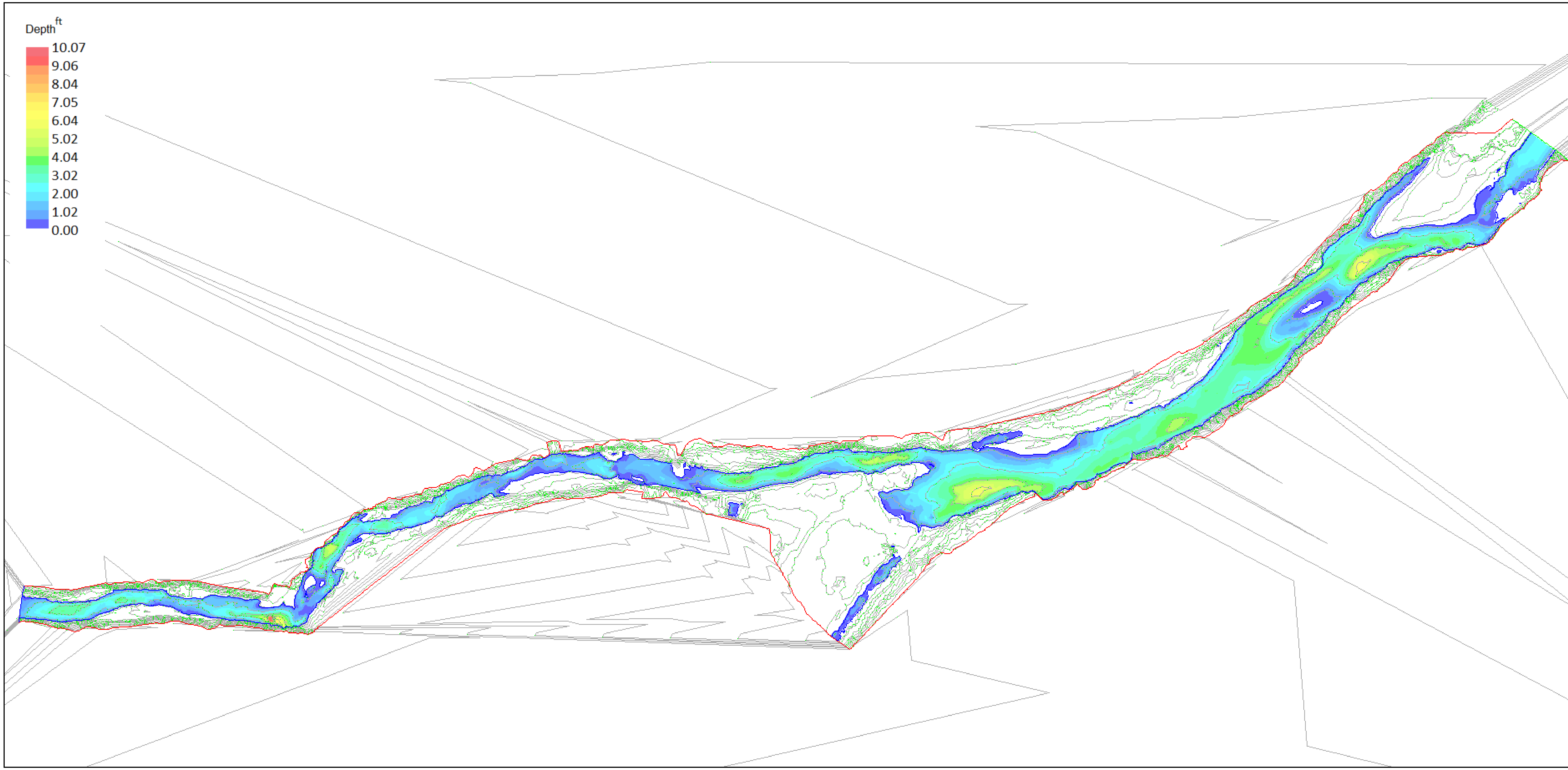


Figure 3.3.3-27. USFWS Site topographic contours and depth at 25 cfs.

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Rating curves provide initial model stage and discharge conditions for a range of modeled flow simulations and are used as model boundary conditions. Rating curves for each study site were developed using field measurements collected during each calibration field effort. Final rating curves for the Upstream and Downstream sites are provided in Attachment E3.3.3A.

Target fish species and habitat suitability criteria (HSC) were selected through a collaborative process with Relicensing Participants. Study target species and life stages were confirmed in the collaborative process and include Chinook Salmon spawning, fry, and juvenile; steelhead spawning, fry, and juvenile; sturgeon spawning; and hardhead adult and juvenile rearing. Final HSC and a description of the HSC selection procedure are provided in Attachment 3.3.3B.

A total of 18 discharges were simulated at each of SSWD's study sites. Simulation flows ranged from 10 cfs, the lowest minimum instream flow requirement for the lower Bear River, to 700 cfs, the typical maximum operational release from Camp Far West Reservoir (Table 3.3.3-29). At a flow of 700 cfs, the inundation level equates to areas of 363,344 sq ft, 332,235 sq ft and 271,037 sq ft for the Upstream, Downstream and USFWS sites, respectively. A tapered step-up approach was used for selection of specific simulations flows, with small increases between low flows from 10 cfs to 100 cfs, and graduated larger changes between higher flows (150 cfs to 700 cfs).

Table 3.3.3-29. Simulation discharges run for SSWD and USFWS models.

Simulation Discharge (cfs)	Simulation Description
10	Minimum Flow Requirement from July through March
15	Simulation only
20	Simulation only
25	Minimum Flow Requirement from April through June
30	Simulation only
35	Simulation only
40	Simulation only
50	Simulation only
75	Simulation only
100	Simulation only
125	Simulation only
150	Simulation only
175	Simulation only
200	Simulation only
250	Simulation only
300	Simulation only
450	Simulation only
700	Operational Capacity of Camp Far West Dam

Habitat suitability and weighted usable area (WUA), for all target species and life stages was calculated at each simulation flow. WUA is the product of a composite habitat suitability index at every node in the model domain and the area associated with each node. Four data inputs are required to calculate habitat suitability: a preference file, a channel index, depth, and velocity. Preference files were created from the final target species and life stage HSC. Two channel index files were developed for each study site: a substrate channel index for spawning life stages, and a cover channel index for salmonid fry and juvenile rearing life stages. Hardhead juvenile and adult HSC only include preferences for depth and velocity and no channel index file was used in these WUA calculations. To improve efficiency through revisions and production of maps and assessment tools, final WUA was calculated using a modeling tool developed in the Python programming language. A subset of River 2D output WUA calculations were compared to calculations from the tool. Resulting differences from this comparison were generally less than 3 percent.

Several open source libraries were used to develop the tool, namely ‘numpy’, ‘scipy’, ‘pandas’, and ‘pyqtgraph’. ‘Scipy’ (scientific python) is used to interpolate the irregular triangulated mesh output from River2D into regularly spaced gridded data. Each grid cell throughout the model domain is 0.25 m^2. ‘Numpy’ (numerical python) is used to perform arithmetic operations on the gridded data, such as interpolation of depth and velocity, application of the suitability curves, and multiplication of the gridded data.

Modeling results from Upstream and Downstream Sites developed by SSWD, and results from the USFWS Site generated a total of 486 distinct WUA calculations. The results are driven by the geomorphic character of each study site and the specific species requirements described by the HSC information. Figures 3.3.3-28 through 3.3.3-36 provide the amount of WUA at each site for each target species life stage. Detailed data are provided in in Attachment 3.3.3C.

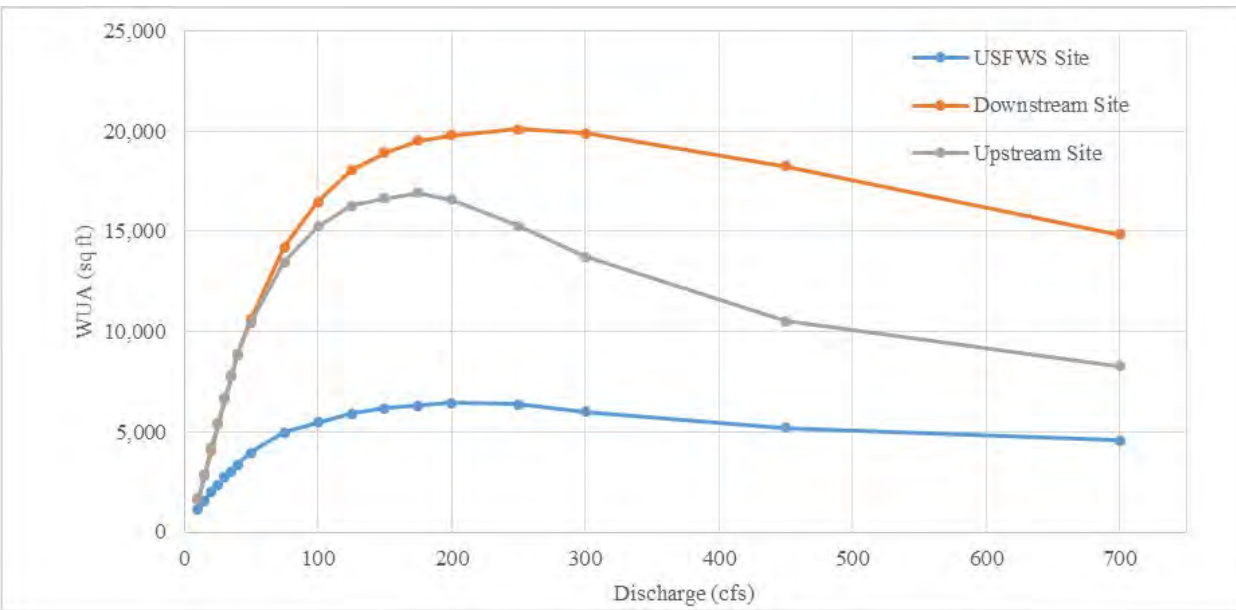

Figure 3.3.3-28. Chinook salmon spawning WUA at SSWD and USFWS sites.

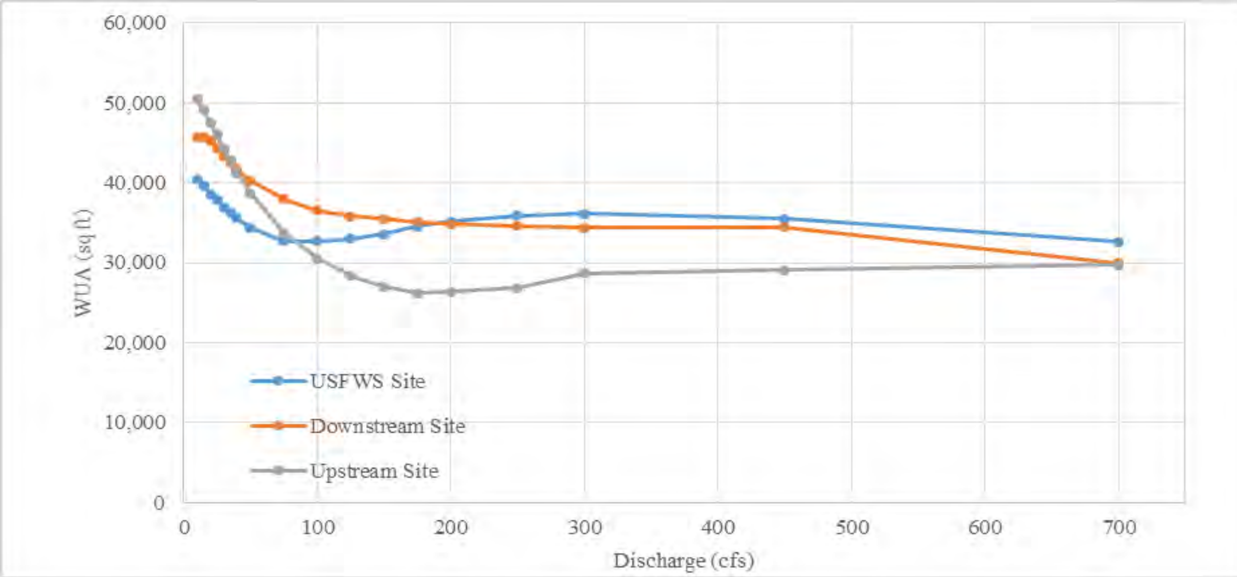

Figure 3.3.3-29. Chinook salmon fry rearing WUA at SSWD and USFWS sites.

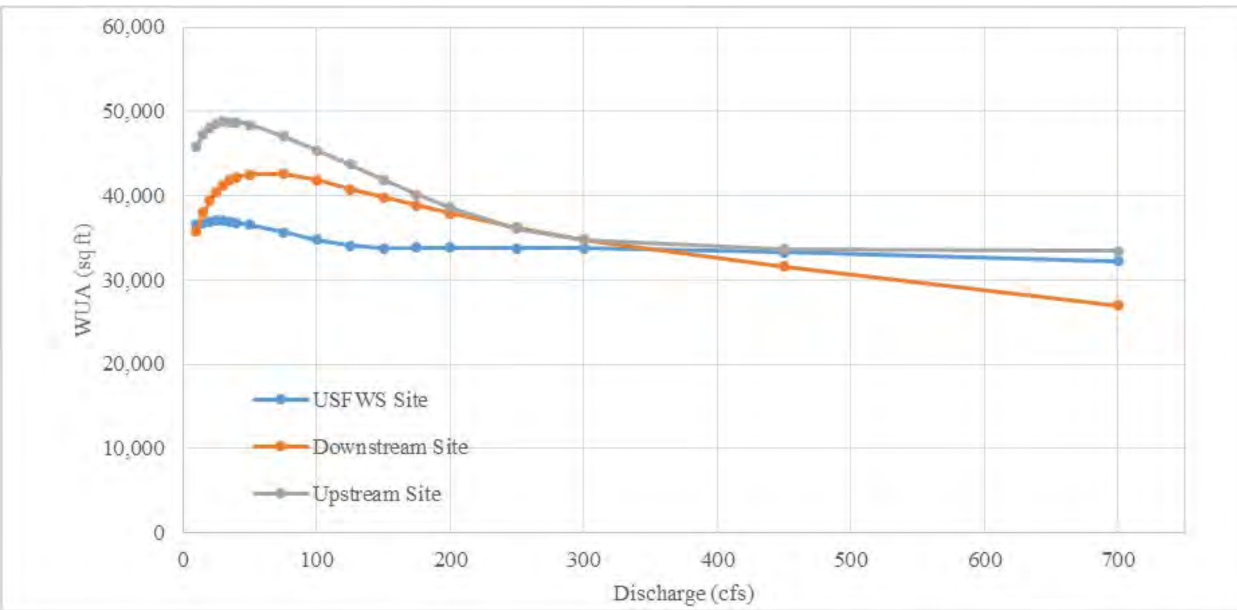

Figure 3.3.3-30. Chinook salmon juvenile rearing WUA at SSWD and USFWS sites.

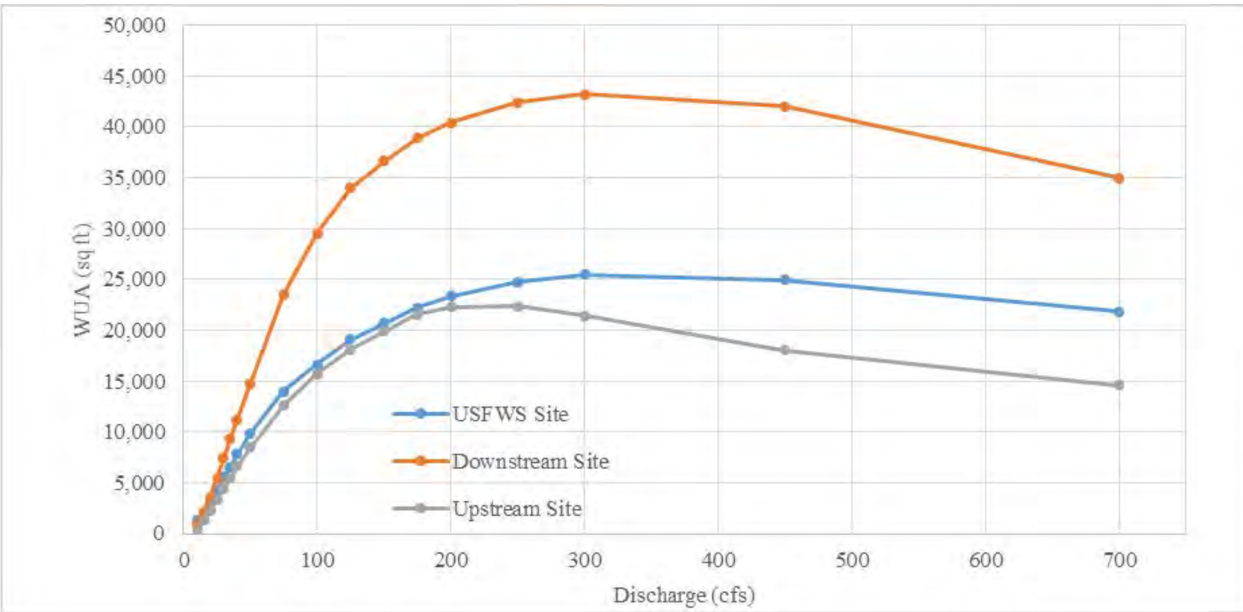

Figure 3.3.3-31. Steelhead spawning WUA at SSWD and USFWS sites.

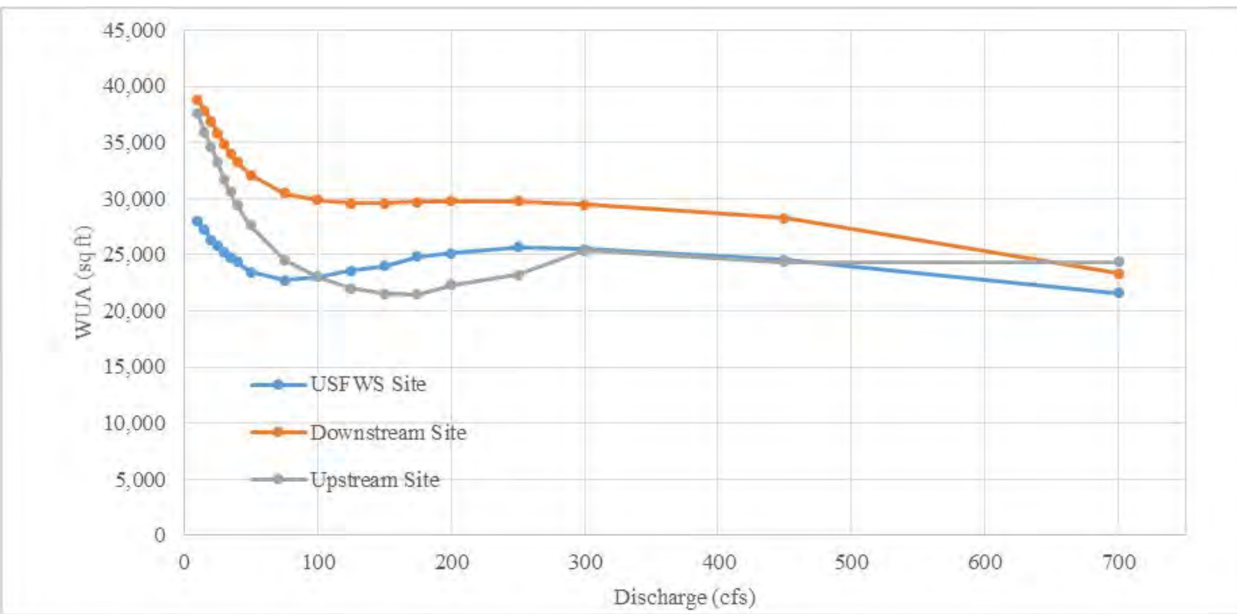

Figure 3.3.3-32. Steelhead fry rearing WUA at SSWD and USFWS sites.

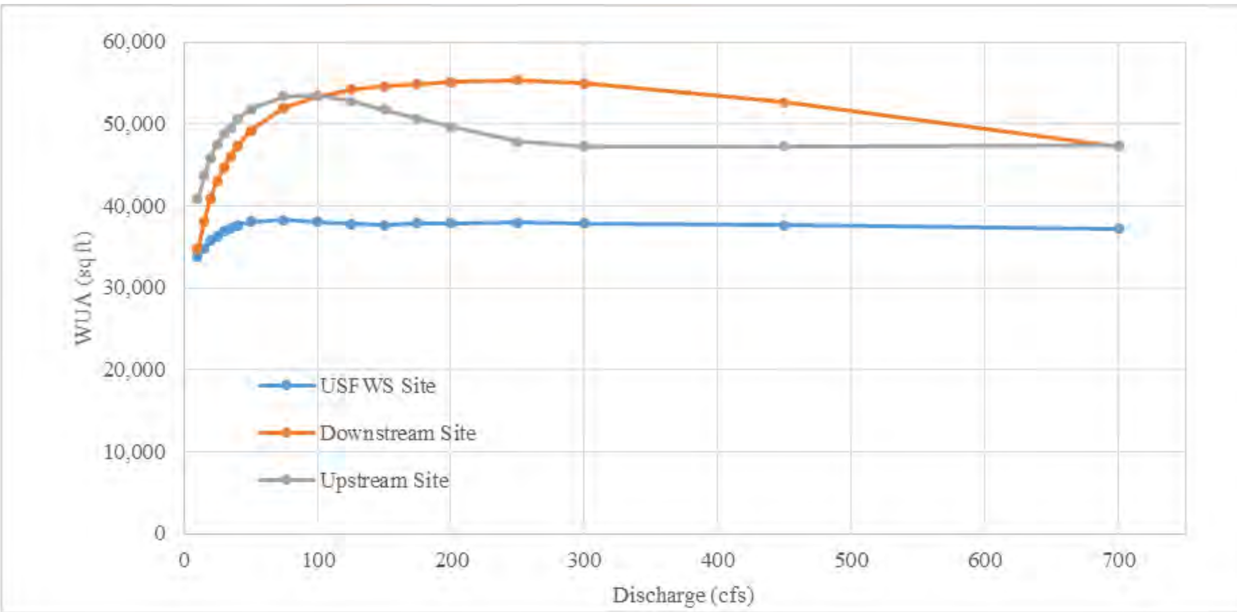

Figure 3.3.3-33. Steelhead juvenile rearing WUA at SSWD and USFWS sites.

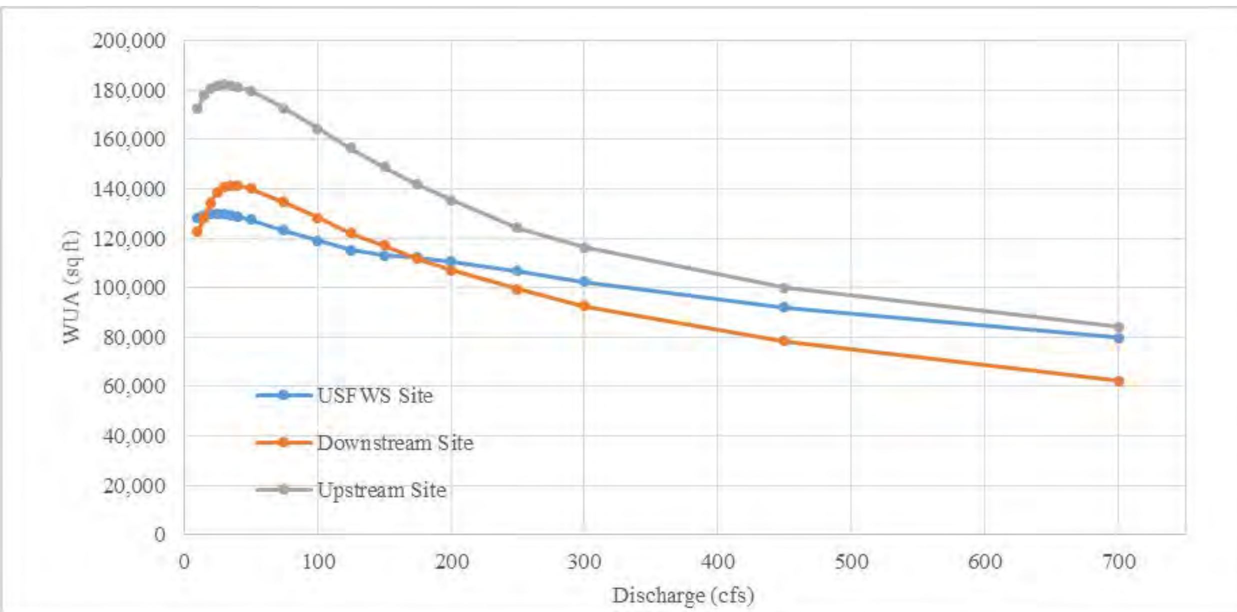

Figure 3.3.3-34. Hardhead juvenile WUA at SSWD and USFWS sites.

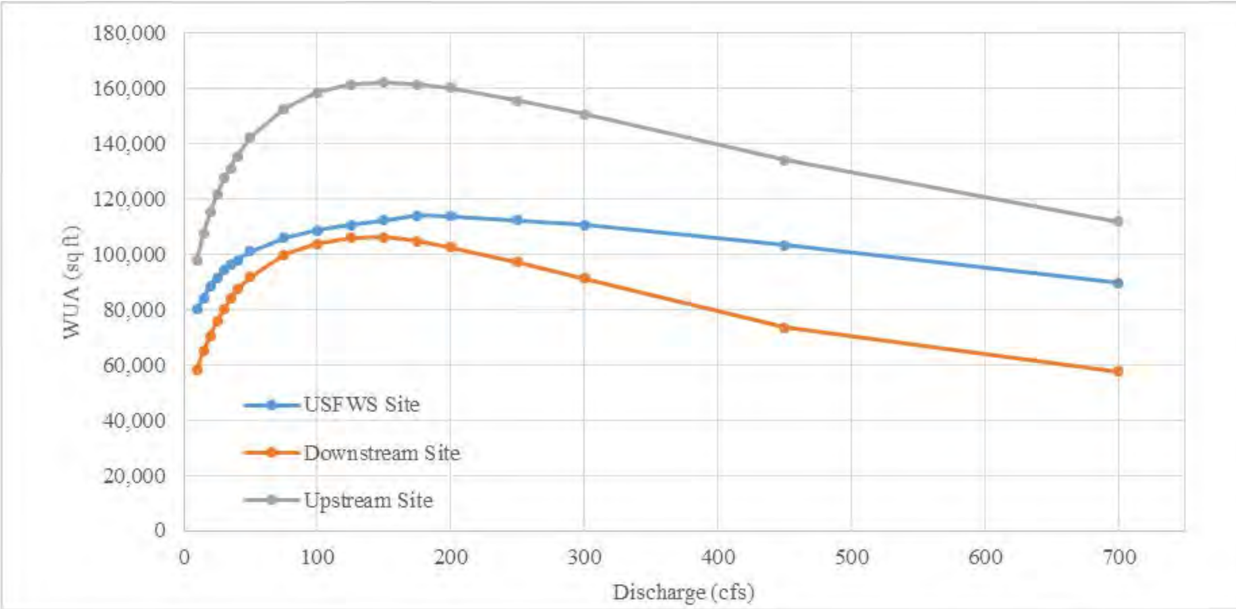

Figure 3.3.3-35. Hardhead adult WUA at SSWD and USFWS sites.

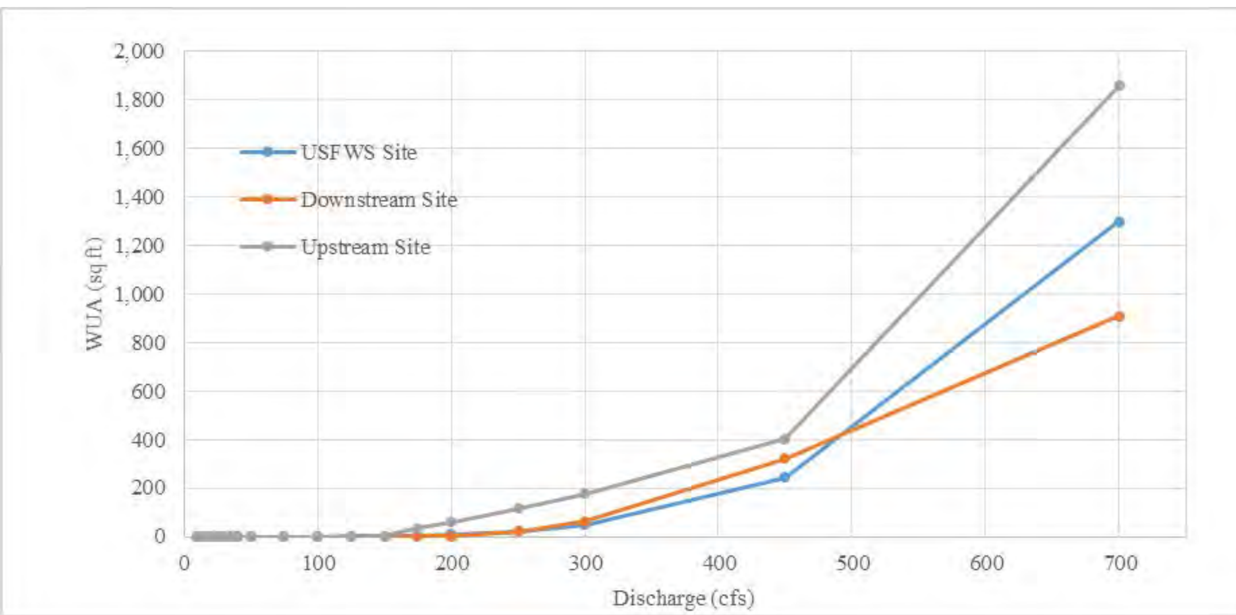

Figure 3.3.3-36. Sturgeon spawning WUA at SSWD and USFWS sites.

Habitat for Chinook Salmon Under Existing Conditions

The Instream Flow Study does not consider temperature as a parameter of suitability and assumes that water temperatures for each life stage of CV fall-run Chinook salmon ESU is adequate. However, this is not true at all times in the lower Bear River. The lower Bear River is a relatively small, valley floor tributary to the Feather River that is a rain-fed watershed and lacks any access to snowpack or water-on-snow freshet runoff. As a result, summer conditions, even pre-Project, would typically be represented by warm, low flows, more akin to a coastal stream than a coldwater Sierran stream. The system can respond rapidly to precipitation, but is highly influenced by ambient warming from late spring into early fall and from releases from upstream water projects. As a result, water temperature is currently a limiting factor to salmonids.

To examine water temperature constraints for CV fall-run Chinook salmon ESU, SSWD developed a water temperature model based on the 1975 to 2014 period of record. The development of this model is discussed in Section 3.3.2.1.2.3 of this Exhibit E. Using its Temp Model, Chinook salmon lifestage usage periodicities in Table 3.3.3-1 and EPA water temperature guidelines in Table 3.3.3-4. SSWD assessed under the No Action Alternative (i.e., Environmental Baseline [current conditions]) the suitability of water temperature in the lower Bear River for the various life stages of CV fall-run Chinook salmon ESU. The evaluation was done at four nodes in the lower Bear River: 1) RM 16.9 immediately downstream of non-Project diversion dam; 2) RM 11.5 at the Highway 65 bridge; 3) RM 6.8 at the Pleasant Grove Road bridge; and 4) RM 3.5 at the Highway 70 bridge. Suitable water temperatures for the lifestage are expressed in terms of the percent of days in each month that stream water temperatures meet EPA guidelines. To do this, SSWD calculated 7DADM water temperatures from the Base Case Temp Model output, which is mean daily water temperature. The results of this analysis by lifestage is presented in Table 3.3.3-30 and discussed below.

Table 3.3.3-30. Percent of days per month where the No Action Alternative stream water temperature at four locations in the lower Bear River is within the EPA guidelines for specific lifestages of CV fall-run Chinook salmon ESU. Temperatures are output from SSWD's Temp Model. For each lifestage, only months where utilization based on periodicity is expected are shown. Zero percent indicates that no days have suitable water temperatures and 100 percent indicates that all the days have suitable water temperatures.[11]

Lower Bear River Location	Month											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
CHINOOK SALMON SPAWNING/INCUBATION/EMERGENCE (EPA GUIDELINE: LESS THAN 13°C 7DADM)												
Below the non-Project diversion dam	100%	100%	80%							0%	31%	99%
Highway 65	100%	81%	53%							0%	51%	99%
Pleasant Grove Bridge gage	98%	75%	46%							0%	49%	99%
Highway 70	94%	69%	38%							0%	49%	98%
CHINOOK SALMON CORE JUVENILE REARING (EPA GUIDELINE: LESS THAN 16°C 7DADM)												
Below the non-Project diversion dam	100%	100%	99%	99%	85%	34%						100%
Highway 65	100%	98%	78%	63%	14%	0%						100%
Pleasant Grove Bridge gage	100%	97%	75%	57%	7%	0%						100%
Highway 70	100%	96%	72%	54%	4%	0%						100%
CHINOOK SALMON MIGRATION (EPA GUIDELINE: LESS THAN 18°C 7DADM)												
Below the non-Project diversion dam							9%	5%	29%	48%	98%	100%
Highway 65							0%	0%	0%	32%	100%	100%
Pleasant Grove Bridge gage							0%	0%	0%	30%	99%	100%
Highway 70							0%	0%	0%	30%	99%	100%
Number of Days included in Each Month's Analysis (WYs 1976 through 2014)	1,209	1,102	1,209	1,170	1,209	1,170	1,209	1,209	1,170	1,203	1,170	1,209

Key: Blue cells are 100% suitable water temperatures based on EPA guideline; green cells are 80% to 99% suitable; yellow cells are 70% to 79% suitable; orange cells are 60% to 69% suitable; and red cells are less than 60% suitable.

[11] This table shows percent of days with suitable water temperature for the entire period of analysis and as one WY type since the existing license includes only one WY type. Refer to tables 3.3.3-35 through 3.3.3-49 for a similar analysis of percent days with suitable water temperature by the five WY types proposed by SSWD for inclusion in the new license.

CV Fall-run Chinook Salmon ESU Immigration and Staging

CV fall-run Chinook salmon ESU immigration and staging primarily occurs from July through December (Table 3.3.3-4), with minimal activity, if any, occurring July through September. Summer fish observations as part of 2018 Water Transfer Monitoring did not document CV fall-run Chinook salmon ESU adult presence in the lower Bear River. In addition, multiple years of Vaki monitoring on the Yuba River generally shows passage events beginning in small numbers in September and increasing by October. In 2015, adults on the Yuba River were not documented until October 12, 2015 (Yuba RMT 2015) and only began to arrive in moderate numbers in November.

Suitable CV fall-run Chinook salmon migration characteristics are not relatively complex to maintain. Primarily, adults need complete access to spawning grounds, without physical impairment due to obstacle or shallow water barrier. The lower Bear River maintains sufficient continuity for adult access to the spawning grounds and no instream barriers or impediments to passage were noted during any relicensing surveys completed (e.g. habitat mapping, redd mapping and fish sampling). Specific instream habitat models were not developed for this lifestage because of the general simplistic needs do not require advanced modeling to measure suitability.

The EPA provides a temperature guideline of 18°C 7DADM for migrating adult salmon to ensure that adults are not stressed and that potential eggs within females are not compromised due to excessively warm water. Returning adults may become stressed as their food stores deplete during their journey to their natal spawning grounds under excessively high water temperature. Adults generally manage for temperature by holding in cooler water, in the Sacramento or Feather rivers on their return until conditions begin to improve and then continuing upstream migration. Water temperature analyses in Table 3.3.3-30 shows that water temperatures from July through September are unsuitable, and even in October early returning adults may be exposed to unsuitable water temperatures for most of the time. Water temperatures are suitable in November and December. Wetter years expand the window of opportunity for returning adults, while drier years limit access due to temperature. These conditions are typical of any small watershed, particularly in the Central Valley, and would occur regardless of the Project.

CV Fall-run Chinook Salmon ESU Spawning

CV fall-run Chinook salmon ESU spawning can occur in the lower Bear River from October through January (Table 3.3.3-4). Spawning surveys found that significant activity appears to occur in January. SSWD's studies, as described above, show that the lower Bear River contains good quantities of Chinook salmon spawning substrate and the overall capacity for spawning does not appear to be limited by gravel based on general activity observed of adult spawners (i.e. opportunistic observation and carcass counts) and related spatial requirements. The EPA (2003) guidelines state that a cool 13°C 7DADM or less is desired for suitable temperature during spawning. The guideline is relatively cold, especially for fall water temperature in the lower Bear River that has not fully chilled due to seasonal ambient cooling. The low elevation of the Bear River and relatively smaller reservoir does not cool the water as quickly as other watersheds. As a result, as shown in Table 3.3.3-31, water temperatures are not suitable for spawning in October, marginal at best in November (i.e., 31% to 51% of the days suitable, most of which occurs in the wetter water years), and become suitable in December and January. Temperature results appear to correlate with significant spawning activity observed in January during SSWD's redd surveys with moderate amounts or spawning in November and December.

During this period, the existing minimum flow requirement is 10 cfs, and SSWD and CFWID are not diverting water for irrigation at the non-Project diversion dam. At a flow of 10 cfs and based on the habitat-flow relationship in Figure 3.3.3-28 and water temperature, there would be no habitat available in October due to water temperature, and some habitat in November, but only about 30 to 50 percent of the time. The amount of habitat available for spawning in every year in December and January is 9 percent of the maximum WUA (Max WUA) at the Instream Flow Study Upstream Site, 8 percent of Max WUA at the Downstream Site, and 17 percent of Max WUA at the USFWS Site.

<u>CV Fall-run Chinook Salmon ESU Egg Incubation</u>

CV fall-run Chinook salmon ESU egg incubation immediately follows spawning and generally requires 40 to 60 days to complete (Moyle 2002). Since spawning in the lower Bear River mainly occurs from November through January, egg incubation can then extend through March, but can begin as early as October (Table 3.3.3-4). SSWD's studies, as described above, show that CV fall-run Chinook salmon ESU spawning substrate has good permeability for egg incubation and there are extensive quality gravel beds extending throughout the lower reach.

SSWD's relicensing Instream Flow Study does not include a specific egg incubation model, but is encompassed as part of the overall spawning curve. Assuming that salmon are able to successfully spawn in suitable habitat and that sufficient water stage is maintained for covering redds, then the overall conditions for egg incubation are physically met for velocity, depth, and substrate habitat modeling.

The EPA (2003) guideline similarly maintains that 13°C 7DADM is advised through spawning and egg incubation. This results in a similar scenario to spawning with unsuitable water temperatures in October, marginal at best in November (i.e., 30% to 48% of the days suitable, and these occur in the wetter years), suitable in December and January, with decreasing suitability in February and March (i.e., 38% to 80% of the days suitable) (Table 3.3.3-30). While the early window for egg incubation may be limited in some warmer, drier water years, it is anticipated that cooler, wetter years expand the opportunity for both spawning and incubation. The seasonal opportunity driven by precipitation and cooler weather is a strong factor that persisted prior to the Project and still influences the opportunistic salmonid production levels in the lower Bear River.

<u>CV Fall-run Chinook Salmon ESU Fry Rearing</u>

Young fish that have emerged from gravel incubation represent a fry lifestage. CV fall-run Chinook salmon ESU fry rearing may occur in December, but is more likely to occur from January through April (Table 3.3.3-4). SSWD's studies, as described above, show that the lower Bear River contains good structural habitat for fry rearing. Instream Flow Study modeling differentiates fry from juvenile fishes, because they are not strong swimmers and tend to occupy different habitat when compared to the more mature juvenile counterparts. The existing minimum flow requirement is 10 cfs, and SSWD and CFWID are not diverting water for irrigation at the non-Project diversion dam. At a flow of 10 cfs and based on the habitat-flow relationship in Figure 3.3.3-29, the existing minimum flow provides 91 to 100 percent of Max WUA at each of the Instream Flow Study Upstream and Downstream sites and at the USFWS Site. Therefore, habitat for fry rearing does not appear to be limited, based on depth, velocity and substrate.

The EPA (2003) guidelines do not recommend different prescriptions for fry or juvenile developmental stages and only officially identify juvenile rearing. Regardless, the EPA suggests that 16°C 7DADM is an appropriate guideline for rearing salmon of either fry or juvenile. Temperature conditions for fry are suitable from December through February, decline slightly in March, and, except for immediately below the non-Project diversion dam, are generally unsuitable in April and May (Table 3.3.3-30).

CV Fall-run Chinook Salmon ESU Juvenile Rearing

As fry mature, food prey items increase in size, swimming ability improves and the developmental stage transitions to juvenile. CV fall-run Chinook salmon ESU juvenile fish are more robust, can handle quicker water and access a greater range of habitat when compared to fry. Juvenile fish are most likely to be present from January through June (Table 3.3.3-4). The existing minimum flow requirement is 10 cfs, and SSWD and CFWID are not diverting water for irrigation at the non-Project diversion dam. At a flow of 10 cfs and based on the habitat-flow relationship in Figure 3.3.3-30, the existing minimum flow provides 84 to 100 percent of Max WUA at each of the relicensing Instream Flow Study Upstream and Downstream sites and at the USFWS Site. Therefore, habitat for juvenile rearing does not appear to be limited, based on depth, velocity and substrate.

As discussed for fry rearing, the EPA suggests that 16°C 7DADM is an appropriate guideline for rearing salmonids (fry or juvenile developmental stages). Temperature conditions for rearing juveniles are excellent from December through February, begin to decline in April and May, and by June are broadly unsuitable (Table 3.3.3-30). While water may warm in these later months, some studies have shown slightly warmer conditions may improve growth for rearing juvenile fish and may not pose as strong of an impact as once contemplated. Maximum growth of juvenile fall-run Chinook salmon has been reported to occur in Nimbus Hatchery fall-run Chinook salmon at 19°C (Cech and Myrick 1999). Regardless, suitable conditions persist for multiple months and the window for extended rearing likely persists in wetter water years, which would be anticipated under unimpaired conditions prior to the Project as well.

CV Fall-run Chinook Salmon ESU Smoltification

Smoltification is the process of a juvenile freshwater anadromous fish moving into saltwater. The process is a general physiological change that begins in freshwater and requires suitable water temperature to occur. Habitat requirements for CV fall-run Chinook salmon ESU fry or juvenile fishes as discussed above address what is needed during rearing, but water temperature during smoltification is suggested to be 14°C 7DADM by EPA guidelines. Smoltification may begin with downstream movement during the fry stage, and so can occur between mid-December and June (Table 3.3.3-4), which generally remain cooler during the earlier months of this time period. During mid-spring and early summer months, temperature warms and would exceed the EPA guideline.

Habitat for Hardhead Under Existing Conditions

Hardhead Juvenile

Juvenile hardhead habitat is predicted throughout each site excluding swift riffle sections. The most suitable habitat occurs in slow sections and along the margins of pools away from the thalweg, as well as in discrete locations off the main channel. Hardhead juvenile WUA was highest at the Upstream Site for all discharge simulations, followed by the Downstream Site and the USFWS Site, with some variation on either end of the simulation range (Figure 3.3.3-34). Max WUA occurs at 25 cfs for the USFWS Site, 40 cfs for the Downstream Site, and 30 cfs for the Upstream Site; however, any one of these flows provides more than 99 percent of Max WUA at each site.

Hardhead Adult

The models identified adult hardhead habitat throughout each site excluding swift riffle sections. Adult hardhead suitability is similar to juvenile suitability except for preferring deeper habitat and slightly faster velocities. The most suitable habitat occurred in slow, deeper sections of pools away from the thalweg, as well as in discrete locations off the main channel. Hardhead adult WUA was highest at the Upstream Site for all discharge simulations, followed by the USFWS Site and then the Downstream Site (Figure 3.3.3-35). Max WUA occurs at 175 cfs for the USFWS Site, and 150 cfs for the Upstream and Downstream sites. Simulation flows between 40 cfs and 300 cfs produced at least 80 percent of Max WUA at all sites.

Habitat for Sturgeon Under Existing Conditions

Sturgeon spawning habitat was limited to a few locations within each site at the highest flows simulated. Suitable habitat was predicted in deep pools with sufficiently high velocity through the thalweg. For simulations less than 125 cfs, no suitable spawning habitat was identified. For simulations from 125 to 200 cfs suitable habitat remains limited enough that it is likely does not provide any spawning benefit. Suitable spawning habitat increases throughout each simulation at all sites, peaking at the highest modeled flow of 700 cfs. (Figure 3.3.3-36.)

SSWD's Relicensing Benthic Macroinvertebrates Study

Only one source of information was found regarding benthic macroinvertebrates downstream of the project Area. In 2011 and 2013, SWRCB staff conducted studies in the lower Bear River as part of the SWAMP Statewide Perennial Streams Assessment. One of the studies was conducted about 0.3-mi upstream of the Pleasant Grove Bridge (RM 7.2) and the other about 0.5-mi upstream of the Highway 70 Bridge (RM 4.0; SWRCB 2011, SWRCB 2013). While the data provided did not include any benthic macroinvertebrate (BMI) metric calculations, the 14 orders and 24 families identified during sampling suggest a diverse assemblage of benthic macroinvertebrates. However, only seven of the 24 families (25%) were from Ephemeroptera, Plecoptera, and Trichoptera (EPT) taxa which suggest a warm water, altered environment (Table 3.3.3-31).

Table 3.3.3-31. Orders and families of aquatic macroinvertebrates that were found at two locations in the lower Bear River (downstream of the Project).

Order	**Amphipoda (scuds)**	**Arhynchobdellida (leeches)**	**Hydroida (hydra)**	**Coleoptera (aquatic beetles)**	**Plecoptera (stoneflies)**	**Hoplonemertea (worms)**
Family	Gammaridae	Erpobdellidae	Hydridae	Elmidae	Perlodidae	Tetrastemmatidae
Order	**Trombidiformes (mites)**	**Veneroida (clams)**	**Basommatophora (snails)**	**Ephemeroptera (mayflies)**	**Trichoptera (caddisflies)**	**Diptera (true flies)**
Family	Sperchontidae	Corbiculidae	Lymnaeidae	Baetidae	Leptoceridae	Chironomidae
	Hygrobatidae	Sphaeriidae	Planorbidae	Leptohyphidae	Hydropsychidae	Simuliidae
	--	--	Ancylidae	Caenidae	Philopotamidae	--
Order	**Hemiptera (true bugs)**	**Odonata (damsel and dragonflies)**	--	--	--	--
Family	Naucoridae	Libellulidae	--	--	--	--
	--	Coenagrionidae	--	--	--	--

Source: SWRCB 2011 and SWRCB 2013.

In 2017, SSWD conducted BMI surveys for Study 3.4. Surveys were conducted at two representative sites on the Bear River between the non-Project diversion dam and the Feather River confluence. Sampling methods conformed to the standard reach wide benthos (RWB) methods for documenting and describing BMI assemblages and physical habitat described by the SWRCB's SWAMP protocol (Ode et al. 2016). Measurements on water chemistry and physical habitat where collected in conjunction with BMI samples.

The sample sites differed in habitat, substrate composition, and transect characteristics (Table 3.3.3-32). The upstream site was dominated by pools, and the downstream site was comprised of pool, run, and riffle habitats. Moving downstream, dominant substrate size shifted from larger to smaller size classes. The shift in substrate composition is likely a function of the more sediment deposition occurring in the reach and geomorphic processes.

Table 3.3.3-32. Water quality and habitat characteristics collected from SSWD's 2017 study at the Bear River downstream of Camp Far West Reservoir.

Category	**Metric**	**Bear River Upstream of Pleasant Grove Bridge**	**Bear River Downstream of Highway 70 Bridge**
Water Quality	Water Temperature (°C)	25.4	25.9
	Dissolved Oxygen (mg/l)	8.6	10.1
	Specific Conductivity (µS/cm)	89	155.7
	pH	7.6	7.78
Site Characteristics	Reach Length (m)	250	150
	Flow (cfs)	15.2	36.4
	Habitat Composition (% of Site)		
	Pool	66	35
	Glide	12	0
	Riffle	19	40
	Run	4	25
	Dominant Thalweg Substrate Composition (% of site)		
	Bedrock	0	0
	Boulder	0	0
	Cobble	10	0
	Gravel, Course	71	35
	Gravel, Fine	15	20
	Sand	0	20
	Fines	0	24

Table 3.3.3-32. (continued)

Category	Metric	Bear River Upstream of Pleasant Grove Bridge	Bear River Downstream of Highway 70 Bridge
Transect Characteristics	Average Sample Plot Depth (cm)	52.5	63.2
	Average Wetted Width (m)	13.5	9.7
	Average Bankful Width (m)	34	16.1
	Average Bankful Height (m)	1.7	1.2
	Riparian Canopy Cover (%)	23	70

Key: µS = microsiemens; cm = centimeters; °C = Celsius; cfs = cubic feet per second; % = percent; µm -= micrometers; mg/l = milligrams/liter; m = meter

BMI samples were collected at the "11" main transects for each site on the Bear River. BMI samples were processed by Ecoanalysts, a qualified taxonomy laboratory that complies with requirements outlined in the SWAMP protocol. Ecoanalysts calculated the California Stream Condition Index (CSCI) scores using BMI data (Table 3.3.3-33). CSCI is California's new assessment tool that translates BMI data into a numerical measurement of stream health. CSCI scores indicate if a stream's health is altered and to what degree as well as reflects ecological structure and the degree of variation of the observed to expected outcome (Rehn et al. 2015). Scores are calculated using two indices, a multi-metric index (MMI) and observed-to-expected (O/E) index. MMI scores reflect ecological structure and function and O/E scores measure taxonomic completeness (Rehn et al. 2015).

The O/E index compares the observed versus expected BMI taxa and measures the biological condition of a site. The MMI index combines several BMI metrics into a single measurement of biological condition (Rehn et al. 2015). The mean CSCI score of reference sites is 1. CSCI scores greater than 1 indicate more complex ecological functioning and taxonomic richness than predicted. As a stream's CSCI score approaches 0, it represents a stream's increased variance from reference conditions and a degradation of the stream's biological conditions (Rehn et al 2015).

An estimated 20,264 organisms were collected from the two sample sites. A randomly sorted subset of 1,381 invertebrates was used to derive BMI metrics. Eight common BMI metrics were calculated for each site and compared to the CSCI predicted value (Table 3.3.3-33). The BMI community upstream of Pleasant Grove was dominated by seed shrimp (Ostrocoda) which made up 94 percent of the sample. The BMI community downstream of Highway 70 was dominated by thee orders: midges (Diptera); Caddisflies (Trichoptera); and mayflies (Ephemeroptera).

The site upstream of Pleasant Grove scored the lower of the two sites. The CSCI score fell into the "very likely altered" status. It was below the expect value for all eight BMI metrics. The second site, downstream of highway 70 had the highest score of 0.70, indicating a "likely altered" state. The site downstream of highway seventy was below the predicted value for all metrics except percent Coleoptera (beetle family).

The BMI communities at both sites were dominated by tolerant species and did not contain intolerant species. Intolerant species refers to macroinvertebrates that are highly susceptible to stream impairment. Shredder taxa were absent from BMI samples. The term Shredder refers to one of the BMI functional feeding groups known for shredding coarse particulate organic matter.

Shredders are found in slower moving water in cold streams where leaf material accumulates (Harrington and Born 1999). Having a high number of shredder taxa can be a good indicator for riparian cover. Both BMI sites scored below the predicted value for taxonomic richness, percent EPT, and percent clinger taxa. EPT percent is an important indicator of stream health because of EPT's sensitivity to disturbance and pollution (Harrington and Born 1999). Variability in site BMI metrics is likely related to differences in habitat complexity. The low species richness is likely related to extremely high flows from the past season.

Table 3.3.3-33. BMI metrics from samples collected from SSWD's 2017 study at the Bear River downstream of Camp Far West Reservoir.

BMI Metrics	Bear River Upstream of Pleasant Grove	Bear River Downstream of Highway 70
ABUNDANCE		
MMI Score	0.49	0.69
CSCI Score	0.47	0.70
Status	Very Likely Altered	Likely Altered
RICHNESS		
Taxonomic Richness	13.55	23.05
Taxonomic Richness Predicted	34.05	33.71
Percent EPT	34	32
Percent EPT predicted	43	44
Percent Coleoptera Taxa	7	13
Percent Coleoptera Taxa Predicted	13	13
INTOLERANCE		
Intolerant Percent	0	0
Intolerant Percent Predicted	15	15
FEEDING		
Percent Clinger Taxa	33	43
Percent Clinger Taxa Predicted	54	50
Shredder Taxa	0	0
Shredder Taxa Predicted	1.8	1.8

Key: MMI = multimetric index; CSCI = California Stream Condition Index; EPT = Ephemeroptera, Plecoptera, Trichoptera

3.3.3.2 Environmental Effects

This section discusses the potential environmental effects of SSWD's Proposed Project, as described in Section 2.2 of this Exhibit E. As part of the Project relicensing, SSWD proposes a Pool Raise, modifications of existing recreation facilities, and modification of the existing Project Boundary. SSWD proposes four measures that will effect aquatic resources: 1) WR1, Implement Water Year Types; 2) AR1, Implement Minimum Streamflows; 3) AR2, Implement Fall and Spring Pulse Flows; and 4) AR3, Implement Ramping Rates. In addition, SSWD assumes its release through December 2035 of up to 4,400 ac-ft of water from July through September (maximum of 37 cfs) in dry and critically dry water years to meet SSWD's Bay-Delta Water Quality Control Plan objectives and consistent with SSWD's water rights will continue outside of relicensing until the SSWD/SWRCB Settlement Agreement expires (Section 2.1.5.2.3). The section below is divided into the following areas: 1) effects of construction-related activities; 2) effects of continued Project O&M.

3.3.3.2.1 Effects of Construction-Related Activities

This section provides a summary of the effects of the construction-related activities associated with the Pool Raise on aquatic resources in the Project Area.

Effects of Construction on Fish and BMI

There would be no change to flow requirements in the new license in the lower Bear River as a result of construction related to the Pool Raise and, therefore, no effect on aquatic habitats, fish, or BMI as a result of construction. SSWD does not anticipate that a scheduled drawdown would be required to facilitate construction: work would proceed during the normal drawdown period. During construction, including relocation of recreation facilities, SSWD would follow all appropriate permit conditions related to water quality and erosion to prevent impacts to aquatic species and habitats in Camp Far West Reservoir.

Effects of Construction on FYLF and WPT

Construction would have no effect on FYLF and WPT. No FYLF or WPT have been documented within or adjacent to the work area, nor is there any appropriate habitat in the area of the proposed work.

Effects of Construction on AIS

Construction would have no effect on AIS, in that the work would not increase the likelihood of these species being introduced to the Project or spreading them outside or to new sites on the Project. The work would be done in the dry, using appropriate equipment, which would be cleaned prior to being brought onto the Project. All recreation construction would be done in existing NSRA and SSRA, so no new sites would be opened for AIS invasion. Further, SSWD will comply with all mitigation measures required under various permits, including those that may relate to preventing the introduction and spread of AIS.

3.3.3.2.2 Effects of Proposed Project Operations and Maintenance

Under SSWD's Proposed Project, water quantity would change, as compared to the No Action Alternative, but any changes to water quality, excluding temperature, would be very minor, as discussed in Section 3.2 in Exhibit E. This section discusses effects of SSWD's Proposed Project on: 1) fish and BMI resources in Camp Far West Reservoir; 2) fish and BMI resources downstream of the Project; 3) FYLF; 4) WPT; and 5) AIS.

Effects on Fish and AIS in Camp Far West Reservoir

Fish in Camp Far West Reservoir would be affected by the Pool Raise. The Pool Raise would create additional storage capacity in Camp Far West Reservoir and, as a result, would create additional shoreline habitat, which would potentially benefit fishes within the Project. The additional storage provided by the Pool Raise would result in a very small increase in the quantity of coldwater stored in the reservoir (Table 3.3.2-21), which may provide additional habitat for coldwater fishes. The additional water surface created by the Pool Raise may also create additional spawning habitat for fishes that utilize the margins of the reservoir (i.e., black bass species).

The Pool Raise would have no effect on AIS in Camp Far West Reservoir.

Effects on Fish in the Lower Bear River

SSWD developed its Proposed Measures WR1, AR1 and AR2 in collaboration with CDFG and USFWS and are continuing to collaborate with these agencies to refine Measure AR3. These flow measures were developed targeting fall-run Chinook salmon with the realization that the Project controls a small amount of water and that this water is warm in summer and fall. With that in mind, SSWD and the agencies developed Measure WR1, Implement Water Year Types, so that, when cool water is available in winter and spring, the key periods for fall-run Chinook salmon, in wetter years the water could be allocated for the benefit of fall-run Chinook salmon. Further emphasis was placed on fall-run Chinook salmon juvenile rearing (i.e., extending the period of suitable conditions, where possible). Measure AR1, Implement Minimum Streamflows, reflects this emphasis with an increase in winter and spring minimum streamflows from existing minimum flows of between 10 to 115 cfs, depending on month and WY type. Minimum streamflows from June through October would be the same, or even slightly less than existing minimum streamflows, recognizing that the water is better used in the winter and spring and no amount of release would substantially improve aquatic habitat over existing conditions in summer and fall, primarily due to ambient warming and the subsequent warm water temperatures. In addition, Measure AR2, Implement Fall and Spring Pulse Flow, would provide a fall pulse flow in Wet, Above Normal, and Below Normal WYs to encourage fall-run Chinook salmon to enter the lower Bear River and spawn, and a spring pulse flow in Below Normal, Dry, and Critically Dry WYs to encourage whatever fall-run Chinook salmon are in the river to outmigrate before conditions in the lower Bear River become unfavorable due to water temperature. Measure AR3, Implement Ramping Rates, would establish ramping rates to protect fall-run Chinook salmon spawning and minimize fish stranding, including for sturgeon. The existing license includes only one water year type and does not include pulse flows or ramping rates.

The discussion below examines the effects to fishes in the lower Bear River that would result from implementing SSWD's Proposed Measures as compared to the existing condition. The analyses focus on fall-run Chinook salmon.

<u>CV Fall-Run Chinook Salmon Adult Migration, Spawning, and Egg Incubation</u>

As shown in Table 3.3.3-4, SSWD's Instream Flow Study examined the relationship between streamflows and fall-run Chinook salmon spawning, which can be considered to include the periods of adult migration (July through December), spawning (October through January) and egg incubation (October through March), at three sites in the lower Bear River. In terms of WUA, SSWD's Proposed Measure AR1 would increase habitat for fall-run Chinook salmon spawning at all three sites and in all WY types (Table 3.3.3-34). The greatest benefits would be in wetter WYs when % Max WUA would be increased from less than 20 percent under existing conditions to more than 90 percent in some months under SSWD's Proposed Project. Increases would be less in drier WYs because of limited water availability.

Table 3.3.3-34. Percent of maximum weighted usable area (WUA) for fall-run Chinook salmon spawning and embryo incubation under existing minimum streamflows (Environmental Baseline) and SSWD's Proposed Project minimum streamflows. The differences between the two scenarios are also presented. All values are presented as the range in percent of maximum WUA that are observed across the three different Instream Flow Study sites.

Month[1]	Range of Percent of Maximum WUA for Fall-run Chinook Salmon for 3 Instream Flow Study Sites Spawning and Embryo Incubation				
	Wet Water Year	Above Normal Water Year	Below Normal Water Year	Dry Water Year	Critically Dry Water Year
ENVIRONMENTAL BASELINE					
Oct 1-14	8 - 17	8 - 17	8 - 17	8 - 17	8 - 17
Oct 15-31	8 - 17	8 - 17	8 - 17	8 - 17	8 - 17
Nov 1-14	8 - 17	8 - 17	8 - 17	8 - 17	8 - 17
Nov 15-30	8 - 17	8 - 17	8 - 17	8 - 17	8 - 17
Dec 1-14	8 - 17	8 - 17	8 - 17	8 - 17	8 - 17
Dec 15-31	8 - 17	8 - 17	8 - 17	8 - 17	8 - 17
Jan 1-14	8 - 17	8 - 17	8 - 17	8 - 17	8 - 17
Jan 15-31	8 - 17	8 - 17	8 - 17	8 - 17	8 - 17
Feb 1-14	8 - 17	8 - 17	8 - 17	8 - 17	8 - 17
Feb 15-28	8 - 17	8 - 17	8 - 17	8 - 17	8 - 17
Mar 1-14	8 - 17	8 - 17	8 - 17	8 - 17	8 - 17
Mar 15-31	8 - 17	8 - 17	8 - 17	8 - 17	8 - 17
PROPOSED PROJECT					
Oct 1-14	8 - 17	8 - 17	8 - 17	8 - 17	8 - 17
Oct 15-31	53 - 62	27 - 36	27 - 36	8 - 17	8 - 17
Nov 1-14	82 - 90	61 - 70	33 - 42	20 - 31	8 - 17
Nov 15-30	90 - 96	61 - 70	33 - 42	20 - 31	14 - 24
Dec 1-14	90 - 96	61 - 70	33 - 42	20 - 31	14 - 24
Dec 15-31	90 - 96	61 - 70	33 - 42	20 - 31	14 - 24
Jan 1-14	90 - 96	61 - 70	33 - 42	20 - 31	14 - 24
Jan 15-31	90 - 96	61 - 70	33 - 42	20 - 31	14 - 24
Feb 1-14	90 - 96	61 - 70	33 - 42	20 - 31	14 - 24
Feb 15-28	90 - 96	61 - 70	33 - 42	20 - 31	14 - 24
Mar 1-14	61 - 70	44 - 53	33 - 42	20 - 31	14 - 24
Mar 15-31	61 - 70	44 - 53	33 - 42	20 - 31	14 - 24
DIFFERENCE BEWTEEN ENVIRONMENTAL BASELINE AND PROPOSED RROJECT					
Oct 1-14	0 - 0	0 - 0	0 - 0	0 - 0	0 - 0
Oct 15-31	44 - 53	12 - 23	12 - 23	0 - 0	0 - 0
Nov 1-14	68 - 81	51 - 60	25 - 43	12 - 16	0 - 0
Nov 15-30	74 - 87	51 - 60	25 - 43	12 - 16	6 - 8
Dec 1-14	74 - 87	51 - 60	25 - 43	12 - 16	6 - 8
Dec 15-31	74 - 87	51 - 60	25 - 43	12 - 16	6 - 8
Jan 1-14	74 - 87	51 - 60	25 - 43	12 - 16	6 - 8
Jan 15-31	74 - 87	51 - 60	25 - 43	12 - 16	6 - 8
Feb 1-14	74 - 87	51 - 60	25 - 43	12 - 16	6 - 8
Feb 15-28	74 - 87	51 - 60	25 - 43	12 - 16	6 - 8
Mar 1-14	51 - 60	35 - 43	25 - 43	12 - 16	6 - 8
Mar 15-31	51 - 60	35 - 43	25 - 43	12 - 16	6 - 8

[1] The months shown correspond to the fall-run Chinook salmon period for spawning in the lower Bear River, as shown in Table 3.3.3-4.

SSWD's Proposed Measure AR2 would provide a fall pulse flow in wetter years to encourage fall-run Chinook salmon to enter the lower Bear River and spawn, and SSWD's Proposed Measure AR3 would establish ramping rates to minimize fish stranding.

However, the increased flow releases would have some unintended effects on suitable water temperatures because allocating higher flows in spring depletes the coldwater pool in Camp Far West Reservoir. Table 3.3.3-35 through Table 3.3.3-49 show changes in stream temperatures for each Chinook salmon lifestage by comparing 7DADM stream temperatures derived from the output of SSWD's Temp Model for the existing condition and the Proposed Project relative to the EPA water temperature guidelines (2003), and presented by WY type. As shown in Tables 3.3.3-37, -40, -43, -46 and -49, water temperatures for migration generally improve, except in Critically Dry WYs, whereas water temperatures for spawning and egg incubation are less suitable in November in all WYs, with a slight decrease in December in some WY types. The lower water temperature suitability in November, which is marginal under existing conditions, is a reasonable trade-off for the significant improvements in overall habitat.

Table 3.3.3-35. Percent of days per month where, under the existing condition in Wet WYs, stream temperature at four locations in the lower Bear River is less than EPA temperature guidelines for specific lifestages of CV fall-run Chinook salmon. Temperatures are output from the Temp Model and are expressed as the 7DADM in degrees Celsius. For each lifestage, only months where utilization based on periodicity is expected are shown. Zero percent indicates that no days have suitable water temperatures and 100 percent indicates that all the days have suitable water temperatures.

Lower Bear River Location	Month											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
CHINOOK SALMON SPAWNING/INCUBATION/EMERGENCE (EPA GUIDELINE: LESS THAN 13°C 7DADM)												
Below the non-Project diversion dam	100%	100%	96%							0%	32%	97%
Highway 65	100%	100%	94%							0%	51%	99%
Pleasant Grove Bridge gage	96%	99%	88%							0%	49%	97%
Highway 70	93%	98%	83%							0%	49%	94%
CHINOOK SALMON CORE JUVENILE REARING (EPA GUIDELINE: LESS THAN 16°C 7DADM)												
Below the non-Project diversion dam	100%	100%	100%	100%	78%	34%						100%
Highway 65	100%	100%	100%	100%	31%	0%						100%
Pleasant Grove Bridge gage	100%	100%	100%	97%	20%	0%						100%
Highway 70	100%	100%	100%	91%	13%	0%						100%
CHINOOK SALMON MIGRATION (LESS THAN 18°C 7DADM)												
Below the non-Project diversion dam							15%	2%	30%	52%	100%	100%
Highway 65							0%	0%	0%	37%	100%	100%
Pleasant Grove Bridge gage							0%	0%	0%	35%	100%	100%
Highway 70							0%	0%	0%	35%	100%	100%
Number of Days included in Each Month's Analysis (9 Wet WYs)	279	253	279	270	279	270	279	279	270	279	270	279
Minimum Flows (cfs) at which Temp Model was Run	10	10	10	25	25	25	10	10	10	10	10	10

Key: Blue cells are 100% suitable water temperatures based on EPA guideline; green cells are 80% to 99% suitable; yellow cells are 70% to 79% suitable; orange cells are 60% to 69% suitable; and red cells are less than 60% suitable.

Table 3.3.3-36. Percent of days per month where, under the Proposed Project in Wet WYs, stream temperature at four locations in the lower Bear River is less than EPA temperature guidelines for specific lifestages of CV fall-run Chinook salmon. Temperatures are output from the Temp Model and are expressed as the 7DADM in degrees Celsius. For each lifestage, only months where utilization based on periodicity is expected are shown. Zero percent indicates that no days have suitable water temperatures and 100 percent indicates that all the days have suitable water temperatures.

Lower Bear River Location	Month											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
CHINOOK SALMON SPAWNING/INCUBATION/EMERGENCE (EPA GUIDELINE: LESS THAN 13°C 7DADM)												
Below the non-Project diversion dam	100%	100%	97%							0%	23%	97%
Highway 65	100%	100%	94%							0%	37%	99%
Pleasant Grove Bridge gage	96%	99%	88%							0%	39%	97%
Highway 70	94%	98%	83%							0%	40%	94%
CHINOOK SALMON CORE JUVENILE REARING (EPA GUIDELINE: LESS THAN 16°C 7DADM)												
Below the non-Project diversion dam	100%	100%	100%	100%	81%	41%						100%
Highway 65	100%	100%	100%	100%	34%	0%						100%
Pleasant Grove Bridge gage	100%	100%	100%	98%	20%	0%						100%
Highway 70	100%	100%	100%	92%	13%	0%						100%
CHINOOK SALMON MIGRATION (LESS THAN 18°C 7DADM)												
Below the non-Project diversion dam							29%	0%	42%	51%	96%	100%
Highway 65							0%	0%	0%	37%	100%	100%
Pleasant Grove Bridge gage							0%	0%	0%	35%	100%	100%
Highway 70							0%	0%	0%	35%	100%	100%
Number of Days included in Each Month's Analysis (9 Wet WYs)	279	253	279	270	279	270	279	279	270	279	270	279
Minimum Flows (cfs) at which Temp Model was Run	125 125	125 125	60 60	40 40	40 25	25 20	10 10	10 10	10 10	10 50	125 125	125 125

Key: Blue cells are 100% suitable water temperatures based on EPA guideline; green cells are 80% to 99% suitable; yellow cells are 70% to 79% suitable; orange cells are 60% to 69% suitable; and red cells are less than 60% suitable.

Table 3.3.3-37. Net change in suitable water temperature between the Proposed Project and existing condition in Wet WYs, in percent of days per month where stream temperature at four locations in the lower Bear River is less than EPA temperature guidelines for specific lifestages of CV fall-run Chinook salmon ESU. Positive values indicate a benefit from the Proposed Project to the given lifestage at the given location.

Lower Bear River Location	Month											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
CHINOOK SALMON SPAWNING/INCUBATION/EMERGENCE (EPA GUIDELINE: LESS THAN 13°C 7DADM)												
Below the non-Project diversion dam	0%	0%	1%							0%	-9%	-3%
Highway 65	0%	0%	0%							0%	-14%	-4%
Pleasant Grove Bridge gage	0%	0%	0%							0%	-10%	-3%
Highway 70	1%	0%	0%							0%	-9%	-2%
CHINOOK SALMON CORE JUVENILE REARING (EPA GUIDELINE: LESS THAN 16°C 7DADM)												
Below the non-Project diversion dam	0%	0%	0%	0%	3%	7%						0%
Highway 65	0%	0%	0%	0%	3%	0%						0%
Pleasant Grove Bridge gage	0%	0%	0%	1%	0%	0%						0%
Highway 70	0%	0%	0%	1%	0%	0%						0%
CHINOOK SALMON MIGRATION (EPA GUIDELINE: LESS THAN 18°C 7DADM)												
Below the non-Project diversion dam							14%	-2%	12%	-1%	-4%	0%
Highway 65							0%	0%	0%	0%	0%	0%
Pleasant Grove Bridge gage							0%	0%	0%	0%	0%	0%
Highway 70							0%	0%	0%	0%	0%	0%
Number of Days included in Each Month's Analysis (9 Wet WYs)	279	253	279	270	279	270	279	279	270	279	270	279

Key: Green shaded cells indicate more suitable water temperature conditions for that CV fall-run Chinook salmon ESU lifestage under Proposed Project then under existing conditions; red shaded cells indicate less suitable water temperature conditions under Proposed Project then under existing conditions .

Table 3.3.3-38. Percent of days per month where, under the existing condition in Above Normal WYs, stream temperature at four locations in the lower Bear River is less than EPA temperature guidelines for specific lifestages of CV fall-run Chinook salmon. Temperatures are output from the Temp Model and are expressed as the 7DADM in degrees Celsius. For each lifestage, only months where utilization based on periodicity is expected are shown. Zero percent indicates that no days have suitable water temperatures and 100 percent indicates that all the days have suitable water temperatures.

Lower Bear River Location	Month											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
CHINOOK SALMON SPAWNING/INCUBATION/EMERGENCE (EPA GUIDELINE: LESS THAN 13°C 7DADM)												
Below the non-Project diversion dam	100%	100%	95%							0%	31%	100%
Highway 65	99%	91%	77%							0%	51%	100%
Pleasant Grove Bridge gage	96%	86%	66%							0%	51%	100%
Highway 70	85%	76%	49%							0%	48%	100%
CHINOOK SALMON CORE JUVENILE REARING (EPA GUIDELINE: LESS THAN 16°C 7DADM)												
Below the non-Project diversion dam	100%	100%	100%	100%	89%	26%						100%
Highway 65	100%	100%	95%	98%	19%	0%						100%
Pleasant Grove Bridge gage	100%	100%	96%	86%	5%	0%						100%
Highway 70	100%	96%	89%	79%	3%	0%						100%
CHINOOK SALMON MIGRATION (LESS THAN 18°C 7DADM)												
Below the non-Project diversion dam							10%	2%	27%	16%	93%	100%
Highway 65							0%	0%	0%	22%	98%	100%
Pleasant Grove Bridge gage							0%	0%	0%	20%	97%	100%
Highway 70							0%	0%	0%	22%	97%	100%
Number of Days included in Each Month's Analysis (9 Above Normal WYs)	279	255	279	270	279	270	279	279	270	279	270	279
Minimum Flows (cfs) at which Temp Model was Run	10	10	10	25	25	25	10	10	10	10	10	10

Key: Blue cells are 100% suitable water temperatures based on EPA guideline; green cells are 80% to 99% suitable; yellow cells are 70% to 79% suitable; orange cells are 60% to 69% suitable; and red cells are less than 60% suitable.

Table 3.3.3-39. Percent of days per month where, under the Proposed Project in Above Normal WYs, stream temperature at four locations in the lower Bear River is less than EPA temperature guidelines for specific lifestages of CV fall-run Chinook salmon. Temperatures are output from the Temp Model and are expressed as the 7DADM in degrees Celsius. For each lifestage, only months where utilization based on periodicity is expected are shown. Zero percent indicates that no days have suitable water temperatures and 100 percent indicates that all the days have suitable water temperatures.

Lower Bear River Location	Month											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
CHINOOK SALMON SPAWNING/INCUBATION/EMERGENCE (EPA GUIDELINE: LESS THAN 13°C 7DADM)												
Below the non-Project diversion dam	100%	100%	95%							0%	21%	95%
Highway 65	99%	97%	76%							0%	40%	99%
Pleasant Grove Bridge gage	96%	90%	65%							0%	41%	100%
Highway 70	87%	72%	48%							0%	40%	100%
CHINOOK SALMON CORE JUVENILE REARING (EPA GUIDELINE: LESS THAN 16°C 7DADM)												
Below the non-Project diversion dam	100%	100%	100%	100%	92%	46%						100%
Highway 65	100%	100%	94%	98%	24%	0%						100%
Pleasant Grove Bridge gage	100%	100%	93%	86%	5%	0%						100%
Highway 70	100%	97%	85%	78%	2%	0%						100%
CHINOOK SALMON MIGRATION (LESS THAN 18°C 7DADM)												
Below the non-Project diversion dam							22%	0%	30%	27%	85%	100%
Highway 65							0%	0%	0%	16%	95%	100%
Pleasant Grove Bridge gage							0%	0%	0%	18%	95%	100%
Highway 70							0%	0%	0%	21%	97%	100%
Number of Days included in Each Month's Analysis (9 Above Normal WYs)	279	255	279	270	279	270	279	279	270	279	270	279
Minimum Flows (cfs) at which Temp Model was Run	60 60	60 60	40 40	25 25	25 25	25 20	10 10	10 10	10 10	10 25	60 60	60 60

Key: Blue cells are 100% suitable water temperatures based on EPA guideline; green cells are 80% to 99% suitable; yellow cells are 70% to 79% suitable; orange cells are 60% to 69% suitable; and red cells are less than 60% suitable.

Table 3.3.3-40. Net change in suitable water temperature days between the Proposed Project and existing conditions in Above Normal WYs, in percent of days per month where stream temperature at four locations in the lower Bear River is less than EPA temperature guidelines for specific lifestages of CV fall-run Chinook salmon ESU. Positive values indicate a benefit from the Proposed Project to the given lifestage at the given location.

Lower Bear River Location	Month											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
CHINOOK SALMON SPAWNING/INCUBATION/EMERGENCE (EPA GUIDELINE: LESS THAN 13°C 7DADM)												
Below the non-Project diversion dam	0%	0%	0%							0%	-10%	-5%
Highway 65	0%	6%	-1%							0%	-11%	-1%
Pleasant Grove Bridge gage	0%	4%	-1%							0%	-10%	0%
Highway 70	2%	-4%	-1%							0%	-8%	0%
CHINOOK SALMON CORE JUVENILE REARING (EPA GUIDELINE: LESS THAN 16°C 7DADM)												
Below the non-Project diversion dam	0%	0%	0%	0%	3%	20%						0%
Highway 65	0%	0%	-1%	0%	5%	0%						0%
Pleasant Grove Bridge gage	0%	0%	-3%	0%	0%	0%						0%
Highway 70	0%	1%	-4%	-1%	-1%	0%						0%
CHINOOK SALMON MIGRATION (EPA GUIDELINE: LESS THAN 18°C 7DADM)												
Below the non-Project diversion dam							12%	-2%	3%	11%	-8%	0%
Highway 65							0%	0%	0%	-6%	-3%	0%
Pleasant Grove Bridge gage							0%	0%	0%	-2%	-2%	0%
Highway 70							0%	0%	0%	-1%	0%	0%
Number of Days included in Each Month's Analysis (9 Above Normal WYs)	279	255	279	270	279	270	279	279	270	279	270	279

Key: Green shaded cells indicate more suitable water temperature conditions for that CV fall-run Chinook salmon ESU lifestage under Proposed Project then under existing conditions; red shaded cells indicate less suitable water temperature conditions.

Table 3.3.3-41. Percent of days per month where, under the existing condition in Below Normal WYs, stream temperature at four locations in the lower Bear River is less than EPA temperature guidelines for specific lifestages of CV fall-run Chinook salmon. Temperatures are output from the Temp Model and are expressed as the 7DADM in degrees Celsius. For each lifestage, only months where utilization based on periodicity is expected are shown. Zero percent indicates that no days have suitable water temperatures and 100 percent indicates that all the days have suitable water temperatures.

Lower Bear River Location	Month											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
CHINOOK SALMON SPAWNING/INCUBATION/EMERGENCE (EPA GUIDELINE: LESS THAN 13°C 7DADM)												
Below the non-Project diversion dam	100%	100%	80%							0%	36%	100%
Highway 65	100%	68%	45%							0%	57%	97%
Pleasant Grove Bridge gage	99%	56%	37%							0%	57%	96%
Highway 70	96%	49%	28%							0%	53%	96%
CHINOOK SALMON CORE JUVENILE REARING (EPA GUIDELINE: LESS THAN 16°C 7DADM)												
Below the non-Project diversion dam	100%	100%	99%	98%	91%	27%						100%
Highway 65	100%	98%	86%	73%	14%	0%						100%
Pleasant Grove Bridge gage	100%	97%	82%	66%	6%	0%						100%
Highway 70	100%	96%	79%	60%	3%	0%						100%
CHINOOK SALMON MIGRATION (LESS THAN 18°C 7DADM)												
Below the non-Project diversion dam							2%	5%	26%	52%	100%	100%
Highway 65							0%	0%	0%	35%	100%	100%
Pleasant Grove Bridge gage							0%	0%	0%	31%	100%	100%
Highway 70							0%	0%	0%	31%	100%	100%
Number of Days included in Each Month's Analysis (7 Below Normal WYs)	217	198	217	210	217	210	217	217	210	217	210	217
Minimum Flows (cfs) at which Temp Model was Run	10	10	10	25	25	25	10	10	10	10	10	10

Key: Blue cells are 100% suitable water temperatures based on EPA guideline; green cells are 80% to 99% suitable; yellow cells are 70% to 79% suitable; orange cells are 60% to 69% suitable; and red cells are less than 60% suitable.

Table 3.3.3-42. Percent of days per month where, under the Proposed Project in Below Normal WYs, stream temperature at four locations in the lower Bear River is less than EPA temperature guidelines for specific lifestages of CV fall-run Chinook salmon. Temperatures are output from the Temp Model and are expressed as the 7DADM in degrees Celsius. For each lifestage, only months where utilization based on periodicity is expected are shown. Zero percent indicates that no days have suitable water temperatures and 100 percent indicates that all the days have suitable water temperatures.

Lower Bear River Location	Month											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
CHINOOK SALMON SPAWNING/INCUBATION/EMERGENCE (EPA GUIDELINE: LESS THAN 13°C 7DADM)												
Below the non-Project diversion dam	100%	100%	86%							0%	14%	94%
Highway 65	100%	83%	32%							0%	40%	97%
Pleasant Grove Bridge gage	99%	70%	26%							0%	45%	96%
Highway 70	96%	62%	21%							0%	48%	96%
CHINOOK SALMON CORE JUVENILE REARING (EPA GUIDELINE: LESS THAN 16°C 7DADM)												
Below the non-Project diversion dam	100%	100%	100%	98%	93%	38%						100%
Highway 65	100%	99%	83%	73%	18%	0%						100%
Pleasant Grove Bridge gage	100%	97%	78%	66%	8%	0%						100%
Highway 70	100%	96%	72%	62%	6%	0%						100%
CHINOOK SALMON MIGRATION (LESS THAN 18°C 7DADM)												
Below the non-Project diversion dam							16%	2%	34%	59%	94%	100%
Highway 65							0%	0%	0%	32%	100%	100%
Pleasant Grove Bridge gage							0%	0%	0%	31%	100%	100%
Highway 70							0%	0%	0%	29%	100%	100%
Number of Days included in Each Month's Analysis (7 Below Normal WYs)	217	198	217	210	217	210	217	217	210	217	210	217
Minimum Flows (cfs) at which Temp Model was Run	30 30	30 30	30 30	25 25	25 20	15 10	10 10	10 10	10 10	10 25	30 30	30 30

Key: Blue cells are 100% suitable water temperatures based on EPA guideline; green cells are 80% to 99% suitable; yellow cells are 70% to 79% suitable; orange cells are 60% to 69% suitable; and red cells are less than 60% suitable.

Table 3.3.3-43. Net change in suitable water temperature days between the Proposed Project flow schedule and existing minimum streamflows in Below Normal WYs, in percent of days per month where stream temperature at four locations in the lower Bear River is less than EPA temperature guidelines for specific life stages of CV fall-run Chinook salmon ESU. Positive values indicate a benefit from the Proposed Project to the given lifestage at the given location.

Lower Bear River Location	Month											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
CHINOOK SALMON SPAWNING/INCUBATION/EMERGENCE (EPA GUIDELINE: LESS THAN 13°C 7DADM)												
Below the non-Project diversion dam	0%	0%	6%							0%	-22%	-6%
Highway 65	0%	15%	-13%							0%	-17%	0%
Pleasant Grove Bridge gage	0%	14%	-11%							0%	-12%	0%
Highway 70	0%	13%	-7%							0%	-5%	0%
CHINOOK SALMON CORE JUVENILE REARING (EPA GUIDELINE: LESS THAN 16°C 7DADM)												
Below the non-Project diversion dam	0%	0%	1%	0%	2%	11%						0%
Highway 65	0%	1%	-3%	0%	4%	0%						0%
Pleasant Grove Bridge gage	0%	0%	-4%	0%	2%	0%						0%
Highway 70	0%	0%	-7%	2%	3%	0%						0%
CHINOOK SALMON MIGRATION (EPA GUIDELINE: LESS THAN 18°C 7DADM)												
Below the non-Project diversion dam							14%	-3%	8%	7%	-6%	0%
Highway 65							0%	0%	0%	-3%	0%	0%
Pleasant Grove Bridge gage							0%	0%	0%	0%	0%	0%
Highway 70							0%	0%	0%	-2%	0%	0%
Number of Days included in Each Month's Analysis (7 Below Normal WYs)	217	198	217	210	217	210	217	217	210	217	210	217

Key: Green shaded cells indicate more suitable water temperature conditions for that CV fall-run Chinook salmon ESU lifestage under Proposed Project then under existing conditions; red shaded cells indicate less suitable water temperature conditions under Proposed Project then under existing conditions.

Table 3.3.3-44. Percent of days per month where, under the existing condition in Dry WYs, stream temperature at four locations in the lower Bear River is less than EPA temperature guidelines for specific lifestages of CV fall-run Chinook salmon. Temperatures are output from the Temp Model and are expressed as the 7DADM in degrees Celsius. For each lifestage, only months where utilization based on periodicity is expected are shown. Zero percent indicates that no days have suitable water temperatures and 100 percent indicates that all the days have suitable water temperatures.

Lower Bear River Location	Month											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
CHINOOK SALMON SPAWNING/INCUBATION/EMERGENCE (EPA GUIDELINE: LESS THAN 13°C 7DADM)												
Below the non-Project diversion dam	100%	100%	68%							0%	29%	100%
Highway 65	100%	66%	15%							0%	49%	100%
Pleasant Grove Bridge gage	100%	60%	12%							0%	47%	100%
Highway 70	100%	52%	5%							0%	49%	100%
CHINOOK SALMON CORE JUVENILE REARING (EPA GUIDELINE: LESS THAN 16°C 7DADM)												
Below the non-Project diversion dam	100%	100%	99%	96%	83%	43%						100%
Highway 65	100%	95%	51%	14%	0%	0%						100%
Pleasant Grove Bridge gage	100%	92%	42%	11%	0%	0%						100%
Highway 70	100%	93%	40%	12%	0%	0%						100%
CHINOOK SALMON MIGRATION (LESS THAN 18°C 7DADM)												
Below the non-Project diversion dam							11%	5%	34%	59%	99%	100%
Highway 65							0%	0%	0%	40%	100%	100%
Pleasant Grove Bridge gage							0%	0%	0%	36%	100%	100%
Highway 70							0%	0%	0%	37%	100%	100%
Number of Days included in Each Month's Analysis (9 Dry WYs)	279	255	279	270	279	270	279	279	270	279	270	279
Minimum Flows (cfs) at which Temp Model was Run	10	10	10	25	25	25	10	10	10	10	10	10

Key: Blue cells are 100% suitable water temperatures based on EPA guideline; green cells are 80% to 99% suitable; yellow cells are 70% to 79% suitable; orange cells are 60% to 69% suitable; and red cells are less than 60% suitable.

Table 3.3.3-45. Percent of days per month where, under the Proposed Project in Dry WYs, stream temperature at four locations in the lower Bear River is less than EPA temperature guidelines for specific lifestages of CV fall-run Chinook salmon. Temperatures are output from the Temp Model and are expressed as the 7DADM in degrees Celsius. For each lifestage, only months where utilization based on periodicity is expected are shown. Zero percent indicates that no days have suitable water temperatures and 100 percent indicates that all the days have suitable water temperatures.

Lower Bear River Location	Month											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
CHINOOK SALMON SPAWNING/INCUBATION/EMERGENCE (EPA GUIDELINE: LESS THAN 13°C 7DADM)												
Below the non-Project diversion dam	100%	100%	85%							0%	18%	97%
Highway 65	100%	74%	17%							0%	34%	100%
Pleasant Grove Bridge gage	100%	67%	14%							0%	38%	100%
Highway 70	100%	56%	6%							0%	42%	100%
CHINOOK SALMON CORE JUVENILE REARING (EPA GUIDELINE: LESS THAN 16°C 7DADM)												
Below the non-Project diversion dam	100%	100%	100%	97%	84%	51%						100%
Highway 65	100%	100%	58%	9%	0%	0%						100%
Pleasant Grove Bridge gage	100%	96%	47%	6%	0%	0%						100%
Highway 70	100%	93%	38%	6%	0%	0%						100%
CHINOOK SALMON MIGRATION (LESS THAN 18°C 7DADM)												
Below the non-Project diversion dam							12%	7%	37%	68%	99%	100%
Highway 65							0%	0%	0%	42%	100%	100%
Pleasant Grove Bridge gage							0%	0%	0%	37%	100%	100%
Highway 70							0%	0%	0%	37%	100%	100%
Number of Days included in Each Month's Analysis (9 Dry WYs)	279	255	279	270	279	270	279	279	270	279	270	279
Minimum Flows (cfs) at which Temp Model was Run	20 20	20 20	20 20	20 20	15 10	10 10	10 10	10 10	10 10	10 10	20 20	20 20

Key: Blue cells are 100% suitable water temperatures based on EPA guideline; green cells are 80% to 99% suitable; yellow cells are 70% to 79% suitable; orange cells are 60% to 69% suitable; and red cells are less than 60% suitable.

Table 3.3.3-46. Net change in suitable water temperature days between the Proposed Project flow schedule and existing minimum streamflows in Dry WYs, in percent of days per month where stream temperature at four locations in the lower Bear River is less than EPA temperature guidelines for specific lifestages of CV fall-run Chinook salmon ESU. Positive values indicate a benefit from the Proposed Project to the given lifestage at the given location.

Lower Bear River Location	Month											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
CHINOOK SALMON SPAWNING/INCUBATION/EMERGENCE (EPA GUIDELINE: LESS THAN 13°C 7DADM)												
Below the non-Project diversion dam	0%	0%	17%							0%	-11%	-3%
Highway 65	0%	8%	2%							0%	-15%	0%
Pleasant Grove Bridge gage	0%	7%	2%							0%	-9%	0%
Highway 70	0%	4%	1%							0%	-7%	0%
CHINOOK SALMON CORE JUVENILE REARING (EPA GUIDELINE: LESS THAN 16°C 7DADM)												
Below the non-Project diversion dam	0%	0%	1%	1%	1%	8%						0%
Highway 65	0%	5%	7%	-5%	0%	0%						0%
Pleasant Grove Bridge gage	0%	4%	5%	-5%	0%	0%						0%
Highway 70	0%	0%	-2%	-6%	0%	0%						0%
CHINOOK SALMON MIGRATION (EPA GUIDELINE: LESS THAN 18°C 7DADM)												
Below the non-Project diversion dam							1%	2%	3%	9%	0%	0%
Highway 65							0%	0%	0%	2%	0%	0%
Pleasant Grove Bridge gage							0%	0%	0%	1%	0%	0%
Highway 70							0%	0%	0%	0%	0%	0%
Number of Days included in Each Month's Analysis (9 Dry WYs)	279	255	279	270	279	270	279	279	270	279	270	279

Key: Green shaded cells indicate more suitable water temperature conditions for that CV fall-run Chinook salmon ESU lifestage under Proposed Project then under existing conditions; red shaded cells indicate less suitable water temperature conditions under Proposed Project then under existing conditions.

Table 3.3.3-47. Percent of days per month where, under the existing condition in Critically Dry WYs, stream temperature at four locations in the lower Bear River is less than EPA temperature guidelines for specific lifestages of CV fall-run Chinook salmon. Temperatures are output from the Temp Model and are expressed as the 7DADM in degrees Celsius. For each lifestage, only months where utilization based on periodicity is expected are shown. Zero percent indicates that no days have suitable water temperatures and 100 percent indicates that all the days have suitable water temperatures.

Lower Bear River Location	Month											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
CHINOOK SALMON SPAWNING/INCUBATION/EMERGENCE (EPA GUIDELINE: LESS THAN 13°C 7DADM)												
Below the non-Project diversion dam	100%	99%	48%							0%	27%	100%
Highway 65	99%	71%	15%							0%	42%	100%
Pleasant Grove Bridge gage	98%	64%	12%							0%	39%	100%
Highway 70	99%	64%	13%							0%	45%	100%
CHINOOK SALMON CORE JUVENILE REARING (EPA GUIDELINE: LESS THAN 16°C 7DADM)												
Below the non-Project diversion dam	100%	100%	96%	100%	89%	0%						100%
Highway 65	100%	96%	45%	8%	0%	0%						100%
Pleasant Grove Bridge gage	100%	92%	41%	5%	0%	0%						100%
Highway 70	100%	95%	41%	5%	0%	0%						100%
CHINOOK SALMON MIGRATION (LESS THAN 18°C 7DADM)												
Below the non-Project diversion dam							7%	17%	21%	72%	100%	100%
Highway 65							0%	0%	0%	26%	100%	100%
Pleasant Grove Bridge gage							0%	0%	0%	22%	100%	100%
Highway 70							0%	0%	0%	23%	100%	100%
Number of Days included in Each Month's Analysis (5 Critically Dry WYs)	155	141	155	150	155	150	155	155	150	155	150	155
Minimum Flows (cfs) at which Temp Model was Run	10	10	10	25	25	25	10	10	10	10	10	10

Key: Blue cells are 100% suitable water temperatures based on EPA guideline; green cells are 80% to 99% suitable; yellow cells are 70% to 79% suitable; orange cells are 60% to 69% suitable; and red cells are less than 60% suitable.

Table 3.3.3-48. Percent of days per month where, under the Proposed Project in Critically Dry WYs, stream temperature at four locations in the lower Bear River is less than EPA temperature guidelines for specific lifestages of CV fall-run Chinook salmon. Temperatures are output from the Temp Model and are expressed as the 7DADM in degrees Celsius. For each lifestage, only months where utilization based on periodicity is expected are shown. Zero percent indicates that no days have suitable water temperatures and 100 percent indicates that all the days have suitable water temperatures.

Lower Bear River Location	Month											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
CHINOOK SALMON SPAWNING/INCUBATION/EMERGENCE (EPA GUIDELINE: LESS THAN 13°C 7DADM)												
Below the non-Project diversion dam	100%	100%	80%							1%	22%	95%
Highway 65	99%	76%	17%							0%	33%	100%
Pleasant Grove Bridge gage	98%	67%	13%							0%	33%	100%
Highway 70	99%	66%	14%							0%	37%	100%
CHINOOK SALMON CORE JUVENILE REARING (EPA GUIDELINE: LESS THAN 16°C 7DADM)												
Below the non-Project diversion dam	100%	100%	100%	96%	70%	27%						100%
Highway 65	100%	96%	50%	11%	0%	0%						100%
Pleasant Grove Bridge gage	100%	94%	44%	5%	0%	0%						100%
Highway 70	100%	94%	42%	5%	0%	0%						100%
CHINOOK SALMON MIGRATION (LESS THAN 18°C 7DADM)												
Below the non-Project diversion dam							15%	18%	18%	59%	91%	100%
Highway 65							0%	0%	0%	26%	100%	100%
Pleasant Grove Bridge gage							0%	0%	0%	22%	100%	100%
Highway 70							0%	0%	0%	23%	100%	100%
Number of Days included in Each Month's Analysis (5 Critically Dry WYs)	155	141	155	150	155	150	155	155	150	155	150	155
Minimum Flows (cfs) at which Temp Model was Run	15 15	15 15	15 15	15 15	15 10	10 10	10 10	10 10	10 10	10 10	10 15	15 15

Key: Blue cells are 100% suitable water temperatures based on EPA guideline; green cells are 80% to 99% suitable; yellow cells are 70% to 79% suitable; orange cells are 60% to 69% suitable; and red cells are less than 60% suitable.

Table 3.3.3-49. Net change in suitable water temperature days between the Proposed Project flow schedule and existing minimum streamflows in Critically Dry WYs, in percent of days per month where stream temperature at four locations in the lower Bear River is less than EPA temperature guidelines for specific lifestages of CV fall-run Chinook salmon ESU. Positive values indicate a benefit from the Proposed Project to the given lifestage at the given location.

Lower Bear River Location	Month											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
CHINOOK SALMON SPAWNING/INCUBATION/EMERGENCE (EPA GUIDELINE: LESS THAN 13°C 7DADM)												
Below the non-Project diversion dam	0%	1%	32%							1%	-5%	-5%
Highway 65	0%	5%	2%							0%	-9%	0%
Pleasant Grove Bridge gage	0%	3%	1%							0%	-6%	0%
Highway 70	0%	2%	1%							0%	-8%	0%
CHINOOK SALMON CORE JUVENILE REARING (EPA GUIDELINE: LESS THAN 16°C 7DADM)												
Below the non-Project diversion dam	0%	0%	4%	-4%	-19%	-12%						0%
Highway 65	0%	0%	5%	3%	0%	0%						0%
Pleasant Grove Bridge gage	0%	2%	3%	0%	0%	0%						0%
Highway 70	0%	-1%	1%	0%	0%	0%						0%
CHINOOK SALMON MIGRATION (EPA GUIDELINE: LESS THAN 18°C 7DADM)												
Below the non-Project diversion dam							8%	1%	-3%	-13%	-9%	0%
Highway 65							0%	0%	0%	0%	0%	0%
Pleasant Grove Bridge gage							0%	0%	0%	0%	0%	0%
Highway 70							0%	0%	0%	0%	0%	0%
Number of Days included in Each Month's Analysis (5 Critically Dry WYs)	155	141	155	150	155	150	155	155	150	155	150	155

Key: Green shaded cells indicate more suitable water temperature conditions for that CV fall-run Chinook salmon ESU lifestage under Proposed Project then under existing conditions; red shaded cells indicate less suitable water temperature conditions under Proposed Project then under existing conditions.

CV Fall-Run Chinook Salmon Fry Rearing

As shown in Table 3.3.3-4, SSWD's Instream Flow Study examined the relationship between streamflows and fall-run Chinook salmon fry rearing, which extends from December through April. In terms of WUA, SSWD's Proposed Measure AR1 would decrease habitat for fall-run Chinook salmon fry rearing at all three sites and in all WY types (Table 3.3.3-34). However, in most months, the percent of Max WUA would still be very high with greater than 80 percent of Max WUA. The changes seem reasonable for the significant improvements in other lifestages.

Table 3.3.3-50. Percent of maximum modeled weighted usable area (WUA) for Chinook salmon fry rearing under existing minimum streamflows (Environmental Baseline) and the water-year-type-specific minimum streamflows that would be implemented under the Proposed Project. The differences between the two scenarios are also presented. All values are presented as the range in percent of maximum WUA that are observed across the three different Instream Flow Study sites.

Month[1]	Range of Percent of Maximum WUA for Fall-run Chinook Salmon for 3 Instream Flow Study Sites Fry Rearing				
	Wet Water Year	Above Normal Water Year	Below Normal Water Year	Dry Water Year	Critically Dry Water Year
ENVIRONMENTAL BASELINE					
Dec 15-31	100 - 100	100 - 100	100 - 100	100 - 100	100 - 100
Jan 1-14	100 - 100	100 - 100	100 - 100	100 - 100	100 - 100
Jan 15-31	100 - 100	100 - 100	100 - 100	100 - 100	100 - 100
Feb 1-14	100 - 100	100 - 100	100 - 100	100 - 100	100 - 100
Feb 15-28	100 - 100	100 - 100	100 - 100	100 - 100	100 - 100
Mar 1-14	100 - 100	100 - 100	100 - 100	100 - 100	100 - 100
Mar 15-31	100 - 100	100 - 100	100 - 100	100 - 100	100 - 100
Apr 1-14	91 - 97	91 - 97	91 - 97	91 - 97	91 - 97
Apr 15-30	91 - 97	91 - 97	91 - 97	91 - 97	91 - 97
PROPOSED PROJECT					
Dec 15-31	56 - 82	73 - 86	88 - 95	94 - 99	97 - 100
Jan 1-14	56 - 82	73 - 86	88 - 95	94 - 99	97 - 100
Jan 15-31	56 - 82	73 - 86	88 - 95	94 - 99	97 - 100
Feb 1-14	56 - 82	73 - 86	88 - 95	94 - 99	97 - 100
Feb 15-28	56 - 82	73 - 86	88 - 95	94 - 99	97 - 100
Mar 1-14	73 - 86	82 - 91	88 - 95	94 - 99	97 - 100
Mar 15-31	73 - 86	82 - 91	88 - 95	94 - 99	97 - 100
Apr 1-14	82 - 91	91 - 97	91 - 97	94 - 99	97 - 100
Apr 15-30	82 - 91	91 - 97	91 - 97	94 - 99	97 - 100
DIFFERENCE BEWTEEN ENVIRONMENTAL BASELINE AND PROPOSED RROJECT					
Dec 15-31	-18 - -44	-14 - -28	-5 - -12	-1 - -6	-3 - 0
Jan 1-14	-18 - -44	-14 - -28	-5 - -12	-1 - -6	-3 - 0
Jan 15-31	-18 - -44	-14 - -28	-5 - -12	-1 - -6	-3 - 0
Feb 1-14	-18 - -44	-14 - -28	-5 - -12	-1 - -6	-3 - 0
Feb 15-28	-18 - -44	-14 - -28	-5 - -12	-1 - -6	-3 - 0
Mar 1-14	-14 - -28	-9 - -18	-5 - -12	-1 - -6	-3 - 0
Mar 15-31	-14 - -28	-9 - -18	-5 - -12	-1 - -6	-3 - 0
Apr 1-14	-6 - -9	0 - 0	0 - 0	2 - 3	3 - 6
Apr 15-30	-6 - -9	0 - 0	0 - 0	2 - 3	3 - 6

1 The months shown correspond to the fall-run Chinook salmon period for fry rearing in the lower Bear River, as shown in Table 3.3.3-4.

SSWD's Proposed Measure AR3 would establish ramping rates to minimize fish stranding.

However, the increased flow releases would have some unintended effects on suitable water temperatures because allocating higher flows in spring depletes the coldwater pool in Camp Far West Reservoir. As shown in Tables 3.3.3-37, -40, -43, -46 and -49, under the Proposed Project suitable water temperatures for rearing would slightly decrease in some months, but overall would slightly improve or not change. The lower river habitats generally improve, except in

Critically Dry WYs, whereas water temperatures for spawning and egg incubation are less suitable in November in all WYs, with a slight decrease in December in some WY types. As with habitat, the changes seem reasonable for the significant improvements in other fall-run Chinook salmon lifestages.

CV Fall-run Chinook Salmon Juvenile Rearing

As shown in Table 3.3.3-4, SSWD's Instream Flow Study examined the relationship between streamflows and fall-run Chinook salmon juvenile rearing, which can be considered to include the periods of juvenile rearing (mid-January through June) and smoltification (mid-December through June) at three sites in the lower Bear River. In terms of WUA, SSWD's Proposed Measure AR1 would have a minor effect on juvenile rearing habitat that is already greater than 90% Max WUA in most months and WY types (Table 3.3.3-34).

Table 3.3.3-51. Percent of maximum modeled weighted usable area (WUA) for Chinook salmon juvenile rearing under existing minimum streamflows (Environmental Baseline) and the water-year-type-specific minimum streamflows that would be implemented under the Proposed Project. The differences between the two scenarios are also presented. All values are presented as the range in percent of maximum WUA that are observed across the three different Instream Flow Study sites.

Month[1]	Range of Percent of Maximum WUA for Fall-run Chinook Salmon at 3 Instream Flow Study Sites Juvenile Rearing				
	Wet Water Year	Above Normal Water Year	Below Normal Water Year	Dry Water Year	Critically Dry Water Year
ENVIRONMENTAL BASELINE					
Jan 15-31	84 - 99	84 - 99	84 - 99	84 - 99	84 - 99
Feb 1-14	84 - 99	84 - 99	84 - 99	84 - 99	84 - 99
Feb 15-28	84 - 99	84 - 99	84 - 99	84 - 99	84 - 99
Mar 1-14	84 - 99	84 - 99	84 - 99	84 - 99	84 - 99
Mar 15-31	84 - 99	84 - 99	84 - 99	84 - 99	84 - 99
Apr 1-14	95 - 100	95 - 100	95 - 100	95 - 100	95 - 100
Apr 15-30	95 - 100	95 - 100	95 - 100	95 - 100	95 - 100
May 1-14	95 - 100	95 - 100	95 - 100	95 - 100	95 - 100
May 15-31	95 - 100	95 - 100	95 - 100	95 - 100	95 - 100
Jun 1-14	95 - 100	95 - 100	95 - 100	95 - 100	95 - 100
Jun 15-30	95 - 100	95 - 100	95 - 100	95 - 100	95 - 100
PROPOSED PROJECT					
Jan 15-31	90 - 96	98 - 100	97 - 100	93 - 100	89 - 99
Feb 1-14	90 - 96	98 - 100	97 - 100	93 - 100	89 - 99
Feb 15-28	90 - 96	98 - 100	97 - 100	93 - 100	89 - 99
Mar 1-14	98 - 100	99 - 100	97 - 100	93 - 100	89 - 99
Mar 15-31	98 - 100	99 - 100	97 - 100	93 - 100	89 - 99
Apr 1-14	99 - 100	95 - 100	95 - 100	93 - 100	89 - 99
Apr 15-30	99 - 100	95 - 100	95 - 100	93 - 100	89 - 99
May 1-14	99 - 100	95 - 100	95 - 100	89 - 99	89 - 99
May 15-31	95 - 100	95 - 100	93 - 100	84 - 99	84 - 99
Jun 1-14	95 - 100	95 - 100	89 - 99	84 - 99	84 - 99
Jun 15-30	93 - 100	93 - 100	84 - 99	84 - 99	84 - 99
DIFFERENCE BEWTEEN ENVIRONMENTAL BASELINE AND PROPOSED PROJECT					
Jan 15-31	-7 - 12	-1 - 16	1 - 13	1 - 9	0 - 5
Feb 1-14	-7 - 12	-1 - 16	1 - 13	1 - 9	0 - 5
Feb 15-28	-7 - 12	-1 - 16	1 - 13	1 - 9	0 - 5
Mar 1-14	-1 - 16	1 - 15	1 - 13	1 - 9	0 - 5
Mar 15-31	-1 - 16	1 - 15	1 - 13	1 - 9	0 - 5
Apr 1-14	-1 - 4	0 - 0	0 - 0	-2 - 0	-6 - 0
Apr 15-30	-1 - 4	0 - 0	0 - 0	-2 - 0	-6 - 0
May 1-14	-1 - 4	0 - 0	0 - 0	-6 - 0	-6 - 0
May 15-31	0 - 0	0 - 0	-2 - 0	-11 - 1	-11 - 1
Jun 1-14	0 - 0	0 - 0	-6 - 0	-11 - 1	-11 - 1

Table 3.3.3-51. (continued)

Month[1]	Range of Percent of Maximum WUA for Fall-run Chinook Salmon at 3 Instream Flow Study Sites Juvenile Rearing				
	Wet Water Year	Above Normal Water Year	Below Normal Water Year	Dry Water Year	Critically Dry Water Year
Jun 15-30	-2 - 0	-2 - 0	-6 - 0	-11 - 1	-11 - 1

[1] The months shown correspond to the fall-run Chinook salmon period for juvenile rearing in the lower Bear River, as shown in Table 3.3.3-4.

SSWD's Proposed Measure AR2 would provide a spring pulse flow in drier years to encourage fall-run Chinook salmon to migrate out of the lower Bear River before conditions became unfavorable, and SSWD's Proposed Measure AR3 would establish ramping rates to minimize fish stranding.

As shown in Tables 3.3.3-37, -40, -43, -46 and -49, water temperatures for juvenile rearing would generally improve, except in Critically Dry WYs.

Summary

Implementing the Proposed Project and the associated WY-type-specific minimum streamflow schedules would beneficially affect fall-run Chinook salmon in the lower Bear River by increasing spawning habitat availability in all proposed WY types, and by maintaining high availability of juvenile rearing habitat in all WY types. There are currently suitable quantities of salmonid spawning habitats and LWM, and the Proposed Project does not alter the mechanisms by which those habitats or habitat features are maintained or diminished. Implementation of ramping rates reduces the potential for any aquatic organisms, including anadromous salmonids and sturgeon, to become stranded as a result of flow fluctuations, while implementation of pulse flows is expected to facilitate initiation of migratory behaviors in anadromous fish species. Implementation of the Proposed Project generally does not substantially improve or reduce water temperature conditions in any WY type, although some minor benefits and detriments to water temperature conditions can be expected across all WY types and fall-run Chinook salmon lifestages.

Direct insight into the thermal responsiveness of the Bear River during elevated flows in July and August was observed during a water transfer in 2018. Project releases increased from 12 cfs to approximately 125 cfs and were maintained from July 2 to August 28, 2018. At the start of the water transfer discharge ramp-up, temperature was 27.5°C at RM 3.5. Temperature reduced to 22.9°C by July 4 as higher discharge moved through the system, but then steadily warmed to 26.2°C by July 19, even though discharge was maintained at 125 cfs. The relatively small coldwater pool available in Camp Far West Reservoir provided only minimal relief at flows 10 times the baseflow. Ambient conditions rapidly began to warm elevated discharges and nullified any thermal cooling benefit. The small storage capacity, low elevation, and warm ambient summer conditions exceeded the Project's ability to provide any meaningful extended thermal offset for coldwater fishes in late spring through fall months.

Additional insights are provided by SSWD's analysis of the thermal characteristics of Camp Far West Reservoir inflow and Project releases that was conducted for both existing conditions and the Proposed Project, which shows that, from June through October or November (depending on WY type), Project releases are cooler than reservoir inflows under either scenario, but the cooler release temperatures still exceed suitable temperature thresholds for salmonid rearing and spawning lifestages, and the benefits are spatially ephemeral and generally lost to ambient air temperatures by Highway 65. Furthermore, at Highway 65, temperatures in the lower Bear River were more similar to reservoir inflow temperatures, indicating that without the Project or Camp Far West Dam in place, the lower Bear River would still not be hospitable to coldwater fish species during the summer and fall months. Details of this analysis are provided in Section 3.3.5.2.2 (existing conditions analysis) and Section 3.3.5.3.1 (Proposed Project analysis) of this Exhibit E.

While not specifically analyzed here, the beneficial effects that implementation of the Proposed Project would provide for fall-run Chinook salmon would likely be realized for other anadromous fish species that opportunistically utilize the lower Bear River when conditions allow (e.g., white sturgeon). Therefore, the Proposed Project would be expected to be beneficial to all anadromous fish species that may utilize the Bear River.

Effects on FYLF

SSWD's Proposed Project would have no effect on FYLF. The Project is located at the western edge of the range for this species, and well below an elevation of 600 ft, where FYLF normally occur (Sycamore Associates 2013).

Effects on WPT

The Proposed Project would have a potentially beneficial effect on WPT. While the Pool Raise may affect potential habitat for this species, this would likely result in an increase to aquatic habitat for WPT within the reservoir. However, this elevation raise would also result in the conversion of 470 linear ft of riverine habitat in the Bear River and 295 linear ft of habitat in Rock Creek for WPT into lacustrine habitat. Both of these habitats are utilized by this species and this increase in water surface elevation should have minimal effect on WPT.

Effects on AIS

The Proposed Project would have no effect on AIS. Recreation at Camp Far West Reservoir, which is the activity most likely to introduce and spread AIS, will continue as it does now. The prevention program portion of the Dreissenid Mussel Assessment Plan should reduce the potential introduction of dreissenid mussels, as well as other AIS that can be introduced and spread through recreation activities. American bullfrog is already present in the Project, at the two sewage ponds near the Project, and generally throughout the region. The Proposed Project would not cause the further spread of American bullfrog.

3.3.3.3 Cumulative Effects

3.3.3.3.1 Fish

The cumulative effects resulting from past, present, and reasonably foreseeable future actions, including the Proposed Project, have the potential to affect fisheries resources in the lower Bear

River. These activities include timber harvest, livestock grazing, mining, and operation of upstream and downstream water projects.

While timber harvest and grazing rates are likely to decline in the future, the effects of past impacts from these activities are likely negative to anadromous salmonids and other native fishes in the lower Bear River and come in the form of altered regimes for flows and sediment delivery, increased stream temperatures, and reduced availability of large woody material. The water projects on the Bear River further these effects by blocking sediment and large woody material from traveling downstream and altering flow and temperature regimes.

Similarly, mining on the scale that occurred in the mid-1800s has ceased, but those activities significantly altered the geology and soils in the Bear River watershed. These activities moved massive amounts of sediments, some of which were deposited in the lower Bear River channel. The effect of that deposition on fishes is mixed, since these gravels were deposited prior to the construction of the water projects and continue to be available to fish in the lower Bear River (e.g., spawning habitat for anadromous fish), despite reduced sediment transport caused by the various water projects, including Camp Far West. Mining activities also introduced mercury and other harmful metals into the Bear River. Camp Far West and the other reservoirs provide an opportunity for these elements to settle and in the case of mercury be bioaccumulated in fish.

The construction and ongoing operation of the various water projects on the Bear River, all of which went into operation prior to the Project, represent the most significant past and present actions in the Project area, and the operators of those projects are predicting increased demand for water in the foreseeable future. The upstream projects affect inflow into the Project, and the non-Project diversion dam immediately downstream of Camp Far West Dam affects the Project's water releases to the lower Bear River. The resulting hydrograph in the lower Bear River is impaired and can be unpredictable. Such a hydrograph likely has negative effects to anadromous salmonids and other native fishes through reduced streamflows (including large run-off flows in spring), which may negatively impact available spawning and rearing habitats and alter stream temperatures.

Another cumulative effect on native Bear River fish is the introduction and persistence of non-native fish species. These species have been introduced by resource agencies, the public, or conveyance from upstream projects. Camp Far West Reservoir provides good habitat for non-native fish (especially black bass species) that compete with native species and could be transported downstream during spill events. Similarly, the Sacramento River basin has also been stocked with non-native fish which are now present in the Bear River.

The net impact of the cumulative effects to anadromous salmonids and other native fishes in the lower Bear River is likely negative and potentially realized in lower productivity and survival rates resulting from reductions in suitable habitats, altered magnitude and timing of stream flows, and increased stream temperatures. However, implementing the Proposed Project would reduce the impact of these cumulative effects by improving aquatic habitat availability in the lower Bear River during the winter and spring months in years when water is more plentiful.

3.3.3.3.2 FYLF

As described above, the Project is located at the western edge of the range for this species, and well below an elevation of 600 ft, where FYLF normally occur (Sycamore Associates 2013).

3.3.3.3.3 WPT

WPT is significantly affected by loss and degradation of existing habitats – ponds, shallow lakes, and low gradients streams – to urban, agricultural, and water development. Historical over-collection for food and the pet trade was likely a major factor in the early decline of the species. Introduction of non-native competing species, particularly other species of turtles and predators; the proliferation of native predators, such as raccoons, in areas of human development; and road mortality also have significant impacts. Although the Project provides potential habitat for WPT in the Project reservoir, deep water reservoirs may represent low quality habitat, with negligible benefit to the species. As a source of predatory fish into tributaries, the Project may contribute to cumulative effects on WPT. In the lower Bear River, historical mining has altered instream and floodplain wetland habitats for WPT; this activity is not associated with the Project, which has no cumulative effect.

3.3.3.4 Unavoidable Adverse Effects

The Proposed Project will continue to capture sediment, truncate high flows, and alter flow and water temperature in the lower Bear River, which may affect fish (and habitat) downstream of the Project. These effects are considered at best beneficial (e.g., slightly cooler water temperatures from the Proposed Project) and at worst long-term, minor impacts that are cumulative in nature when considering the entire Bear River watershed. Instream flow and water temperature modeling shows that simply releasing more flow to provide additional physical habitat will not significantly improve water temperature and therefore not make conditions better overall for threatened or endangered fish species.

The Project will continue to have no other effect on FYLF and WPT than periodically inundating a portion of the Bear River and Rock Creek with slack water as Camp Far West Reservoir is filled. It is unlikely that FYLF or WPT utilize these habitats since these fluctuations happen in most years.

3.3.3.5 Measures or Studies Recommended by Agencies and Not Adopted by SSWD

As described in Appendix E4 in this Exhibit E, USFWS, NMFS, CDFW, SWRCB and FWN each submitted written comments on SSWD's December 29, 2018, DLA. SSWD reviewed each letter or email and, with regards to aquatic resources, identified three individual proposals to modify a SSWD proposed measure or add a new measure. In addition, during discussions with Relicensing Participants, CDFW and others expressed an interest in exploring whether use of the Camp Far West Dam low-level outlet from April 16 through June 30 would improve water temperature conditions for fall-run Chinook salmon during that period. Each of the comments is discussed below.

Camp Far West Reservoir Aquatic Invasive Species Management Plan

In USFWS' April 10, 2019 letter commenting on the DLA, USFWS stated:

> Six aquatic invasive species that are known to occur in the Project area were not addressed adequately in the DLA: Asian clam (*Corbicula fluminea*), Brazilian waterweed (*Egeria densa*), floating water primrose (*Ludwigia peploides* ssp. *Montevidensis*), parrot's feather milfoil (*Myriophyllum aquaticum*), Eurasian watermilfoil (*Myriophyllum spicatum*), and American bullfrog (*Lithobates catesbeianus*). The Commission and Licensee should develop an Aquatic Invasive Management Plan that addresses these and the additional aquatic invasive species that have the potential to occur within the Project area due to their proximal known locations. Management actions related to bullfrogs should be coordinately closely with measures to protect the California red-legged frog. This plan should be developed within one year of license issuance.

In CDFW's April 14, 2019 letter commenting on the DLA, CDFW stated:

> The Department recommends the Licensee develop an Aquatic Invasive Species Management Plan in order to comply with Fish and Game Code 2302. Per the DLA, a search of the USGS Non-indigenous Aquatic Animals database and the CalWeedMapper database and other information, six aquatic invasive species (AIS) occur in Camp Far West Reservoir.

Based on the AIS known from and with the potential to be introduced to the Project, a specific aquatic invasive species management plan is unnecessary. Outside of the FERC relicensing process, SSWD has developed a Dreissenid Mussel Vulnerability Assessment, as required by California State law and Fish and Game Code § 2302 (described in Sections 3.3.3.1.2 and 3.3.3.3.2 in Exhibit E of the FLA), which includes public education provisions for prevention of introduction of dreissenid mussel species. The public education component also applies to other aquatic invasive species. Since prevention is the main management tool for aquatic invasive species, a plan in the new license which duplicates the one required by State law, would not provide added benefit. There are no currently known effective management strategies for the four species located in the FERC Project Boundary - Asian clam, Eurasian milfoil, floating water primrose and American bullfrog, so prevention of further spread also remains the best management tool.

Lower Bear River Aquatic Monitoring Plan for Stream Fish, Macroinvertebrates, Water Temperature, and Water Quality

In USFWS' April 10, 2019 letter commenting on the DLA, USFWS stated:

> The DLA contains no proposal to monitor the status of salmonids within the lower Bear River for the new license period. Without periodic monitoring of these populations, the USFWS is unable to ascertain the long-term effects the Project and resulting PME conditions or how these future license conditions may need to be adjusted to better manage salmonid production. The USFWS requests that the Licensee, agencies, and TLP relicensing team collaboratively develop a reasonable monitoring plan for salmonids within the lower Bear River that allows a comparison of juvenile production and survival between years. The monitoring plan should be finalized within one year of license issuance.

In CDFW's April 14, 2019 letter commenting on the DLA, CDFW stated:

> Additionally, the Department recommends the Licensee develop a framework for the monitoring of aquatic and water resources. At a minimum, an aquatic and water resources monitoring plan should address the following areas: stream fish, benthic macroinvertebrates, water temperature, and water quality (potentially including mercury bioaccumulation) so that the Licensee and the RP can obtain a baseline and determine if the revised flow and ramping schedule is impacting these suggested parameters.

In FWN's April 15, 2019 letter commenting on the DLA, FWN stated:

> The DLA does not contain any recommendations or a proposal for monitoring of salmonids in the lower Bear River. The Network believes that monitoring is important in determining the actual benefits of the proposed actions. FWN would like to work with the Licensee and agencies to develop a proposal that can effectively measure and monitor this fish population.

SSWD has not included in its FLA a PM&E measure for monitoring aquatic and water resources for three reasons. First, CDFW, USFWS, and FWN do not provided an adequate description of the rationale, scope or estimated cost for the suggested monitoring so that SSWD can provide a detailed reply to CDFW's, USFWS', and FWN's requests. Without these details, SSWD can only evaluate and reply to CDFW's, USFWS', and FWN's suggestions in general terms. Second and in general terms, the need for monitoring is unclear: the best available science shows SSWD's proposed PM&E measures would improve conditions for stream fish including salmonids, BMI and water temperature (water quality is in good condition, and SSWD's proposed PM&E measures would have no effect on water quality) in the lower Bear River, and CDFW, USFWS, and FWN do not suggest a mechanism under normal Project O&M that would negate these improvements. CDFW, USFWS, and FWN provide no basis for monitoring improvements in stream fish, BMI and water temperature that would occur under SSWD's proposal. Monitoring these improvements is not needed because it would not provide additional improvements. Third and in general terms, the use of monitoring data is unclear. Specifically, CDFW, USFWS, and FWN do not describe mechanisms to isolate in monitoring data Project-related effects from non-Project-related effects on these resources, or how the monitoring data would be used to modify license conditions. While monitoring would track changes in stream fish, BMI and water temperature over time, information that may be useful to agencies that are delegated the responsibility to manage these resources, the monitoring would be of no value from a Project license compliance perspective.

Spawning Gravels and Large Woody Material

In its comment letter on the DLA, NMFS states:

> The Project effects on the recruitment of large woody material and spawning gravel should be mitigated for based on the length of the license. Even though these resources are available now, the Project will continue to inhibit the addition of new materials; future sediment/LWM surveys and new substrate augmentation are likely to be needed. This Project effect should be acknowledged and long-term mitigation measures should be developed.

and

> NMFS does not agree that the Project is beneficial to anadromous fish resources in the Bear River. The Project's dam blocks any ongoing recruitment of large woody material and spawning gravels as well as operations altering the natural hydrograph, including the natural recession rates from high to low flows. NMFS also believes that fall-run Chinook salmon are not the only anadromous fish, "that is most sensitive to flow and temperature." CCV steelhead, North American green sturgeon, and CV spring-run Chinook salmon are also seasonal present and are sensitive to changes in flow and water temperature.

SSWD has not included in its FLA a PM&E measure for monitoring or augmenting LWM or spawning gravels in the Bear River downstream of Camp Far West Dam and the non-Project diversion dam for the following reasons. First, NMFS does not provide an adequate description of the rationale, scope, or estimated cost for the suggested monitoring and augmentation so that SSWD can respond in detail to NMFS's request. Without these details, SSWD can only evaluate and reply to NMFS's suggestion in general terms. Second, and in general terms, the need for monitoring is unclear, because the best available science shows that adequate quantities of these resources currently exist and continue to persist in the lower Bear River, and because NMFS does not provide adequate description of a mechanism by which these resources would become depleted in the future. Finally, and also in general terms, the use of monitoring data and utility of LWM and gravel augmentation is unclear. Specifically, NMFS does not describe a mechanism to isolate in monitoring data Project-related effects from non-Project-related effects on these resources, and does not describe how monitoring data would be used to inform and guide augmentation activities.

SSWD clarifies that the Proposed Project, as described in Appendix E2 and evaluated in this section and in Section 3.3.5.3.2, is anticipated to be beneficial to anadromous fish resources in the Bear River because of the inclusion of flow-related measures that are being collaboratively developed by SSWD, agencies and NGOs. While SSWD is collaborating on proposed conditions to provide pulse flows and ramping rates, the proposed flow-related measures do not represent an attempt to mimic the 'natural hydrograph' but simply to provide more favorable conditions for aquatic resources in the lower Bear River. The Bear River does not experience a natural hydrograph because of the cumulative effects of the operations of four projects upstream of Camp Far West and the non-Project diversion dam downstream.

Use of the Low-Level Outlet in Spring to Improve Water Temperatures for Fall-run Chinook Salmon

CDFW and other Relicensing Participants requested SSWD perform a sensitivity run of the Proposed Project with the Temp Model where spill flows from Camp Far West Dam between April 16 and June 30 would be reduced up to the capacity of the Camp Far West Dam's low-level outlet to evaluate whether use of the low-level outlet would improve water temperatures in the Lower Bear River for fall-run Chinook salmon. The objective was to maintain water temperatures in the Bear River below the EPA guideline for juvenile Chinook salmon rearing of 16°C for an extended period of time relative to the Proposed Project.

SSWD performed the analysis and showed that Camp Far West Dam release temperatures are initially cooler when spill flows are diverted through the low-level outlet, but then increase immediately following the spill event, often causing the 7DADM water temperature below the non-Project diversion dam to exceed the EPA guideline for rearing of 16°C up to 2 weeks earlier than under the Proposed Project. Water temperatures were also observed to be warmer below the non-Project diversion dam in the sensitivity run in the fall when releases were switched from the powerhouse to the low-level outlet because releases from the low-level outlet earlier in the year had reduced the coldwater pool available in the fall. Temperature benefits were observed at Highway 65 when spill flows were diverted to the low-level outlet, often keeping the 7DADM below the 16°C guideline for a few days longer. Once spill was over, both scenarios had similar temperature conditions at Highway 65 indicating that temperatures were at equilibrium with the environment.

Results of the sensitivity analysis indicated a net loss of suitable temperature conditions for rearing salmonids downstream of the non-Project diversion dam in spring when spill flow is diverted through the low-level outlet (Table 3.3.3-52).

Table 3.3.3-52. Number of days (and percent of total number of days), by water year type, where 7DADM water temperatures in the lower Bear River below the non-Project diversion dam are less than EPA (2003) guidelines for salmonid rearing (16°C) under the Proposed Project and an alternative scenario where the Camp Far West low-level outlet (LLO) would be utilized in an attempt to reduce stream temperatures in the lower Bear River for the benefit of rearing salmonids. Also shown are the differences in suitable temperature days between the two scenarios – positive differences indicate a benefit from reoperation of the low-level outlet, while negative differences indicate detrimental temperature effects of reoperating the low-level output compared to the Proposed Project.

Scenario	Number and Percent of Days Water Temperatures Meet EPA Guideline for Chinook Salmon Rearing					
	Wet Water Year	Above Normal Water Year	Below Normal Water Year	Dry Water Year	Critically Dry Water Year	All Water Years
Proposed Project	1,562 (88%)	1,610 (91%)	1,236 (90%)	1,586 (89%)	834 (85%)	6,828 (89%)
Use of Low-Level Outlet Alternative	1,592 (90%)	1,562 (88%)	1,227 (89%)	1,585 (89%)	834 (85%)	6,800 (88%)
Difference	**30 (2%)**	**-48 (-3%)**	**-9 (-1%)**	**-1 (0%)**	**0 (0%)**	**-28 (0%)**

The initial benefit of cooler release temperatures often occurred when 7DADM temperatures immediately below the non-Project diversion dam were already less than the EPA temperature guideline in the Proposed Project. A small temperature benefit often occurred at Highway 65, but the negative outcome of increased temperatures below the non-Project diversion dam post-spill outweighs any short-term positive benefits that occur during spill events. For this reason and the cost related to shifting flows to the low-level outlet, SSWD does not propose a measure to sue the low-level outlet in the spring.

3.3.3.6 List of Attachments

Attachment 3.3.3A Final Rating Curves for the Upstream and Downstream Instream Flow Study Sites

Attachment 3.3.3B Final HSC and a Description of the HSC Selection Procedure

Attachment 3.3.3C Fall-Run Chinook and Steelhead Map Sets

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Attachment 3.3.3A

Final Rating Curves for Hydraulic Simulation Modeling of the Upstream and Downstream Sites

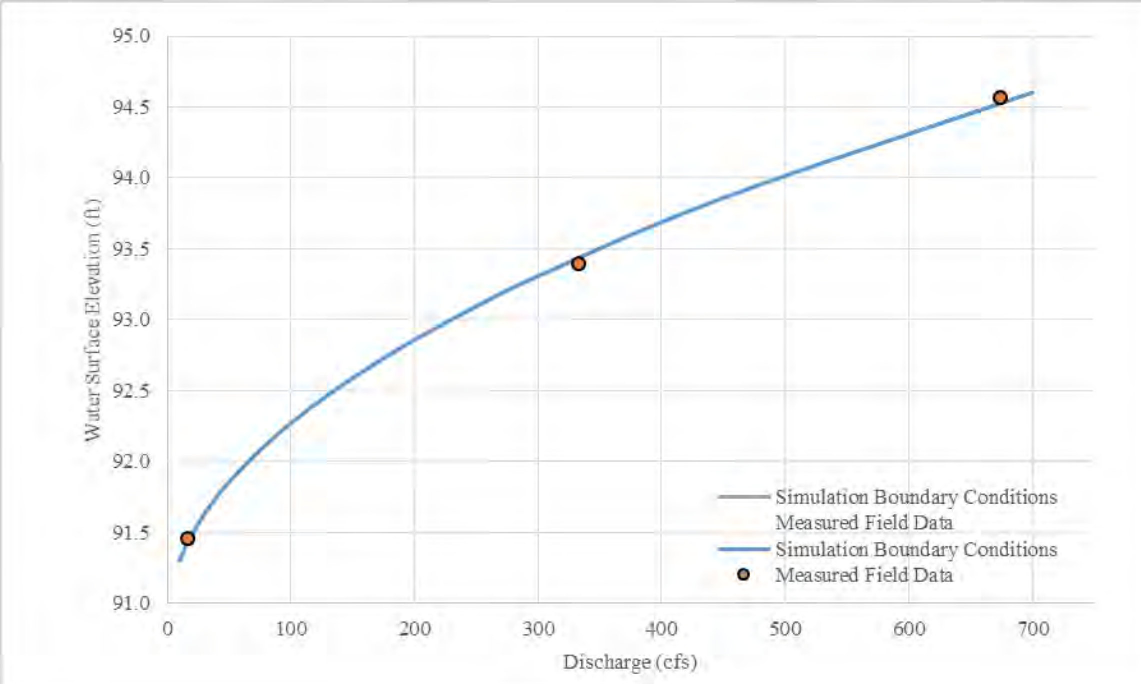

Figure 3.3.3A-1. Final rating curve for boundary conditions at the Upstream Site.

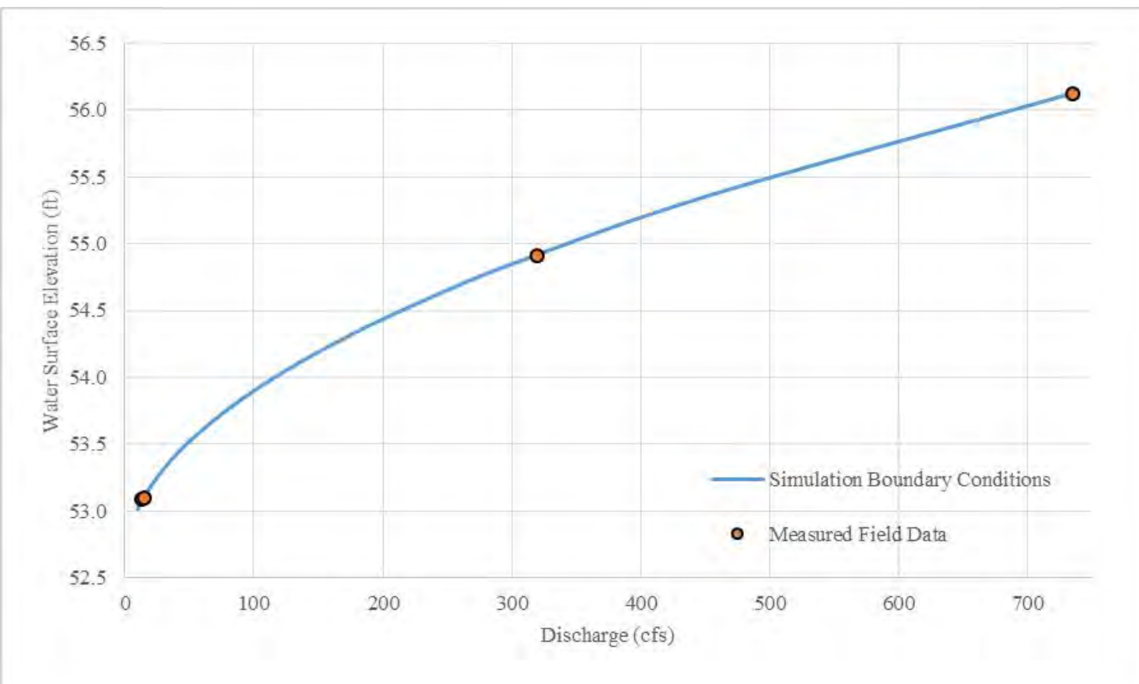

Figure 3.3.3A-2. Final rating curve for boundary conditions at the Downstream Site.

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Attachment 3.3.3B
Habitat Suitability Criteria

Summary of Habitat Suitability Criteria (HSC) for Target Fish Species and Life Stages on the Lower Bear River

The procedures employed for selecting Habitat Suitability Criteria (HSC) for use in assessing instream habitat in the Bear River, California are described below.

HSC were selected through a collaborative process involving a variety of instream flow specialists, as well as the California Department of Fish and Wildlife (CDFW), U.S. fish & Wildlife Service (FWS), and other relicensing participants. Two collaboration meetings were held, the first on July 20, 2018, with a follow-up meeting on August 20, 2018.

Prior to the HSC meeting, a list of proposed target species and life-stages were discussed with the following selections:

Species	Life-stage	Variables*
Chinook Salmon	Spawning	Depth, MC Velocity, Substrate
(fall run)	Fry	Depth, MC Velocity, Cover
	Juvenile	Depth, MC Velocity, Cover
Steelhead	Spawning	Depth, MC Velocity, Substrate
	Fry	Depth, MC Velocity, Cover
	Juvenile	Depth, MC Velocity, Cover
Hardhead	Juvenile	Depth, MC Velocity
	Adult	Depth, MC Velocity
Sturgeon	Spawning	Depth, MC Velocity, Substrate
(white or green)		

*MC Velocity = Mean Column Velocity

This list was presented and agreed upon by the meeting participants. Candidate HSC curves representing each of these species and life-stages were developed prior to the meeting, then presented and discussed until a final HSC curve was approved by everyone in attendance. The list of candidate HSC was developed from a master list of HSC data, which for salmon and steelhead were filtered to a subset of HSC developed from California streams and rivers and applied in previous instream flow studies. The HSC dataset for Chinook salmon, being very large, was further filtered to represent HSC from medium-sized streams similar to the Bear River (e.g., HSC from large rivers such as the Sacramento River, Klamath River, etc. were dropped from consideration). Candidate HSC for steelhead were drawn from all California studies, but emphasis was focused on data from medium-sized rivers. In general, the consensus-selected HSC for these two species relied heavily on HSC from Clear Creek and the lower Yuba River relicensing studies, as well as Big Sur HSC for steelhead fry and juvenile rearing.

Due to the paucity of HSC data for sturgeon spawning (green or white), all available HSC datasets were presented for discussion; however the consensus HSC for use in the Bear River relied on HSC developed and selected for use on the lower Yuba River. Hardhead HSC previously vetted and utilized in the Yuba-Bear Drum-Spaulding instream flow study were presented and selected to represent that species in the Bear River.

Specific notes RE selection of individual HSC for each species and life-stage are presented below. Please refer to the tables at the end of this document for the final HSC curve points.

Chinook Salmon

Spawning. Ten candidate HSC datasets were presented to represent spawning by Chinook Salmon, in addition to site-specific data collected at 73 salmon redds in the Bear River study area. Following discussion of the site-specific data and comparison of candidate HSC curves, a consensus HSC curve for spawning velocity was selected that utilized the Clear Creek fall Chinook curve from 0.9 fps to 1.83 fps, then followed the lower Yuba HSC curve to 5.32 fps (see figures). The consensus HSC for spawning depth likewise followed the Clear Creek fall Chinook HSC from 0.4-1.1 ft, then descended to 5 ft based on consensus and discussion regarding the site-specific characteristics of the Bear River study area. HSC representing spawning substrate for Chinook utilized consensus for gravel less than one inch in diameter, then followed the Clear Creek HSC for substrates dominated by gravels 1-3 inches to gravels ranging from 3-5 inches in diameter.

Fry Rearing. Seven candidate HSC datasets were presented to represent rearing by Chinook salmon. The consensus HSC for mean column velocity for Chinook fry was based on the FWS Yuba River HSC, which was largely adopted for the lower Yuba instream flow study, except the consensus HSC was truncated at 1.8 fps. The consensus HSC for fry depth bracketed the FWS Yuba fry curve from 0.0 to 1.5 ft, but then descended proximal to the lower Yuba curve to 4.0 ft. HSC for fry cover suitability was based on the Clear Creek fall Chinook HSC, except for consensus-based decisions for aquatic vegetation, which was rare in the Bear River.

Juvenile Rearing. The FWS Yuba HSC for juvenile Chinook velocity suitability, subsequently adopted for use in the lower Yuba instream flow study (with slight modifications), was likewise selected for use in the Bear River. In contrast to the FWS and Lower Yuba curves, the Bear consensus curve dropped to zero suitability at 3.0 fps. For juvenile depth, the Bear River participants selected a new curve that utilized components of several existing HSC, including the Battle Creek, Stanislaus River, and lower Yuba curves. Use of instream cover by juvenile Chinook was based on the Clear Creek fall Chinook curve, except suitability was downgraded for aquatic vegetation, as for fry.

Steelhead

Spawning. Eight HSC curves for steelhead spawning were presented, along with site-specific redd data previously collected in the lower Yuba River. Following discussion the Clear Creek HSC for spawning velocity was selected to represent the Bear River. The final Bear HSC for spawning depth was also largely based on the Clear Creek HSC from depths of 0.3 to 2.5 ft, but then the curve dropped along the lower Yuba redd data to an intermediate value at 4 ft, then extended to 10 ft. The maximum depth was based in part on the maximum spawning depths observed in Clear Creek. Spawning substrate HSC for steelhead followed the Clear Creek HSC for substrate sizes up to 1-2 inches, then followed the lower Yuba HSC for larger substrates.

Fry Rearing. Seven HSC datasets were presented as candidate curves for steelhead rearing. The consensus HSC from fry velocity suitability was a curve drawn intermediate to the HSC from Clear Creek and the Big Sur River. The fry depth curve was drawn by consensus to bracket both the Clear Creek and the Big Sur River HSC. Instream cover HSC for steelhead fry was largely based on the Clear Creek HSC, with some adjustments for suitability of cobble and boulder substrates based on Big Sur data, and adjustments to aquatic vegetation suitability based on lower Yuba HSC.

Juvenile Rearing. Consensus HSC representing velocity suitability for juvenile steelhead bracketed the Big Sur HSC, except for velocities less than 0.75 fps which were intermediate to HSC from the Big Sur River and Clear Creek. The final HSC for juvenile depth suitability likewise bracketed the Big Sur HSC, with somewhat higher suitability for depths over 3 ft and maximum depth of 6 ft due to higher values represented by the Clear Creek HSC. As noted for steelhead fry, the cover HSC for juvenile steelhead followed the Clear Creek HSC except for cobble/boulder substrate which was adjusted based on HSC data from the Big Sur River.

Sturgeon

Spawning. As noted above, the HSC selected to represent spawning by green or white sturgeon was taken directly from the HSC selected for use in the lower Yuba River instream flow study.

Hardhead

Juvenile and Adult Rearing. As noted above, the HSC selected to represent juvenile and adult rearing by hardhead were taken directly from the HSC selected for use in the Yuba-Bear Drum-Spaulding instream flow study.

Table 3.3.3B-1. Fall-run Chinook salmon spawning habitat suitability criteria.

Velocity (fps)	Suitability	Depth (ft)	Suitability	Substrate (in. diameter)	Suitability
0.09	0	0.4	0	<0.1	0
0.1	0.06	0.5	0.39	0.1-1	0
0.15	0.08	0.6	0.59	1-2	0.5
0.22	0.1	0.7	0.76	1-3	1
0.29	0.12	0.8	0.88	2-3	0.8
0.36	0.14	0.9	0.95	2-4	0.6
0.43	0.17	1	0.99	3-4	0.3
0.5	0.21	1.1	1	3-5	0
0.57	0.24	1.5	1	4-5	0
0.64	0.29	3	0.2	4-6	0
0.71	0.33	5	0	6-8	0
0.78	0.38	--	--	8-10	0

Table 3.3.3B-1. (continued)

Velocity (fps)	Suitability	Depth (ft)	Suitability	Substrate (in. diameter)	Suitability
0.85	0.43	--	--	8-12	0
0.92	0.48	--	--	>12	0
0.95	0.5	--	--	--	--
0.99	0.53	--	--	--	--
1.06	0.59	--	--	--	--
1.13	0.64	--	--	--	--
1.2	0.7	--	--	--	--
1.27	0.75	--	--	--	--
1.34	0.8	--	--	--	--
1.41	0.84	--	--	--	--
1.48	0.88	--	--	--	--
1.55	0.92	--	--	--	--
1.62	0.95	--	--	--	--
1.69	0.97	--	--	--	--
1.76	0.99	--	--	--	--
1.83	1	--	--	--	--
2.95	1	--	--	--	--
3.25	0.5	--	--	--	--
5.32	0	--	--	--	--

Table 3.3.3B-2. Fall-run Chinook salmon fry rearing habitat suitability criteria.

Velocity (fps)	Suitability	Depth (ft)	Suitability	Cover Code	Cover Description	Suitability
0	1	0	0	0.1	none	0.33
0.1	0.99	0.2	0.85	1	cobble	0.33
0.2	0.95	0.4	1	2	boulder	0.33
0.3	0.89	1.5	1	3	fine woody veg (<1")	1
0.4	0.81	3	0.25	3.7	3+ovh	1
0.6	0.65	4	0	4	branches	1
0.7	0.56	--	--	4.7	4+ovh	1
0.8	0.49	--	--	5	log (>1' diam)	1
0.9	0.42	--	--	5.7	5+ovh	1
1.1	0.3	--	--	7	ovh (>2' abv sub)	0.33
1.3	0.22	--	--	8	ucb	1
1.8	0	--	--	9	aq veg	0.2
--	--	--	--	9.7	9+ovh	0.2
--	--	--	--	10	rip-rap	0.33

Table 3.3.3B-3 Fall-run Chinook salmon juvenile rearing habitat suitability criteria.

Velocity (fps)	Suitability	Depth (ft)	Suitability	Cover Code	Cover Description	Suitability
0	1	0.2	0	0.1	none	0.33
0.1	1	1.25	1	1	cobble	1
0.2	0.99	1.5	1	2	boulder	0.33
0.3	0.98	2.1	1	3	fine woody veg (<1")	0.33
0.4	0.97	3	0.4	3.7	3+ovh	1
0.5	0.96	7	0	4	branches	1
0.6	0.94	--	--	4.7	4+ovh	1
0.7	0.92	--	--	5	log (>1' diam)	1
0.8	0.89	--	--	5.7	5+ovh	1
0.9	0.87	--	--	7	ovh (>2' abv sub)	0.33
1	0.84	--	--	8	ucb	1
1.1	0.81	--	--	9	aq veg	0.24
1.2	0.78	--	--	9.7	9+ovh	0.24
1.3	0.74	--	--	10	rip-rap	0.33
1.4	0.71	--	--	--	--	--
1.5	0.67	--	--	--	--	--
1.6	0.63	--	--	--	--	--
1.7	0.6	--	--	--	--	--
1.8	0.56	--	--	--	--	--
1.9	0.52	--	--	--	--	--
2	0.48	--	--	--	--	--
2.1	0.45	--	--	--	--	--
2.2	0.41	--	--	--	--	--
3	0	--	--	--	--	--

Table 3.3.3B-4. Steelhead spawning habitat suitability criteria.

Velocity (fps)	Suitability	Depth (ft)	Suitability	Substrate (in. diameter)	Suitability
0.6	0	0.3	0	0.1	0
0.61	0.08	1	1	1	0.38
0.7	0.14	2.5	1	1-2	1
0.8	0.25	4	0.3	1-3	0.85
0.9	0.38	10	0	2-4	0.28
1	0.53	--	--	3-5	0.16
1.1	0.66	--	--	4-6	0.05

Table 3.3.3B-4. (continued)

Velocity (fps)	Suitability	Depth (ft)	Suitability	Substrate (in. diameter)	Suitability
1.2	0.78	--	--	6-8	0
1.3	0.87	--	--	8-10	0
1.4	0.94	--	--	8-12	0
1.5	0.98	--	--	>12	0
1.6	1	--	--	--	--
1.7	1	--	--	--	--
1.8	0.99	--	--	--	--
1.9	0.97	--	--	--	--
2	0.95	--	--	--	--
2.1	0.93	--	--	--	--
2.2	0.9	--	--	--	--
2.3	0.87	--	--	--	--
2.4	0.85	--	--	--	--
2.5	0.82	--	--	--	--
2.6	0.8	--	--	--	--
2.7	0.78	--	--	--	--
2.8	0.76	--	--	--	--
2.9	0.73	--	--	--	--
3	0.7	--	--	--	--
3.1	0.66	--	--	--	--
3.2	0.61	--	--	--	--
3.3	0.56	--	--	--	--
3.4	0.49	--	--	--	--
3.5	0.41	--	--	--	--
3.6	0.33	--	--	--	--
3.7	0.25	--	--	--	--
3.8	0.17	--	--	--	--
3.89	0.11	--	--	--	--
3.9	0	--	--	--	--

Table 3.3.3B-5. Steelhead fry rearing habitat suitability criteria.

Velocity (fps)	Suitability	Depth (ft)	Suitability	Cover Code	Cover Description	Suitability
0	1	0	0	0.1	none	0.33
0.1	1	0.1	1	1	cobble	0.75
0.25	1	0.75	1	2	boulder	0.33
1	0.2	2	0.2	3	fine woody veg (<1")	0.66
3.6	0	4	0	3.7	3+ovh	1
--	--	--	--	4	branches	0.66
--	--	--	--	4.7	4+ovh	1
--	--	--	--	5	log (>1' diam)	1

Table 3.3.3B-5. (continued)

Velocity (fps)	Suitability	Depth (ft)	Suitability	Cover Code	Cover Description	Suitability
--	--	--	--	5.7	5+ovh	1
--	--	--	--	7	ovh (>2' abv sub)	0.66
--	--	--	--	8	ucb	1
--	--	--	--	9	aq veg	0.5
--	--	--	--	9.7	5+ovh	0.5
--	--	--	--	10	rip-rap	0.33

Table 3.3.3B-6. Steelhead juvenile rearing habitat suitability criteria.

Velocity (fps)	Suitability	Depth (ft)	Suitability	Cover Code	Cover Description	Suitability
0	0.7	0	0	0.1	none	0.31
0.5	1	1	1	1	cobble	0.75
1.5	1	2	1	2	boulder	0.6
3.5	0.1	4	0.2	3	fine woody veg (<1")	0.4
5.6	0	6	0	3.7	3+ovh	1
--	--	--	--	4	branches	1
--	--	--	--	4.7	4+ovh	1
--	--	--	--	5	log (>1' diam)	1
--	--	--	--	5.7	5+ovh	1
--	--	--	--	7	ovh (>2' abv sub)	1
--	--	--	--	8	ucb	1
--	--	--	--	9	aq veg	0.4
--	--	--	--	9.7	5+ovh	0.4
--	--	--	--	10	rip-rap	0.4

Table 3.3.3B-7. Hardhead juvenile habitat suitability criteria.

Velocity (fps)	Suitability	Depth (ft)	Suitability
0	1	0.5	0
0.25	1	0.67	1
1.75	0.25	3.67	1
2.6	0	8.71	0.1
--	--	18	0.1

Table 3.3.3B-8. Hardhead adult habitat suitability criteria.

Velocity (fps)	Suitability	Depth (ft)	Suitability
0	0.82	0.66	0
0.2	1	2.62	1
0.9	1	18	1
2.13	0.22	--	--
3.5	0	--	--

Table 3.3.3B-9. Sturgeon spawning habitat suitability criteria.

Velocity (fps)	Suitability	Depth (ft)	Suitability	Substrate Category	Suitability
1.6	0	5	0	snags	0
3.6	1	10	1	organics	0
10	1	100	1	hard clay	0
15	0	--	--	silt/fine clay	0
--	--	--	--	sand	0.1
--	--	--	--	gravel	1
--	--	--	--	cobble	1
--	--	--	--	boulder	0.75
--	--	--	--	bedrock	0.4

Attachment 3.3.3C
Weighted Usable Area Map Sets

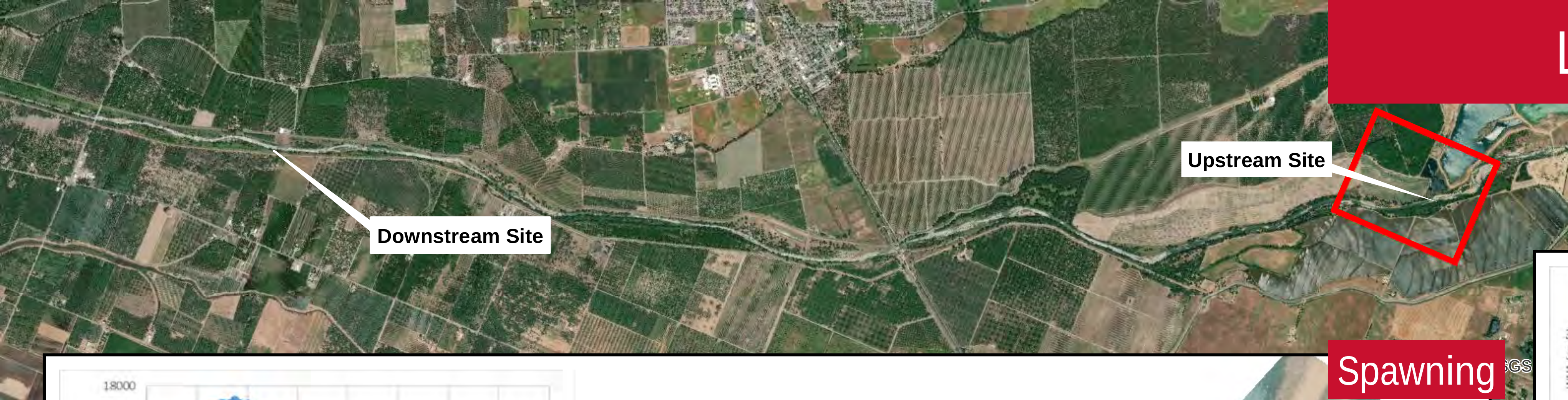
Maps Summarizing the Location and Quality of Fall-Run Chinook Salmon and Steelhead Habitat at the Upstream and Downstream Sites Modeled by SSWD

Lower Bear River - Instream Flow Study

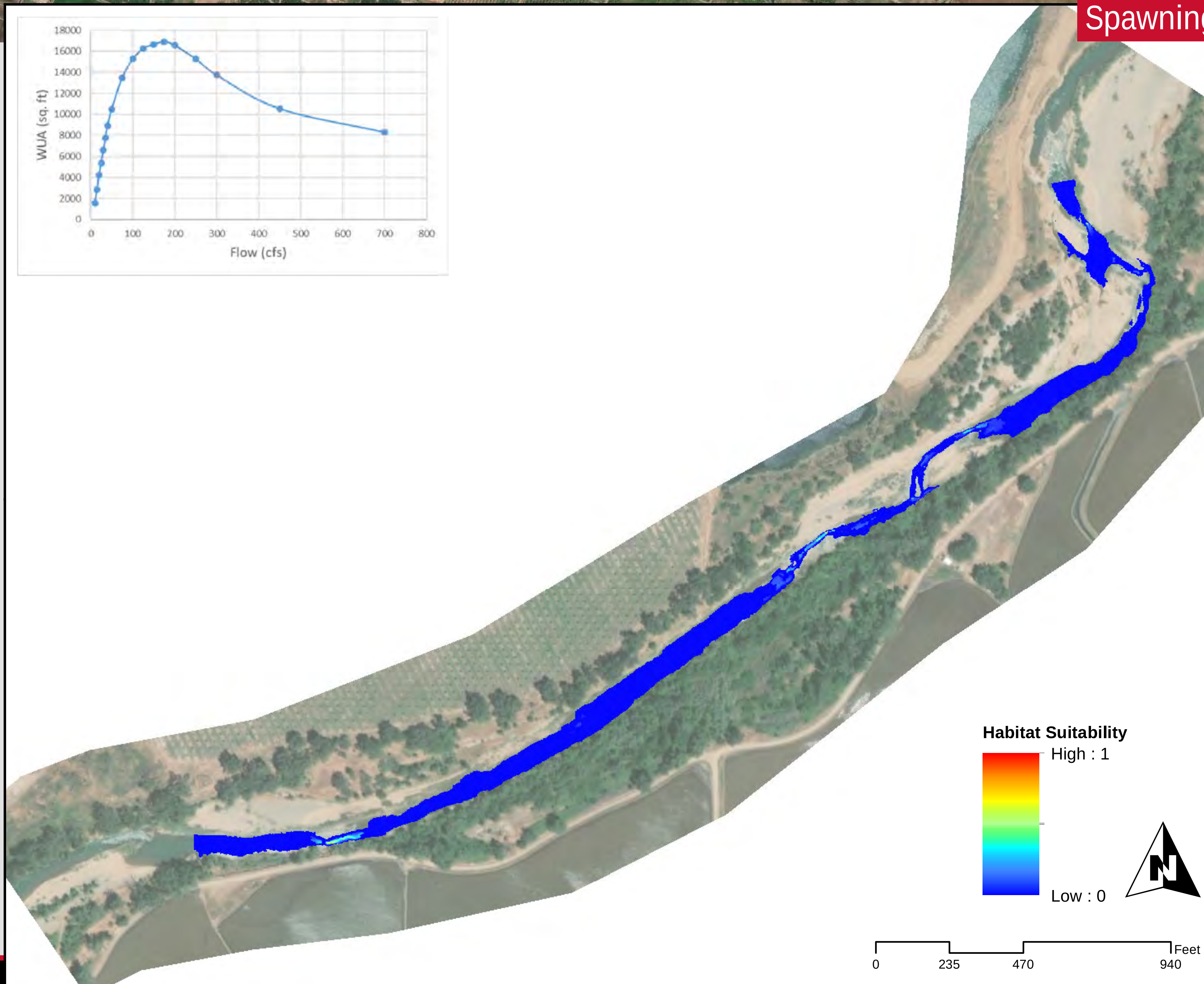
SSWD HDR

Fall-Run Chinook Salmon

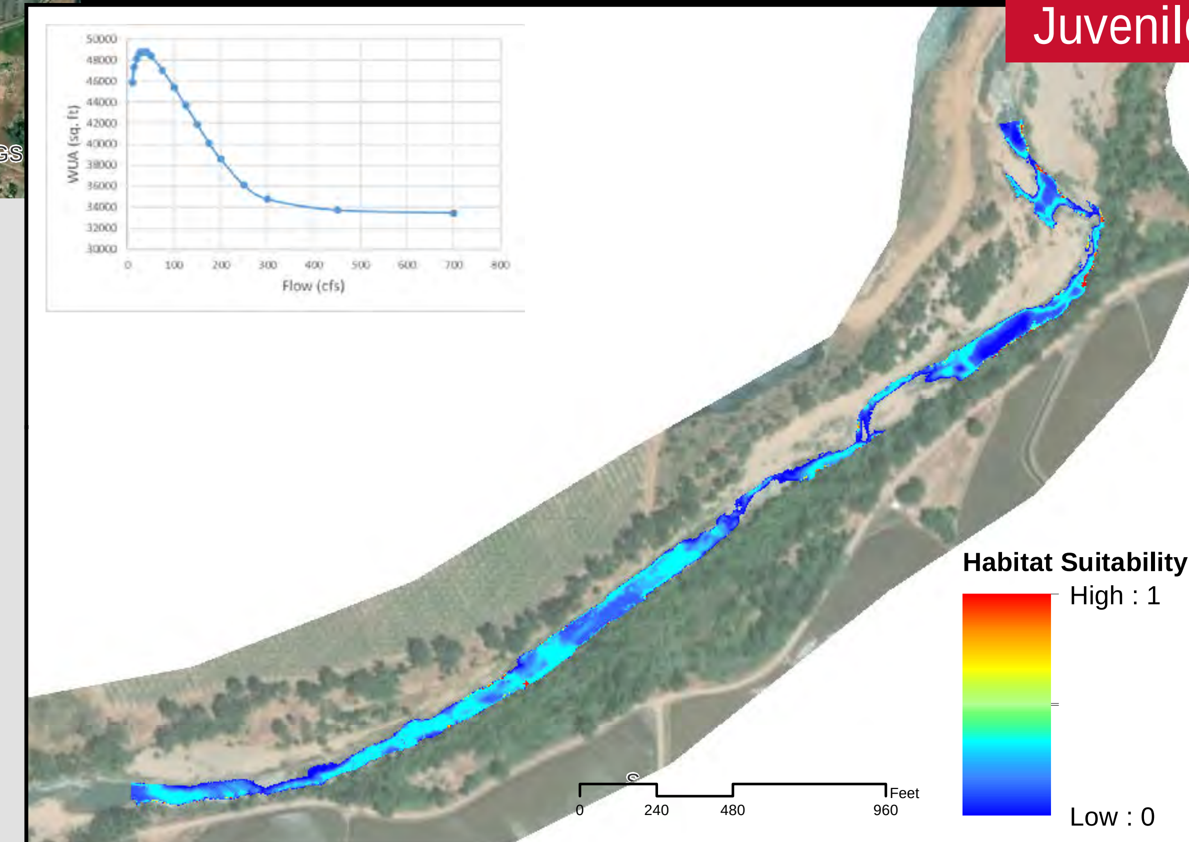
Upstream Study Site 10 cfs



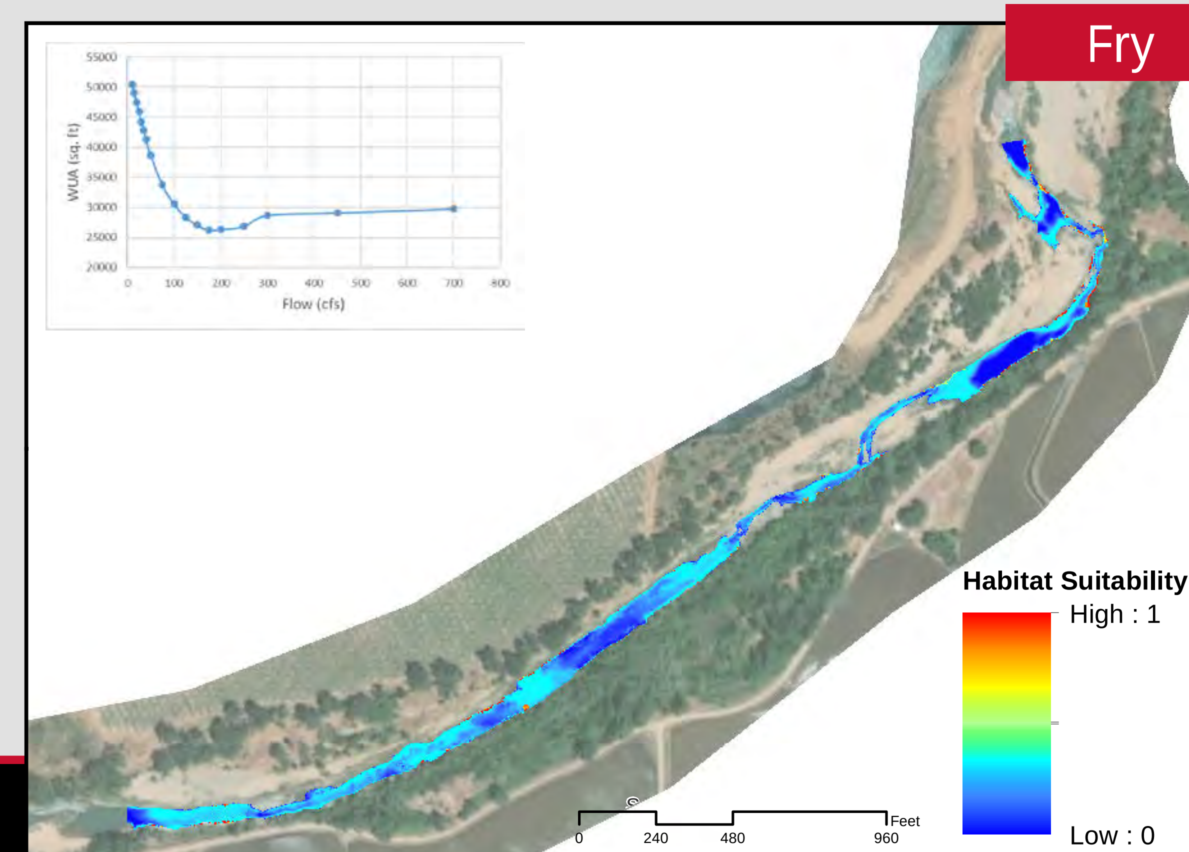
Spawning



Juvenile

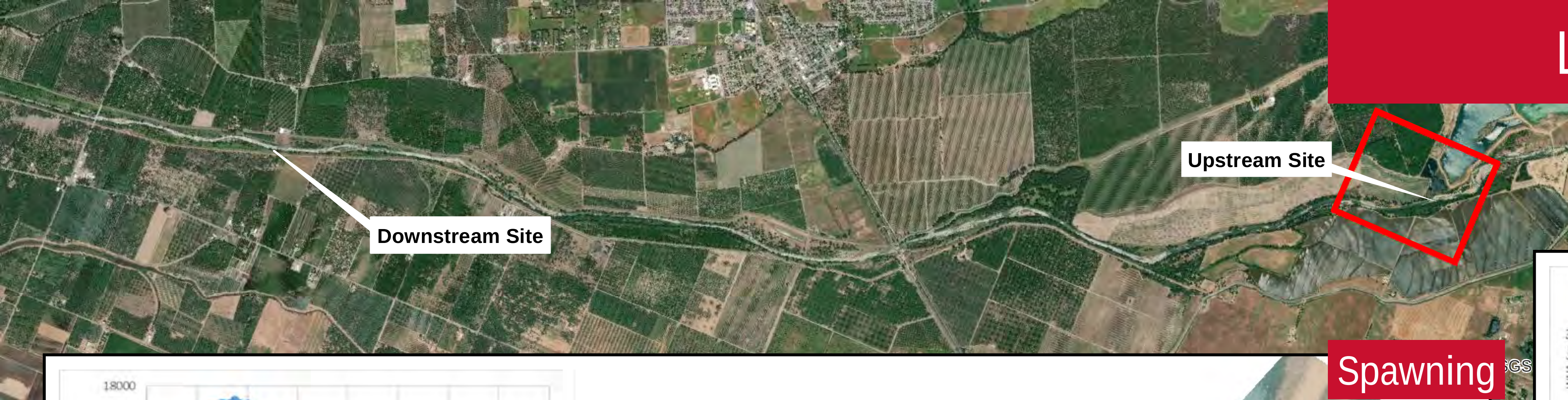


Fry



Lower Bear River - Instream Flow Study

Fall-Run Chinook Salmon
Upstream Study Site 15 cfs



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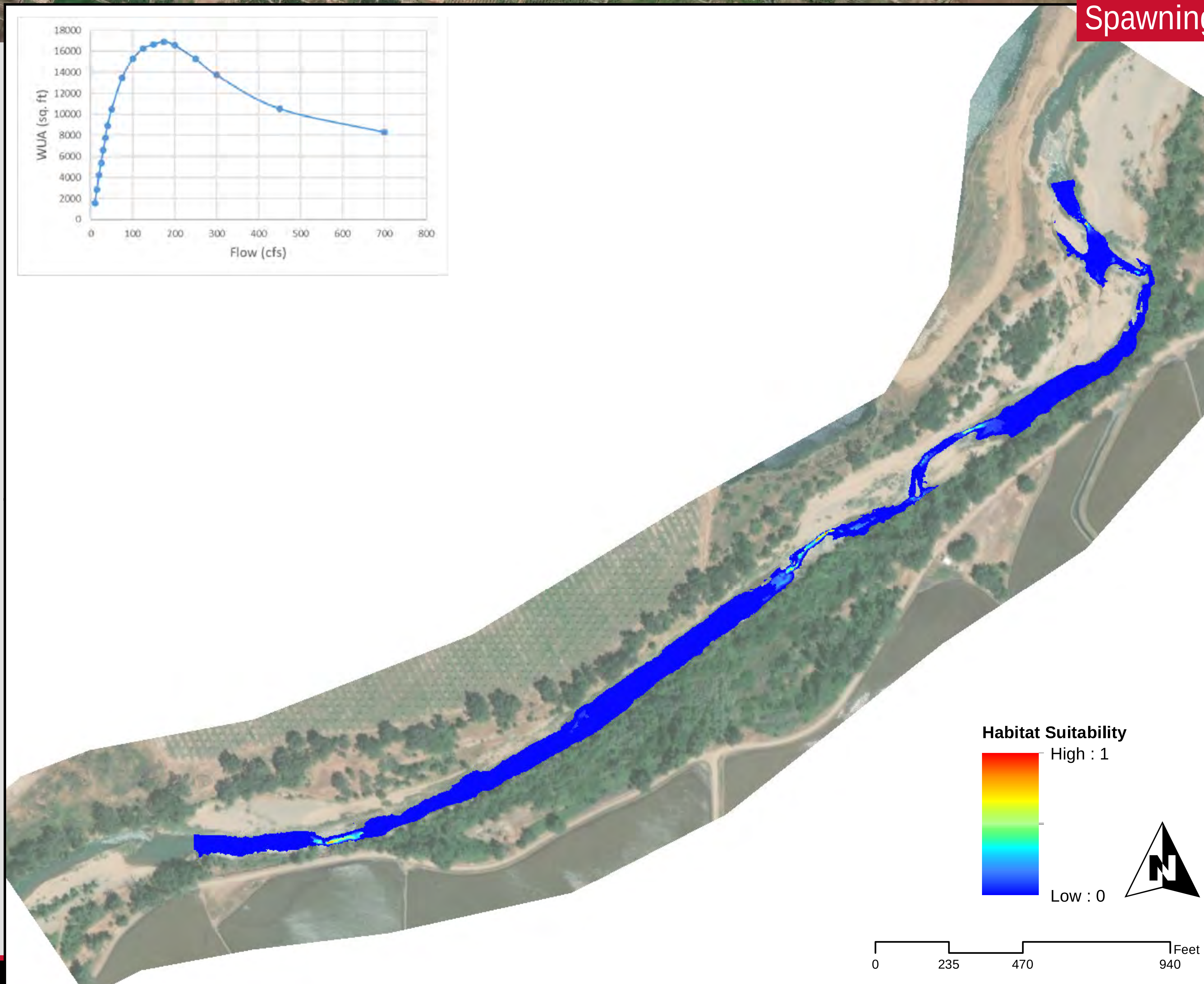

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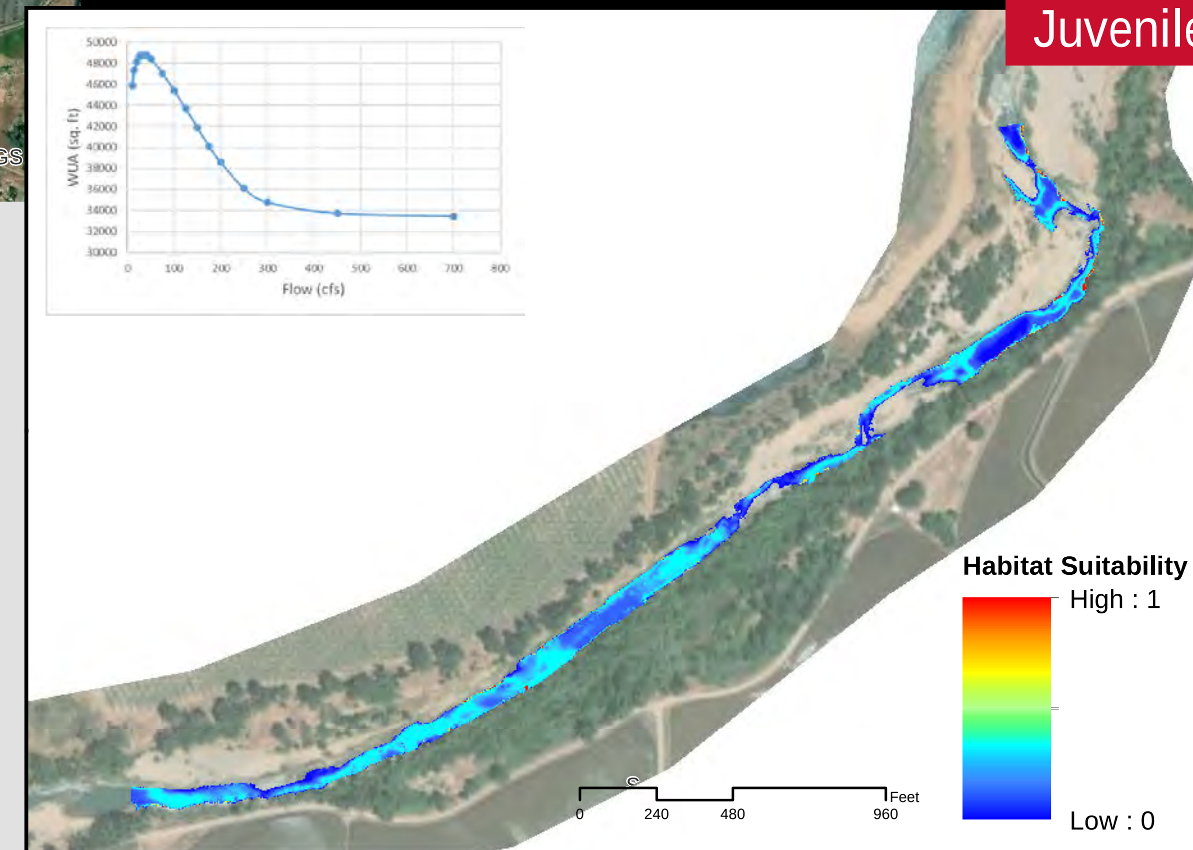
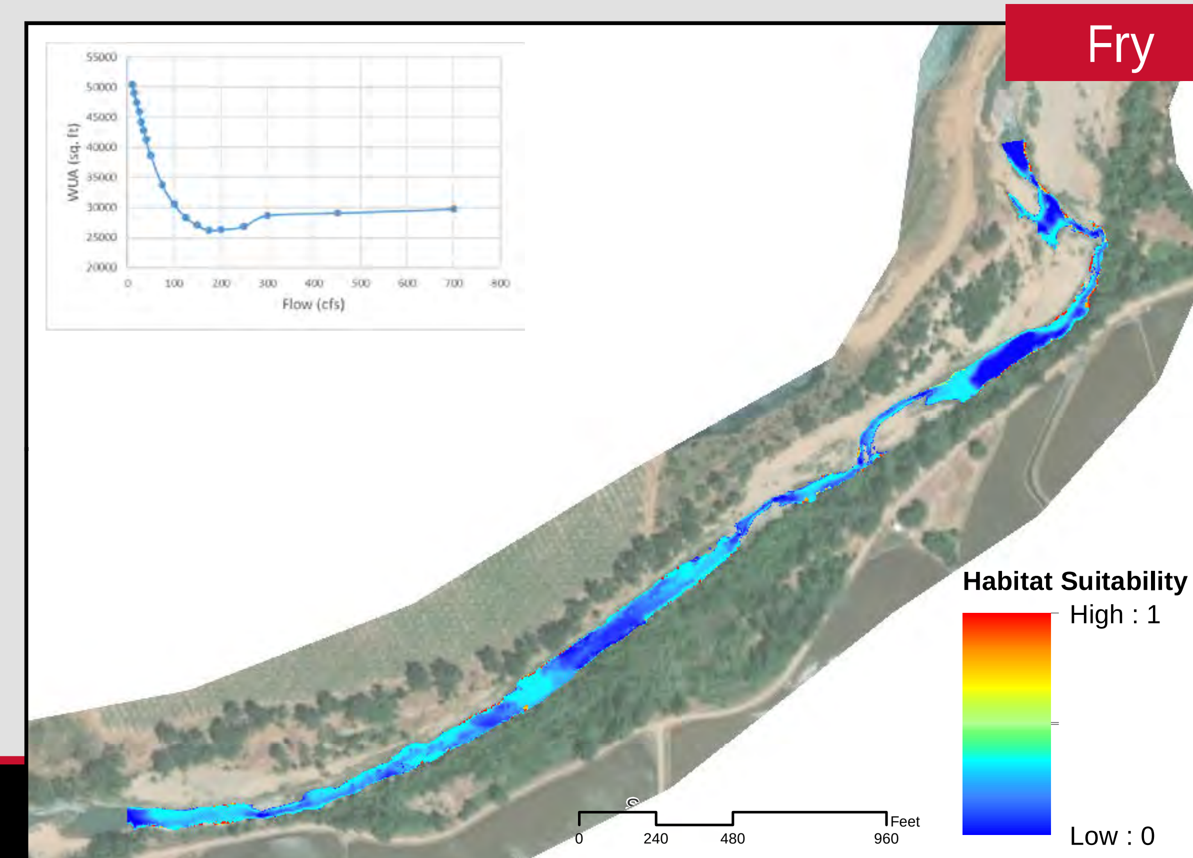


Fry



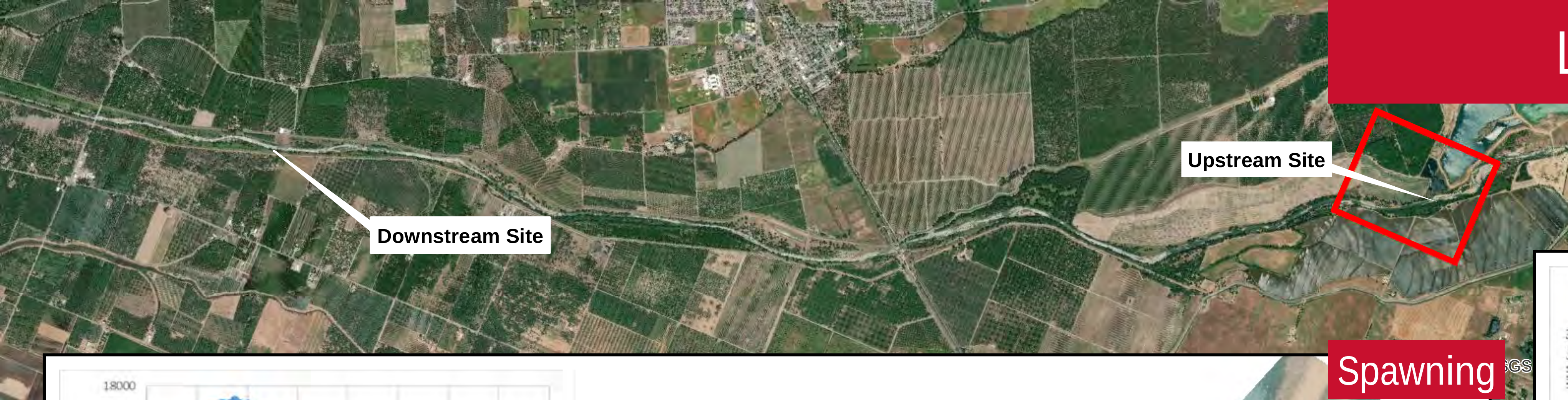
PATH: V:\CLIENT FILES\HDR\SSWD\INSTREAMFLOW\HABITAT\ATTACHMENT_ISF_MODEL_RESULTS.MXD - USER: GPOPULIS - DATE: 6/24/2019

Lower Bear River - Instream Flow Study

SSWD HDR

Fall-Run Chinook Salmon

Upstream Study Site 20 cfs



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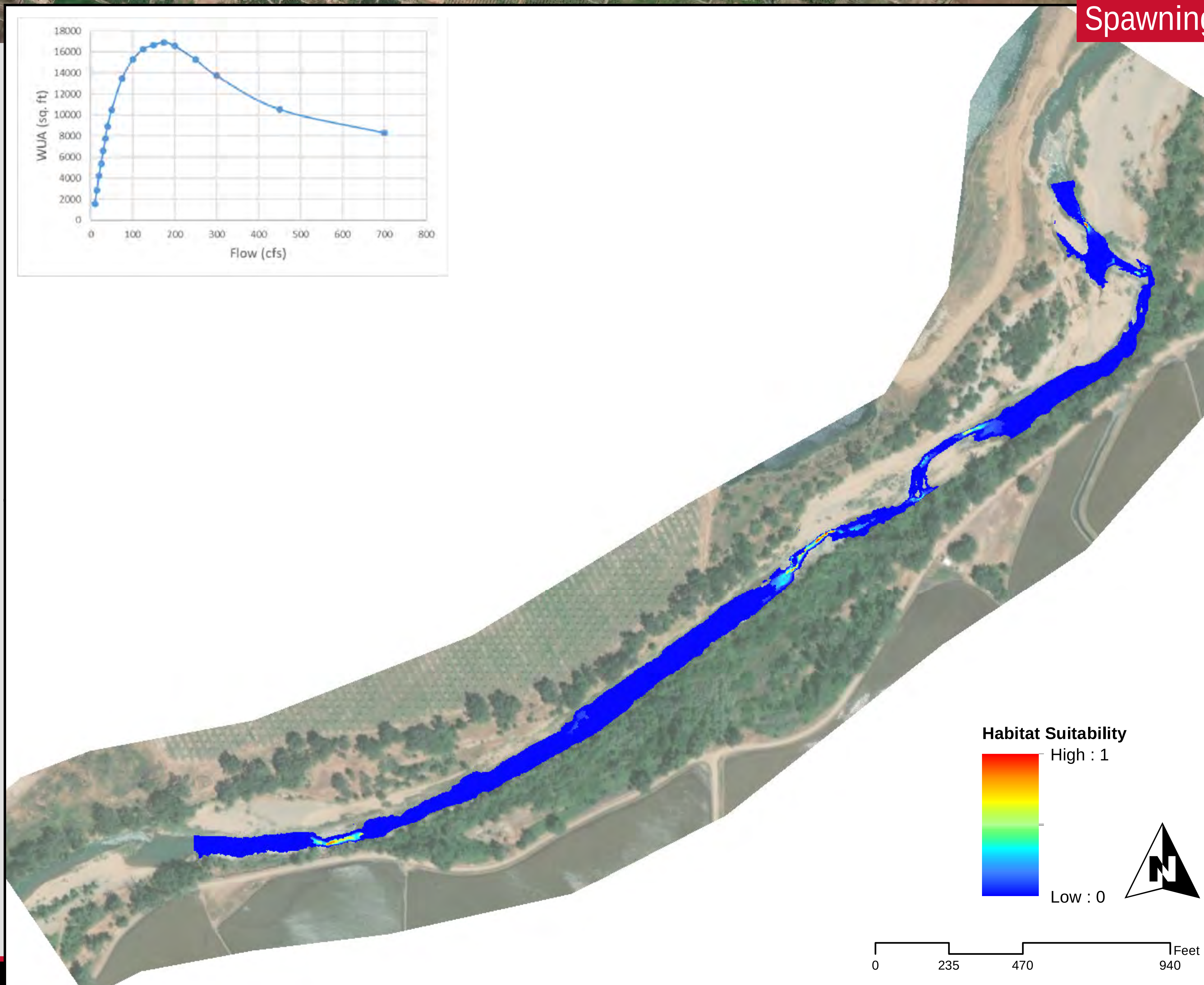

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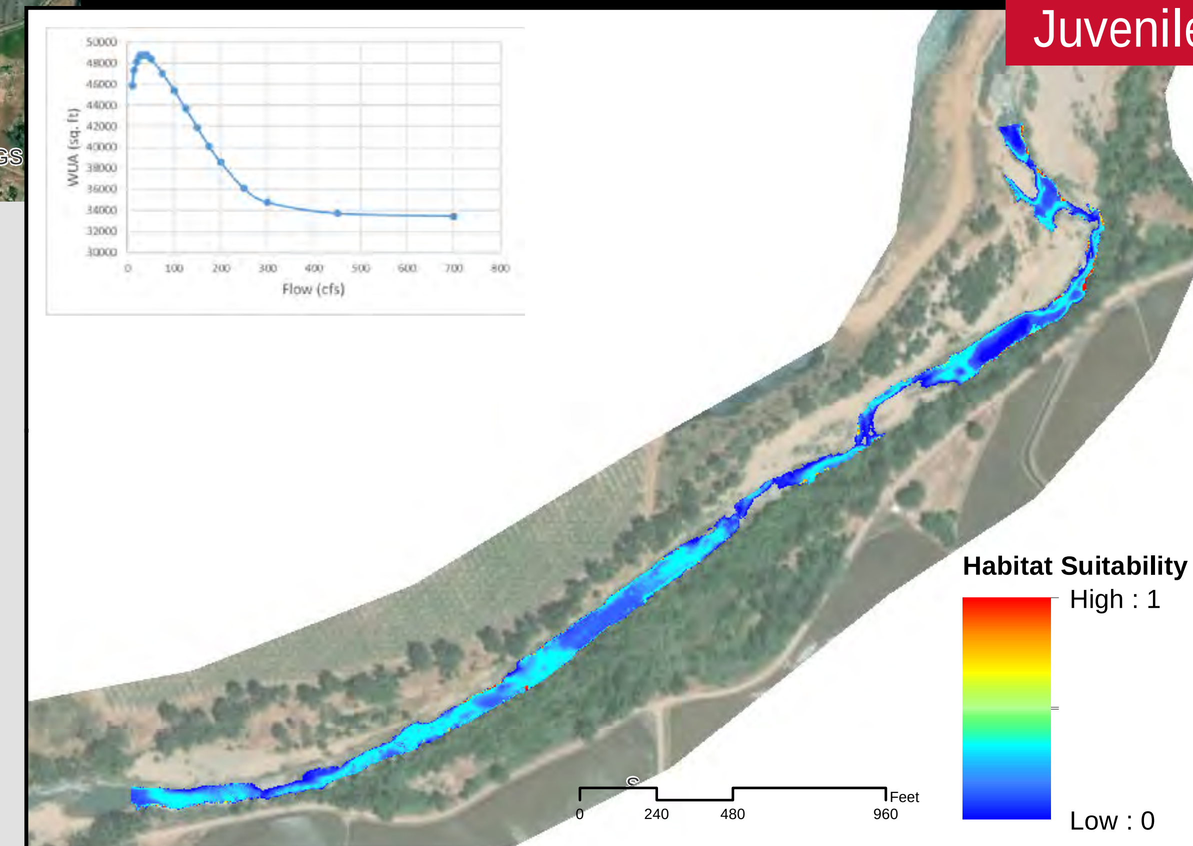

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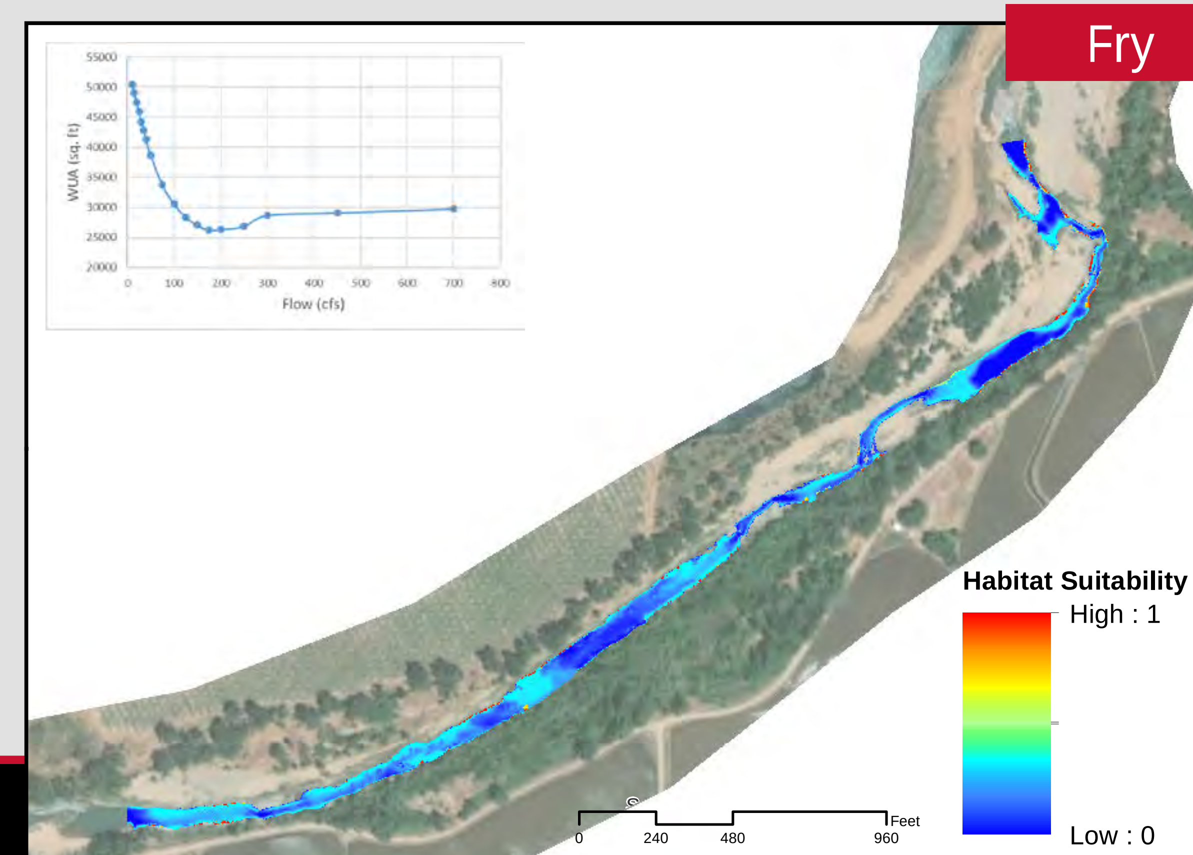
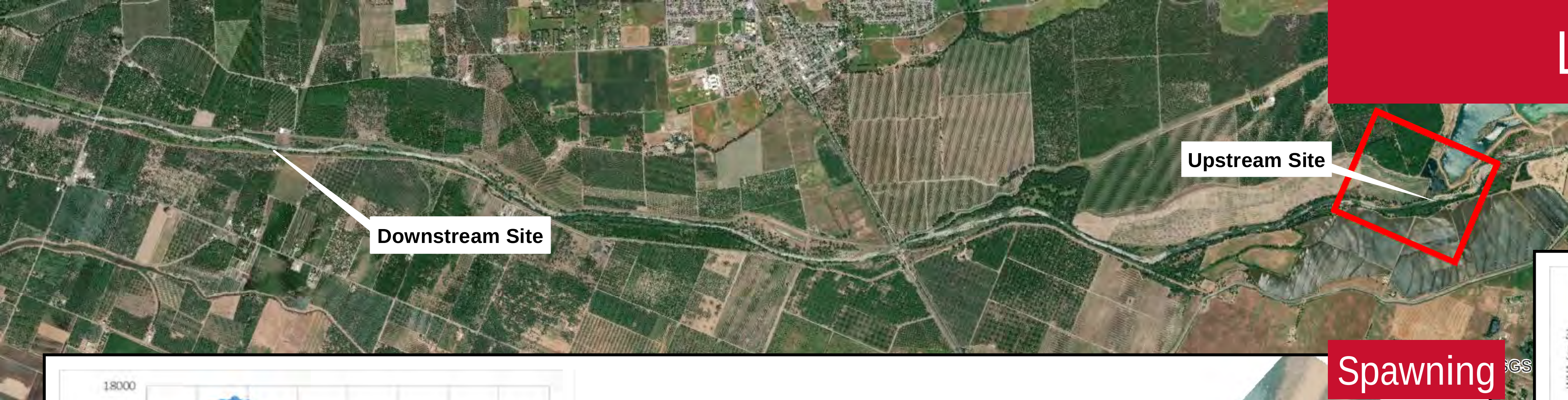


Lower Bear River - Instream Flow Study

SSWD HDR

Fall-Run Chinook Salmon

Upstream Study Site 25 cfs



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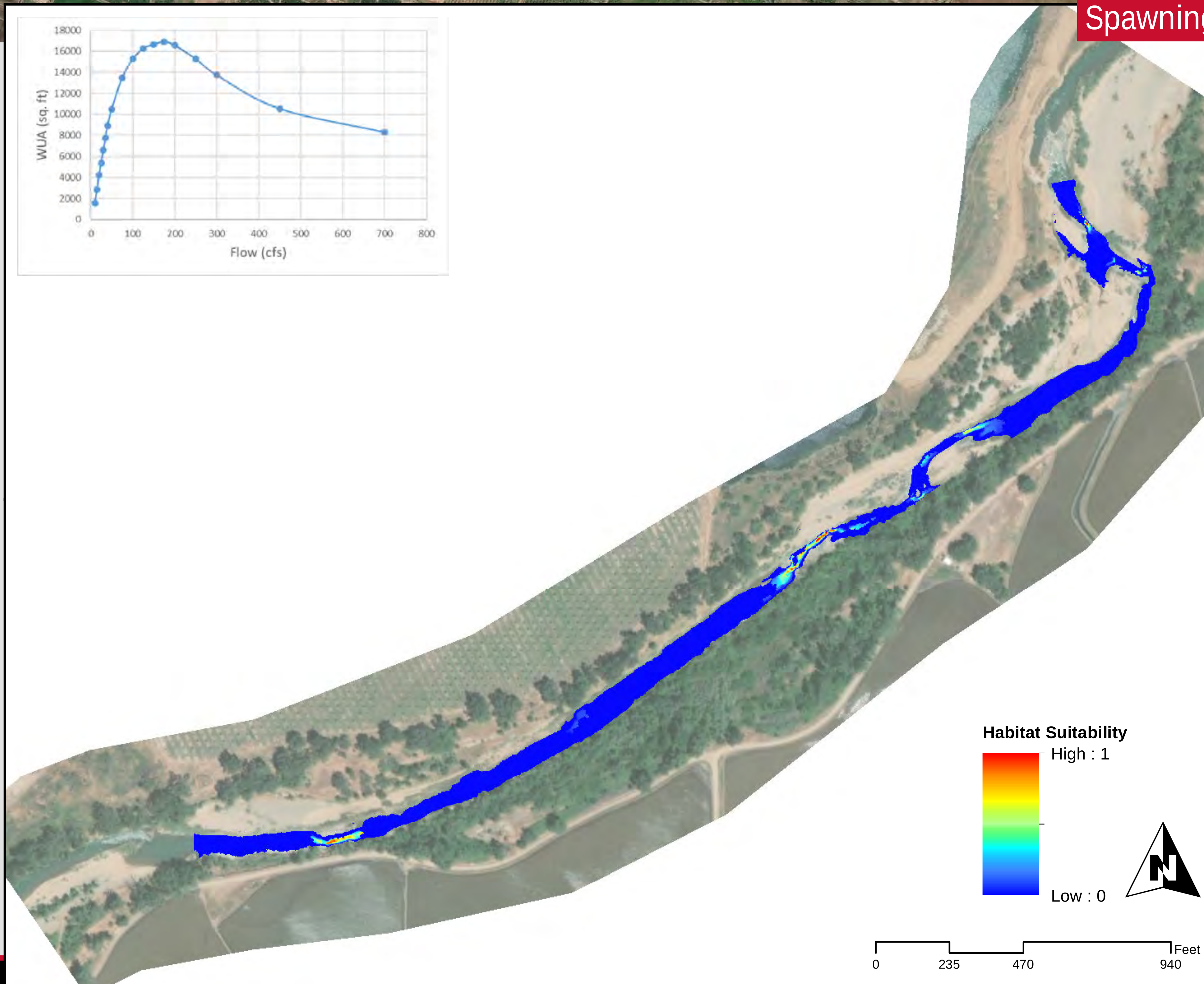

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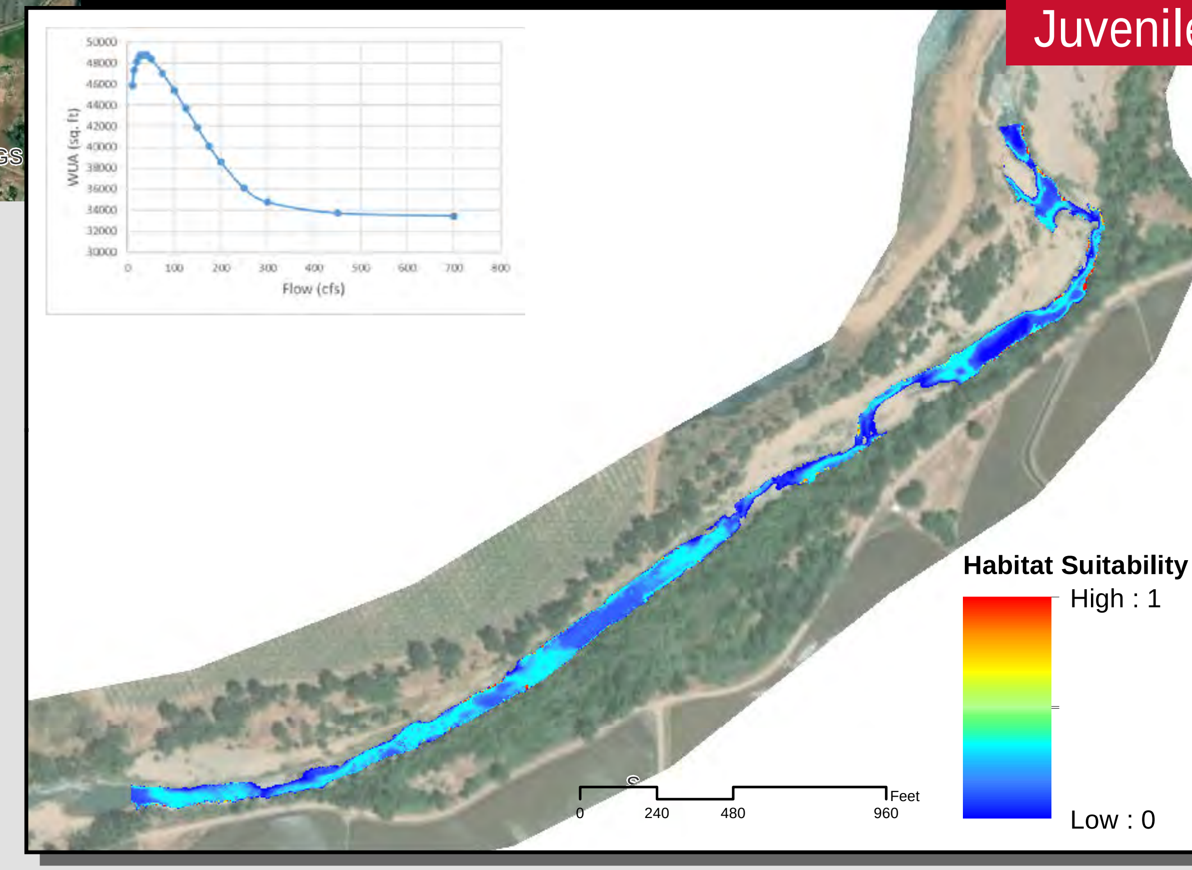

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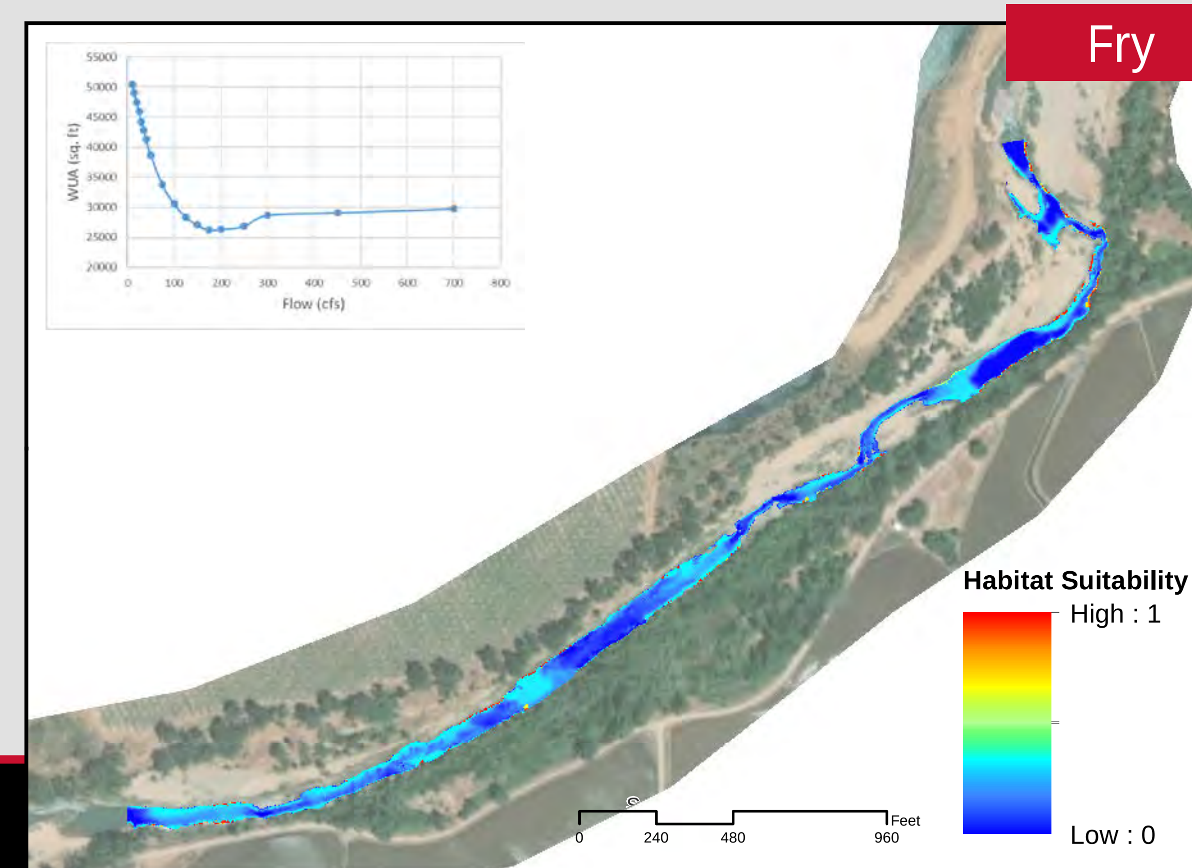


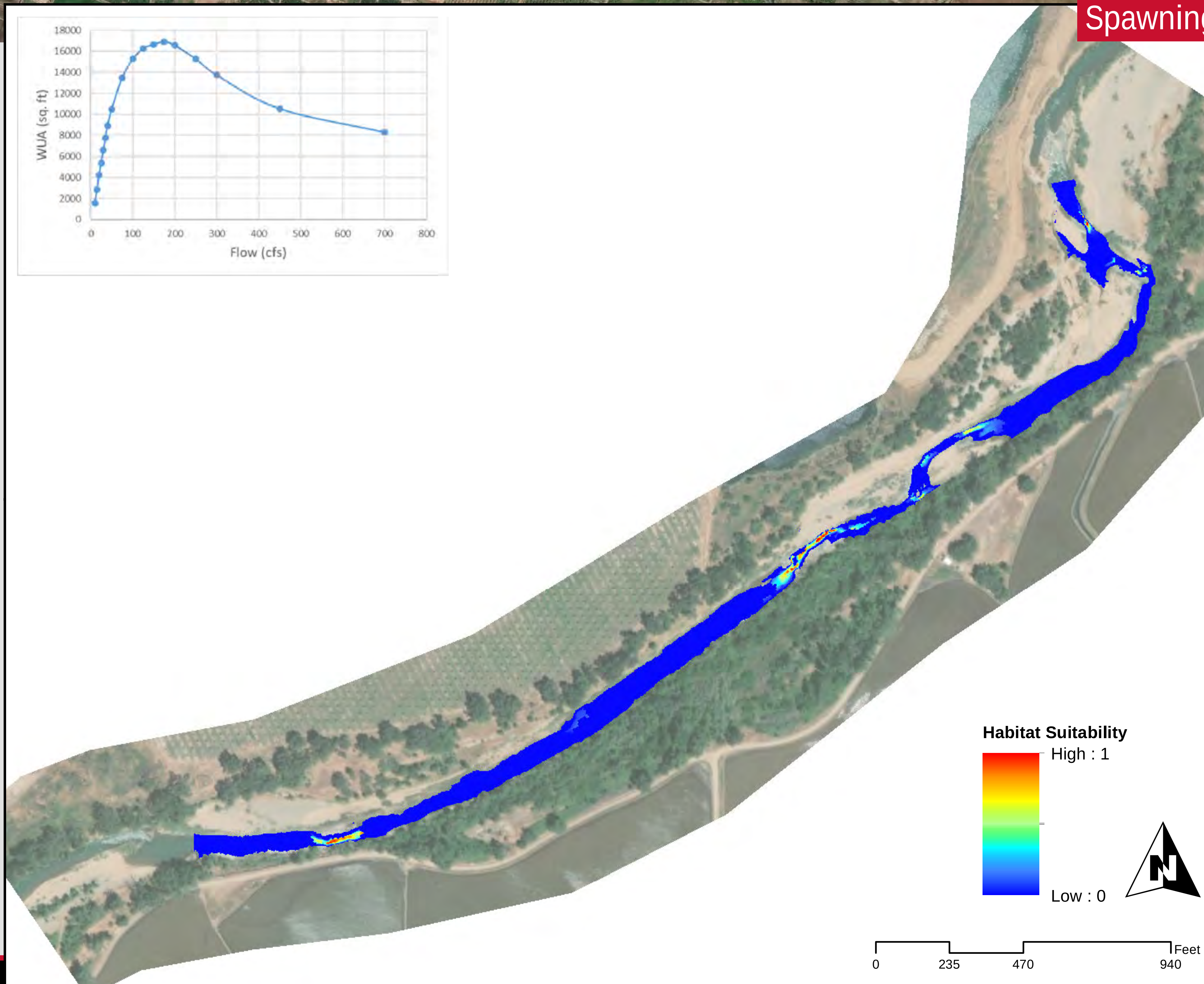
PATH: V:\CLIENT FILES\HDR\SSWD\INSTREAMFLOW\HABITAT\ATTACHMENT_ISF_MODEL_RESULTS.MXD - USER: GPOPULIS - DATE: 6/24/2019

Lower Bear River - Instream Flow Study

SSWD HDR

Fall-Run Chinook Salmon
Upstream Study Site 30 cfs

Spawning



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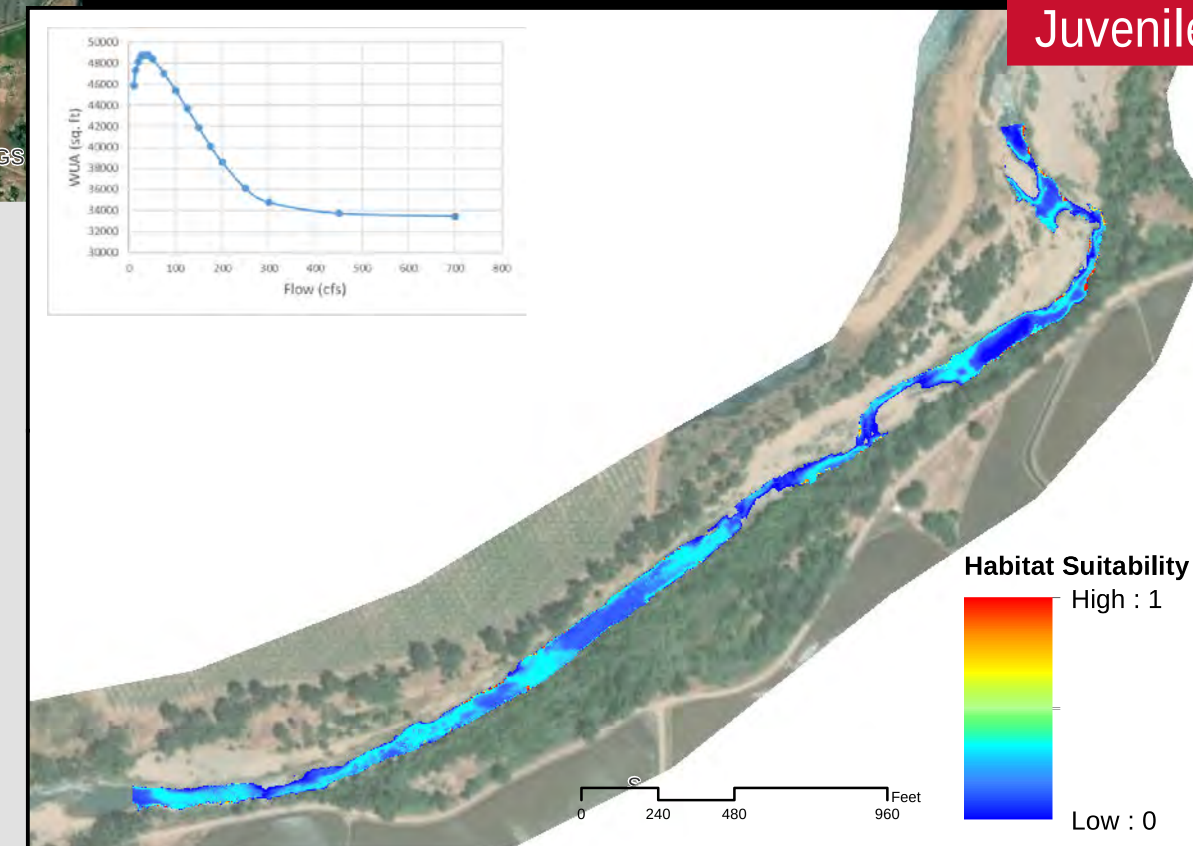

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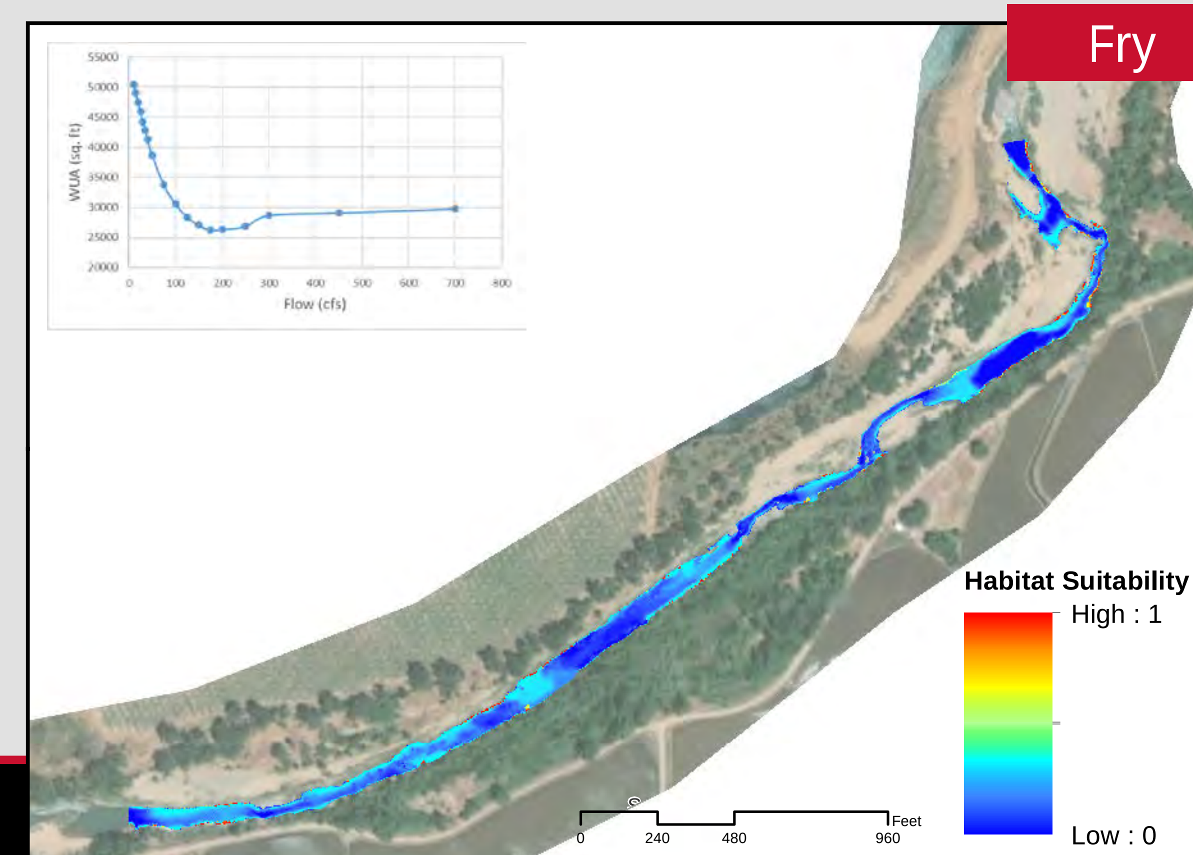

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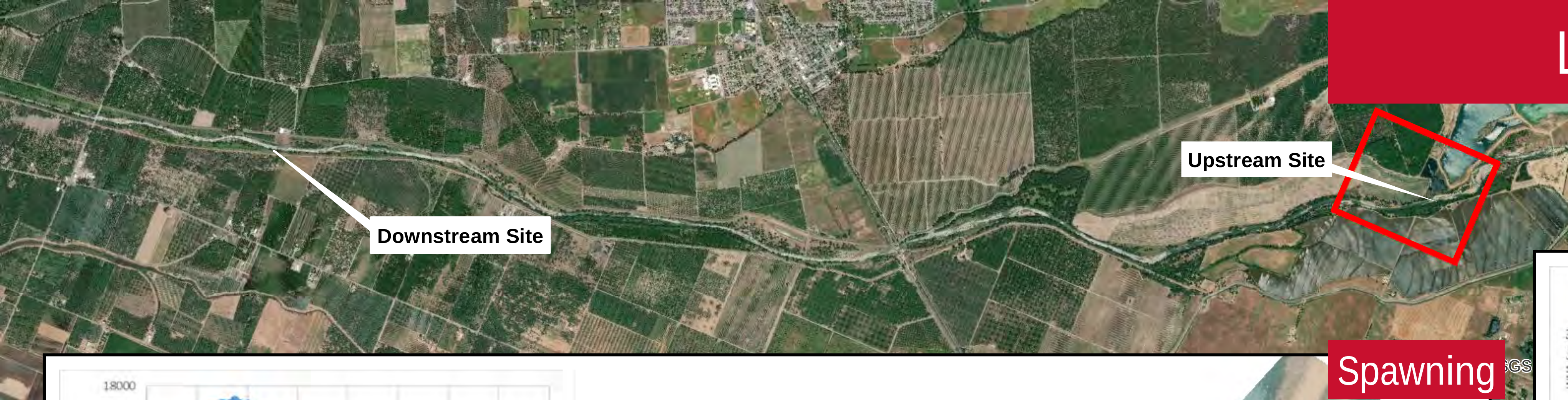
Lower Bear River - Instream Flow Study

Fall-Run Chinook Salmon
Upstream Study Site 35 cfs



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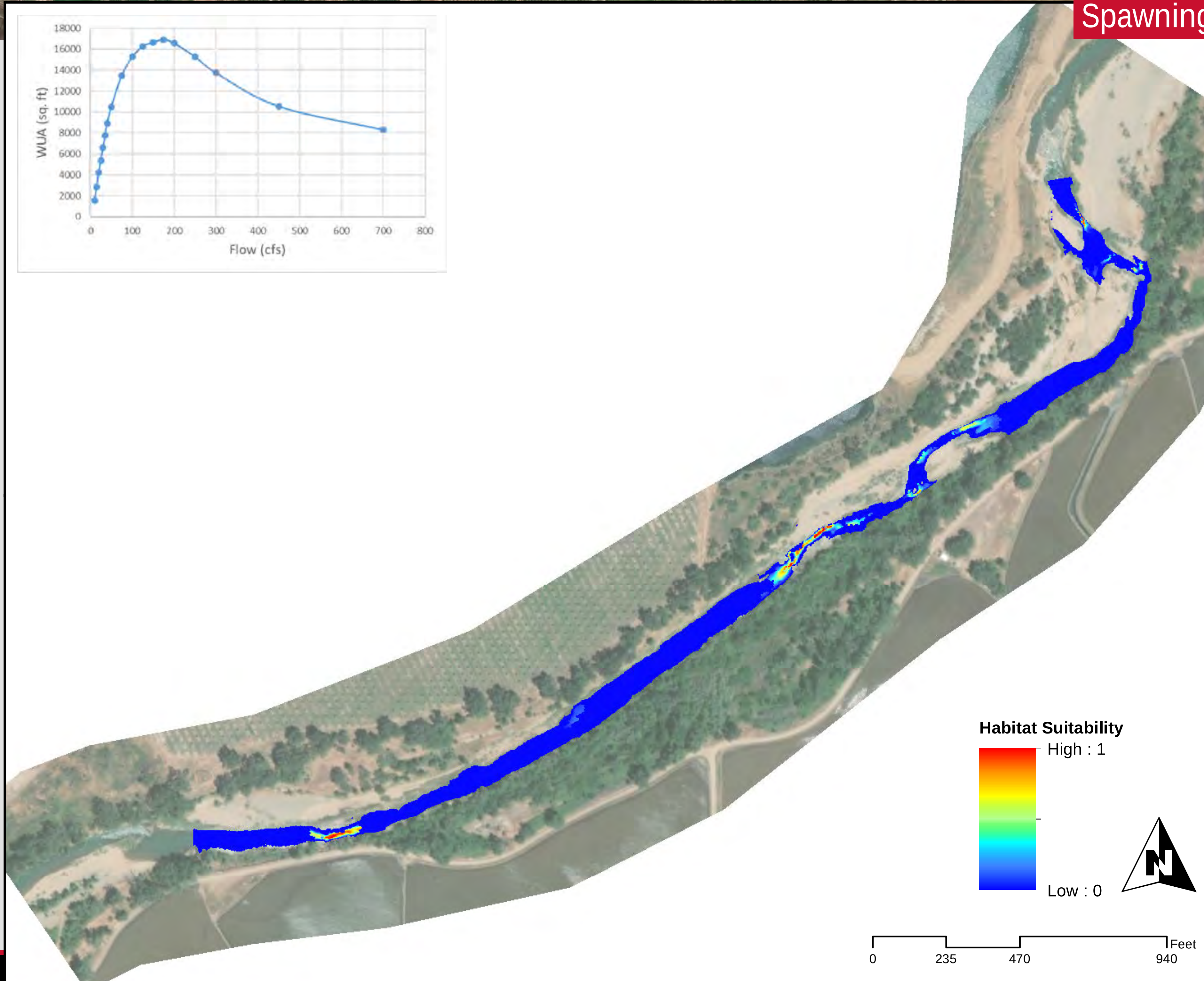

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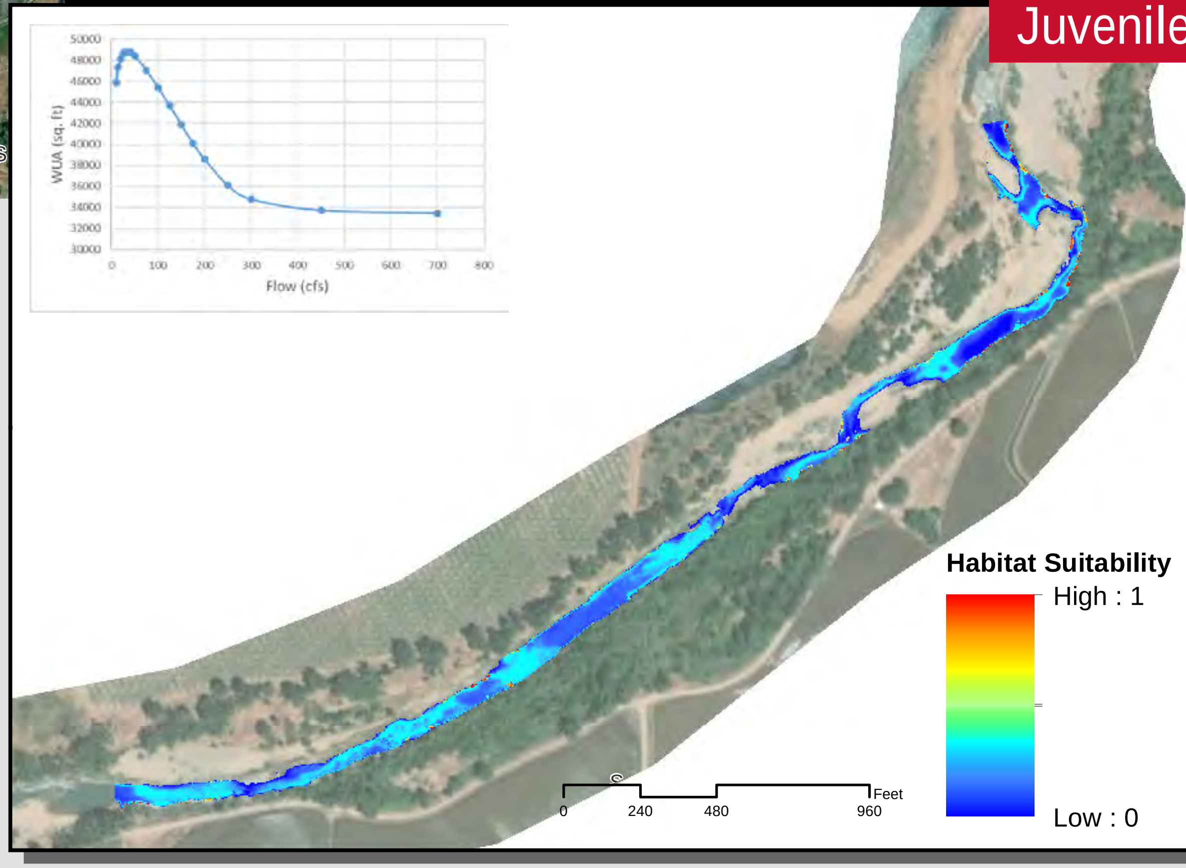

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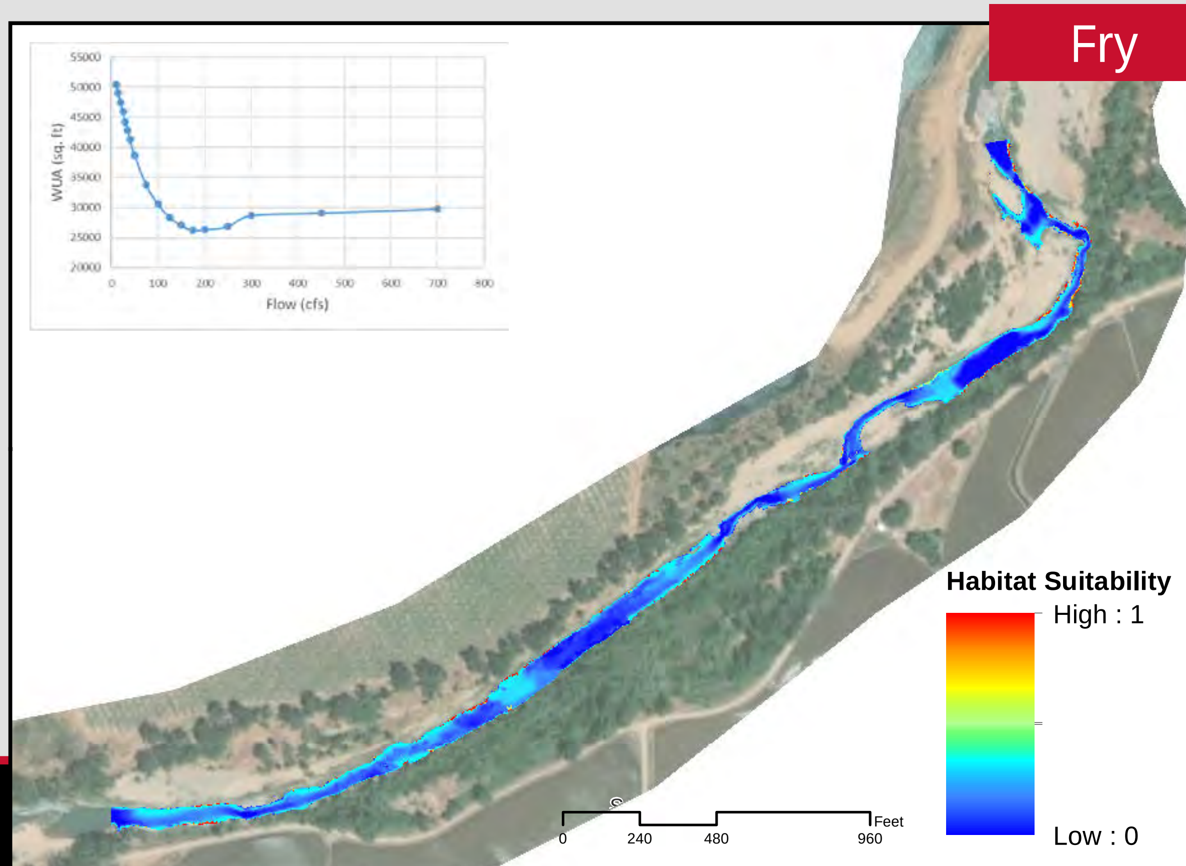
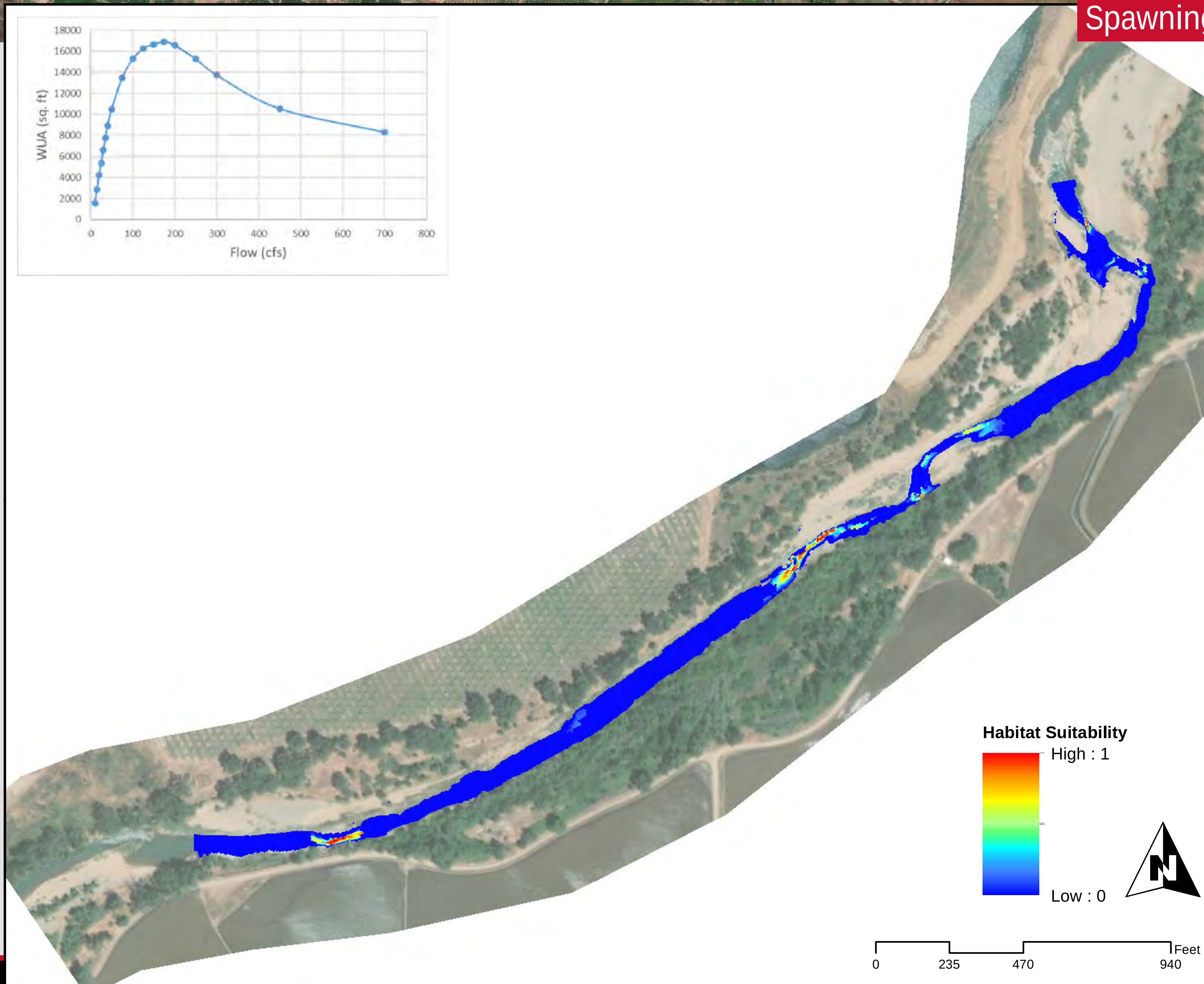
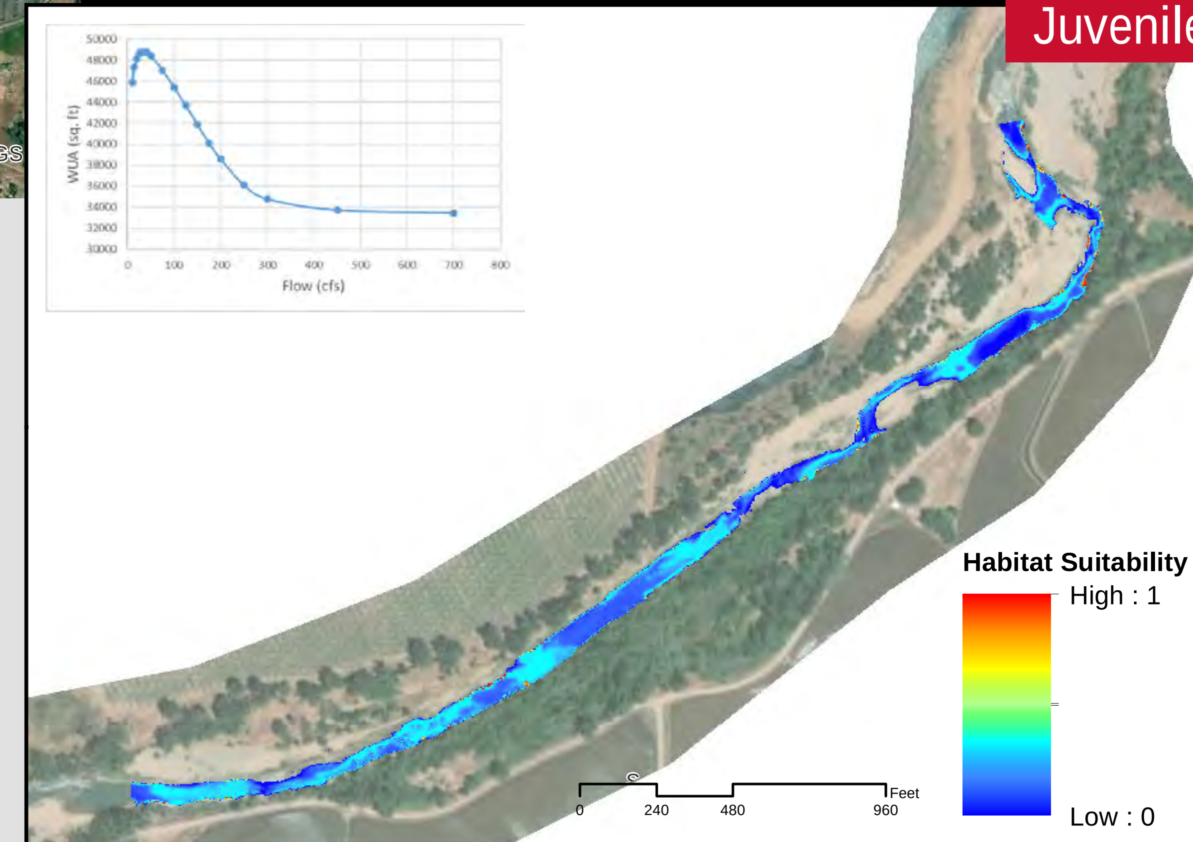


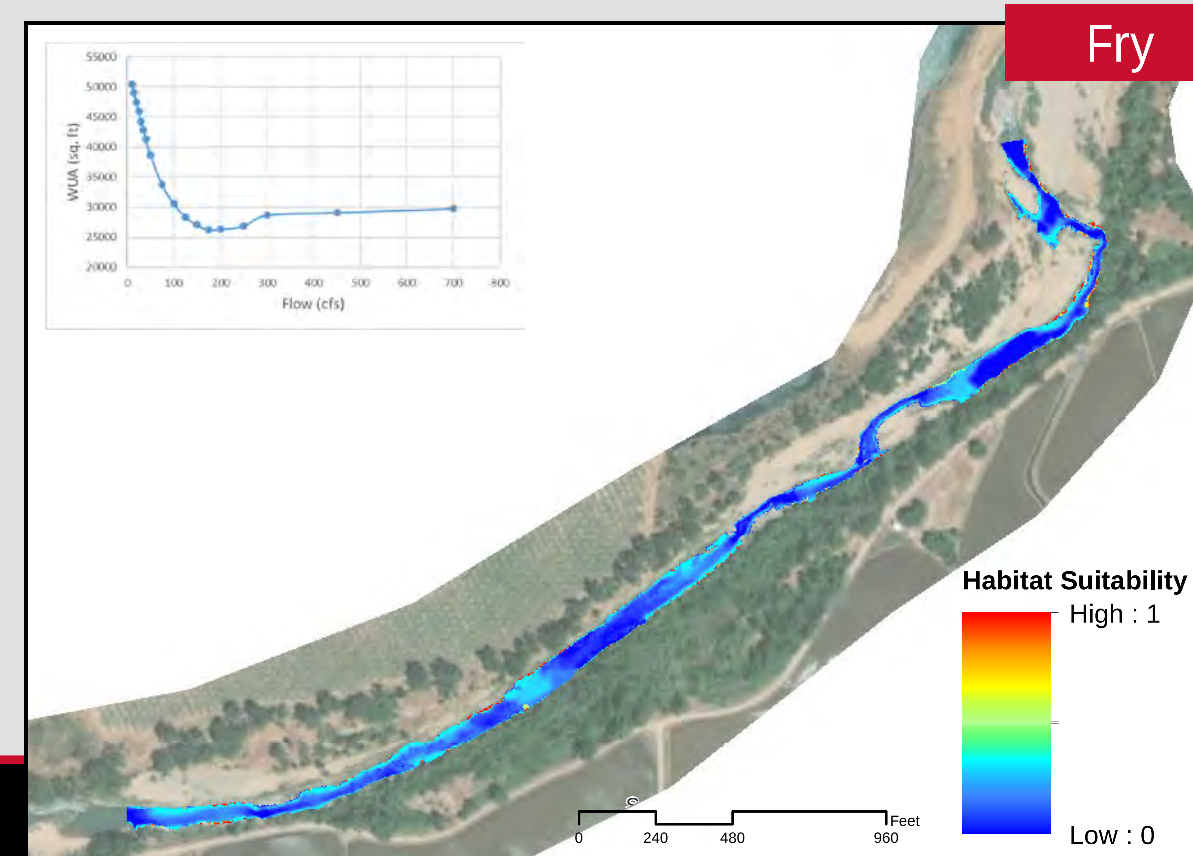
Lower Bear River - Instream Flow Study

SSWD HDR

Fall-Run Chinook Salmon
Upstream Study Site 40 cfs





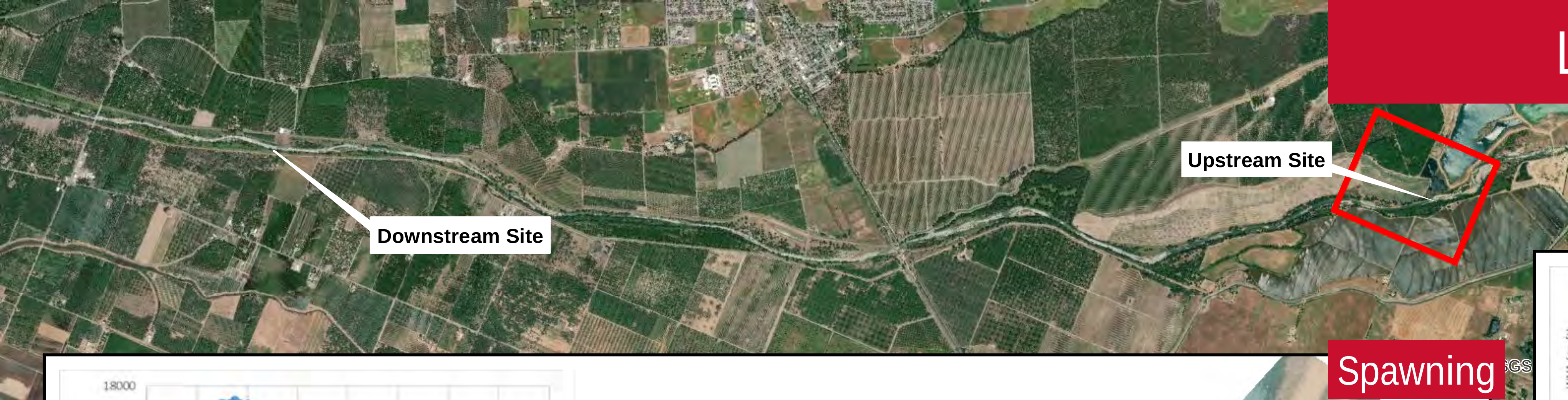


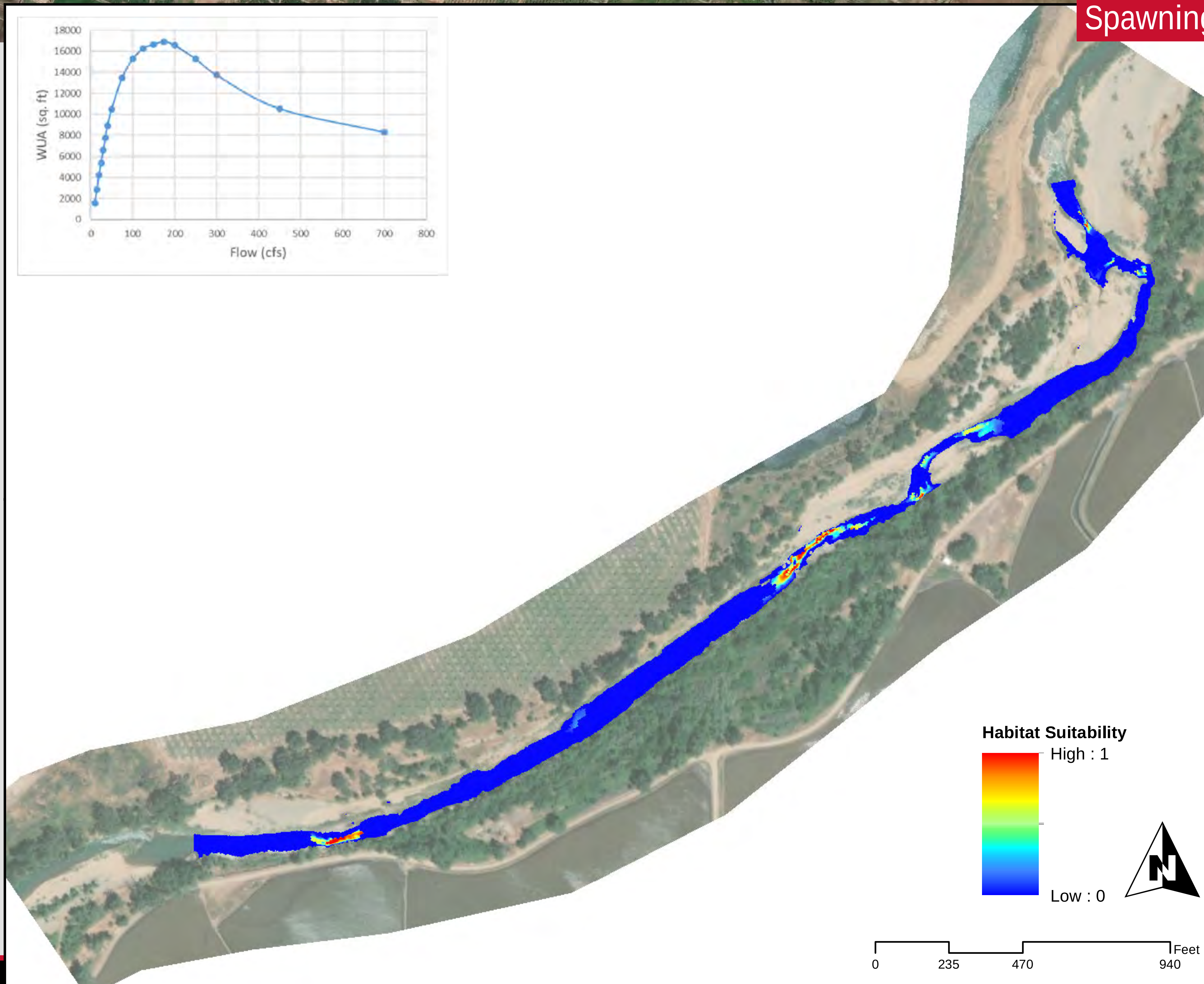
Lower Bear River - Instream Flow Study

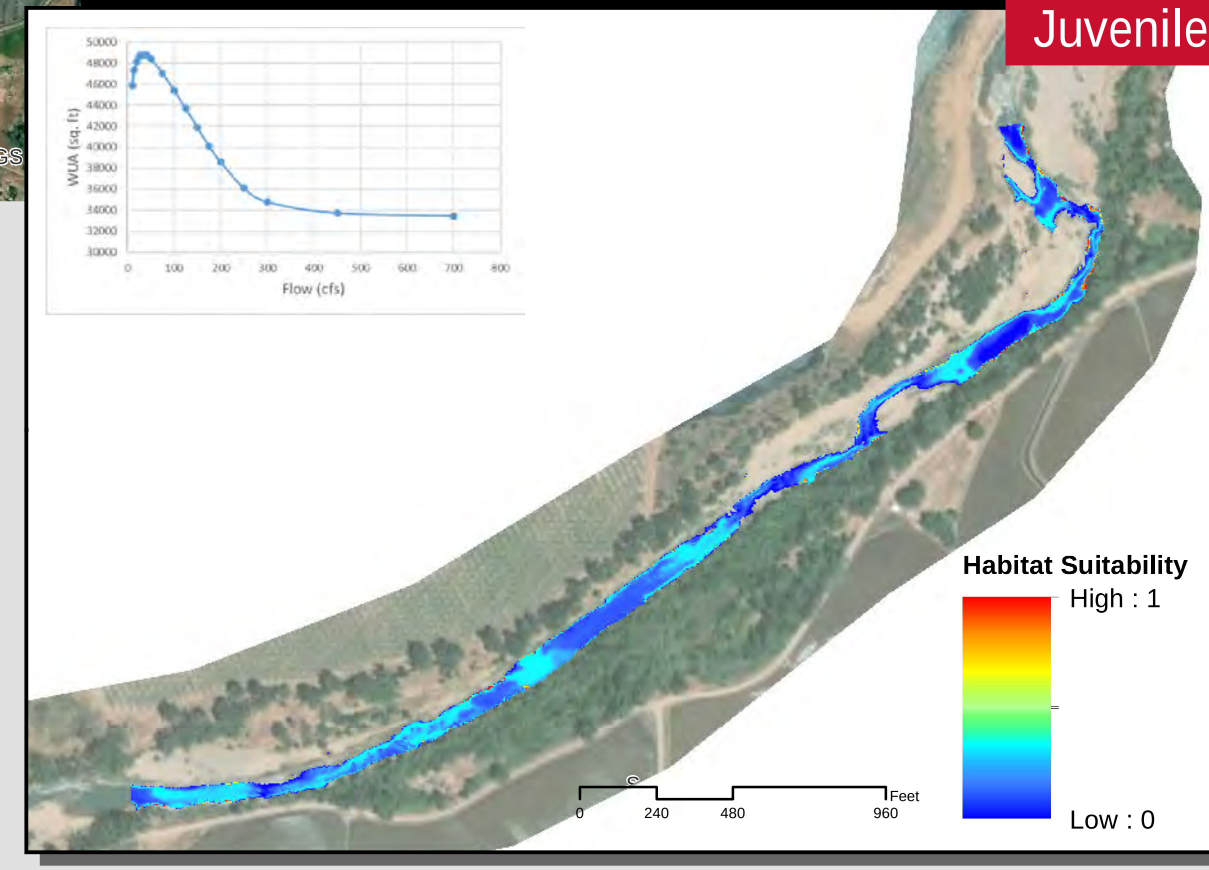
SSWD HDR

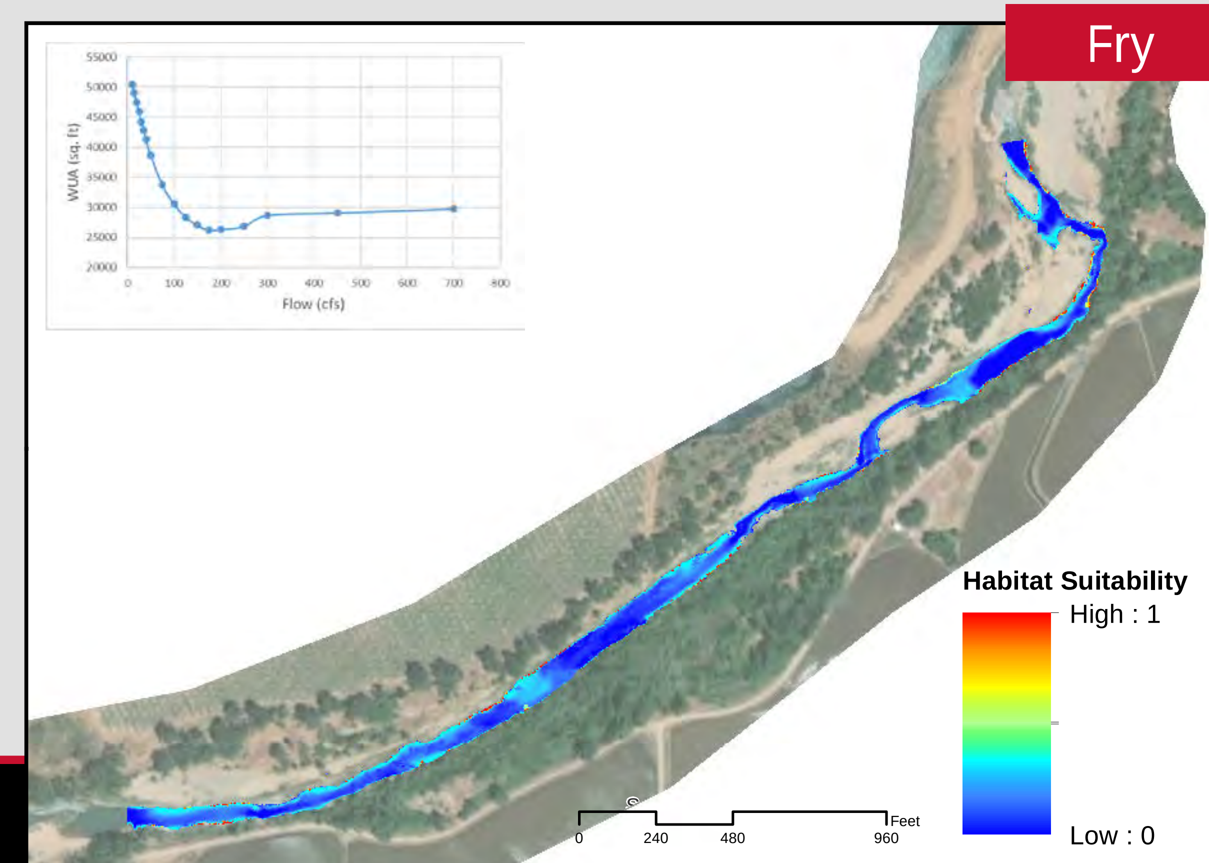
Fall-Run Chinook Salmon

Upstream Study Site 50 cfs









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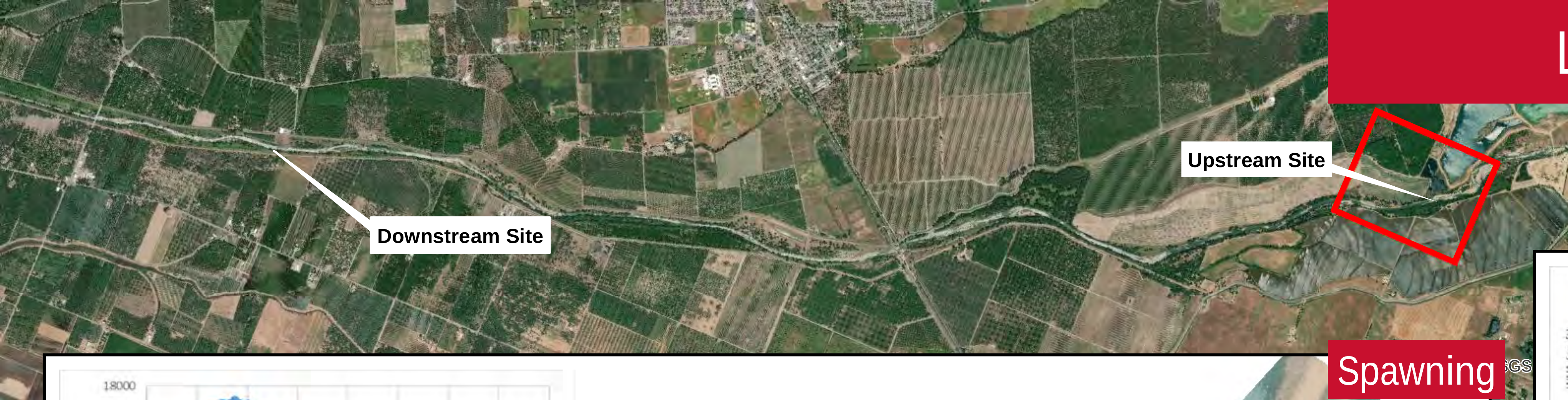
Lower Bear River - Instream Flow Study

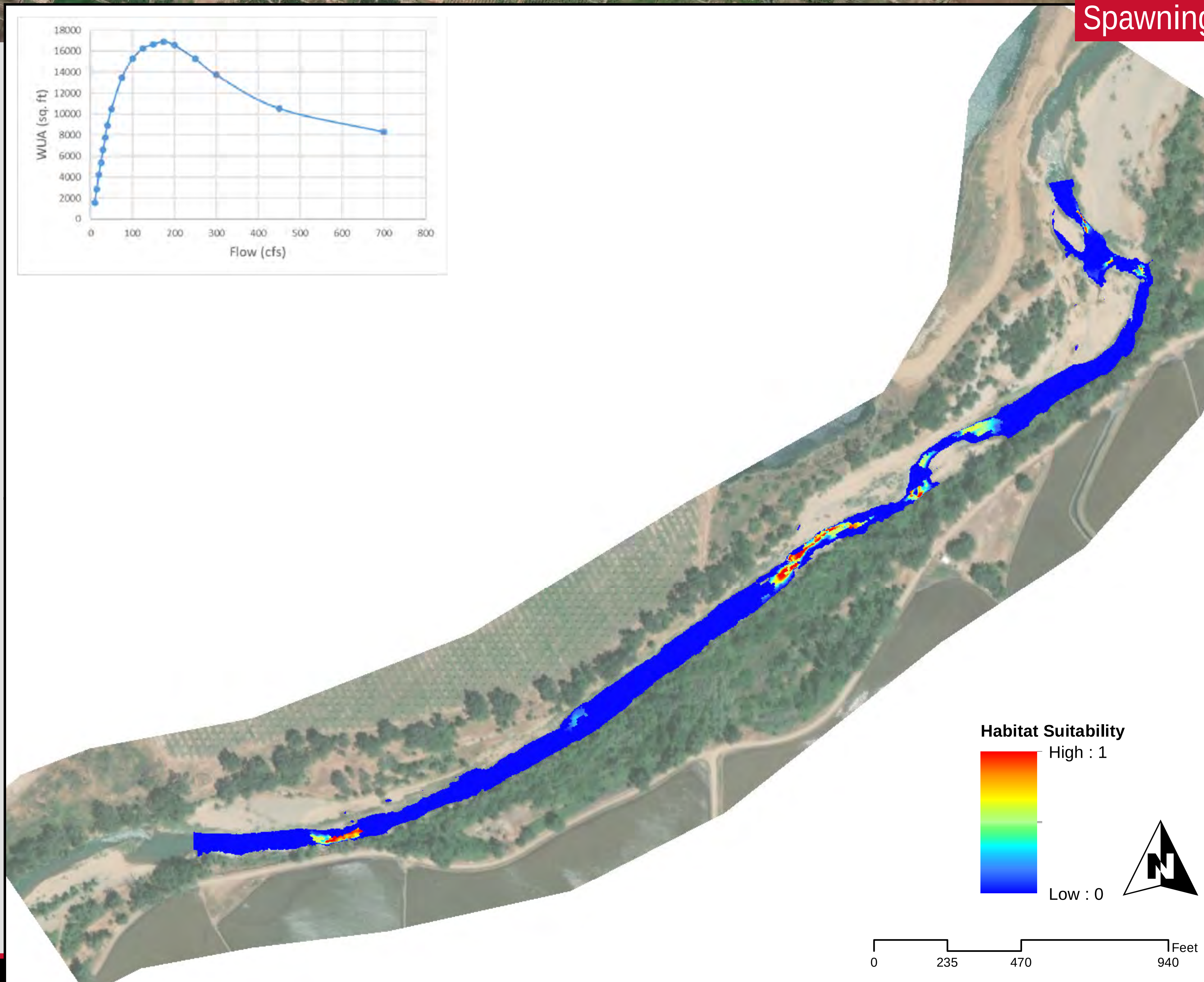
SSWD HDR

Fall-Run Chinook Salmon

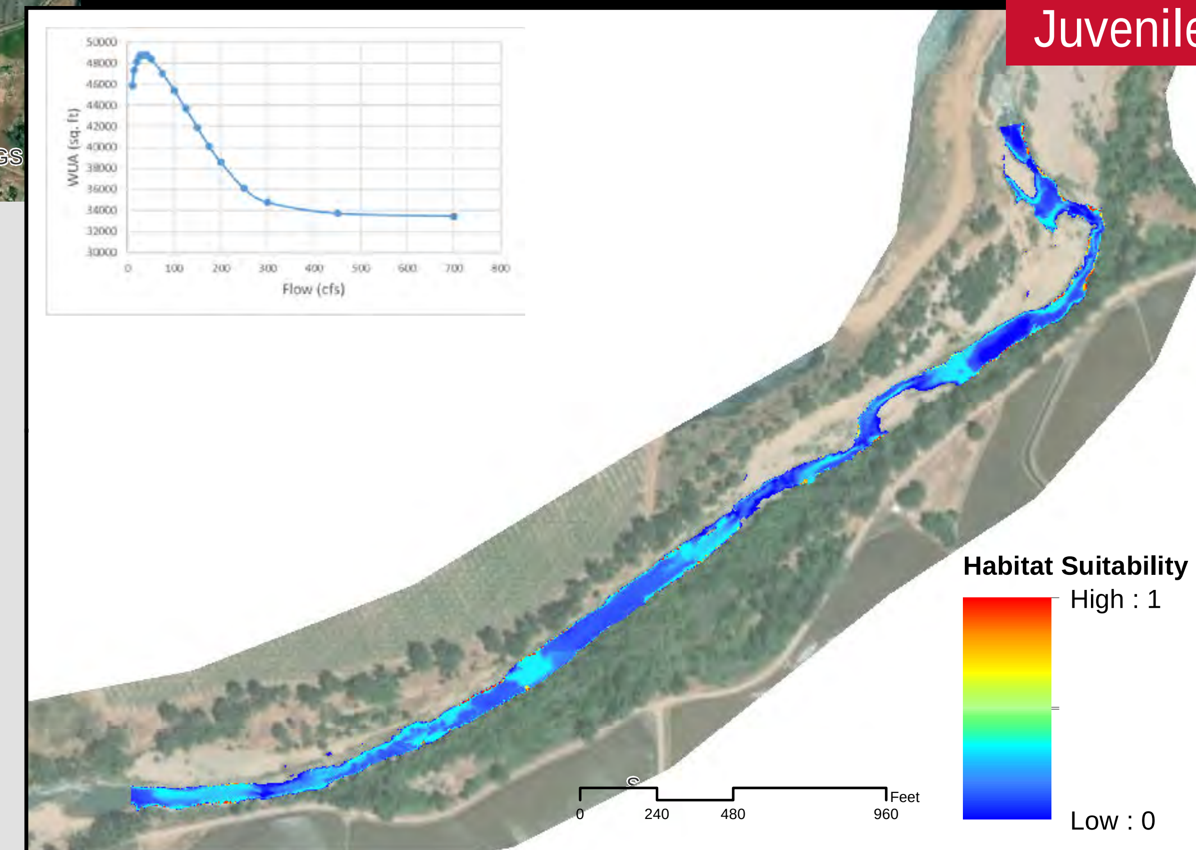
Upstream Study Site 75 cfs



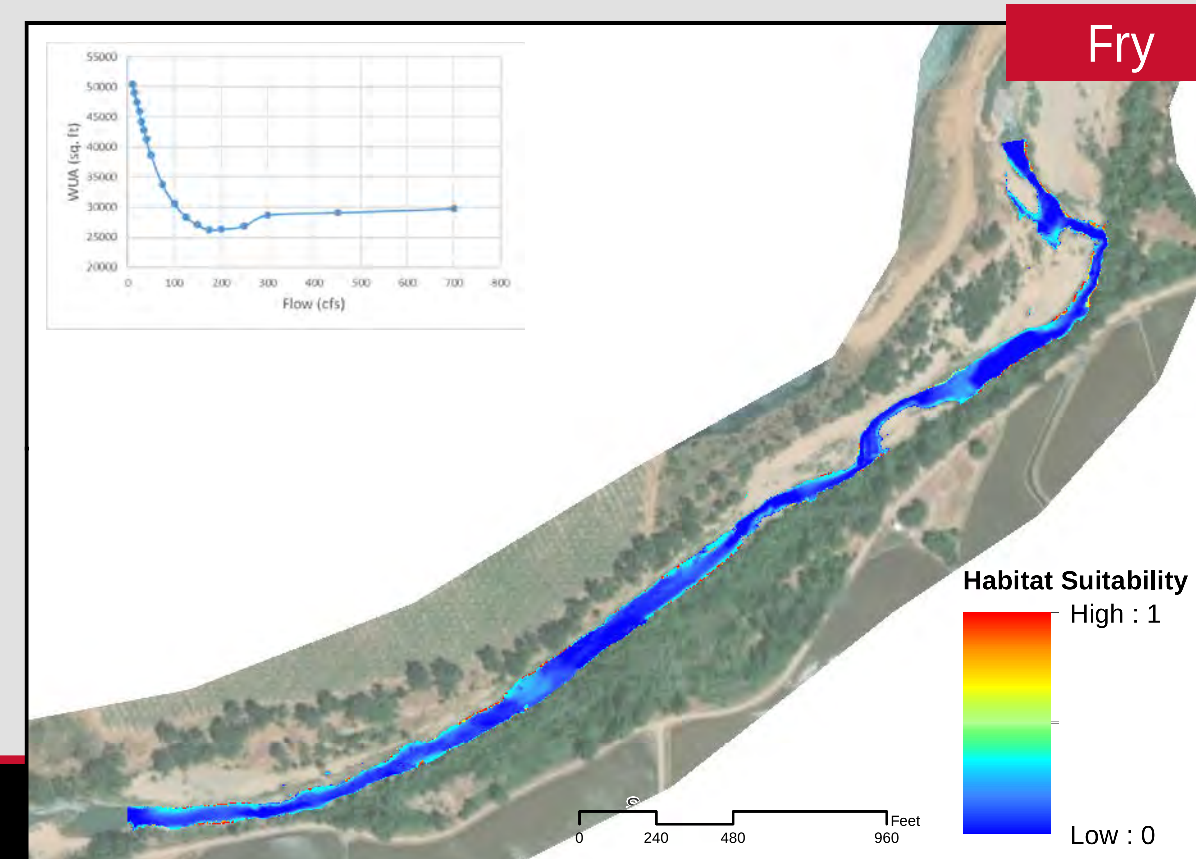
Spawning



Juvenile



Fry



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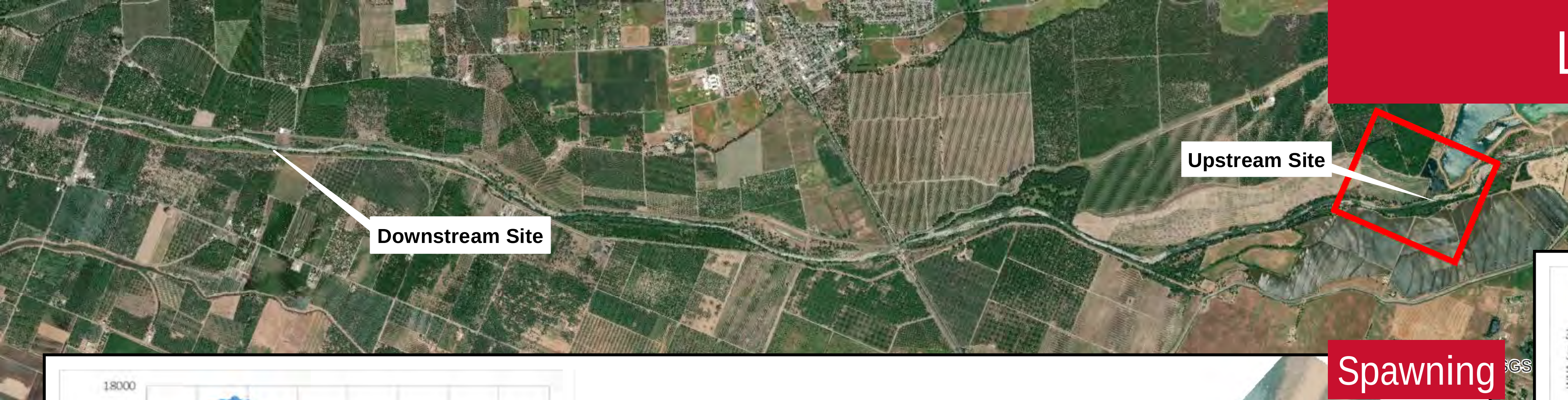
Lower Bear River - Instream Flow Study

SSWD HDR

Fall-Run Chinook Salmon

Upstream Study Site 100 cfs



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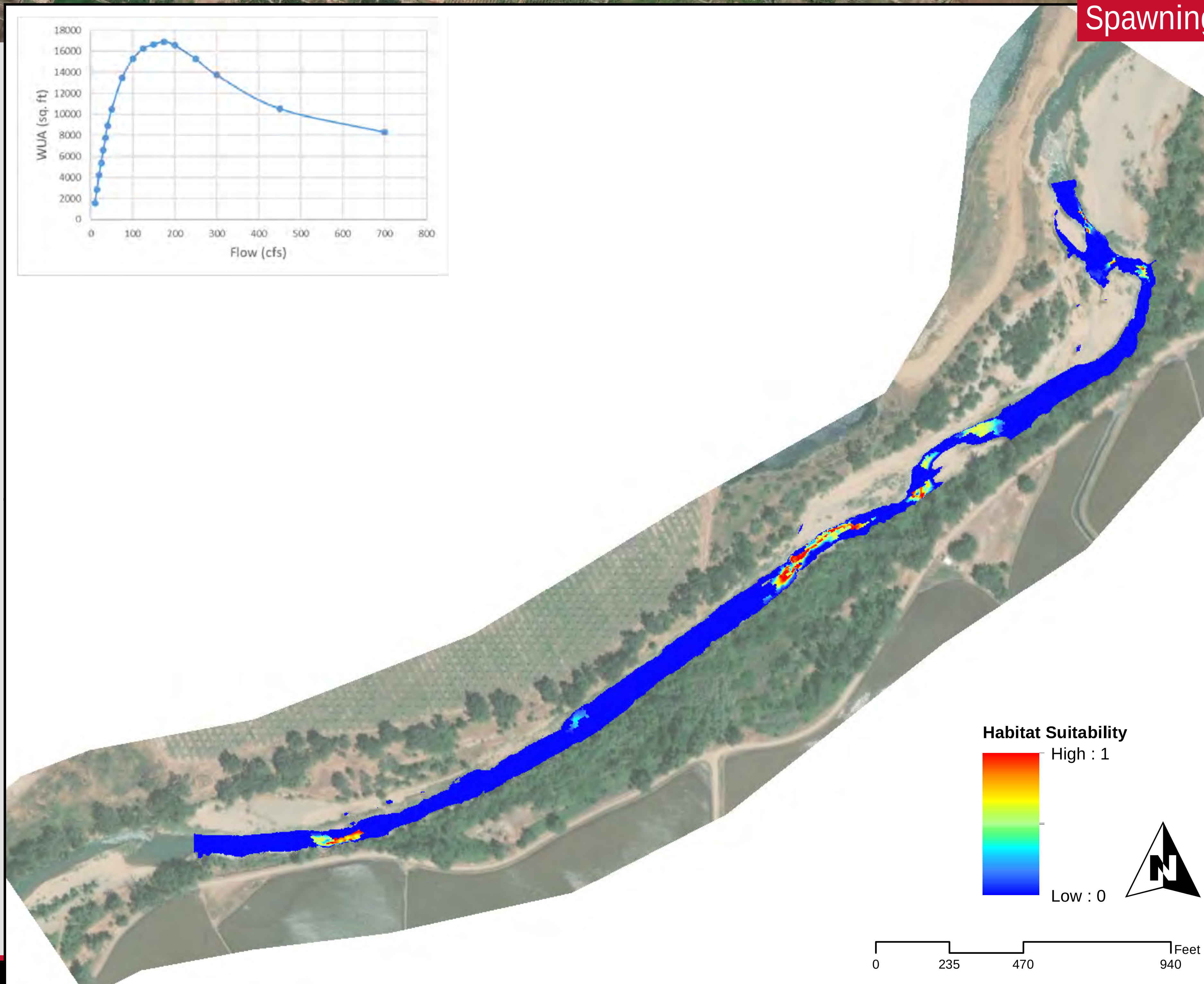

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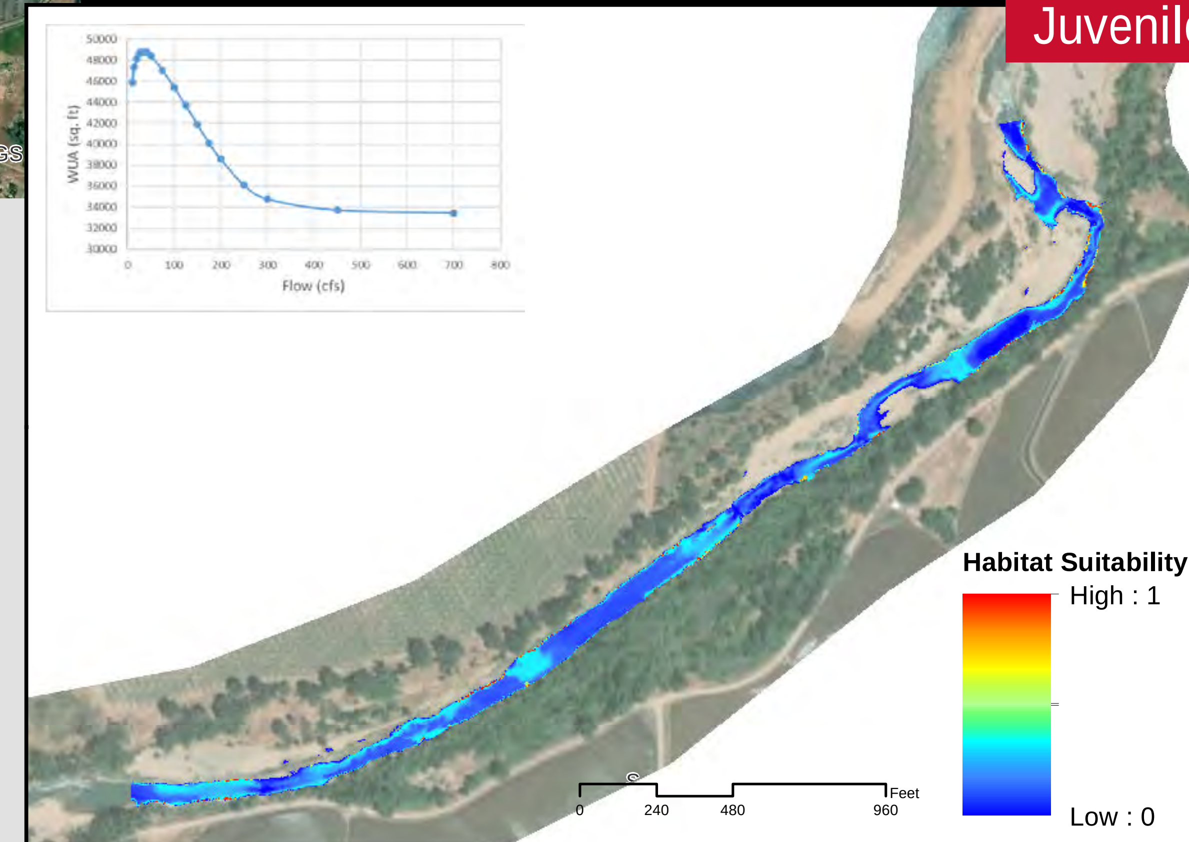

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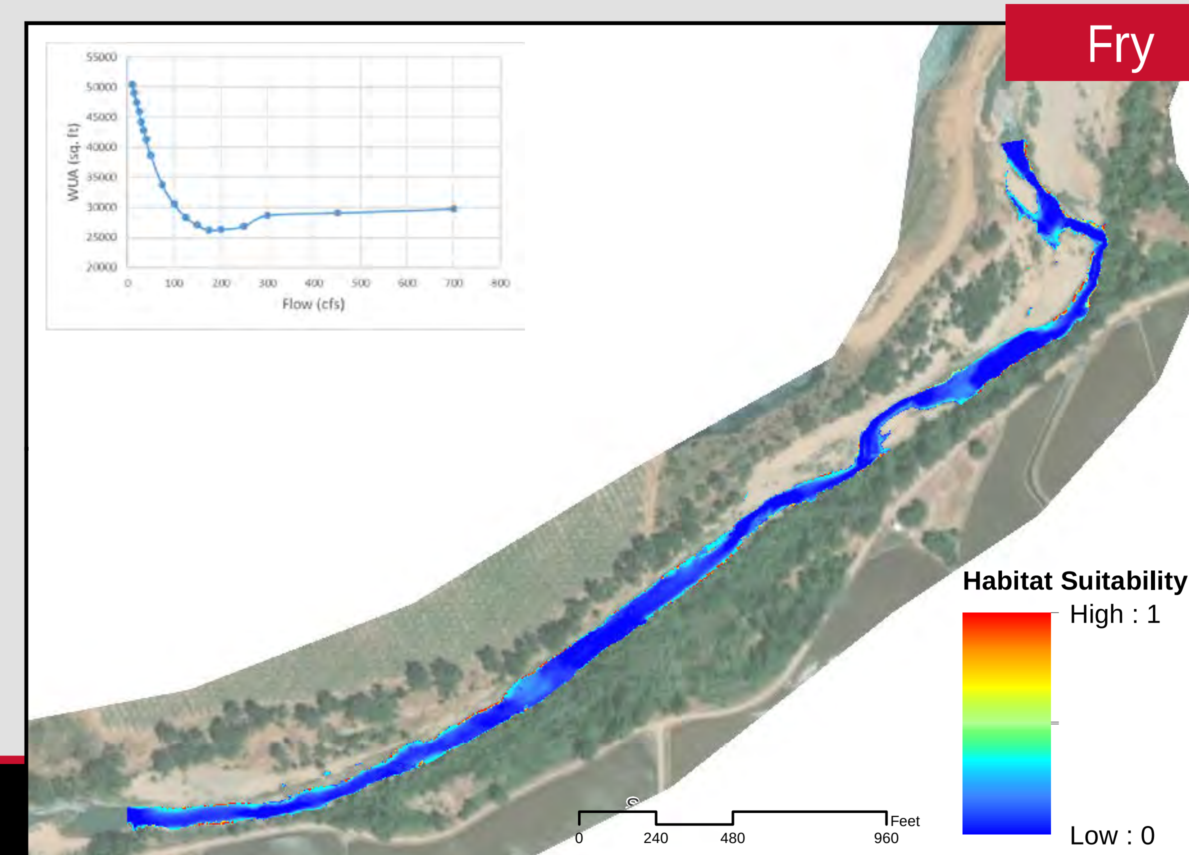
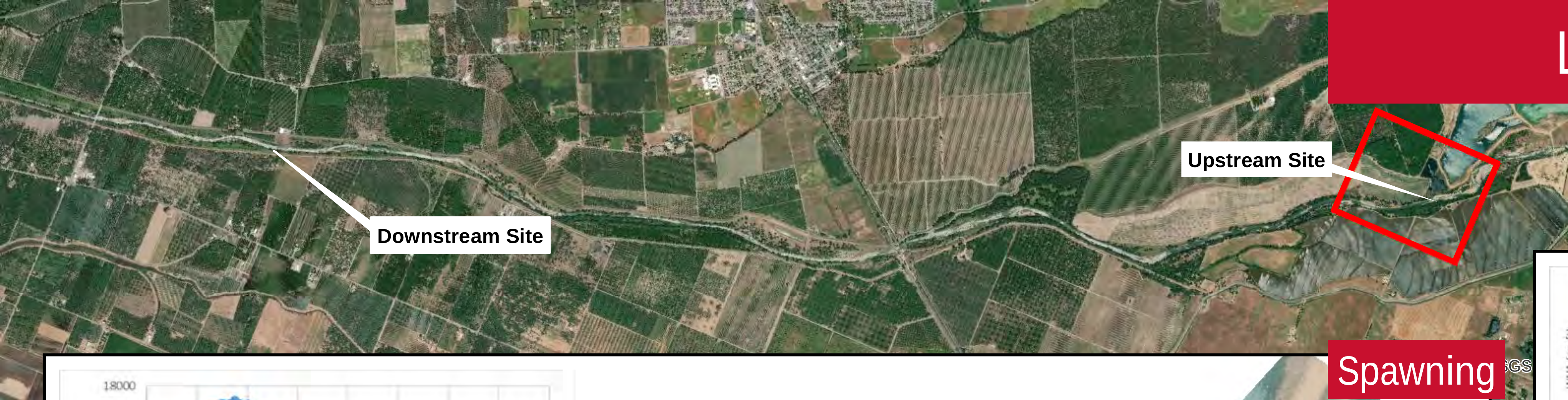


Lower Bear River - Instream Flow Study

SSWD HDR

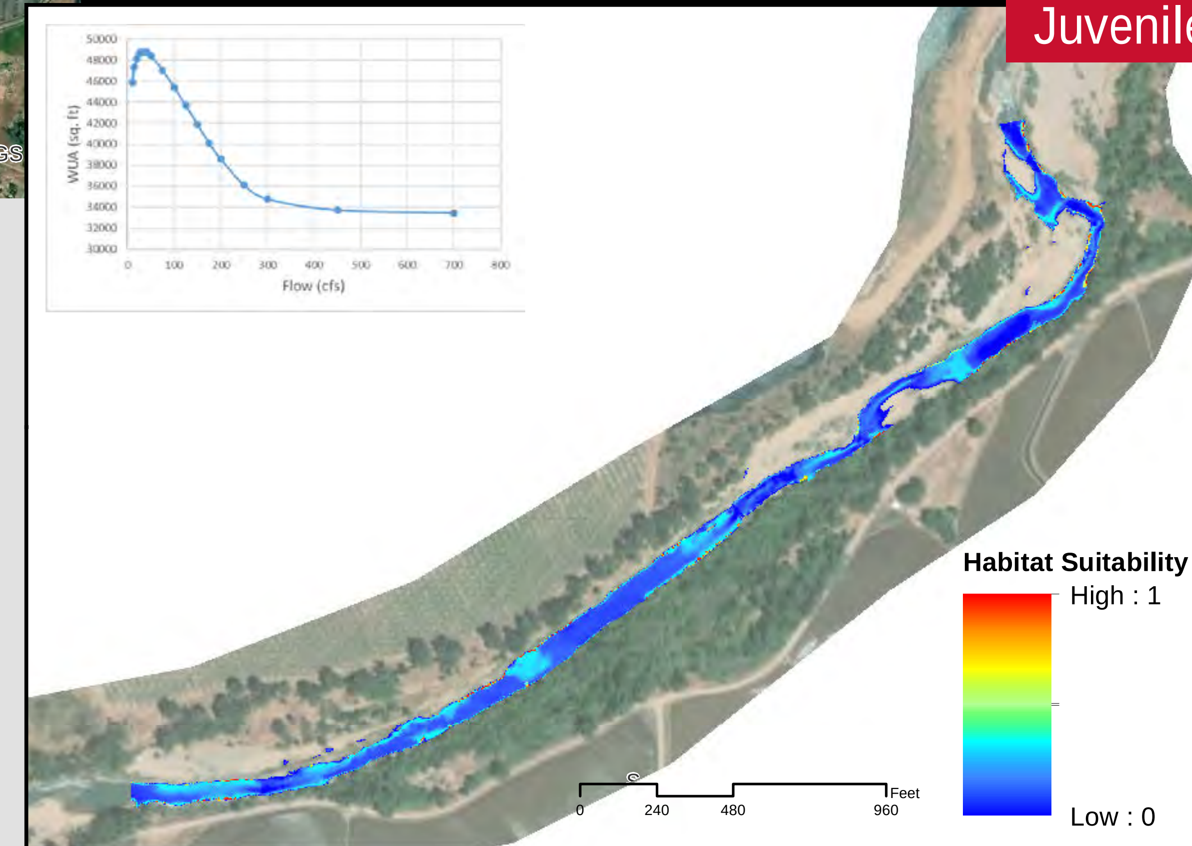
Fall-Run Chinook Salmon

Upstream Study Site 125 cfs



Spawning

Juvenile



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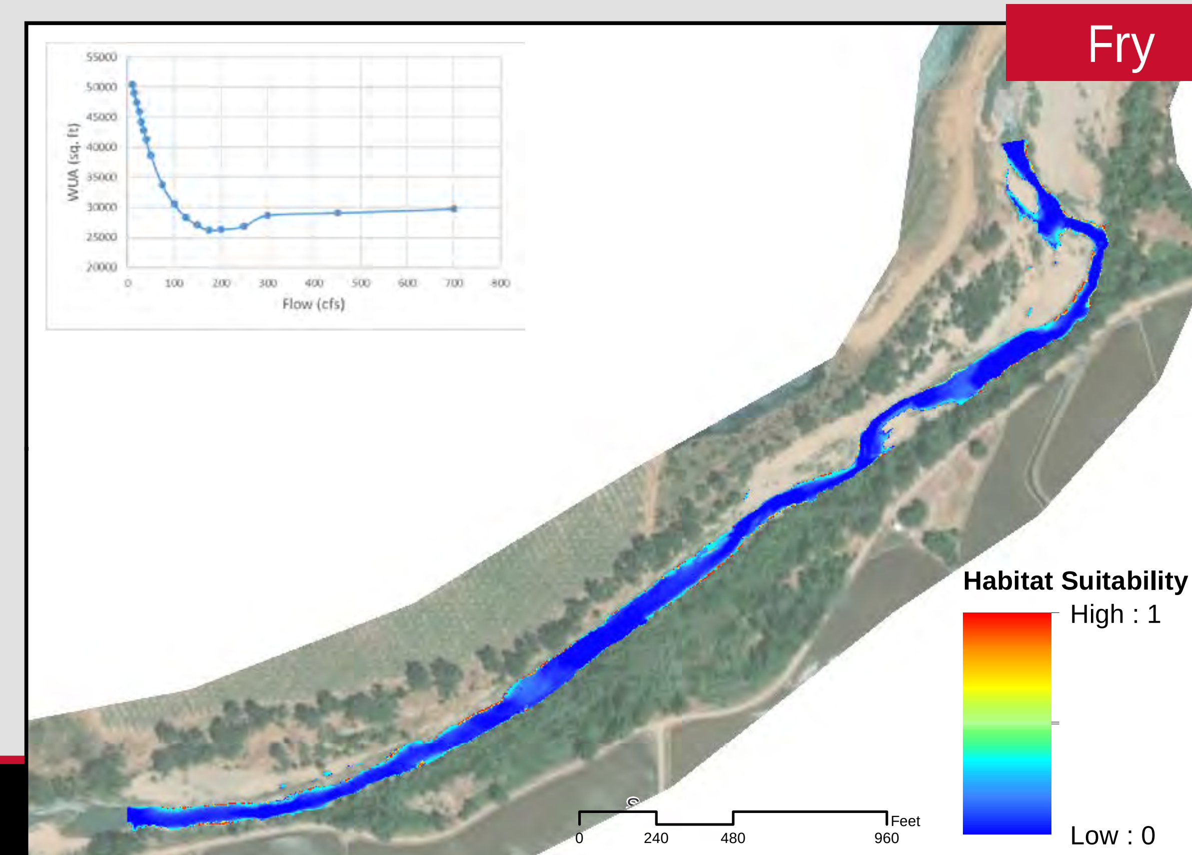
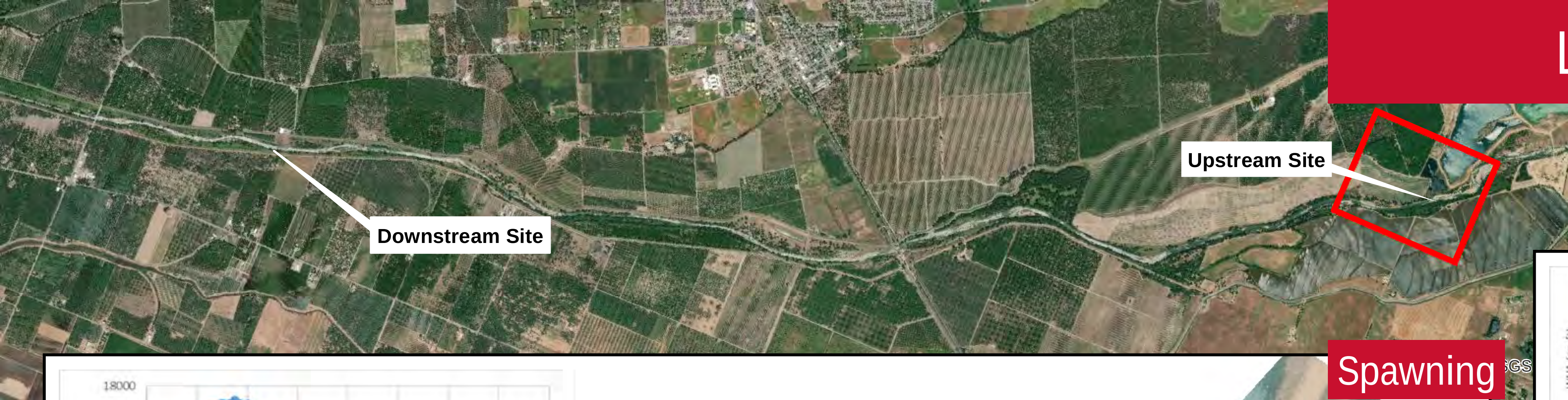


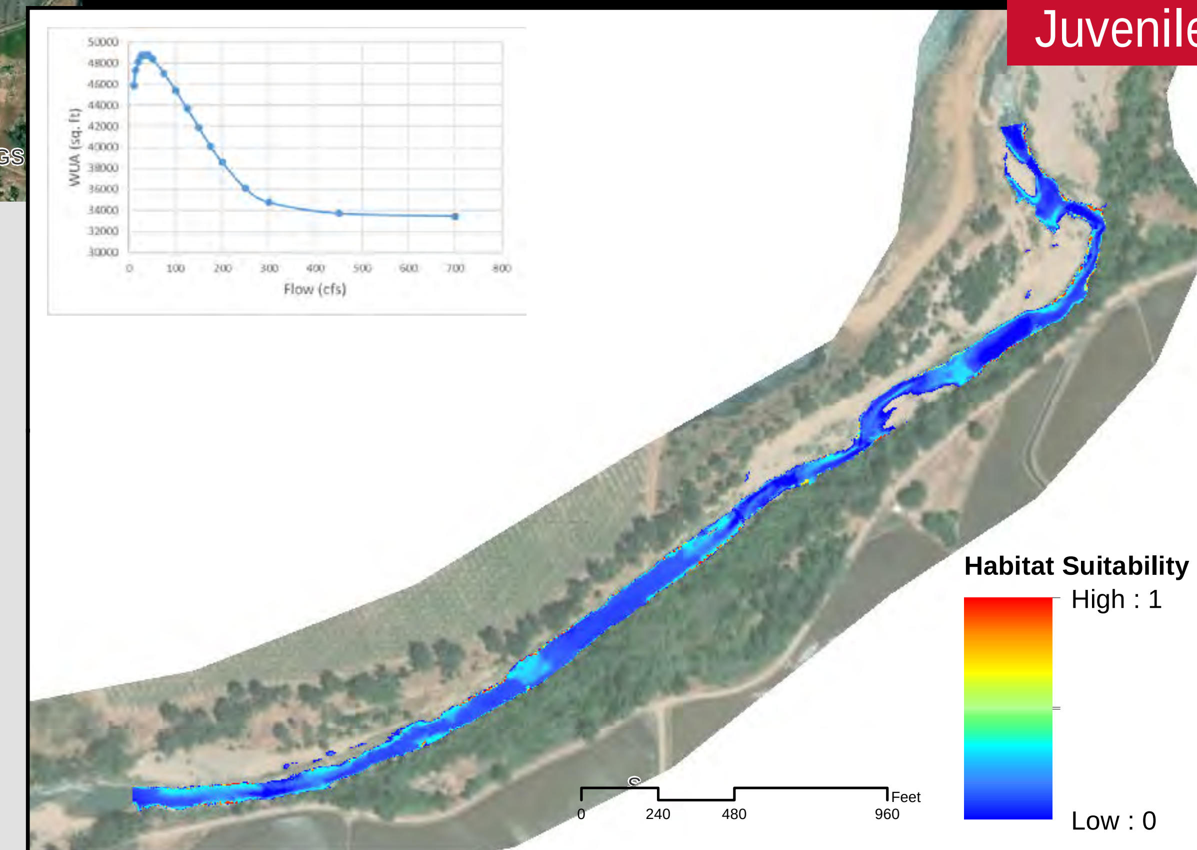
Lower Bear River - Instream Flow Study

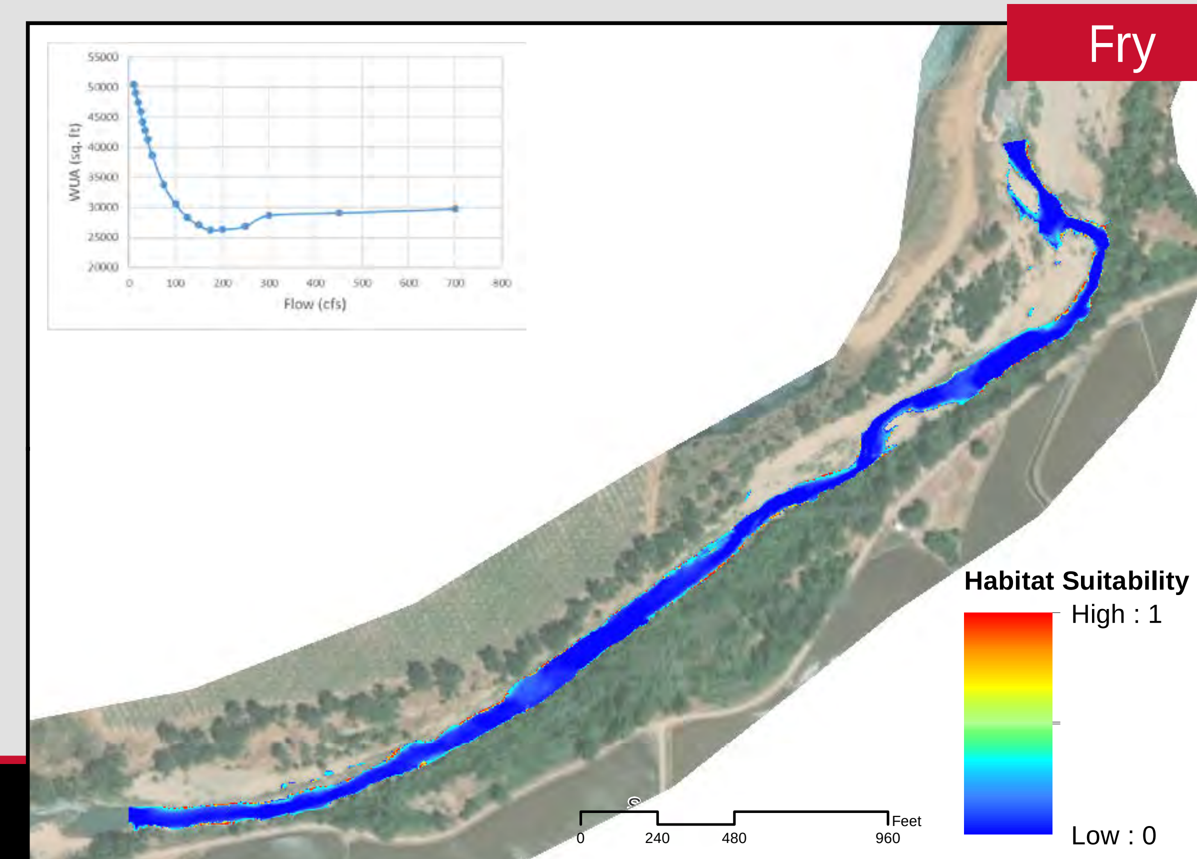
SSWD HDR

Fall-Run Chinook Salmon

Upstream Study Site 150 cfs





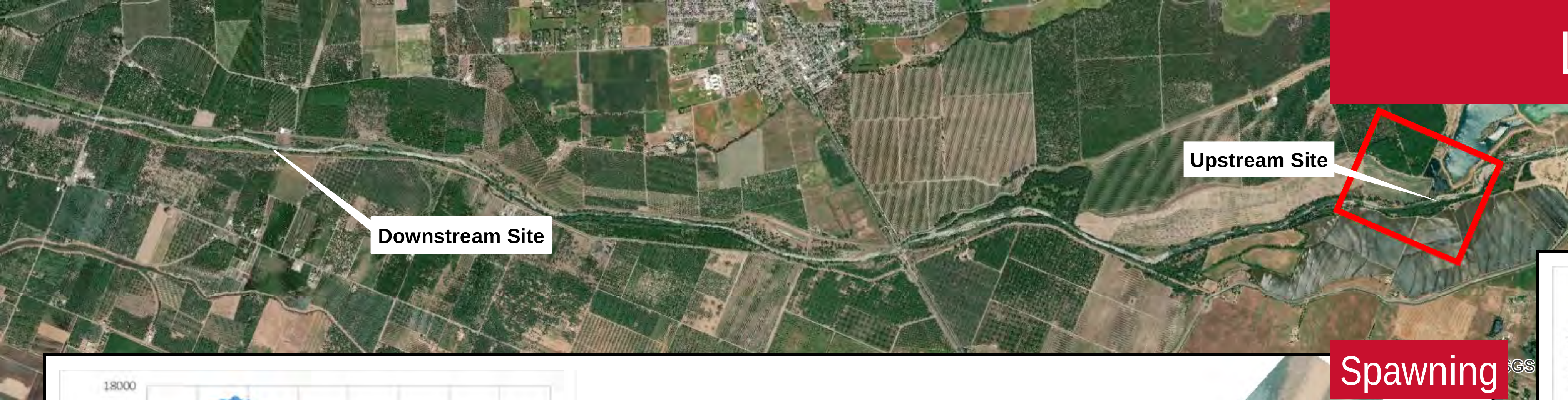


Lower Bear River - Instream Flow Study

SSWD HDR

Fall-Run Chinook Salmon

Upstream Study Site 175 cfs



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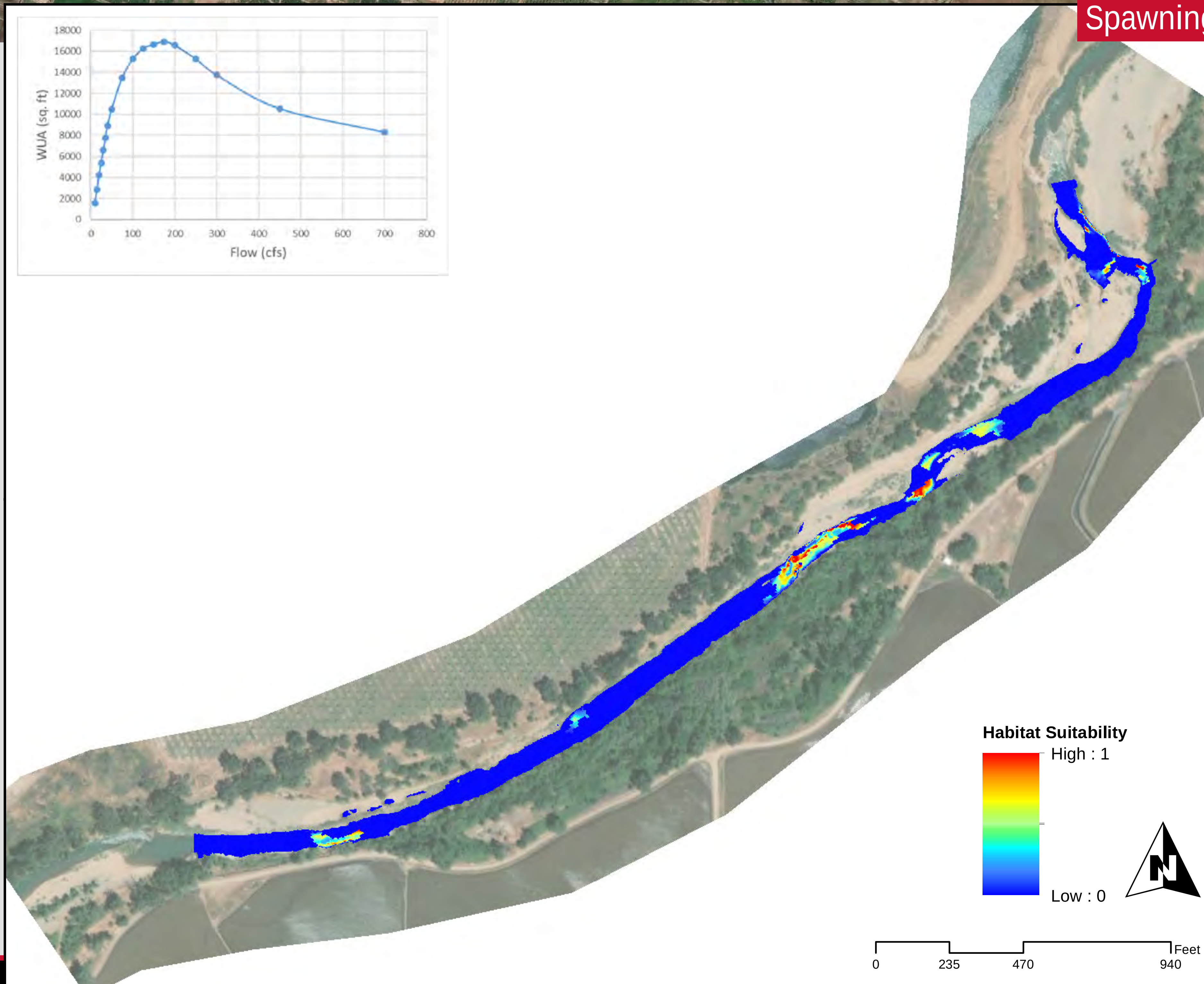

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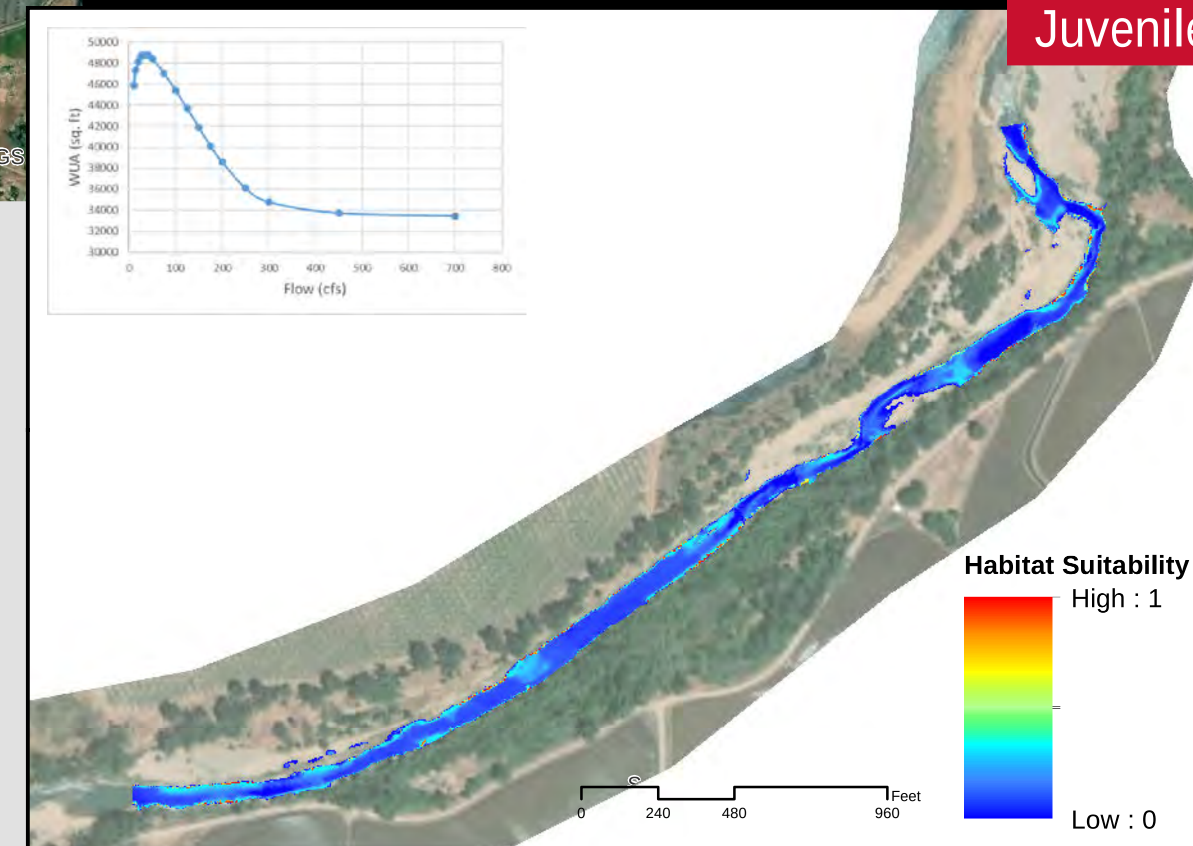

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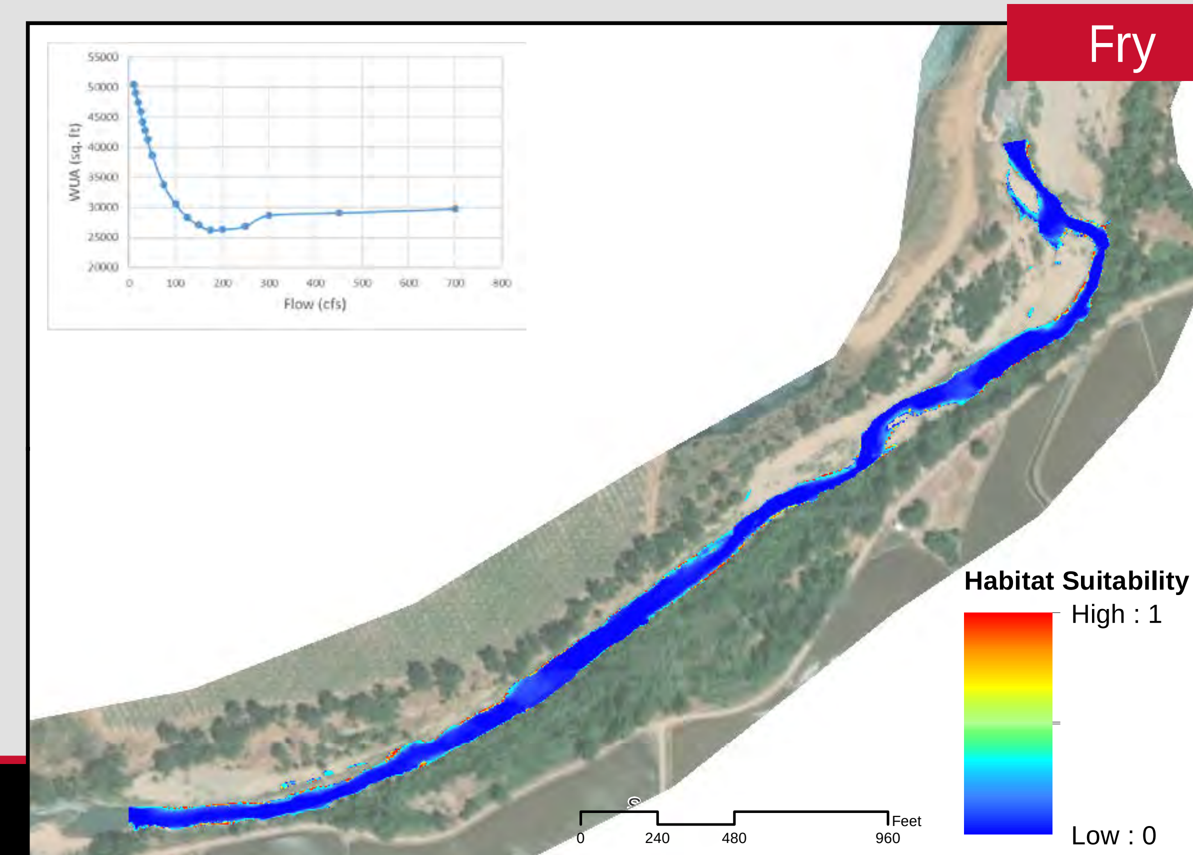

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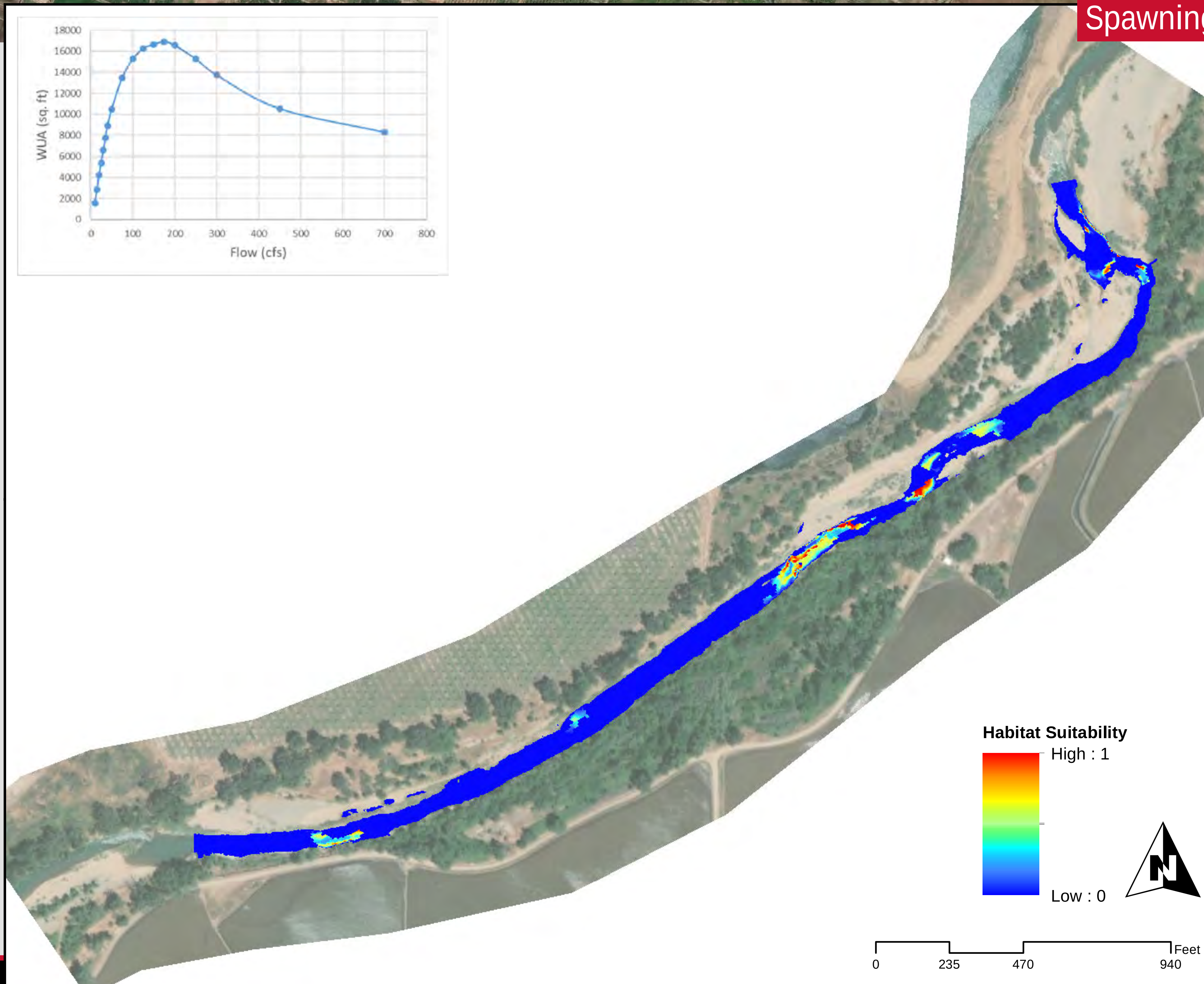
Lower Bear River - Instream Flow Study

SSWD HDR

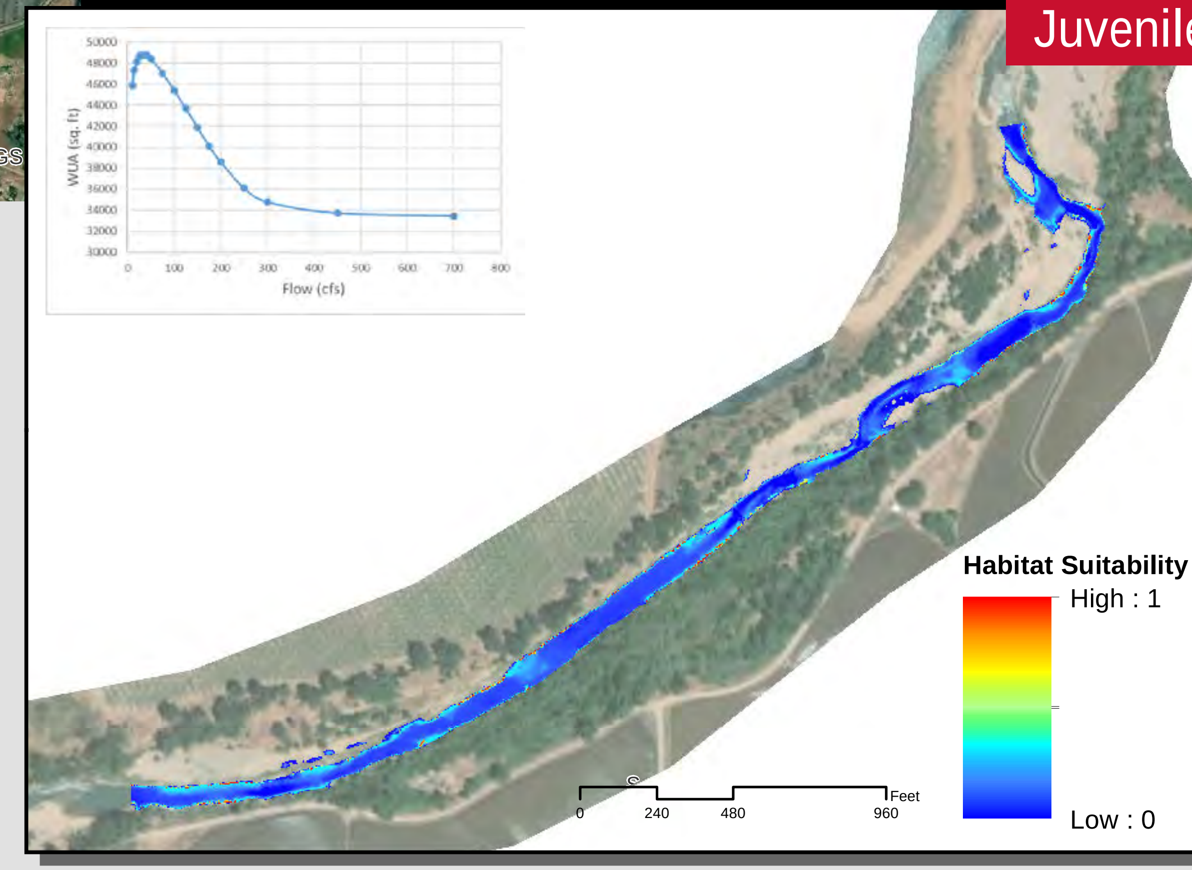
Fall-Run Chinook Salmon

Upstream Study Site 200 cfs

Spawning



Juvenile



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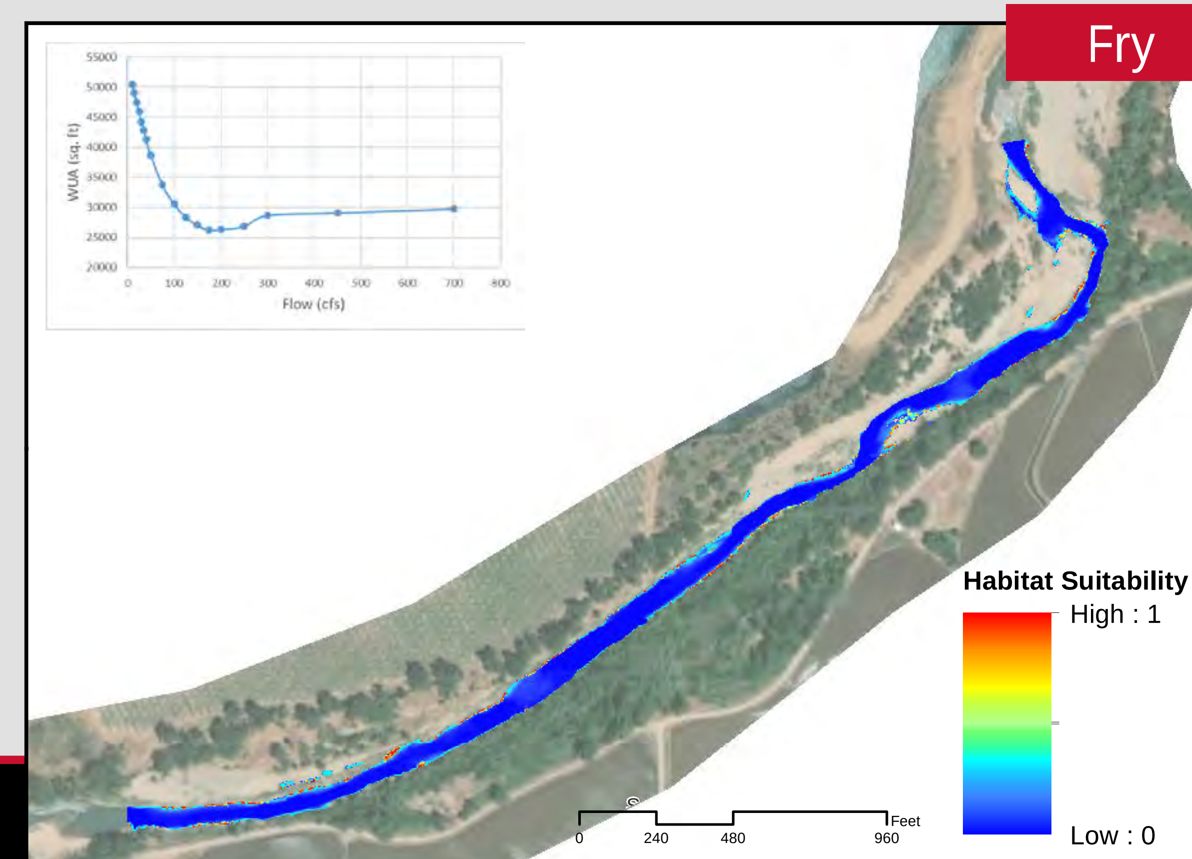

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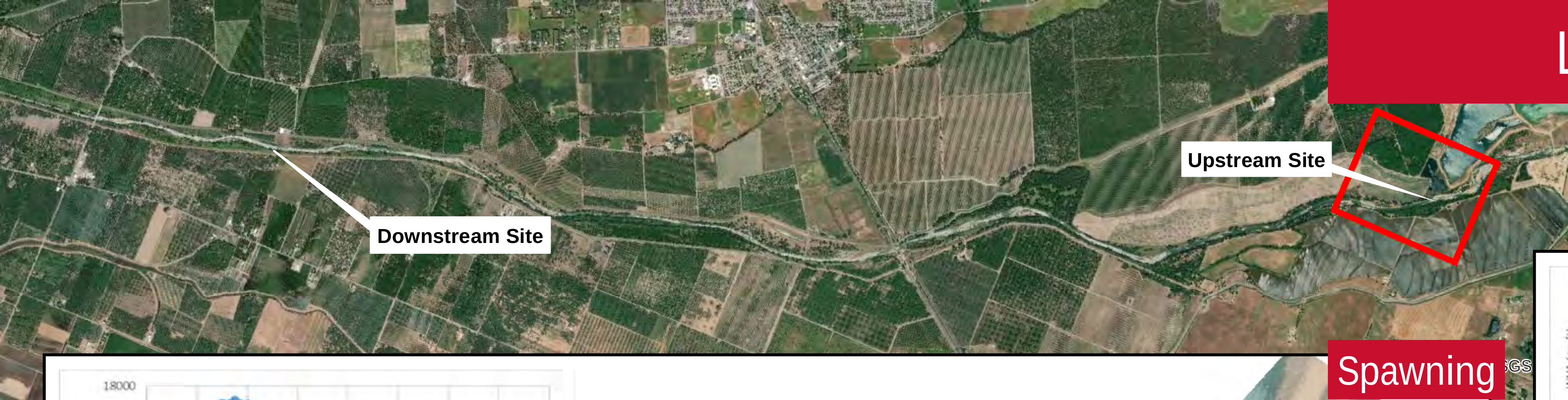
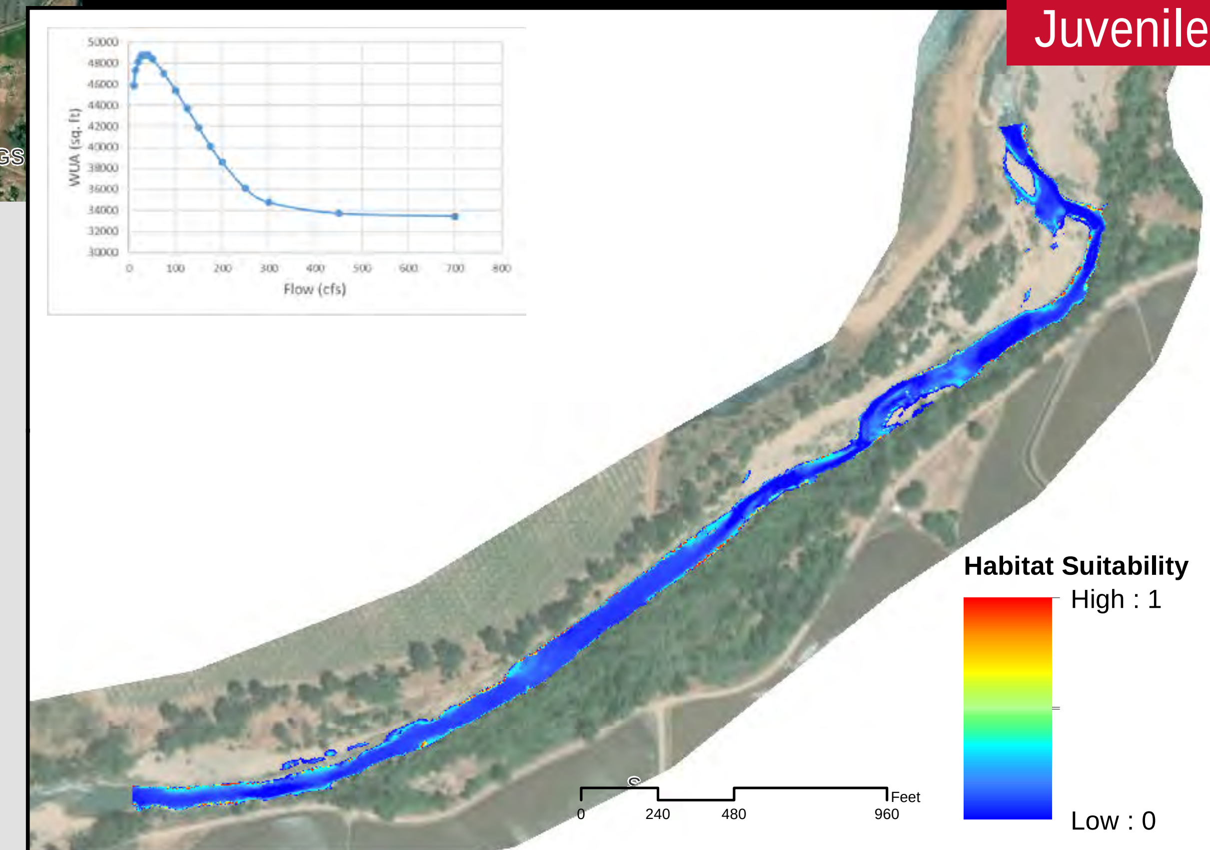
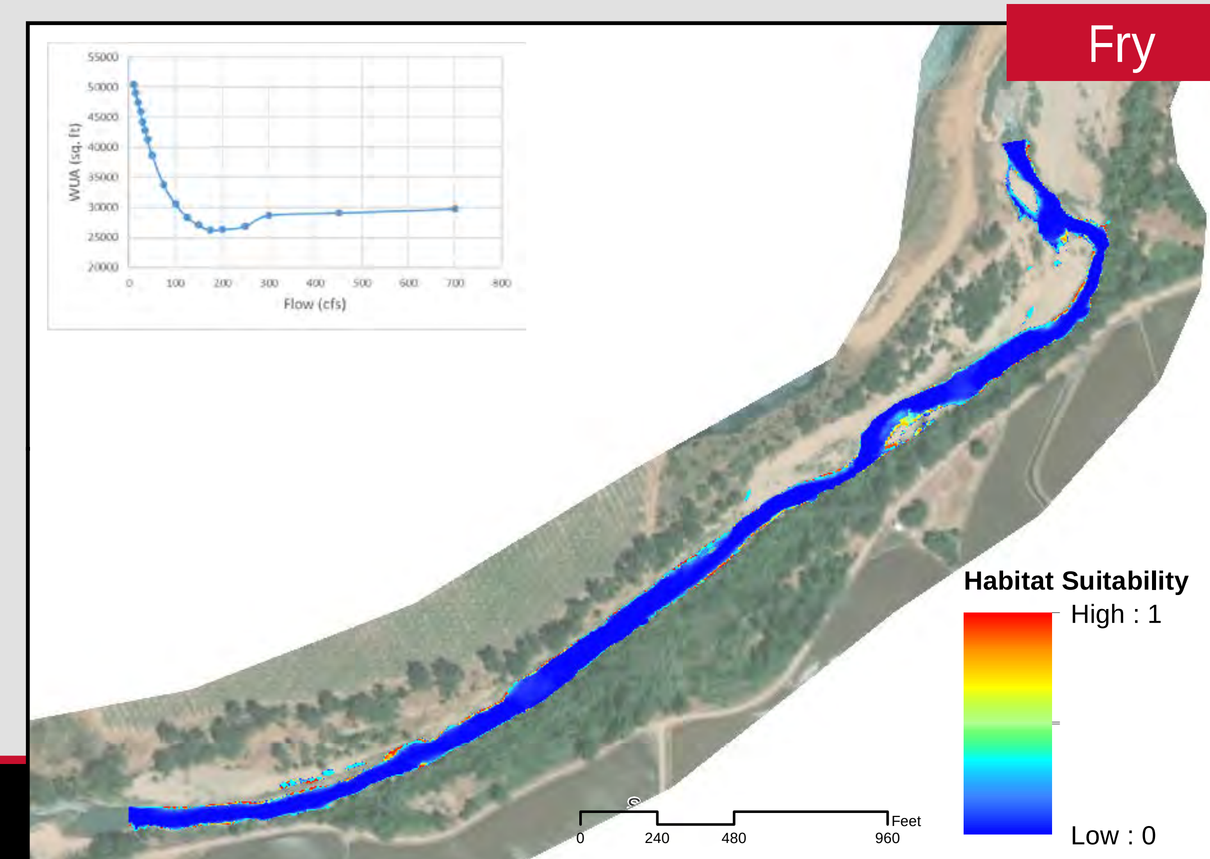
Lower Bear River - Instream Flow Study

Fall-Run Chinook Salmon

Upstream Study Site 250 cfs







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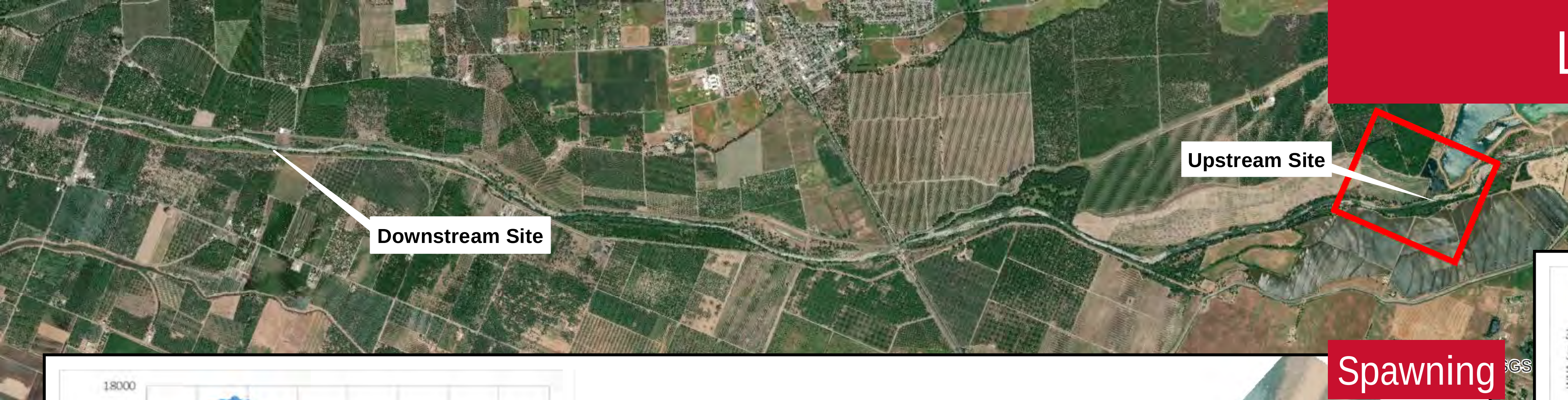
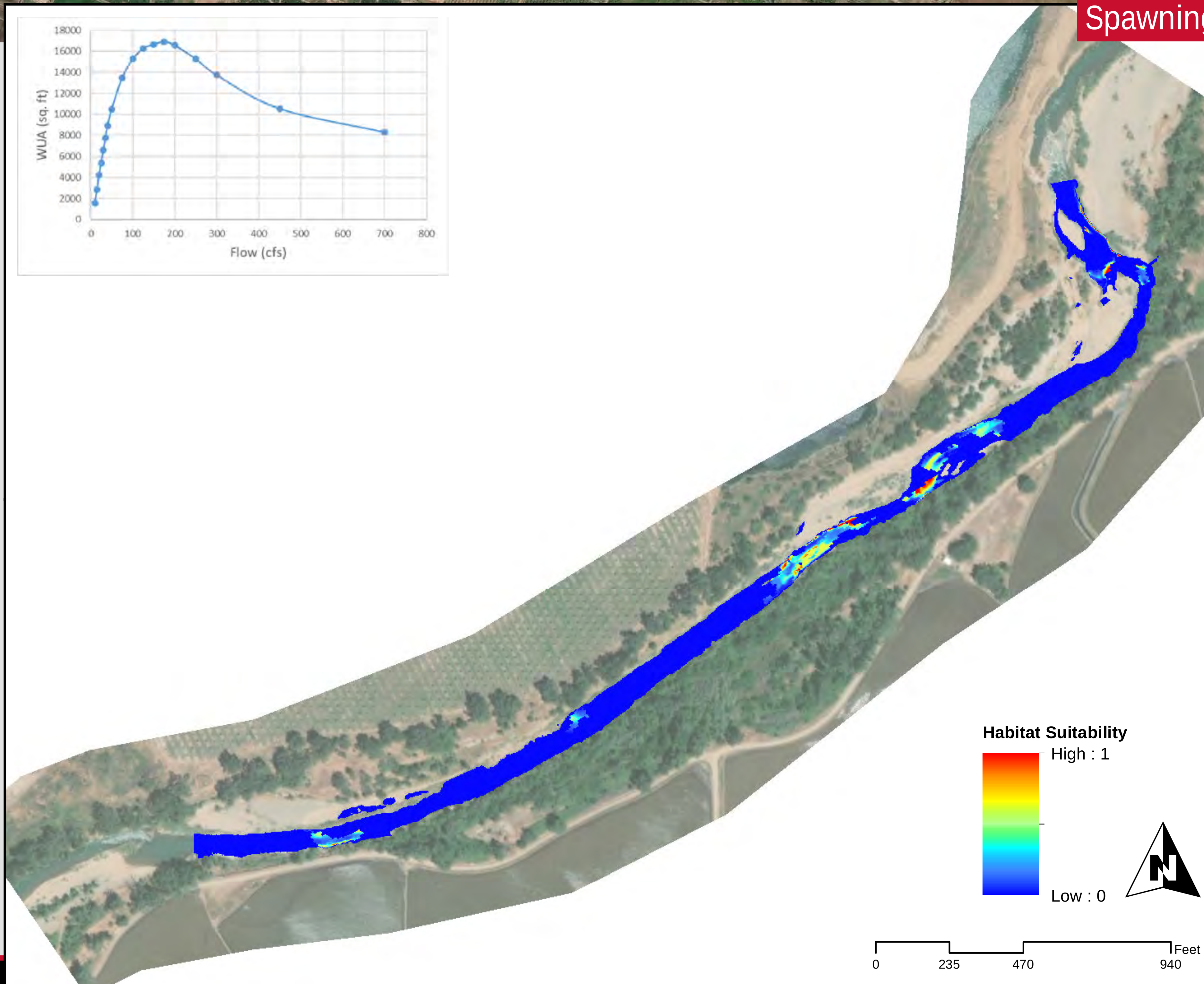
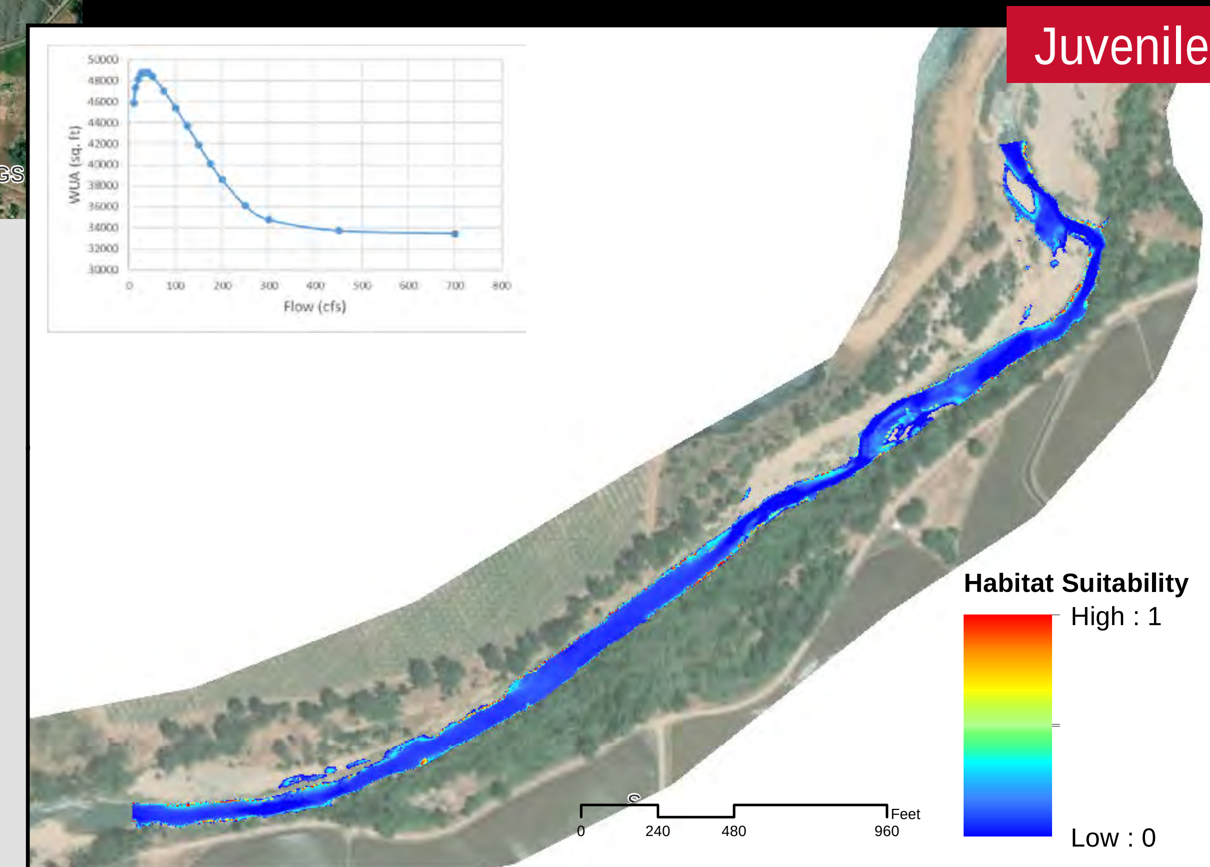
Lower Bear River - Instream Flow Study

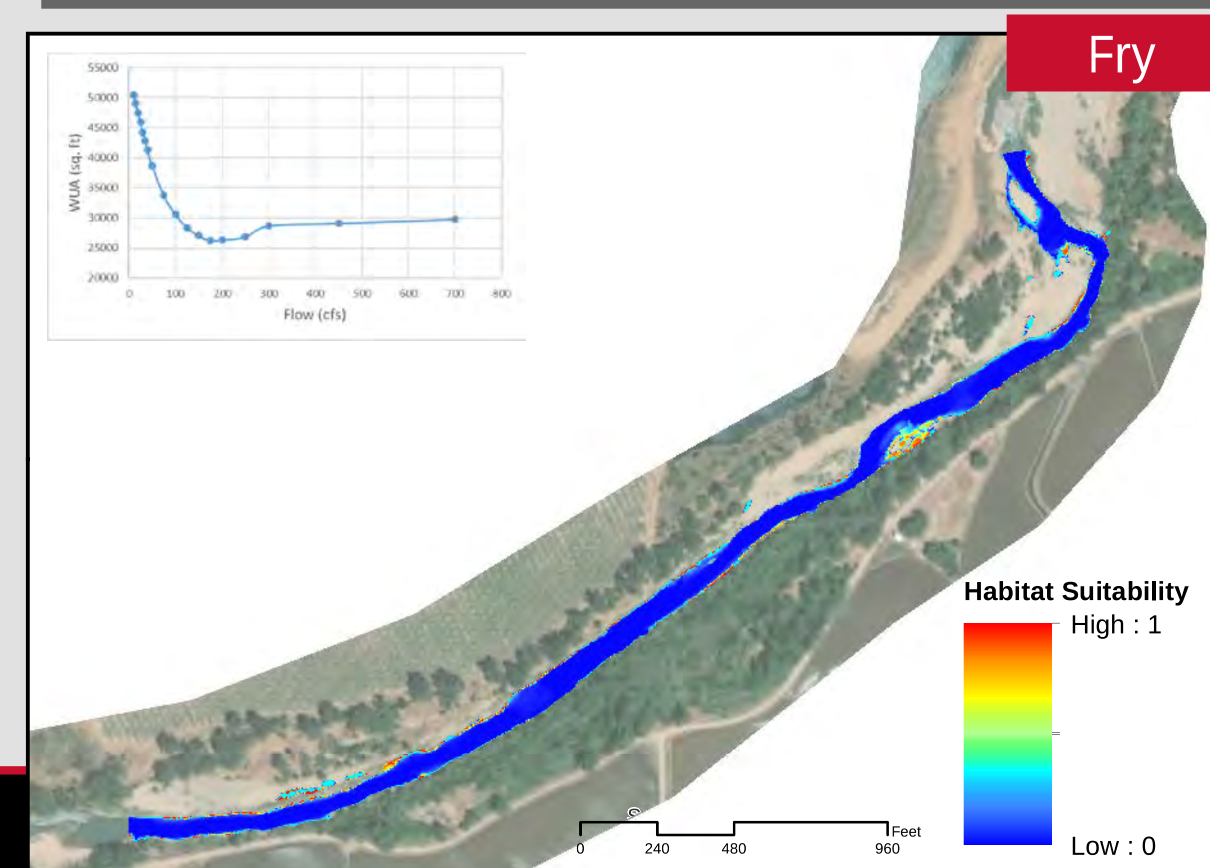
Fall-Run Chinook Salmon

Upstream Study Site 300 cfs









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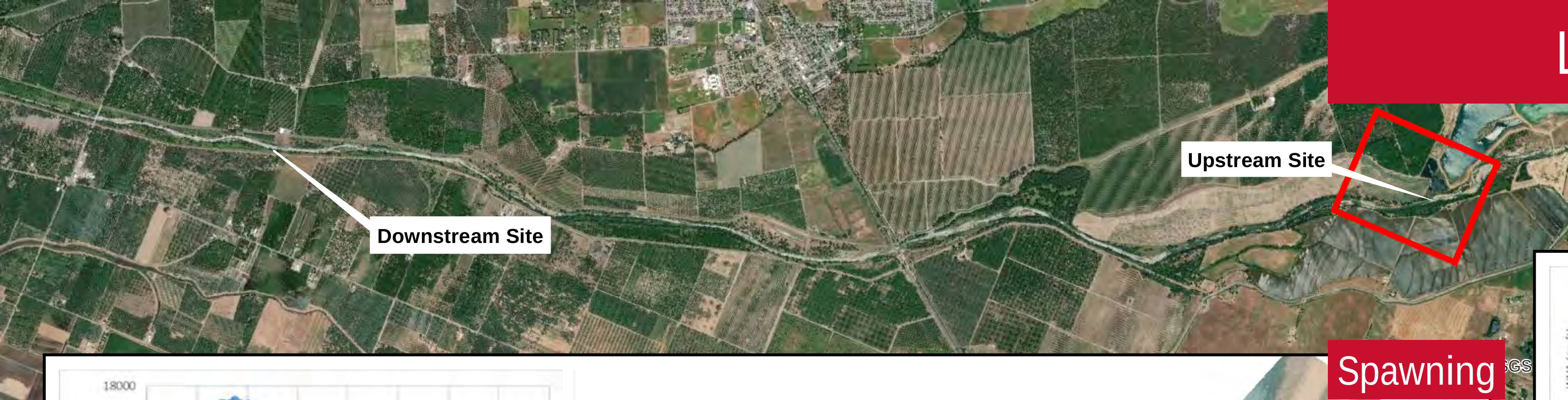
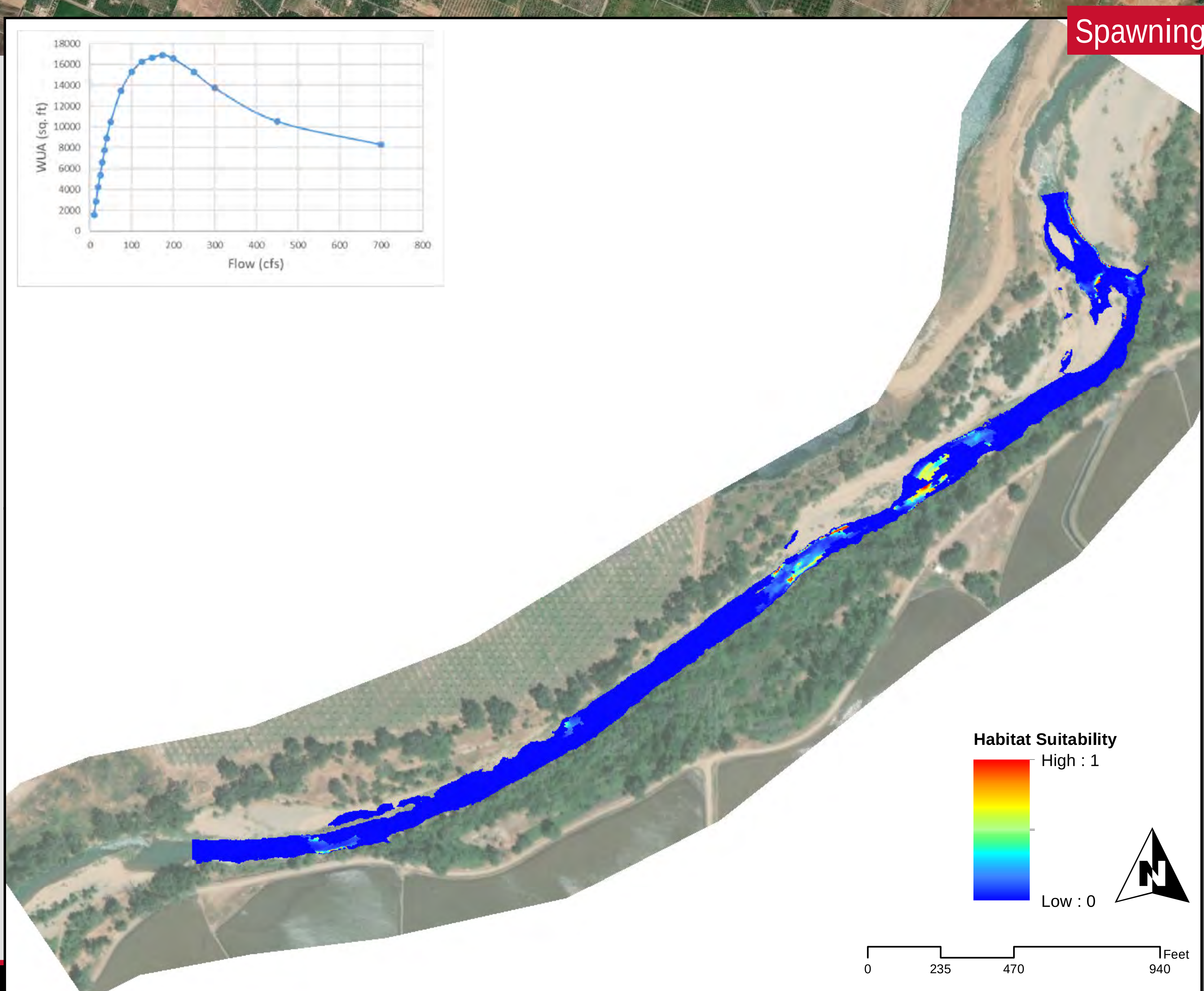
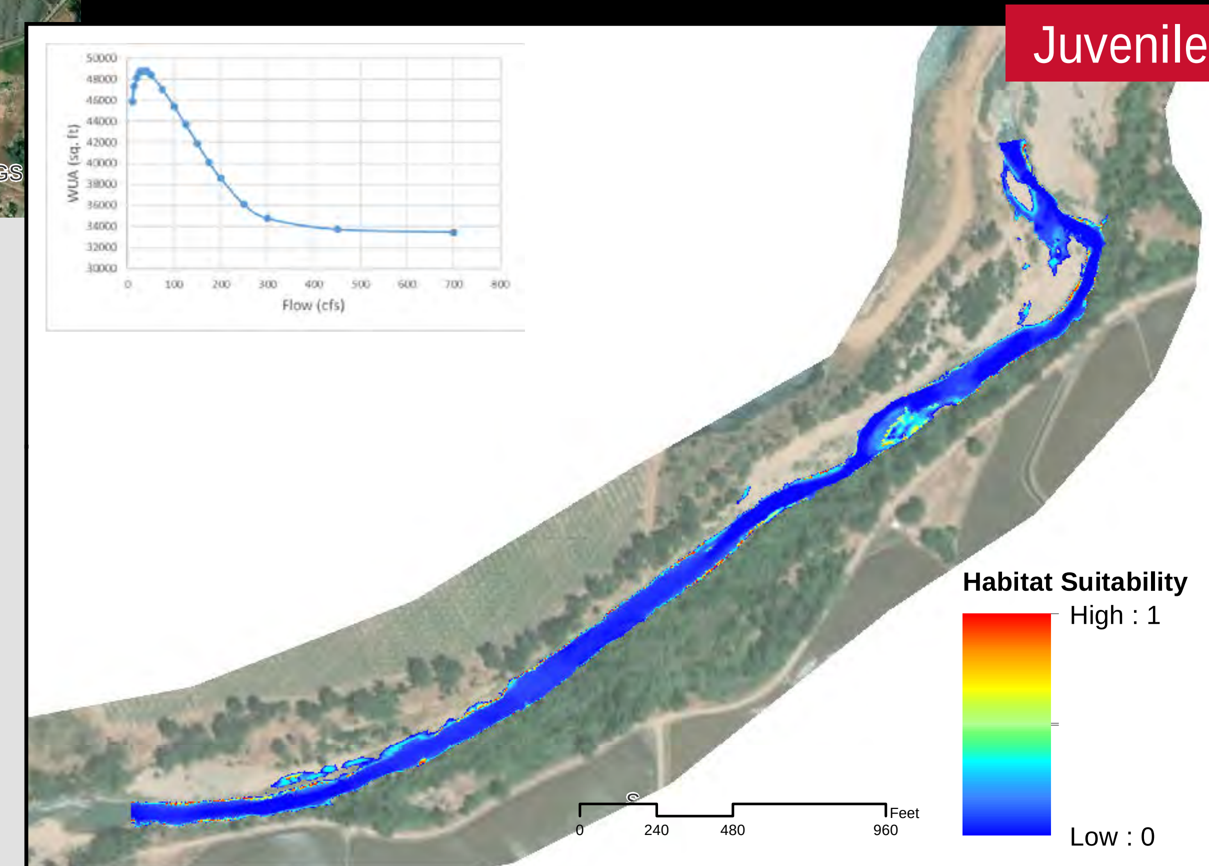
Lower Bear River - Instream Flow Study

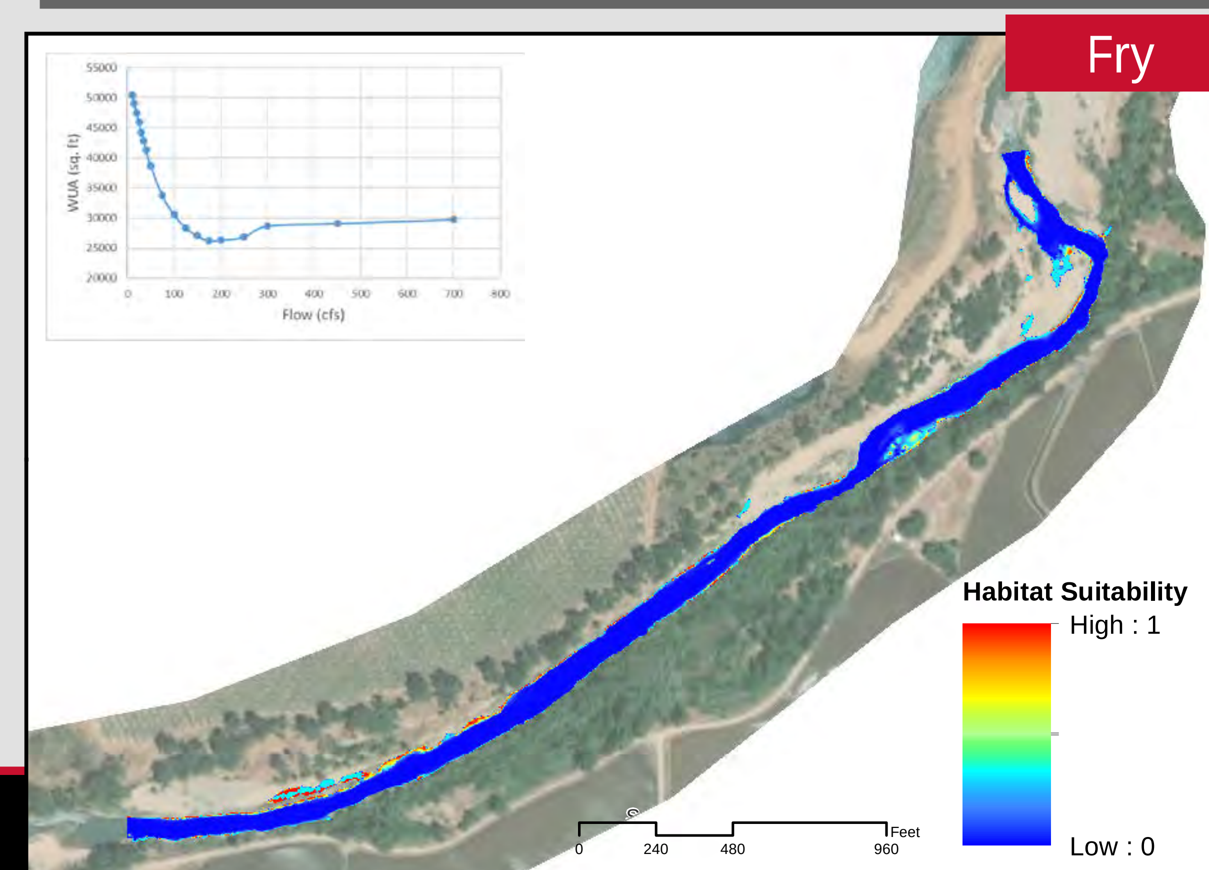


Fall-Run Chinook Salmon

Upstream Study Site 450 cfs







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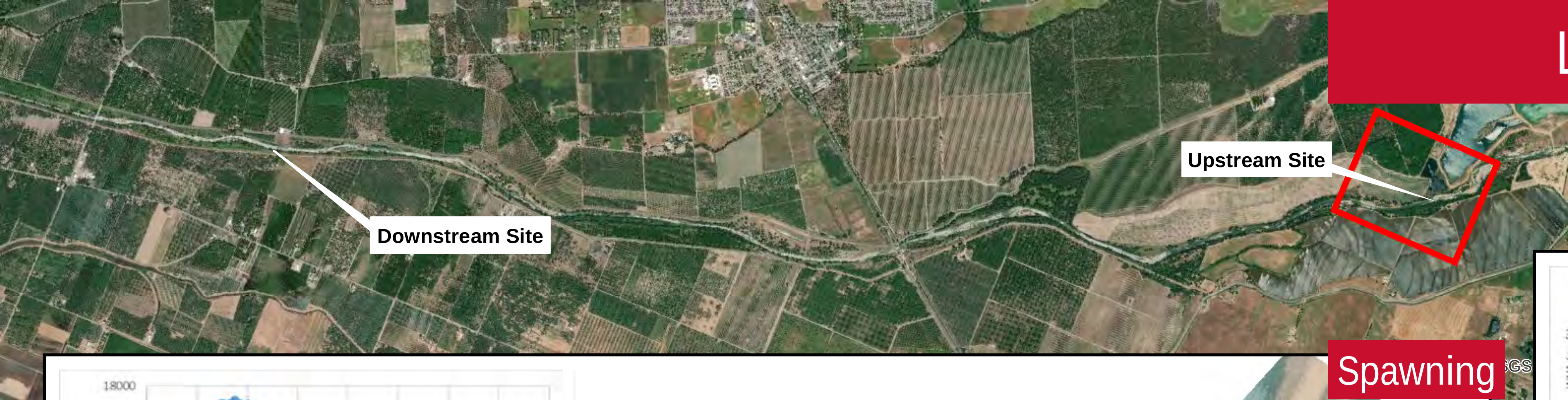
Lower Bear River - Instream Flow Study

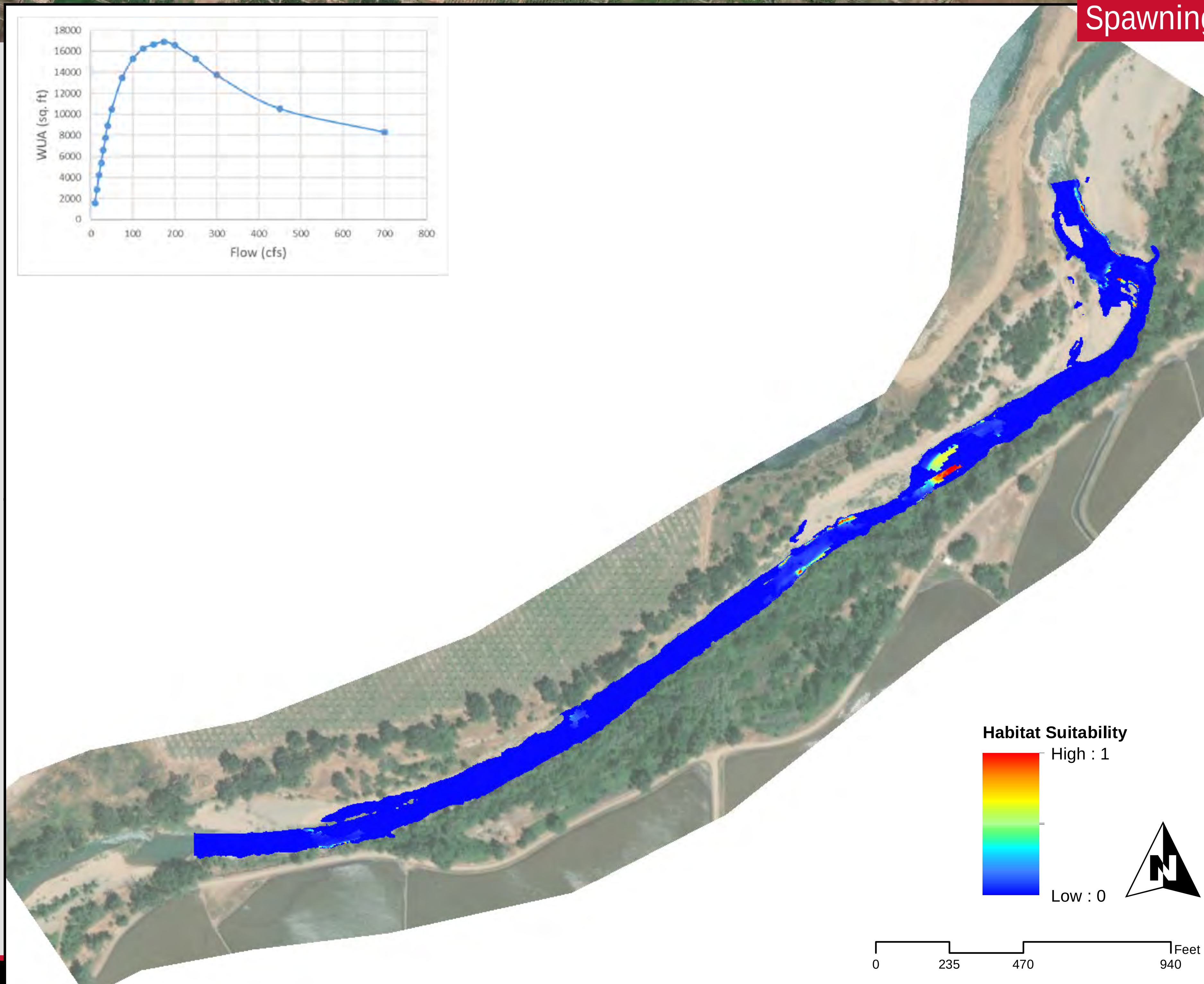
SSWD HDR

Fall-Run Chinook Salmon

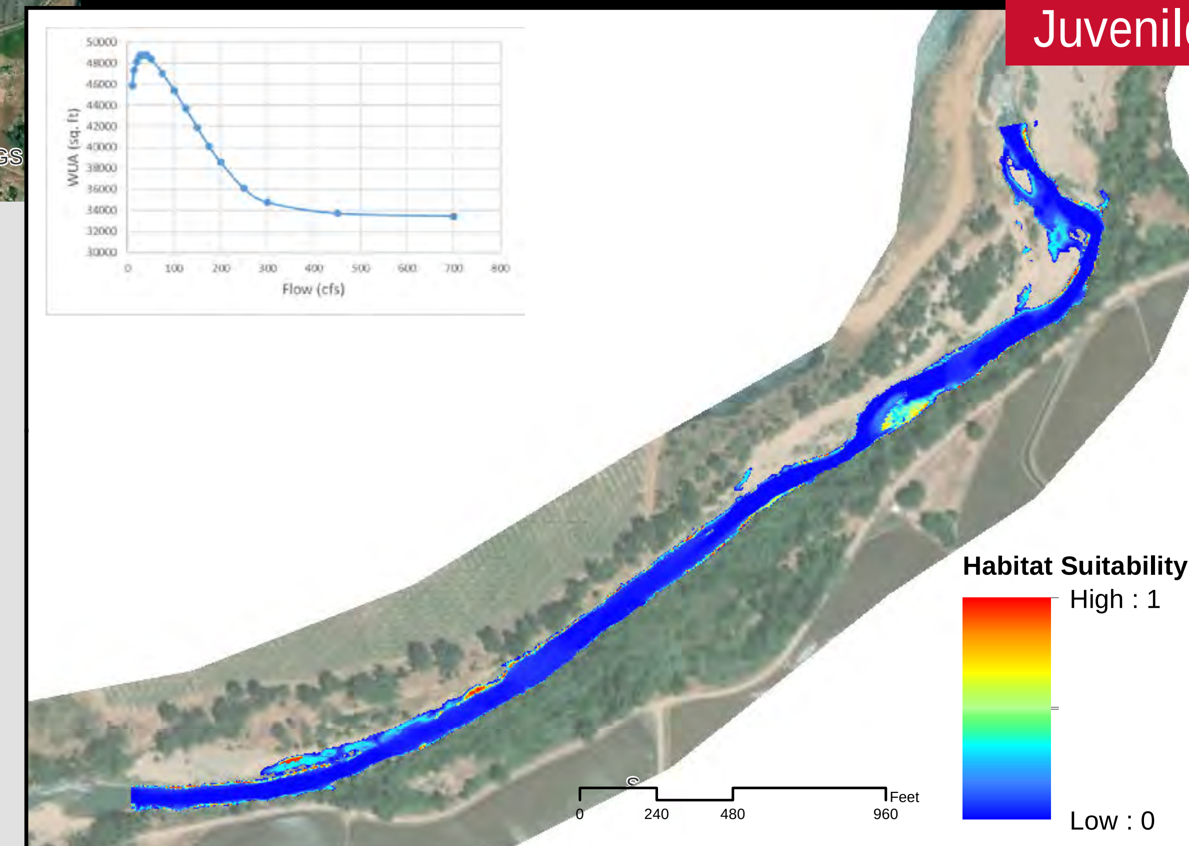
Upstream Study Site 700 cfs



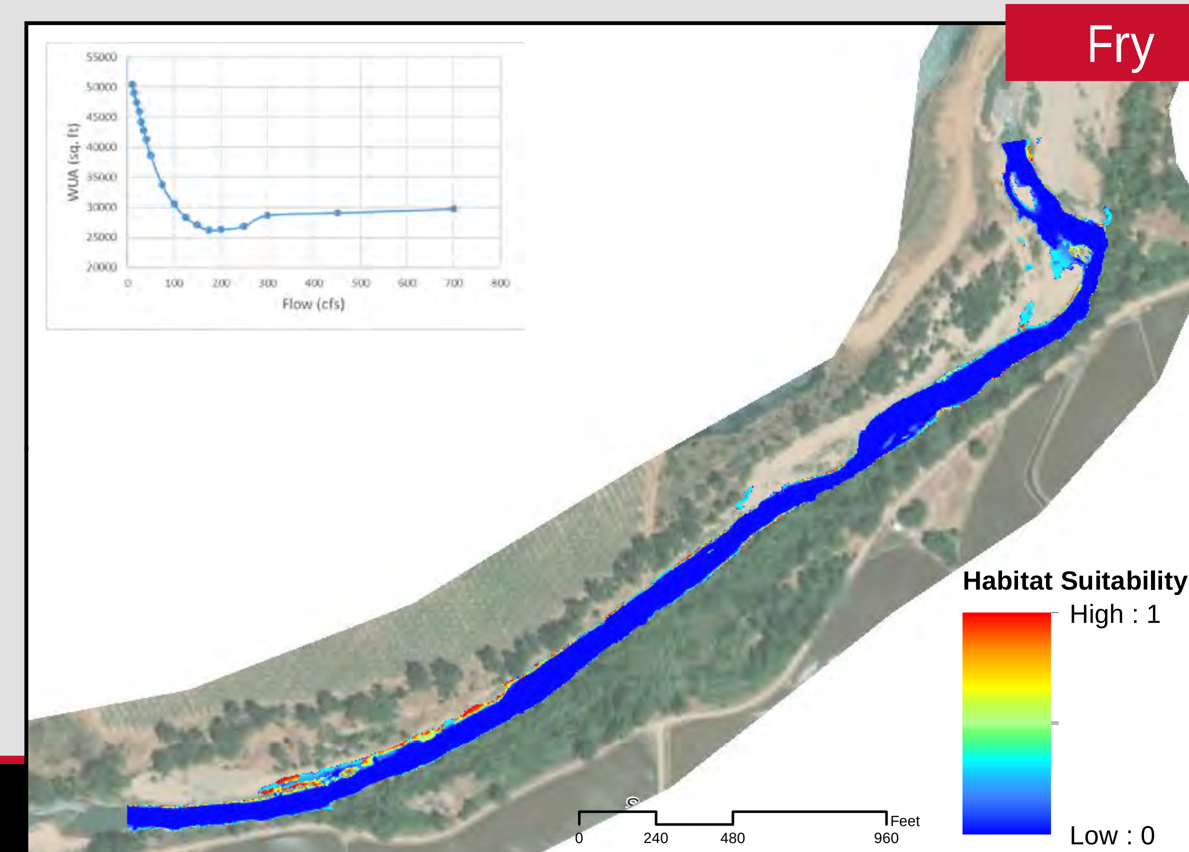
Spawning



Juvenile



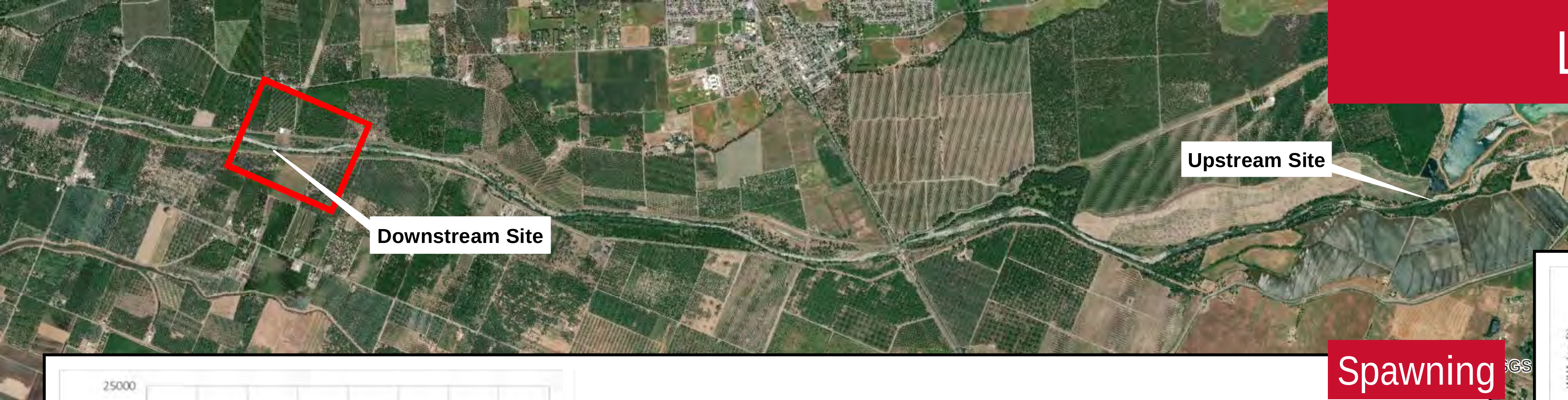
Fry

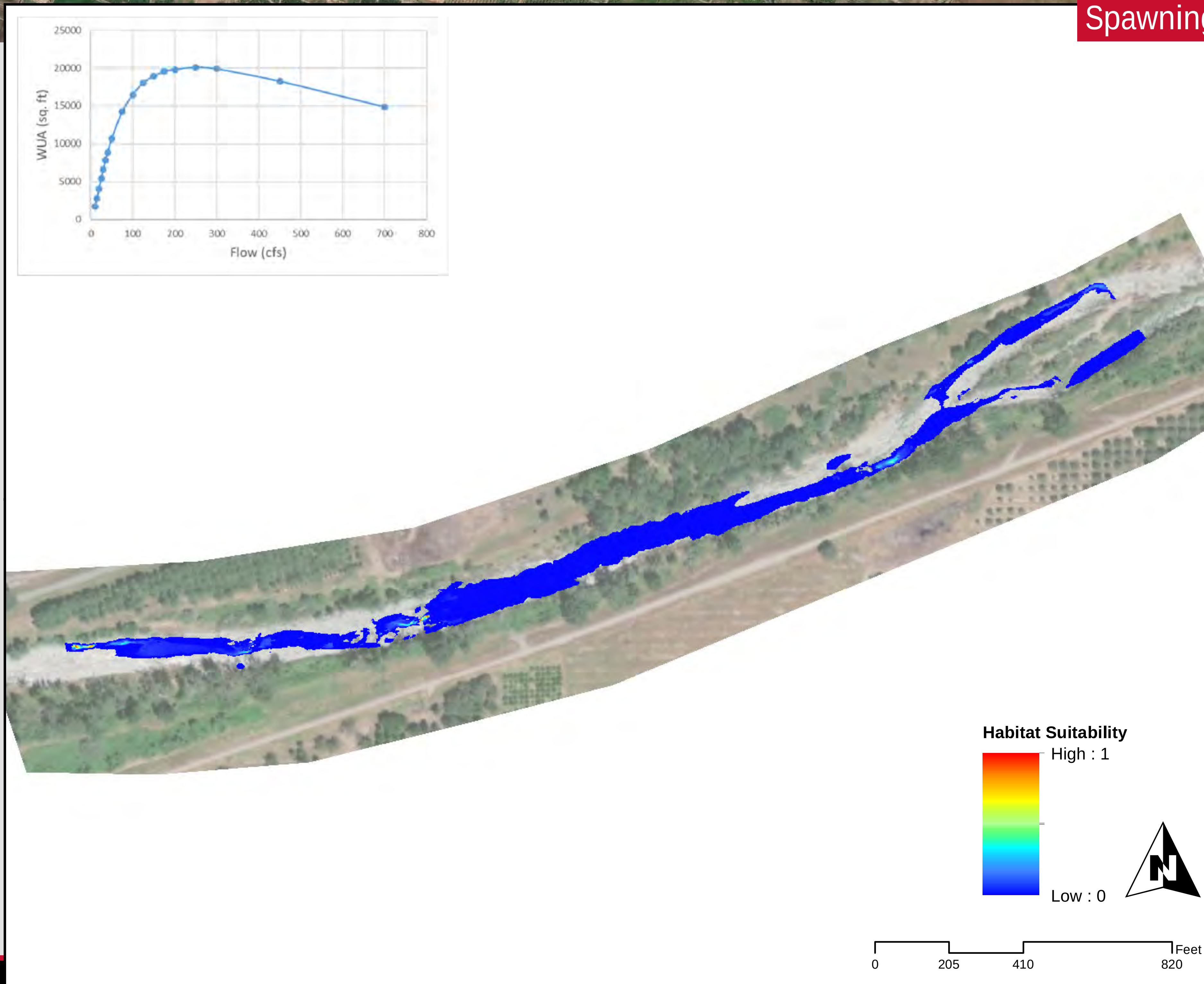


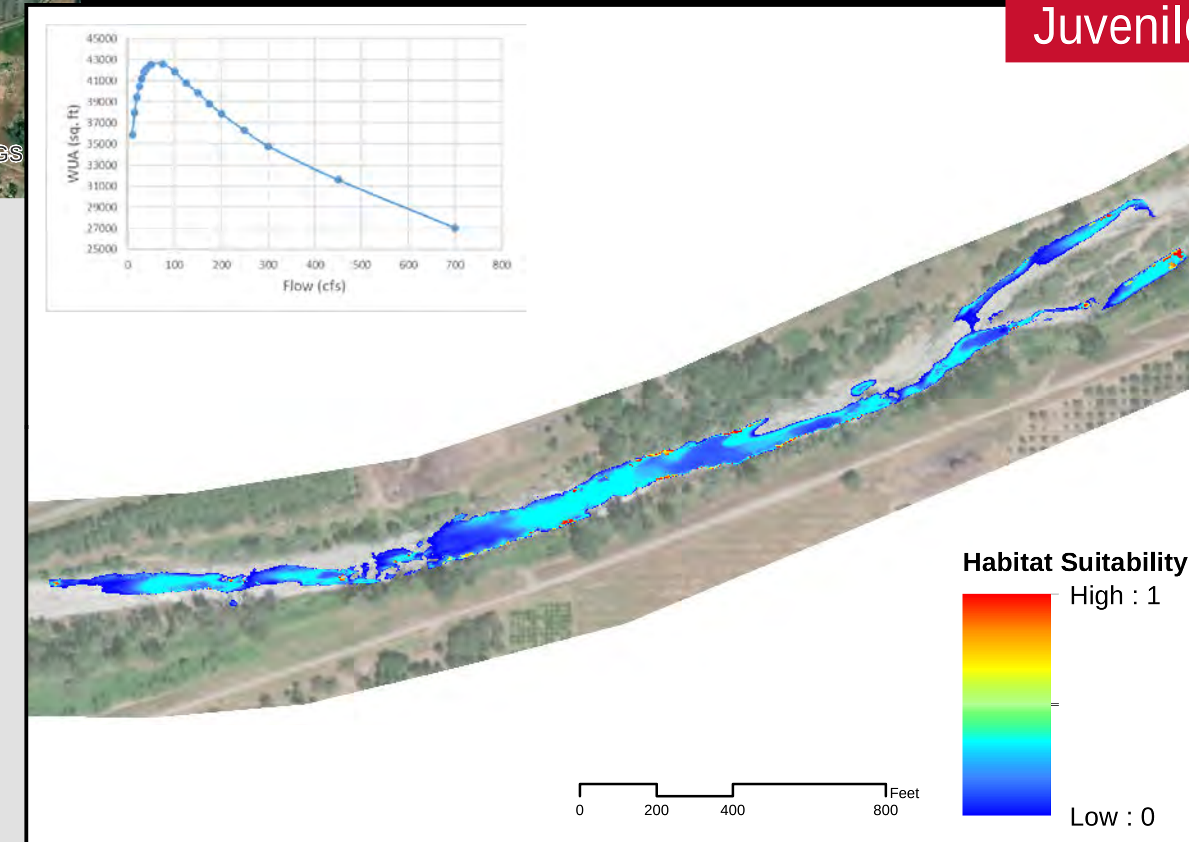
Lower Bear River - Instream Flow Study

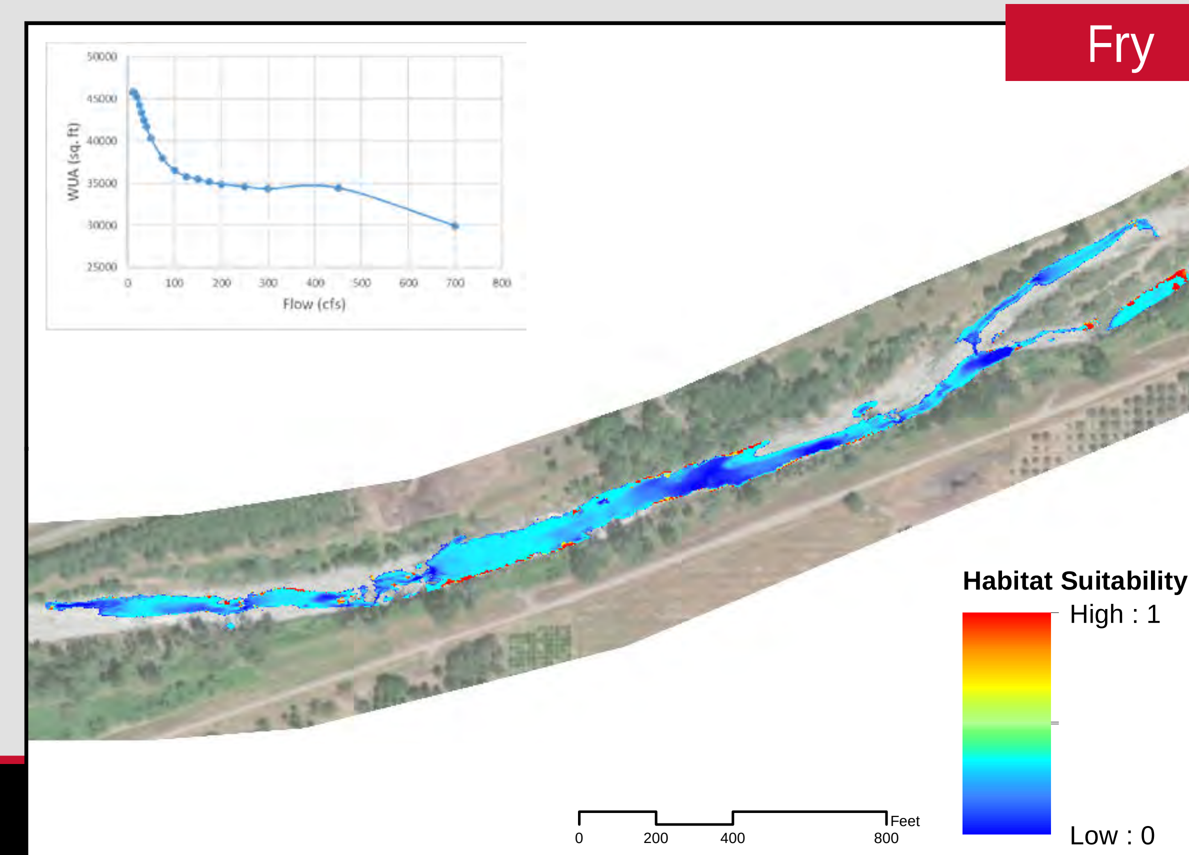
SSWD HDR

Fall-Run Chinook Salmon
Downstream Study Site 10 cfs







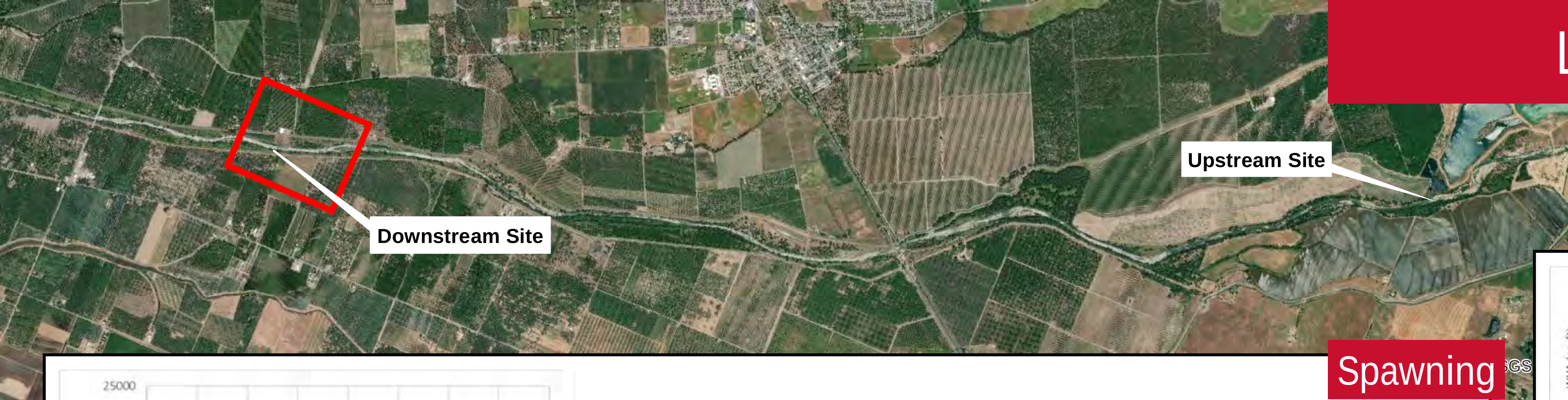


Lower Bear River - Instream Flow Study

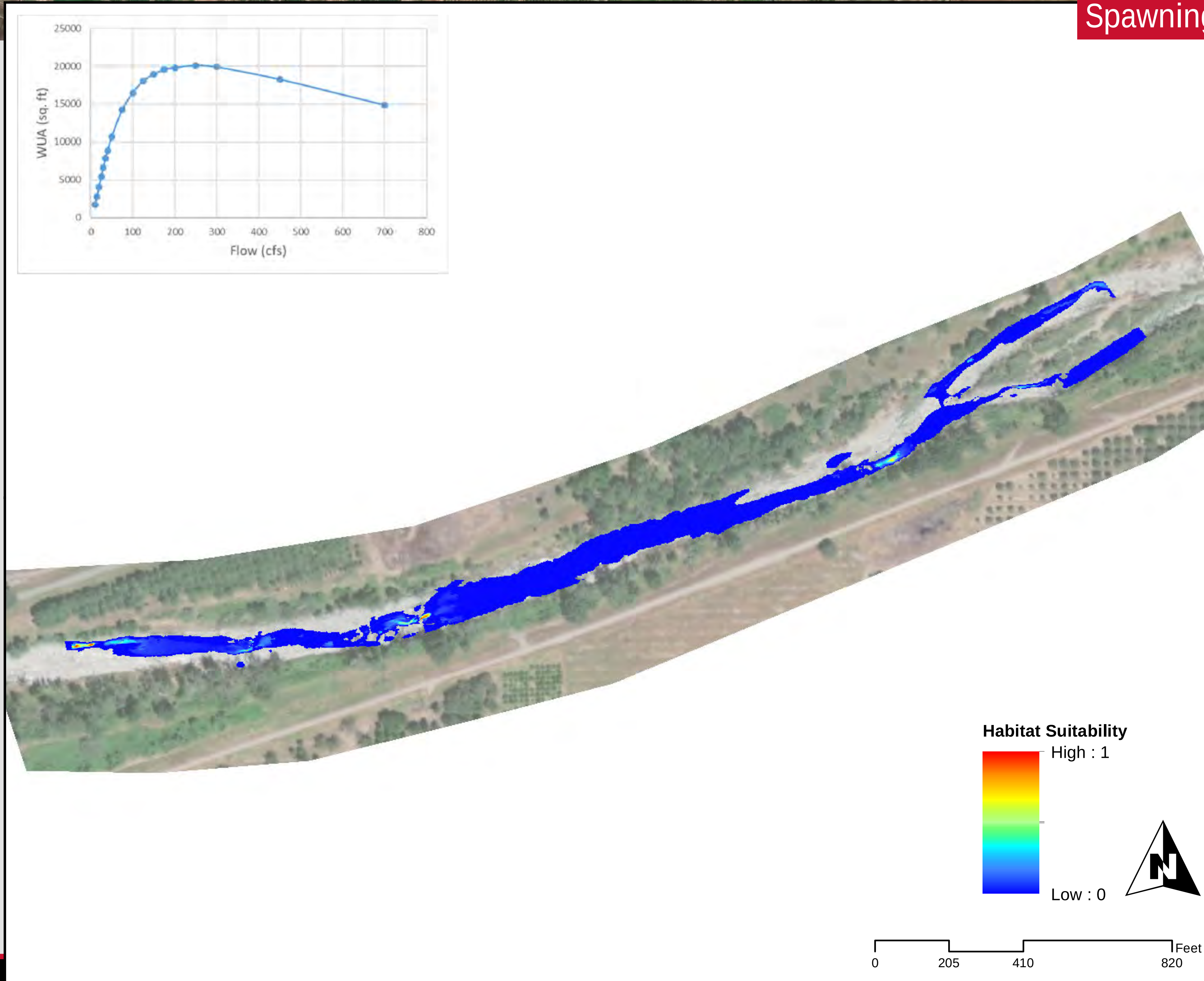
SSWD HDR

Fall-Run Chinook Salmon

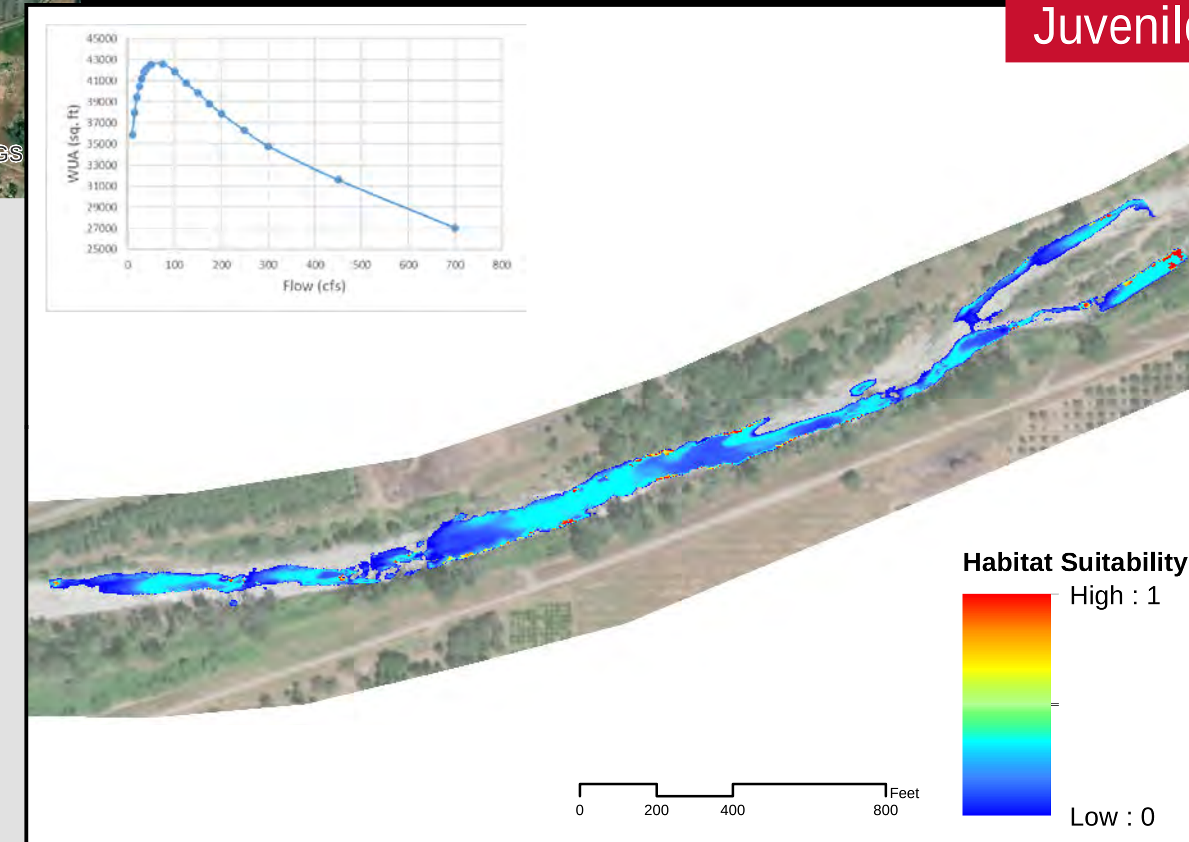
Downstream Study Site 15 cfs



Spawning



Juvenile



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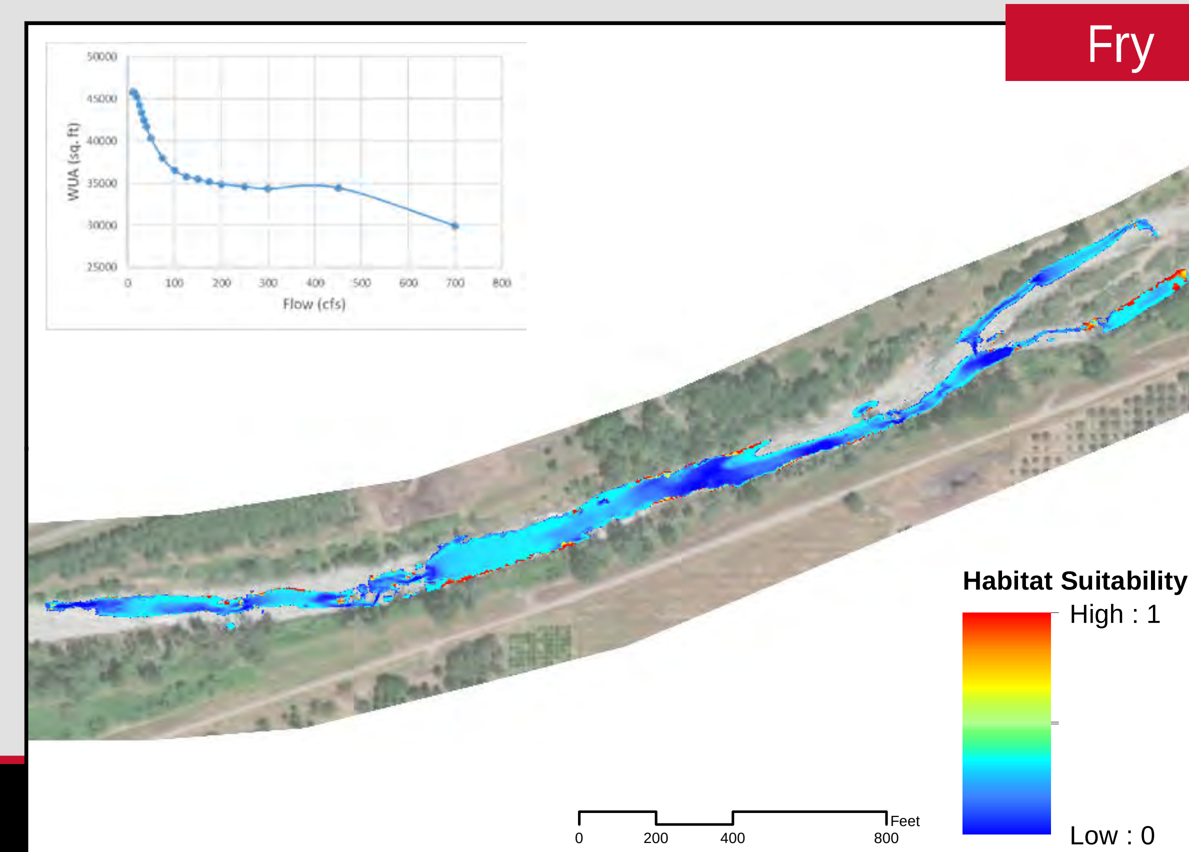
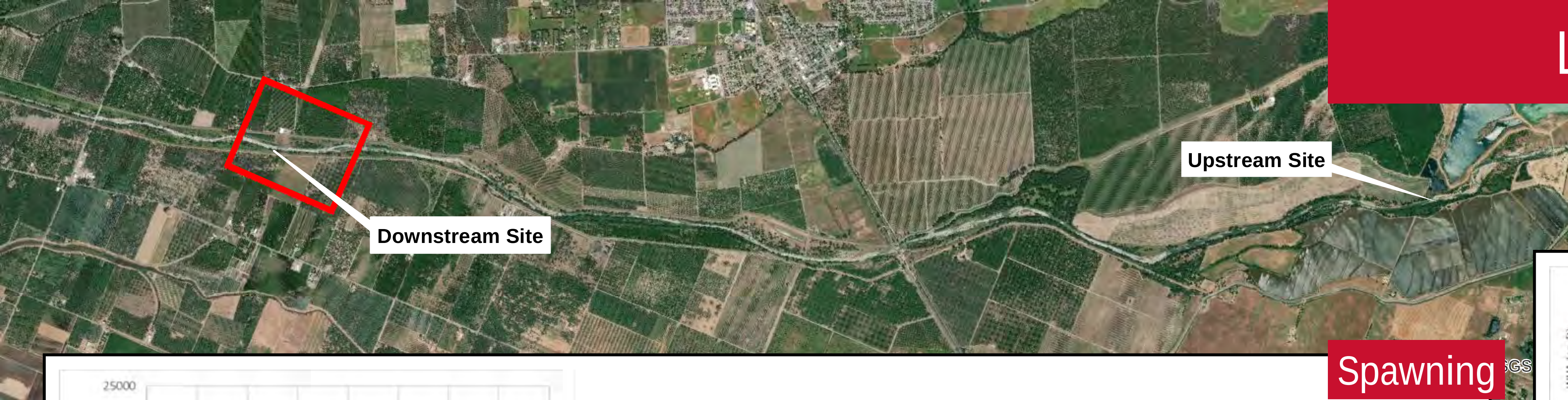


Lower Bear River - Instream Flow Study

SSWD HDR

Fall-Run Chinook Salmon

Downstream Study Site 20 cfs



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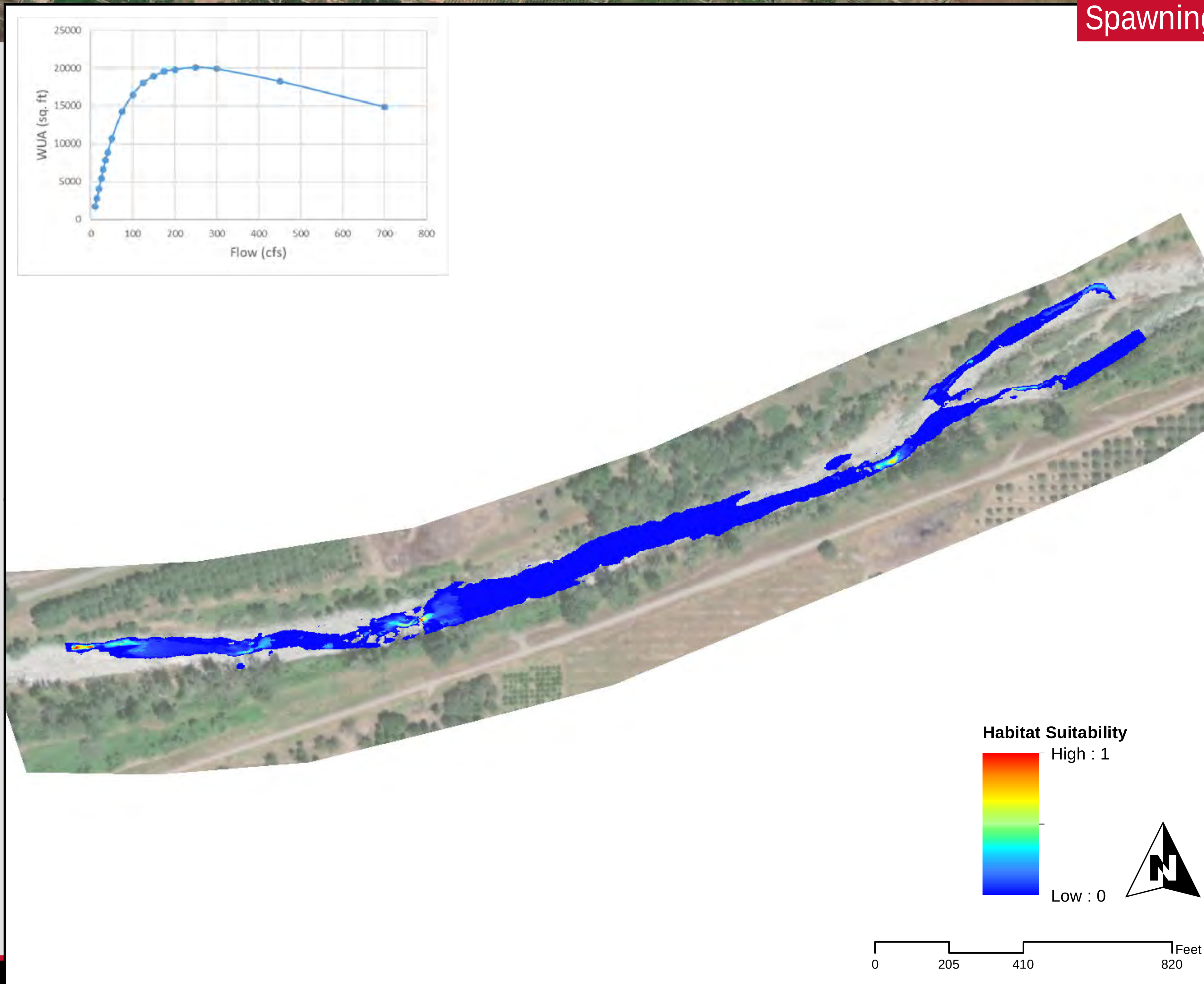

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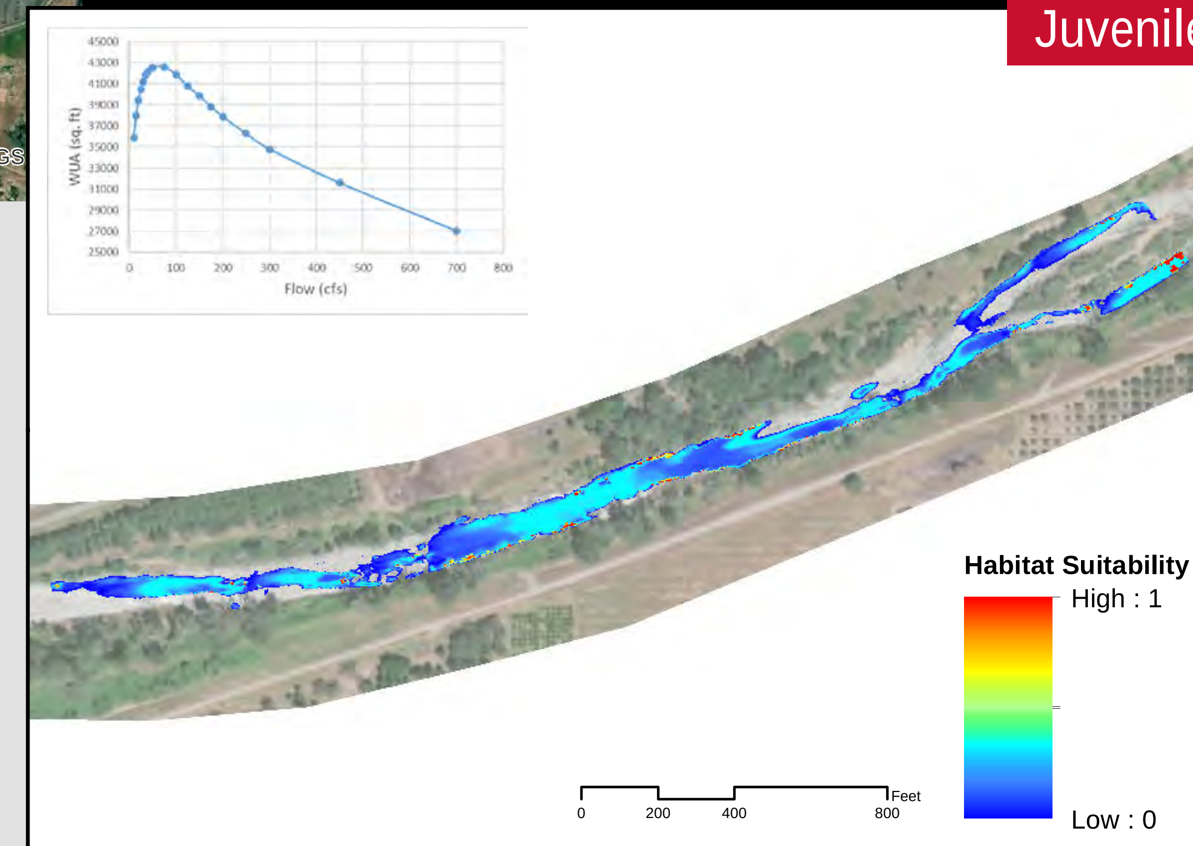

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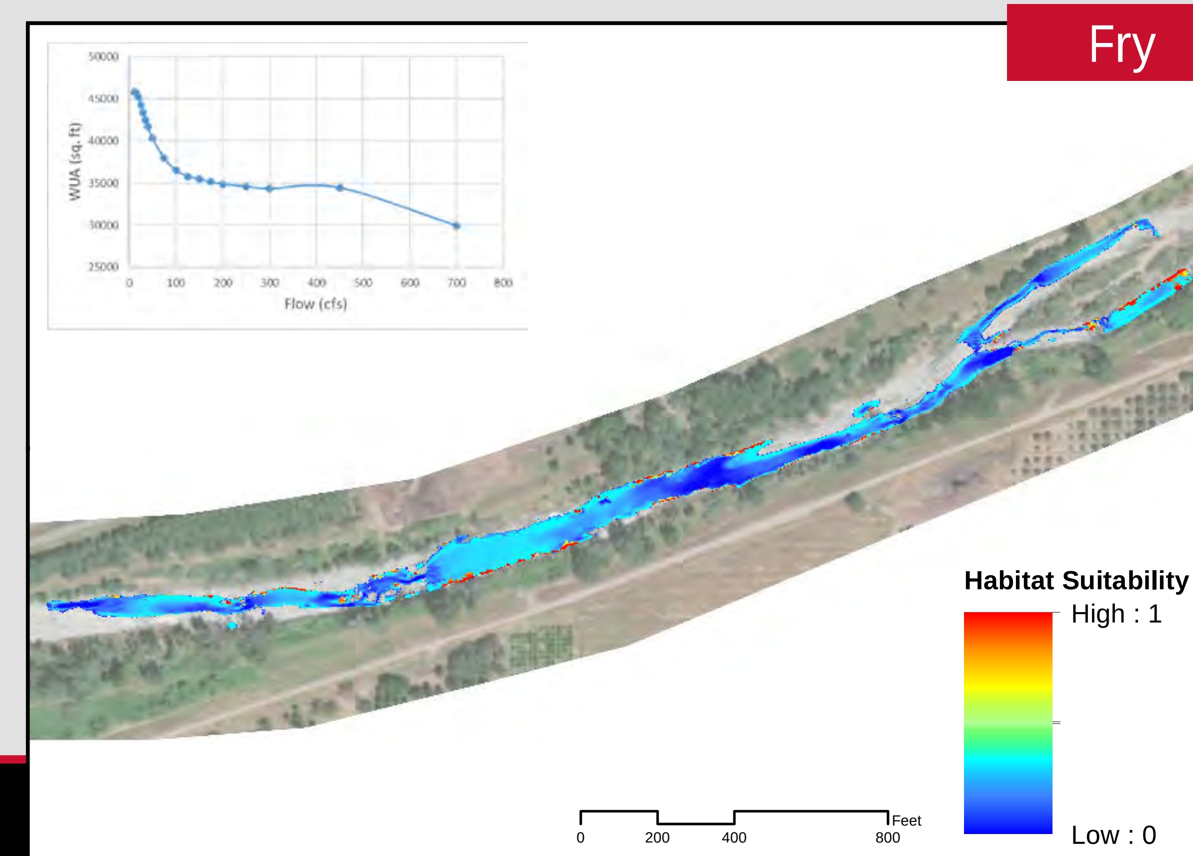
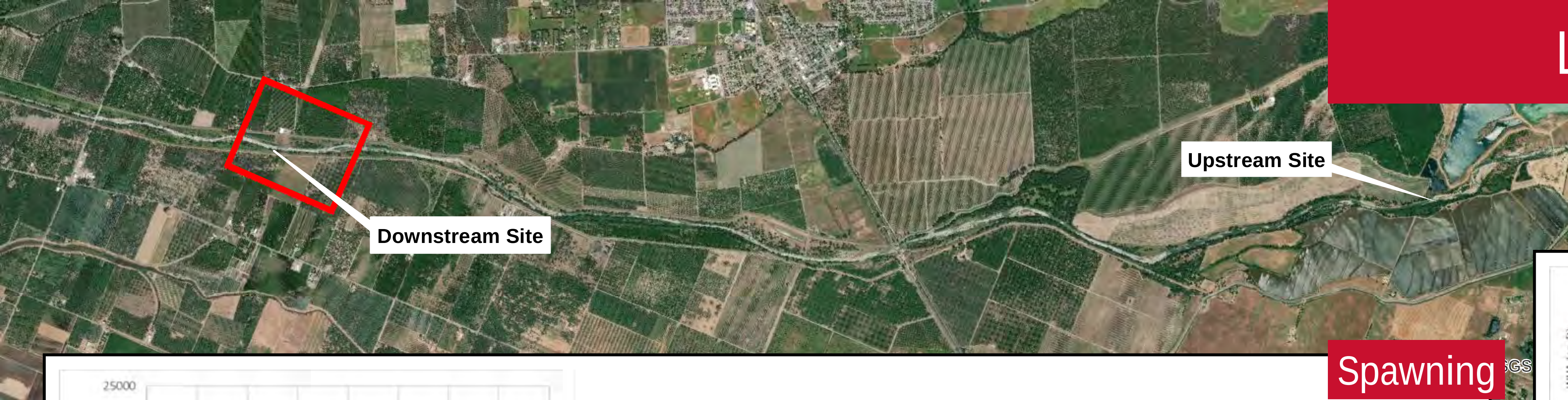


Lower Bear River - Instream Flow Study

Fall-Run Chinook Salmon

Downstream Study Site 25 cfs



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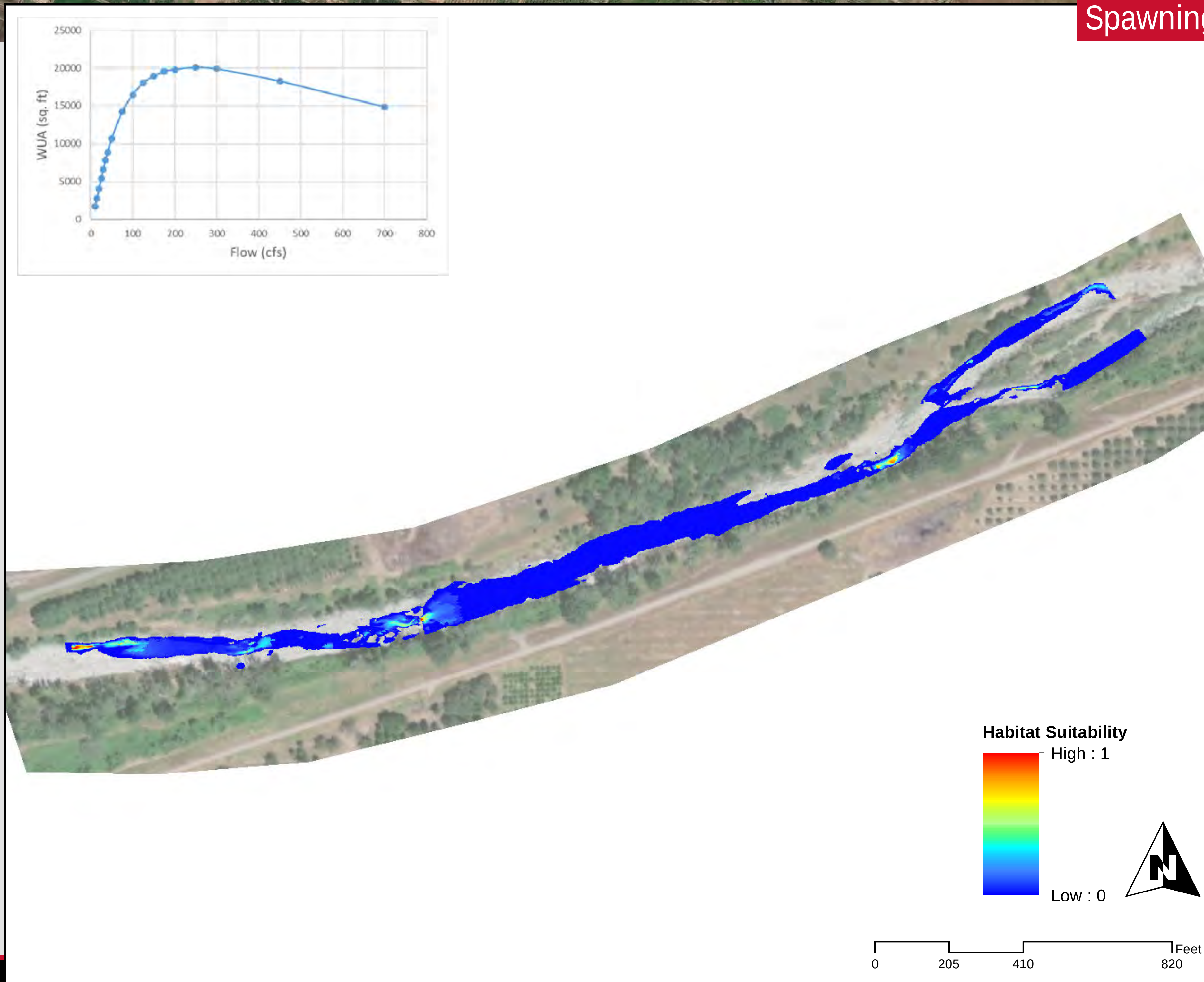

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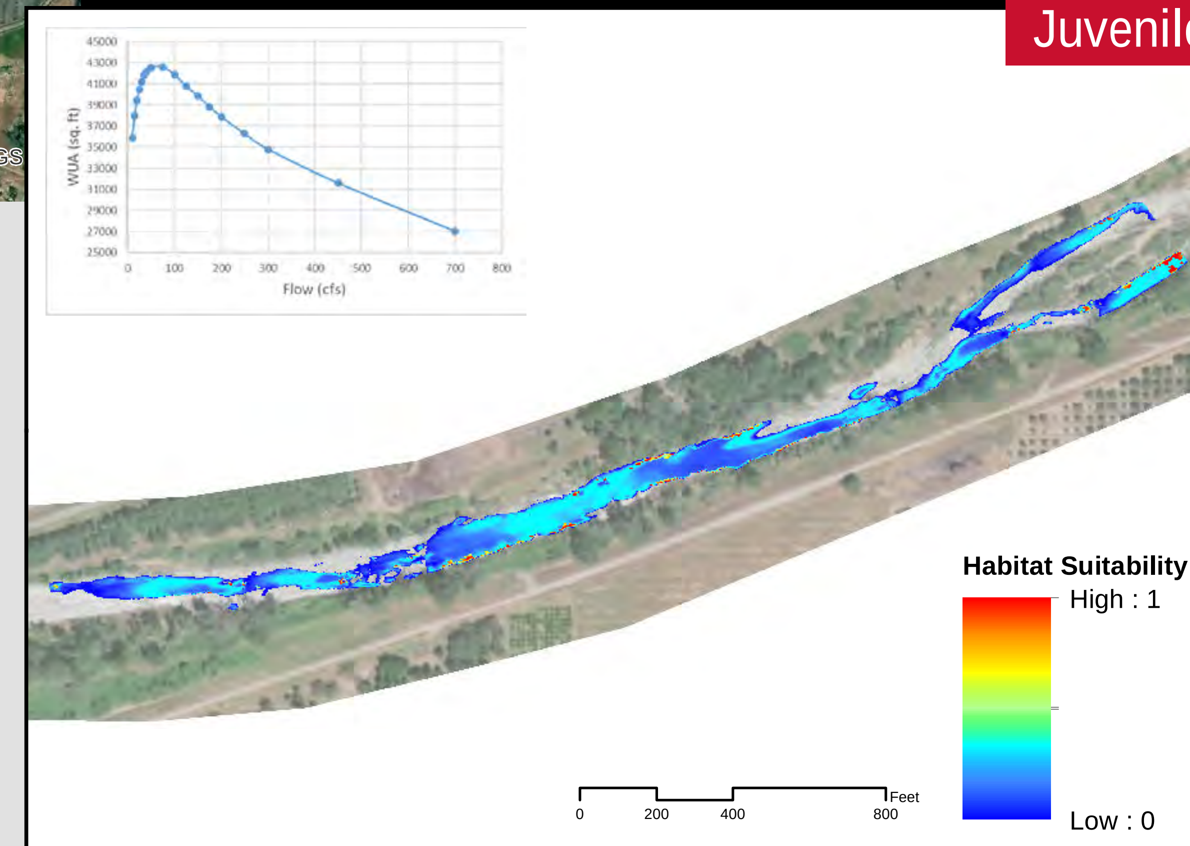

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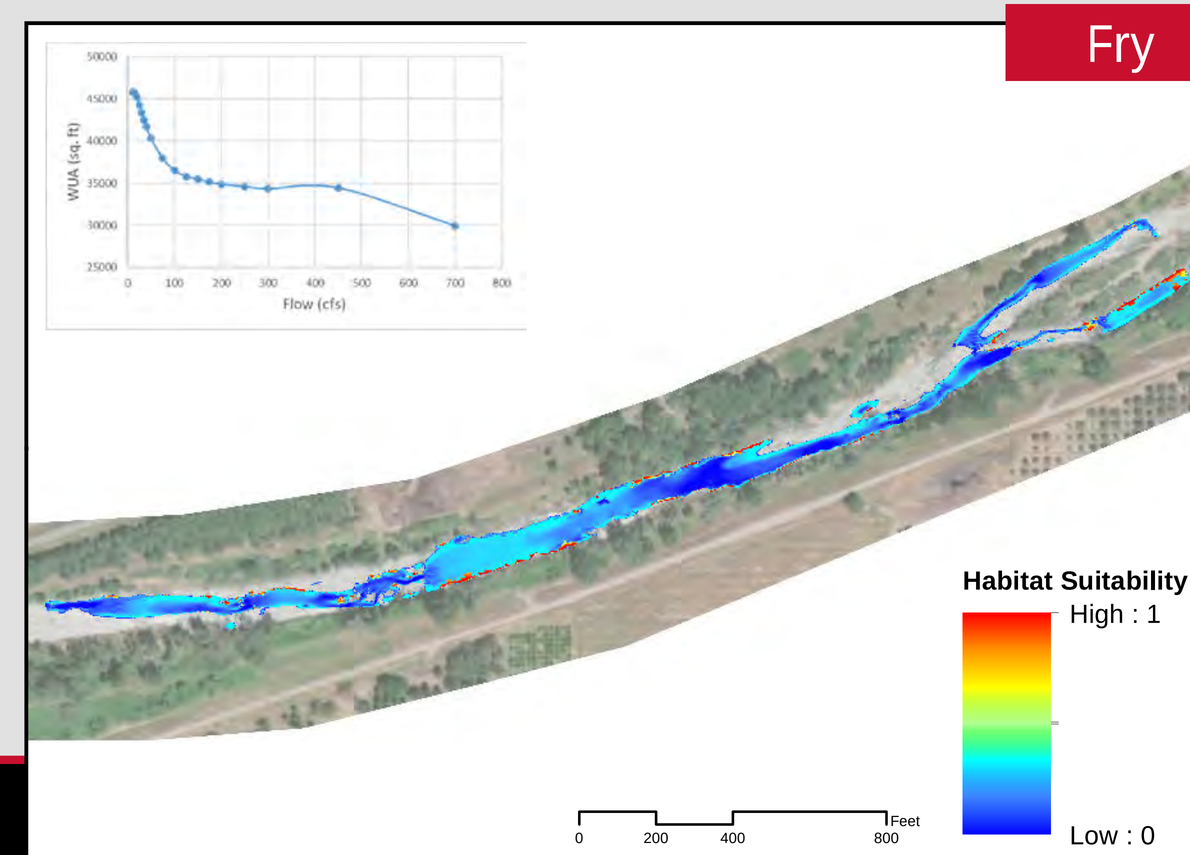

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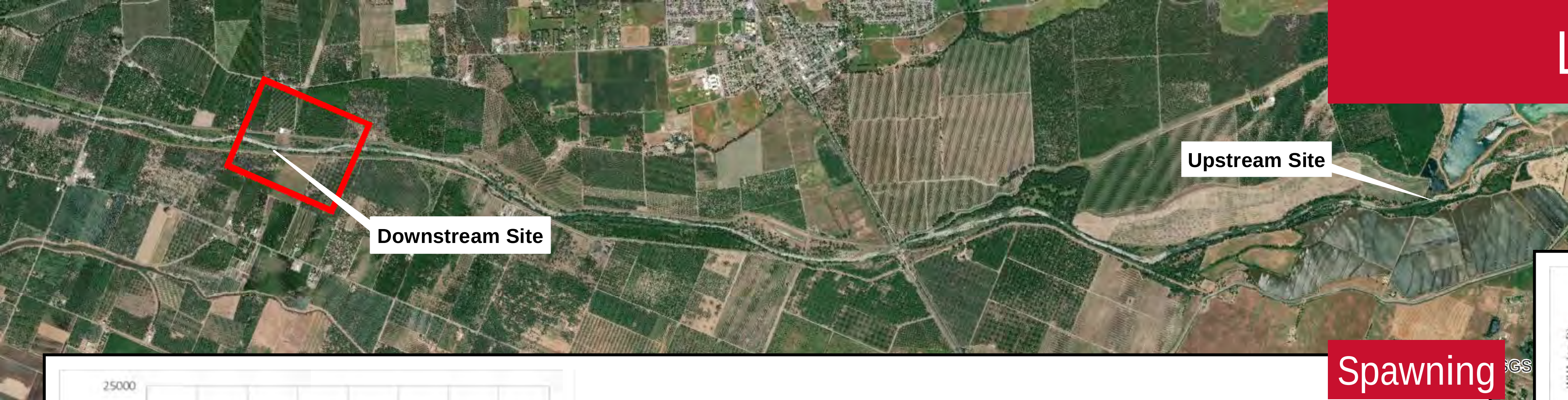
Lower Bear River - Instream Flow Study

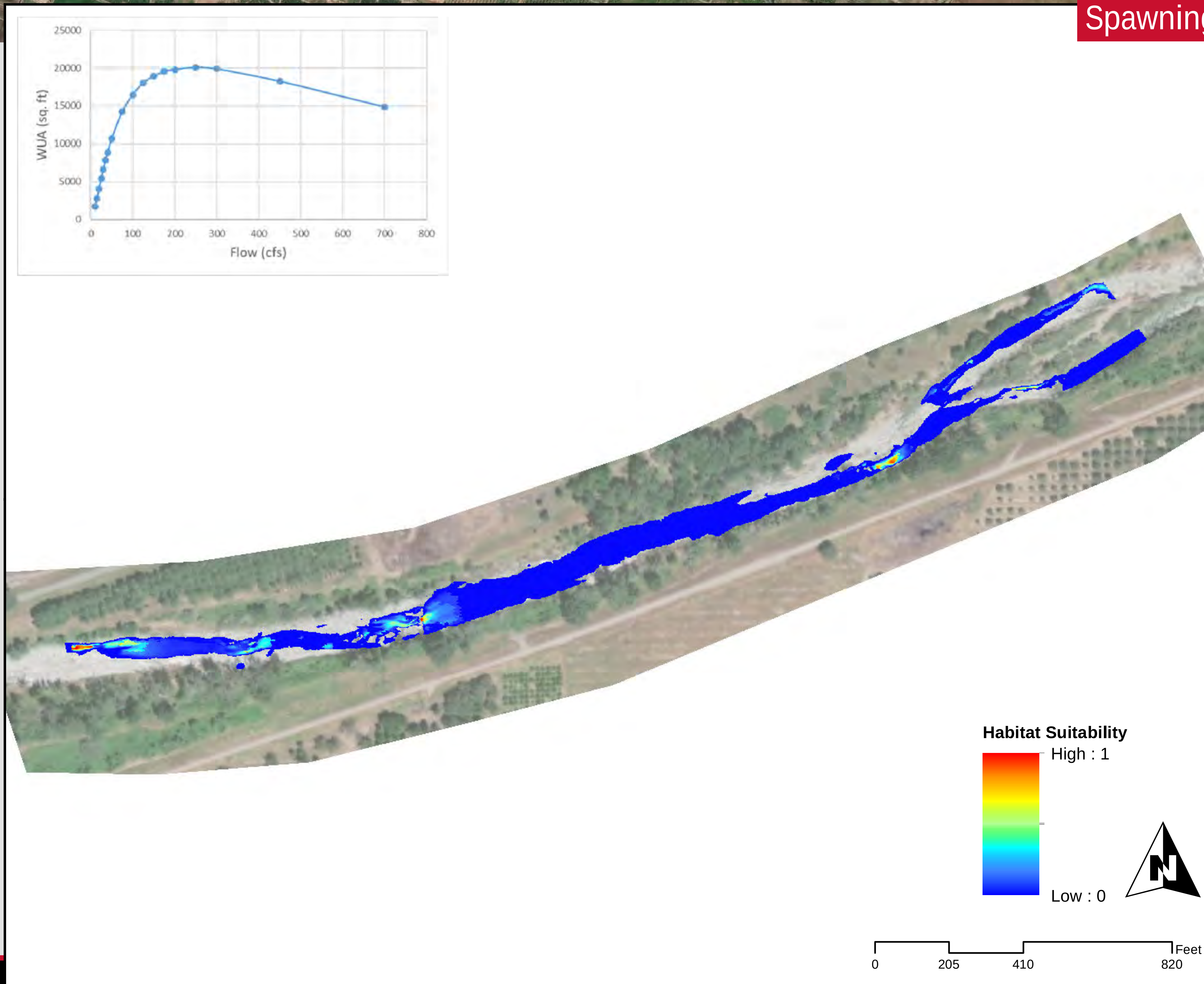


SSWD HDR

Fall-Run Chinook Salmon

Downstream Study Site 30 cfs

Spawning



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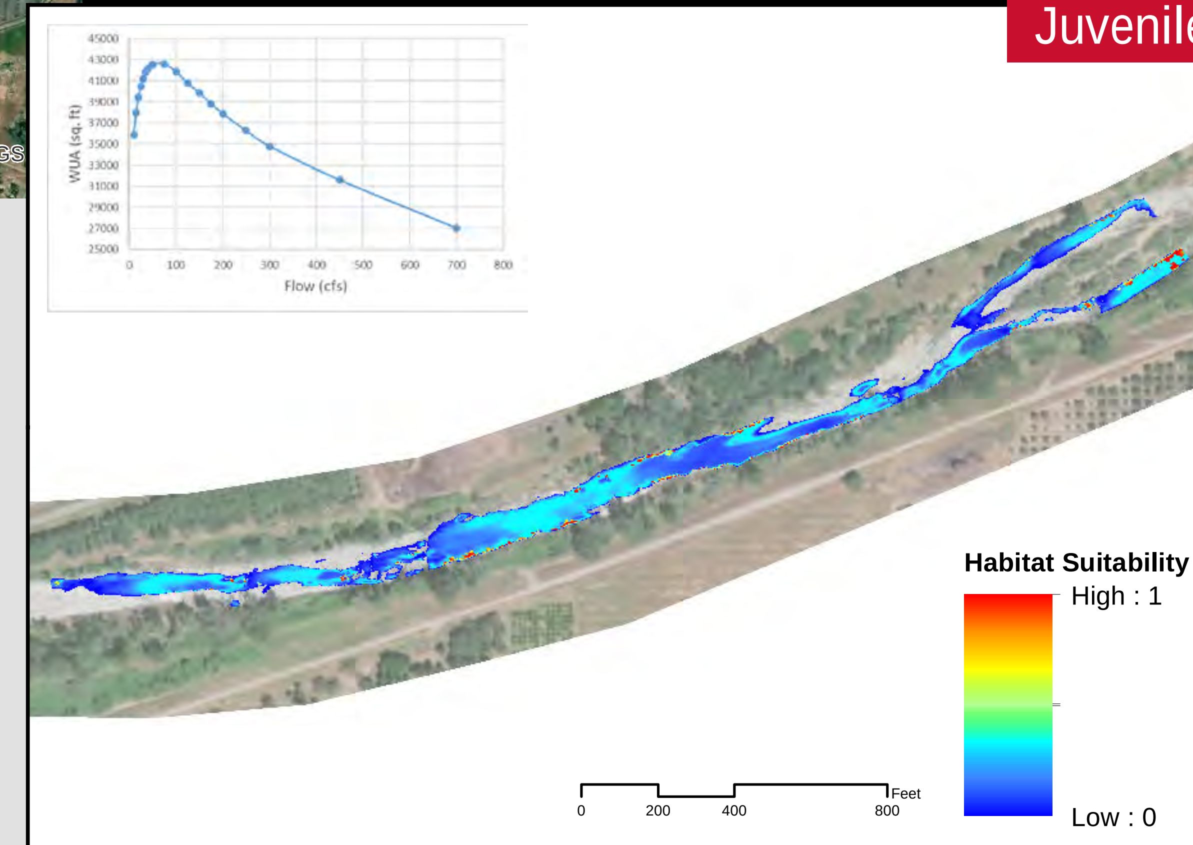

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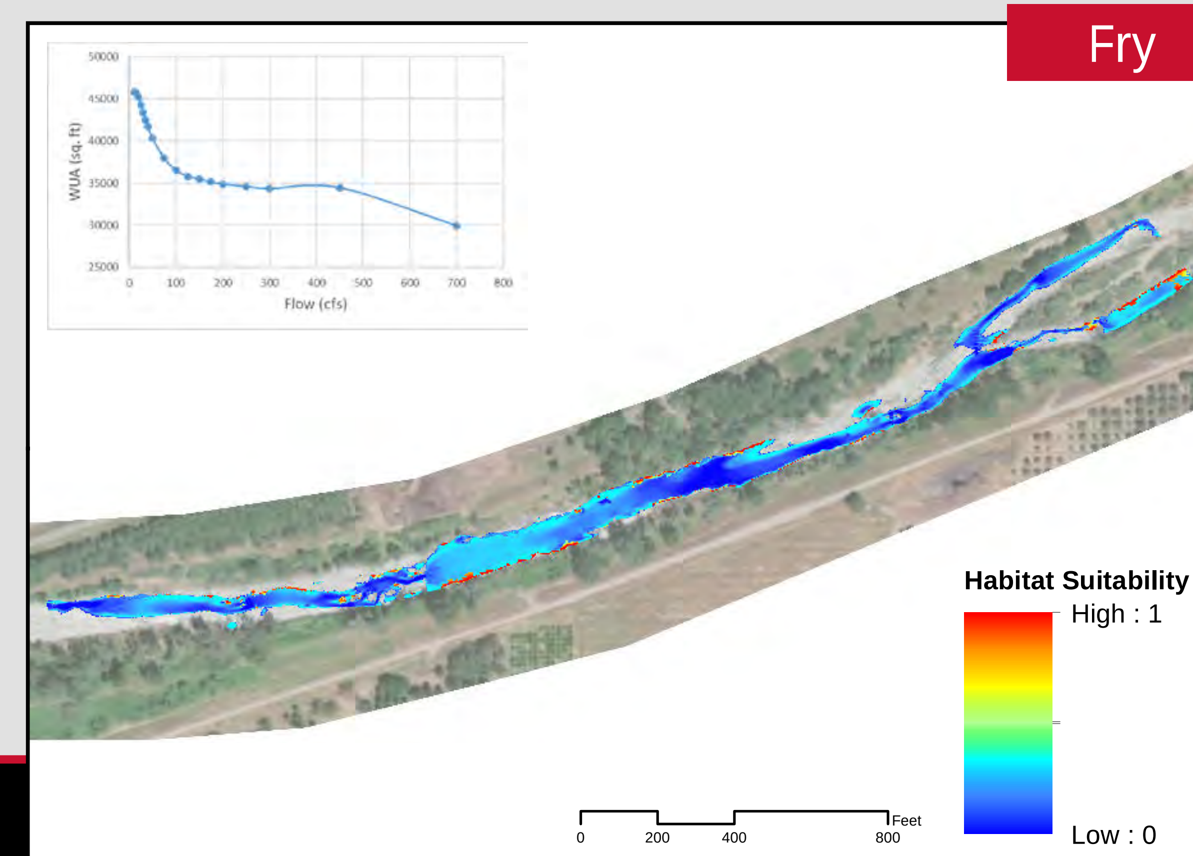
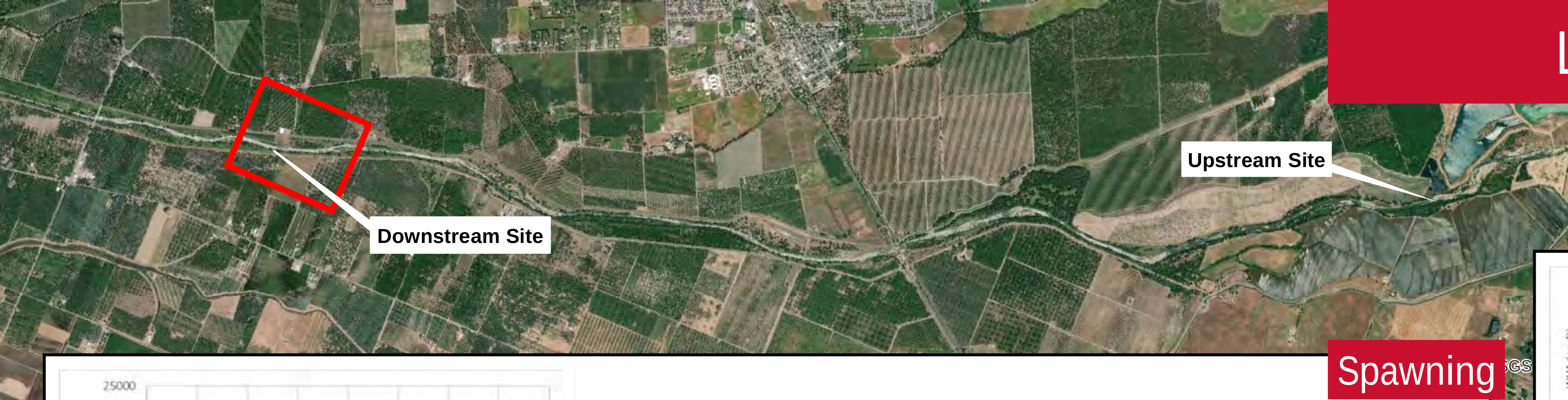


Lower Bear River - Instream Flow Study

SSWD HDR

Fall-Run Chinook Salmon

Downstream Study Site 35 cfs



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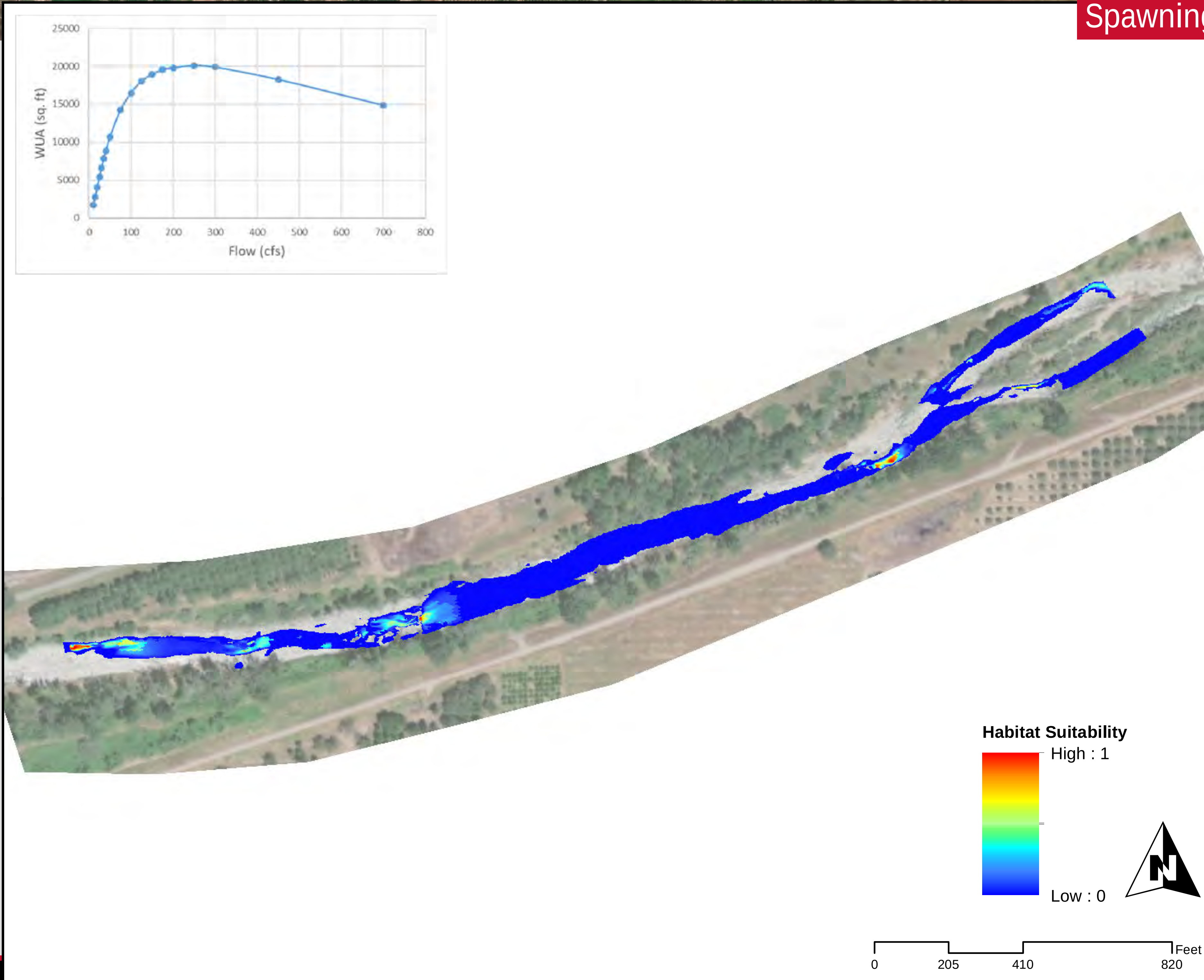

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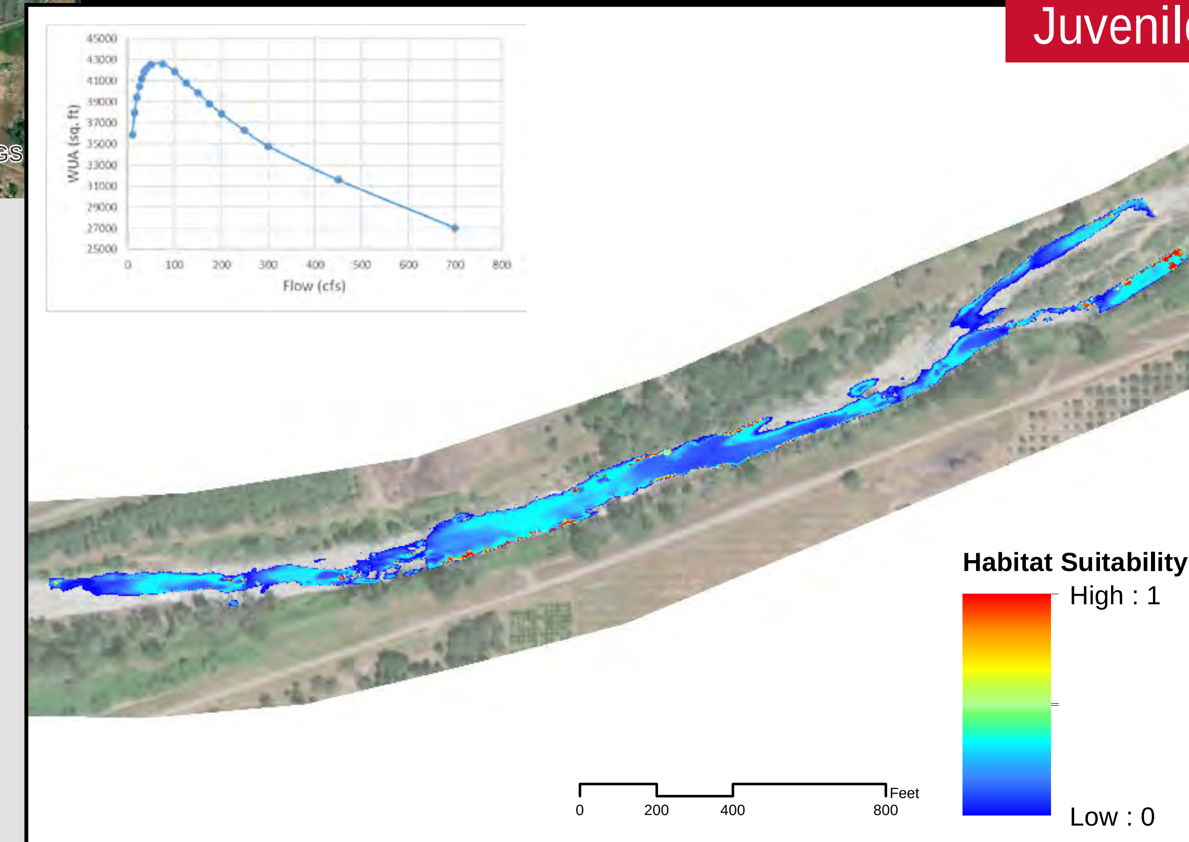

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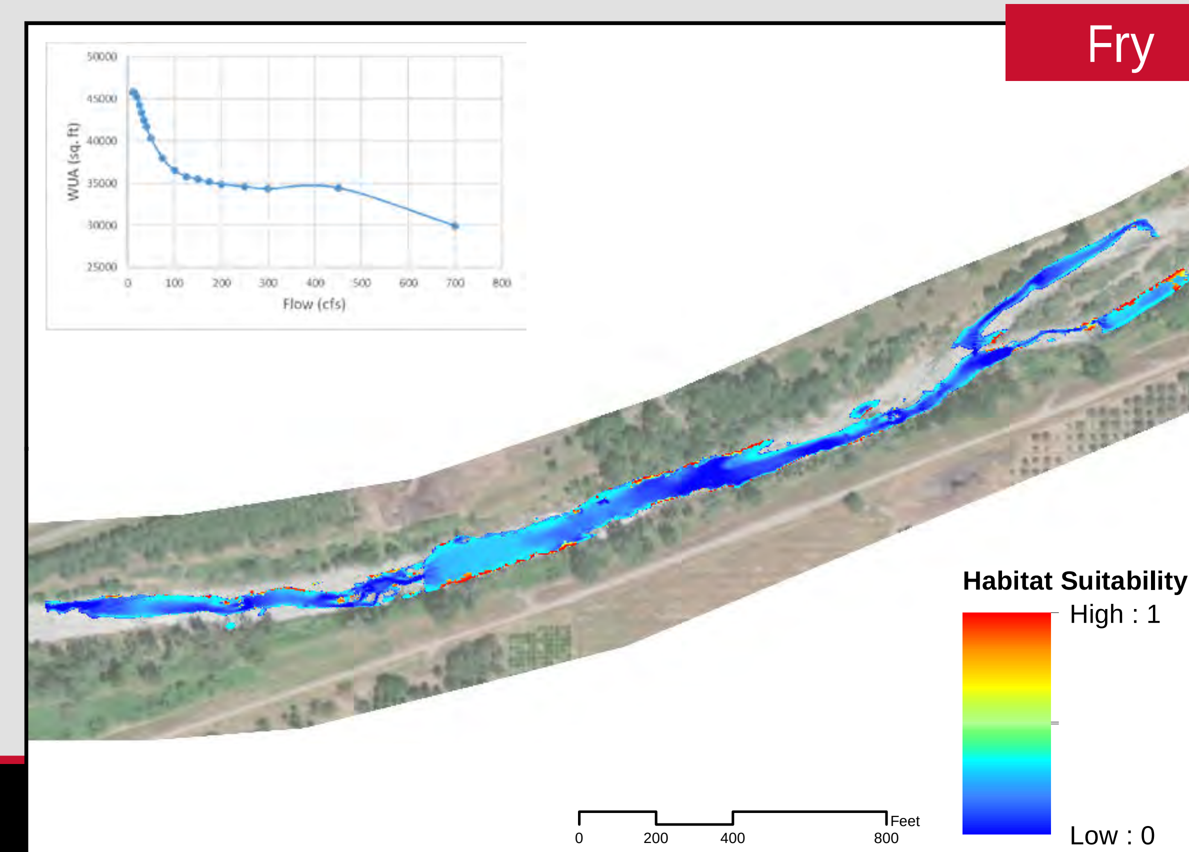
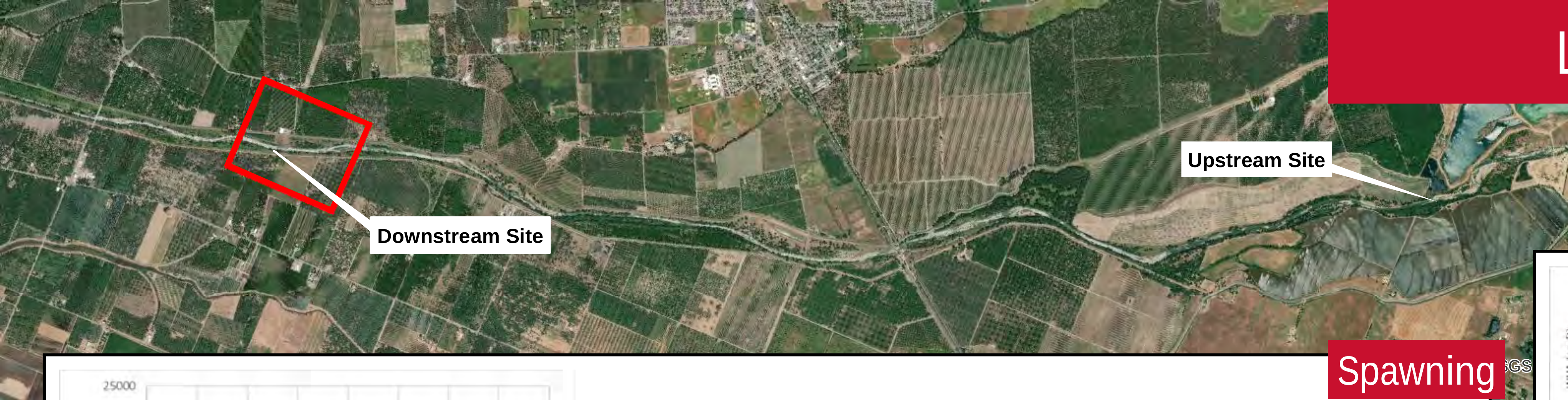
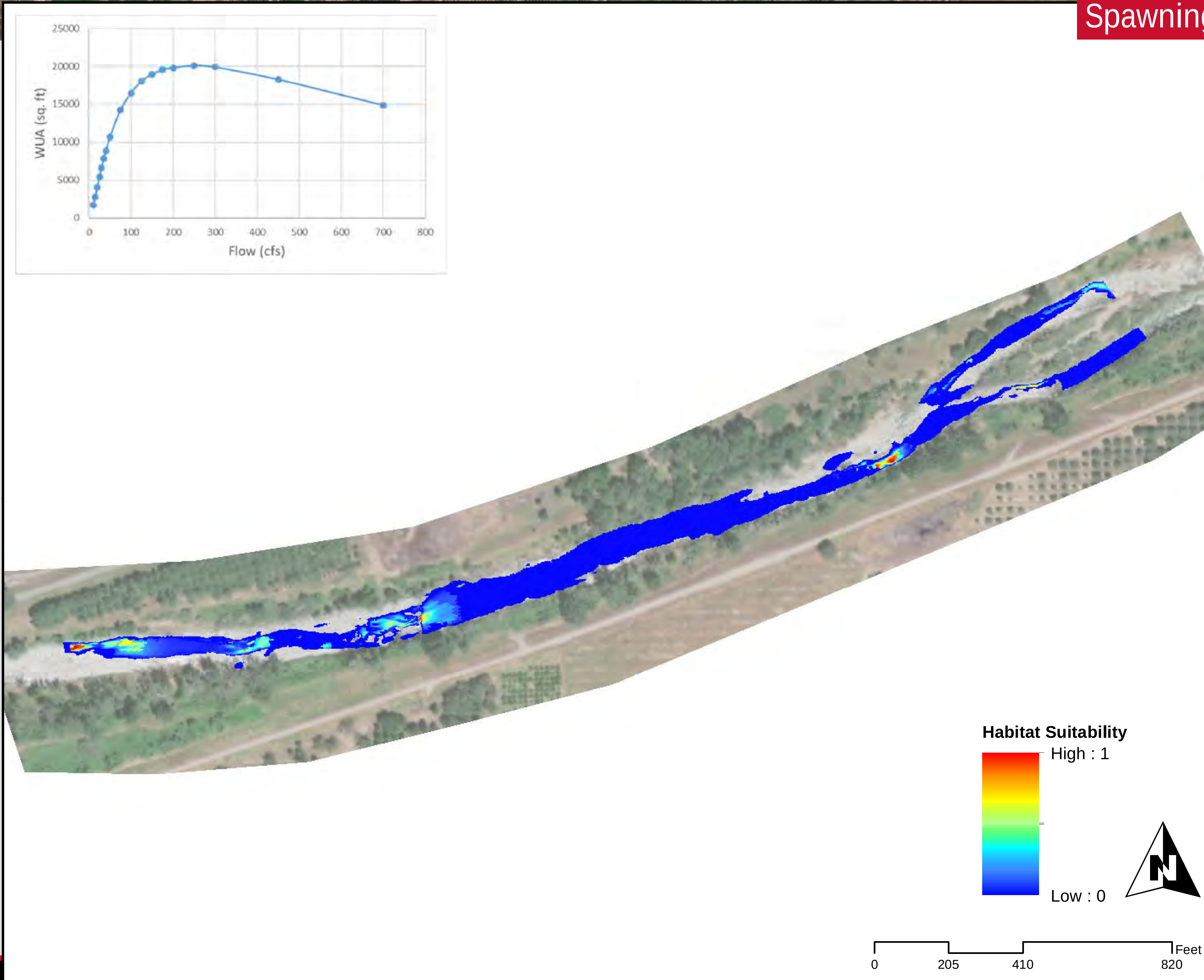


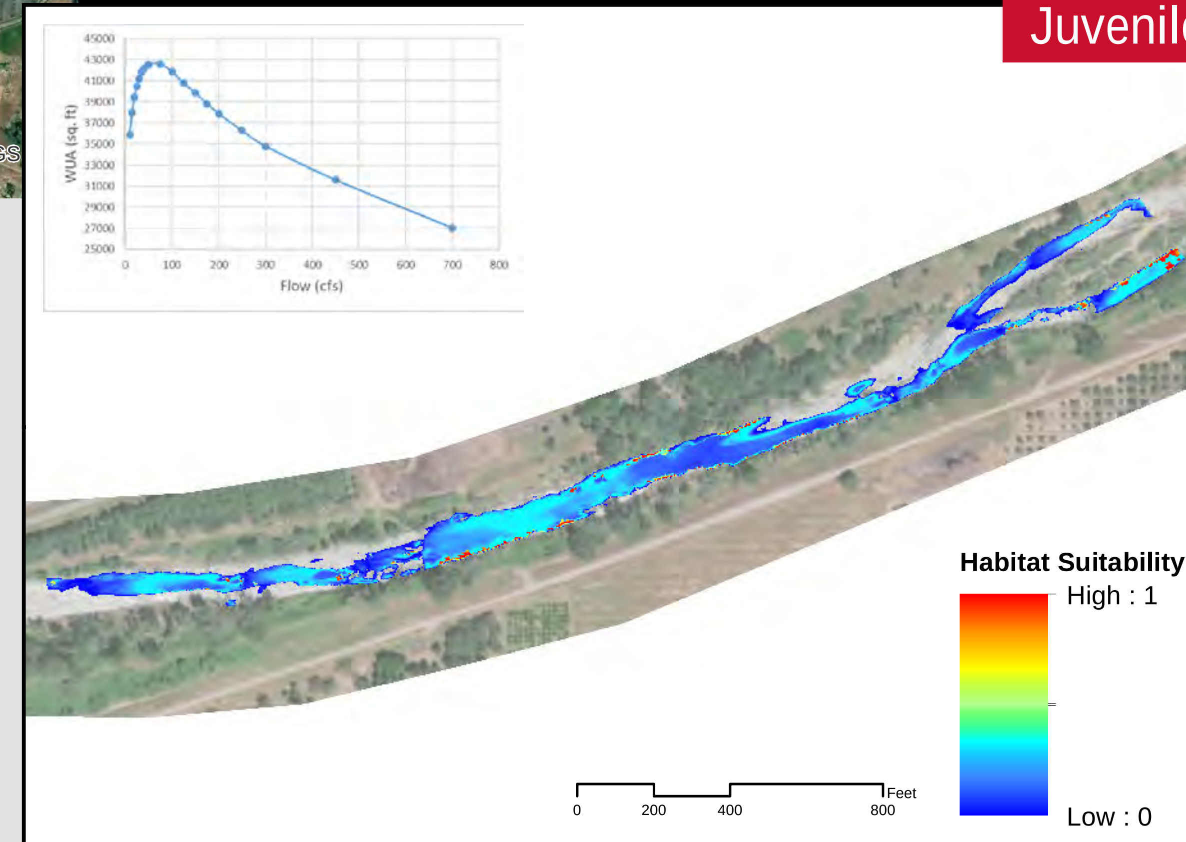
Lower Bear River - Instream Flow Study

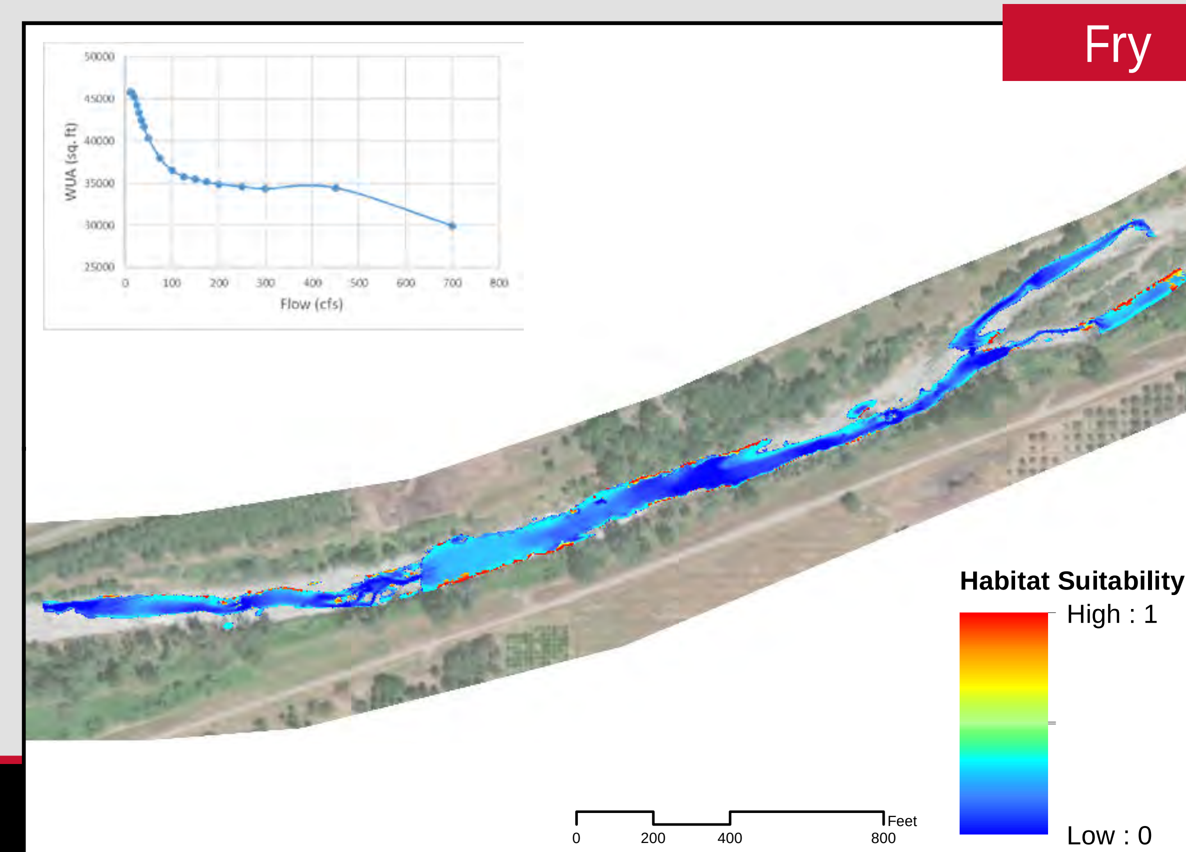
Fall-Run Chinook Salmon

Downstream Study Site 40 cfs







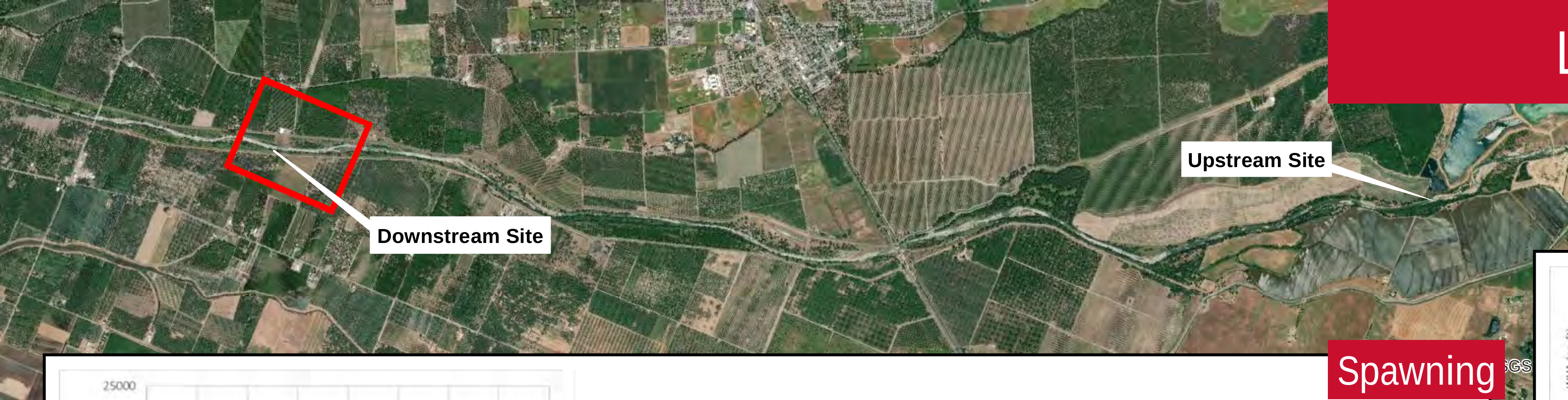


Lower Bear River - Instream Flow Study

SSWD HDR

Fall-Run Chinook Salmon

Downstream Study Site 50 cfs



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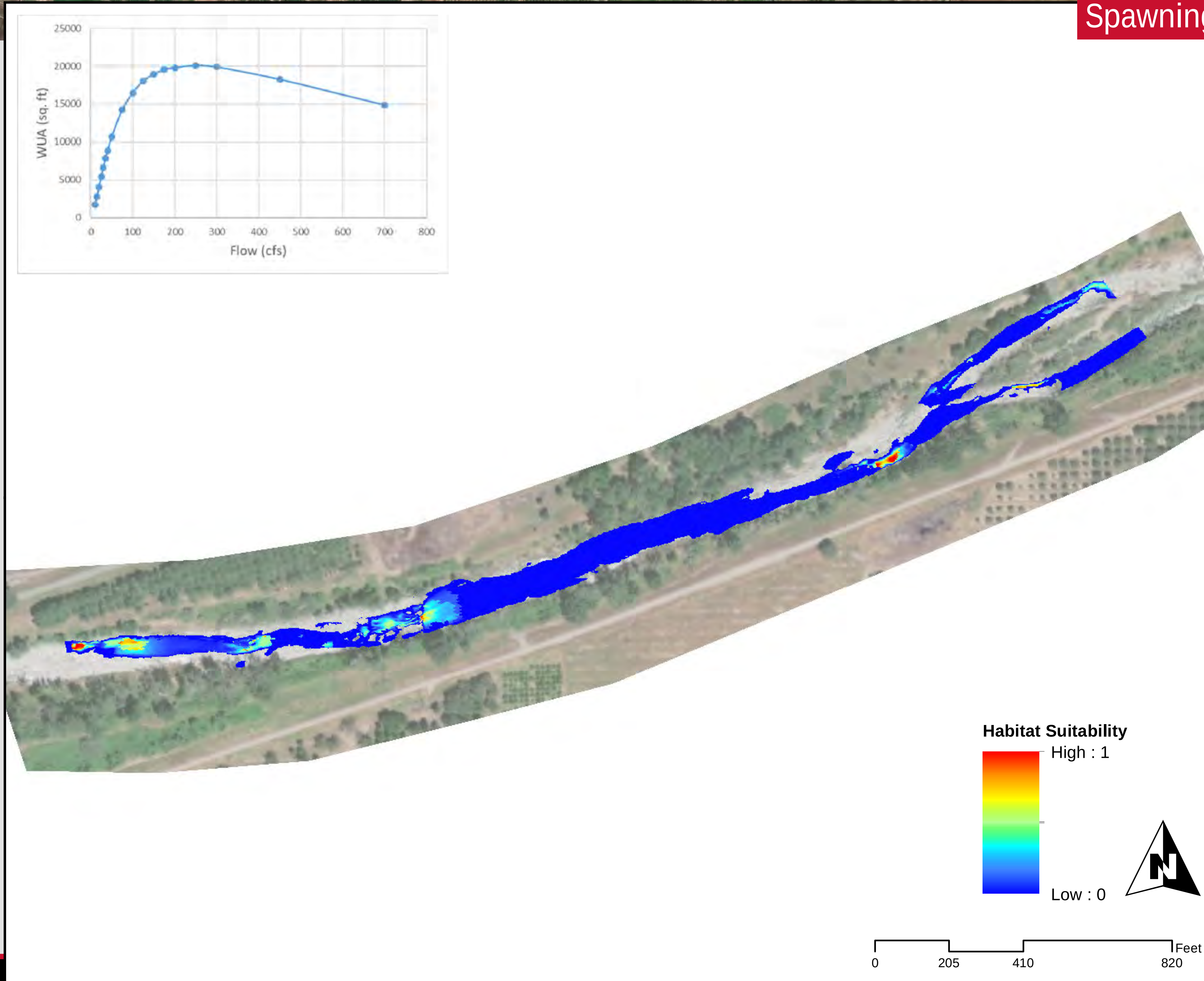

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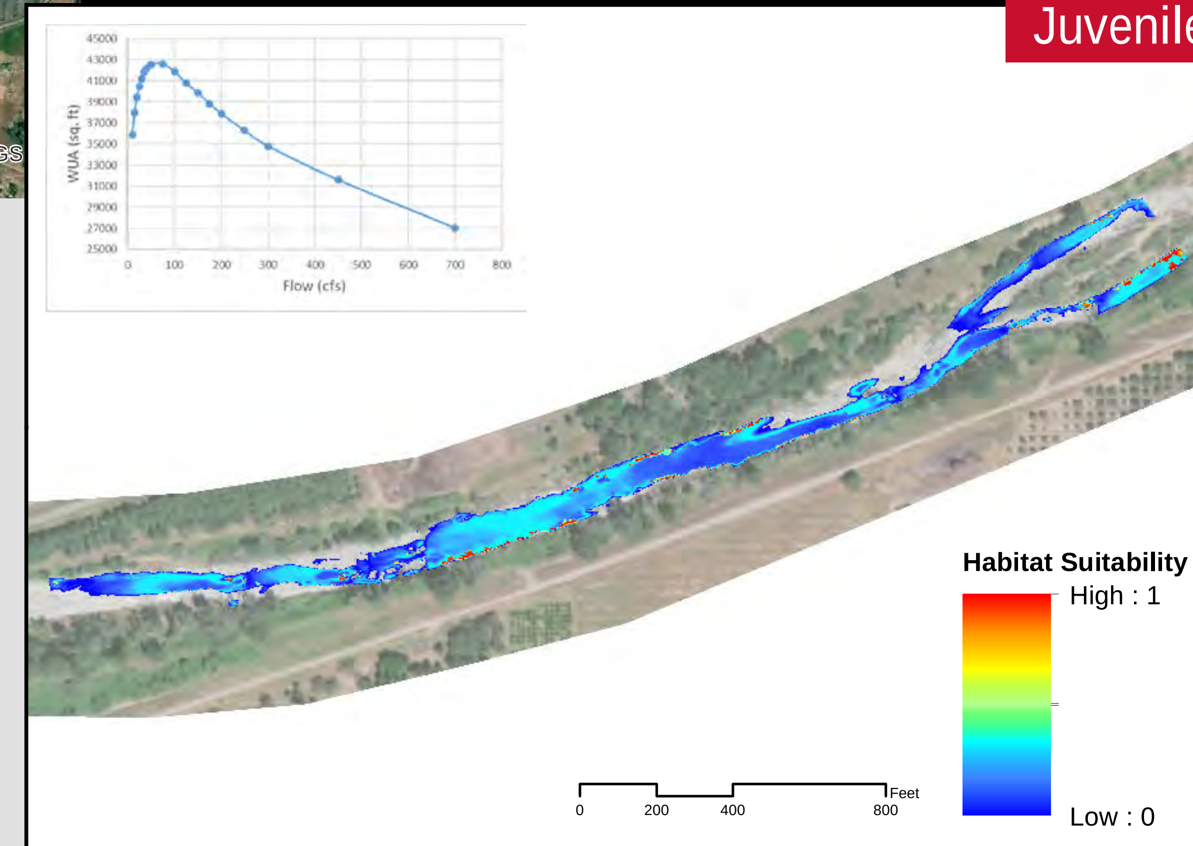

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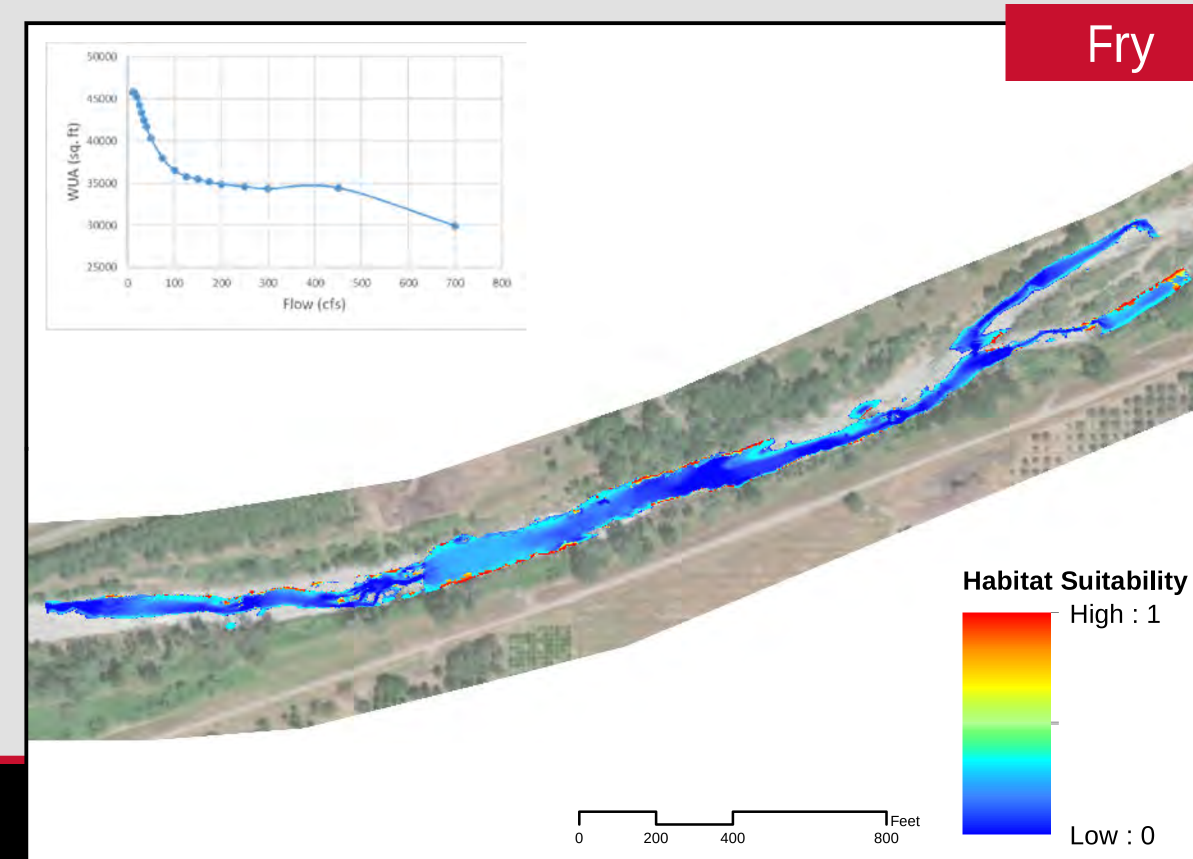
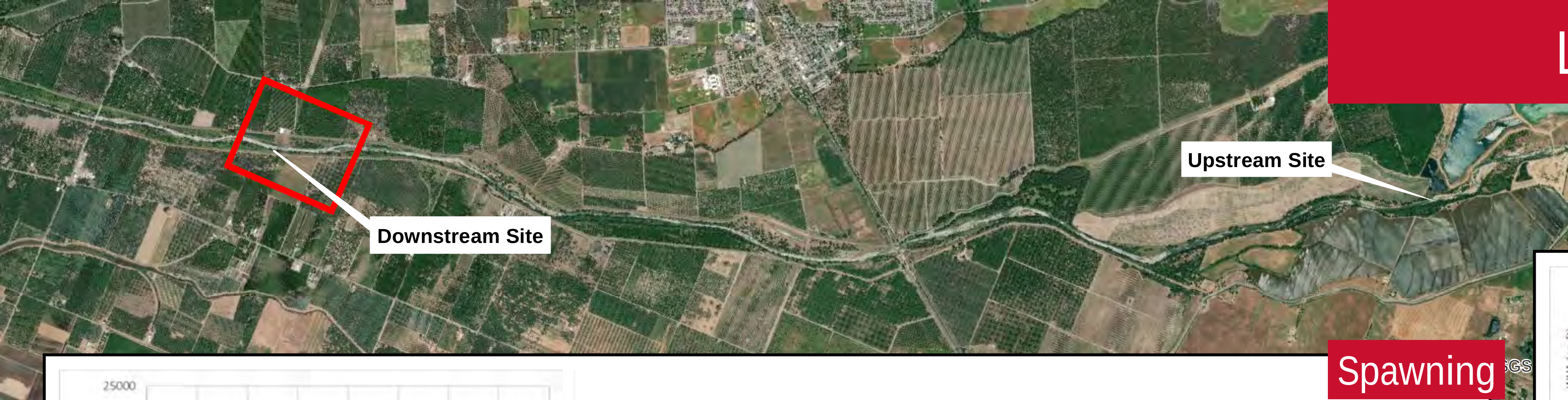


Lower Bear River - Instream Flow Study

SSWD HDR

Fall-Run Chinook Salmon

Downstream Study Site 75 cfs



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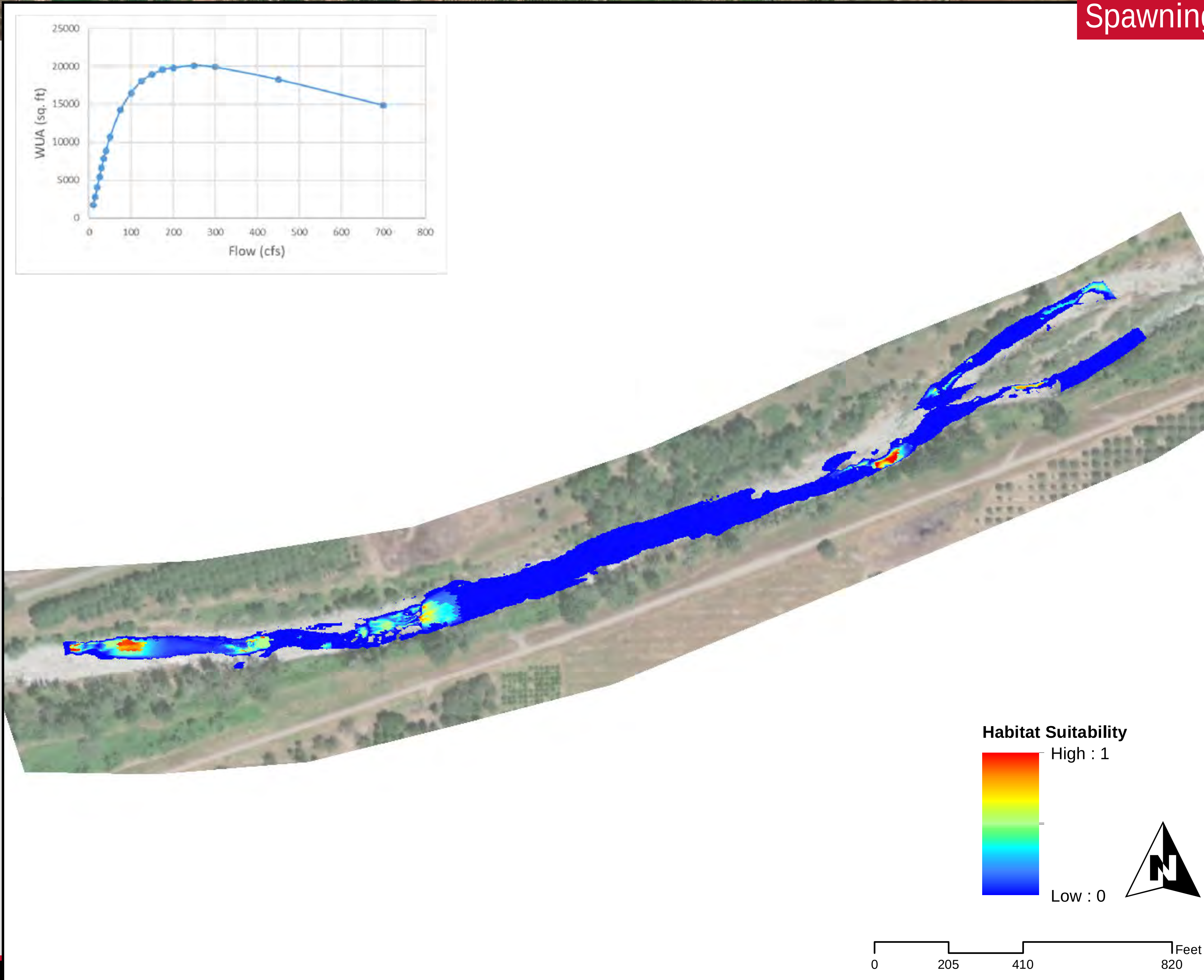

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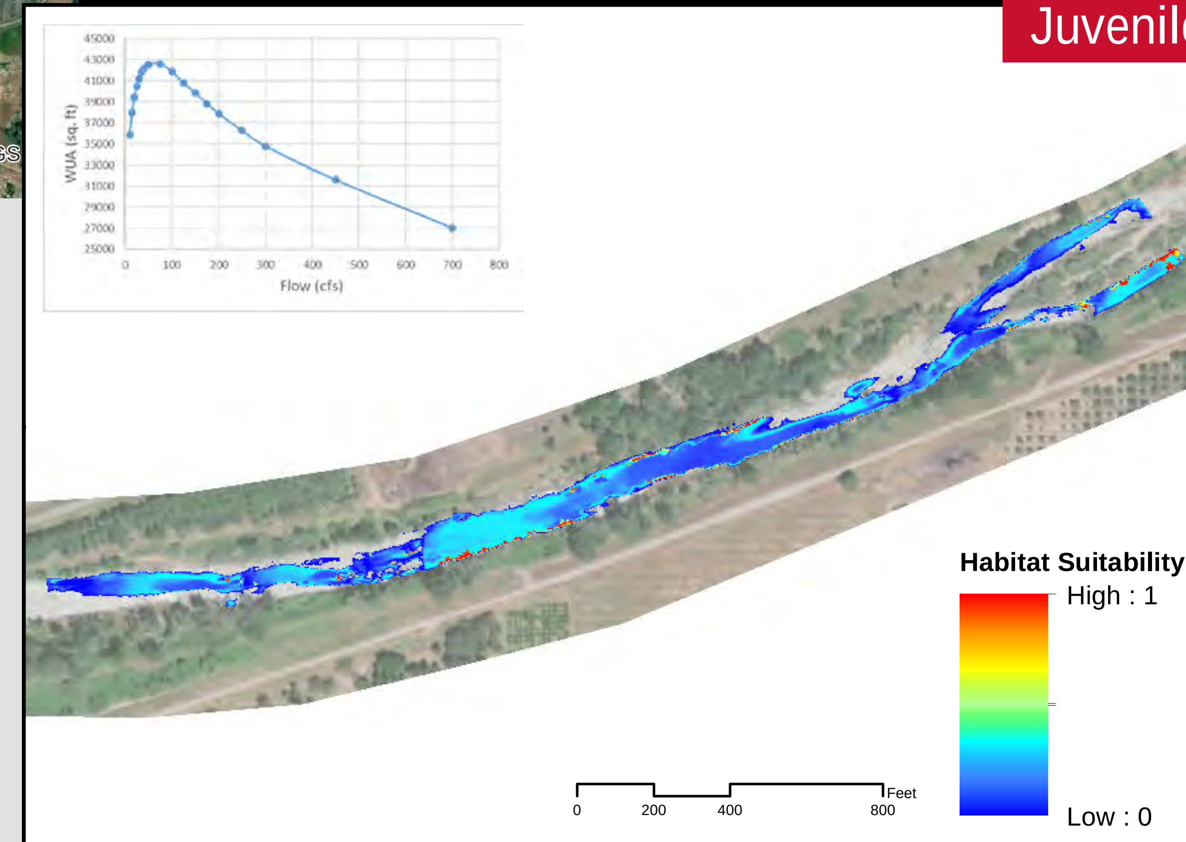

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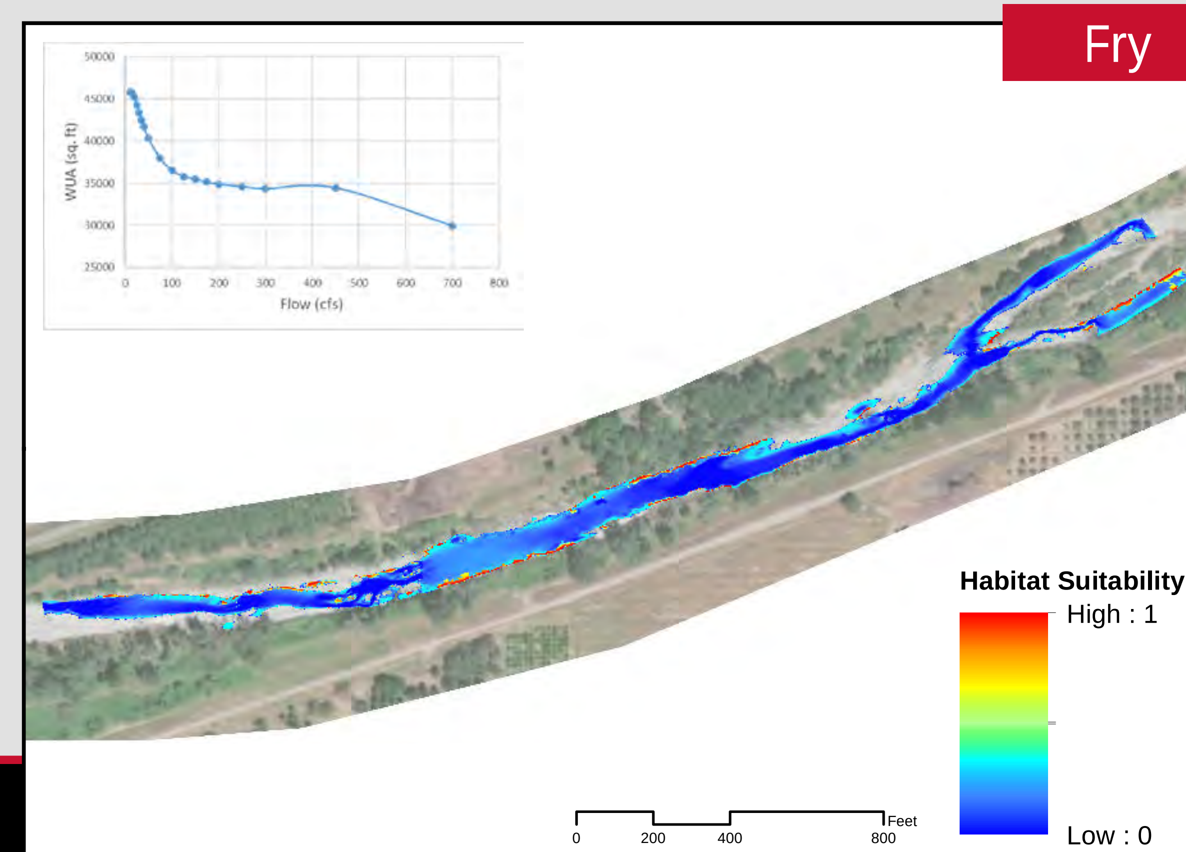
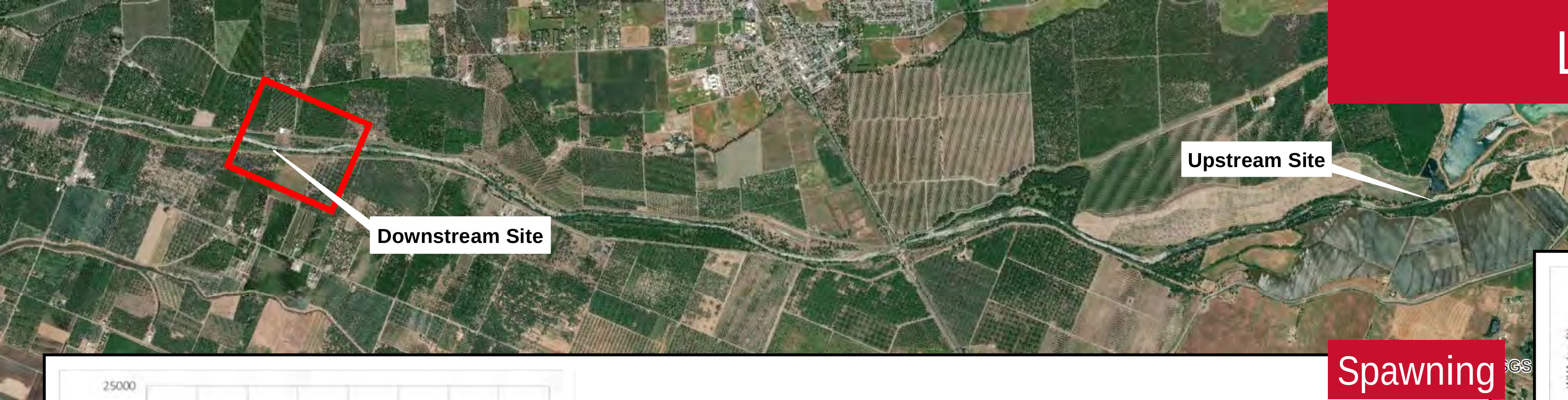


Lower Bear River - Instream Flow Study

SSWD HDR

Fall-Run Chinook Salmon

Downstream Study Site 100 cfs



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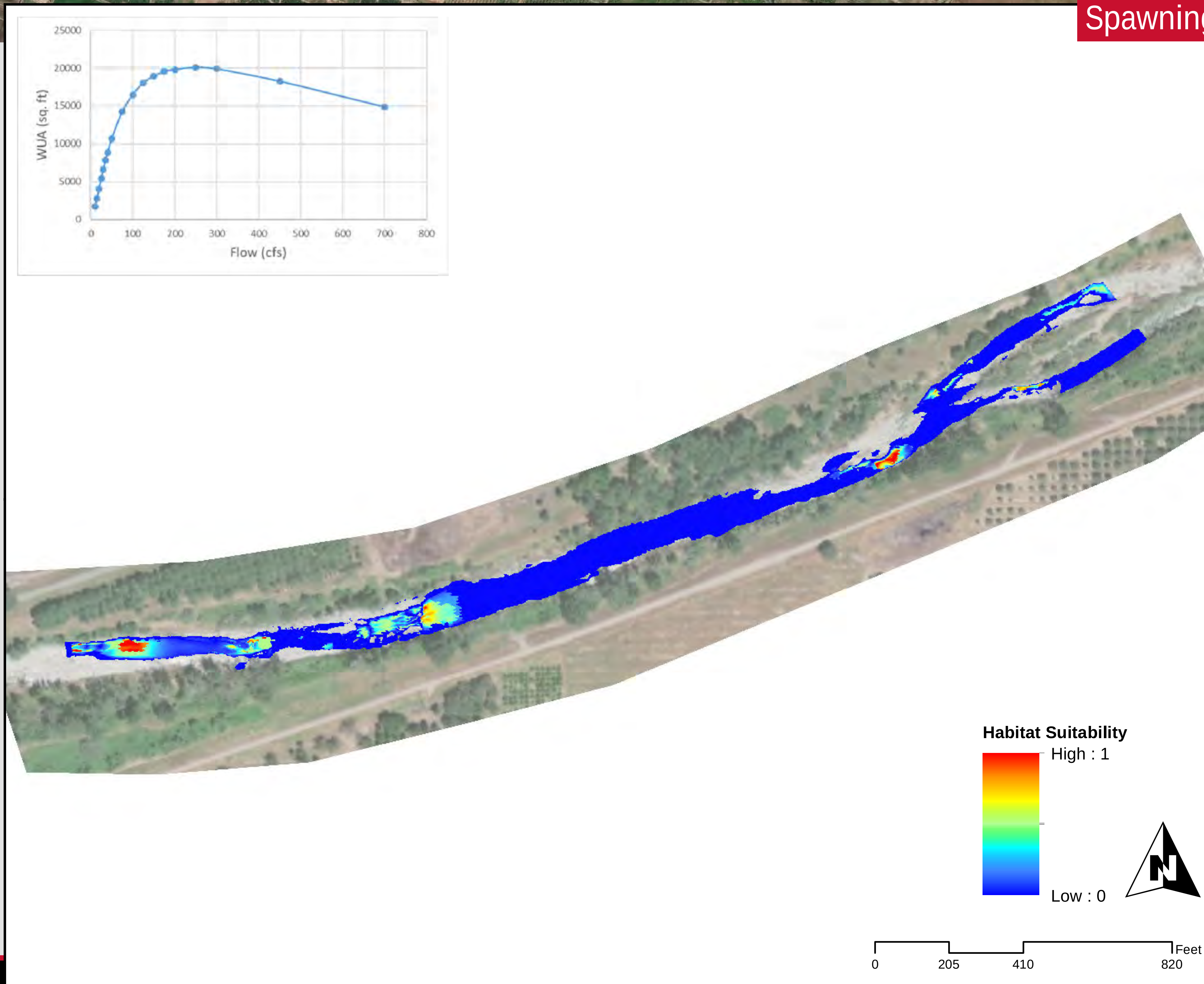

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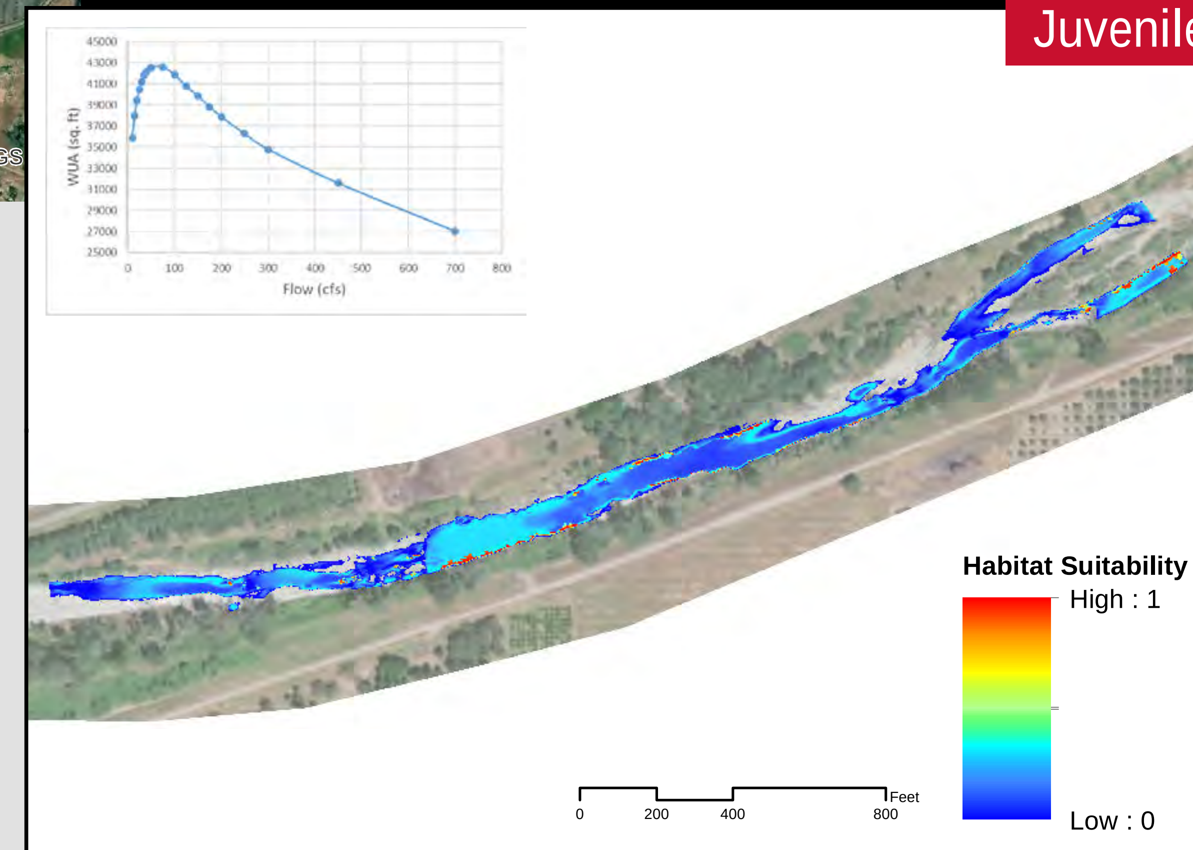

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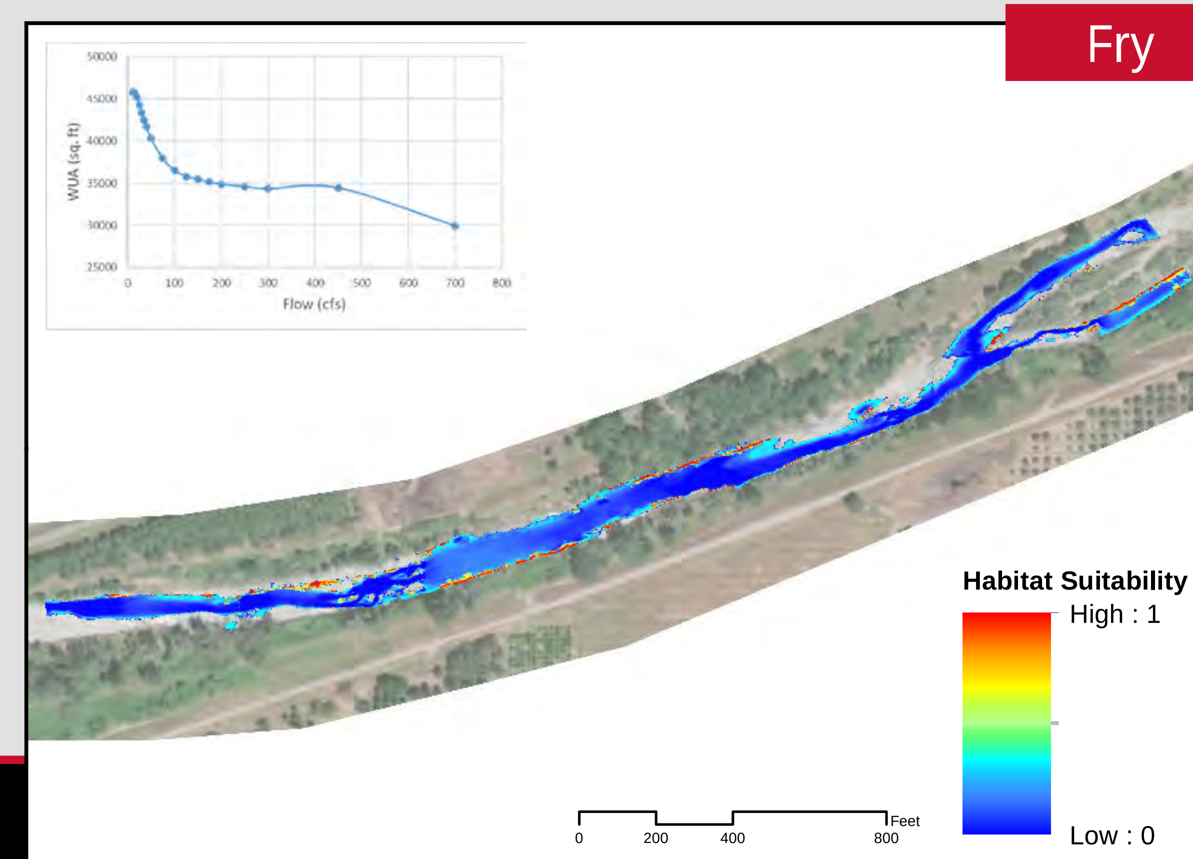

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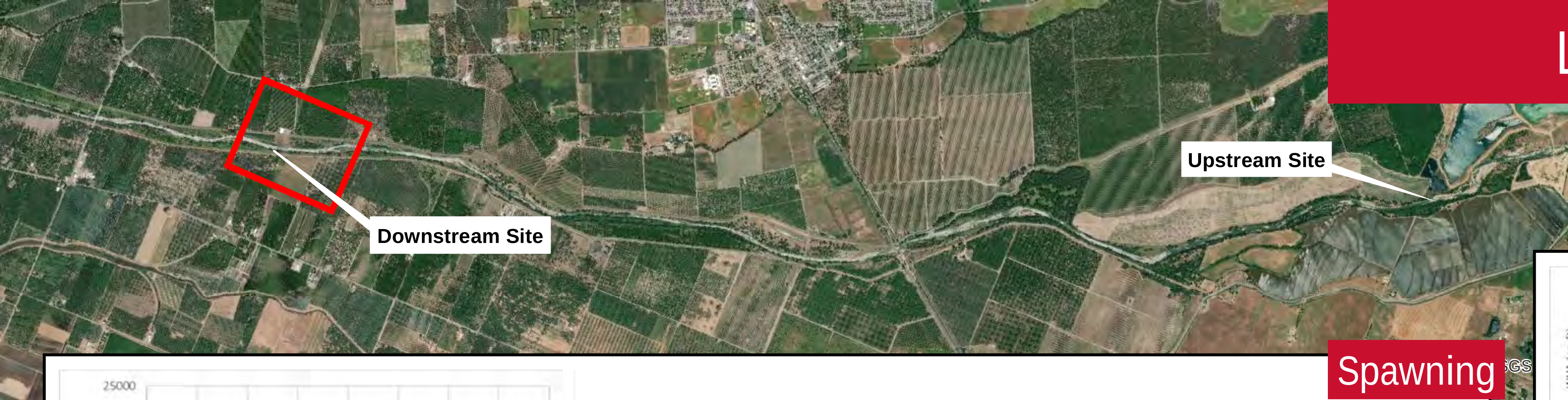
Lower Bear River - Instream Flow Study

Fall-Run Chinook Salmon

Downstream Study Site 125 cfs



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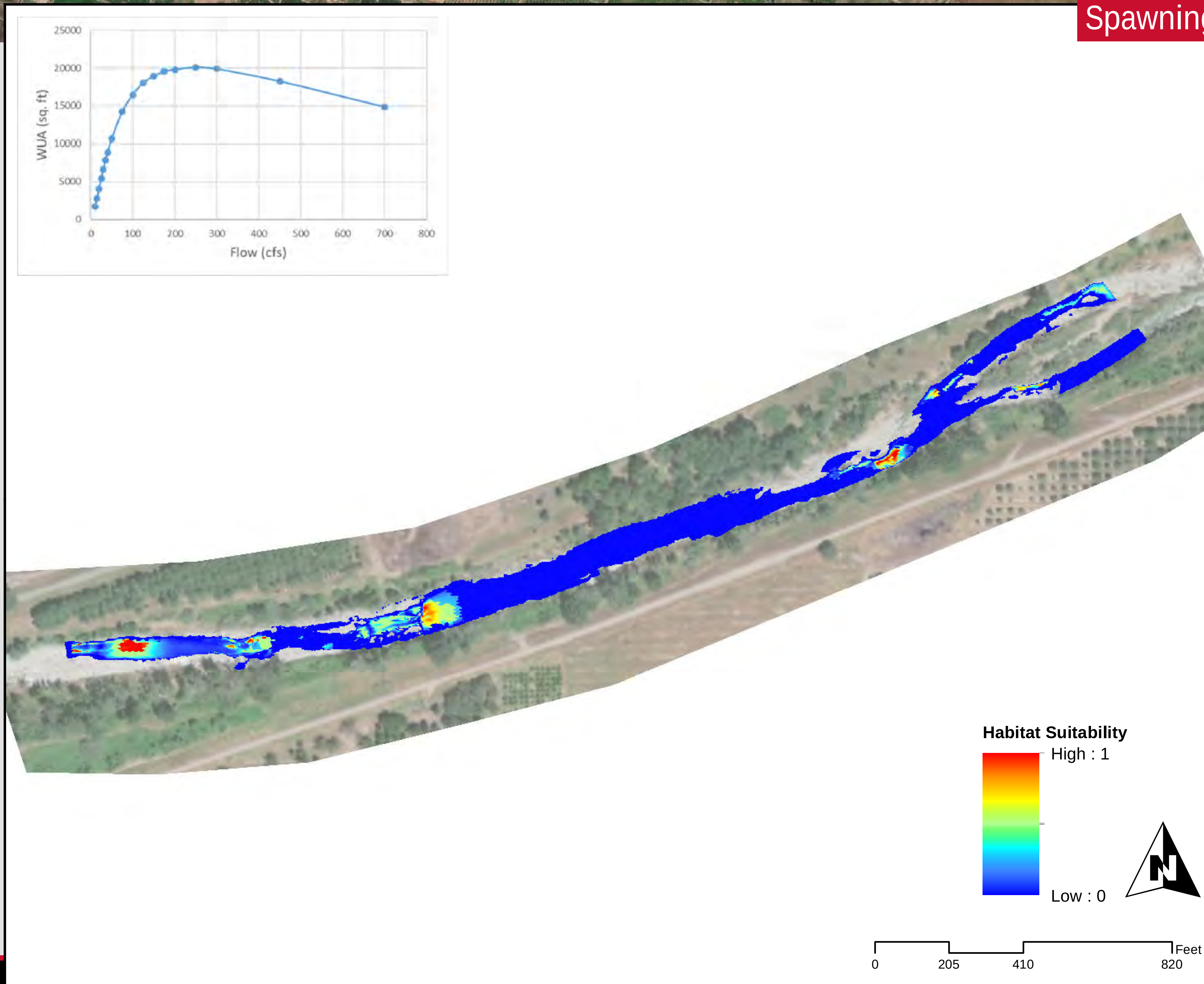

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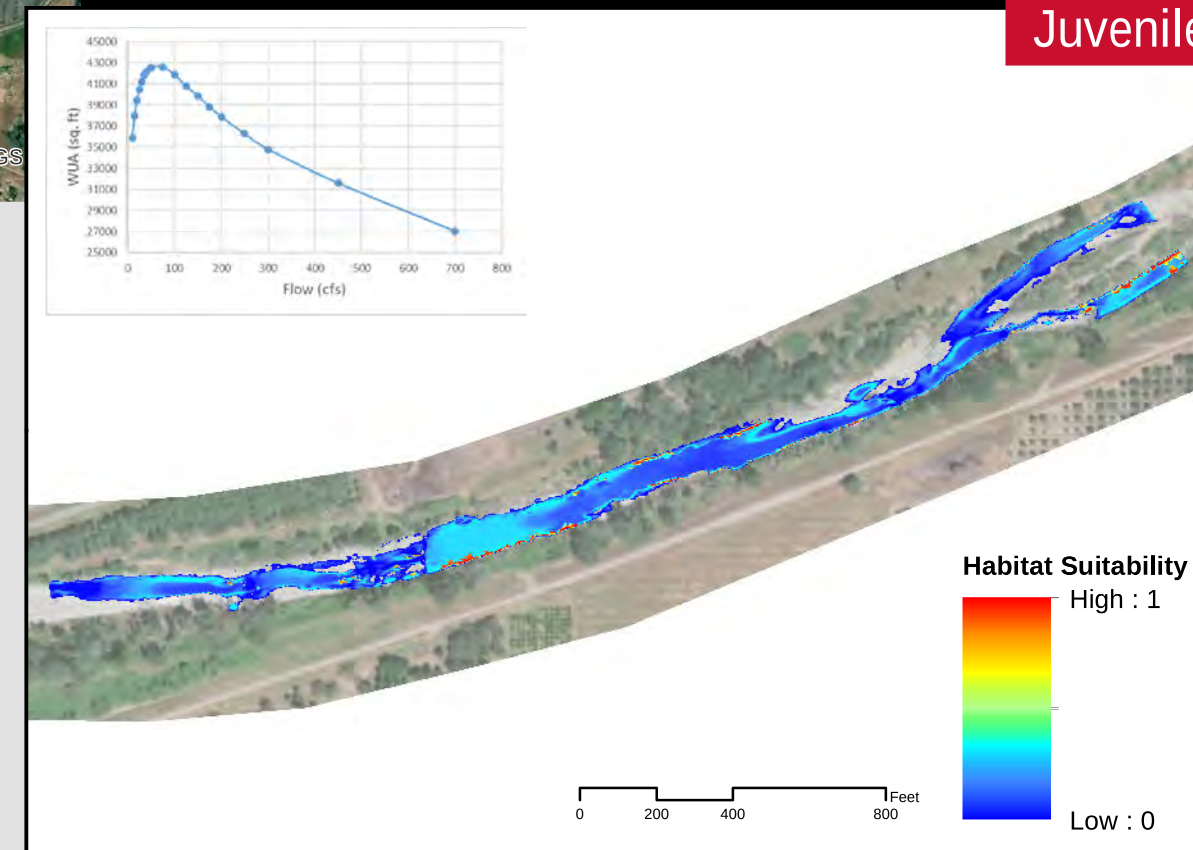

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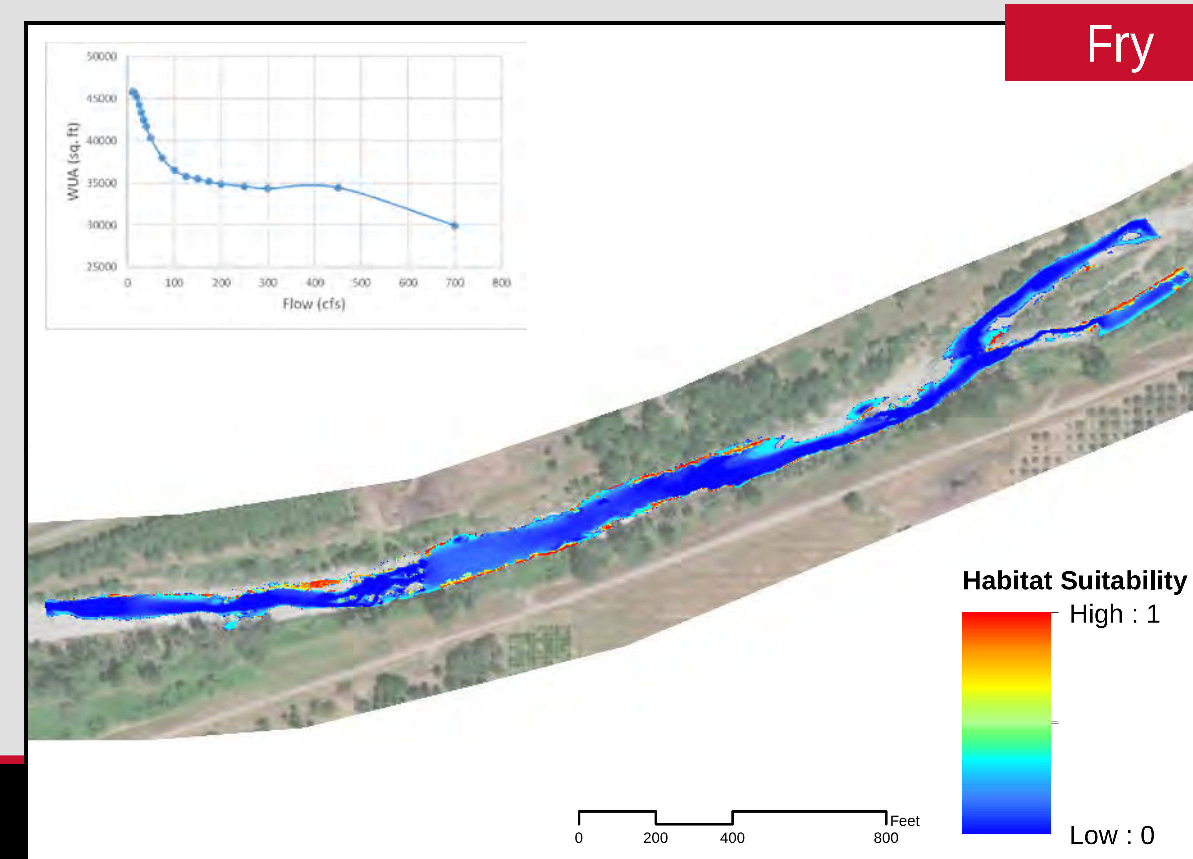
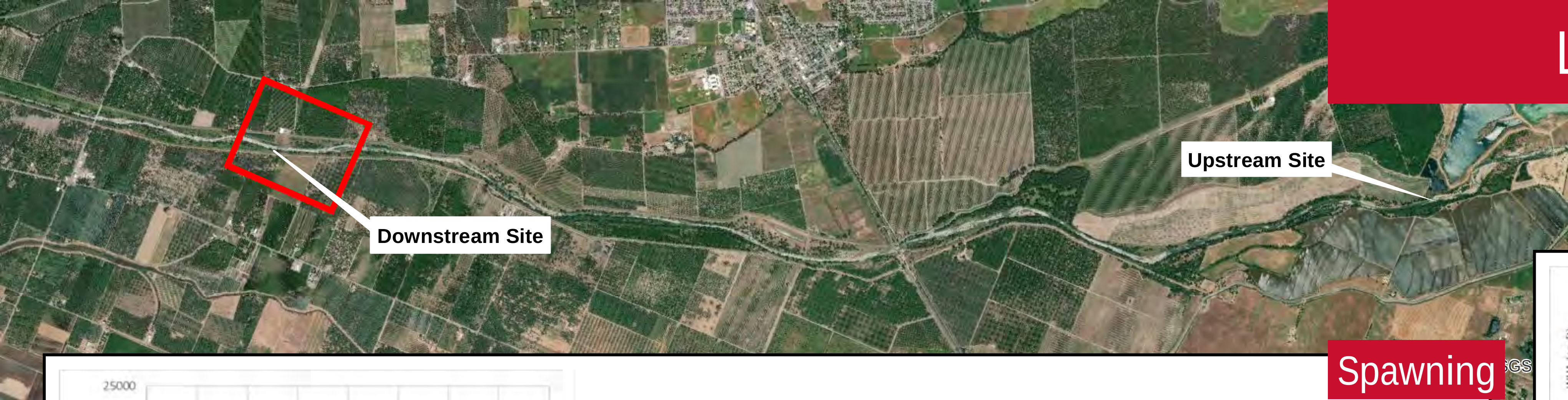


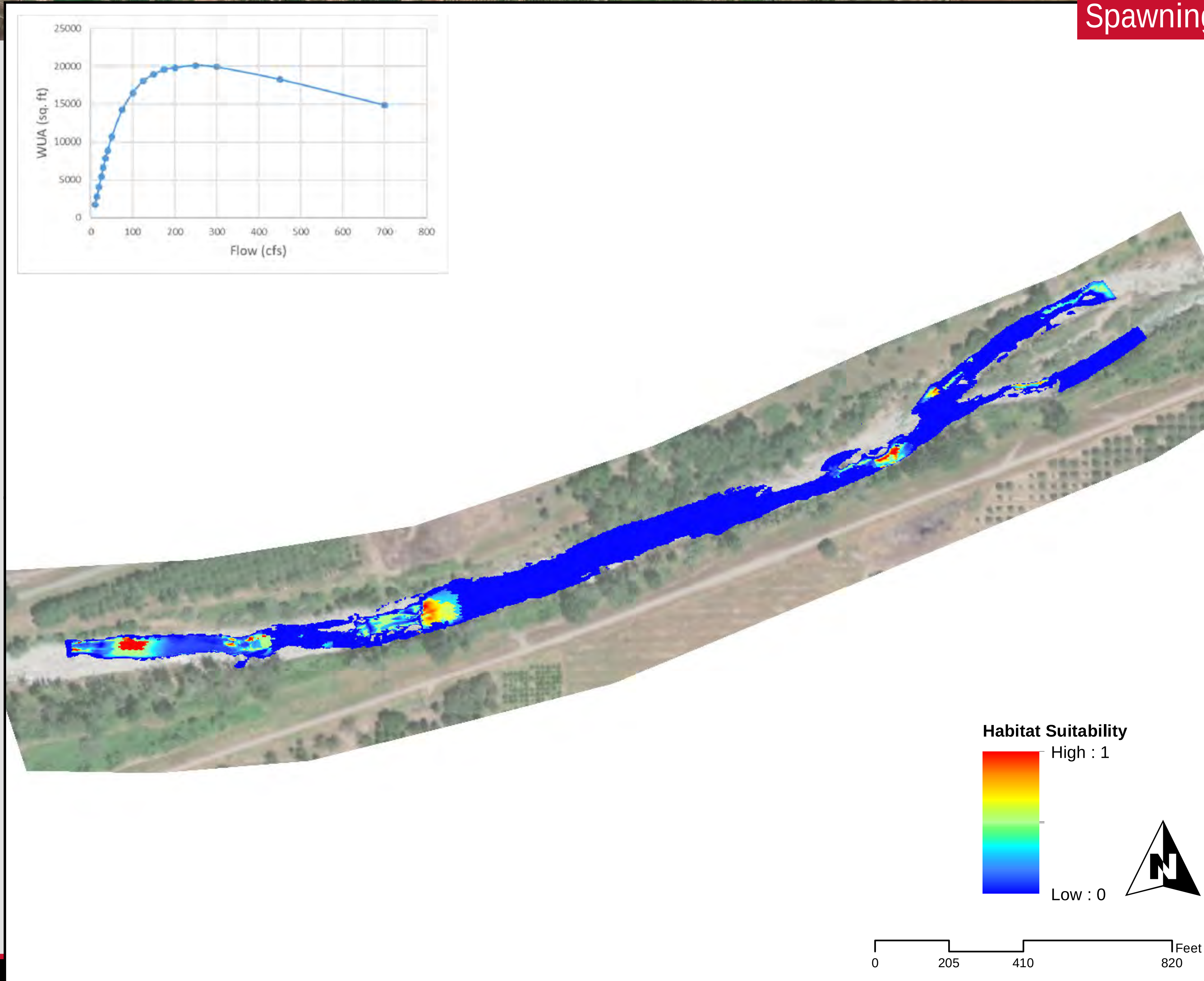
Lower Bear River - Instream Flow Study

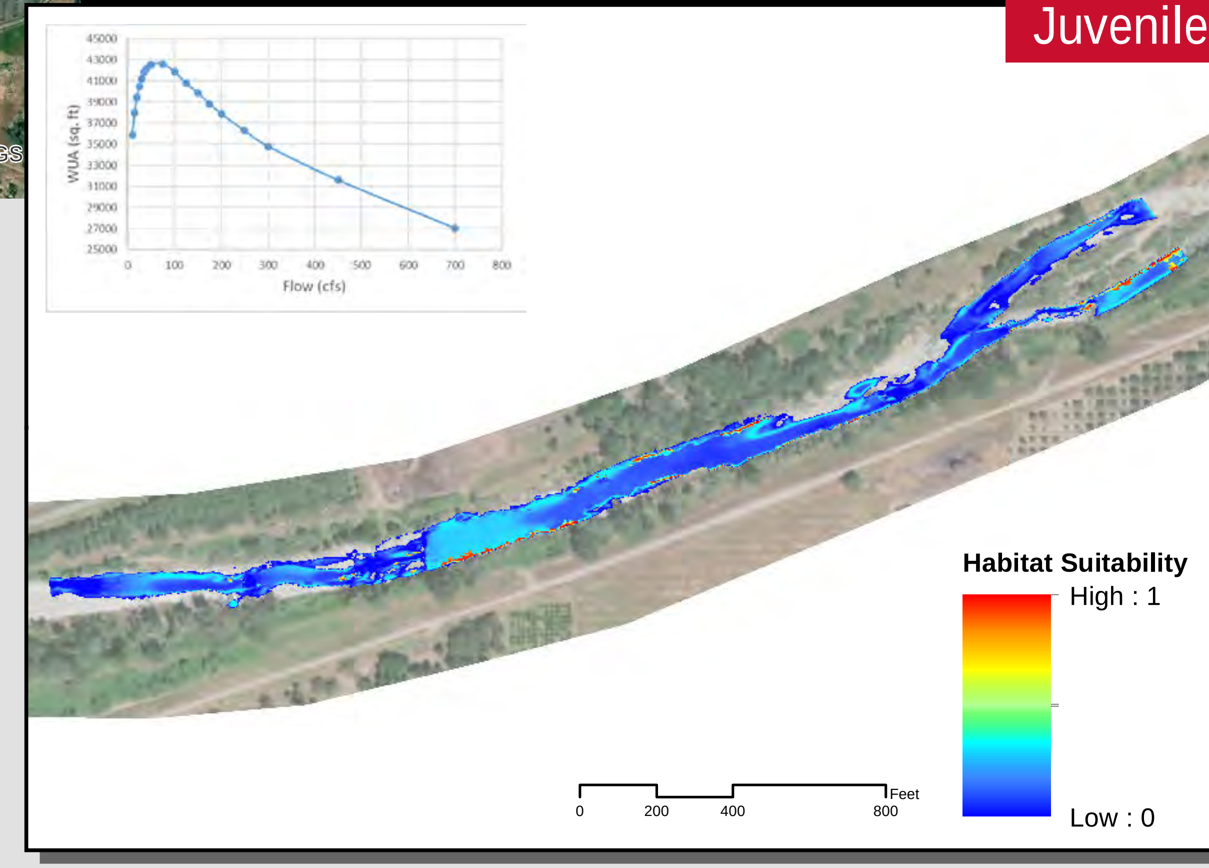
SSWD HDR

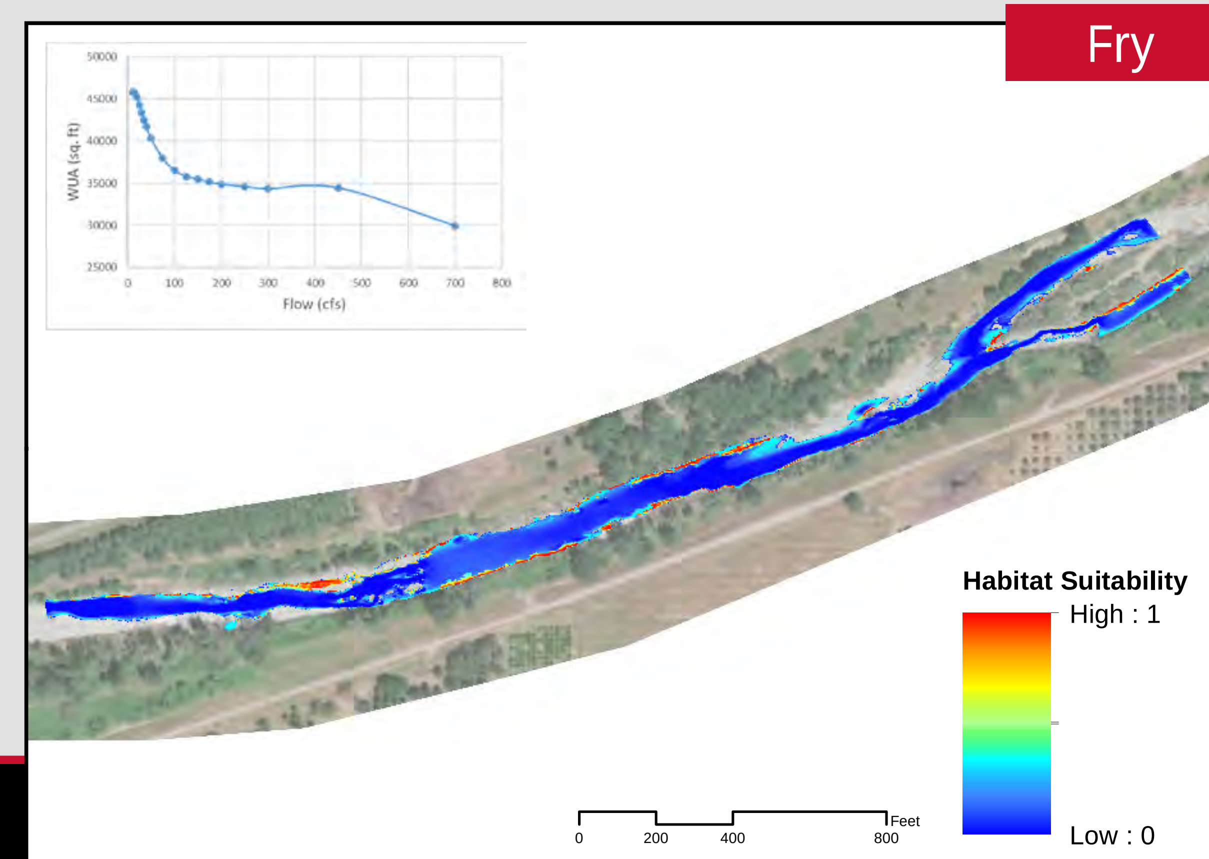
Fall-Run Chinook Salmon

Downstream Study Site 150 cfs









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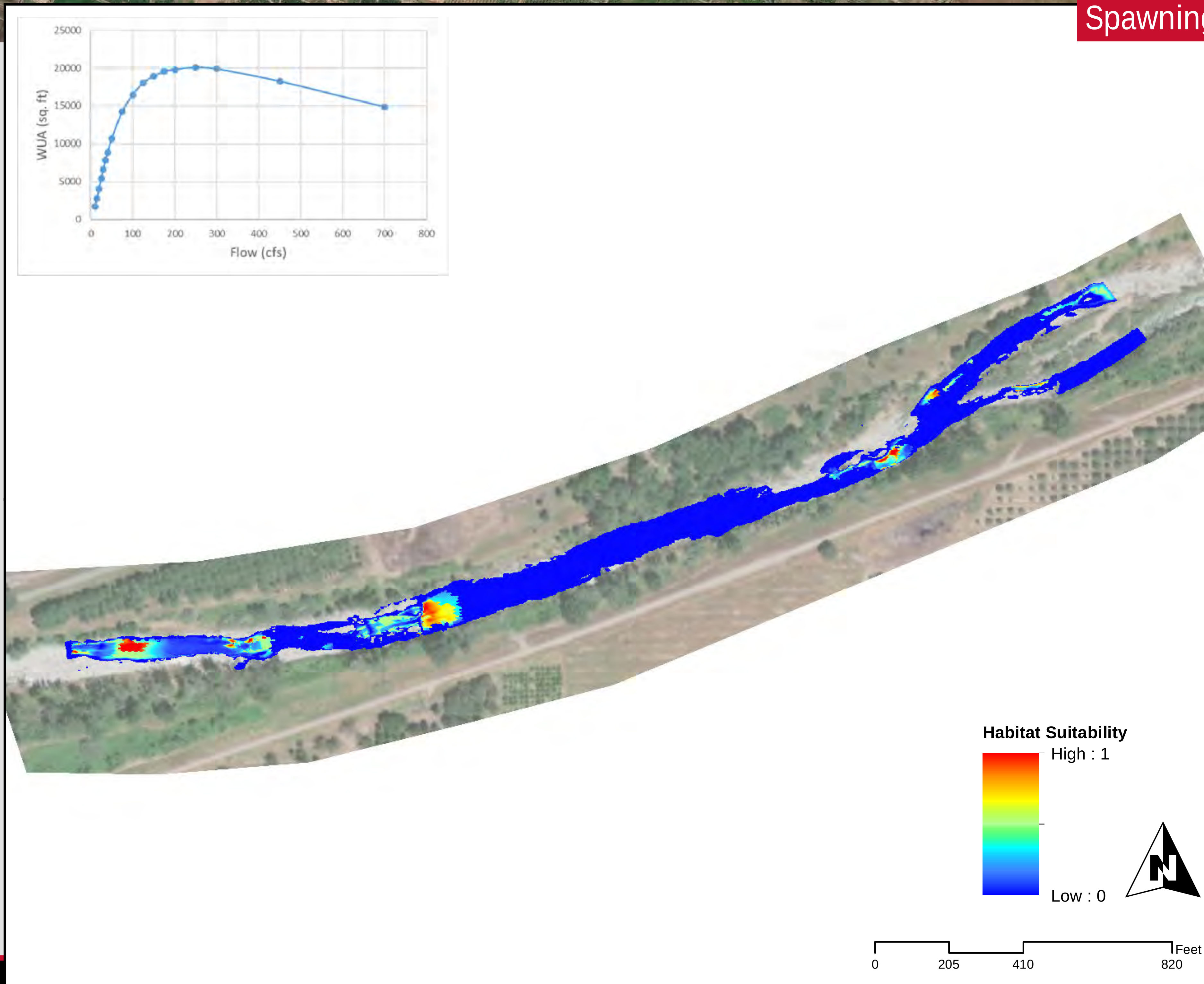
Lower Bear River - Instream Flow Study

Fall-Run Chinook Salmon

Downstream Study Site 175 cfs

Spawning



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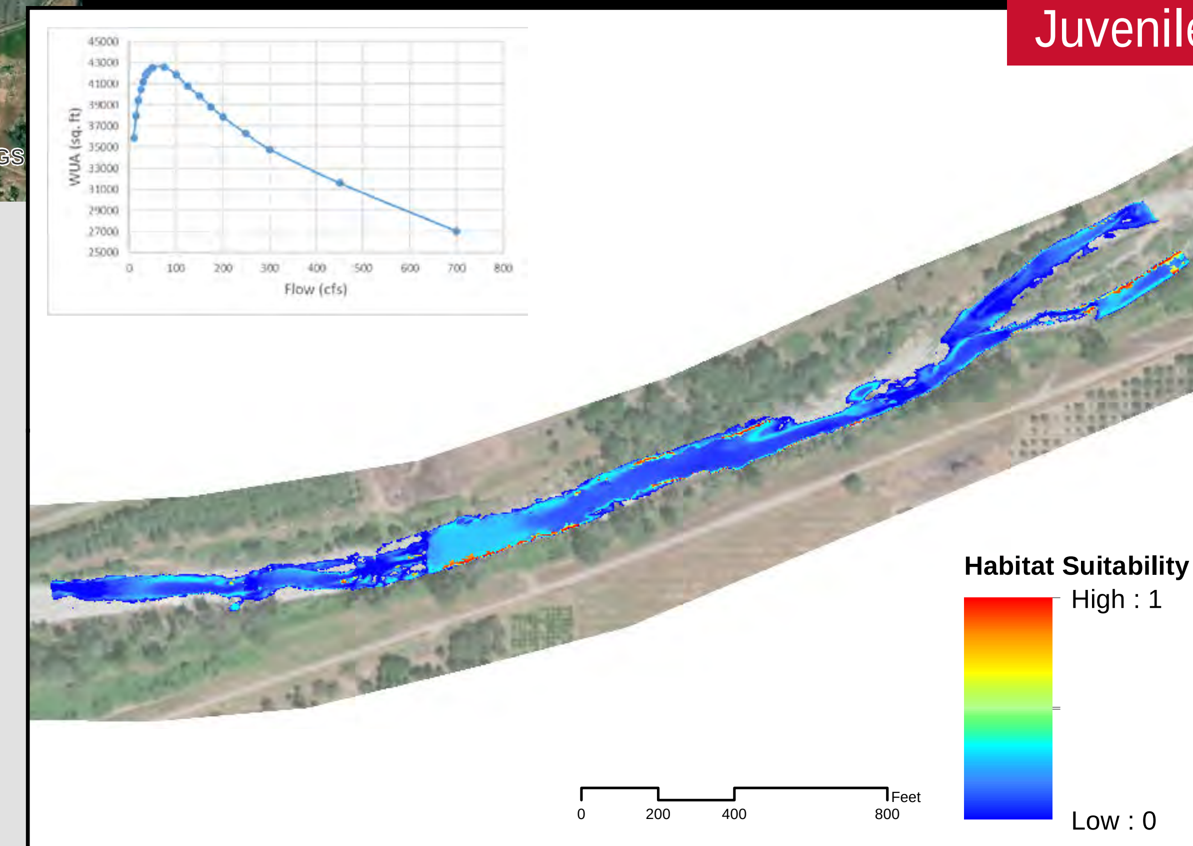

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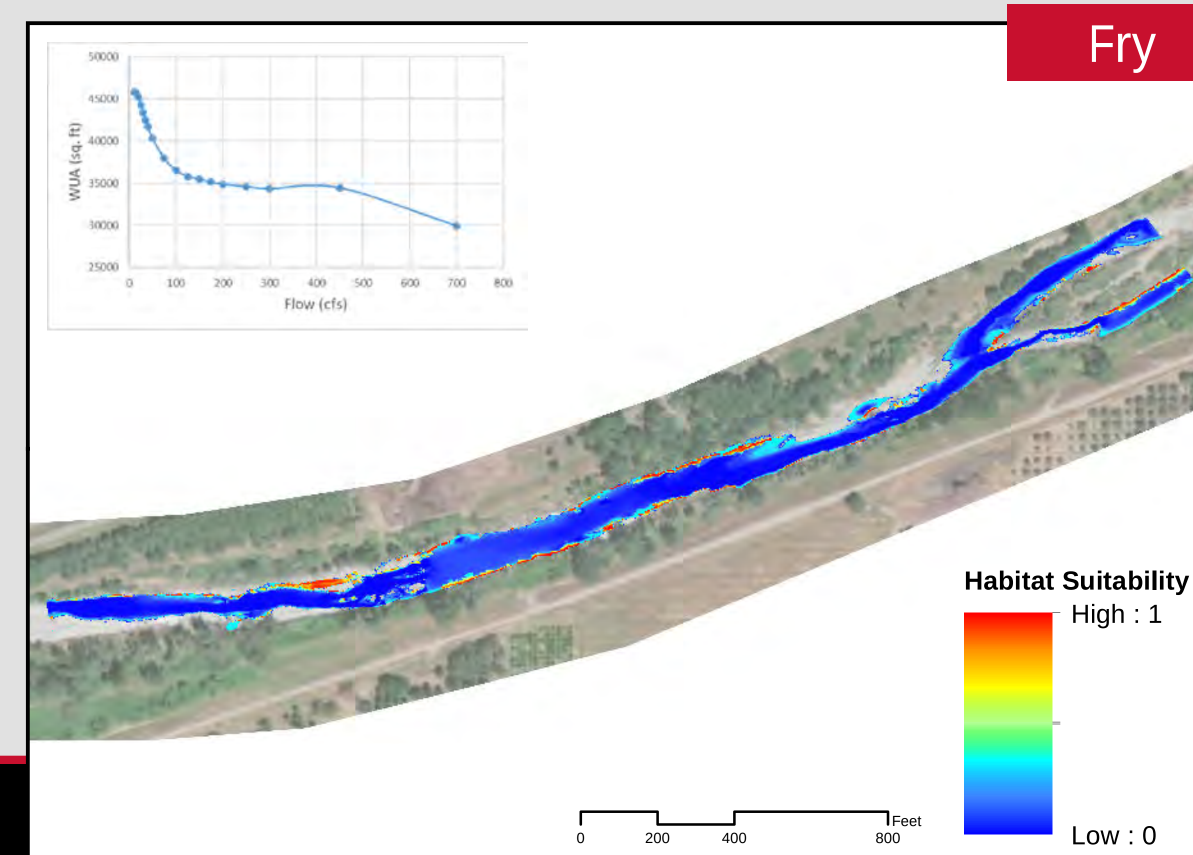
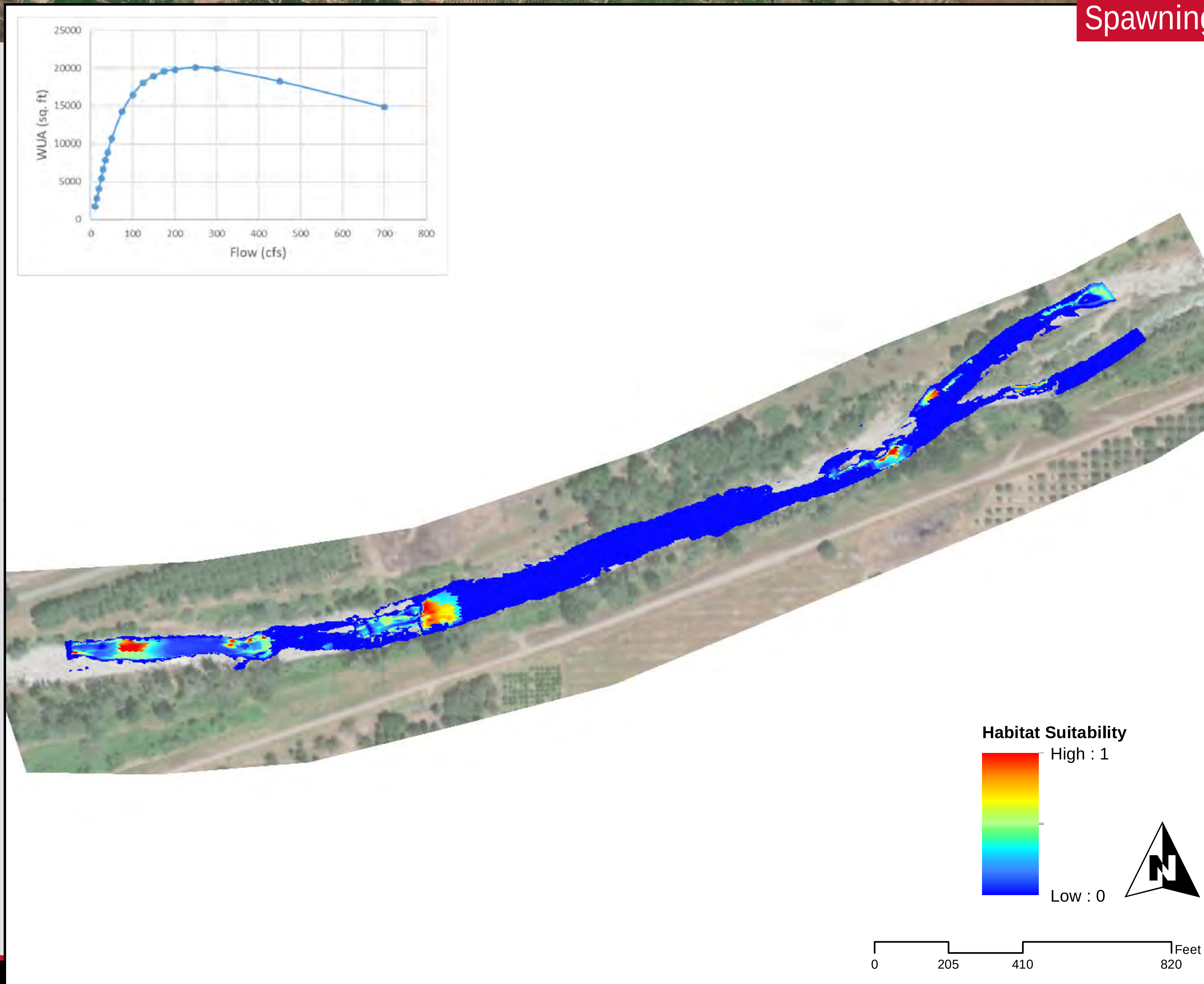


Lower Bear River - Instream Flow Study

Fall-Run Chinook Salmon

Downstream Study Site 200 cfs

Spawning



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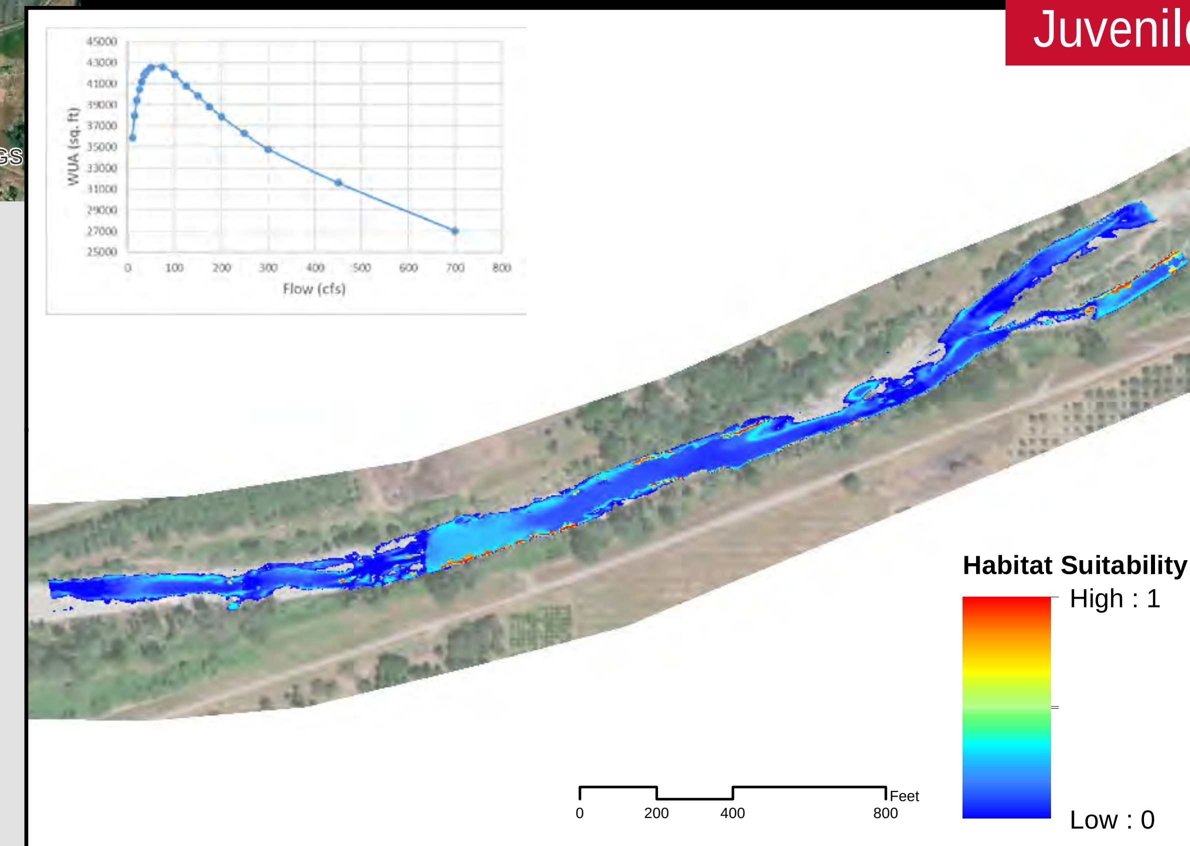

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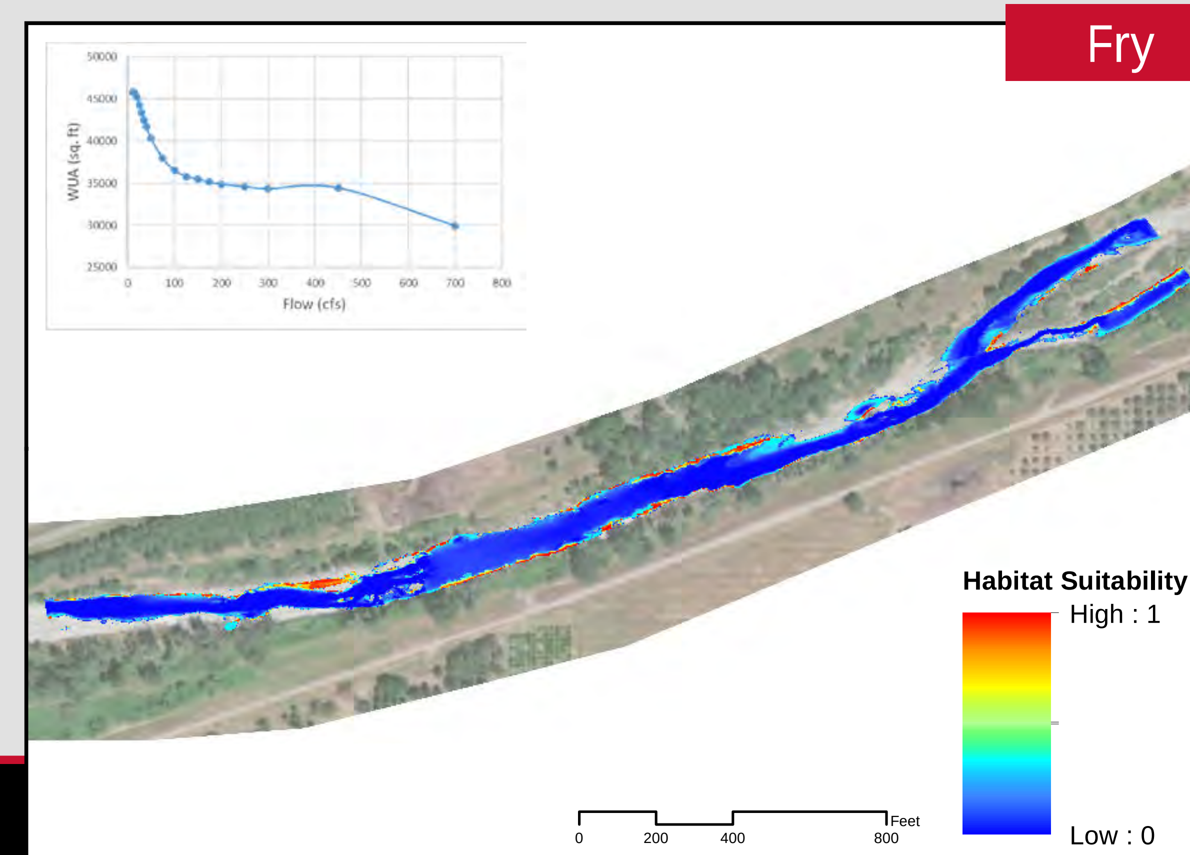
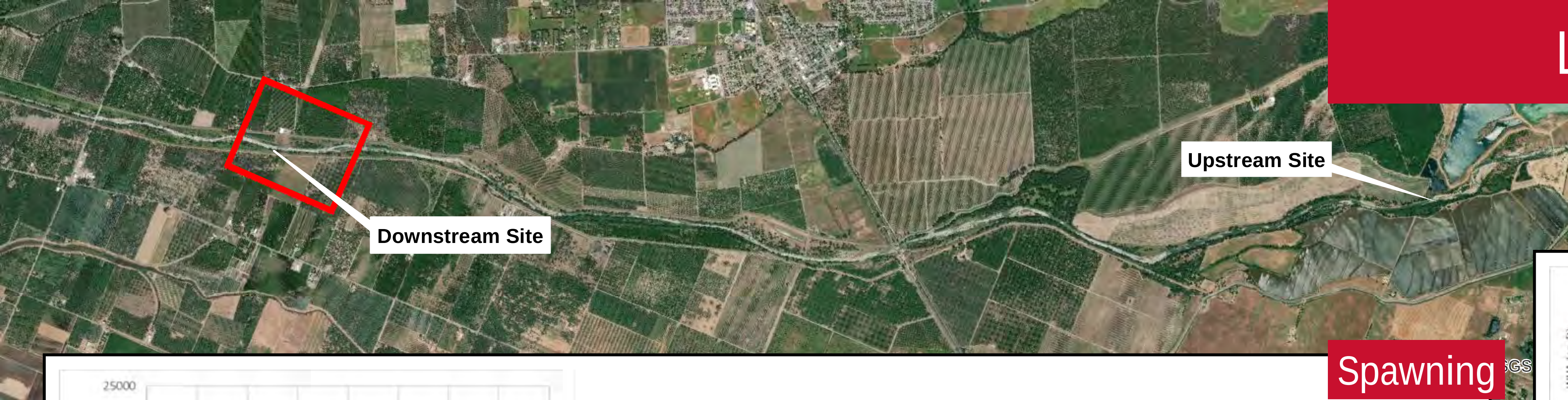


Lower Bear River - Instream Flow Study

Fall-Run Chinook Salmon

Downstream Study Site 250 cfs



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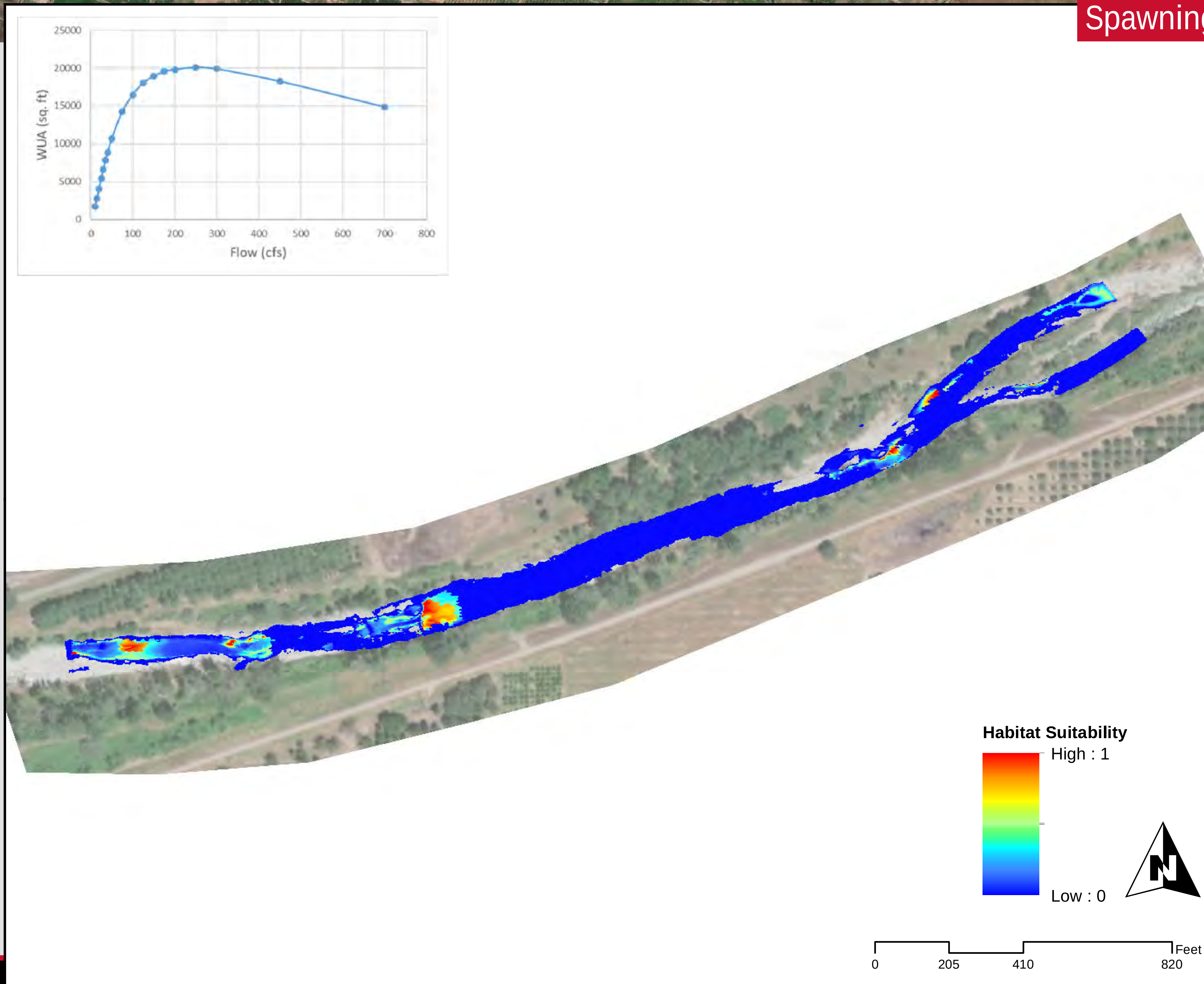

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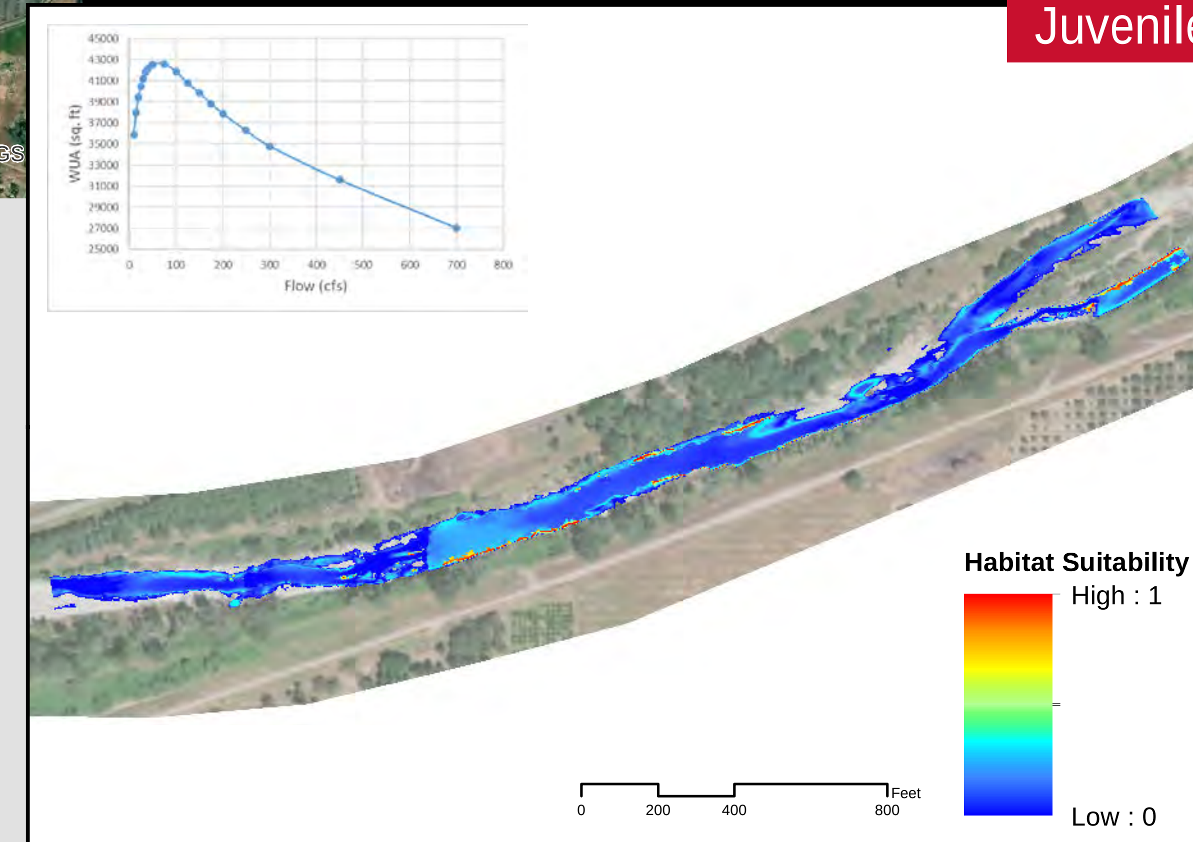

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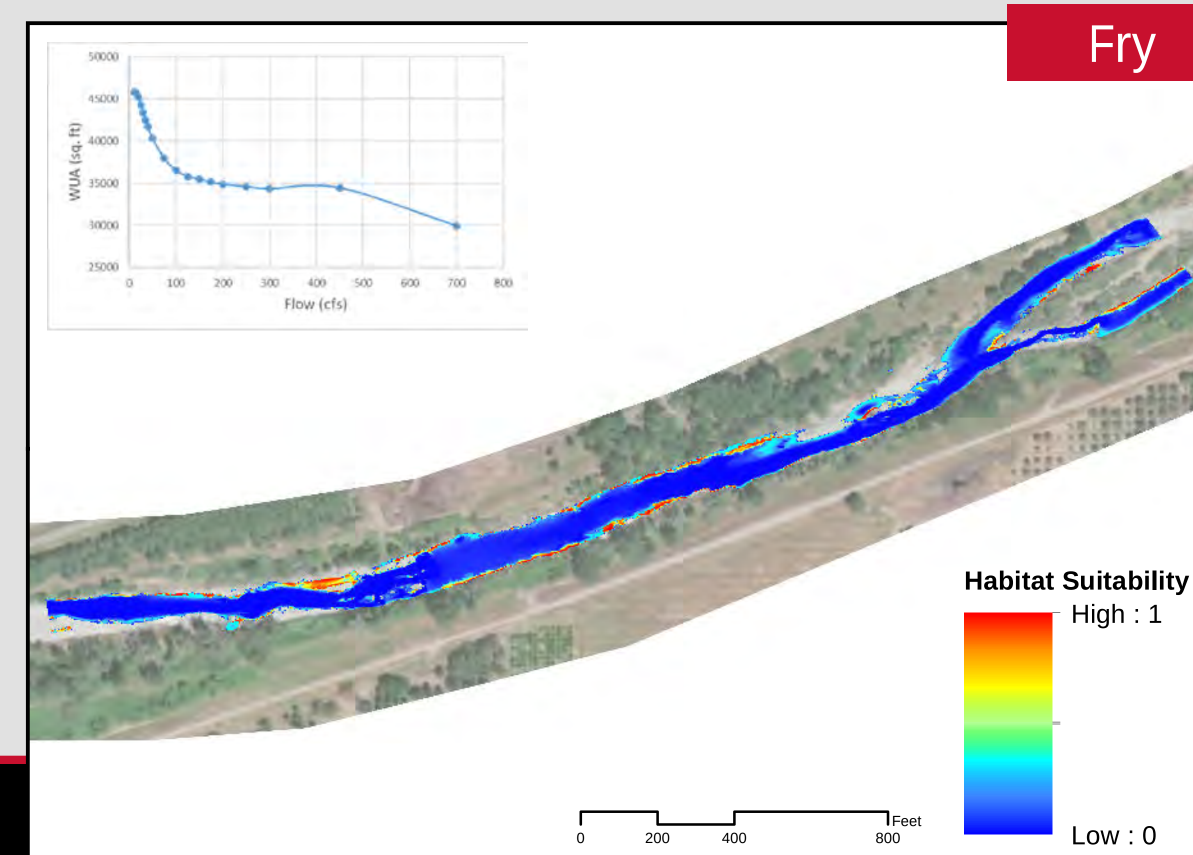
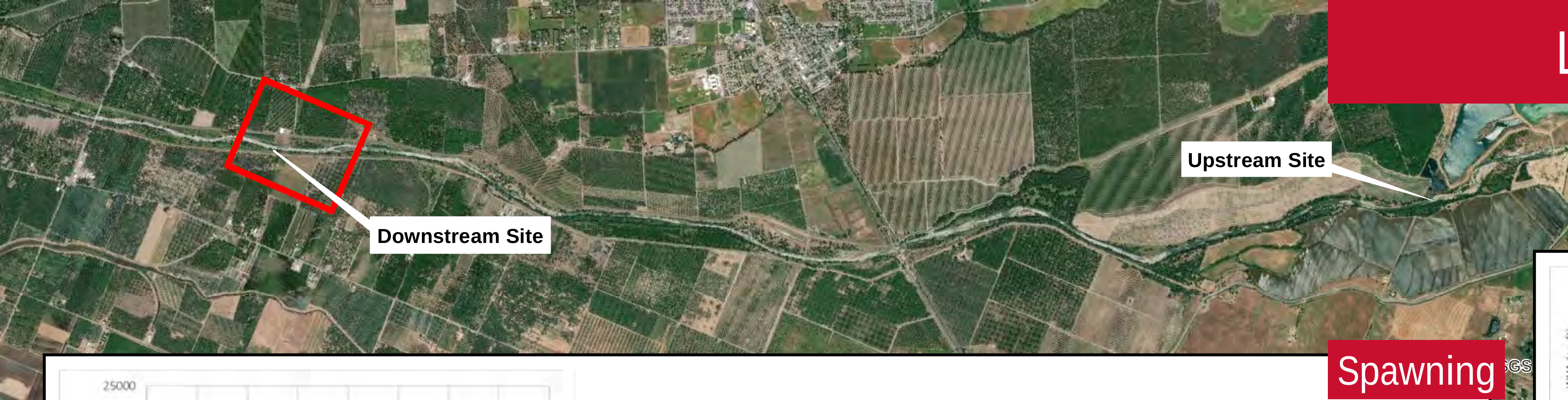


Lower Bear River - Instream Flow Study

SSWD HDR

Fall-Run Chinook Salmon

Downstream Study Site 300 cfs



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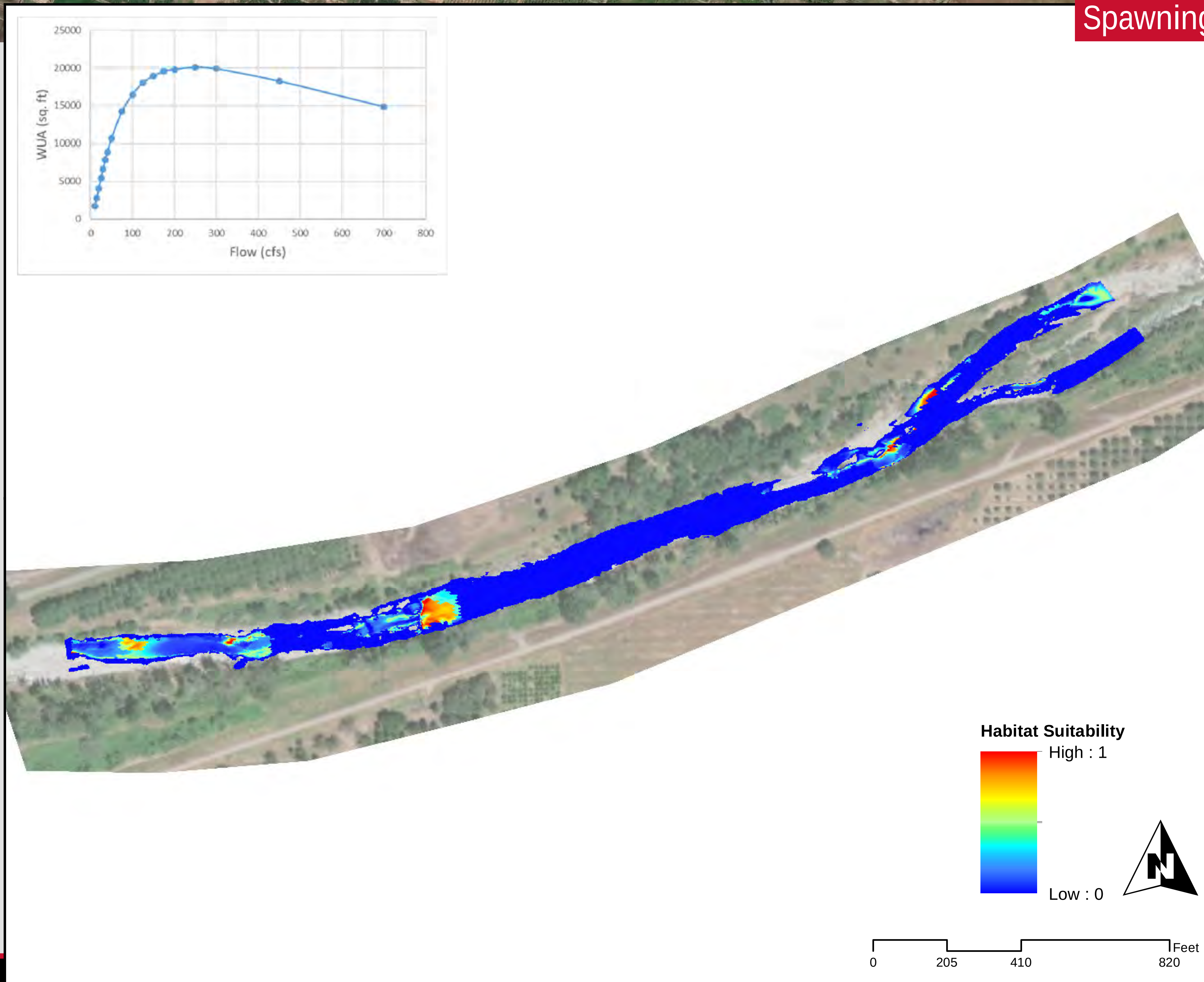

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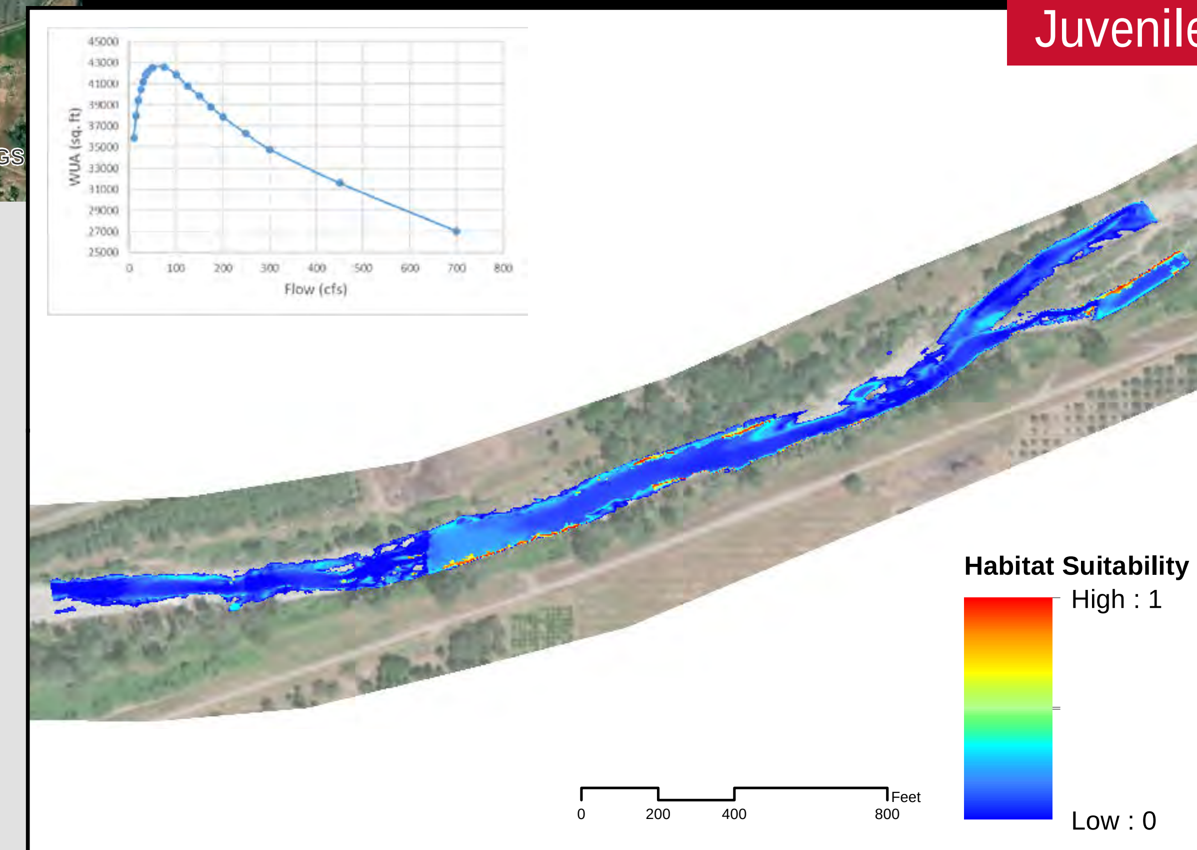

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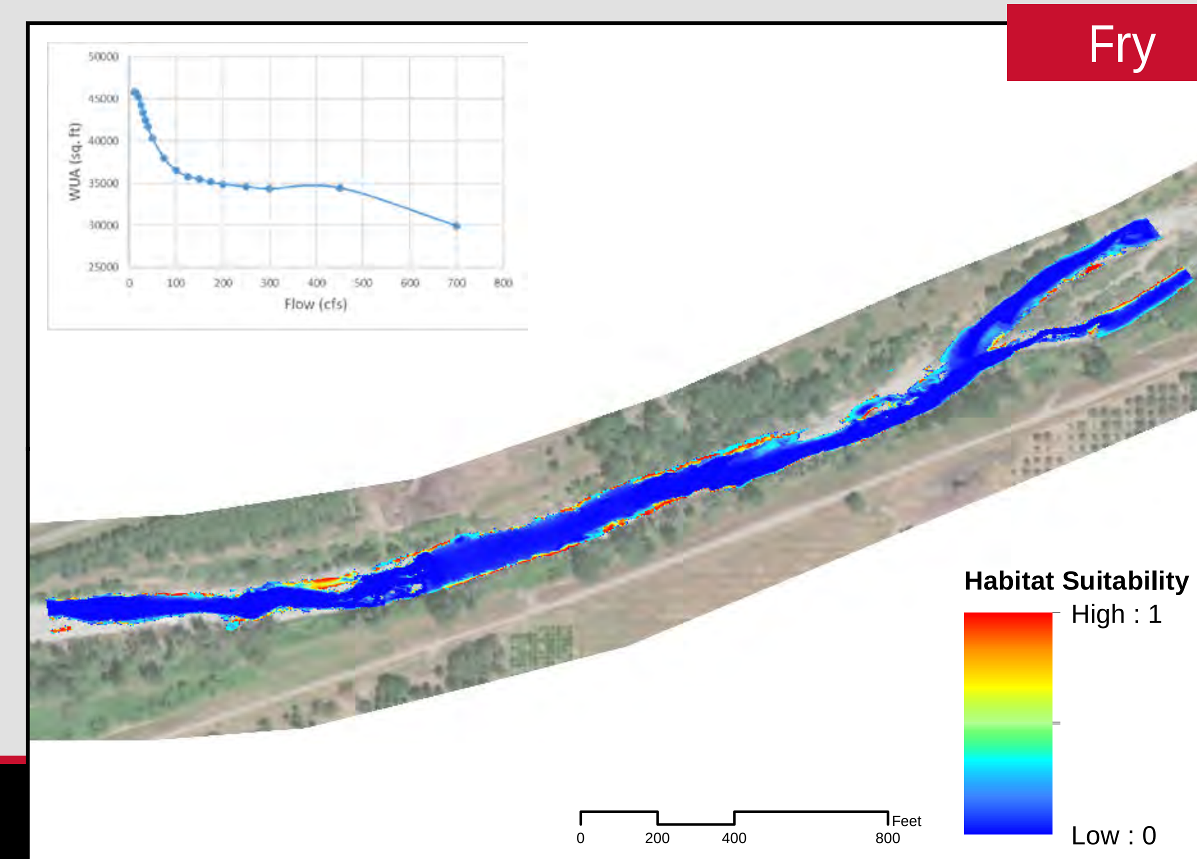

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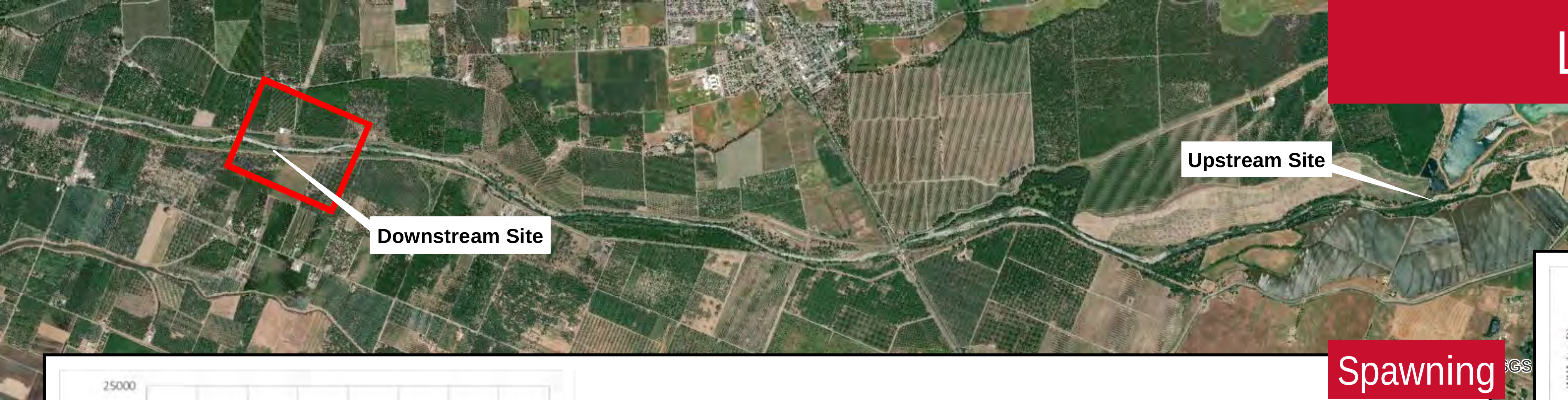
Lower Bear River - Instream Flow Study

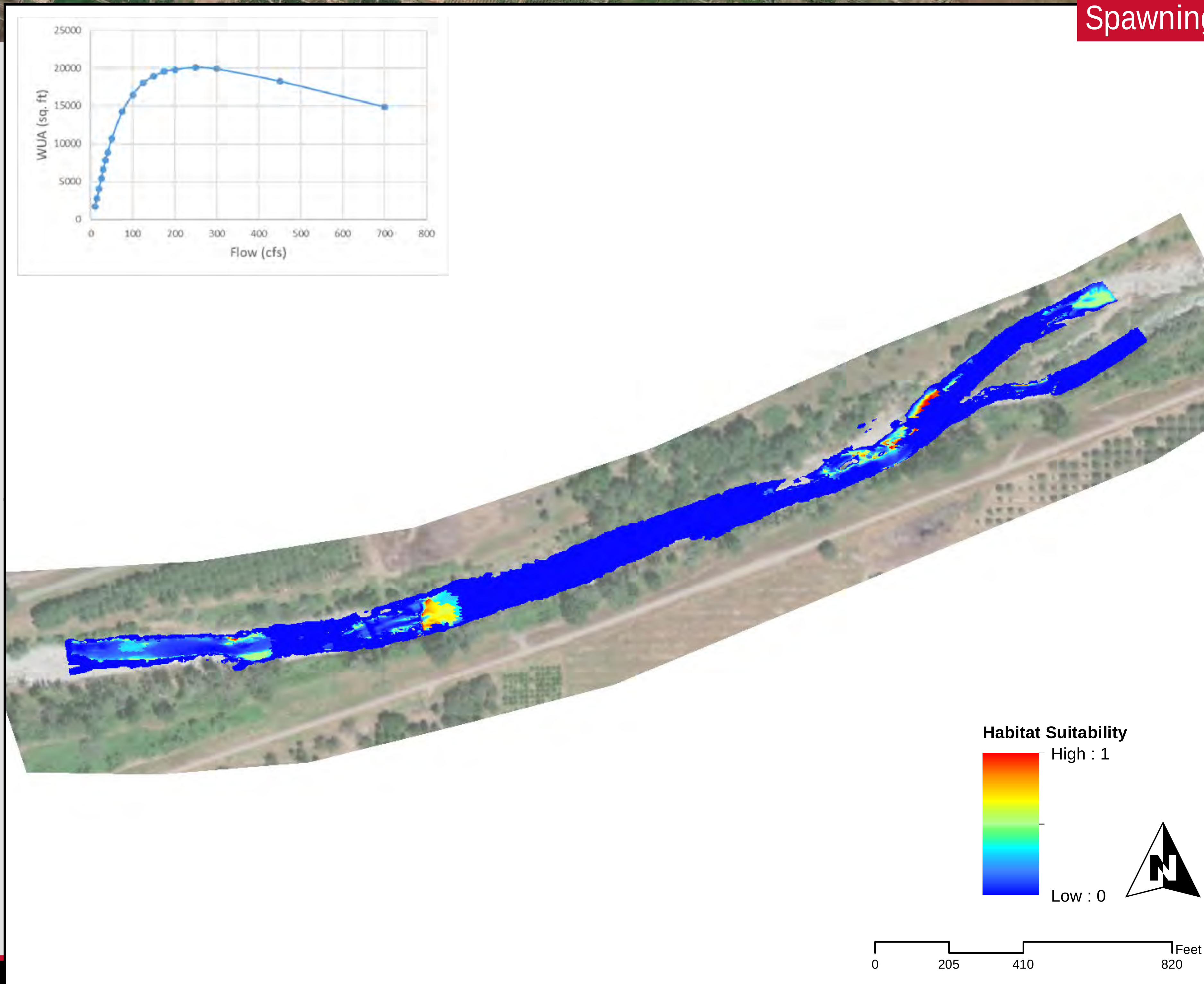
SSWD HDR

Fall-Run Chinook Salmon

Downstream Study Site 450 cfs



Spawning



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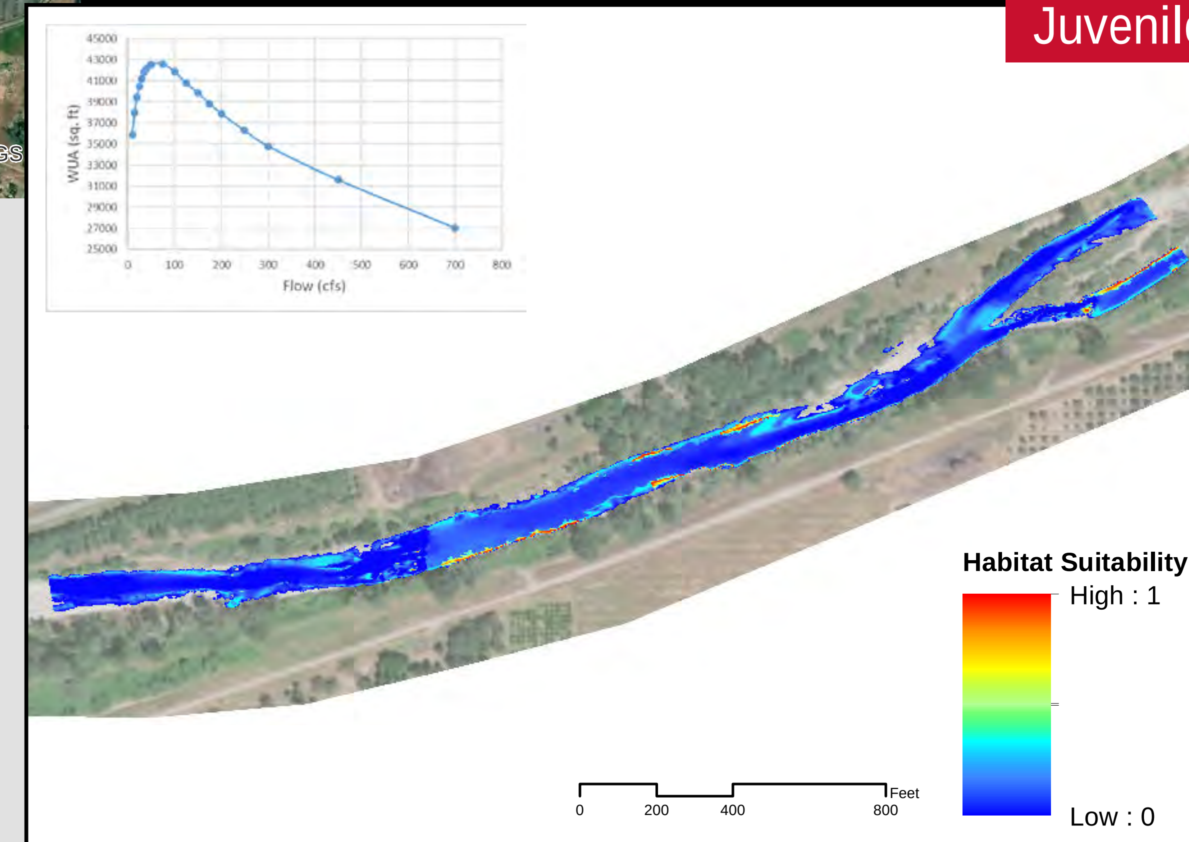

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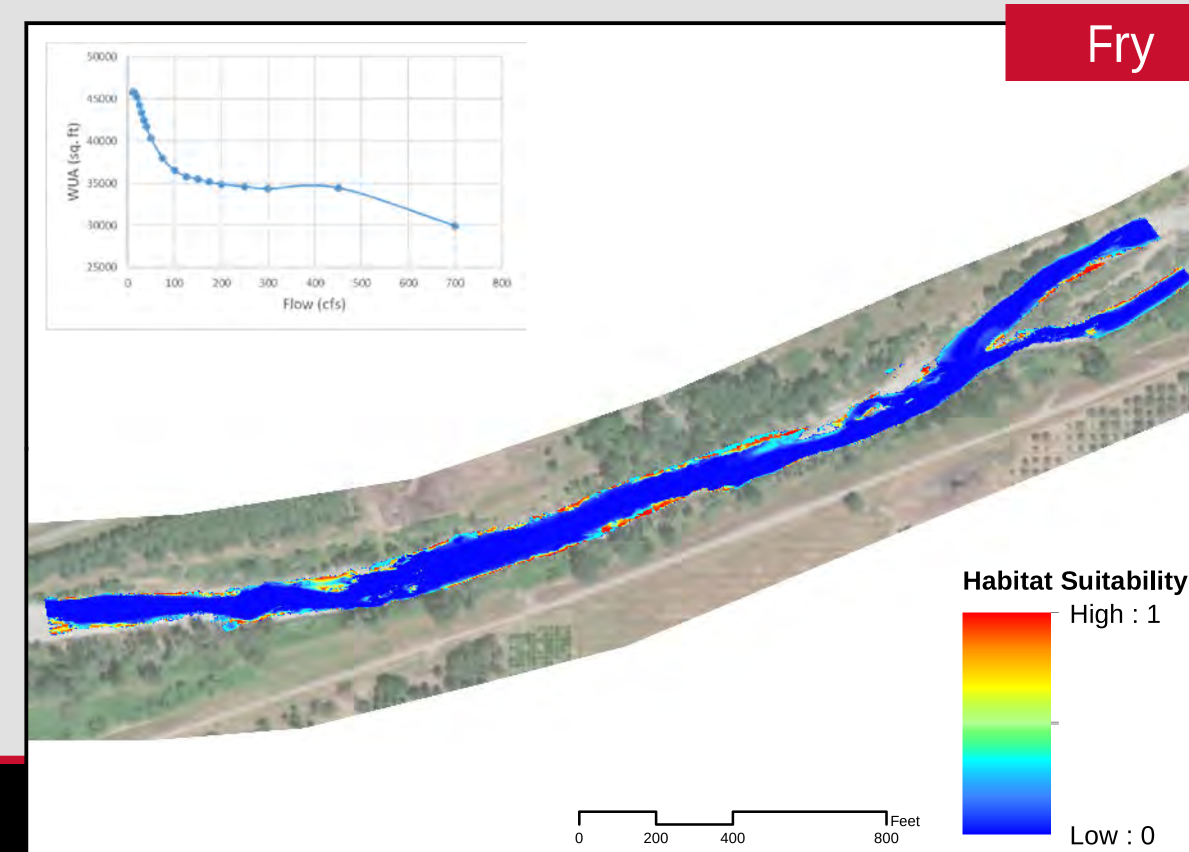

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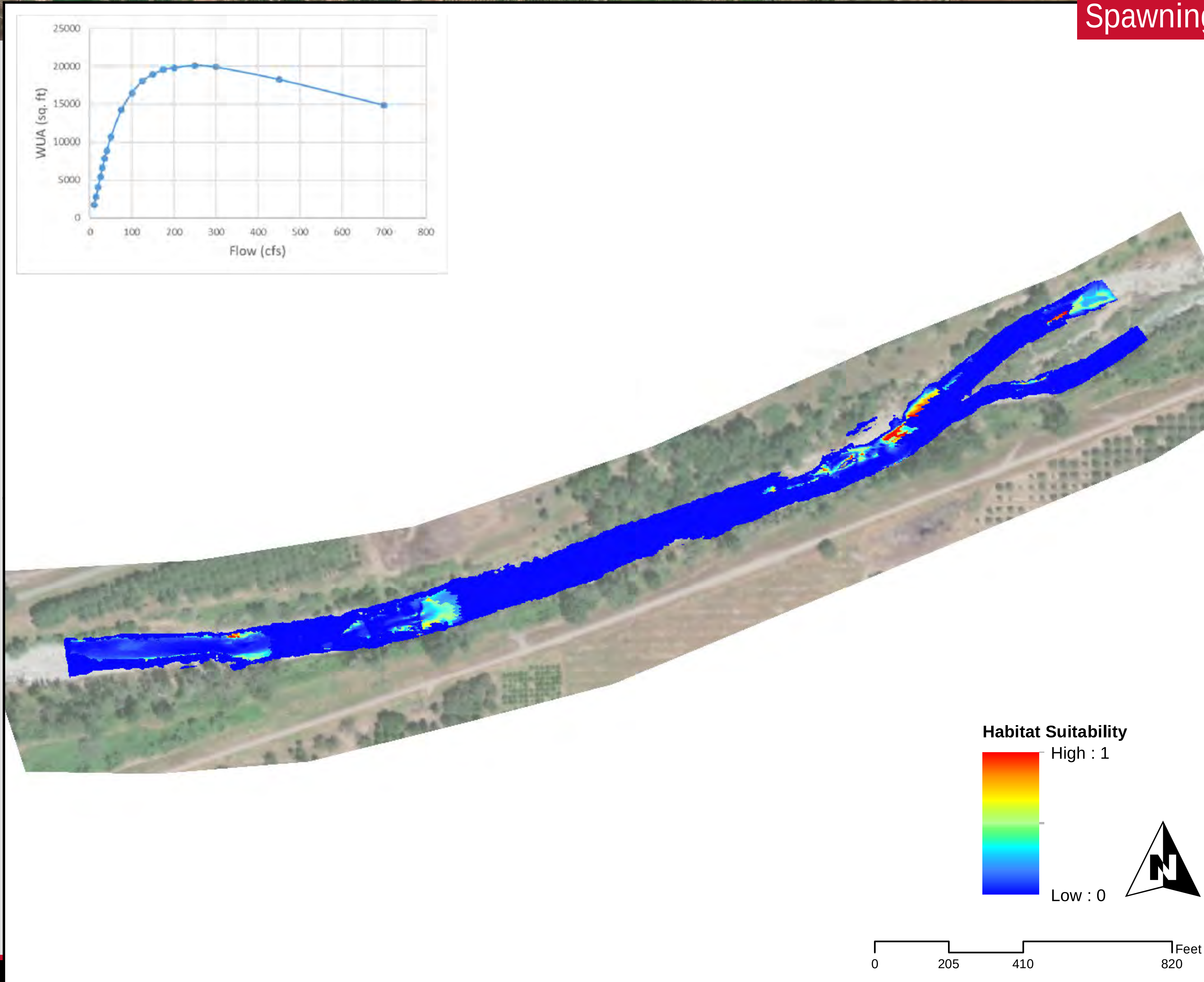
Lower Bear River - Instream Flow Study

SSWD HDR

Fall-Run Chinook Salmon
Downstream Study Site 700 cfs

Spawning



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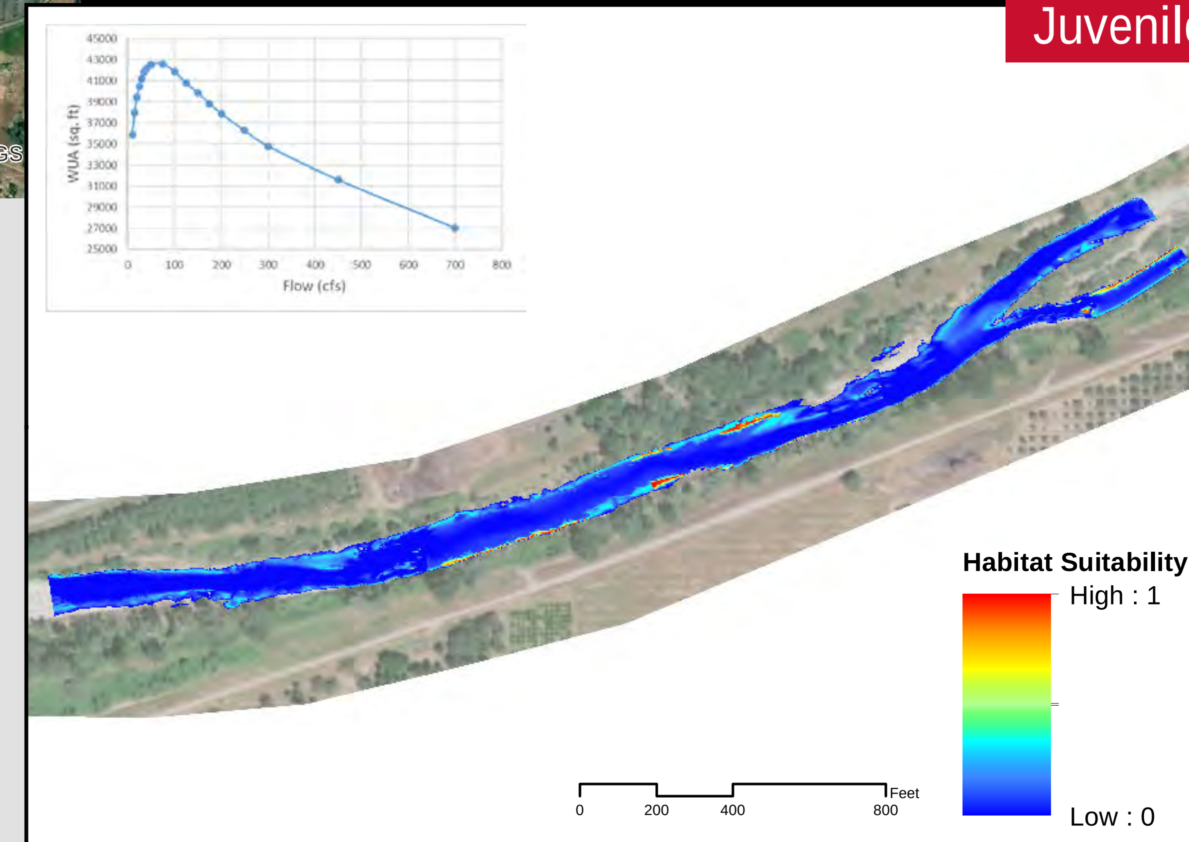

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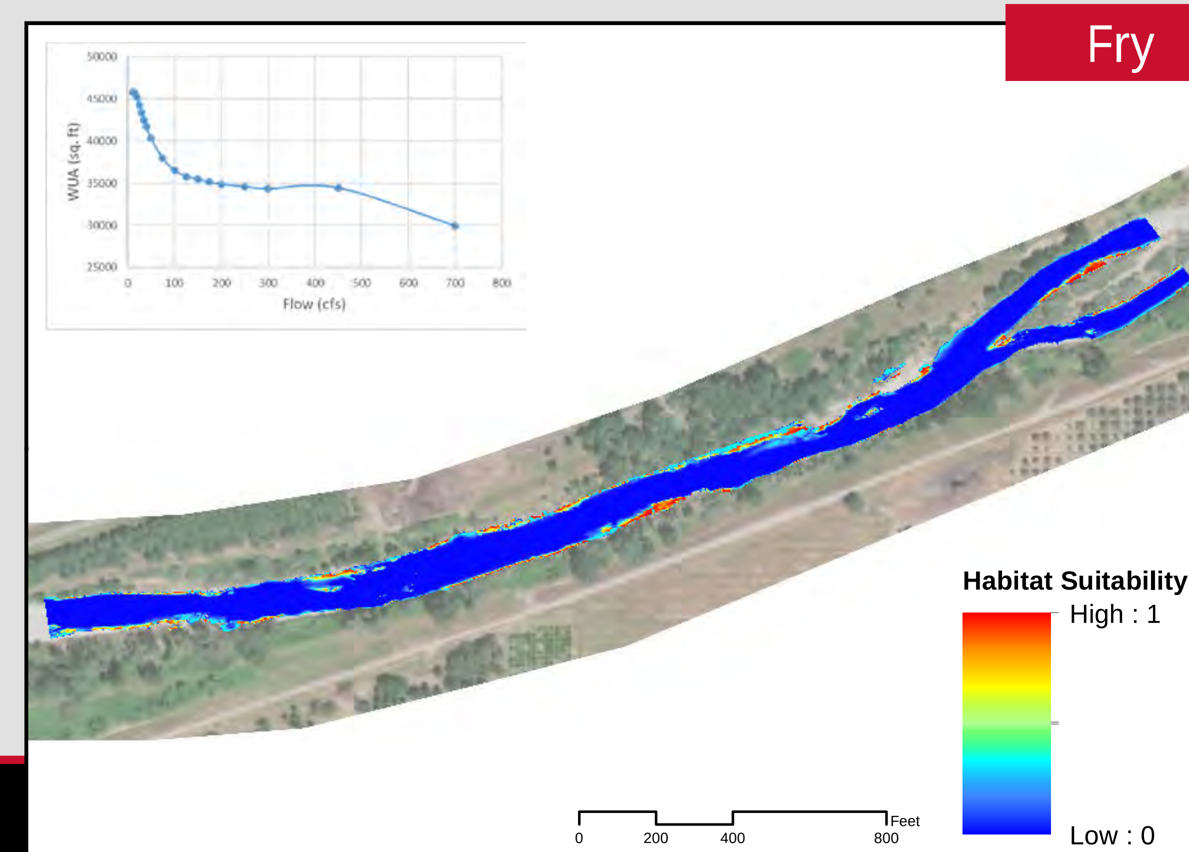
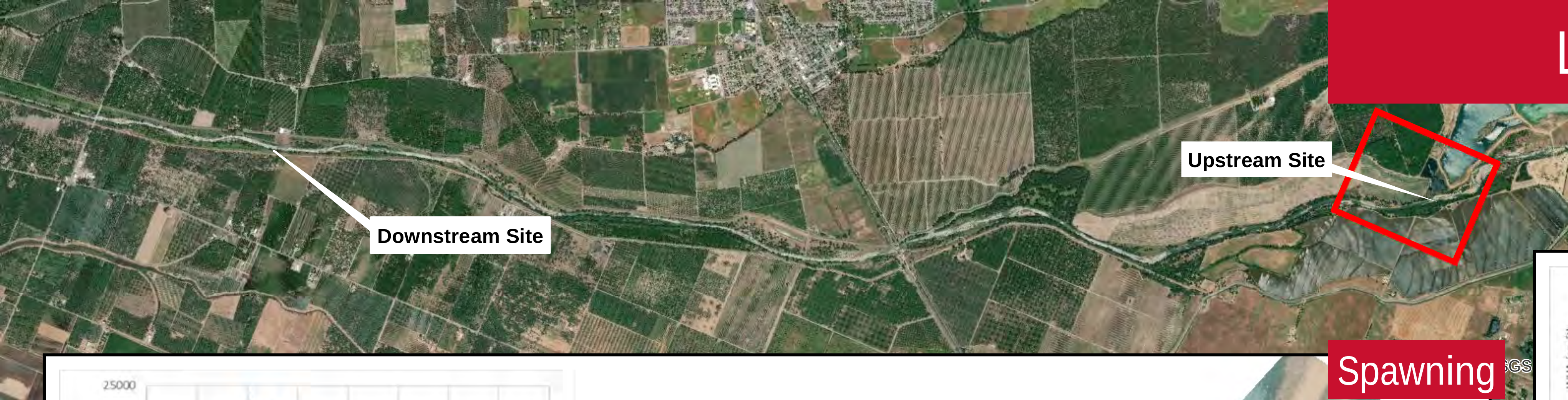


Lower Bear River - Instream Flow Study

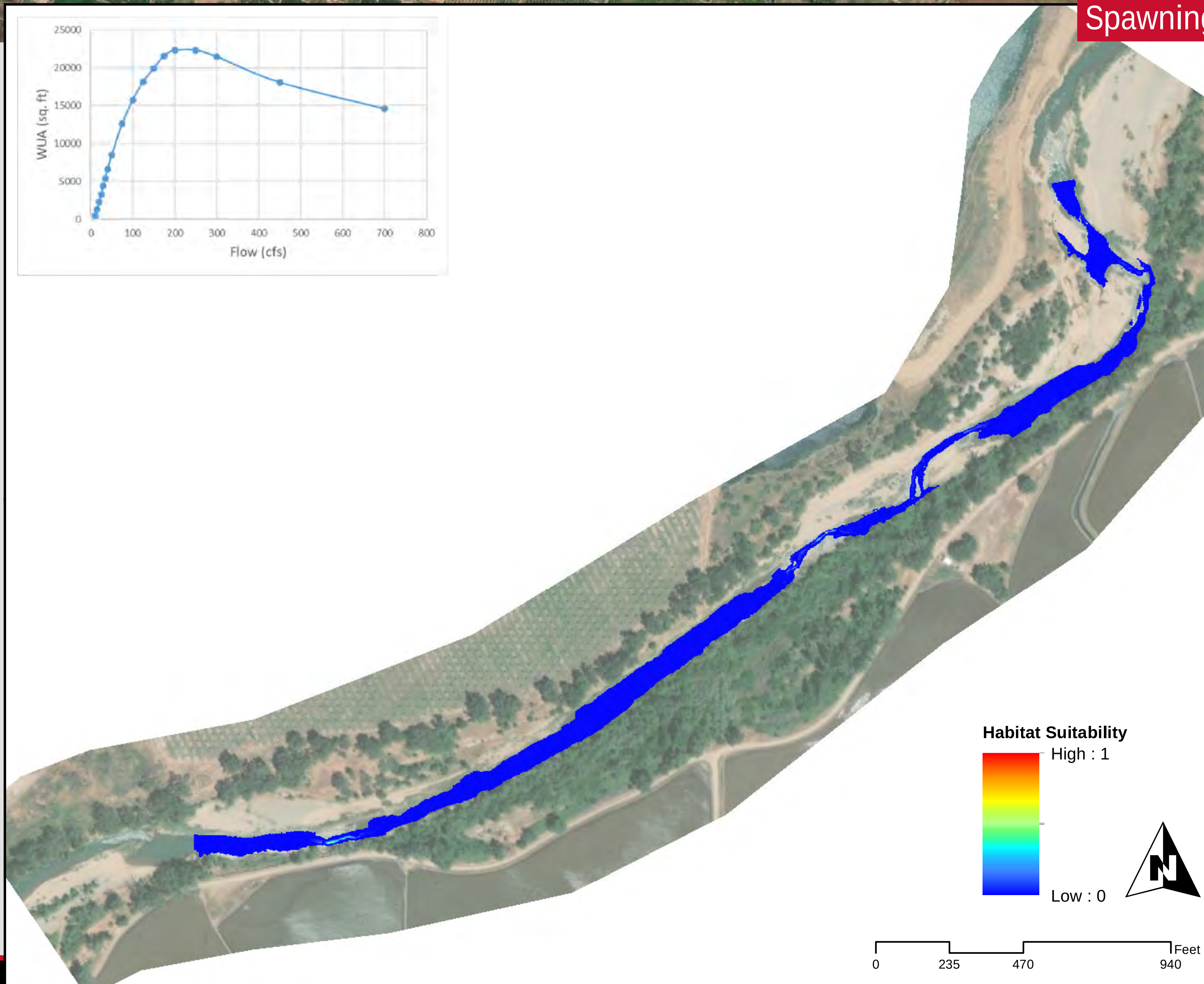
SSWD HDR

Steelhead

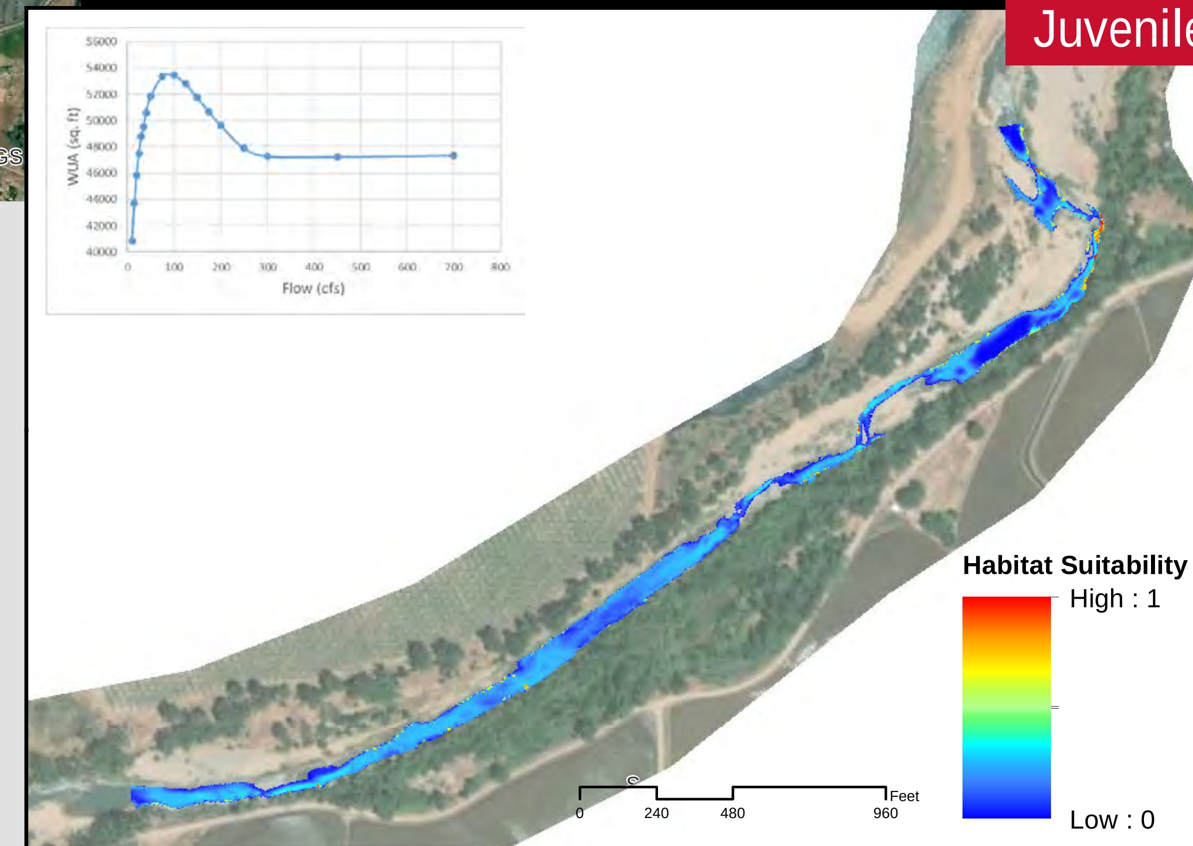
Upstream Study Site 10 cfs



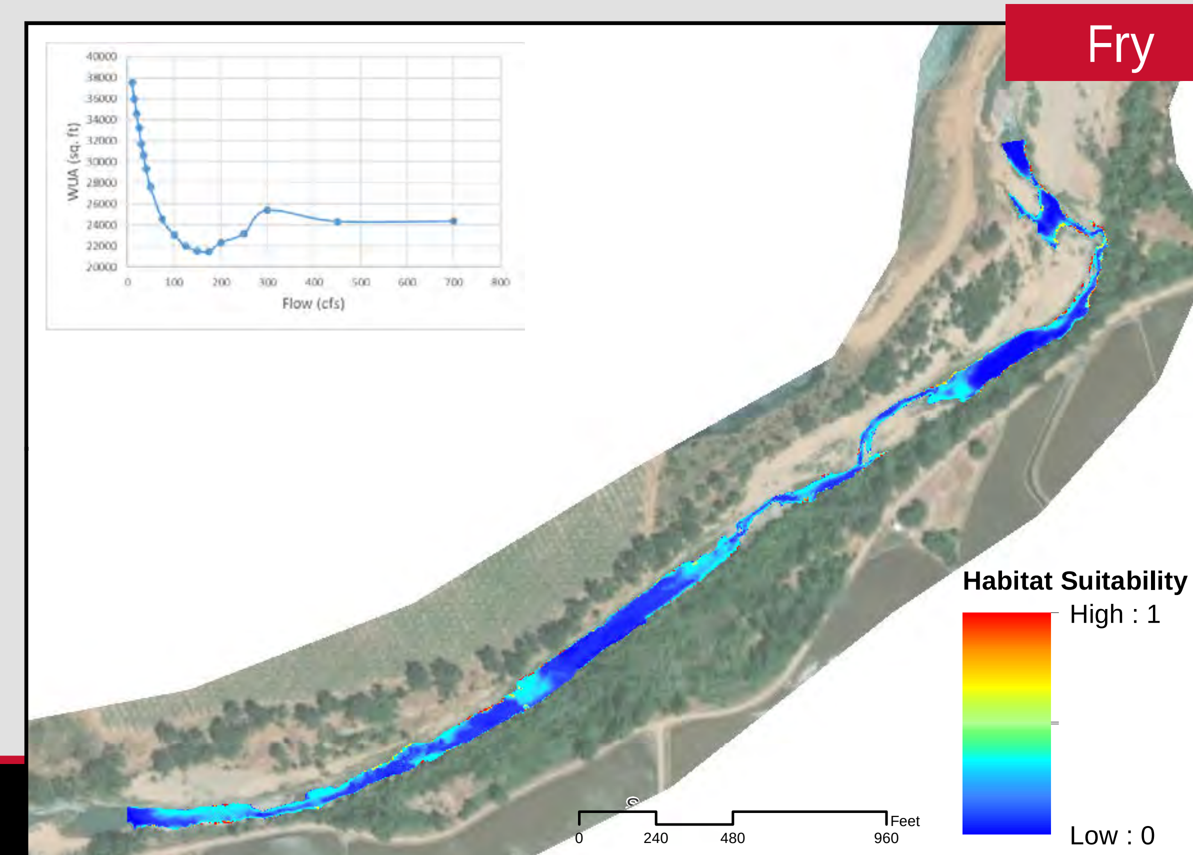
Spawning



Juvenile



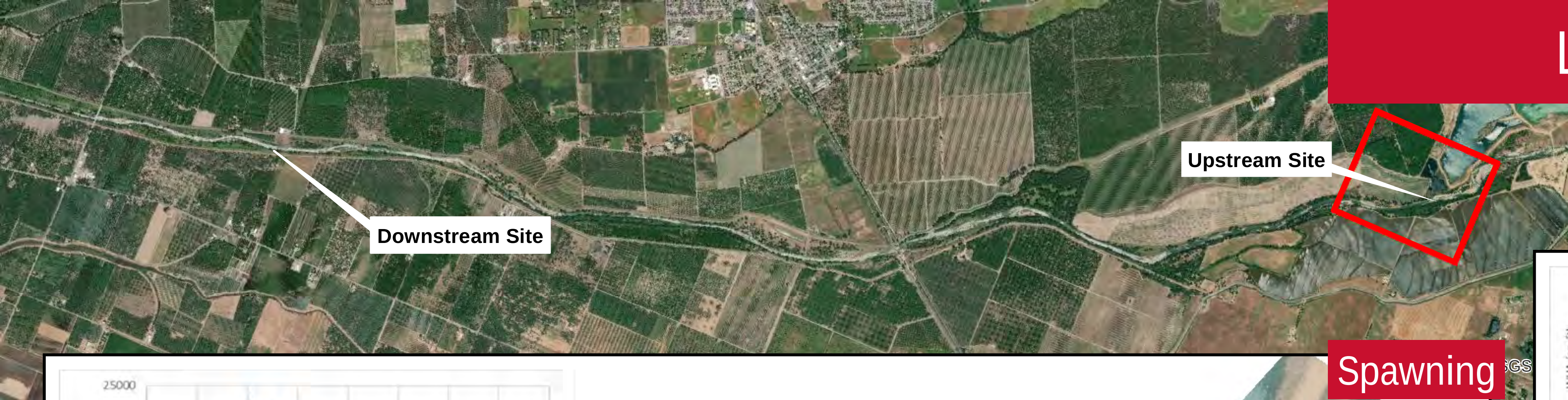
Fry

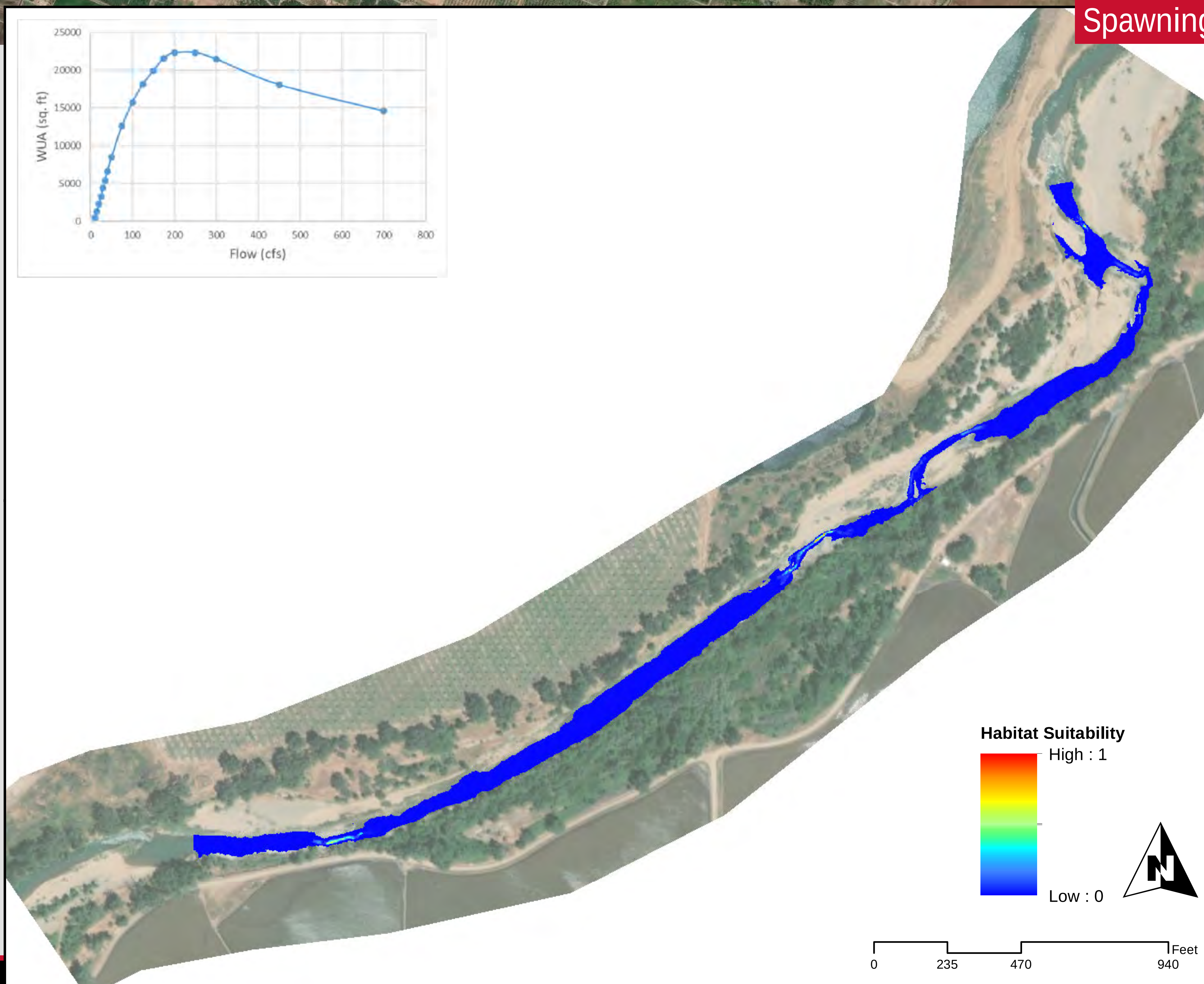


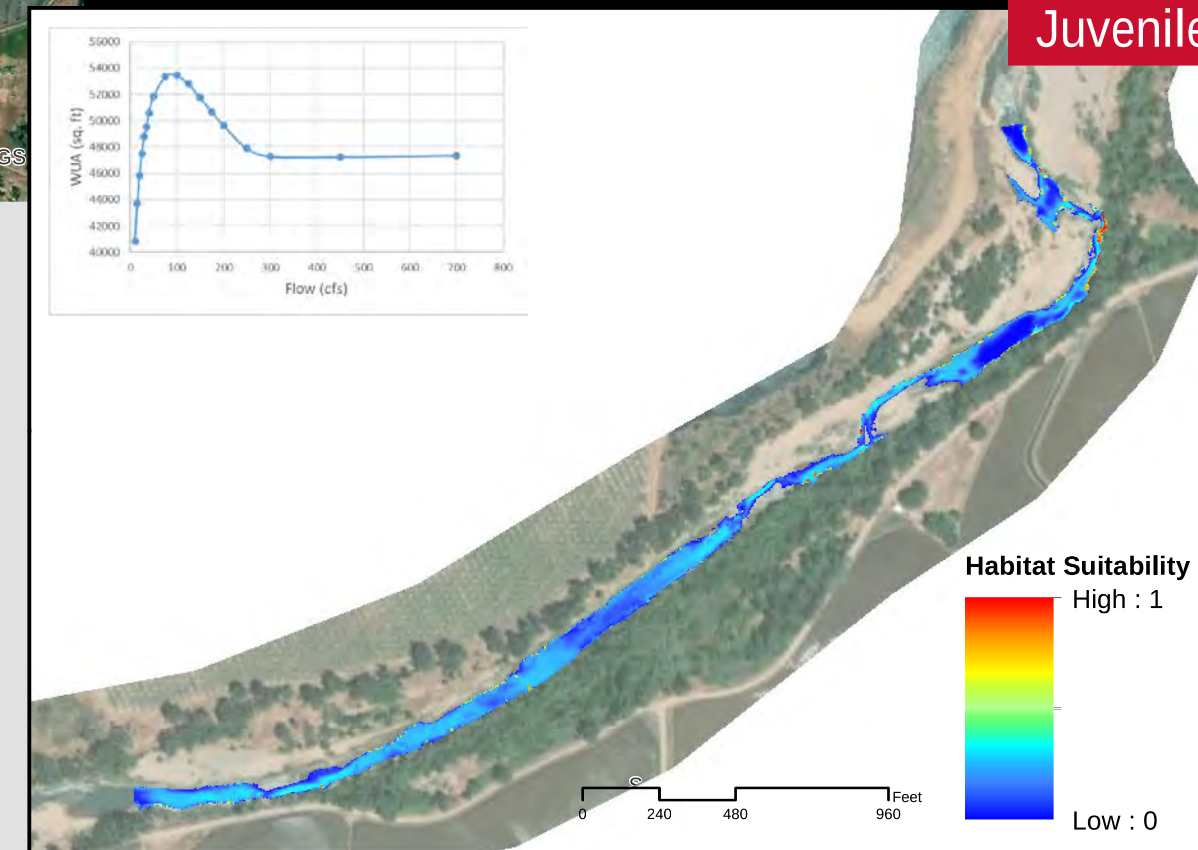
Lower Bear River - Instream Flow Study

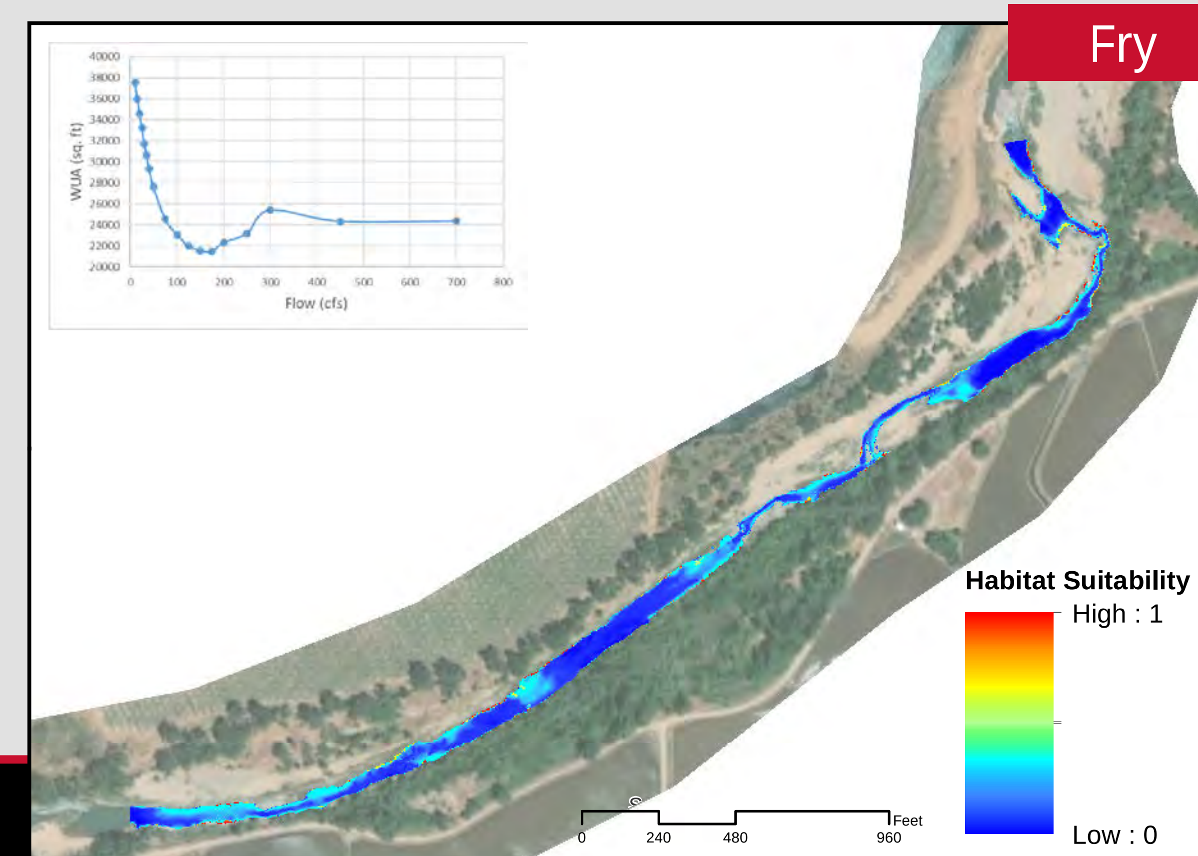
Steelhead

Upstream Study Site 15 cfs









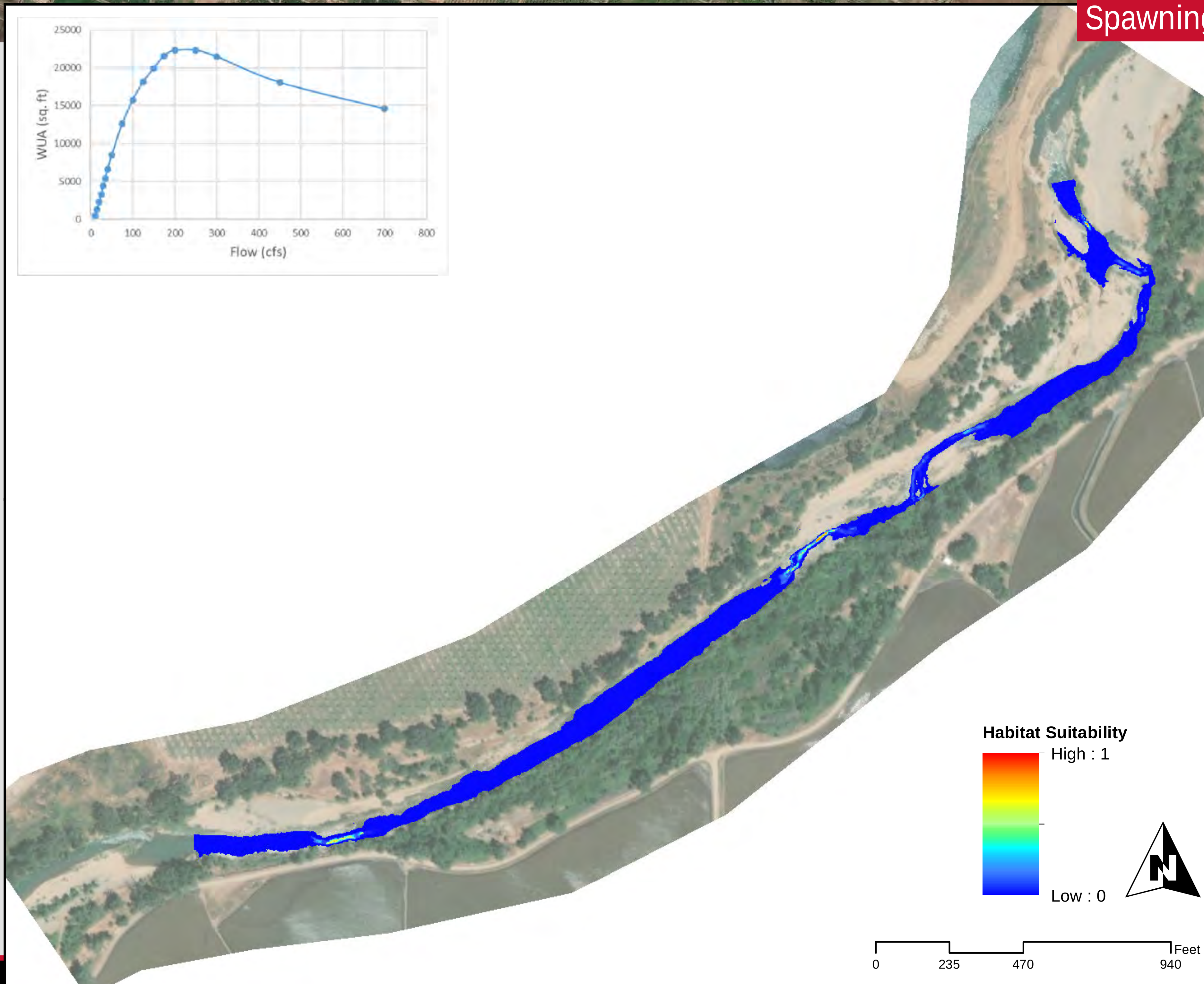
Lower Bear River - Instream Flow Study

SSWD HDR

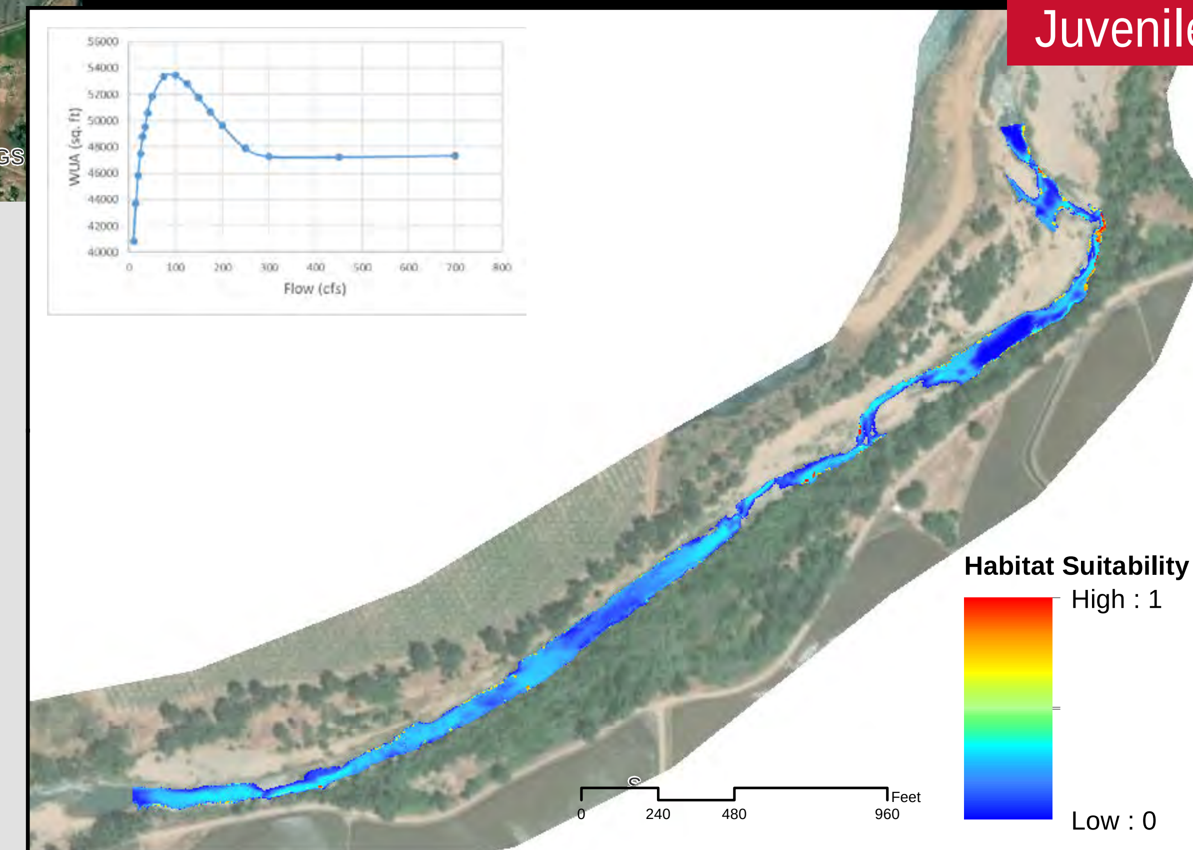
Steelhead

Upstream Study Site 20 cfs

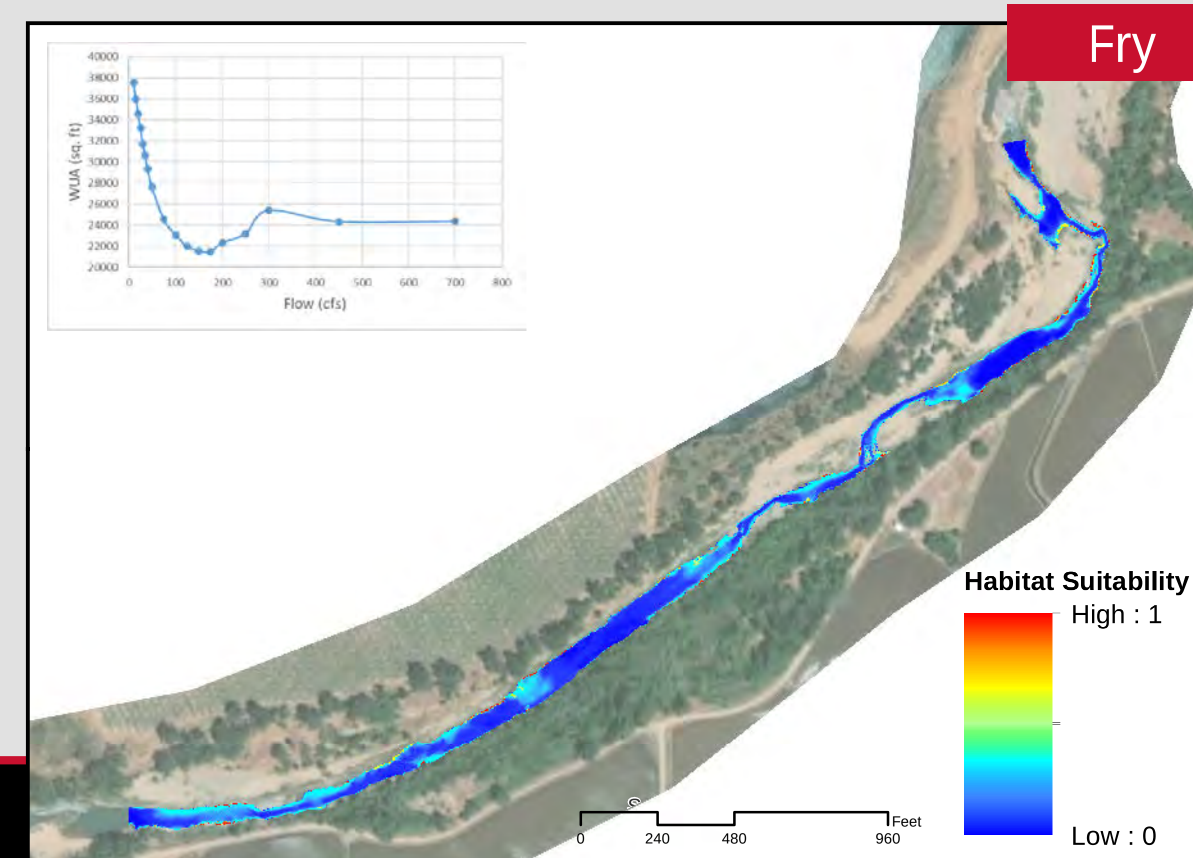
Spawning



Juvenile



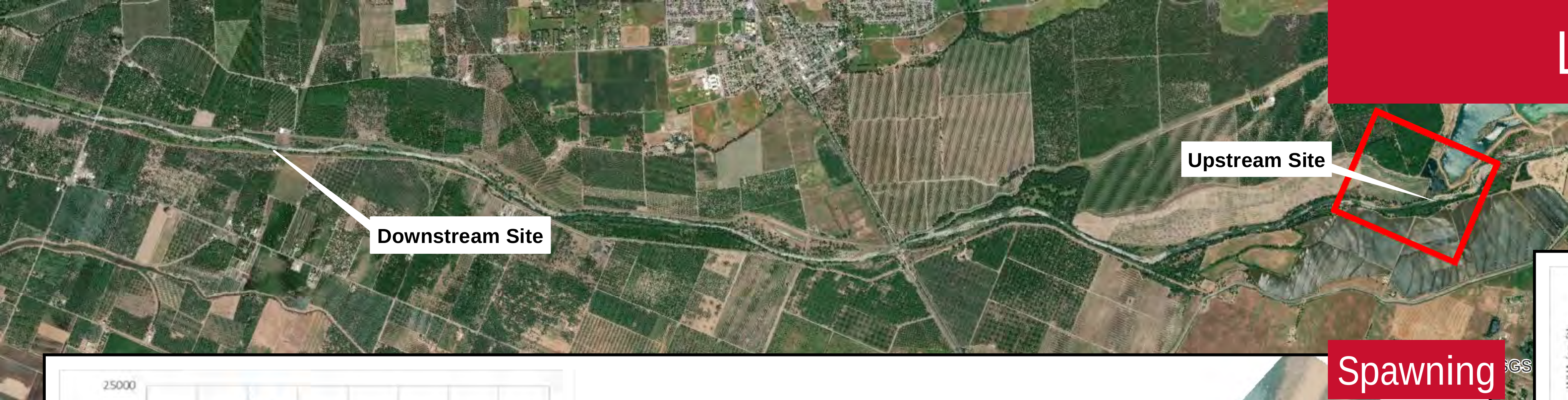
Fry

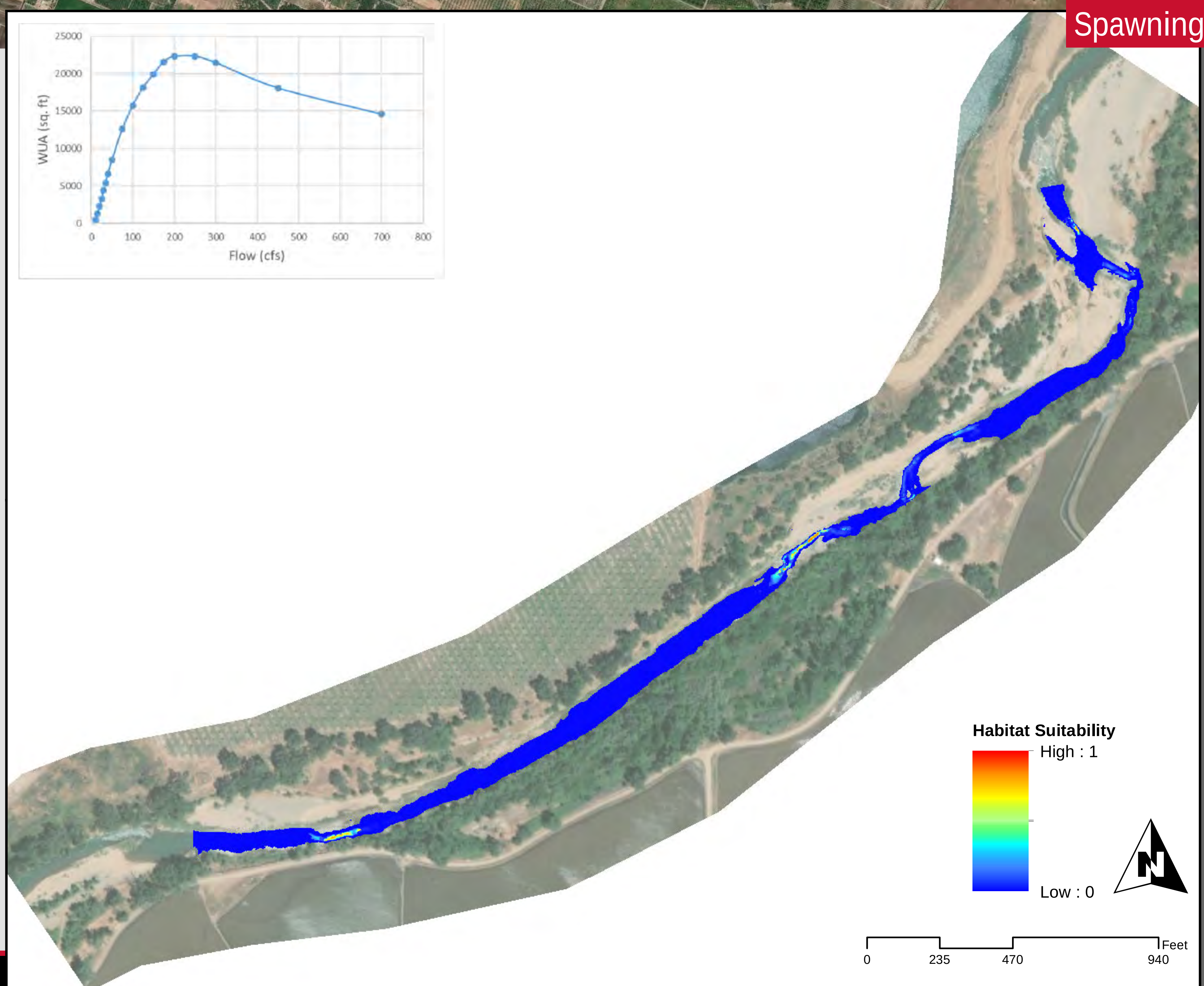


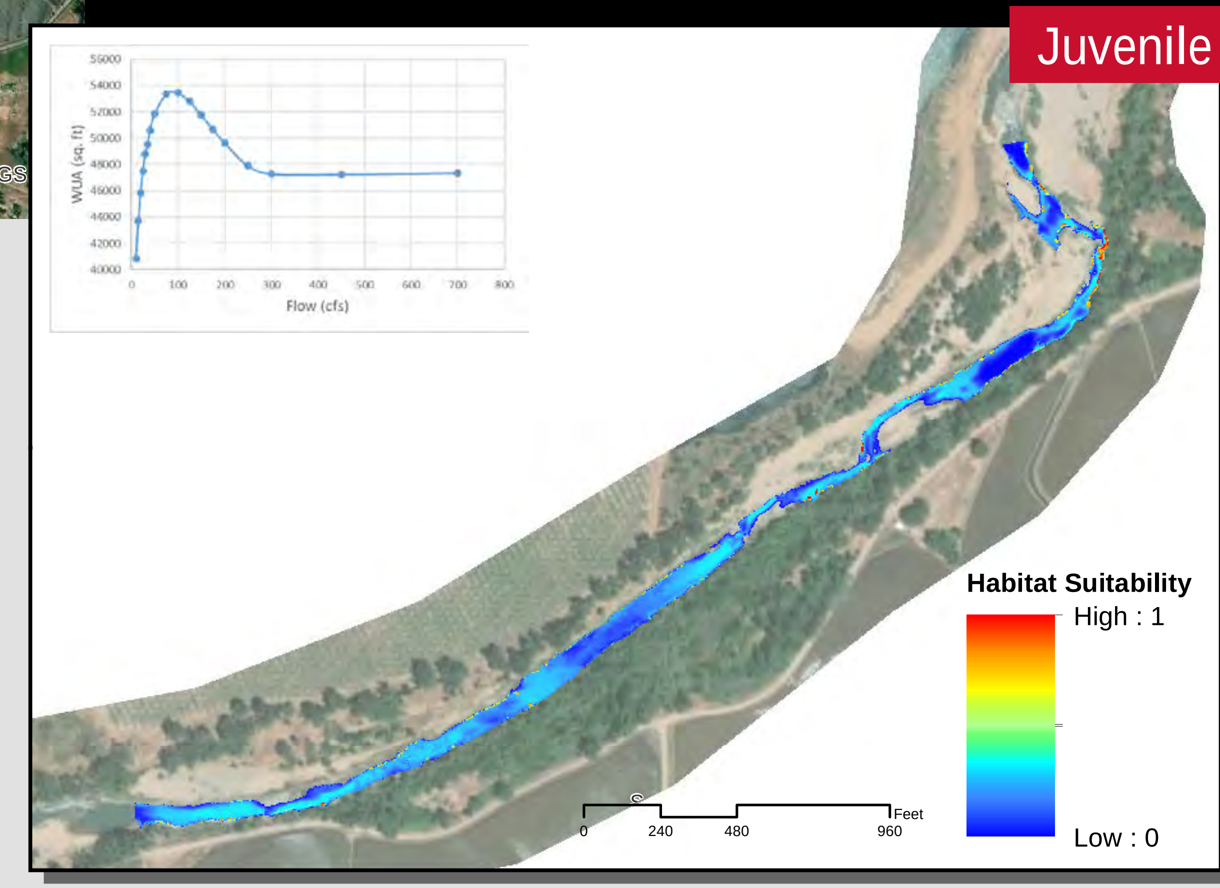
Lower Bear River - Instream Flow Study

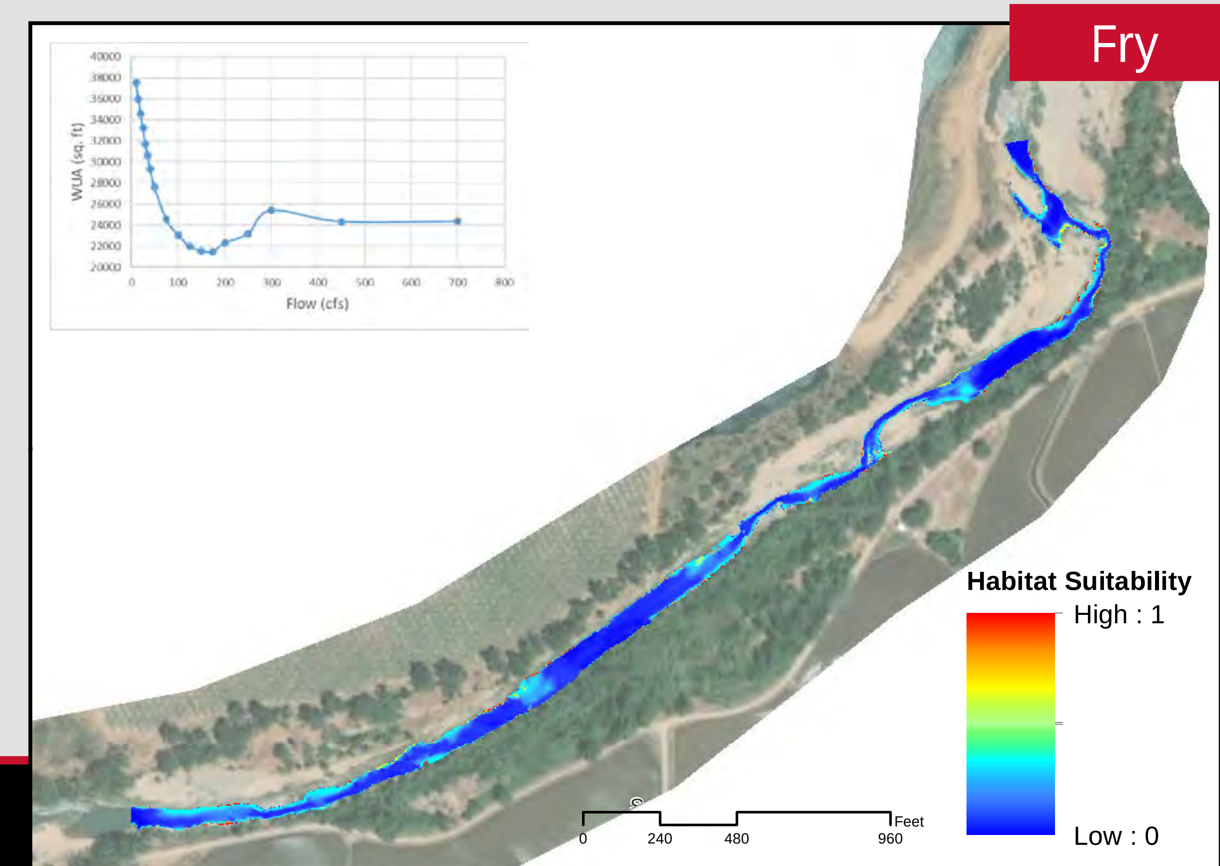
Steelhead

Upstream Study Site 25 cfs







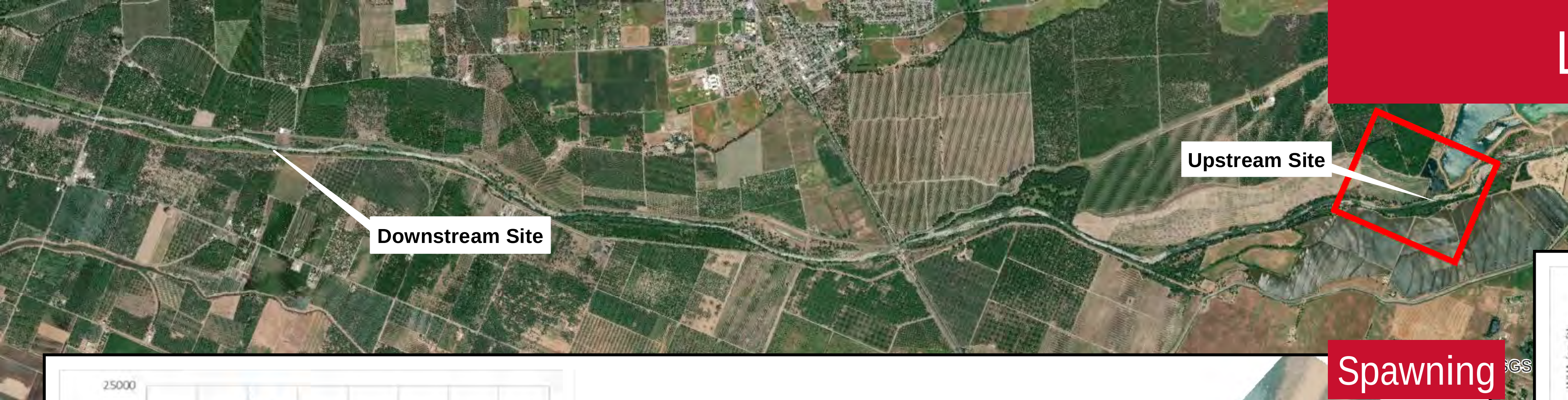


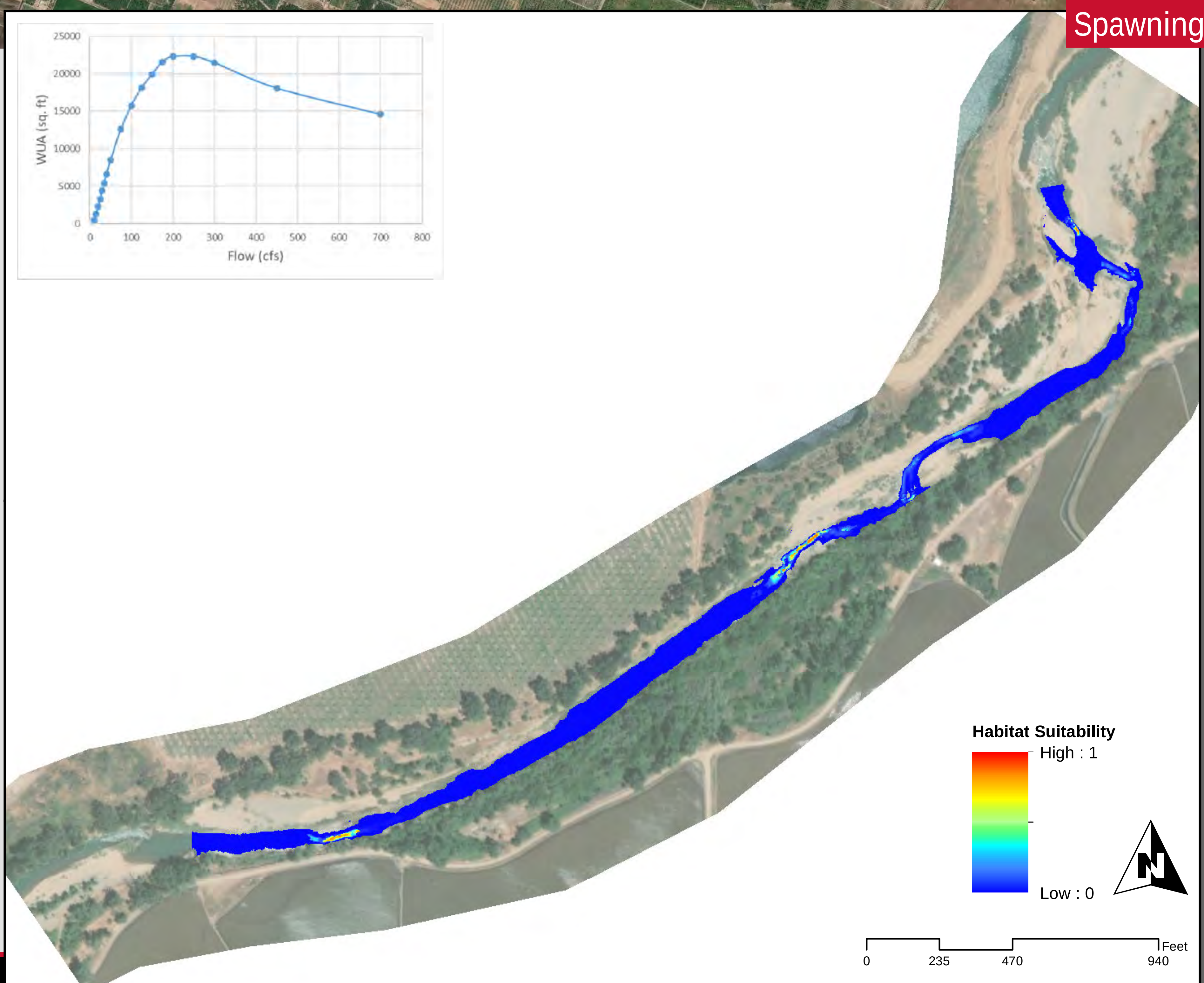
Lower Bear River - Instream Flow Study

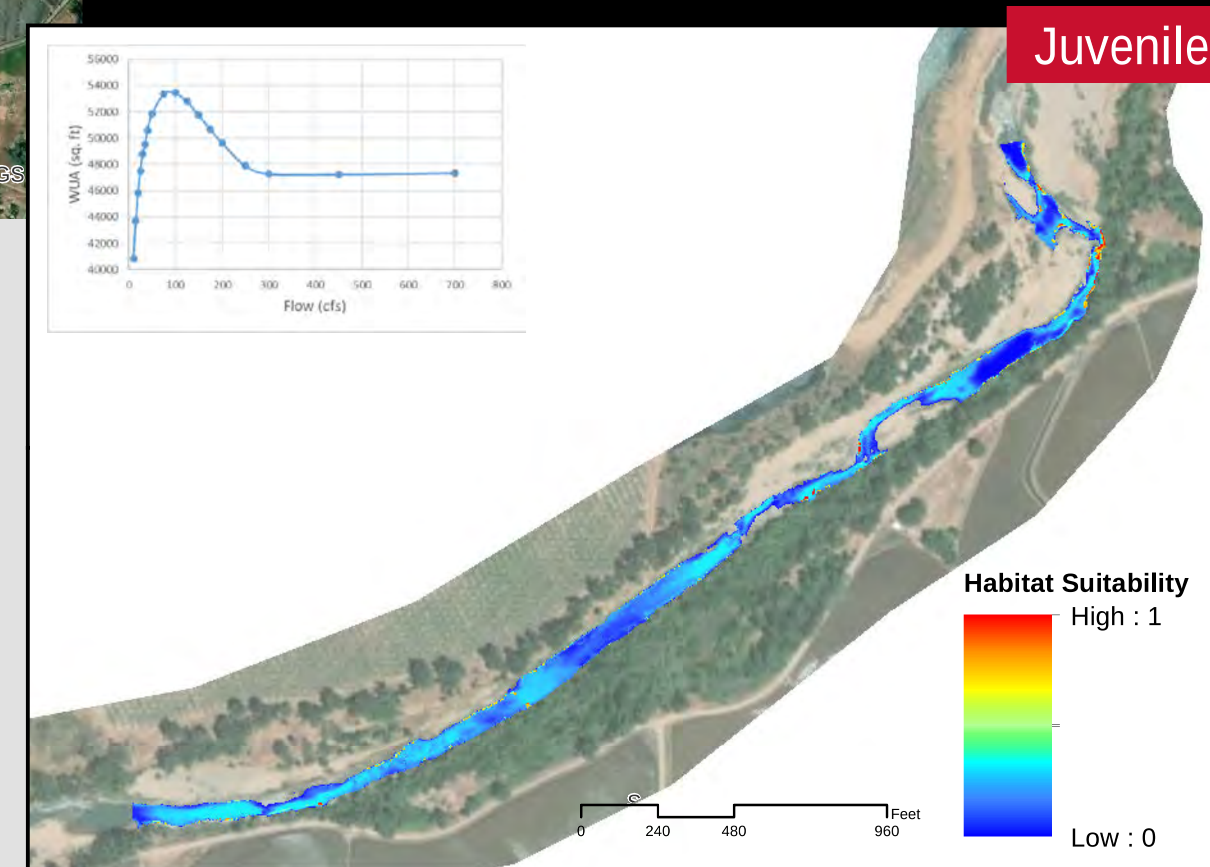
SSWD HDR

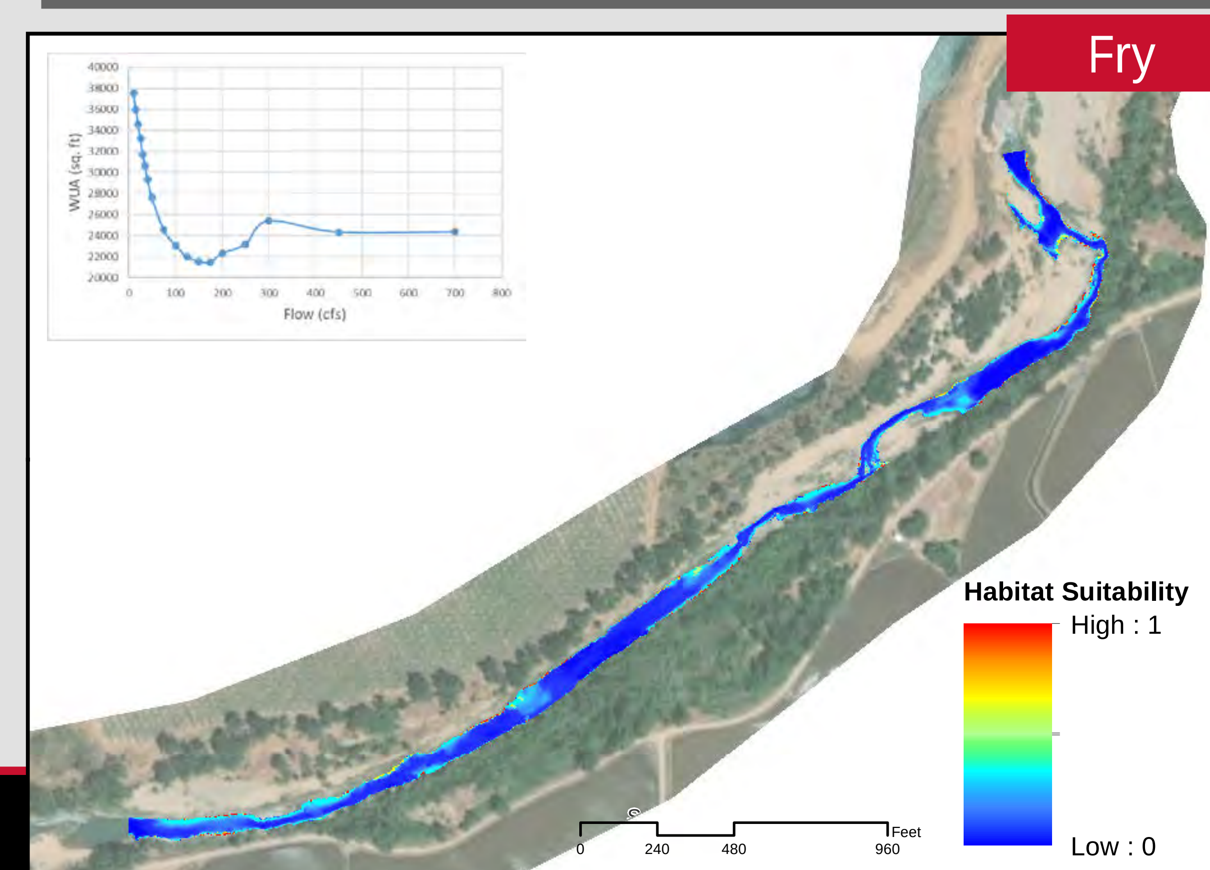
Steelhead

Upstream Study Site 30 cfs

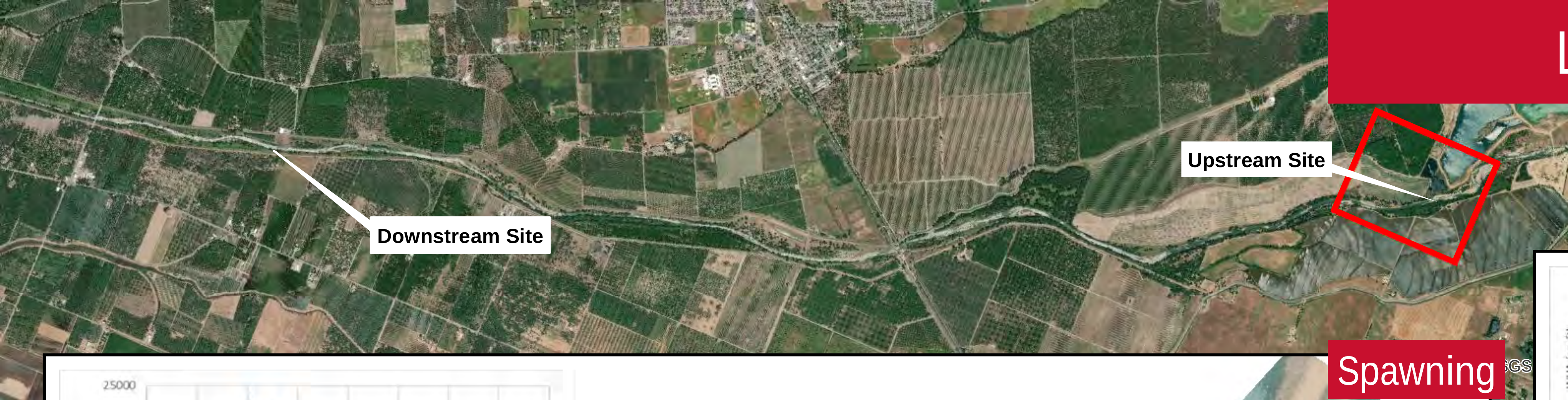






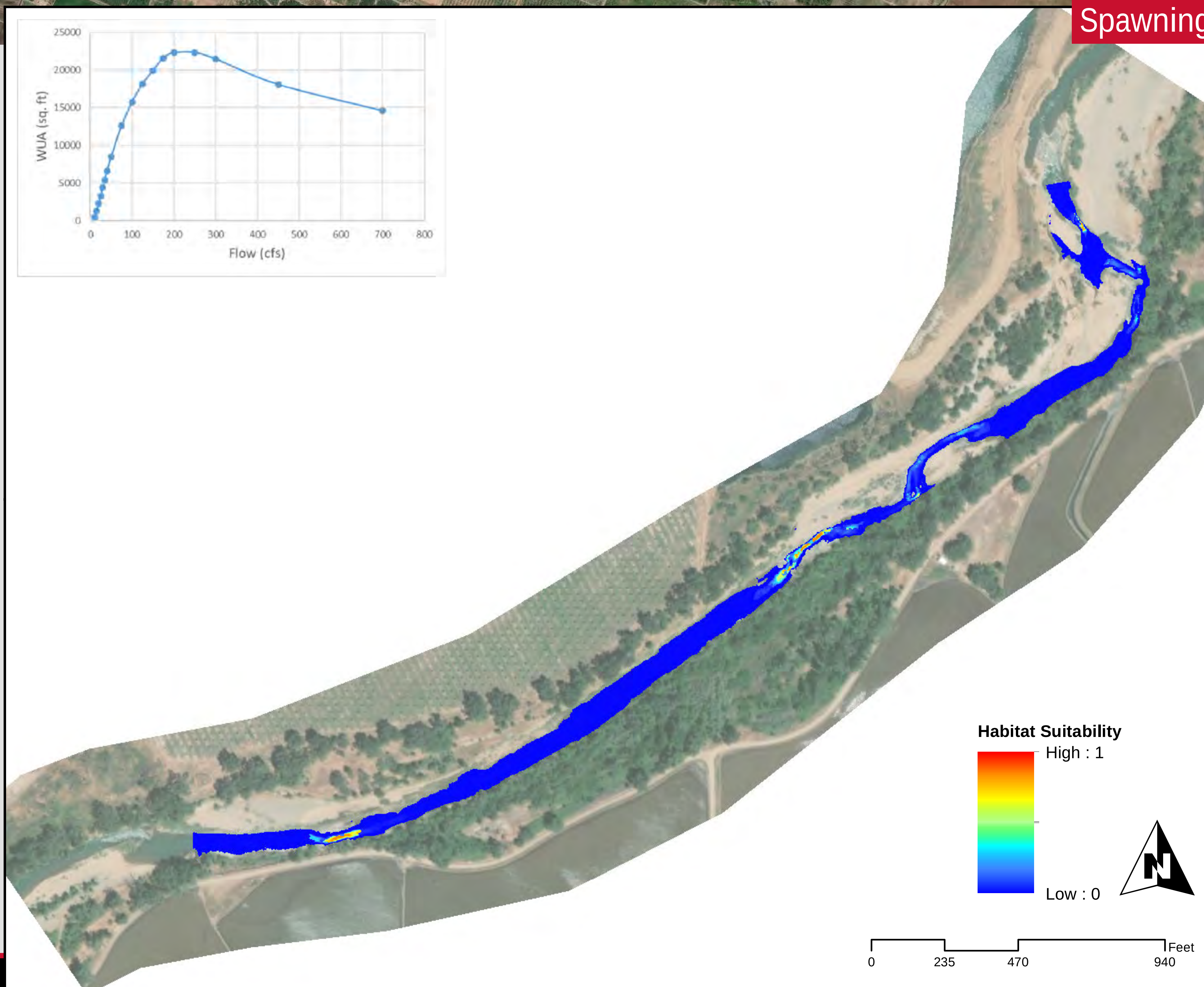


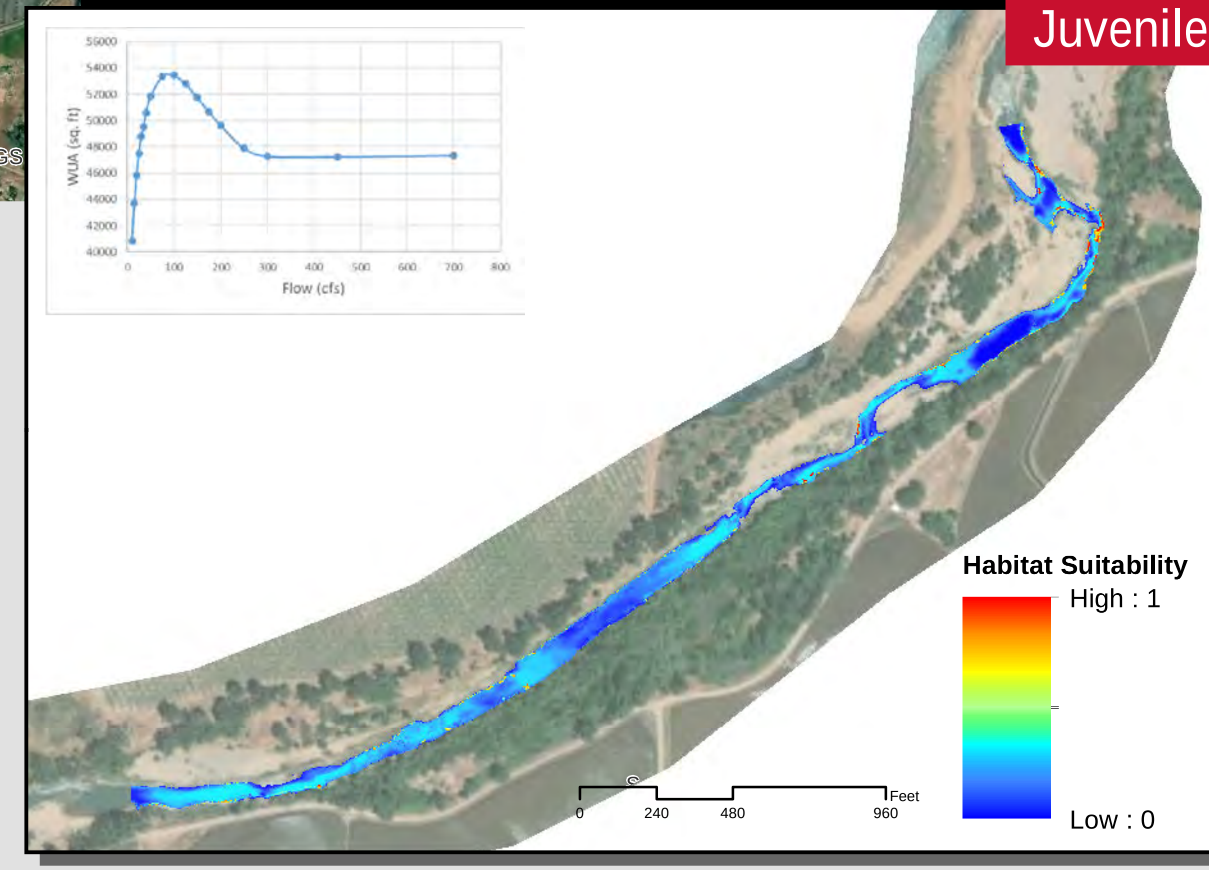
Lower Bear River - Instream Flow Study

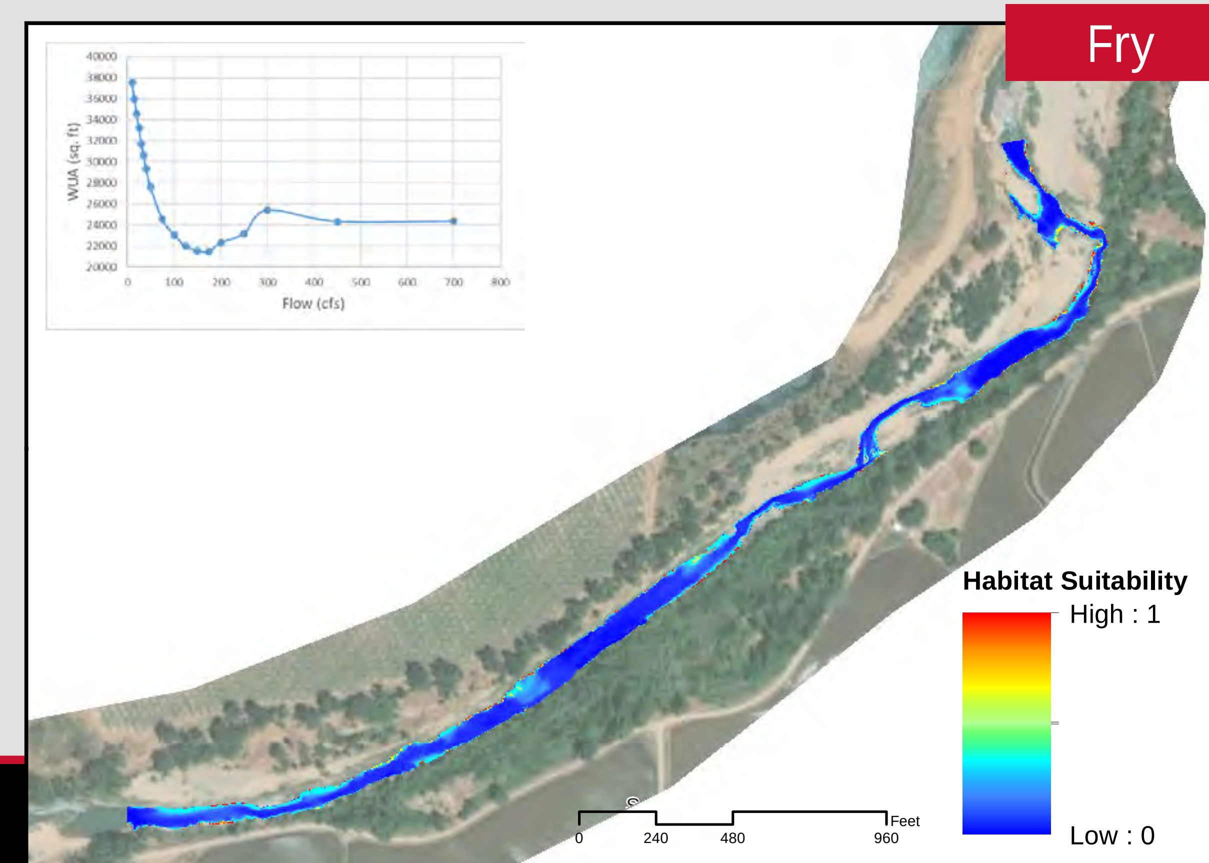


Steelhead

Upstream Study Site 35 cfs





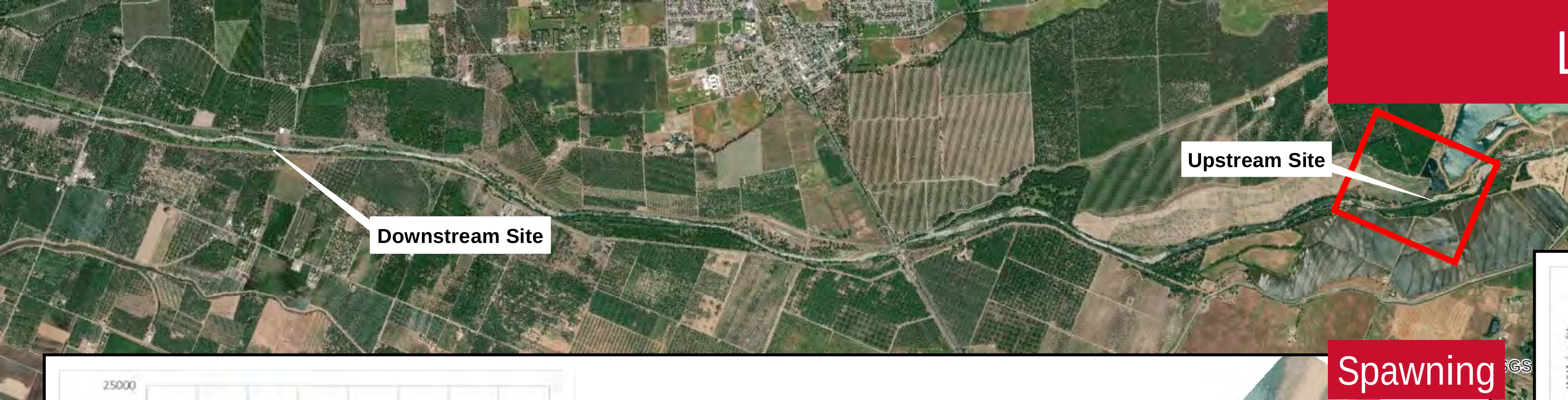


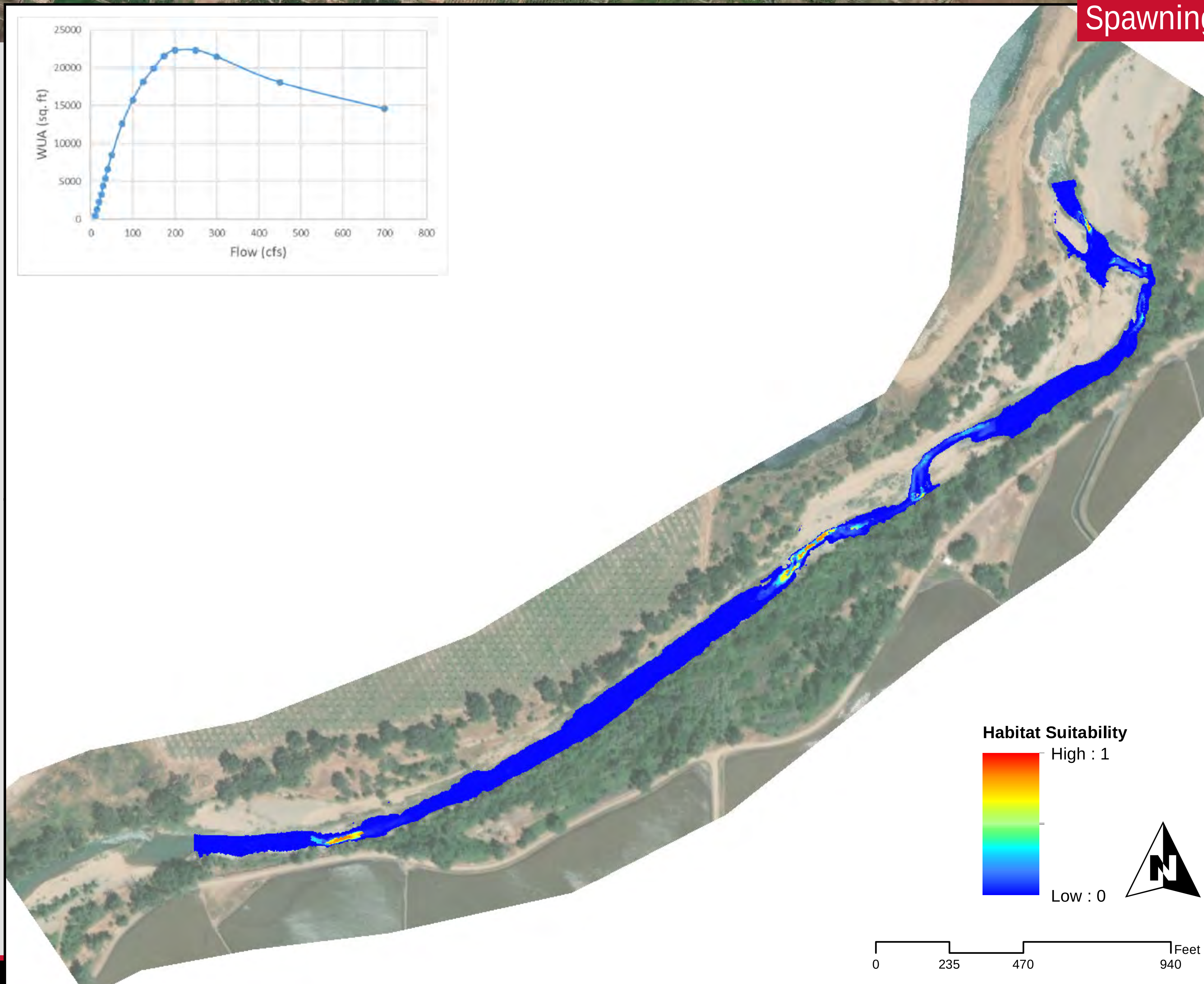
Lower Bear River - Instream Flow Study

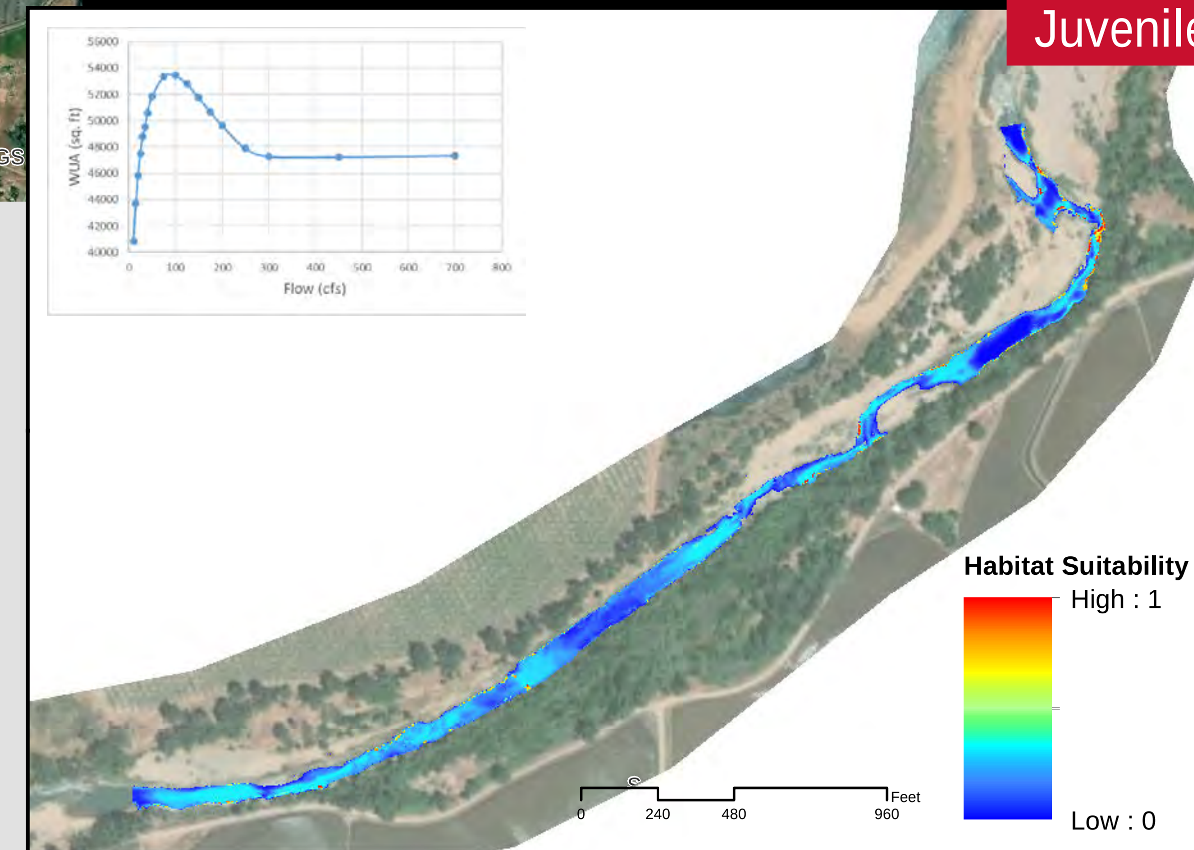
SSWD HDR

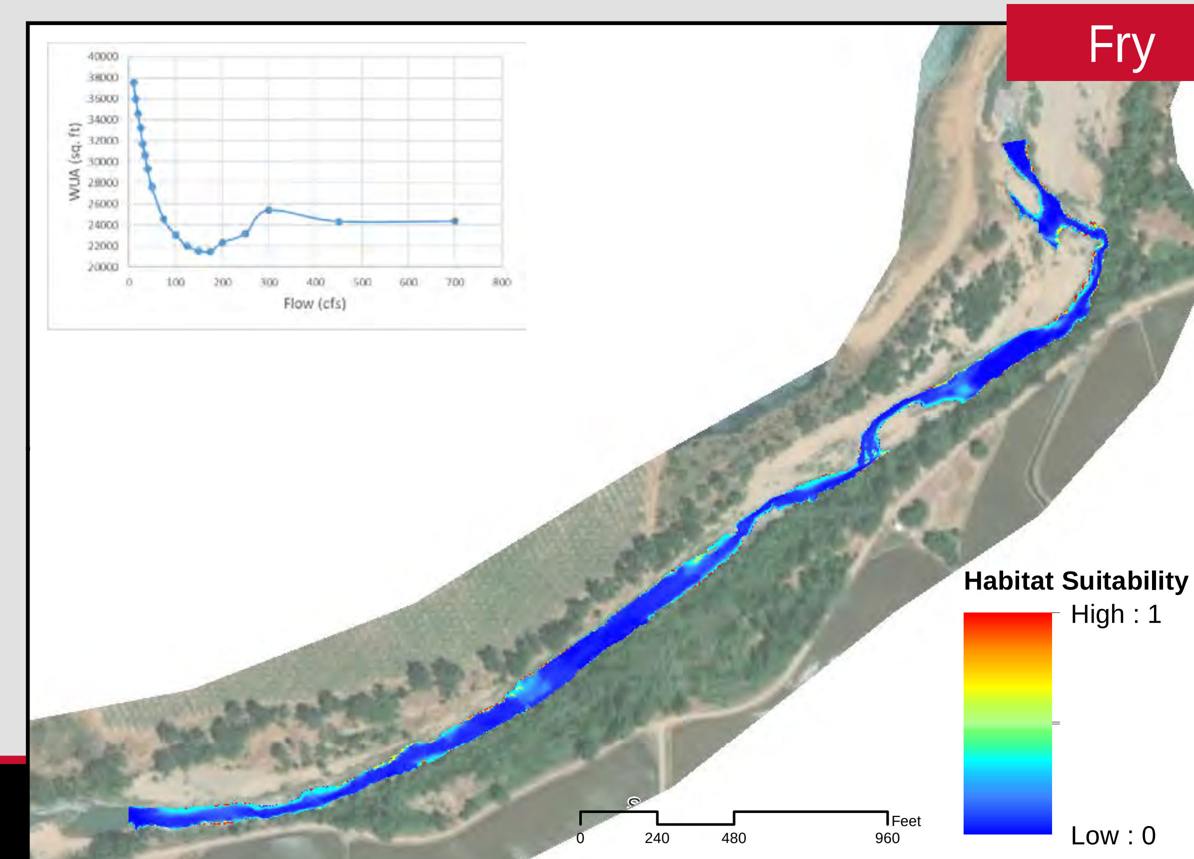
Steelhead

Upstream Study Site 40 cfs







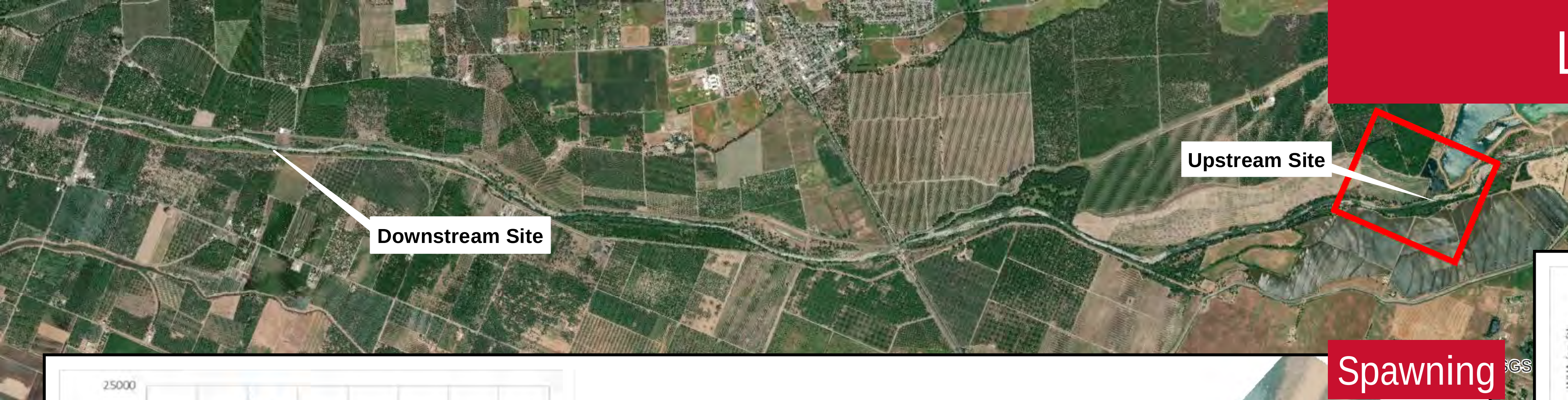


Lower Bear River - Instream Flow Study

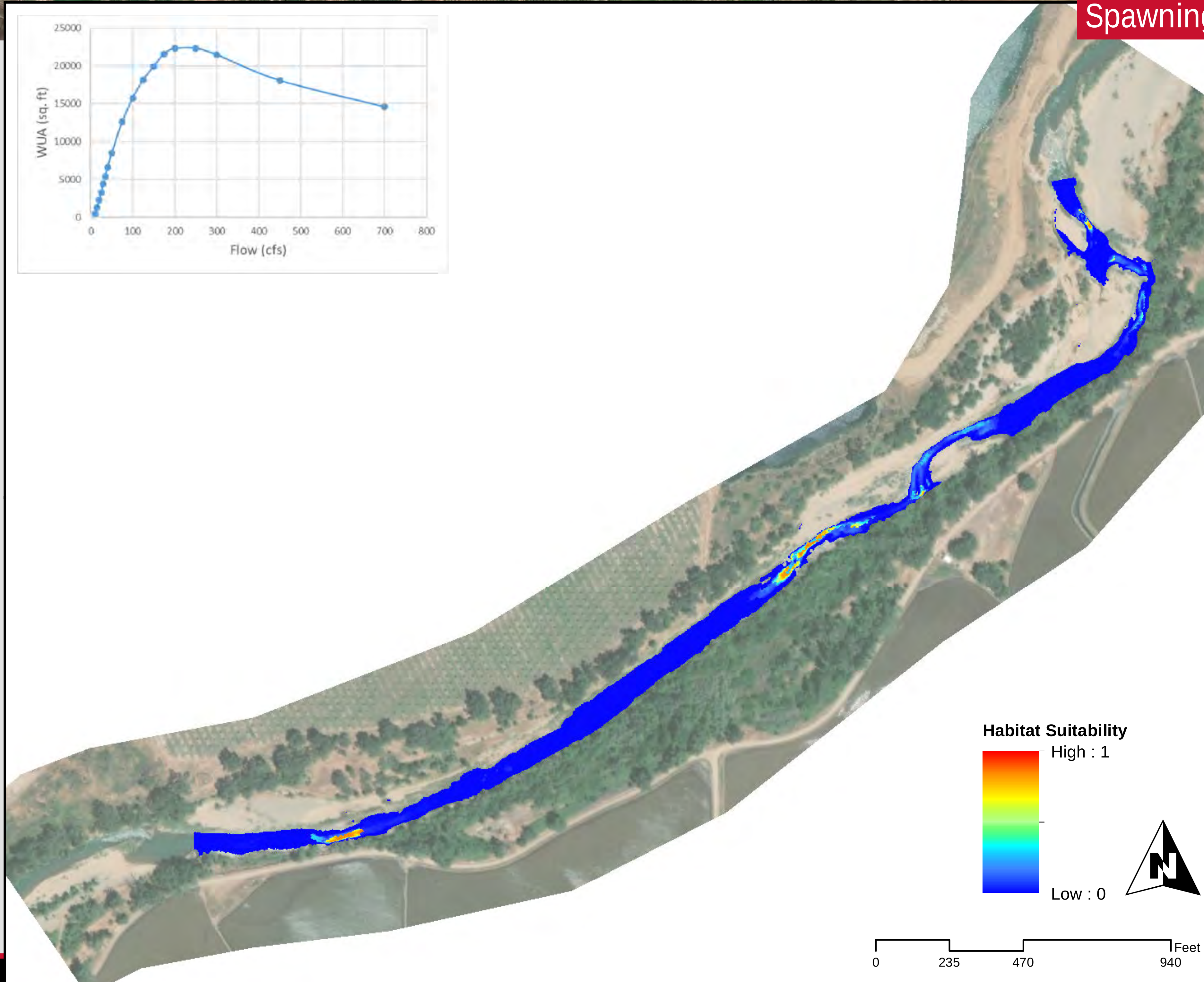
SSWD HDR

Steelhead

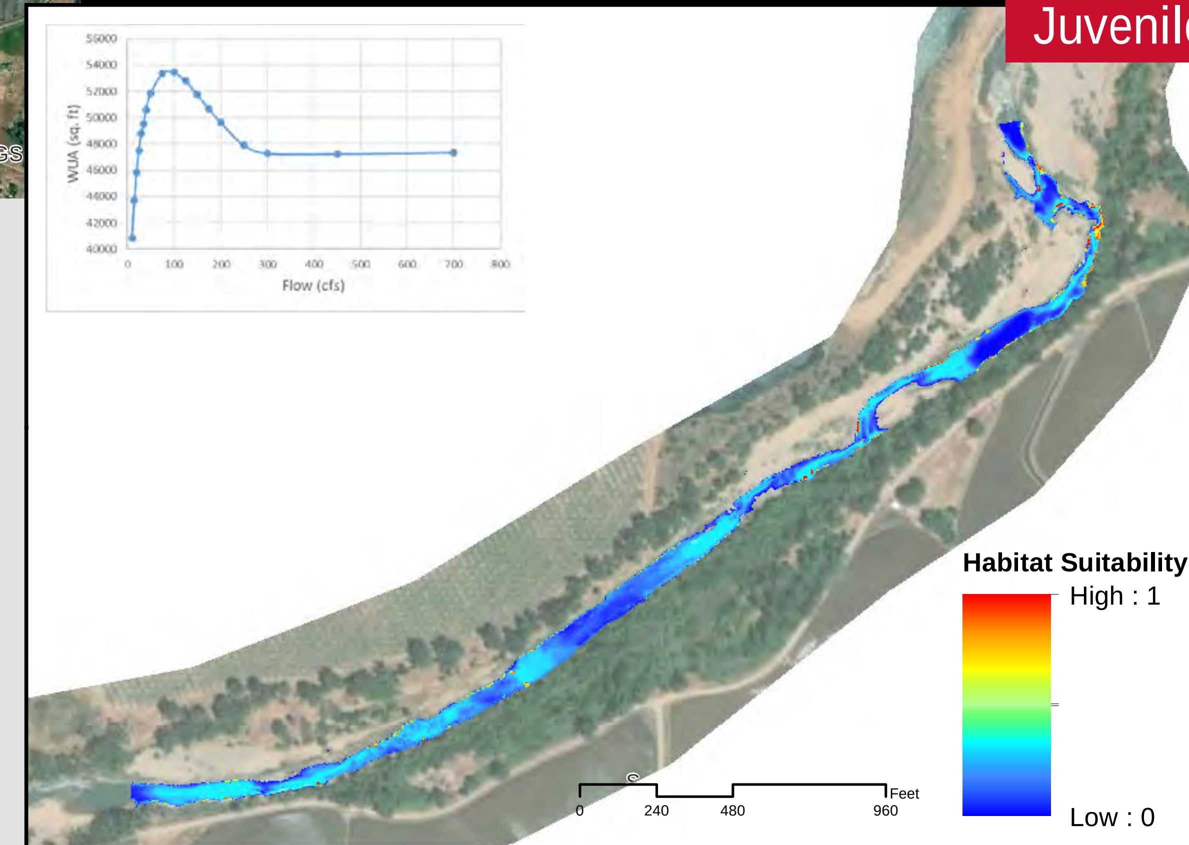
Upstream Study Site 50 cfs



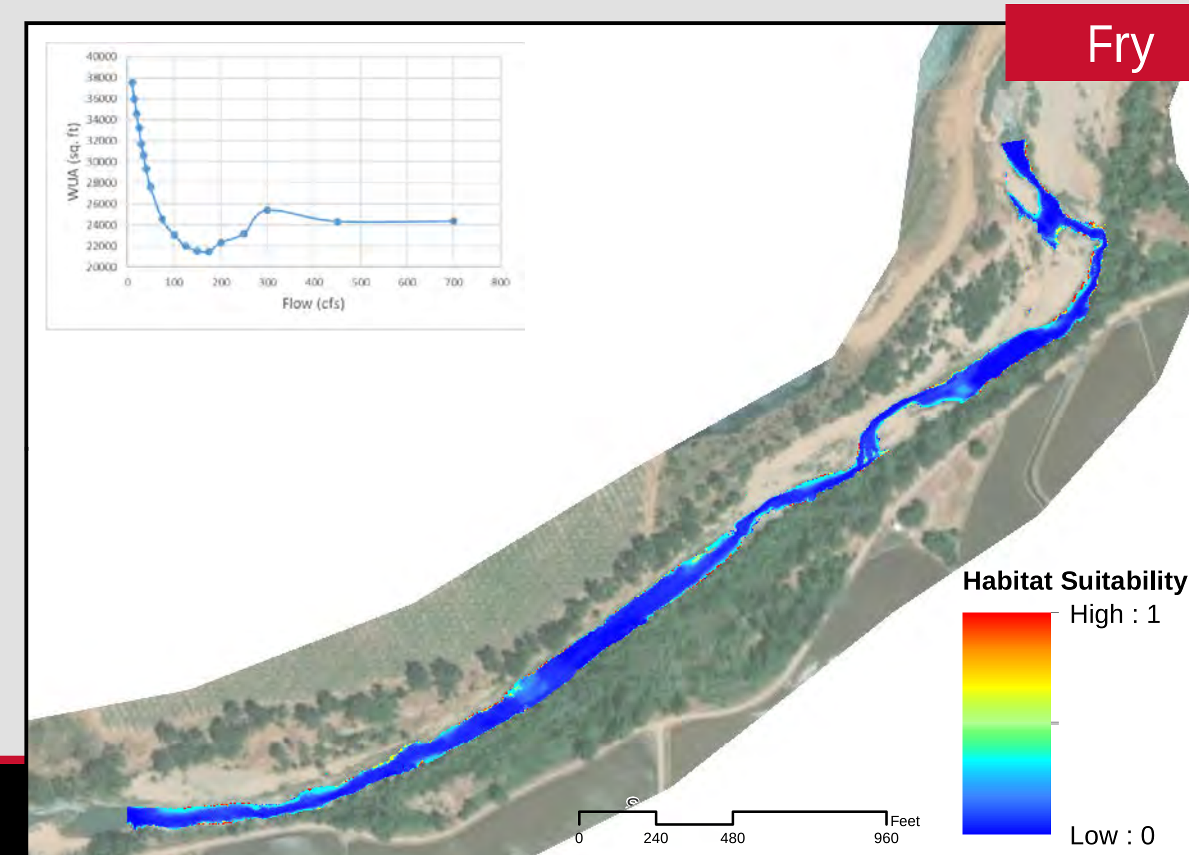
Spawning



Juvenile



Fry



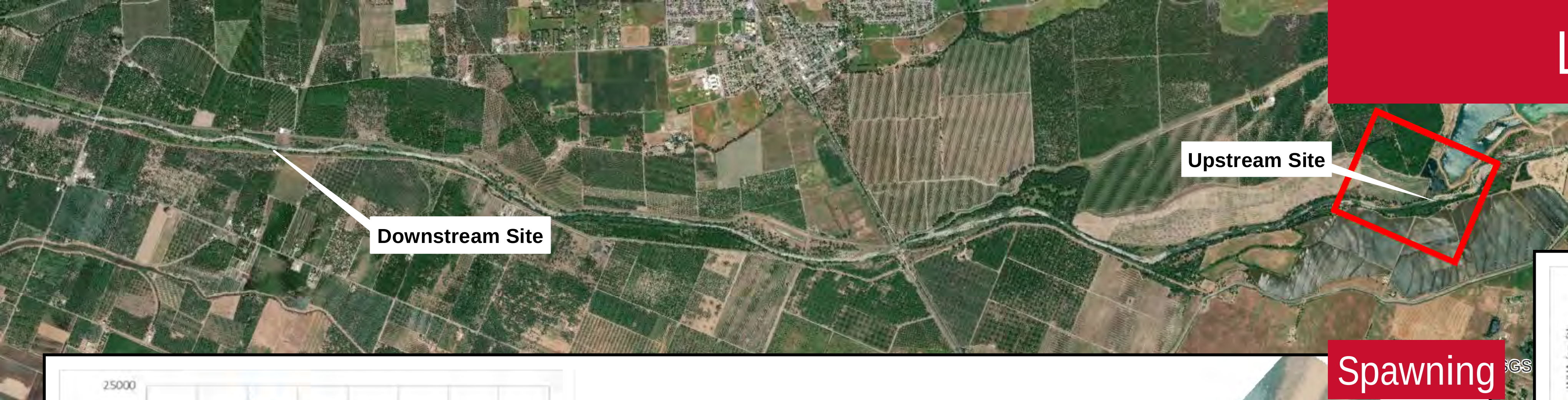
PATH: V:\CLIENT FILES\HDR\SSWD\INSTREAMFLOW\HABITAT\ATTACHMENT_ISF_MODEL_RESULTS.MXD - USER: GPOPULIS - DATE: 6/24/2019

Lower Bear River - Instream Flow Study

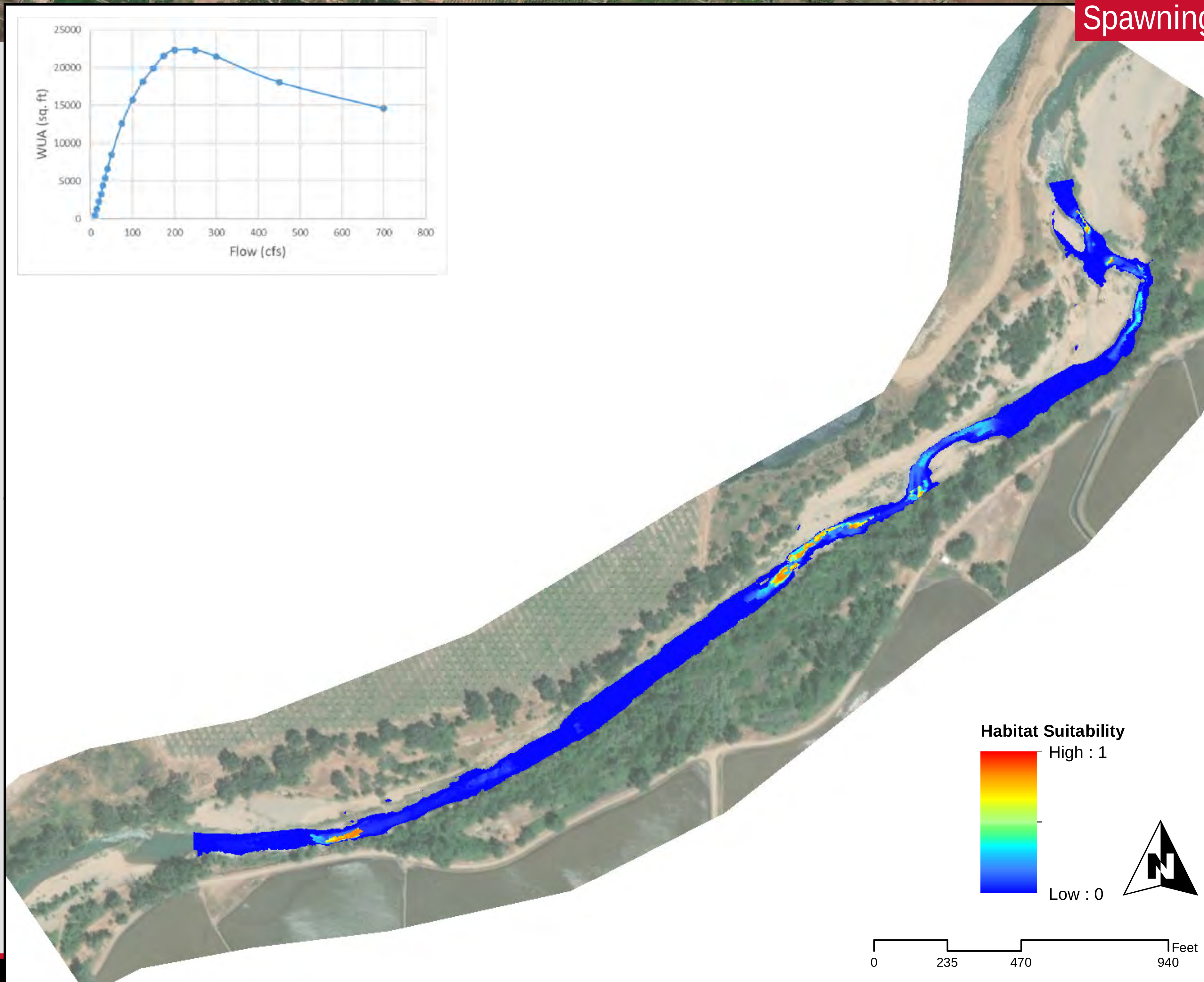
SSWD HDR

Steelhead

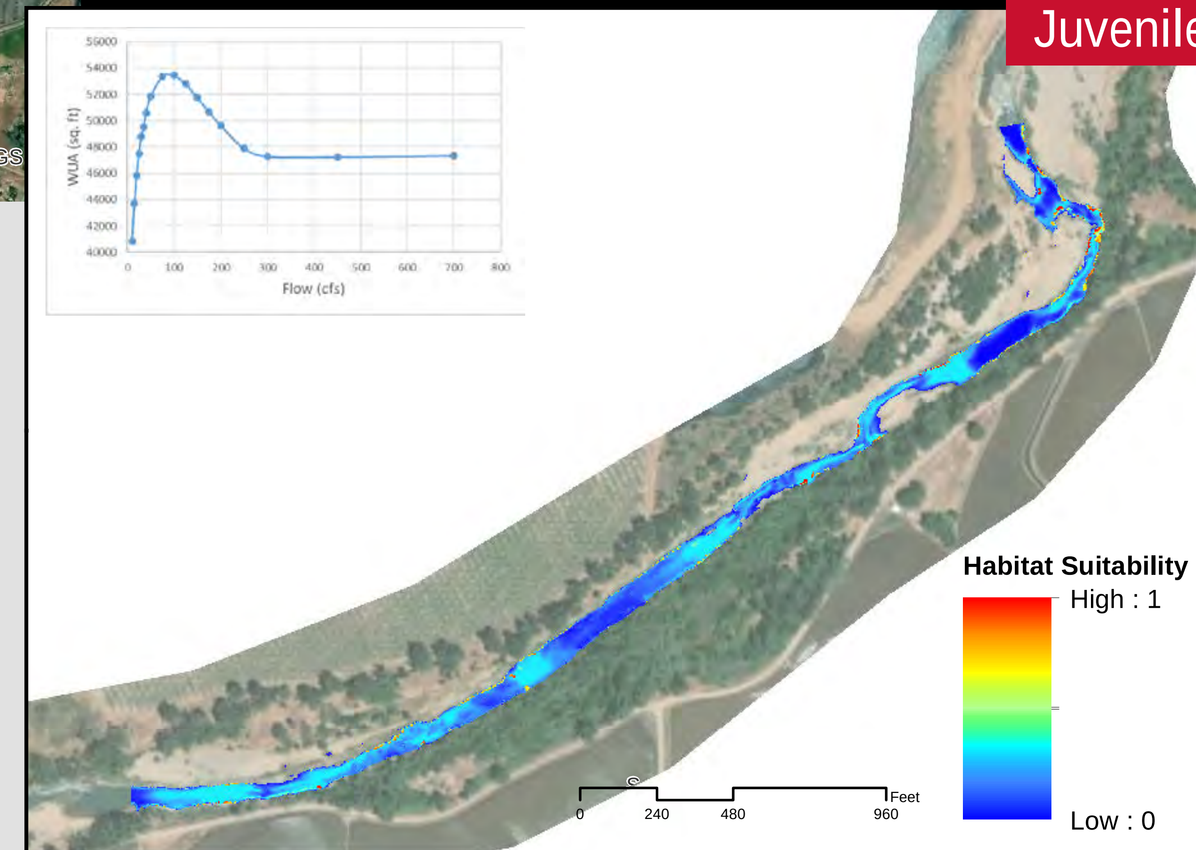
Upstream Study Site 75 cfs



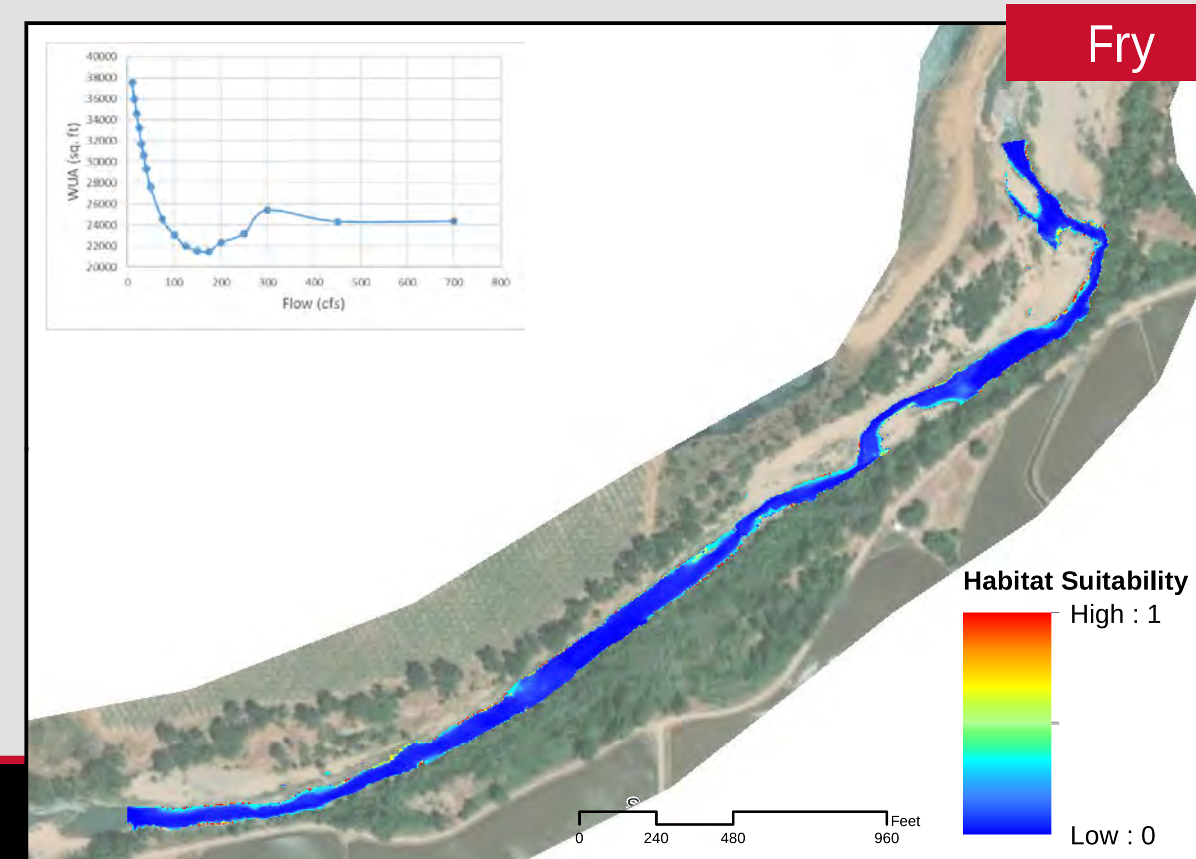
Spawning



Juvenile

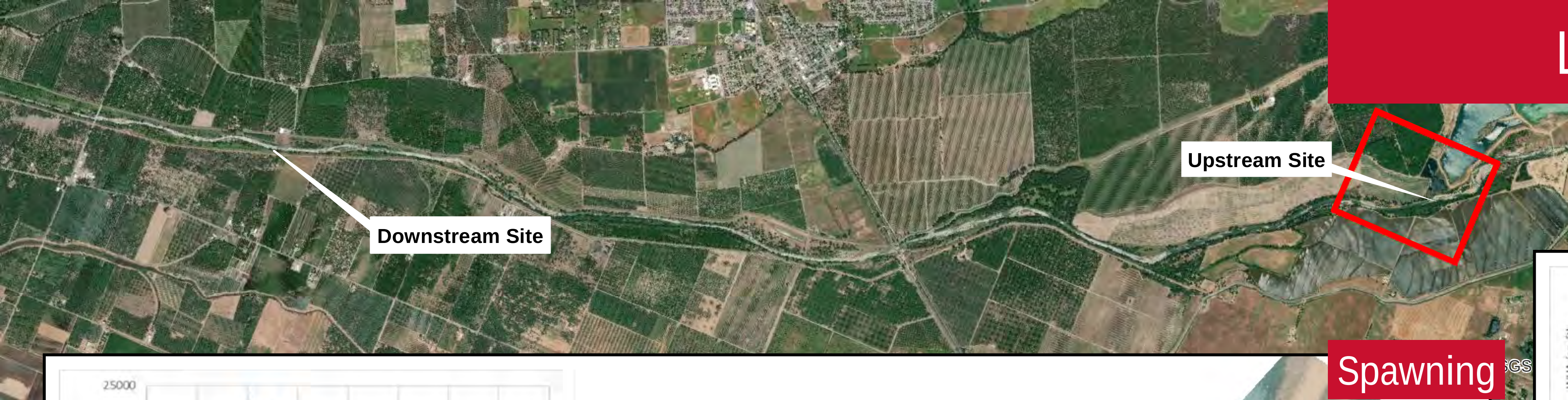


Fry



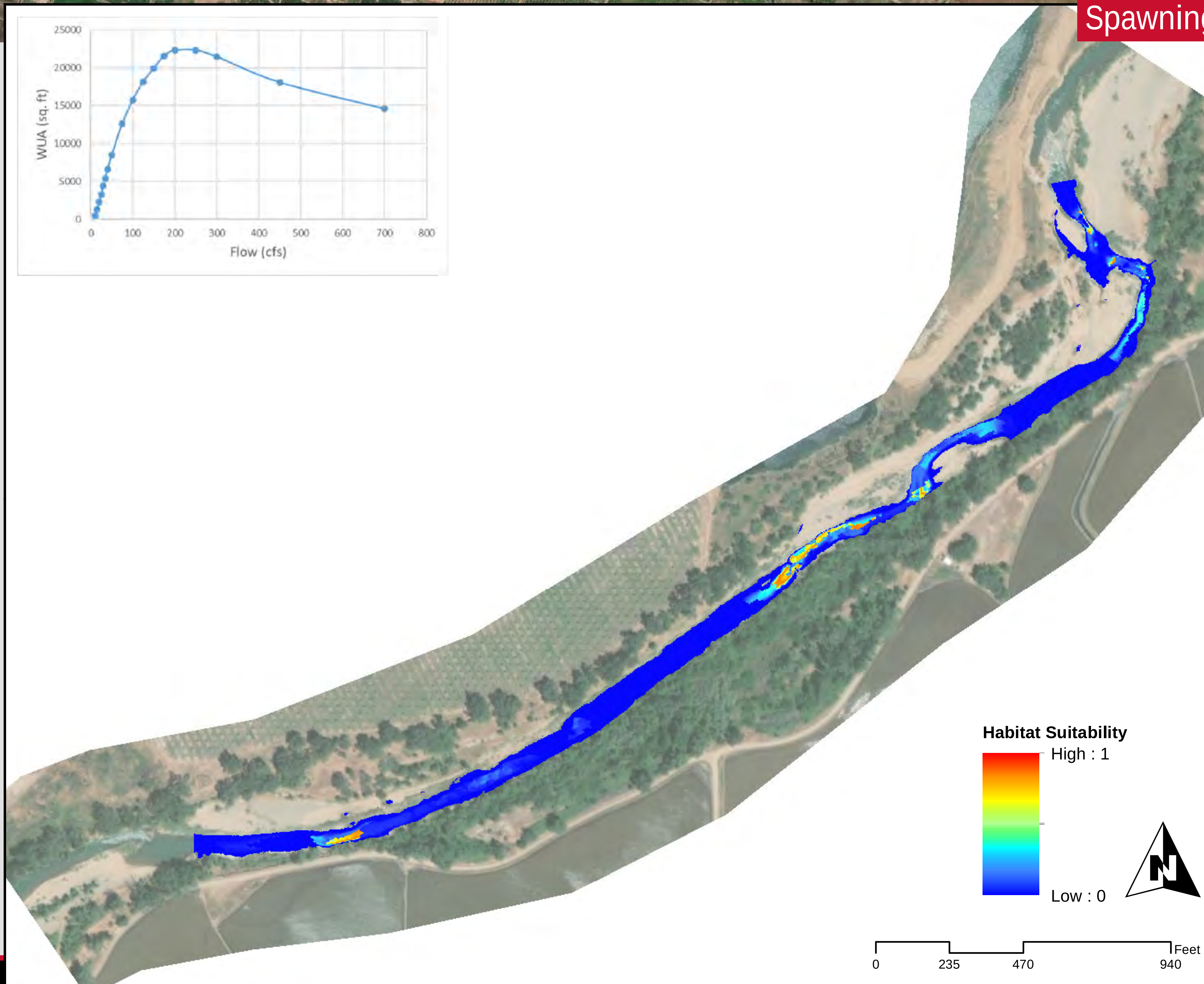
PATH: V:\CLIENT FILES\HDR\SSWD\INSTREAMFLOW\HABITAT\ATTACHMENT_ISF_MODEL_RESULTS.MXD - USER: GPOPULIS - DATE: 6/24/2019

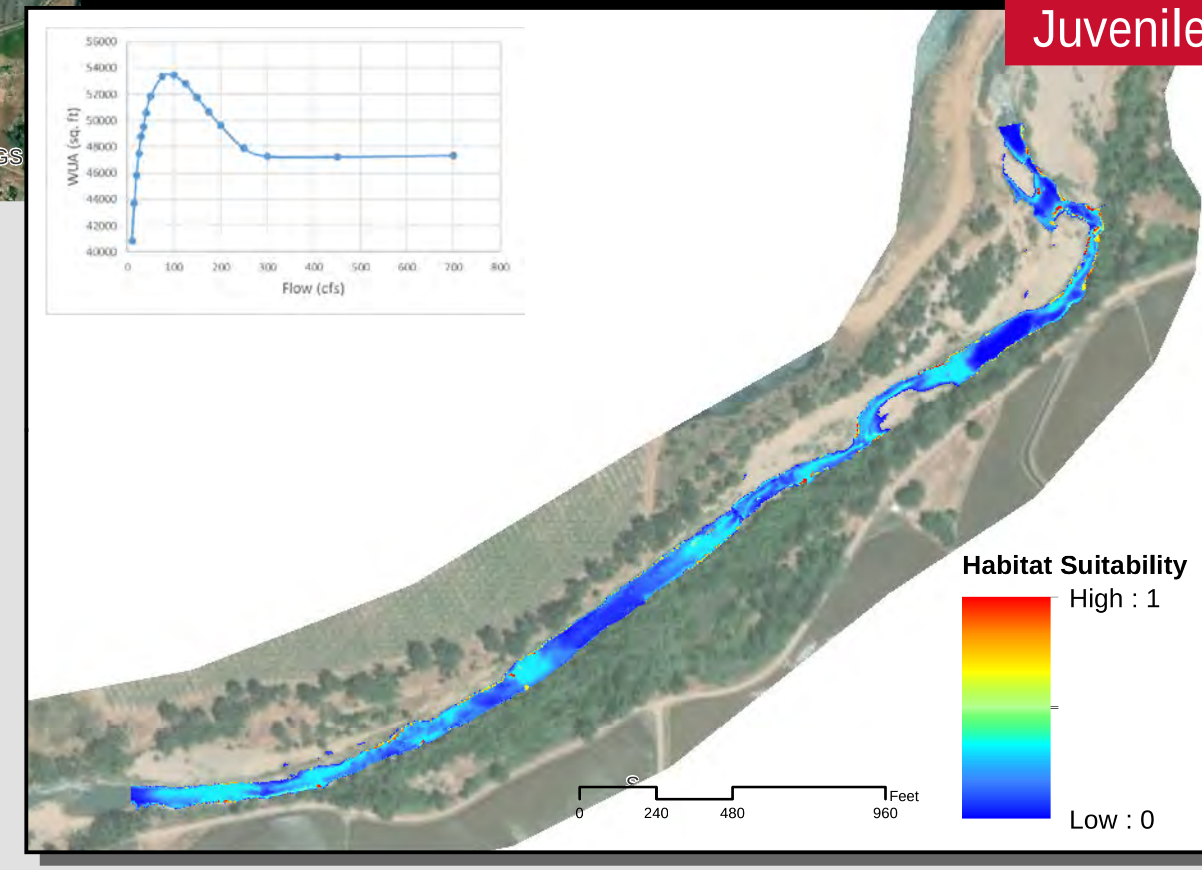
Lower Bear River - Instream Flow Study

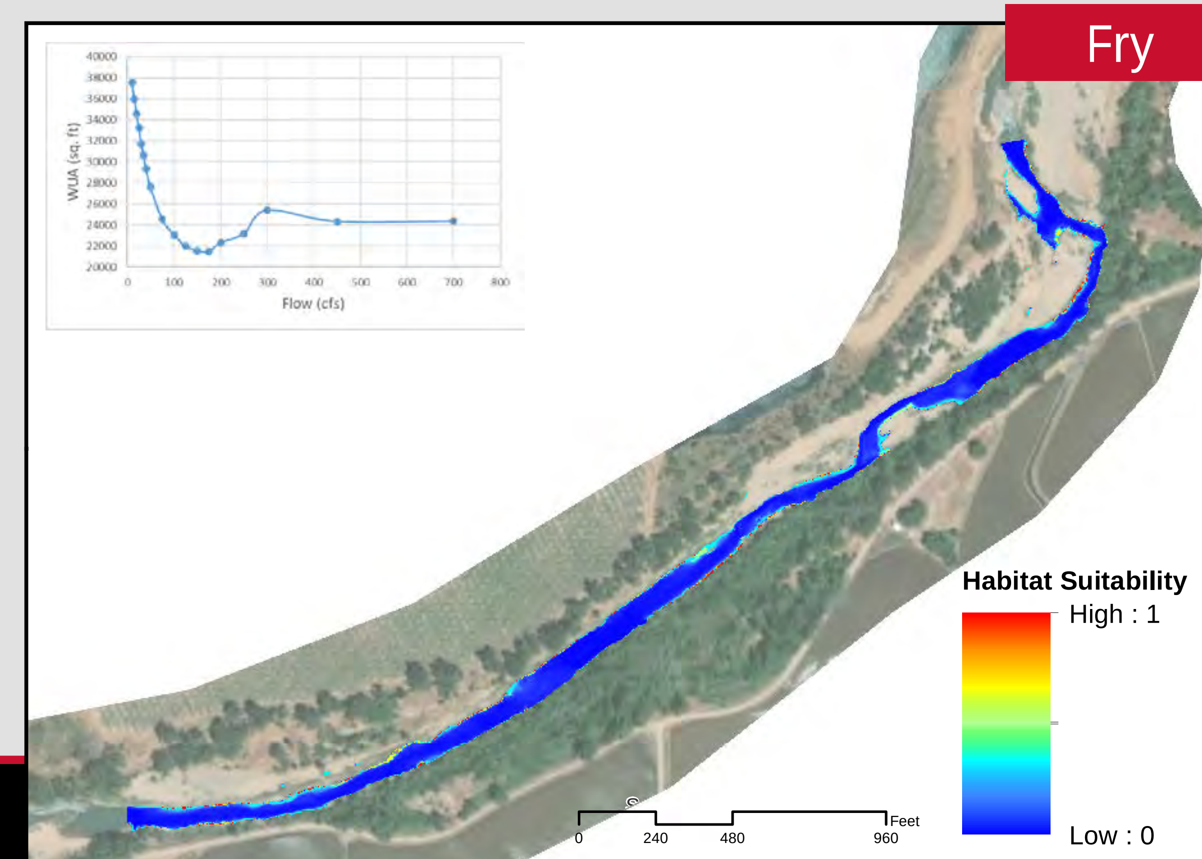


Steelhead

Upstream Study Site 100 cfs





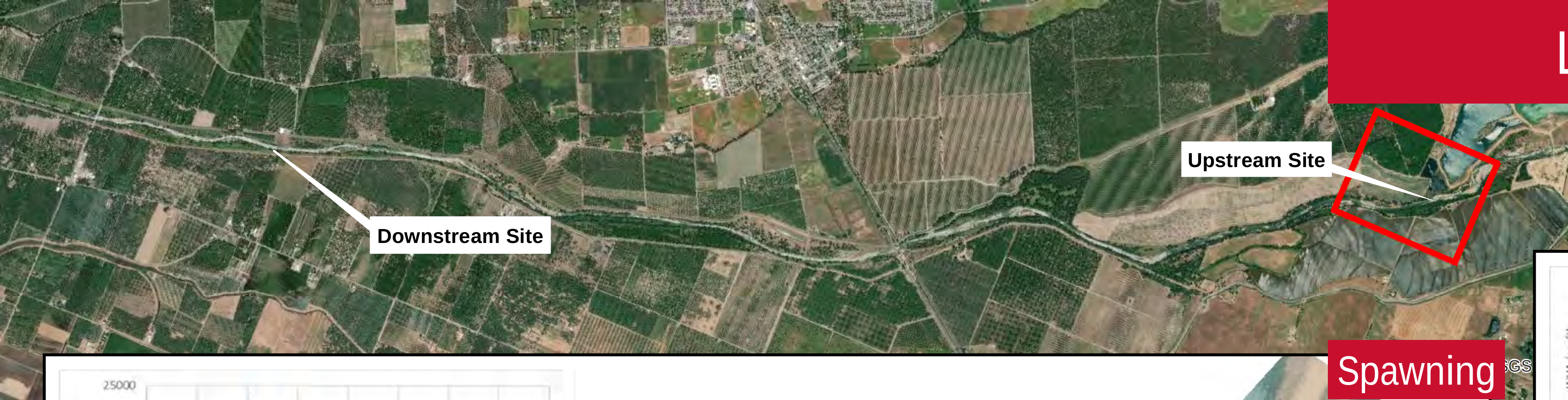


Lower Bear River - Instream Flow Study

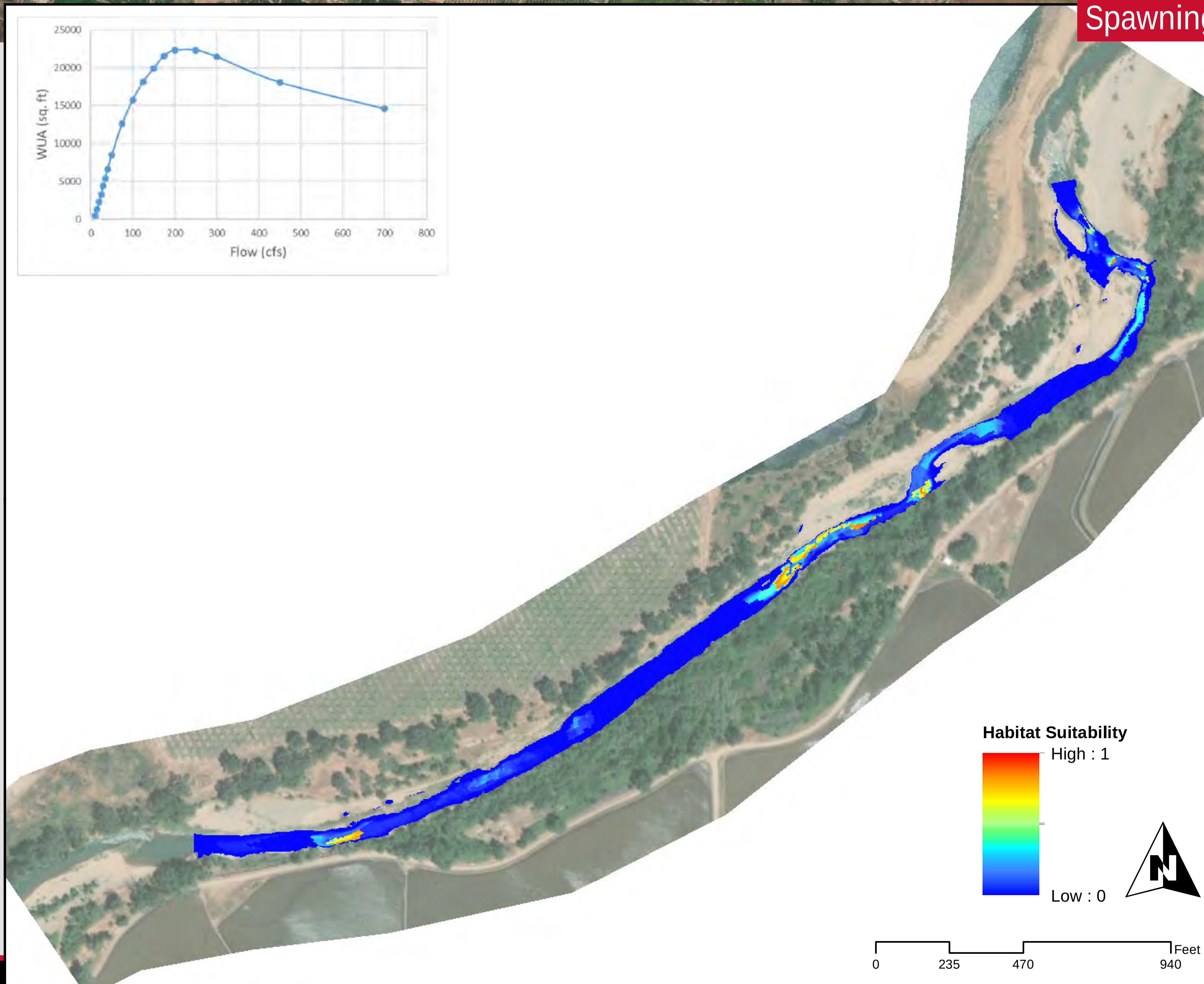
SSWD HDR

Steelhead

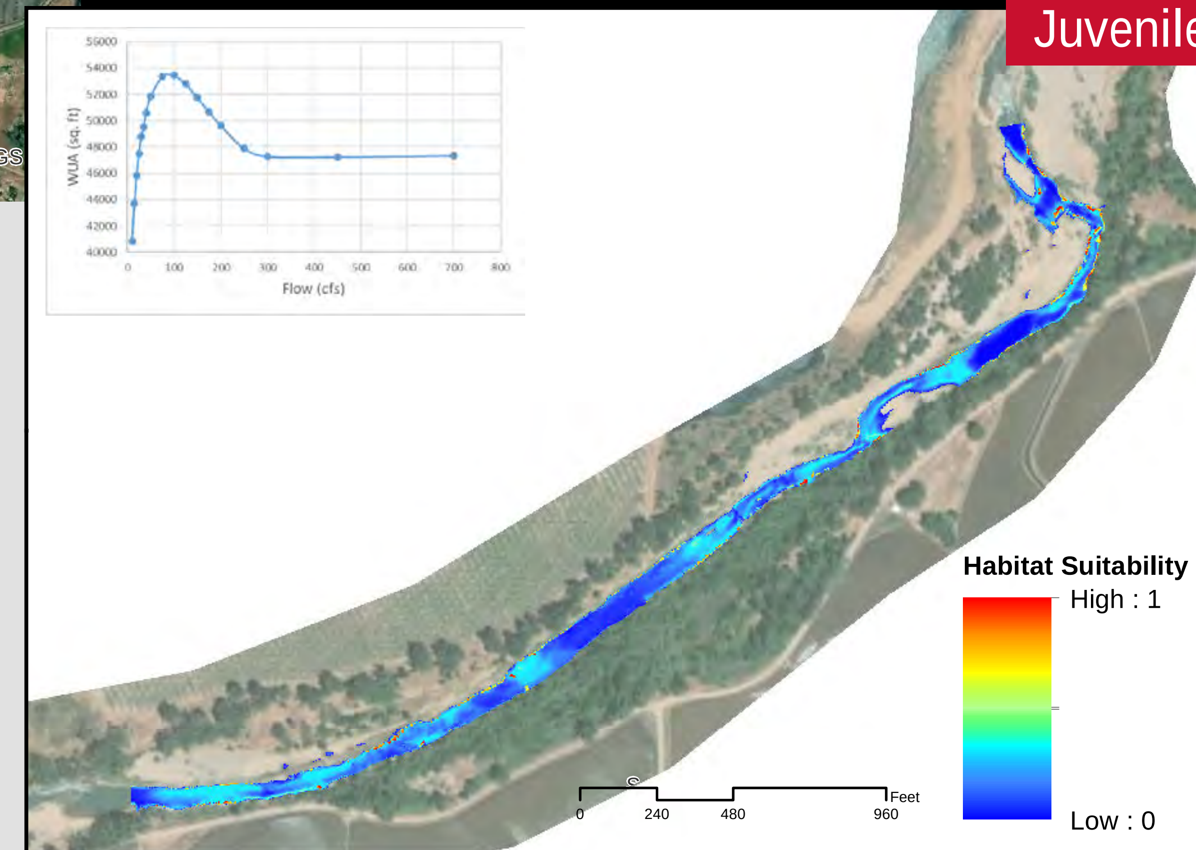
Upstream Study Site 125 cfs



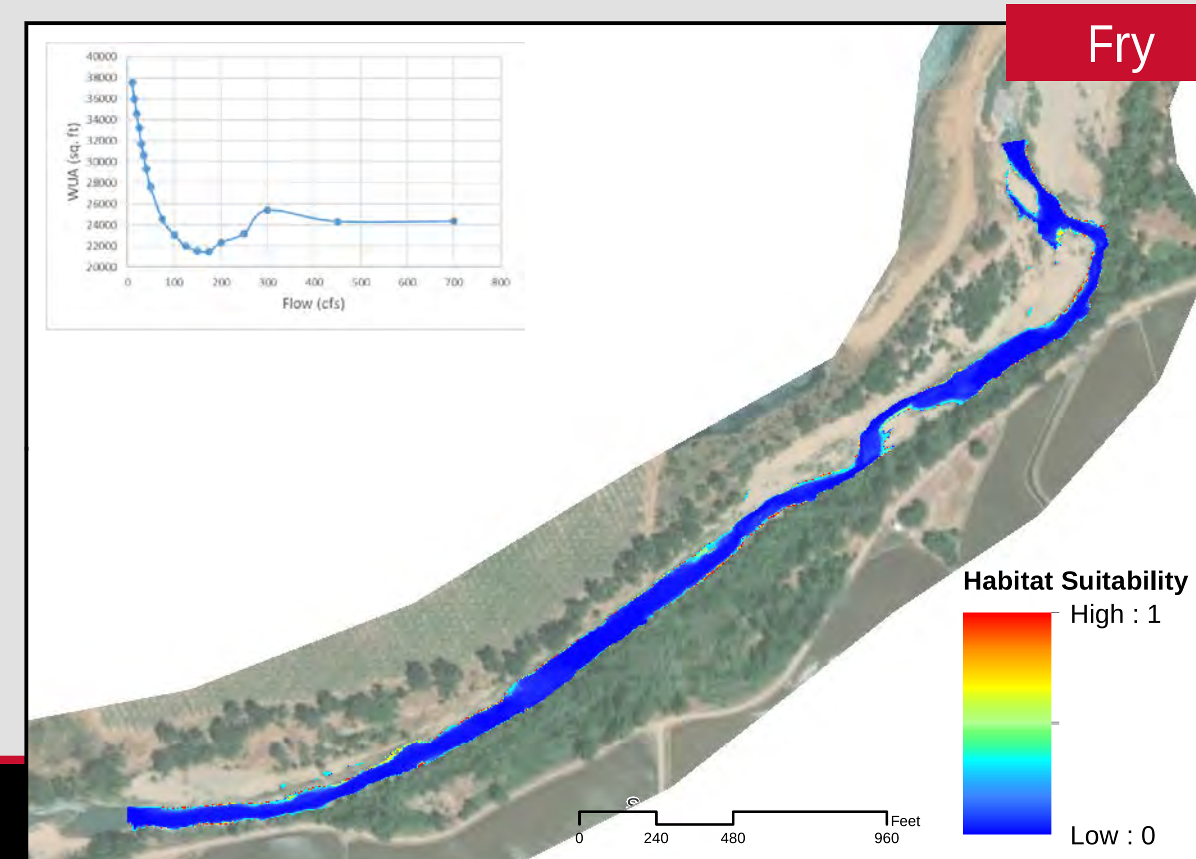
Spawning



Juvenile



Fry



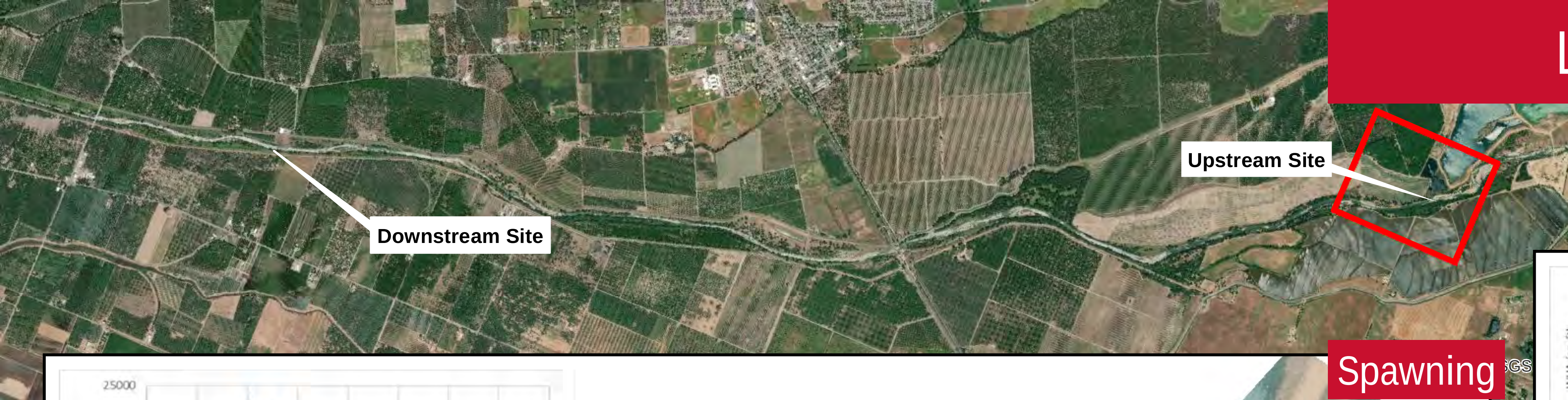
PATH: V:\CLIENT FILES\HDR\SSWD\INSTREAMFLOW\HABITAT\ATTACHMENT_ISF_MODEL_RESULTS.MXD - USER: GPOPULIS - DATE: 6/24/2019

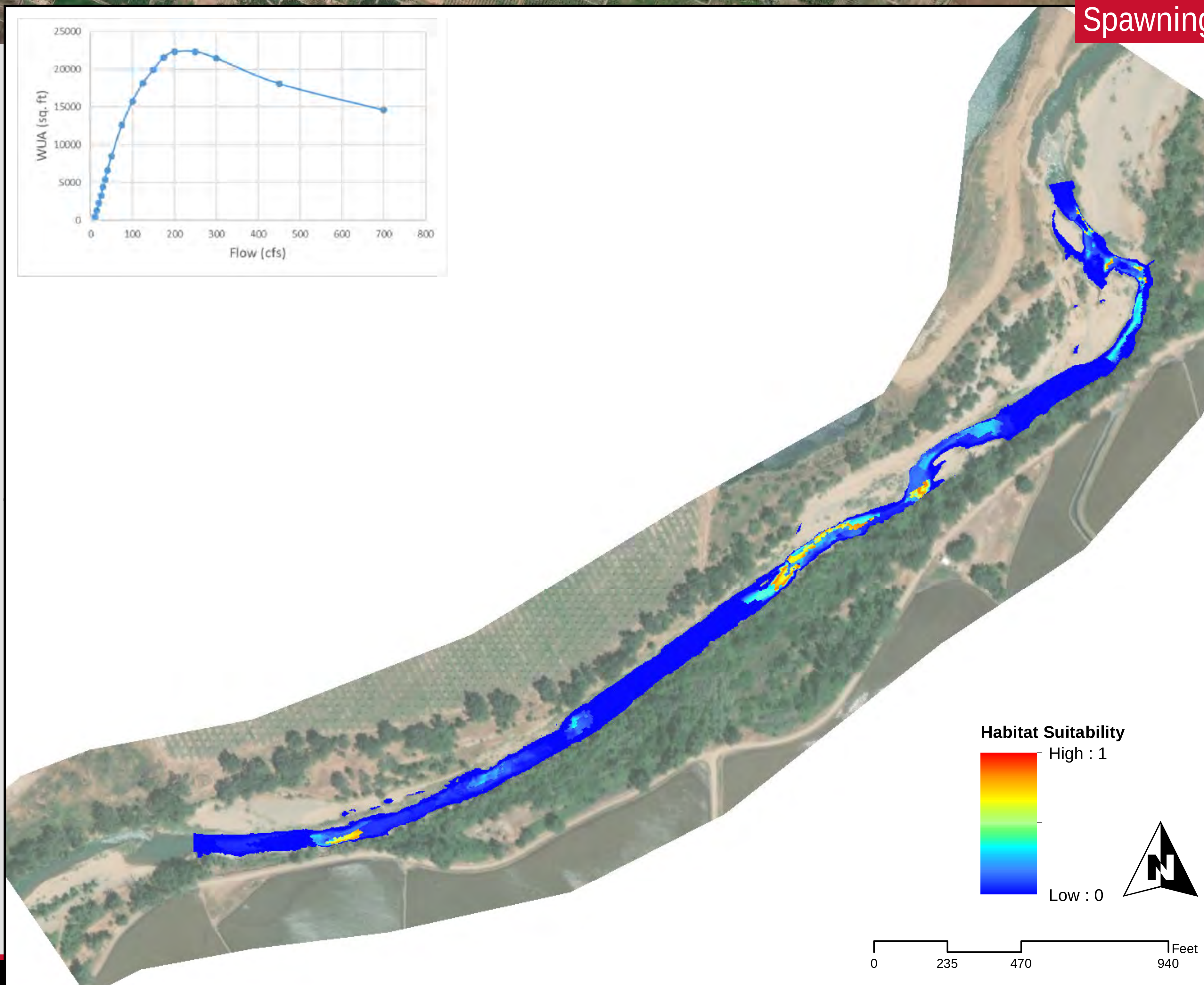
Lower Bear River - Instream Flow Study

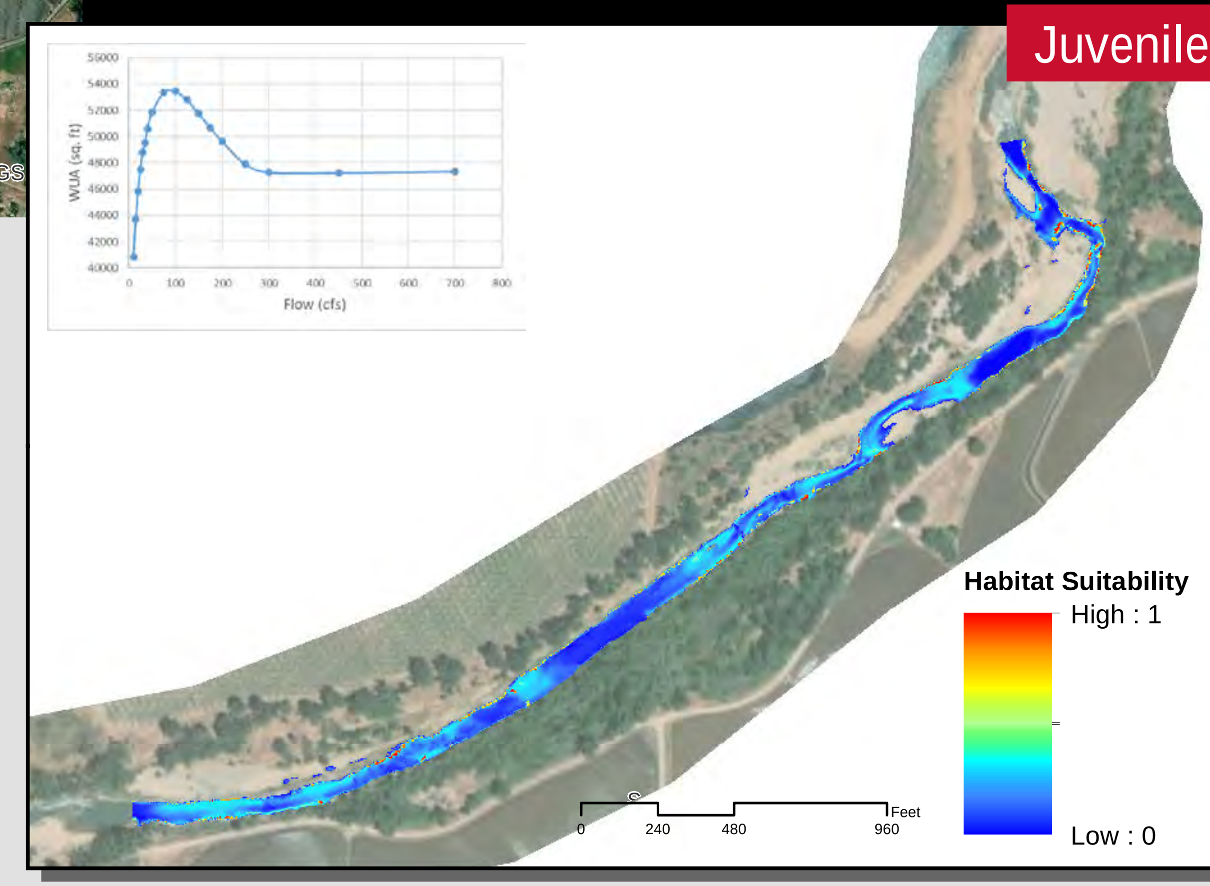
SSWD HDR

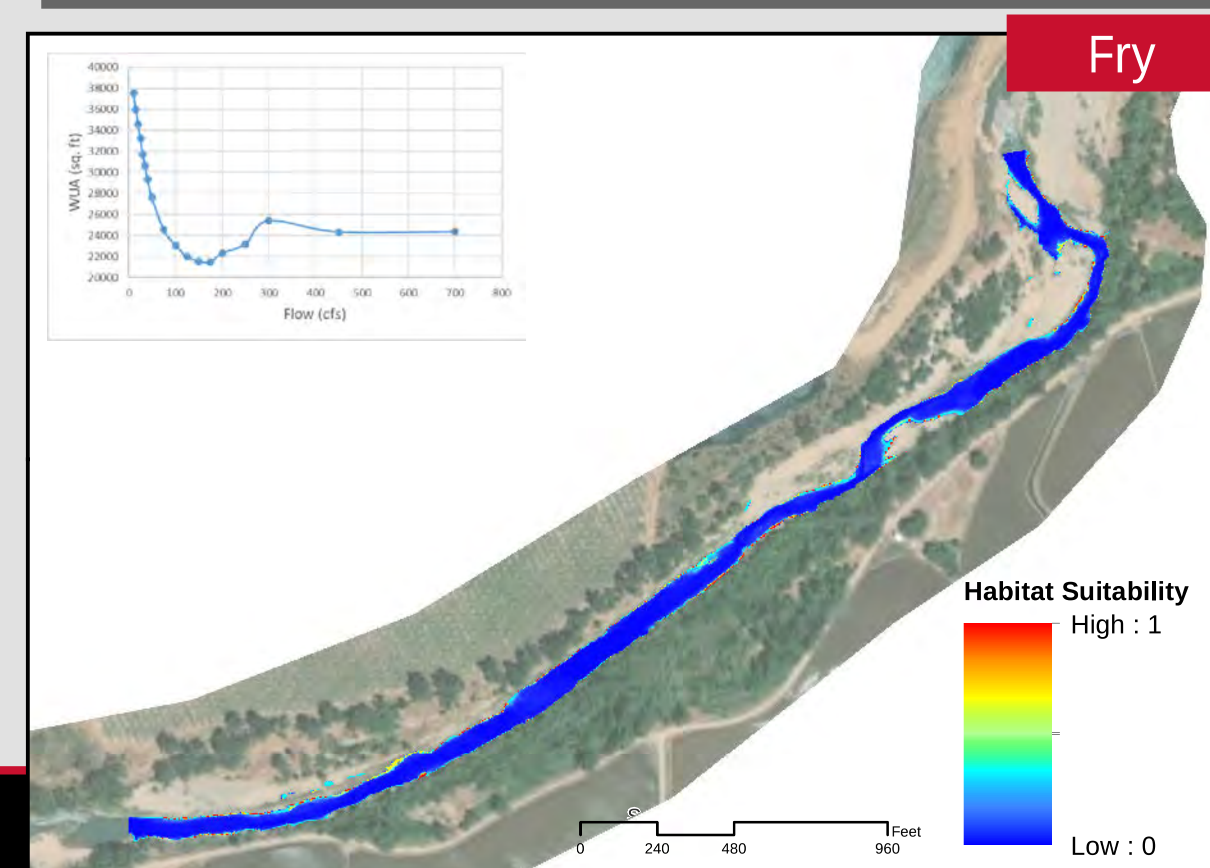
Steelhead

Upstream Study Site 150 cfs







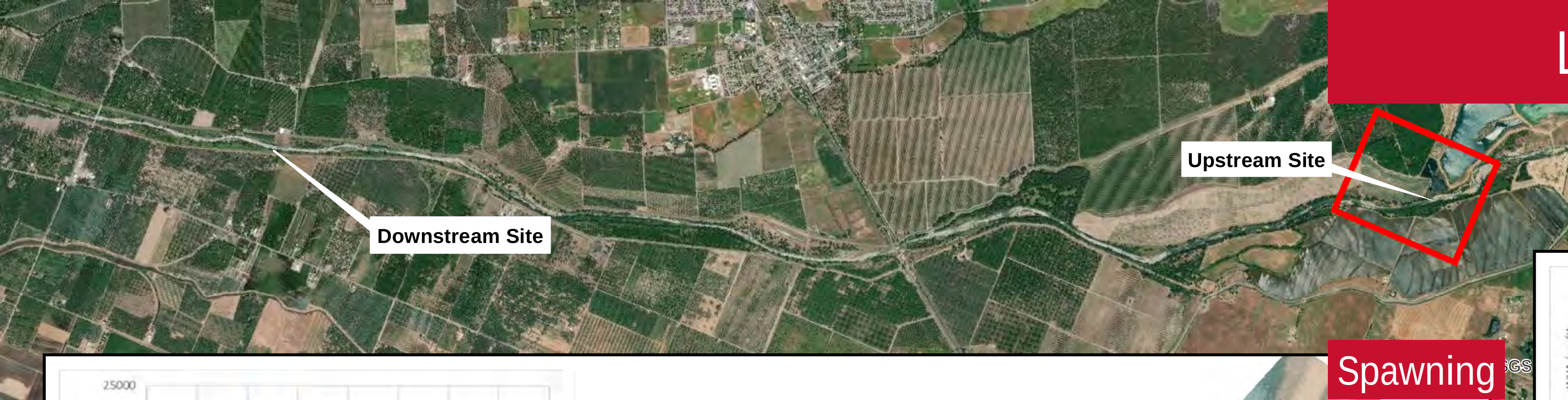


Lower Bear River - Instream Flow Study

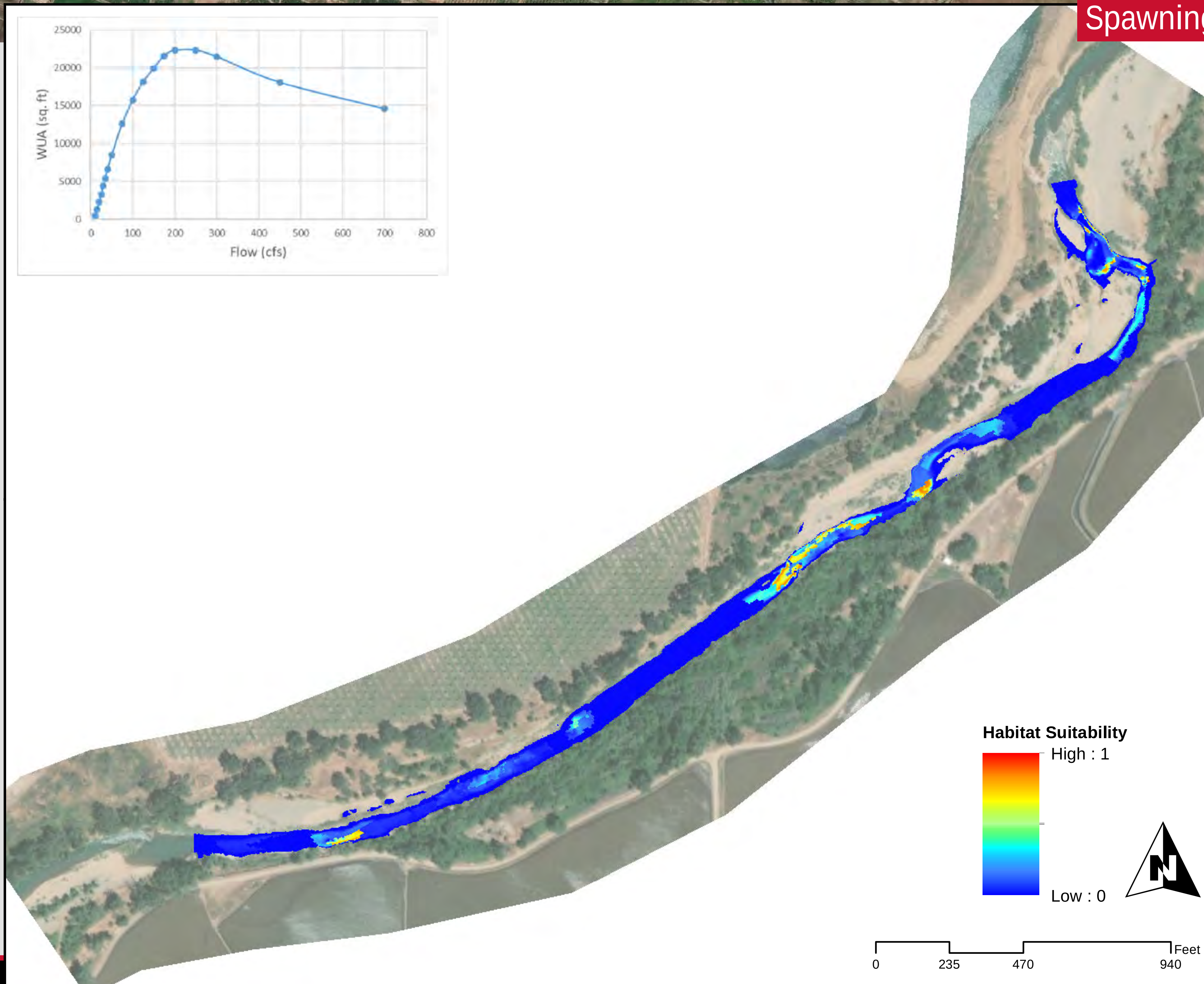
SSWD HDR

Steelhead

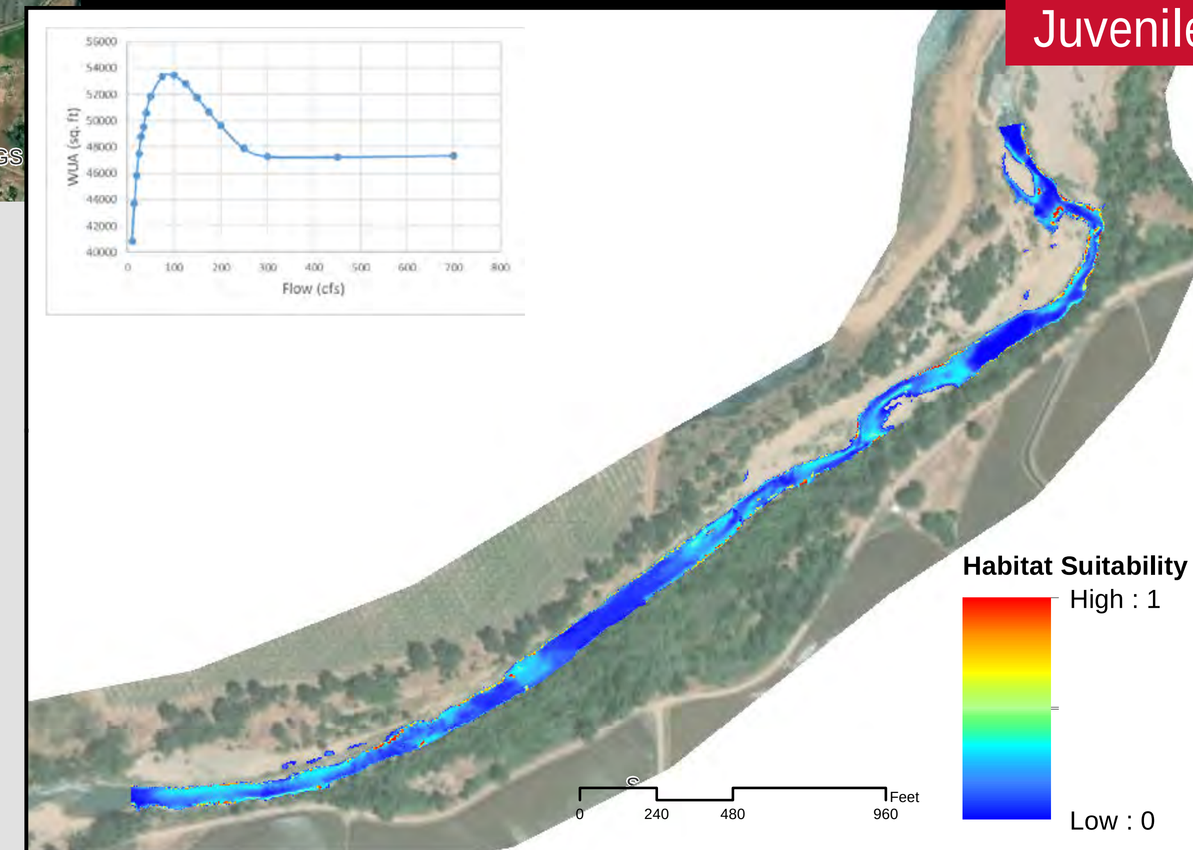
Upstream Study Site 175 cfs



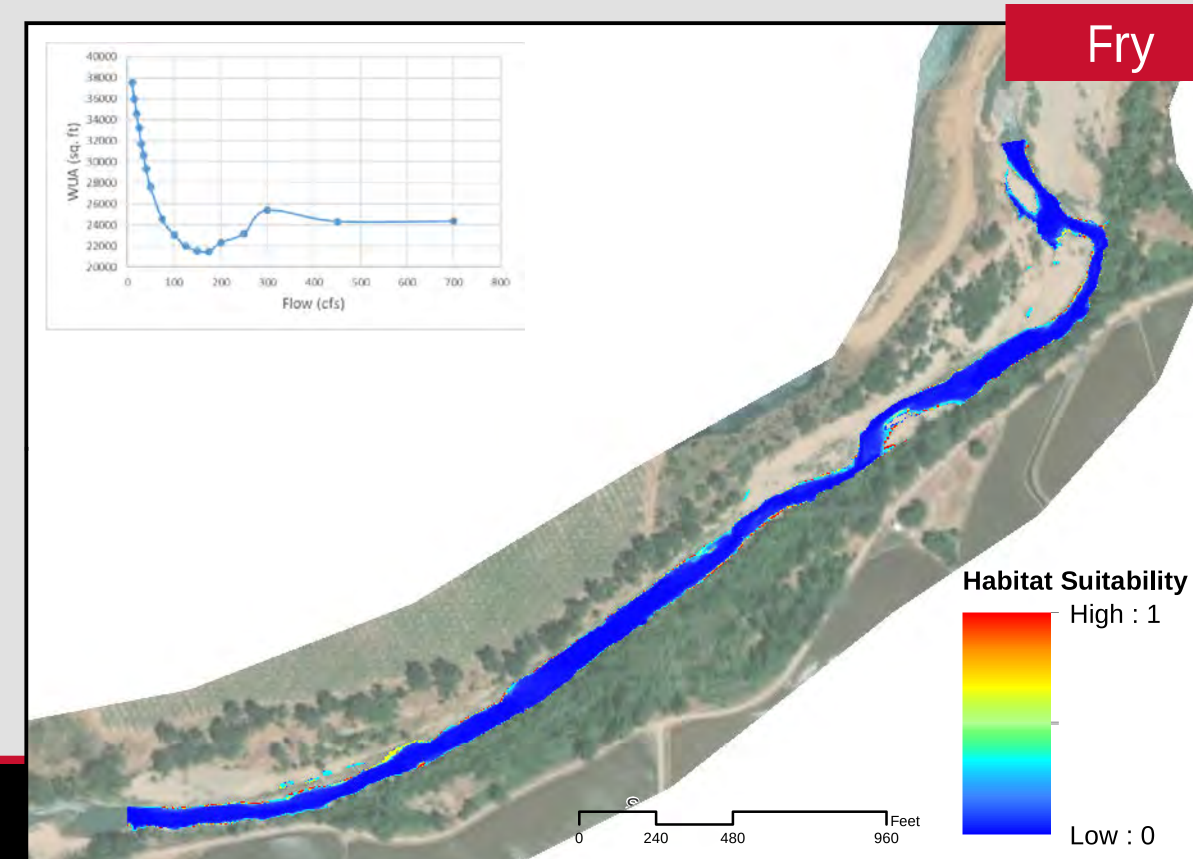
Spawning



Juvenile



Fry

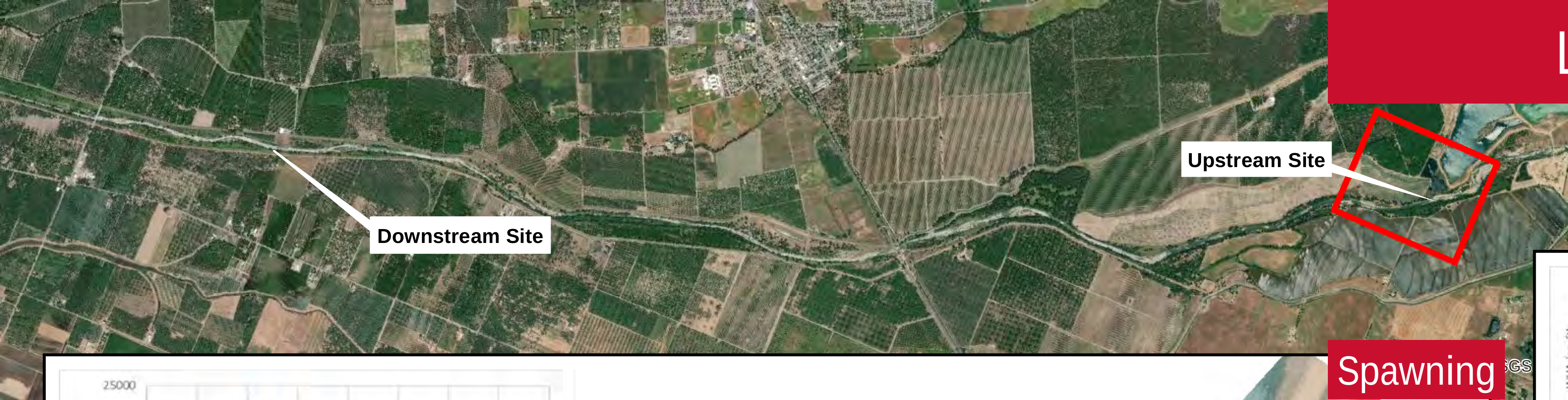


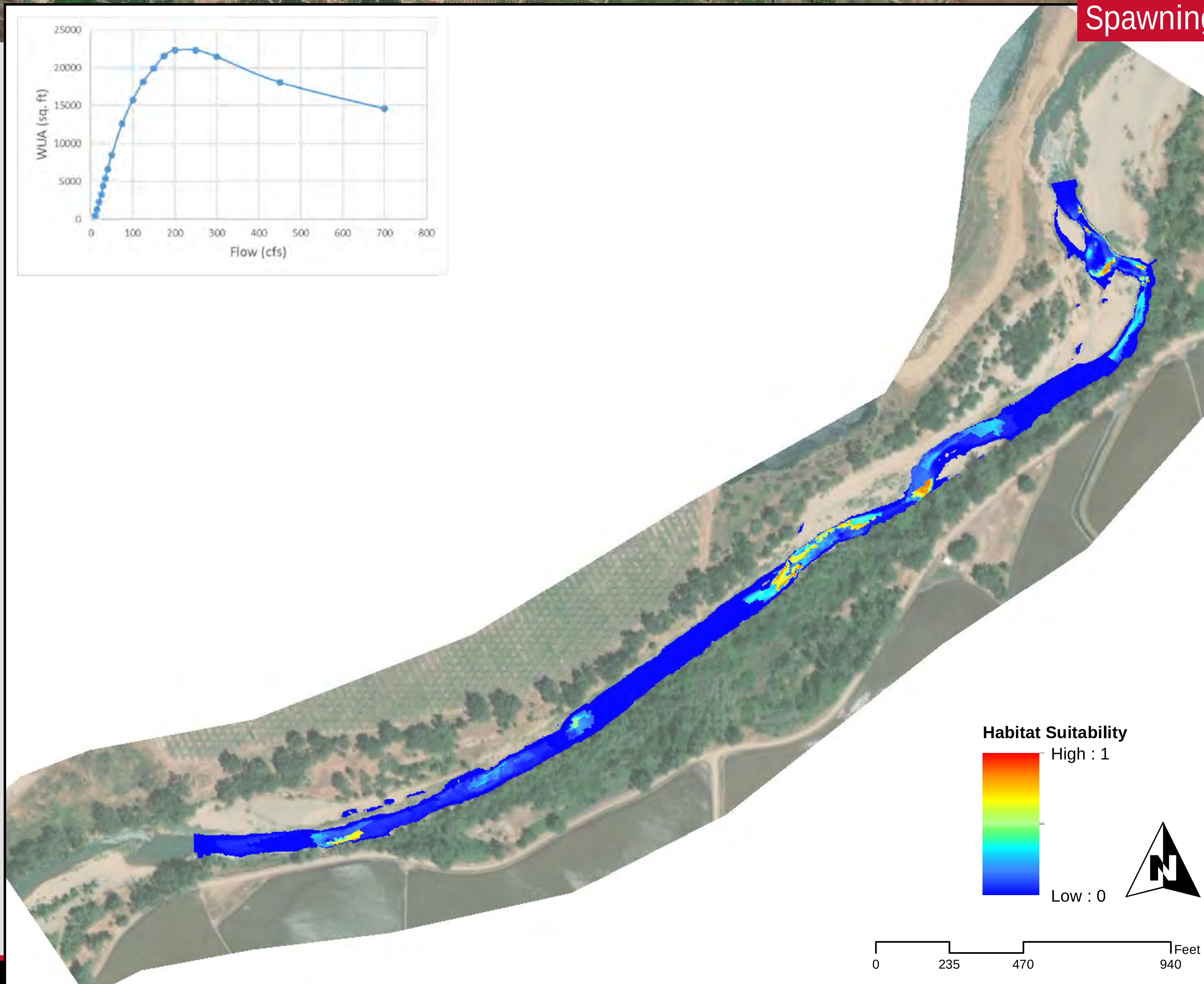
Lower Bear River - Instream Flow Study

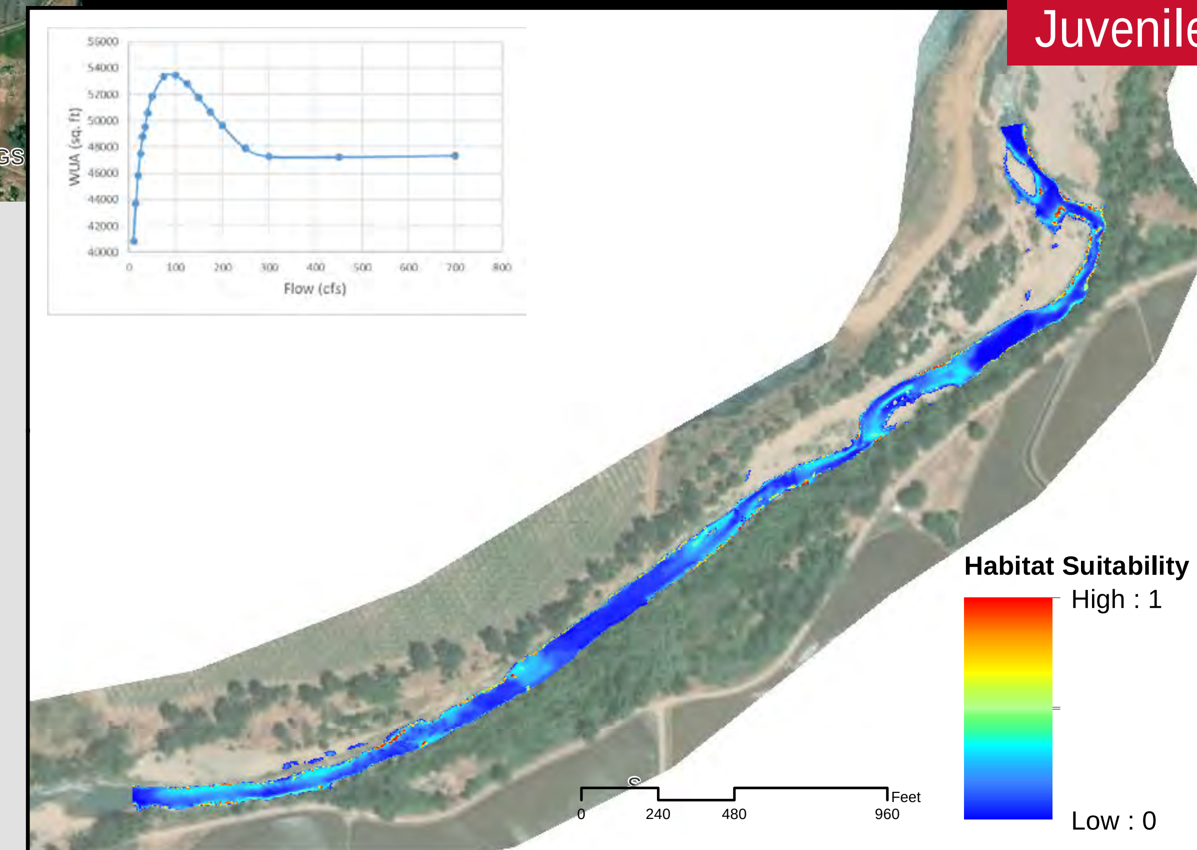
SSWD HDR

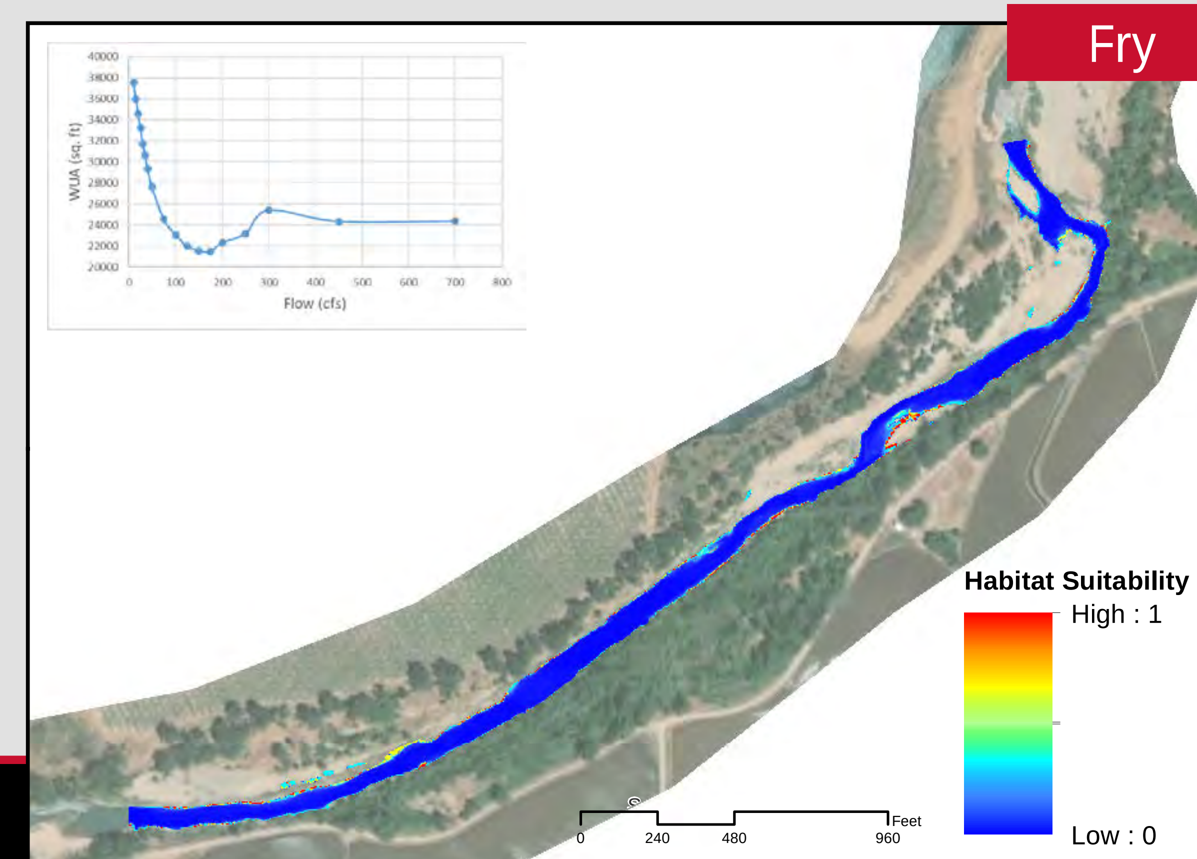
Steelhead

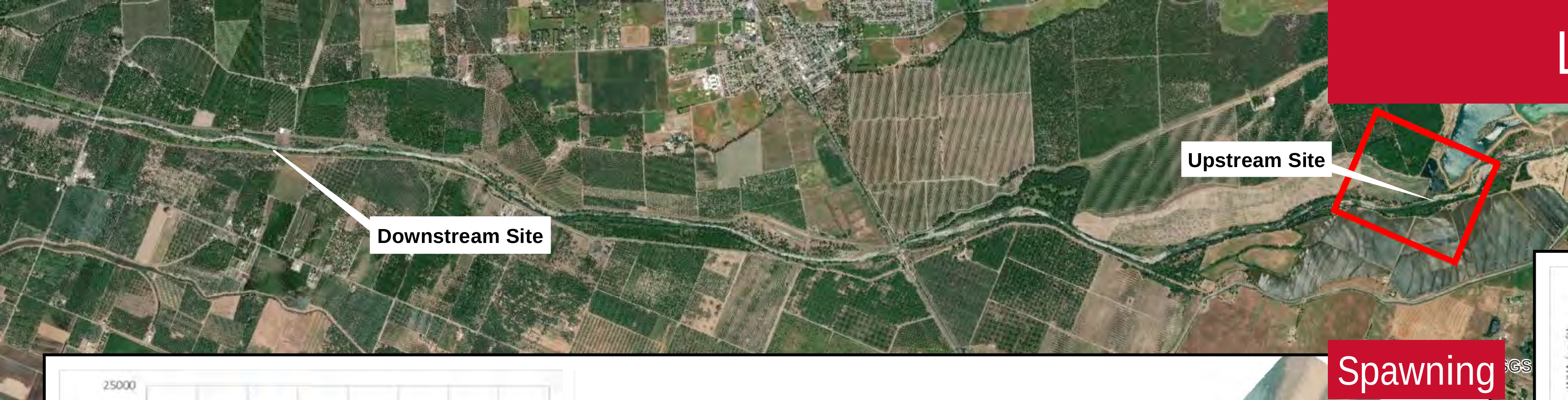
Upstream Study Site 200 cfs







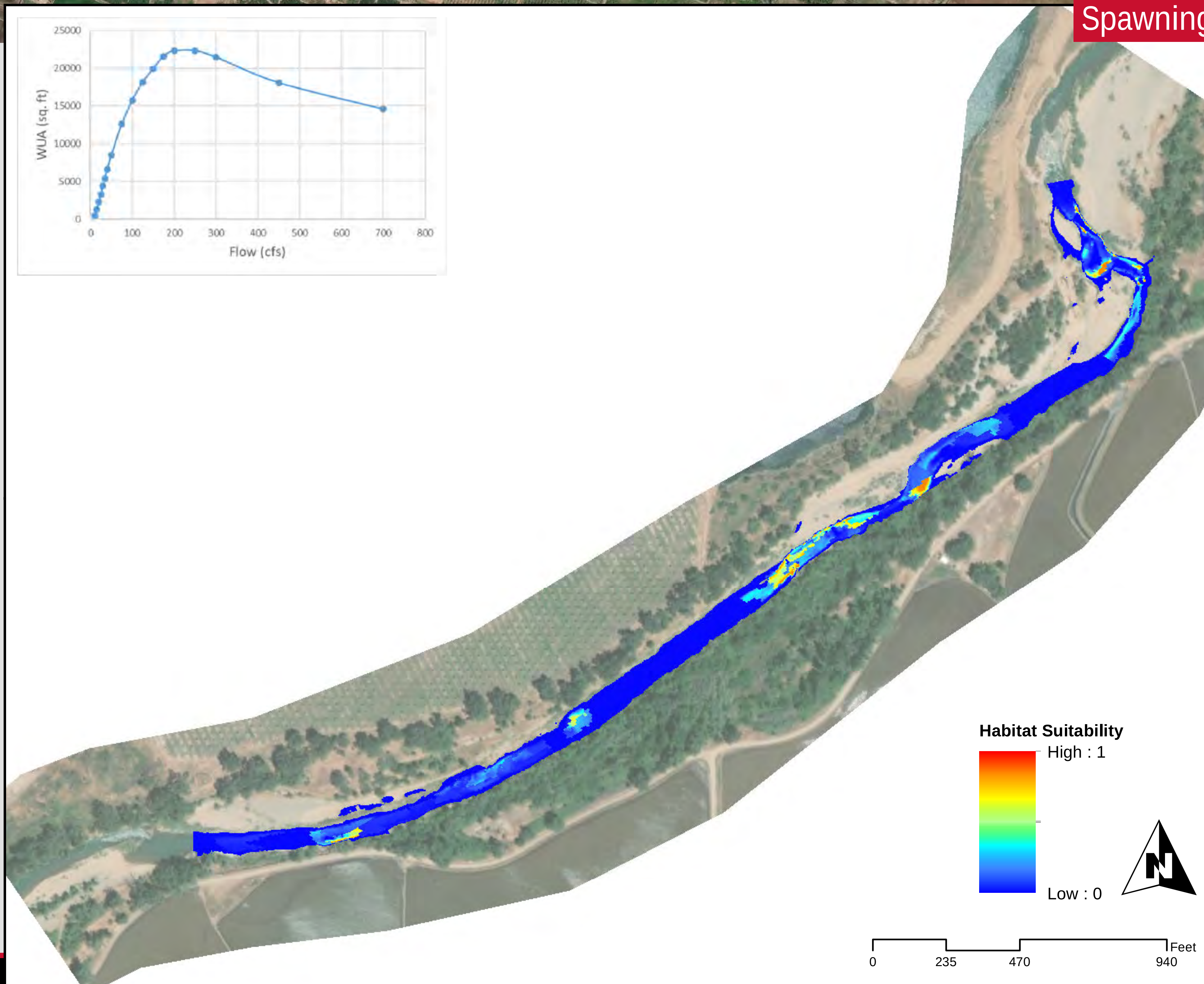


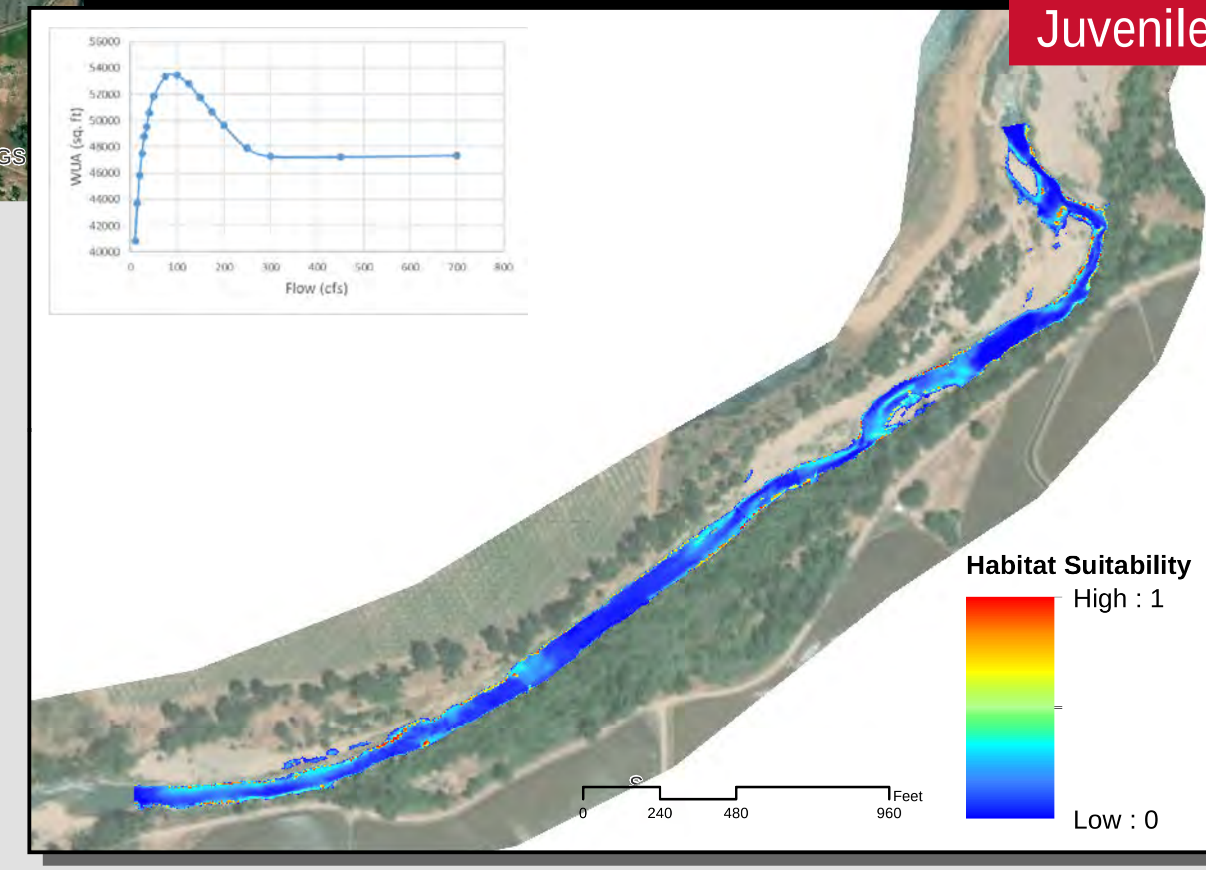


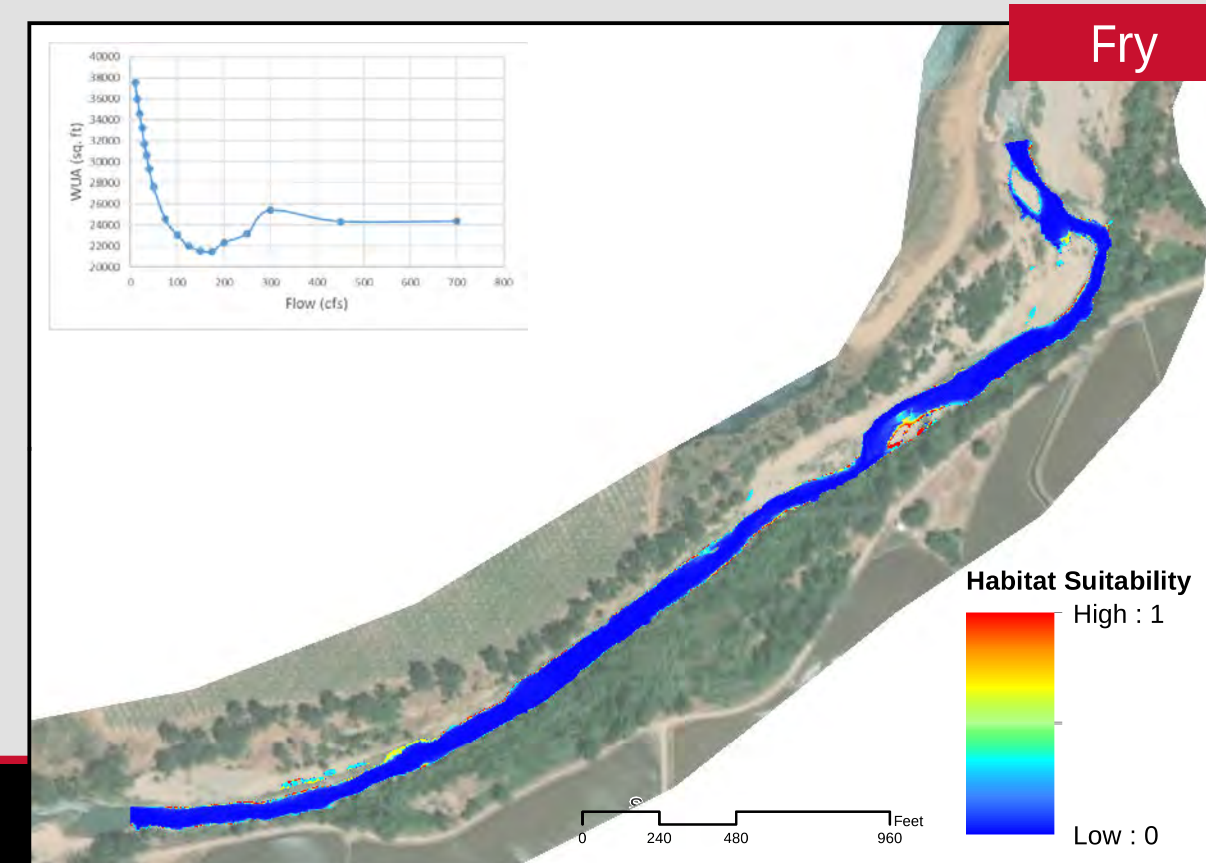
Lower Bear River - Instream Flow Study

Steelhead

Upstream Study Site 250 cfs







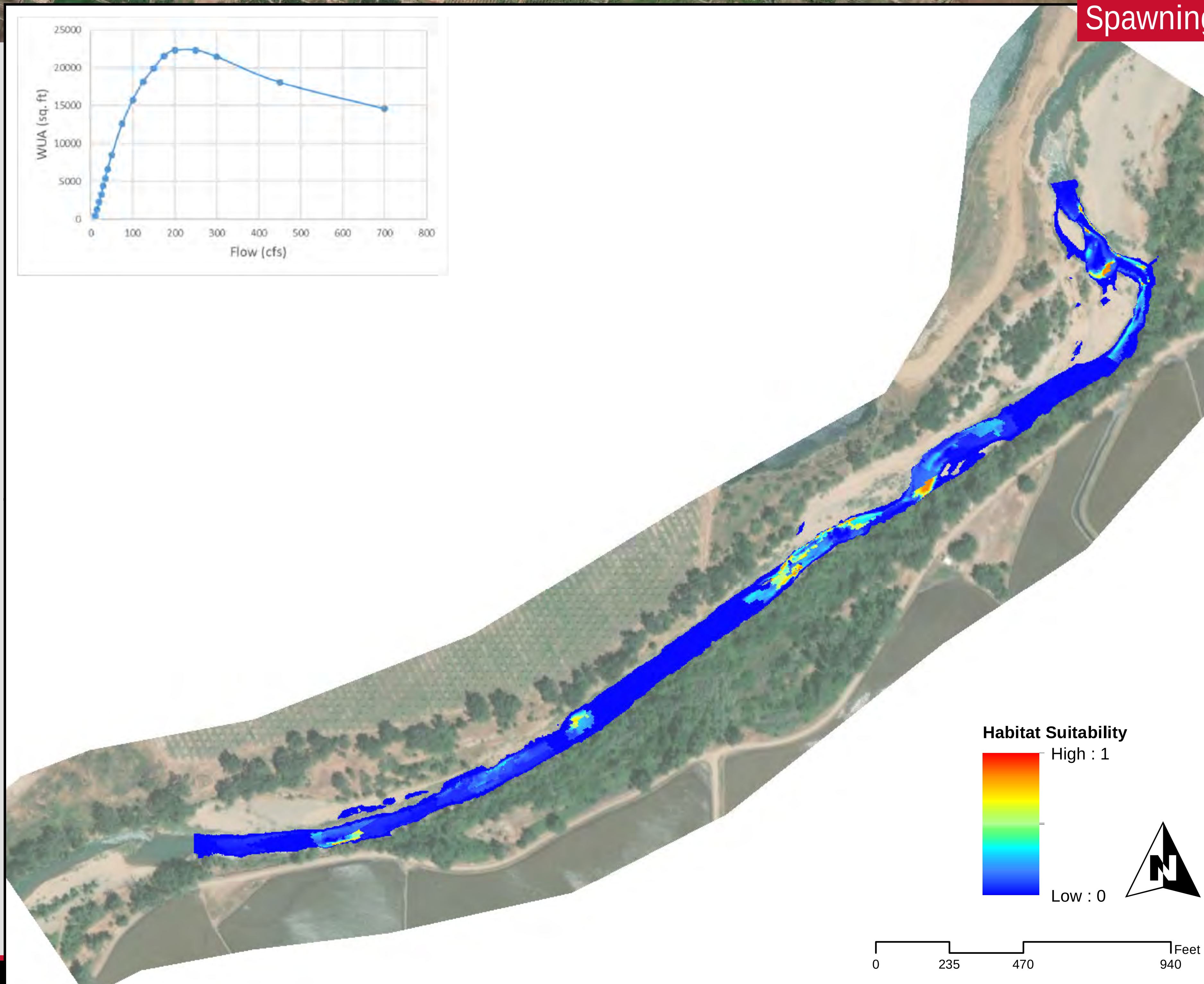
PATH: V:\CLIENT FILES\HDR\SSWD\INSTREAMFLOW\HABITAT\ATTACHMENT_ISF_MODEL_RESULTS.MXD - USER: GPOPULIS - DATE: 6/24/2019

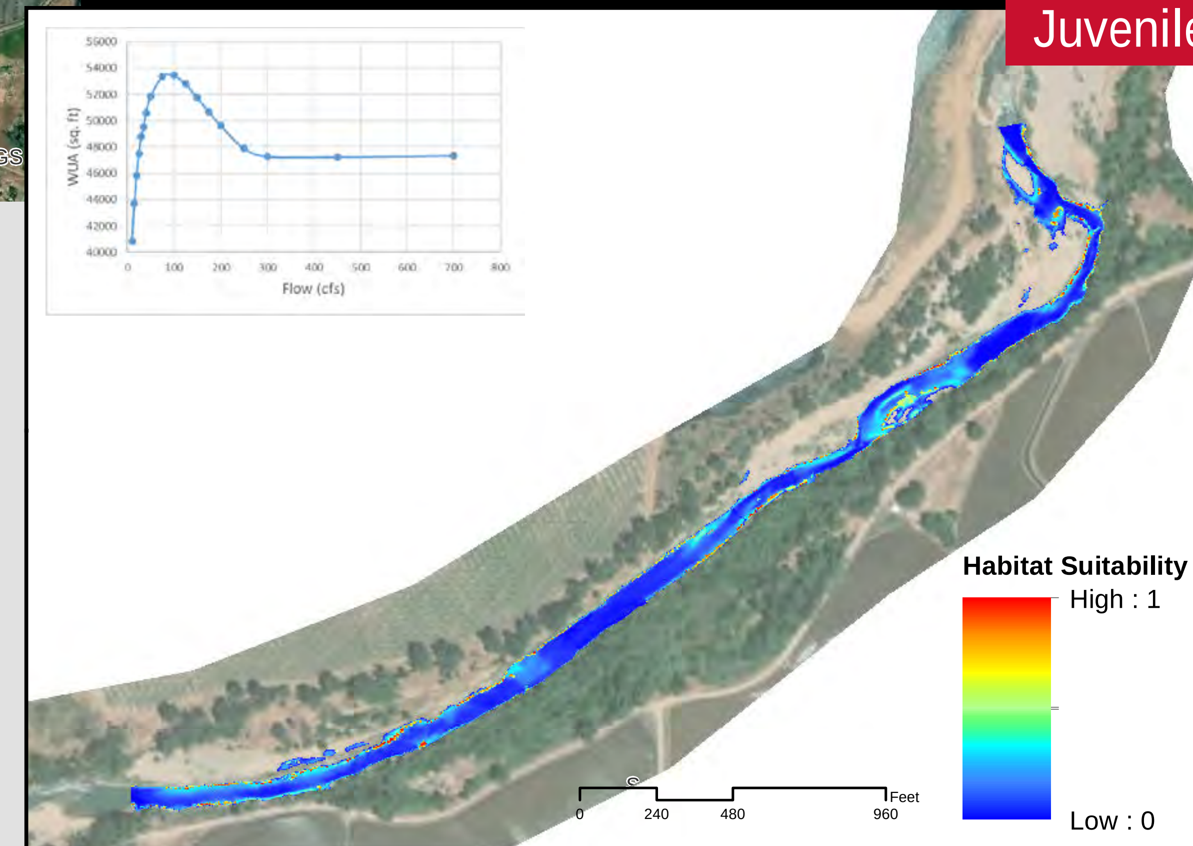
Lower Bear River - Instream Flow Study

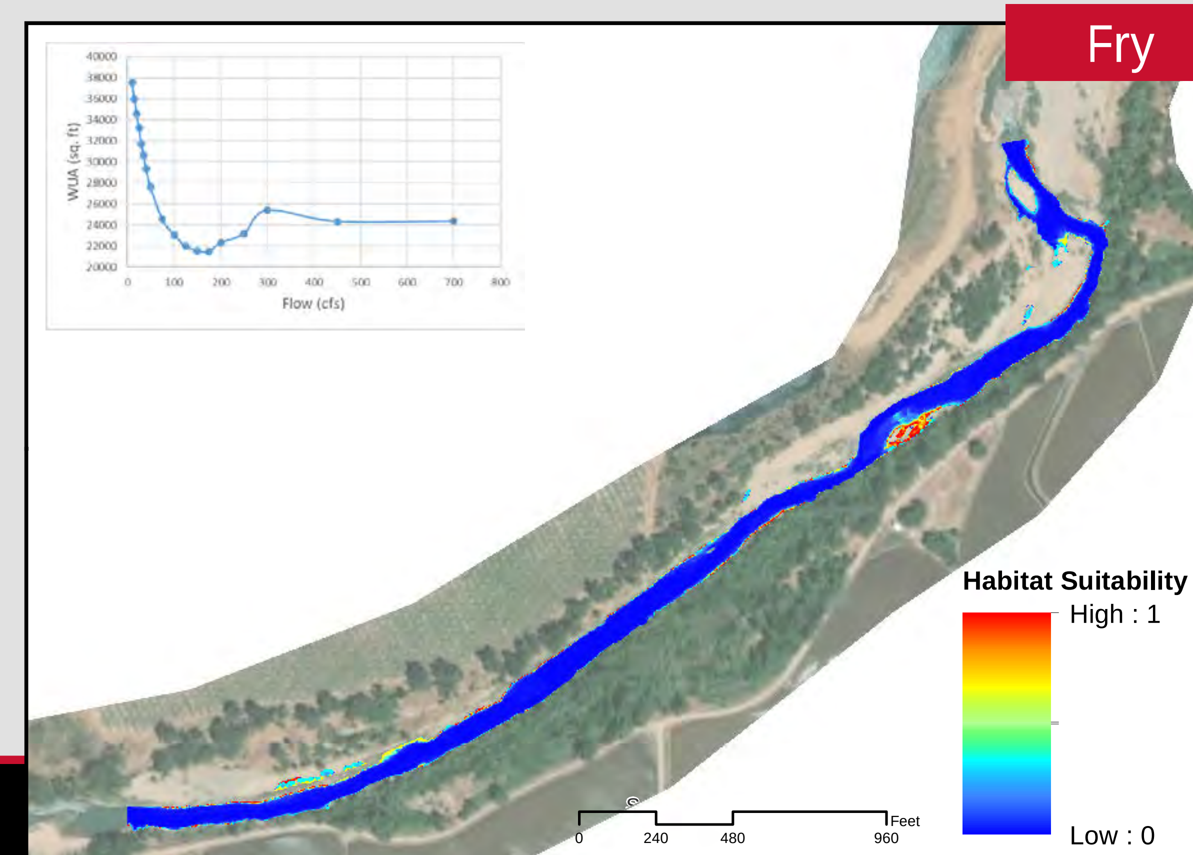
SSWD HDR

Steelhead

Upstream Study Site 300 cfs



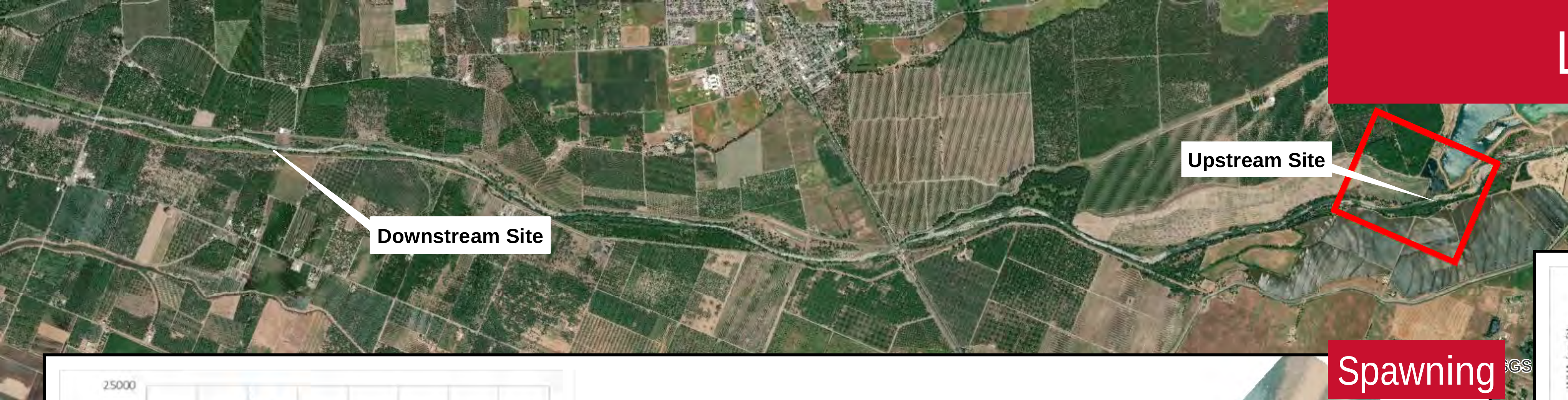




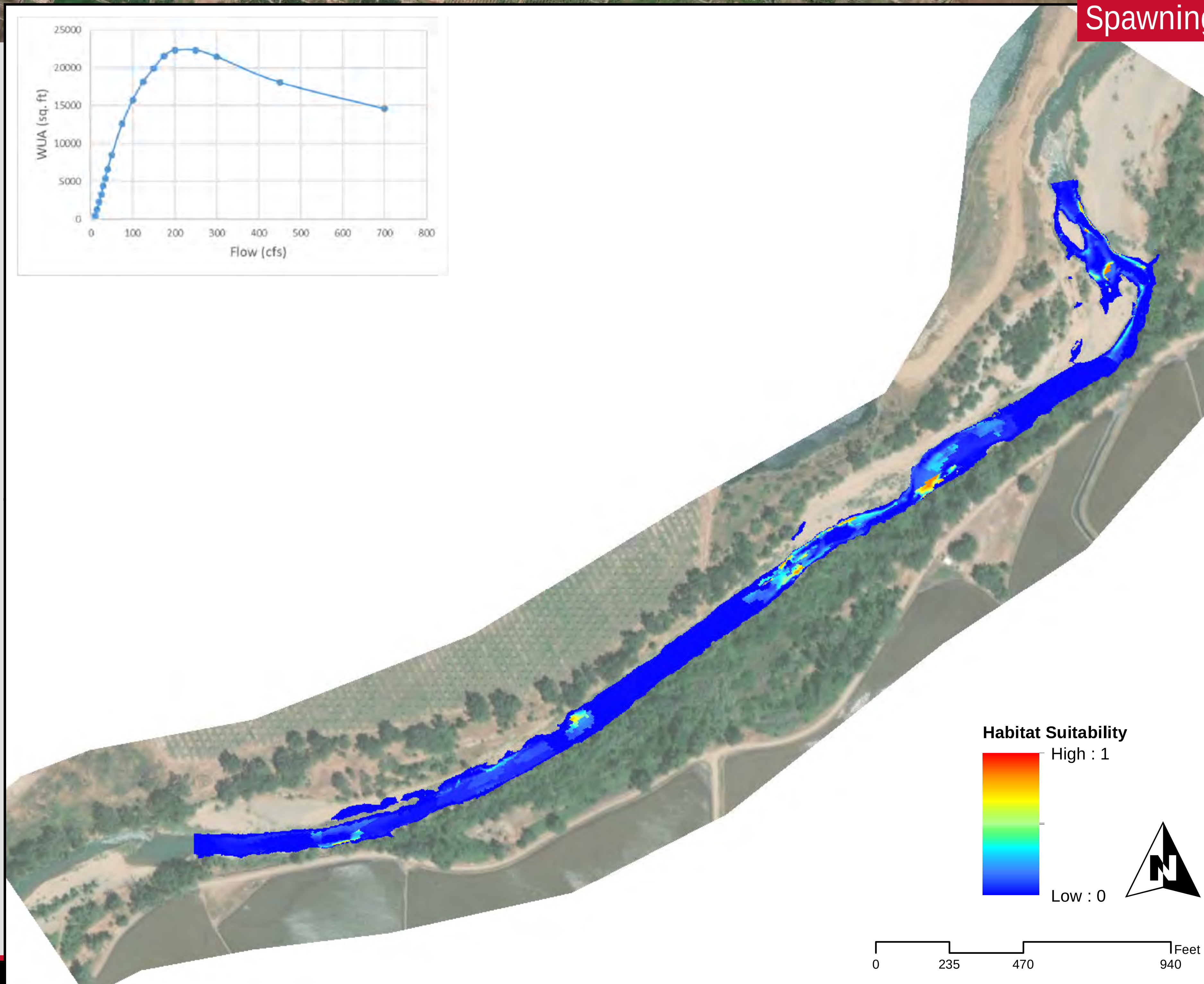
Lower Bear River - Instream Flow Study

Steelhead

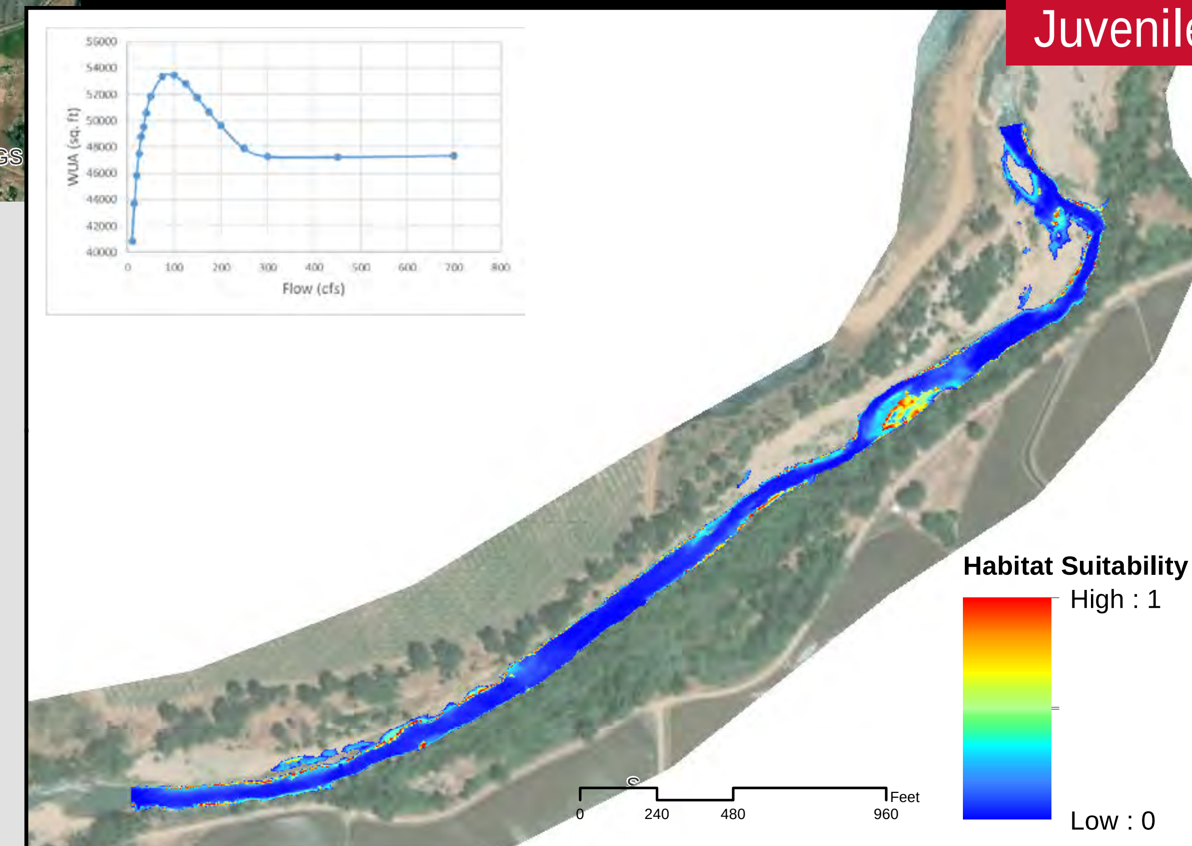
Upstream Study Site 450 cfs



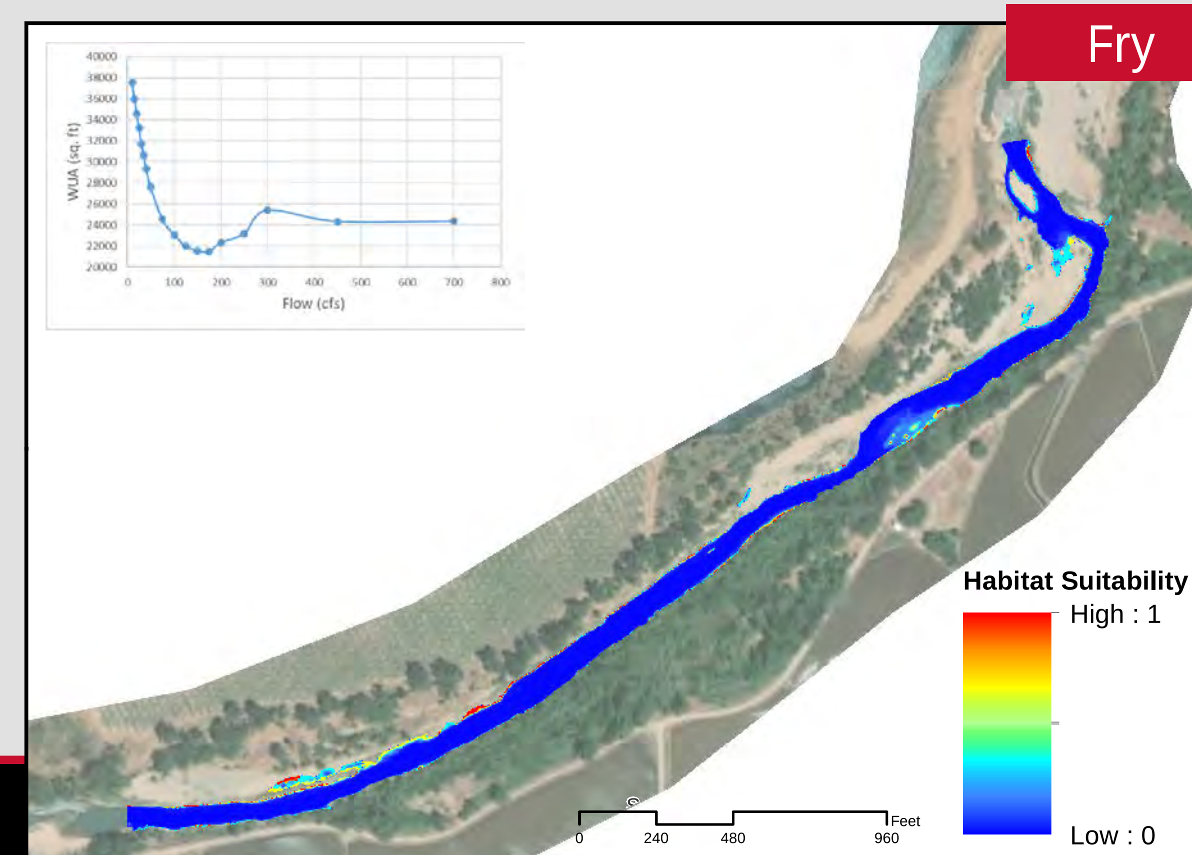
Spawning



Juvenile



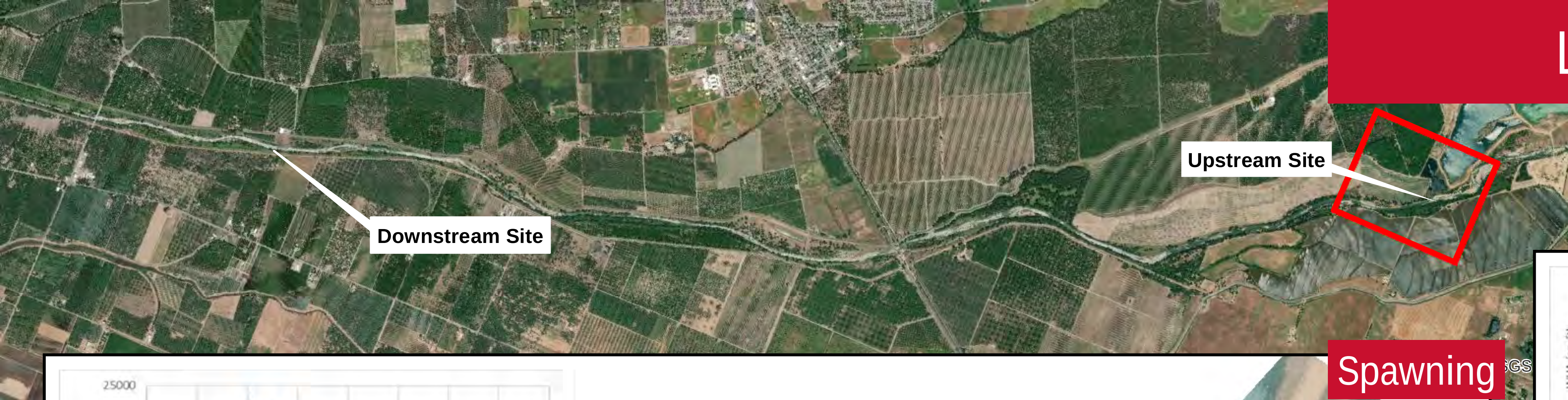
Fry



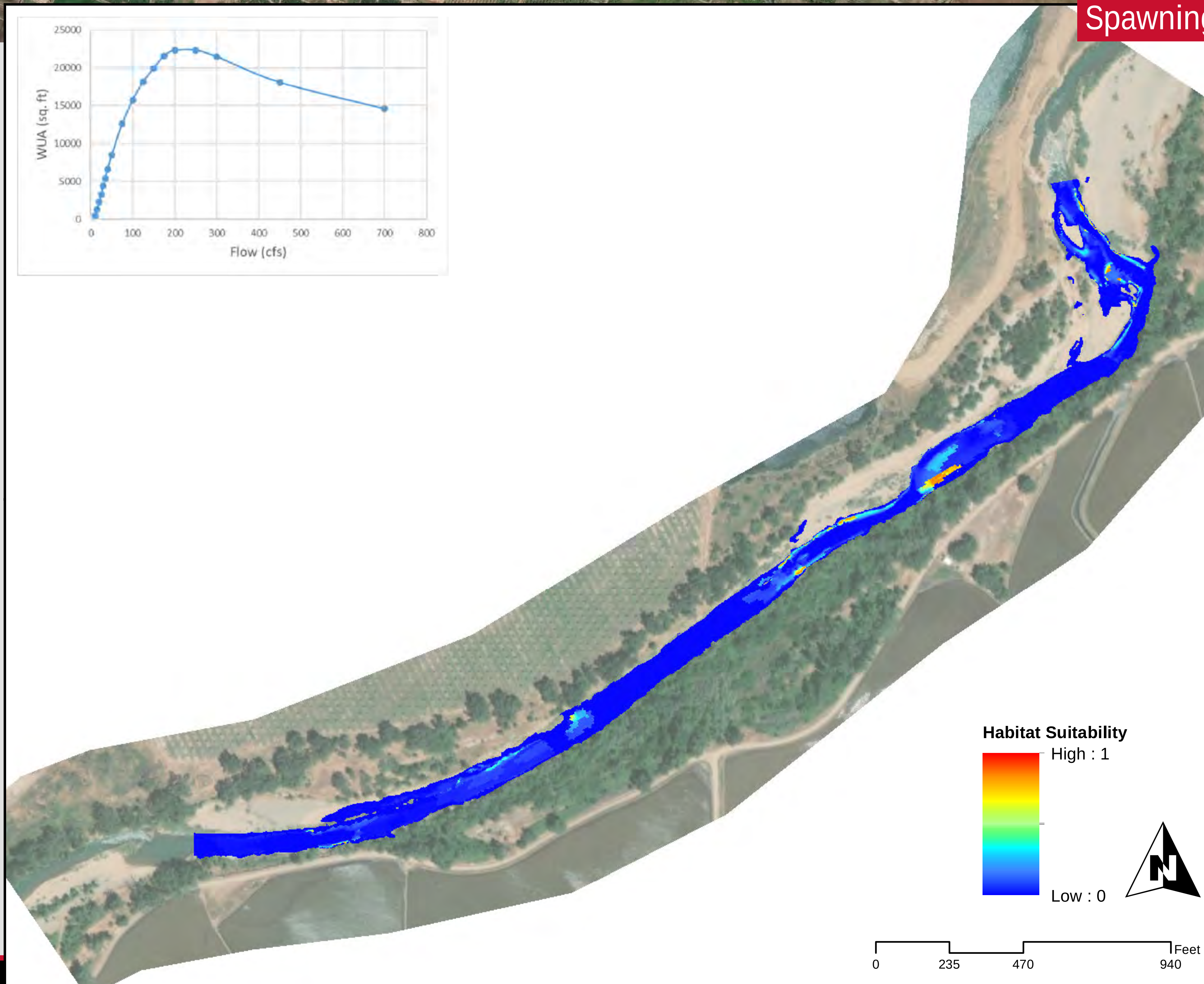
Lower Bear River - Instream Flow Study

Steelhead

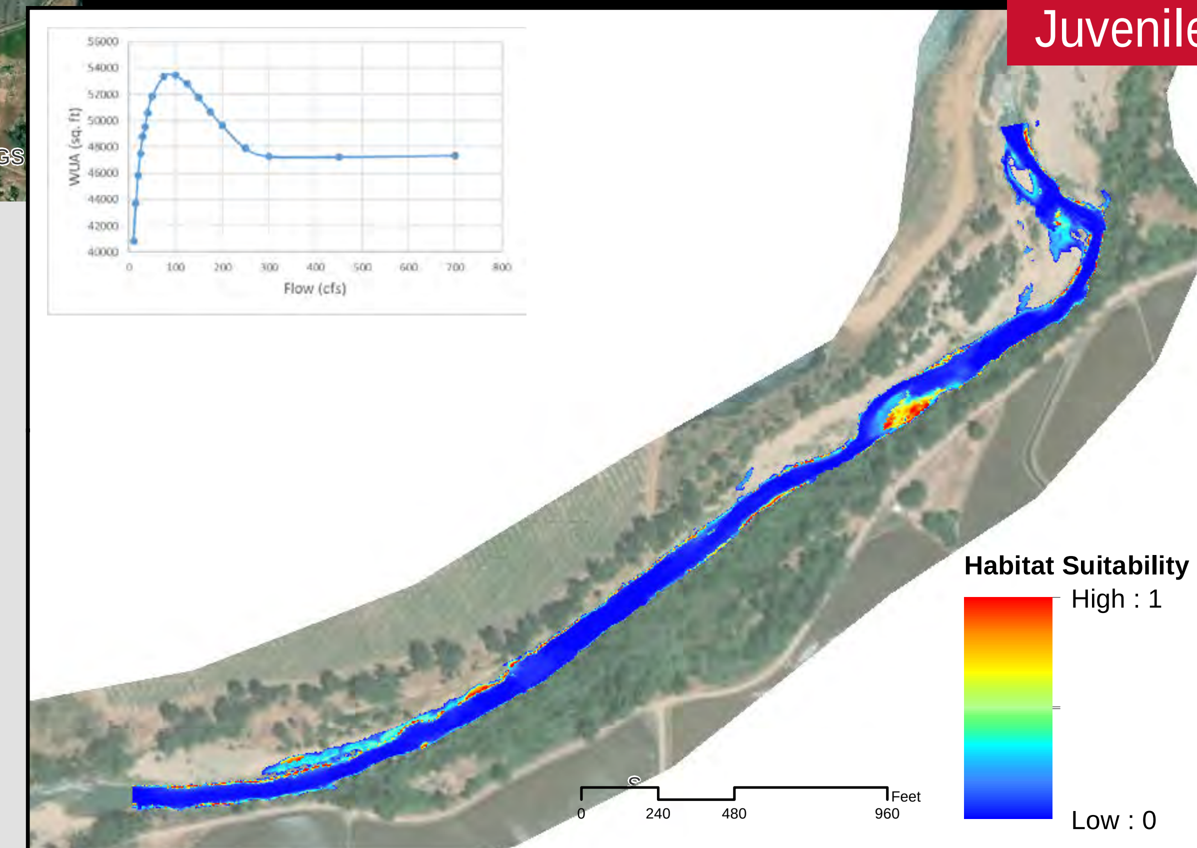
Upstream Study Site 700 cfs



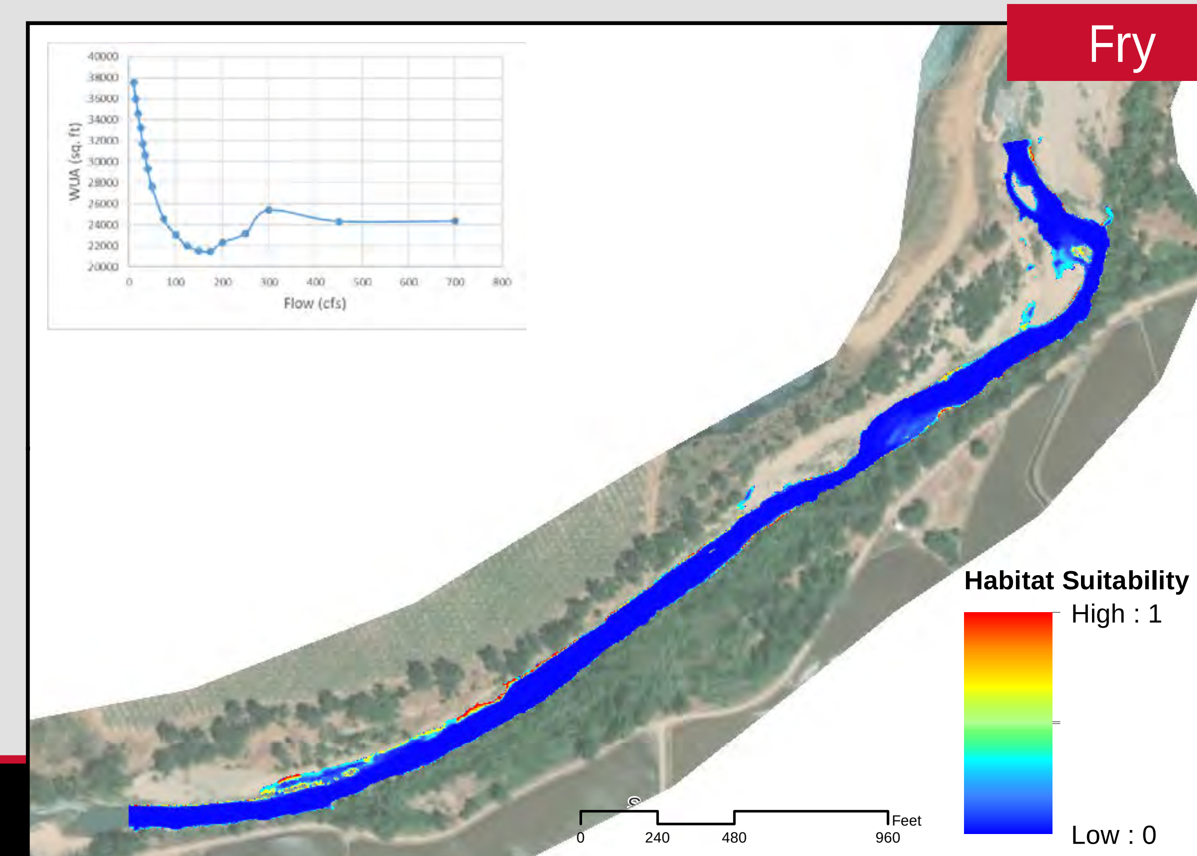
Spawning



Juvenile



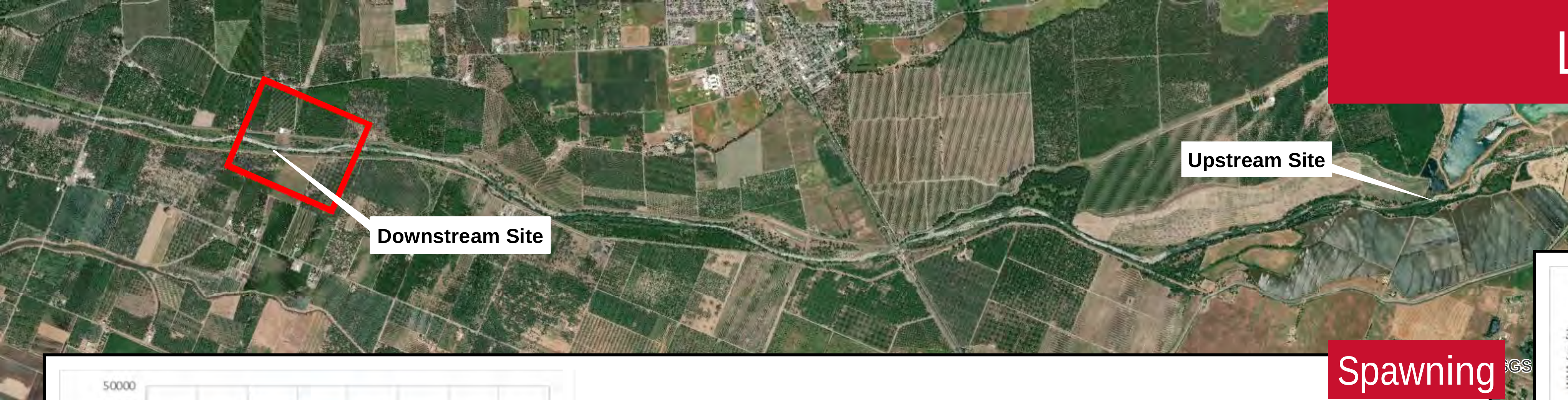
Fry



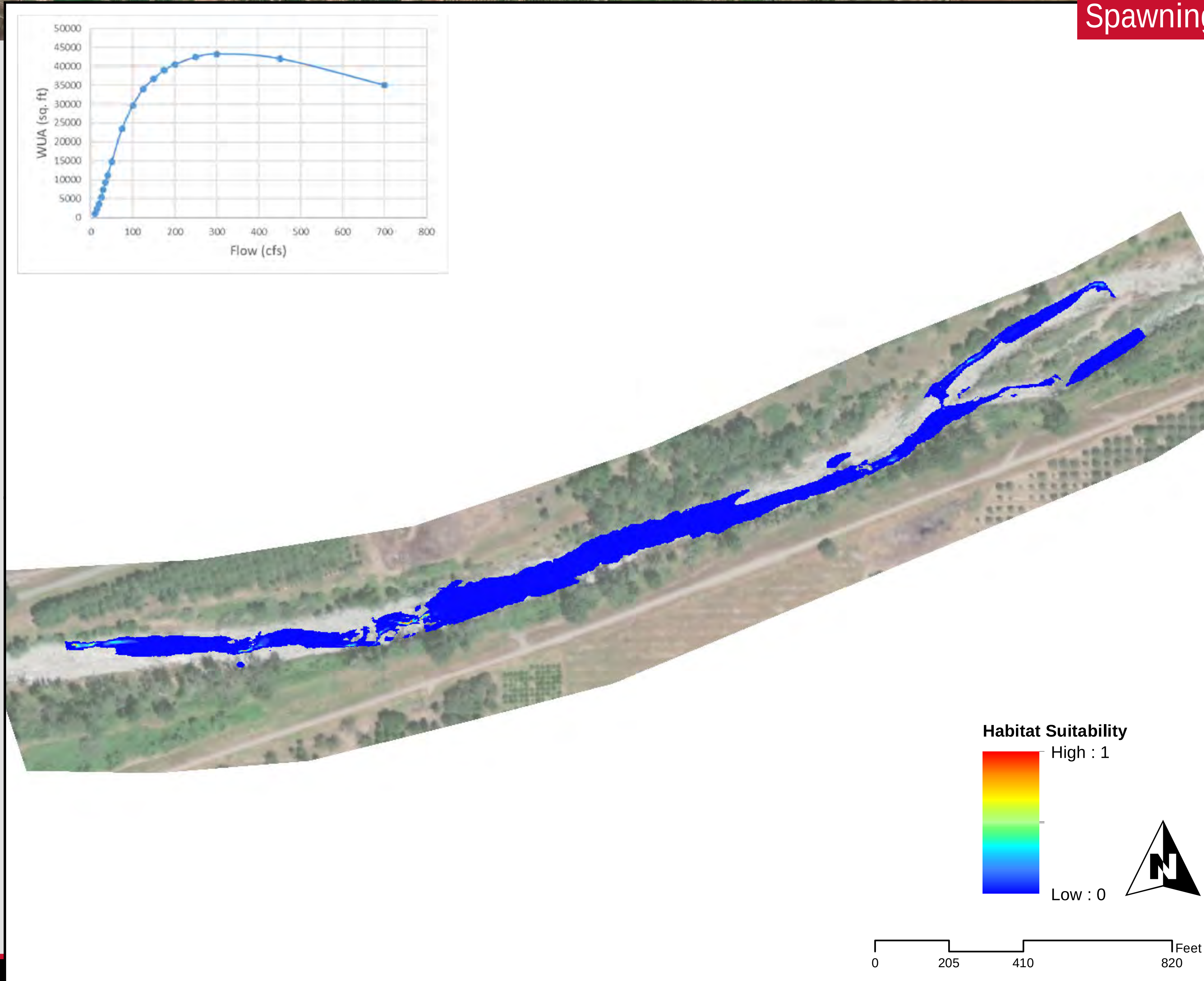
Lower Bear River - Instream Flow Study

Steelhead

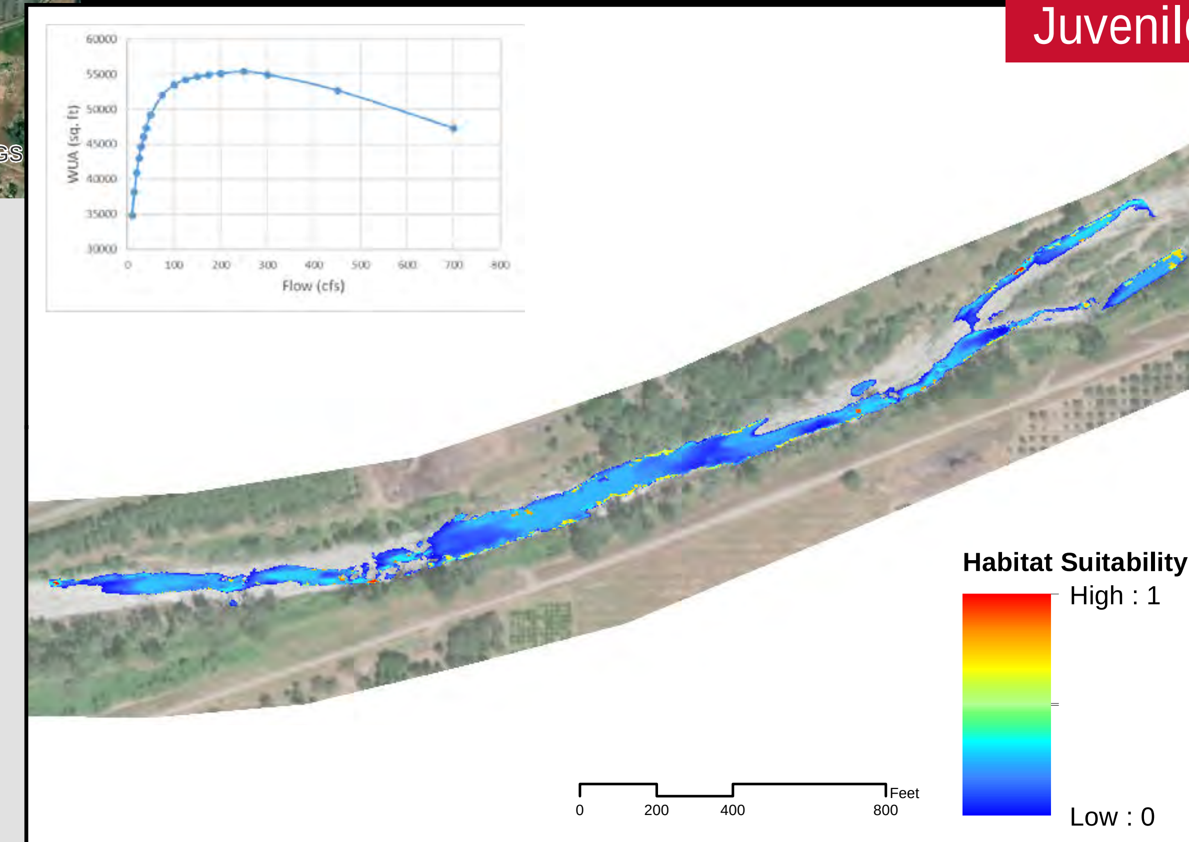
Downstream Study Site 10 cfs



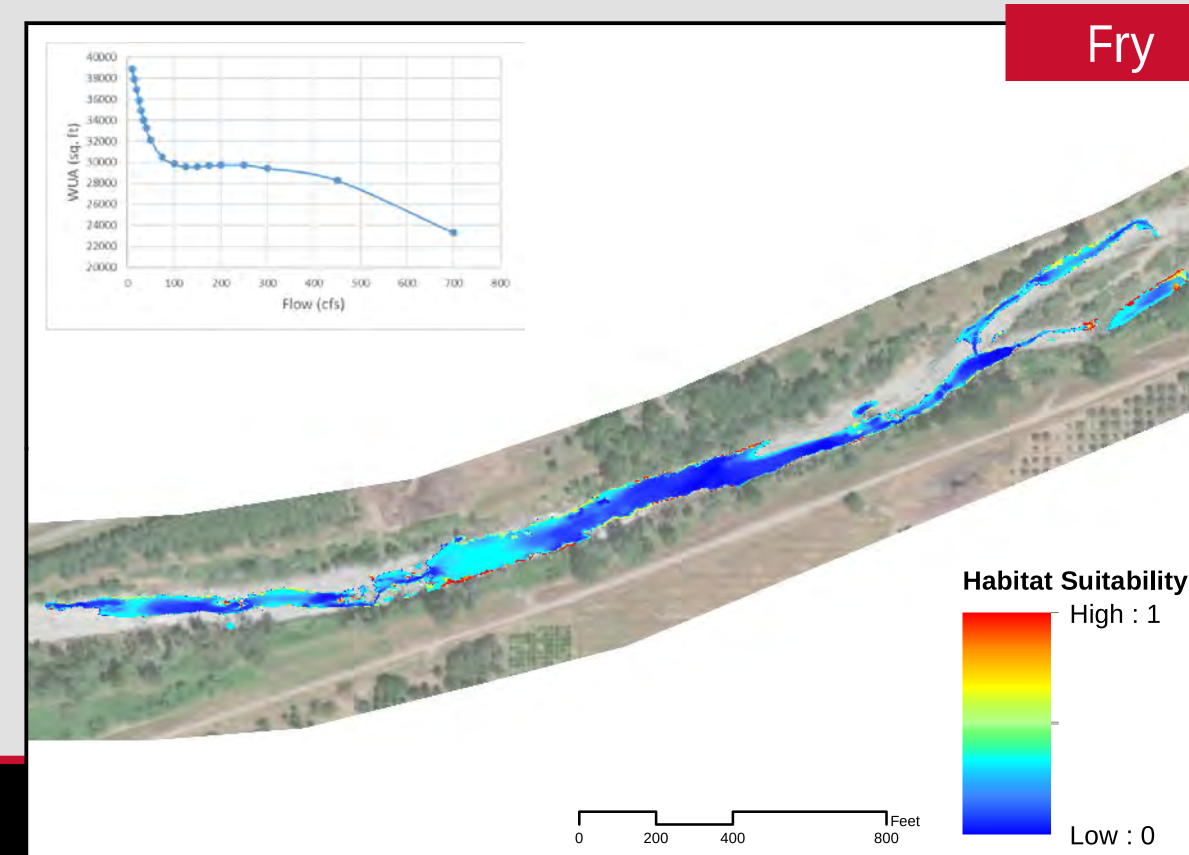
Spawning



Juvenile



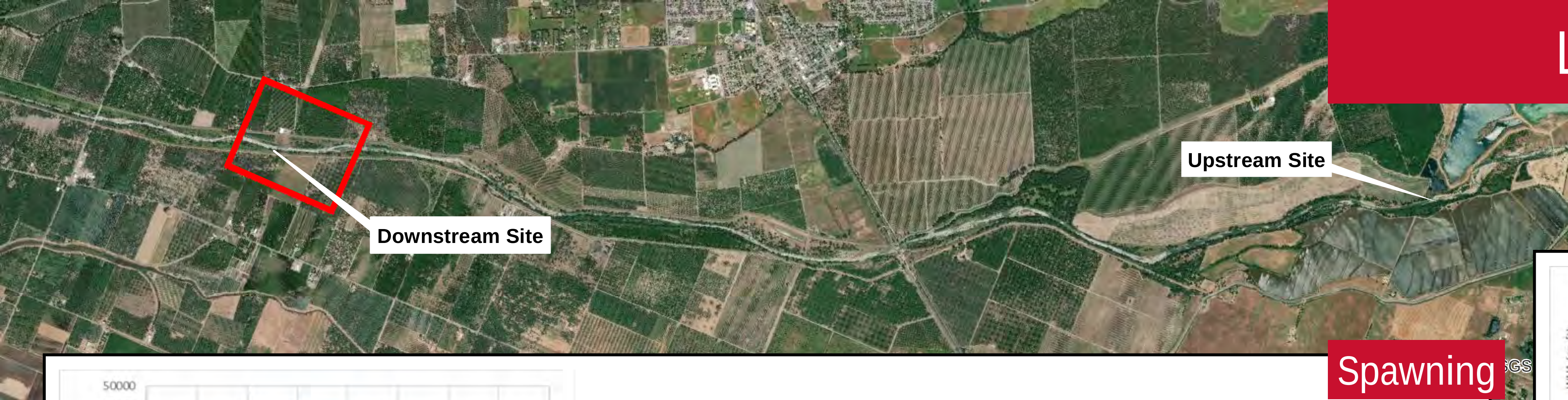
Fry



Lower Bear River - Instream Flow Study

Steelhead

Downstream Study Site 15 cfs



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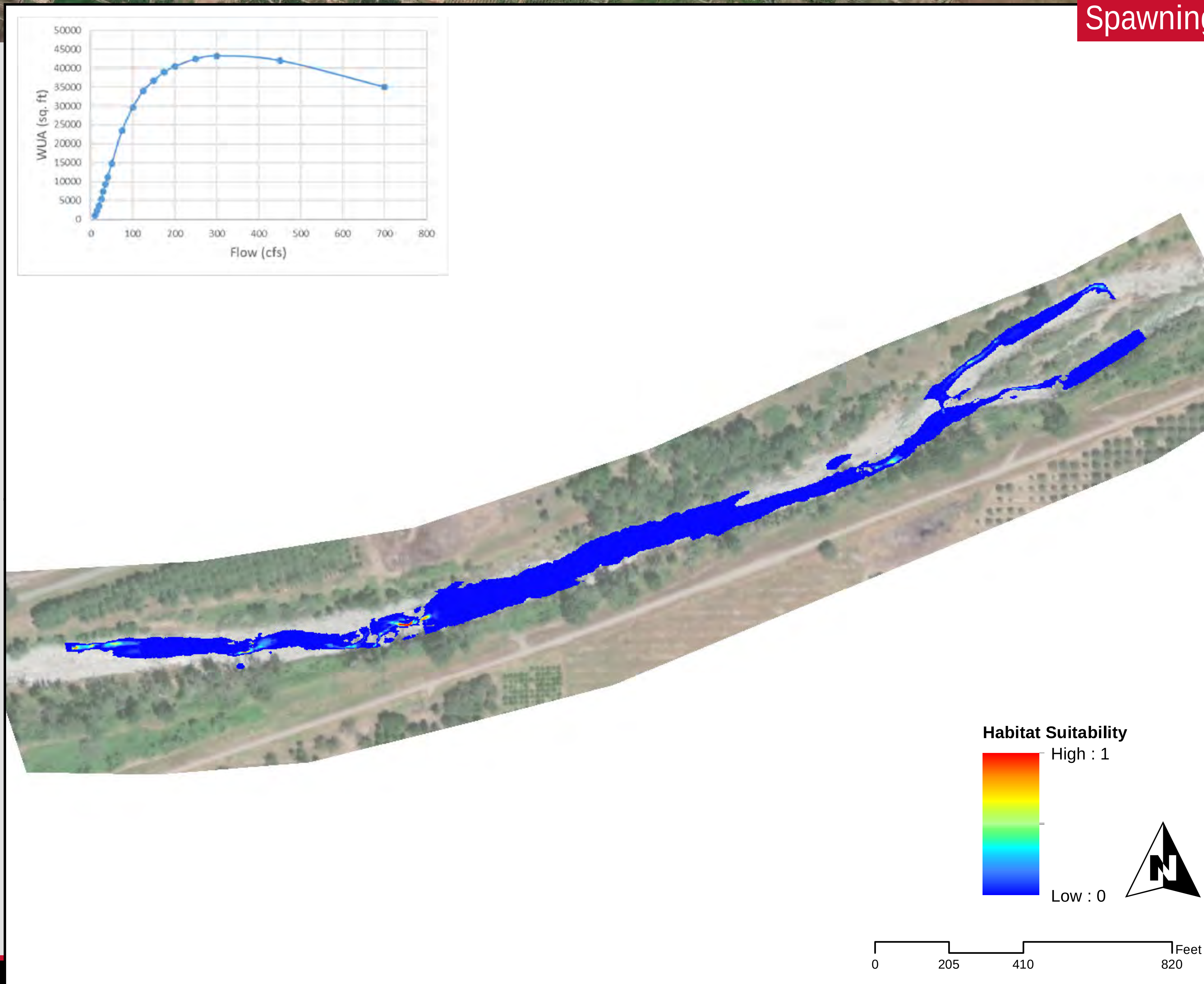

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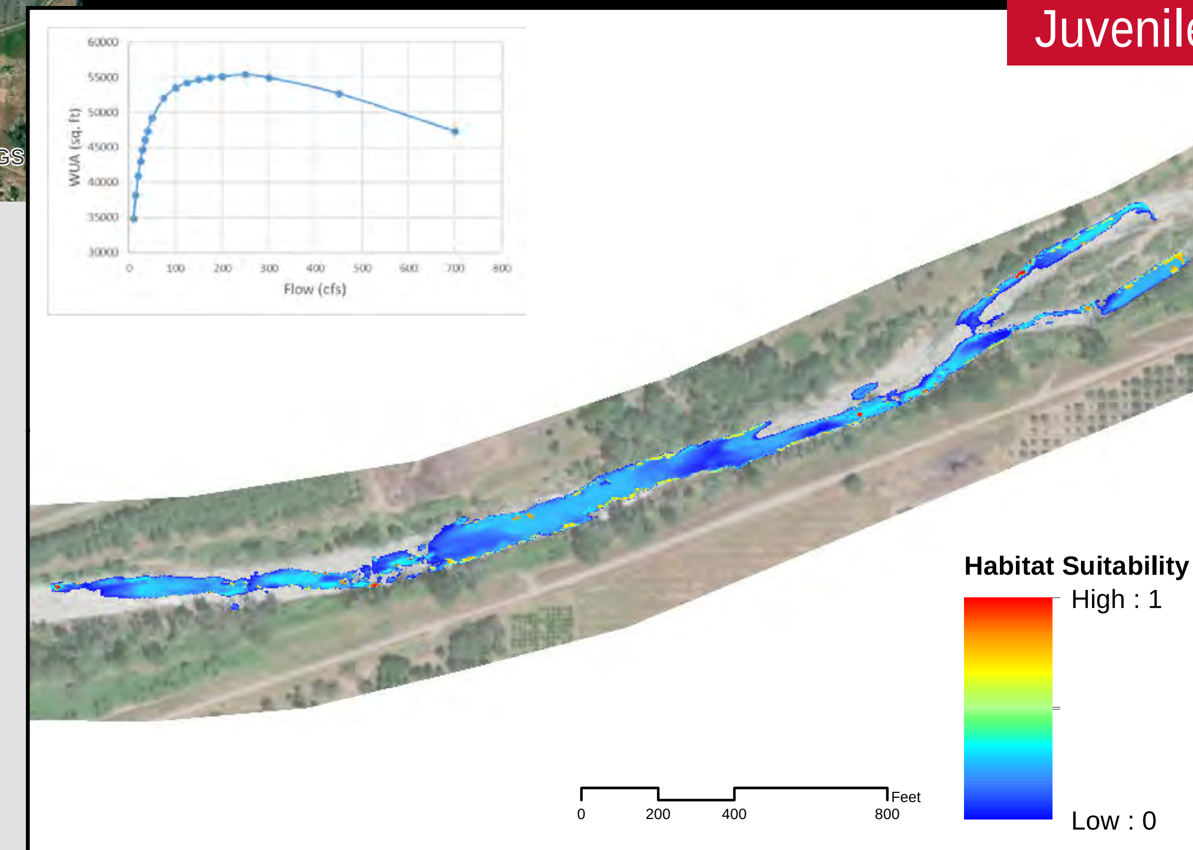

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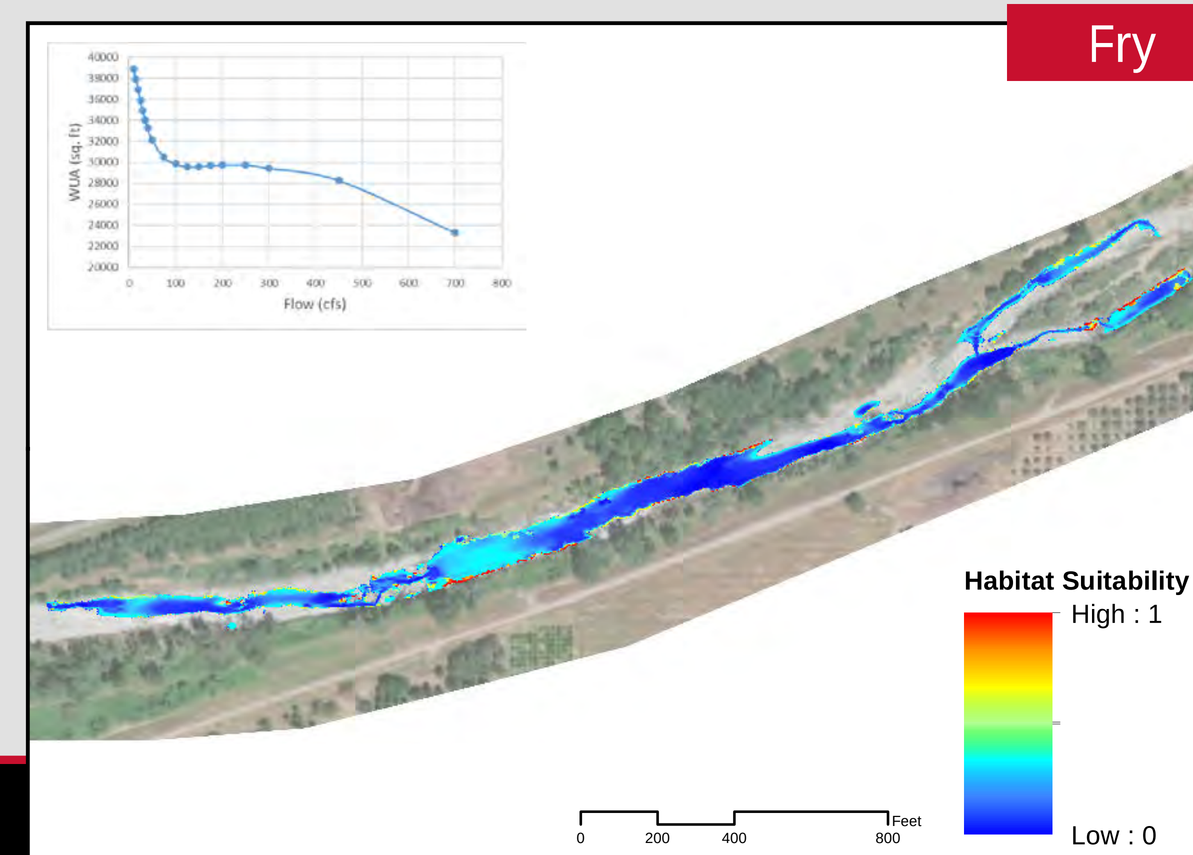
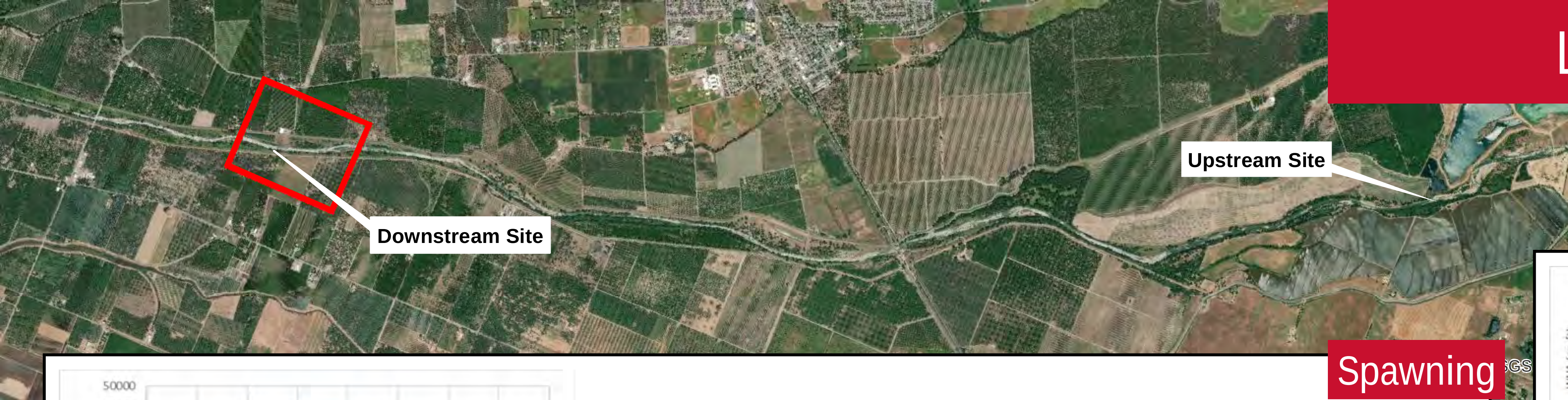


Lower Bear River - Instream Flow Study

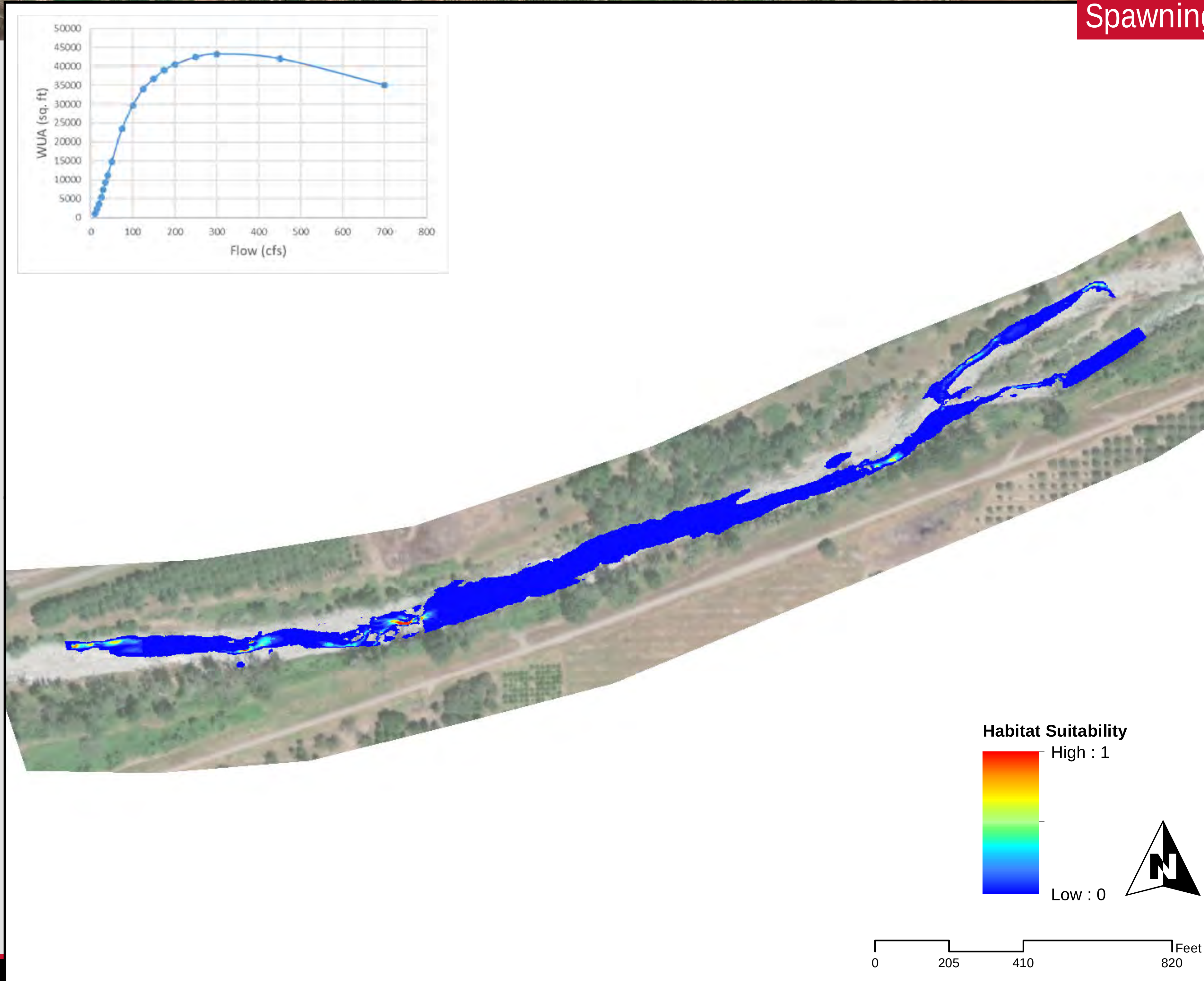


SSWD HDR

Steelhead

Downstream Study Site 20 cfs

Spawning



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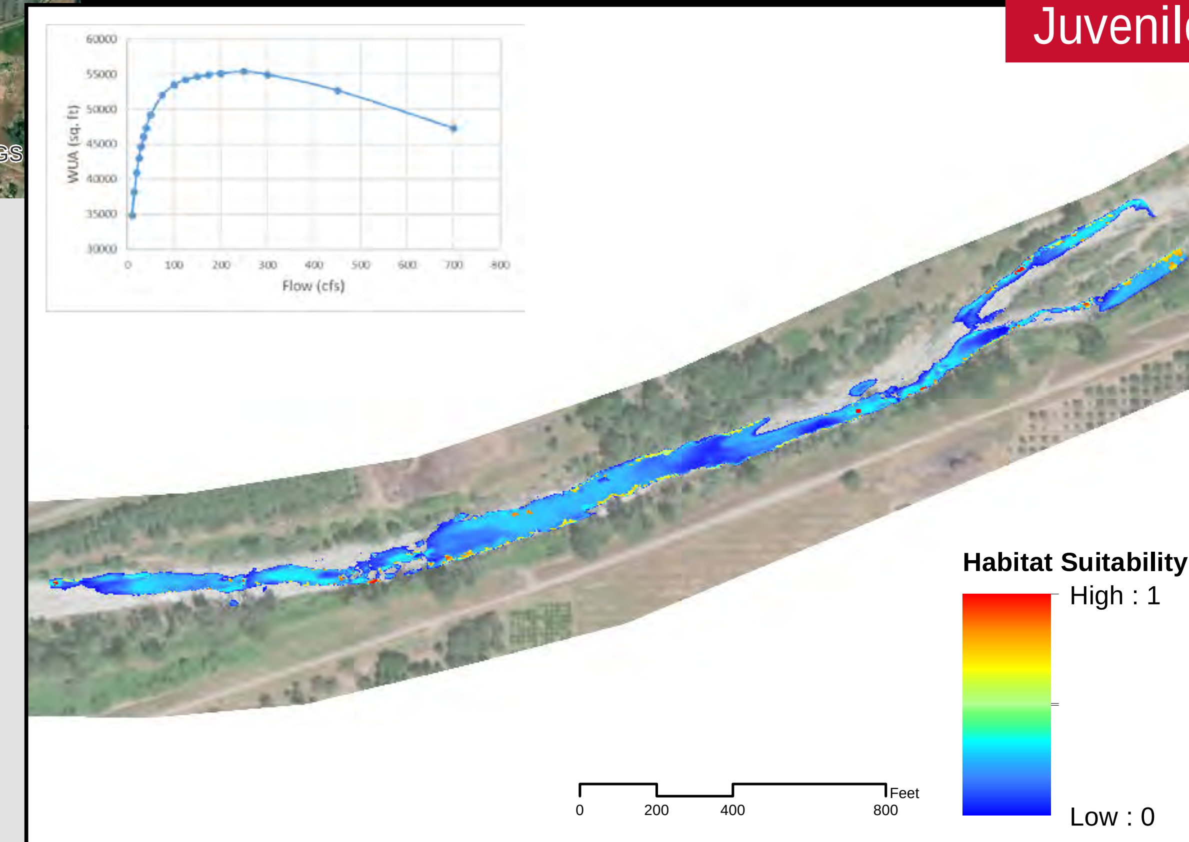

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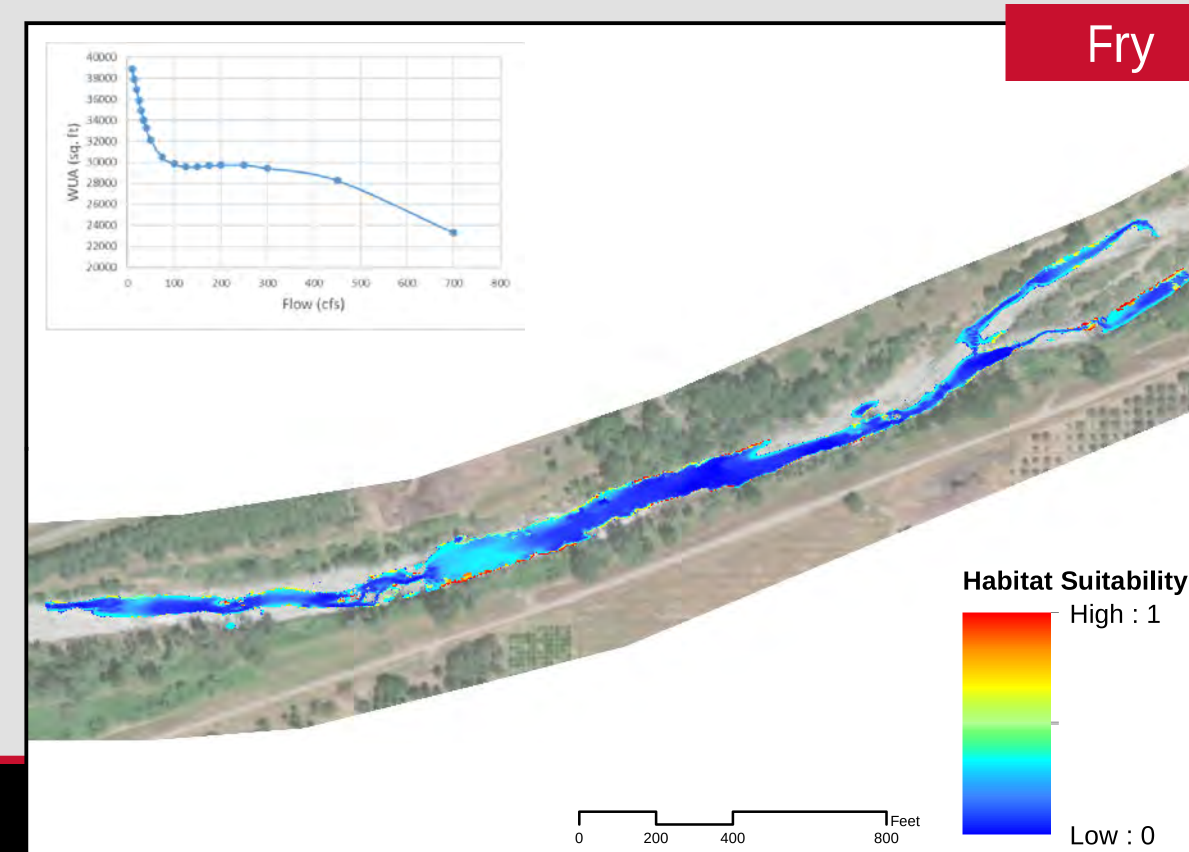
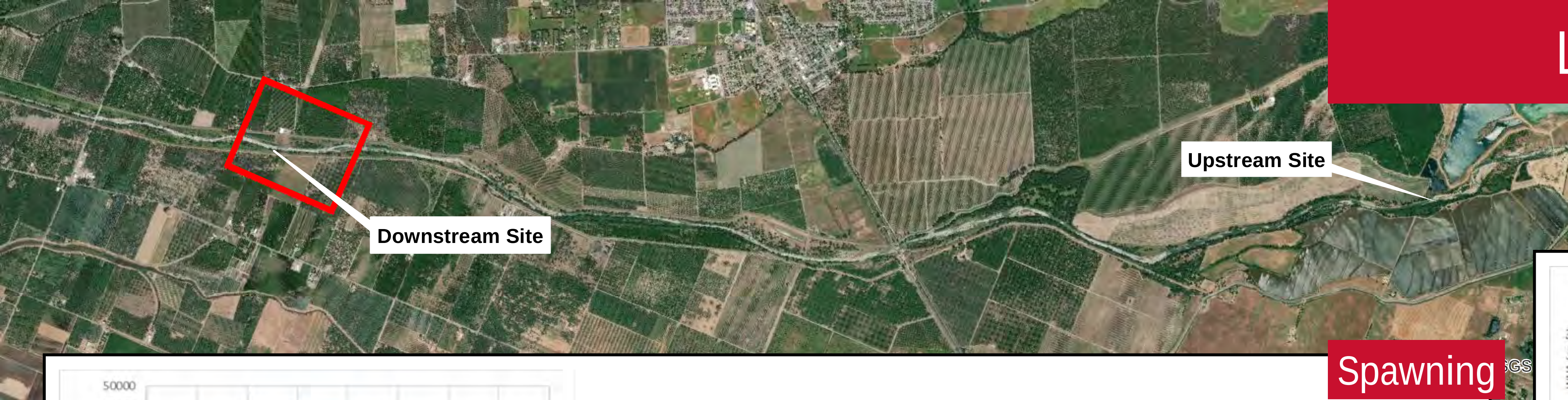


Lower Bear River - Instream Flow Study

SSWD HDR

Steelhead

Downstream Study Site 25 cfs



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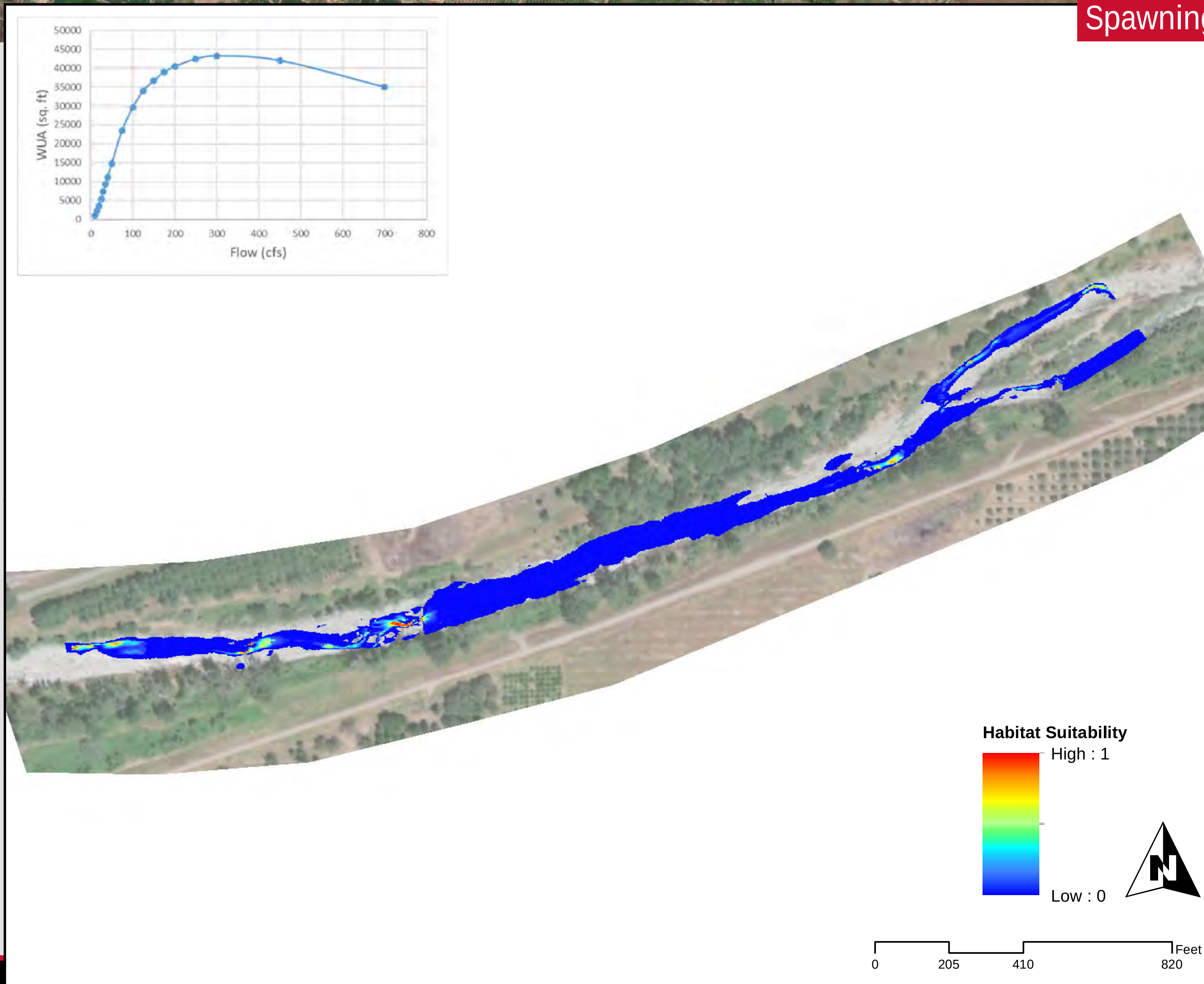

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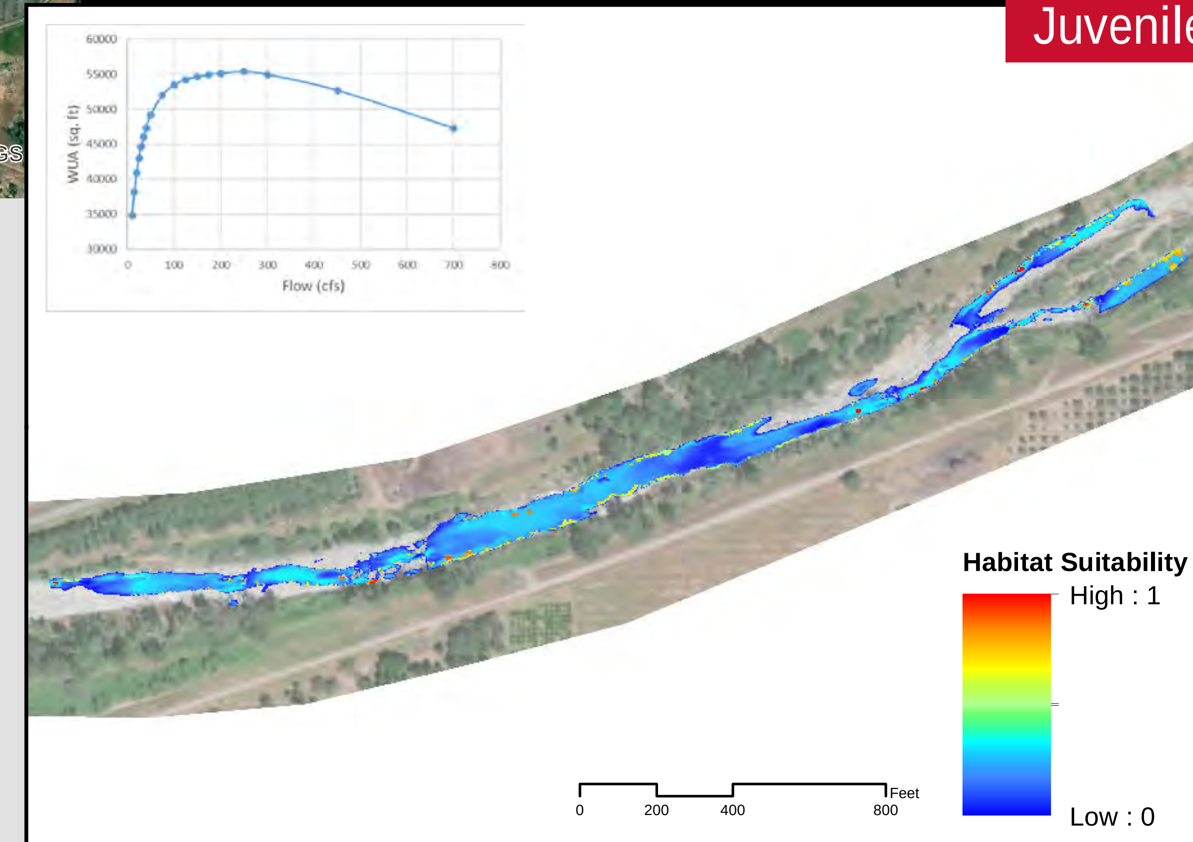

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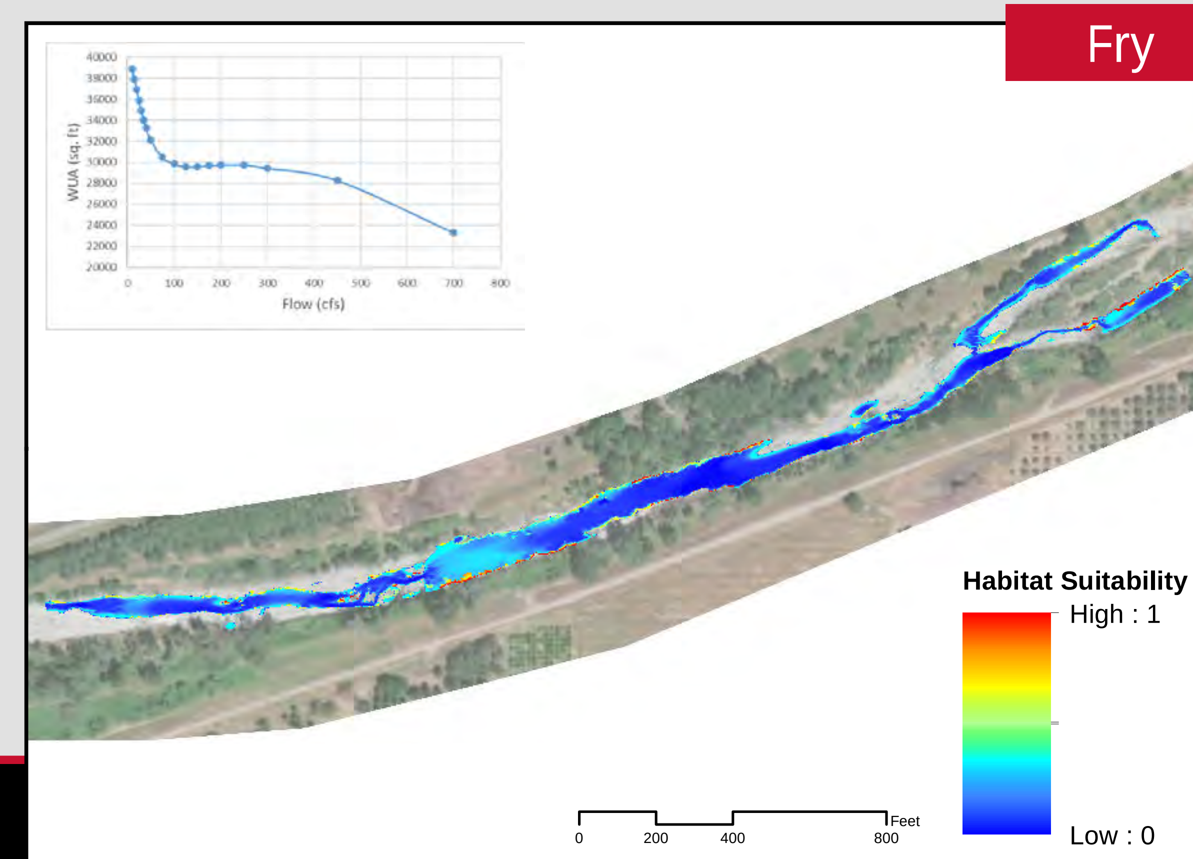

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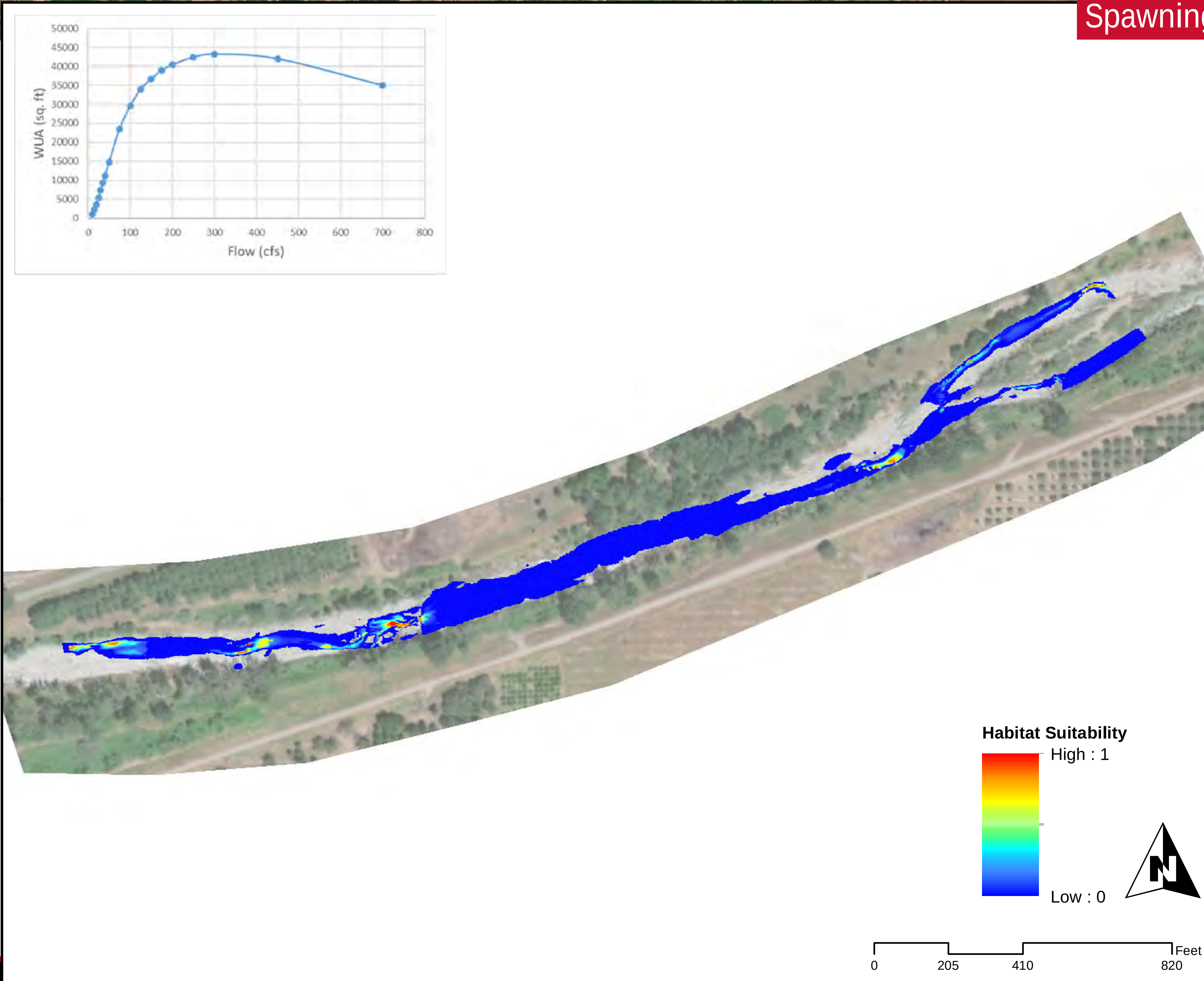
Lower Bear River - Instream Flow Study

SSWD HDR

Steelhead

Downstream Study Site 30 cfs

Spawning



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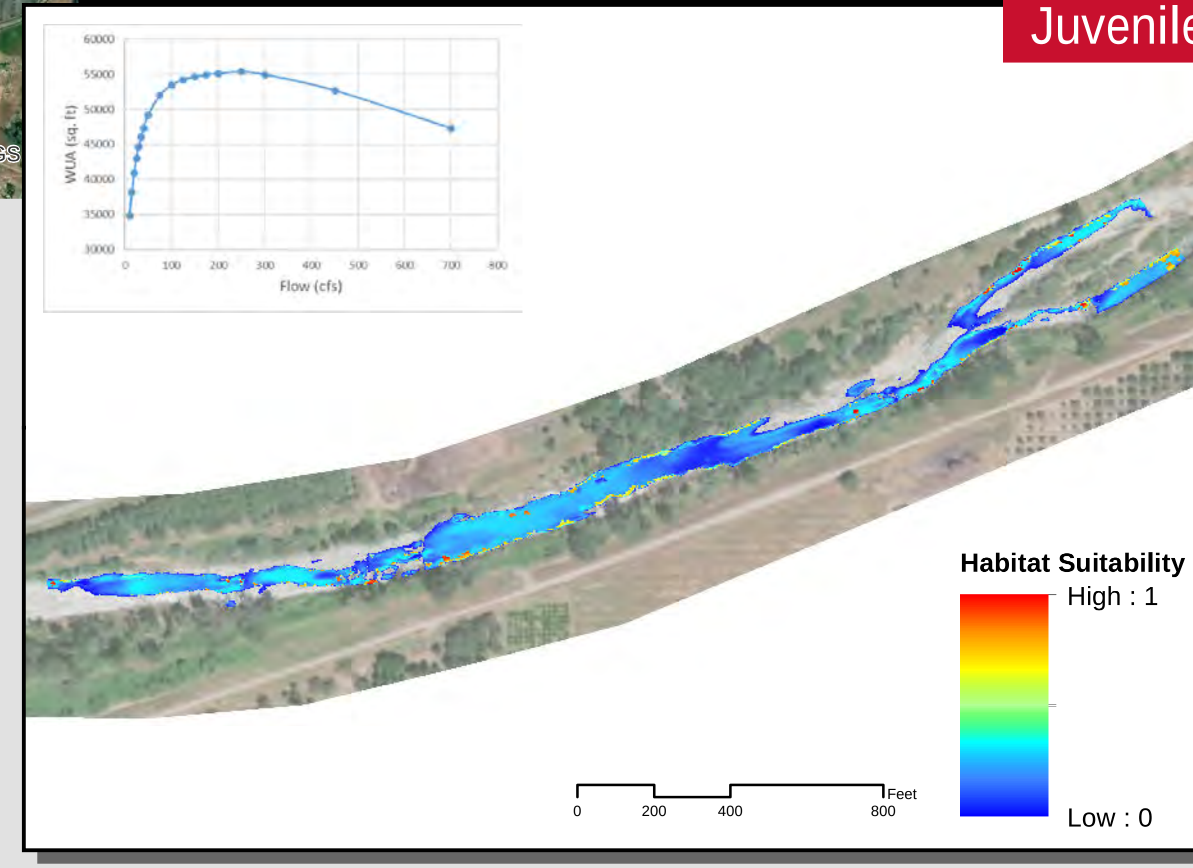

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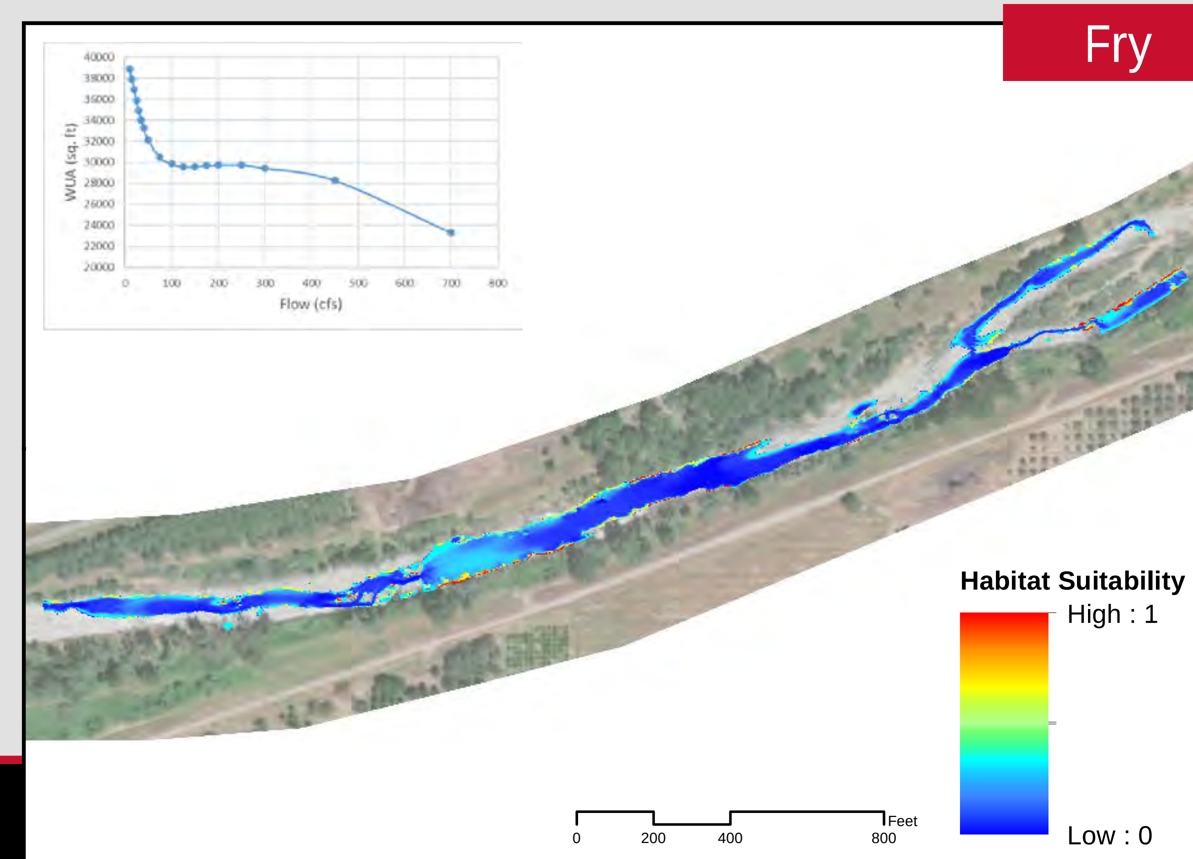
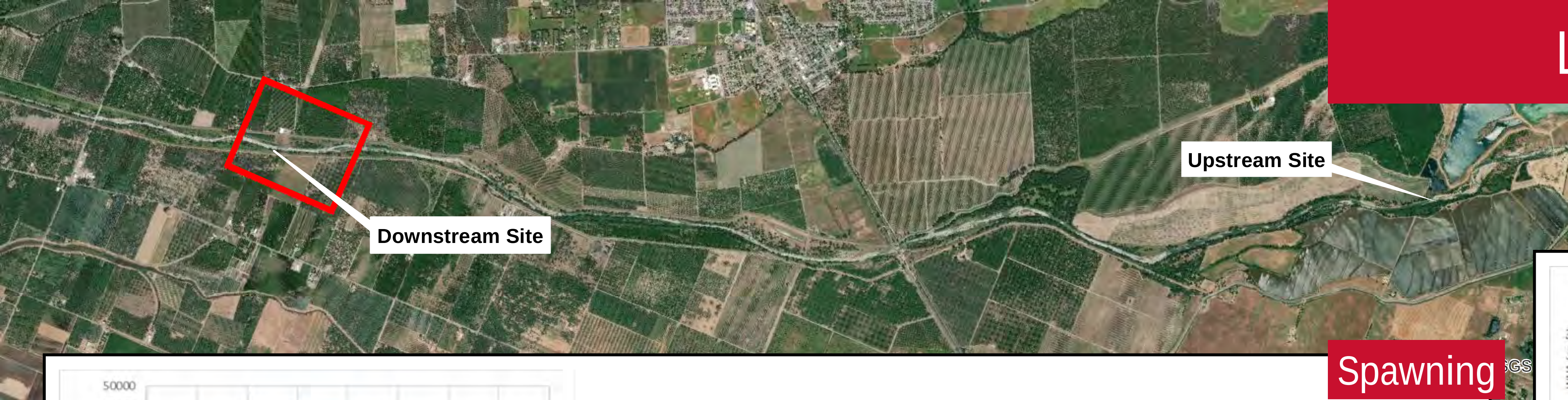


Lower Bear River - Instream Flow Study

SSWD HDR

Steelhead

Downstream Study Site 35 cfs



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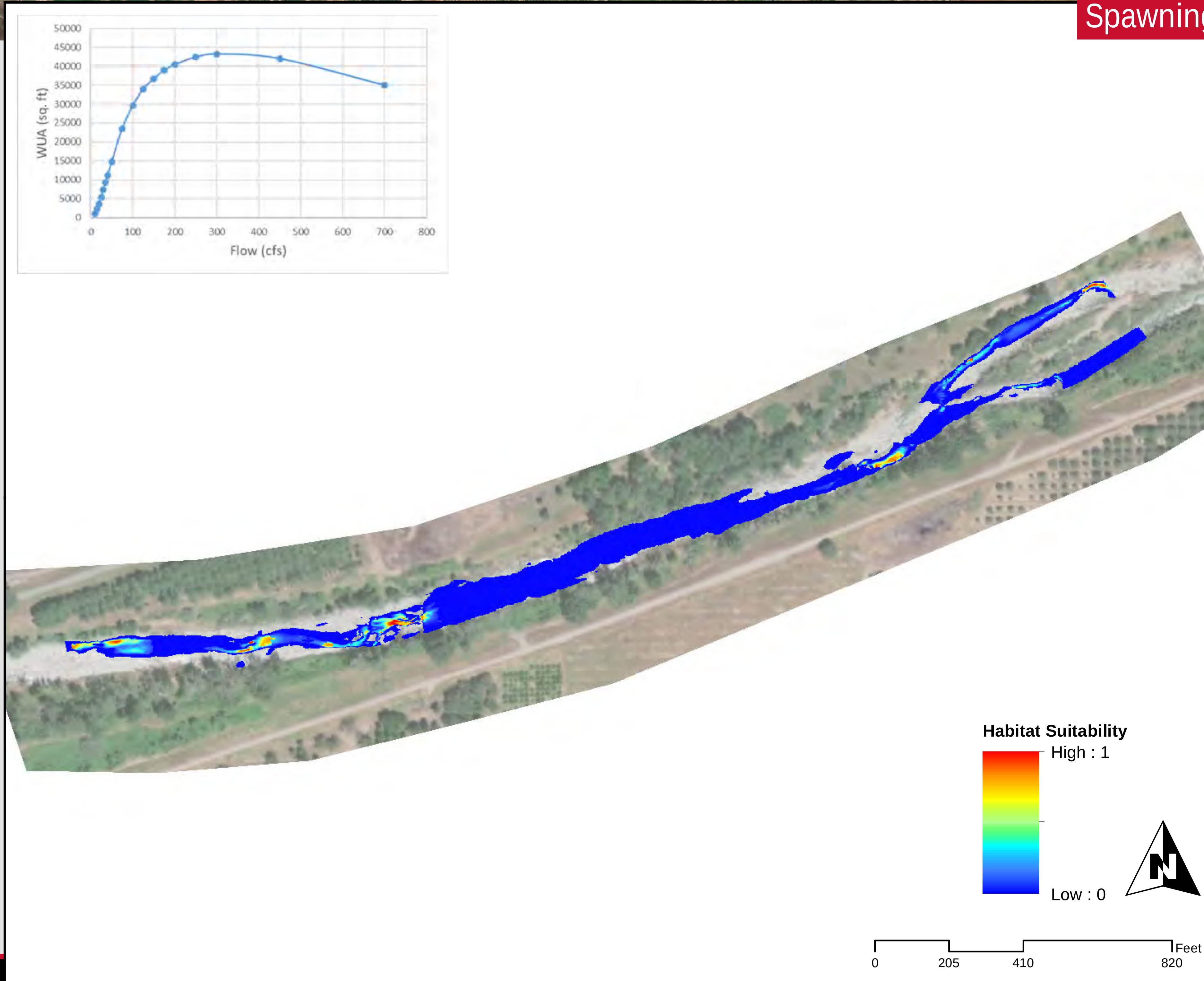

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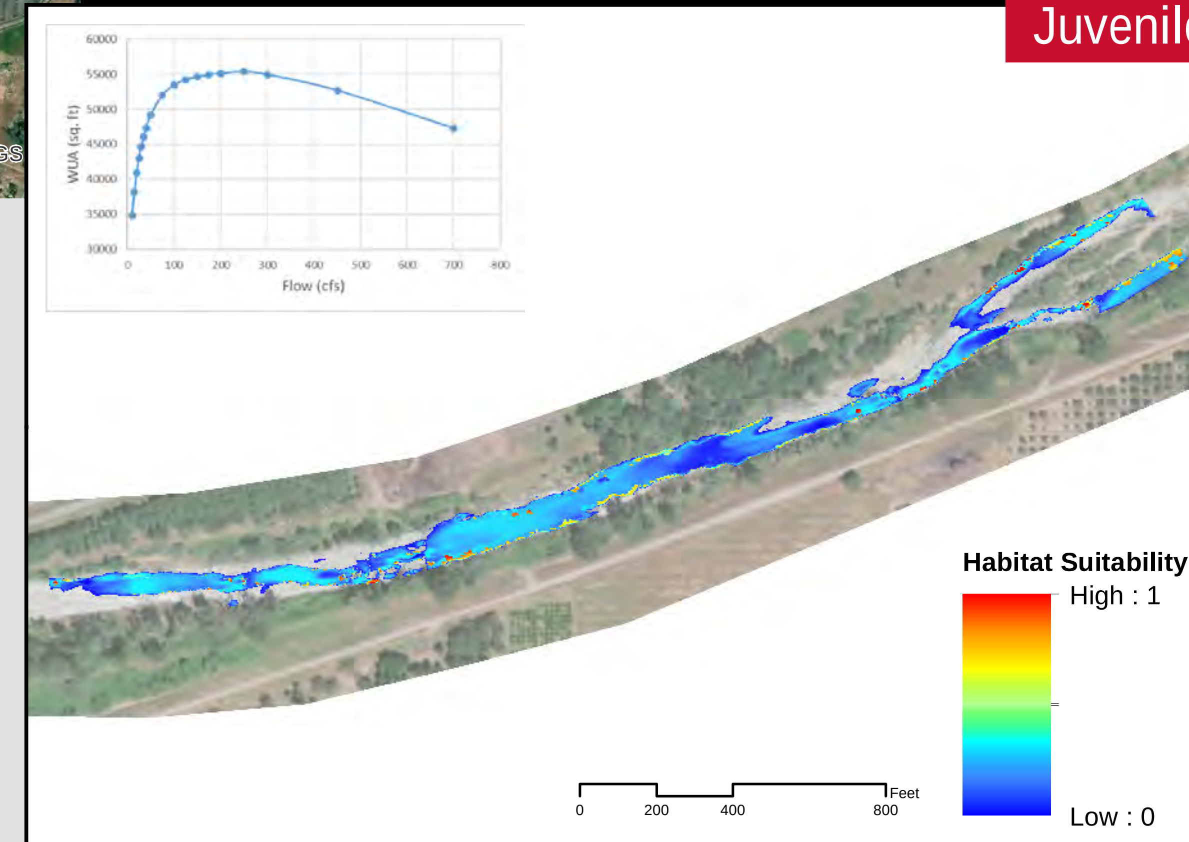

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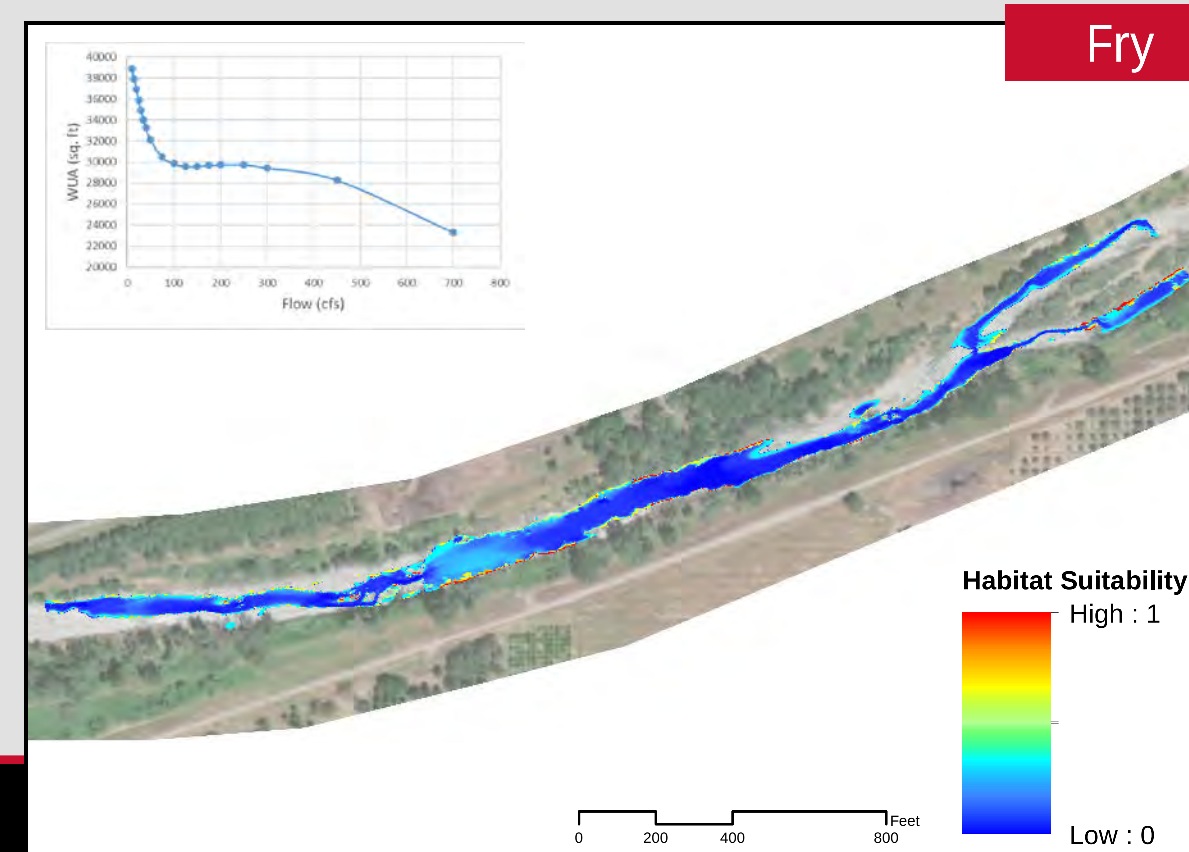
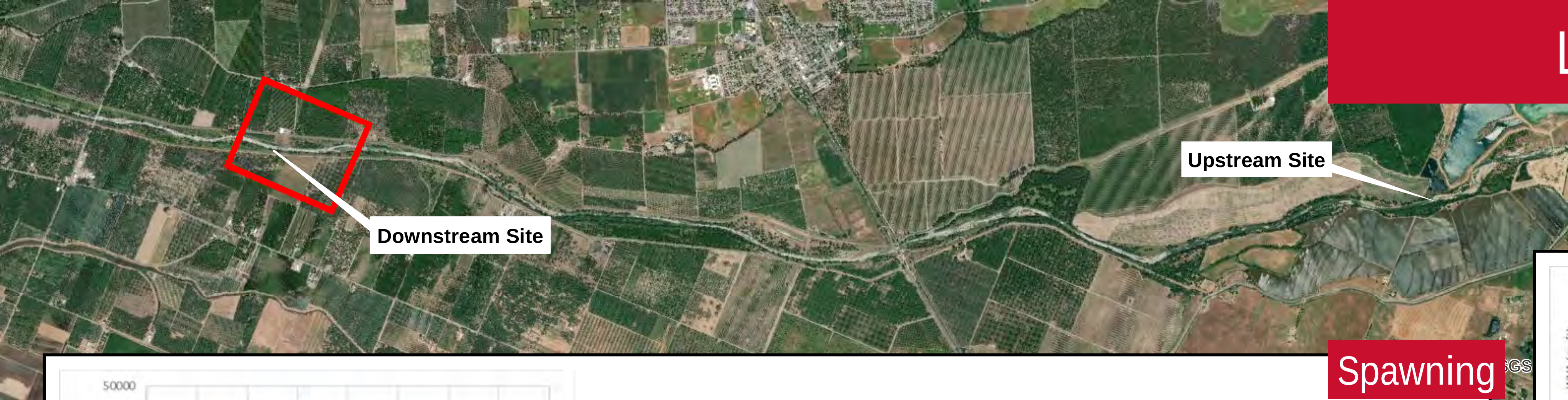


Lower Bear River - Instream Flow Study

SSWD HDR

Steelhead

Downstream Study Site 40 cfs



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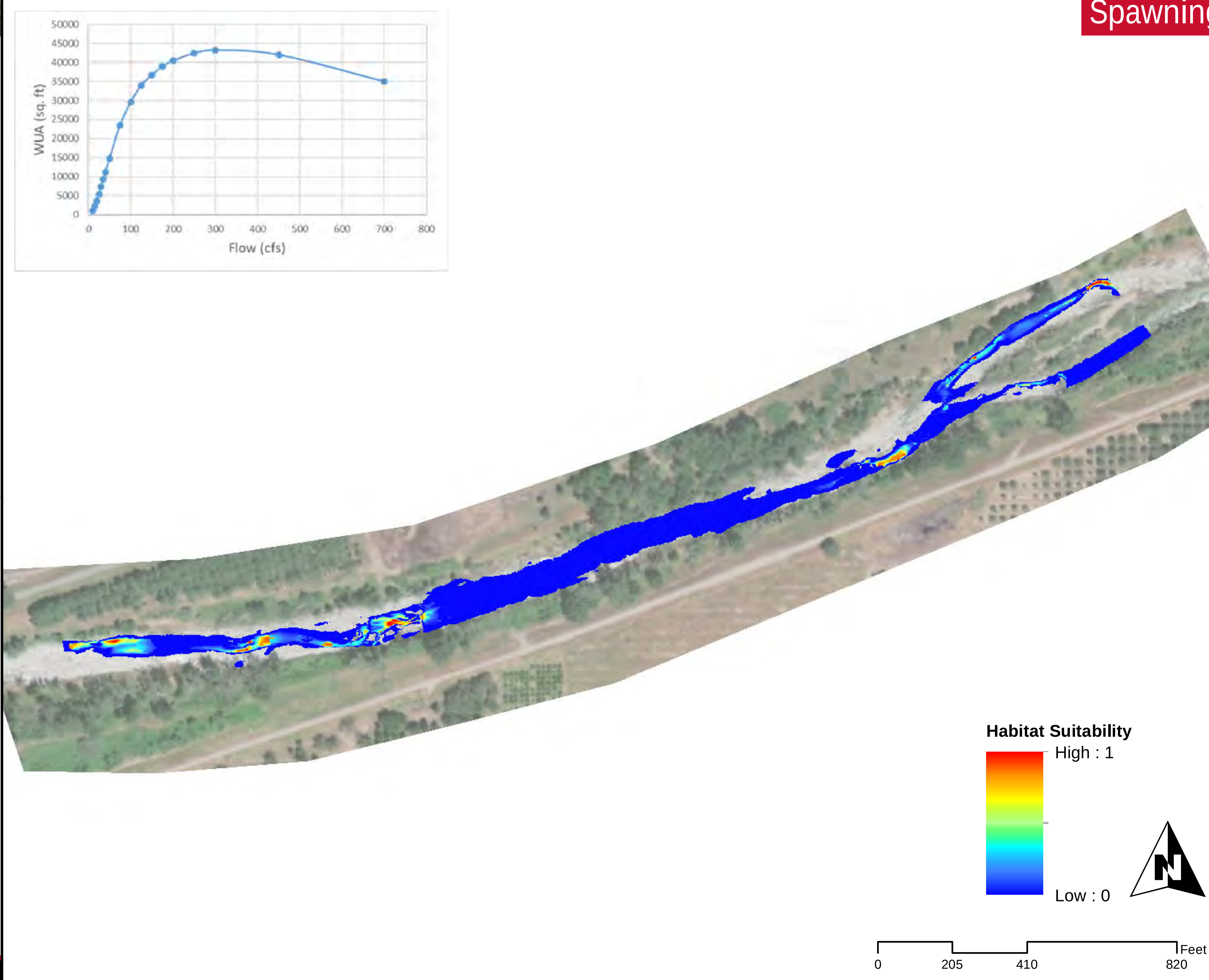

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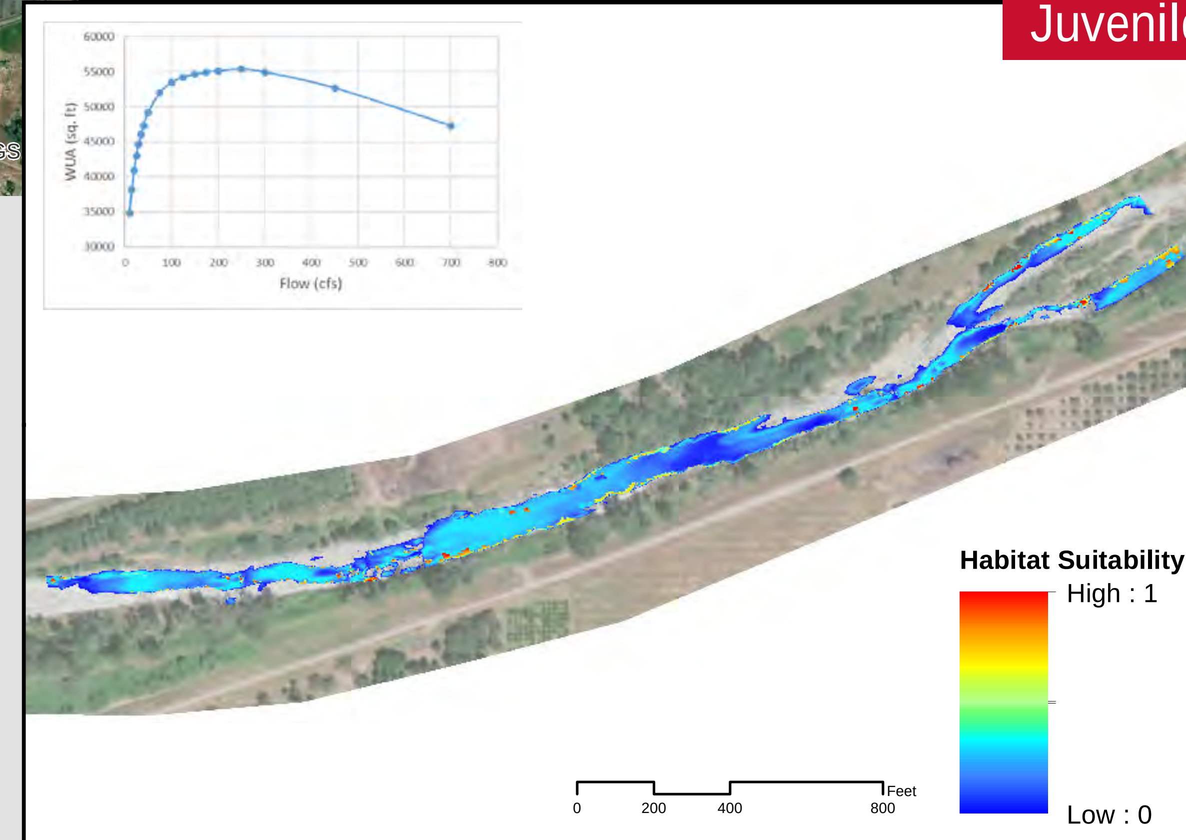

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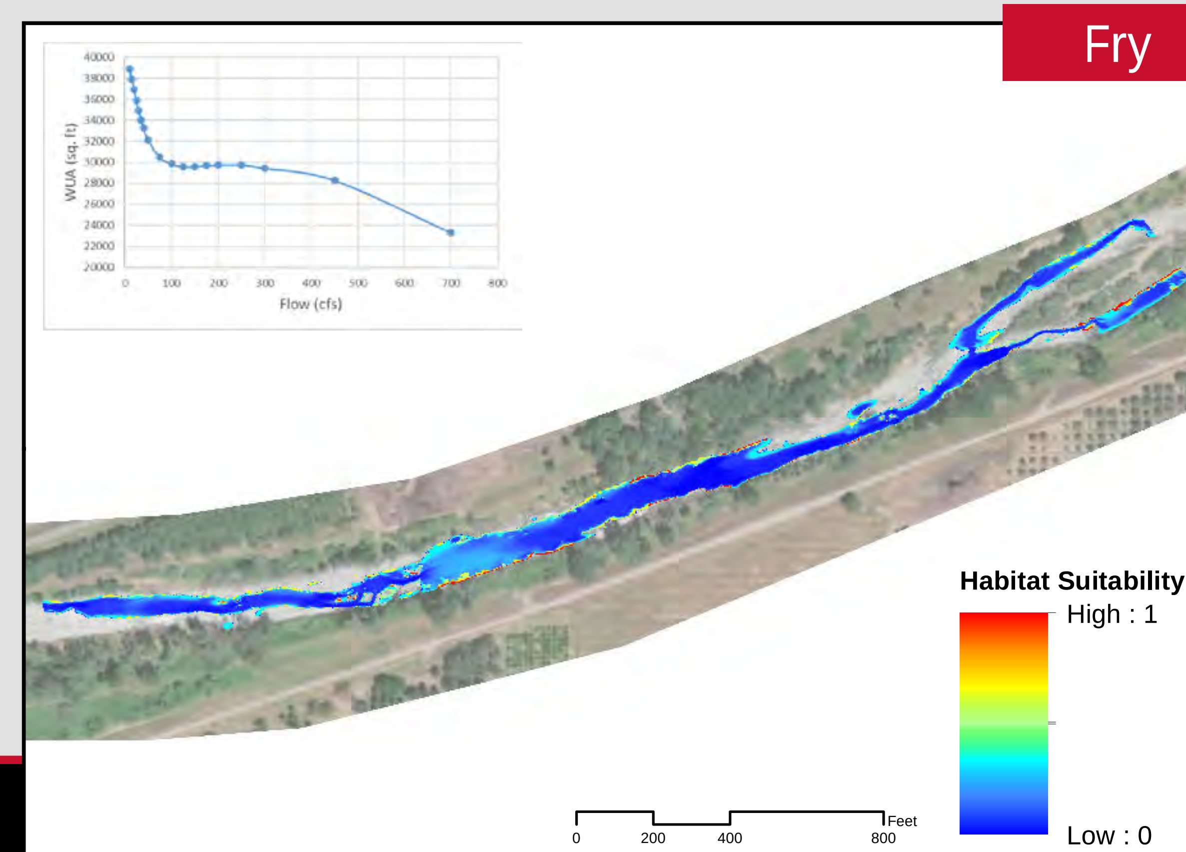


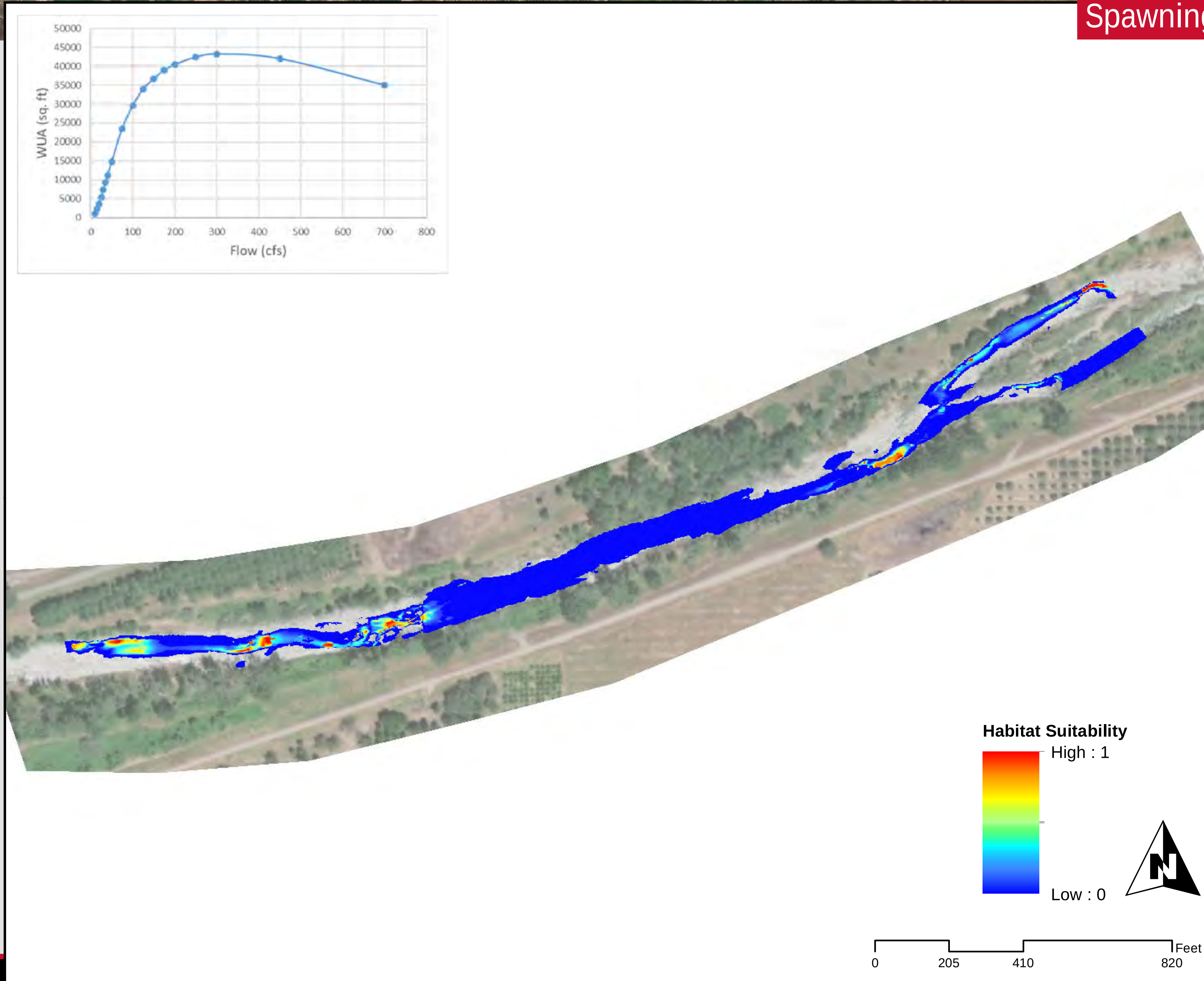
Lower Bear River - Instream Flow Study

SSWD HDR

Steelhead

Downstream Study Site 50 cfs

Spawning



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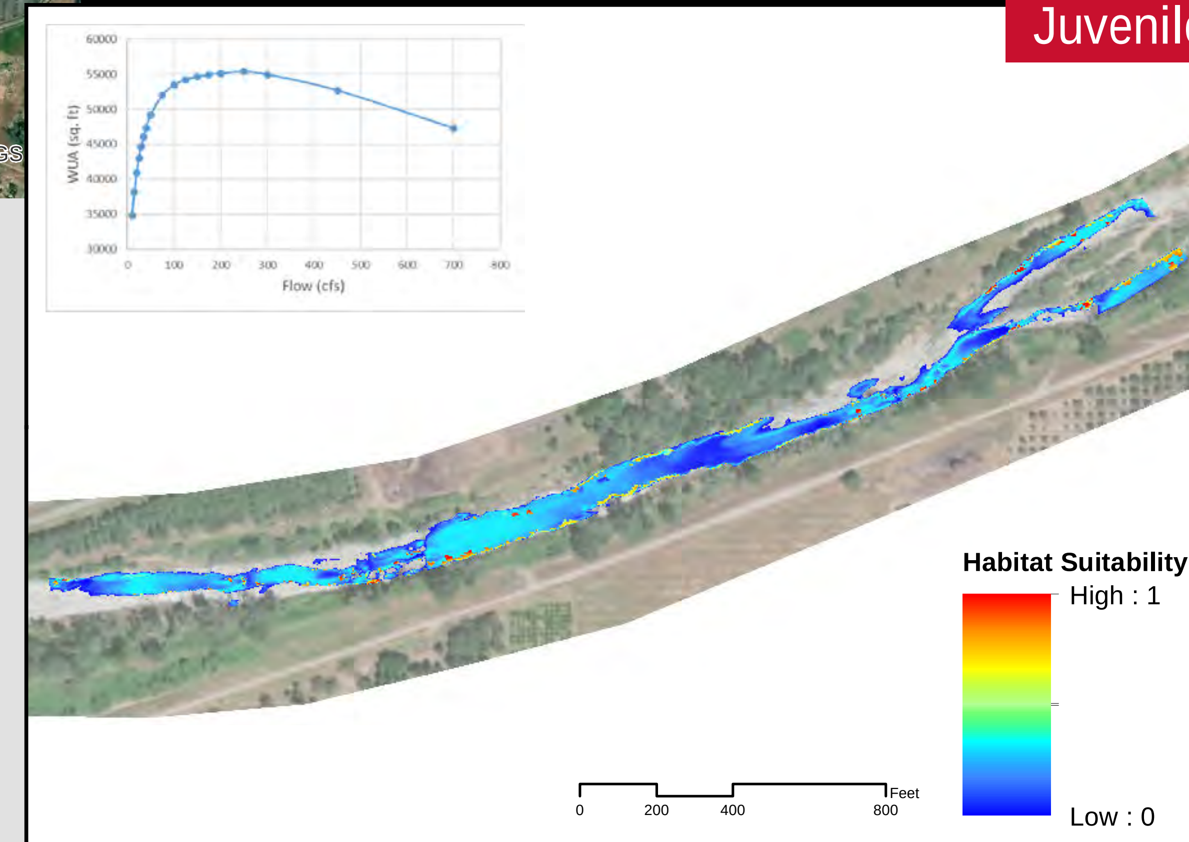

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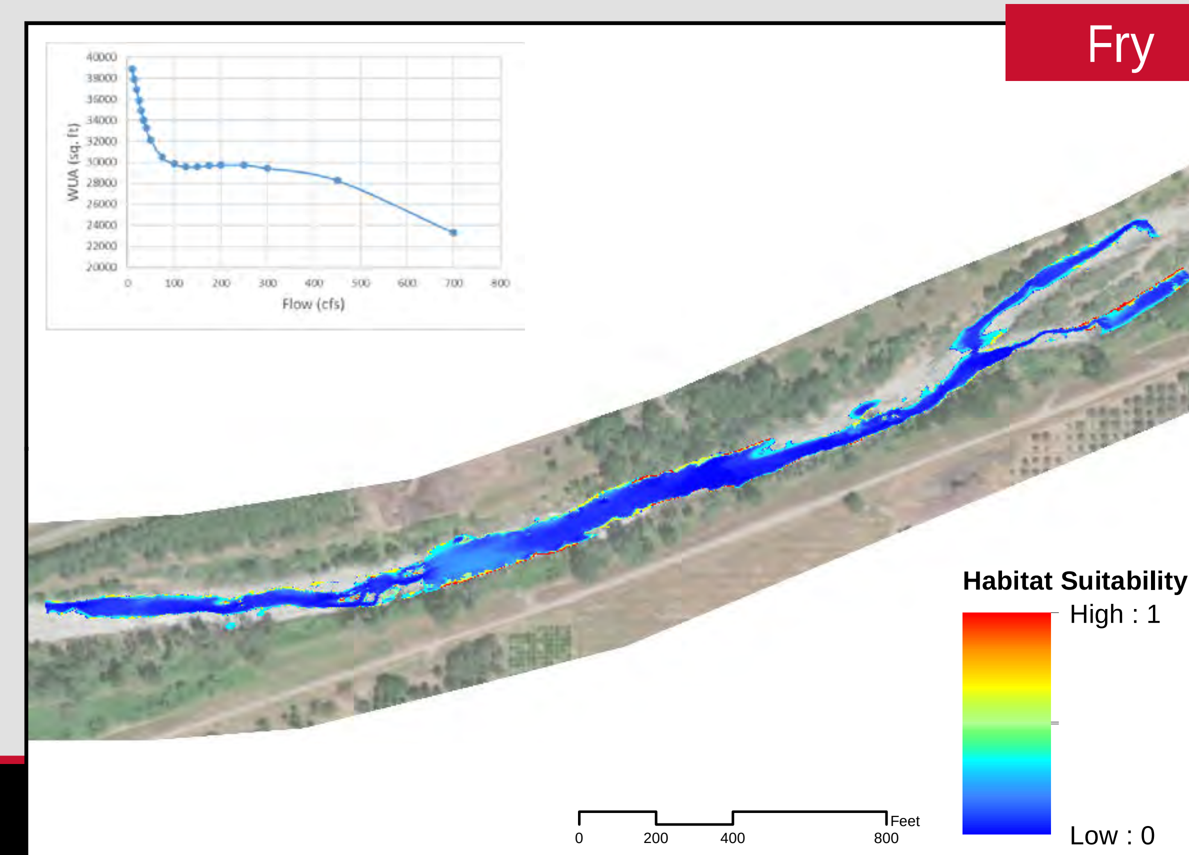
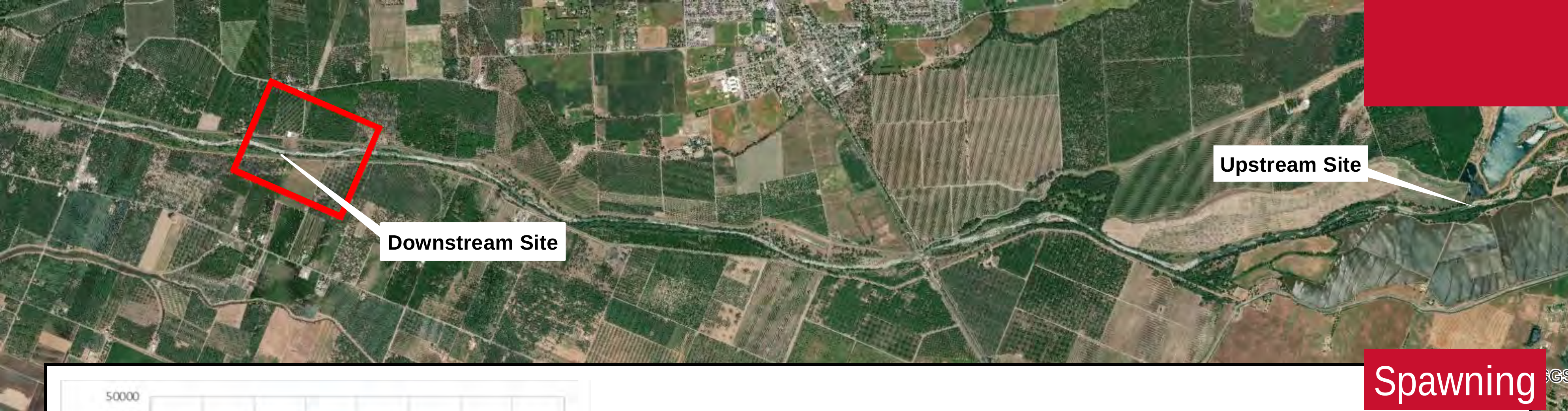


Lower Bear River - Instream Flow Study

Steelhead

Downstream Study Site 75 cfs



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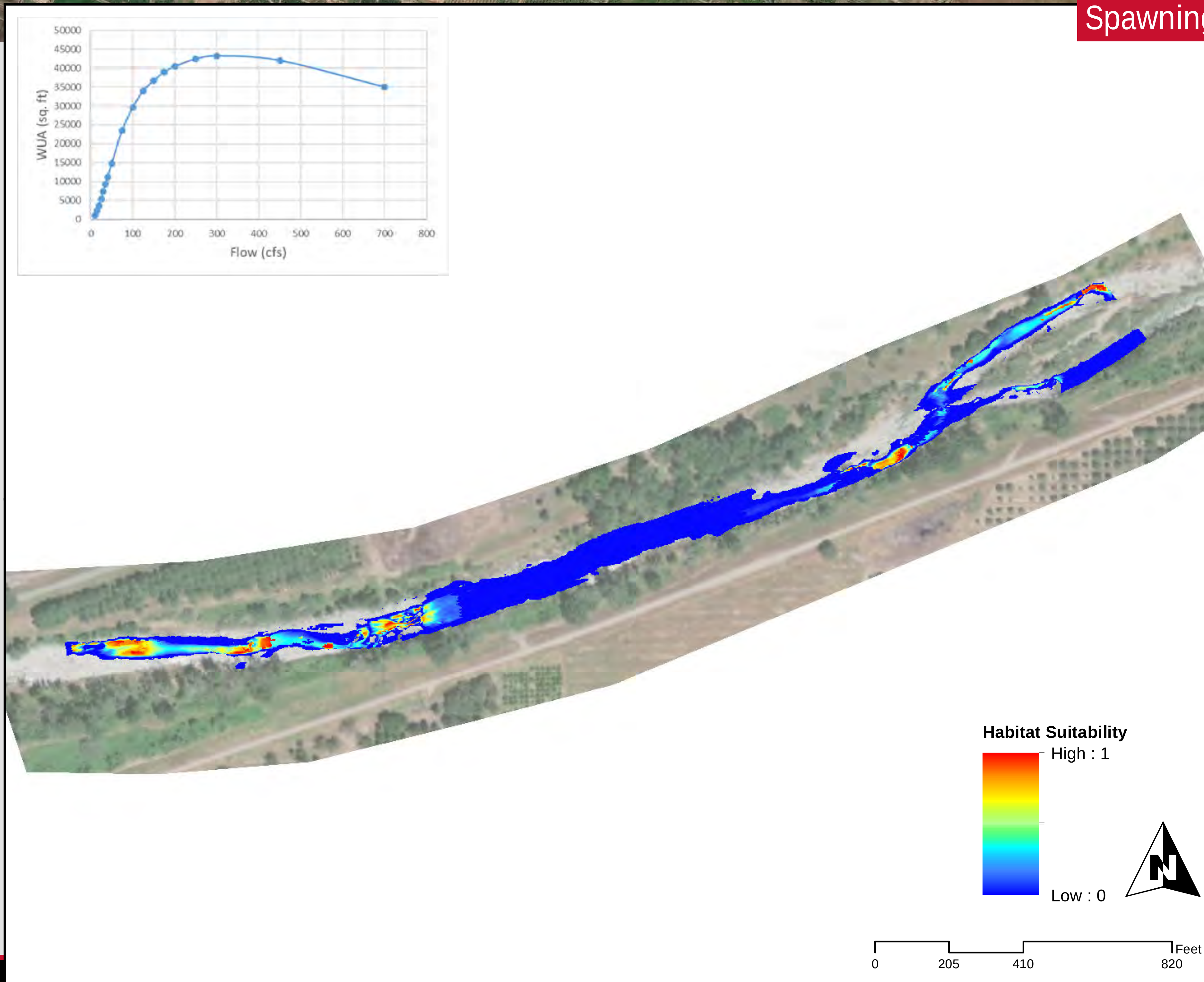

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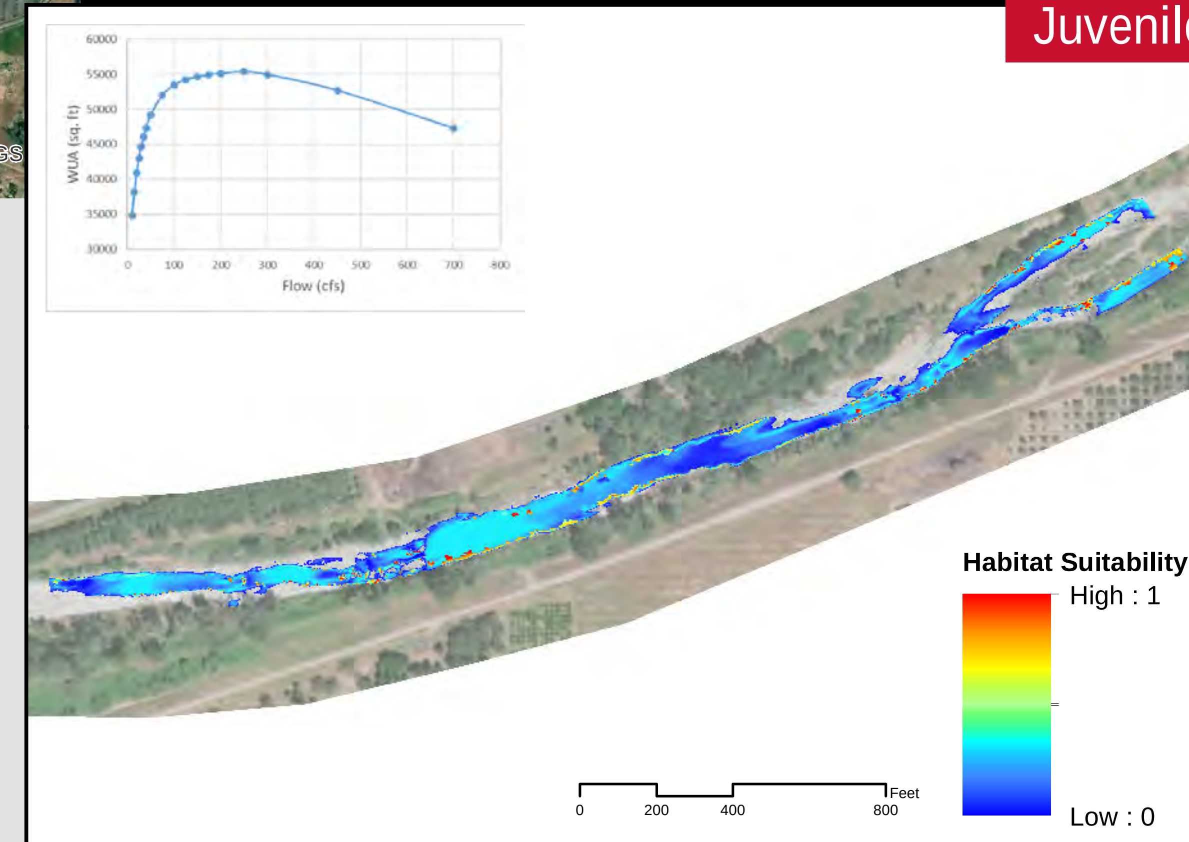

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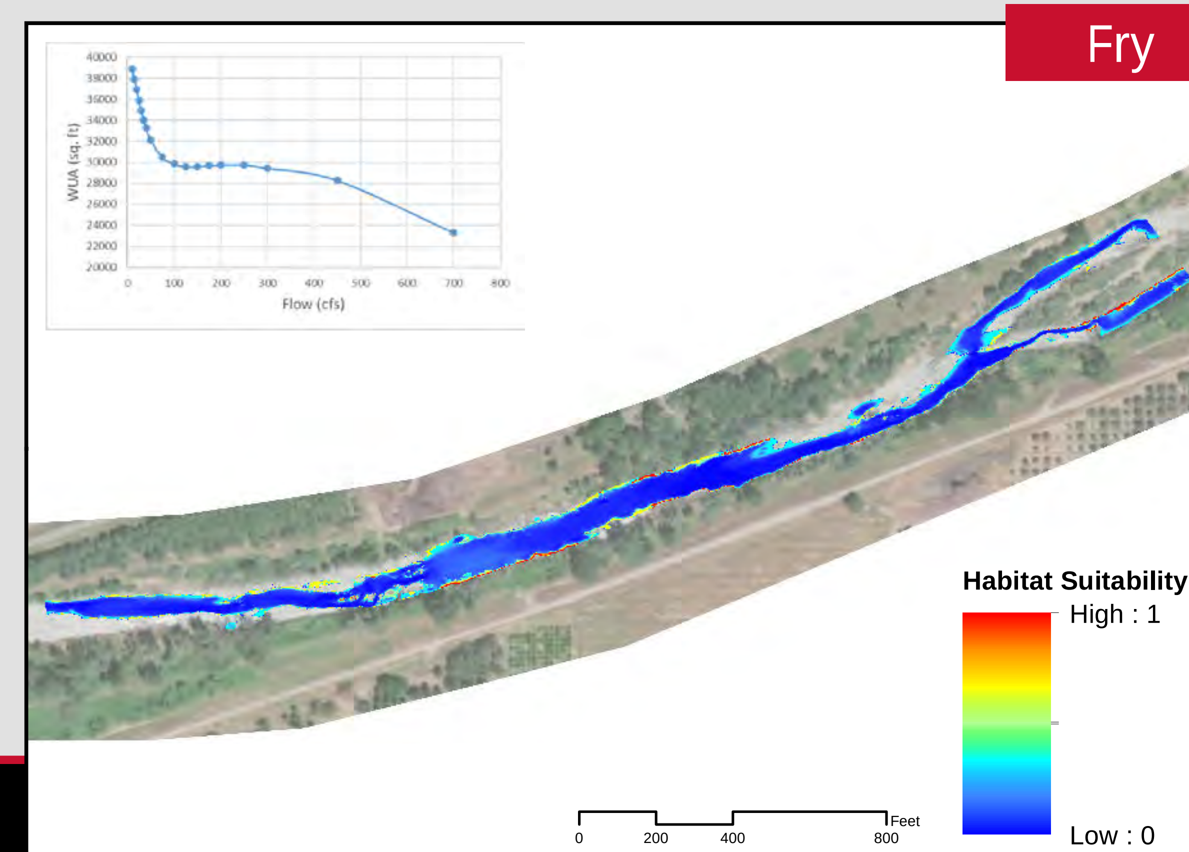

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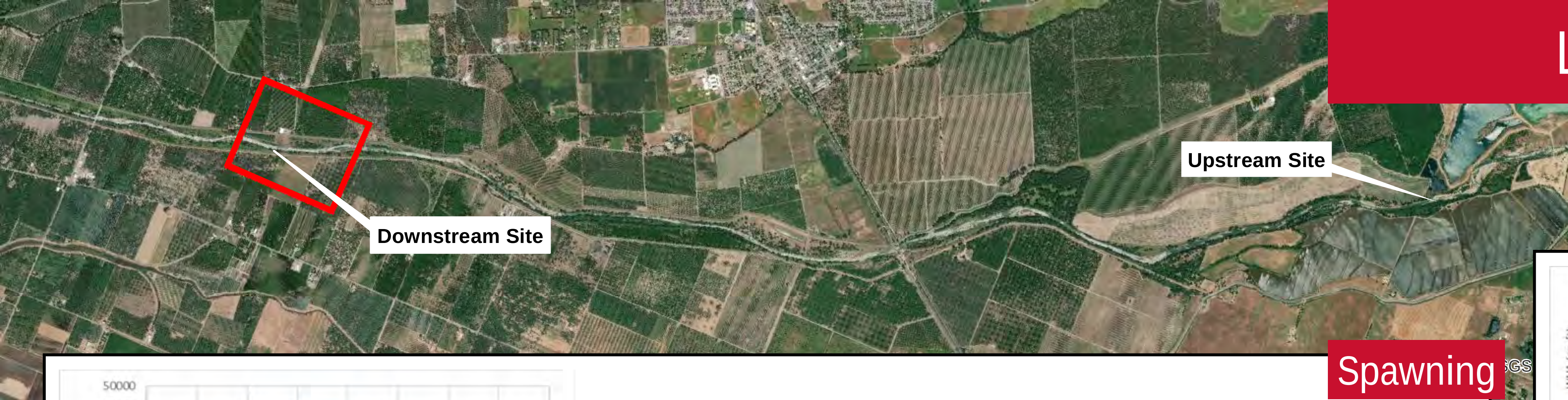
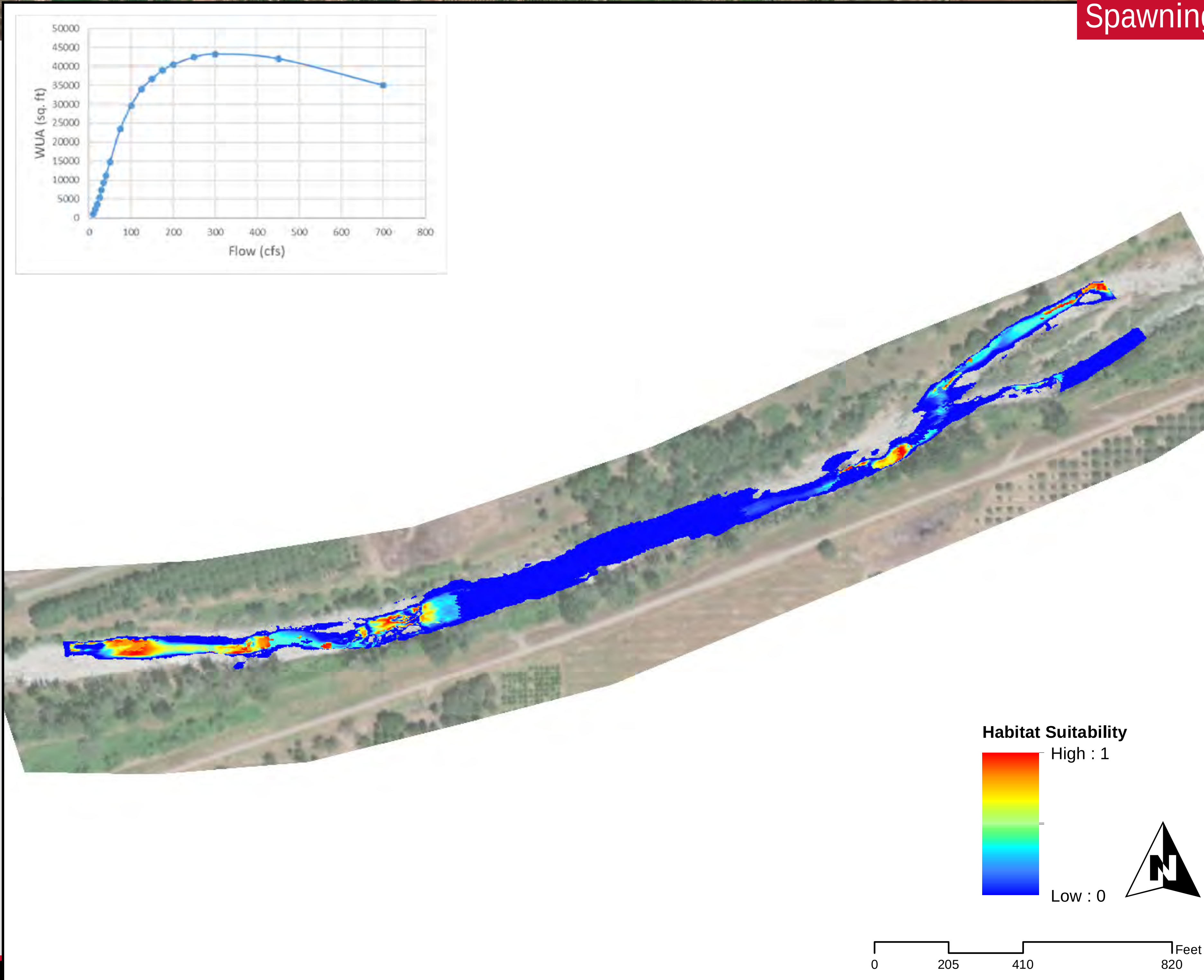
Lower Bear River - Instream Flow Study



Steelhead

Downstream Study Site 100 cfs

Spawning



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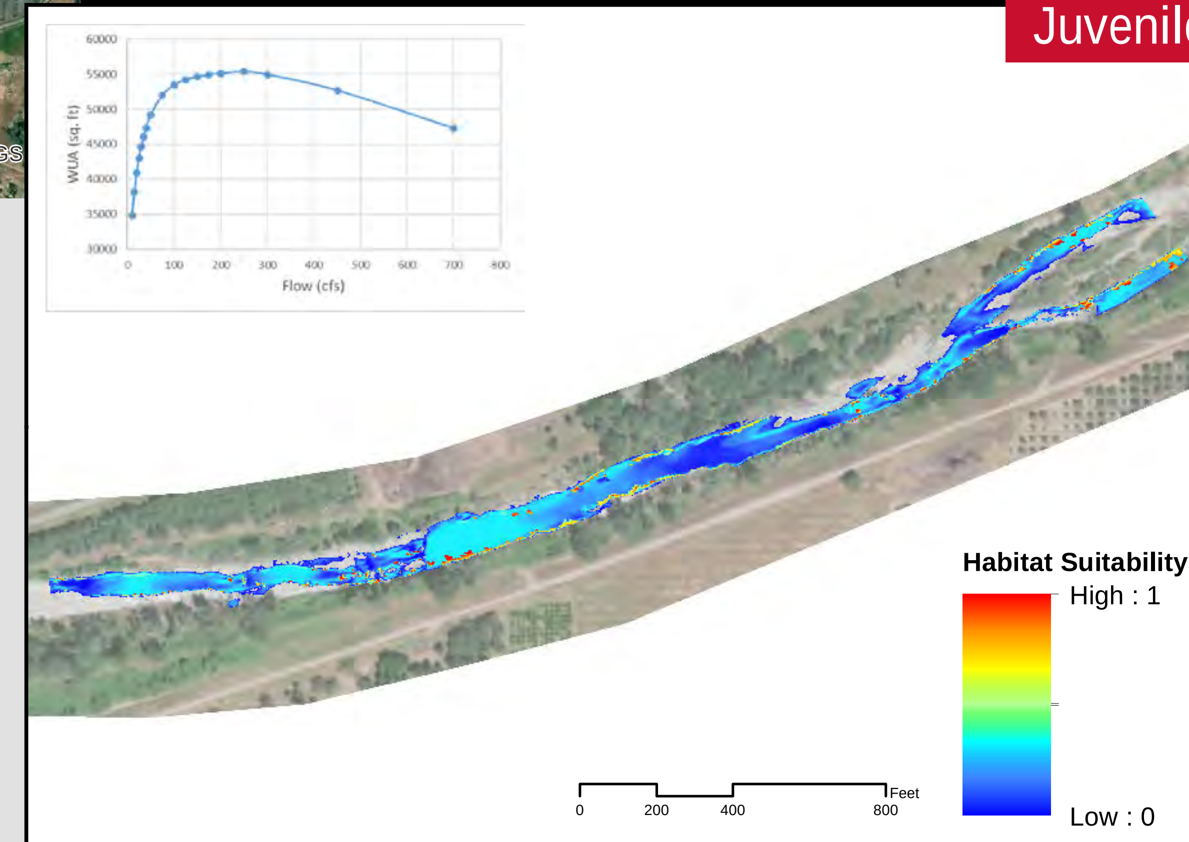

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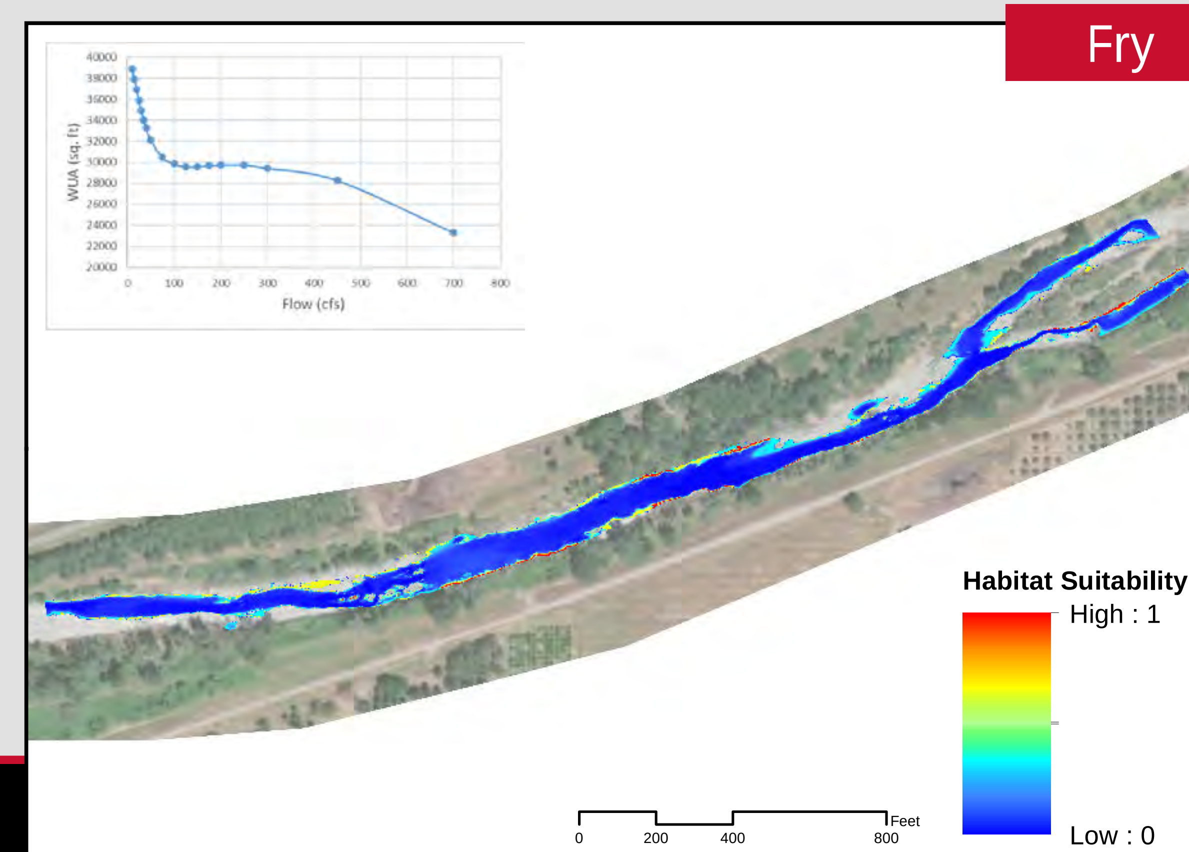
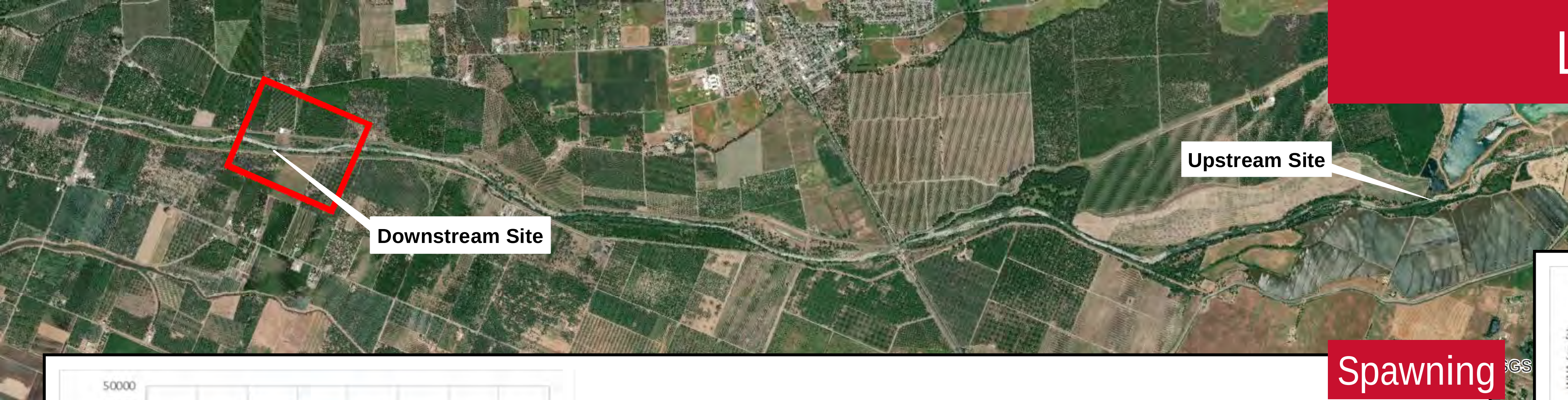


Lower Bear River - Instream Flow Study

Steelhead

Downstream Study Site 125 cfs



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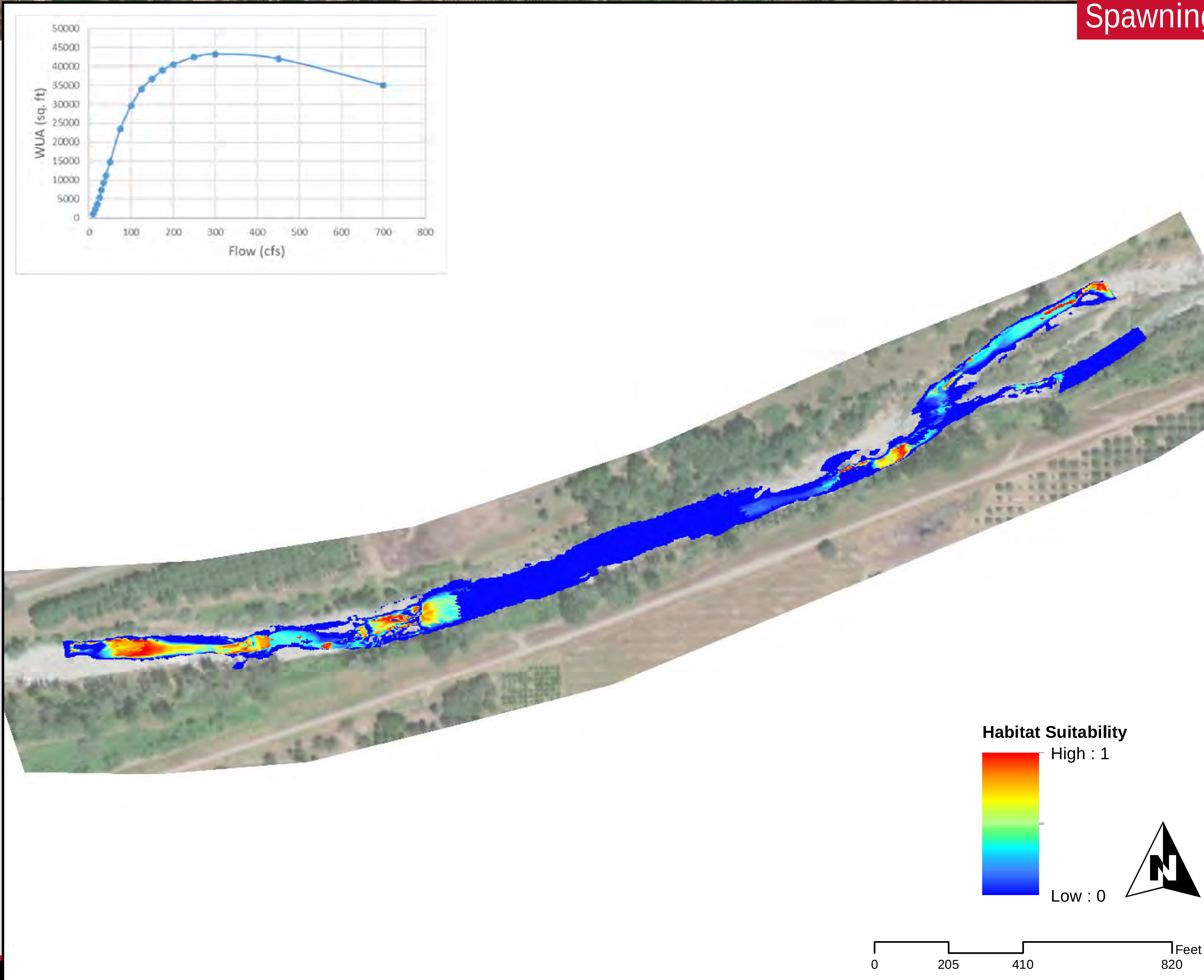

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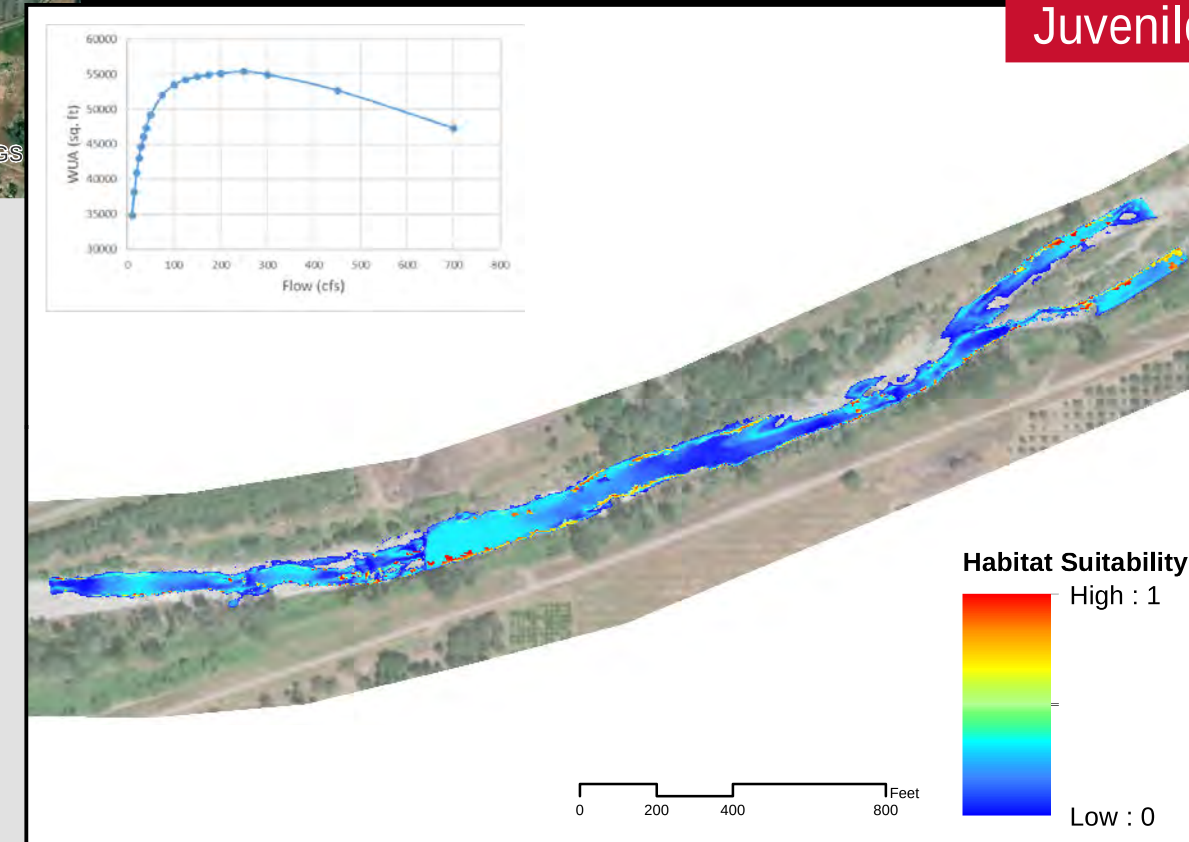

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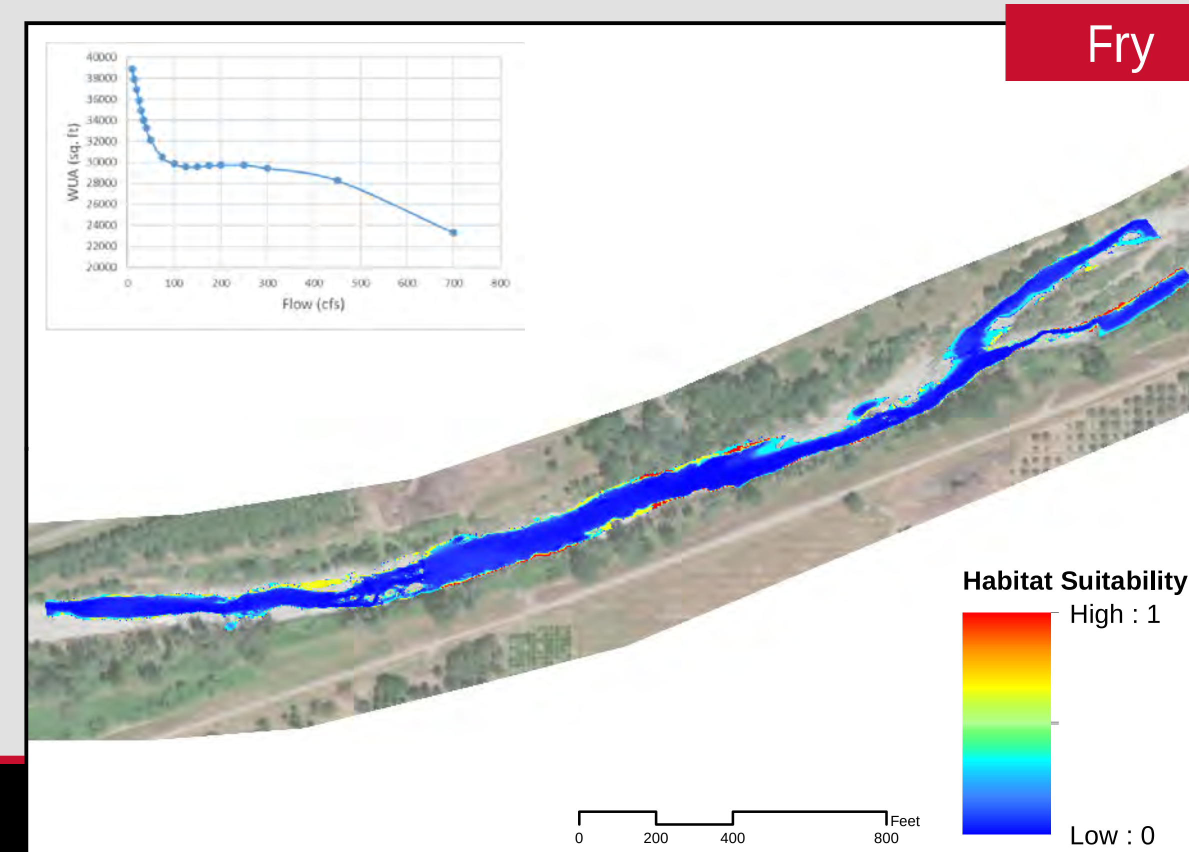
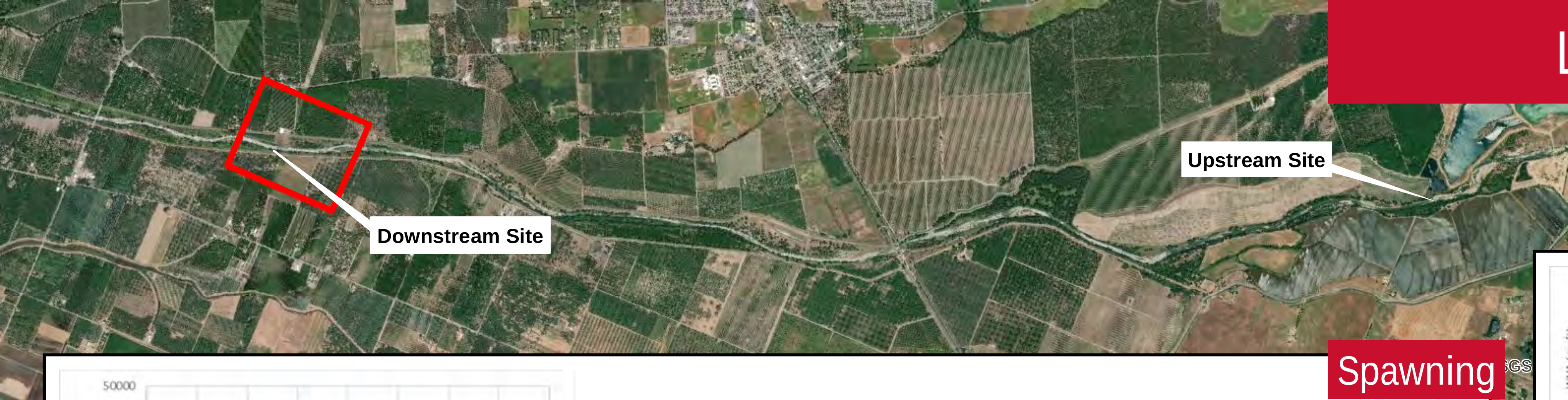


Lower Bear River - Instream Flow Study

Steelhead

Downstream Study Site 150 cfs



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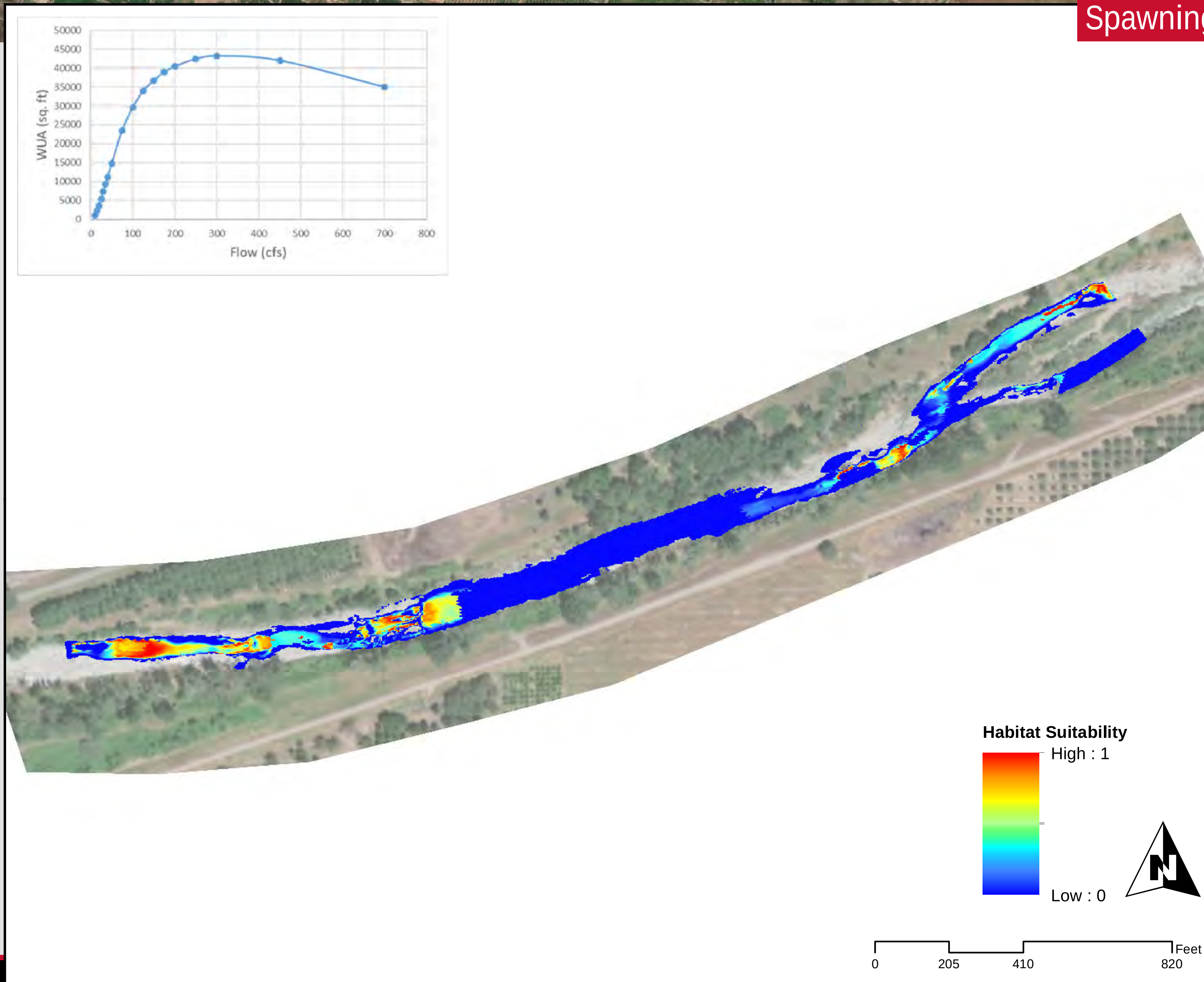

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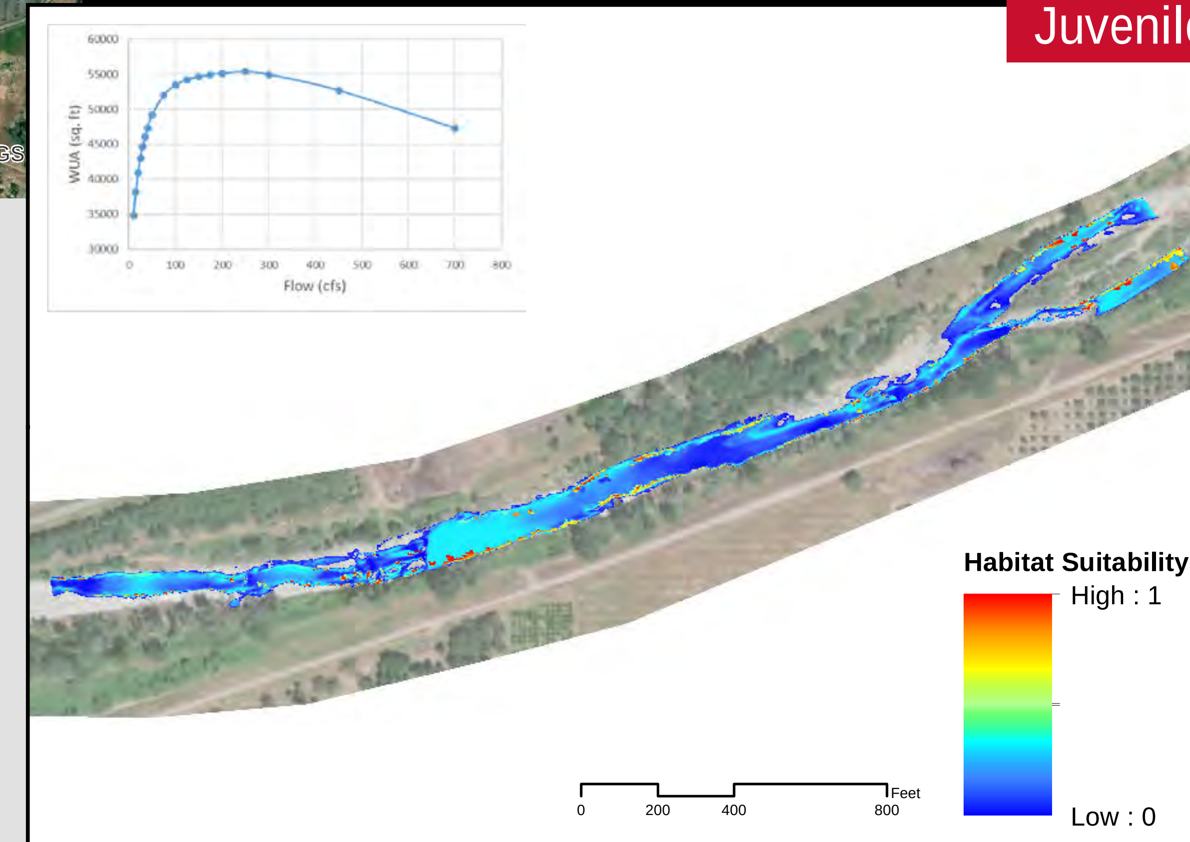

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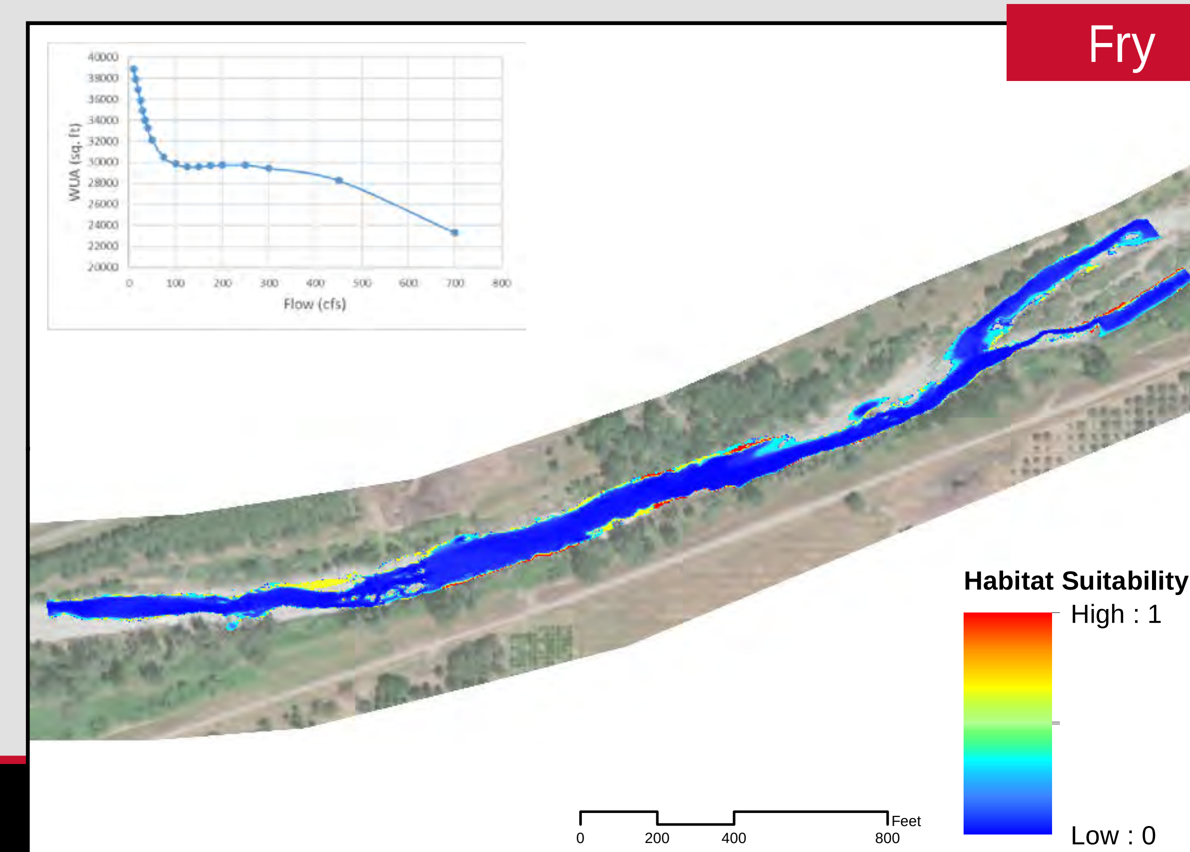
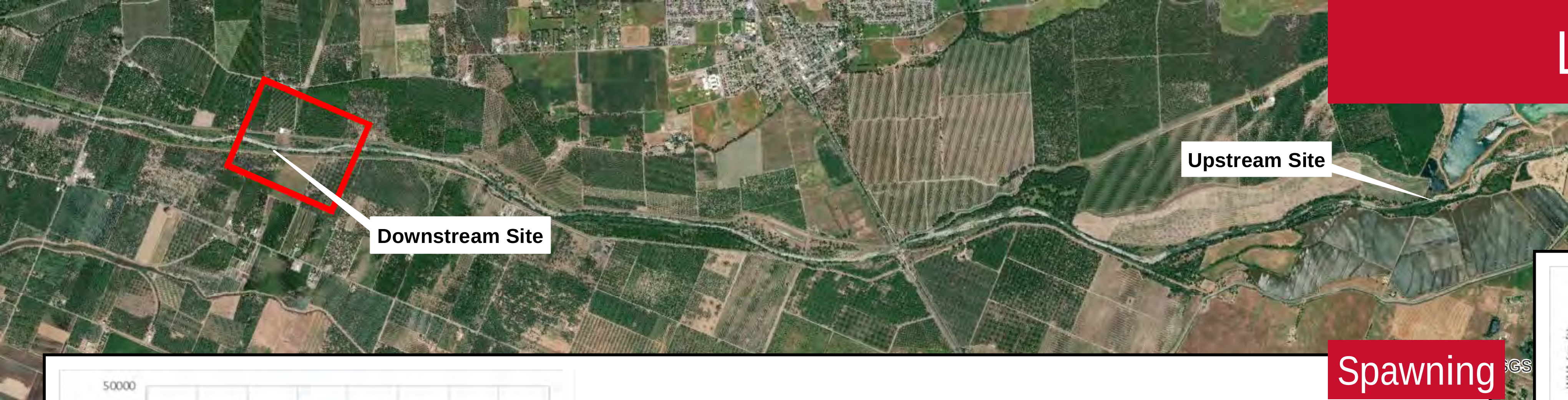


Lower Bear River - Instream Flow Study

SSWD HDR

Steelhead

Downstream Study Site 175 cfs



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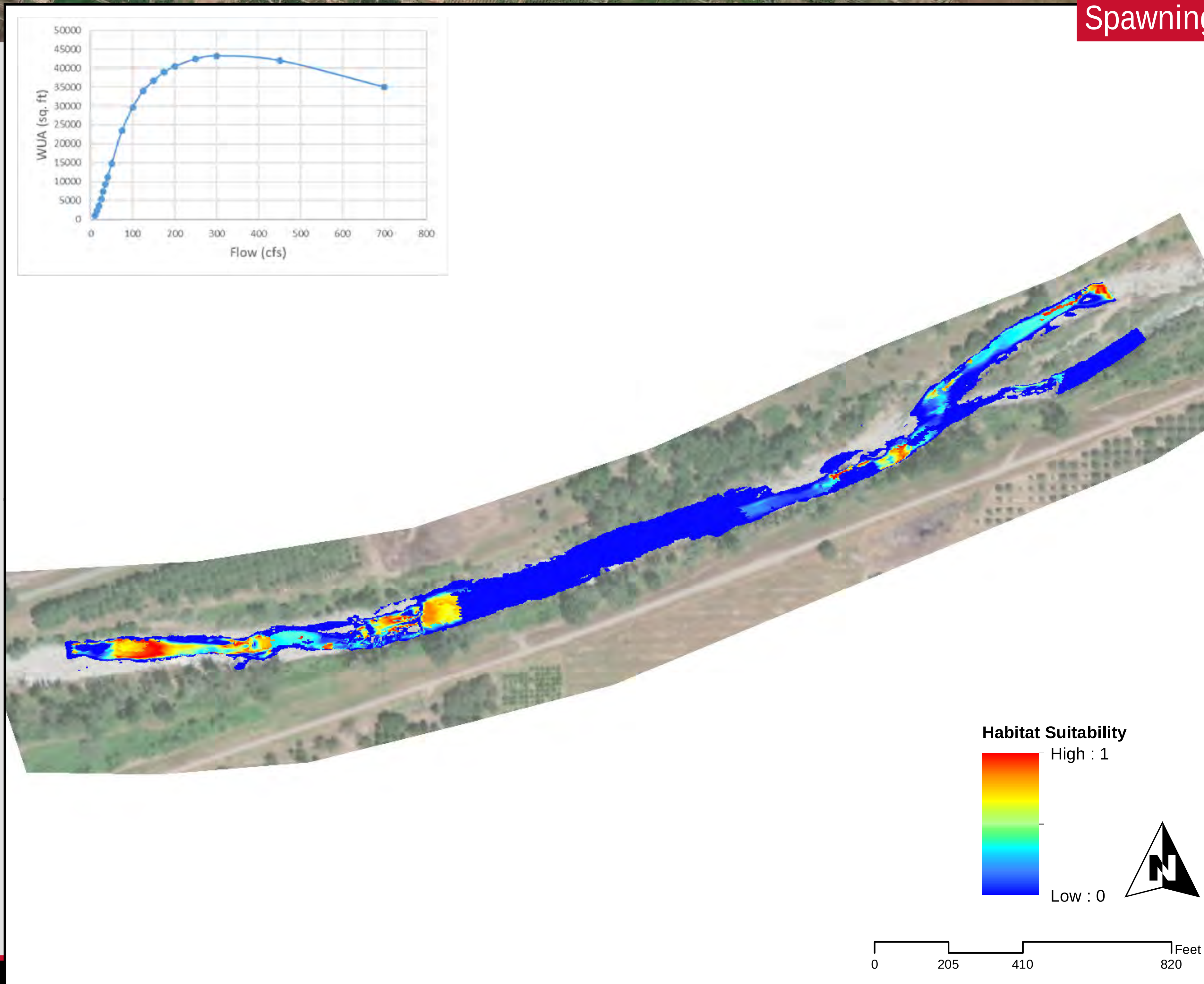

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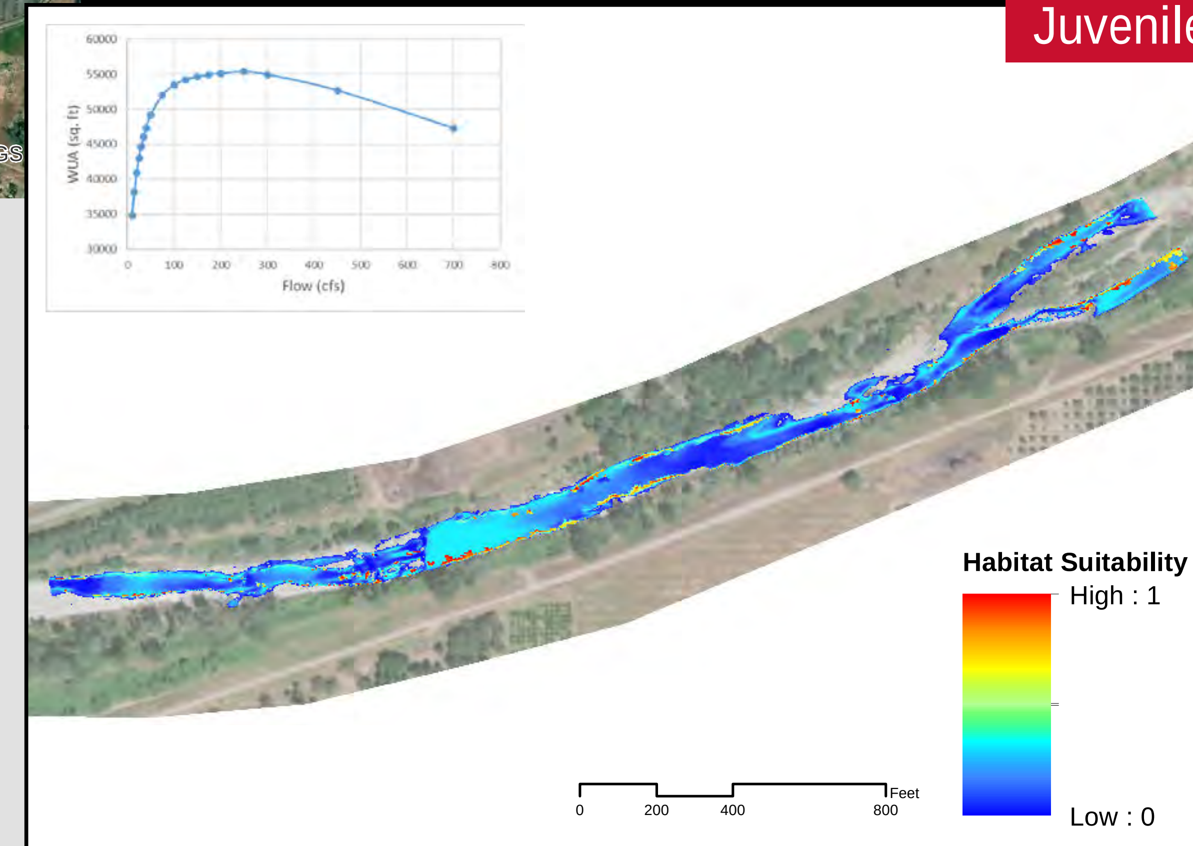

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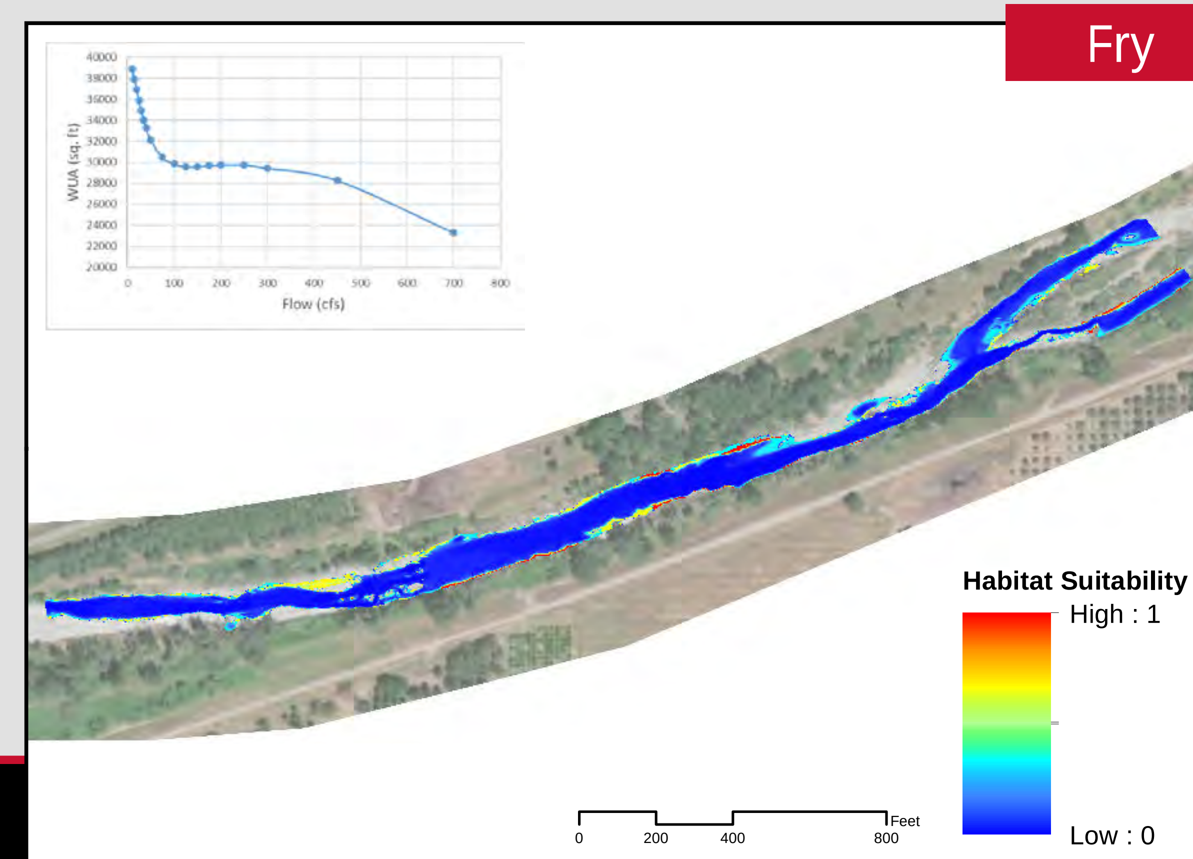

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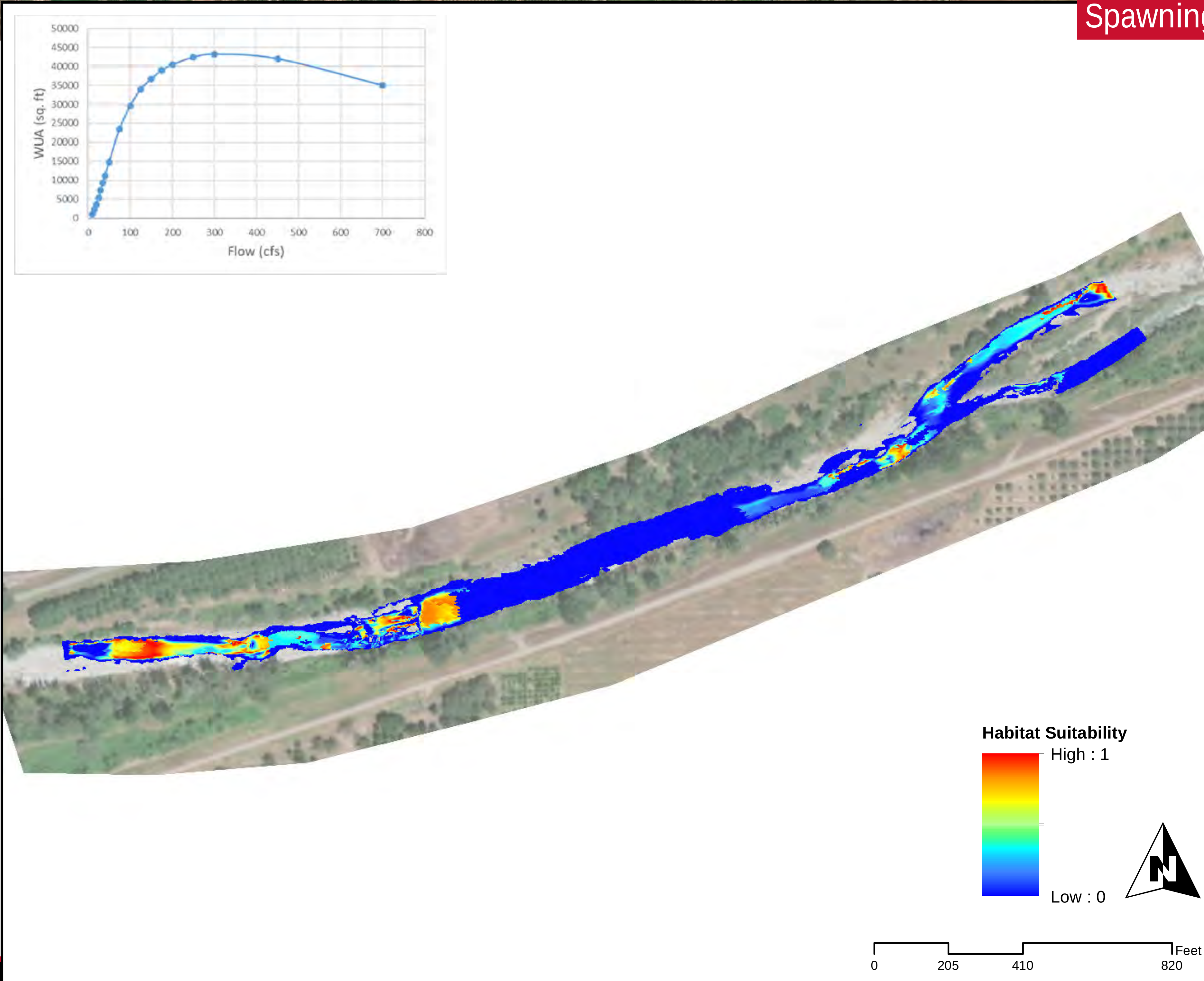
Lower Bear River - Instream Flow Study

SSWD HDR

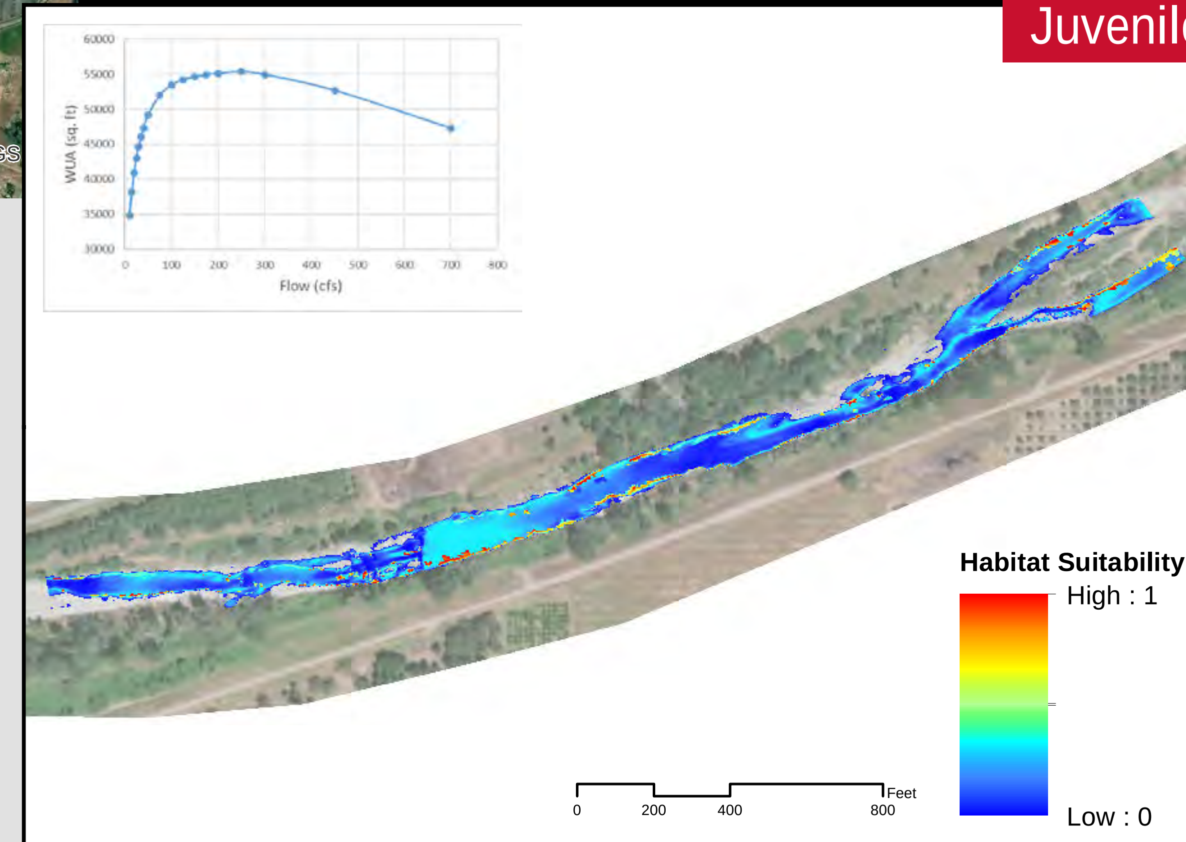
Steelhead

Downstream Study Site 200 cfs

Spawning



Juvenile



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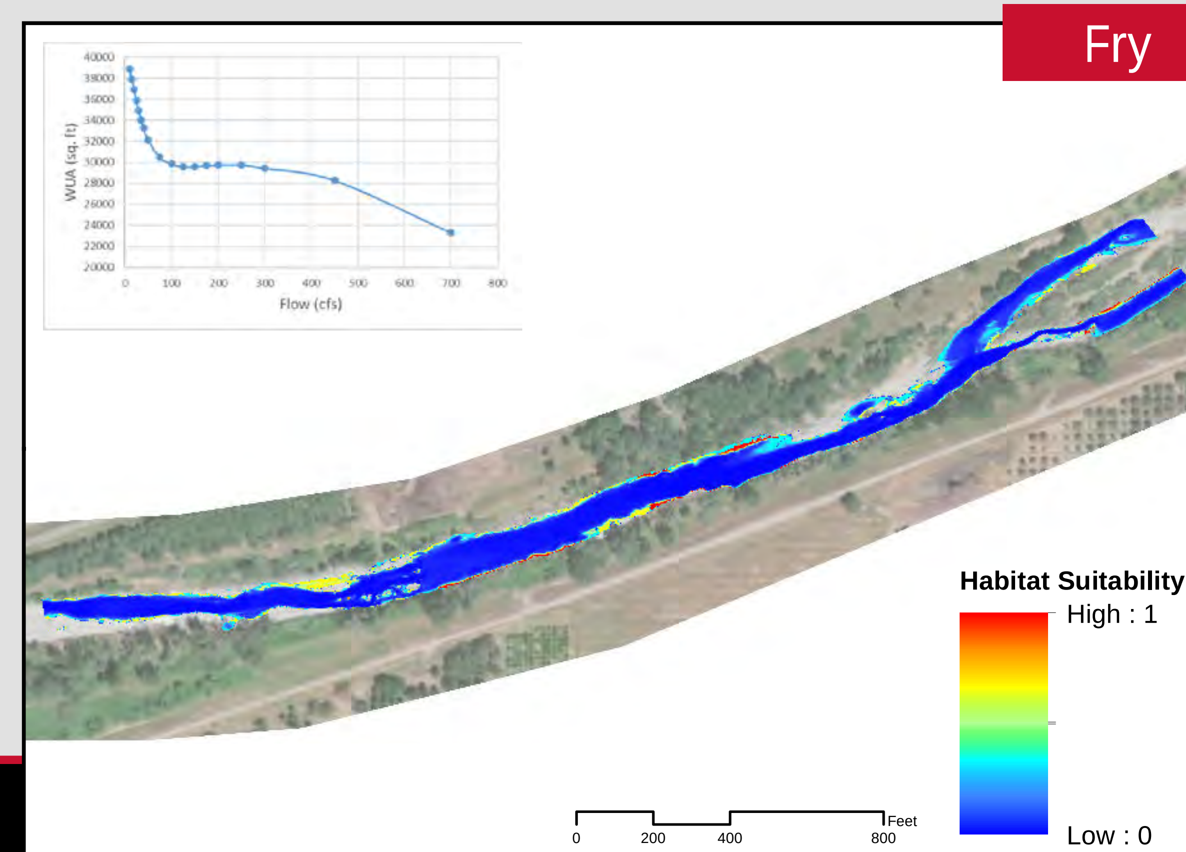
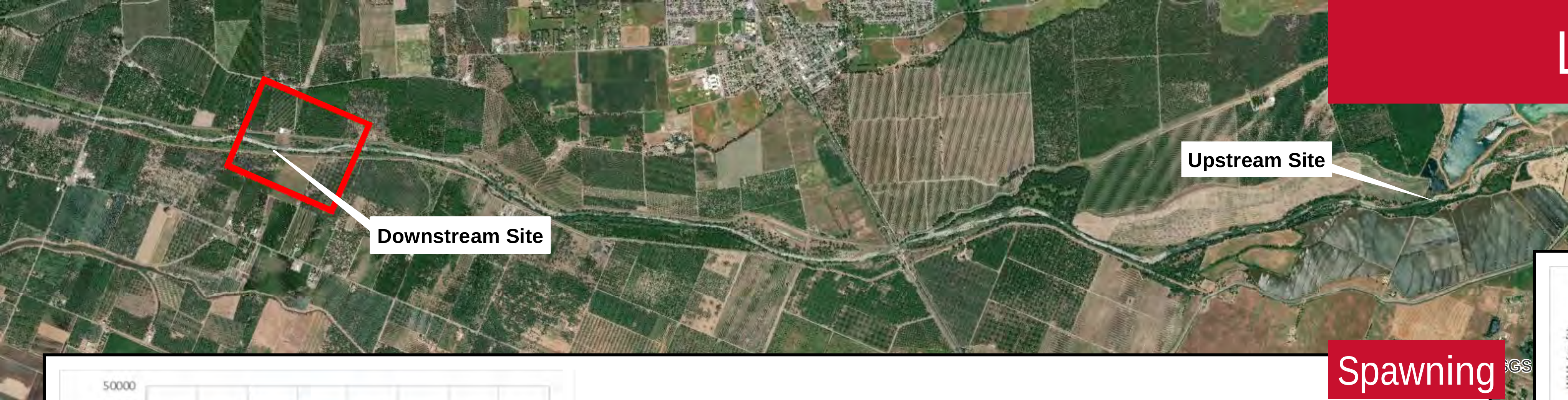
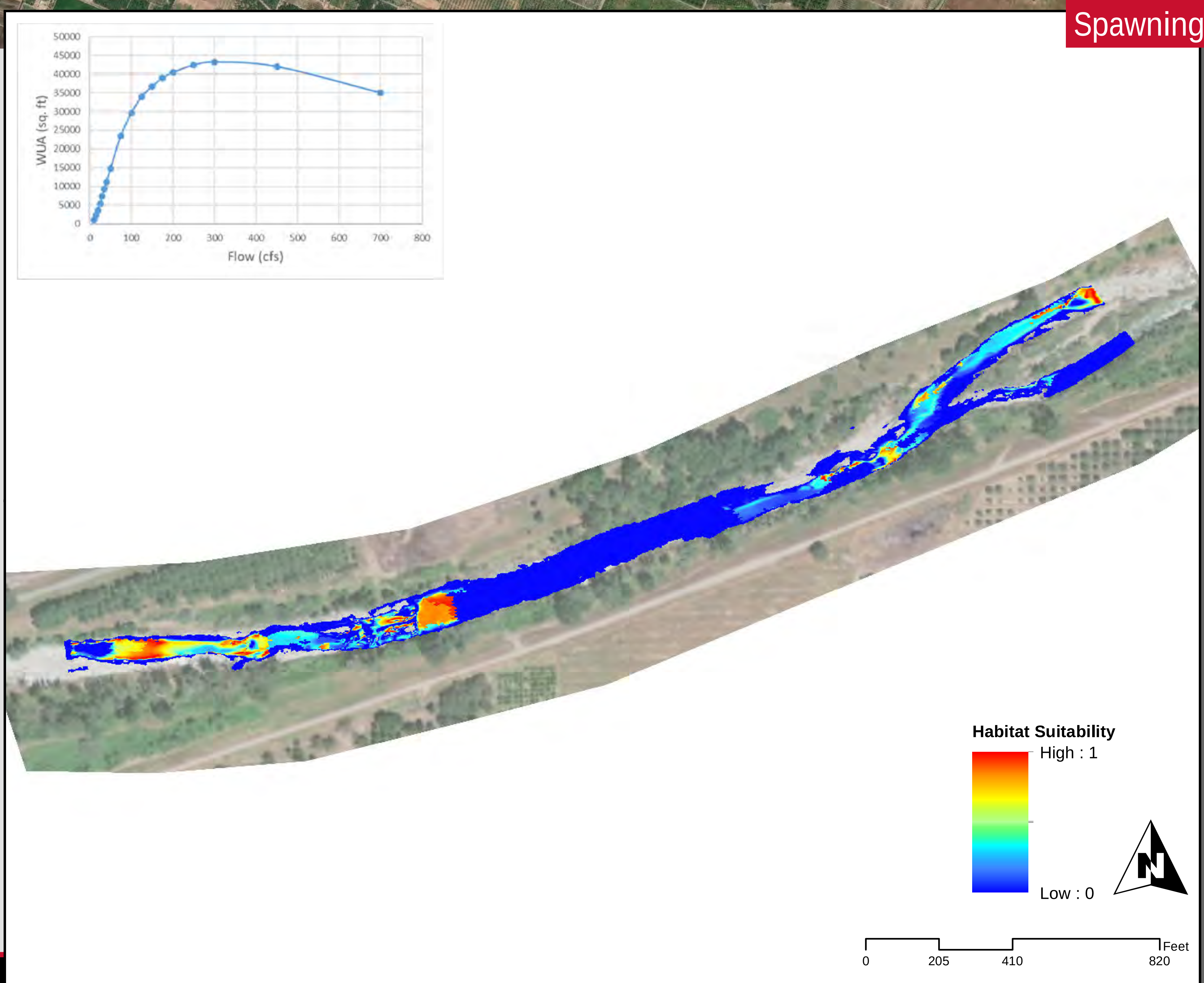


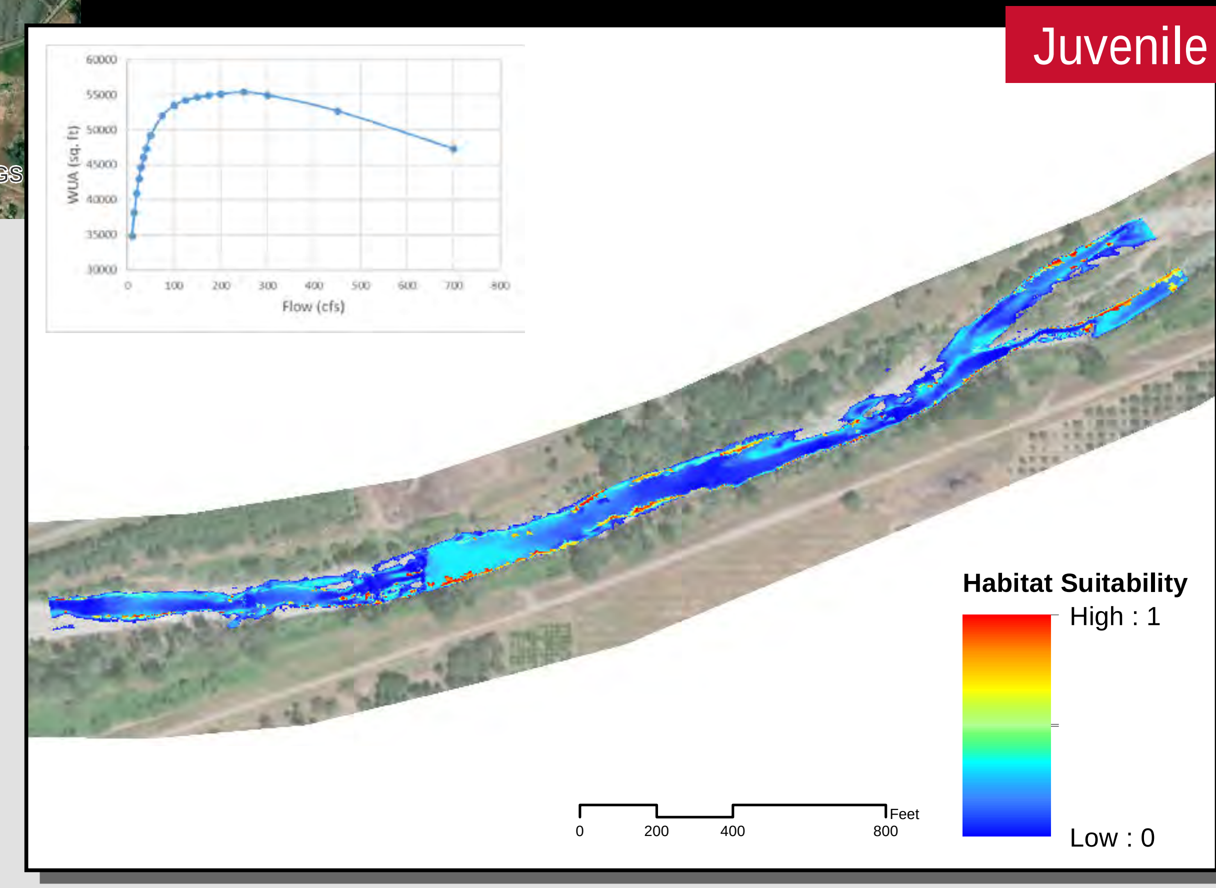
Lower Bear River - Instream Flow Study

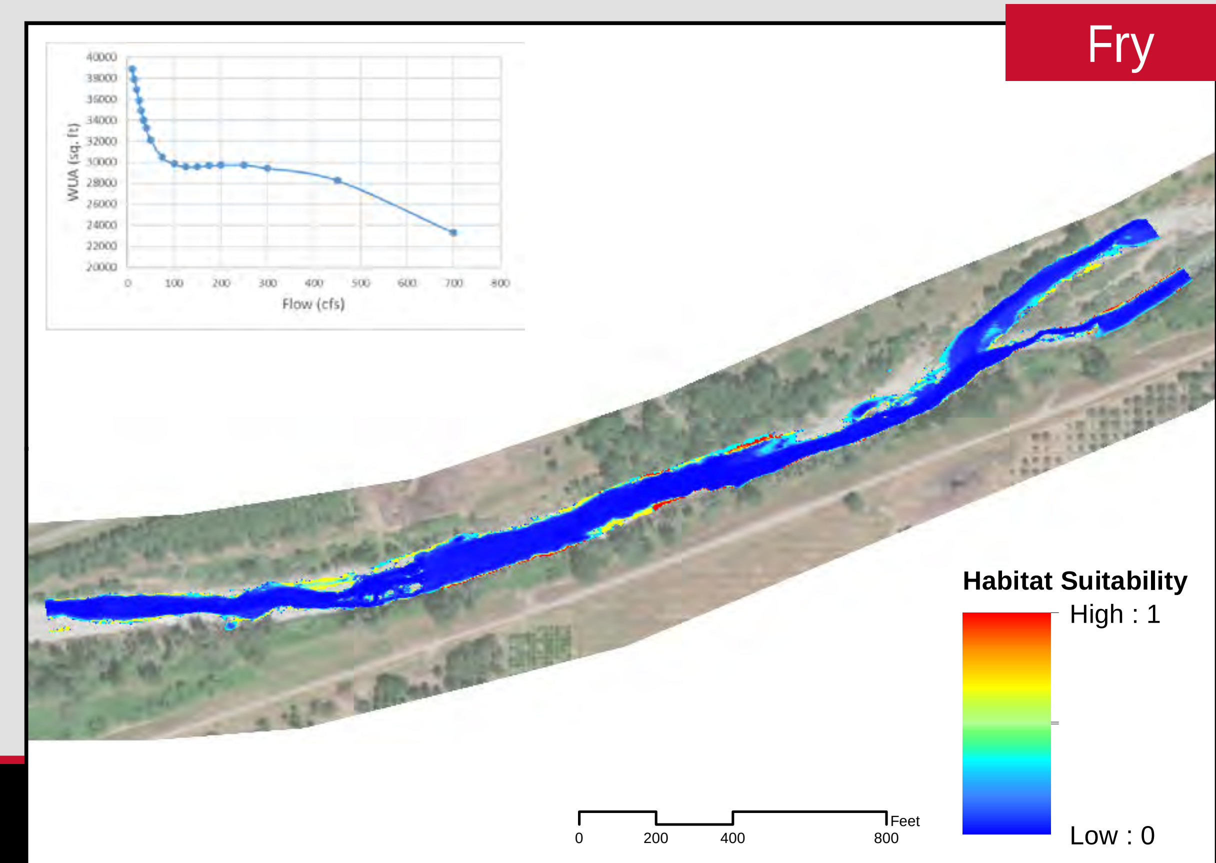
Steelhead

Downstream Study Site 250 cfs









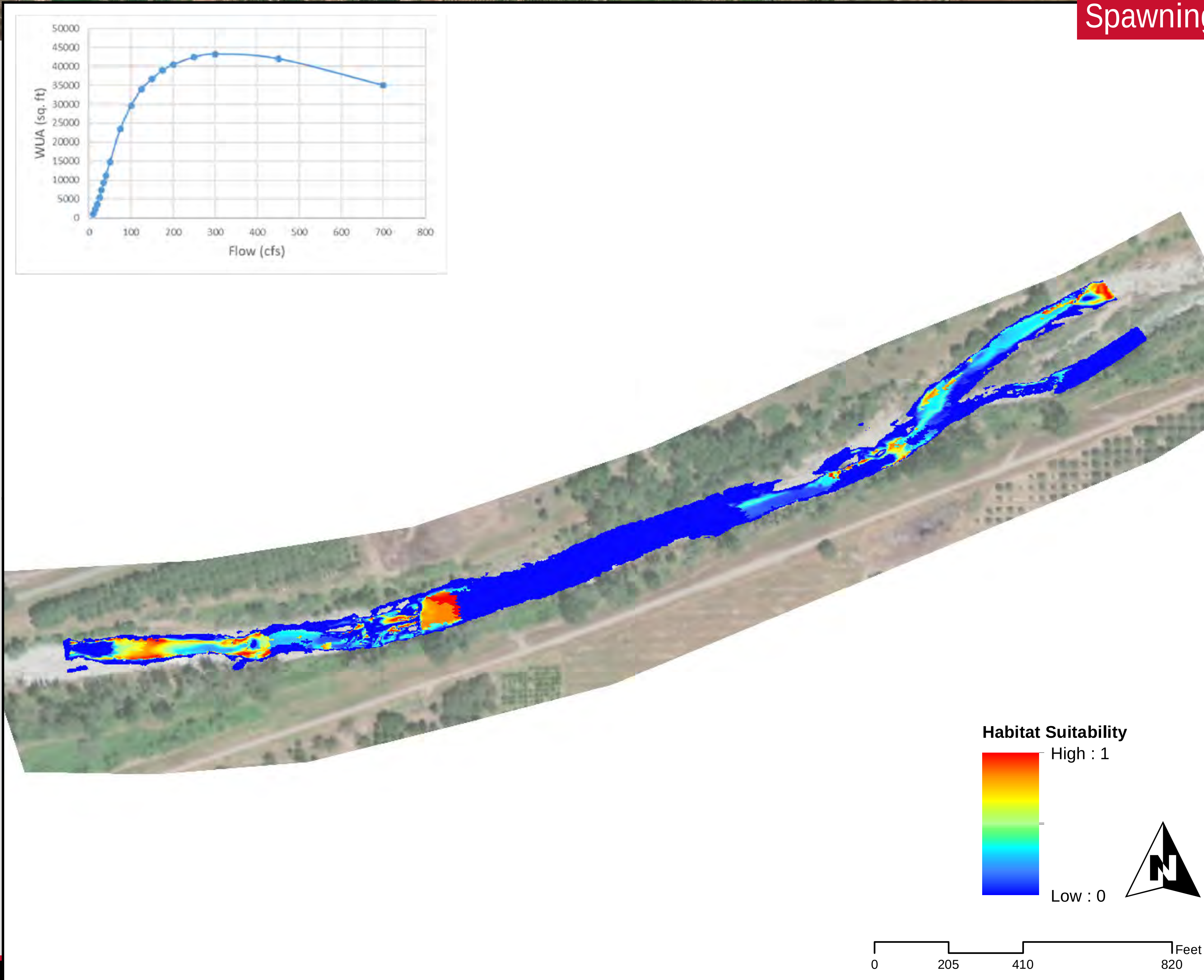
Lower Bear River - Instream Flow Study

SSWD HDR

Steelhead

Downstream Study Site 300 cfs

Spawning



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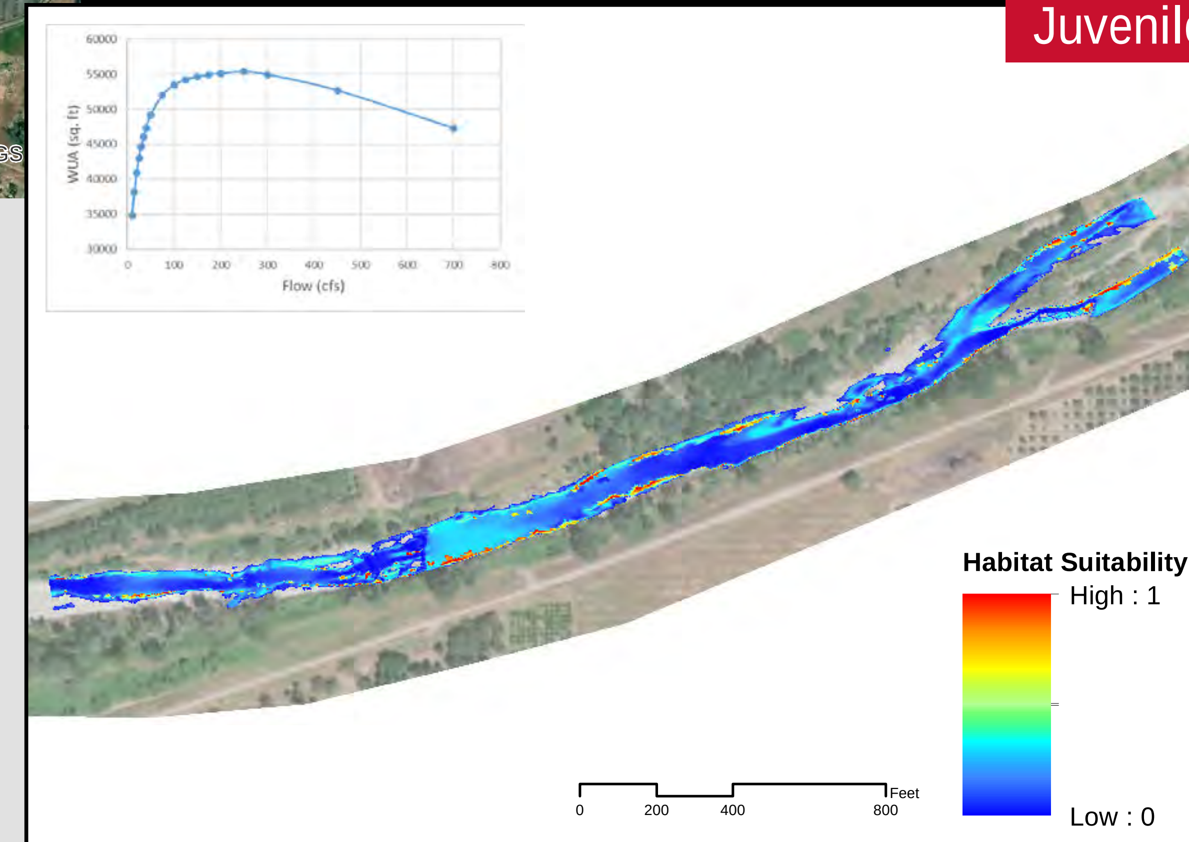

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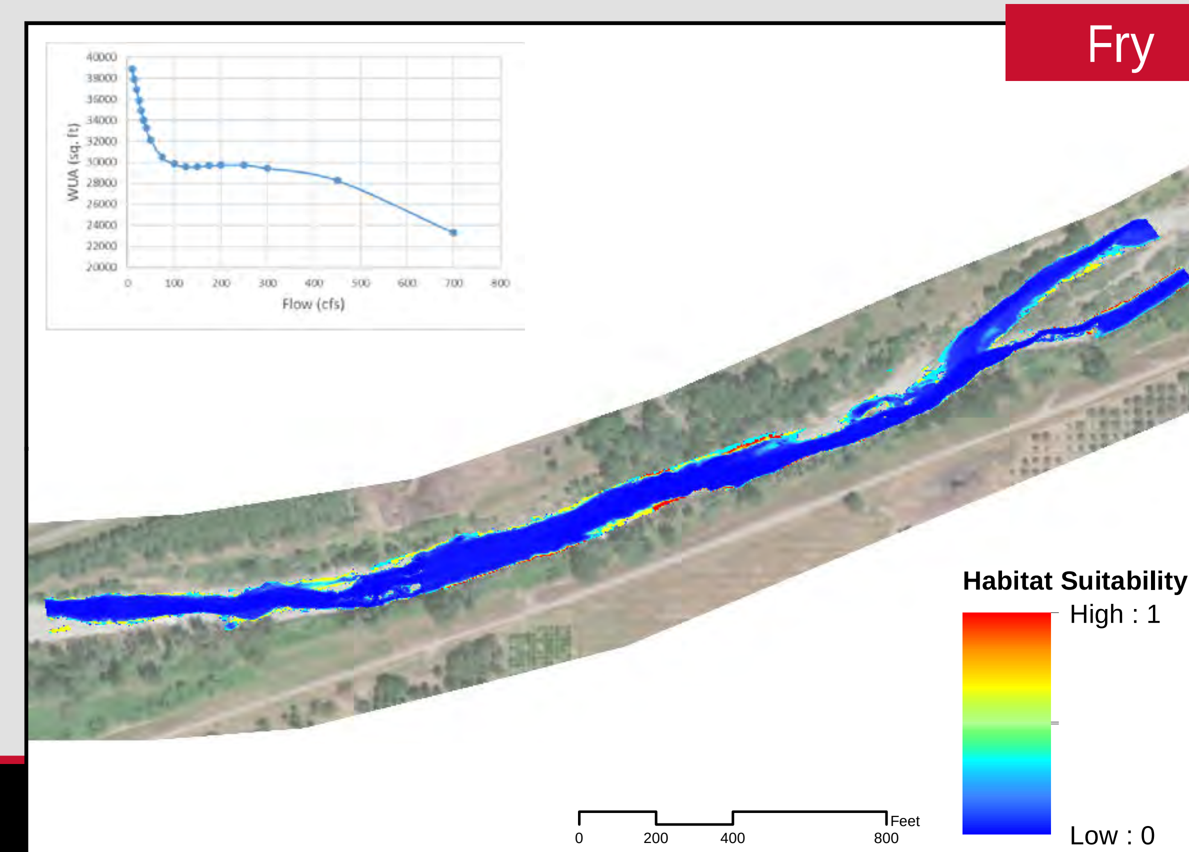

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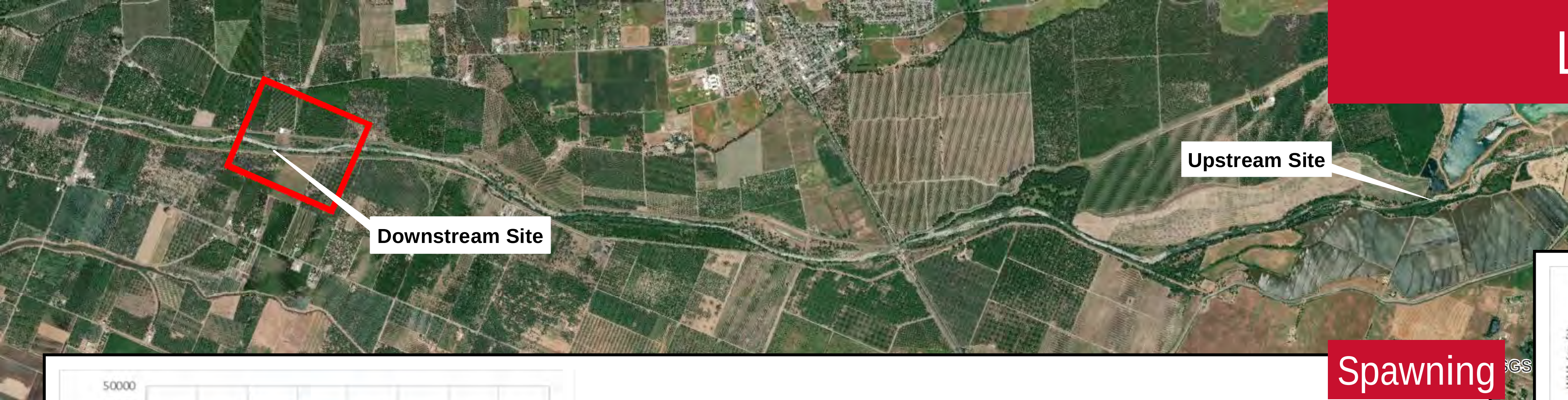
Lower Bear River - Instream Flow Study

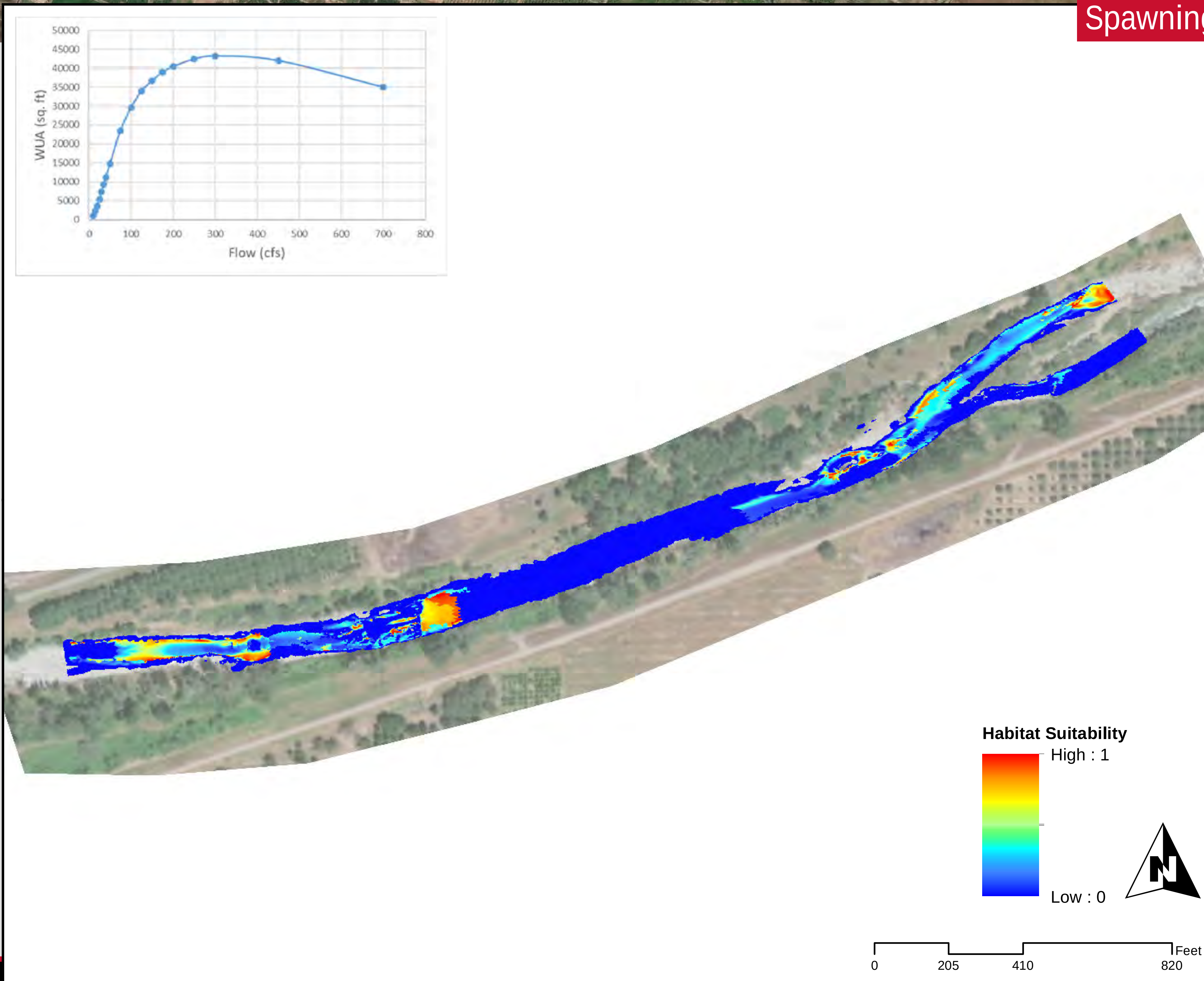
SSWD HDR

Steelhead

Downstream Study Site 450 cfs



Spawning



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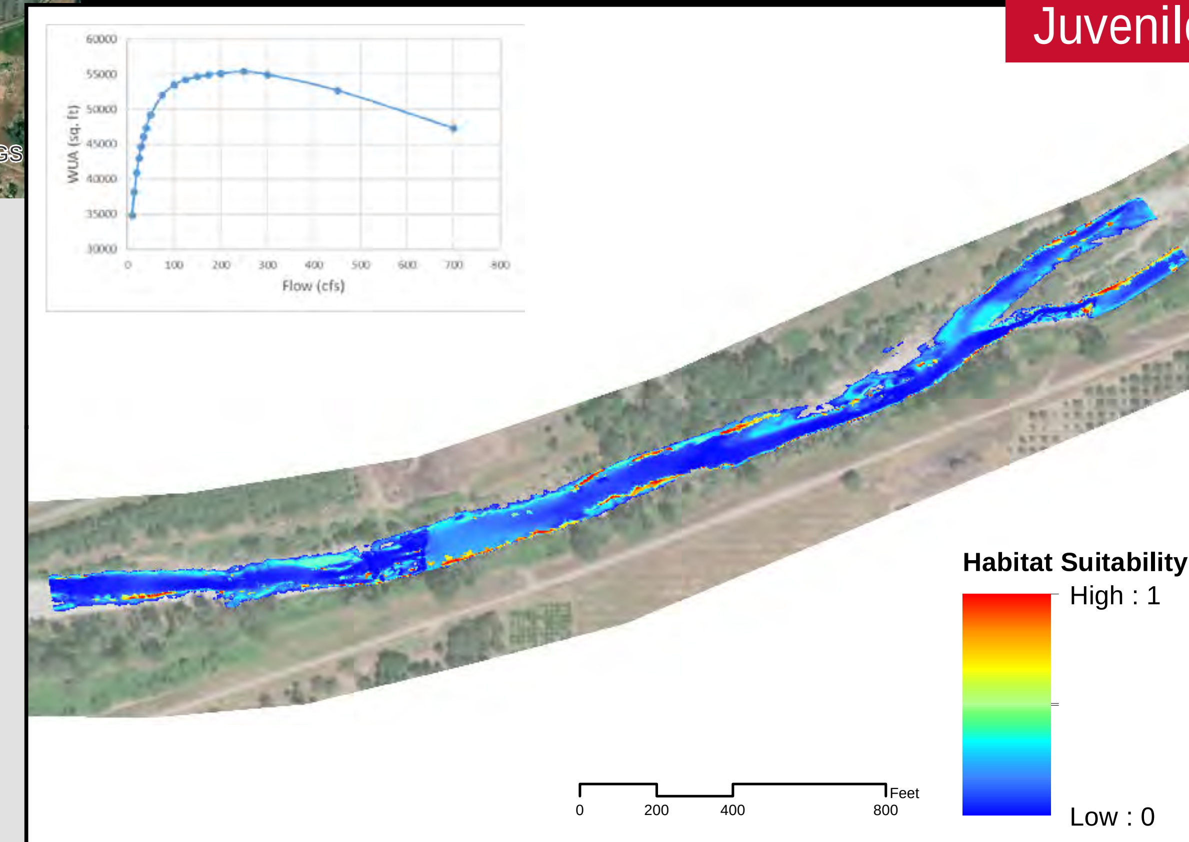

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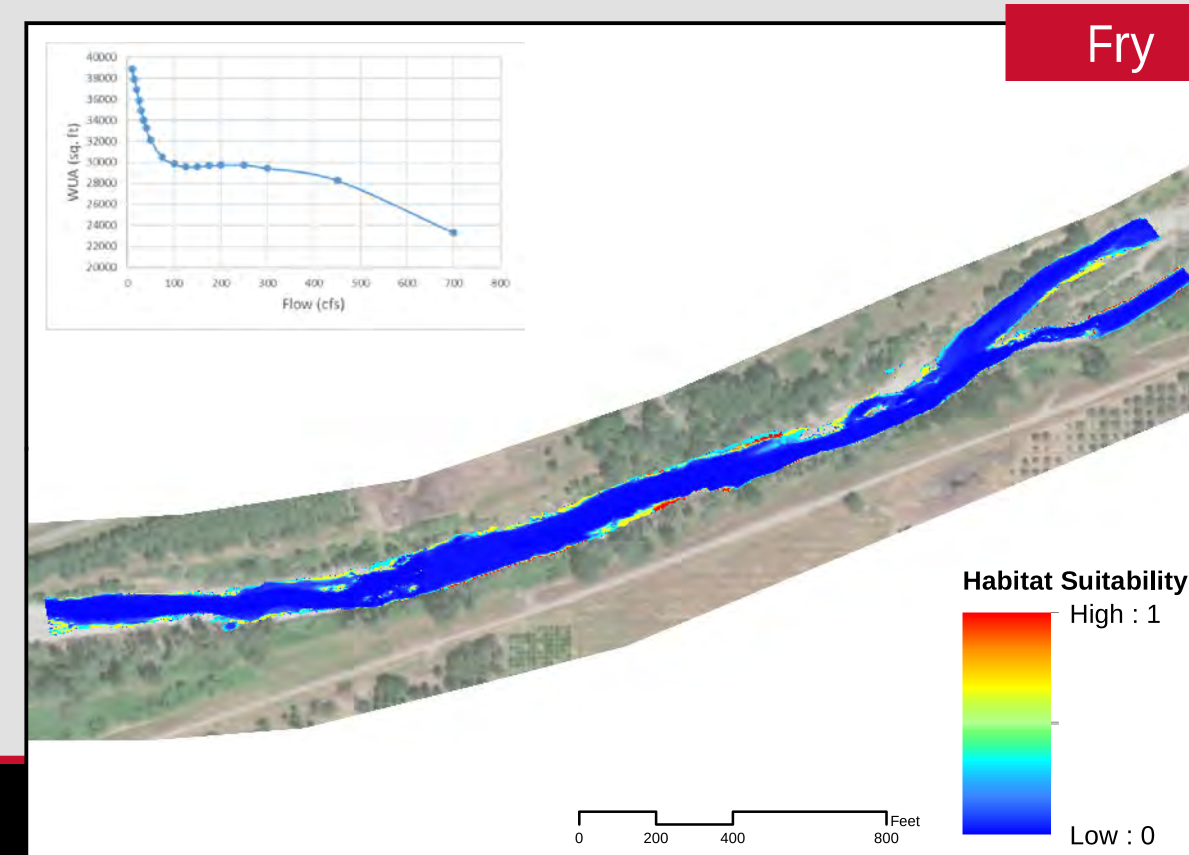
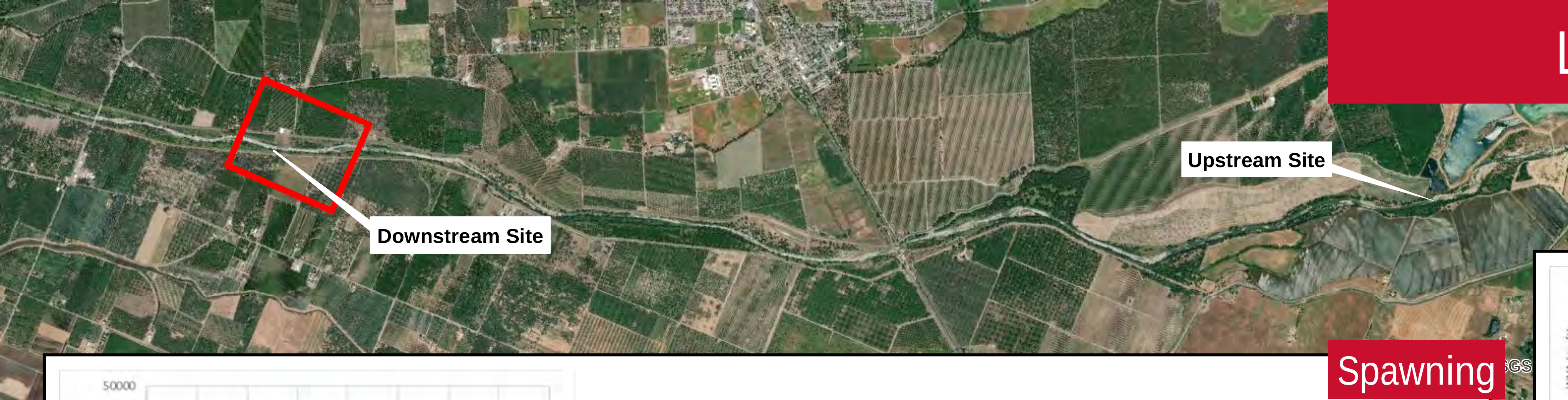


Lower Bear River - Instream Flow Study

SSWD HDR

Steelhead

Downstream Study Site 700 cfs



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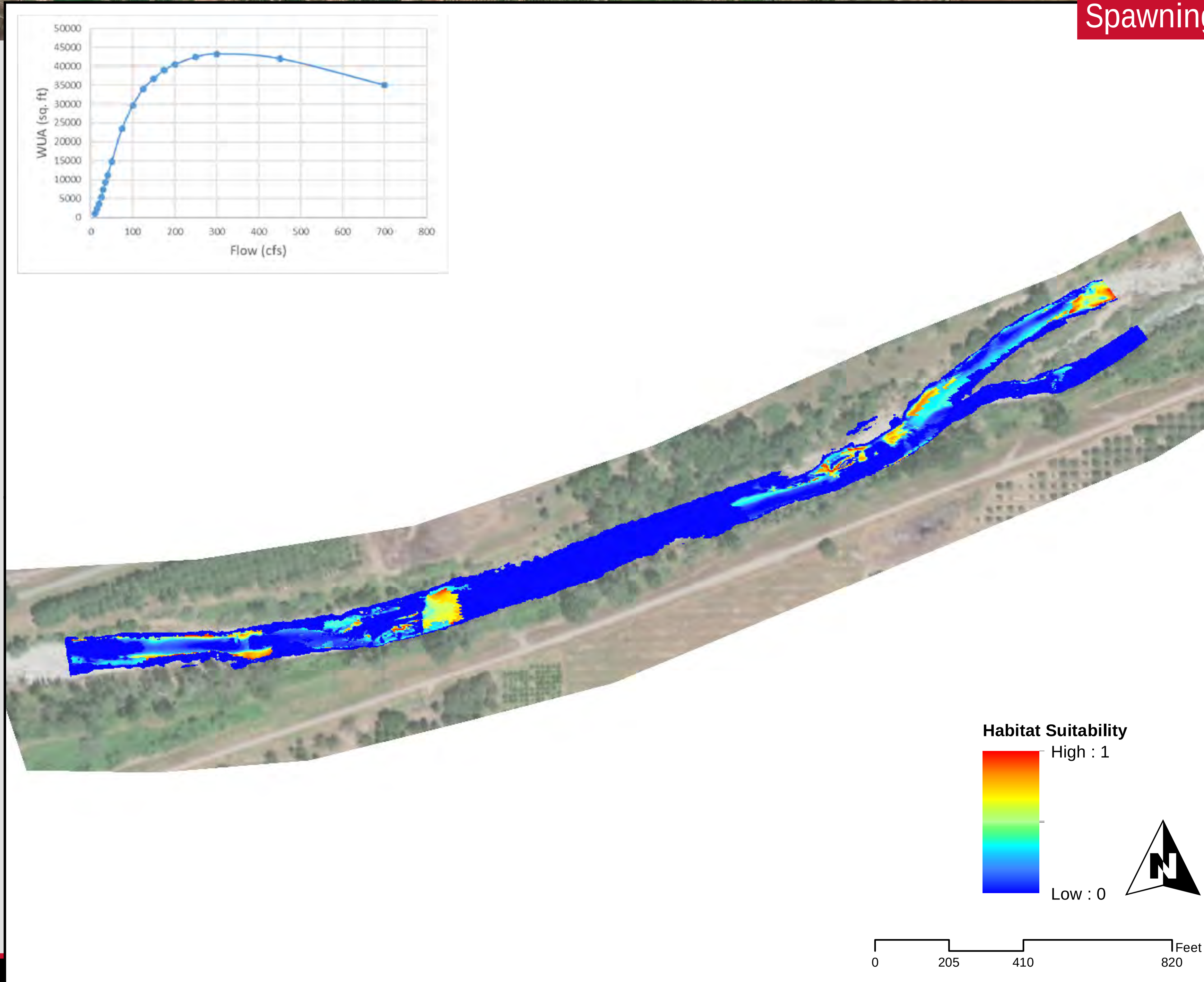

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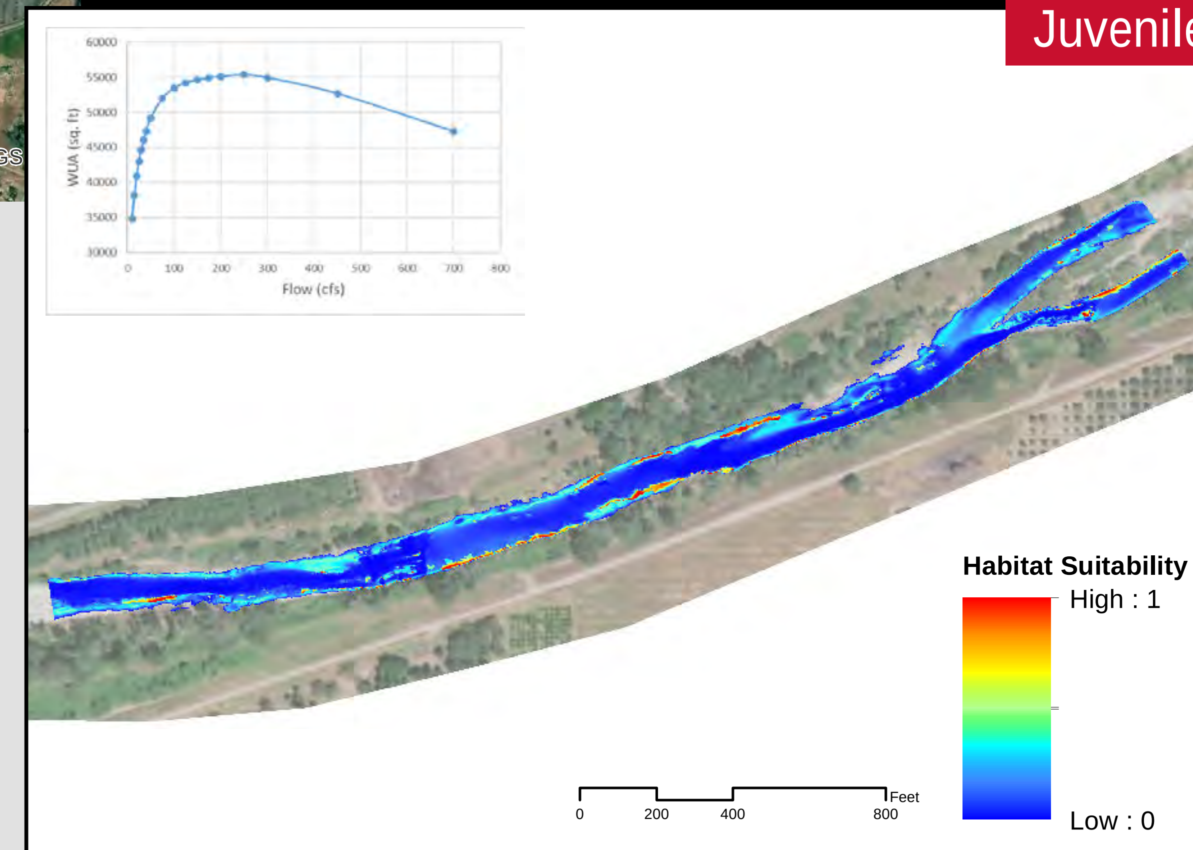

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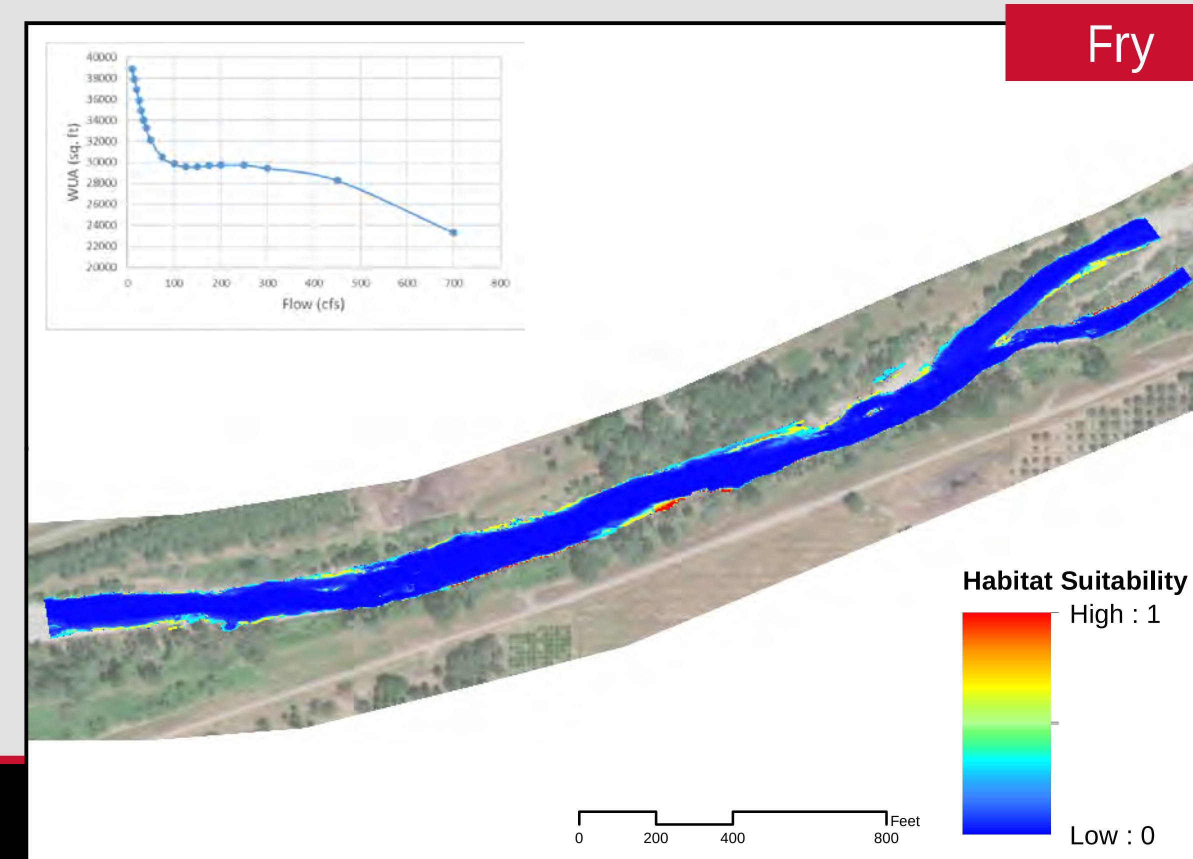

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3.3.4 Terrestrial Resources

This discussion of terrestrial resources is divided into six subsections. Section 3.3.4.1 discusses the affected environment (environmental baseline), including vegetation classifications, special-status plants[1], non-native invasive plants (NNIP);[2] Section 3.3.4.2 describes wildlife habitat, special-status wildlife,[3] commercially valuable wildlife,[4] and wetland, riparian and littoral habitats.[5] Section 3.3.4.3 addresses wetlands, riparian, and littoral habitats within the Project area. Section 3.3.4.4 describes known or potential Project effects on terrestrial resources, including cumulative effects, Section 3.3.4.5 describes unavoidable adverse effects, and proposed measures recommended by agencies and other interested parties in written comments on SSWD's DLA that were not adopt by SSWD are discussed in Section 3.3.4.6.

Where existing, relevant and reasonably available information was not sufficient to determine the potential effects of the Project on terrestrial resources, SSWD conducted four studies: 1) Study 3.3, *Instream Flow*; 2) Study 4.1, *Special-Status Plants and Non-Native Invasive Plants*; 3) Study 4.2, *Special-Status Wildlife – Raptors*; and 4) Study 4.3, *Special-Status Wildlife – Bats.* The studies are complete, and information on the study results can be found in this Application for New License. Additionally, data related to each study is located in Appendix E1 of this Application.

3.3.4.1 Affected Environment

3.3.4.1.1 Vegetation in the Proposed FERC Project Boundary

SSWD assessed vegetation with information from the CDFW's Vegetation Classification and Mapping Program (VegCAMP), which is publicly available data. The data were mapped using a GIS database and overlaid in layers. The area depicted includes the proposed FERC Project Boundary, and VegCAMP classifications within this area were quantified using GIS.

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1 For the purpose of this Application for New License, a special-status plant is a species that has a reasonable possibility of being affected by Project O&M or associated recreation and meets one or more of the following criteria: 1) listed on CDFW's list of California Rare (SR) species under the Native Species Plant Protection Act; 2) listed as threatened or endangered under CESA; or 3) listed on the California Native Plant Society's (CNPS) Inventory of Rare and Endangered Plants. Botanical species listed as threatened or endangered, or a candidate or proposed for listing, under the ESA are discussed separately in Section 3.3.5.

2 For the purpose of this Application for New License, NNIP are defined as those plant species listed as noxious weeds by the California Department of Food and Agriculture (CDFA). State-designated noxious weeds are typically assigned one of three ratings: 1) A-list species are mandated for eradication or control; 2) B-list species are widespread plants that agricultural commissioners may designate for local control efforts; and 3) C-list species are considered too widespread to control (CDFA 2018). Aquatic invasive plants, including algae, are discussed in Section 3.3.3.

3 For the purpose of this Application for New License, a special-status wildlife species is a species that has a reasonable possibility of being affected by Project O&M or associated recreation and meets one or more of the following criteria: 1) protected under the Bald and Golden Eagle Protection Act; 2) designated by CDFW as a Species of Special Concern (SSC); 3) listed as threatened or endangered, or a candidate or proposed for listing under CESA; or 4) Fully Protected (FP) under California law. Wildlife species listed as threatened or endangered, or a candidate or proposed for listing, under the ESA are discussed separately in Section 3.2.5.

4 For the purpose of this Application for New License, a commercially-valuable wildlife species is any species listed as a 'Harvest species' by CDFW. Per CDFW, a "Harvest species" is "game birds (Fish and Game Code § 3500); Game Mammals (Fish and Game Code § 3950) and Fur-bearing Mammals and Non-game animals as designated in the California Code of Regulations" (CDFW 2015a).

5 Aquatic reptiles, mollusks and snails are discussed in Section 3.3.3.

The area evaluated for vegetation encompasses 2,661.9 ac. The VegCAMP classifications and total acreage within the proposed FERC Project Boundary are summarized in Table 3.3.4-1, and shown in Figure 3.3.4-1. This information is generated by software and not necessarily ground-truthed at any given location.

Table 3.3.4-1. Acres of each VegCAMP vegetation classification within the Camp Far West Hydroelectric proposed FERC Project Boundary and adjacent area.[1]

Vegetation and Habitat Type	Sensitive Natural Community[2]	Area (acres)[1]	Percentage of Area (%)
TREE DOMINATED HABITATS			
Aesculus californicus	S3	1.42	0.05
Pinus sabiniana	--	2.66	0.10
Populus fremontii	S3	1.33	0.05
Quercus douglasii	--	452.60	17.00
Quercus lobata	S3	2.99	0.12
Quercus wislizeni	--	91.55	3.45
Salix laevigata	S3	3.35	0.12
Subtotal		555.90	20.89
HERBACEOUS HABITATS			
California Annual and Perennial Grassland	--	231.43	8.70
Californian Warm Temperate Marsh/Seep Group	S2	2.83	0.11
Irrigated Pasture Lands	--	9.00	0.34
Mediterranean California Naturalized Annual and Perennial Grassland	--	80.78	3.03
Subtotal		324.04	12.18
OTHER HABITATS			
Built-Up and Urban Disturbance	--	27.81	1.04
Perennial Stream Channel	--	0.84	0.03
Reservoir	--	1,749.61	65.73
River and Lacustrine Flats and Streambeds	--	1.73	0.06
Small Earthen Dam Ponds and Natural Lakes	--	1.58	0.06
Vernal Pool & Californian Annual and Perennial Grassland Matrix	S2	0.39	0.01
Subtotal		1,781.96	66.93
Total		**2,661.90**	**100.00**

Source: CDFW 2018a

1 The area evaluated for vegetation encompasses 2,661.9 ac (i.e., 2,674.0 ac in the Proposed Project Boundary and an additional 12.1 ac adjacent to the boundary).

2 S2, Imperiled - Imperiled in the State because of rarity due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors making it very vulnerable to extirpation from the state.
S3, Vulnerable - Vulnerable in the State due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation from the state.

Six of the VegCAMP natural communities identified within the Proposed Project Boundary are considered Sensitive Natural Communities with rankings of S2 and S3 by the CDFW.[6] These cover 12.31 ac and are: 1) *Aesculus californicus; 2) Populus fremontii; 3) Quercus lobata; 4) Salix laevigata;* 5) Californian Warm Temperate Marsh/Seep Group; and 6) Vernal Pool & Californian Annual and Perennial Grassland Matrix.

6 CDFW encourages Natural Communities with Sensitive ranks of S1 to S3 be addressed in the environmental review processes of CEQA and its equivalents (CDFW 2018a). The ranks are defined as follows: S1, Critically Imperiled - Critically imperiled in the State because of extreme rarity (often 5 or fewer populations) or because of factor(s) such as very steep declines making it especially vulnerable to extirpation from the state; S2, Imperiled - Imperiled in the State because of rarity due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors making it very vulnerable to extirpation from the state; and S3, Vulnerable - Vulnerable in the State due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation from the state.

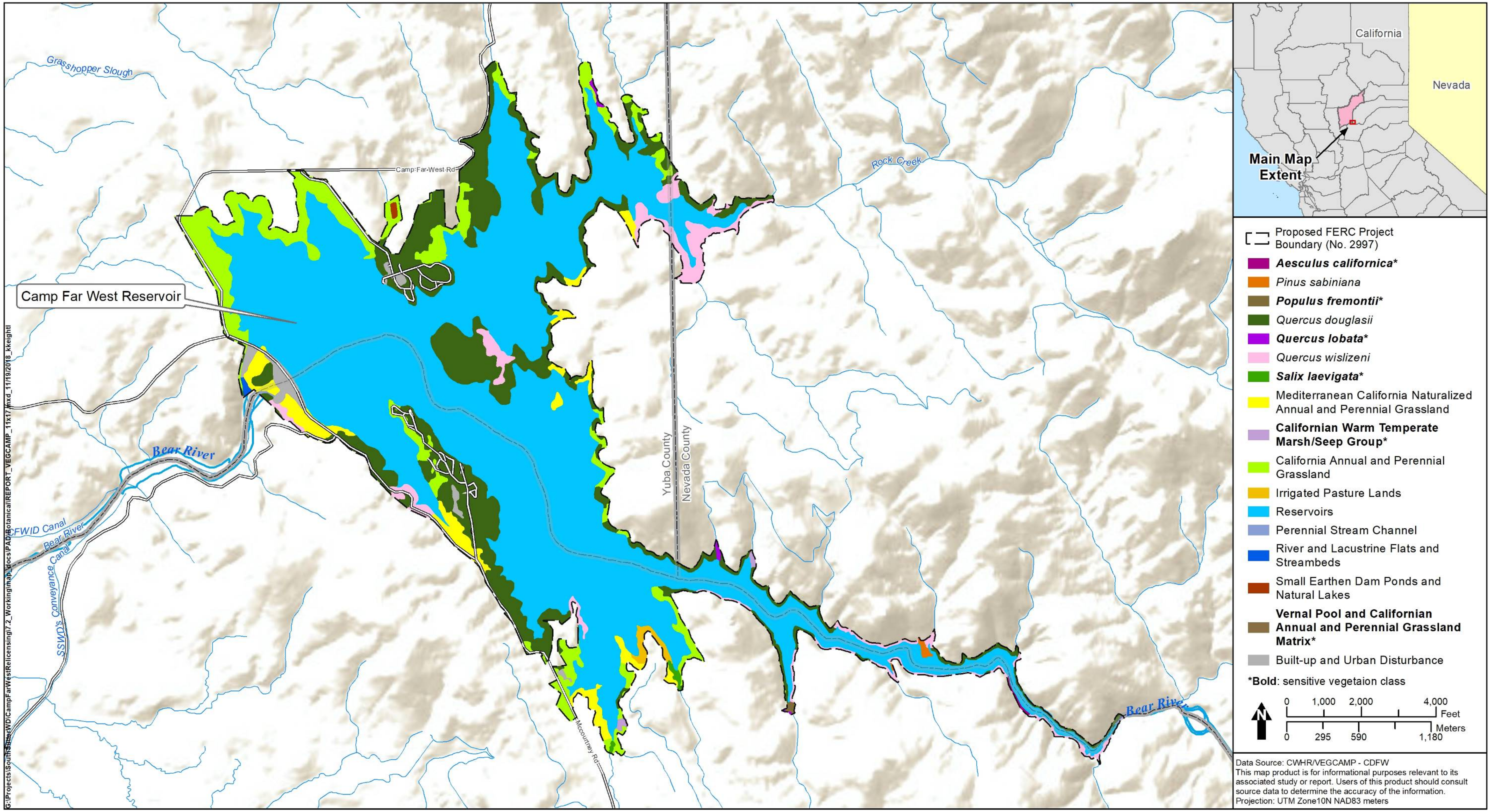

Figure 3.3.4-1. VegCAMP Classifications within the proposed FERC Project Boundary for the Camp Far West Hydroelectric Project.

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Tree-Dominated Habitats

Overall, tree-dominated habitats cover 555.90 ac of the area evaluated (Table 3.3.4-1). A discussion of each tree-dominated habitat is below (CDFW 2018a, Sawyer et al. 2009).

- *Aesculus californica* (1.42 ac). California buckeye (*Aesculus californica*) dominates the tree layer, with California ash (*Fraxinus dipetala*), foothill pine (*Pinus sabiniana*), and holly leaved cherry (*Prunus ilicifolia*) also present. Within this vegetation type there is often a developed shrub layer and a sparse and grassy understory. VegCAMP identified *Aesculus californica* in the furthest southeast portion of the proposed FERC Project Boundary (Figure 3.3.4-1). This vegetation type is a Sensitive Natural Community with a ranking of S3.
- *Pinus sabiniana* (2.66 ac). Foothill pine is the dominant species in the tree canopy, but often co-occurs with California buckeye, California black oak (*Quercus kelloggii*), and canyon live oak (*Quercus chrysolepis*). The canopy tends to be open to intermittent with a somewhat common shrub layer and sparse or grassy understory. *Pinus sabiniana* was identified at one location near the southeast corner of the proposed FERC Project Boundary (Figure 3.3.4-1).
- *Populus fremontii* (1.33 ac). This variable forest habitat includes Fremont's cottonwood (*Populus fremontii*), box elder (*Acer negundo*), western sycamore (*Platanus racemosa*), red willow (*Salix laevigata*) and other species in lesser quantities. Each of the three strata are variable in openness and density. *Populus fremontii* was identified at one location near the southeast corner of the proposed FERC Project Boundary down a short arm of the reservoir (Figure 3.3.4-1). This vegetation type is a Sensitive Natural Community with a ranking of S3.
- *Quercus douglasii* (452.60 ac). *Quercus douglasii* is dominated by California blue oak in the tree layer with some co-occurrence with California buckeye, foothill pine, valley oak (*Quercus lobata*), and interior live oak (*Quercus wislizeni*). The canopy can be savannah like to dense with a low to moderately developed shrub layer and seasonally present herb layer. *Quercus douglasii* can be found throughout the proposed FERC Project Boundary and is the most common terrestrial vegetation classification (Figure 3.3.4-1).
- *Quercus lobata* (2.99 ac). The tree layer includes valley oak with some box elder, western sycamore, Fremont's cottonwood, and California black oak. The canopy has a variable understory of shrubs and herbs. Within the proposed FERC Project Boundary, *Quercus lobata* occurs in an isolated area near the Nevada, Placer, and Yuba County border (Figure 3.3.4-1). This vegetation type is a Sensitive Natural Community with a ranking of S3.
- *Quercus wislizeni* (91.55 ac). Interior live oak, California buckeye, foothill pine, and California black oak all occur in the tree layer. The canopy cover, shrub cover, and herbaceous layers are all variable within this vegetation community. *Quercus wislizeni* is the second most common tree-dominated habitat, occurring in isolated pockets

throughout the proposed FERC Project Boundary, but the largest concentration is located in the northeastern corner (Figure 3.3.4-1).

- Salix laevigata (3.35 ac). Generally dominated by red willow in the tree layer, this community includes various other tree species including, but not limited to, box elder and white alder (*Alnus rhombifolia*). These woodlands tend to have a moderately developed shrub layer and a variable understory. *Salix laevigata* within the proposed FERC Project Boundary is located in two narrow riparian crevices on the southern-most portion of the reservoir (Figure 3.3.4-1). This vegetation type is a Sensitive Natural Community with a ranking of S3.

Herbaceous Habitats

Herbaceous habitats cover 324.04 ac of the area evaluated (Table 3.3.4-1). A discussion of each herbaceous habitat is below (CDFW 2018a, Sawyer et al. 2009).

- California Annual and Perennial Grassland (231.43 ac). California annual and perennial grasslands are generally dominated by non-native species such as small quaking grass (*Briza minor*), foxtail chess (*Bromus madritensis* ssp. *madritensis*), crane's bill geranium (*Geranium molle*), and hairy hawkbit (*Leontodon saxatilis*) at varying covers with some assemblages of other species including, but not limited to common fiddleneck (*Amsinckia menziesii*) and western buttercup (*Ranunculus occidentalis* var. *occidentalis*). Areas of low grass density occur in isolated patches allowing for a non-grassy herbaceous layer to develop. Perennial species consisting of goose grass (*Galium aparine*), shiny peppergrass (*Lepidium nitidum*), and bulbous blue grass (*Poa bulbosa*), and others can also occur in patches. These types of grasslands are present in most areas of the proposed FERC Project Boundary (Figure 3.3.4-1).

- California Warm Temperate Marsh/Seep Group (283.00 ac). California Warm Temperate Marsh/Seeps are characterized by a mixture of sedges (*Carex* spp.), rushes (*Juncus* spp.), as well as some instances of seep monkey flower (*Erythranthe guttata*), deergrass (*Muhlenbergia rigens*), and beardless wildrye (*Elymus triticoides*). Within the proposed FERC Project Boundary, these types of marshes and seeps occur in two narrow riparian crevices on the southeast portion of the reservoir (Figure 3.3.4-1). This vegetation type is a Sensitive Natural Community with a ranking of S2.

- Irrigated Pasture Lands (9.00 ac). Irrigated pasture lands are typically dominated by a random assemblage of non-native species including, but not limited to, slender wild oat (*Avena barbata*), Italian thistle (*Carduus pycnocephalus* ssp. *pycnocephalus*), greenstem filaree (*Erodium moschatum*), and cutleaf plantain (*Plantago coronopus*). The one location of this type of habitat within the proposed FERC Project Boundary is at the southern boundary of the reservoir just east of McCourtney Road (Figure 3.3.4-1)

- Mediterranean California Naturalized Annual and Perennial Grassland (80.78 ac). Mediterranean California Naturalized Annual and Perennial Grasslands are generally dominated by various non-native grass species including, but not limited to slender oat, poverty brome (*Bromus sterilis*), and bristly dogtail grass (*Cynosurus echinatus*). Additionally, non-grassy herbaceous species can also co-dominate including, but not limited to, black mustard (*Brassica nigra*), common groundsel (*Senecio vulgaris*), yellow star-thistle (*Centaurea solstitialis*), and narrowleaf plantain (*Plantago lanceolata*). These types of grasslands are present in multiple areas of the proposed FERC Project Boundary with the exception of regions of the Project east of the Nevada and Yuba County longitudinal border (Figure 3.3.4-1).

Other Habitats

Other habitats cover 1,781.96 ac of the area of the area evaluated (Table 3.3.4-1). A discussion of each other habitat is below (CDFW 2018a).

- Built-Up and Urban Disturbance (27.81 ac). Built-Up and Urban Disturbance cover types apply to landscapes that are dominated by urban structures, residential units, or other developed land use elements such as highways, city parks, dams, etc. Within the proposed FERC Project Boundary, urban lands occur in the northwest portion of the Project (Figure 3.3.4-1).
- Perennial Stream Channels (0.84 ac). Perennial Stream Channels are labeled in VegCAMP mapping as areas of perennially flowing channels, instream bars, and either mostly or completely unvegetated intermittent stream channels. Within the proposed FERC Project Boundary, perennial stream channels can be found downstream of the Camp Far West Dam at the west end of the Project and at the furthest southeast edge (Figure 3.3.4-1).
- Reservoir (1,749.61 ac). This cover type is composed of all open water contained by the reservoir boundaries. This is the most common classification type within the proposed FERC Project Boundary (Figure 3.3.4-1).
- River and Lacustrine Flats and Streambeds (1.73 ac). River and Lacustrine Flats and Streambeds are typically composed of tributaries of major water bodies and contain a high degree of riparian and/or wetland vegetation cover. Within the proposed FERC Project Boundary this habitat occurs downstream of the Camp Far West Dam at the west end of the Project (Figure 3.3.4-1).
- Small Earthen Dam Ponds and Natural Lakes (1.58 ac). Small Earthen Dam Ponds and Natural Lakes is a cover type typically associated with small freshwater lacustrine systems that are either completely natural or only have earthen banks with no permanent or impermeable structures that control hydrology. Within the proposed FERC Project Boundary, this habitat is found north of the reservoir surrounded by a large patch of grassland (Figure 3.3.4-1).
- Vernal Pool & Californian Annual and Perennial Grassland Matrix (0.39 ac). Vernal Pool & Californian Annual and Perennial Grassland Matrix habitat is composed of vernal pools with a semi-impermeable layer allowing for water to pond for an intermittent period of time. These habitats are typically surrounded by grasslands. This habitat is found at the northwest corner of the proposed FERC Project Boundary. This vegetation type is a Sensitive Natural Community with a ranking of S2.

3.3.4.1.2 Vegetation Along the Bear River Downstream of the Project

A narrow band of vegetation on either side of the Bear River downstream of the Project may be cumulatively affected by Project releases and downstream non-Project water diversions. SSWD assessed vegetation with information from the CDFW's VegCAMP. The data were mapped using a GIS database and overlaid in layers. The area depicted included the band of vegetation within a 250-ft wide buffer of the Bear River downstream of the Project to its confluence with the Feather River. VegCAMP classifications within this area were quantified using GIS and are described in Table 3.3.4-2 and shown on Figures 3.3.4-2 to 3.3.4-5.

Table 3.3.4-2. Acres of each VegCAMP vegetation classification downstream of the Camp Far West Hydroelectric Project.

Vegetation and Habitat Type	Sensitive Natural Community[1]	Area (acres)	Percentage of Area (%)
TREE DOMINATED HABITATS			
Acer negundo	S2	3.75	0.34
Alnus rhombifolia	--	5.97	0.55
Juglans hindsii and hybrids	S1	3.37	0.31
Populus fremontii	S3	215.18	19.66
Quercus douglasii	--	19.66	1.79
Quercus lobata	S3	171.75	15.70
Quercus wislizeni	--	6.95	0.64
Salix gooddingii	S3	28.33	2.59
Salix laevigata	S3	2.09	0.19
Subtotal		457.05	41.77
HERBACEOUS HABITATS			
Arundo donax	--	37.74	3.45
California Annual and Perennial Grassland	--	7.72	0.71
Californian Warm Temperate Marsh/Seep Group	S2	4.42	0.40
Cephalanthus occidentalis	S2	1.48	0.14
Mediterranean California Naturalized Annual and Perennial Grassland	--	218.18	19.94
Myriophyllum spp. – Permanently Flooded Herbaceous Alliance	--	0.61	0.06
Naturalized warm-temperate riparian and wetland group	--	6.46	0.59
Rubus armeniacus	--	14.53	1.33
Salix exigua	--	19.88	1.82
Salix lasiolepis	--	22.10	2.02
Vitis californica - Provisional	--	1.81	0.17
Subtotal		334.93	30.63
OTHER HABITATS			
Agriculture	-	100.08	9.15
Bare Gravel and Sand	--	10.48	0.96
Built Up and Urban Disturbance	--	0.17	0.02
Perennial Stream Channel	--	34.08	3.11
Quarry, Mine, Gravel	--	10.0	0.91
River and Lacustrine Flats and Streambeds	--	2.76	0.25
Urban	--	16.59	1.52
Water	--	127.76	11.68
Subtotal		301.92	27.6
Total		**1,093.90**	**100.00**

Source: CDFW 2018a

[1] S2, Imperiled - Imperiled in the State because of rarity due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors making it very vulnerable to extirpation from the state.
S3, Vulnerable - Vulnerable in the State due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation from the state.

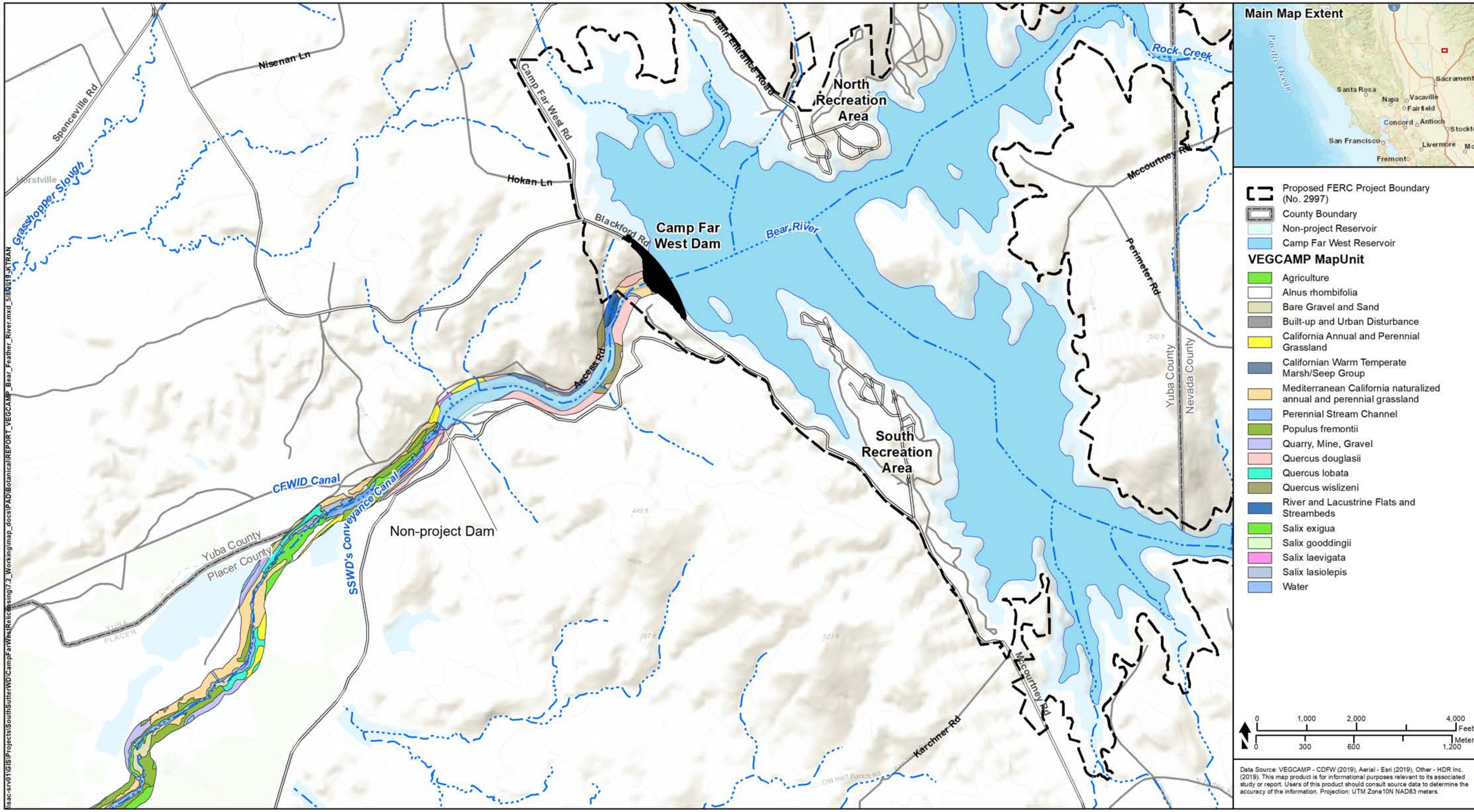

Figure 3.3.4-2. VegCAMP Classifications downstream of the proposed FERC Project Boundary for the Camp Far West Hydroelectric Project.

Figure 3.3.4-3. VegCAMP Classifications downstream of the proposed FERC Project Boundary for the Camp Far West Hydroelectric Project.

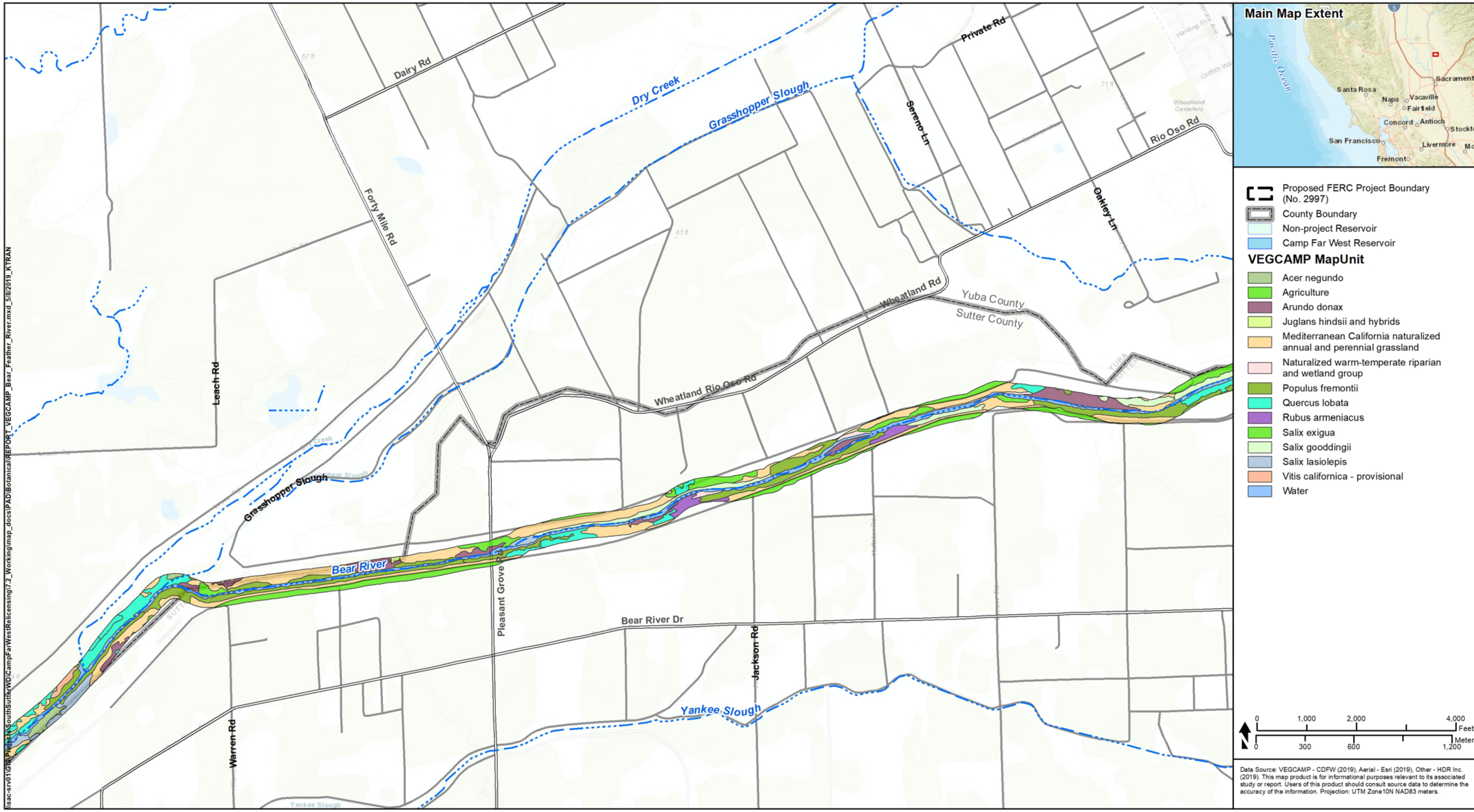

Figure 3.3.4-4. VegCAMP Classifications downstream of the proposed FERC Project Boundary for the Camp Far West Hydroelectric Project.

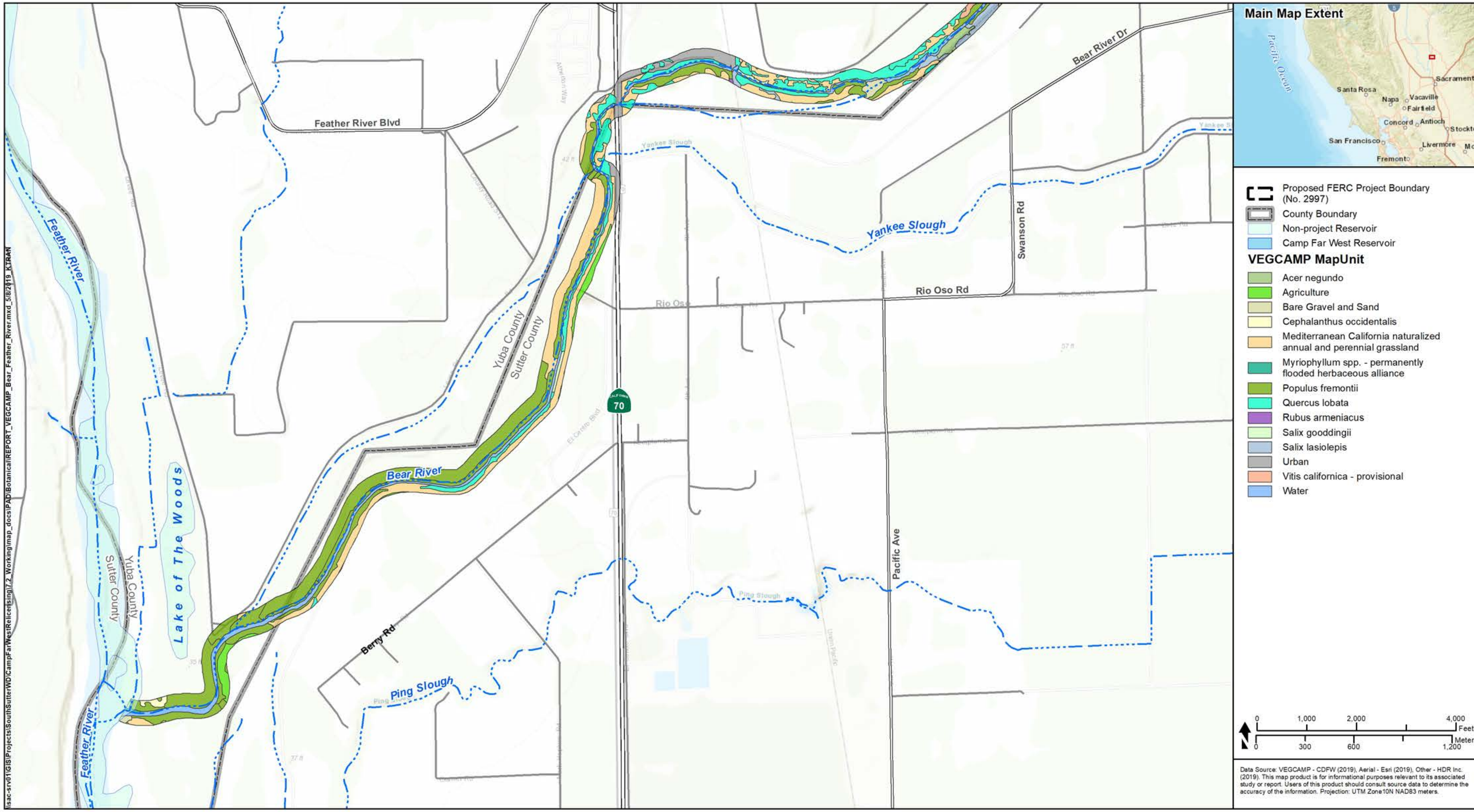

Figure 3.3.4-5. VegCAMP Classifications downstream of the proposed FERC Project Boundary for the Camp Far West Hydroelectric Project.

Tree-Dominated Habitats

Overall, tree-dominated habitats cover 457.05 ac of the band of vegetation within a 250 ft buffer of the Bear River downstream of the Project to its confluence with the Feather River (Table 3.4.4-2). A discussion of each of tree-dominated habitat is below (CDFW 2018a, Sawyer et al. 2009).

- *Acer negundo* (3.75 ac). Box-elder (*Acer negundo)* is dominant or co-dominant in tree canopy with *Alnus rhombifolia, Fraxinus latifolia, Juglans hindsii* and hybrids, *Platanus racemosa, Populus fremontii, P. trichocarpa, Quercus lobata, Salix gooddingii,* and other *Salix spp.* Trees are less than 20 m in height; cover is intermittent to continuous, and it may be two tiered. Shrub layer is open to intermittent and the herbaceous layer is sparse to abundant. This vegetation type is a Sensitive Natural Community with a ranking of S2.
- *Alnus rhombifolia* (5.97 ac). White alder (*Alnus rhombifolia*) is dominant or co-dominant in tree canopy with *Acer macrophyllum, Chamaecyparis lawsoniana, Fraxinus latifolia, Lithocarpus densiflorus, Platanus racemosa, Populus fremontii, P. Trichocarpa, Pseudotsuga menziesii, Quercus lobata,* and *Salix spp.* Trees are less than 35 m in height; canopy is open to continuous; it may be two tiered, shrub layer is sparse to continuous, and herbaceous layer is variable.
- *Juglans hindsii* and hybrids (3.37 ac). Hind's walnut (*Juglans hindsii*) or hybrids are dominant in the tree canopy with *Populus fremontii, Quercus lobata, Salix exigua, Salix gooddingii, and Sambucus nigra.* Trees are less than 25 m in height; canopy is intermittent to continuous, the shrub layer is open to intermittent, and the herbaceous layer is sparse. Habitat requirements include intermittently flooded or saturated riparian corridors, floodplains, stream banks, and terraces with alluvial soils. This vegetation type is a Sensitive Natural Community with a ranking of S1.
- *Populus fremontii* (215.18 ac). See Section 3.3.4.1.1.
- *Quercus douglasii* (19.66 ac), *Quercus lobata* (171.75 ac), and *Quercus wislizeni* (6.95 ac). See Section 3.3.4.1.1.
- *Salix gooddingii (*28.33 ac*).* Black willow (*Salix gooddingii)* is dominant or co-dominant in the tree canopy with *Alnus rhombifolia*, *Populus fremontii, Salix laevigata, Salix lasiolepis, Salix lucida spp. lasiandra, Sambucus nigra,* and *Washingtonia filifera.* Trees are less than 30 m in height; canopy is open to continuous, the shrub layer is open to continuous, and the herbaceous layer is variable. This vegetation type is a Sensitive Natural Community with a ranking of S3.
- *Salix laevigata* (2.09 ac). See Section 3.3.4.1.1.

Herbaceous Habitats

Herbaceous habitats cover 334.93 ac of the area within a 250 foot buffer of the Bear River downstream of the Project to its confluence with the Feather River, with Mediterranean

California naturalized annual and perennial grassland being the dominant habitat type (Table 3.3.4-2). A discussion of each herbaceous habitats is below (CDFW 2018a, Sawyer et al. 2009).

- *Arundo donax* (37.74 ac). *Arundo donax* is dominant in the herbaceous layer. Emergent trees may occur at low cover. *Arundo donax* is less than 8 m in height and canopy is continuous.
- California Annual and Perennial Grassland (7.72 ac). See Section 3.3.4.1.1.
- Californian Warm Temperate Marsh/Seep Group (4.42 ac). See Section 3.3.4.1.1.
- *Cephalanthus occidentalis* (1.48 ac). Button willow (*Cephalanthus occidentalis*) is dominant in the shrub canopy with *Cornus sericea, Salix gooddingii, S. lucida ssp. lasiandra*, and *Salix exigua*. Shrubs are less than 6 m in height; canopy is continuous, intermittent, or open and the herbaceous layer is sparse or grassy. This vegetation type is a Sensitive Natural Community with a ranking of S2.
- Mediterranean California Naturalized Annual and Perennial Grassland (218.18 ac). See Section 3.3.4.1.1.
- *Myriophyllum spp.* (0.61 ac). *Myriophyllum spp.* or other non-native submersed aquatic plant is dominant or co-dominant in the aquatic herb layer with other aquatics including *Azolla filiculoides, Ceratophyllum demersum, Eichhornia crassipes, Elodea canadensis, Ludwigia peploides, Myriophyllum aquaticum* or *Potamogeton crispus.* Naturalized Warm-Temperate Riparian and Wetland Group (6.46 ac). Includes *Lepidium latifolium* which is dominant in the herbaceous layer. Emergent trees and shrubs may occur at low cover, herbs are less than 2 m in height, and canopy is intermittent to continuous. The group also includes smartweed (*Persicaria lapathifolia or Xanthium strumarium*) which is dominant or co-dominant in the herbaceous layer. Smartweed is less than 1.5 m in height and cover is open to continuous.
- *Rubus armeniacus* (14.53 ac). Himalayan black berry (*Rubus armeniacus)* is dominant or co-dominant in the shrub layer. Shrubs are less than 3 m in height, canopy is intermittent to continuous, and herbaceous layer is open to intermittent. Himalayan black berry is an invasive species found in pastures, forest plantations, roadsides, streamsides, river flats, floodplains, fence lines, and right-of-way corridors.
- *Salix exigua* (19.88 ac). Sandbar willow (*Salix exigua*) is dominant or co-dominant in the shrub canopy with *Baccharis spp., Brickellia californica, Rosa californica, Rubus armeniacus, R. ursinus, Salix lasiolepis*, and *S. melanopsis*. Emergent trees of many different species may be present at low cover. Shrubs are less than 7 m in height; canopy is intermittent to continuous.
- *Salix lasiolepis* (22.10 ac). Arroyo willow (*Salix lasiolepis*) is dominant or co-dominant in the shrub or tree canopy. As a shrubland, emergent trees may be present at low cover. Plants are less than 10 m in height; canopy is open to continuous and the herbaceous layer is variable.

- *Vitis californica* (1.81 ac). California grape (*Vitis californica*) can be found throughout central and northern California. It is a deciduous vine that can grow to over 10 m in length. *Vitis californica* grows along streams and rivers and is native to California.

Other Habitats

Other habitats cover 301.92 ac of the area within a 250 ft buffer of the Bear River downstream of the Project to its confluence with the Feather River, with water as the dominant habitat type (Table 3.3.4-2). A discussion of each other habitat is below (CDFW 2018a).

- Agriculture (100.08 ac). Agricultural land is used primarily for the production of food and fiber. High-altitude imagery indicates agricultural activity by distinctive geometric field and road patterns on the landscape and traces produced by mechanized equipment. Agricultural land uses include forest landscapes such as orchards as well as non-forested land uses such as vineyards and field crops. Land used exclusively for livestock pasture may, however, be mapped as annual grassland in those cases in which land uses are not recognizable.
- Bare Gravel and Sand (10.48 ac). Landscapes generally devoid of vegetation as seen from a high-altitude image source such as aerial photography, are labeled as Barren. This category includes mappable landscape units in which surface lithology is dominant, such as exposed bedrock, cliffs, interior sandy or gypsum areas, and the like. It usually does not include barren areas considered as modified or developed, as in urban areas.
- Built Up and Urban Disturbance (0.17 ac). See Section 3.3.4.1.1.
- Perennial Stream Channel (34.08 ac). See Section 3.3.4.1.1.
- Quarry, Mine, Gravel (10.0 ac). Urban development in California occurs in phases. When land is cleared prior to being paved, this type represents the occurrence of non-vegetated barren ground that is caused by urbanization. This land-use type also represents other mechanically-caused barren ground, such as open quarries or mined areas, barren ground along highways and other areas cleared of vegetation prior to construction.
- River and Lacustrine Flats and Streambeds (2.76 ac). See Section 3.3.4.1.1.
- Urban (16.59 ac). The juxtaposition of urban vegetation types within cities produces a rich mosaic with considerable edge areas. The overall mosaic may be more valuable as wildlife habitat than the individual units in that mosaic. Species composition in urban habitats varies with planting design and climate. Monoculture is commonly observed in tree groves and street tree strips.
- Water (127.76 ac). Water is labeled in those cases in which permanent sources of surface water are identified within a landscape unit of sufficient size to be mapped. The category includes lakes, streams, and canals of various size, bays and estuaries and similar water bodies. These areas are considered to have a minimum of vegetation components, except along the edges, which may be mapped as types such as Wet Meadows, Tule-Cattail freshwater marshes, or Pickleweed-Cordgrass saline or mixed marshes. Islands of

sufficient size within water bodies will be mapped according to their terrestrial dominant vegetation types.

3.3.4.1.3 Special-Status Plants

Both documented and potentially occurring special-status plants are described below based on the results of queries to the CDFW's CNDDB (CDFW 2018b); USFWS' Information, Planning, and Conservation System (IPaC) Trust Resources Report for Nevada, Placer and Yuba counties (USFWS 2018a); the CNPS' Inventory of Rare and Endangered Plants database (CNPS 2018); and the Camp Far West Project's Biological Assessment (Sycamore Associates 2013a, Appendix A). Database queries included all United States Geological Survey (USGS) 1:24,000 topographic quadrangles that include the proposed FERC Project Boundary and the surrounding quadrangles. Quadrangles containing the proposed FERC Project Boundary include Camp Far West and Wolf. Quadrangles immediately adjacent to the Proposed Project Boundary quadrangles include Auburn, Browns Valley, Gold Hill, Grass Valley, Lake Combie, Lincoln, Rough and Ready, Sheridan, Smartsville, and Wheatland.

Table 3.3.4-3 lists the 14 special-status plants known to occur or with the potential to occur in the Proposed Project Boundary, six of which are known from the Proposed Project Boundary or quadrangles containing the proposed FERC Project Boundary.

Table 3.3.4-3. Special-status plants known or with the potential to occur in the Camp Far West Hydroelectric Project Vicinity.

Scientific Name / Common Name	Status[1]	Blooming Period[2]	Habitat Characteristics[2]	Potential	Rationale
FOUND WITHIN CAMP FAR WEST AND WOLF QUARDRANGLES (PROPOSED PROJECT BOUNDARY)					
Azolla microphylla/ Mexican mosquito fern	4.2	August	Ponded areas and slow moving water in marshes and swamps; 98 - 328 ft	Present	One occurrence found in Seep 3, which was located along the NSRA shoreline (Sycamore Associates 2013a)
Clarkia biloba ssp. *brandegeeae*/ Brandegee's clarkia	4.2	May–July	Chaparral, cismontane woodland, and lower montane coniferous forests, often in roadcuts; 245 - 3,000 ft	Present	Two occurrences along the south side of 'riverine' reach of the reservoir (Sycamore Associates 2013a)
Lilium humboldtii ssp. *humboldtii*/ Humboldt lily	4.2	May–August	Openings in chaparral, cismontane woodland, and lower montane coniferous forest; 295 - 4,200 ft	Yes	Suitable habitat is present in the FERC Project Boundary
Wolffia brasiliensis/ Brazilian watermeal	2B.3	April and December	Shallow freshwater marshes and swamps; 65 - 330 ft	Yes	Suitable habitat is present in the FERC Project Boundary

Table 3.3.4-3. (continued)

Scientific Name / Common Name	Status[1]	Blooming Period[2]	Habitat Characteristics[2]	Potential	Rationale
FOUND WITHIN CAMP FAR WEST AND WOLF QUARDRANGLES (PROPOSED PROJECT BOUNDARY) (cont.)					
Brodiaea sierrae/ Sierra foothills brodiaea	4.3	May–August	Usually found in serpentine or gabbro soils in chaparral, cismontane woodland, and lower montane coniferous forest; 160 - 3,215 ft	Present	One occurrence along south side of 'riverine' reach of reservoir (Sycamore Associates 2013a)
Subtotal	*5*				
FOUND WITHIN AUBURN, BROWNS VALLEY, GOLD HILL, GRASS VALLEY, LAKE COMBIE, LINCOLN, ROUGH AND READY, SHERIDAN, SMARTSVILLE, AND WHEATLAND QUARDRANGLES (OUTSIDE PROPOSED PROJECT BOUNDARY)					
Allium jepsonii/ Jepson's onion	1B.2	April–August	Serpentine or volcanic soils in chaparral, cismontane woodland, and lower montane coniferous forest; 980 - 4,330 ft	No	No serpentine or volcanic soils are present in the FERC Project Boundary
Allium sanbornii var. *sanbornii/* Sanborn's onion	4.2	May–September	Usually serpentine or gravelly soils in chaparral, cismontane woodland, and lower montane coniferous forest; 850 - 4,955 ft	No	No serpentine soils are present in the FERC Project Boundary
Balsamorhiza macrolepis/ Big-scale balsamroot	1B.2	March–June	Occasionally in serpentine soils in chaparral, cismontane woodland, and grasslands; 295 - 5,100 ft	No	No serpentine soils are present in the FERC Project Boundary
Fritillaria eastwoodiae/ Butte County fritillary	3.2	March–June	Sometimes serpentine soils in chaparral, cismontane woodland, and lower montane coniferous forest; 160 - 4,920 ft	Yes	Suitable habitat is present in the FERC Project Boundary
Juncus leiospermus var. *ahartii/* Ahart's dwarf rush	1B.2	March–May	Mesic soils in grasslands; 95 - 750 ft	Yes	Suitable habitat is present in the FERC Project Boundary.
Plagiobothrys glyptocarpus var. *modestus/* Cedar Crest popcornflower	3	April–June	Cismontane woodland and mesic grasslands; 2,850 - 2,855 ft	Yes	Suitable habitat is present in the FERC Project Boundary.
Rhynchospora capitellata/ Brownish beaked-rush	2B.2	July–August	Mesic soils in meadows, seeps, marshes, swamps, and montane coniferous forests; 145 - 6,560 ft	Yes	Suitable habitat is present in the FERC Project Boundary.
Sidalcea gigantea/ Giant checkerbloom	4.3	(January–June) July–October	Meadows and seeps of montane coniferous forests; 2,195 - 6,400 ft	Yes	Suitable habitat is present in the FERC Project Boundary.

Table 3.3.4-3. (continued)

Scientific Name / Common Name	Status[1]	Blooming Period[2]	Habitat Characteristics[2]	Potential	Rationale
FOUND WITHIN AUBURN, BROWNS VALLEY, GOLD HILL, GRASS VALLEY, LAKE COMBIE, LINCOLN, ROUGH AND READY, SHERIDAN, SMARTSVILLE, AND WHEATLAND QUARDRANGLES (OUTSIDE PROPOSED PROJECT BOUNDARY) (cont.)					
Sidalcea stipularis/ Scadden Flat checkerbloom	1B.1, SE	July–August	Montane freshwater marshes and swamps; 2,295 - 2,395 ft	Yes	Suitable habitat is present in the FERC Project Boundary.
Subtotal	*9*				
Total	**14**				

[1] Status (CDFW 2018a; CNPS 2018)
SE = State Endangered
California Rare Plant Rank
1B Plants Rare, Threatened, or Endangered in California and elsewhere
2B Plants Rare, Threatened, or Endangered in California, but more common elsewhere
3 Plants about which we need more information - review list
4 Plants of limited distribution - watch list
.1 Seriously threatened in California (over 80% of occurrences threatened; high degree and immediacy of threat)
.2 Moderately threatened in California (20–80% of occurrences threatened; moderate degree and immediacy of threat)
.3 Not very threatened in California (<20% of occurrences threatened; low degree and immediacy of threat or no current threats known)

[2] Source: CNPS 2018

Special-Status Plants and Non-Native Invasive Plants Study

SSWD conducted a special-status plant and NNIP Study (Study 4.1, *Special-Status Plants and Non-Native Invasive Plants*) within a designated study area inside the proposed FERC project Boundary, including background literature reviews, desktop analyses, and field investigations.

The study area consisted of four specific areas: 1) the North Shore Recreation Area (NSRA); 2) the SSRA; 3) the Camp Far West Dam and associated dikes and Spillway; and 4) the Camp Far West Dam Powerhouse, for a total of 505 ac. Figure 3.3.4-6 shows the study area for special-status plants and NNIP. These are the areas where SSWD's Project O&M activities or Project-related recreation could affect special-status plants or spread NNIP.

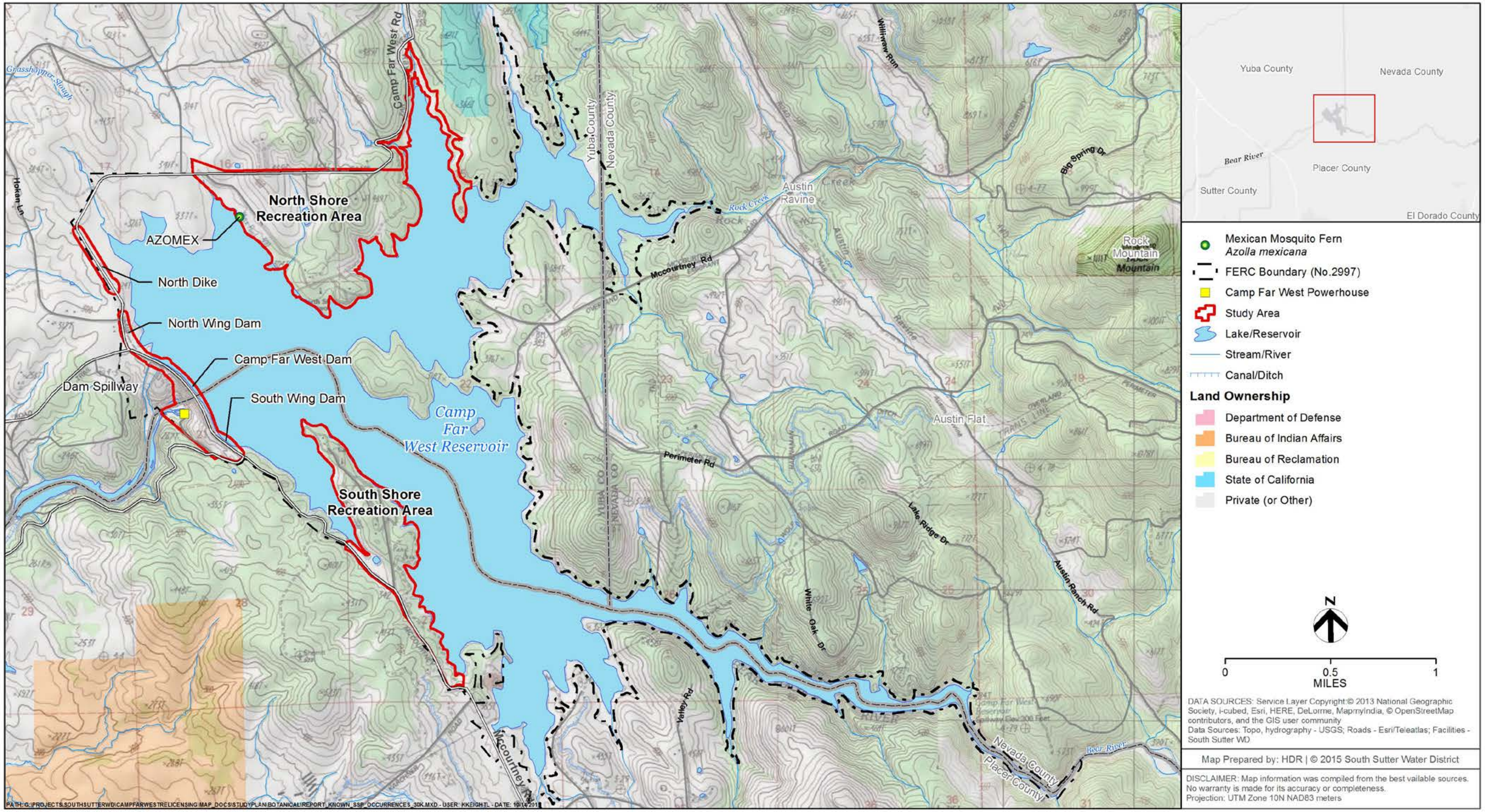

Figure 3.3.4-6. Study Area for special-status plants and NNIP studies.

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The study was conducted consistent with Section 6.0 of the *Special-Status Plants and Non-Native Invasive Plant Study Plan* that was filed with FERC on January 9, 2017. This study was conducted in conjunction with SSWD's relicensing Study 5.1, *ESA-Listed Plants*, and Study 5.2, *ESA-Listed Wildlife – Valley Elderberry Longhorn Beetle.* Additional information describing NNIP surveys and results is provided below in Section 3.3.4.1.3 and field data are provided in Appendix E1.

Before starting field surveys, SWWD identified and mapped known occurrences of special-status plants within the Study Area and prepared field maps for use by field survey teams. The maps included aerial imagery, Project features, and known special-status plant and NNIP occurrences. The maps were used for guidance purpose only; during the study, all special-status plant species and NNIP occurrences were mapped.

Field surveys were conducted from April 2017 through July 2017. Survey timing was planned based on known bloom times and herbarium collection dates. SSWD's surveyors conducted special-status plant surveys and NNIP surveys as outlined in the "Botanical Survey" section of the CDFW's *Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities* (CDFG 2009). Surveys were comprehensive over the entire study area, except for areas deemed to be unsafe (e.g., due to steep, unstable terrain) by the field team, using systematic field techniques to ensure thorough coverage, with additional efforts focused in habitats with a higher probability of supporting special-status plants (e.g., serpentine outcrops) and NNIP. Surveys were floristic in nature, documenting all species observed; taxonomy and nomenclature were based on *The Jepson Manual* (Baldwin et al. 2012).

Following field surveys, SSWD developed GIS maps depicting NNIP occurrences, Project facilities, features, and specific Project-related impacts (e.g., dispersed use camping) and other related information collected during the study. Field data were subject to QA/QC procedures, including spot-checks of transcription and comparison of GIS maps with field notes to verify locations of mapped occurrences.

The final step of the study, SSWD's Project Operations Staff Consultation, was completed on March 15, 2018.

A total of 206 plant species was identified during the 2017 surveys (Attachment 3.3.4A); 94 were native species. No special-status plant species were identified in the study area. However five occurrences of special-status plants were identified during 2013 surveys by SSWD, all in the Proposed Project Boundary. These species are described below.

Mexican Mosquito Fern (*Azolla microphylla*)[7]

Mexican mosquito fern is a small, floating green plant with simple roots; plants are often 0.5-1 inch wide with small, alternate, overlapping leaves and dichotomous (forked branches of equal size) branching. Leaves are divided into two lobes: (1) a smaller floating upper lobe 0.7 mm long, papillose (small rounded projections) on the upper surface, the largest hairs on upper (dorsal) leaf lobes thick, 2–3 celled; and (2) a lower lobe that is larger, and variously described as submerged or floating. Plants may be green or red in color. Sporocarps (fruiting bodies) occur in pairs in the leaf axils of older plants. The species is usually found growing in ponds and slow streams at elevations less than 3,937 ft (Jepson Flora Project 2017; B.C. Ministry of Environment 2016).

SSWD located one occurrence of Mexican mosquito fern that was found in Seep 3, which is located along the NSRA shoreline (Sycamore Associates 2013a).

Brandegee's Clarkia (*Clarkia biloba* ssp. *brandegeeae*)

Brandegee's clarkia is a small (less than 3.5 ft tall) herbaceous annual with an erect stem. The leaves of Brandegee's clarkia are about 0.75 to 2.4 in. long, narrow, and have pinnate veins emanating from the mid-vein. Its pink to purple flowers (sometimes tinged with red) are widely rotate with wedge-shaped petals. A diagnostic taxonomic character for Brandegee's clarkia is the length of the petal lobes, which are generally less than one fifth the length of the entire petal. It is generally found growing in the Sierra Nevada foothill woodlands at elevations ranging from 1,260 to 4,495 ft (Jepson Flora Project 2017).

SSWD located two occurrences along the south side of the Bear River reach of the reservoir (Sycamore Associates 2013a).

Sierra Foothills Brodiaea (*Brodiaea sierrae*)

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Sierra foothills brodiaea is a perennial bulbiferous herb that typically grows at elevations from 591-3,100 ft. This species is usually found in serpentinite or gabbroic habitats. It has also been observed in the following habitat types: chaparral; cismontane woodland; and lower montane coniferous forest. This species typically grows in soils derived from basic and ultramafic intrusive rocks. The species has one to 10 linear to narrow lanceolate basal leaves. The species is potentially threatened by vehicles, road maintenance, road widening, development,

7 Photograph found at: http://www.env.gov.bc.ca/wld/documents/recovery/rcvrystrat/mexican_mosquito_fern_rcvry_strat240708.pdf (B.C. Ministry of Environment 2016).

urbanization, horticultural collecting, and hydrological alterations (CNPS 2018; Jepson Flora Project 2017).

SSWD located one occurrence of Sierra foothills brodiaea along the south side of the riverine reach of reservoir (Sycamore Associates 2013a).

3.3.4.1.3 Non-Native Invasive Plants

Both known and potential NNIP occurrences are listed in Table 3.3.4-4, based on the 2017 NNIP study, which is described below, BA for Camp Far West (Sycamore Associates 2013a), the CalWeedMapper Database (Cal-IPC 2018a), the Jepson Flora Project (2017), and collection records of plants in the Camp Far West Region with CDFA rankings (CCH 2018).

Table 3.3.4-4 lists the 42 NNIPs known to occur or with the potential to occur in the Project Vicinity, 11 of which are known to occur in the proposed FERC Project boundary.

Table 3.3.4-4. NNIP known to occur or potentially occurring in the Camp Far West Hydroelectric Project Vicinity.

Common Name/ Scientific Name	CDFA[1] Status	Flowering Period	Elevation(ft)	Habitat
KNOWN TO OCCUR WITHIN THE PROPOSED FERC PROJECT BOUNDARY				
Barbed goatgrass *(Aegilops triuncialis)*	B	May-Aug	Below 3,300	Disturbed sites, cultivated fields, roadsides
Cheatgrass (*Bromus tectorum*)	-	May-Aug	Below 3,400	Open and disturbed areas
Italian thistle *(Carduus pycnocephalus* ssp. *pycnocephalus)*	B	May-Jul	Below 3,300	Roadsides, pastures, waste areas
Maltaese starthistle (*Centaurea melitensis*)	C	Apr-Jul	Below 2,200	Disturbed fields and open woodland
Yellow starthistle *(Centaurea solstitialis)*	C	Jun-Dec	Below 4,300	Pastures, roadsides, disturbed grassland or woodland
Rush skeletonweed *(Chondrilla juncea)*	A	May-Dec	Below 2,000	Disturbed areas
Bindweed (*Convolvulus arvensis*)	C	Mar-Oct	Below 2,610	Roadsides and open areas
Bermudagrass *(Cynodon dactylon)*	C	Jun-Aug	Below 3,000	Disturbed areas
Medusahead (*Elymus caput-medusae*)	C	Apr-Jul	Below 2,000	Disturbed areas
Klamathweed *(Hypericum perforatum)*	C	Jun-Sep	Below 5,000	Rangeland areas, pastures, fields, roadsides, forest clearings, burned areas
Scarlet sesban (*Sesbania punicea*)	B	Jun-Sep	Below 600	Along streams, lake shores, other moist sites, and roadsides
Subtotal	*11*			
NOT KNOWN TO OCCUR WITHIN THE PROPOSED FERC PROJECT BOUNDARY				
Russian knapweed *(Acroptilon repens)*	A	May-Sept	Below 6,200	Fields, roadsides, cultivated ground, disturbed areas
Camelthorn *(Alhagi maurorum)*	A	Jun-Aug	Below 1,640	Agricultural areas, riverbanks
Alligatorweed *(Alternanthera philoxeroides)*	A	Jun-Oct	Below 700	Shallow water, wet soils, ditches, marshes, pond margins, slow-moving watercourse
Capeweed *(Arctotheca calendula)*	A	Mar-Jun	Below 820	Disturbed sites
Plumeless thistle *(Carduus acanthoides)*	A	May-Aug	Below 4,300	Roadsides, pastures, waste areas

Table 3.3.4-4. (continued)

Common Name/ Scientific Name	CDFA[1] Status	Flowering Period	Elevation(ft)	Habitat
NOT KNOWN TO OCCUR WITHIN THE PROPOSED FERC PROJECT BOUNDARY (cont'd)				
Musk thistle *(Carduus nutans)*	A	Jun-Jul	330-4,000	Roadsides, pastures, waste areas
Slenderflower thistle *(Carduus tenuiflorus)*	C	May-Jul	Below 3,300	Disturbed sites, roadsides, pastures, annual grasslands, waste areas
Woolly distaff thistle *(Carthamus lanatus)*	B	July-Aug	Below 3,600	Disturbed sites
Purple starthistle *(Centaurea calcitrapa)*	B	Jul-Oct	Below 3,300	Disturbed areas
Diffuse knapweed *(Centaurea diffusa)*	A	Jun-Sep	Below 7,600	Fields, roadsides
Spotted knapweed *(Centaurea stoebe* ssp. *micranthos)*	A	July-Aug	Below 8,500	Open disturbed sites, grasslands, forested areas, roadsides
Squarrose knapweed *(Centaurea virgata* var. *squarrosa)*	A	Jun-Aug	Below 4,600	Degraded rangelands
Canada thistle *(Cirisum arvense)*	B	Jun-Sep	Below 5,900	Disturbed areas
Artichoke thistle *(Cynara cardunculus)*	B	Apr-Jul	Below 1,640	Disturbed sites, open sites in grasslands, pasture, chaparral, riparian areas, abandoned agricultural fields
Scotch broom *(Cytisus scoparius)*	C	Mar-Jun	Below 3,300	Disturbed areas
Water hyacinth *(Eichhornia crassipes)*	C	Jun-Oct	Below 650	Ponds, sloughs, waterways
Oblong spurge *(Euphorbia oblongata)*	B	Apr-Aug	Below 3,300	Waste areas, disturbed sites, roadsides, fields
Leafy spurge *(Euphorbia virgate)*	A	Jun-Sep	Below 4,600	Waste areas, disturbed sites, roadsides, fields
Japanese knotweed *(Fallopia japonica)*	B	Jul-Oct	Below 3,300	Disturbed moist sites, roadsides, and riparian and wetland areas, upland sites where water tables are shallow
Giant knotweed *(Fallopia sachalinensis)*	B	Jul-Oct	Below 1,640	Disturbed moist sites, roadsides, and riparian and wetland areas
French broom *(Genista monspessulana)*	C	Mar-May	Below 1,600	Disturbed areas
Hydrilla *(Hydrilla verticillata)*	A	Jun-Aug	Below 650	Ditches, canals, ponds, reservoirs, lakes
Dyer's woad *(Isatis tinctoria)*	B	Apr-Jun	Below 3,300	Roadsides, fields, disturbed sites
Hairy whitetop *(Lepidium appelianum)*	B	Apr-Oct	Below 6,600	Disturbed open sites, fields, pastures
Lense-podded whitetop *(Lepidium chalepense)*	B	Apr-Aug	Below 5,000	Disturbed open sites, fields, pastures
White-top *(Lepidium draba)*	B	Apr-Aug	Below 5,000	Disturbed, generally saline soils, fields
Dalmation toadflax *(Linaria genistifolia* ssp. *dalmatica)*	A	May-Sep	Below 3,300	Disturbed places, pastures, fields
Purple loosestrife *(Lythrum salicaria)*	B	Jun-Sep	Below 5,300	Seasonal wetlands, ditches, cultivated fields
Scotch thistle *(Onopordum acanthium)*	A	Jul-Sep	Below 5,300	Disturbed areas
Tansy ragwort *(Senecio jacobaea)*	B	Jul-Sep	Below 5,000	Disturbed sites, waste places, roadsides, fields
Gorse *(Ulex europaeus)*	B	Nov-Jul	Below 1,300	Disturbed areas
Subtotal	*31*			
Total	**42**			

Sources: Cal-IPC 2018a; CDFA 2018, CCH 2018, Jepson Flora Project 2017, and Sycamore Associates 2013a.

[1] CDFA 2018
A: eradication, containment, rejection, or other holding action at the state-county level is mandated
B: eradication, containment, control, or other holding action is at the discretion of the commissioner
C: no state action is required except to retard the speed of spreading

As described above, SSWD conducted a special-status plants and NNIP study within the defined study area that included background literature reviews, desktop analyses, and field investigations. Components of the study specific to NNIP, including the results, are provided below.

Field surveys were conducted from April 2017 through July 2017 to document NNIP in the study area. The following information was collected when NNIP were documented within the study area:

- Digital photographs, if needed, to describe the occurrence
- For those species where "quantitative" data was required, if a plant population was estimated to cover an area greater than 0.1 ac, or if the occurrence was linear (e.g., as along a road) and greater than 100 ft long, surveyors delineated the approximate occurrence boundary, or end-points in the case of a linear occurrence, using a handheld GPS with an accuracy of at least 50 ft. When occurrences were smaller than those dimensions, only a single central GPS point was taken to indicate the location of the occurrence. If a single GPS point was used to map an occurrence, the area of the NNIP population was estimated using one of two acreage classes: up to 0.01 ac, and 0.01 to 0.1 ac. The NNIP cover of the occurrence was characterized as either concentrated or diffuse
- NNIP indicated with the descriptor "qualitative" were described more generally. These species tend to produce large or diffuse populations that may be unwieldy to map in detail. These "qualitative" species were mapped using a single GPS point near the center of the occurrence to indicate an occurrence. The area of the infestation was estimated into one of four acreage classes: up to 0.1 ac, 0.1-0.25 ac, 0.25-4.0 ac, and greater than 4 ac. The NNIP cover of the occurrence was characterized as either concentrated or diffuse
- Estimated distance to nearest Project facility, feature, or Project-related activity
- Activities observed in the vicinity of the NNIP population that have a potential to spread NNIP
- Estimated phenology and descriptions of reproductive state of that invasive occurrence

A total of 206 plant species was identified during the surveys. Of the plant species found, a total of 94 are native and a total of 102 are non-native. Eleven of the non-native species are currently considered invasive (Attachment 3.3.4A).

The 2017 survey found 10 NNIP species (the 11th NNIP species was located prior to the study in a section of the Proposed Project Boundary outside of the study area), comprising 487 occurrences (Attachment 3.3.4B, Figures 3.3.4B-1 to 11 for maps and Attachment 3.3.4C for a table of all NNIP occurrences), within the Proposed Project Boundary, including the following: 11 occurrences of barbed goatgrass (*Aegilops triuncialis*); 2 occurrences of cheatgrass (*Bromus tectorum*); 137 occurrences of Italian thistle (*Carduus pycnocephalus* ssp. *pycnocephalus*); 6 occurrences of Maltese starthistle (*Centaurea melitensis*); 73 occurrences of yellow starthistle (*Centaurea solstitialis*); 31 occurrences of rush skeletonweed (*Chondrilla juncea*); 1 occurrence of bindweed (*Convolvulus arvensis*); 25 occurrences of Bermudagrass (*Cynodon dactylon*); 81

occurrences of Medusahead (*Elymus caput-medusae*); and 120 occurrences of Klamathweed (*Hypericum perforatum*). One additional NNIP species, scarlet sesban (*Sesbania punicea*) has been reported to be recorded by a private collector at the southern margin of Camp Far West Reservoir (CCH 2018).

Each of the 11 NNIP species found in the Proposed Project Boundary is discussed in detail below.

Barbed Goatgrass *(Aegilops triuncialis)*

Barbed goatgrass is an annual, which primarily infests rangelands, pastures, grasslands, oak woodlands, and rarely, chaparral, throughout parts of California that are north of San Francisco and Modesto (Jepson Flora Project 2017). Prevention is the key in dealing with the species, because once it becomes established, controlling it is very difficult. Barbed goatgrass spread occurs only by seed dispersal, which are dormant for two or more years, and seeds may be transported on hair, fur, wool, shoes or clothes (DiTomaso and Healy 2007).

Recommended treatments for the control of barbed goatgrass include hand-pulling, mowing, burning and selected herbicides; however, mowing and burning treatments are difficult to implement in a forested setting. Nonselective herbicides, such as glyphosate, or grass-specific herbicides, such as fluazifop (Envoy II) or clethodim (Fusilade), may be applied to control infestations and should be applied in a way that minimizes the damage to native vegetation (Aigner and Woerly 2010). There are currently no biological controls for barbed goatgrass (CDFA 2018).

SSWD found 11 occurrences of barbed goatgrass, all within the NSRA. Most of these occurrences were mapped as discrete points or population lines, covering at most 20 sq ft. One population was mapped as widespread between the water line and campgrounds.

Cheatgrass (*Bromus tectorum*)

Cheatgrass is an annual that occurs throughout California (Jepson Flora Project 2017). Cheatgrass reproduces by seed, dispersing short distances by wind, animals, or on the clothing of humans. Long-distance dispersal is facilitated through recreational, agricultural, and construction activities, especially in areas of soil disturbance or overgrazing (Cal-IPC 2018a). Cheatgrass has the potential to increase the frequency and spread of wildfire in certain communities. Increased fire frequency may contribute to potential habitat conversion, as shrubs and trees killed from fire are often unable to regenerate (DiTomaso and Healy 2007).

The favored treatment methods for cheatgrass are mowing and burning; both can be effective to reduce seed production. However, with both methods, treatment timing is sensitive. Mowing within a week after flower initiation can reduce seed production and burning should occur before spikelets break apart. Glyphosate and other readily available herbicides have also been used to effectively control populations (DiTomaso and Healy 2007).

Cheatgrass has limited distribution in the study area. SSWD found 2 occurrences, both in the southern most portion of the NSRA, in the grassy portions of the campground area outside the drip line of oak trees.

Italian Thistle *(Carduus pycnocephalus* ssp. *pycnocephalus)*

Italian thistle is an annual occurring throughout California (Jepson Flora Project 2017). Occurrences can reach nearly 100 percent cover in some areas and inhibit the recruitment and survivorship of native plant species. Plants are considered to spread aggressively by seed, which fall near the parent plant, but can travel long distances by wind, water, birds, small mammals and human activities. Seeds can persist for 7 to 10 years and germinate under drought conditions (DiTomaso and Healy 2007).

Recommended treatment strategies for Italian thistle include mowing and burning. Mowing 2 to 4 days after flowering starts is an effective way to prevent seed production; however, removal of basal portions of the plant is recommended because flower buds easily regenerate. Burning can help remove dense stands of mature Italian thistle, but is not very effective at removing plants still in the basal rosette stage (DiTomaso and Healy 2007). Clopyralid, picloram and triclopyr are common herbicides for thistles. With repeated use, Italian thistle generally shows herbicide resistance to 2, 4-D or MCPA. Grazing sheep and goats can also be effective in controlling thistle (CABI 2015).

SSWD found 137 occurrences of Italian thistle distributed throughout the entire study area within the Proposed Project Boundary. It is found typically within the dripline of large trees and adjacent to buildings and paved areas.

Maltese Starthistle (*Centaurea melitensis*)[8]

Maltese starthistle is an annual occurring throughout California, but is generally more prevalent in the southern half of the state (Jepson Flora Project 2017). It is primarily found in disturbed sites, but also known to move into annual grasslands. When this species forms dense stands, it displaces native vegetation and animals, in addition to increasing soil erosion and reducing water percolation. Maltese starthistle reproduces by seed; an individual plant can produce up to 60 or more seeds per flower head and up to 100 or more flower heads (up to 6,000 seeds per plant). Seeds fall near the parent plant and are dispersed by wind, human activities, animals, water and soil movement (DiTomaso and Healy 2007).

8 Photograph found at http://www.cal-ipc.org/?s=Maltese+Starthistle (Cal-IPC undated).

Recommended treatments for Maltese starthistle are not well documented, but the control methods recommended for yellow starthistle are assumed to be effective at control of Maltese thistle (DiTomaso and Healy 2007; CDFA 2018).

SSWD found 6 occurrences of Maltese starthistle, all within the NSRA. All occurrences of Maltese starthistle were mapped as discreet patches of approximately 5 to 20 sq ft in size.

Yellow Starthistle *(Centaurea solstitialis)*

Yellow starthistle is an annual occurring throughout California, but is generally more prevalent in the northern half of the state (Jepson Flora Project 2017). It is highly competitive and will typically develop into very dense stands, displacing native vegetation in otherwise natural areas. This species is a prolific seed producer, producing seeds at levels of 10,000 per square meter, which remain viable in soil for 3 or more years. Seeds can be transported by human vectors, including the movement of contaminated hay and infested equipment or vehicle transport. Some seeds are dispersed by wind, and birds and mammals after ingestion (DiTomaso and Healy 2007).

Recommended treatment methods include grazing, mowing and burning, all of which can prevent seed production and control infestations. However, all methods are recommended as annual treatments, ranging over a period of 2 to 3 years or more. Like those treatments described for other NNIPs, the effectiveness of the treatment is dependent upon accurate timing. Grazing is recommended when the plants have developed flowering stems, but before the spiny heads develop. Mowing is most effective when plants just begin to bloom, and it is recommended that plants are cut below the height of the lowest branches. Burning is recommended after the plants have dried, but before seed is produced. Regardless of the treatment, vigilant monitoring is recommended to curb subsequent infestations. In addition to mechanical treatments, all species of starthistle are highly susceptible to the herbicide cloppyralid (CDFA 2018).

SSWD found 73 occurrences of yellow starthistle distributed throughout the entire study area within the Proposed Project Boundary. It is found typically adjacent to buildings and paved areas or other areas of relatively high disturbance.

Rush Skeletonweed *(Chondrilla juncea)*

Rush skeletonweed is an herbaceous perennial or biennial that is localized to several regions in California (North Sierra foothills, South San Francisco Bay, San Luis Obispo, etc.) but forms large dense populations where it does occur (Jepson Flora Project 2017). This species prefers habitat in disturbed areas, such as roadsides, croplands, pastures and residential areas. The species will tolerate a wide variety of conditions, but grows best on well-drained soils, cool winters and hot, dry summers without periods of prolonged drought. Seeds are primarily wind-dispersed, but may also be vectored by water, animals and human activity (DiTomaso and Healy 2007).

A combination of methods is necessary to effectively control skeletonweed. Hand-pulling can remove small occurrences, but all parts of the plant must be removed, bagged and thrown away to prevent re-sprouting. Mechanical tillage can effectively eliminate seedlings and older plants in the short-term. However, the plants will continue to persist, due to vegetative reproduction. Mechanical tillage is not always possible in a forested setting, since tillage would damage the roots of other plants in addition to skeletonweed. Very few herbicides are known to control skeletonweed and single treatments are ineffective. Of herbicides that are labeled for use in California, tank mixes of clopyralid and MCPA (2-methyl-4-chlorophenoxyacetic acid) or two 4-D have been shown to be more effective than any of those chemicals applied alone. Glyphosate helps to control rosettes. Three forms of biological control, the skeletonweed gall mite (*Eriophyes chondrillae*), skeletonweed gall midge (*Cystiphora schmidtii*) and skeletonweed rust (*Puccinia chondrillina*) have been shown to be successful in skeletonweed control and are all approved for use in California (CDFA 2018).

SSWD found 31 occurrences of skeletonweed scattered throughout the study area within the Proposed Project Boundary. It was typically mapped as discrete clusters of variable sizes. A number of occurrences were noted to have been mowed, hiding the true extent of the population.

Bindweed (*Convolvulus arvensis*)

Bindweed is a perennial vine that occurs throughout California (Jepson Flora Project 2017). This species is known to completely carpet areas, which can inhibit native growth. It generally prefers open areas with high levels of disturbance and can be particularly damaging to grassland ecosystems. Bindweed is a serious agriculture weed that causes damages to cereal, bean, and potato crops. It also is a vector for several viruses that kill tomatoes and potatoes. This species is spread by seed and deep rhizomes (DiTomaso and Healy 2007).

Hand removal of rhizomes is recommended for the control of bindweed in small areas. For large areas, tilling or disking is recommended and exposes rhizomes to sun-drying or freezing, or summer solarization in moist soils. There are no biological controls of bindweed authorized for California (DiTomaso and Healy 2007). Chemical control of bindweed can be achieved with the use of Dicamba in the fall, Glyphosate and/or Metsulfuron during the peak bloom, or 2, 4-D in early fall or during the bud stage. Application of a wetting agent can increase the effectiveness of the control. However, chemical control is reduced in effectiveness during drought and multiple treatments will likely be needed to control bindweed (CDFA 2018).

SSWD found one occurrence of bindweed (an 800 - sq ft patch) just northwest of the Camp Far West dam, within the Proposed Project Boundary.

Bermudagrass (***Cynodon dactylon)***

Bermudagrass is a perennial herb that occurs throughout California (Jepson Flora Project 2017). The species is known to form extensive networks of creeping rhizomes and stolons. The species can form dense ground covering mats, which inhibit native vegetation and fragment habitat. Bermudagrass favors disturbed sites, gardens, agronomic crops, orchards, turf, landscaped and forested areas. It prefers moist soil types in irrigated areas, or areas that receive some warm seasonal moisture (CDFA 2018). The species can be spread vegetatively and by seed. Long distance dispersal may be achieved via contaminated hay, livestock feed, soil movement, and transport of mowing equipment and vehicles (Bossard et al. 2000).

Hand removal of rhizomes and stolons is recommended treatment for the control of Bermudagrass in small areas. For large areas, tilling or disking is recommended and exposes rhizomes to sun-drying or freezing, or summer solarization in moist soils. Herbicide application in the summer to mid-fall before plant dormancy can be effective (CDFA 2018). Weaker growth of Bermudagrass can be achieved by increasing shade from tall shrubs and trees and then repeated hand pulling for complete removal. Covering the Bermudagrass with black or clear plastic for 6 to 8 week periods have proven effective during the summer months on south and southwest facing slopes and flat areas. Grass-selective herbicides are most effective in early spring. Non-selective herbicides are most effective in the late summer. Other herbicides will simply suppress Bermudagrass, but may harm desirable vegetation (Cudney et al. 2014).

SSWD found 26 occurrences of Bermudagrass throughout the study area in the Proposed Project Boundary. It was typically mapped in patches in disturbed areas near roads and along the Camp Far West Reservoir margin.

Medusahead (*Elymus caput-medusae*)

Medusahead is an annual occurring throughout northern California (Jepson Flora Project 2017). Medusahead is unpalatable to livestock, except during the early growth stages. Senesced individuals form dense layers of litter that decompose slowly, creating fuel for wildfire and altering moisture characteristics in the soil. This species tends to colonize disturbed sites, including grassland, oak woodland and agronomic fields. A prolific seed producer, seeds are dispersed locally via wind and water, and achieve long distance dispersal through various human activities, and the movement of contaminated soil, clinging to the feet and fur of animals (DiTomaso and Healy 2007).

The recommended treatment for the control of Medusahead is burning and disking/plowing. A slow, hot burn, applied when other vegetation has dried and Medusahead seeds have not yet matured, can reduce infestations. Alternately, disking or plowing before seeds set can be an effective method to reduce stands (CDFA 2018). The application of foliar herbicides and soil active compounds can be effective, if applied with good coverage (Stannard et al. 2010).

SSWD found 83 occurrences of Medusahead throughout the study area in the Proposed Project Boundary. These were typically mapped as discrete patches along roads or as widespread populations within grassland habitats.

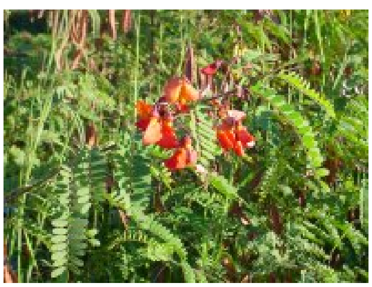
Klamathweed *(Hypericum perforatum)*

Klamathweed is a perennial herb found in the northern Sierra Mountain and foothills region of California (Jepson Flora Project 2017). Klamathweed spreads aggressively by rhizomatous growth and through seed dispersal, with seeds remaining viable for up to 10 years. Known long-distance vectors include vehicle tires and other heavy equipment, while wind, water and soil movement provide short-distance dispersal (CDFA 2018).

The recommended treatment for the control of Klamathweed is mowing, which can reduce seed production. A new or small infestation of Klamathweed can be hand-pulled; however, repeated pulls are necessary for complete eradication. However, plants can propagate from the rhizomes (CDFA 2018). Systematic herbicide application in the spring can be effective (DiTomaso and Healy 2007).

SSWD found 120 occurrences of Klamathweed scattered throughout the entire study area in the Proposed Project Boundary.

Scarlet Sesban (*Sesbania punicea*)[9]



Scarlet sesban typically grows along streams, lake shores, other moist sites, roadsides, and the species is often cultivated as ornamental (Jepson Flora Project 2017). Scarlet sesban grows rapidly and forms dense stands that can limit access to riparian areas. This species is known to displace native vegetation used by wildlife and contributes to bank erosion and flooding (Cal-IPC 2018b).

Recommended treatments for the control of scarlet sesban include hand-pulling, mowing, burning and selected herbicides; however, mowing and burning treatments are difficult to implement in a forested setting, such as the Project Area. Cutting scarlet sesban to ground level in spring before it flowers will reduce the number of seeds produced and will deplete the plant's energy reserves (DiTomaso and Kyser 2013). Nonselective herbicides, such as glyphosate, may be applied to control infestations and should be applied when the plants are growing rapidly. Selective herbicides may also be used, such as Triclopyr, and in cut stump treatments, the herbicide should be applied immediately after cutting. There are currently no USDA-approved biological controls for scarlet sesban (DiTomaso and Kyser 2013).

9 Photograph found at http://www.cal-ipc.org/plants/profile/sesbania-punicea-profile/ (Cal-IPC undated).

According to CCH (2018), scarlet sesban was observed in 2013 along the southern margin of the Camp Far West Reservoir. This occurrence is believed to be inside the Proposed Project Boundary.

3.3.4.2 Wildlife Resources

3.3.4.2.1 Wildlife Habitat

Based on the vegetation classifications described in Section 3.3.4.1.1, SSWD classified wildlife habitats in the proposed FERC Project Boundary and adjacent area using CDFW's California Wildlife Habitat Relationships (CWHR) system, Version 9.0 (CDFW 2015b). Table 3.3.4-5 presents the eight CWHR habitat types identified in the proposed FERC Project Boundary (CDFW 2015b). The two most common habitat types present are Lacustrine and Annual Grassland, followed by Blue Oak Woodland and then the remaining 5 habitat types

Table 3.3.4-5. Wildlife habitat types in the proposed FERC Project Boundary.[1]

CWHR Types	Area (acres)[1]	Percentage of Area (%)
Annual Grassland	324.04	12.16
Barren	4.00	0.15
Blue Oak Woodland	452.60	17.01
Blue Oak-Foothill Pine	82.09	3.06
Montane Hardwood	35.05	1.32
Mixed Chaparral	2.29	0.08
Urban	12.22	0.50
Lacustrine	1,749.61	65.72
8 CWHR Types	**2,661.90**	**100.00**

Source: CDFW 2015b
[1] The area evaluated for vegetation encompasses 2,661.9 ac (i.e., 2,674.0 ac in the Proposed Project Boundary and an additional 12.1 ac adjacent to the boundary).

In addition to classifying wildlife habitat, the CWHR model predicts wildlife use based on habitat type, age class, size class, canopy closure or cover, and occurrence of specific habitat elements (e.g., natural or manmade features such as cliffs, springs, or transmission lines) that may influence thermal cover, forage, prey availability, nesting, escape cover, and breeding.

This analysis indicates that the proposed FERC Project Boundary supports a diversity of wildlife habitats and associated wildlife species. Using the identified habitat types and the CWHR system, SSWD identified 28 special-status terrestrial vertebrate wildlife species that potentially may occur within the proposed FERC Project Boundary (CDFW 2015b). These species include 1 reptile, 21 birds, and 6 mammals (see Table 3.3.4-6).

Although CWHR-generated lists are a useful tool for predicting general species occurrence, they should be interpreted cautiously because errors of omission (e.g., excluding a species that is present) and commission (e.g., including a species that is absent) are likely when this broad-scale model is used for localized applications.

3.3.4.2.2 Special-status Wildlife Species

Table 3.3.4-6 presents information on the special-status wildlife species that occur, or have the potential to occur, in the Proposed Project Boundary. Along with CWHR, CDFW's CNDDB was used as the initial source to identify previously reported occurrences of special-status species and sensitive habitats in the Project Vicinity (CDFW 2018b). Two other sources were the Camp Far West BA (Sycamore Associates 2013a) and the USFWS' IPaC Trust Resource Report (USFWS 2018a). Potential occurrences of special-status wildlife species and their corresponding temporal and spatial information were also derived from a query of the CWHR database (CDFW 2015b). Habitat types known to occur within the Project Area (listed in Table 3.3.4-5) were used as the search criteria within CWHR (CDFW 2015b). Descriptions of suitable habitat types were synthesized from species accounts found online at NatureServe® (2017) and the CWHR life history database. Temporal data provided in Table 3.3.4-6 correspond to the seasonal occurrence of the species. Spatial data correspond to the habitat types typically supporting each species. Additional sources of information were queried for potentially occurring special-status species. These additional sources included CDFW's *State and Federally Listed Endangered and Threatened Animals of California* (CDFW 2017), and *List of State Fully Protected Animals* (CDFW undated). Table 3.3.4-6 includes 30 wildlife species: 1 reptile, 23 birds, and 6 mammals.

Table 3.3.4-6. Special-Status wildlife species (i.e., reptiles, birds, and mammals) occurring or potentially occurring in the Camp Far West Hydroelectric Project Area.

Common Name/ Scientific Name	Status[1]	Suitable Habitat Type	Temporal and Spatial Distribution[2]	Occurrence in Project Area	Known From Project
REPTILES					
Coast horned lizard *(Phrynosoma blainvillii)*	SSC	Utilization of a variety of habitats, including scrubland, grassland, coniferous woods, and broadleaf woodlands; typically it is found in areas with sandy soil, scattered shrubs, and ant colonies, such as along the edges of arroyo bottoms or dirt roads.	Yearlong: AGS, BOP, BOW, MCH	Project Vicinity: Potentially occur within suitable habitat.	There are no documented occurrences of coast horned lizard on the Project, but suitable habitat exists (Sycamore Associates 2013a).
BIRDS					
Tricolored blackbird *(Agelaius tricolor)*	SSC, SE	Fresh-water marshes of cattails, tule (*Schoenoplectus acutus*), and sedges. Nests in vegetation of marshes or thickets, sometimes nests on the ground. Historically strongly tied to emergent marshes; in recent decades much nesting has shifted to non-native vegetation.	Yearlong: AGS, URB	Project Vicinity: Potentially occur within suitable habitat.	No, and no suitable nesting habitat was observed during BA surveys (Sycamore Associates 2013a).
Grasshopper sparrow *(Ammodramus savannarum)*	SSC	Prefer grasslands of intermediate height for breeding and are often associated with clumped vegetation interspersed with patches of bare ground.	Summer: AGS	Project Vicinity: Camp Far West.	No, and no suitable nesting habitat was observed during BA surveys (Sycamore Associates 2013a).
Golden eagle *(Aquila chrysaetos)*	BGEPA, FP	Generally open country, in prairies, arctic and alpine tundra, open wooded country, and barren areas, especially in hilly or mountainous regions.	Yearlong: AGS, BAR, BOP, BOW, MHW, MCH, URB	The species was identified as having the potential to occur within the Project Vicinity (CDFW 2018b).	Yes, there were six observations during 2017 special-status raptor surveys.
Short-eared owl *(Asio flammeus)*	SSC	Broad expanses of open land with low vegetation for nesting and foraging are required.	Yearlong: AGS, URB Winter: BOP, BOW, MCH	Project Vicinity: Potentially occur within suitable habitat.	No
Long-eared owl *(Asio otus)*	SSC	Riparian bottomland forest with over story of willows (*Salix* spp.) and cottonwoods (*Populus fremontii*); riparian forest along stream corridors (often dominated by live oak trees). Wooded areas with dense vegetation needed for roosting and nesting, adjacent open areas needed for hunting.	Yearlong: AGS, BOP, BOW, MCH, MHW	Project Vicinity: Potentially occur within suitable habitat.	No, and no suitable nesting habitat was observed during BA surveys (Sycamore Associates 2013a).
Burrowing owl *(Athene cunicularia)*	SSC	Open grasslands, especially prairie, plains, and savanna, sometimes in open areas near human installations.	Yearlong: AGS, BAR, BOW, MCH, URB	Project Vicinity: Potentially occur within suitable habitat.	Yes, one individual was seen in 2018 near NSRA.
Redhead *(Aythya americana)*	SSC	Open water on lakes, ponds, and reservoirs.	Winter: LAC	Project Vicinity: Potentially occur within suitable habitat.	No

Table 3.3.4-6. (continued)

Common Name/ Scientific Name	Status[1]	Suitable Habitat Type	Temporal and Spatial Distribution[2]	Occurrence in Project Area	Known From Project
BIRDS (cont'd.)					
Swainson's hawk *(Buteo swainsoni)*	ST	Breeds in grasslands with scattered trees, juniper-sage flats, riparian areas, savannahs and agricultural or ranch (CDFW 2015b).	Summer: AGS, BAR, BOP, BOW, MCH, MHW, URB	This species was found adjacent to the Project Vicinity within the Nicolaus, Sheridan, Wheatland and Verona quads (CDFW 2018b).	Yes, three individuals were observed during special-status raptor surveys in 2017.
Vaux's swift *(Chaetura vauxi)*	SSC	Found in mature forests, but also forages and migrates over open country.	Summer: BOP, LAC, MCH, MHW, URB	Project Vicinity: Potentially occur within suitable habitat.	No
Black tern *(Chlidonias niger)*	SSC	Marshes, along sloughs, rivers, lakeshores, and impoundments, or in wet meadows.	Summer: LAC	Project Vicinity: Potentially occur within suitable habitat.	No
Northern harrier *(Circus hudsonius)*	SSC	Marshes, meadows, grasslands, and cultivated fields.	Yearlong: AGS, BAR, BOP, BOW, LAC, URB Winter: MCH	Project Vicinity: Wheatland, Camp Far West.	Yes, a single individual was seen flying over the grassland area of the NSRA during 2017 surveys.
Olive-sided flycatcher *(Contopus cooperi)*	SSC	Non-breeding habitat includes a variety of forest, woodland, and open areas with scattered trees, especially where tall dead snags are present. Primary habitat is mature, evergreen montane forest. Birds breed in various forest and woodland habitats.	Migrant: BOP Summer: MCH, MHW	Project Vicinity: Potentially occur within suitable habitat.	No
Black swift *(Cypseloides niger)*	SSC	Nests in moist crevices or caves, or on cliffs near waterfalls in deep canyons. Forages widely over many habitats.	Summer: AGS, BAR, BOP, BOW, LAC, MCH, MHW, URB	Project Vicinity: Potentially occur within suitable habitat.	No
White-tailed kite *(Elanus leucurus)*	FP	Savanna, open woodland, marshes, partially cleared lands and cultivated fields, mostly in lowland situations.	Yearlong: AGS, BAR, BOP, BOW, MCH, URB	Project Vicinity: Potentially occur within suitable habitat.	This species was observed during BA surveys (Sycamore Associates 2013a).
Common loon *(Gavia immer)*	SSC	Lakes containing both shallow and deep water.	Winter: LAC	Project Vicinity: Potentially occur within suitable habitat.	No

Table 3.3.4-6. (continued)

Common Name/ Scientific Name	Status[1]	Suitable Habitat Type	Temporal and Spatial Distribution[2]	Occurrence in Project Area	Known From Project
BIRDS (cont'd)					
Bald eagle *(Haliaeetus leucocephalus)*	BGEPA, SE, FP	Breeding habitat usually includes areas close to coastal areas, bays, rivers, lakes, or other bodies of water that reflect the general availability of primary food sources. Preferentially roosts in conifers or other sheltered sites in winter in some areas.	Yearlong: AGS, BAR, BOP, BOW, LAC, MHW, Winter: MCH	The species is known to occur within the Project Vicinity (Sycamore Associates 2013a)	Two active bald eagle nests were documented on the Project during 2017 surveys, as well as some inactive nests. A total of 47 bald eagle occurrences were documented on the Project during 2017 surveys.
Loggerhead shrike *(Lanius ludovicianus)*	SSC	Open country with scattered trees and shrubs, savanna, desert scrub, and, occasionally, open woodland; often perches on poles, wires or fence posts	Yearlong: AGS, BOP, BOW, URB	Project Vicinity: Potentially occur within suitable habitat	No
California black rail (*Laterallus jamaicensis coturniculus*)	ST, FP	Inhabits freshwater marshes, wet meadows and shallow margins of saltwater marshes bordering larger bays.	Yearlong: LAC	The species was found within the Project Vicinity in the Camp Far West and Wolf quads (CDFW 2018b).	Neither the species nor suitable habitat was observed during BA surveys (Sycamore Associates 2013a)
American white pelican *(Pelecanus erythrorhynchos)*	SSC	Rivers, lakes, reservoirs, estuaries, bays, marshes; sometimes inshore marine habitats.	Summer: BAR Yearlong: LAC	Project Vicinity: Potentially occur within suitable habitat	This species was observed during BA surveys (Sycamore Associates 2013a)
Purple martin *(Progne subis)*	SSC	A wide variety of open and partly open situations, frequently near water or around towns.	Summer: AGS, BOP, BOW, LAC, MHW, URB	Project Vicinity: Potentially occur within suitable habitat	No
Bank swallow *(Riparia riparia)*	ST	Colonial nester; nests primarily in riparian and other lowland habitats west of the desert.	Summer: AGS, BAR, LAC, URB Migrant: MCH	This species was found near the Project Vicinity, within the Camp Far West, Nicolaus and Verona quads (CDFW 2018b).	Neither species nor suitable habitat was observed during BA surveys (Sycamore Associates 2013a)
Yellow warbler *(Setophaga petechial)*	SSC	Open scrub, second-growth woodland, thickets, farmlands, and gardens, especially near water; riparian woodlands, especially of willows, in the west.	Summer: BOP, BOW, MCH, MHW, URB	Project Vicinity: Camp Far West	Neither species nor suitable habitat was observed during BA surveys (Sycamore Associates 2013a)
Yellow-headed blackbird *(Xanthocephalus xanthocephalus)*	SSC	Fresh-water marshes of cattail, tule, or bulrushes. Nests in wet grasses, reeds, cattails. Also in open cultivated lands, pastures and fields.	Yearlong: LAC Summer: AGS	Project Vicinity: Potentially occur within suitable habitat	No

Table 3.3.4-6. (continued)

Common Name/ Scientific Name	Status[1]	Suitable Habitat Type	Temporal and Spatial Distribution[2]	Occurrence in Project Area	Known From Project
MAMMALS					
Pallid bat *(Antrozous pallidus)*	SSC	Arid deserts and grasslands, often near rocky outcrops and water. Less abundant in evergreen and mixed conifer woodland. Usually roosts in rock crevice or building, less often in cave, tree hollow, mine, etc.	Yearlong: AGS, BAR, BOP, BOW, MCH, MHC, URB	Project Vicinity: Potentially occur within suitable habitat.	No
Townsend's big-eared bat *(Corynorhinus townsendii)*	SSC	Maternity and hibernation colonies typically are in caves and mine tunnels. Prefers relatively cold places for hibernation, often near entrances and in well-ventilated areas.	Summer: AGS Yearlong: BAR, BOP, BOW, MCH, MHW, URB	Project Vicinity: Potentially occur within suitable habitat.	Neither species nor suitable habitat was observed during BA surveys (Sycamore Associates 2013a).
Spotted bat *(Euderma maculatum)*	SSC	Possibly occupies coniferous stands in summer and migrates to lower elevations in late summer/early fall.	Yearlong: AGS, BOP, BOW, URB	Project Vicinity: Potentially occur within suitable habitat.	No
Western mastiff bat *(Eumops perotis)*	SSC	Roosts in crevices and shallow caves on the sides of cliffs and rock walls, and occasionally buildings. Roosts usually high above ground with unobstructed approach. Most roosts are not used throughout the year. May alternate between different day roosts.	Yearlong: AGS, BAR, BOP, BOW, MCH, MHW, URB	Project Vicinity: Potentially occur within suitable habitat.	No
Western red bat *(Lasiurus blossevillii)*	SSC	Roosts in foliage, forages in open areas (sea level up through mixed conifer forests).	Yearlong: AGS, BOP, BOW, URB Summer: LAC, MCH, MHW	Project Vicinity: Potentially occur within suitable habitat.	Neither species nor suitable habitat was observed during BA surveys (Sycamore Associates 2013a).
American badger *(Taxidea taxus)*	SSC	Prefers open areas and may also frequent brushlands with little groundcover. When inactive, occupies underground burrow.	Yearlong: AGS, BAR, BOP, BOW, MCH, MHW	Project Vicinity: Potentially occur within suitable habitat.	No
Total	**30**				

Source: CDFW 2018b

[1] Status:

BGEPA = Bald and Golden Eagle Protection Act
SSC = California Species of Special Concern (CDFW 2018d)
ST = State Threatened
FP = Fully Protected
SE = State Endangered

[2] CWHR Habitat Types:

AGS = Annual Grass
BAR = Barren
BOP = Blue Oak Foothill Pine
BOW = Blue Oak Woodland
LAC = Agriculture Ponds, Water Features, General Water (i.e., lakes, ponds, reservoirs, diversion impoundments)
MCH = Mixed Chaparral
MHW = Montane Hardwood
URB = Urban

Each of the 22 wildlife species with the potential to occur in the Proposed Project Boundary that did not have further study done is discussed in detail below.

Coast Horned Lizard (*Phrynosoma blainvillii*)

The coast horned lizard is designated as SSC (CDFW 2018b). The coast horned lizard may be found along the Sierra Nevada foothills up to an elevation of 4,000 ft from Butte County south to Kern County. Habitat types occupied by the coast horned lizard include valley foothill hardwood, conifer, riparian and annual grasslands. This species will often burrow into loose sandy soil to escape from predators and extreme heat, or utilize logs, rocks, mammal burrows or crevices during periods of inactivity and winter hibernation (Zeiner et al. 1988 – 1990).

Based on information available from Zeiner et al. (1988 – 1990), habitat for coast horned lizard is present in the Project area, and as a result, this species may occur. SSWD's query of the CNDDB revealed no occurrences of coast horned lizard within the proposed FERC Project Boundary.

Tricolored Blackbird (*Agelaius tricolor*)

The tricolored blackbird is designated as a SSC and SE (CDFW 2018b). A highly gregarious species, the tricolored blackbird can be found roosting and foraging in flocks. Colonies can sometimes be found within short distances of one another (NatureServe 2017). This species can be found in herbaceous wetland areas, as well as cropland and hedgerow habitats. Tricolored blackbirds are known to breed in fresh-water marshes, consisting of cattails (*Typha* sp.), tule (*Schoenoplectus acutus*), bulrushes and sedges (*Carex* sp.) (NatureServe 2017). In addition to insects, tricolored blackbirds feed on seeds and grain in the fall and winter months.

As described in Section 3.3.4.3.1, wetland habitat is minimal within the Proposed Project Boundary. Eleven emergent wetlands were identified on the reservoir margin and are influenced by groundwater and dry season[10] hydrology inputs, with some surface water dependency (Sycamore Associates 2013b). Additionally, no cropland habitat is located within the Project Boundary. The CNDDB search found occurrences of tricolored blackbird in the vicinity of State Route 65 south of the Project, but no occurrences in 5 mi of the Project. According to Sycamore Associates (2013a), no suitable nesting habitat was observed during BA surveys.

Grasshopper Sparrow (*Ammodramus savannarum*)

The grasshopper sparrow is designated as SSC (CDFW 2018b). The grasshopper sparrow prefers grassland habitat, but can also be found in old fields, savannahs and shortgrass prairies. During breeding season, clumped vegetation of intermediate height, interspersed in grasslands is required (NatureServe 2017). They are an uncommon and local summer resident in foothills and lowlands west of the Cascade-Sierra Nevada crest from Mendocino and Trinity County's south to San Diego County (Zeiner et al. 1988 – 1990). They arrive at nesting areas between March

10 Dry season hydrology refers to water inputs during the non-rainy season (approximately May-November), which include artificial sources, like irrigation runoff from nearby fields and natural sources, such as nearby springs and seeps.

and June in eastern Washington, central Nevada and southern California. Departure for the wintering grounds in central California, southern Arizona and south through Mexico and Central America occurs in mid-September. The grasshopper sparrow eats insects, other small invertebrates, grain and seeds that are picked up from the ground (NatureServe 2017).

While grasshopper sparrow may occur within the Project Area, it is not known to breed or nest within the Proposed Project Boundary. Additionally, according to Sycamore Associates (2013a), no suitable nesting habitat was observed during BA surveys, nor was any seen during relicensing studies.

Short-eared Owl (*Asio flammeus*)

The short-eared owl is designated as a SSC (CDFW 2018b). According to Zeiner et al. (1988 – 1990), the short-eared owl inhabits open areas nearly absent of trees, such as annual grasslands, prairies, dunes, meadows, irrigated lands, and saline and fresh emergent wetlands. Nests are depressions on dry ground that are lined with grasses, forbs, sticks and feathers, and concealed by surrounding grasses and shrubs. This species is known to breed in the coastal areas of Del Norte and Humboldt counties, the San Francisco Bay Delta, northeastern Modoc plateau, east side of the Sierra Nevada between Lake Tahoe and Inyo counties, as well as the San Joaquin Valley. The short-eared owl migrates from breeding areas in September or October to wintering areas in the Central Valley, western Sierra Nevada foothills, and along the California coast. Numbers have declined over most of the range because of destruction and fragmentation of grassland and wetland habitats, and grazing (Zeiner et al. 1988-1990).

While short-eared owl may occur within the Project Area, it is not known to breed or nest within the proposed FERC Project Boundary.

Long-eared Owl (*Asio otus*)

The long-eared owl is designated as a SSC (CDFW 2018b). In California, this species can be found from the Sierra Nevada foothills up to dense conifer stands at higher elevations. For roosting and nesting, long-eared owls require dense riparian and live oak thickets that contain densely canopied trees (Zeiner et al. 1988-1990). Resident populations in California have been declining since the 1940s, especially in southern California (Grinnell and Miller 1944; Remsen 1978, as cited by Zeiner et al. 1988-1990). While specific reasons for their decline is unknown, habitat fragmentation of riparian habitat and live oak groves are thought to be major factors. The long-eared owl hunts in open areas for voles and other rodents (Zeiner et al. 1988-1990).

Due to their use of a wide variety of habitats, long-eared owl has the potential to occur within or adjacent to the Project. However, no occurrences of this species have been reported. Additionally, according to Sycamore Associates (2013a), no suitable nesting habitat was observed during BA surveys.

Burrowing Owl (*Athene cunicularia*)

The burrowing owl is a SSC (CDFW 2018b). A small ground dwelling owl, its habitat is associated with open grassland, open lots near human habitation, and along roadsides. Within California, the breeding range of burrowing owl includes the northeastern plateau, Central Valley, San Joaquin Valley, Imperial Valley, Mojave and Colorado deserts, the southwest corner of San Diego County, and in a few coastal counties between Los Angeles and San Francisco. Burrowing owls nest in abandoned burrows dug by small mammals, such as ground squirrels (*Spermophilus* spp.), as well as larger mammals, such as foxes (*Vulpes* spp.) and badgers (*Taxidea taxus*). If burrows are unavailable, burrowing owls may dig their own in soft soil, or utilize pipes, culverts and/or nest boxes (Zeiner et al. 1988-1990).

One burrowing owl was seen in 2018 near the NSRA. No nesting burrowing owls have been reported on the Project.

Redhead (*Aythya americana*)

The redhead is designated as SSC (CDFW 2018b). The redhead is uncommon to locally common during the winter months from Modoc County to Mono County in eastern California in lacustrine waters, where it is a common breeder during the summer months. It can also be found in the Central Valley, central California foothills and coastal lowlands and along the coast from Monterey County to Ventura County during the winter months. Breeding also occurs locally in the Central Valley, coastal Southern California and eastern Kern County (Zeiner et al. 1988 – 1990). Its habitat includes large marshes, lakes, lagoons, rivers and bays. Nesting sites can be found in dense bulrush or cattail stands that are interspersed with small areas of open water (NatureServe 2017). This species is known to lay eggs in the nest of other redheads and other duck species, as well as nests of Northern harriers (Woodin and Michot 2002). Necessary foraging habitat includes large freshwater marshes with persistent emergent vegetation (NatureServe 2017). Redheads dive for food primarily eating leaves, stems, seeds and tubers of aquatic plants with smaller amounts of aquatic insects (Zeiner et al. 1988 – 1990).

Redheads may occur in the Project, but there are no reports of this species.

Vaux's Swift (*Chaetura vauxi*)

The Vaux's swift is designated as a SSC (CDFW 2018b). The Vaux's swift can be found in mature forests, but also forages and migrates over open country (NatureServe 2017). The species prefers late seral stages of coniferous and mixed deciduous/coniferous forest and is more abundant in old-growth areas than younger stands (NatureServe 2017). The multi-layered broken overstory of old-growth forest may provide easier access to aerial insects than closed, continuous canopies of younger forests (NatureServer 2017). Nests are normally found in large-diameter hollow trees, broken-top trees, or stumps. The Vaux's swift usually locates the nest near to the bottom of the nesting cavity (NatureServer 2017).

Though Vaux's swift could potentially occur on the Project, there is no appropriate old growth forest habitat.

Black Tern (*Chlidonias niger*)

Black tern is designated as a SSC (CDFW 2018b). The black tern breeds from British Columbia south to central California. Black tern can be found in fresh emergent wetlands, moist grasslands and agricultural fields. Within California, black tern are common migrants and breeders on wetlands of the northeastern plateau and in Central Valley rice farms, which serve as surrogate habitat, due to the loss of wetlands through agricultural development. Natural lakes that experience little fluctuation in water surface elevation and have fresh emergent wetlands or marsh habitat provide nesting and foraging habitat, as well. Such lakes include Lake Tahoe and Eagle Lake. Nests are built on floating vegetation located in shallow water close to open water in stands of emergent vegetation. The black tern forages by hovering above wet meadows and fresh emergent wetlands. Insects are caught in the air and plucked from water and vegetation surfaces. They will also plunge into the water for tadpoles, crayfish, small fish and small mollusks (Zeiner et al. 1988-1990).

While the black tern was predicted to occur within the Project vicinity, it is not known to nest within the proposed FERC Project Boundary. Furthermore, no occurrences of black tern have been reported within or adjacent to the FERC Project Boundary. The absence of black tern is likely due to a lack of suitable nesting habitat (i.e. fresh emergent wetlands or water bodies that experience little fluctuation in water surface elevation) within or adjacent to the proposed FERC Project Boundary.

Northern Harrier (*Circus hudsonius*)

The Northern harrier is designated as a SSC (CDFW 2018b). In California, the Northern harrier ranges from sea level up to 5,700 ft and can be found in the Central Valley and Sierra Nevada. Suitable habitat for this species includes meadows, grasslands, open rangelands, desert sinks, and fresh and saltwater emergent wetlands (Zeiner et al. 1988 – 1990). According to NatureServe (2017), Northern harrier may also be found in wheat fields, ungrazed or lightly grazed pastures, and some croplands (alfalfa, grain, sugar beets [*Beta* spp.], tomatoes [*Solanum* spp.] and melons [*Benincasa* spp., *Citrullus* spp., *Cucumis* spp., *Momordica* spp.]). Nesting habitat includes shrubby vegetation along the edges of marshes, emergent wetlands or along rivers and lakes. They have been known to nest in grasslands, grain fields or on sagebrush (*Artemisia* spp.) flats several miles from water. Nests are constructed of a large mound of sticks in wet areas, or a smaller cup of grasses in drier areas (Zeiner et al. 1988 – 1990).

During SSWD's special-status raptor study, a single individual was seen flying over the NSRA during 2017.

Olive-sided Flycatcher (*Contopus cooperi*)

The olive-sided flycatcher is a SSC (CDFW 2018b). This species is a common to uncommon summer resident in a wide variety of forest and woodland habitats below 9,000 ft throughout California. It is not found in the deserts, the Central Valley and other lowland valleys and basins (Zeiner et al. 1988 – 1990). The olive-sided flycatcher will breed at forest edges and openings such as meadows and ponds (Audubon 2018). Nests are made of twigs, rootlets and lichens placed out near the tip of horizontal branches of trees. Its winter habitat is also forest edges and clearings where tall trees or snags are present (Altman and Sallabanks 2000). These flycatchers forage primarily by hovering or sallying forward, concentrating on prey via aerial attack. This bird is a passive searcher as well as an active pursuer. Its diet consists of mostly flying insects, with a fondness for wild honeybees and other Hymenoptera (NatureServe 2017).

Due to their affinity towards woodland habitats, olive-sided flycatcher has the potential to occur within or adjacent to Project. However, no occurrences of this species have been reported in the Project area.

Black Swift (*Cypseloides niger*)

The black swift is designated as a SSC (CDFW 2018b). The black swift breeds locally in the Sierra Nevada and Cascade Range (Zeiner et al. 1988 – 1990). The breeding populations in the United States make long migrations to their winter range in Central America. Nests are built of mud, mosses and algae in a cup-like structure in moist locations, behind or next to waterfalls, and wet cliffs with an unobstructed flight path. These birds feed on insects that are caught in the air, often at great heights, and can be seen foraging with other swifts at the leading edges of rainstorms (NatureServe 2017).

There is no appropriate nesting habitat on the Project, though the species may be an occasional visitor to the Project area.

White-tailed Kite (*Elanus leucurus*)

The white-tailed kite is designated as a FP bird (CDFW 2018b). The white-tailed kite is a common to uncommon, yearlong resident in the Sierra Nevada foothills and adjacent valley lowlands within California. The species has increased in numbers and extended its range in recent decades (Zeiner et al. 1988-1990).

The white-tailed kite feeds mostly on voles and other small, diurnal mammals, and occasionally on birds, insects, reptiles, and amphibians. They forage in undisturbed, open grasslands, meadows, farmlands, and emergent wetlands. Trees with dense canopies provide cover, and nests are usually placed near the top of dense oaks, willows, or other tree stands near foraging areas. Breeding occurs from February to October, with the peak from May to August. The average clutch is composed of four to five eggs, and the incubation period is about 28 days. Young fledge in 35 to 40 days after hatching. The female incubates eggs and broods young exclusively, while the male supplies her with food (Zeiner et al. 1988-1990).

According to Sycamore Associates (2013a), white-tailed kite was observed during BA surveys within the proposed FERC Project Boundary.

Common Loon (*Gavia immer*)

The common loon is designated as a SSC (CDFW 2018b). The common loon breeds on remote freshwater lakes with both shallow and deep, clear water, in the northern United States and

Canada (NatureServe 2017). From May to September, the common loon can be seen in estuarine and subtidal marine habitats along the California coast, but are uncommon on large, deep lakes in valley and foothills throughout the state (Zeiner et al. 1988 – 1990). Northeastern California is considered to be within the historic breeding range of this species. Courtship begins shortly after territory reoccupation and involves shared displays, including simultaneous swimming, head posturing and short dives. Many times, a nesting pair will reuse the same site the following year. Nests are nearly always built at the water's edge in a quiet, protected hidden area and made of aquatic and terrestrial vegetation. Both the male and female build the nest together over the course of a week in May or early June. In winter and during migration, they can be found on lakes, rivers, estuaries and coastlines. Some individuals will overwinter in inland lakes and rivers. Up to 80 percent of their diet is fish, while the remaining 20 percent consists of crustaceans and aquatic plants (Zeiner et al. 1988 – 1990).

While Camp Far West Reservoir is a deep freshwater lake, the Proposed Project Boundary is not within either the current or historic breeding range of the common loon. Furthermore, no occurrences of common loon or nesting have been reported within or adjacent to the proposed FERC Project Boundary.

Loggerhead Shrike (*Lanius ludovicianus*)

The loggerhead shrike is designated as a SSC (CDFW 2018b). It is a common resident and winter visitor in lowland and foothills throughout California. This species' prefers habitats that include open-canopied valley foothill hardwood, valley foothill hardwood-conifer, valley foothill riparian, pinyon-juniper (*Juniperus* spp.), juniper, desert riparian and Joshua tree (*Yucca brevifolia*) habitats (Zeiner et al. 1988-1990). Loggerhead shrike may often be found perched on poles, wires or fenceposts.

Due to their use of a wide variety of habitats, loggerhead shrike has the potential to occur within or adjacent to the proposed FERC Project Boundary. However, no occurrences of this species have been reported.

California Black Rail (*Laterallus jamaicensis coturniculus*)

The California black rail is designated as a ST and FP species (CDFW 2018b). California black rail are rarely seen, scarce, yearlong residents of saline, brackish, and fresh emergent wetlands in the San Francisco Bay area, Sacramento-San Joaquin Delta, coastal southern California at Morro Bay and a few other locations, the Salton Sea, and lower Colorado River area. Formerly a local resident in coastal wetlands from Santa Barbara Co. to San Diego Co.; reported to still winter there rarely. In freshwater wetlands, this species is usually found in bulrushes and cattails. The species typically inhabits the high wetland zones near the upper limit, not in low wetland areas with considerable annual and/or daily fluctuations in water levels (Zeiner et al. 1988-1990). California black rail nests are typically concealed in dense vegetation, near the upper limits of flooding. The species builds a deep, loose cup, at ground level or elevated several inches.

California black rail was found within the Project vicinity in the Camp Far West and Wolf quadrangles (CDFW 2018b). According to Sycamore Associates (2013a), neither California black rail nor suitable habitat was observed during BA surveys.

American White Pelican (*Pelecanus erythrorhynchos*)

The American white pelican is designated as a SSC (CDFW 2018b). Its habitat includes rivers, lakes, reservoirs, estuaries, bays, and open marshes (NatureServe 2017). Nesting sites require flat or gently sloped topography, without shrubs or other obstructions that would impede taking flight, are free of human disturbances and usually have loose earth suitable for constructing nest-mounds (Zeiner et al. 1988 – 1990). According to Zeiner et al. (1988 – 1990) and NatureServe (2017), this species currently nests at large lakes in the Klamath Basin of Northern California. Outside of nesting season (i.e., April to August), migrant flocks are often seen throughout California.

While the Project area does contain a large body of water (Camp Far West Reservoir) that may provide suitable habitat for American white pelicans, this area is outside of any known breeding areas for this species (Shuford and Gardali 2008). According to Sycamore Associates (2013a), American white pelican was observed during BA surveys within the proposed FERC Project Boundary. Occurrences of American white pelicans in the Project area are likely related to migratory flocks moving between nesting habitat in the Klamath Basin and wintering habitat elsewhere in California.

Purple Martin (*Progne subis*)

The purple martin is designated as a SSC (CDFW 2018b). It is a long distance migrant, arriving in California from South America in late March and departing by late September. This species is described by Zeiner et al. (1988 – 1990) as an uncommon to rare local summer resident of various wooded, low-elevation habitats comprised of montane hardwood, valley foothill and montane hardwood-conifer, and riparian habitats. Purple martin also occurs in coniferous habitats including closed-cone pine-cypress, ponderosa pine, Douglas-fir and redwood (*Sequioia sempervirens*). These habitats vary structurally and may be old growth, multi-layered or open, and may also have snags. Purple martin most often nest in old woodpecker cavities found in tall, old, isolated trees or snags in open forests or woodlands. However, they may utilize man-made structures, such as bridges and culverts for nesting.

Due to their use of a wide variety of habitats, purple martin has the potential to occur within or adjacent to the proposed FERC Project Boundary. However, no occurrences of this species have been reported.

Bank Swallow (*Riparia riparia*)

The bank swallow is designated as ST (CDFW 2018b). Bank swallows are neotropical migrants that arrive in California from South America in early March to breed. In July and August, bank swallows begin their migration back to South America. During the breeding period in California, they form nesting colonies that can range from 10 to 1,500 individuals, but most known colonies have 100 to 200 nesting pairs. Nests are constructed by digging small burrows into vertical banks, bluffs and cliffs made of fine-textured or sandy soils, and are located in riparian habitat along rivers, ponds lakes and the ocean. According to the CDFW (CDFG 2005b), the range of the bank swallow has been reduced by 50 percent since 1900. Bank stabilization projects (use of rip-rap) and channelization of rivers have been identified as the greatest factor in the reduction of this species range.

SSWD's CWHR search identified suitable nesting habitat as occurring within the proposed FERC Project Boundary. However, according to Sycamore Associates (2013a), neither bank swallow nor suitable habitat was observed during BA surveys.

Yellow Warbler (*Setophaga petechia*)

The yellow warbler is designated as a SSC (CDFW 2018b). The yellow warbler is a migrant, found in California between April and October. Yellow warblers construct nests 2-16 ft above ground in riparian deciduous habitat along the western slope of the Sierra Nevada. These riparian deciduous habitats are comprised of cottonwoods, willows, alders, and other small trees and shrubs found in low, open-canopy woodland. This species breeds in montane shrubbery in open conifer forests. Territory occupied by yellow warbler usually contains tall trees for singing and foraging, and heavy brush in the understory for nesting (Zeiner et al. 1988-1990). Forage consists mostly of insects and spiders taken from the upper canopy of deciduous trees and shrubs. Yellow warblers have also been known to eat berries (Zeiner et al. 1988-1990). Brood parasitism by brown-headed cowbirds (*Molothrus ater*) is thought to be a major cause of population decline in lowland localities in recent decades.

Due to their affinity towards riparian deciduous habitat, yellow warbler has the potential to occur within or adjacent to the proposed FERC Project Boundary. However, no occurrences of this species have been reported.

Yellow-headed Blackbird (*Xanthocephalus xanthocephalus*)

The yellow-headed blackbird is designated as a SSC (CDFW 2018b). This species breeds commonly, but locally, in fresh-water marshes of cattail, tule (*Schoenoplectus* sp.) or bulrush east of the Cascade Range and Sierra Nevada (Zeiner et al. 1988 – 1990). Nests are basketlike structures of wet grasses, reeds and cattails woven around stems. Nests are placed within a male's territory and always overhanging the water (Twedt and Crawford 1995). During migration and winter, open, cultivated lands, pastures and fields are used. The yellow-headed blackbird feeds on insects, seeds and grain in fields, on muddy ground near water or at the water's surface during breeding season (NatureServe 2017), while foraging outside of the breeding season takes place in upland areas, eating grains and weed seeds (Twedt and Crawford 1995).

While yellow-headed blackbird was predicted to occur within the Project vicinity, it is not known to breed or nest within the proposed FERC Project Boundary.

American Badger (*Taxidea taxus*)

The American badger is designated as a SSC species (CDFW 2018b). An uncommon, but permanent, resident found throughout most of California, except in the North Coast area (Zeiner et al. 1988-1990), the American badger is found most abundantly in drier open stages of most shrub, forest, and herbaceous habitats, with friable soils. This species' diet consists mostly of rodents: rats (*Rattus* spp.), mice, chipmunks, pocket gophers (*Geomyidae* family), and ground squirrels. The American badger will also take some reptiles, insects, earthworms, eggs, birds, and carrion as prey items when ground squirrel populations are low (NatureServe 2017). Seasonal dietary shifts in response to prey availability have been observed.

There are no reports of badgers in the proposed FERC Project Boundary, though there is suitable habitat. However, Project O&M would not alter suitable habitat, so activities would only impact badgers by way of temporary disturbance.

3.3.4.2.3 Special-Status Bat Study

In September 2015, SSWD evaluated all Project recreation facilities[11] within the NSRA and SSRA for evidence of bat activity. At each location, SSWD surveyed the exterior and interior of buildings for active bat roosts and signs of historic use via the presence of guano and staining resulting from urine and body oils. Any observed bat use (i.e., not just special-status bats, but all bat species) was documented on a standard data sheet, photographed and the location was recorded with a GPS unit (field data located in Appendix E1). Table 3.3.4-7 summarizes the Project recreation facilities that were included in the survey.

Table 3.3.4-7. List of Project facilities and recreation facilities that were surveyed by SSWD in September 2015 for evidence of bat use and results of the survey.

Project Facility	Access Point	Signs of Bat Use
CAMP FAR WEST – SOUTH SHORE RECREATION AREA		
Store	Small hole in wall	Staining – possibly from birds
Restroom 1	Open entrance doors, eaves, corrugated roof	None
Storage shed	Garage door, eaves, holes in screens	Some staining – possibly from birds
Restroom 2	Open entrance doors, holes in roof	Staining – possibly from birds
Restroom 3	Open entrance doors, corrugated roof	None
Restroom 4	Open entrance doors, holes in screens, corrugated roof	None
CAMP FAR WEST – NORTH SHORE RECREATION AREA		
Store	None	None [1]
Restroom 1	Open entrance doors, holes in screens, corrugated roof	None
Restroom 2	Open entrance doors, holes in screens, corrugated roof	None
Restroom 3	None	None [1]
Restroom 4	Open entrance doors, holes in screens, corrugated roof	Staining – possibly from birds
Old snack bar	Walls – several holes, eaves	None
ADDITIONAL STRUCTURES		
1967 bridge – Camp Far West Road	Deck	None [2]

[1] Not applicable.
[2] Observed during 2017 surveys.

11 The Camp Far West Powerhouse was not accessible during the survey, but was included in the 2017 acoustic and emergence surveys.

The following types of bat roosts were considered during SSWD's survey:

- Maternity Roosts. A maternity roost is a man-made or natural structure that provides protection from the elements and predators, and provides the correct thermal environment for young rearing. Maternity roosts tend to be warmer in temperature because breeding females need to maintain a high metabolism to aid in lactation. Juvenile bats need to keep warm to maintain a metabolic rate that allows for rapid growth. Maternity roost thermal requirements are species dependent but generally remains between 70°F and 90°F, however big-eared bat nursery roosts have been discovered in sites where ambient temperatures are as low as 60°F. Species that form large colonies can be found raising young in mines with ambient temperatures as low as 56°F, but often prefer 66°F or higher (Tuttle and Taylor 1998).
- Day Roosts. A day roost is a man-made or natural structure where bats are able to spend the non-active period of the day resting or in torpor, depending on weather conditions. Day roosts provide shelter from the elements and safety from predators (Tuttle and Taylor 1998).
- Night Roost. A night roost is a man-made or natural structure where bats may rest between foraging bouts, digest prey, escape from predators, shelter from weather, and possibly for social purposes. Night roosts are typically sites or structures that retain heat to aid the bat in maintaining the higher metabolism necessary for digestion (Tuttle and Taylor 1998).
- Winter Hibernacula. These are man-made or natural structures used by bats during colder winter months. During this time, bats enter torpor, receiving nourishment from their fat storage gained during summer months. Many species will awaken for brief periods of time to stretch, but will resume torpor. Bats, such as the Townsend's big-eared bat, will hibernate for short periods of time and will often resume feeding behavior during warm winter spells. Airflow and temperature are key determinants in use of structures, such as tunnels and adits, as hibernacula. Temperatures within these roost sites are generally below 53°F at the onset of hibernation, and remain between 34°F and 50°F by midwinter. Structures that have a varying temperature regime allow bats to find suitable temperatures during warm or cold winters (Tuttle and Taylor 1998).

No bats were seen during the survey of Project facilities. The facilities may be suitable for roosting, though there was no presence of guano and the staining seen was most likely from birds. A few of the screens that cover exterior windows of several facilities were damaged, providing possible points of entry for bats. SSWD has not installed bat exclusionary devices on any Project facilities.

In addition to the evaluation of all Project recreation facilities within the NSRA and SSRA for evidence of bat activity described above, SSWD conducted an additional bat study (Study 4.3, *Special-Status Wildlife – Bats*) to identify the location of bats, including special-status bats, in relation to two facilities not surveyed during the reconnaissance survey described above. The study was conducted consistent with Section 6.0 of the *Special-status Wildlife – Bats Study Plan* that was filed with FERC on January 9, 2017.

The study area consisted of two sites – the Camp Far West Powerhouse and the non-Project Camp Far West Road Bridge over the Camp Far West spillway.

The study methods consisted of two primary steps: 1) nighttime emergence surveys including acoustic monitoring during the surveys; and 2) quality assurance/quality control (QA/QC) review. Each step is summarized below.

Nighttime emergence surveys performed at the Camp Far West Bridge were conducted on May 11 and August 11, 2017; and nighttime emergence surveys at the Camp Far West Powerhouse were conducted on May 12 and August 7, 2017. One additional night of unattended acoustic monitoring was performed overnight on August 2, 2017 at both locations. Each survey lasted at least one or two hours, beginning 30 minutes prior to sundown. Acoustic monitoring also occurred during these nighttime emergence surveys.

Before conducting the emergence surveys, observation points were identified where surveyors could view the majority of the facility and the most likely points of egress. The surveyors were positioned so that emerging bats would be silhouetted against the sky as they exited the roost.

During the nighttime emergence surveys, the surveyors performed the following activities or recorded the following information:

- Survey start/stop times;
- An Anabat SD1 bat detector system was deployed to identify the exact timing of bats emerging and was used to help differentiate between low- and high-frequency bat species;
- Surveyors identified and recorded obvious features of bats observed (e.g., fur color, ear size);
- Surveyors recorded numbers of bats and the location of where bats were observed emerging from. Tallies of emerging bats were recorded every few minutes or as natural breaks in bat activity allowed. If no bats were seen, observations continued until it was too dark to see emerging bats (approximately one-two hours);
- Field data was collected and recorded on a data sheet developed by the USFWS; and
- Analook computer software (most recent version available) was used to analyze the acoustic data collected by the Anabat SD1 system to identify bat species.

Bat activity is affected by weather, therefore nighttime emergence surveys were conducted on clear, calm and dry evenings when bats are active and there was good visibility. Conducting the emergence surveys during windy conditions was avoided.

Following the emergence surveys, SSWD performed a QA/QC review of all data, including maps, recordings, identifications, and sightings.

SSWD observed four bats during nighttime emergence surveys: two each night at the Camp Far West Powerhouse. No bats were observed at the Camp Far West Bridge. No bats were observed emerging from Project facilities; the four bats were seen flying overhead near the powerhouse.

Two species of bat were positively identified through acoustic monitoring: California myotis (*Myotis californicus*) and Mexican free-tailed bat (*Tadarida brasiliensis*). One additional bat species was also recorded and tentatively identified as a Western pipistrelle (*Pipistrellus hesperus*). A total of 18 bat calls were recorded over three surveys at locations around the Camp Far West Powerhouse; one on May 12, 16 on August 2, and one on August 7, 2017. None of the above bat species have special-status designations.

3.3.4.2.4 Special-Status Raptor Study

SSWD conducted a special-status raptor study (Study 4.2, *Special-Status Wildlife – Raptors*) within the Proposed Project Boundary that included background literature reviews, desktop analyses, and field investigations. The study conducted was consistent with Section 6.0 of the *Special-status Wildlife – Raptors Study Plan* that was filed with FERC on January 9, 2017. The study area encompassed the Camp Far West Reservoir.

The study consisted of the following three steps: 1) identify and map known raptor nest sites and other occurrences within the study area; 2) conduct surveys following specific protocols for bald eagle, golden eagle and Swainson's hawk; and 3) perform quality assurance/quality control (QA/QC) review. Each step is summarized below and field data are provided in Appendix E1.

SSWD identified and mapped known occurrences of bald eagle, golden eagle and Swainson's hawk sightings, nests and roosts in the study area. The map was based on existing CWHR data, CNDDB data, discussions with wildlife biologists, discussions with Project Operations Staff, and incidental sightings by field staff during fieldwork on Camp Far West Reservoir.

Raptor surveys for the bald eagle consisted of winter surveys and nest surveys. Winter surveys were conducted in accordance with the *Protocol for Evaluating Bald Eagle Habitat and Populations in California* (Jackman and Jenkins 2004), and the nest surveys were conducted in accordance with the *Bald Eagle Breeding Survey Instructions* (CDFG 1999) and *Protocol for Evaluating Bald Eagle Habitat and Populations in California* (Jackman and Jenkins 2004). Nesting territories for bald eagles were checked at least three times during the nesting season (primarily February through July). Bald eagle surveys were conducted on December 20-22, 2016; January 16-18; February 15, 23-24; March 16; April 6, 25; May 2; and June 16, 2017.

SSWD conducted nesting golden eagle surveys according to the *Interim Golden Eagle Inventory and Monitoring; and Other Recommendations* (USFWS 2010) and *Protocol For Golden Eagle Occupancy, Reproduction, and Prey Population Assessment* (Driscoll 2010). Nesting territories for golden eagle surveys were checked four times during the nesting season (i.e., primarily February through July), with each survey spaced at least 30 days apart. Golden eagle surveys were conducted on January 18, February 1, March 8, April 6; and June 16, 2017.

SSWD conducted nesting Swainson's hawk surveys according to the *Recommended Timing and Methodology for Swainson's Hawk Nesting Surveys in California's Central Valley* (Swainson's Hawk Technical Advisory Committee [SHTAC] 2000). Swainson's hawk surveys were conducted on January 18, February 1, March 23, 31; April 6, 14, 18 and 28, 2017.

During the study, SSWD recorded any raptor sightings and nests observed looking inland within 0.25-mi from the edge of the shoreline at the Camp Far West Reservoir, photographed the nest, and recorded the location using GPS. Incidental sightings of other special-status raptors including northern harrier, short-eared owl, long-eared owl, and white-tailed kite were recorded when they were seen. If reasonably possible, SSWD made determinations as to whether the raptor nest was active or inactive during the survey year. Additionally, SSWD biologists recorded all bird species observations throughout the special-status raptor study, and these species are documented in Table 3.3.4-8.

Table 3.3.4-8. Incidental bird species observed while conducting the relicensing Special-Status Raptor Study.

Common Name~	Scientific Name[1]	Status[2]
Red-tailed hawk	*Buteo jamaicensis*	--
Bald eagle	*Haliaeetus leucocephalus*	BGEPA, CE, FP
Canada goose	*Branta Canadensis*	Harvest
Turkey vulture	*Cathartes aura*	--
American kestrel	*Falco sparverius*	--
Steller's jay	*Cyanocitta stelleri*	--
Downy woodpecker	*Picoides pubescens*	--
Hairy woodpecker	*Picoides villosus*	--
Least grebe	*Tachybaptus dominicus*	--
Double-crested cormorant	*Phalacrocorax auritus*	--
American coot	*Fulica americana*	Harvest
Ruby-throated hummingbird	*Archilochus colubris*	--
Black-chinned hummingbird	*Archilochus alexandri*	--
Mallard	*Anas platyrhynchos*	Harvest
Yellow-billed magpie	*Pica nuttalli*	--
Killdeer	*Charadrius vociferus*	--
Snow goose	*Anser caerulescens*	Harvest
Great blue heron	*Ardea herodias*	--
Blue-winged teal	*Spatula discors*	Harvest
Canvasback	*Aythya valisineria*	Harvest
Northern harrier	*Circus hudsonius*	SSC
Swainson's hawk	*Buteo swainsoni*	CT
Greater white-fronted goose	*Anser albifrons*	Harvest
Sharp-shinned hawk	*Accipiter striatus*	--
Golden eagle	*Aquila chrysaetos*	BGEPA, FP
Western meadowlark	*Sturnella neglecta*	--
Western grebe	*Aechmophorus occidentalis*	--
Common merganser	*Mergus merganser*	Harvest
Belted kingfisher	*Megaceryle alcyon*	--
American avocet	*Recurvirostra americana*	--
Osprey	*Pandion haliaetus*	--
Green heron	*Butorides virescens*	--
American crow	*Corvus brachyrhynchos*	Harvest
Common raven	*Corvus corax*	--

Table 3.3.4-8. (continued)

Common Name~	Scientific Name[1]	Status[2]
Acorn woodpecker	*Melanerpes formicivorus*	--
American white pelican	*Pelecanus erythrorhynchos*	SSC
Anna's hummingbird	*Calypte anna*	--
Total	**37**	

[1] Taxonomy derived from California Birds Record Committee (2018).
[2] CDFW 2018c
BGEPA = Bald and Golden Eagle Protection Act
CE = California Endangered
FP = California Fully Protected
SSC = California Species of Special Concern
CT = California Threatened
Harvest = Harvest Species

Following completion of the study, SSWD performed a QA/QC review of all data, including maps and sightings. Of the 37 bird species recorded during this study, two are considered SSC- northern harrier and American white pelican- and nine are considered harvest species- Canada goose, American coot, mallard, snow goose, blue-winged teal, canvasback, greater white-fronted goose, common merganser, and American crow.

Forty-seven bald eagle occurrences (including multiple bald eagles at the same site), six golden eagles, and three Swainson's hawks were observed during surveys. A map of these special-status raptor 2017 sightings within the FERC Project Boundary is included in Figure 3.3.4-7.

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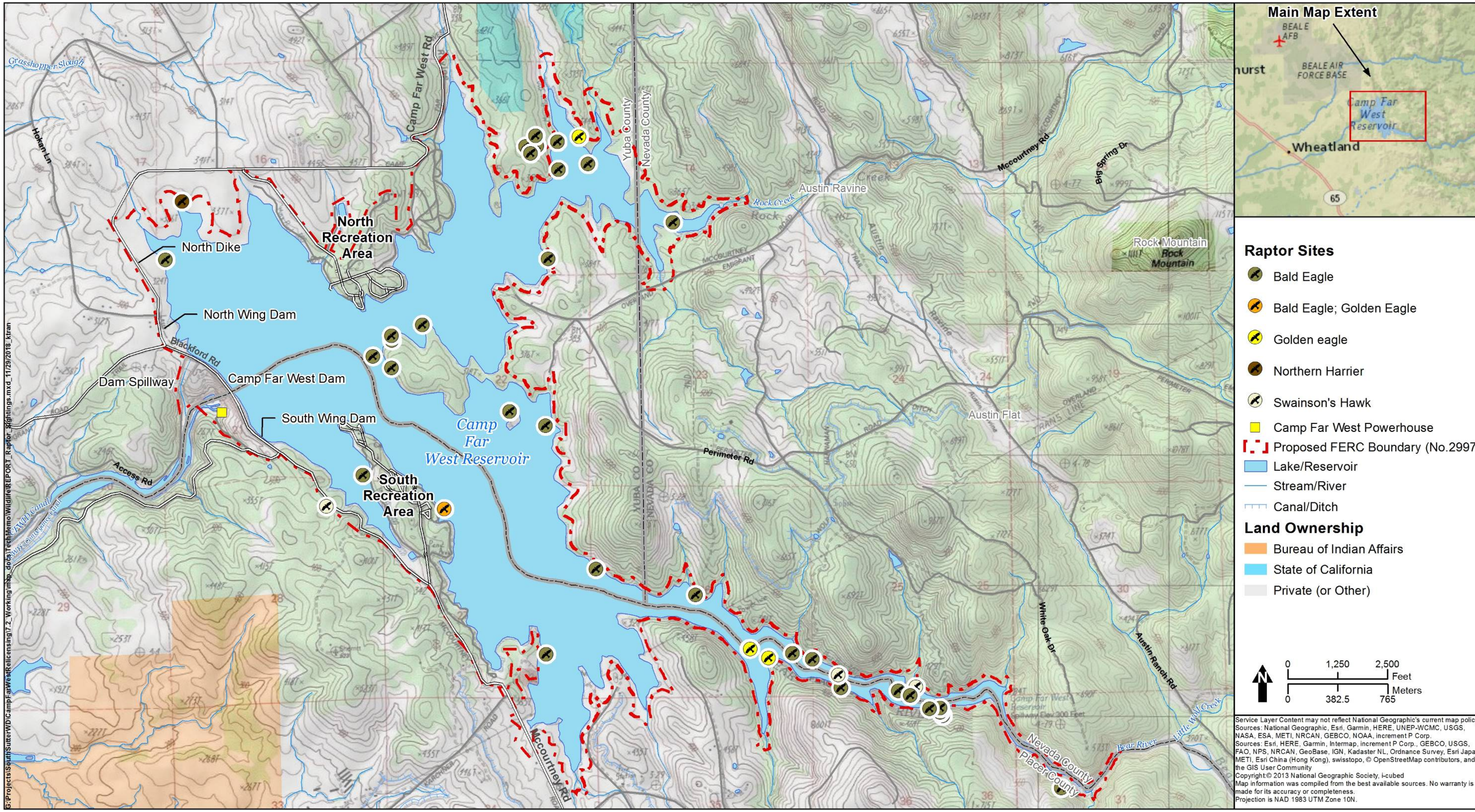

Figure 3.3.4-7. Special-status raptor 2017 sightings within the Proposed Project Boundary.

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Two active bald eagle nests were found within the Proposed Project Boundary in 2017. One nest is historic, previously found on the Bear River Arm of Camp Far West Reservoir in adjacent trees. It was previously documented in a 2013 report by Sycamore Associates. A second active bald eagle nest was found on the Rock Creek Arm of the reservoir, east of the NSRA boat ramp. Both active bald eagle nests and the three osprey (*Pandion haliaetus*) nests found within the FERC Project Boundary are identified on the map included in Figure 3.3.4-8. A great blue heron (*Ardea herodias*) rookery was also located in the SSRA, near the site location of the bald and golden eagles, as shown on Figure 3.3.4-9.

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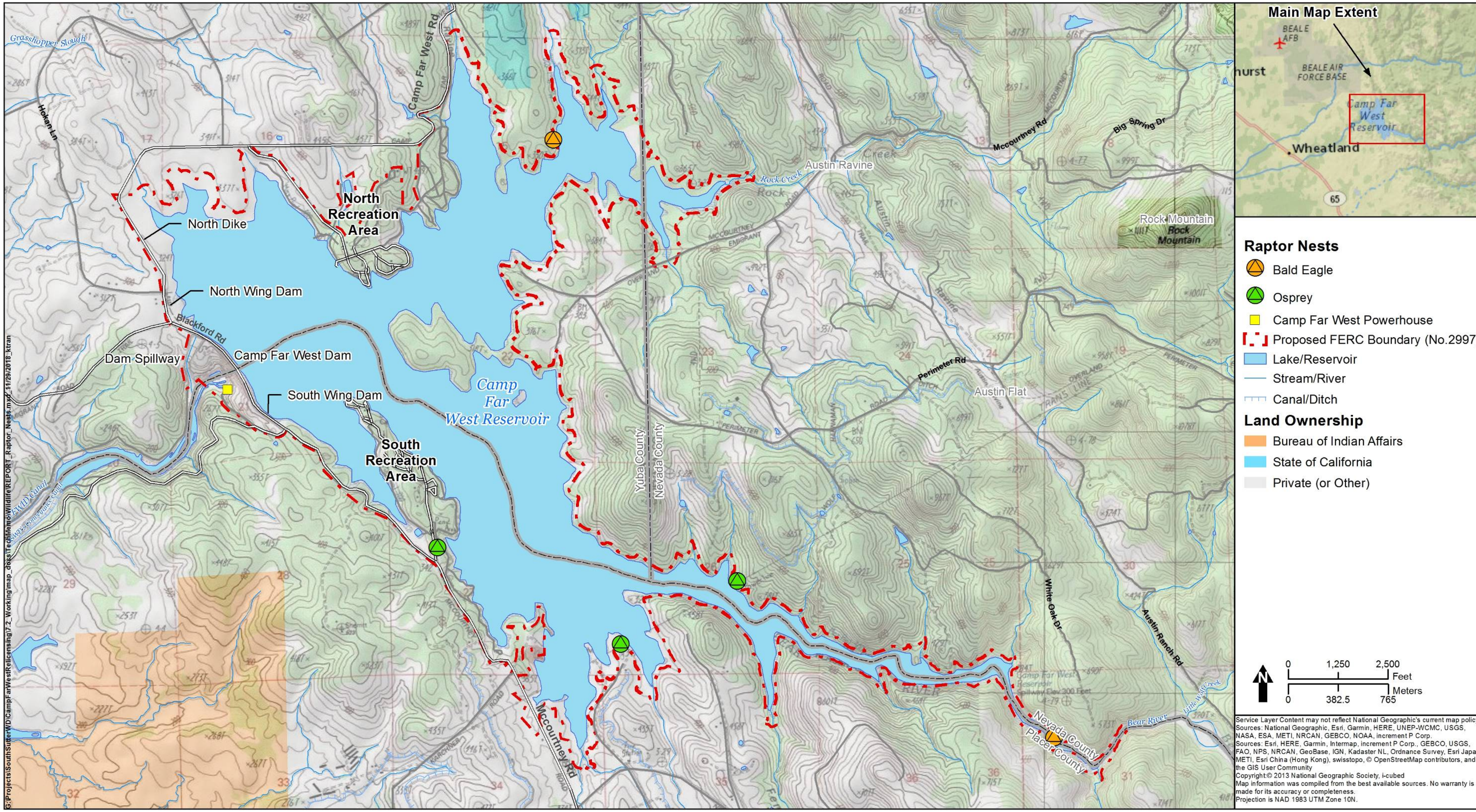

Figure 3.3.4-8. Active bald eagle nests and osprey nests found within the Proposed Project Boundary.

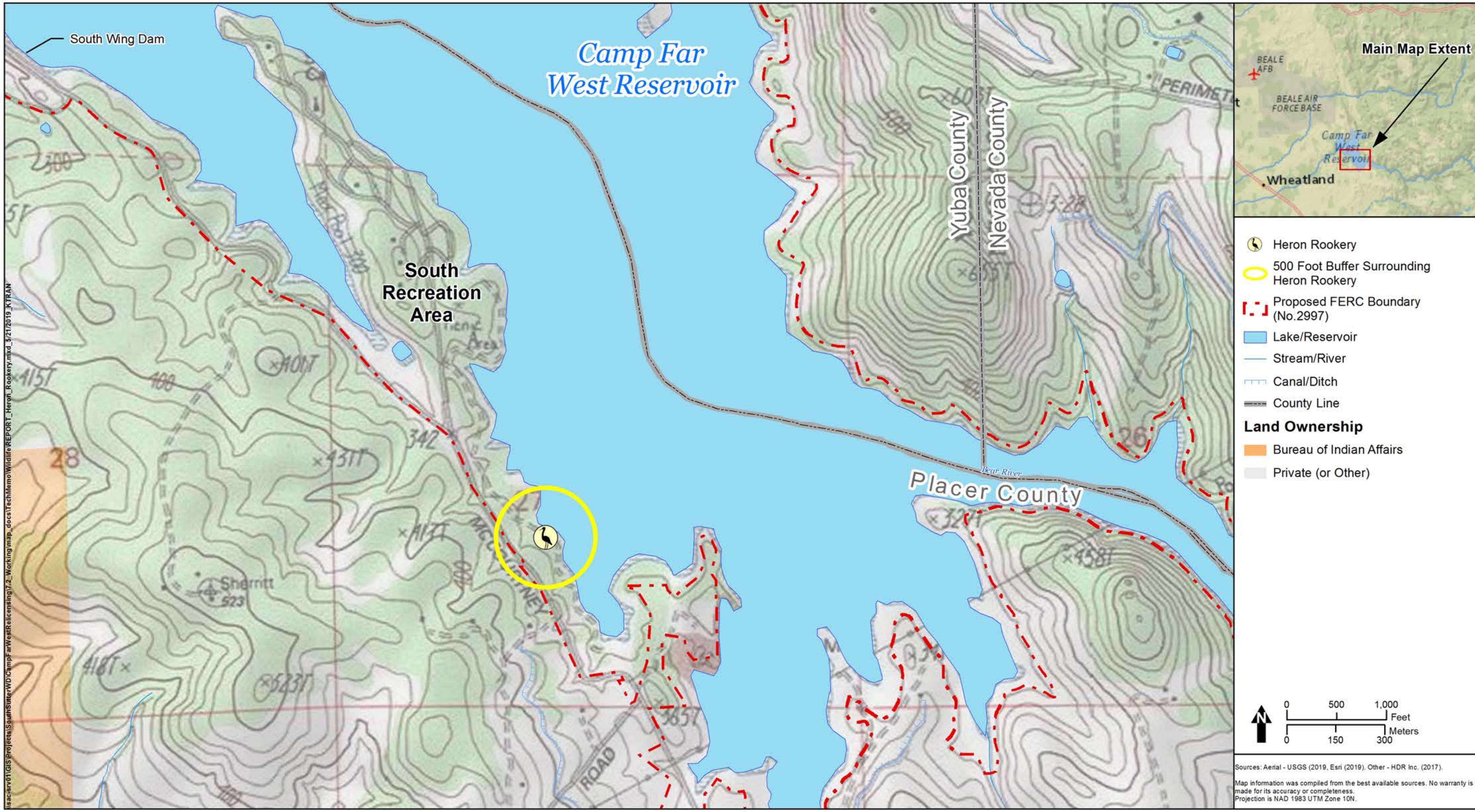

Figure 3.3.4-9. Blue heron rookery at South Shore Recreation Area with proposed 500 foot buffer

Additional information on the three special-status raptor species that were the focus of the surveys is below.

Golden Eagle (*Aquila chrysaetos*)[12]

The golden eagle is protected under the BGEPA and listed as a FP species (CDFW 2018b). It ranges from sea level up to 11,500 ft and can be found throughout California, except the center of the Central Valley (Zeiner et al. 1988-1990). Throughout the Sierra Nevada and foothills adjacent to the Central Valley, golden eagle may be found in sparse woodlands, grasslands, savannas, lower successional forest stages, and shrubland. Cliffs, large trees, and man-made structures (e.g., electric transmission towers) with a commanding view are used for nesting.

During SSWD's special-status raptor study, six occurrences of golden eagle were observed at Camp Far West Reservoir. None of these occurrences include nesting birds or evidence of nesting activities, nor are any known historically at the Project, which suggests that golden eagles are occasional visitors to the Project.

Swainson's Hawk (*Buteo swainsoni*)[13]

The Swainson's hawk is listed as ST species (CDFW 2018b). According to the last available California Swainson's Hawk Inventory (CDFG 2005a), Swainson's hawk inhabit the flat portions of California's Central Valley, lower elevation Great Basin in Northeastern California, Owen's Valley and portions of the Mojave Desert. Typical breeding habitat consists of trees within mature riparian forest, lone trees and oak groves, and mature roadside trees. It forages in native grasslands, lightly-grazed dryland pasture, and suitable grain or alfalfa (*Medicago sativa*) fields that are adjacent to nesting habitat. Historically, Swainson's hawks were found throughout California, except in the Sierra Nevada. The current range of Swainson's hawk, while similar to the historic range, has become fragmented and irregularly distributed. Yolo, San Joaquin and Sacramento counties are inhabited by 85 percent of the Central Valley breeding pairs (CDFG 1993). This concentration of breeding pairs is attributed to compatible land use practices (irrigated farmland, such as alfalfa). North and south of those three counties, the number of nesting pairs falls dramatically, which is likely due to incompatible crop-types such as cotton (*Gossypium* spp.), vineyards and orchards. Furthermore, no significant foothill region breeding populations have been discovered (CDFG 1993).

During SSWD's special-status raptor study, three individuals were observed within the FERC Project Boundary, but no nests were observed. However, Swainson's hawk may nest in the vicinity of the Project given their affinity for the Central Valley.

12 Photo source: < https://gfp.sd.gov/outdoor-learning/bald-eagle-awareness-days/golden_eagle.aspx>.
13 Photo source: Tony Hisgett - Flickr: Swainson's Hawk, CC BY 2.0, Wikimedia Commons

Bald Eagle (*Haliaeetus leucocephalus*)[14]

The bald eagle is a SE and FP species and protected under the BGEPA (CDFW 2018b). The bald eagle is a large raptor with a wingspan between 6 and 8 ft and can weigh up to 14 pounds. They typically nest within 1 mi of water bodies. The bald eagle breeds and winters throughout California, except for the desert areas, and the number of breeding pairs known to be occupying territories in California is steadily growing (CDFW 2018c). Most breeding in the state occurs in the northern Sierra Nevada, Cascades, and north Coast Ranges. California's breeding population is resident year-round in most areas where the climate is relatively mild (Jurek 1988). Between mid-October and December, migratory birds from areas north and northeast of California arrive in the state. Wintering populations remain through March or early April. Breeding generally occurs from February to July, but can be initiated as early as January via courtship, pair bonding, and territory establishment. The breeding season normally ends around August 31, as the fledglings are no longer attached to their nest area. According to the CDFW (2018c), California's winter population appears to be at least stable, although varying from year to year, exceeding 1,000 birds some winters. The results of Midwinter Bald Eagle Surveys conducted from 1986-2005 estimates a 1.2 percent increase in California's wintering bald eagle population.

During SSWD's 2017 special-status raptor study, 47 bald eagles (including multiple birds at the same site), were observed during surveys within the FERC Project Boundary. Additionally, two active bald eagle nests were found within the Proposed Project Boundary. One nest is historic, previously found on the Bear River Arm of Camp Far West Reservoir in adjacent trees (Sycamore Associates 2013a). A second active bald eagle nest was found on the Rock Creek Arm of the reservoir, east of the NSRA boat ramp.

3.3.4.2.4 Commercially-Valuable Wildlife Species

One amphibian, 34 birds, and 21 mammal species that have been designated as commercially valuable by the CDFW have the potential to occur within the proposed FERC Project Boundary (CDFW 2018b). Table 3.3.4-9 lists these species and includes temporal and spatial information and descriptions of suitable habitat used by each of the species. CWHR system habitat types listed in Table 3.3.4-4 were used to obtain temporal and spatial information for each species (CDFW 2018b). Descriptions of suitable habitat types were synthesized from species accounts found online at NatureServe (2017) and the CDFW's CWHR life history database (CDFW 2015b).

14 Photo source: Pacific Southwest Region USFWS from Sacramento, US - A lone Bald eagle, Public Domain.

Table 3.3.4-9. Commercially-valuable wildlife species occurring or potentially occurring in the Camp Far West Hydroelectric Proposed Project Boundary.

Common Name/ Scientific Name	Suitable Habitat Type	Temporal and Spatial Distribution[1]	Known From Project
AMPHIBIANS			
American bullfrog (*Lithobates catesbeianus*)	Ponds, swamps, lakes, reservoirs, marshes, brackish ponds. May disperse from water in wet weather and sometimes are found in temporary waters hundreds of meters from permanent water. Non-native.	Yearlong: AGS, BOP, BOW, LAC, MCH, MHW, URB	Located at multiple places on the Project.
BIRDS			
Chukar *(Alectoris chukar)*	Rocky hillsides, mountain slopes with grassy vegetation, open and flat desert with sparse grasses, and barren plateaus. Non-native.	Yearlong: AGS	Potentially occur within suitable habitat.
Wood duck *(Aix sponsa)*	Inland waters near woodlands such as swamps and marshes.	Yearlong: BOP, BOW, LAC, MHW, URB	Potentially occur within suitable habitat.
Northern pintail *(Anas acuta)*	Lakes, rivers, marshes and ponds in grasslands, barrens, dry tundra, open boreal forest, or cultivated fields. Most breeding associated with seasonal and semi-permanent wetlands.	Yearlong: AGS, LAC, URB Winter- LAC	Potentially occur within suitable habitat.
American wigeon *(Anas americana)*	Open water on lakes, ponds, reservoirs and backwaters.	Yearlong: AGS, LAC, URB	Potentially occur within suitable habitat.
Northern shoveler *(Anas clypeata)*	Open water on lakes, ponds and reservoirs.	Yearlong: AGS, LAC	Potentially occur within suitable habitat.
Green-winged teal *(Anas crecca)*	Open water on lakes, ponds, reservoirs and in marshes.	Yearlong: AGS Winter- LAC, URB	Potentially occur within suitable habitat.
Cinnamon teal *(Anas cyanoptera)*	Shallow open water on lakes, ponds, reservoirs and in marshes.	Yearlong: AGS, LAC	Potentially occur within suitable habitat.
Blue-winged teal *(Anas discors)*	Open water on lakes, ponds, reservoirs and in marshes.	Summer: AGS Yearlong- LAC	Potentially occur within suitable habitat.
Eurasian wigeon *(Anas penelope)*	Winters primarily in freshwater (marshes, lakes) and brackish situations in coastal areas, but migrates extensively through inland regions; occurs in shallow water and fields and meadows.	Winter: AGS, LAC, URB	Potentially occur within suitable habitat.
Mallard *(Anas platyrhynchos)*	Primarily shallow waters such as ponds, lakes, marshes, and flooded fields.	Yearlong: AGS, LAC, URB	Observed on Camp Far West Reservoir.
Gadwall *(Anas strepera)*	Open water on lakes, ponds, reservoirs and backwaters.	Yearlong: AGS, LAC	Potentially occur within suitable habitat.
Greater white-fronted goose[2] *(Anser albifrons)*	Wetlands, grain fields, grassy fields, marshes, lakes and ponds. Breeds on arctic tundra on edge of marshes, lakes, sloughs, rivers.	Winter: AGS, LAC	Observed on Camp Far West Reservoir.
Lesser scaup *(Aythya affinis)*	Open water on lakes, ponds and reservoirs.	Summer: AGS Yearlong: LAC	Potentially occur within suitable habitat.
Redhead[3] *(Aythya americana)*	Open water on lakes, ponds and reservoirs.	Winter: LAC	Potentially occur within suitable habitat.
Ring-necked duck *(Aythya collaris)*	Open water on lakes, ponds, and reservoirs.	Yearlong: LAC	Potentially occur within suitable habitat.
Greater scaup *(Aythya marila)*	Open water and on emergent wetlands. Breeds primarily in tundra and northern borders of the taiga.	Winter: LAC	Potentially occur within suitable habitat.

Table 3.3.4-9. (continued)

Common Name/ Scientific Name	Suitable Habitat Type	Temporal and Spatial Distribution[1]	Occurrence in Project Area
BIRDS (cont'd)			
Canvasback *(Aythya valisineria)*	Open water on lakes, ponds, reservoirs, and marshes.	Winter: LAC	Potentially occur within suitable habitat.
Canada goose *(Branta canadensis)*	Overhead while migrating, marshes with tall grass and sedges near water.	Yearlong: AGS, LAC, URB	Observed on Camp Far West Reservoir.
Bufflehead *(Bucephala albeola)*	Lakes, ponds, rivers and seacoasts. Breeds in tree cavities in mixed coniferous-deciduous woodland near lakes and ponds.	Yearlong: LAC	Potentially occur within suitable habitat.
Common goldeneye *(Bucephala clangula)*	Open water on lakes, ponds and reservoirs.	Winter: LAC	Potentially occur within suitable habitat.
California quail[2] *(Callipepla californica)*	Lower elevations and transition zone of mixed conifer forest between 1,200 and 7,000 ft elevation.	Yearlong: AGS, BOP, BOW, MCH, MHW, URB	Potentially occur within suitable habitat.
Snow goose *(Chen caerulescens)*	Freshwater wetlands, wet prairies and extensive sandbars, foraging in pastures, cultivated lands and flooded fields.	Winter: AGS, LAC	Observed on Camp Far West Reservoir.
Ross's goose *(Chen rossii)*	Marshy lakes, wet prairies, foraging in grassy areas, pastures and cultivated fields.	Winter: AGS, LAC	Potentially occur within suitable habitat.
Band-tailed pigeon *(Columba fasciata)*	Lower elevations and transition zone of mixed conifer forest between 1,200 and 5,500 ft elevation.	Winter: BOP, BOW, MCH Yearlong: MHW, URB	Potentially occur within suitable habitat.
American crow *(Corvus brachyrhynchos)*	Open and partly open country: agricultural lands, suburban areas, orchards, and tidal flats.	Yearlong: AGS, BOP, BOW, LAC, MHW, URB	Observed at recreation areas.
American coot *(Fulica americana)*	Open water areas, along lake shores and stream edges, and in marshes.	Winter: AGS Yearlong: LAC, URB	Observed on Camp Far West Reservoir.
Common gallinule *(Gallinula galeata)*	Freshwater marshes, canals, quiet rivers, lakes, ponds, mangroves, primarily in areas of emergent vegetation and grassy borders. Nests usually among marsh plants over water, occasionally in shrub in or near water.	Yearlong: LAC, URB	Potentially occur within suitable habitat.
Wild turkey *(Meleagris gallopavo)*	Pinyon-Juniper woodlands. Non-native.	Yearlong: AGS, BOP, BOW, MCH, MHW	Potentially occur within suitable habitat.
Hooded merganser *(Mergus cucullatus)*	Open water on lakes, ponds and reservoirs.	Winter: LAC, URB	Potentially occur within suitable habitat.
Common merganser *(Mergus merganser)*	Open water on lakes, ponds and reservoirs.	Yearlong: LAC Winter: URB	Potentially occur within suitable habitat.
Red-breasted merganser *(Mergus serrator)*	Open water on lakes, ponds and reservoirs.	Winter: LAC	Potentially occur within suitable habitat.
Ruddy duck *(Oxyura jamaicensis)*	Open water on lakes, ponds, reservoirs and Marshes.	Yearlong: LAC	Potentially occur within suitable habitat.
Ring-necked pheasant *(Phasianus colchicus)*	Open country (especially cultivated areas, scrubby wastes, open woodland and edges of woods), grassy steppe, desert oases, riverside thickets, swamps and open mountain forest. Non-native.	Yearlong: AGS, BOP, MCH, URB	Potentially occur within suitable habitat.
Mourning dove *(Zenaida macroura)*	Lower elevations and transition zone of mixed conifer forest between 1,200 and 5,500 ft elevation.	Yearlong: AGS, BOP, BOW, MCH, MHW, URB	Observed at recreation areas.

Table 3.3.4-9. (continued)

Common Name/ Scientific Name	Suitable Habitat Type	Temporal and Spatial Distribution[1]	Occurrence in Project Area
MAMMALS			
Coyote *(Canis latrans)*	Wide range of habitats in its extensive range, from open prairies of the west to the heavily forested areas of the Northeast; sometimes found in cities.	Yearlong: AGS, BAR, BOP, BOW, MCH, MHW, URB	Potentially occur within suitable habitat.
American beaver *(Castor canadensis)*	Readily occupy artificial ponds, reservoirs, and canals, if food is available.	Yearlong: AGS, BOW, LAC	Potentially occur within suitable habitat.
Virginia opossum *(Didelphis virginiana)*	Very adaptable; may be found in most habitats. Prefers wooded riparian habitats. Also in suburban areas. Abandoned burrows, buildings, hollow logs, and tree cavities are generally used for den sites.	Yearlong: AGS, BOP, BOW, MCH, MHW, URB	Potentially occur within suitable habitat.
Bobcat *(Felis rufus)*	Various habitats including deciduous-coniferous woodlands and forest edge, hardwood forests, swamps, forested river bottomlands, brushlands, deserts, mountains, and other areas with thick undergrowth.	Yearlong: AGS, BOP, BOW, MCH, MHW	Potentially occur within suitable habitat.
Black-tailed jackrabbit[3] *(Lepus californicus)*	Open plains, fields, and deserts; open country with scattered thickets or patches of shrubs.	Yearlong: AGS, BOP, BOW, MCH, MHW, URB	Potentially occur within suitable habitat.
Striped skunk *(Mephitis mephitis)*	Semi-open country with woodland and meadows interspersed, brushy areas, bottomland woods. Frequently found in suburban areas.	Yearlong: AGS, BOP, BOW, MCH, MHW, URB	Potentially occur within suitable habitat.
Long-tailed weasel *(Mustela frenata)*	Wide variety of habitats, usually near water. Favored habitats include brushland and open woodlands, field edges, riparian grasslands, swamps, and marshes.	Yearlong: AGS, BOP, BOW, MCH, MHW, URB	Potentially occur within suitable habitat.
American mink *(Mustela vison)*	Favors forested permanent or semi-permanent wetlands with abundant cover, marshes, and riparian zones.	Yearlong: LAC	Potentially occur within suitable habitat.
Mule deer *(Odocoileus hemionus)*	Early to intermediate successional stages of most forest, woodland, and brush habitats interspersed with herbaceous openings, dense brush or tree thickets, riparian areas, and abundant edge.	Yearlong: AGS, BOP, BOW, MCH, MHW, URB	Observed at Camp Far West Reservoir.
Common muskrat *(Ondatra zibethicus)*	Fresh or brackish marshes, lakes, ponds, swamps, and other bodies of slow-moving water. Rare or absent in artificial impoundments with fluctuating water levels.	Yearlong: LAC	Potentially occur within suitable habitat.
Raccoon *(Procyon lotor)*	Various habitats; usually in moist situations, often along streams and shorelines.	Yearlong: AGS, BOP, BOW, LAC, MCH, MHW, URB	Potentially occur within suitable habitat.
Western gray squirrel *(Sciurus griseus)*	Dependent upon mature stands of mixed conifer and oak habitats, closely associated with oaks.	Yearlong: BOP, BOW, MCH, MHW	Potentially occur within suitable habitat.
Western spotted skunk[2] *(Spilogale gracilis)*	Brushy canyons, rocky outcrops (rimrock) on hillsides and walls of canyons. When inactive or bearing young, occupies den in rocks, burrow, hollow log, brush pile, or under building,	Yearlong: AGS, BOP, BOW, MCH, MHW, URB	Potentially occur within suitable habitat.
Audubon's cottontail *(Sylvilagus audubonii)*	Various habitats; dry uplands as well as low valleys and canyons. May inhabit open grasslands, brushlands, edges of foothill woodlands, willow thickets, sometimes in cultivated fields or under buildings.	Yearlong: AGS, BOP, BOW, MCH, URB	Potentially occur within suitable habitat.
Wild pig *(Sus scrofa)*	Densely forested mountainous terrain, brushlands, dry ridges, swamps; sometimes in fields, marshes. Often in mixed hardwood forest with permanent water source. Seasonal changes in habitat use are linked to food availability. Non-native	Yearlong: AGS, BOP, BOW, MCH, MHW	Potentially occur within suitable habitat.

Table 3.3.4-9. (continued)

Common Name/ Scientific Name	Suitable Habitat Type	Temporal and Spatial Distribution[3]	Occurrence in Project Area
MAMMALS (cont'd)			
Brush rabbit[2] *(Sylvilagus bachmani)*	Dense scrub and brushy edges of habitats, chaparral, and cactus. Also brushy areas on sand dunes and in bramble thickets. Usually near dense vegetative cover. Seldom uses burrows.	Yearlong: AGS, BOP, BOW, MCH, MHW	Potentially occur within suitable habitat.
Douglas' squirrel *(Tamiasciurus douglasii)*	Coniferous forests, in upper pine belt and in fir, spruce, and hemlock forests.	Yearlong: MHW	Potentially occur within suitable habitat.
American badger[3] *(Taxidea taxus)*	Prefers open areas and may also frequent brushlands with little groundcover. When inactive, occupies underground burrow.	Yearlong: AGS, BAR, BOP, BOW, MCH, MHW	Potentially occur within suitable habitat.
Gray fox *(Urocyon cinereoargenteus)*	Often found in woodland and shrubland in rough, broken country.	Yearlong: AGS, BOP, BOW, MCH, MHW, URB	Potentially occur within suitable habitat.
Black bear *(Ursus americanus)*	Occur in fairly dense, mature stands of many forest habitats mostly above 3,000 ft elevation, and feed in a variety of habitats including brushy stands of forest, valley foothill riparian and wet meadows.	Yearlong: AGS, BOP, MCH, MHW Summer: LAC	Potentially occur within suitable habitat.
Red fox[2] *(Vulpes vulpes)*	Various open and semi-open habitats. Usually avoids dense forest, although open woodlands frequently are used.	Yearlong: AGS, BAR, MCH	Potentially occur within suitable habitat.
Total	**56**		

Sources: CDFW 2015b; NatureServe 2017

[1] CWHR Habitat Types:
AGS = Annual Grass
BAR = Barren
BOP = Blue Oak Foothill Pine
BOW = Blue Oak Woodland
LAC = Agriculture Ponds, Water Features, General Water (i.e., lakes, ponds, reservoirs, diversion impoundments)
MCH = Mixed Chaparral
MHW = Montane Hardwood
URB = Urban

[2] Subspecies designated as special-status

[3] Species designated as special-status

Of the commercially-valuable (i.e., harvestable) species that are known to occur or have the potential to occur in the Proposed Project Boundary, eight are also designated as special-status wildlife species (Table 3.3.4-9). According to the CDFW (2015b), the special-status designation of six of those species is assigned to subspecies, and they are unlikely to occur within the Proposed Project Boundary, as the Project is outside the subspecies' range. These subspecies include: tule greater white-fronted goose (*Anser albifrons elgasi*) (SSC); Catalina California quail (*Callipepla californica catalinensis*) (SSC); San Diego black-tailed jackrabbit (*Lepus californicus bennettii*) (SSC); Sierra Nevada red fox (*Vulpes necator*) (ST); Channel Islands spotted skunk (*Spilogale gracilis amphiala*) (SSC); and riparian brush rabbit (*Sylvilagus bachmani riparius*) (FE and SE). The two remaining commercially-valuable species that have also been given a special-status designation are redhead (*Aythya americana*) (SSC) and American badger (*Taxidea taxus*) (SSC) (CDFW 2015b), which have the potential to occur within the Project Area.

SSWD does not allow hunting within the Proposed Project Boundary.

Mule Deer (*Odocoileus hemionus*)

California mule (*Odocoileus hemionus californicus*) and black-tailed deer (*Odocoileus hemionus columbianus*) are among the most visible and widespread species found in most habitats throughout California. Deer are California's most popular game mammal, with most hunting opportunities occurring on public lands (CDFG 1998). Deer are free-ranging animals whose habitat requirements can result in conflicts with humans. Deer are an integral component in the food chain from their role as grazers to prey species to California's top carnivores. Deer inhabit about 70 percent of California's wildlands in a variety of habitats (CDFW 2015c). Approximately 50 percent of the deer range is public land administered by the federal government and 45 percent of the range is privately-owned (CDFG 1998). The deer population in California has fallen in the years between 1991 and 2014 from approximately 850,000 to approximately 450,000 (CDFW 2015c).

The deer living in the Project Area were classified as part of the Camp Beale Herd in 1952 and included in the 1983 Mother Lode Deer Herd Management Plan (CDFG 1983). Both subspecies inhabit and are considered residents in the area and do not migrate like other herds in California. The Mother Lode Deer Herd occupies approximately 3,660 sq mi over an elevation range from sea level to 3,000 ft in the foothills of the Sierra Nevada.

In the past forty years, CDFW has developed and updated deer management strategies in California. In 1976, CDFG developed *A Plan for California Deer* (CDFG 1976). The primary goal of the plan was to restore deer populations to the record high numbers of the 1960s, and the plan included habitat and management goals for deer populations by herd units. In the plan, 79 deer herd plans were identified with separate management objectives for each herd and plans were completed and implemented by the mid-1980s. The herd units were based primarily on administrative boundaries (e.g., county lines, regional boundaries, and roads), deer behavior (i.e., migratory or resident), and subspecies (i.e., mule deer or black-tailed deer) (CDFW 2015c). The Mother Lode Deer Herd Management Plan, one of the 79 separate plans, was completed in July 1983.

At the end of a meeting in January 1997 and at the request of the California Fish and Game Commission, CDFG, the Forest Service, and the USDOI, Bureau of Land Management concluded with a collective recommendation that an overall assessment of deer populations and deer habitat conditions was needed to help identify key problems on an area-by-area basis. In 1998, CDFG combined the 45 hunt zones in California into 11 Deer Assessment Units based on similarities in habitat and environmental and ecological factors rather than the artificial boundaries of the hunt zones. The Central Sierra Deer Assessment Units covers the area of the Project and includes about 10,500 sq mi from the Feather River drainage south to Yosemite National Park. The reported deer herd in the area in 1998 was between 50,000 to 90,000 (CDFG 1998).

In March of 2015, the California Deer Conservation and Management Plan was developed by the CDFW. To determine how changing conditions may be impacting deer, the CDFW planned to assess habitat conditions and populations based on population data and current habitat assessments. A goal of the 2015 California Deer Conservation and Management Plan is to develop Deer Conservation Units (DCU) by taking a landscape level approach to deer planning categorizing California deer herd units into 10 DCUs. The Project is located on the boundary of the Sierra Nevada and Central Valley DCUs. The development of the Sierra Nevada DCU was scheduled for November 2015 and implementation for March 2016. The development of the Central Valley DCU was in March 2016 and was to be implemented in July 2016, but there is no updated information about this plan (CDFW 2015c).

3.3.4.3 Wetlands, Riparian, and Littoral Habitats of the Project Area

USFWS' National Wetlands Inventory (NWI) maps (USFWS 2018b) show the distribution, extent, and types of Palustrine and Riverine wetlands, and Lacustrine littoral zones within the FERC Project Boundary and downstream. However, NWI maps are based on aerial imagery and are typically not verified by ground surveys. A jurisdictional delineation was performed by Sycamore and Associates in 2013 (Sycamore Associates 2013b) in the proposed five foot raise around the reservoir south east edge. Information from these field efforts is discussed below.

Figure 3.3.4-10, contains a map showing NWI-mapped wetlands, riparian, and littoral habitats within the Proposed Project Boundary.

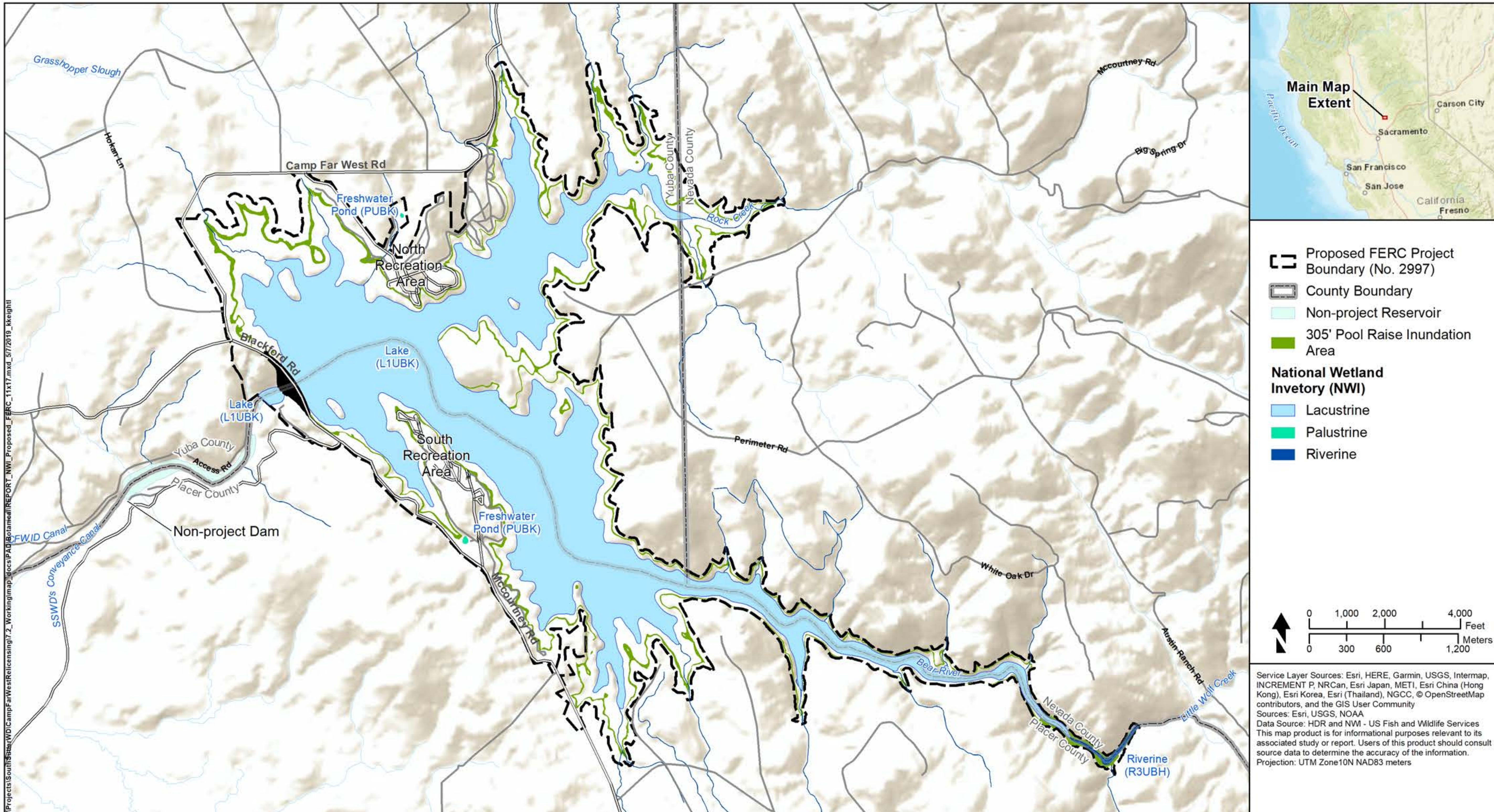

Figure 3.3.4-10. NWI-mapped wetlands, riparian, and littoral habitats within the proposed Camp Far West Hydroelectric Project Boundary.

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3.3.4.3.1 Wetlands

Wetlands are transitional lands that occur between uplands and aquatic systems. However, wetlands also may include certain shallow aquatic areas and are more accurately defined according to the following attributes (Cowardin et al. 1979):

- at least periodically, the land supports predominantly hydrophytes (i.e., vegetation associated with moist soil conditions);
- the substrate is predominantly un-drained hydric soil (i.e., soil characterized by anaerobic conditions); and
- the substrate is non-soil (i.e., boulder, bedrock or similar substrate) and is saturated with water or covered by shallow water at some time during the growing season of each year.

Areas of deep, permanent water are not included under the definition of wetland. Ponds, swamps, marshes, bogs, springs, fens, and wet meadows are examples of wetlands.

All wetlands discussed in this section are categorized as Palustrine, Riverine, or Lacustrine by Cowardin et al. (1979). Eight major classes of Palustrine wetlands have been described, and one of these is found within the Proposed Project Boundary (Figure 3.3.4-10). Additionally, seven major classes of Riverine wetlands have been described, and one of these is found within the Proposed Project Boundary. Nine classes of Lacustrine wetlands have been described, and one of these occurs within the proposed FERC Project Boundary.

The three NWI wetland classes that may be found in the Proposed Project Boundary are listed in Table 3.3.4-10. This table also provides the total linear ft of the three NWI-mapped wetland classes within the Proposed Project Boundary. Following Table 3.3.4-10, more detailed descriptions of the three defined NWI wetland classes are provided, including their known occurrence within the Proposed Project Boundary, based on mapping of wetland types by NWI.

Table 3.3.4-10. NWI palustrine, riverine, and lacustrine wetland classes within the proposed Camp Far West proposed FERC Project Boundary.

Type	Definition	Acres
RIVERINE UNCONSOLIDATED BOTTOM		
R3UBH	Riverine upper perennial, unconsolidated bottom, permanently flooded	69.56
PALUSTRINE UNCONSOLIDATED BOTTOM		
PUBK	Palustrine, unconsolidated bottom, artificially flooded	0.79
LACUSTRINE UNCONSOLIDATED BOTTOM		
L1UBK	Lacustrine limnetic, unconsolidated bottom, artificially flooded	1,202.4
Totals	--	**1,272.75**

Source: USFWS 2018b

Riverine Unconsolidated Bottom (RUB)

Riverine unconsolidated bottom wetlands are characterized by 25 percent or more exposed sand, gravel, or small stones, and 30 percent or less vegetative cover contained within an open conduit either naturally or artificially created which periodically or continuously contains moving water (Cowardin et al. 1979). NWI mapped RUB wetlands cover approximately 69.56 ac within the Proposed Project Boundary (Table 3.3.4-10), and occurs at one location: on the southern tip of Camp Far West Reservoir just north of Little Wolf Creek (Figure 3.3.4-10).

Palustrine Unconsolidated Bottom (PUB)

Palustrine unconsolidated bottom wetlands are characterized by 25 percent or more exposed sand, gravel, or small stones, and 30 percent or less vegetative cover in nontidal wetlands dominated by trees, shrubs, and persistent emergents (Cowardin et al. 1979). NWI mapped PUB wetlands cover approximately 0.79 ac within the Proposed Project Boundary (Table 3.3.4-10), and occurs at two locations: one occurrence is roughly centered between Camp Far West Road and the NSRA, the second occurrence is settled between McCourtney Road and west of the turnoff for the SSRA (Figure 3.3.4-10).

Lacustrine Unconsolidated Bottom (LUB)

Lacustrine unconsolidated bottom wetlands are characterized by 25 percent or more exposed sand, gravel, or small stones, and 30 percent or less vegetative cover in permanently flooded lakes and reservoirs (Cowardin et al. 1979). NWI mapped Lacustrine wetlands cover approximately 1,202.4 ac within the Proposed Project Boundary (Table 3.3.4-10), and occurs at two locations: one small area downstream of the Camp Far West Dam and Camp Far West Reservoir (Figure 3.3.4-10).

3.3.4.3.2 Additional Information for Wetlands

2013 Wetland Delineation

A formal USACE's wetland delineation was performed for the entirety of the Camp Far West Reservoir in 2013, which identified 5 seasonal wetlands (0.077-ac), 10 seasonal wetland swales (0.22-ac), 9 seeps (0.457-ac), 11 emergent wetlands (1.018 ac), 6 irrigated wetlands (1.484 ac) and 1 scrub-shrub wetland (0.236-ac). None of the identified wetlands were determined to be caused by or receiving water from the reservoir or any other Project-related sources (Sycamore Associates 2013b).

The seasonal wetlands were scattered around the margin of the reservoir, but their water was provided by runoff during the rainy season. Three of the wetlands were in ditches related to ground disturbance. Plant species located in the seasonal wetlands included dallisgrass (*Paspalum dilatatum*), dock (*Rumex* spp.), Italian ryegrass (*Festuca perennis*), and English plantain (*Plantago lanceolata*), all non-native species. There were hydric soils present (Sycamore Associates 2013b).

The ten seasonal swales were also scattered around the reservoir margin and derived their water from surface runoff. The most common plant species in the swales included spiny-fruit buttercup (*Ranunculus muricatus*), common toad rush (*Juncus bufonius*), Italian ryegrass, whitetip clover (*Trifolium variegatum*), beardstyle (*Pogogyne* spp.), water chickweed (*Montia fontana*), and Buenos Aires buttercup (*Ranunculus bonariensis* var. *trisepalus*). Hydric soils were located at the swale sites (Sycamore Associates 2013b).

The nine seeps were all groundwater-dependent and scattered around the reservoir margins. They were dominated by perennial rushes (*Juncus* spp.) and pennyroyal (*Mentha pulegium*), as well as annuals such as seep-spring monkeyflower and Italian ryegrass. Hydric soils were also present (Sycamore Associates 2013b).

The eleven emergent wetlands on the reservoir margin are influenced by groundwater and dry season hydrology inputs, with some surface water dependency. Sedges (*Carex* spp.), longstem spikerush (*Eleocharis macrostachya*), small mannagrass (*Glyceria declinata*), rushes, and pennyroyal were the most common vegetation at these sites. Indicators for hydric soils were located at the emergent wetlands (Sycamore Associates 2013b).

All of the irrigated wetlands receive water from non-Project sources, including the Wolf Hannaman Ditch, rural residence and livestock pastures and a Nevada Irrigation District ditch. These areas would not be wetlands without the presence of water from man-made irrigation (Sycamore Associates 2013b).

Finally, the scrub-shrub wetland is located near Lakeview Lane on the southernmost arm of the Camp Far West Reservoir. Willows (*Salix* spp.) and Himalayan blackberry (*Rubus armeniacus*) makeup the majority of the vegetation. Water may be provided by a retention pond just uphill of the site (Sycamore Associates 2013b).

2018 Aquatic Resources Delineation

An aquatic resources delineation was performed for the north western portion of the existing FERC Project Boundary in 2018 for the Spillway Modification. (South Sutter District 2018). A total of 83 aquatic features, comprising 4.40 ac (3.35 ac are inside the Proposed Project Boundary), were detected during the delineation and are itemized in Table 3.3.4-11 below.

Table 3.3.4-11. Aquatic resources located during 2018 delineation.

Feature Class	Number of Features	Acreage
Ephemeral channel	1	0.02
Intermittent channel	1	0.09
Reservoir	5	0.80
Seasonal swale	19	0.37
Seasonal wetland	2	0.09
Seep	22	0.93
Spillway	1	1.15
Vernal pool	32	0.95
Total	**83**	**4.40**

The location of these features, and the associated survey area, within the Proposed Project Boundary is depicted on Figure 3.3.4-11.

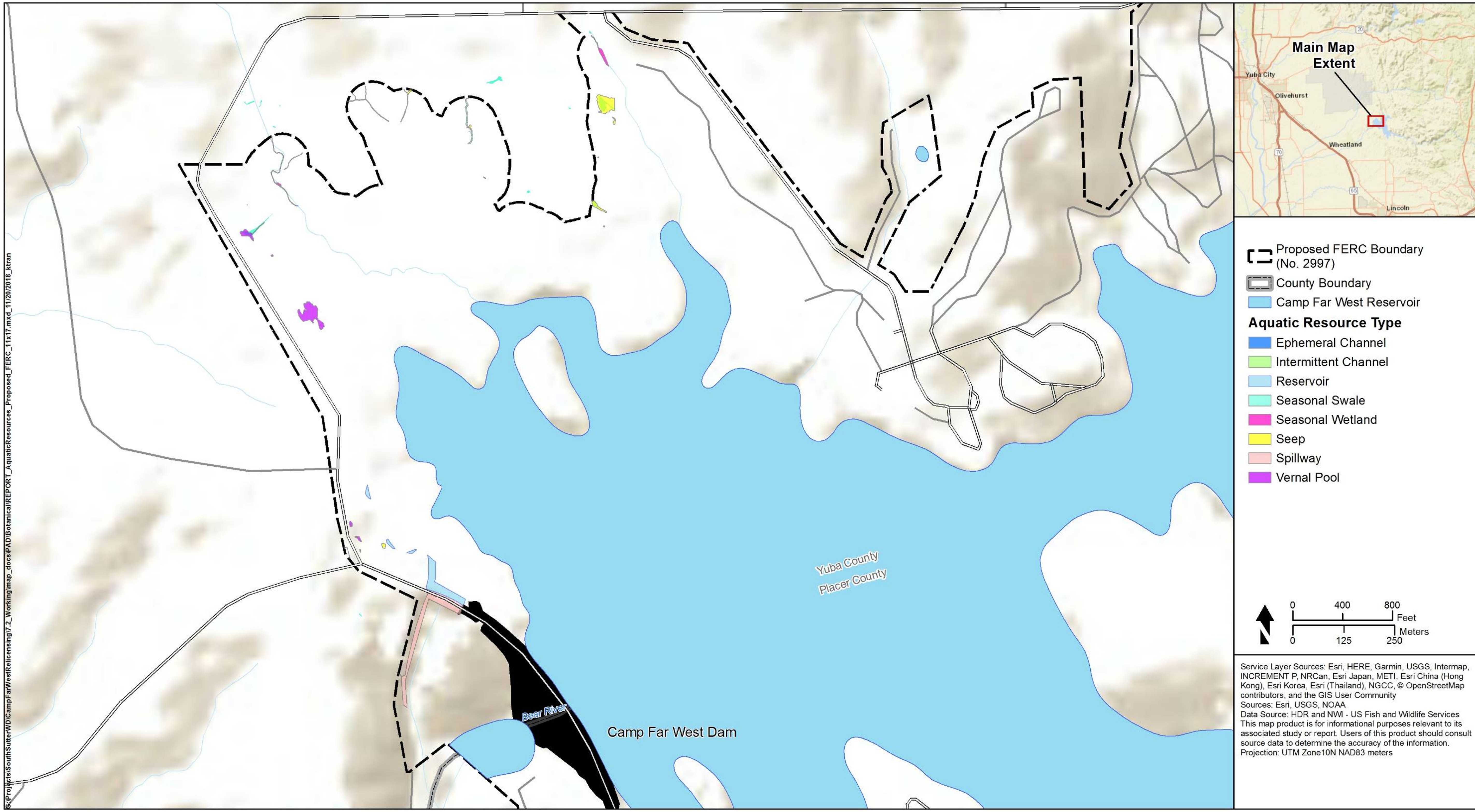

Figure 3.3.4-11. Aquatic resources located during 2018 delineation.

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Each of these features is described in detail below.

Ephemeral Channel

Ephemeral features have flowing water for only a short duration after precipitation in a normal year. The beds of ephemeral streams are located above the water table year round; therefore, groundwater is not a source of water for these features, and runoff from rainfall and snowmelt are the primary water sources. Given the short hydroperiod, the vegetation within the ephemeral channel in the survey area is characteristic of the surrounding grasslands. The ephemeral channel is a mix of scoured, unvegetated channel segments and segments characterized by herbaceous vegetation similar to the surrounding grasslands. There were 0.02-ac located during aquatic resources delineation, including 0.001-ac in the Proposed Project Boundary.

Intermittent Channel

Intermittent channels have flowing water during portions of the year when groundwater provides water for stream flow. Runoff from rainfall is a supplemental source of water for stream flows. During the dry months, these features typically do not have flowing water. The intermittent channel in the survey area is fed by a mix of an upstream, off-site impoundment and on-site seeps (groundwater). Like the ephemeral channel, some portions of the intermittent channel are scoured bare by water movement. Other portions of the channel support herbaceous vegetation such as seaside barley (*Hordeum marinum*), Carter's buttercup (*Ranunculus bonariensis*), and coyote thistle (*Eryngium* sp.). There were 0.09-ac located during aquatic resources delineation, including 0.056-ac in the Proposed Project Boundary.

Reservoir

Reservoir habitat in the survey area includes Camp Far West Reservoir, which is a wide and shallow man-made storage reservoir that is impounded by Camp Far West dam. At the time of surveys, the reservoir elevation was at full pool and was spilling. Camp Far West Reservoir's shoreline is predominantly bare soil or rock. Sparse willows and cottonwoods are scattered along the shoreline, while the groundcover consists of invasive weeds consistent with species found in annual grasslands. There were 0.80-ac located during aquatic resources delineation, all inside the Proposed Project Boundary.

Seasonal Swale

Seasonal swales in the survey area are defined as linear drainage features that fall somewhere between ephemeral channel and wetland. These linear features support hydrophytic vegetation similar to that found in vernal pools and seep features in the survey area. Most of the swales are adjacent to and associated with the drainage of other aquatic features in the survey area. There were 0.37-ac located during aquatic resources delineation, including 0.183-ac inside the Proposed Project Boundary.

Seasonal Wetland

Seasonal wetlands in the survey area are features located adjacent to linear channels or the reservoir, and function as a floodplain. Hydrologically, seasonal wetlands in the survey area differ from vernal pools and seeps (described below) because seasonal wetlands are dependent on adjacent features. Vegetatively, seasonal wetlands are similar to other wetland features, with the exception of the wetland bordering the northern portion of the reservoir, which is covered in a dense layer of woody debris and does not support plant cover. There were 0.09-ac located during aquatic resources delineation, including 0.088-ac inside the Proposed Project Boundary.

Seep

Seeps differ from vernal pools in the survey area by having different topography, water source, and vegetation. For example, seeps in the survey area are located on slopes and are not depressional like vernal pools. Because of this, the hydrology of seeps is not driven by surface water flow from rainwater. Instead, the seeps are fed solely by groundwater. Plant species associated with seeps are slightly different from vernal pools and include rush (*Juncus* spp.), spike rush (*Eleocharis macrostachya*), rabbit's-foot grass (*Polypogon monspeliensis*), seep monkey flower (*Mimulus guttatus*), dallis grass (*Paspalum dilatatum*), and dock (*Rumex* spp.). There were 0.93-ac located during aquatic resources delineation, including 0.486-ac inside the Proposed Project Boundary.

Spillway

This feature is characterized by the rock spillway associated with the existing dam. The area is devoid of vegetation, has sheer rock slopes on either side, and experiences perennial flows contingent on the release volumes from the reservoir. There were 1.144 ac located during aquatic resources delineation, all inside the Proposed Project Boundary.

Vernal Pool

Vernal pools are areas that are ephemerally wet as a result of the accumulation of surface water flow from rainwater in depressional areas. Several vernal pools are scattered throughout the grassland portions of the survey area, as well as along the edges of roads and the reservoir. These features are dominated by low-growing hydrophytic vegetation and seasonal hydrology. Species observed during surveys include seaside barley, annual hairgrass (*Deschampsia danthonioides*), Italian ryegrass, spike rush, Carter's buttercup, watercress (*Nasturtium officianale*), coyote thistle, and fiddle dock (*Rumex pulcher*). There were 0.95-ac located during aquatic resources delineation, including 0.590-ac inside the Proposed Project Boundary. Discussion of ESA-listed species that live in vernal pools is included in Section 3.3.5.

3.3.4.3.3 Wetlands Downstream of Camp Far West Dam

The NWI identified the following 12 wetland classes on the Bear River downstream of Camp Far West Reservoir to the confluence of the Feather River: L1UBK, PUBK, PABFx, PEM1A, PFOA, PFO1A, PSS1A, PSS/EM1C, R2UBH, R5UBF, R2USA, and R2USC (USFWS 2018b).

Two of these wetland classes (L1UBK and PUBK) were also found within the proposed FERC Project Boundary. Table 3.3.4-12 includes a definition of each additional class of wetland found along the Bear River. Figures 3.3.4-12 and 3.3.4-13, contain maps showing NWI-mapped wetlands, riparian, and littoral habitats within the Bear River from Camp Far West Dam to the Feather River confluence.

Table 3.3.4-12. NWI palustrine, riverine, and lacustrine wetland classes found along the Bear River from Camp Far West Dam to the Feather River.

Type	Definition	Area (acres)
Palustrine Unconsolidated Bottom		
PUBF	Palustrine, unconsolidated bottom, semi-permanently flooded	0.13
Lacustrine Unconsolidated Bottom		
L1UBK	Lacustrine limnetic, unconsolidated bottom, artificially flooded	1,254.25
Palustrine Emergent		
PEM1/USC	Palustrine, emergent, persistent/ unconsolidated shore, seasonally flooded	11.8
PEM1A	Palustrine, emergent, persistent, temporary flooded	16.8
Palustrine Forested		
PFOA	Palustrine, forested, temporary flooded	6.64
PFOC	Palustrine, forested, seasonally flooded	12.97
PFO1A	Palustrine, broad-leafed deciduous forested, temporary flooded	164.73
PFO1C	Palustrine, forested, broad-leaved deciduous, seasonally flooded	106.14
Palustrine Scrub-Shrub		
PSSA	Palustrine, scrub-shrub, temporarily flooded	0.36
PSSC	Palustrine, scrub-shrub, seasonally flooded	0.63
PSS1A	Palustrine, scrub-shrub, broad-leafed deciduous, temporary flooded	34.26
PSS1C	Palustrine, scrub-shrub, broad-leaved deciduous, seasonally flooded	8.47
PSS/EM1C	Palustrine, scrub-shrub, emergent, persistent, seasonally flooded	84.92
Riverine Unconsolidated Bottom		
R2AB3Hx	Riverine, lower perennial, aquatic bed, rooted vascular, permanently flooded, excavated	1.14
R2UBH	Riverine, lower perennial, unconsolidated bottom, permanently flooded	58.37
R2UBHx	Riverine, lower perennial, unconsolidated bottom, permanently flooded, excavated	17.98
R3UBH	Riverine, upper perennial, unconsolidated bottom, permanently flooded	88.84
R2UBF	Riverine, lower perennial, unconsolidated bottom, semi-permanently flooded	20.18
R5UBF	Riverine, unknown perennial, unconsolidated bottom, semi-permanently flooded	5.13
Riverine Unconsolidated Shore		
R2USA	Riverine, lower perennial, unconsolidated shore, temporary flooded	16.57
R2USC	Riverine, lower perennial, unconsolidated shore, seasonally flooded	38.24
R4SBC	Riverine, intermittent, streambed, seasonally flooded	0.19
	Total:	**1,948.74**

Source: USFWS 2018b

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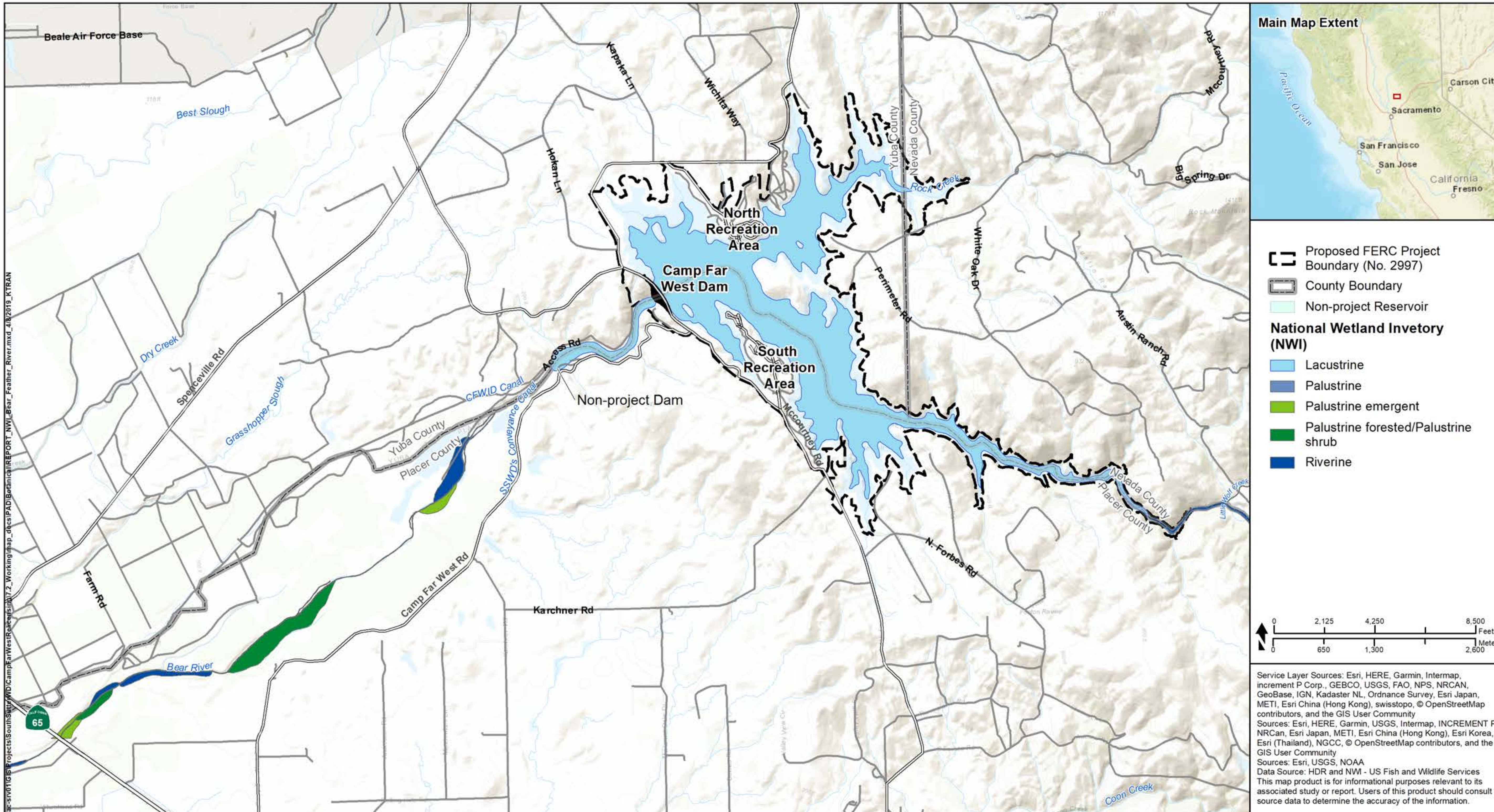

Figure 3.3.4-12. NWI-mapped wetlands, riparian, and littoral habitats within the Bear River from Camp Far West Dam to the Feather River confluence

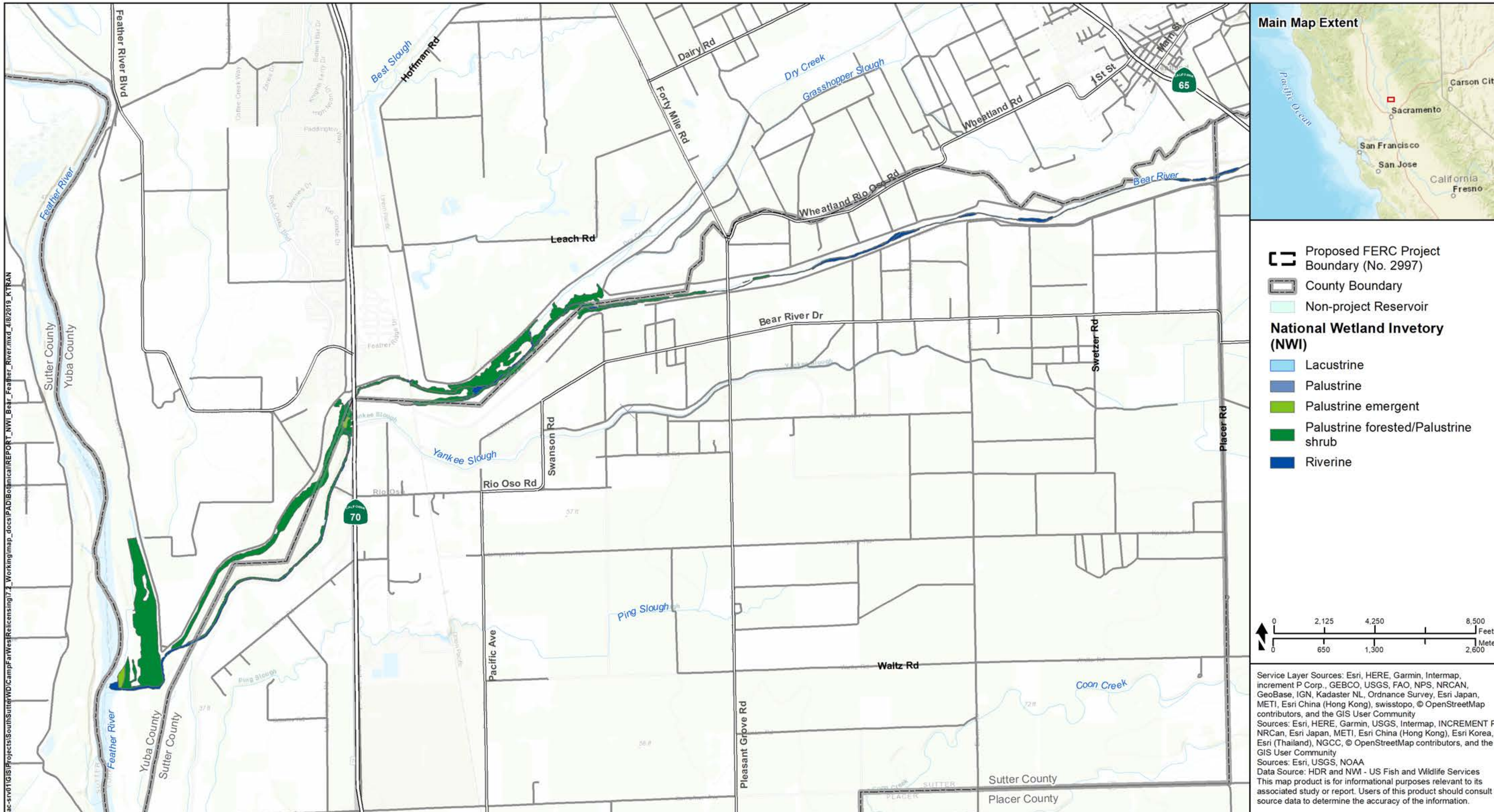

Figure 3.3.4-13. NWI-mapped wetlands, riparian, and littoral habitats within the Bear River from Camp Far West Dam to the Feather River confluence.

3.3.4.3.4 Riparian Habitat Within the Camp Far West Reservoir

The term "riparian" applies to the vegetation and other biological resources *"…contiguous to and affected by surface and subsurface hydrologic features of perennial or intermittent lotic [rivers, streams, or drainage ways] and lentic [lakes] water bodies..."* (USFWS 1997). Although the term has traditionally been applied only to lotic systems, in the western U.S. "riparian" is also used to describe the distinctive vegetation associated with the moister conditions around lentic reservoirs. Wetlands and riparian areas may overlap (e.g., riparian wetlands), but not all riparian areas are wetlands and not all wetlands are riparian areas.

No riparian habitat was identified in the proposed FERC Project Boundary in the NWI (USFWS 2018b). A 2013 wetland delineation of Camp Far West identified riparian vegetation only on Rock Creek, upstream of the reservoir, where it would not be affected by water fluctuations. Vegetation in that area included white alder, California button willow (*Cephalanthus occidentalis*), Himalayan blackberry, and torrent sedge (*Carex nudata*). The area of the Bear River was specifically noted as having little to no riparian vegetation (Sycamore Associates 2013b).

3.3.4.3.5 Riparian Habitat in the Bear River Downstream of the Project

As part of the instream flow study (Study 3.3 *Instream Flow Study*), HDR biologists created a riparian vegetation map in April 2018 at the two study sites that were selected along the lower Bear River (Figures 3.3.4-14 and 3.3.4-15). The limits of the mapping were set to approximately 50 ft outside of the instream flow markers and between the levee banks. For the purposes of this section, this creates a downstream and an upstream vegetation study area

Vegetation was mapped in the field on an aerial photograph at a scale of 1 in. equals 250 ft (1″=250′). Where vegetation overlaps another type of mapping unit (e.g., a tree canopy over water or roads), the area was mapped according to the uppermost layer of vegetation. A minimum mapping unit of 0.01-ac was used when differentiating vegetation types. For each vegetation type observed in the field, species composition and percent cover were recorded on vegetation mapping data forms. Nomenclature of vegetation types generally followed that of the Manual of California Vegetation (Manual) (Sawyer et al. 2009). When a vegetation type was recorded that did not easily conform to a described vegetation type, a new name was created conforming to the general format of the Manual. The associated field data are provided in Appendix E1.

The vegetation mapping represents a snapshot of the riparian vegetation at two sites along the Bear River. Table 3.3.4-13 depicts the vegetation types mapped, whether they are dominated by native or non-native vegetation, and whether or not it is a riparian vegetation type.

Table 3.3.4-13. Vegetation types, origin, and riparian status in the relicensing Special-Status Plants and Non-Native Invasive Plants Study area.

Vegetation Type	Vegetation Origin	Riparian Status
Agriculture	Non-Native	Not Riparian
Annual Brome Grasslands	Non-Native	Not Riparian
Arroyo Willow Thicket/Himalayan Blackberry Thicket	Native	Riparian

Table 3.3.4-13. (continued)

Vegetation Type	Vegetation Origin	Riparian Status
Bare Ground	N/A	Sometimes Riparian
Bermudagrass Thicket	Non-Native	Sometimes Riparian
Cobble Plain	N/A	Sometimes Riparian
Disturbed Coyote Bush Scrub	Native	Not Riparian
Disturbed Deer Grass Beds	Native	Riparian
Disturbed Hind's Walnut Stand	Native	Sometimes Riparian
Fremont Cottonwood-Boxelder Forest	Native	Riparian
Fremont Cottonwood Forest/Himalayan Blackberry Thicket	Native	Riparian
Giant Reed Thicket	Non-Native	Riparian
Himalayan Blackberry Thicket	Non-Native	Sometimes Riparian
Non-Native Woodland	Non-Native	Not Riparian
Open Water	N/A	Riparian
Partially Vegetated Channel	Native	Riparian
Ruderal Thicket	Non-Native	Sometimes Riparian
Sandbar Willow Thicket	Native	Riparian
Sandbar Willow Thicket (Mature Variant)	Native	Riparian
Valley Oak-Interior Live Oak Woodland	Native	Sometimes Riparian
Valley Oak-Interior Live Oak Woodland (Young Variant)	Native	Sometimes Riparian
Total	**21**	

One special-status plant species, Northern California black walnut (*Juglans hindsii*), a California Rare Plant Rank (CRPR) 1B.1 species, was observed primarily within an instream island surrounded by giant reed (*Arundo donax*) in the western vegetation study area. The walnuts were at sufficient cover to form their own vegetation type, called Disturbed Hind's Walnut Stand per the nomenclature of the Manual (Figures 3.3.4-14 and 3.3.4-15). The total number of individuals observed in this area was six. Approximately 10 to 15 additional Northern California black walnuts were observed mixed within the Valley Oak-Interior Live Oak Woodland on the southern bank of both vegetation study areas. No other special status plant species were observed during the surveys. Four NNIP species were observed, including; Bermudagrass, bull thistle (*Cirsium vulgare*), Italian thistle, and yellow starthistle.

Figure 3.3.4-14. Riparian VegCamp Vegetation Classification Map (downstream site).

Figure 3.3.4-15. Riparian VegCamp Vegetation Classification Map (upstream site).

3.3.4.3.6 Littoral Habitat

In Lacustrine or lake systems, the littoral habitat corresponds to the shallow water area beginning at the lowest depth at which rooted aquatic plants can occur, regardless of whether plants are present. Cowardin et al. (1979) describes the littoral zone as the wetland habitats which extend to a depth of 6.6 ft below the low water line. Submerged bars, beaches, and flats are examples of littoral habitats. Emergent wetlands along the shallow edges of lakes are technically littoral, but are classified in the NWI system as Palustrine.

As stated above, 11 emergent wetlands on the reservoir margin were identified during wetland delineation. These are influenced by groundwater and dry season hydrology inputs, with some surface water dependency. Sedges, creeping spikerush, small mannagrass, rushes, and pennyroyal were the most common vegetation at these sites. Indicators for hydric soils were located at the emergent wetlands (Sycamore Associates 2013b).

3.3.4.4 Environmental Effects

This section discusses the potential terrestrial resources effects of SSWD's Proposed Project, as described in Section 2.2 of this Exhibit E. As part of the Project relicensing, SSWD proposes a Pool Raise, modifications of existing recreation facilities, and modification of the existing Project boundary. SSWD proposes to include in the new license two measures related to terrestrial resources. Measure TR1 includes a *Bald Eagle Management Plan*, being developed in collaboration with CDFW and USFWS. Measure TR2 includes a Limited Operating Period (LOP) and buffer to reduce disturbance to great blue heron rookeries.

3.3.4.4.1 Effects of Construction-Related Activities

Recreation Construction

The recreation construction would occur in already developed areas and may affect wildlife by way of temporary disturbance. No habitat would be modified. The known bald eagle nesting sites are not in the construction areas. Per measure TR2, a LOP would be in place within a 500ft buffer of great blue heron rookeries to mitigate for any potential impacts. Direct effects to special-status birds could result from disturbances that disrupt breeding birds or cause nest abandonment. Indirect effects could result from the reduction of perching, foraging, and potential nesting habitat.

Many of the recreation buildings have openings that bats can access to roost, though none were observed in 2015. However, if bats are roosting in the recreation buildings, their reconstruction would impact them. Prior to SSWD reconstructing a Project recreation facility a qualified biologist would inspect the facility for bats. If bats are found to be present, reconstruction would be held until bats are clear from the structure, per the California Code of Regulations (251.1).

Pool Raise

Some 161.24 ac will be inundated by the Pool Raise, as detailed in Table 3.3.4-14.

Table 3.3.4-14. Acreages of VegCAMP habitat inundated by Pool Raise.

Vegetation Type	Sensitive Natural Community	Area To Be Covered by Water (acres)
Aesculus californica	Y	0.36
Built-up and Urban Disturbance	N	1.07
California Annual and Perennial Grassland	N	42.74
Californian Warm Temperate Marsh/Seep Group	Y	0.61
Irrigated Pasture Lands	N	2.70
Mediterranean California naturalized annual and perennial grassland	N	11.00
Perennial Stream Channel	N	0.06
Pinus sabiniana	N	0.62
Populus fremontii	Y	0.18
Quercus douglasii	N	60.04
Quercus lobata	Y	0.36
Quercus wislizeni	N	15.93
Reservoirs	N	24.58
Salix laevigata	Y	0.99
	Total	**161.24**

Five of the vegetation types that will be partially inundated are Sensitive Natural Communities - *Aesculus californica*, California Warm Temperate Marsh/Seep Group, *Populus fremontii*, *Quercus lobata*, and *Salix laevigata*. Of these, all but *Quercus lobata*, are riparian or wetland/marsh habitat types, which may shift uphill with the change in water level. However, the *Aesculus californica* and *Quercus lobata*'s inundated area would likely result in the permanent loss of this bit of habitat. A total of 0.36-ac of the 1.42 ac of *Aesculus californica* will be inundated, representing a loss of 25 percent of the vegetation type within the Proposed Project Boundary. There are 2.99 ac of *Quercus lobata* within the Proposed Project Boundary and a loss of 0.36-ac would represent 12 percent of that total. However, the loss of 0.36 ac of this VegCAMP type represents a *de minimus* amount of the overall acreage within California, so it would not be a significant effect.

The Brandegee's clarkia occurrences are above the raise and impacts to hydrology, but the Sierra foothills brodiaea will at least be seasonally inundated, potentially leading to the loss of this occurrence. The seep identified containing Mexican mosquito fern will be covered by the rising reservoir, and the occurrence may be lost as its habitat includes ponds, but not larger reservoirs or lakes. However, both of these occurrences are small and the species are rated as Watchlist, either moderately or not very threatened in California, so they will not represent a significant effect on the species. None of the special-status populations are in the recreation areas, so recreation construction will not affect special-status plants.

Some occurrences of NNIP may also be inundated and drown due to the Pool Raise, but seeds from NNIP occurrences, along with pieces from species that spread vegetatively, may also be carried to new areas of the Project shoreline by the higher waterline. Additionally, there are hundreds of NNIP occurrences in the recreation areas, and construction there could spread NNIP both on and off the Project. Adherence to the conditions in the necessary permits for this construction work would minimize the spread of NNIP.

Raising the NMWSE of the Camp Far West Reservoir would have a less than significant effect on wildlife resources, since the inundation area will be relatively small (a total of 161.24 ac), and effects on habitat overall will be minimal. Minor and localized reductions in the various habitat types bordering the reservoir could occur. These changes could affect individuals, but would not be expected to reduce the capability of the remaining habitat to support wildlife over the long-term. Inundation associated with raising the reservoir elevation could cause individuals to leave the immediate area; however, similar habitats types located adjacent to the inundation area are abundant, thus, these effects would be localized and would not preclude wildlife from using the Project area. Additionally, individual animals that could be displaced during inundation should continue to use habitats along the new reservoir margins.

Raising the NMWSE of the Camp Far West Reservoir would result in the extended inundation along the shoreline of the reservoir that are only seasonally or never inundated under current conditions. In the area being inundated, 3.3 ac support herbaceous wetland, 0.2-ac support scrub-shrub wetland, and 1.53 ac support tree dominated riparian habitat. A total of 28 NWI mapped riverine features, comprising 6.44 ac, will be converted into lacustrine features by the Pool Raise. These NWI mapped features occur throughout the proposed FERC Project Boundary in narrow riparian crevices, particularly at the south eastern corner of the proposed FERC Project Boundary (Figure 3.3.4-10).

All of the wetlands mapped in 2018 occur at the north-west corner of the proposed FERC Project Boundary directly west of the North Recreation Area (Figure 3.3.4-10). A total of 14 of these wetlands, totaling 0.19-ac, will be inundated by the Pool Raise. These features are composed of the following components: 1 intermittent channel (0.04-ac); 5 seasonal swales (0.06-ac); 2 seasonal wetlands (0.03-ac) and 6 seeps (0.06-ac).

Some of the shallower inundated areas may continue to support or develop herbaceous or scrub-shrub wetland vegetation after raising the normal maximum surface elevation of the reservoir. Fringe riparian scrub may also develop along the new waterline; therefore, any loss of wetlands and riparian habitat may be temporary. The increase in the water elevation may enable herbaceous wetland vegetation to dominate on benches that currently support upland species. There are no wetland or riparian resources in the area of recreation construction.

SSWD will obtain all necessary permits and approvals for the proposed changes to the NMWSE of the Camp Far West Reservoir, including FERC’s approval. Adherence to the terms and conditions of these construction-related permits and approvals would provide protection and mitigation for terrestrial resources.

3.3.4.4.2 Effects of Proposed Project Operations and Maintenance

SSWD routinely clears vegetation in the immediate vicinity of Project structures, including the powerhouse, recreation areas, and Project access roads. Clearing is performed by mechanical and hand means (e.g., chain saws), and occurs only in those areas needed by SSWD to maintain the structure. SSWD also applies herbicides on an annual basis at Project Facilities supervised by a Qualified Applicator with direction of a licensed PCA. SSWD does not use ground-disturbing equipment for vegetation clearing. SSWD also removes hazard trees are necessary on the Project.

SSWD restricts vegetation management to areas where it is mandated by law and/or necessary to maintain facilities. Although the majority of vegetation is cleared from these locations, the total area affected represents a small portion of the overall Project.

No Project facilities are located in or around sensitive vegetation associations; the majority of managed vegetation is comprised of common plant communities and only a small proportion of their acreage is affected. SSWD will continue the current vegetation management efforts throughout the life of the Project, however, the effects are minor (less than significant) and site-specific.

The occurrences of special-status plants are along the riverine area (Bear River arm) of the reservoir and in seeps near the reservoir edge. All are outside of areas with Project O&M, though occasional recreation may occur in the general area. However, there were no signs of disturbance at the occurrences, including from dispersed recreation.

NNIP occurrences are widespread throughout the FERC Project Boundary and areas adjacent to the FERC Project Boundary also appear to have similar concentrations of NNIP. Project O&M in the area of NNIP occurrences includes mowing in the recreation areas around campsites, herbicide application on the dam face, and maintenance of Project roads. The other Project activity in the areas of NNIP occurrences is recreation, which is year-round at the NSRA and at dispersed sites around the reservoir and seasonal at the SSRA. The Project and associated O&M can promote the spread of NNIP, and the potential for NNIP to be spread into new areas both inside and outside of the Project. NNIP can be transported during Project activities, including into non-infested areas, on equipment, tires, and clothing. Areas that have been disturbed by Project activities are also easier for NNIP to invade than undisturbed areas. However, as described above, most Project activities that have the potential to spread NNIP are confined to areas around already developed Project facilities and in a narrow band around the reservoir where dispersed recreation occurs. Additionally, the Project and surrounding areas are already significantly disturbed by human activities and heavily invaded by non-native plant species. Therefore, Project activity effects are not significant in and of themselves, but could be potentially significant when combined with other reasonably foreseeable projects or activities that overlap or are adjacent to the Project area and the effects of other public and private projects in the Project vicinity. SSWD will utilize Best Management Practices (BMP) for Project O&M to prevent the introduction and spread of NNIP and managing the most invasive species.

Project O&M has the potential to impact special-status wildlife by way of temporary disturbance and modification of habitat. Project O&M is kept to already developed areas, including the Powerhouse, roads, and recreation areas, and the work is done by hand and small mechanical implements, which limits the amount of disturbance to special-status wildlife. If any vegetation management requires removal of vegetation during nesting bird season, SSWD will conduct surveys and erect buffers to prevent impacts to nesting birds. Three osprey nests, two bald eagle nests and one heron rookery were observed during relicensing studies on the Project. Project effects on bald eagles will be reduced to less than significant through the implementation of the *Bald Eagle Management Plan* (TR1). As part of the plan, SSWD will implement a LOP for each occupied nest and will install water and land barriers and appropriate signage around known active bald eagle nests in order to delineate a buffer for the LOP. The buffer will also serve to restrict recreation activities in the vicinity of the nests.

A great blue heron rookery is known at SSRA and could be impacted by recreation activities in the area. Measure TR2 will implement a *Limited Operating Period for Great Blue Heron Rookeries* at this location between March 15 and July 31 of every year where the rookery is active. Water and land barriers, with appropriate signage, will be erected around the rookery to provide a buffer of 500 feet for the nesting herons. This buffer should be sufficient to protect nests from impacts from the infrequent recreation use (the area is only open on some weekends) at SSRA. The buffer will not extend beyond the proposed FERC Project Boundary, though signage will be placed along it, so McCourtney Road will remain open.

The proposed measures include changes to water year types (WR1), minimum instream flows (AR1), pulse flows (AR2), and ramping rates (AR3) all of which effect the Bear River downstream of the Project. The proposed changes to Project operations are not anticipated to change vegetation communities downstream. As the communities will remain similar or the same as currently occur, wildlife would be expected to continue to utilize that habitat in the same fashion.

The wetland resources associated with the Project have developed under the current conditions and were generally found to be stable. There was no observed evidence of any ongoing adverse effects to wetland resources due to Project operations. The wetlands associated with the Camp Far West Reservoir, and the downstream reach of the Bear River below the Camp Far West Dam were found to be healthy, and appeared to be in a state of equilibrium with the existing frequency, duration, and magnitude of inundation. The species richness and diversity of all wetland types observed in the study area generally reflect natural community expectations for this area. There are neither excessive nor insufficient water levels in the Camp Far West Reservoir or the downstream reach of the Bear River below Camp Far West Dam for a duration to cause any significant impact to the structure, composition, or function of the wetland communities that have developed within the study area.

SSWD identified potential stressors, which may or may not be Project induced, to the riparian habitat in Project affected reaches as NNIPs, changes in substrates from altered sediment, changes in flow timing and duration between With- and Without-Project flows, and reduced LWM recruitment. The potential effects of NNIPs are addressed below.

Changes in substrates, due to an altered sediment supply, have the potential to significantly affect the germination and distribution of riparian species due to the capillary fringe potential associated with various substrates. Capillary fringe is a zone immediately above the water table in which water is drawn upward into soil pores by forces of adhesion and surface tension. Finely textured soils tend to have greater capillary potential than coarser sands due to a wicking action that allows plant roots to use water in the soil above the ground-water depth. Capillary action is a key factor in supporting germination, as it allows plants access to water in the soils even as the water table drops (rootfollow) (Naiman et al. 2005). Larger substrates, such as cobble, boulder and bedrock, may not provide capillary action due to a reduced attraction between the substrate particles and the water molecules (Raven et al. 2005). According to literature sources, several woody riparian species found in the Project area are adapted to fine, medium and coarse soil textures rather than larger particles, such as gravels and cobbles. Changes in fine sediment input in Project-affected reaches downstream of the Camp Far West Reservoir, changes in substrate size, and effects from historical disturbances in the Bear River downstream of the Camp Far West Dam may affect the vegetative spread of Hind's willow, which is the dominant woody riparian species along the downstream water margin. No changes of sediment transport due to the Proposed Project are expected.

Changes in flow timing and inundation duration between With- and Without-Project flows may alter the distribution or abundance of woody riparian vegetation. The magnitude and frequency, and the seasonal and inter-annual timing of flows are important determinants in composition, turnover, and ecological functioning of riparian areas. The magnitude of flow can determine where seeds are distributed laterally in the channel. Some woody riparian vegetation, such as cottonwood seedlings, must be located within the floodprone zone close enough to the channel so that roots can reach ground water or capillary fringe during the growing season but enough above the base flow level in order to avoid being scoured out during high flows. The timing of peak flows may be critical to distribute riparian seeds as they are dispersed from the parent plants, so that they may be deposited in nursery sites adequate to support germination. Riparian vegetation is strongly influenced by prolonged periods of inundation, which create anoxic soil conditions and contribute to seed germination conditions. The duration and frequency of inundation influences lateral distribution of plant species in the channel, depending on a plant's anaerobic or drought tolerance and germination adaptations.

However, the riparian habitats within the Project-affected reaches appear healthy, based on the distribution of plants in the channel, the richness and vigor of the plants, and the full suite of age classes of woody riparian vegetation (i.e., indicates that germination is continuing to occur). NNIPs are considered a potential threat to the riparian areas. There is not currently evidence of a reduced functioning of the riparian communities. The topographic sequence, or lateral stratification, in the channel is within expected parameters in Project-affected reaches, with willows and younger (shorter) trees nearer the wetted channel or accessed by lower flows. This indicates an availability of water, either through flows, groundwater availability, and/or capillary fringe which supports successful recruitment; but also indicates vegetation may be removed by peak flow events. Willows have short rooting depths, and germinating seedlings need shallow root access to water; willows and younger trees were found near the low-flow wetted edge of most Project-affected reaches. More mature (taller) trees, as well as a greater abundance of cottonwoods, were observed in areas accessed by higher flows, generally farther from the wetted channel. Seedlings germinate in these areas following higher flows (Mahoney and Rood 1998) and grow to maturity without being scoured out of the channel, while still accessing water using deep root systems. In the Bear River downstream of the Camp Far West Dam, white alder and box elder provided canopy cover in the mid-ranges of flows, with rooting depths intermediate between willows and cottonwoods. There are no proposed changes to flow that would be anticipated to have a negative impact on the riparian communities.

3.3.4.5 Unavoidable Adverse Effects

The Proposed Project would have both short-term and long-term minor unavoidable impacts on terrestrial resources. However, none of these effects would be considered adverse to any of the resources.

The main effects to terrestrial resources would be from the Pool Raise, which will inundate an additional 5 ft above the NMWSE. One occurrence of a special-status plant species, Sierra foothills brodiaea, will most likely be drowned by the raise. Approximately 12.67 ac of NWI mapped riverine features will be converted into lacustrine feature by the Pool Raise, as well as one 0.004 ac wetland mapped in 2018. Additionally, 2.50 ac of Sensitive Natural Communities will be covered by water. Some spread of NNIP may also occur due to this Pool Raise.

Continued Project O&M and recreation use has the potential to contribute to the spread of NNIPs. However, many of these weeds are ubiquitous throughout the region, and Project activities would constitute a small piece of the vectors spreading NNIPs in the area.

Project O&M activities and recreation would have the potential to affect special-status wildlife species. However, these affects are considered to be minor. Additionally, two active bald eagle nests were found within the Proposed Project Boundary - on the Bear River Arm and on the Rock Creek Arm of the reservoir, east of the NSRA boat ramp. The continued use of the Bear River arm nest and the presence of a second nest suggests that the Project is a benefit to bald eagles by providing valuable nesting habitat and wintering habitat. Further, SSWD’s proposed Bald Eagle Management Plan would assure an additional level of protection.

Impacts to special-status wildlife resulting from Project O&M and construction would, in general, be short in duration and restricted to existing disturbed areas in recreation areas and near the existing spillway. Temporary impacts include noise and an increase in human presence. Implementation of SSWD’s proposed Bald Eagle Management Plan (TR1) and great blue heron rookery limited operating period (TR2) would reduce the effects of construction.

3.3.4.6 List of Attachments

Attachment 3.3.4A	SSWD’s Complete Floristic List
Attachment 3.3.4B	Map of NNIP Occurrences
Attachment 3.3.4C	NNIP Data Table

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Attachment 3.3.4A

SSWD's Complete Floristic List

Species	Common Name	Native or NN or NNIP?	NSRA	SSRA	CFW Dam, Dikes, & Spillway	CFW Dam Powerhouse	Family
Achillea millefolium	thousand-leaved yarrow	Native		X	X	X	ASTERACEAE – SUNFLOWER FAMILY
Achyrachaena mollis	soft blow-wives	Native			X	X	ASTERACEAE – SUNFLOWER FAMILY
Aegilops triuncialis*	barbed goat grass	NNIP (High)	X				POACEAE – GRASS FAMILY
Aesculus californica	California buckeye	Native		X	X	X	SAPINDACEAE – SOAPBERRY FAMILY
Aira caryophyllea*	silver hair grass	NN	X	X			POACEAE – GRASS FAMILY
Alisma sp.	water plantain	Native		X			ALISMATACEAE – WATER–PLANTAIN FAMILY
Amsinckia intermedia	common fiddleneck	Native	X	X	X	X	BORAGINACEAE – BORAGE FAMILY
Amsinckia menziesii	common fiddleneck	Native		X			BORAGINACEAE – BORAGE FAMILY
Anthemis cotula*	mayweed	NN	X				ASTERACEAE – SUNFLOWER FAMILY
Artemisia douglasiana	mugwort	Native	X	X	X	X	ASTERACEAE – SUNFLOWER FAMILY
Avena barbata*	slender wild oat	NNIP (Moderate)	X	X	X	X	POACEAE – GRASS FAMILY
Avena fatua*	wild oat	NNIP (Moderate)	X	X	X	X	POACEAE – GRASS FAMILY
Baccharis pilularis ssp. consanguinea	coyote brush	Native	X	X	X	X	ASTERACEAE – SUNFLOWER FAMILY
Brassica nigra*	black mustard	NNIP (Moderate)		X	X	X	BRASSICACEAE – MUSTARD FAMILY
Brassica rapa*	field mustard	NNIP (Limited)			X	X	BRASSICACEAE – MUSTARD FAMILY
Briza maxima*	rattlesnake grass	NNIP (Limited)	X	X	X	X	POACEAE – GRASS FAMILY
Briza minor*	annual quaking grass	NN	X	X	X	X	POACEAE – GRASS FAMILY
Brodiaea elegans ssp. elegans	harvest brodiaea	Native		X			THEMIDACEAE – BRODIAEA FAMILY
Bromus diandrus*	ripgut grass	NNIP (Moderate)	X	X	X	X	POACEAE – GRASS FAMILY
Bromus hordeaceus*	soft chess	NNIP (Limited)	X	X	X	X	POACEAE – GRASS FAMILY
Bromus madritensis ssp. madritensis*	foxtail chess	NN	X	X	X	X	POACEAE – GRASS FAMILY
Bromus madritensis ssp. rubens*	red brome	NNIP (High)		X			POACEAE – GRASS FAMILY
Bromus sterilis*	poverty brome	NN		X			POACEAE – GRASS FAMILY
Calandrinia menziesii	red maids	Native	X	X			MONTIACEAE – MINER'S–LETTUCE FAMILY
Calochortus luteus	yellow mariposa-lily	Native	X	X	X		LILIACEAE – LILY FAMILY
Calystegia sp.	morning-glory	Native	X				CONVOLVULACEAE – MORNING–GLORY FAMILY
Canna sp.*	canna lily	NN	X				CANNABACEAE – HEMP FAMILY
Capsella bursa-pastoris*	shepherd's purse	NN	X				BRASSICACEAE – MUSTARD FAMILY
Cardamine oligosperma	few-flowered bitter-cress	Native	X				BRASSICACEAE – MUSTARD FAMILY
Carduus pycnocephalus ssp. pycnocephalus*	Italian thistle	NNIP (Moderate)	X	X	X	X	ASTERACEAE – SUNFLOWER FAMILY
Castilleja affinis ssp. affinis	related paintbrush	Native		X			OROBANCHACEAE – BROOM–RAPE FAMILY
Castilleja attenuata	valley tassels	Native			X	X	OROBANCHACEAE – BROOM–RAPE FAMILY
Castilleja campestris ssp. campestris	field paintbrush	Native	X				OROBANCHACEAE – BROOM–RAPE FAMILY
Castilleja lineariloba	linear-lobed paintbrush	Native	X	X			OROBANCHACEAE – BROOM–RAPE FAMILY
Ceanothus cuneatus var. cuneatus	buckbrush	Native	X	X	X		RHAMNACEAE – BUCKTHORN FAMILY
Centaurea melitensis*	Maltese star-thistle	NNIP (Moderate)	X	X			ASTERACEAE – SUNFLOWER FAMILY
Centaurea solstitialis*	yellow star-thistle	NNIP (High)	X	X	X	X	ASTERACEAE – SUNFLOWER FAMILY
Cephalanthus occidentalis	California button willow	Native	X	X			RUBIACEAE – COFFEE FAMILY
Cerastium glomeratum*	sticky mouse-ear chickweed	NN		X	X	X	CARYOPHYLLACEAE – PINK FAMILY
Chlorogalum pomeridianum var. pomeridianum	afternoon soap plant	Native	X	X			AGAVACEAE – AGAVE FAMILY
Chondrilla juncea*	skeleton weed	NN	X	X			ASTERACEAE – SUNFLOWER FAMILY
Cichorium intybus*	chicory	NN		X			ASTERACEAE – SUNFLOWER FAMILY
Cicuta maculata var. angustifolia	narrow-leaved spotted water-hemlock	Native	X				APIACEAE – CARROT FAMILY
Clarkia purpurea ssp. quadrivulnera	four-spot purple clarkia	Native		X			ONAGRACEAE – EVENING PRIMROSE FAMILY
Claytonia parviflora ssp. parviflora	small-flowered spring beauty	Native	X	X	X	X	MONTIACEAE – MINER'S–LETTUCE FAMILY

Species	Common Name	Native or NN or NNIP?	NSRA	SSRA	CFW Dam, Dikes, & Spillway	CFW Dam Powerhouse	Family
Claytonia perfoliata	miner's lettuce	Native	X	X			MONTIACEAE – MINER'S–LETTUCE FAMILY
Cordylanthus pilosus ssp. trifidus	tripartite hairy bird's-beak	Native	X	X			OROBANCHACEAE – BROOM–RAPE FAMILY
Cynodon dactylon*	bermuda grass	NNIP (Moderate)	X	X	X	X	POACEAE – GRASS FAMILY
Cynosurus echinatus*	bristly dogtail grass	NNIP (Moderate)	X	X			POACEAE – GRASS FAMILY
Cyperus eragrostis	lovegrass flatsedge	Native		X	X	X	CYPERACEAE – SEDGE FAMILY
Dactylis glomerata*	orchard grass	NNIP (Limited)		X			POACEAE – GRASS FAMILY
Daucus pusillus	small wild carrot	Native		X			APIACEAE – CARROT FAMILY
Delphinium variegatum ssp. variegatum	royal larkspur	Native	X				RANUNCULACEAE – BUTTERCUP FAMILY
Dichelostemma capitatum ssp. capitatum	blue dicks	Native	X				THEMIDACEAE – BRODIAEA FAMILY
Dichelostemma multiflorum	wild hyacinth	Native		X			THEMIDACEAE – BRODIAEA FAMILY
Dichelostemma volubile	twining brodiaea	Native	X	X			THEMIDACEAE – BRODIAEA FAMILY
Elymus caput-medusae*	medusa head	NNIP (High)	X	X	X	X	POACEAE – GRASS FAMILY
Erodium botrys*	long-beaked filaree	NN	X				GERANIACEAE – GERANIUM FAMILY
Erodium cicutarium*	redstem filaree	NNIP (Limited)	X	X	X	X	GERANIACEAE – GERANIUM FAMILY
Erodium moschatum*	greenstem filaree	NN		X			GERANIACEAE – GERANIUM FAMILY
Eryngium castrense	great valley coyote-thistle	Native		X			APIACEAE – CARROT FAMILY
Erythranthe guttata	red-dotted monkeyflower	Native	X	X	X	X	PHRYMACEAE – LOPSEED FAMILY
Eschscholzia lobbii	Lobb's poppy	Native	X	X			PAPAVERACEAE – POPPY FAMILY
Festuca myuros*	rattail sixweeks grass	NNIP (Moderate)	X	X	X		POACEAE – GRASS FAMILY
Festuca perennis*	rye grass	NNIP (Moderate)	X	X	X	X	POACEAE – GRASS FAMILY
Ficus carica*	edible fig	NNIP (Moderate)			X	X	MORACEAE – MULBERRY FAMILY
Foeniculum vulgare*	fennel	NNIP (High)		X	X	X	APIACEAE – CARROT FAMILY
Frangula californica ssp. tomentella	woolly haired California coffee berry	Native		X			RHAMNACEAE – BUCKTHORN FAMILY
Fraxinus latifolia	Oregon ash	Native		X			OLEACEAE – OLIVE FAMILY
Galium aparine	goose grass	Native		X	X		RUBIACEAE – COFFEE FAMILY
Galium divaricatum*	Lamarck's bedstraw	NN		X			RUBIACEAE – COFFEE FAMILY
Galium murale*	tiny bedstraw	NN		X			RUBIACEAE – COFFEE FAMILY
Galium parisiense*	wall bedstraw	NN	X				RUBIACEAE – COFFEE FAMILY
Geranium dissectum*	dissected geranium	NNIP (Limited)	X	X	X	X	GERANIACEAE – GERANIUM FAMILY
Geranium molle*	soft geranium	NN	X	X	X	X	GERANIACEAE – GERANIUM FAMILY
Gnaphalium palustre	marsh cudweed	Native	X				ASTERACEAE – SUNFLOWER FAMILY
Gratiola ebracteata	bractless hedge-hyssop	Native	X		X		PLANTAGINACEAE – PLANTAIN FAMILY
Grindelia camporum	field gumplant	Native	X				ASTERACEAE – SUNFLOWER FAMILY
Hirschfeldia incana*	shortpod mustard	NNIP (Moderate)		X			BRASSICACEAE – MUSTARD FAMILY
Hordeum marinum ssp. gussoneanum*	Mediterranean barley	NN	X	X			POACEAE – GRASS FAMILY
Hordeum murinum ssp. leporinum*	hare barley	NN	X	X			POACEAE – GRASS FAMILY
Hypericum perforatum ssp. perforatum*	Klamathweed	NN	X	X	X	X	HYPERICACEAE – ST JOHN'S WORT FAMILY
Hypochaeris glabra*	smooth cat's-ear	NNIP (Limited)		X	X	X	ASTERACEAE – SUNFLOWER FAMILY
Hypochaeris radicata*	rough cat's-ear	NNIP (Moderate)	X			X	ASTERACEAE – SUNFLOWER FAMILY
Iris hartwegii	Hartweg's iris	Native	X				IRIDACEAE – IRIS FAMILY
Juncus balticus ssp. ater	Baltic rush	Native		X	X	X	JUNCACEAE – RUSH FAMILY
Juncus bufonius var. occidentalis	western toad rush	Native	X				JUNCACEAE – RUSH FAMILY
Juncus capitatus*	dwarf rush	NN	X	X			JUNCACEAE – RUSH FAMILY
Juncus tenuis	poverty rush	Native	X	X	X		JUNCACEAE – RUSH FAMILY
Juncus xiphioides	iris-leaved rush	Native	X				JUNCACEAE – RUSH FAMILY

Species	Common Name	Native or NN or NNIP?	NSRA	SSRA	CFW Dam, Dikes, & Spillway	CFW Dam Powerhouse	Family
Lamium amplexicaule*	henbit	NN	X				LAMIACEAE – MINT FAMILY
Layia fremontii	Fremont's layia	Native	X	X			ASTERACEAE – SUNFLOWER FAMILY
Lemna sp.	duckweed	Native	X				ARACEAE – ARUM FAMILY
Leontodon saxatilis*	hairy hawkbit	NN			X	X	ASTERACEAE – SUNFLOWER FAMILY
Lepidium campestre*	field peppergrass	NN		X			BRASSICACEAE – MUSTARD FAMILY
Lepidium nitidum	shining peppergrass	Native	X	X			BRASSICACEAE – MUSTARD FAMILY
Leptosiphon bicolor	bi-colored leptosiphon	Native	X				POLEMONIACEAE – PHLOX FAMILY
Leptosiphon ciliatus	whisker brush	Native	X				POLEMONIACEAE – PHLOX FAMILY
Leptosiphon filipes	thread leptosiphon	Native	X				POLEMONIACEAE – PHLOX FAMILY
Linum bienne*	bi-annual flax	NN	X	X			LINACEAE – FLAX FAMILY
Lithophragma bolanderi	Bolander's woodland star	Native			X	X	SAXIFRAGACEAE – SAXIFRAGE FAMILY
Ludwigia peploides ssp. montevidensis*	montevidean false loosestrife	NN	X	X			ONAGRACEAE – EVENING PRIMROSE FAMILY
Lupinus bicolor	miniature lupine	Native	X	X	X	X	FABACEAE – LEGUME FAMILY
Lupinus nanus	little lupine	Native		X	X	X	FABACEAE – LEGUME FAMILY
Lysimachia arvensis*	scarlet pimpernel	NN	X	X	X	X	MYRSINACEAE – MYRSINE FAMILY
Madia exigua	small tarweed	Native			X	X	ASTERACEAE – SUNFLOWER FAMILY
Marrubium vulgare*	common horehound	NNIP (Limited)	X	X			LAMIACEAE – MINT FAMILY
Matricaria discoidea*	pineapple weed	Native	X	X	X		ASTERACEAE – SUNFLOWER FAMILY
Medicago arabica*	Arabian medick	NN		X			FABACEAE – LEGUME FAMILY
Medicago polymorpha*	variable burclover	NNIP (Limited)	X	X			FABACEAE – LEGUME FAMILY
Melilotus indicus*	indian sweetclover	NN			X	X	FABACEAE – LEGUME FAMILY
Mentha canadensis	Canadian cornmint	Native	X				LAMIACEAE – MINT FAMILY
Mentha pulegium*	pennyroyal	NNIP (Moderate)	X				LAMIACEAE – MINT FAMILY
Micropus californicus var. californicus	California cottontop	Native	X	X			ASTERACEAE – SUNFLOWER FAMILY
Microseris nutans	nodding microseris	Native	X				ASTERACEAE – SUNFLOWER FAMILY
Microsteris gracilis	slender microsteris	Native	X				POLEMONIACEAE – PHLOX FAMILY
Morus alba*	white mulberry	NN	X				MORACEAE – MULBERRY FAMILY
Nasturtium officinale	water cress	Native	X	X			BRASSICACEAE – MUSTARD FAMILY
Navarretia intertexta	intertwined navarretia	Native	X				POLEMONIACEAE – PHLOX FAMILY
Navarretia pubescens	downy navarretia	Native		X	X		POLEMONIACEAE – PHLOX FAMILY
Opuntia sp.	prickly-pear	NN			X		CACTACEAE – CACTUS FAMILY
Oxalis micrantha*	dwarf wood-sorrel	NN	X	X			OXALIDACEAE – OXALIS FAMILY
Parentucellia viscosa*	sticky parentucellia	NNIP (Limited)	X	X	X	X	OROBANCHACEAE – BROOM–RAPE FAMILY
Pellaea mucronata var. mucronata	bird's-foot fern	Native			X	X	PTERIDACEAE – BRAKE FAMILY
Pentagramma triangularis	goldback fern	Native	X	X	X	X	PTERIDACEAE – BRAKE FAMILY
Perideridia kelloggii	Kellogg's yampah	Native	X				APIACEAE – CARROT FAMILY
Petrorhagia dubia*	doubtful petrorhagia	NN	X	X	X	X	CARYOPHYLLACEAE – PINK FAMILY
Pinus sabiniana	ghost pine	Native	X	X	X	X	PINACEAE – PINE FAMILY
Plagiobothrys fulvus var. campestris	field popcornflower	Native	X				BORAGINACEAE – BORAGE FAMILY
Plagiobothrys greenei	Greene's spiny-nut popcornflower	Native			X	X	BORAGINACEAE – BORAGE FAMILY
Plagiobothrys nothofulvus	rusty popcornflower	Native	X	X	X	X	BORAGINACEAE – BORAGE FAMILY
Plagiobothrys stipitatus var. micranthus	small-flowered great valley popcornflower	Native		X			BORAGINACEAE – BORAGE FAMILY
Plagiobothrys tenellus	Pacific popcornflower	Native			X	X	BORAGINACEAE – BORAGE FAMILY
Plantago coronopus*	cleft-leaved plantain	NN	X	X			PLANTAGINACEAE – PLANTAIN FAMILY
Plantago erecta	erect plantain	Native	X	X			PLANTAGINACEAE – PLANTAIN FAMILY

Species	Common Name	Native or NN or NNIP?	NSRA	SSRA	CFW Dam, Dikes, & Spillway	CFW Dam Powerhouse	Family
Plantago lanceolata*	English plantain	NNIP (Limited)	X	X	X		PLANTAGINACEAE – PLANTAIN FAMILY
Plantago major*	common plantain	NN	X		X	X	PLANTAGINACEAE – PLANTAIN FAMILY
Poa bulbosa*	bulbous blue grass	NN	X				POACEAE – GRASS FAMILY
Polypogon interruptus*	ditch beard grass	NN			X		POACEAE – GRASS FAMILY
Populus fremontii ssp. fremontii	fremont cottonwood	Native	X	X			SALICACEAE – WILLOW FAMILY
Portulaca oleracea*	purslane	NN	X	X			PORTULACACEAE – PURSLANE FAMILY
Potamogeton diversifolius	diverse-leaved pondweed	Native		X			POTAMOGETONACEAE – PONDWEED FAMILY
Psilocarphus brevissimus var. brevissimus	dwarf woolly-marbles	Native		X			ASTERACEAE – SUNFLOWER FAMILY
Quercus douglasii	blue oak	Native	X	X	X	X	FAGACEAE – OAK FAMILY
Quercus lobata	valley oak	Native	X	X	X	X	FAGACEAE – OAK FAMILY
Quercus wislizeni var. wislizeni	interior live oak	Native	X	X	X	X	FAGACEAE – OAK FAMILY
Ranunculus aquatilis var. aquatilis	water buttercup	Native	X		X	X	RANUNCULACEAE – BUTTERCUP FAMILY
Ranunculus hebecarpus	pubescent-fruited buttercup	Native		X			RANUNCULACEAE – BUTTERCUP FAMILY
Ranunculus muricatus*	sharp-point buttercup	NN	X	X	X	X	RANUNCULACEAE – BUTTERCUP FAMILY
Ranunculus occidentalis var. occidentalis	western buttercup	Native	X				RANUNCULACEAE – BUTTERCUP FAMILY
Raphanus raphanistrum*	jointed charlock	NN			X	X	BRASSICACEAE – MUSTARD FAMILY
Robinia pseudoacacia*	black locust	NNIP (Limited)			X	X	FABACEAE – LEGUME FAMILY
Rosa californica	California rose	Native			X	X	ROSACEAE – ROSE FAMILY
Rubus armeniacus*	Himalayan blackberry	NNIP (High)	X	X	X	X	ROSACEAE – ROSE FAMILY
Rumex crispus*	curly dock	NNIP (Limited)	X	X	X	X	POLYGONACEAE – BUCKWHEAT FAMILY
Rumex pulcher*	fiddle dock	NN			X	X	POLYGONACEAE – BUCKWHEAT FAMILY
Salix exigua var. exigua	narrow-leaved willow	Native	X		X	X	SALICACEAE – WILLOW FAMILY
Salix lasiolepis	arroyo willow	Native			X	X	SALICACEAE – WILLOW FAMILY
Sambucus nigra ssp. caerulea	blue elderberry	Native			X	X	ADOXACEAE – MUSKROOT FAMILY
Sanicula bipinnatifida	purple sanicle	Native	X				APIACEAE – CARROT FAMILY
Sanicula crassicaulis	thick-stemmed sanicula	Native	X	X			APIACEAE – CARROT FAMILY
Schoenoplectus californicus	California bulrush	Native	X				CYPERACEAE – SEDGE FAMILY
Selaginella hansenii	Hansen's spike-moss	Native		X			SELAGINELLACEAE – SPIKE–MOSS FAMILY
Senecio vulgaris*	common groundsel	NN	X	X	X	X	ASTERACEAE – SUNFLOWER FAMILY
Sesbania punicea*	scarlet sesban	NNIP (High)	X	X			FABACEAE – LEGUME FAMILY
Sherardia arvensis*	field madder	NN		X			RUBIACEAE – COFFEE FAMILY
Silene gallica*	small-flower catchfly	NN	X	X	X	X	CARYOPHYLLACEAE – PINK FAMILY
Silybum marianum*	blessed milk thistle	NNIP (Limited)	X	X			ASTERACEAE – SUNFLOWER FAMILY
Sisymbrium officinale*	hedge mustard	NN	X	X			BRASSICACEAE – MUSTARD FAMILY
Soliva sessilis*	sessile-leaved soliva	NN		X			ASTERACEAE – SUNFLOWER FAMILY
Sonchus asper ssp. asper*	prickly sow thistle	NN	X	X			ASTERACEAE – SUNFLOWER FAMILY
Spergula arvensis*	starwort	NN	X				CARYOPHYLLACEAE – PINK FAMILY
Spergularia rubra*	red sand-spurrey	NN			X		CARYOPHYLLACEAE – PINK FAMILY
Spiranthes porrifolia	leek-leaved ladies tresses	Native	X				ORCHIDACEAE – ORCHID FAMILY
Stellaria media*	common chickweed	NN	X	X			CARYOPHYLLACEAE – PINK FAMILY
Stellaria nitens	shining chickweed	Native		X			CARYOPHYLLACEAE – PINK FAMILY
Stipa lemmonii var. lemmonii	Lemmon's needle grass	Native	X				POACEAE – GRASS FAMILY
Taraxacum officinale*	common dandelion	NN	X	X	X		ASTERACEAE – SUNFLOWER FAMILY
Torilis arvensis*	tall sock-destroyer	NNIP (Moderate)	X	X	X	X	APIACEAE – CARROT FAMILY
Toxicodendron diversilobum	western poison oak	Native	X	X	X	X	ANACARDIACEAE – SUMAC FAMILY

Species	Common Name	Native or NN or NNIP?	NSRA	SSRA	CFW Dam, Dikes, & Spillway	CFW Dam Powerhouse	Family
Trifolium angustifolium*	narrow-leaved clover	NN	X				FABACEAE – LEGUME FAMILY
Trifolium campestre*	hop clover	NN		X	X	X	FABACEAE – LEGUME FAMILY
Trifolium depauperatum var. depauperatum	dwarf sack clover	Native	X		X		FABACEAE – LEGUME FAMILY
Trifolium dubium*	little hop clover	NN	X	X			FABACEAE – LEGUME FAMILY
Trifolium glomeratum*	clustered clover	NN	X	X			FABACEAE – LEGUME FAMILY
Trifolium hirtum*	rose clover	NNIP (Moderate)	X	X	X	X	FABACEAE – LEGUME FAMILY
Trifolium repens*	white clover	NN	X				FABACEAE – LEGUME FAMILY
Trifolium subterraneum*	subterranean clover	NN	X	X			FABACEAE – LEGUME FAMILY
Trifolium tomentosum*	woolly clover	NN			X	X	FABACEAE – LEGUME FAMILY
Trifolium variegatum	variagated clover	Native	X				FABACEAE – LEGUME FAMILY
Trifolium willdenovii	tomcat clover	Native			X	X	FABACEAE – LEGUME FAMILY
Triphysaria eriantha ssp. eriantha	butter-and-eggs	Native	X	X	X		OROBANCHACEAE – BROOM–RAPE FAMILY
Triphysaria pusilla	small owl's-clover	Native		X			OROBANCHACEAE – BROOM–RAPE FAMILY
Triteleia hyacinthina	hyacinth triplet lily	Native	X	X	X	X	THEMIDACEAE – BRODIAEA FAMILY
Triteleia ixioides	corn lily-like triplet lily	Native			X	X	THEMIDACEAE – BRODIAEA FAMILY
Triteleia laxa	loose triplet lily	Native	X	X	X	X	THEMIDACEAE – BRODIAEA FAMILY
Typha angustifolia*	narrow-leaved cattail	NN	X	X	X	X	TYPHACEAE – CATTAIL FAMILY
Urtica urens*	dwarf nettle	NN	X				URTICACEAE – NETTLE FAMILY
Valerianella locusta*	locust corn salad	NN	X		X		VALERIANACEAE – VALERIAN FAMILY
Verbena litoralis*	seashore vervain	NN		X	X	X	VERBENACEAE – VERVAIN FAMILY
Veronica persica*	Persian speedwell	NN	X				PLANTAGINACEAE – PLANTAIN FAMILY
Vicia hirsuta*	hairy vetch	NN		X	X	X	FABACEAE – LEGUME FAMILY
Vicia sativa*	garden vetch	NN	X	X	X	X	FABACEAE – LEGUME FAMILY
Vicia villosa*	hairy vetch	NN	X	X	X	X	FABACEAE – LEGUME FAMILY
Vitis californica	California wild grape	Native			X	X	VITACEAE – GRAPE FAMILY
Xanthium strumarium	cocklebur	Native		X			ASTERACEAE – SUNFLOWER FAMILY

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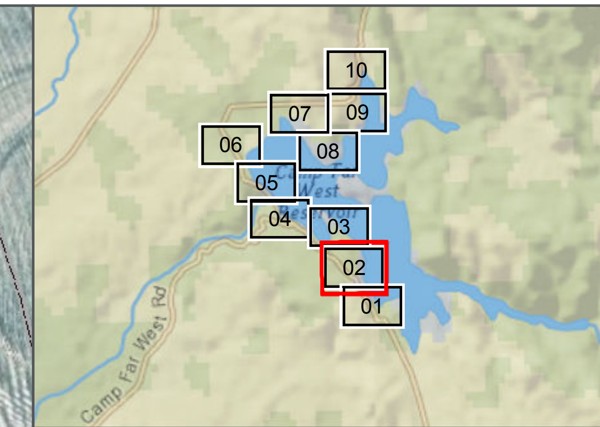
Attachment 3.3.4B

Maps of NNIP Occurrences

NON-NATIVE INVASIVE PLANT SPECIES
CAMP FAR WEST HYDROELECTRIC PROJECT
FERC NO. 2997

Data Sources: Base Map - ArcGIS Online Streaming Layer (Imagery); Ferc Boundary - Yuba and Placer Counties GIS; Land Ownership - Yuba and Placer Counties CD-Data; Botanical Survey Area, Non-native Plant Species - HDR. Map information was compiled from the best available sources. No warranty is made for its accuracy or completeness.



Project Features

Proposed FERC Boundary (No.2997)

Non-Project Features

Transmission Line

Base Map

Study Area

County Line

Major Road

Minor Road

Non-native Plant Species (NNIP)

- *Carduus pycnocephalus* (CARPYC)
- *Centaurea solstitialis* (CENSOL)
- *Cynodon dactylon* (CYNDAC)
- *Elymus caput-medusae* (ELYCAP)
- *Hypericum perforatum* (HYPPER)
- *Carduus pycnocephalus* (CARPYC)
- *Cynodon dactylon* (CYNDAC)
- *Hypericum perforatum* (HYPPER)
- *Elymus caput-medusae* (ELYCAP)

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NON-NATIVE INVASIVE PLANT SPECIES
CAMP FAR WEST HYDROELECTRIC PROJECT
FERC NO. 2997

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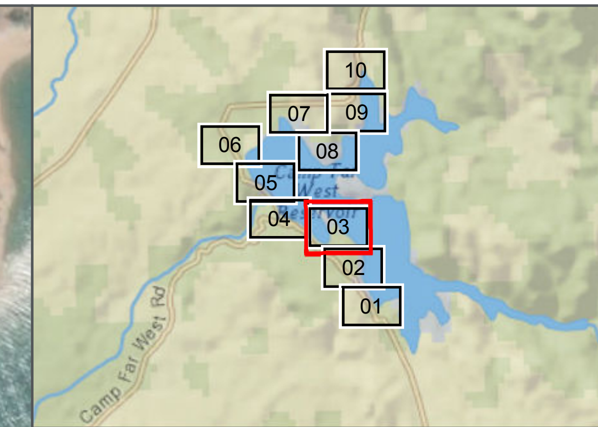
Map Prepared by: HDR |



Project Features

Proposed FERC Boundary (No.2997)

Non-Project Features

Transmission Line

Base Map

Study Area

County Line

Major Road

Minor Road

Non-native Plant Species (NNIP)

Carduus pycnocephalus (CARPYC)

Elymus caput-medusae (ELYCAP)

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NON-NATIVE INVASIVE PLANT SPECIES
CAMP FAR WEST HYDROELECTRIC PROJECT
FERC NO. 2997

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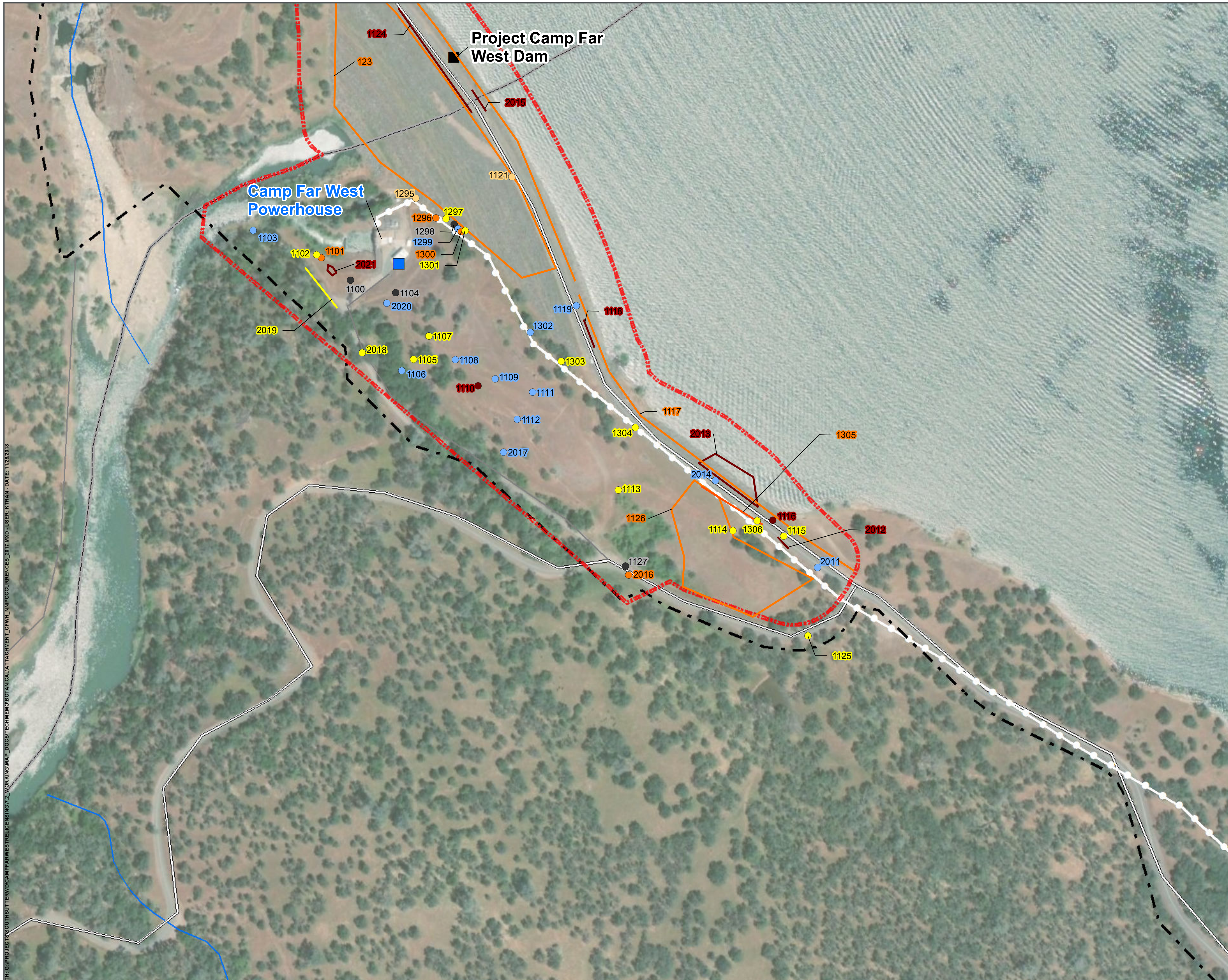

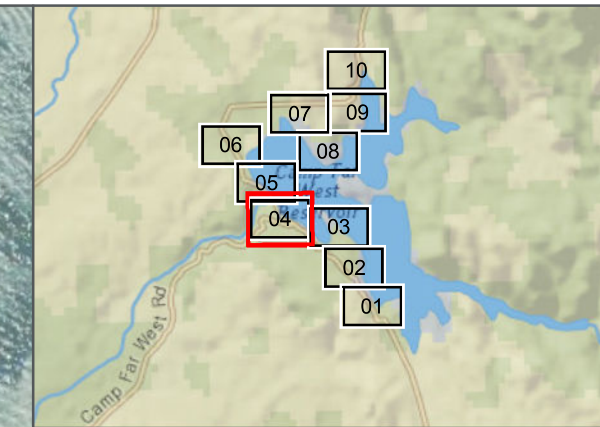

Project Features

- Proposed FERC Boundary (No.2997)
- Dam
- PowerHouse

Non-Project Features

- Transmission Line

Base Map

- Study Area
- County Line
- Major Road
- Minor Road
- StreamRiver

Non-native Plant Species (NNIP)

- *Carduus pycnocephalus* (CARPYC)
- *Centaurea solstitialis* (CENSOL)
- *Chondrilla juncea* (CHOJUN)
- *Cynodon dactylon* (CYNDAC)
- *Elymus caput-medusae* (ELYCAP)
- *Hypericum perforatum* (HYPPER)
- *Carduus pycnocephalus* (CARPYC)
- *Centaurea solstitialis* (CENSOL)
- *Chondrilla juncea* (CHOJUN)
- *Centaurea solstitialis* (CENSOL)
- *Chondrilla juncea* (CHOJUN)

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NON-NATIVE INVASIVE PLANT SPECIES
CAMP FAR WEST HYDROELECTRIC PROJECT
FERC NO. 2997

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Camp Far West Rd
Project Features
Proposed FERC Boundary (No.2997)
Dam
PowerHouse
Non-Project Features
Transmission Line
Base Map
Study Area
County Line
Major Road
Minor Road
StreamRiver
Non-native Plant Species (NNIP)
Carduus pycnocephalus (CARPYC)
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Hypericum perforatum (HYPPER)
Carduus pycnocephalus (CARPYC)
Centaurea solstitialis (CENSOL)
Chondrilla juncea (CHOJUN)
Convolvulus arvensis CONARV
Centaurea solstitialis (CENSOL)
Chondrilla juncea (CHOJUN)
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NON-NATIVE INVASIVE PLANT SPECIES
CAMP FAR WEST HYDROELECTRIC PROJECT
FERC NO. 2997
Data Sources: Base Map - ArcGIS Online Streaming Layer (Imagery); Ferc Boundary - Yuba and Placer Counties GIS; Land Ownership - Yuba and Placer Counties CD-Data; Botanical Survey Area, Non-native Plant Species - HDR. Map information was compiled from the best available sources. No warranty is made for its accuracy or completeness.
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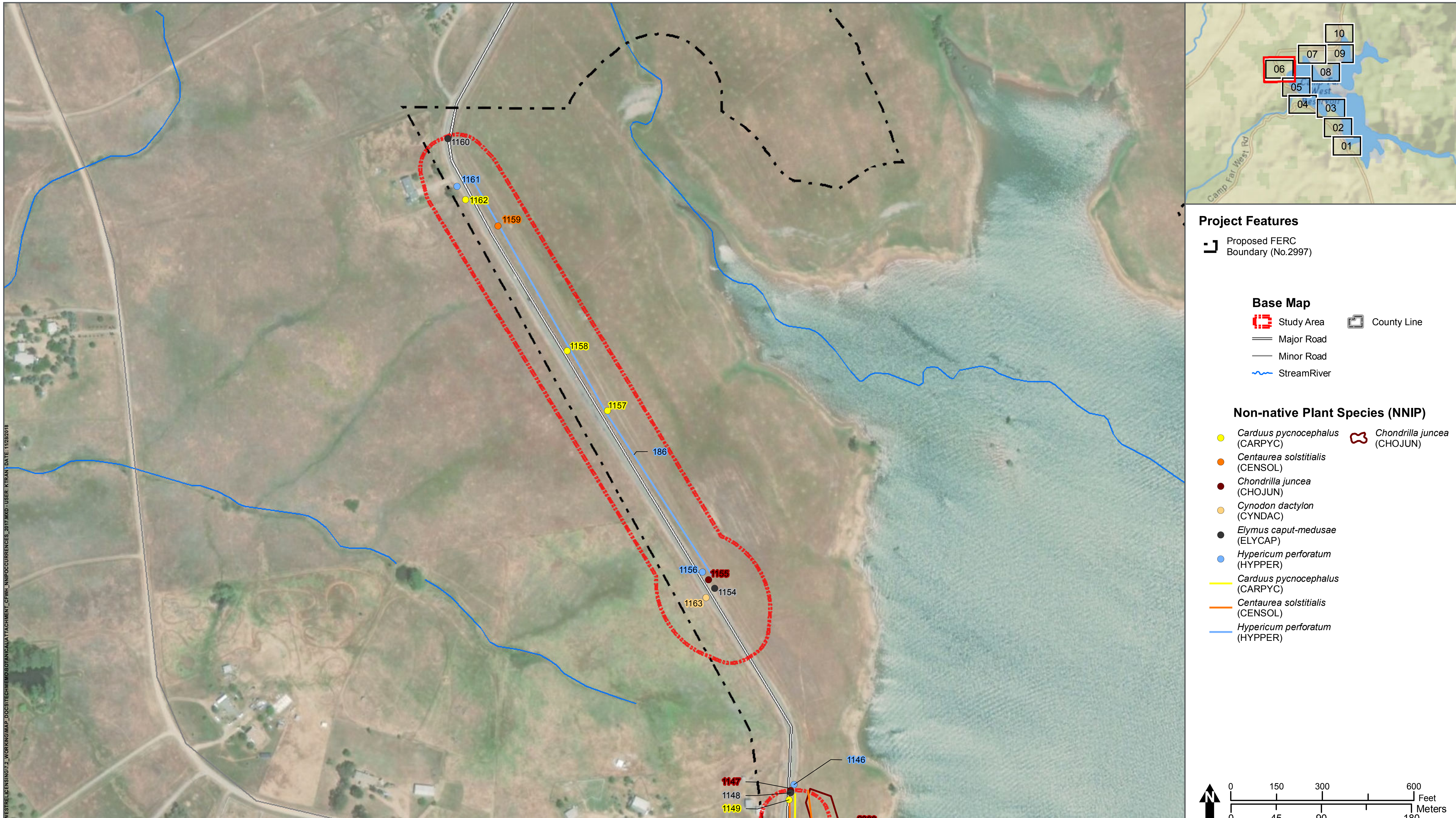

NON-NATIVE INVASIVE PLANT SPECIES
CAMP FAR WEST HYDROELECTRIC PROJECT
FERC NO. 2997

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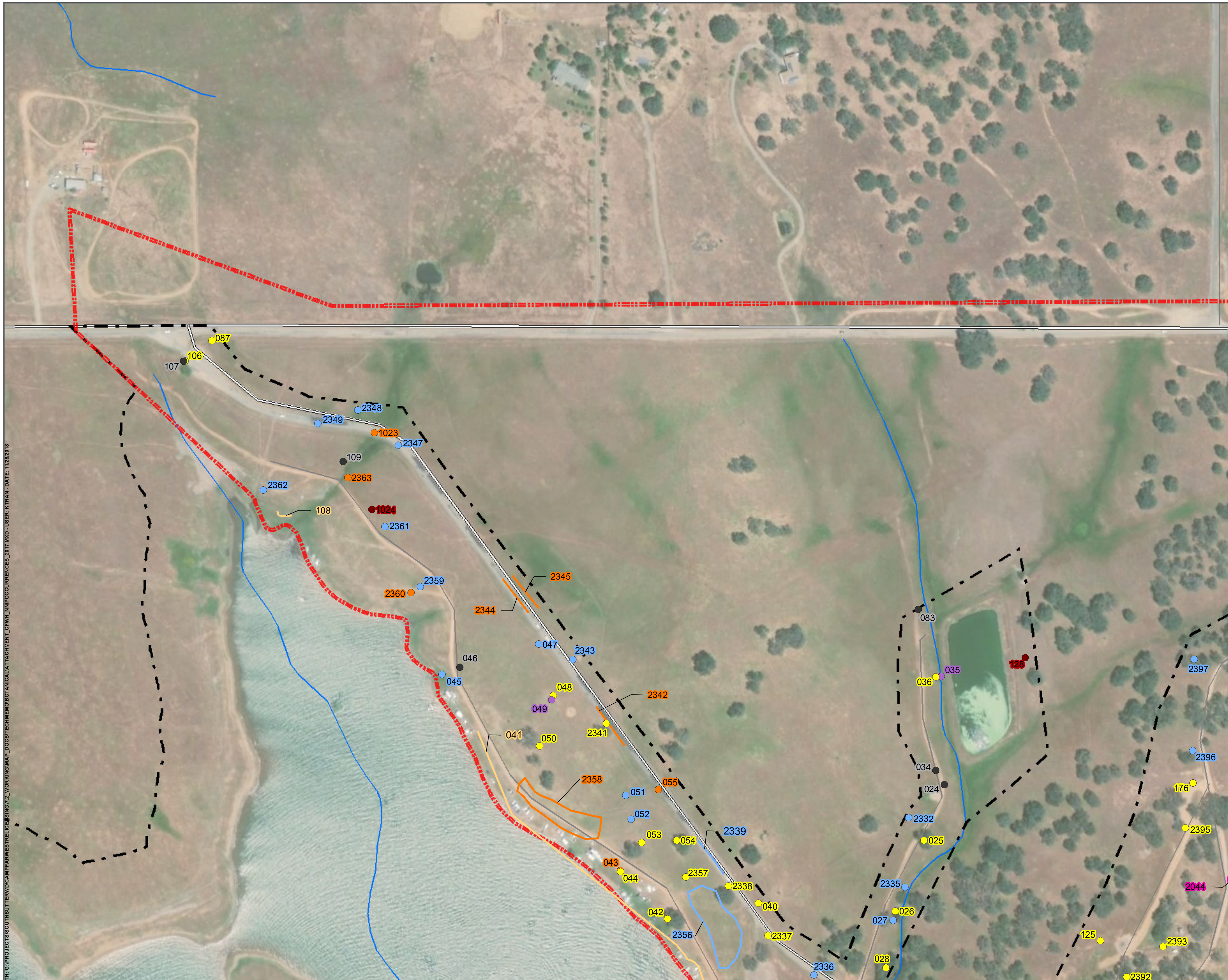

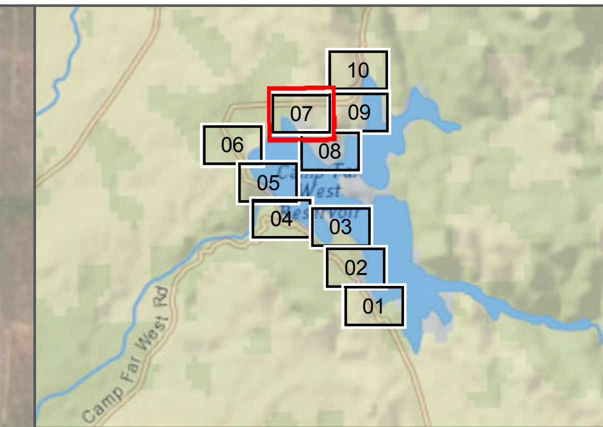

Project Features

Proposed FERC Boundary (No.2997)

Base Map

Study Area

County Line

Major Road

Minor Road

StreamRiver

Non-native Plant Species (NNIP)

Carduus pycnocephalus (CARPYC)

Centaurea melitensis (CENMEL)

Centaurea solstitialis (CENSOL)

Chondrilla juncea (CHOJUN)

Elymus caput-medusae (ELYCAP)

Hypericum perforatum (HYPPER)

Aegilops triuncialis (AEGTRI)

Centaurea solstitialis (CENSOL)

Cynodon dactylon (CYNDAC)

Hypericum perforatum (HYPPER)

Centaurea solstitialis (CENSOL)

Hypericum perforatum (HYPPER)

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NON-NATIVE INVASIVE PLANT SPECIES
CAMP FAR WEST HYDROELECTRIC PROJECT
FERC NO. 2997

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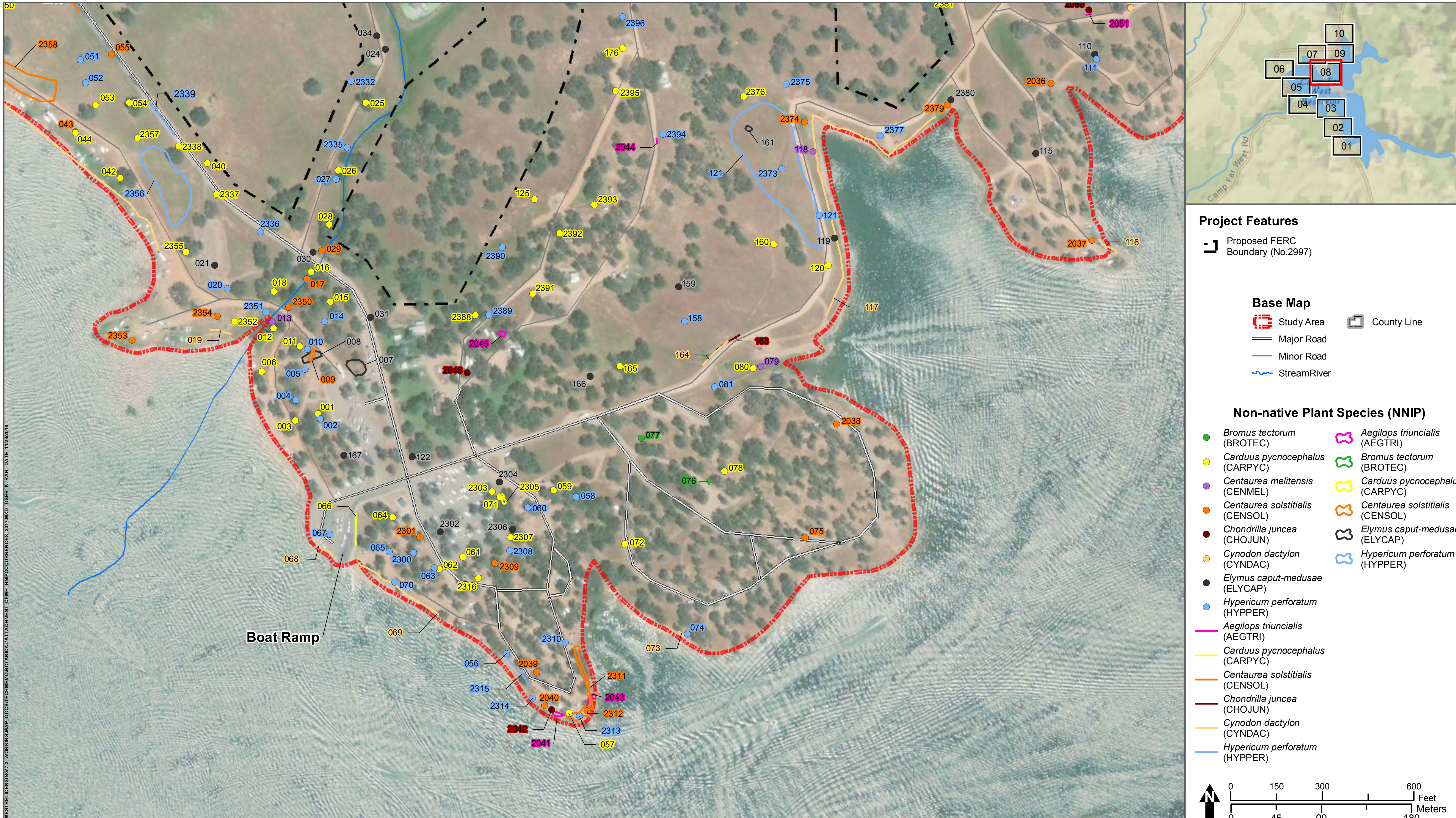

NON-NATIVE INVASIVE PLANT SPECIES
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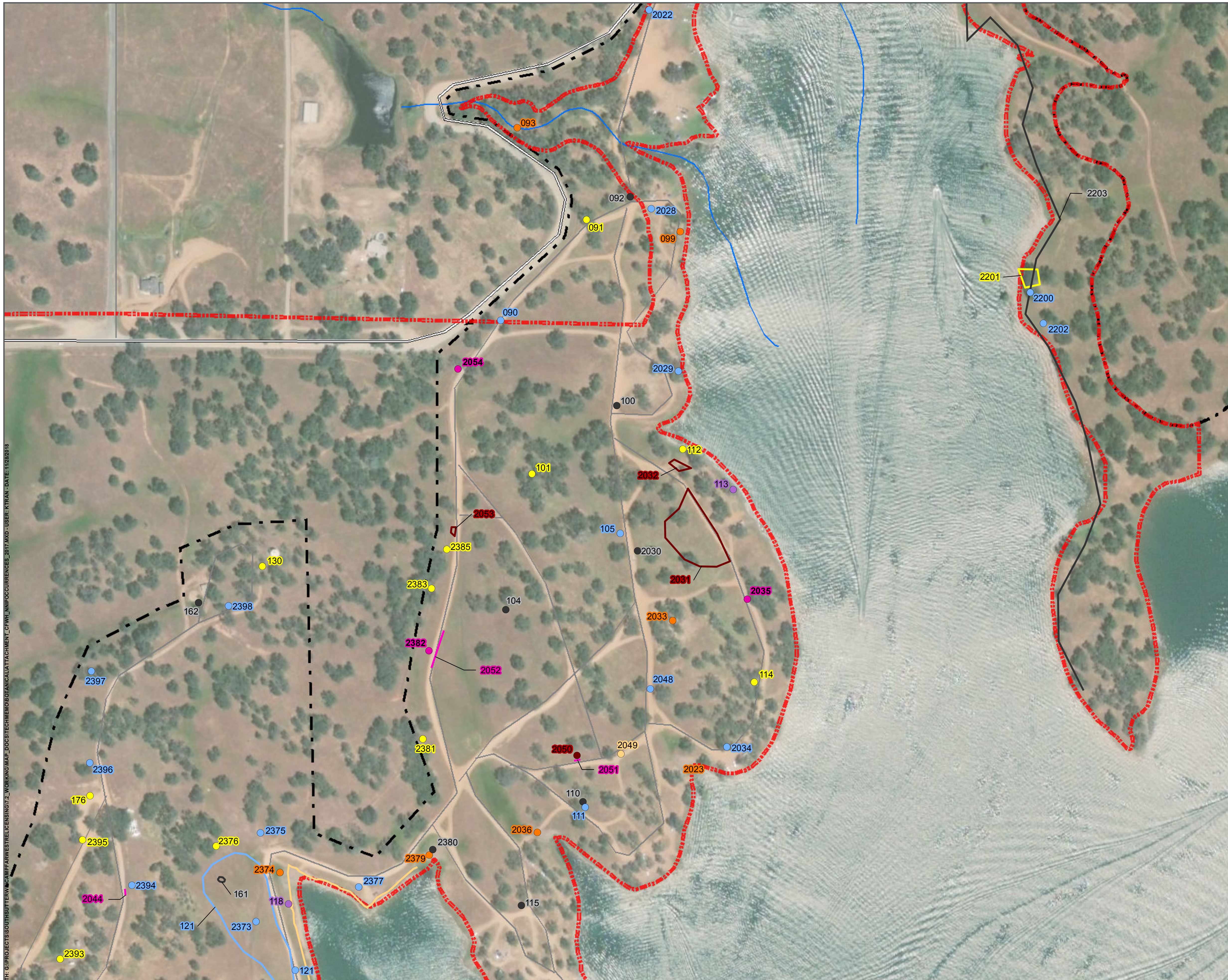

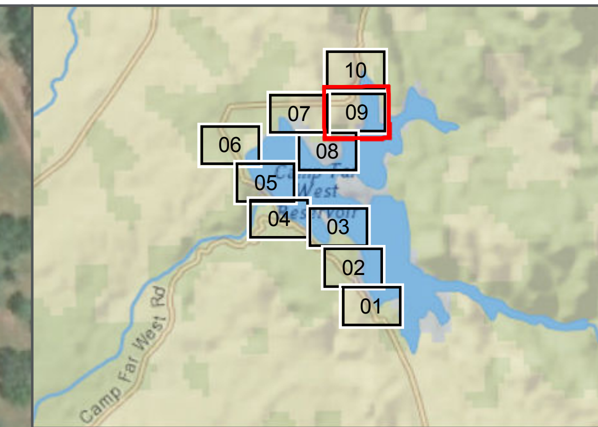

Project Features

Proposed FERC Boundary (No.2997)

Base Map

Study Area

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Major Road

Minor Road

StreamRiver

Non-native Plant Species (NNIP)

Aegilops triuncialis (AEGTRI)

Carduus pycnocephalus (CARPYC)

Centaurea melitensis (CENMEL)

Centaurea solstitialis (CENSOL)

Chondrilla juncea (CHOJUN)

Cynodon dactylon (CYNDAC)

Elymus caput-medusae (ELYCAP)

Hypericum perforatum (HYPPER)

Aegilops triuncialis (AEGTRI)

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Elymus caput-medusae (ELYCAP)

Hypericum perforatum (HYPPER)

N

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NON-NATIVE INVASIVE PLANT SPECIES
CAMP FAR WEST HYDROELECTRIC PROJECT
FERC NO. 2997

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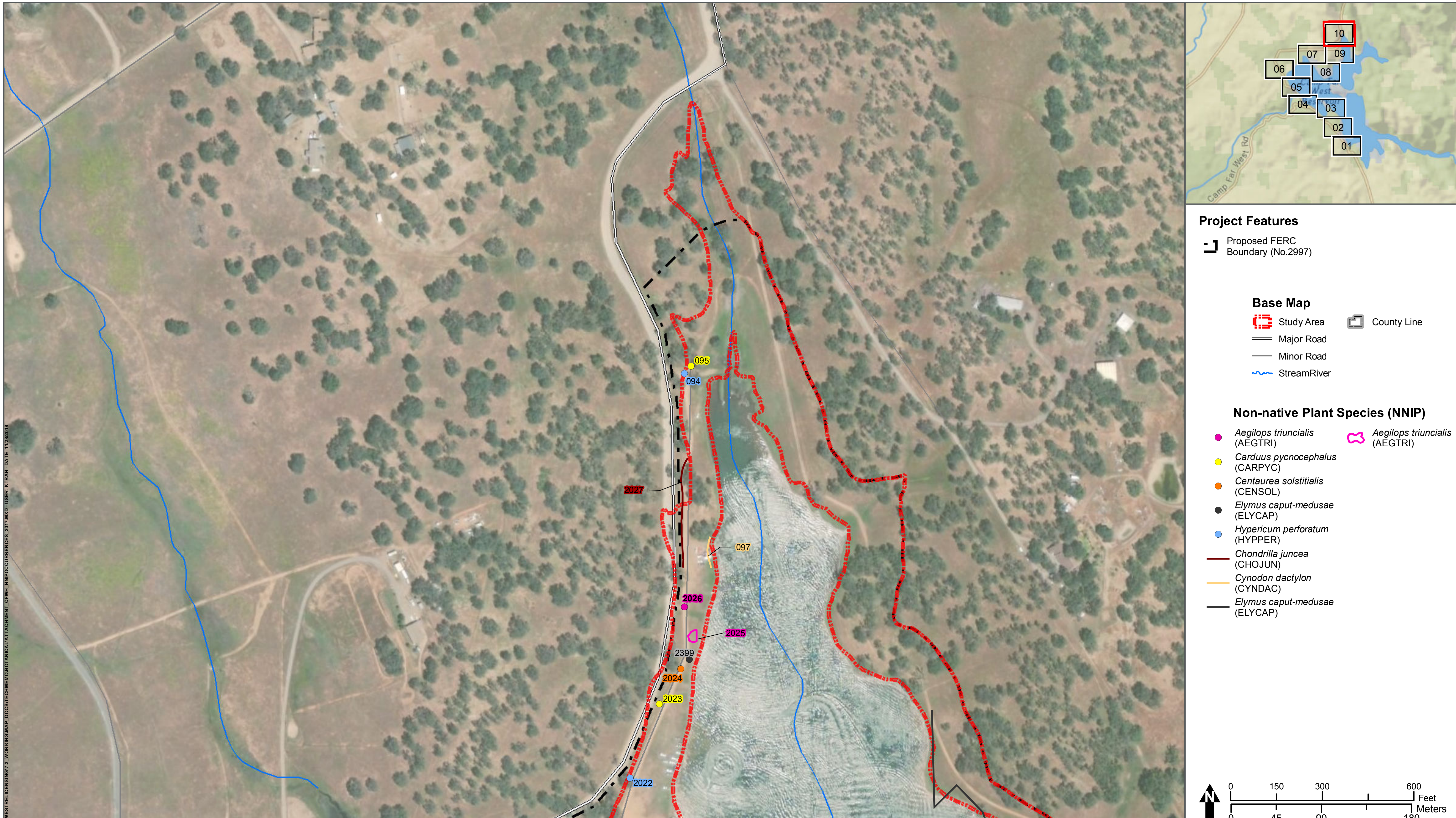

NON-NATIVE INVASIVE PLANT SPECIES
CAMP FAR WEST HYDROELECTRIC PROJECT
FERC NO. 2997

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Attachment 3.3.4C

NNIP Data Table

NNIP Species Code	Occurrence Number	Discrete / Widespread (D / W)	Concentrated / Diffuse (C / D)	Percent Cover (%)	Percent Phenology (Vegetative | Flower | Fruit | Senescent) (V | Flw | Frt | S)	Description	AR EA
barbed goatgrass (*Aegilops triuncialis*)	2025	D	D	15	100 Flw	heavy rec use in area; from access road edge to OHWM; diffuse throughout; may extend beyond polygon.	NSRA
	2026	D	C	30	100 Flw	2 ft. x 2 ft. Small patch near seep at access road edge; heavy rec use.	NSRA
	2035	D	C	<1	100 Flw	small patch at piont, heavy rec use, rock outcrop adjacent.	NSRA
	2041	D	D	5	100 Flw	polygon has been mowed; small stature plants; heavy rec use.	NSRA
	2043	W	D	5	100 V	At OHWM and up into campsites; rec use throughout.	NSRA
	2044	D	D	<1	100 Flw	along access road, incorporated private area of campground.	NSRA
	2045	D	C	15	100 Flw	private mowed area into rec but facility uses area may be more widespread but because of mowing unable to see extent.	NSRA
	2051	D	C	5	100 Flw	1 ft. x 7 ft. Small patch along road; growing w/ CHOJUN 2050.	NSRA
	2052	D	C	5	100 Flw	1 ft. x 20 ft. narrow swath along road; heavy rec; both sides.	NSRA
	2054	D	C	5	100 Flw	1 ft. x 2 ft. small patch along road; heavy rec use.	NSRA
	2382	D	C	2	100 Frt/Dead	2 ft. x 2 ft. 3 individual plants.	NSRA
cheatgrass (*Bromus tectorum*)	076	D	C	10	75 Flw 25 V	5 ft. x 5 ft. growing around oak tree within shade/drip line adjacent to bathroom	NSRA
	077	D	D	2	75 Flw 25 V	throughout grass area of campground, within full sun areas, not under oaks	NSRA
Italian thistle (*Carduus pycnocephalus* ssp. *pycnocephalus*)	001	D	D	5	100 V	camping/ parking lot/restrooom	NSRA
	003	D	C	<1	100 V	camping/ parking lot/restrooom, clustered under oak	NSRA
	006	D	D	5	100 V	fairly larger number near shoreline, under oaks, rec disturbance	NSRA
	011	D	C	<1	100 V	under oak tree in grassy area with heavy rec use	NSRA
	012	D	C	5	100 V	under oak tree at water edge with heavy rec use	NSRA

NNIP Species Code	Occurrence Number	Discrete / Widespread (D / W)	Concentrated / Diffuse (C / D)	Percent Cover (%)	Percent Phenology (Vegetative | Flower | Fruit | Senescent) (V | Flw | Frt | S)	Description	AREA
Italian thistle (*Carduus pycnocephalus* ssp. *pycnocephalus*). (cont'd)	015	W	D	5	100 V	patches under every oak on hillslope, heavy rec use	NSRA
	016	D	C	5	100 V	patch at edge of drainage from under road, some rec use	NSRA
	018	W	D	<1	100 V	patches under every oak in area, rec use common	NSRA
	023	D	C	5	100 V	under oaks and around roads in shage in grassy area, roads, rec use, grazing	NSRA
	025	D	C	<1	100 V	3 plants, under oak in grassy area with rec use, road and cattle grazing	NSRA
	026	D	C	<1	100 V	more under oad and rec use, grazing and road	NSRA
	028	D	C	<1	100 V	under additional oaks near road; cattle grazing, rec use	NSRA
	032	D	C	20	100 V	5 ft. x 30 ft. adjacent to ditch, disturbed area	NSRA
	036	D	C	50	100 V	10 ft. x 10 ft.surrounding raised manhole, adjacent to waste pond	NSRA
	038	D	D	10	100 V	20 ft. x 10 ft. growing around rock outcrop	NSRA
	039	W	D	10	100 V	40 ft. x 40 ft. growing around oak tree within shade/drip line	NSRA
	040	D	D	5	100 V	10 ft. x 20 ft. parallel to paved access road and ditch	NSRA
	042	D	C	30	100 V	20 ft. x 30 ft. growing around oak tree within shade/drip line	NSRA
	044	D	C	25	95 V 5 Flw	3 ft. x 8 ft. rock outcrop in day use area	NSRA
	048	D	D	5	100 V	20 ft. x 20 ft. near snag and rock outcrop	NSRA
	050	D	C	10	100 V	growing around most oak in grassland within drip/shade	NSRA
	053	D	D	15	50 Flw 50 V	growing around most oak in grassland within drip/shade	NSRA
	054	D	C	5	100 V	growing around most oak in grassland within drip/shade	NSRA
	057	D	C	50	100 V	5 ft. s 5 ft. growing around most oak in grassland within drip/shade	NSRA
	059	D	C	100	100 V	1 ft. x 2 ft. at base of oak, within campground	NSRA
	061	D	C	100	100 V	edge of campground, adjacent to asphault parking lot	NSRA

NNIP Species Code	Occurrence Number	Discrete / Widespread (D / W)	Concentrated / Diffuse (C / D)	Percent Cover (%)	Percent Phenology (Vegetative | Flower | Fruit | Senescent) (V | Flw | Frt | S)	Description	AREA
Italian thistle (*Carduus pycnocephalus* ssp. *pycnocephalus*). (cont'd)	062	W	C	15	100 V	under oaks and adjacent to asphault parking lot	NSRA
	064	W		10	100 V	in camprgound, adjacent to boak ramp and restroom bldg.	NSRA
	066	W	C	30	100 V	2 ft. x 150 ft. adjacent to sidewalk leading to boatramp, in landscape area within rocks and along ramp edges	NSRA
	071	W	C	5	100 V	small strip in asphalt parking lot, within other islands in parking lot	NSRA
	072	D	D	10	100 V	rock outcrops throughout campground, concentrated patches but otherwise diffuse, also growing at base of oak trees in shade/drip line	NSRA
	078	D	C	25	100 V	4 ft. x 10 ft. adjacent to restroom building	NSRA
	080	D	C	5	90 V 10 Flw	both sides of drainage	NSRA
	082	D	C	1	100 V	under large oaks shade/drip, at top of grassy hill, growing with another similar thistle.	NSRA
	085	D	C	5	95 V 5 Flw	growing around rock outcrop and dead tree and stumps	NSRA
	087	D	C	5	100 V	at wire fence on rock outcrop and between barbed fence and outside project road	NSRA
	091	D	C	40	100 V	single point for entire area; within dripline of most oaks; denser patches at some oaks	NSRA
	095	D	C	2	100 V	on edges of dirt road and uder oaks to end of path; patchy throughout area	NSRA
	101	D	C	5	100 V	in oak stand, within drip lines at base of most oaks	NSRA
	106	D	C	10	100 V	at edge of entrance gate to NSRA, along landscape bolders and edge of road; rock outcrops and drainages.	NSRA
	112	D	C	15	100 V	10 ft. x 5 ft. associated with ground squirrel burrows	NSRA
	114	D	C	20	90 V 10 Flw	15 ft. x 15 ft. under drip line of oaks	NSRA
	120	D	C	15	90 V 10 Flw	20 ft. x 10 ft. rock outcrop on edge of dirt road	NSRA
	125	D	C	5	90 V 10 Flw	burn pile area; within dripline of oaks in open areas; concentrated patches	NSRA

NNIP Species Code	Occurrence Number	Discrete / Widespread (D / W)	Concentrated / Diffuse (C / D)	Percent Cover (%)	Percent Phenology (Vegetative | Flower | Fruit | Senescent) (V | Flw | Frt | S)	Description	AREA
Italian thistle (*Carduus pycnocephalus* ssp. *Pycnocephalus*). (cont'd)	130	D	D	2	100 V	under tree dripline of oaks adjacent to tank	NSRA
	147	W	C	5	5 V 95 Flw	mostly under trees or disturbed mounds/piles; common throughout grassland; grazing; can be thick in patches	SSRA
	155	D	C	60	5 V 95 Flw	Thick patch near reservoir edge in area with CARPYC, CENSOL; rec use	SSRA
	156	W	C	25	5 V 95 Flw	present under oaks at point and most oaks in view; concentrated patches with same rec use disturbance	SSRA
	160	D	C	30	90 V 10 Flw	within oak woodland dripline of trees,	NSRA
	165	D	C	1	90 V 10 Flw	under blue oak in dripline/shade	NSRA
	168	D	C	2	90 V 10 Flw	under blue oak in dripline/shade	NSRA
	171	D	C	5	80 V 20 Flw	along paved portion of road btwn road and barbed fence; adjacent ot culvert; 40x20	NSRA
	176	D	C	7	80 V 20 Flw	incorporation waste area from campground	NSRA
	179	W	D	75	100 Frt	Extended population via line, along road	DAM
	195	D	C	2	80 V 20 Flw	concentrated patches under blue oak trees and along reservoir edge	SSRA
	203	C	D	2	70 V 30 Flw	concentrated patches throughout area; adjacent to drainage and CFW Road	SSRA
	207	D	C	2	70 V 30 Flw	concentrated patches adj to drainage on both sides and under oaks	SSRA
	216	W	D	5	80 V 20 Flw	diffuse throughout grassland; concentrated patches	SSRA
	223	D	C	<1	80 V 20 Flw	concentrated patches under oaks and in middle of meadow	SSRA
	227	D	C	<1	90 V 10 Flw	concentrated patches under oaks and random individualsin middle of meadow and at CFW Road edge	SSRA
	230	D	C	5	60 V 40 Flw	within drip line of large oak trees in concentrated patches	SSRA
	234	W	D	5	80 V 20 Flw	concentrated patches, but diffuse throughout	SSRA
	236	D	C	1	70 V 30 Flw	concentrated patches within oak tree drip lines	SSRA

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Italian thistle (*Carduus pycnocephalus* ssp. *Pycnocephalus*). (cont'd)	242	D	C	5	60V 40 Flw	under trees	SSRA
	243	D	C	5	60V 40 Flw	concentrated under trees	SSRA
	245	D	C	8	50 V 50 Flw	under large group of oaks	SSRA
	248	D	C	2	50 V 50 Flw	under trees near road	SSRA
	251	D	C	5	60 V 40 Flw	another occurrence concentrated under oaks	SSRA
	252	D	C	5	50 V 50 Flw	under oaks near road	SSRA
	257	D	C	4	50 V 50 Flw	along opposite side of road under trees	SSRA
	258	D	C	5	50 V 50 Flw	near shoreline under trees, opposite of boat ramp	SSRA
	260	D	C	1	30 V 70 Flw	small patch under trees near to shoreline	SSRA
	263	D	C	5	50 V 50 Flw	another patch under trees near shoreline	SSRA
	264	D	C	6	60 V 40 Flw	concentrated under band of oaks	SSRA
	267	D	C	4	50 V 50 Flw	larger patch under oaks near shoreline	SSRA
	269	W	D	2	70 V 30 Flw	spread throughout oaks in area near shoreline	SSRA
	273	D	C	2	60 V 40 Flw	small patch under trees near to shoreline	SSRA
	274	D	C	1	50 V 50 Flw	under trees near shore	SSRA
	275	D	C	1	70 V 30 Flw	small patch in open at shoreline	SSRA
	278	D	C	1	50 V 50 Flw	under trees near shore	SSRA
	279	D	C	1	50 V 50 Flw	under trees near shore	SSRA
	280	D	C	3	60 V 40 Flw	patches under tree and in open near road	SSRA
	282	D	C	5	50 V 50 Flw	small patch under oak tree	SSRA
	283	D	C	5	60 V 40 Flw	small patch in open near trails	SSRA
	284	D	C	1	50 V 50 Flw	under a large oak	SSRA
	285	W	D	10	70 V 30 Flw	spread along a trail, mostly under trees	SSRA
	289	D	C	1	60 V 40 Flw	small patch under oaks	SSRA
	290	D	C	1	60 V 40 Flw	little patch under small oak	SSRA
	294	W	D	2	70 V 30 Flw	spread throughout grassland between t-line and road	SSRA
	296	D	C	5	60 V 40 Flw	patch under larger patch of oaks	SSRA
	1102	D	D	5	50 V 50 Flw	Along hill slope	PH
	1107	W	D	30	50 V 50 Flw	20' x 20'	DAM
	1113	D	D	10	50 V 50 Flw	20' X 20'; under tree, around rocks	DAM
	1114	W	D	10	50 V 50 Flw	10' X 10'	DAM
	1115	W	D	5	50 V 50 Flw	10' X 50'+; along roadside	DAM
	1122	W	D	10	50 V 50 Flw	5' x entire roadway; continues down dam face	DAM

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Italian thistle (*Carduus pycnocephalus* ssp. *Pycnocephalus*). (cont'd)	1125	W	D	5	50 V 50 Flw	Along dam access road	DAM
	1133	D	C	10	90 V 10 Flw	Rock outcrops on east side of bridge; concentrated patches throughout fenced off area north of road	DAM
	1140	D	C	20	80 V 20 Flw	Densely concentrated population in rock outcrop, south side of road and west of bridge	DAM
	1149	D	C	3	70 V 30 Flw	CFW Road, east side, adjacent to barbed fence and other side of fence (towards reservoir); none found towards the reservoir	DAM
	1150	D	C	2	75 V 25 Flw	In rock outcrops, close to edge of water	DAM
	1157	D	C	<1	90 V 10 Flw	1' x 3'; discrete patch	DAM
	1158	W	D	1	75 V 25 Flw	Concentrated patches, widespread throughout from this point towards curve in road	DAM
	1162	C	D	<1	90 V 10 Flw	Concentrated patches, diffuse throughout	DAM
	1297	D	D	10	50 V 50 Flw	At the base of the dam, approx 100 feet from the Power House	PH
	1301	D	C	1	100 V	Throughout lower field; Hydro station	PH
	1303	D	D	1	100 V	near small seasonal drainage	DAM
	1304	W	D	5	100 V	hillslope adjacent to the dam	DAM
	1306	D	C	5	100 V	small 10x10 population adjacent to McCourtney Road	DAM
	1318	W	C	50	50 V 50 Flw	Adjacent to TL and under drip line of oaks	SSRA
	1321	D	D	15	50 V 50 Flw	Small 5x5 patch under TL	SSRA
	1323	D	D	5	50 V 50 Flw	Small 5x5 patch under TL and within open ELYCAP area	SSRA
	1325	D	D	10	50 V 50 Flw	10x10 patch under the dripline of oaks and adjacent to small stock pond	SSRA
	1330	D	D	15	50 V 50 Flw	large 30x20 population at the intersection of McCourtney Road and SSRA entrance	SSRA
	1331	D	D	10	50 V 50 Flw	very large population 80x10 just south of intersection of McCourtney Road and SSRA entrance	SSRA
	1335	W	D	10	100% S	large 25x25 population adjacent to McCourtney Road	SSRA
	1337	D	D	10	100% S	adjacent to McCourtney Road	SSRA
	1338	D	D	5	100% S	adjacent to McCourtney Road	SSRA

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Italian thistle (*Carduus pycnocephalus* ssp. *Pycnocephalus*). (cont'd)	1341	D	D	5	100% S	adjacent to McCourtney Road	SSRA
	1342	D	D	5	100% S	adjacent to McCourtney Road	SSRA
	1344	D	D	10	100 V	small 5x5 population under the dripline of oaks	SSRA
	1348	D	C	15	50 V 50 Flw	large 10x20 population directly under the TL	SSRA
	1349	W	D	40	50 V 50 Flw	Very large 70x30 population under the dripline of oaks	SSRA
	2018	D	C	30	100 S	50 ft. x 50 ft. larger dead, seeded population under oak near road.	DAM
	2019	W	D	20	100 Frt/S	160 ft. line, in ditch along road, x 1 ft.	PH
	2023	D	C	<1	100 Frt/S	2 ft. x 2 ft. Sm patch @ road outcrop @ access road edge; heavy rec use; extends along road.	NSRA
	2047	W	C	20-40	100 Flw/S	under all oaks in shade line - little rec use in area	NSRA
	2201	W	C	60	100 Flw	concentrated under shoreline oak trees	NSRA
	2303	D	D	5	100 S	5 ft. x 5 ft.	NSRA
	2305	D	D	15	100 Frt/S	24.88 square meters.	NSRA
	2307	D	D	10	100 Frt/S	5 ft. x 5 ft.	NSRA
	2316	D	C	20	50 Frt 50 S	10 ft. x 10 ft. under oak.	NSRA
	2318	D	D	20	50 Frt 50 S	5 ft. x 5 ft.	NSRA
	2322	D	C	50	50 Frt 50 Dead	10 ft. x 4 ft.	NSRA
	2324	D	C	50	50 Frt 50 Dead	30.3 meter line along fenceline	NSRA
	2328	D	C	15	100 Frt	30 ft. x 30 ft. Under oak tree.	NSRA
	2330	D	C	5	100 Frt	5 ft. x 5 ft. Under oak tree.	NSRA
	2331	D	C	30	100 Frt/Dead	30 ft. x 30 ft.	NSRA
	2334	D	C	20	100 Frt/Dead	25 ft. x 25 ft.	NSRA
	2337	D	D	10	100 Frt/Dead	10 ft. x 10 ft.	NSRA
	2338	D	C	35	100 Frt/Dead	20 ft. x 20 ft.	NSRA
	2340	D	C	30	100 Frt/Dead	30 ft. x 30 ft. Under 3 oaks.	NSRA
	2341	D	D	15	100 Frt/Dead	20 ft. x 20 ft.	NSRA
	2352	D	D	1	100 Frt/Dead	10 ft. x 10 ft. 1 plant.	NSRA
	2355	D	C	20	100 Frt/Dead	20 ft. x 15 ft. Under oak.	NSRA
	2357	D	D	5	100 Frt/Dead	30 ft. x 10 ft.	NSRA
	2366	D	C	--	100 Frt/Dead	33.66 meters along road, in patches.	NSRA
	2367	D	C	50	100 Frt/Dead	20 ft. x 20 ft. Under oaks.	NSRA
	2368	D	C	50	100 Frt/Dead	20 ft. x 20 ft. Under oaks.	NSRA
	2371	D	C	--	100 Frt/Dead	25.19 meters along road in patches.	NSRA
	2376	D	C	25	100 Frt/Dead	25 ft. x 25 ft.	NSRA

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	2381	D	C	5	100 Frt/Dead	30 ft. x 10 ft. Under oaks - small populations.	NSRA
	2383	D	C	5	100 Frt/Dead	10 ft. x 10 ft. ~ 10 individuals.	NSRA
	2385	D	C	15	100 Frt/Dead	25 ft. x 25 ft. ~ 50 individuals.	NSRA
	2387	D	C	15	100 Frt/Dead	50 ft. x 50 ft.	NSRA
	2388	D	C	10	100 Frt/Dead	1 ft. x 1 ft. 1 individual plant.	NSRA
	2391	D	C	30	100 Frt/Dead	5 ft. x 5 ft.	NSRA
	2392	D	C	25	100 Frt/Dead	25 ft. x 20 ft.	NSRA
	2393	D	C	20	100 Frt/Dead	5 ft. x 20 ft. Along fence line, between oaks.	NSRA
	2395	D	C	90	100 Frt/Dead	2 ft. x 2 ft. ~ 3 individuals.	NSRA
Maltese starthistle (*Centaurea melitensis*)	035	D	D	20	100 V	5 ft. x 20 ft. at culvert near ditch, adj to waste pond, on both sides of culvert crossing	NSRA
	049	D	D	1	100 V	near snag and rock outcrop	NSRA
	079	D	C	10	100 V	both sides of drainage	NSRA
	113	D	C	15	100 V	5 ft. x 5 ft. at water line	NSRA
	118	D	C	5	100 V	discrete patches on edge of dirt oradk; mostly basal leaves	NSRA
	013	D	C	<1	100 V	scatterd at the waters edge, heavy rec use	NSRA
yellow starthistle (*Centaurea solstitialis*)	009	D	C	<1	100 V	small patch in grassy area, heavy rec use	NSRA
	017	D	C	<1	100 V	small patch near small drainage, with rec use, <10 plants	NSRA
	029	D	C	<1	100 V	small patch just below road and above drainage in grassland, grazing, rec use, road	NSRA
	043	D	C	5	100 V	5 ft. x 5 ft. rock outcrop in day use area	NSRA
	055	D	C	?	100 V	early veg (basal veg only seen), adjacent to paved road	NSRA
	075	D	C	2	100 V	at edge of paved campground, diffuse throughout ditch at edge of road	NSRA
	093	D	C	5	100 V	2 ft. x 5 ft. next to drainage; localized in one spot; several patches along creek edge	NSRA
	099	D	C	2	100 V	along edge or reservoir; diescret and concentrated patches between dirt road and reseroir edge.	NSRA

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yellow starthistle (*Centaurea solstitialis*). (cont'd)	123	W	D	80	50 V 50 Flw	6.1 ac. Remapped polygon, entire dam face.	DAM
	148	D	C	<1	100 V	small ptach near raised mond I ngrassland; evidence of grazing; roads, rec use; approx 50 plants	SSRA
	150	D	C	30	100 V	motly on side of fence next to road, but gegin to spread into rec area, roaduse, some CARPYC	SSRA
	154	D	C	<1	100 V	a few plants in patch near edge of reservoir in grassland; rec use	SSRA
	172	D	C	5	100 V	overlap with CARPYC171; larger area; previously mowed.	NSRA
	196	D	C	1	100 V	concentrated patches ; esp at edge of reservoir	SSRA
	202	C	D	50	50 V 50 Flw	btwn barbed fence and CFW Road	SSRA
	208	D	C	1	100 V	concentrated patches adj to drainage on both sides and under oaks	SSRA
	218	D	C	<1	100 V	concentrated patches; along drainage; also concentrated patches along edge of CFW Road	SSRA
	266	W	d	<1	100 V	scattered in an occurrence near shoreline	SSRA
	1023	D	C	5	100 V	culvert on lakeside of road; 5x5 area surroundingculvert	NSRA
	1101	D	C	1	100 V	Along hill slope	PH
	1105	W	D	75	50 V 50 Flw	Extended population via line, along road	DAM
	1117	W	D	20	50 V 50 Flw	2 ac along hillside, remapped old point.	DAM
	1118	W	D	25	50 V 50 Flw	Line 1,257 ft. extended point via line, along all road.	DAM
	1120	W	D	25	50 V 50 Flw	remapped/expanded via line	DAM
	1123	W	D	10	100 V	5' x entire roadway; continues down dam face	DAM
	1128	W	D	5	100 V	Along roadside - throughout west of bridge to bridge north side of road	DAM
	1131	W	D	20	100 V	From bridge going east along roadside, north of road	DAM
	1138	W	D	2	100 V	Dense patches along roadside on south side, east of bridge	DAM

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yellow starthistle (*Centaurea solstitialis*). (cont'd)	1142	C	D	10	100 V	Densely concentrated population in rock outcrop, south side of road and west of bridge, more along roadside, concentrated patches, widespread throughout	DAM
	1145	W	D	75	50 V 50 Flw	change to line; concentrated along access road; heavy rec use.	DAM
	1159	C	D	5	75 V 25 Flw	Concentrated patchfrom this point towards curve in the road	DAM
	1296	D	C	1	100 V	small concentrated patches between edge of reservoir and dirt road	NSRA
	1300	W	D	10	100 V	Found throughout the lowerfield adjacent to the Power House	PH
	1305	W	D	25	50 V 50 Flw	230 ft, remapped as a line	DAM
	1329	D	D	10	--	area at the junction of McCourtney road and SSRA entrance	SSRA
	1332	D	D	10	100 V	large 80x10 population along the roadside	SSRA
	1351	D	D	10	100 V	small 10x10 population under the drip line of oaks	SSRA
	2000	D	C	70	100 V	15 ft x 60 ft. Concentrated patch along roadside/fence	DAM
	2004	W	D	20	100 V	10 ft. x 362 ft. Mapped via line, along back side of levee.	DAM
	2004	W	C	20	100 V	extend point into line - concentrated along access road.	DAM
	2007	W	D	10	100 V	lines 2 track/cow trail.	DAM
	2010	W	D	25	50 V 50 Flw	230 ft. x 2 ft.	DAM
	2016	D	D	16	50 V 50 Flw	50 ft. x 50 ft. small patch along road.	DAM
	2024	D	C	30	95 V 5 Flw	15 ft. x 15 ft. At rock outcrop; disturbed area; heavy rec use. ELYCAP throughout.	NSRA
	2033	D	C	50	100 V	Concentrated patch at backwater cove. ELYCAP surrounds heavy rec use.	NSRA
	2036	D	C	30	95 V 5 Flw	mixed with CENMEL, heavy rec use at backwater cove.	NSRA
	2037	D	C	40	100 V	concentrated patch, heavy rec use.	NSRA
	2038	D	C	20	100 V	patch at water and scattered throughout campsite, rec use.	NSRA

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yellow starthistle (*Centaurea solstitialis*). (cont'd)	2039	D	C	<1	95 V 5 Flw	2 ft. x 2 ft. Small patch in between mowed area and campsites; heavy rec use; all campsites mowed.	NSRA
	2040	D	C	15	100 V	extends around point ~ 20 ft. from OHWM. Diffuse, patchy; heavy rec use - area mowed; new CENSOL growth since mowing.	NSRA
	2301	D	D	3	50 Flw 50 Frt	80 ft. x 10 ft.	NSRA
	2309	D	D	5	50 Flw 50 Frt	5 ft. x 10 ft.	NSRA
	2311	D	C	20	50 Flw 50 Frt	20 ft. x 15 ft.	NSRA
	2312	W	C	30	50 Flw 50 Frt	213.6 square meters. In Ipad.	NSRA
	2325	D	C	25	50 Flw 50 Frt	16.4 meter line along fenceline.	NSRA
	2342	W	D	--	50 Flw 50 Frt	46.62 meter line along roadside	NSRA
	2344	W	D	--	50 Flw 50 Frt	41.08 meter line one side of entrance road.	NSRA
	2345	W	D	--	50 Flw 50 Frt	40.82 meter line other side of entrance road.	NSRA
	2350	W	C	50	50 Flw 50 Frt	80 ft. x 40 ft.	NSRA
	2353	D	C	40	50 Flw 50 Frt	10 ft. x 15 ft.	NSRA
	2354	D	D	10	50 Flw 50 Frt	40 ft. x 40 ft.	NSRA
	2358	W	C	40	50 Flw 50 Frt	1551 square meters.	NSRA
	2360	D	D	10	50 Flw 50 Frt	15 ft. x 10 ft.	NSRA
	2032	D	C	5	100 V	Small area, diffuse. Heavy rec use.	NSRA
	2042	D	C	<1	100 V	1 plant. Single plant at rock outcrop - area previously mowed.	NSRA
	2046	D	C	<1	100 V	1 plant in mowed private area - may be more widespread	NSRA
	2050	D	C	<1	100 V	1 ft. x 1 ft. single plant growing w/ AEGTRI 2051.	NSRA
	2053	D	C	15	100 V	small patch; diffuse throughout; heavy use.	NSRA
	2327	D	C	5	100 Dead	50 ft. x 30 ft.	NSRA
bindweed (*Convolvulus arvensis*)	2001	W	D	30	100 Flw	8 ft x 100 ft. Woven throughout grass on roadside.	DAM
Bermudagrass (*Cynodon dactylon*).	019	W	D	<1	100 V	line along shoreline edge, rec use heavy	NSRA

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Bermudagrass (*Cynodon dactylon*). (cont'd)	041	W	C	5	100 V	extend line along arm of reservoir.	NSRA
	068	D	C	100	100 V	at edge of road to boatramp, between road and waterline, between boat ramp and waterline	NSRA
	069	W	D	40	100 V	at edge of boatramp, throughout edge of campground to reservoir edge, at OHWM and below	NSRA
	073	D	C	7	100 V	along wateredge	NSRA
	097	D	C	25	100 V	in area at edge of water; open area with recreation; occurs along most of reservoir edge at OHWM and lower	NSRA
	108	D	D	2	100 V	adjacent to edge of reservoir at jetski cove and barbed wire boundary	NSRA
	116	D	C	10	100 V	reserved site; at water edge	NSRA
	117	D	C	5	100 V	edge of grassland	NSRA
	117	D	D	5	100 V	extend line around cove. High water and below.	NSRA
	151	W	C	<1	100 V	disturbed soil	SSRA
	157	W	D	60	100 V	rec use, veg management	SSRA
	164	D	C	7	100 V	drainage; both sides of road	NSRA
	220	D	C	<1	100 V	middle of dirt road	SSRA
	232	D	C	1	100 V	along water's edge w/ no other vegetation	SSRA
	235	D	C	5	100 V	areas surrounding drainage, associated with Carex sp. and large Juncus, curly doc	SSRA
	238	D	C	<1	100 V	competitors; near edge of water	SSRA
	250	W	C	<1	100 Fr	all along the shoreline in a thin band	SSRA
	1121	W	D	50	100 V	3' x 1000'+; along edge of entire road	DAM
	1129	D	C	10	95 V 5 Flw	Rock outcrops in fenced off area north side of road	DAM
	1139	W	D	5	50 V 50 Flw	Dense in rip-rap and slope east of bridge, south side of roadside	DAM
	1153	D	C	1	80 V 20 Flw	Along roadside at edge of asphalt	DAM
	1163	C	D	<1	90 V 10 Flw	At edge of asphalt of Camp Far West Road (west side); 1 foot wide at edge	DAM
	1295	D	D	30	100 V	At base of the dam, just beyond the powerhouse	DAM
	2049	D	C	<1	100 V	1 ft. x 1 ft. Small patch at access road edge; heavy rec in area.	NSRA

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Medusahead (*Elymus caput-medusae*).	007	D	D	<1	100 Flw	spread into grassy area near store and parking lot, rec disturbance	NSRA
	008	D	D	5	50 V 50 Flw	in grassy area with lots of rec use	NSRA
	021	W	D	20	50 V 50 Flw	rec use, roads, throughout grass area near rec site, grassy	NSRA
	024	W	D	20	50 V 50 Flw	large numbe rin grassland near old road and t-line, grazing	NSRA
	030	D	C	<1	100 Flw	small pacth (10 plants) road, grazing, rec use	NSRA
	031	D	C	<1	100 Flw	few plants on roadside, rec use, road use, grazing, grassy	NSRA
	034	W	D	22	50 V 50 Flw	in veg in center of road	NSRA
	046	W	D	32	50 Flw 50 V	throughout grassland, between dirt and paved road	NSRA
	083	W	D	15	50 V 50 Flw	widespread throughout grassland/slope area	NSRA
	086	W	D	2	80 V 20 Flw	throughout open grassland	NSRA
	088	W	D	5	80 V 20 Flw	throughout open grassland	NSRA
	092	W	D	2	70 V 30 Flw	single point for entire area; along side of dirt road of overflow camping	NSRA
	100	W	D	7	70 V 30 Flw	overflow camp dirt road intersection, in island where two roads meet.	NSRA
	103	W	D	2	70 V 30 Flw	diffuse overall with concentrated patches in openings of oaks	NSRA
	104	D	C	2	70 V 30 Flw	concentrated patches in open areas of oak woodland	NSRA
	107	D	C	50	60 V 40 Flw	concentrated patches throughout area	NSRA
	109	W	D	6	70 V 30 Flw	open grassland adjacent to drainage and below main road to NSRA	NSRA
	110	W	C	5	70 V 30 Flw	throughout grassland ; difffuse overall with concentrated patches	NSRA
	115	W	C	15	60 V 40 Flw	throughout grassland; generally widespread; concentrated intermittent patches	NSRA
	119	D	C	2	80 V 20 Flw	discrete patches in widspread area	NSRA
	122	D	C	2	80 V 20 Flw	rock outcrop in front of residental area and main NSRA access road	NSRA
	127	W	D	2	80 V 20 Flw	discrete patches throughout open grassland	NSRA

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Medusahead (*Elymus caput-medusae*). (cont'd).	145	W	D	25	100 Flw	rec area grassland along old roads/tracks; signs of grazing; widespread throughout area	SSRA
	149	W	D	10	100 Flw	continues into grassland of rec area; blue heron rookery nearby	SSRA
	153	W	D	10	100 Flw	in grassland of rec area, fairly heavy presence; some disturbance	SSRA
	159	W	D	1	70 V 30 Flw	concentrated patches in/near drainages	NSRA
	161	D	C	30	70 V 30 Flw	20 ft. x 30 ft. adjacent to drainage and oak stand in open grassland; discrete and concentrated patches	NSRA
	162	W	D	2	70 V 30 Flw	concentrated patches in widespread grassland; btwn oaks	NSRA
	166	D	C	5	70 V 30 Flw	concentrated patches in widespread grassland; btwn oaks	NSRA
	167	W	D	10	70 V 30 Flw	day use area adjacent oto boatramp	NSRA
	169	D	C	5	70 V 30 Flw	patchy, conentrated areas throughout grassland	NSRA
	175	W	D	2	70 V 30 Flw	concentrated patches in widespread grassland	NSRA
	198	C	D	1	70 V 30 Flw	concentrated patches; diffuse throughout	SSRA
	199	C	D	5	70 V 30 Flw	btwn line and interior oak and drainage; concentrated patches; diffuse throughout	SSRA
	205	W	D	10	70 V 30 Flw	concentrated patches throughout widespread grassland	SSRA
	210	D	D	5	70 V 30 Flw	concentrated patches; widesprread throughout	SSRA
	215	W	D	15	70 V 30 Flw	diffuse throughout grassland; possible camping area	SSRA
	221	W	D	5	70 V 30 Flw	meadow north of drainage and west of edge of reservoir; adjacent to dirt road	SSRA
	224	W	D	5	70 V 30 Flw	continuous from fence to edge of water with some concentrated patches	SSRA
	229	W	D	5	70 V 30 Flw	concentrated patches but widespread throughout meadow	SSRA
	233	D	C	10	70 V 30 Flw	concentrated patch between dirt road and edge of water. Also in concentrated patches in meadow between dirt road and fence on CFW Road	SSRA
	239	W	D	5	70 V 30 Flw	concentrated patches, diffuse throughout	SSRA
	241	D	C	10	70 V 30 Flw	concentrated patch under oaks	SSRA

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Medusahead (*Elymus caput-medusae*). (cont'd).	246	D	C	10	70 V 30 Flw	concentrated patch under oaks	SSRA
	247	W	D	5	70 V 30 Flw	concentrated patches, diffuse throughout area	SSRA
	253	W	D	5	70 V 30 Flw	more ELYCAP through area	SSRA
	255	W	D	5	70 V 30 Flw	more ELYCAP through area	SSRA
	256	W	D	5	80 V 20 Flw	along roadside	SSRA
	261	W	D	10	70 V 30 Flw	spread throughout grasslands in areas	SSRA
	262	W	D	10	70 V 30 Flw	spread throughout grasslands in areas	SSRA
	268	W	D	10	70 V 30 Flw	spread throughout grasslands in area	SSRA
	270	D	C	1		small patch of grass	SSRA
	271	D	D	5	60 V 40 Flw	occurrence right near the tip of the recreation area	SSRA
	276	W	D	5	70 V 30 Flw	spread throughout open area along shoreline	SSRA
	277	D	C	1	70 V 30 Flw	concetrated under oaks	SSRA
	281	W	D	5	70 V 30 Flw	spread throughout open area along shoreline	SSRA
	286	W	D	5	70 V 30 Flw	spread throughout open area along shoreline	SSRA
	287	D	C	1	60 V 40 Flw	small patches under trees	SSRA
	288	W	D	5	70 V 30 Flw	spread throughout open area in interior grasslands	SSRA
	291	D	W	5	70 V 30 Flw	occurrence on interior along edge of rec area	SSRA
	292	W	D	5	70 V 30 Flw	spread under the transmission lines	SSRA
	293	W	D	2	70 V 30 Flw	spread throughout grasslands in area	SSRA
	1100	W	D	10	100 V	Throughout lower field; Hydro station	PH
	1104	W	D	5	100 V	Hill slope adjacent to dam	PH
	1127	W	D	10	100 V	Along dam access road	DAM
	1135	W	D	10	80 V 20 Flw	Entire area east of bridge and north of road	DAM
	1136	W	D	10	80 V 20 Flw	Concentrated patches, diffuse throughout, east and south of road	DAM
	1141	W	D	20	70 V 30 Flw	Densely concentrated population in rock outcrop, south side of road and west of bridge	DAM
	1144	W	D	30	100 V	CFW Road, west side, adjacent to residential; recently mowed along road	DAM

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Medusahead (*Elymus caput-medusae*). (cont'd).	1148	W	D	20	75 V 25 Flw	CFW Road, east side, adjacent to barbed fence and other side of fence (towards reservoir); all the way to the reservoir	DAM
	1154	W	D	10	75 V 25 Flw	Entire east side of Camp Far West Road	DAM
	1160	W	D	10	70 V 30 Flw	West side of Camp Far West Road (from curve)	DAM
	1298	W	D	15	100 V	widespread throughout grassland/slope area	PH
	1324	D	D	5	100 V	adjacent to stock pond	SSRA
	1326	D	D	10	80 V 20 Flw	large 100x20 area adjacent to stock pond	SSRA
	1333	D	D	5	80 V 20 Flw	along roadside, just south of McCourtney Road and SSRA entance intersection	SSRA
	1336	D	D	5	80 V 20 Flw	adjacent to McCourtney Road	SSRA
	1340	D	D	15	80 V 20 Flw	adjacent to McCourtney Road	SSRA
	1346	W	D	30	80 V 20 Flw	large 50x20 area under the TL	SSRA
	1350	D	D	40	80 V 20 Flw	very large 120x70 area under the TL	SSRA
	2030	W	C	60	100 Flw	Clarkia revisit within population; nearby rec use.	NSRA
	2203	W	D	20	100 Frt	spread along shoreline.	NSRA
	2302	D	D	5	100 Frt	10 ft. x 10 ft.	NSRA
	2304	D	C	10	100 Frt	30 ft. x 10 ft.	NSRA
	2306	D	D	5	100 Frt	5 ft. x 10 ft.	NSRA
	2380	W	D	70	100 Frt/Dead	200 ft. x 100 ft.	NSRA
	2399	D	C	5	100 V	20 ft. x 20 ft. throughout area between water edge and road	NSRA
Klamathweed (*Hypericum perforatum).*	002	D	C	<1	100 V	camping/ parking lot/restrooom, previous years blooms	NSRA
	004	D	C	<1	100 V	in grasses behind restroom, camping, fishing, rec. etc.	NSRA
	005	D	C	<1	100 V	in same field, same disturbances	NSRA
	010	D	C	<1	100 V	a few in small area of grass, heavy rec use	NSRA
	014	W	D	<1	100 V	scattered throughout grassy hillslope with heavy rec use	NSRA
	020	W	D	<1	100 V	scattered in grassy slope above small ????, <50 plants, rec use heavy, also old pavement	NSRA

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Klamathweed (*Hypericum perforatum).* (cont'd).	022	W	D	<1	100 V	scattered in grassy area across road from shoreline, rec use , grazing	NSRA
	027	D	C	<1	100 V	scattered in grassland and under oak, cattle grazing, rec use, road	NSRA
	033	W	D	20	100 V	throughout grassland, grazing	NSRA
	037	W	C	15	100 V	10 ft. x 20 ft. dead stocks, growing around rock outcrop	NSRA
	045	D	D	5	100 V	10 ft. x 20 ft. in ditch flowing into reservoir, backwater	NSRA
	047	W	D	5	100 V	throughout grassland area	NSRA
	051	W	D	10	100 V	growing throughout grassland, adjacent to culvert, grassy area	NSRA
	052	D	C	25	100 V	rock outcrop in distubed rec area	NSRA
	056	D	D	10	100 V	at campground, near campsites at edge of water	NSRA
	058	D	C	100	100 V	20 ft. x 5 ft. at campground, between oaks and throughout oak stand	NSRA
	060	D	C	100	100 V	edge of campground	NSRA
	063	W	D	100	100 V	groing within oak stand, adjacent to boat ramp area	NSRA
	065	W	D	50	100 V	in camprgound, adjacent to boak ramp and restroom bldg.	NSRA
	067	D	C	50	100 V	2 ft. x 2 ft. in rock landscape at boat ramp	NSRA
	070	W	C	35	100 V	in dayuse area at waterline, between dirt road and waterline	NSRA
	074	W	C	5	100 V	throughout peninsula, concentrated patches throughout grassland	NSRA
	081	W	C	2	100 V	concentrated at mappped point to diffuse or no cover throughout campground	NSRA
	084	W	D	1	100 V	patchy and diffuse throughout grassland	NSRA
	089	D	C	5	100 V	5 ft. x 5 ft. small concentrated population	NSRA
	090	W	D	2	100 V	overflow camping area; dense patches along drainage edge, parking areas, dirt road edges	NSRA
	094	D	C	5	100 V	along campground dirt road at end of property; diffuse along road edge	NSRA
	1299	D	D	10	100 V	small 5x5 area at the base of the dam approx 100 feet from the Power House	PH

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Klamathweed (*Hypericum perforatum).* (cont'd).	102	W	C	8	100 V	adjacent ot CFW road and barbed wire fence border	NSRA
	105	D	C	3	100 V	along edge of access roadks; concentrated patches, diffuse overall. Open grassy areas in oak woodland	NSRA
	111	W	C	5	100 V	throughout grassland ; difffuse overall with concentrated patches	NSRA
	1320	D	C	20	100 V	15x15 area within a grove of oaks	SSRA
	121	W	D	1	100 V	concentrated patches at edge of road, widespread throughout	NSRA
	126	W	D	2	100 V	discrete patches throughout open grassland	NSRA
	1327	W	D	15	--	large 100x20 area between poles AO-14 and AO-13	SSRA
	129	W	D	1	100 V	underdripline of oak stand	NSRA
	1334	D	D	5	100 S	adjacent to McCourtney Road	SSRA
	1339	D	D	5	100 S	adjacent to McCourtney Road	SSRA
	1343	D	D	10	100 V	small 5x5 area adjacent to McCourtney Road	SSRA
	1345	D	D	10	100 V	small 5x5 area adjacent to McCourtney Road	SSRA
	146	W	D	30	100 V	in rec area grasslands along with ELYCAP and CARPYC; grazing	SSRA
	1347	D	D	2	100 V	large 40x20 area beneath TL	SSRA
	152	W	D	<1	100 V	more found in grassland of SSRA; grassland	SSRA
	158	W	D	1	100 V	grassy area; some concentrated patches; new growth in oak stand	NSRA
	173	D	C	5	100 V	overlap with CARPYC171; larger area; CENSOL 172.	NSRA
	174	D	C	10	95 V 5 Flw	rock outcrop in middle of grassland; concentrated patches in widespread area	NSRA
	197	D	C	<1	80 V 20 Flw	concentrated patched under pine treees	SSRA
	201	C	D	<1	100 V	adjacent to CHOJUN 200	SSRA

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Klamathweed (*Hypericum perforatum).* (cont'd).	206	D	C	1	90 V 10 Flw	concentrated patches throughout	SSRA
	209	D	C	<1	100 V	small concentated populations near drainage and edge of water	SSRA
	212	D	D	1	100 V	concentrated pacht but spreds diffusly throughout	SSRA
	217	D	C	1	90 V 10 Flw	concentrated patches at reservoir edge; in and around drainage	SSRA
	222	D	C	<1	80 V 20 Flw	concentrated patches in middle of meadow describedin ELYCAP 221 and below road and water's edge	SSRA
	226	D	C	1	95 V 5 Flw	concentrated patches in meadow on both sides of drainage and along CFW Road	SSRA
	228	D	C	<1	100 V	at water's edge in concentrated patches or individual plants; in meadow in small patches	SSRA
	231	D	C	2	80 V 20 Flw	concentrated patches; diffuse throughout meadow	SSRA
	237	D	C	<1	90 V 10 Flw	concentrated patches, diffuse throughout	SSRA
	240	D	C	<1	90 V 10 Flw	small patch in open grassland	SSRA
	244	D	C	<1	90 V 10 Flw	a few patches under oaks	SSRA
	249	W	D	2	80 V 20 Flw	strung along near roadside	SSRA
	254	D	C	<1	90 V 10 Flw	small patch under oaks	SSRA
	259	W	D	2	80 V 20 Flw	strung along near roadside	SSRA
	265	W	D	1	80 V 20 Flw	strung along near roadside	SSRA
	272	D	W	2	90 V 10 Flw	occurrence near tip of the rec area	SSRA
	295	W	D	1	80 V 20 Flw	spread along the road in rec area	SSRA
	1302	D	D	5	50 V 50 Flw	found along the hillslope adjacent to the Power House	PH
	1103	D	D	1	100 V	Near water	PH
	1106	D	C	5	100 V	10' x 10'	PH
	1108	D	C	10	100 V	5' x 5'	DAM
	1109	D	D	1	100 V	2' x 2'	DAM
	1111	D	C	20	50 V 50 Flw	5' X 5'	DAM
	1112	D	D	3	50 V 50 Flw	10' X 20'	DAM
	1119	D	C	5	50 V 50 Flw	5' x 50'+; along roadside	DAM
	1130	D	C	15	85 V 15 Flw	15 ft. x 5 ft. Along fenced area between bridge and gate north of road	DAM
	1132	D	C	30	95 V 5 Flw	2 ft. x 3 ft. Rock outcrop east of bridge, along roadside, north of road	DAM

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Klamathweed (*Hypericum perforatum).* (cont'd).	1134	W	D	5	95 V 5 Flw	Concentrated patches, diffuse throughout	DAM
	1137	W	D	10	95 V 5 Flw	Concentrated patches, diffuse throughout, east and south of road; concentrated in rock outcrops	DAM
	1143	C	D	2	80 V 20 Flw	Concentrated patch near rock outcrop	DAM
	1146	W	D	5	70 V 30 Flw	CFW Road, east side, adjacent to barbed fence and other side of fence (towards reservoir); in concentrated patches, diffuse throughout; east side and other side of fence (towards reservoir)	DAM
	1151	D	C	5	75 V 25 Flw	At water's edge, in cove	DAM
	1152	D	C	2	75 V 25 Flw	Rock outcrops in fenced off area north side of road; concentrated patches in rock outcrop	DAM
	1156	D	C	2	70 V 30 Flw	Concentrated patches along roadside, widespread throughout	DAM
	1161	C	D	1	70 V 30 Flw	Concentrated patches, diffuse throughout	DAM
	2005	D	C	6	100 Flw	10 ft. x 10 ft. 6 individuals tucked in blackberry.	DAM
	2006	W	D	8	100 Flw	50 ft. x 100 ft. just on edge of project boundary.	DAM
	2009	D	C	10	100 Flw	6 ft. x 6 ft. 3 plants.	DAM
	2011	D	C	5	100 Flw	5 ft. x 5 ft. Small patch near tailrace and large rocks on road.	DAM
	2014	W	D	67	100 Flw	adjacent to the lake side of the road	DAM
	2017	D	C	5	100 Flw	10 ft. x 10 ft. 5 individuals on drop off.	DAM
	2020	D	C	15	100 Flw	~10 plants up access road to powerplant.	PH
	2022	W	C	50	100 Flw	10 ft. x 20 ft. Along access road, both sides. Rec use heavy in area. CENSOL other side of boundary fence.	NSRA
	2028	W	D	10	100 Flw	diffuse to concentrated throughout grasslands; heavy rec use.	NSRA
	2029	W	D	20	100 Flw	Throughout grassland; heavy rec use in area, mixed with ELYCAP.	NSRA
	2034	W	D	60	5 V 95 Flw	Entire hillslope covered. Heavy rec use. ELYCAP throughout.	NSRA
	2048	W	D	20-60	5 V 95 Flw	throughout all grasslands; heavy rec in area.	NSRA

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Klamathweed (*Hypericum perforatum).* (cont'd).	2200	W	D	40	100 Flw	50 ft x 300 ft	NSRA
	2202	W	D	50	100 Flw	30 ft x 300 ft. Occurs along majority of shoreline.	NSRA
	2300	D	D	2	50 Frt 50 S	80 ft. x 10 ft. Along parking lot on mower tracks.	NSRA
	2308	D	D	2	100 Frt/S	50 ft x. 30 ft.	NSRA
	2310	D	D	10	50 Flw 50 Frt	5 ft. x 5 ft.	NSRA
	2313	D	D	10	50 Frt 50 S	20 ft. x 20 ft.	NSRA
	2314	D	D	5	50 Frt 50 S	15 ft. x 10 ft.	NSRA
	2315	D	D	15	50 Frt 50 S	38.94 meter long line.	NSRA
	2317	W	D	5	50 Frt 50 S	250 ft. x 60 ft.	NSRA
	2319	W	D	10	20 Flw 80 Frt	200 ft. x 150 ft.	NSRA
	2320	D	D	5	50 Frt 50 Dead	25 ft. x 30 ft.	NSRA
	2321	D	D	2	50 Frt 50 Dead	30 ft. x 30 ft.	NSRA
	2323	W	D	3	10 Flw 90 Frt/Dead	100 ft. x 10 ft. Along fenceline.	NSRA
	2326	D	D	1	50 Frt 50 Dead	100 ft. x 40 ft.	NSRA
	2329	D	D	5	100 Frt/Dead	60 ft. x 20 ft.	NSRA
	2332	D	D	2	100 Frt/Dead	40 ft. x 10 ft.	NSRA
	2333	W	D	10	100 Frt/Dead	300 ft. x 200 ft.	NSRA
	2335	D	D	2	100 Frt/Dead	100 ft. x 30 ft.	NSRA
	2336	D	D	2	100 Frt/Dead	30 ft. x 10 ft. Under/near oaks.	NSRA
	2339	D	D	3	100 Frt/Dead	41.14 meter line along roadside.	NSRA
	2343	D	D	2	100 Frt/Dead	25 ft. x 10 ft.	NSRA
	2346	D	D	2	100 Frt/Dead	60 ft. x 10 ft.	NSRA
	2347	D	D	1	100 Frt/Dead	100 ft. x 20 ft.	NSRA
	2348	D	D	5	100 Frt/Dead	20 ft. x 20 ft.	NSRA
	2349	D	D	10	100 Frt/Dead	10 ft. x 15 ft.	NSRA
	2351	D	D	5	100 Frt/Dead	20 ft. x 30 ft.	NSRA
	2356	D	D	5	100 Frt/Dead	2016 square meters.	NSRA
	2359	D	D	5	100 Frt/Dead	40 ft. x 40 ft.	NSRA
	2361	D	D	2	100 Frt/Dead	150 ft. x 50 ft.	NSRA
	2362	D	D	2	100 Frt/Dead	50 ft. x 50 ft.	NSRA
	2364	W	D	--	15 Flw 85 Frt/Dead	43.73 meters along road	NSRA
	2370	W	D	--	100 Frt/Dead	35.63 meters along road	NSRA
	2372	W	D	--	20 Flw 80 Frt/Dead	42.24 meters along road.	NSRA
	2373	W	D	10	100 Frt/Dead	0.5914 HA (hectares). Associated with HYPPER 121	NSRA
	2375	W	D	5	100 Frt/Dead	200 ft. x 75 ft.	NSRA
	2377	D	C	5	100 Frt/Dead	10 ft. x 10 ft. ~ 10 plants.	NSRA
	2378	W	D	15	100 Frt/Dead	0.7436 HA.	NSRA
	2384	W	D	<5	100 Frt/Dead	1213 square meters.	NSRA

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Klamathweed (*Hypericum perforatum).* (cont'd).	2386	W	D	<10	100 Frt/Dead	1703 square meters.	NSRA
	2389	D	C	75	100 Frt/Dead	120 ft. x 30 ft.	NSRA
	2390	D	C	60	100 Frt/Dead	35 ft. x 50 ft. Under oak.	NSRA
	2394	W	D	<5	100 Frt/Dead	50 ft. x 50 ft. Open areas adjacent to oaks into road.	NSRA
	2396	W	D	20	100 Frt/Dead	20 ft. x 15 ft. ~ 10 plants.	NSRA
	2397	W	D	10	100 Frt/Dead	30 ft. x 30 ft.	NSRA
	2398	W	D	15	100 Frt/Dead	30 ft. x 30 ft.	NSRA
	186	W	D	10	100 Flw	remapped extent as line along road.	DAM