UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

Klamath River Renewal Corporation	**Project Nos. 14803-001;**
PacifiCorp	**2082-063**

AMENDED APPLICATION FOR SURRENDER OF LICENSE FOR MAJOR PROJECT AND REMOVAL OF PROJECT WORKS

EXHIBIT A
Aquatic Resources Management Plan
(Amended December 15, 2021)

KLAMATH RIVER RENEWAL CORPORATION

Lower Klamath Project
FERC Project No. 14803

Aquatic Resources Management Plan

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December 2021

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1.0 Introduction

The Lower Klamath Project (FERC No. 14803) consists of four hydroelectric developments on the Klamath River: J.C. Boyle, Copco No. 1, Copco No. 2, and Iron Gate (Figure 1-1). Specifically, the reach between J.C. Boyle dam and Iron Gate dam is known as the Hydroelectric Reach. In September of 2016, the Klamath River Renewal Corporation (Renewal Corporation) filed an *Application for Surrender of License for Major Project and Removal of Project Works,* FERC Project Nos. 2082-063 & 14803-001 (License Surrender). The Renewal Corporation filed the License Surrender Application as the dam removal entity for the purpose of implementing the Klamath River Hydroelectric Settlement (KHSA). In November of 2020, the Renewal Corporation filed its Definite Decommissioning Plan (DDP) as Exhibits A-1 and A-2 to its Amended License Surrender Application (ALSA). The DDP is the Renewal Corporation's comprehensive plan to physically remove the Lower Klamath Project and achieve a free-flowing condition and volitional fish passage, site remediation and restoration, and avoidance of adverse downstream impacts (Proposed Action). The Limits of Work is a geographic area that encompasses dam removal and restoration related activities associated with the Proposed Action. The Limits of Work may extend beyond the Federal Energy Regulatory Commission (Commission) boundary associated with the Lower Klamath Project where specifically noted.

The Proposed Action includes the deconstruction of the J.C. Boyle Dam and Powerhouse (Figure 1-2), Copco No. 1 Dam and Powerhouse (Figure 1-3), Copco No. 2 Dam and Powerhouse (Figure 1-4), and Iron Gate Dam and Powerhouse (Figure 1-5), as well as associated features. Associated features vary by development, but generally include powerhouse intake structures, embankments and sidewalls, penstocks and supports, decks, piers, gatehouses, fish ladders and holding facilities, pipes and pipe cradles, spillway gates and structures, diversion control structures, aprons, sills, tailrace channels, footbridges, powerhouse equipment, distribution lines, transmission lines, switchyards, original cofferdams, portions of the Iron Gate Fish Hatchery, residential facilities, and warehouses. Facility removal will be completed within an approximately 20-month period.

This Aquatic Resources Management Plan describes the measures that the Renewal Corporation will implement to protect aquatic resources as part of the Proposed Action. The Renewal Corporation has prepared 16 Management Plans for the Commission's review and approval as conditions of a License Surrender Order. These Management Plans were developed in consultation with federal, state, and county governments and tribes.

In February 2021, the Renewal Corporation filed the 16 Management Plans with the Commission. Since that time, the Renewal Corporation has undertaken further consultation, resulting in material revisions. Table 2-2 herein shows the material revisions to the February 2021 version of this Aquatic Resources Management Plan. An updated Consultation Record for the Aquatic Resources Management Plan is included as Appendix G.

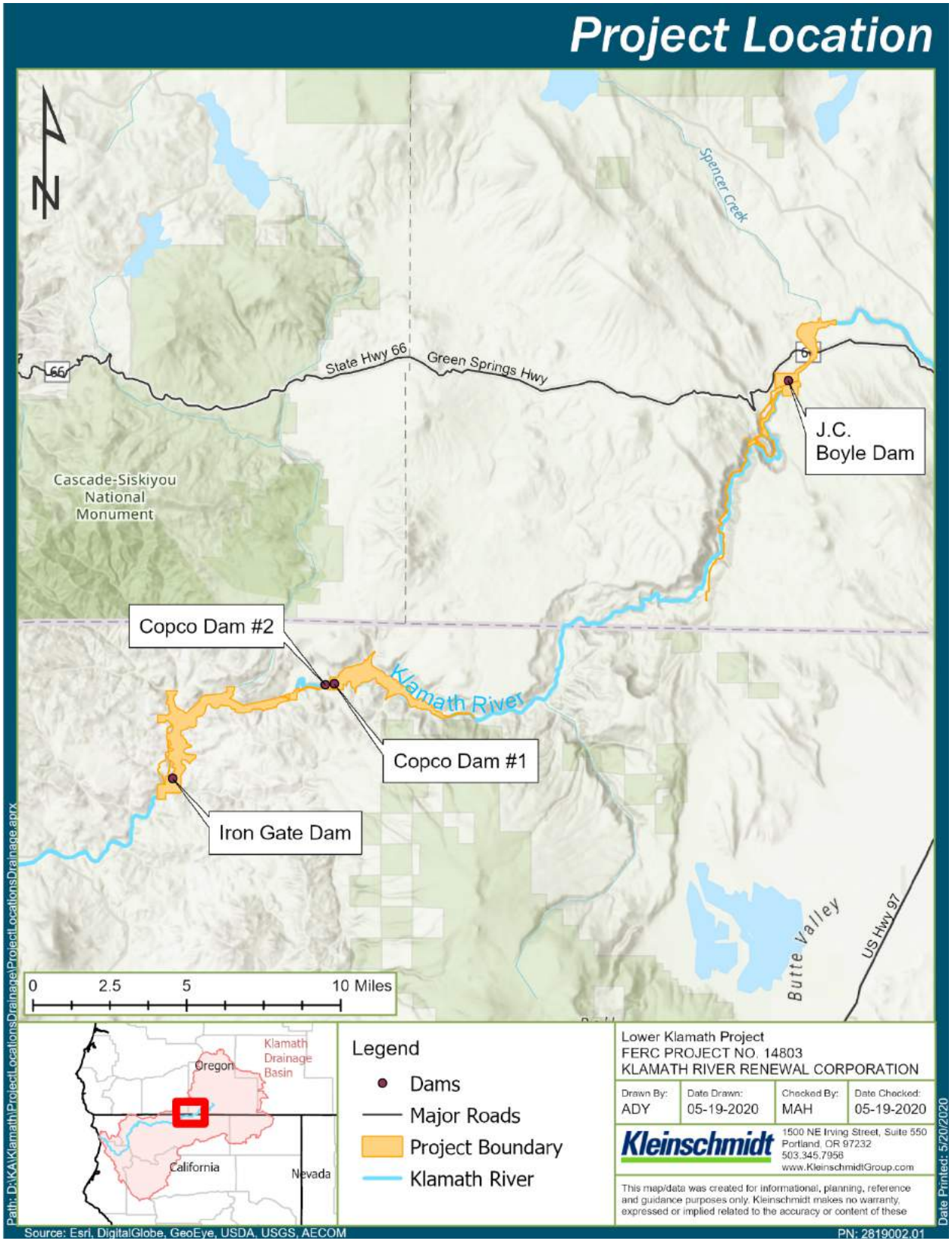

Figure 1-1. Lower Klamath Project Location

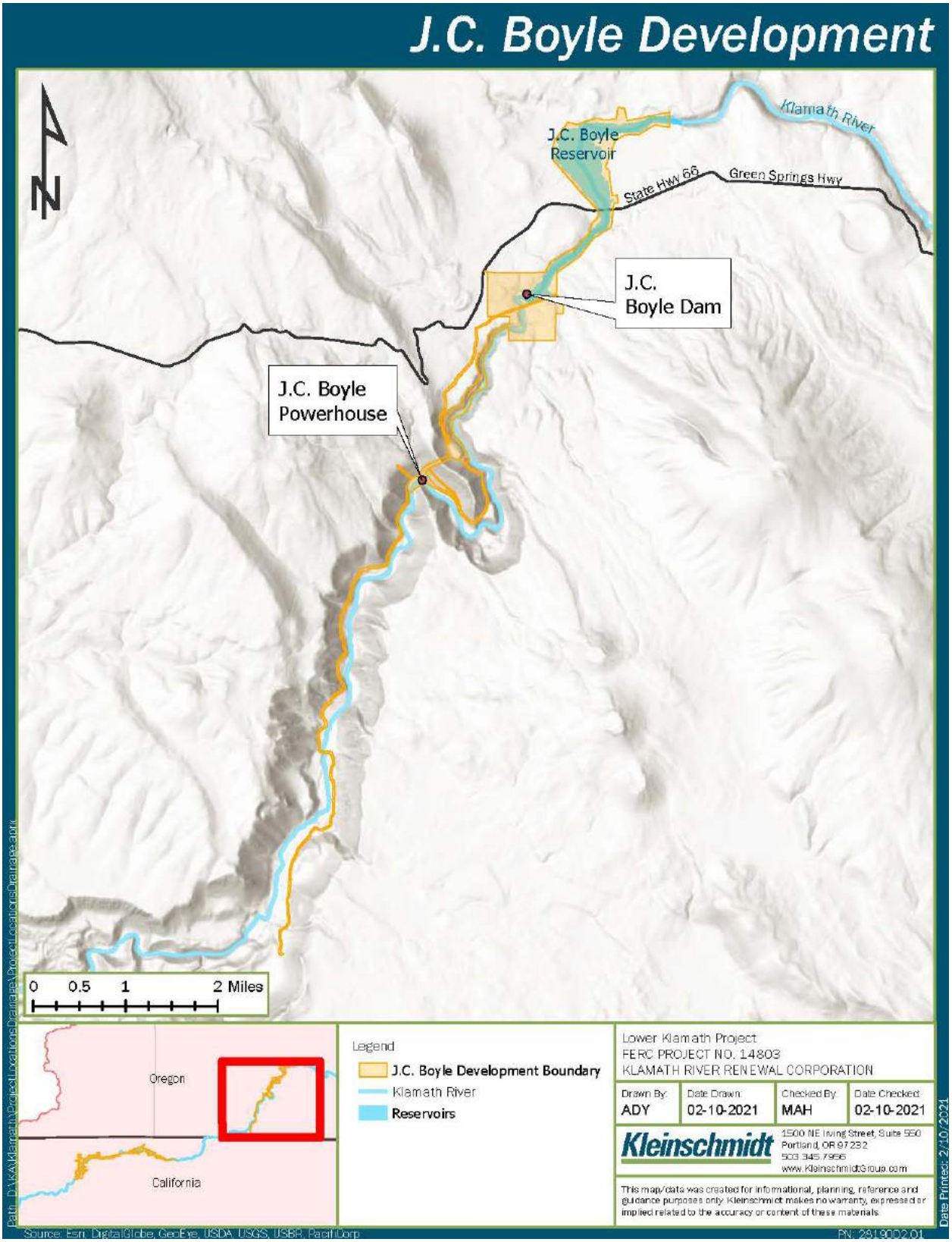

Figure 1-2. J.C. Boyle Development Facility Details

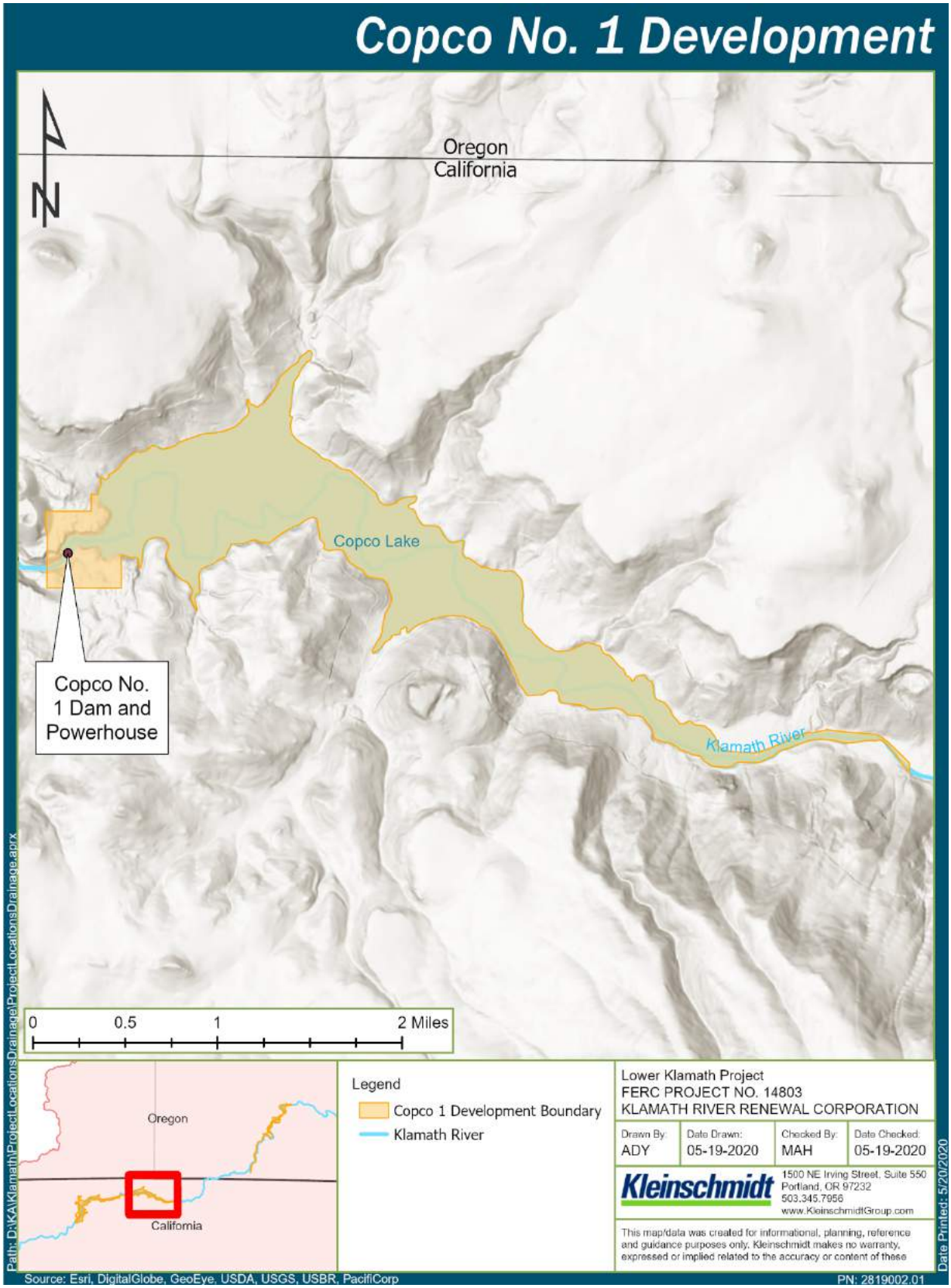

Figure 1-3. Copco No.1 Development Facility Details

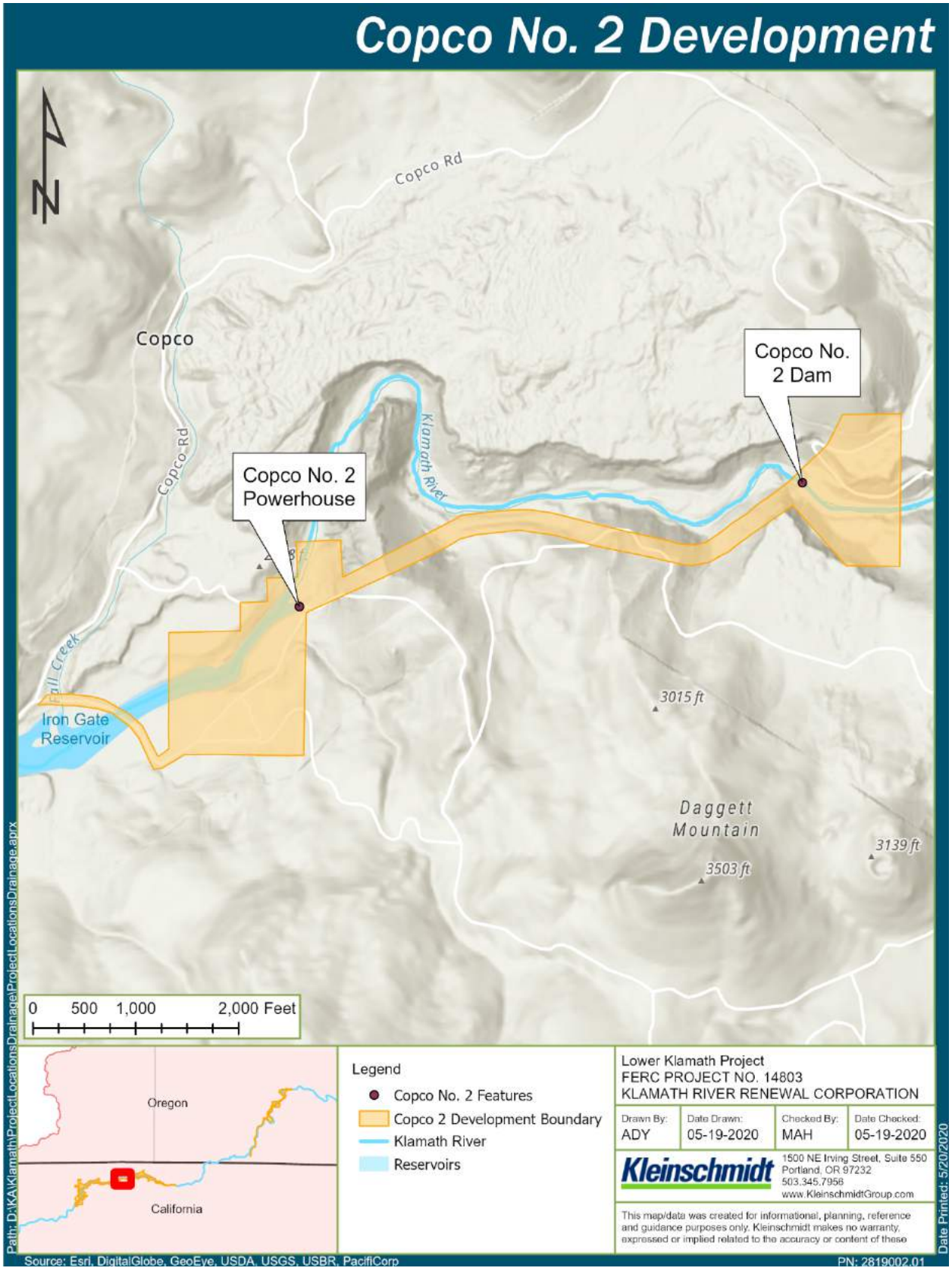

Figure 1-4. Copco No.2 Development Facility Details

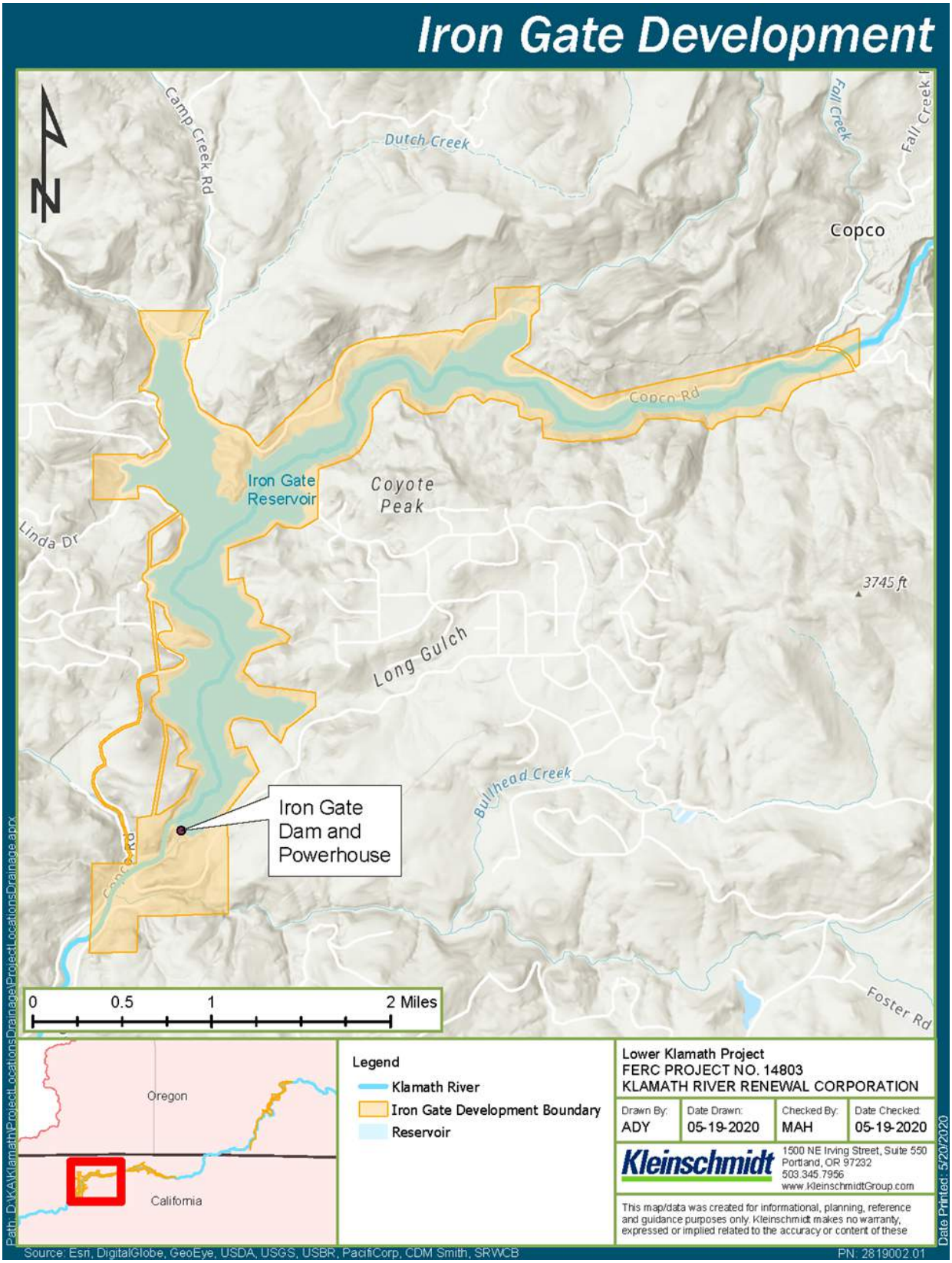

Figure 1-5. Iron Gate Development Facility Details

2.0 Regulatory Context

As described in Table 2-1, the Aquatic Resources Management Plan is one of 16 Management Plans implementing the DDP.

Table 2-1. Lower Klamath River Management Plans

1. Aquatic Resources Management Plan	9. Remaining Facilities Plan
2. Construction Management Plan	10. Reservoir Area Management Plan
3. Erosion and Sediment Control Plan	11. Reservoir Drawdown and Diversion Plan
4. Hatcheries Management and Operations Plan	12. Sediment Deposit Remediation Plan
5. Health and Safety Plan	13. Terrestrial and Wildlife Management Plan
6. Historic Properties Management Plan	14. Waste Disposal and Hazardous Materials Management Plan
7. Interim Hydropower Operations Plan	15. Water Quality Monitoring and Management Plan
8. Recreation Facilities Plan	16. Water Supply Management Plan

2.1 Organizational Structure

The Aquatic Resources Management Plan identifies the measures that the Renewal Corporation will implement to protect aquatic resources as part of the Proposed Action. Specifically, the Aquatic Resources Management Plan includes an updated Consultation Record and six sub-plans, included amongst the Appendices identified below.

- Appendix A: Spawning Habitat Availability Report and Plan
- Appendix B: California AR-6 Adaptive Management Plan-Suckers
- Appendix C: Fish Presence Monitoring Plan
- Appendix D: Tributary-Mainstem Connectivity Plan
- Appendix E: Juvenile Salmonid and Pacific Lamprey Rescue and Relocation Plan
- Appendix F: Oregon AR-6 Adaptive Management Plan-Suckers
- Appendix G: Consultation Record

2.2 Specific Regulatory Interests

The Renewal Corporation considered the following regulatory interests in the development of the Aquatic Resources Management Plan:

- California Section 401 Water Quality Certification

- Oregon Section 401 Water Quality Certification
- California Department of Fish and Wildlife (CDFW) Memorandum of Understanding
- Oregon Memorandum of Understanding
- California Environmental Quality Act, Final Environmental Impact Report
- Biological Assessment (National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS))

2.3 Results of Consultation since February 2021

The Renewal Corporation has revised the February 2021[1] version of this plan, on the basis of further consultation, in the following material respects.

Table 2-2. Results of Consultation

SUB-PLAN	CHANGES TO FEBRUARY 2021 VERSION
Appendix A: Spawning Habitat Availability Report and Plan	• Added note that meeting Target Metrics and enhancing spawning habitat under the Spawning Habitat Availability Report and Plan will also offset the potential impact to Pacific lamprey and coho salmon.
Appendix B: California AR-6 Adaptive Management Plan-Suckers	• Increased monitoring obligations during transport runs.
Appendix C: Fish Presence Monitoring Plan	• Revised to permit the Renewal Corporation to delay the commencement of the monitoring period by one year if determined necessary in consultation with the ARG. • Revised to permit reduction in the duration and/or scope of monitoring upon request by the Renewal Corporation based on new information. • Added obligation for the Renewal Corporation to implement the relevant BMPs in the RAMP to minimize potential transport of aquatic invasive species.
Appendix D: Tributary-Mainstem Connectivity Plan	• Added requirement that the Renewal Corporation confer with the HRG and ARG if a natural barrier materially and unexpectedly restricts fish passage. • Revised to increase period during which the Renewal Corporation will be obligated to monitor the first 5-year or greater flow event after drawdown from 2 years to 5 years.

[1] Appendices B and F (California AR-6 Adaptive Management Plan – Suckers and Oregon AR-6 Adaptive Management Plan – Suckers, respectively) were submitted to the Commission in March 2021.

SUB-PLAN	CHANGES TO FEBRUARY 2021 VERSION
Appendix E: Juvenile Salmonid and Pacific Lamprey Rescue and Relocation Plan	• Added language to clarify that Pacific lamprey will not be relocated under the Juvenile Salmonid and Pacific Lamprey Rescue and Relocation Plan. • Added obligation to consult with ARG regarding a number of decisions, including whether capture and relocation efforts are required, whether water temperature loggers need to be temporarily offloaded more frequently, modification of monitored areas, the location of alternative relocation sites, and restrictions placed on relocation sites. • Added obligation for the Renewal Corporation to regularly update the regression analysis during the drawdown and monitoring phases. • Added obligation for the Renewal Corporation to take supplemental point samples if a Monitored Tributary exceeds or is anticipated to exceed the Water Temperature Trigger. • Added obligation for the Renewal Corporation to implement the relevant BMPs in the RAMP to minimize potential transport of aquatic invasive species.
Appendix F: Oregon AR-6 Adaptive Management Plan-Suckers	• Increased monitoring obligations during transport runs.

2.4 Regulatory Approval Process

The Renewal Corporation will implement the Aquatic Resources Management Plan as approved by the Commission in the License Surrender Order. The Renewal Corporation will obtain and report to the Commission any required approvals from other agencies.

3.0 Aquatic Resources Group

The Renewal Corporation assembled an Aquatic Technical Work Group (ATWG) during development of this plan. The work group was comprised of fisheries scientists from a number of federal and state resource agencies and tribal entities, including CDFW, Oregon Department of Fish and Wildlife (ODFW), NMFS, USFWS, the California State Water Resources Control Board (SWRCB), the Bureau of Land Management (BLM)-Klamath Falls Field Office, the Yurok Tribe and the Karuk Tribe. The plan, including the metrics and objectives contained herein, reflect that consultation on best available science and management measures.

Upon the Commission's issuance of a License Surrender Order, the Renewal Corporation will assemble an Aquatic Resources Group (ARG) for the purpose of consultation on implementing the Aquatic Resources Management Plan. This work group will include members of the

Renewal Corporation's team (e.g., RES), CDFW, ODFW, NMFS, USFWS, the California State Water Resources Control Board, the BLM-Klamath Falls Field Office, the Yurok Tribe, the Karuk Tribe, and the Klamath Tribes. Each member will designate a lead who will represent it at ARG meetings and serve as its primary contact for all ARG-related matters.

The Renewal Corporation will establish protocols for consultation with the ARG. These protocols will address meeting logistics and frequency, agenda development, and recordkeeping and other procedures. As to meeting frequency, the Renewal Corporation expects to meet with the ARG approximately once per week during reservoir drawdown and less frequently (approximately once per quarter) before and after drawdown.

The Renewal Corporation will actively consult with the ARG during implementation of the Aquatic Resources Management Plan. The Renewal Corporation will maintain a record of the topics covered, decision points reached, and actions items agreed to. Under the License Surrender Order, the Renewal Corporation will be responsible for implementation of the plan and is not delegating or assigning that responsibility to the ARG.

4.0 Force Majeure

The Aquatic Resources Management Plan includes metrics, objectives, and obligations that are dependent upon natural systems, which are inherently variable. Acts of God, natural disasters, flooding, fire, drought, labor shortages, and other events beyond the control of the Renewal Corporation (Force Majeure Event) may affect or delay compliance with a given obligation in the plan. If there is a Force Majeure Event, the Renewal Corporation will, following consultation with the ARG, report to the Commission and SWRCB and/or ODEQ, as applicable, proposing a variance or other appropriate adjustment of the plan.

5.0 Reporting

By April 15 of each year, the Renewal Corporation will prepare and submit to the Commission an Annual Report which will include information pertaining to implementation of the Aquatic Resources Management Plan. The report will include the records of consultation described in Section 3.

Appendix A

Spawning Habitat Availability Report and Plan

KLAMATH RIVER RENEWAL CORPORATION

Lower Klamath Project
FERC Project No. 14803

Spawning Habitat Availability Report and Plan

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1.0 Introduction

This Spawning Habitat Availability Report and Plan is a subplan of the Aquatic Resources Management Plan that will be implemented as part of the Proposed Action (Proposed Action) for the Lower Klamath Project. As described in Section 4.0 below, the Renewal Corporation will update the Spawning Habitat Availability Report and Plan following the completion of the survey activities described in Section 3.0 (Activity 2).

For purposes of the Spawning Habitat Availability Report and Plan, Year 1 refers to the year before drawdown, Year 2 refers to the drawdown year and Year 3 refers to the year following the drawdown year.

1.1 Purpose of Spawning Habitat Availability Report and Plan

The purpose of the Spawning Habitat Availability Report and Plan is to describe (1) the target metrics that will be used by the Renewal Corporation to determine whether it is necessary to implement spawning habitat enhancement activities, (2) the surveys that the Renewal Corporation will conduct to determine whether the target metrics have been met, (3) the updates that the Renewal Corporation will make to the Spawning Habitat Availability Report and Plan following completion of the surveys, and (4) the timing of the implementation of the spawning habitat enhancement activities if such activities are determined to be necessary. As recommended by the Aquatic Technical Work Group (ATWG), the Spawning Habitat Availability Report and Plan focuses primarily on the potential impacts to Chinook salmon and steelhead. See Section 3.0 of the Aquatic Resources Management Plan for additional details regarding the ATWG. As noted below, meeting the Target Metrics (as defined below) will also confirm spawning habitat availability for coho salmon and Pacific lamprey. In addition, any actions taken by the Renewal Corporation to enhance spawning habitat under Section 5.0 of the Spawning Habitat Availability Report and Plan would also be expected to enhance spawning habitat for coho salmon and Pacific lamprey.

1.2 Relationship to Other Management Plans

The Spawning Habitat Availability Report and Plan is supported by elements of the Reservoir Area Management Plan. So as not to duplicate information, elements from the Reservoir Area Management Plan are not repeated herein but are, where appropriate, referenced in this Spawning Habitat Availability Report and Plan. To facilitate its implementation in the field, the Renewal Corporation will provide the Aquatic Resources Group (ARG) with copies of the Spawning Habitat Availability Report and Plan in an electronic format that contains links to the other management plans referenced herein. See Section 3.0 of the Aquatic Resources Management Plan for additional details regarding the ARG.

1.3 Spawning Habitat Availability Report and Plan Activities

The remainder of the Spawning Habitat Availability Report and Plan describes the actions that the Renewal Corporation will take and is divided into the following sections:

- Section 2.0 Activity 1: Spawning Habitat Target Metrics: Describes the two spawning habitat target metrics that will be used by the Renewal Corporation to determine whether it is necessary to implement spawning habitat enhancement activities.

- Section 3.0 Activity 2: Spawning Habitat Availability Surveys: Provides a summary of the surveys that the Renewal Corporation will conduct to determine whether the Target Metrics have been met, including information about survey methods and survey timing.

- Section 4.0 Activity 3: Updated Spawning Habitat Availability Report and Plan: Describes the updates that the Renewal Corporation will make to the Spawning Habitat Availability Report and Plan following the completion of the surveys described in Section 3.0. The updated Spawning Habitat Availability Report and Plan will include a summary of survey results and, if determined to be necessary, a description of the spawning habitat enhancement activities that the Renewal Corporation will implement, including the location, duration, and timing of each proposed activity.

- Section 5.0 Activity 4: Spawning Habitat Enhancement Implementation: States that spawning habitat enhancement activities that are determined to be necessary will be implemented Year 2 and Year 3.

2.0 Activity 1: Spawning Habitat Target Metrics

The Renewal Corporation's analysis (2018) predicts short-term impacts to approximately 2,100 fall Chinook salmon redds and approximately 13 Southern Oregon/Northern California Coast (SONCC) coho salmon redds during reservoir drawdown. Additionally, the Renewal Corporation (2018) anticipates direct suspended sediment effects to steelhead and Pacific lamprey migrating within the mainstem Klamath River after December 31 during Year 2. Table 2-1 includes the likely and worst-case effects to adult anadromous fish species downstream from Iron Gate Dam potentially attributable to the Proposed Action based on the Renewal Corporation's analysis.

Table 2-1. 2012 EIS/R anticipated effects summary for migratory adult salmonids and Pacific lamprey

SPECIES	LIFE STAGE	LIKELY EFFECTS	WORST EFFECTS
SONCC Coho salmon	Adult spawning	Loss of 13 redds (0.7-26%)[1]	Loss of 13 redds (0.7-26%)[1]
Chinook salmon - fall	Adult spawning	Loss of 2,100 redds (8%)[1]	Loss of 2,100 redds (8%)[1]
Steelhead - summer	Migrating adults	No anticipated mortality	Loss of 0-130 adults

SPECIES	LIFE STAGE	LIKELY EFFECTS	WORST EFFECTS
Steelhead - winter	Migrating adults	Loss of up to 1,008 adults (14%)[1]	Loss of up to 1,988 adults (28%)[1]
Pacific lamprey	Adult migration and spawning	36%[2] mortality	71%[2] mortality

Source: USBR and CDFG 2012
1. Range of potential year class loss based on the average number of redds associated with the evaluated population(s).
2. The 2012 EIS/R predicted Pacific lamprey mortality based on mortality models developed for suspended sediment impacts to salmonids. Model output did not include the number of predicted Pacific lamprey mortalities.

In response to the potential impacts to Chinook salmon and steelhead, the Renewal Corporation (2018) developed targets for increased access to spawning habitat for Chinook salmon and steelhead based on typical spawning redd dimensions for the two species. These targets are anticipated to offset the anticipated short-term loss of Chinook salmon redds and adult steelhead due to reservoir drawdown. Fortune et al. (1966) used 21 yd^2 and 26 yd^2 of suitable gravel per Chinook salmon redd and steelhead redd, respectively, to calculate spawning potential in areas of the Klamath River and selected tributaries upstream of Iron Gate Dam (Table 2-2). These areas are approximately four times the approximate redd size for each species to allow for interred space when estimating the capacity of spawning gravel areas (Burner 1951).

Based on a potential loss of 2,100 Chinook salmon redds downstream from Iron Gate Dam and a 21 yd^2 area per redd, the Renewal Corporation determined that access to 44,100 yd^2 of additional spawning habitat in the mainstem of the Klamath would offset the potential loss of 2,100 Chinook salmon redds (Mainstem Target).

Based on recent winter steelhead counts, the Renewal Corporation predicts that reservoir drawdown and sediment release could affect an estimated 358 adult steelhead representing 179 spawning redds. Applying Fortune et al. (1966) steelhead redd dimensions, the Renewal Corporation determined that access to approximately 4,700 yd^2 of spawning habitat in key tributaries would offset the potential loss of 358 winter steelhead (Tributary Target).

Meeting the Target Metrics will also offset the potential impact to Pacific lamprey and the small numbers of coho salmon that use the mainstem Klamath River for spawning as it confirms spawning habitat availability for those species.

Table 2-2. Fall Chinook Salmon and Winter Steelhead Redd Losses and Offsets

METRIC	FALL CHINOOK SALMON	WINTER STEELHEAD
Potential redd loss due to reservoir drawdown and sediment release	2,100	179[1]
Surface area per spawning redd (yd^2)	21	26
Spawning habitat area necessary to offset redd loss (yd^2)	44,100	4,700

1. Updated anticipated winter steelhead loss based on peak steelhead return (631 in 2001) to Iron Gate Hatchery between 2000-2016 (California Department of Fish and Wildlife (CDFW) 2016). Expected mortality calculated using the methodology contained in the 2012 EIS/R (631*0.80*0.71=358). The Renewal Corporation converted the 358 adult steelhead to 179 redds that would be lost due to adult steelhead mortality.

3.0 Activity 2: Spawning Habitat Availability Surveys

Under Activity 2, the Renewal Corporation will conduct field surveys and remote sensing efforts prior to and following reservoir drawdown to evaluate and quantify the existing spawning habitat which will be available to anadromous salmonids following dam removal. The hydroelectric reach includes the Klamath River and its tributaries, from the upstream end of the J.C. Boyle Reservoir downstream to the base of Iron Gate Dam (Hydroelectric Reach). As described in more detail below, the Renewal Corporation will conduct wading surveys on Jenny Creek, Fall Creek, Shovel Creek, and Spencer Creek. The Renewal Corporation will also conduct unmanned aerial vehicle (UAV) surveys (and if necessary, field and/or GPS surveys, as described below) on the mainstem Klamath River between Iron Gate Dam (river mile (RM) 193.1) and Keno Dam (RM 239.2). See Section 6.2.7 (Headcut Migration Monitoring) of the Reservoir Area Management Plan for additional detail.

3.1 Tributaries Survey

3.1.1 Overview

The Renewal Corporation will complete a targeted survey to quantify the amount of spawning habitat available to adult anadromous salmonids following reservoir drawdown and dam removal in the following four tributaries: Jenny Creek, Fall Creek, Shovel Creek, and Spencer Creek (Table 3-1). During the tributaries survey, the Renewal Corporation will walk and survey (1) Shovel Creek and Spencer Creek from their mouths upstream for two miles and (2) Jenny Creek and Fall Creek from their mouths upstream to the first natural fish passage barrier. If the Tributary Target of 4,700 yd^2 of spawning habitat is documented at any time during the tributaries survey, the tributaries survey will cease and be considered completed. If the survey does not result in the identification of 4,700 yd^2 of spawning habitat, the Renewal Corporation will conduct a follow-up survey of the remainder of Shovel Creek and Spencer Creek upstream to the first natural fish passage barrier. If the Tributary Target is still not met after the follow-up survey, the Renewal Corporation will survey the following additional tributaries within the

Hydroelectric Reach that are anticipated to support steelhead following dam removal: Camp Creek, Scotch Creek, Dutch Creek, Deer Creek and/or Beaver Creek. If the Tributary Target of 4,700 yd^2 of spawning habitat is documented at any time during these additional surveys, the tributaries survey will cease and be considered completed. Wetted side channels that meet the minimum water depth and water velocity criteria set forth in Table 3-3 will be surveyed and included in the results of the tributaries survey.

The Renewal Corporation may need to receive permission from certain property owners to conduct the wading survey on their land. If permission is required, the Renewal Corporation will ask the property owner to grant it temporary access to conduct the survey. If permission is not granted, the Renewal Corporation will skip the inaccessible section of the tributary and resume the wading survey at the next accessible location on the tributary.

The Renewal Corporation will document any man-made fish passage barriers observed during the tributaries survey.

Table 3-1. Initial existing spawning habitat survey tributaries in the Hydroelectric Reach

TRIBUTARY	TRIBUTARY CONFLUENCE LOCATION AT THE KLAMATH RIVER (RM)	TRIBUTARY LENGTH TO FIRST NATURAL BARRIER (MI)[1]	SURVEY LENGTH (MI)[2]
Jenny Creek	197.4	1.0	1.0
Fall Creek	199.8	1.2	1.2
Shovel Creek	212.0	2.7	2.0
Spencer Creek	233.4	13.0	2.0

1. Tributary length is based on pre-dam removal stream lengths. Since Jenny Creek, Fall Creek, and Spencer Creek are all expected to increase in length following the drawdown, the distance to the first natural fish passage barrier for these creeks is also anticipated to increase post drawdown.
2. If the distance to the first natural fish passage barrier for Jenny Creek, Fall Creek, and/or Spencer Creek increases post-drawdown, as expected (see footnote 1 above), there will be a commensurate increase in survey length.

3.1.2 Survey Timing

The tributaries survey will be conducted during Year 1 and/or Year 2. The Renewal Corporation will conduct each tributary survey in either the winter or spring during a period in which flows are similar to spawning period flows for steelhead (Table 3-2).

Table 3-2. Expected spawning periods for fall Chinook salmon and steelhead within the Klamath Hydroelectric Reach and tributaries

SPECIES	SPAWNING PERIOD	SURVEY TYPE
Fall Chinook Salmon	September 1 – December 31	Mainstem Klamath River Survey

SPECIES	SPAWNING PERIOD	SURVEY TYPE
Steelhead	December 15 – May 31	Tributaries Survey

Although tributaries in the Hydroelectric Reach are currently outside the extent of anadromy, resident adult redband trout and suckers may currently use these streams for spawning. If the Renewal Corporation observes redds or adult spawners during the tributary wading surveys, qualifying spawning patches (described in detail below) will be flagged and GPS locations will be marked with detailed habitat measurements taken at a later date to avoid disturbing spawning fish.

The Renewal Corporation will schedule surveys to target the receding limb of the hydrograph following a flow event, when flows are elevated but stable, and when water clarity is acceptable for identifying substrate size and composition. If a follow-up survey is necessary, the Renewal Corporation will, to the extent feasible, target tributary discharge comparable to the measured discharge of the previous survey.

3.1.3 Stream Discharge

The Renewal Corporation will measure tributary discharge once at the start of each survey day in the first run or glide encountered upstream from the backwater effect of the reservoir or the mainstem of the Klamath River. The Renewal Corporation will use a portable flow meter and reel tape to measure the discharge. The flow meter will be calibrated each day prior to discharge measurement. The Renewal Corporation will use the Sum of Partial Discharges Method (West Virginia Department of Environmental Protection (WVDEP), 2018) to measure and then calculate the discharge.

The Sum of Partial Discharges Method consists of: 1) measuring the average velocity of water in each of several subsections (called a vertical) of a cross-sectional transect; 2) computing the partial discharge of each subsection as the product of the velocity and area of the subsection; and 3) summing the partial discharges to obtain the total discharge (Figure 3-1).

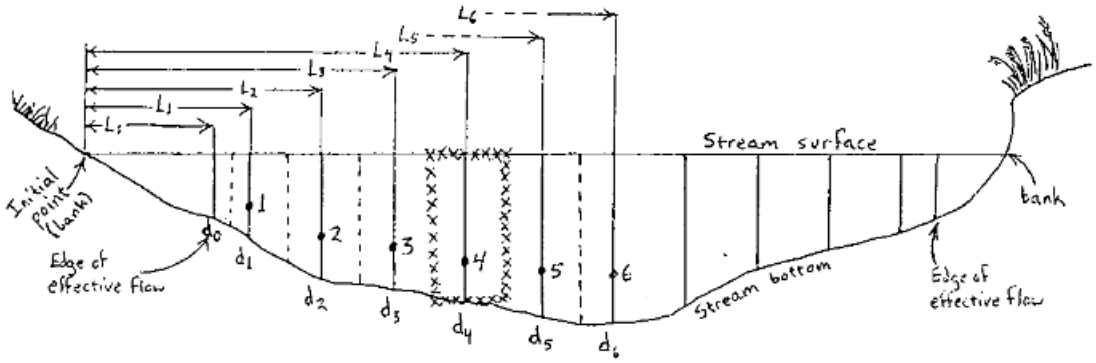

Figure 3-1. Example schematic of sum of partial discharge method

3.1.4 Spawning Habitat Patch Size

The Renewal Corporation will quantify patches of spawning habitat it encounters using a modified version of the Timber-Fish-Wildlife Cooperative Monitoring, Evaluation, and Research Committee's Salmonid Spawning Habitat Availability Survey, referred to hereafter as the TFW SHA patch survey method (Schuett-Hames et al. 1999). The Renewal Corporation will quantify a patch of spawning habitat if it meets all minimum criteria contained in Table 3-3. The Renewal Corporation selected most of the minimum criteria for identifying a spawning habitat patch as recommended by Schuett-Hames and Pleus (1996). These minimum criteria are generally due to the extensive variation in spawning habitat values both within fish stocks and between stocks and species (Burner, 1951; Smith, 1973; Bjornn and Reiser, 1991; Kondolf and Wolman, 1993). The minimum patch size criterion was adapted to meet the minimum redd sizes specified for the target species as described in Fortune et al. (1966).

Table 3-3. Minimum criteria for determining qualifying patches

PATCH METRIC	MINIMUM CRITERIA (METRIC)	MINIMUM CRITERIA (IMPERIAL)
Dominant Substrate Size	8 – 128 mm	0.3 – 5 in
Substrate Depth	≥ 23 cm	≥ 9 in
Water Depth	≥ 10 cm	≥ 4 in
Water Velocity	> Slack	> Slack
Patch Size	≥ 5 m^2	≥ 6 yds^2

To qualify as spawning habitat, more than half of the surface area of a patch must be comprised of substrate sizes ranging from small spawning gravel (8 - 64 mm) to large spawning gravel (64 - 128 mm). The Renewal Corporation will determine this by visually estimating the substrate

composition of the total patch surface. Minimum substrate depth and water depth are determined using a measuring stick or a staff with a fixed mark. Minimum velocity requirement can be determined by floating a leaf or twig to confirm the presence of water velocity. Once a qualifying patch is identified by the Renewal Corporation, the Renewal Corporation will record GPS coordinates using a handheld GPS unit positioned near the center of the patch. If GPS coverage is adequate, the Renewal Corporation will use survey grade GPS to survey the perimeter of each qualifying patch. If GPS coverage is inadequate, the Renewal Corporation will take a specific set of measurements for each qualifying patch using a reel tape. The Renewal Corporation will measure the total length of the patch along the longest axis and record to the nearest tenth of a foot. To determine the average width of the patch, the Renewal Corporation will take five width measurements perpendicular to the length measurement at approximately 10%, 30%, 50%, 70%, and 90% distance along the length axis. The Renewal Corporation will record the five width measurements to the nearest tenth of a foot. Figure 3-2 includes a schematic of the measurement locations along a qualifying spawning habitat patch.

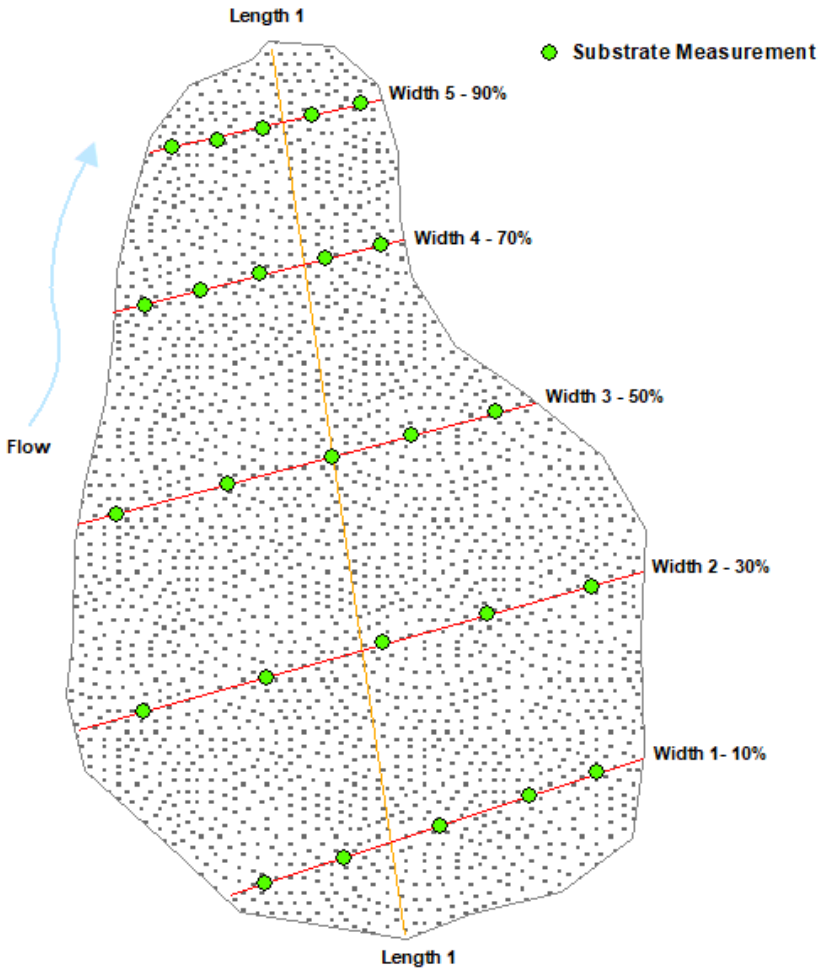

Figure 3-2. Example schematic of length, width, and substrate measurements taken on a qualifying gravel patch

In addition to the spawning habitat patch measurements, the Renewal Corporation will record the sequential patch number, habitat unit type, GPS coordinates, and any photo numbers. If a patch extends into multiple habitat units (e.g., pool and riffle), the Renewal Corporation will split the patch into multiple patches with separate measurements taken for each patch.

3.1.5 Substrate

The Renewal Corporation will estimate substrate visually to determine if a patch meets the qualifying criteria. The Renewal Corporation will estimate the total percentage of the patch that is comprised of either small spawning gravel (8 - 64 mm) or large spawning gravel (64 - 128 mm) and record each spawning patch. The Renewal Corporation will take photographs of the substrate containing a scale object at each qualifying patch.

Additionally, the Renewal Corporation will quantify and classify substrate size using a gravelometer for a subset of qualifying patches in each reach, as described below. At the first four qualifying patches encountered in each tributary surveyed, the Renewal Corporation will take a total of 25 substrate measurements by measuring five particles along each of the five width-measurement transects (see Figure 3-2). The particle measurements taken with respect to the four qualifying patches referenced above will be taken at 10%, 30%, 50%, 70%, and 90% of the distance across the width measurement transect. The Renewal Corporation will measure the substrate size along the intermediate axis of each particle or by using a gravelometer. The Renewal Corporation will then record the particle size class using the classification codes contained in Table 3-4. Additionally, at each transect, the Renewal Corporation will record a visual estimate of the percent fines (sand and silt combined) located along the transect.

Table 3-4. Substrate type, size classes, and classification codes

SUBSTRATE TYPE	SIZE (MM)	CODE[1]
Silt, Clay, Organics, Vegetation	--	1
Sand (coarse)	--	2
Small gravel	2-16	3
Medium gravel	16-32	4
Large gravel	32-64	5
Small cobble	64-128	6
Large cobble	128 - 256	7
Boulder	>256	8
Bedrock	--	9

1. For purposes of quantifying and classifying substrate size for a subset of qualifying patches in each reach, only codes 3-9 will be used.

3.2 Mainstem Klamath River Survey

The Renewal Corporation will conduct spawning habitat surveys using remote sensing techniques on the mainstem Klamath River between Iron Gate Dam (RM 193.1) and Keno Dam (RM 239.2) to determine the amount of mainstem spawning habitat in the Hydroelectric Reach suitable for immediate spawning. The surveys will be conducted during the summer or falloff Year 2. The Renewal Corporation will use an unmanned aerial vehicle (UAV) to acquire air photos of the free-flowing reach following reservoir drawdown and dam removal. The Renewal Corporation will take air photos at low flows with sufficient water clarity to view the substrate. The Renewal Corporation will capture air photos at a resolution that is adequate for interpreting breaks between substrate sizes of 5 inches (128 mm) or less. If determined necessary by the Renewal Corporation, GPS and/or field surveys will be used to identify patch delineation and substrate composition and/or to otherwise aid in air photo interpretation and measurements. The Renewal Corporation will then use Geographic Information Systems to delineate and quantify spawning patches based on the information collected using remote sensing techniques in order to determine if the Mainstem Target has been met.

Surface substrate measurements will be taken to ground truth and support UAV calibration. The number of reference locations and measurements to be taken will be determined in coordination with a UAV drone pilot, GIS analyst, and fisheries biologist following the UAV image capture and will be informed by water clarity, image resolution, and image quality at the time of the UAV flight. Ground truth locations will be reported in the updated Spawning Habitat Availability Report and Plan described in Section 4.0 below.

4.0 Activity 3: Updated Spawning Habitat Availability Report and Plan

As Activity 3, the Renewal Corporation will update the Spawning Habitat Availability Report and Plan following the completion of the tributaries and mainstem Klamath River surveys described in Section 3.0 above. For the Klamath River and each tributary stream reach surveyed, the Renewal Corporation will update the Spawning Habitat Availability Report and Plan to include a summary description of survey conditions, typical reach characteristics, total spawning habitat available, and a description of all man-made fish barriers encountered during the surveys. The Spawning Habitat Availability Report and Plan will be updated by including an appendix that summarizes data collected on each individual spawning habitat patch documented during the surveys, including patch dimensions, area, and spatial location information.

If, based on the surveys, one or more of the Target Metrics have not been met, the Renewal Corporation will, in consultation with the ARG, evaluate a range of actions to augment spawning habitat. In the event that gravel augmentation is not appropriate, the Renewal Corporation will evaluate other actions to improve spawning habitat, including installation of large woody material, riparian planting for shade coverage, wetland construction or enhancement, and cattle exclusion fencing.

If the Renewal Corporation determines, following consultation with the ARG, that it is necessary to implement actions to improve spawning habitat, the Spawning Habitat Availability Report and Plan will be updated to include the following with respect to any proposed actions: 1) a detailed description of each proposed action, including any avoidance or minimization measures that may be implemented to protect fish and wildlife resources; 2) the location(s) of each proposed action; 3) the duration and timing (e.g., season) for implementation of the proposed actions; and 4) an assessment of estimated spawning habitat benefits resulting from the proposed action in compensating for the difference between the Target Metrics and the amount of spawning habitat documented during the surveys. The updated Spawning Habitat Availability Report and Plan with descriptions of the proposed actions will then be submitted to the SWRCB for approval. If the updated Spawning Habitat Availability Report and Plan is approved by the SWRCB, the Renewal Corporation will file a report with the Federal Energy Regulatory Commission within 14 calendar days, which shall include a copy of the updated Spawning Habitat Availability Report and Plan and documentation of consultation with the SWRCB.

The Renewal Corporation may concurrently be implementing restoration measures under the Reservoir Area Management Plan that increase spawning habitat availability, including actions related to fish passage barrier removal, installation of large woody material, riparian planting for shade coverage, gravel augmentation, wetland construction or enhancement, and/or cattle exclusion fencing. To the extent measures taken or to be taken under the RAMP provide spawning habitat benefits, the Renewal Corporation will consider such benefits when determining, in consultation with the ARG, whether and what actions are necessary to improve spawning habitat under the Spawning Habitat Availability Report and Plan.

5.0 Activity 4: Spawning Habitat Enhancement Implementation

As Activity 4, if the Target Metrics have not been met, the Renewal Corporation will implement the proposed actions developed by the Renewal Corporation in accordance with Section 4.0 above. The Renewal Corporation will (if necessary) implement the proposed actions during the Year 2 and Year 3 in conjunction with the Klamath River and select tributary stream restoration activities described in the Reservoir Area Management Plan.

The Renewal Corporation proposes to apply the in-water work best management practices (BMPs) set forth in Appendix C (Best Management Practices) of the RAMP. In-water work BMPs related to seasonal timing of in-stream work, work area isolation and/or dewatering, and fish rescue and relocation will likely minimize any effects to coho salmon and other aquatic species present.

6.0 Reporting

The Renewal Corporation will prepare and submit an annual report by April 1 of every year for as long as the Renewal Corporation has performance obligations under the Spawning Habitat

Availability Report and Plan. Each annual report will be submitted to the SWRCB and ODEQ, and copied to the ARG. . The annual report will include the following:

1. Monitoring data, including graphical representations, as appropriate;
2. Consultation records
3. Narrative interpretation of results
4. Compliance evaluations

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Appendix B

California AR-6 Adaptive Management Plan-Suckers

KLAMATH RIVER RENEWAL CORPORATION

Lower Klamath Project
FERC Project No. 14803

California AR-6 Adaptive Management Plan-Suckers

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1.0 Introduction

This California AR-6[1] Adaptive Management Plan - Suckers (CA Suckers Plan) is a subplan of the Aquatic Resources Management Plan that will be implemented as part of the Proposed Action for the Lower Klamath Project (Project).

1.1 Purpose

This CA Suckers Plan describes the measures the Renewal Corporation has completed to better understand Lost River sucker (*Deltistes luxatus*) and shortnose sucker (*Chasmistes brevirostris*) (listed suckers) populations in Copco No. 1 Reservoir and Iron Gate Reservoir, and to plan the salvage and translocation of the listed suckers from the two reservoirs prior to reservoir drawdown and dam removal. The sampling plan described herein furthered understanding of sucker demographics and genetics, population sizes, habitat use, and successful gear types and fishing methods. Informed by sampling plan results, the Renewal Corporation will conduct sucker salvage and translocation efforts to remove Lost River and shortnose suckers from the Lower Klamath Project reservoirs prior to reservoir drawdown and dam removal.

2.0 Overview

The CA Suckers Plan entails two actions as part of the Proposed Action: Action 1: Reservoir and River Sampling, and Action 2: Sucker Salvage and Translocation which are summarized below. The Renewal Corporation has completed Action 1 activities as detailed in *Section 3.0 Action 1: Sampling Plan Methods and Results*. The Action 2 activities outlined in *Section 4.0 Action 2: Salvage and Translocation Plan* will be completed prior to reservoir drawdown. A similar plan for J.C. Boyle Reservoir is included in the Oregon AR-6 Adaptive Management Plan - Suckers (OR Suckers Plan).

2.1 Action 1: Reservoir and River Sampling

The Renewal Corporation coordinated a sucker sampling program with U.S. Fish and Wildlife Service (USFWS), California Department of Fish and Wildlife (CDFW), and the U.S. Geological Survey (USGS) from 2018 through 2020. The Renewal Corporation completed sampling in Copco No. 1 Reservoir and Iron Gate Reservoir and in Klamath River reaches upstream from the respective reservoirs between fall 2018 and spring 2020. Sampling included placing trammel nets in the reservoirs and electrofishing, which was used in the Klamath River reaches

[1] AR-6 is an acronym for Aquatic Resources Measure 6. This terminology was used in the 2018 Definite Plan to identify and describe the measures the Renewal Corporation would implement under the Aquatic Resources Management Plan to protect aquatic resources. Since the 2020 Definite Decommissioning Plan has superseded the Definite Plan, the "AR-6" terminology is no longer relevant. Regardless, the Renewal Corporation has retained the original name of this subplan to avoid confusion and ensure continuity during the consultation process.

entering the reservoirs and to augment trammel net sampling. Captured Lost River and shortnose suckers were identified by species and sex, marked with a PIT tag (Burdick 2013), fin clipped for genetic material, measured, and released. Klamath smallscale suckers (*Catostomus rimiculus*) were also processed in 2020 to collect genetic material for USFWS. It is the Renewal Corporation's understanding that USFWS will use the genetic material to develop genetic assays. Recaptured fish were used to estimate sucker abundance, and fin clips were provided to USFWS for genetic testing at the discretion of USFWS. Sampling was typically completed over three nights. Sampling was typically completed over two nights on Copco No. 1 Reservoir and two nights on Iron Gate Reservoir during each sampling period. The Renewal Corporation completed annual summary reports following each sampling effort and reports were submitted to CDFW and USFWS. The Renewal Corporation also presented sampling results to the Aquatic Technical Work Group (ATWG), a working group assembled to consult with the Renewal Corporation with respect to the development of the Aquatic Resources Management Plan. See Section 3.0 of the Aquatic Resources Management Plan for additional details regarding the ATWG. The sampling performed under Action 1 was completed in 2020.

2.2 Action 2: Sucker Salvage and Translocation

The Renewal Corporation will capture adult listed suckers in Copco No. 1 Reservoir and Iron Gate Reservoir using similar methods as those employed for the Action 1 sampling effort. In the spring or fall prior to reservoir drawdown, the Renewal Corporation will translocate captured suckers to the Klamath National Fish Hatchery and/or Tule Lake Sump 1A. Other translocation sites may be used following consultation with the Aquatic Resources Group (ARG) and agreement between the Renewal Corporation, USFWS, CDFW and ODFW. If agreement is reached to use other translocation sites, the Renewal Corporation will file a report with the Federal Energy Regulatory Commission (Commission) within 14 calendar days that includes the location of the additional translocation site, the reasons for the additional translocation site, and documentation of consultation with USFWS, CDFW and ODFW. See Section 3.0 of the Aquatic Resources Management Plan for additional details regarding the ARG. The Renewal Corporation anticipates salvaging a combined total of approximately 300 listed suckers from Copco No. 1 Reservoir and Iron Gate Reservoir over 7 days based on sampling catch efficiencies. The 300 listed suckers equate to between 8 and 22 percent of the mean population estimates calculated for Copco No. 1 Reservoir and Iron Gate Reservoir. A similar effort will be completed on J.C. Boyle Reservoir in Oregon (see OR Suckers Plan). During the salvage action, the Renewal Corporation does not anticipate salvaging and translocating the entire populations of Lost River and shortnose suckers residing in the two reservoirs.

3.0 Action 1: Sampling Plan Methods and Results

3.1 Purpose

The Renewal Corporation coordinated a sucker sampling program with USFWS, CDFW, and the USGS from 2018 through 2020. Renewal Corporation field crews completed sampling in fall 2018, spring and fall 2019, and spring 2020. Collected data were used to develop a better understanding of sucker demographics and genetics, population sizes, habitat use, and successful gear types and fishing methods for catching Lost River and shortnose suckers. The

sampling performed under Action 1 was completed in 2020, and the sampling results directly informed the salvage and translocation efforts described in *Section 4.0 Action 2: Salvage and Translocation Plan*.

3.2 Previous Efforts

The Renewal Corporation reviewed previous sampling studies completed on Upper Klamath Lake, J.C. Boyle Reservoir (Oregon), Copco No. 1 Reservoir, and Iron Gate Reservoir as part of pre-sampling planning. The literature review focused on studies that evaluated Lost River and shortnose sucker habitat use and demographics in Copco No. 1 Reservoir and Iron Gate Reservoir. Studies of interest included Coots (1965), California Department of Fish and Game (CDFG) (1980), Beak Consultants (1987), Buettner and Scoppettone (1991), and Desjardins and Markle (2000). These studies documented shortnose suckers in Copco No. 1 Reservoir and Iron Gate Reservoir. Beak Consultants (1987) and Desjardins and Markle (2000) each captured one Lost River sucker in Copco No. 1 Reservoir. Buettner and Scoppettone (1991) referenced the decline of Lost River suckers from Copco No. 1 Reservoir since the 1950s as documented by previous CDFW studies (Coots 1965; CDFG 1980). Buettner and Scoppettone (1991) also noted there was no prior evidence of Lost River or shortnose suckers inhabiting Iron Gate Reservoir, although Desjardins and Markle (2000) subsequently captured shortnose suckers in Iron Gate Reservoir. Sucker spawning habitat upstream from Copco No. 1 Reservoir and Iron Gate Reservoir is limited due to short riverine reaches, coarse bed material, and fluctuating river levels (Buettner and Scoppettone 1991; Desjardins and Markle 2000). Limited juvenile rearing habitat and predation by non-native fish species also likely limit the reproductive potential of Lost River and shortnose suckers in the reservoirs (Desjardins and Markle 2000). Beak Consultants documented shortnose sucker spawning in the Klamath River in the 1-mile reach of the Klamath River upstream from Copco No. 1 Reservoir (1987), but they found few larval shortnose suckers in Copco No. 1 Reservoir (1988). Identified sucker larvae were believed to be Klamath smallscale suckers or shortnose sucker-Klamath smallscale sucker hybrids (Beak Consultants 1988).

J.C. Boyle Dam and Keno Dam have fish ladders that do not meet current sucker passage criteria (ODFW OAR 412; FishPro 2000) and potentially impede the upstream migration of Lost River and shortnose suckers from the Lower Klamath Project reach to Upper Klamath Lake (PacifiCorp 2013). Desjardins and Markle (2000) suggested the presence of non-native predatory fish, and the lack of rearing habitat in Copco No. 1 Reservoir and Iron Gate Reservoir reduce recruitment to the reservoir populations. Reservoir fluctuations related to water management may also impact juvenile suckers due to juvenile suckers' poor swimming ability (PacifiCorp 2013). Desjardins and Markle (2000) also captured adult and larval suckers in Copco Reservoir No. 1 and Iron Gate Reservoir, but few juvenile suckers in Copco Reservoir No. 1 and no juvenile suckers in Iron Gate Reservoir. Sucker populations in Copco Reservoir No. 1 and Iron Gate Reservoir function as sink populations whereby adults persist but there is no evidence of significant reproduction (Rasmussen 2012; USFWS 2012; PacifiCorp 2013).

3.3 Sampling Periods and Locations

The Renewal Corporation field crews completed sampling in Copco No. 1 Reservoir and Iron Gate Reservoir over four sampling periods (Renewal Corporation 2020). Spring sampling was completed in late March and mid-May, and fall sampling was completed in early November. Sampling typically began before dusk and ended after midnight. Sampling effort focused on habitats less than 20 ft deep as adult Lost River and shortnose suckers in Upper Klamath Lake preferentially selected habitats up to 15 ft deep (Reiser et al. 2001; Banish et al. 2009). In addition to target depth, field crews also prioritized habitats with similar depths over distances of at least 300 ft to accommodate the dimension of the deployed trammel nets. Nets were often placed to fish transitional features such as from the shallow shoreline into a submerged historical mainstem channel of a tributary or the Klamath River. Sampling locations were generally in coves and tributary confluence areas that met the sampling habitat criteria defined by water depths less than 20 ft deep and habitats with consistent elevations over a 300 ft distance. Habitats that were successfully sampled during previous efforts, and over the course of the Renewal Corporation's work, were repeatedly sampled.

3.4 Sampling Methods

The Renewal Corporation field crews deployed sampling boats[2] with a captain and two crew members on each boat. The captain was responsible for driving the boat and assisting with data recording during fish processing. Crew members were responsible for deploying and retrieving fishing gear and processing captured fish. Crew members used trammel nets and boat electrofishing to sample suckers. Trammel nets were most frequently used and accounted for nearly all the sampled suckers. A boat electrofisher was used in flowing portions of the Klamath River upstream from Copco No. 1 Reservoir and Iron Gate Reservoir and in select shallow coves. Table 3-1 summarizes the sampling gear employed.

Table 3-1. Gear for sampling listed suckers in Copco No. 1 Reservoir and Iron Gate Reservoir.

SAMPLING EQUIPMENT ITEM	NUMBER	SPECIFICATIONS
Sampling Boat	1 or 2	18 ft and 19 ft sampling boats with necessary safety and anti-pollution equipment
Trammel Net	6	USGS specifications - 300 feet long, 6 feet high; two 12-inch mesh outer panels; one 1.5-inch mesh (3-inch stretch) inner panel; foam-core float line; lead-core bottom line
Electrofishing Equipment	1	3250 watt generator operated boat-mounted Smith-Root Model 1.5 KVA Electrofisher

[2] Two crews conducted sampling in fall 2018, and spring and fall 2019. One crew conducted sampling in spring 2020. Sampling level of effort was comparable across the four sampling efforts.

3.4.1 Trammel Nets

Netting of suckers was predominantly completed at night by one or two boats. Each boat set between two and six nets during each net set. Each trammel net included two 12-inch mesh outer panels and one 1.5-inch mesh inner panel sandwiched between the outer 12-inch mesh panels. A foam-core float line and lead-core bottom line maintained net position. Nets were clipped to an end poly rope with a mushroom or pyramid anchor secured at the bottom of the poly rope and a buoy secured to the top of the poly rope. The distance between the top of the clipped net and the buoy was based on water depth such that nets were fished on the bottom. Nets were paid out from either the bow or the side of the boat depending on the boat. A second anchor and buoy were attached to the poly rope at the end of the trammel net. Each net set location was documented with either a handheld or on-board GPS. During spring 2020, one sampling boat was used to deploy six trammel nets.

Nets were generally set perpendicular to the shoreline in water depths ranging from 3 ft to 50 ft, but nets were most commonly set in 20 ft or less of water. Nets were typically fished for approximately 2 hours, but up to 6 hours during the spring 2020 sampling. At the end of each net soak, the nets were retrieved, and captured fish were removed from the nets and placed in live wells for processing. Non-target species were identified, enumerated, and released. One Lost River sucker was caught in Copco No. 1 Reservoir in fall 2019, no Lost River suckers were caught in Iron Gate Reservoir.

3.4.2 Boat Electrofishing

Boat electrofishing was an added gear type for fall 2019 and spring 2020 sampling. The electrofishing equipment included dual bow-mounted anode/cathode arrays (each with a terminal 4 wire umbrella). Dual cathode arrays were hung from each side of the boat, each with 14 terminal wires. The electrofisher components were mounted on a 17-foot jet boat. The anode/cathode arrays were operated by a Smith-Root electrofisher control module (Model 1.5 KVA) with electricity provided by a gas-powered generator (Generac GP 3250) with a maximum output of 3250 running watts. The Smith-Root 1.5 KVA electrofisher has a maximum output power of 1,700 watts and can be set to pulsed AC or DC current that draws between 0 and 10 amps. The AC mode produces 60 Hz alternating current between the anode and cathode wires. The DC position produces direct current, pulsing at 120 pulses per second. There is no wattage adjustment on the Smith-Root 1.5 KVA electrofisher.

Per the USFWS Incidental Take Permit for listed suckers, only the DC setting was used. Following the user manual, the Smith-Root 1.5 KVA electrofisher controller was set to DC current and the voltage was set to the lowest setting. The electrofisher was then activated to determine the amount of current (amperage) drawn at the lowest voltage setting. Test electrofishing was conducted and the voltage was increased in a stepwise manner until the desired level of electrotaxis to facilitate capture was exhibited by the target species, while also minimizing injury and mortality of target and non-target species. The effective DC voltage for the Klamath Reservoir surveys was approximately 150 volts, which drew about 5 amps. During electrofishing, two fish netters stationed in the bow controlled the electrofisher via a foot switch.

Sampling focused on shallow water areas less than 6 ft deep in coves and tributary confluences to ensure electrofisher effectiveness and to minimize injury to suckers. Sampling areas mirrored net set locations from previous sampling, as well as flowing reaches of the Klamath River upstream of Copco No. 1 Reservoir and Iron Gate Reservoir in spring 2020. Field crews recorded boat electrofishing level of effort by recording the time the electrofishing unit was engaged by the field crew.

3.4.3 Sucker Processing Procedures

Crew members processed captured shortnose suckers on the boat of capture. Fish processing involved the following observations and other measurements of each captured shortnose sucker.

- Identified the fish species and sex, noting the presence of tubercles and anal fin shape as sex characteristics.
- Identified any external abnormalities including tumors, parasites, lamprey marks, and fin and scale anomalies.
- Measured fork length to the nearest millimeter using a wetted PVC measuring board.
- Collected a fin clip to serve as a genetic material sample.
- Confirmed absence of existing PIT tag, then inserted a PIT tag into the ventral musculature anterior to the pelvic girdle using pre-loaded single use 12-gauge hypodermic needles (HPT12 PLT) fitted onto an implant device (MK-25). Existing or inserted PIT tag numbers were recorded.
- Collected photographs of each sucker's mouth, lateral body view, and features of concern such as lesions or parasites.

Measurement data were recorded on field sheets and photographs and GPS data were transferred from field equipment to laptop computers following sampling. Processed fish were returned to the reservoir away from the immediate sampling area to minimize repeat capture. All efforts were made to minimally handle suckers and release fish in good condition. One shortnose sucker mortality occurred in Copco No. 1 Reservoir due to net entanglement and suffocation.

3.4.4 Sucker Genetics

In 2020, the USFWS-Abernathy Lab compiled genetic libraries for the four Klamath sucker species including Lost River suckers, shortnose suckers, Klamath largescale suckers (*Catostomus snyderi*), and Klamath smallscale suckers (Smith et al. 2020). Genetic results suggested genetic variation within each of the four sucker species was primarily partitioned among subbasins (Smith et al. 2020). Smith et al. (2020) also determined there are potentially thousands of genetic markers for species and population differentiation that will be useful in the recovery of Lost River and shortnose suckers. It is the Renewal Corporation's understanding that USFWS will use the genetic results to develop assays that will likely allow fisheries managers to distinguish among the four Klamath Basin sucker species, providing an important tool for species conservation (Smith et al. 2020). The fin clips collected by the Renewal Corporation in the Lower Klamath Project reservoirs have been provided to the USFWS.

USFWS will be responsible for determining whether assays are applied to the fin clips to determine sucker genetics.

3.5 Sampling Results

The four sampling efforts results completed between 2018 and 2020 on Copco No. 1 Reservoir and Iron Gate Reservoir are presented below. Results for J.C. Boyle Reservoir are provided in the OR Suckers Plan.

3.5.1 Level of Effort

Table 3-2 and Table 3-3 include the effort for the trammel net sets and boat electrofishing, respectively.

Table 3-2. Level of effort for trammel net sets.

METRIC	SAMPLING EVENT	RESERVOIRS		NET SET COMBINED VALUES
		COPCO NO. 1	IRON GATE	
Total Net Sets (#)	Spring 2020	36	12	48
	Fall 2019	30	36	66
	Spring 2019	31	25	56
	Fall 2018	22	24	46
	Total	**119**	**97**	**216**
Total Net Soak Time (hrs)	Spring 2020	137.5	45.7	183.3
	Fall 2019	50.3	61.0	111.3
	Spring 2019	42.4	42.6	85.0
	Fall 2018	33.6	37.3	70.9
	Total	**263.8**	**186.6**	**450.5**
Average Net Soak Time (hrs)	Spring 2020	3.8	3.8	3.8
	Fall 2019	1.7	1.7	1.7
	Spring 2019	1.4	1.7	1.5
	Fall 2018	1.5	1.6	1.5
	Average	**2.1**	**2.2**	**2.1**

Table 3-3. Boat electrofishing level of effort for Copco No. 1 Reservoir and Iron Gate Reservoir from fall 2019 and spring 2020 sampling.

SAMPLING EVENT	BOAT ELECTROFISHING EFFORT (SECONDS)	
	COPCO NO. 1 RESERVOIR	IRON GATE RESERVOIR
Spring 2020	1097	1764
Fall 2019	1271	1000
Total	**2368**	**2764**

3.5.2 Catch Composition

3.5.2.1 Trammel Nets

The Renewal Corporation field crews caught 2,101 fish during the four sampling periods using trammel nets. Fish counts and native and non-native species composition are included in Table 3-4 and Table 3-5, respectively.

Table 3-4. Total trammel net catch for Copco No. 1 Reservoir and Iron Gate Reservoir.

SAMPLING EVENT	COPCO NO. 1 RESERVOIR	IRON GATE RESERVOIR	TOTAL FISH CAUGHT
Spring 2020	309	139	448
Fall 2019	124	146	270
Spring 2019	176	933	1109
Fall 2018	125	149	274
Total	**734**	**1367**	**2101**

Table 3-5. The most common native and non-native fish species caught using trammel nets in Copco No. 1 Reservoir and Iron Gate Reservoir.

NATIVE/NON-NATIVE SPECIES	SPECIES NAME	TOTAL FISH CAUGHT
Native Species	Rainbow Trout (*Oncorhynchus mykiss*)	255
	Smallscale Sucker (*Catostomus rimiculus*)	142
	Tui Chub (*Siphatales bicolor bicolor)*	136

NATIVE/NON-NATIVE SPECIES	SPECIES NAME	TOTAL FISH CAUGHT
	Shortnose Sucker (*Chasmistes brevirostris*)	120
	Lamprey (potentially multiple species)	5
Non-native Species	Yellow Perch (*Perca flavescens*)	782
	Crappie spp. (*Pomoxis* spp.)	290
	Brown Bullhead (*Ameiurus nebulosus*)	223
	Bluegill (*Lepomis macrochirus*)	68
	Redear Sunfish (*Lepomis microlophus*)	42

3.5.2.2 Boat Electrofishing

The Renewal Corporation field crews caught 2,347 fish during fall 2019 and spring 2020 boat electrofishing. Fish counts and native and non-native species composition are included in Table 3-6 and Table 3-7, respectively.

Table 3-6. Total boat electrofishing catch for Copco No. 1 Reservoir and Iron Gate Reservoir.

SAMPLING EVENT	COPCO NO. 1 RESERVOIR	IRON GATE RESERVOIR	TOTAL FISH CAUGHT
Spring 2020	1006	1241	2247
Fall 2019	50	50	100
Total	**1056**	**1291**	**2347**

Table 3-7. The most common native and non-native fish species caught using boat electrofishing in Copco No. 1 Reservoir and Iron Gate Reservoir in 2019 and 2020 sampling.

NATIVE/NON-NATIVE SPECIES	SPECIES NAME	TOTAL FISH CAUGHT
Native Species	Tui Chub (*Siphatales bicolor bicolor)*	46
	Rainbow Trout (*Oncorhynchus mykiss*)	20
	Smallscale Sucker (*Catostomus rimiculus*)	5
	Shortnose Sucker (*Chasmistes brevirostris*)	1
Non-native Species	Yellow Perch (*Perca flavescens*)	2037
	Other Sunfish (*Lepomis* sp.)	110
	Crappie (*Pomoxis* sp.)	100

NATIVE/NON-NATIVE SPECIES	SPECIES NAME	TOTAL FISH CAUGHT
	Golden Shiner (*Notemigonus crysoleucas*)	100
	Largemouth Bass (*Micropterus* sp.)	11

3.5.3 Trammel Net and Boat Electrofishing Summary

Table 3-8 includes the total catch for the four sampling periods in Copco No. 1 Reservoir and Iron Gate Reservoir. Table 3-9 includes the most common native and non-native fish species caught in Copco Reservoir 1 and Iron Gate Reservoir using trammel nets and boat electrofishing.

Table 3-8. Total trammel net catch and boat electrofishing catch for Copco No. 1 Reservoir and Iron Gate Reservoir.

SAMPLING EVENT	COPCO NO. 1 RESERVOIR	IRON GATE RESERVOIR	TOTAL FISH CAUGHT
Spring 2020	1415	1380	2795
Fall 2019	174	196	370
Spring 2019	176	933	1109
Fall 2018	125	149	274
Total	**1890**	**2658**	**4548**

Table 3-9. The most common native and non-native fish species caught using trammel nets and boat electrofishing in Copco No. 1 Reservoir and Iron Gate Reservoir.

NATIVE/NON-NATIVE SPECIES	SPECIES NAME	TOTAL FISH CAUGHT
Native Species	Rainbow Trout (*Oncorhynchus mykiss*)	255
	Smallscale Sucker (*Catostomus rimiculus*)	142
	Tui Chub (*Siphatales bicolor bicolor)*	136
	Shortnose Sucker (*Chasmistes brevirostris*)	120
	Lamprey (potentially multiple species)	5
Non-native Species	Yellow Perch (*Perca flavescens*)	2819
	Crappie (*Pomoxis* sp.)	390
	Brown Bullhead (*Ameiurus nebulosus*)	233
	Other Sunfish (*Lepomis* sp.)	220

NATIVE/NON-NATIVE SPECIES	SPECIES NAME	TOTAL FISH CAUGHT
	Golden Shiner (*Notemigonus crysoleucas*)	100

3.5.4 Sucker Catch, Size, and Condition

The Renewal Corporation caught shortnose suckers and potential shortnose sucker hybrids in Copco No. 1 Reservoir and Iron Gate Reservoir (Table 3-10). Potential hybrid suckers were individuals that had intermediate characteristics suggesting hybridization with other sucker species. One Lost River sucker was caught in Copco No. 1 Reservoir. As noted above, the Renewal Corporation provided all fin clip samples to USFWS for genetic testing at the discretion of USFWS. The Renewal Corporation did not catch Lost River suckers in Iron Gate Reservoir.

Table 3-10. Shortnose suckers and potential hybrid suckers caught in Copco No. 1 Reservoir and Iron Gate Reservoir using trammel nets and boat electrofishing.

SPECIES[1]	SAMPLING EVENT	COPCO NO. 1 RESERVOIR	IRON GATE RESERVOIR[2]	TOTAL SUCKERS CAUGHT
Shortnose Suckers	Spring 2020	48	2	50
	Fall 2019	21	10	31
	Spring 2019	16	1	17
	Fall 2018	11	12	23
	Total	**96**	**25**	**121**
Lost River Suckers	Spring 2020	0	0	0
	Fall 2019	1	0	1
	Spring 2019	0	0	0
	Fall 2018	0	0	0
	Total	**1**	**0**	**1**
Potential Hybrid Suckers	Spring 2020	0	0	0
	Fall 2019	0	0	0
	Spring 2019	0	0	0
	Fall 2018	2	5	7
	Total	**2**	**5**	**7**
Total Suckers	Spring 2020	48	2	50
	Fall 2019	22	10	32
	Spring 2019	16	1	17

SPECIES[1]	SAMPLING EVENT	COPCO NO. 1 RESERVOIR	IRON GATE RESERVOIR[2]	TOTAL SUCKERS CAUGHT
	Fall 2018	13	17	30
	Total	**99**	**30**	**129**

[1]: Only includes maiden captures (i.e., first capture), does not include recaptured fish.
[2]: One shortnose sucker was caught using boat electrofishing in spring 2020 in Iron Gate Reservoir.

Table 3-11 includes summary length statistics for shortnose sucker caught in Copco No. 1 Reservoir and Iron Gate Reservoir over the sampling effort. The one Lost River sucker captured in fall 2019 in Copco No. 1 Reservoir measured 538 mm fork length.

Table 3-11. Shortnose sucker length statistics for Copco No. 1 Reservoir and Iron Gate Reservoir.

SPECIES	STATISTIC	COPCO NO. 1 RESERVOIR	IRON GATE RESERVOIR	RESERVOIRS COMBINED
Shortnose Suckers	Count	96	25	121
	Maximum (mm)	555.0	549.0	555.0
	Median (mm)	437.5	480.0	453.0
	Mean (mm)	439.5	483.5	448.6
	Minimum (mm)	317.0	390.0	317.0
	1 SD (mm)	52.0	31.2	51.5

Based on length-age relationships for shortnose suckers in Upper Klamath Lake, shortnose suckers sampled in the reservoirs are likely older fish. However, fifteen shortnose suckers caught in Copco No. 1 Reservoir in spring 2020 were less than 389 mm, suggesting a cohort of younger fish that was not sampled during previous Renewal Corporation sampling efforts. These smaller fish reduced the median length of shortnose sucker caught in Copco No. 1 Reservoir from 448 mm to 435 mm.

Prior to the Renewal Corporation's sampling, sucker populations downstream of Keno Reservoir had not been sampled since the late 1990s (Desjardins and Markle 2000) and early 2000s (Desjardins and Markle, unpublished data). In four sampling years, Desjardins and Markle (2000; unpublished data) caught few Lost River suckers (5 adults: 4 in J.C. Boyle Reservoir and 1 in Copco No. 1 Reservoir), but a greater number of adult shortnose suckers in Copco No. 1 Reservoir (n = 165) and Iron Gate Reservoir (n = 22) (Desjardins and Markle 2000). In 2000-2001, Desjardins and Markle caught 40 shortnose suckers and 5 shortnose suckers in Copco No. 1 Reservoir and Iron Gate Reservoir, respectively. A comparison of shortnose sucker lengths from sampling in 1998-1999 (Desjardins and Markle 2000) and 2000-2001 (Desjardins and Markle, unpublished data), and the Renewal Corporation's sampling (2018-2020) is shown in Figure 3-1. The size distribution for shortnose suckers captured in Copco No. 1 Reservoir tended to be smaller in the 2018-2020 period compared to shortnose suckers caught during the

earlier efforts, and the size distribution was similar for shortnose suckers caught in Iron Gate Reservoir over the three periods.

The Renewal Corporation captured 120 shortnose suckers and potential hybridized shortnose suckers in Copco No.1 Reservoir and Iron Gate Reservoir over four sampling periods using trammel nets, and one additional shortnose sucker was caught using boat electrofishing, for a total of 121 shortnose and potential hybridized shortnose suckers.

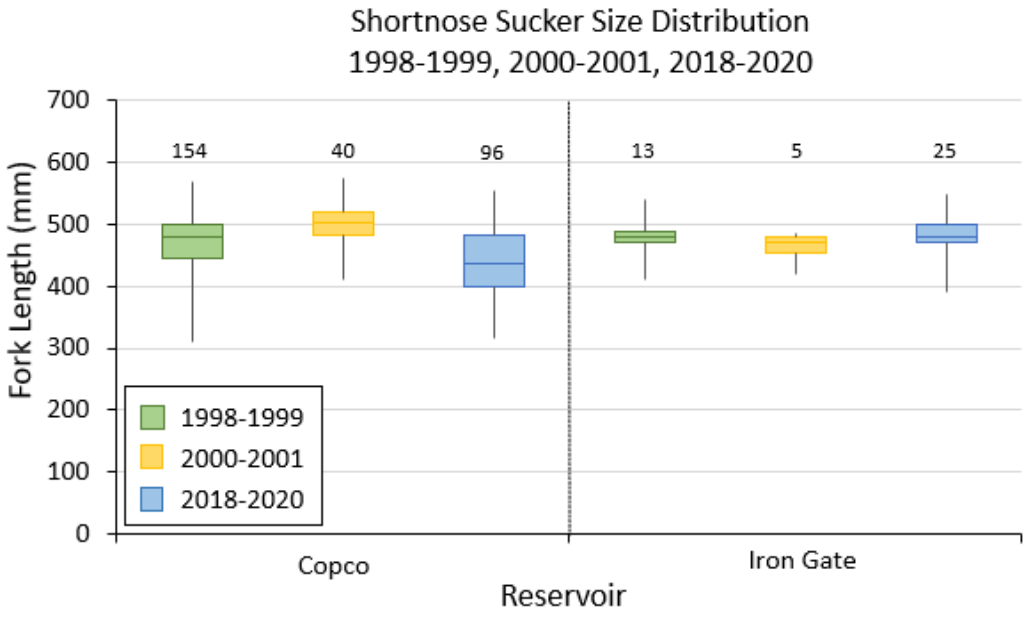

Figure 3-1. Comparison of shortnose sucker fork lengths for fish sampled by Desjardins and Markle (1998-1999 and 2000-2001) and the Renewal Corporation (2018-2020) in Copco No. 1 Reservoir and Iron Gate Reservoir. Sample sizes are posted above each box plot.

Renewal Corporation field crews noted the occurrence of wounds, deformities, and growths/tumors on listed suckers in the reservoirs. Common afflictions included worn fins, caudal fin deformities, parasites, wounds from lamprey attachment, and growths/tumors (Figure 3-2). Between 11% and 33% of suckers had afflictions across the four sampling periods. Due to small sample sizes, affliction patterns across the sampling periods and reservoirs were not apparent although the most afflictions were noted for shortnose suckers (16/48 shortnose suckers with afflictions) sampled in Copco No. 1 Reservoir in spring 2020.

Figure 3-2. Example tumors and growths (left) and deformities (right) afflicting suckers in the Lower Klamath Project reservoirs.

3.5.5 Sucker Catch Per Unit Effort

Table 3-12 compares trammel net catch per unit effort (CPUE) for maiden (i.e., first capture) shortnose suckers over the four sampling events, and the previous sampling completed by Desjardin and Markle in 1998 and 1999 (Desjardins and Markle 2000) for comparison. The CPUE for shortnose suckers caught in Copco No. 1 Reservoir over the four sampling periods was 0.36 fish/net-hour.

Table 3-12. Shortnose sucker trammel net catch per unit effort for the Renewal Corporation sampling and the Desjardins and Markle sampling (2000). The Renewal Corporation had the highest CPUE in Copco No. 1 Reservoir and the lowest in Iron Gate Reservoir.

SAMPLING EFFORT[1]	CPUE (FISH/NET-HOUR)		
	RESERVOIRS		
	COPCO NO. 1	IRON GATE	RESERVOIRS COMBINED
Desjardins and Markle – 1998 and 1999[2]	0.49	0.04	0.20
Renewal Corporation – Spring 2020	0.35	0.02	0.27
Renewal Corporation – Fall 2019	0.42	0.16	0.28
Renewal Corporation – Spring 2019	0.38	0.02	0.20
Renewal Corporation – Fall 2018	0.33	0.32	0.32
Renewal Corporation - All Events Combined	0.36	0.13	0.27

[1]: Catch per unit effort does not include recaptured fish.
[2]: Desjardins and Markle 2000

3.5.6 Sucker Population Estimates

The Renewal Corporation used recaptured suckers (trammel net data only) to develop population estimates for the three reservoirs, as well as a total population estimate across the

three reservoirs. Three different methods were used to develop population estimates, all yielding comparable results.

3.5.6.1 Methods

The Renewal Corporation used the PIT tag mark-recapture data to produce abundance estimates for listed suckers inhabiting each reservoir, and for the three reservoirs combined. Due to the relatively low recapture rates, mark-recapture data for shortnose, Lost River, and potential hybrid suckers were combined. All listed sucker mark-recapture data were aggregated to determine total population estimates. Any listed sucker recaptured at least one day (or longer) after initial capture, tagging, and release was considered a recapture for the determination of the population estimates. Population estimates were then calculated using the following methods.

The Chapman method (Chapman 1951; Johnson et al. 2007) reduces small sample size bias and estimates the total population as:

$$\hat{N} = \frac{(M)(n+1)}{(m+1)}$$

Where:

$\hat{N}$ = Estimated size of the population

n = Number of fish initially marked and released

M = Number of unmarked fish captured during subsequent survey

m = Number of recaptured fish that were marked

Meridian Environmental, Inc. (Renewal Corporation subcontractor) also used a nonparametric bootstrap method (Efron and Tibshirani 1986; Manly 2007) to calculate mean population estimates and estimate variance to produce 95 percent confidence intervals. The bootstrap was run 10 times for each estimate, with 1,000 iterations per run. Population and variance estimates represent the mean of each 10-run set. The Renewal Corporation calculated the 95 percent confidence interval as the square root of the mean bootstrap variance multiplied by 1.96.

Total population estimates were also calculated using the super-population parameterization (Schwarz and Arnason 1996) of the Jolly-Seber model to estimate listed sucker abundance while accounting for subsampling for marking. Abundance is quantified by Schwarz and Arnason (1996) as the total number of gross “births” in the area of interest, which includes listed suckers present at the beginning of the study, those that move into the study area during the monitoring period, and those that do not survive to the end of the monitoring period. The super-population parameterization (Schwarz and Arnason 1996) of the Jolly-Seber model (POPAN model) was applied with the RMark package (Laake 2013) to the capture histories of each individual PIT-tagged sucker with at least one resighting (recapture) opportunity. Intercept-only models were used for capture and survival probabilities due to the low number of recaptured individuals. Because survey occasions were distributed across a period of 18 months, the

estimated abundance represents a mean for that time period. Bootstrapping was initially applied to obtain reasonable (i.e., non-negative and finite) confidence interval limits. However, bootstrapped confidence intervals resulted in unrealistically large upper bounds, so confidence intervals based on asymptotic normality were constructed.

The mark-recapture estimates include the following assumptions: 100 percent PIT tag retention (i.e., no tag loss); mortality of tagged target suckers is the same as untagged target suckers; no emigration of tagged target suckers occurs from the reservoirs between the first and last survey; and trammel net set locations are representative of habitats used by suckers in the three reservoirs. Combining shortnose sucker, Lost River sucker, and potential hybrid sucker mark-recapture data also assumes that the trammel net catchability of these three categories of fish is the same.

An additional assumption is that each sucker species identification is correct. The field teams have collected genetic samples from all shortnose sucker, Lost River sucker, and potential hybrid suckers captured during the three survey efforts, and all target suckers were PIT-tagged. As noted above, once genetic assays are available, USFWS will decide whether the genetic samples provided by the Renewal Corporation will be used to confirm sucker genetics. If they are, reservoir mark-recapture population estimates could be further refined based on species genetic assignment of each fish in the dataset.

3.5.6.2 Results

The Renewal Corporation's population estimates suggest that the total number of adult listed suckers is highest in Copco No. 1 Reservoir, slightly less in J.C. Boyle Reservoir, and lowest in Iron Gate Reservoir (Table 3-13). The 95 percent confidence intervals suggest that there are several thousand adult suckers in Copco No. 1 Reservoir and J.C. Boyle Reservoir, and several hundred adult suckers in Iron Gate Reservoir. Based on sampling results, shortnose suckers are more abundant than Lost River suckers in J.C. Boyle Reservoir, and Lost River suckers are at low population levels in Copco No. 1 Reservoir and potentially absent from Iron Gate Reservoir. Due to the low number of recaptured suckers over the sampling effort, the 95 percent confidence intervals for the population estimates are large compared to the magnitude of the population estimate (i.e., confidence interval widths greater than ±100 percent of the population estimate for Copco No. 1 Reservoir and J.C. Boyle Reservoir).

Using the Chapman Method, the Renewal Corporation estimates 4,509 listed suckers in all three reservoirs. The bootstrap method yielded a mean estimate of 5,540 listed suckers and a 95% confidence maximum estimate of 11,531 listed suckers across the three reservoirs. The Jolly-Seber model estimated 2,201 listed suckers and a 95% confidence maximum estimate of 4,615 listed suckers across the three reservoirs.

Table 3-13. Population Estimate attributes and estimates for listed and potential hybrid suckers in the Lower Klamath Project reservoirs.

POPULATION ESTIMATE ATTRIBUTES	RESERVOIRS			
	J.C. BOYLE	COPCO NO. 1	IRON GATE	RESERVOIRS COMBINED
Total Maiden Suckers Captured (Fall 2018 through Spring 2020)	95	98	29	222
Total Target Suckers PIT-tagged and Available for Recapture (Fall 2018, Spring 2019, Fall 2019, Spring 2020)[1]	71	83	27	181
Total Tagged Suckers Recaptured (Fall 2018 through Spring 2020)	3	3	2	8
Recapture Efficiency (# Recaptured / # Tagged)	4.2%	3.6%	7.4%	4.4%
Chapman Method - Population Estimate	1,727	2,078	279	4,509
Bootstrap Method - Mean Population Estimate	2,766	3,371	399	5,540
Bootstrap Method - 95% Confidence Interval	±3,730	±4,508	±544	±5,991
Jolly-Seber Model - Mean Population Estimate	864	1,235	102	2,201
Jolly-Seber Model - 95% Confidence Interval	±951	±1,374	±89	±2,414

[1]: Although all target suckers captured on the final night of sampling at each reservoir were PIT-tagged, they were not available for subsequent recapture, and therefore, they were excluded from the total number of target suckers PIT-tagged and released for the mark-recapture estimate.

4.0 Action 2: Salvage and Translocation Plan

4.1 Purpose

The Renewal Corporation will undertake salvage and translocation measures to remove adult listed suckers from Copco No. 1 Reservoir and Iron Gate Reservoir prior to reservoir drawdown and dam removal to reduce project effects on listed suckers residing in the reservoir.

During the development of the sampling and salvage plan, the Renewal Corporation coordinated with the ATWG to develop aquatic resource plan components. The Renewal Corporation initially proposed salvaging 100 Lost River and 100 shortnose suckers from each of the three reservoirs for a total of 600 suckers (Klamath River Renewal Corporation 2017). With the sampling information presented in *Section 3 Action 1: Sampling Plan Methods and Results,* the Renewal Corporation now believes the original proposal is not feasible especially for Lost River suckers which are at low numbers in Copco No. 1 Reservoir and potentially absent from Iron Gate Reservoir.

Under this CA Suckers Plan, the Renewal Corporation will salvage suckers over a 14-day period including a total 5 days on Copco No. 1 Reservoir, 2 days on Iron Gate Reservoir, and 7 days on J.C. Boyle Reservoir. Based on catch efficiencies from the sampling effort, the Renewal Corporation anticipates catching a combined total of approximately 300 listed suckers from Copco No. 1 Reservoir and Iron Gate Reservoir, and 300 listed suckers from J.C. Boyle Reservoir. The 300 listed suckers equate to between 8 percent and 23 percent of the sucker mean population estimates calculated for Copco No. 1 Reservoir and Iron Gate Reservoir (see *Section 3.5.7 Sucker Population Estimate*). Salvage will continue for 7 days even if the 300-sucker estimate is exceeded. Salvaged suckers caught in Copco No. 1 Reservoir and Iron Gate Reservoir will be translocated to the Klamath National Fish Hatchery and/or Tule Lake Sump 1A. Other translocation sites may be used following consultation with the ARG and agreement between the Renewal Corporation, USFWS, CDFW and ODFW. If agreement is reached to use other translocation sites, the Renewal Corporation will file a report with the Commission within 14 calendar days that includes the location of the additional translocation site, the reasons for the additional translocation site, and documentation of consultation with USFWS, CDFW and ODFW.

4.2 Regulatory Compliance

This CA Suckers Plan supports compliance with the federal Endangered Species Act of 1973, the California Endangered Species Act, and the State Water Resources Control Board 401 Water Quality Certification pertaining to the Lost River and shortnose suckers. In addition, this CA Suckers Plan is consistent with Assembly Bill No 2640, Chapter 586 (2018), which revised Section 2081.11 of the state Fish and Game Code to read: "*The take authorization requires department approval of a sampling, salvage, and relocation plan to be implemented and that describes the measures necessary to minimize the take of adult Lost River sucker and shortnose sucker associated with the department's authorization. The plan shall provide for a sampling effort, the results of which will provide information used to make decisions and to implement the plan while utilizing the principles of adaptive management.*"

4.3 Salvage Period

The Renewal Corporation will perform sucker salvage and translocation in the spring or fall prior to reservoir drawdown.

During the spring, shortnose suckers congregate in shallower habitats in advance of and during the spring spawning period. Initiation of shortnose sucker spawning runs in Upper Klamath Lake coincides with water temperatures approaching or exceeding 12 °C in the Williamson River (Hewitt et al. 2017). A similar temperature-related spawning migration pattern was documented by Beak Consultants (1987) for shortnose suckers in Copco No. 1 Reservoir. In the Beak Consultants study, shortnose suckers began spawning when average water temperatures exceeded 12 °C on April 15, 1987. Spawning peaked between April 22 and April 30 and spawning ended approximately May 15, 1987 (Beak Consultants 1987). Therefore, a spring salvage period would be completed between mid-April and early May. The Renewal Corporation previously sampled Copco No. 1 Reservoir and Iron Gate Reservoir in late March 2019, and

mid-May 2020 and captured shortnose suckers. These previous efforts likely bracketed the listed suckers spawning period.

If sucker salvage and translocation cannot be performed in the spring for any reason, the Renewal Corporation will perform this measure in the fall prior to reservoir drawdown. A fall salvage period is less dependent on water temperature-related sucker behavior and habitat use, although suckers inhabited deeper habitats in a study conducted on Upper Klamath Lake (Reiser et al. 2001). A fall salvage period would take place after water temperatures decrease to less than 16 °C and Copco No. 1 Reservoir's microsystin levels decline to concentrations below human health advisory levels. A fall salvage period would occur between late October and early November. The Renewal Corporation previously sampled Copco No. 1 Reservoir and Iron Gate Reservoir in early November 2018 and 2019 and captured shortnose suckers, and one Lost River sucker in Copco No. 1 Reservoir.

4.4 Salvage Locations

Copco No. 1 Reservoir and Iron Gate Reservoir salvage locations will correspond to the previous sampling locations and include shallower habitats associated with coves and tributary confluences. During a spring salvage, the Klamath River in the 1.0 mile upstream of Copco Road Bridge in the reach Beak Consultants previously documented shortnose sucker spawning (Beak Consultants 1987) would be prioritized for salvage. Similar reservoir locations would be targeted in a fall salvage period.

4.5 Salvage Methods

The Renewal Corporation will employ similar methods for processing salvaged suckers as were used during the sucker sampling effort. The Renewal Corporation will use trammel nets and boat electrofishing. While the Renewal Corporation expects to fish primarily at night, it may also use boat electrofishing during the day if the Renewal Corporation thinks that day fishing will be effective based on its professional judgment and expertise. Two boats will each deploy eight trammel nets in Copco No. 1 Reservoir and Iron Gate Reservoir.

The Renewal Corporation will set trammel nets sequentially and fish the nets for 3-6 hours in previously sampled reservoir habitats. Two or three net sets will be completed per night depending on catch efficiency and bycatch. Electrofishing will focus on shallow areas in coves and the Klamath River upstream from Copco No. 1 Reservoir. Tangle nets may also be used in riverine reaches if congregations of shortnose suckers are encountered during electrofishing. Captured shortnose suckers, and while less likely to be encountered, Lost River suckers will be identified to species and sex, measured, fin clipped, photographed, and PIT tagged. Each sucker will also be scanned to detect existing PIT tags. Salvaged suckers will be held in aerated live wells and periodically transferred to net pens near boat access sites where suckers will be held until transport. If a captured sucker is identified as a hybrid based on a visual inspection of its physical characteristics, it will be released back into the salvage reservoir.

The Renewal Corporation may also use tangle nets or a resistance board weir to salvage suckers from the upstream extent of Copco No. 1 Reservoir, or in flowing portions of the Klamath River upstream from Copco No. 1 Reservoir and Iron Gate Reservoir.

The Renewal Corporation will acquire current information on water quality to better anticipate water quality conditions in the salvage reservoirs, the Klamath National Fish Hatchery, and Tule Lake Sump 1A. The information will be used to understand water quality conditions in the salvage and translocation sites. Water quality constituents of interest include water temperature, dissolved oxygen, salinity concentrations, and pH levels. Acquiring this information in advance of the salvage will be necessary to condition the water in the transport live well and to plan the acclimation period at the release locations.

4.6 Transport and Translocation Methods

The Renewal Corporation will remove suckers following the two-day Iron Gate Reservoir salvage, and then after the second day and fifth day of the Copco No. 1 Reservoir salvage and transport them to the translocation sites. At the time of transport, the Renewal Corporation field crews will remove suckers from net pens and scan suckers for PIT tag identification prior to loading fish into aerated live wells (approximately 200-300 gallons) for transport. The Renewal Corporation will coordinate with USFWS, CDFW, ODFW, U.S. Bureau of Reclamation, the Klamath Tribes, and the Yurok Tribe to access transport vehicles. Large live wells will be fiberglass, steel, or polyethylene and will be sized to fit in the open bed of a standard pickup truck or on a trailer. Live wells will be baffled to limit sloshing during transport. The live well will be filled to 75% capacity (about 150 gallons) with salvage reservoir water in the vicinity of the net pens. Transported fish will be large (>300 mm) and care will be required to minimize overstocking the live well. Densities should be the equivalent of approximately 1 lb. of fish per gallon of water. Based on an average 3.0 lb. weight, no more than 50 shortnose suckers would be transported at one time. The transport density will be adjusted as conditions and sucker response dictate. The following methods will be used to prepare the transport tanks (USBR, 2008; USFWS, unpublished report).

- Live wells are to be disinfected using a Virkon (1.3 oz/gallon) solution or other approved disinfectant. Live wells are to be disinfected daily and thoroughly rinsed following disinfection.
- Water will be pumped from the salvage reservoir into the live well using a portable pump. A handheld YSI meter will be used to measure water quality constituents including water temperature, dissolved oxygen, salinity, and pH prior to adding suckers to the live well. The live well will be refilled at the salvage reservoir prior to each transport.
- Water temperature will be monitored in the live well during initial transport runs from each location. Water temperature will be monitored during subsequent transport runs as necessary. Water temperature in the live well should remain within 4 °C of the initial ambient water temperature during the transport. Water temperature will be modified by chillers or heaters.

- Dissolved oxygen concentrations will be monitored in the live well during initial transport runs from each location. Dissolved oxygen concentrations will be monitored during subsequent transport runs as necessary. Dissolved oxygen levels should be maintained at approximately 100 percent saturation. If needed, a portable aeration system will be installed to maintain dissolved oxygen levels at approximately 100 percent saturation.
- Salinity levels should be approximately 0.5%. Coarse ground sodium chloride will be added in small increments to the live well until a 0.5% salinity level is achieved. Since Tule Lake Sump 1A is more saline than the Klamath River, additional ground sodium chloride may need to be added to the live well when fish are being transported to Tule Lake Sump 1A. Additional coordination with USFWS will be completed prior to the salvage of fish that will be transported to Tule Lake Sump 1A.
- The Renewal Corporation field crews transporting the listed suckers will be attentive to the condition of the equipment throughout the transport process.
- To acclimate suckers at the receiving waterbody, salvage reservoir water in the live well will be replaced with recipient waterbody water over the course of at least an hour. Approximately a quarter to a half of the salvage reservoir water will be drained from the live well and replaced with recipient waterbody water that will be pumped into the live well. Tempering the live well will be important for acclimating the suckers to the recipient waterbody's water quality constituents. Live well water will be drained away from Tule Lake Sump 1A to avoid discharging salvage reservoir water directly to Tule Lake Sump 1A. Other live well discharge strategies will be coordinated with USFWS. Water quality constituents should be consistently measured during the tempering process. USFWS suggests the target suckers can tolerate a 1 °C temperature change every 15 minutes and temperature changes should not exceed 4 °C per 15 minutes. Releasing fish into the recipient waterbody after dusk is recommended to maximize survival (M. Yost, USFWS, personal communication), although this may require additional personnel to achieve.

4.6.1 Translocation Sites

The Klamath National Fish Hatchery and Tule Lake Sump 1A will be the primary translocation sites for suckers salvaged from Copco No. 1 Reservoir and Iron Gate Reservoir. Other translocation sites may be used following consultation with the ARG and agreement between the Renewal Corporation, USFWS, CDFW and ODFW. If agreement is reached to use other translocation sites, the Renewal Corporation will file a report with the Commission within 14 calendar days that includes the location of the additional translocation site, the reasons for the additional translocation site, and documentation of consultation with USFWS, CDFW and ODFW.

Salvaged suckers will first be taken to the Klamath National Fish Hatchery where they will be isolated and receive an external parasite treatment before they are integrated into hatchery groups. The Klamath National Fish Hatchery has capacity for approximately 100 salvaged adult suckers. USFWS has requested a ratio between 60:40 and 70:30 shortnose suckers to Lost River suckers be provided to the hatchery, of which, half of the salvaged shortnose suckers (approximately 30 to 35 individuals) originate in Copco No. 1 Reservoir and half originate in J.C.

Boyle Reservoir. Because Lost River suckers appear to be at low population levels in Copco No. 1 and Iron Gate reservoirs, Lost River suckers from J.C. Boyle Reservoir will be provided to the Klamath National Fish Hatchery.

Salvaged suckers exceeding the 30 to 35 shortnose sucker capacity of the Klamath National Fish Hatchery will be released into Tule Lake Sump 1A. Historically, Tule Lake was the terminal lake for the Lost River. Agricultural development in the basin has altered the Lost River, and Lost River and shortnose suckers in Tule Lake Sump 1A are now isolated to the Tule Lake sump complex and a 5-mile reach of the Lost River between Tule Lake Sump 1A and Anderson-Rose Dam. Tule Lake Sump 1A functions as an agricultural sump that is maintained by agricultural return flow. Until 2018, USFWS used Tule Lake Sump 1A as a translocation site for Lost River suckers and shortnose suckers salvaged from other areas in the basin. However, since 2018, USFWS has translocated salvaged suckers from other areas of the basin to the Klamath National Fish Hatchery rather than to Tule Lake Sump 1A. Adult Lost River and shortnose suckers are known to occupy Tule Lake Sump 1A and listed suckers have been relocated from the sump to Upper Klamath Lake in the past (Courter et al. 2010). Tule Lake Sump 1A is known to currently have the capacity for an additional 3,000 relocated suckers (J. Rasmussen, USFWS, personal communication, 2017). Management of Tule Lake Sump 1A is complicated by multiple user groups and the periodic need to draw down the reservoir for sediment maintenance. USFWS will continue to manage Tule Lake Sump 1A for multiple uses.

4.6.2 Transport Route

The preferred transport route between Copco No. 1 Reservoir and the Klamath National Fish Hatchery is approximately 100 miles and includes two lane county road and state highway. The travel time is estimated at 2 hours. The preferred route includes the following roadways.

- Ager Beswick Road from Copco No. 1 Reservoir to Ager, CA (14 miles)
- Montague Grenada Road from Ager to Grenada, CA (17 miles)
- 99-97 Cutoff Road from Grenada, CA to Highway 97 to Township Road (79 miles)
- Township Road to Lower Klamath Lake Road (8 miles)
- 1 mile on Lower Klamath Lake Road to the Klamath National Fish Hatchery

The preferred transport route between Copco No. 1 Reservoir and the Tule Lake Sump 1A is approximately 115 miles. The entire route is improved roads including two lane county road and state highway. The travel time is estimated at 2 hours. The preferred route includes the following roadways.

- Ager Beswick Road from Copco No. 1 Reservoir to Ager, CA (14 miles)
- Montague Grenada Road from Ager to Grenada, CA (17 miles)
- 99-97 Cutoff Road from Grenada, CA to Highway 97 (18 miles)
- Highway 97 to Tule Lake Sump 1A (66 miles)

The preferred transport route between Iron Gate Reservoir and the Klamath National Fish Hatchery is approximately 102 miles. The travel time is estimated at 2 hours. The preferred route includes the following roadways:

- Copco Road from Iron Gate Reservoir to Hornbrook, CA (12 miles)
- CA I-5 to Ashland, OR (21 miles)
- Deer Indian Memorial Road to OR-140 E (36 miles)
- OR-140 E to Volcanic Legacy Scenic Byway (6 miles)
- Volcanic Legacy Scenic Byway to Weed Rd E (22 miles)
- Weed Rd E to Loosely Road (0.5 mile)
- Loosely Road to OR-62 E (1.5 miles)
- OR-62 E to Klamath Fish Hatchery (2 miles)

The preferred transport route between Iron Gate Reservoir and the Tule Lake Sump 1A is approximately 121 miles. The travel time is estimated at 2.5 hours. The preferred route includes the following roadways:

- Copco Road from Iron Gate Reservoir to Ager Road (8 miles)
- Ager Road to 99-97 Cutoff Road (20 miles)
- 99-97 Cutoff Road to US-97 N (18 miles)
- US-97 N to Township Road (44 miles)
- Township Road to CA-161 E (11 miles)
- Hill Rd to SW Sump South Rd (18 miles)
- SW Sump South Rd to Tule Lake Sump 1A (2 miles)

4.7 Reporting

The Renewal Corporation will process sucker salvage data including information on the salvaged and transported suckers and water quality constituents. Sucker genetic material will be linked to the individual unique PIT tag identification numbers. The Renewal Corporation will provide the USGS and the ARG with an electronic copy of the Microsoft Excel data workbook and photographs. The genetic material will be provided to USFWS. Summary reports will be submitted to the Commission, SWRCB and ODEQ, and copied to USGS and the ARG, within three months of completing the salvage. The Renewal Corporation's sucker salvage responsibilities end once listed suckers are released at the intended facility or waterbody. USFWS and CDFW will maintain management responsibilities for Lost River and shortnose suckers through and after the salvage effort.

4.8 Salvage Plan Summary

The Renewal Corporation completed four sampling efforts to gain a better understanding of current sucker demographics and population sizes in the Lower Klamath Project reservoirs.

The Renewal Corporation will conduct a combined 7 days of salvage and translocation of listed suckers from Copco No. 1 Reservoir and Iron Gate Reservoir. Based on catch efficiencies from the sampling effort, the Renewal Corporation anticipates relocating a combined total of approximately 300 listed suckers from the two reservoirs. The Renewal Corporation will continue to coordinate sucker salvage planning with USFWS, CDFW, and the Klamath Tribes.

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Appendix C

Fish Presence Monitoring Plan

KLAMATH RIVER RENEWAL CORPORATION

Lower Klamath Project
FERC Project No. 14803

Fish Presence Monitoring Plan

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December 2021

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Table of Contents

Appendices

1.0 Introduction

This Fish Presence Monitoring Plan is a subplan of the Aquatic Resources Management Plan that will be implemented as part of the Proposed Action (Proposed Action) for the Lower Klamath Project (Lower Klamath Project).

1.1 Purpose of the Fish Presence Monitoring Plan

The Fish Presence Monitoring Plan specifically describes monitoring efforts the Renewal Corporation will undertake in California to document adult anadromous fish presence within the hydroelectric reach of the Lower Klamath Project following dam removal. The hydroelectric reach includes the Klamath River and its tributaries, from the upstream end of the J.C. Boyle Reservoir downstream to the base of Iron Gate Dam (Hydroelectric Reach). The Fish Presence Monitoring Plan also describes additional fish monitoring that will be undertaken following dam removal by the California Department of Fish and Wildlife (CDFW) in the California portion of the Hydroelectric Reach and by the Oregon Department of Fish and Wildlife (ODFW) in the Oregon portion of the Hydroelectric Reach. Collectively, the monitoring by CDFW, ODFW, and the Renewal Corporation will document anadromous fish presence within the full Hydroelectric Reach. As discussed in more detail in Section 2.3, the Renewal Corporation will regularly coordinate with CDFW and ODFW regarding their fish monitoring efforts.

1.2 Relationship to Other Management Plans

The Fish Presence Monitoring Plan is supported by elements of the following management plans for effective implementation: Reservoir Area Management Plan and the Hatcheries Management and Operations Plan. So as not to duplicate information, elements from these other management plans are not repeated herein but are, where appropriate, referenced in this Fish Presence Monitoring Plan.

2.0 Adult Anadromous Fish Presence Monitoring

2.1 Monitoring Overview

2.1.1 Renewal Corporation Obligations

The Fish Presence Monitoring Plan describes the geographic area that the Renewal Corporation will monitor, the period during which monitoring will occur, and the methods that will be used by the Renewal Corporation during monitoring. In addition, Section 2.3 of this Fish Presence Monitoring Plan describes the monitoring that the CDFW and ODFW are expected to undertake within the Hydroelectric Reach. The Renewal Corporation will coordinate with the CDFW and ODFW with respect to their monitoring within the Hydroelectric Reach.

2.1.2 Target Species

Under the Fish Presence Monitoring Plan, monitoring efforts by the Renewal Corporation will target the following anadromous fish species: coho salmon (*Oncorhynchus kisutch*), spring-run

and fall-run Chinook salmon (*O. tshawytscha*), steelhead (anadromous form of rainbow trout; *O. mykiss*[1]), and Pacific lamprey[2] (*Entosphenus tridentatus*) (collectively, the Target Species). While all of the Target Species were historically found above Iron Gate Dam, each varied in their distribution throughout the tributaries in the Upper Klamath Basin (Hamilton *et al.*, 2005).

2.1.3 Monitoring Area

Several tributaries in the Hydroelectric Reach are thought to currently have viable anadromous fish habitat, including Jenny Creek, Fall Creek, Shovel Creek, and Spencer Creek (Huntington, 2006). Other tributaries that historically provided anadromous fish habitat include Camp Creek and Scotch Creek (i.e., the Camp-Scotch Creek complex; Hamilton *et al.*, 2005) and Beaver Creek (DOI, 2007). In addition, more than 40 miles of potential salmonid spawning habitat will become available on the mainstem Klamath River following dam removal (Huntington, 2006).

Renewal Corporation will conduct fish presence monitoring at (1) the Camp-Scotch Creek complex, Jenny Creek, and Beaver Creek channel lengths within the former reservoir footprints and (2) a reach of the mainstem Klamath River from RM 213.6 to the confluence with Shovel Creek (collectively, the Project Monitoring Area). Figures depicting each portion of the Project Monitoring Area and an overview map (Figure 1) are provided in the detailed map book in Appendix A. As discussed in more detail in Section 2.3, the CDFW will conduct fish presence monitoring at Fall Creek and Shovel Creek following dam removal, while the ODFW will conduct fish presence monitoring at Spencer Creek.

2.1.4 Monitoring Duration

The Renewal Corporation will begin monitoring for the Target Species in October of the first year after the year in which the drawdown is completed and will continue monitoring for a total of four consecutive years. During the monitoring period, surveys on the mainstem Klamath River will be conducted every other week from the second week of October until the last week of November. Surveys in the tributaries will be conducted every other week beginning in the first two weeks of November and continuing through the first two weeks of January. A minimum of four (4) weeks prior to monitoring, the Renewal Corporation will notify the Aquatic Resources Group (ARG) so that staff of the ARG member agencies may (if desired) participate in the Renewal Corporation's monitoring activities. See Section 3.0 of the Aquatic Resources Management Plan for additional details regarding the ARG.

If commencement of the monitoring period needs to be delayed for any reason, including safety considerations or high turbidity, the Renewal Corporation will immediately notify the ARG. The

[1] For the purposes of the Fish Presence Monitoring Plan, *O. mykiss* with fork lengths longer than approximately 16 inches will be considered anadromous. This standard conforms with CDFW fishing regulations (CDFW, 2020) and roughly aligns with the typical maximum length of resident rainbow trout (Moyle, 2002).

[2] For the purposes of the Fish Presence Monitoring Plan, lamprey with total lengths greater than 11 inches will be considered Pacific lamprey (Moyle, 2002).

Renewal Corporation will then determine, following consultation with the ARG, whether the commencement of monitoring under the Plan needs to be delayed by one (1) year until October of the second year after the year in which the drawdown is completed. If commencement of monitoring is delayed, the Renewal Corporation will file a report with the Federal Energy Regulatory Commission (Commission) within 14 calendar days, which shall include the reasons for the delay.

Finally, the Renewal Corporation may request a reduction in the duration or scope of monitoring under the Fish Presence Monitoring Plan based on new information (e.g., monitoring results that substantiate either anadromous fish presence or the absence of fish passage barriers related to the Proposed Action). The Renewal Corporation may, following consultation with the ARG, submit such a request to the SWRCB at any time during the monitoring period. If the request is approved by the SWRCB, the Renewal Corporation will file a report with the Commission within 14 calendar days, which shall include a description of the request, the reasons for the request (including the new information on which it was based), and documentation of consultation with the SWRCB.

2.2 Monitoring Actions

2.2.1 Tributary Fish Presence Monitoring

The primary monitoring method used by the Renewal Corporation in these tributaries will target adults during their spawning period and will include redd[3] and carcass surveys. The Renewal Corporation will follow methodology similar to that used by the Mid Klamath Watershed Council to survey tributaries in the mid-Klamath watershed (MKWC, 2017). Surveys will be conducted by a crew of two persons, with at least one person who is trained in the survey method being used.

Surveys will be conducted primarily by walking along the tributary, though snorkeling may be used to survey select holding pools if the Renewal Corporation determines that adequate data cannot be collected by a walking survey. Data will be collected on electronic tablets or paper data sheets (an example is provided in Appendix B). The Renewal Corporation will record the tributary name, crew members, date, start and end times, weather, and a description of water visibility. Global positioning system (GPS) points will be collected for the start and stop points as well as for observations of live anadromous fish, carcasses, and/or redds. Redd measurements (length and width) and photographs will be taken when practical. To minimize potential transport of aquatic invasive species, restoration staff will implement the relevant BMPs set forth in Appendix C (Best Management Practices) of the RAMP during monitoring.

If a monitoring survey documents the presence of adult anadromous fish in a given tributary, the Renewal Corporation will finish surveying the tributary. Any further monitoring for that year in

[3] If adult fish are observed on or within the immediate vicinity of a redd, it will be inferred that the adult fish and redd are of the same species. If there are no adult fish on or within the immediate vicinity, the Renewal Corporation will take measurements of the redd, where feasible, to help identify the species of the redd.

that tributary will cease because fish presence in the tributary demonstrates that anadromous fish currently have access to the tributary and the mainstem below the tributary. Monitoring of the tributary will resume the following year.

The sections below provide additional information that is specific to each tributary, including the length of the survey reaches, length of the historical channels being restored, and the Target Species that are expected to be encountered in the tributary. The Renewal Corporation will monitor each tributary from its confluence with the Klamath River (or Camp Creek, in the case of Scotch Creek) to the Limits of Work and Restoration (as defined in the Reservoir Area Management Plan). This monitoring area will include all portions of these tributaries that are being restored by the Renewal Corporation. The restoration activities related to Jenny Creek and the Camp-Scotch Creek Complex are described in more detail in Section 5.6 of the Reservoir Area Management Plan while the restoration activities related to Beaver Creek are described in more detail in Section 5.5 of the Reservoir Area Management Plan.

2.2.1.1 Camp-Scotch Creek Complex

Camp Creek is the first major tributary upstream of Iron Gate Dam. Following reservoir drawdown, approximately 1.35 miles of historical channel will be restored upstream of the Camp Creek confluence with the Klamath River. Based on historical channel alignments, Scotch Creek will flow into Camp Creek at approximately river mile (RM) 1.20. Together, these tributaries form the Camp-Scotch Creek complex, which was historically important for Chinook salmon and steelhead trout (Hamilton *et al.*, 2005). Both Camp Creek and Scotch Creek currently support resident *O. mykiss* (BLM, 2000).

The Renewal Corporation will survey Camp Creek from its confluence with the Klamath River to the Copco Road crossing as shown in Appendix A, Figure 2. This reach is approximately 1.40 miles long. The Renewal Corporation will survey Scotch Creek from its confluence with Camp Creek to the Copco Road crossing as shown on Appendix A, Figure 2. This reach is approximately 0.25 miles long. In the aggregate, the Renewal Corporation will survey 1.65 miles of the Camp-Scotch Creek complex for Target Species.

2.2.1.2 Jenny Creek

Jenny Creek is a major, perennial tributary within the Iron Gate Reservoir footprint. Following reservoir drawdown, approximately 0.50 mile of historical channel will be restored upstream of the Jenny Creek confluence with the Klamath River. Historically, Jenny Creek was an important tributary for Chinook salmon and coho salmon (Hamilton *et al.*, 2005). In addition, Jenny Creek is currently occupied by resident *O. mykiss* (BLM, 2000). Based on the historical and current occurrence records, Chinook salmon, coho salmon, and steelhead are expected to occur in Jenny Creek following dam removal.

The Renewal Corporation will monitor Jenny Creek from its confluence with the Klamath River to just upstream of the Copco Road crossing as shown on Appendix A, Figure 3. This reach is approximately 0.65 miles long.

2.2.1.3 Beaver Creek

Beaver Creek is the only anticipated anadromous fish-bearing tributary located within what is currently Copco No. 1 Reservoir. This tributary contains habitat for steelhead, Chinook salmon, coho salmon, and Pacific lamprey (DOI, 2007). Following reservoir drawdown, approximately 1.10 miles of historical channel on Beaver Creek will be restored. The Renewal Corporation will monitor Beaver Creek from its confluence with the Klamath River confluence to the Copco Road crossing as shown on Appendix A, Figure 4. This reach is approximately 1.30 miles long.

2.2.2 Mainstem Klamath River Fish Presence Monitoring

The Renewal Corporation will monitor an approximately 1.60-mile-long reach on the mainstem Klamath River in the California portion of the Hydroelectric Reach from RM 213.6 (PacifiCorp Fishing Access Site 6) to the confluence with Shovel Creek as shown on Appendix A, Figure 5.

The primary survey method employed by the Renewal Corporation will be redd and carcass surveys from inflatable catarafts. This technique is currently used by the U.S. Fish and Wildlife Service (USFWS) and the Karuk Tribe to conduct redd and carcass surveys of the Klamath River below Iron Gate Dam (USFWS, 2020). The Renewal Corporation has been consulting with both USFWS and the Karuk Tribe regarding their survey methods and will continue coordinating with their survey crews throughout the monitoring period.

Cataraft surveys are anticipated to be conducted by a crew of two persons, with one person rowing and one person observing and recording data. Data will be collected on electronic tablets or paper sheets and will include the survey reach name, crew members, date, start and end times, weather condition, and water visibility description. GPS points will be collected for the start and stop points as well as for observations of live anadromous fish, carcasses and redds. Redd measurements (length and width) and photographs will be taken when practical. If raft-based observation is insufficient to collect the necessary data, the Renewal Corporation may use masks and snorkels to conduct a snorkel survey for fish presence and/or to verify redd presence, subject to safety considerations. If necessary for species identification, the observation crew will stop at fish carcasses.

2.3 Agency Monitoring

Following dam removal, several different state and federal Agencies, as well as Tribal fisheries programs, will be engaged in efforts to monitor and study the response of anadromous fish to the restored access of hundreds of miles of habitat. These monitoring programs will vary in terms of their management objectives and research questions, and, by extension, the methodologies they employ. A commonality will be their focus on documenting anadromous fish presence.

2.3.1 Coordination

The Renewal Corporation will consult with the relevant regulatory agencies (e.g., ODFW, CDFW, USFWS and NMFS) on a quarterly basis regarding the scope of fish presence monitoring to be conducted. In addition, the Renewal Corporation will regularly communicate

and coordinate its efforts with members of the relevant Tribal fisheries programs, including the fisheries programs of the Karuk Tribe, Yurok Tribe, and Klamath Tribes. Finally, coordination and communication are anticipated with academic institutions to better understand the scope of their anadromous fish presence monitoring activities and data to be collected.

2.3.1.1 CDFW Monitoring

CDFW currently conducts anadromous salmonid surveys in the Lower Klamath Basin in coordination with federal, Tribal, local government, and NGO partners. Following dam removal, the CDFW is expected to monitor anadromous fish presence in several tributaries in the Upper Klamath Basin in California, including Fall Creek and Shovel Creek (K. Bainbridge, pers. comm., 2020). CDFW's monitoring is expected to follow similar protocols to the monitoring currently conducted under CDFW's Klamath River Project. These monitoring efforts include underwater video surveillance of returning adult salmonids, spawning ground and carcass surveys, and juvenile outmigration monitoring on Bogus Creek, Scott River, and Shasta River (CDFW, 2018, 2019a, 2019b). The Renewal Corporation will coordinate with CDFW on the location and species of anadromous fish observed during the fish presence monitoring period.

2.3.1.1.1 Fall Creek

Under the Hatcheries Management and Operations Plan, the Fall Creek Fish Hatchery will be modified prior to reservoir drawdown to support salmonid production goals in the Upper Klamath Basin. Priority species of production include fall-run Chinook salmon and coho salmon. Production will continue for eight years following dam removal. CDFW is expected to monitor anadromous fish returns at the Fall Creek Fish Hatchery following dam removal. Coordination with CDFW will determine the species of anadromous fish that return to Fall Creek during the Fish Presence Monitoring Plan's monitoring period.

2.3.1.1.2 Shovel Creek

Historically, Shovel Creek was an important tributary for Chinook salmon and steelhead (Hamilton *et al.*, 2005). Positioned upstream of Copco No. 1 Reservoir and downstream of the California-Oregon border, it lays outside of reservoir influence and therefore outside of the Proposed Action's tributary restoration area. Following dam removal, CDFW is expected to monitor Shovel Creek for anadromous fish presence (K. Bainbridge, pers. comm., 2020). In addition, CDFW's Heritage and Wild Trout Program currently includes backpack electrofishing, habitat typing, and spawning surveys for trout on Shovel Creek at five-year intervals (CDFW, 2016). Monitoring efforts from these two CDFW programs are expected to document anadromous fish presence in Shovel Creek.

2.3.1.2 ODFW Monitoring

Following dam removal, the ODFW is expected to implement an anadromous salmonid monitoring program in the Upper Klamath Basin (ODFW, 2020) to, among other things, monitor anadromous fish presence with the Oregon portion of the Hydroelectric Reach. As described below, this program is expected to include monitoring at Spencer Creek as well as in the mainstem Klamath River from Keno Dam to the state line. The Renewal Corporation will

coordinate with ODFW following dam removal, to aid in the documentation of the location and species of anadromous fish that are observed in Oregon's portion of the Hydroelectric Reach during the Fish Presence Monitoring Plan's monitoring period. If anadromous fish are documented by ODFW within the Oregon portion of the Hydroelectric Reach, it would confirm fish presence throughout California's portion of the mainstem Klamath River.

2.3.1.2.1 Spencer Creek

Historically, Spencer Creek was an important tributary for Chinook salmon, coho salmon, steelhead trout, and Pacific lamprey (Hamilton *et al.*, 2005). ODFW is expected to conduct salmonid life cycle monitoring at Spencer Creek, which is expected to include a combination of electrofishing surveys and spawning ground and carcass surveys. On the lower reach of Spencer Creek, ODFW's monitoring is expected to include an outmigrating juvenile fish trap, a video weir, and passive integrated transponder (PIT) tag arrays.

2.3.1.2.2 Oregon Reach: State Line to Spencer Creek

ODFW is expected to monitor approximately 13 miles of the mainstem Klamath River from Keno Dam to the state line for anadromous salmonid spawning and carcasses. The survey reaches include the Keno Reach, which extends 6.8 miles from Keno Dam to just downstream of Spencer Creek, and the Frain Ranch Reach, which extends 6 miles from the Spring Island Boat Ramp to Caldera Rapid. In addition, ODFW's monitoring is expected to include the operation of a rotary screw trap on the Klamath River downstream of the Spencer Creek confluence and/or on the lower end of the Frain Ranch Reach.

3.0 Reporting

If the presence of an adult anadromous fish is documented during a monitoring survey in either a tributary or the mainstem Klamath River, the Renewal Corporation will promptly notify the ARG and provide it with the species, location and number of the documented fish.

In addition, the Renewal Corporation will prepare and submit an annual report by April 1 of every year for as long as the Renewal Corporation has performance obligations under the Fish Presence Monitoring Plan. Each annual report will be submitted to the SWRCB and ODEQ, and copied to the ARG. Each annual report will include the following information:

1. A summary of the fish presence results; and
2. An overall assessment of fish presence in the newly accessible mainstem Klamath and tributaries, including a consideration of fish return projections and observations.

The final annual report will include a summary of the obstructions (if any) identified by the Renewal Corporation during fish passage monitoring conducted under the Tributary-Mainstem Connectivity Plan and Reservoir Area Management Plan as well as a description of the impacts (if any) that the identified obstructions had on fish presence in the Project Monitoring Area.

The information obtained under the Fish Presence Monitoring Plan will be used to help determine whether adaptive management is required to meet the fish passage objectives of the Lower Klamath Project. The Renewal Corporation will make decisions regarding adaptive management based on the framework described in Section 6.2.9 of the Reservoir Area Management Plan.

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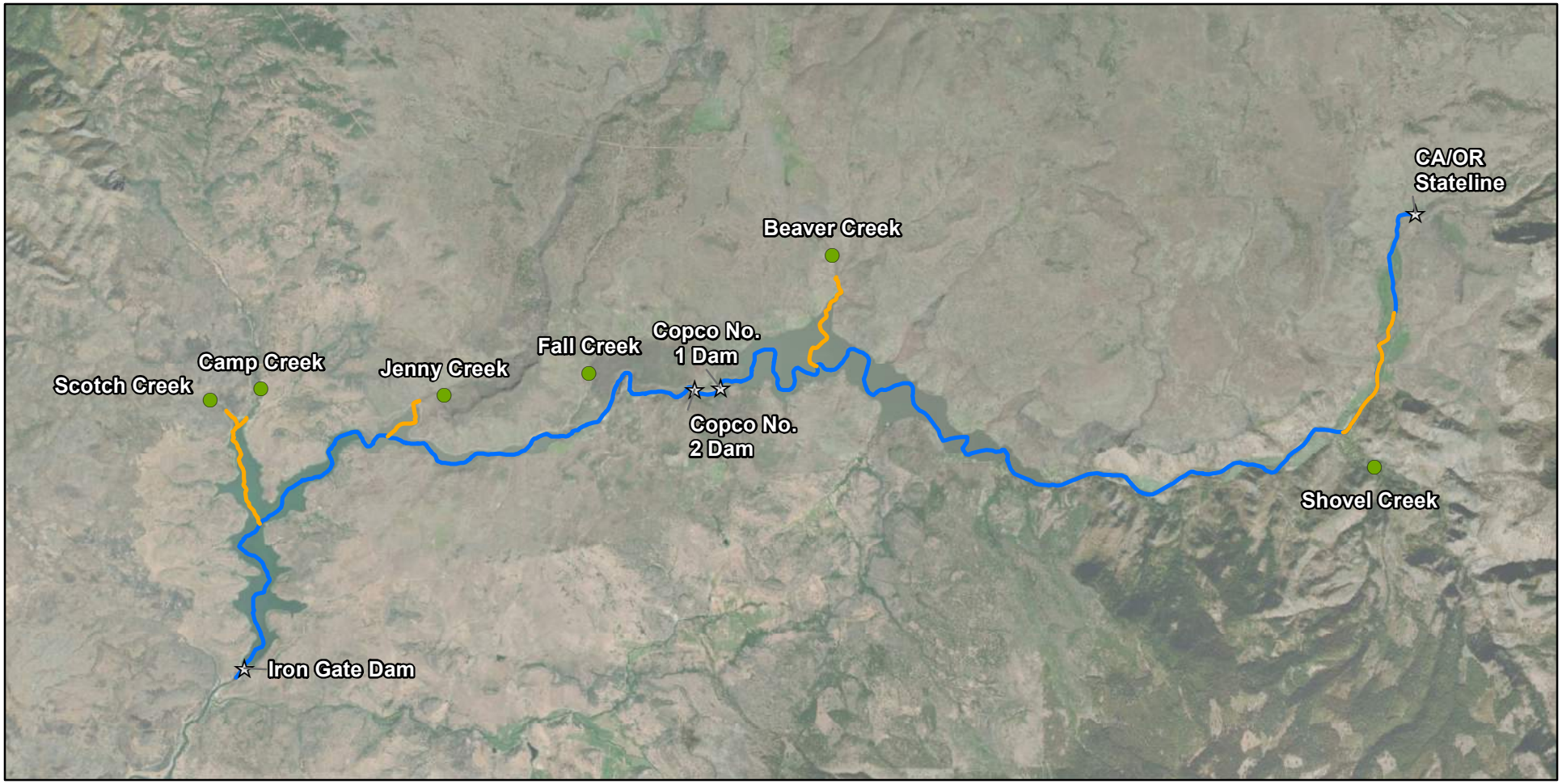
Appendix A

Detailed Map Books



KLAMATH RIVER RENEWAL CORPORATION

Lower Klamath Project

Fish Presence Plan

Figure 1. Project Monitoring Area

December 2, 2020

PRELIMINARY DESIGN (NOT FOR CONSTRUCTION)

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Legend

- ☆ Reference Sites
- ● Tributaries
- Monitoring Reaches
- Historic Klamath River Aligment

N

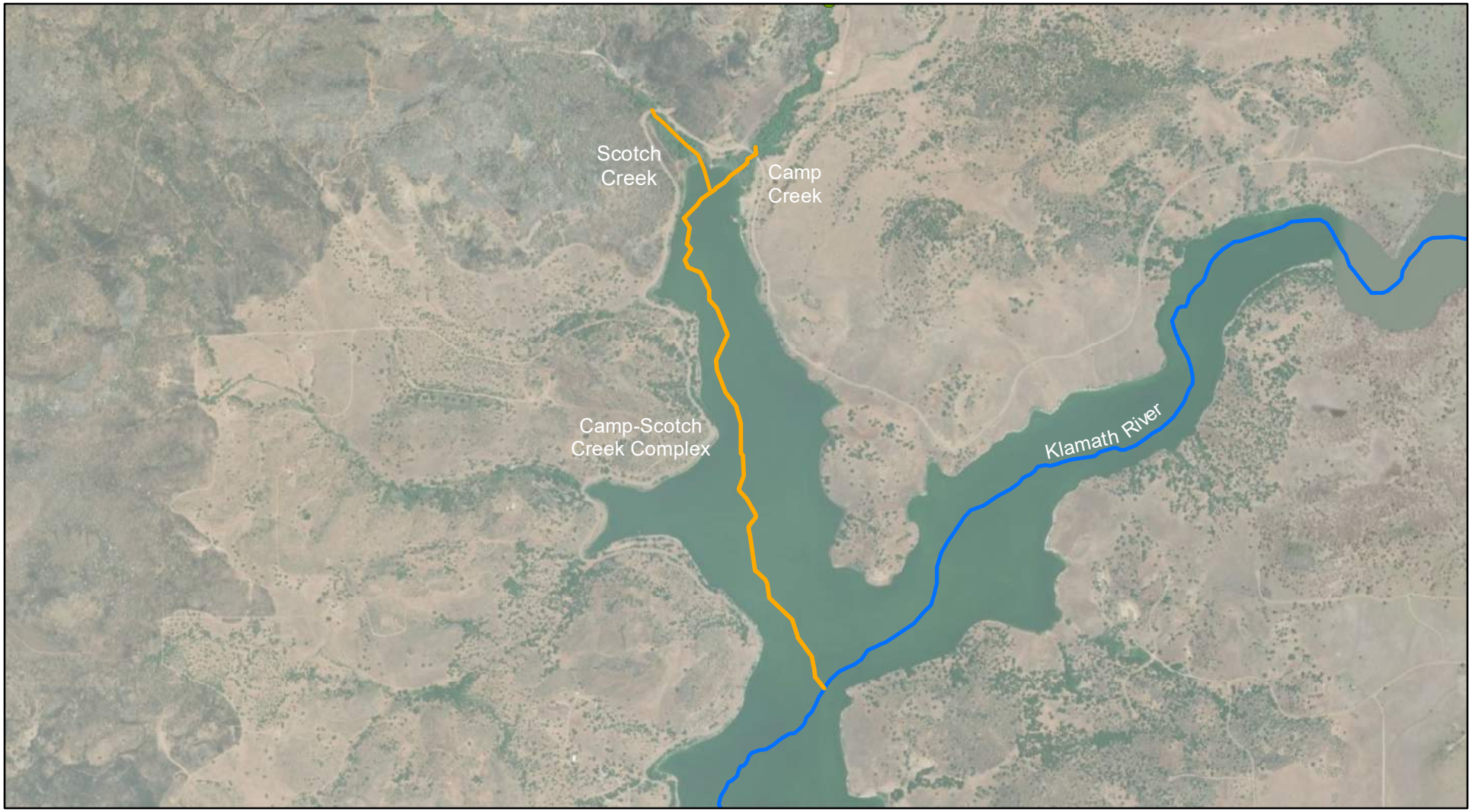
0 1.5 3 Miles

Notes

1. *Coordinate System: NAD 1983 2011 StatePlane California I FIPS 0401 Ft US*

2. *Data Sources: Monitoring Sites: RES; Klamath River: RES*

3. *Background: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community*



KLAMATH RIVER RENEWAL CORPORATION

Lower Klamath Project

Fish Presence Plan

Figure 2. Camp-Scotch Creek Complex Monitoring Reaches

December 3, 2020

PRELIMINARY DESIGN (NOT FOR CONSTRUCTION)

Legend

☆ Reference Sites

Monitoring Reaches

Historic Klamath River Aligment

N

0 0.3 0.6 Miles

Notes

1. *Coordinate System: NAD 1983 2011 StatePlane California I FIPS 0401 Ft US*

2. *Data Sources: Monitoring Sites: RES; Klamath River: RES*

3. *Background: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community*

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Lower Klamath Project

Fish Presence Plan

Figure 3. Jenny Creek Monitoring Reach

December 3, 2020

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Legend

☆ Reference Sites

Monitoring Reach

Historic Klamath River Aligment

N

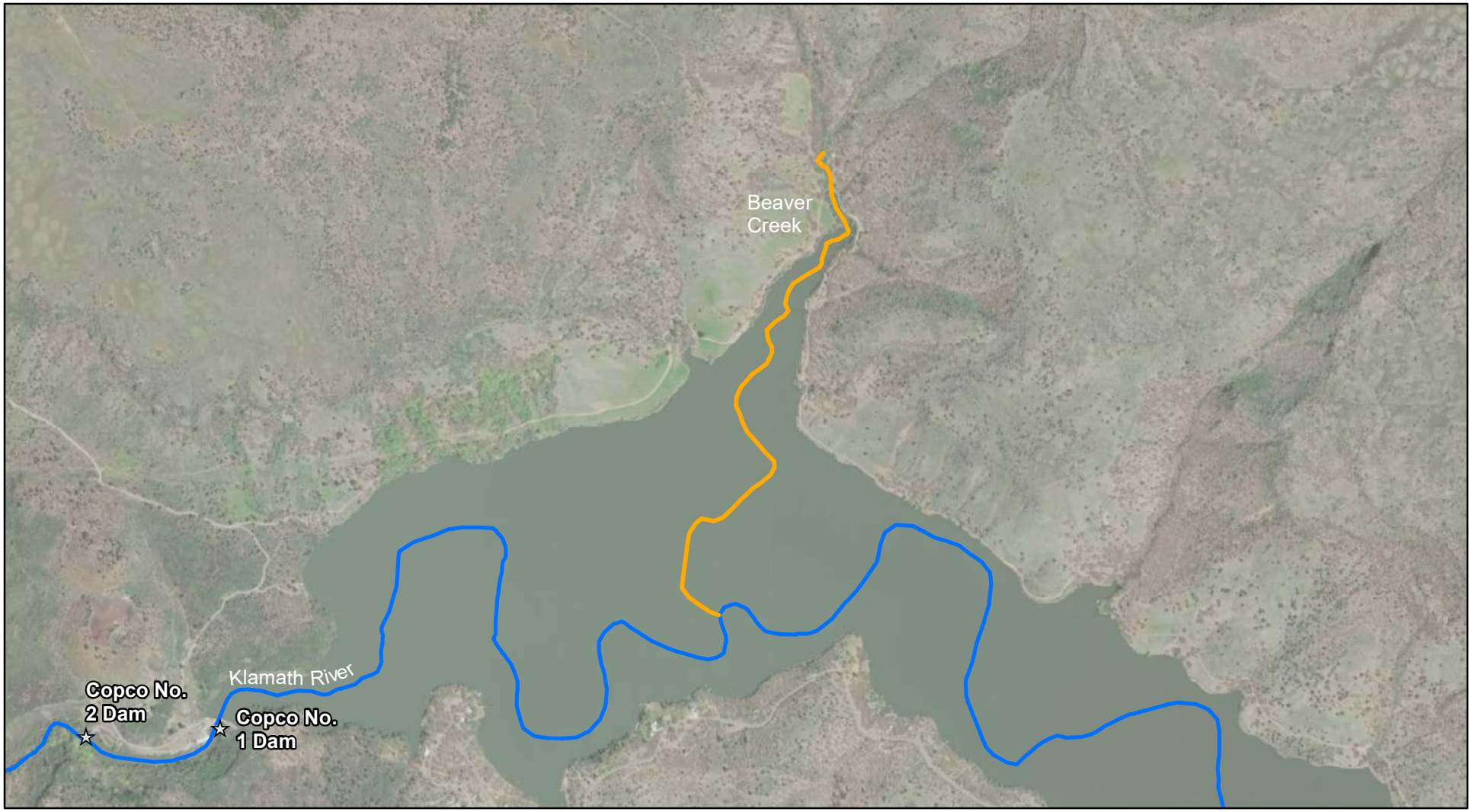
0 0.1 0.2 Miles

Notes

1. *Coordinate System: NAD 1983 2011 StatePlane California I FIPS 0401 Ft US*

2. *Data Sources: Monitoring Sites: RES; Klamath River: RES*

3. *Background: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community*



KLAMATH
RIVER RENEWAL
CORPORATION

Lower Klamath Project

Fish Presence Plan

Figure 4. Beaver Creek Monitoring Reach

December 3, 2020

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Legend

☆ Reference Sites

Monitoring Reach

Historic Klamath River Aligment

N

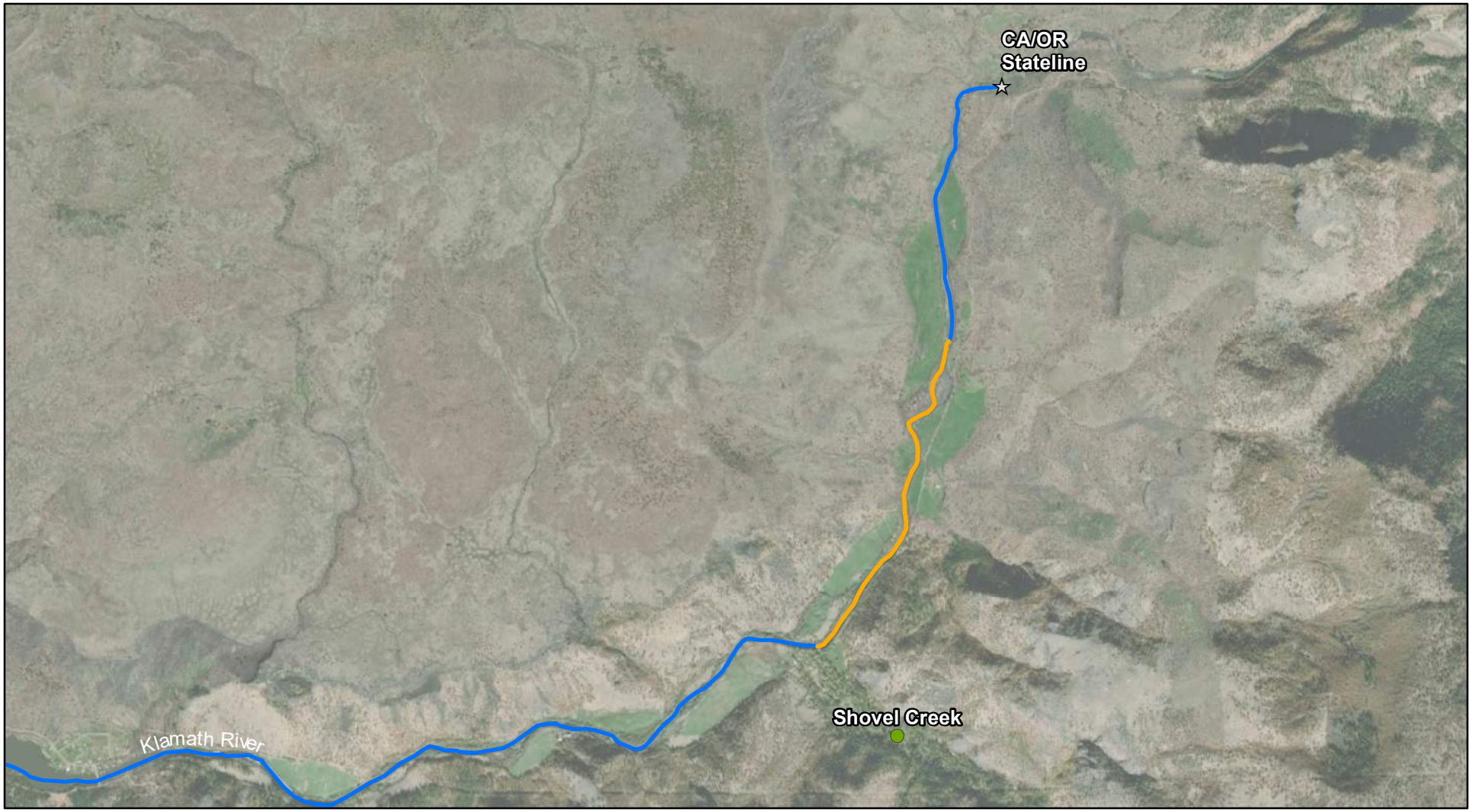
0 0.3 0.6 Miles

Notes

1. *Coordinate System: NAD 1983 2011 StatePlane California I FIPS 0401 Ft US*

2. *Data Sources: Monitoring Sites: RES; Klamath River: RES*

3. *Background: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community*



KLAMATH RIVER RENEWAL CORPORATION

Lower Klamath Project

Fish Presence Plan

Figure 5. Mainstem Klamath Monitoring Reach

December 3, 2020

PRELIMINARY DESIGN (NOT FOR CONSTRUCTION)

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Legend

- ☆ Reference Sites
- Tributary
- Monitoring Reach
- Historic Klamath River Aligment

N

0 0.65 1.3 Miles

Notes

1. *Coordinate System: NAD 1983 2011 StatePlane California I FIPS 0401 Ft US*

2. *Data Sources: Monitoring Sites: RES; Klamath River: RES*

3. *Background: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community*

Appendix B

Monitoring Data Sheets

Lower Klamath Project

Fish Presence Plan – Survey Data Sheet

Monitoring Reach: _____

Survey Date: _____

Crew: _____

_____

Weather: _____

Water Visibility: _____

Start Time: _____

Start GPS Point Name: _____

End Time: _____

End GPS Point Name: _____

Redd Observations					
GPS Point Name	**Photo taken (Y/N)**	**Previously marked (Y/N)**	**Species**	**Fish on redd (Y/N)**	**L (in.) x W (in.)**

Notes and field observations:

Fish Presence Plan – Survey Data Sheet Continued

Monitoring Reach: _____ Survey Date: _____

Fish Observations					
GPS Point Name	**Live fish / carcass**	**Species**	**Carcass length (in.)**	**Photo taken (Y/N)**	**Tissue/otolith taken**

Notes and field observations:

Appendix D

Tributary-Mainstem Connectivity Plan

KLAMATH RIVER RENEWAL CORPORATION

Lower Klamath Project
FERC Project No. 14803

Tributary-Mainstem Connectivity Plan

Klamath River Renewal Corporation
2001 Addison Street, Suite 317
Berkeley, CA 94704

Prepared by:
RES
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Sacramento, CA 95814

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December 2021

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Appendices

1.0 Introduction

This Tributary Mainstem Connectivity Plan is a subplan of the Aquatic Resources Management Plan that will be implemented as part of the Proposed Action (Proposed Action) for the Lower Klamath Project (Lower Klamath Project).

1.1 Purpose of Tributary-Mainstem Connectivity Plan

The purpose of the Tributary Mainstem Connectivity Plan is to describe the fish passage monitoring efforts the Renewal Corporation will undertake to identify potential fish barrier formation along the mainstem Klamath River and at identified fish-bearing tributary confluences within the Tributary Mainstem Connectivity fish passage monitoring area (as described in Section 2.2.1) during the two-year period following the reservoir drawdown. In particular, the Tributary Mainstem Connectivity Plan describes the geographic area that will be monitored by the Renewal Corporation, the period during which monitoring will occur, and the methods that will be used by the Renewal Corporation during monitoring. In addition, the Tributary Mainstem Connectivity Plan summarizes the adaptive management framework that the Renewal Corporation will use to interpret monitoring data and take adaptive management actions.

1.2 Relationship to Other Management Plans

The Tributary Mainstem Connectivity Plan is supported by elements of the following management plans for effective implementation: Reservoir Area Management Plan, Fish Presence Monitoring Plan, Juvenile Salmonid and Pacific Lamprey Rescue and Relocation Plan and the Cultural Resources Plan, a subplan of the Historic Properties Management Plan. So as not to duplicate information, elements from these other management plans are not repeated herein but are, where appropriate, referenced in this Plan.

More specifically, the Tributary Mainstem Connectivity Plan is a subpart to the Renewal Corporation's larger fish passage monitoring effort for the Proposed Action, parts of which are also included in the Reservoir Area Management Plan. In particular, Section 6.2.5 of the Reservoir Area Management Plan describes fish passage monitoring that the Renewal Corporation will conduct on sections of the mainstem Klamath River as well as portions of Spencer Creek, Beaver Creek, Fall Creek, Jenny Creek, and the lower Camp/Scotch Creek Complex. When combined, the fish passage monitoring and reporting procedures described in the Tributary Mainstem Connectivity Plan and the Reservoir Area Management Plan provide a comprehensive framework for fish passage monitoring in connection with the Proposed Action. In addition to the fish passage monitoring areas covered in the Tributary Mainstem Connectivity Plan and the Reservoir Area Management Plan, the Klamath River downstream from J.C. Boyle Dam to the Oregon State Line will be surveyed in accordance with the anticipated conditions of NMFS's Biological Opinion. The Klamath River downstream from the upper end of the former footprint of the J.C. Boyle Reservoir to the Oregon State Line will also be surveyed in accordance with the anticipated conditions of ODFW's Fish Passage Permit. Figure 1-1 provides a graphical depiction of fish passage monitoring requirements for the Proposed Action.

Adaptive management actions, depending on their breadth and complexity, may entail consultation by the Renewal Corporation with the Habitat Restoration Group (HRG) and/or Aquatic Resources Group (ARG). Member entities of the HRG are listed in Appendix I of the Reservoir Area Management Plan, and member entities of the ARG are listed in Section 3.0 of the Aquatic Resources Management Plan. These work groups largely include members from the same tribes and agencies, which will facilitate coordination across management plans.

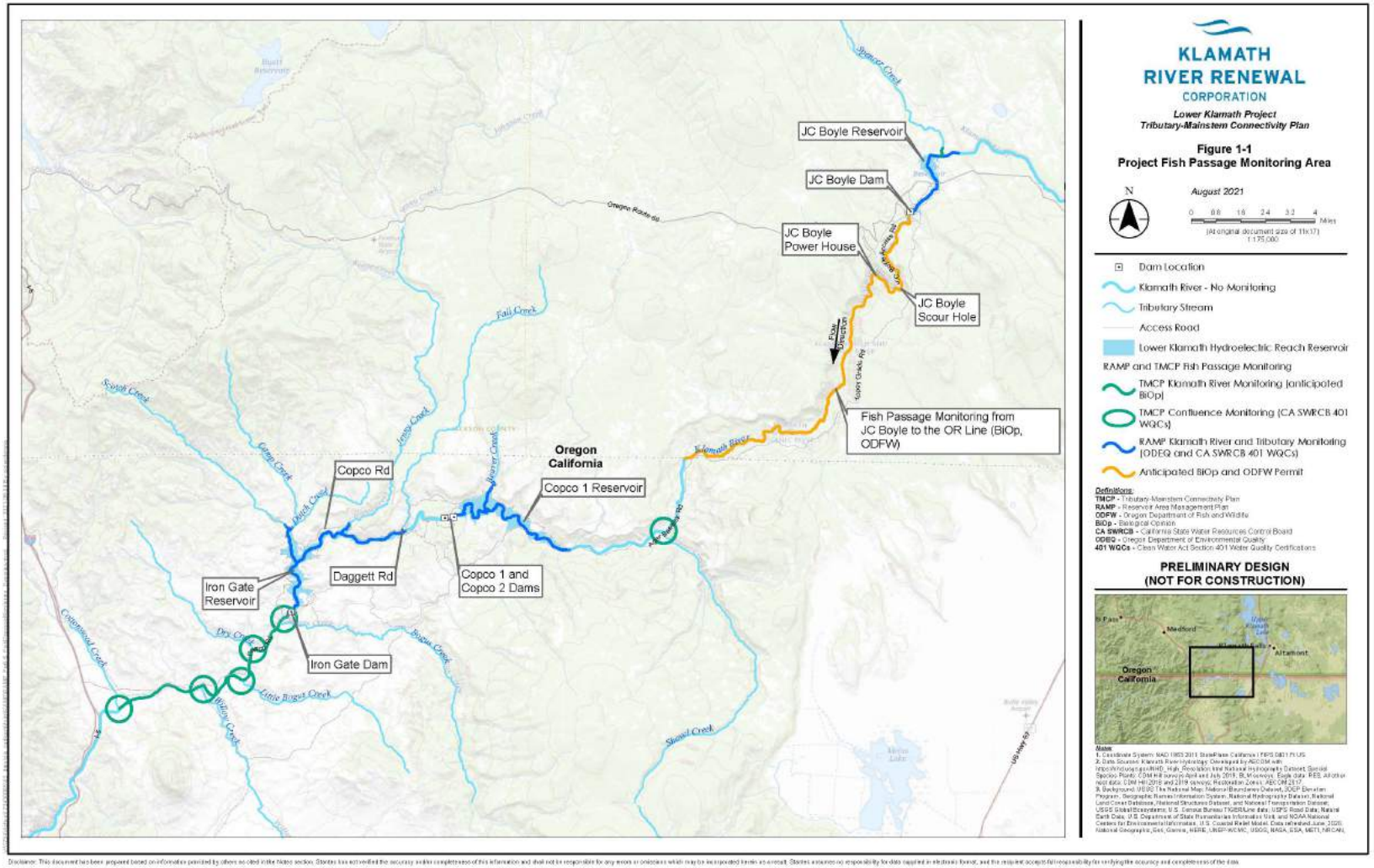

Figure 1-1. Lower Klamath Project Fish Passage Monitoring Area

2.0 Management Plan Measures

2.1 Fish Passage Monitoring Overview

The Renewal Corporation will conduct fish passage monitoring along the 8-mile reach of the mainstem Klamath River (8-Mile Mainstem Reach) from the downstream side of the Iron Gate Dam footprint (river mile (RM) 193.1) to Cottonwood Creek (RM 185.1); at the confluence locations of five tributaries within the 8-Mile Mainstem Reach (Bogus Creek, Dry Creek, Little Bogus Creek, Willow Creek, and Cottonwood Creek); and at the Shovel Creek confluence with the Klamath River above the Copco No. 1 Reservoir. The 5 tributaries within the 8-Mile Mainstem Reach were selected because they are recognized as influential tributaries (e.g., historical fisheries of importance or important freshwater sources) in the mid-Klamath River (Soto et al., 2008). While Shovel Creek is outside the 8-Mile Mainstem Reach (i.e., upstream of Copco No. 1 Reservoir), the Renewal Corporation selected it for connectivity monitoring due to its historical and/or potential habitat for adult salmonids (Huntington, 2006). The Tributary Mainstem Connectivity Plan fish passage monitoring area is depicted in Figure 2-1 and presented in the Map Book in Appendix A.

The Renewal Corporation will monitor the 8-Mile Mainstem Reach for sediment deposition and potential fish barrier formation resulting from the Proposed Action. The fish passage monitoring and associated adaptive management activities in the Tributary Mainstem Connectivity Plan focus on fish passage impediments caused by anthropogenic features, including residual reservoir sediments and anthropogenic debris. Anthropogenic debris includes human-made structures and natural debris caused by dam removal activities. Fish passage barriers may occur within the 8-Mile Mainstem Reach during reservoir drawdown and dam removal because of sediment evacuation or after dam removal when the Klamath River flows freely, allowing for active sediment transport of residual reservoir sediments. Fish passage barriers in the Tributary Mainstem Connectivity fish passage monitoring area could potentially impact the following anadromous fish species: coho salmon (*Oncorhynchus kisutch*), spring-run and fall-run Chinook salmon (*O. tshawytscha*), steelhead (anadromous form of rainbow trout; *O. mykiss*), and Pacific lamprey (*Entosphenus tridentatus*). The Renewal Corporation predicts increased levels of sediment aggradation in the mainstem Klamath River from Bogus Creek (RM 192.6) downstream to Cottonwood Creek (RM 185.1) during reservoir drawdown based on hydraulic and sediment transport modeling completed by United States Bureau of Reclamation (USBR) (USBR, 2011). Areas in the mainstem Klamath River downstream of Cottonwood Creek are expected to have only minor deposition (USBR, 2011).

The Renewal Corporation will conduct tributary confluence fish passage monitoring at the confluence locations of the five fish-bearing streams within the 8-Mile Mainstem Reach (Bogus Creek, Dry Creek, Little Bogus Creek, Willow Creek, and Cottonwood Creek) to support volitional passage at the confluence site following drawdown and dam removal. For the purpose of this Tributary Mainstem Connectivity Plan, the confluence is defined as the reach of tributary stream that extends 150 feet upstream in the tributary from the point where the downstream (in relation to the Klamath River) bank of the tributary stream transitions and becomes a bank of the Klamath River, the area of the tributary where a fish barrier is most likely to occur. Based on the

Renewal Corporation's professional experience, it is highly unlikely that material amounts of residual reservoir sediment or anthropogenic debris will travel more than 150 feet upstream in any of the monitored tributaries.

The Renewal Corporation will also conduct tributary confluence fish passage monitoring at Shovel Creek (RM 209.0) to support volitional passage at the confluence sites following drawdown and dam removal of the J.C. Boyle Dam. The potential for fish passage barrier formation at this site is anticipated to be relatively low because the J.C. Boyle Reservoir has less stored sediment than Copco No. 1 Reservoir or Iron Gate Reservoir and because the confluence is more than 18 miles from the dam removal site.

Culturally sensitive areas will be designated by the Renewal Corporation prior to drawdown to ensure that these areas are not entered with machinery. The identification of previously unknown culturally sensitive areas post-drawdown may unexpectedly constrain or delay the implementation of the Tributary Mainstem Connectivity Plan. If required by these or other unexpected post-drawdown conditions, the Renewal Corporation will develop monitoring and adaptive management measures tailored to site-specific conditions in consultation with the HRG and ARG.

2.2 Monitoring Area, Schedule, and Methods

The fish passage monitoring in the Tributary Mainstem Connectivity Plan focuses on identifying and evaluating barriers and potential barriers caused by anthropogenic debris, as defined in Section 2.2.5, and sediment accretion. The following sections describe the monitoring efforts that the Renewal Corporation will take under the Tributary Mainstem Connectivity Plan.

2.2.1 Fish Passage Monitoring Area

The Renewal Corporation will conduct the volitional fish passage monitoring described in the Tributary Mainstem Connectivity Plan in the following 3 locations along the Klamath River:

- The 8-Mile Mainstem Reach
- At the confluence of five tributaries (Bogus Creek, Dry Creek, Little Bogus Creek, Willow Creek, and Cottonwood Creek) in the 8-Mile Mainstem Reach. These tributaries were selected because they are recognized as influential tributaries (e.g., historical fisheries of importance or important freshwater sources) in the mid-Klamath River (Soto et al., 2008).
- At the confluence of Shovel Creek (RM 209.0). While this tributary is outside the 8-Mile Mainstem Reach (i.e., upstream of Copco No. 1 Reservoir), it was selected for connectivity monitoring due to its historical and/or potential habitat for adult salmonids (Huntington, 2006).

The Tributary Mainstem Connectivity Plan fish passage monitoring area is depicted in Figure 2-1 and presented in the Map Book in Appendix A.

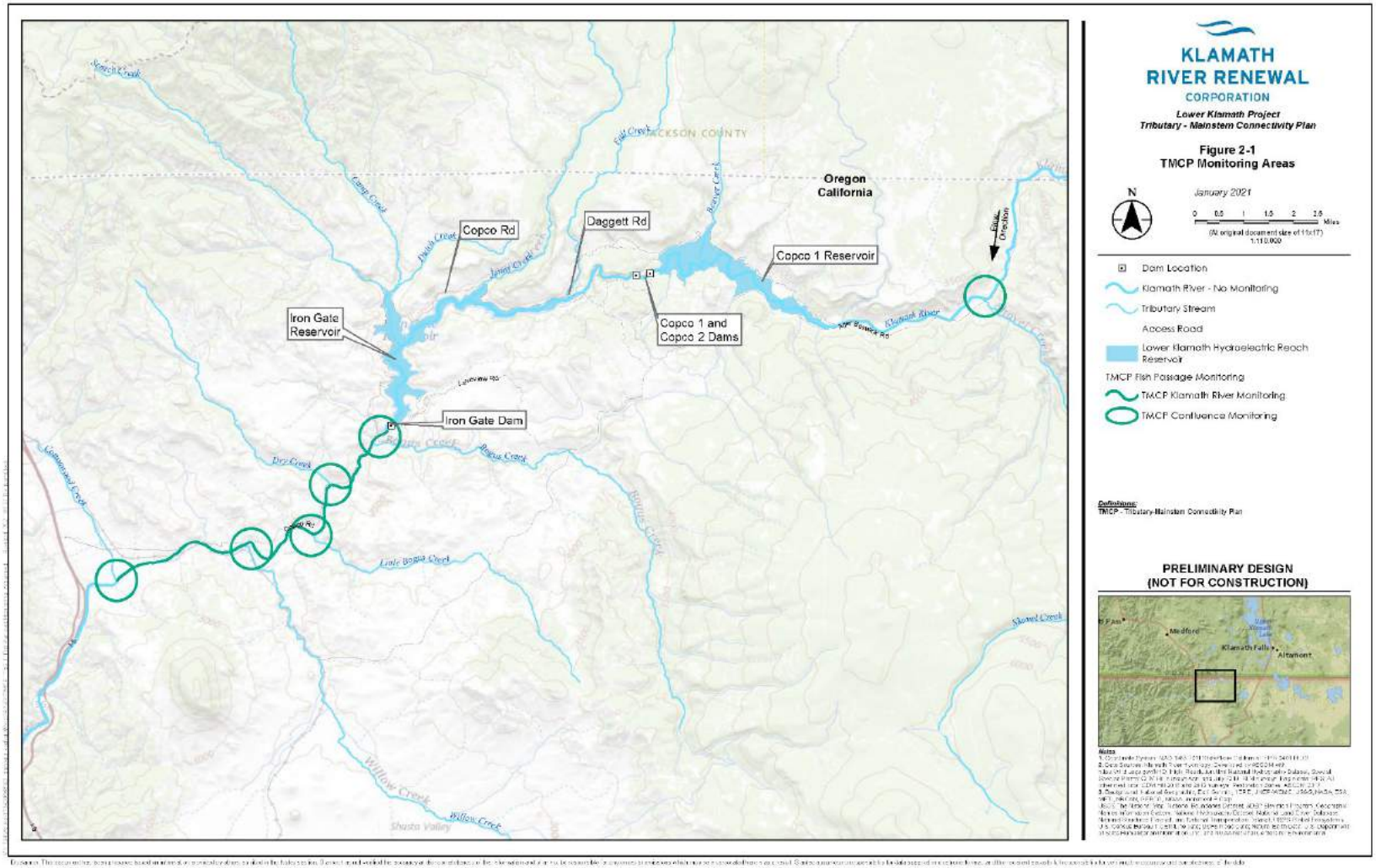

Figure 2-1. Tributary Mainstem Connectivity Plan Monitoring Areas

2.2.2 Fish Passage Monitoring Schedule

The schedule for Tributary Mainstem Connectivity Plan fish passage monitoring is presented in Table 2-1. For purposes of this Tributary Mainstem Connectivity Plan, Year 1 refers to the year before drawdown, Year 2 refers to the drawdown year, Year 3 refers to the year following the drawdown year, Year 4 refers to the following year and so on. During Year 2, the Renewal Corporation will monitor in the spring, post-final drawdown (which is anticipated to occur in late spring or early summer depending on hydrologic conditions), and in the fall. During Year 3, the Renewal Corporation will monitor in June/July after the rainy season (which corresponds to a seasonal window and flow period characteristic of native migratory fish movement in the spring) and in the fall. The Renewal Corporation will monitor during Year 4 (the final year of the Tributary Mainstem Connectivity Plan) in June/July after the rainy season. The Renewal Corporation will conduct additional monitoring following the first 5-year or greater flow event to occur following drawdown if the flow event occurs within 5 years of drawdown. The additional monitoring will occur within one month of the 5-year flow event unless it is unsafe for field crews, in which case the monitoring will occur as soon thereafter as it can safely be conducted.

The Renewal Corporation's annual fish passage monitoring is addressed in the Reservoir Area Management Plan. In addition, the Renewal Corporation will conduct fish passage monitoring on the Klamath River downstream from the upper end of the former footprint of the J.C. Boyle Reservoir to the Oregon State Line in accordance with the anticipated conditions of NMFS's Biological Opinion and ODFW's Fish Passage Permit.

Table 2-1. Schedule for Tributary Mainstem Connectivity Plan Fish Passage Monitoring

YEAR	SURVEY PERIOD	LOCATION
Year 2	Spring	Tributary Mainstem Connectivity Plan Fish Passage Monitoring Area
	Post Final Drawdown	Tributary Mainstem Connectivity Plan Fish Passage Monitoring Area
	Fall	Tributary Mainstem Connectivity Plan Fish Passage Monitoring Area
Year 3	After rainy season[1]	Tributary Mainstem Connectivity Plan Fish Passage Monitoring Area
	Fall	Tributary Mainstem Connectivity Plan Fish Passage Monitoring Area
Year 4	After rainy season	Tributary Mainstem Connectivity Plan Fish Passage Monitoring Area
Drawdown – Year 6	Additional monitoring event will be conducted following the first 5-year or	Tributary Mainstem Connectivity Plan Fish Passage Monitoring Area

	greater flow event to occur following drawdown if such event occurs within 5 years of drawdown. [2]	

Notes:

1. Monitoring during the survey period "after rainy season" is anticipated to occur between June 15 and July 31. The exact dates will be determined based on the 14-day weather forecast to avoid significant storms forecast to cause 0.25 or more inches of rain. During this period, the monthly flow on the mainstem of the Klamath River should be approximately 1,050 to 1,280 cfs, some of the lowest monthly average flow periods for the mainstem.

2. 5-year Flow Event of 10,908 cubic feet per second or greater on the Klamath River recorded at the USGS Klamath River Below Iron Gate Dam CA Gage (#11516530).

2.2.3 Desktop Monitoring, Field Surveys, and Fixed Photo Points

The Renewal Corporation will undertake fish passage monitoring through a combination of the desktop and field review procedures, as described below and in Section 6.2.7 of the Reservoir Area Management Plan (Headcut Migration Monitoring). The reference to survey period in Table 2-1 refers to a scheduled desktop evaluation. If the desktop evaluation of a potential fish passage barrier is inconclusive or if a potential barrier is identified by desktop methods or field personnel, the Renewal Corporation will conduct a field investigation. If the Renewal Corporation determines that a field-based fish passage barrier evaluation is required, the Renewal Corporation will notify the HRG and ARG approximately two (2) weeks prior (or at least 48 hours in the case of an emergency) to the field investigation to allow staff the opportunity to participate in the monitoring effort. The field evaluation will be led by a fisheries biologist or geomorphologist who will assess barriers to volitional fish passage.

Where access allows, the Renewal Corporation will also establish fixed photo point monitoring locations at each of the tributary confluences within the Tributary Mainstem Connectivity Plan fish passage monitoring area during the initial survey period to establish that confluence sites are not blocked by sediment and that the sediment present does not block fish passage. At least two fixed photo points will be established at each location with a minimum of one downstream view and one upstream view. The precise locations of the fixed photo points will be determined during the initial survey period in the spring of Year 2. If access is not granted by one or more private property owners, the Renewal Corporation will determine, in consultation with the HRG and ARG, an alternative monitoring method to replace the absent fixed photo points. At least one photo will be taken from each fixed photo point during every survey period listed in Table 2-1.

2.2.4 Anthropogenic Debris

During the period from drawdown until completion of the final survey after the rainy season in Year 4 (Table 4-1), the Renewal Corporation will remove human-made structures and natural debris barriers caused by dam removal activities within the Tributary Mainstem Connectivity Plan fish passage monitoring area if such barriers are visible within channel beds and present as potential fish passage barriers. Human-made structures and debris present potential fish passage barriers if they cause greater than a six (6) inch discontinuity in water surface elevation (WSE) in Oregon or greater than a 12-inch discontinuity in WSE in California.

2.2.5 Natural Barriers

The Renewal Corporation will not remove any natural barriers consisting of non-residual reservoir sediments, bedrock, and other pre-dam channel elements, such as woody debris and boulders. However, if a natural barrier materially and unexpectedly restricts fish passage within the Tributary Mainstem Connectivity Plan fish passage monitoring area, the Renewal Corporation will determine, in consultation with the ARG and HRG, whether the natural barrier should be removed or manipulated to permit fish passage.

2.2.6 Headcut Migration Monitoring

Discontinuities in the channel bed due to uneven evacuation of sediments may lead to temporary headcuts that could act as barriers to fish migration. Depending on the nature of the residual sediment and subsequent flows experienced, such headcuts may be short-lived and/or unlikely to pose a sustained threat to fish passage or long-term habitat function. The Renewal Corporation's methods for identifying and evaluating residual reservoir sediment headcuts are set forth in Section 6.2.7 of the Reservoir Area Management Plan (Headcut Migration Monitoring), which is incorporated by reference into this Tributary Mainstem Connectivity Plan.

2.2.7 Accreted Sediment Monitoring

2.2.7.1 Initial Establishment

Pre-drawdown topographic data is based on the 2018 baseline bathymetry, which is stored at www.opentopography.org. The open topography website is open to the public and will serve as the baseline data hub for topography and bathymetry. Lower Klamath Project baseline data can be downloaded at https://opentopography.org/news/klamath-river-renewal-project-data-access-through-opentopography and https://doi.org/10.5069/G9DN436N. The Renewal Corporation will continue gathering data following drawdown, run-of-the-river operation, and construction operations to inform conditions for monitoring and adaptive management.

2.2.7.2 Accreted Sediment Monitoring Methods

The Renewal Corporation will conduct monitoring of potential sediment accretion within the fish passage monitoring area through fixed photo point monitoring at each of the tributary confluences within the Tributary Mainstem Connectivity Plan fish passage monitoring area to establish that each confluence site is not blocked by sediment and/or the sediment present does not obscure fish passage. In addition, during headcut migration monitoring (Section 2.2.6), the Renewal Corporation will review digital aerial data capture technologies using low-elevation, geolocated oblique aerial video to assess potential barriers at the tributary confluence sites. While this monitoring protocol is intended for headcut migration monitoring, it also serves to identify potential barriers resulting from accreted residual reservoir sediment to assure connectivity and passability. The presence of accreted sediment alone does not necessitate intervention. Rather, it is the formation of barriers to the fish species listed in Section 2.1 that may trigger adaptive management measures as described in the following sections.

2.3 Adaptive Management

If the monitoring described in Section 2.2 identifies fish passage barriers, the Renewal Corporation will use the adaptive management framework set forth in Section 6.2.9 of the Reservoir Area Management Plan (Adaptive Management), which is incorporated by reference into this Tributary Mainstem Connectivity Plan. The Renewal Corporation will use this adaptive management framework to interpret monitoring data and take adaptive management actions, including the correction of tributary confluence blockages, when necessary to achieve the Tributary Mainstem Connectivity Plan's purpose.

2.3.1 Adaptive Measures and Changing Circumstances

The Renewal Corporation will update the Tributary Mainstem Connectivity Plan as appropriate to address unanticipated fish passage barriers if: (1) a natural disaster or other force majeure event (defined as events beyond the control of the Renewal Corporation, including without limitation flooding and drought) occurs, (2) sediment evacuation or other assumptions used by the Renewal Corporation are updated following dam removal, or (3) other unforeseen circumstances result in more fish passage barriers than anticipated (together, Unforeseen Circumstances). In the event Unforeseen Circumstances occur, the Tributary Mainstem Connectivity Plan may be updated to adjust the monitoring measures the Renewal Corporation takes within the Tributary Mainstem Connectivity Plan fish passage monitoring area during Year 2, 3 and 4 (and after a 5-year or greater flow event if it occurs within 5 years of drawdown) and/or the criteria the Renewal Corporation uses to determine if intervention is required. All updates to the Tributary Mainstem Connectivity Plan will be submitted to the SWRCB for approval and be consistent with the purpose and goals of the Tributary Mainstem Connectivity Plan. If an updated Tributary Mainstem Connectivity Plan is approved by the SWRCB, the Renewal Corporation will file a report with the Federal Energy Regulatory Commission within 14 calendar days, which shall include a copy of the updated Tributary Mainstem Connectivity Plan, a description of the Unforeseen Circumstances, and documentation of consultation with the SWRCB.

2.3.2 In-Water Work Best Management Practices for Significant Interventions

Significant adaptive management interventions involve in-water work and the need for work zone isolation measures. The Renewal Corporation will implement the relevant BMPs set forth in Appendix C (Best Management Practices) of the RAMP during significant adaptive management interventions within the Tributary Mainstem Connectivity Plan Fish Passage Monitoring Area.

3.0 Reporting

The Renewal Corporation will prepare and submit an annual report by April 1 of Year 3 (i.e., the year following the drawdown year), Year 4, and Year 5. Each annual report will be submitted to the SWRCB and ODEQ, and copied to the HRG and ARG. The annual report will include the following:

1. Monitoring results, including maps and graphical representations, as appropriate;
2. Obstructions (if any) observed during monitoring events, including photos of fish passage barriers that required significant interventions;
3. Minor and significant barrier interventions, including the results of each intervention;
4. Consultation records; and
5. An overall assessment of fish passage within the Tributary Mainstem Connectivity fish passage monitoring area.

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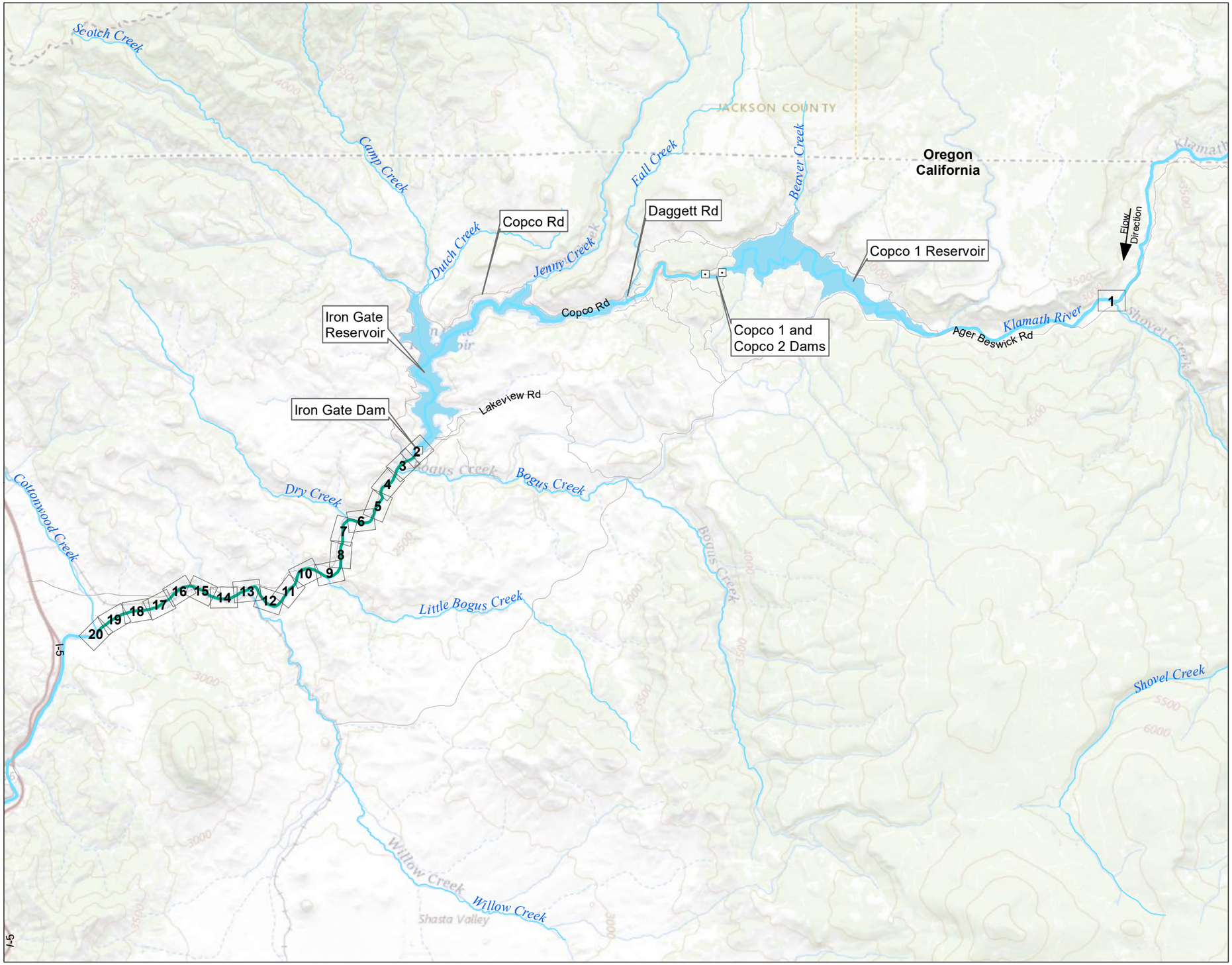
Appendix A

Map Book



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- Klamath River
- Tributary Stream
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Definitions:
TMCP - Tributary-Mainstem Connectivity Plan

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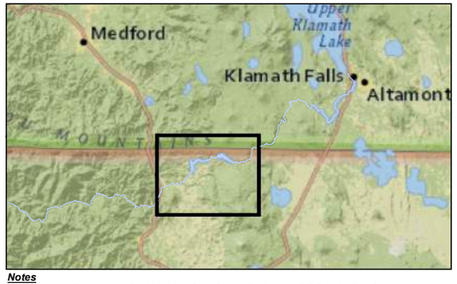

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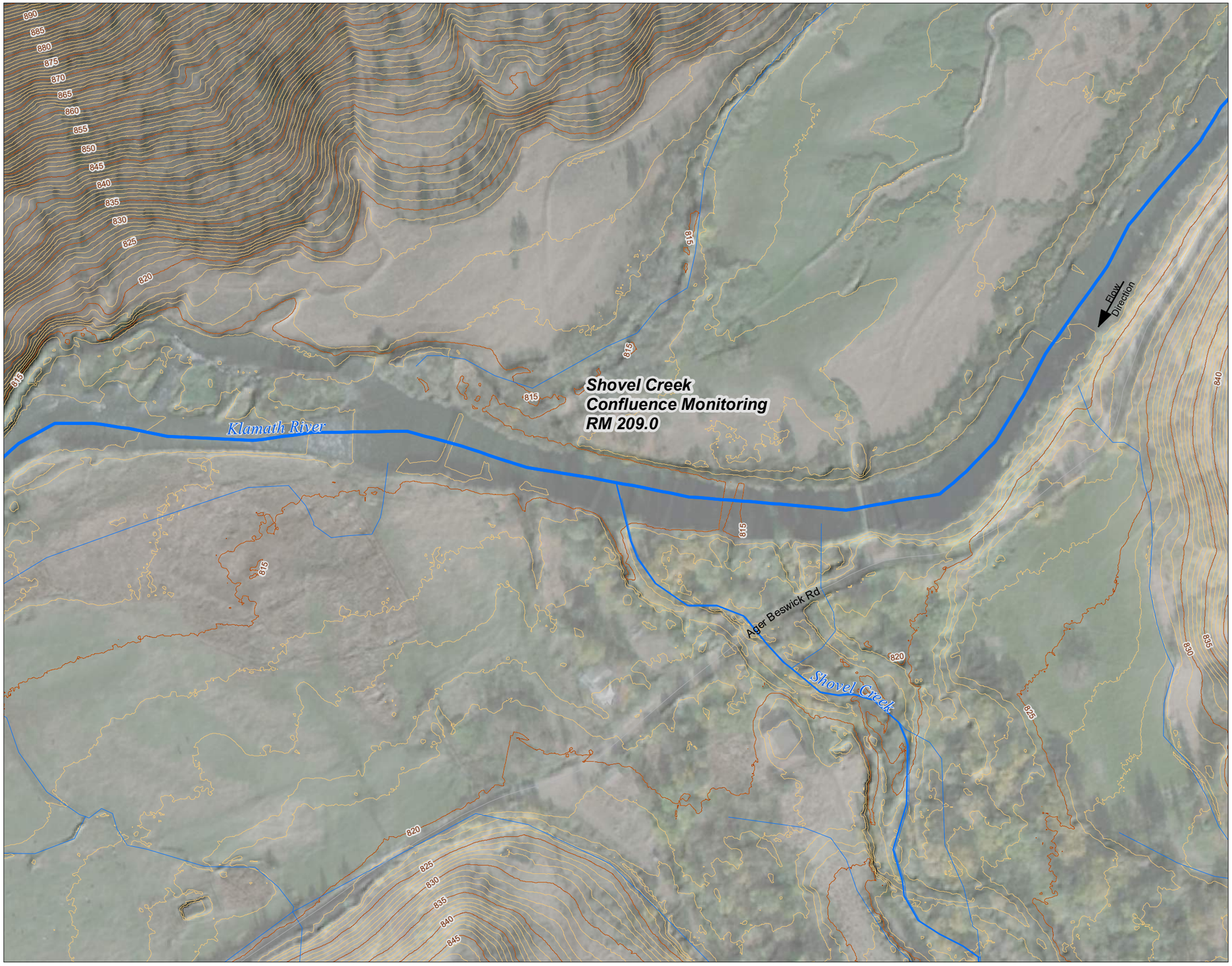

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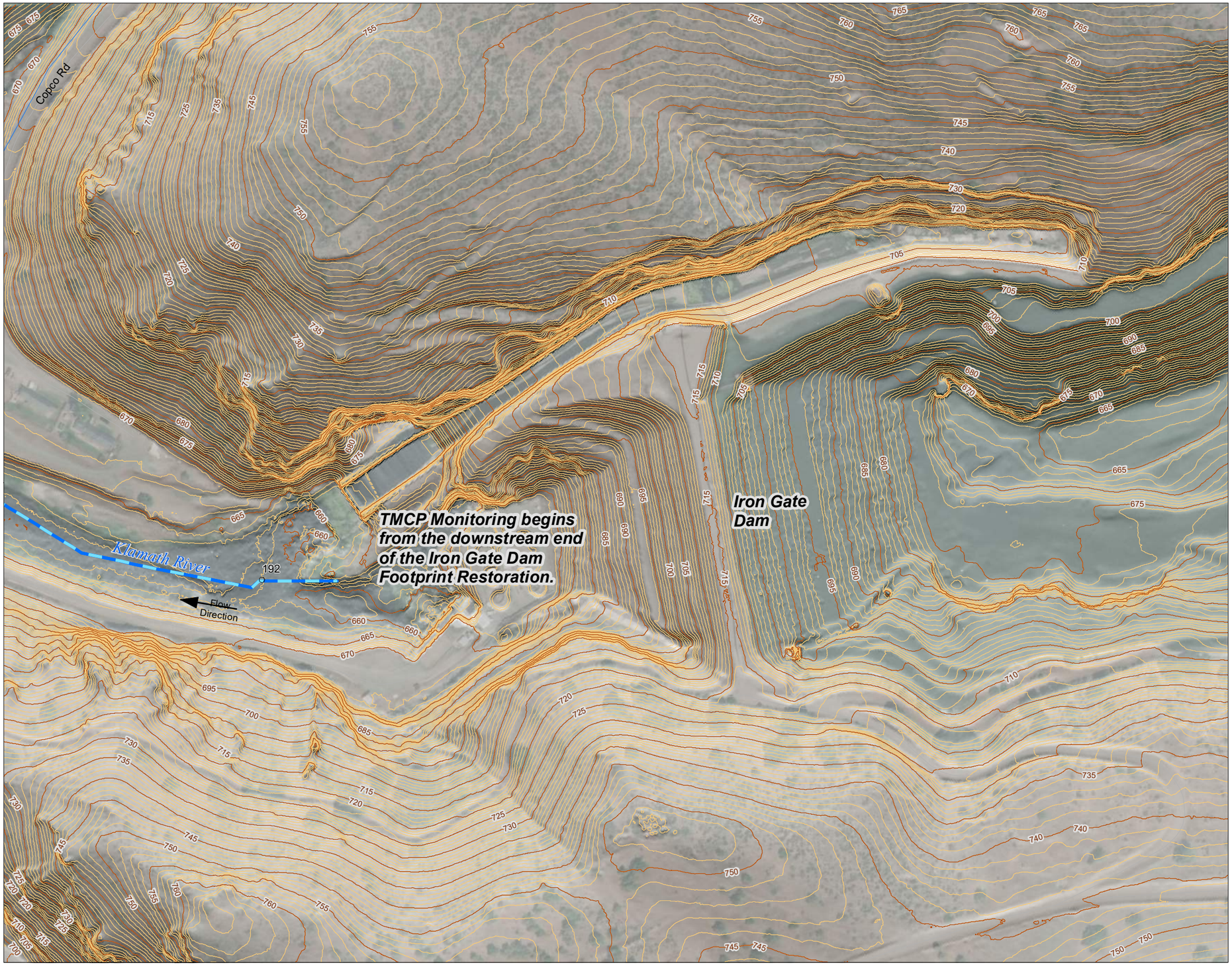

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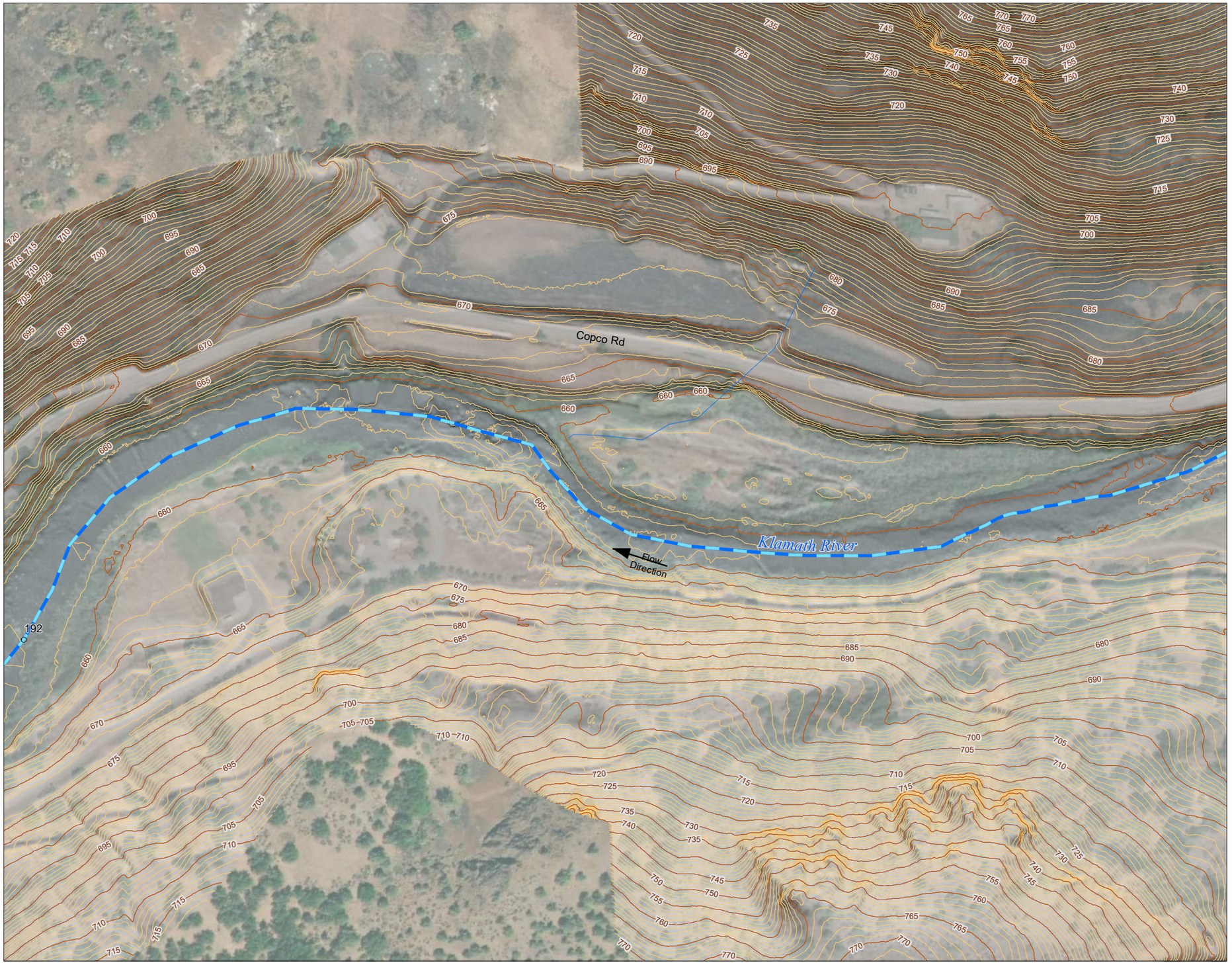

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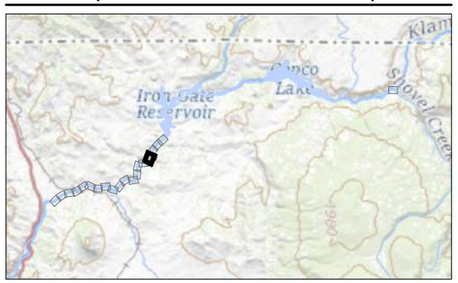

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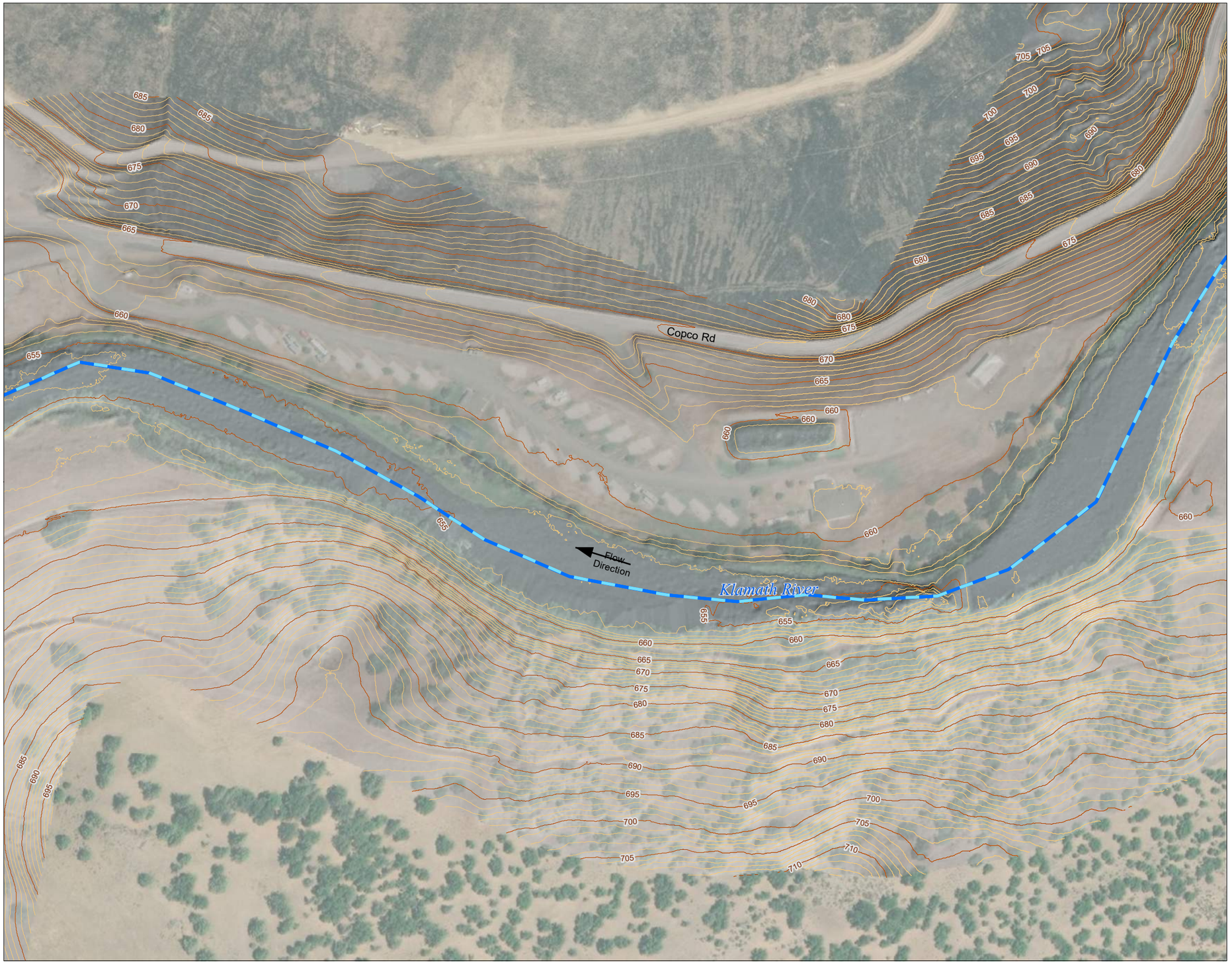

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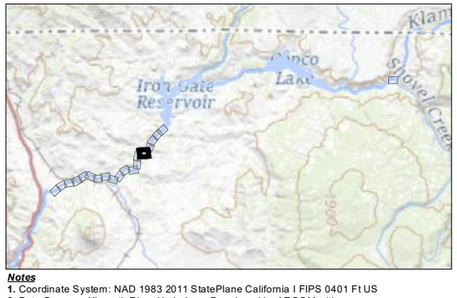

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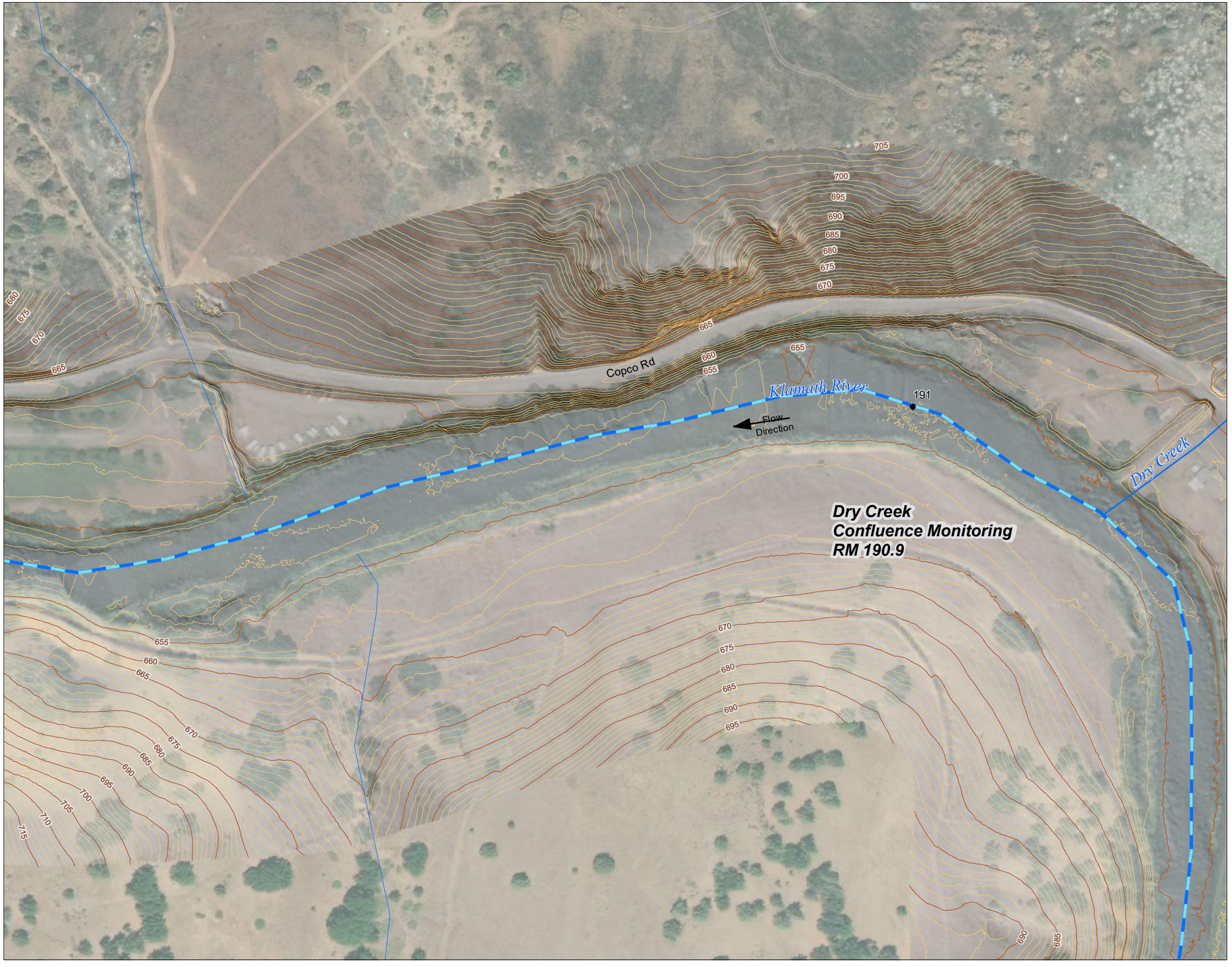

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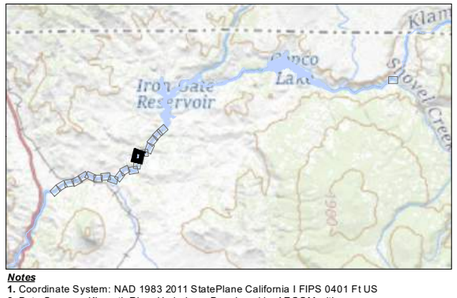

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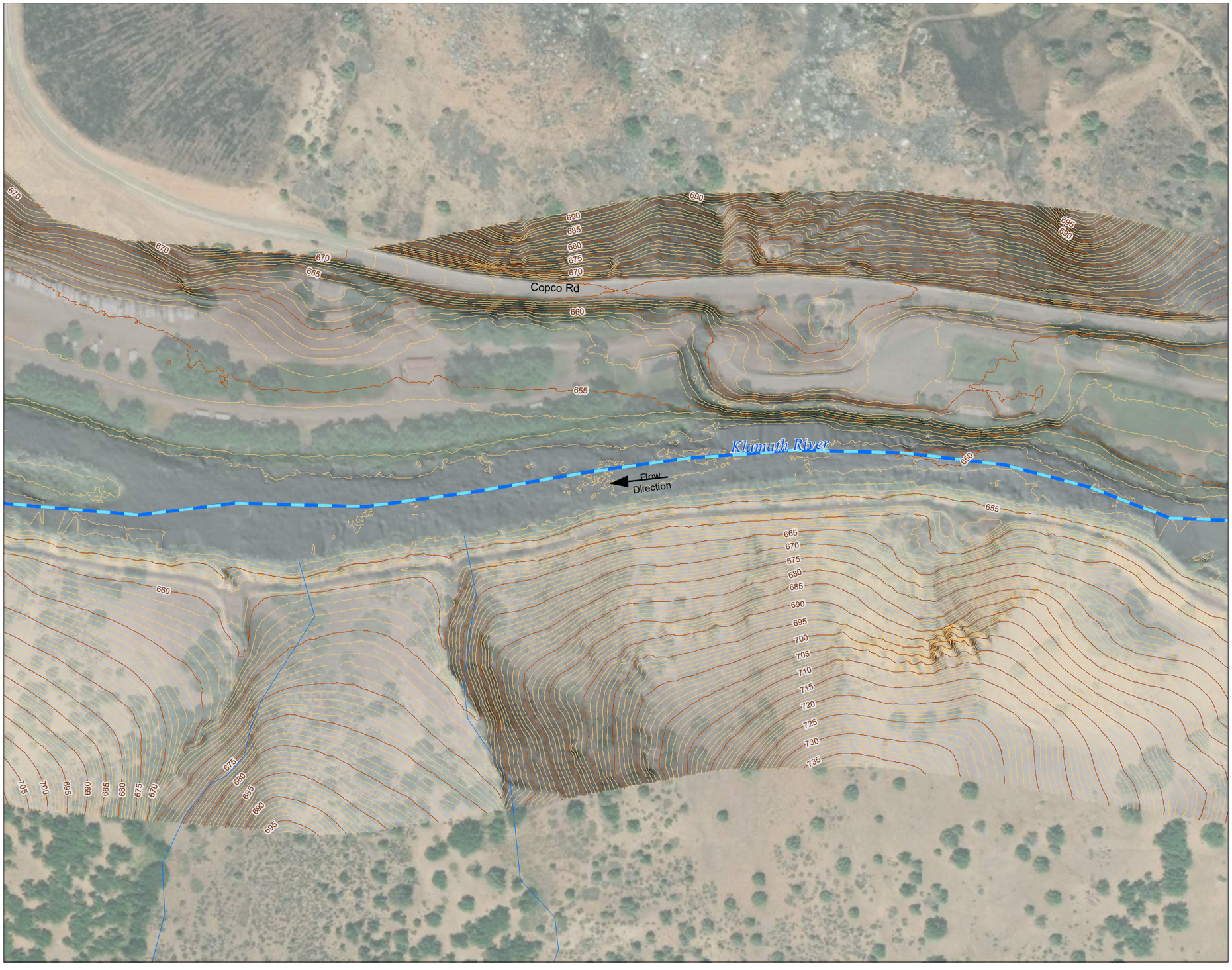

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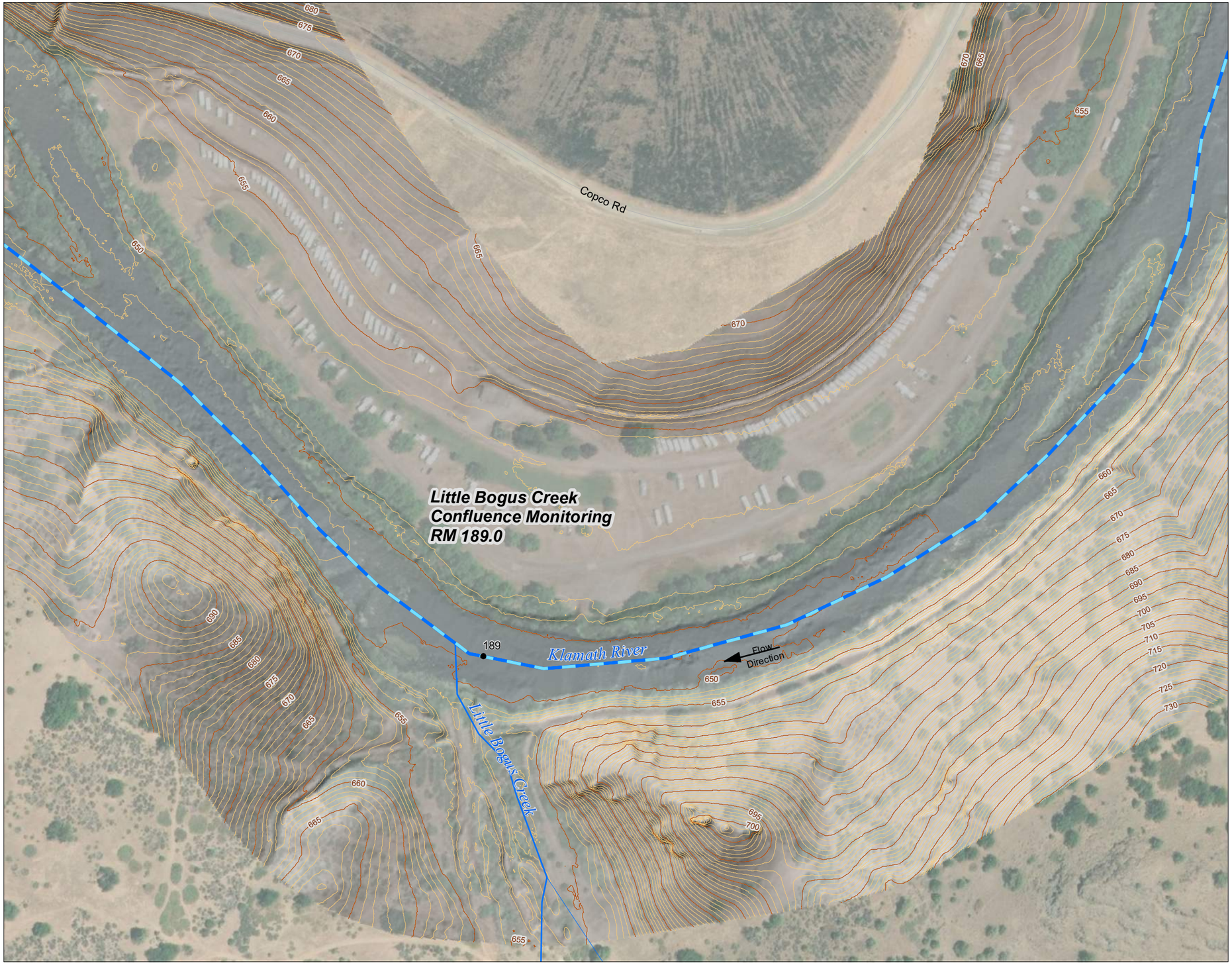

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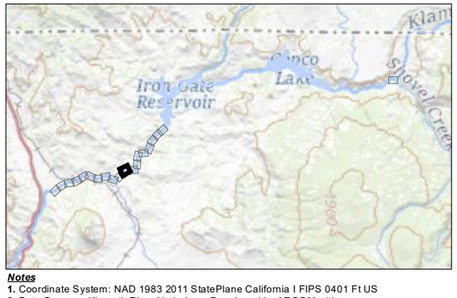

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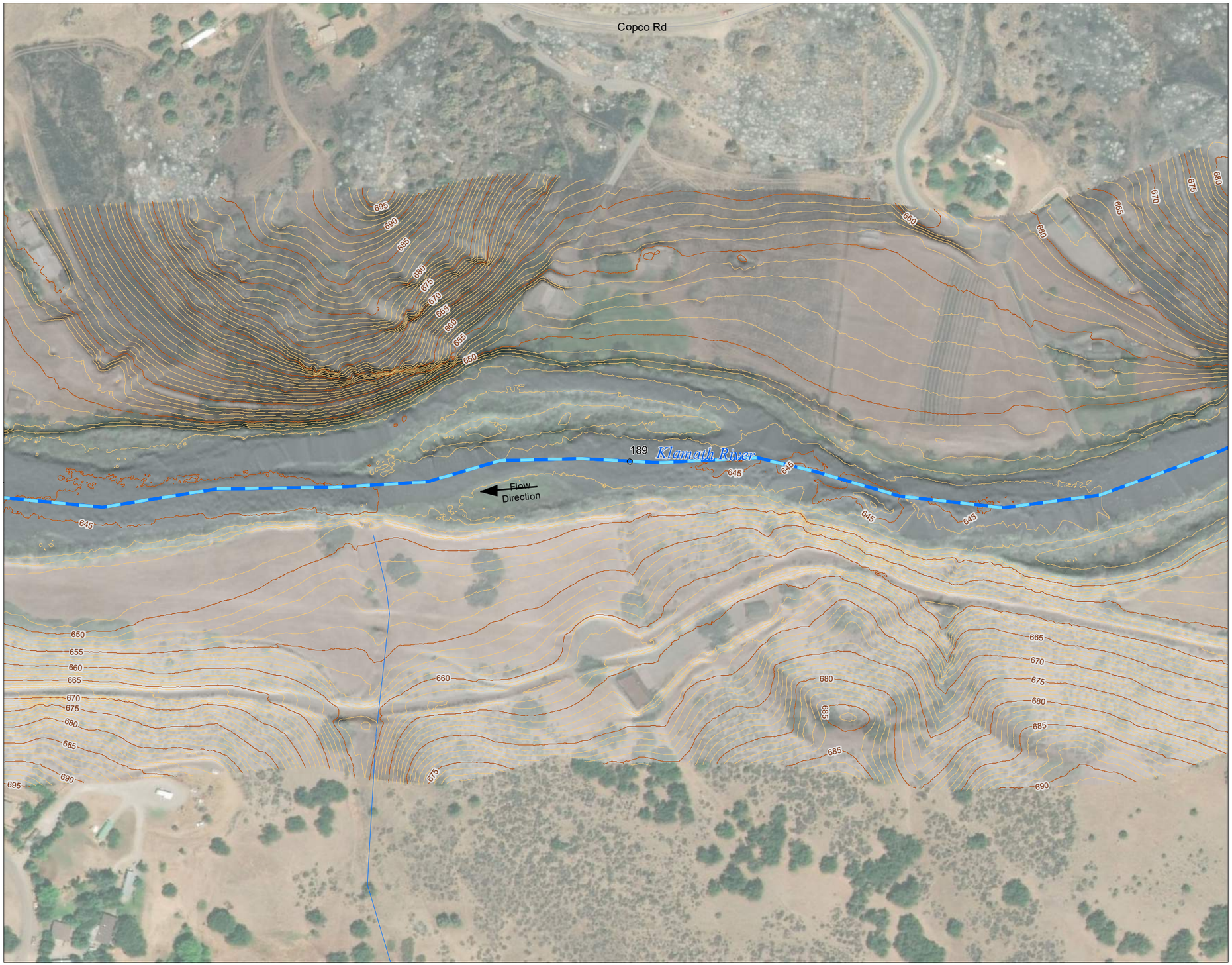

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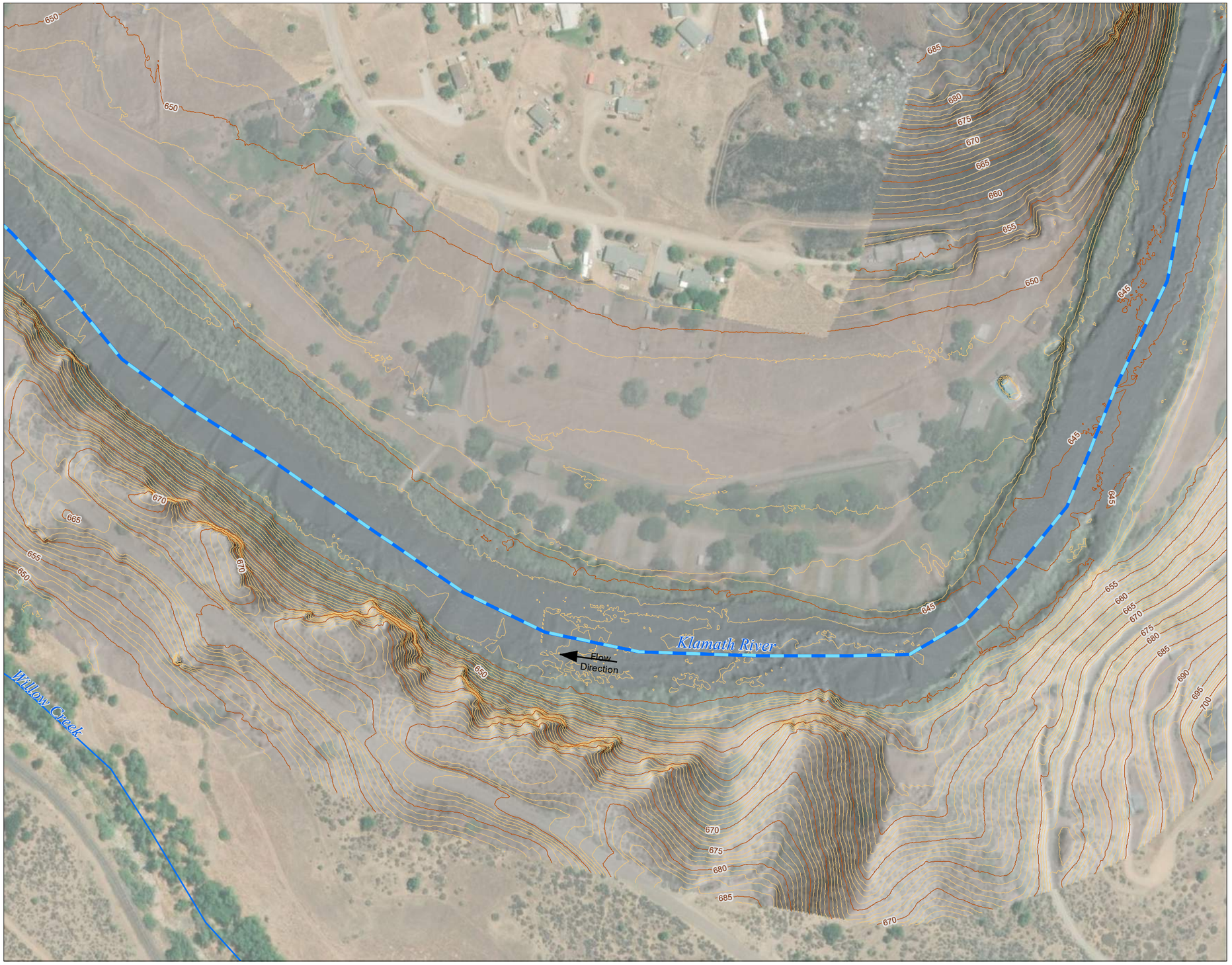

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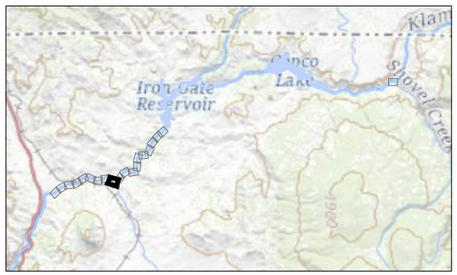

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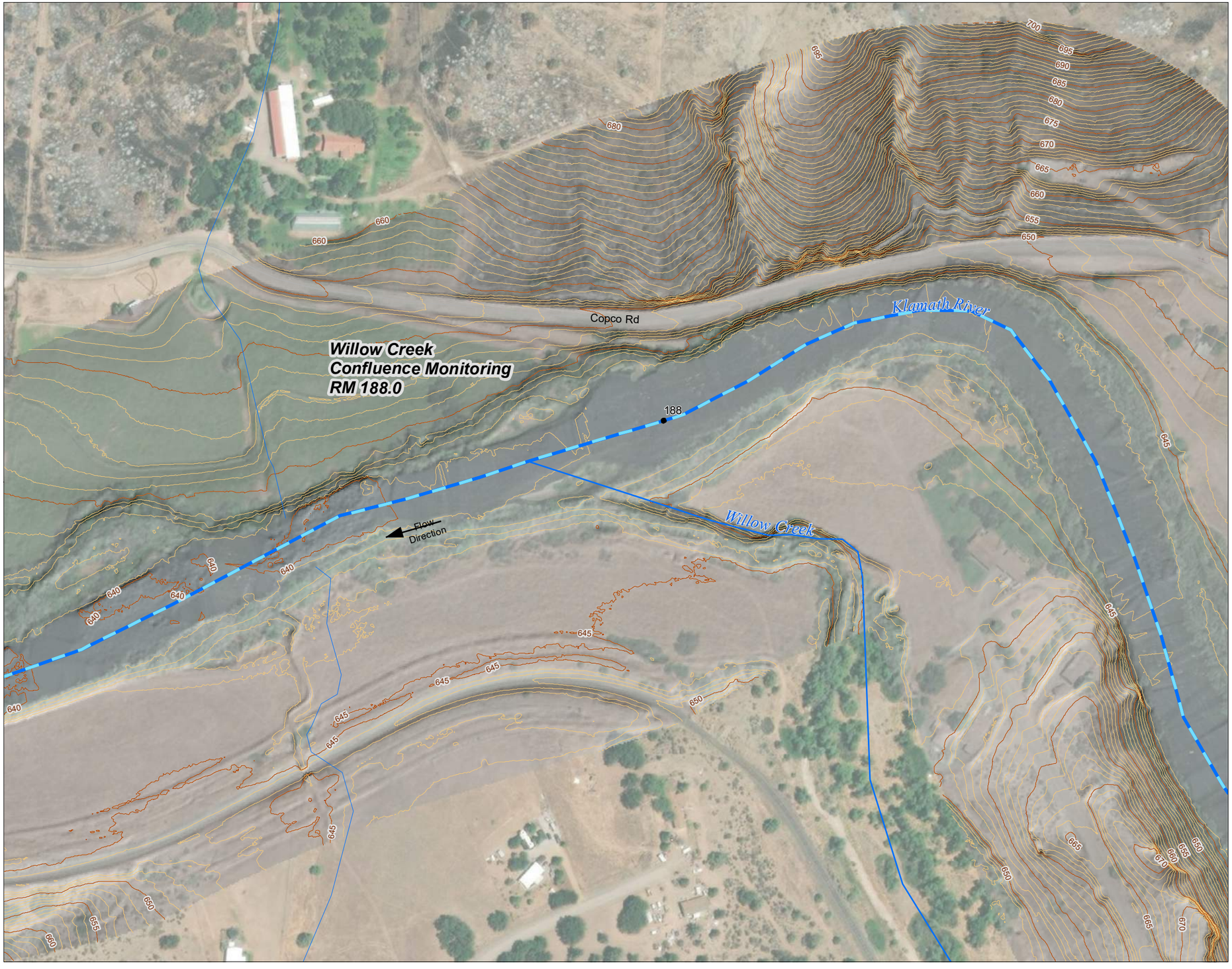

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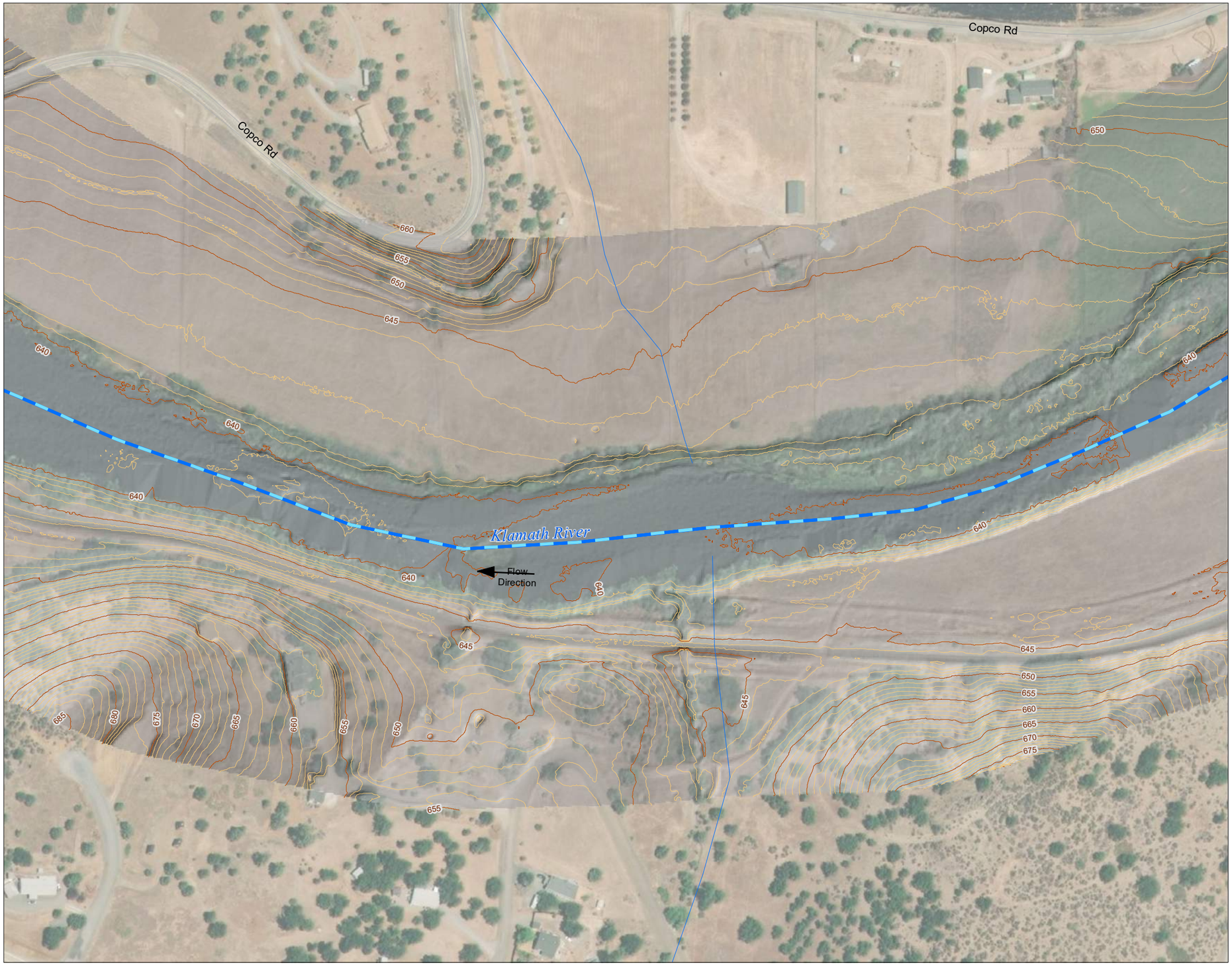

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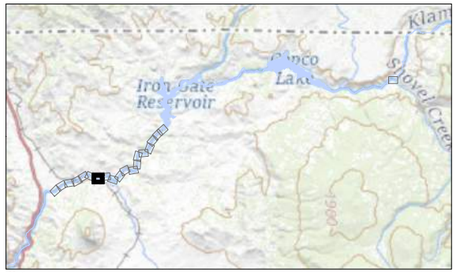

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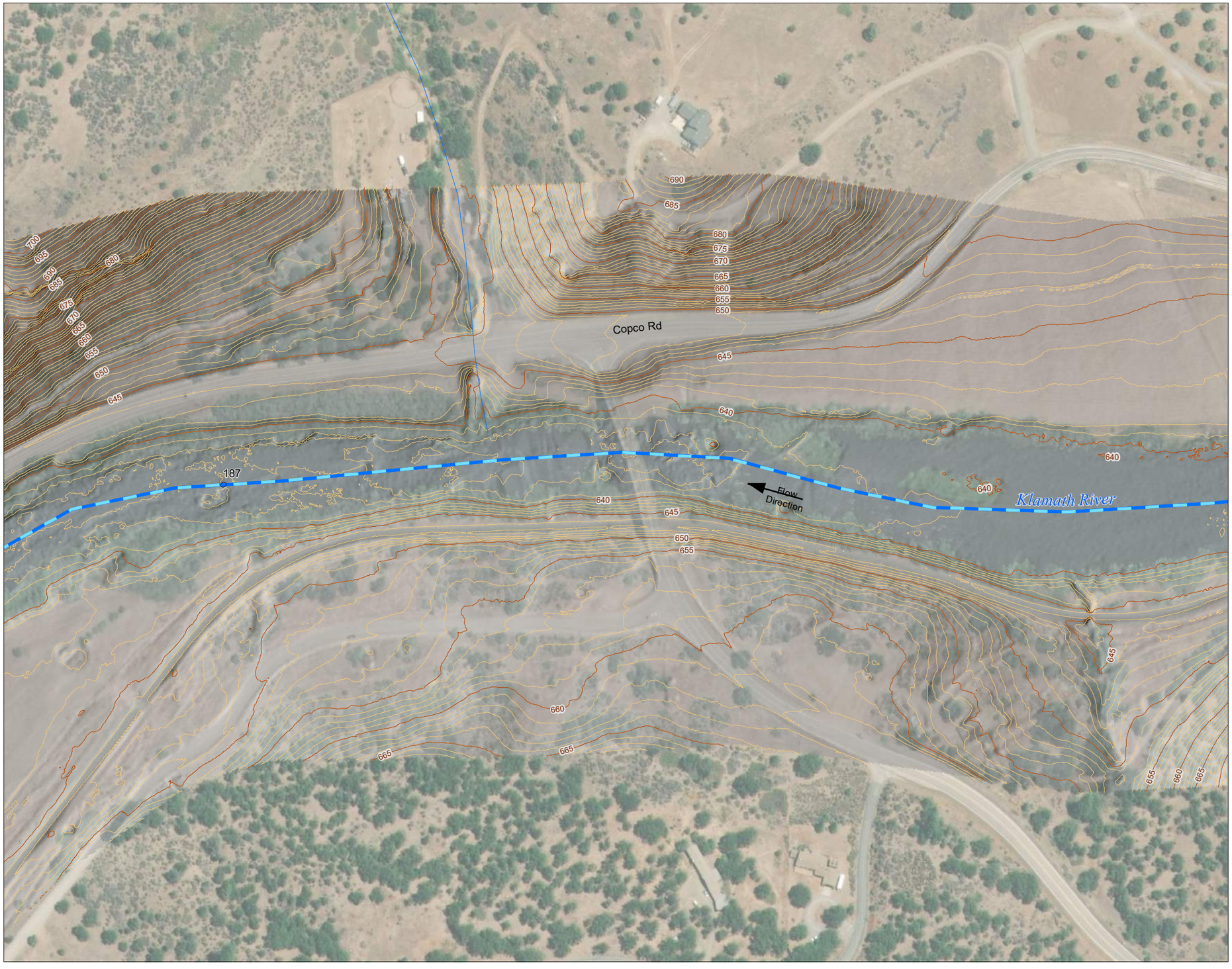

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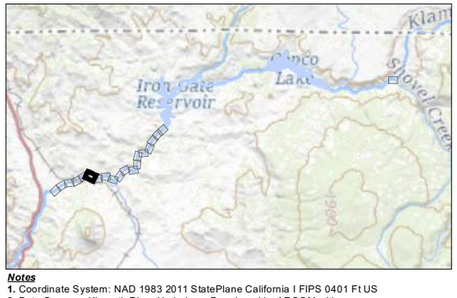

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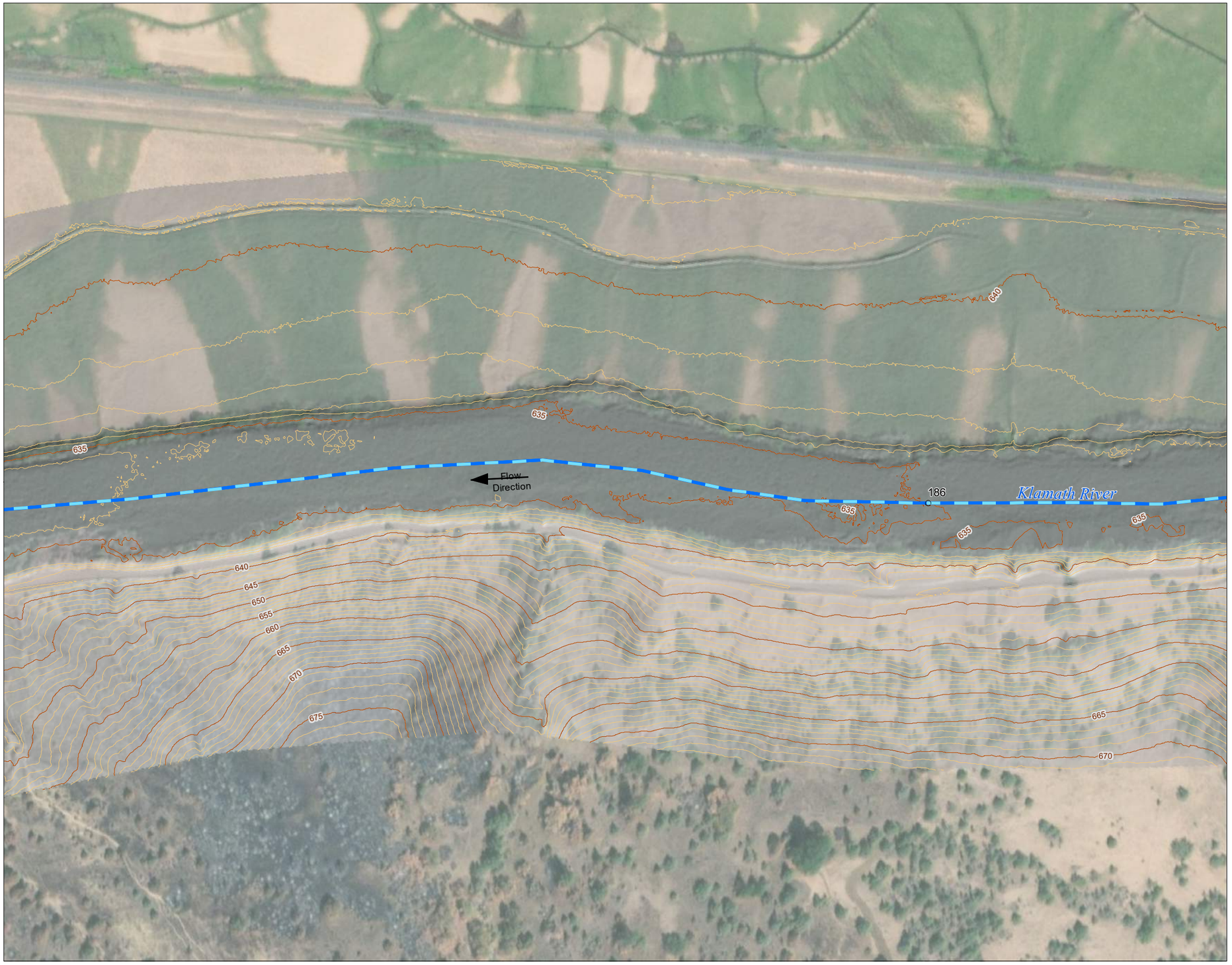

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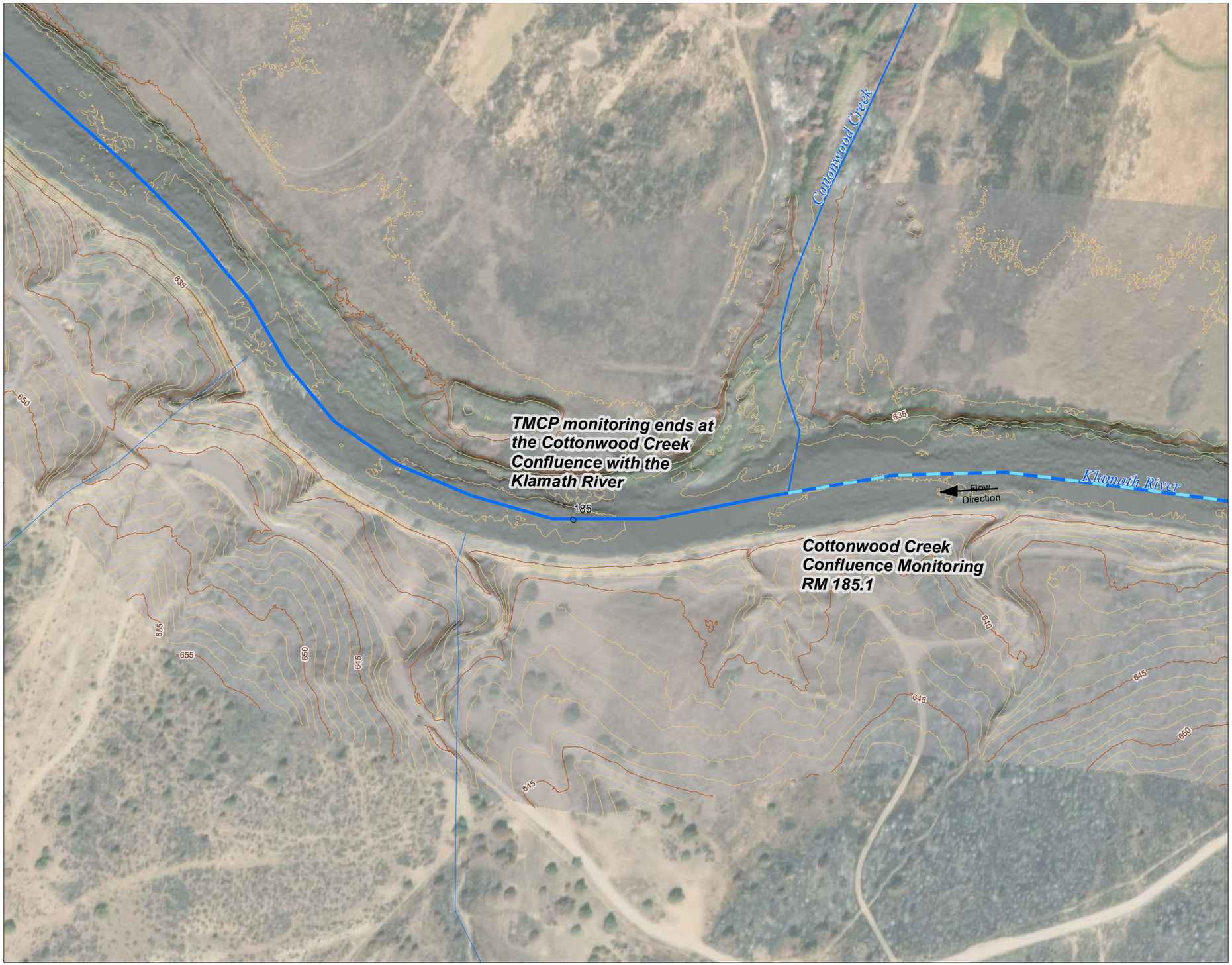

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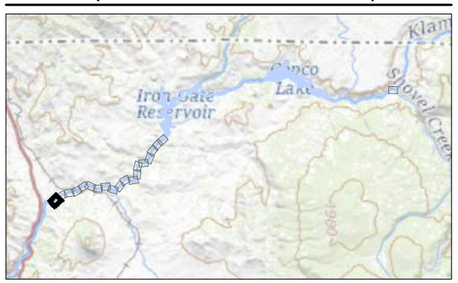

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Appendix E

Juvenile Salmonid and Pacific Lamprey Rescue and Relocation Plan

KLAMATH RIVER RENEWAL CORPORATION

Lower Klamath Project
FERC Project No. 14803

Juvenile Salmonid and Pacific Lamprey Rescue and Relocation Plan

Klamath River Renewal Corporation
2001 Addison Street, Suite 317
Berkeley, CA 94704

Prepared by:
RES
1210 G Street
Sacramento, CA 95814

December 2021

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Appendices

1.0 Introduction

This Juvenile Salmonid and Pacific Lamprey Rescue and Relocation Plan (Juvenile Salmonid Plan) is a sub-plan of the Aquatic Resources Management Plan that will be implemented as part of the Proposed Action (Proposed Action) for the Lower Klamath Project.

For purposes of the Juvenile Salmonid Plan, Year 1 refers to the year before drawdown and Year 2 refers to the drawdown year.

1.1 Purpose of Juvenile Salmonid Plan

Juvenile salmonids use the mainstem Klamath River and its tributaries as migration corridors to redistribute in the spring and early summer (USFWS, 2018a; Soto *et al.*, 2016), when Suspended Sediment Concentrations will likely be highest as a result of the Proposed Action (KRRP, 2020).

The purpose of the Juvenile Salmonid Plan is to describe (1) the water quality and temperature monitoring that the Renewal Corporation will undertake, (2) the framework the Renewal Corporation will use to determine when to relocate juvenile salmonids based on the monitoring criteria, (3) the methods the Renewal Corporation will use to relocate juvenile salmonids, and (4) the reporting requirements applicable to the Renewal Corporation under the Juvenile Salmonid Plan. The actions described in the Juvenile Salmonid Plan will occur between January 1 and December 31 of Year 2.

Pacific lamprey (*Entosphenus tridentatus*), an anadromous fish species, co-occurs with juvenile salmonids in the Klamath River and its tributaries (Goodman and Reid, 2012). Following consultation, the Aquatic Technical Work Group (ATWG) recommended that Pacific lamprey not be relocated. Therefore, Pacific lamprey will not be relocated by the Renewal Corporation under the Juvenile Salmonid Plan. Any incidental catch of Pacific lamprey by the Renewal Corporation will be left at the site of capture to continue volitional outmigration. See Section 3.0 of the Aquatic Resources Management Plan for additional details regarding the ATWG.

1.2 Relationship to Other Management Plans

The Juvenile Salmonid Plan is supported by elements of the California Water Quality Monitoring Plan for effective implementation. So as not to duplicate information, elements from the California Water Quality Monitoring Plan are not repeated herein but are, where appropriate, referenced in the Juvenile Salmonid Plan.

1.3 Juvenile Salmonid Plan Activities

The remainder of the Juvenile Salmonid Plan describes the actions that the Renewal Corporation will take in connection with the Juvenile Salmonid Plan, and is divided into the following sections:

- Section 2.0 provides an overview of the Renewal Corporation's monitoring efforts, including the time period during which monitoring will occur, the areas that the Renewal Corporation will monitor, and the criteria that will be used during monitoring.
- Section 3.0 provides an overview of the Renewal Corporation's capture and relocation efforts, including a list of the target species, a description of the equipment and methods that the Renewal Corporation will use, detailed information regarding site-specific approaches to capture, and a summary of the different relocation sites and relocation logistics.
- Section 4.0 provides a description of the report that the Renewal Corporation will prepare following implementation of the Juvenile Salmonid Plan.

2.0 Juvenile Salmonid Plan Monitoring

2.1 Monitoring Plan Overview

As a natal tributary begins to warm, juvenile salmonids occupying that tributary typically redistribute, including by entering the mainstem to find cooler water (USFWS, 2018a). If the Klamath River mainstem has elevated levels of Suspended Sediment Concentrations due to the reservoir drawdown, juvenile salmonids in the mainstem have an increased risk of mortality. In addition, high water temperatures increase the risk of juvenile salmonid mortality.

The Renewal Corporation will monitor (1) Suspended Sediment Concentrations of the mainstem Klamath River using two U.S. Geological Survey (USGS) water quality monitoring gages and (2) water temperature at the 13 tributary confluences listed in Section 2.3 using underwater temperature data loggers. The locations of the 13 tributary confluences are set forth in the figures included in Appendix A. Grab samples will also be collected every two weeks on the mainstem Klamath River as part of the California Water Quality Monitoring Plan. Additionally, during site visits when water temperature loggers are being offloaded, the Renewal Corporation will record visual observations of fish in the tributary and the thermal mixing zone where the mainstem and tributary waters mix (i.e., Thermal Refugia). The observations will include estimated fish densities and fish behavior, including lethargy, increased agonistic behavior, excessive gill flaring (Nielsen *et al.*, 1994), unusual swimming patterns (Logue *et al.*, 1995), and visible signs of disease, injury, or mortality. The Renewal Corporation will record water quality data and fish behavior observations on electronic tablets or paper data sheets (Appendix B).

Based on the criteria set forth in Section 2.5, the Renewal Corporation will determine, in consultation with Aquatic Resources Group (ARG), if capture and relocation efforts are required. See Section 3.0 of the Aquatic Resources Management Plan for additional details regarding the ARG.

If a decision is made to capture and relocate juvenile salmonids, the Renewal Corporation will relocate collected juvenile salmonids to suitable relocation sites based on the species, life stage, and location of collection. Each monitored tributary has primary and secondary relocation sites (Relocation Sites), which are set forth in Section 3.3.3 and were selected in consultation with the

ATWG. Prior to capture and relocation, the Renewal Corporation will perform a reconnaissance survey of the relevant Relocation Site(s) to ensure habitat conditions and capacity are suitable for the anticipated number of relocated fish. If the Renewal Corporation determines based on reconnaissance surveys that neither the primary nor secondary Relocation Sites for the relevant monitored tributary are suitable, it will identify, in consultation with the ARG, alternative relocation sites with suitable water quality conditions and holding capacity based on the criteria used to identify the Relocation Sites.

2.2 Monitoring Timeline

The Renewal Corporation will conduct monitoring from March 1 to July 1 during Year 2. This timeline, developed in consultation with the ATWG, is based on the timing of juvenile salmonid outmigration, water temperature suitability, and anticipated Suspended Sediment Concentration modeling for the Klamath River during drawdown (KRRC, 2018; KRRP, 2020).

2.3 Areas to be Monitored

The Renewal Corporation will monitor (1) water temperatures at the confluences of 13 tributaries (Monitored Tributaries) between Iron Gate Dam and Seiad Creek (Appendix A, Figure 1) and (2) Suspended Sediment Concentrations at two locations on the mainstem Klamath River.

The Monitored Tributaries (from downstream to upstream) are:

- Seiad Creek (RM 131.9)
- Grider Creek (RM 132.1)
- Walker Creek (RM 135.2)
- O'Neil Creek (RM 139.1)
- Tom Martin Creek (RM 144.6)
- Scott River (RM 145.1)
- Horse Creek (RM 149.5)
- Beaver Creek (RM 163.3)[1]
- Humbug Creek (RM 173.9)
- Shasta River (RM 179.3)
- Cottonwood Creek (RM 185.1)
- Dry Creek (RM 190.9)
- Bogus Creek (RM 192.6)

[1] The Beaver Creek referenced in this Juvenile Salmonid Plan is not the same as the priority tributary at Copco No. 1 Reservoir named Beaver Creek that is referenced in the Reservoir Area Management Plan.

The Renewal Corporation selected the areas to be monitored under the Juvenile Salmonid Plan in consultation with the ATWG based on their importance as natal streams for salmonid spawning or as key Thermal Refugia for juvenile salmonids.

2.4 Monitoring Criteria

2.4.1 Water Quality Triggers

The Renewal Corporation determined the water quality triggers for mainstem Suspended Sediment Concentration and tributary confluence temperatures in consultation with the ATWG (KRRC, 2018). The Suspended Sediment Concentration trigger (Suspended Sediment Concentration Trigger) is a Suspended Sediment Concentration greater than 1,000 mg/L. Because measuring Suspended Sediment Concentration requires lengthy laboratory procedures that do not permit real-time decision making, water turbidity will be used as a proxy for Suspended Sediment Concentration. As set forth below, water turbidity will primarily be measured in 30-minute continuous intervals at two USGS water quality monitoring gages.

The Renewal Corporation will also conduct baseline water quality monitoring on the mainstem Klamath River as part of the California Water Quality Monitoring Plan, including monitoring Suspended Sediment Concentration levels through collections of grab samples every two weeks and continuous monitoring of turbidity starting January 1 of Year 1 and extending into the post-drawdown period. See the California Water Quality Monitoring Plan for additional information. Data collected by the Renewal Corporation during Suspended Sediment Concentration and turbidity monitoring will be fit to a regression developed by the USGS to better define the local relationship between these two variables. Once completed, the regression analysis will be provided to the ATWG and used by the Renewal Corporation to set the continuously-monitored turbidity level that will be the surrogate for the Suspended Sediment Concentration Trigger. The regression analysis will be regularly updated throughout the drawdown and monitoring phases as new data is collected and becomes available.

The Renewal Corporation will monitor water temperatures at the Monitored Tributaries and has, in consultation with the ATWG, established both early-warning and trigger temperatures based on a 7-day average of the daily maximum values (7DADM). A 17°C 7DADM will be used as an early indication of warming temperatures. A 19°C 7DADM will be used as the water temperature trigger (Water Temperature Trigger).

2.4.2 Mainstem Klamath Suspended Sediment Monitoring

The Renewal Corporation will use the following two USGS monitoring gages downstream of Iron Gate Dam to monitor Suspended Sediment Concentration in the mainstem Klamath River (Appendix A, Figure 1): USGS Klamath River Below Iron Gate Dam CA gage (No. 11516530) and USGS Klamath River Near Seiad Valley CA gage (No. 11520500).

The USGS stations provide continuous turbidity monitoring data and will serve as proxies for evaluating if the mainstem Suspended Sediment Concentration Trigger is exceeded, as described in more detail above. In addition, when the water temperature at a Monitored

Tributary either exceeds or is anticipated to exceed the Water Temperature Trigger, the Renewal Corporation will take supplemental point samples of turbidity in the mainstem Klamath River near the Monitored Tributary using a handheld water quality meter.

2.4.3 Tributary Confluence Water Temperature Monitoring

Given the differences between the Monitored Tributaries, the spatial extent of monitoring at each confluence will vary (Appendix A, Figures 2-14). Generally, the confluence is the point where the tributary meets the mainstem Klamath River. The areas monitored by the Renewal Corporation (Tributary Confluence Monitoring Areas) are described in more detail in Section 3.2 below. If the Renewal Corporation needs to modify a monitored area due to landowner and/or access issues that are currently unknown, it will do so in consultation with the ARG. The Renewal Corporation's primary goal at each Monitored Tributary is to identify a location to monitor water temperatures that is representative of where juvenile salmonids may congregate. Given that the spatial extent of the thermal mixing zones shift daily and throughout the season (Brewitt and Danner, 2014), the Renewal Corporation will install a water temperature logger within each Tributary Confluence Monitoring Area in an accessible location that is representative of the Thermal Refugia for that tributary confluence. Loggers will collect water temperature at 30-minute intervals. During Year 2, the Renewal Corporation will offload water temperature loggers every other week between March 1 – April 30 and weekly from May 1 – July 1. If, based on the hydrologic and meteorological forecasts, temperatures are anticipated to approach or exceed the Water Temperature Trigger at a Monitored Tributary, the Renewal Corporation will determine, in consultation with the ARG, whether it is necessary to temporarily offload the water temperature loggers at the Monitored Tributary more frequently.

2.4.4 Behavioral and Observation Monitoring

During site visits when water temperature loggers are being offloaded, the Renewal Corporation will record visual estimates of juvenile fish density and observations of fish behavior. With respect to fish behavior, the Renewal Corporation will note lethargy, increased agonistic behavior, excessive gill flaring (Nielsen *et al.*, 1994), unusual swimming patterns (Logue *et al.*, 1995), and visible signs of disease, injury, or mortality. The Renewal Corporation will photograph noteworthy habitat changes that may adversely impair habitat quality. While visual observations will be made primarily from shore, the Renewal Corporation may undertake in-water fish observations (i.e., snorkel surveys) as temperatures approach the Water Temperature Trigger depending on the Renewal Corporation's ability to obtain visual observations of the fish. The length of the observation period will be dependent on water temperature, turbidity and fish behavior and will be recorded on electronic tablets or paper data sheets (Appendix B).

2.5 Aquatic Technical Working Group Coordination; Capture and Relocation Criteria

The Renewal Corporation will schedule standing calls with the ARG to review water quality data, fish observations, and invasive species updates (if any). Call frequency will be bi-monthly (i.e., twice per month) between March 1 and April 30 of Year 2 and weekly between May 1 and July 1 of Year 2 unless a less frequent call schedule is agreed to by the ARG. In addition to the water quality data, monitoring observations and invasive species updates, the Renewal Corporation

will provide the ARG with hydrologic and meteorological forecasts for the upcoming monitoring period. If the meteorological data forecasts unseasonably high temperatures, the Renewal Corporation will consult with the ARG to determine whether it is necessary to schedule additional calls with the ARG. In addition, as described above in Section 2.4.3, if temperatures are anticipated to approach or exceed the Water Temperature Trigger at a Monitored Tributary based on the hydrologic and meteorological forecasts, the Renewal Corporation will consult with the ARG to determine whether it is necessary to temporarily offload the water temperature loggers at the Monitored Tributary more frequently.

Before each call, the Renewal Corporation will prepare a weekly/bi-weekly monitoring report for rapid tracking of tributary conditions relative to water quality triggers. Each tributary will be color coded to indicate whether no water quality trigger has been exceeded (Green), one water quality trigger has been exceeded (Yellow), or both water quality triggers have been exceeded (Red). An example of a monitoring report is presented in Figure 2-1.

Figure 2-1. Example monitoring report.

Monitoring Period	Tributary Confluence Monitoring Area												
	Seiad Creek	Grider Creek	Walker Creek	O'Neil Creek	Tom Martin Creek	Scott River	Horse Creek	Beaver Creek	Humbug Creek	Shasta River	Cotton-wood Creek	Dry Creek	Bogus Creek
May 24 - May 30													
May 31 - June 6													
June 7 – June 13													

When reviewing water quality data, the Renewal Corporation will determine whether either of the mainstem Klamath River monitoring sites have exceeded the Suspended Sediment Concentration Trigger. If the Suspended Sediment Concentration Trigger has not been exceeded, no capture and relocation efforts will be implemented unless (1) unusual fish behavior has been observed and (2) the Renewal Corporation determines, in consultation with the ARG, that capture and relocation is warranted.

If the Suspended Sediment Concentration Trigger has been exceeded, the Renewal Corporation will determine, in consultation with the ARG, whether any Tributary Confluence

Monitoring Areas have exceeded the early warning temperature of 17°C 7DADM. If both the Suspended Sediment Concentration Trigger and early warning temperature have been exceeded, the Renewal Corporation will determine, in consultation with the ARG, whether capture and relocation is warranted based on (1) observations of fish behavior and (2) upcoming hydrologic and meteorological data.

If both the Suspended Sediment Concentration Trigger has been exceeded and the Water Temperature Trigger of a Tributary Confluence Monitoring Area has been exceeded, the Renewal Corporation will, following consultation with the ARG, proceed with capture and relocation efforts in the manner described in Section 3.0 below.

3.0 Juvenile Fish Capture Methods and Relocation Sites

3.1 Capture and Relocation Overview

If the Renewal Corporation determines, in consultation with the ARG, that fish relocation is necessary at a Monitored Tributary, the Renewal Corporation will promptly commence capture and relocation, typically within 48 hours. The number of crew members required will depend on the level of effort needed at that tributary and on the capture equipment that will be used. The level of effort required will be determined by the Renewal Corporation following consultation with the ARG.

3.1.1 Target Species

Target species for capture and relocation include coho salmon (*Oncorhynchus kisutch*), Chinook salmon (*O. tshawytscha*), and steelhead trout (anadromous form of rainbow trout; *O. mykiss*). The target life stage for these salmonids during capture and relocation is the juvenile life stage, which includes fry and parr (collectively young-of-the-year or YOY) and smolts.

3.1.2 Equipment and Methods

The Renewal Corporation will use seines and fyke nets as its primary fish capture equipment. The equipment used to capture fish at a given tributary confluence will depend on several factors, including habitat type (e.g., shallow eddy vs. deep pool), habitat complexity (e.g., sandy vs. rocky bottom), the total number of fish expected to be captured, and whether fish will be actively out-migrating during the capture period. For example, in a shallow, sandy eddy, a seine may be the best option. Alternatively, trapping with fyke nets may be the best capture option from a deep pool with a rocky bottom in a tributary from which juveniles are actively out-migrating.

Electrofishing, if used, will be performed by a qualified individual and conducted according to the National Marine Fisheries Service (NMFS) *Guidelines for Electrofishing Waters Containing Salmonids Listed Under the Endangered Species Act* (NMFS, 2000). The Renewal Corporation will submit staff qualifications to NMFS for approval prior to conducting electrofishing. Due to both the variation in water quality that may occur as a result of reservoir drawdown conditions

and the variation in species composition and size encountered during capture activities, electrofishing will only be conducted by the Renewal Corporation in the event that seining is considered an ineffective measure for safely collecting and relocating fish from the Tributary Confluence Monitoring Area.

The Renewal Corporation may, in coordination with the California Department of Fish and Wildlife (CDFW), use rotary screw traps and existing outmigration monitoring locations in implementing the Juvenile Salmonid Plan. In addition, baited minnow traps may be used by the Renewal Corporation to supplement the fish capture methods described above.

While the following sections describe the anticipated equipment and capture methods to be used at each Monitored Tributary, the final determination of what methods to use will be site-specific and made by the Renewal Corporation close in time to capture and relocation based on the specific characteristics of the Tributary Confluence Monitoring Area. If required, the Renewal Corporation will use a small boat or cataraft to safely relocate captures fish to transport vehicles.

3.2 Site-Specific Approaches to Juvenile Salmonid Capture

This section of the Juvenile Salmonid Plan addresses the following with respect to the Monitored Tributaries:

- The area that will be monitored for each Monitored Tributary. The areas to be monitored were determined in consultation with the Karuk Tribe on a tributary-by-tributary basis based on the Tribe's local knowledge and experience with the Monitored Tributaries.
- The species that are expected to be most abundant in the Tributary Confluence Monitoring Area during the monitoring period.
- With respect to certain Monitored Tributaries, if volitional fish passage is expected to be available from the Tributary Confluence Monitoring Area to cooler reaches upstream.
- With respect to certain Monitored Tributaries, if and when the Renewal Corporation expects the Water Temperature Trigger to be exceeded.
- With respect to certain Monitored Tributaries, other factors (if any) that the Renewal Corporation will consider in determining if capture is warranted.
- The equipment and methods that the Renewal Corporation anticipates using for fish capture and relocation.

Details for Monitored Tributaries are provided in the following subsections, and tributaries are listed from downstream to upstream. Figures referenced in the sections below delineate the Tributary Confluence Monitoring Area where the Renewal Corporation will install water temperature logger(s) and, if needed, where fish collection activities will take place (Appendix A).

3.2.1 Seiad Creek

The Renewal Corporation will monitor the lower approximately 1,500 ft (0.29 miles) of Seiad Creek (Appendix A, Figure 2). This tributary is anticipated to be heavily used by juvenile coho salmon, especially non-natal individuals (Witmore, 2014). The lower reach and confluence of Seiad Creek may exceed the Water Temperature Trigger around late July to mid-August, which is outside of the monitoring period. Additionally, there is a cold-water refuge near the Highway 96 bridge, about 0.5 miles upstream of the confluence. Since there are no known fish passage barriers between the tributary confluence and the upstream cold-water refuge, fish are expected to be capable of volitionally moving to cooler habitat as needed. Therefore, the Renewal Corporation does not expect that capture and relocation of out-migrating juvenile salmonids will be needed at Seiad Creek.

While the Water Temperature Trigger is not anticipated to be exceeded during the monitoring period, Seiad Creek may experience an increase in use by non-natal salmon, potentially resulting in overcrowding in the Thermal Refugia. If the Renewal Corporation observes overcrowding and negative fish behavior, the Renewal Corporation may engage in capture if the Suspended Sediment Concentration Trigger is exceeded. If the Renewal Corporation engages in capture, a seine is likely to be used, with capture and relocation likely requiring a crew of three persons working over a one or two-day period.

3.2.2 Grider Creek

The Renewal Corporation will monitor approximately 500 ft (0.10 miles) of Grider Creek (Appendix A, Figure 3). The Renewal Corporation does not expect that Grider Creek will exceed the Water Temperature Trigger. Sediment deposition at the confluence is relatively dynamic and typically does not result in deep pools that are utilized by juvenile coho salmon (T. Soto, pers. comm., 2020). In addition, there has not been a significant amount of juvenile habitat identified in the Tributary Confluence Monitoring Area. The Renewal Corporation anticipates using a seine if the Renewal Corporation determines that juvenile fish need to be relocated from this Tributary Confluence Monitoring Area. This capture effort will likely be done by a crew of three persons working over a one to two-day period. If seining is an issue due to substrate and habitat complexity, the Renewal Corporation may use backpack electrofishing instead.

3.2.3 Walker Creek

The Renewal Corporation will monitor the lower approximately 700 ft (0.14 miles) of Walker Creek (Appendix A, Figure 4). The Renewal Corporation does not expect that Walker Creek will exceed the Water Temperature Trigger. Walker Creek does not support a large population of spawning salmonids, though non-natal salmonids are occasionally observed in the Tributary Confluence Monitoring Area (T. Soto, pers. comm., 2020). The confluence of Walker Creek is dynamic, and its structure can shift annually based on flows and sediment deposition. The Renewal Corporation anticipates using a seine if the Renewal Corporation determines that juvenile fish need to be relocated from this Tributary Confluence Monitoring Area. This capture effort will likely be done by a crew of three persons working over a one to two-day period. If seining is an issue due to substrate and habitat complexity, the Renewal Corporation may use backpack electrofishing instead.

3.2.4 O'Neil Creek

The Renewal Corporation will monitor the lower approximately 800 ft (0.15 miles) of O'Neil Creek (Appendix A, Figure 5). The Renewal Corporation has not identified any significant Thermal Refugia in O'Neil Creek upstream of the tributary confluence, though there is a Thermal Refugia for juvenile salmonids at the tributary confluence, which is included in the Tributary Confluence Monitoring Area. This Thermal Refugia typically provides habitat for a large number of non-natal fish, especially Scott River juvenile salmonids (Gorman, 2016). The Renewal Corporation anticipates using a seine, fyke net traps, or backpack electrofishing if the Renewal Corporation determines that juvenile fish need to be relocated from this Tributary Confluence Monitoring Area. Due to the relatively high habitat complexity, the Renewal Corporation will determine the specific equipment type based on site conditions and the anticipated number of fish to be encountered. This capture effort will likely be done by a crew of up to five persons working over a one to four-day period.

3.2.5 Tom Martin Creek

The Renewal Corporation will monitor the lower approximately 350 ft (0.07 miles) of Tom Martin Creek and approximately 580 ft (0.11 miles) of Klamath River side channel habitat (Appendix A, Figure 6). Due to a fish passage barrier just upstream of the mouth, Tom Martin Creek does not have an adult spawning population of anadromous salmonids. However, it is a significant Thermal Refugia for non-natal salmonids (Soto *et al.*, 2016; Witmore, 2014). Importantly, Tom Martin Creek is the first cold water tributary downstream of the Scott River, offering Thermal Refugia for redistributing YOY salmonids (Gorman, 2016).

The Renewal Corporation anticipates that Tom Martin Creek will remain a source of cold-water refuge. Due to its location, the Tributary Confluence Monitoring Area will likely be impacted by increased Suspended Sediment Concentrations in the mainstem Klamath. Therefore, salmonids in this Tributary Confluence Monitoring Area may require capture and relocation if behavioral and habitat observations indicate actions should be taken. The Renewal Corporation anticipates using a seine if the Renewal Corporation determines that juvenile fish need to be relocated from this Tributary Confluence Monitoring Area. If seining is an issue due to substrate and habitat complexity, the Renewal Corporation may use backpack electrofishing instead. This capture effort will likely be done by a crew of up to five persons working over a one to four-day period.

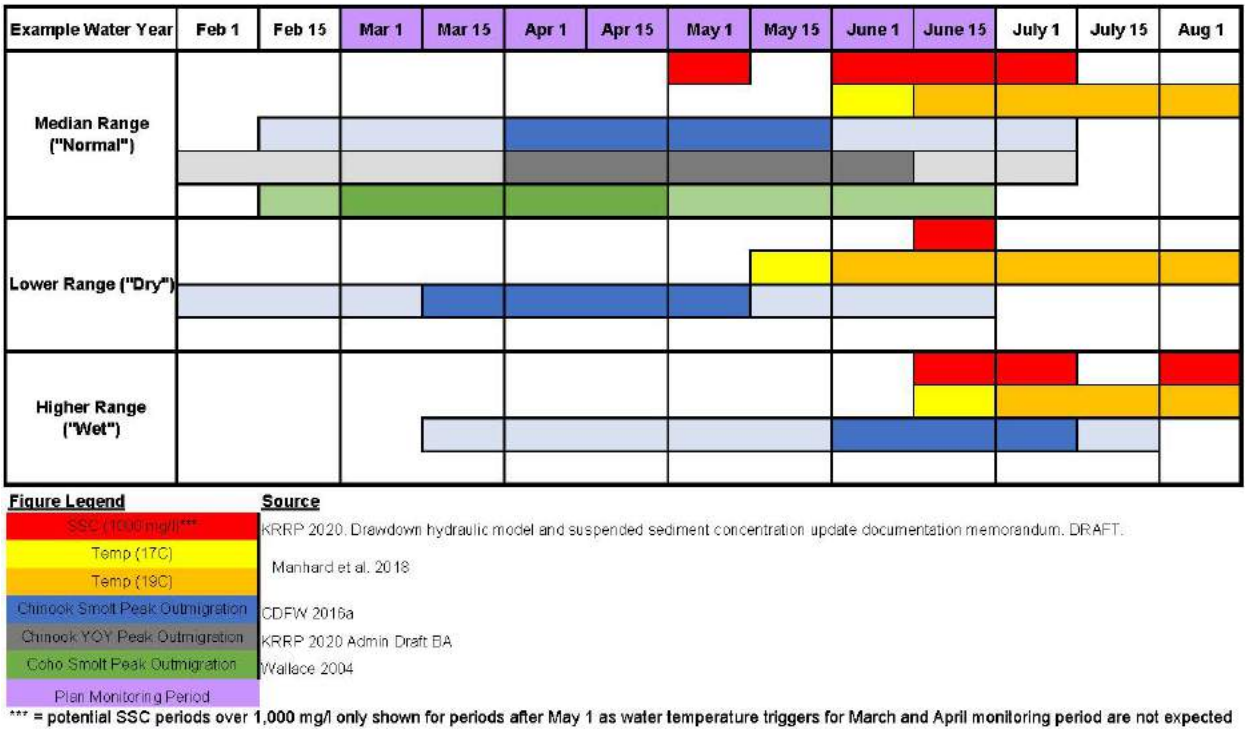
3.2.6 Scott River

The Renewal Corporation will monitor the lower approximately 1,200 ft (0.23 miles) of the Scott River (Appendix A, Figure 7). In typical years, the Scott River begins to warm in late spring, potentially exceeding the Water Temperature Trigger by late May to mid-June (Figure 3-1). This period is anticipated to overlap with elevated Suspended Sediment Concentration levels in the mainstem Klamath River. Therefore, the Renewal Corporation anticipates that both water quality triggers may be exceeded during a 2-4 week period in June of a typical water year.

The Scott River is a significant salmon producing tributary, with large populations of coho salmon, Chinook salmon, and steelhead trout. The timing of peak juvenile salmonid outmigration

is variable based on water year type. Dry water years typically see peak salmon outmigration in late March to early April, with 90 percent of the juveniles having out-migrated by the end of May (CDFW, 2016a). Other water year types have more variable outmigration timing, sometimes extending into June.

Figure 3-1. Scott River Potential Overlap of Water Quality Triggers and Juvenile Salmonid Outmigration.



With the potential overlap of outmigration periods with exceeded water quality triggers, juvenile salmonid outmigrant trapping may be required in this Tributary Confluence Monitoring Area (Figure 3-1). If trapping is required, the Renewal Corporation anticipates deploying two to three fyke net traps to span the majority of the river channel. The Renewal Corporation will check fyke net traps daily, when operating, to process collected fish and clear debris. This capture effort will likely be done by a crew of two to three persons working for the duration of time that the fyke nets are operating. The Renewal Corporation anticipates the fyke nets operating for two to four-weeks, depending on water quality conditions. To the extent necessary, the Renewal Corporation anticipates using seining to capture fish in areas downstream of the deployed fyke nets. If seining is an issue due to substrate and habitat complexity, the Renewal Corporation may instead use backpack electrofishing in the areas that will not have an electric field containing the fyke net live cars (i.e., where captured fish consolidate in the trap).

Of the Monitored Tributaries, the greatest number of out-migrating juvenile salmonids are likely to be encountered during fish collection activities at Scott River. Therefore, the Renewal Corporation will coordinate any outmigrant trapping in this Tributary Confluence Monitoring Area with CDFW. This may include support and/or coordination on capture activities at existing out-migrating trap monitoring locations in the Scott River. The Renewal Corporation will use fish

capture in association with these outmigrant trap locations to support capture efforts during the monitoring period if water quality triggers are exceeded and fish relocation is needed.

3.2.7 Horse Creek

The Renewal Corporation will monitor approximately 650 ft (0.12 miles) of Horse Creek (Appendix A, Figure 8). Horse Creek is a significant producer of coho salmon within the Upper Klamath diversity strata[2]. Previous habitat restoration in the Horse Creek watershed by the Karuk Tribal Fisheries Program and the Mid Klamath Watershed Council has included placement of large woody elements and the construction of several off-channel ponds, providing juvenile salmon in the watershed access to Thermal Refugia. While this creek is not expected to warm in the upper reaches, the lower reaches may warm due to agricultural diversions. The Renewal Corporation anticipates that volitional passage upstream to cooler water will be available. However, if the Renewal Corporation determines that it is necessary to capture and relocate fish from the lower reaches, the Renewal Corporation anticipates using a fyke net trap for out-migrating juvenile salmonids. If necessary, the Renewal Corporation anticipates deploying a single fyke net trap in a location to span the majority of the creek channel. The Renewal Corporation will check the fyke net trap daily, when operating, to process collected fish and clear debris. This capture effort will likely be done by a crew of two to three persons working for the duration of time that the fyke net is operating.

If the Renewal Corporation determines that an alternative method of fish capture should be used, the Renewal Corporation anticipates using a seine net to capture fish within the Tributary Confluence Monitoring Area. This capture effort will likely be done by a crew of three persons working over a one to two-day period.

3.2.8 Beaver Creek

The Renewal Corporation will monitor the lower approximately 500 ft (0.10 miles) of Beaver Creek and approximately 630 ft (0.12 miles) of Klamath River (Appendix A, Figure 9). Beaver Creek is a significant coho salmon producing tributary and a critical site for non-natal rearing. Immediately downstream of the confluence in the mainstem of the Klamath River is a spring-fed Thermal Refugia, which is considered part of the Tributary Confluence Monitoring Area. This pool is heavily utilized by non-natal juvenile salmonids, as it stays cool throughout the summer months.

The Renewal Corporation does not anticipate any fish passage issues in lower Beaver Creek that would impede access of juvenile salmonids to suitable habitat upstream of the Tributary Confluence Monitoring Area. The mainstem Beaver Creek typically does not exceed the Water

[2] Horse Creek is part of the Upper Klamath population unit of the Southern Oregon/Northern California Coast coho salmon Evolutionary Significant Unity. The Upper Klamath population unit boundaries are Portuguese Creek (non-inclusive) upstream to Spencer Creek (inclusive) (NMFS, 2006).

Temperature Trigger during the monitoring period. Therefore, the Renewal Corporation does not expect that capture and relocation will be needed within the mainstem Beaver Creek.

The portion of the Tributary Confluence Monitoring Area that is in the mainstem Klamath River will likely see increased Suspended Sediment Concentration during the reservoir drawdown. While the Renewal Corporation does not expect the Water Temperature Trigger to be exceeded, salmonids in this refuge may still require capture and relocation if behavioral and habitat observations indicate that actions should be taken. The Renewal Corporation anticipates using a seine if the Renewal Corporation determines that fish need to be relocated from this Tributary Confluence Monitoring Area. If seining is an issue due to substrate and habitat complexity, the Renewal Corporation may use backpack electrofishing instead. This capture effort will likely be done by a crew of up to five persons working over a one to four-day period.

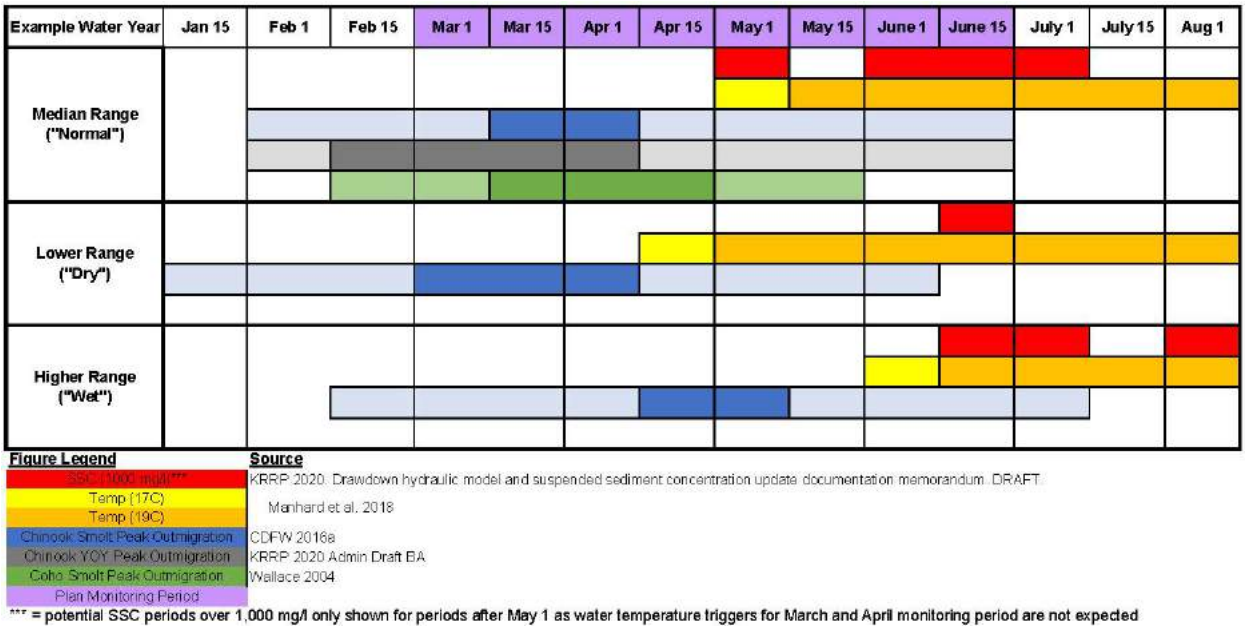
3.2.9 Humbug Creek

The Renewal Corporation will monitor the lower approximately 950 ft (0.18 miles) of Humbug Creek (Appendix A, Figure 10). There are no known documented Thermal Refugia found near the confluence of Humbug Creek or within the Tributary Confluence Monitoring Area. The lower reaches of Humbug Creek typically begin to dewater in early summer and completely disconnect from the Klamath by July or August. The upper reaches of Humbug Creek experience relatively stable flows and temperatures through the summer months (T. Soto, pers. comm., 2020). Since there are no known fish passage issues, fish can volitionally move throughout Humbug Creek and gain access to the cooler upper reaches. In addition, Humbug Creek is not a significant producer of coho salmon. Therefore, the Renewal Corporation does not expect that capture and relocation that capture and relocation will be needed in the Tributary Confluence Monitoring Area at Humbug Creek. If the Renewal Corporation determines that juvenile fish need to be relocated from stranded pools, the Renewal Corporation anticipates using a seine. This capture effort will likely be done by a crew of three persons working over a one to two-day period.

3.2.10 Shasta River

The Renewal Corporation will monitor the lower approximately 700 ft (0.13 miles) of the Shasta River (Appendix A, Figure 11), which covers an area from the confluence upstream to the CDFW rotary screw trap. The Shasta River is among the most significant salmon-producing tributaries of the Klamath River, containing its own evolutionarily significant population of coho salmon (NMFS, 2006). In addition, it warms relatively early, forcing rearing juveniles into the mainstem Klamath. Irrigation diversions typically begin on April 1, sometimes reducing Shasta River average monthly flows by half or more (CDFW, 2016b). In a dry water year, these diversions may result in the Water Temperature Trigger being exceeded as early as mid-April or early May. Juvenile salmonid outmigration begins relatively early on the Shasta River. Peak outmigration is expected to occur throughout March, with 90 percent of the juveniles having out-migrated by mid-April (CDFW, 2016b).

Figure 3-2. Shasta River Potential Overlap of Water Quality Triggers and Juvenile Salmonid Outmigration.



With the potential overlap of outmigration periods with exceeded water quality triggers, the Renewal Corporation anticipates the need for juvenile salmonid outmigrant trapping in the Tributary Confluence Monitoring Area (Figure 3-2). Depending on the type of water year, the Renewal Corporation may initiate outmigrant trapping as early as May though it is most likely to be needed in June. Similar to the Scott River, the Renewal Corporation will coordinate this effort with CDFW due to the large number of fish that may be encountered. CDFW operates a rotary screw trap (RST) about 0.15 miles upstream of the confluence. In the event that fish capture actions are necessary, the Renewal Corporation anticipates working with CDFW to capture fish using this RST since it will provide an efficient and effective capture method. Even if the RST is used, the Renewal Corporation expects that some number of juvenile salmon will be found in the reach downstream of the RST. If both water quality triggers are exceeded and the Renewal Corporation determines that juvenile salmonids in this lower reach need to be relocated, the Renewal Corporation anticipates using a seine.

In the event RST collection is not possible, or capture actions are needed to supplement the RST, the Renewal Corporation anticipates using two to three fyke net traps deployed in locations that span the majority of the river channel. The Renewal Corporation will check the fyke net traps daily, when operating, to process collected fish and clear debris. This capture effort will likely be done by a crew of two to three persons working for the duration of time that the fyke nets are operating. The Renewal Corporation anticipates the fyke nets operating for two to four-weeks, depending on water quality conditions. To the extent necessary, the Renewal Corporation anticipates using seining to capture fish in areas downstream of the deployed fyke nets. If seining is an issue due to substrate and habitat complexity, the Renewal Corporation may instead use backpack electrofishing in the areas that will not have an electric field containing the fyke net live cars (i.e., where captured fish consolidate in the trap).

3.2.11 Cottonwood Creek

The Renewal Corporation will monitor the lower approximately 950 ft (0.18 miles) of Cottonwood Creek (Appendix A, Figure 12). There are no known documented Thermal Refugia found near the confluence of Cottonwood Creek or within the Tributary Confluence Monitoring Area. In the event that the Tributary Confluence Monitoring Area is not directly accessible, the Renewal Corporation will install a temperature logger at the Copco Road crossing.

Cottonwood Creek contains several agricultural diversions, which typically results in the dewatering and pooling of the lower reach during the irrigation season. Juvenile salmonids will not typically congregate near the tributary confluence. However, if the lower reach does dewater during a period when the mainstem Suspended Sediment Concentration Trigger is exceeded, the Renewal Corporation anticipates using a seine to capture and relocate juvenile salmonids that may become stranded in pools in the lower reach. This capture effort will likely be done by a crew of two to four persons working over a one to two-day period.

3.2.12 Dry Creek

The Renewal Corporation will monitor the lower approximately 250 ft (0.05 miles) of Dry Creek (Appendix A, Figure 13). Dry Creek is a relatively small tributary that tends to dewater by summer. This creek is not thought to provide important rearing habitat for juvenile salmonids and does not have great access for juvenile fish to the upper reaches due to its relatively high gradient. It is not expected that juvenile salmonids will be using habitat in the Tributary Confluence Monitoring Area throughout the summer.

Capture and relocation efforts are therefore not expected to be needed in Dry Creek. However, if the Renewal Corporation determines that it is necessary to capture and relocate fish from the Tributary Confluence Monitoring Area, the Renewal Corporation anticipates using a seine. This capture effort will likely be done by a crew of three persons working over a one-day period.

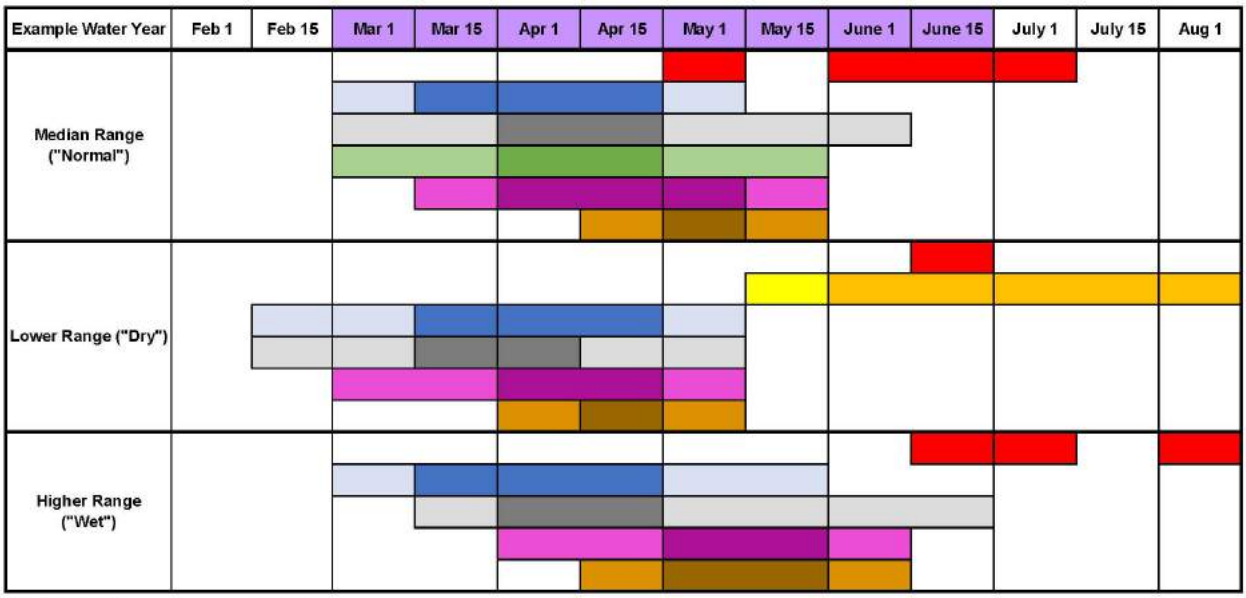
3.2.13 Bogus Creek

The Renewal Corporation will monitor the lower approximately 500 ft (0.1 miles) of Bogus Creek (Appendix A, Figure 14). Bogus Creek is a relatively cool, spring-fed creek. It is anticipated that during normal or wet water year types that Bogus Creek will not exceed the Water Temperature Trigger within the monitoring period. However, in a dry year, Bogus Creek may exceed the Water Temperature Trigger by mid-May or early June.

Bogus Creek is a significant salmonid-producing tributary, especially for Chinook salmon. The CDFW monitors outmigration of juvenile salmonids from Bogus Creek using a fyke net trap to collect demographic data on juvenile run-timing, weekly abundance estimates, size, and future smolt-to-adult survival rates (CDFW 2015, CDFW 2021). In addition, the USFWS operates an RST in the mainstem Klamath River, about one mile downstream of Bogus Creek (USFWS, 2015). Based on data from these stations, peak outmigration is expected to occur from mid-March to late April, with 90 percent of the juveniles having out-migrated by the end of April. Therefore, the Renewal Corporation anticipates that a significant portion of juvenile outmigrants

will have already passed through the Tributary Confluence Monitoring Area prior to the period during which the Water Temperature Trigger may be exceeded (Figure 3-3).

Figure 3-3. Bogus Creek Potential Overlap of Water Quality Triggers and Juvenile Salmonid Outmigration.



If dry conditions occur during the monitoring period and water quality triggers are exceeded, then outmigrant trapping may be necessary for a portion of June. If this occurs, the Renewal Corporation anticipates using one to two fyke net traps deployed in locations that span the majority of the creek channel. The Renewal Corporation will check fyke net traps daily, when operating, to process collected fish and clear debris. This capture effort will likely be done by a crew of two to three persons working for the duration of time that the fyke nets are operating. The Renewal Corporation anticipates the fyke nets operating for two to four-weeks, depending on water quality conditions. The Renewal Corporation will coordinate any outmigrant trapping in this Tributary Confluence Monitoring Area with CDFW. To the extent necessary, the Renewal Corporation anticipates using seining to capture fish in areas downstream of the deployed fyke nets. If seining is an issue due to substrate and habitat complexity, the Renewal Corporation may instead use backpack electrofishing in the areas that will not have an electric field containing the fyke net live cars (i.e., where captured fish consolidate in the trap).

3.3 Juvenile Fish Relocation Sites

3.3.1 Relocation Site Selection

The Juvenile Salmonid Plan identifies relocation sites (Relocation Sites) for each Tributary Confluence Monitoring Area. The Renewal Corporation selected the Relocation Sites based on information from the Karuk Tribal Fisheries Program following consultation with the ATWG (KRRC, 2018; Aquatic Technical Working Group, 2020). To the extent possible, in-watershed Relocation Sites were prioritized.

The Renewal Corporation will relocate YOY (i.e., fry and parr) coho salmon and *O. mykiss* to tributary channels or off-channel ponds (Table 3-1). For the purposes of the Juvenile Salmonid Plan, fry is defined as the life stage immediately after the yolk sac has been absorbed. This life stage is typically under 55 mm in length (CDFW, 2016b). Parr is the life stage immediately following fry, when parr marks are visible and smoltification has not yet begun. Fish will be relocated to the primary Relocation Site listed on Table 3-1 if it is deemed suitable for relocation based on the habitat assessment described in Section 3.3.2. If the primary Relocation Site is not suitable for relocation, the fish will be relocated to the secondary Relocation Site listed on Table 3-1. If neither the primary nor secondary Relocation Sites are suitable for relocation, an alternative relocation site will be identified in consultation with the ARG. Primary tributary Relocation Sites include Beaver Creek (RM 163.3), Horse Creek (RM 149.5), and Seiad Creek (RM 131.9). These three tributaries each have long upper reaches of cool water with suitable habitat for juvenile salmonids, including several constructed off-channel ponds. For the Scott River and Shasta River, the Renewal Corporation will also consider upstream locations that provide suitable Thermal Refugia for YOY rearing. Details for relocation to these key tributaries are outlined in Section 3.3.3.1.

Table 3-1. Primary and Secondary Relocation Sites for YOY Juvenile Salmonids for the 13 Tributary Confluence Monitoring Areas.

TRIBUTARY CONFLUENCE MONITORING AREA	PRIMARY RELOCATION SITE	SECONDARY RELOCATION SITE
Seiad Creek	Upstream Seiad Creek	Seiad Creek off-channel ponds
Grider Creek	Upstream Grider Creek	Seiad Creek off-channel ponds
Walker Creek	Upstream Walker Creek	Seiad Creek off-channel ponds
O'Neil Creek	Upstream O'Neil Creek	Seiad Creek off-channel ponds
Tom Martin Creek	Seiad Creek off-channel ponds	Horse Creek off-channel ponds
Scott River	Scott River	Seiad Creek off-channel ponds
Horse Creek	Upstream Horse Creek	Horse Creek off-channel ponds
Beaver Creek	Upstream Beaver Creek	Horse Creek off-channel ponds
Humbug Creek	Beaver Creek	Horse Creek off-channel ponds
Shasta River	Shasta River	Beaver Creek
Cottonwood Creek	Beaver Creek	Horse Creek off-channel ponds
Dry Creek	Beaver Creek	Horse Creek off-channel ponds
Bogus Creek	Upstream Bogus Creek	Beaver Creek

The Renewal Corporation anticipates relocating coho salmon smolts, steelhead smolts, and all Chinook juvenile life stages directly into the mainstem Klamath River. Smolts are identified by having lost their parr marks, are silvery in color with scales that are beginning to set and have an expected size range of 80-150 mm (Moyle, 2002). The primary reason for relocating these fish to the mainstem is to allow them to continue volitional downstream outmigration. These relocation areas are divided into two reaches: Happy Camp to the Salmon River and Salmon River to the Trinity River. The Renewal Corporation's release locations for each reach are located within two miles upstream of a perennial cold-water tributary. The Renewal Corporation identified these reaches due to the relatively high number of tributary inputs that are expected to increasingly dilute the elevated Suspended Sediment Concentrations from the reservoir drawdown. In general, the Renewal Corporation anticipates relocating these fish to the nearest Klamath River reach listed above, assuming the existence of suitable Suspended Sediment Concentration conditions. Specific relocation areas for these two groups are discussed below in Section 3.3.3.2.

3.3.2 Fish Occupancy and Water Quality at Relocation Sites

To determine if a Relocation Site is suitable for relocation of YOY coho salmon and *O. mykiss,* the Renewal Corporation will conduct a reconnaissance survey in the spring of Year 2 to assess habitat conditions and holding capacity, especially with respect to any off-channel pond site.

The Renewal Corporation will conduct habitat assessments of Relocation Sites to ensure habitat conditions remain supportive of juvenile salmon. The assessment will evaluate (among other things) the suitability of cover, hydrologic connection, depths, and water temperature. As part of the assessment, the Renewal Corporation will use biologists experienced with salmonid habitats and relocation efforts to conduct a visual assessment of habitat conditions at selected Relocation Sites.

In addition to habitat conditions, fish occupancy and holding capacity are critical to understand prior to relocation, as high fish densities may lead to density-dependent food limitation (Brewitt *et al.*, 2017). Holding capacities for several of the constructed off-channel ponds are understood, although capacities may change over time. The Renewal Corporation will qualitatively assess holding capacity and fish occupancy as part of the reconnaissance surveys conducted at Relocation Sites in the spring of Year 2. When available, the Renewal Corporation will use information from independent spawning season surveys to assess anticipated holding capacity and fish occupancy for a Relocation Site.

Based on the results of the reconnaissance surveys, the Renewal Corporation will determine the suitability of each surveyed Relocation Site to support relocated fish. If the Renewal Corporation determines that it is necessary, a follow-up reconnaissance survey of the Relocation Site will be performed up to 48 hours before fish relocation will occur. The Renewal Corporation will consult with the ARG concerning any restrictions or limitations to be placed on the use of a Relocation Site.

3.3.3 Relocation Sites

3.3.3.1 Tributary Relocation Sites

The Renewal Corporation's prioritization of Tributary Confluence Monitoring Area Relocation Sites for YOY coho salmon and *O. mykiss* is set forth above (Table 3-1).

3.3.3.1.1 Seiad Creek Off-Channel Ponds

Seiad Creek contains a complex of six constructed off-channel ponds that are suitable Relocation Sites (Appendix A, Figure 15). These ponds are suitable for winter habitats and are suitable during summer months. Three of these ponds (May Pond, Alexander Pond, and Durazo Pond) have a strong groundwater influence that provides favorable conditions for relocation during summer months. During the summer months, these ponds display relatively low densities of juvenile salmonids compared to similar ponds in the Klamath River Basin (Witmore, 2014).

Seiad Creek's off-channel ponds typically hold 1,000-1,500 juvenile salmon each (Soto *et al.*, 2018). Seiad Creek and its complex of ponds have good vehicle and crew access and are relatively easy to sample if needed. The Karuk Tribal Fisheries Program is anticipated to continue sampling and monitoring work at these locations, including off-channel pond holding capacity surveys and the planned installation of a passive integrated transponder (PIT) tag array on lower Seiad Creek. Data collected from this work will provide additional information on pond

utilization that the Renewal Corporation can factor into its decision to utilize these locations during the monitoring period.

Table 3-1 identifies Tributary Confluence Monitoring Areas being considered by the Renewal Corporation for YOY salmonid relocation to Seiad Creek off-channel ponds. Seiad Creek's off-channel ponds have been identified as the primary Relocation Site for YOY coho salmon and *O. mykiss* from Tom Martin Creek. Seiad Creek's off-channel ponds have also been identified as the secondary Relocation Site from the following creeks and rivers, if needed: Grider Creek, Walker Creek, O'Neil Creek and Scott River. If YOY salmonids from Scott River are not relocated within the Scott River Basin, then Seiad Creek off-channel ponds will be a suitable location, as PIT tagged Scott River fish have been documented using Seiad Creek off-channel ponds to rear (Gorman, 2016). YOY coho salmon and *O. mykiss* relocated from the Seiad Creek Tributary Confluence Monitoring Area will remain in the Seiad Creek watershed.

3.3.3.1.2 Beaver Creek

Beaver Creek contains several miles of cold-water habitat suitable for rearing juvenile salmonids (USFWS, 2018b). In addition, future restoration activities on lower Beaver Creek[3] are expected to provide enhanced reaches with large wood placement and the construction of off-channel ponds. The Renewal Corporation anticipates that this work will be completed prior to the commencement of the monitoring period. The prevalence of cold-water rearing habitat allows YOY fish to volitionally distribute throughout the over 5-mile relocation reach identified below the West Fork of Beaver Creek (Appendix A, Figure 15). Since YOY fish relocated by the Renewal Corporation will have the ability to redistribute to suitable habitat within this reach, issues related to overcrowding and capacity limitations will be minimized. The Renewal Corporation has identified a number of potential Relocation Sites along Beaver Creek, from the confluence with West Fork Beaver Creek down to the confluence with the mainstem Klamath River. These Relocation Sites have good vehicle and crew access from Beaver Creek Road (Forest Road 48N01).

Table 3-1 identifies Tributary Confluence Monitoring Areas being considered by the Renewal Corporation for YOY salmonid relocation to Beaver Creek. Beaver Creek has been identified as the primary Relocation Site for YOY coho salmon and *O. mykiss* from Humbug Creek, Cottonwood Creek, and Dry Creek. Beaver Creek has also been identified as the secondary Relocation Site from the following creeks, if needed: Bogus Creek and Beaver Creek. Depending on the water year, Shasta River may require a relatively large relocation effort, and Beaver Creek is the closest downstream tributary with suitable habitat. If the Renewal Corporation is not able to relocate YOY salmonids from the Shasta River within the Shasta River Basin, then Beaver Creek is next closest suitable location.

[3] As noted above, the Beaver Creek referenced in this Juvenile Salmonid Plan is not the same as the priority tributary at Copco No. 1 Reservoir named Beaver Creek that is referenced in the Reservoir Area Management Plan.

3.3.3.1.3 Horse Creek

The upper reaches of Horse Creek provide several miles of cold-water habitat that is suitable for rearing juvenile salmonids (T. Soto, pers. comm., 2020). Previous habitat enhancement work in Horse Creek included large wood placement as well as multiple off-channel ponds to enhance rearing habitat availability. Approximately 2.75 miles of upper Horse Creek, along with a complex of eight off-channel ponds in upper Horse Creek and two off-channel ponds in Middle Creek (tributary to Horse Creek), provide suitable relocation options (Appendix A, Figure 15).

Table 3-1 identifies Tributary Confluence Monitoring Areas being considered by the Renewal Corporation for YOY salmonid relocation to Horse Creek. Horse Creek's off-channel ponds have been identified as the secondary Relocation Site for YOY coho salmon and *O. mykiss* from the following creeks, if needed: Tom Martin Creek, Beaver Creek, Humbug Creek, Cottonwood Creek, and Dry Creek. YOY coho salmon and *O. mykiss* relocated from the Horse Creek Tributary Confluence Monitoring Area will remain in the Horse Creek watershed.

Depending on the annual adult coho salmon return, Horse Creek typically supports a relatively large population of spawning adult coho salmon. The Renewal Corporation will consider distribution, capacity, and habitat utilization by YOY fish at Horse Creek prior to any decision to relocate captured YOY to the off-channel ponds at Horse Creek. The Renewal's Corporation decision will be informed by the reconnaissance survey(s) conducted at the Relocation Site(s) in the spring of Year 2.

3.3.3.1.4 Scott River

Coho salmon in the Scott River watershed are a distinct population within the Interior Klamath River Diversity Stratum (NMFS, 2016). Therefore, whenever possible, the Renewal Corporation prefers relocating these fish within the same watershed. The upper reaches of the Scott River and its tributaries are therefore the Renewal Corporation's primary Relocation Sites for YOY coho salmon and *O. mykiss* captured in the lower reaches of the Scott River. Relocation Sites in the Scott River watershed include French Creek and Sugar Creek. Both of these tributaries have off-channel ponds that have previously served as Relocation Sites for Scott River juvenile salmonids (Bull *et al.*, 2015). The Renewal Corporation may consider using other Scott River watershed locations, including Shackleford Creek and the South Fork Scott River. The Renewal Corporation will capture and relocate YOY salmonids within the Scott River watershed in coordination with CDFW.

3.3.3.1.5 Shasta River

Coho salmon in the Shasta River watershed are a distinct population within the Interior Klamath River Diversity Stratum (NMFS, 2016). Therefore, whenever possible, the Renewal Corporation will relocate these fish within the same watershed. The upper reaches of the Shasta River and its tributaries are the Renewal Corporation's primary Relocation Sites for YOY coho salmon and *O. mykiss* captured in the lower reaches of the Shasta River. Potential Relocation Sites in the Shasta River watershed are on CDFW's Shasta Big Springs Ranch, which contains 2.2 miles of Big Springs Creek and all of Little Springs Creek. Recent management practices made in the

Big Springs Creek complex have enhanced juvenile coho salmon rearing habitat (Adams, 2013; CDFW, 2012), restoring a critical component of the watershed. The Renewal Corporation will coordinate the capture and relocation of YOY salmonids within the Shasta River with CDFW. The Renewal Corporation's selection of final Relocation Sites will be informed by reconnaissance survey(s) of the potential Relocation Sites.

3.3.3.2 Mainstem Klamath River Relocation Sites

The Renewal Corporation will relocate captured coho salmon smolts, steelhead smolts, and Chinook salmon juveniles to the mainstem Klamath River. As these species/life stages will be out-migrating from their natal tributaries during the monitoring period, the Renewal Corporation will relocate these species/life stages into the mainstem Klamath River at downstream locations to facilitate continued outmigration.

The Happy Camp (RM 108.4) to Salmon River (RM 66.4) and Salmon River to Trinity River (RM 43.4) mainstem release reaches are described below. The Renewal Corporation selected up to four release sites for each reach based on (1) their upstream proximity to a tributary with known suitable water quality conditions and (2) accessibility for transport vehicles. Each subsequent downstream release site in a reach has increasing tributary accretion flows, diluting Suspended Sediment Concentrations in the river and affording relocated fish the option to seek refuge if mainstem conditions worsen.

The Renewal Corporation will give preference to the most upstream release site considered appropriate given the anticipated mainstem Suspended Sediment Concentrations at the time of relocation. For example, if water quality triggers are exceeded and capture activities are required following a short duration sediment spike, the Renewal Corporation will select the most upstream release site. If capture activities are required during the upward peak of a large suspended sediment spike, then release locations further downstream may be used since downstream locations are expected to have lower Suspended Sediment Concentrations due to the dilution effects of incoming tributaries. The Renewal Corporation's final decision regarding the release site will be based on anticipated conditions during release, which will be informed by information from the USGS water quality stations, information collected as part of the California Water Quality Monitoring Plan, and by drawdown and dam removal activities.

3.3.3.2.1 Happy Camp to Salmon River

If water quality conditions are suitable, the Renewal Corporation will relocate coho salmon smolts, steelhead smolts, and Chinook salmon juveniles to the mainstem Klamath River reach between Happy Camp, CA and the Salmon River. The Renewal Corporation has identified river access points in this reach to strategically relocate fish within two miles upstream of a tributary with suitable water quality conditions (Appendix A, Figure 16). The tributaries are Elk Creek, Clear Creek, and Ti Creek. This will allow released fish to volitionally relocate to tributary accretion flows as necessary to refuge from mainstem conditions during their continued outmigration. The Renewal Corporation will determine final Relocation Sites prior to juvenile salmonid relocation using the metrics and objectives described in the Juvenile Salmonid Plan. This reach of the Klamath River is the closest reach to the Tributary Confluence Monitoring

Areas. Therefore, if water quality conditions permit, it will serve as the Renewal Corporation's primary Relocation Site for coho salmon smolts, steelhead smolts, and Chinook salmon juveniles.

3.3.3.2.2 Salmon River to Trinity River

The Renewal Corporation has identified four Relocation Sites between Salmon River and Trinity River for the relocation of coho salmon smolts, steelhead smolts, and Chinook salmon juveniles. The Renewal Corporation expects these Relocation Sites to be used only if water quality conditions require release below Salmon River. The Renewal Corporation has identified river access points in this reach to strategically relocate fish within two miles upstream of a tributary with suitable water quality conditions (Appendix A, Figure 16). The tributaries are Camp Creek, Bluff Creek, and the Trinity River. This will allow released fish to volitionally relocate to tributary accretion flows as necessary to refuge from mainstem conditions during their continued outmigration. The Renewal Corporation does not anticipate relocating any coho salmon smolts, steelhead smolts, and Chinook salmon juveniles to relocation sites below the confluence with the Trinity River because accretion flows in this reach are expected to reduce the elevated Suspended Sediment Concentration from the reservoir drawdown.

3.3.4 Relocation Effort and Logistics

The Renewal Corporation will adjust equipment, capture method and logistics for a specific Tributary Confluence Monitoring Area (Section 3.2) as needed given the type of water year, site access, expected duration of capture activities and the estimated number and species/life stage of the fish. The Renewal Corporation's methods used for capture and handling fish are adapted from *Standard Methods for Sampling North American Freshwater Fishes* (Bonar *et al.*, 2009) and will be supplemented and/or modified based on regulatory requirements. To minimize potential transport of aquatic invasive species, staff will implement the relevant BMPs set forth in Appendix C (Best Management Practices) of the RAMP during monitoring, capture, and relocation. The Renewal Corporation will use the Nonindigenous Aquatic Species (NAS) database maintained by the United States Geological Survey (https://nas.er.usgs.gov/) to determine, in consultation with the ARG, the need to use species-specific BMPs to avoid the transfer of invasive species from infected waters to other locations.

Upon capture, the Renewal Corporation will transfer juvenile salmonids to insulated coolers (i.e., holding coolers), filled with water from the tributary to at least 75% capacity and equipped with battery operated aerators. The Renewal Corporation will handle Endangered Species Act-listed fish with extreme care and fish will be kept in water to the maximum extent possible during capture and relocation activities. The Renewal Corporation will keep all captured fish in cool, shaded, aerated water protected from excessive noise, jostling, or overcrowding and will minimize fish handling to the greatest extent possible. For the purposes of the Juvenile Salmonid Plan, whether overcrowding exists will be determined by the Renewal Corporation in its professional judgment based on several factors, including quality and quantity of habitat, the observed number of fish, and the life stages of the observed fish. Holding coolers will have water temperature and dissolved oxygen levels periodically checked by a handheld YSI meter (or equivalent) to monitor the suitability of water quality. Water will be deemed suitable if its

temperature remains no more than 1° Celsius above the initial ambient water temperature and its dissolved oxygen level remains at or above 6.0 milligrams per liter (Carter, 2008). If necessary, the Renewal Corporation will refresh water in the holding coolers to ensure temperature and dissolved oxygen levels remain suitable for juvenile salmonids.

The Renewal Corporation will mark holding coolers to indicate tributary or mainstem Klamath River Relocation Site destination. The Renewal Corporation will then move the coolers to a truck or sport utility vehicle and secure them to prevent sliding or overturning. The Renewal Corporation will transport fish to Relocation Sites on the same day of capture, so no overnight holding will occur. One transport vehicle will be used to relocate YOY fish to the tributary Relocation Site and a second vehicle will be used to transport smolts and Chinook juveniles to the mainstem Klamath River Relocation Site. Depending on the number and species/life stage anticipated to be encountered during the fish capture activity, the Renewal Corporation may use multiple transport vehicles for a specific Tributary Confluence Monitoring Area.

The Renewal Corporation will measure water temperature in the holding cooler(s) and at the Relocation Site prior to release. If the difference between the two exceeds 1.5°C, then the Renewal Corporation will make partial water transfers in the holding coolers to adjust and acclimate fish to the temperature of the Relocation Site. The Renewal Corporation will then release the fish directly into the Relocation Site. The length of the acclimation period will be dependent on water temperature and fish behavior and will be recorded on electronic tablets or paper data sheets (Appendix B).

Data collected by the Renewal Corporation at each Relocation Site will include the release location, start and end time, counts from each species and life stage, and any mortality during transport. The Renewal Corporation will also record air temperature, water temperature, and dissolved oxygen at the time of release. The Renewal Corporation will record data collected during fish relocation on electronic tablets or paper data sheets (Appendix B). The Renewal Corporation will take photographs of each release site.

4.0 Reporting

The Renewal Corporation will prepare and submit a report within six months following implementation of the Juvenile Salmonid Plan. The report will be submitted to the Federal Energy Regulatory Commission, SWRCB, and ODEQ, and copied to the ARG. The report will include the following information:

1. A summary of applicable water quality data collected;
2. Rescue and relocation actions implemented, including the number and age class of juvenile salmonids rescued;
3. Release location; and
4. Results of relocation.

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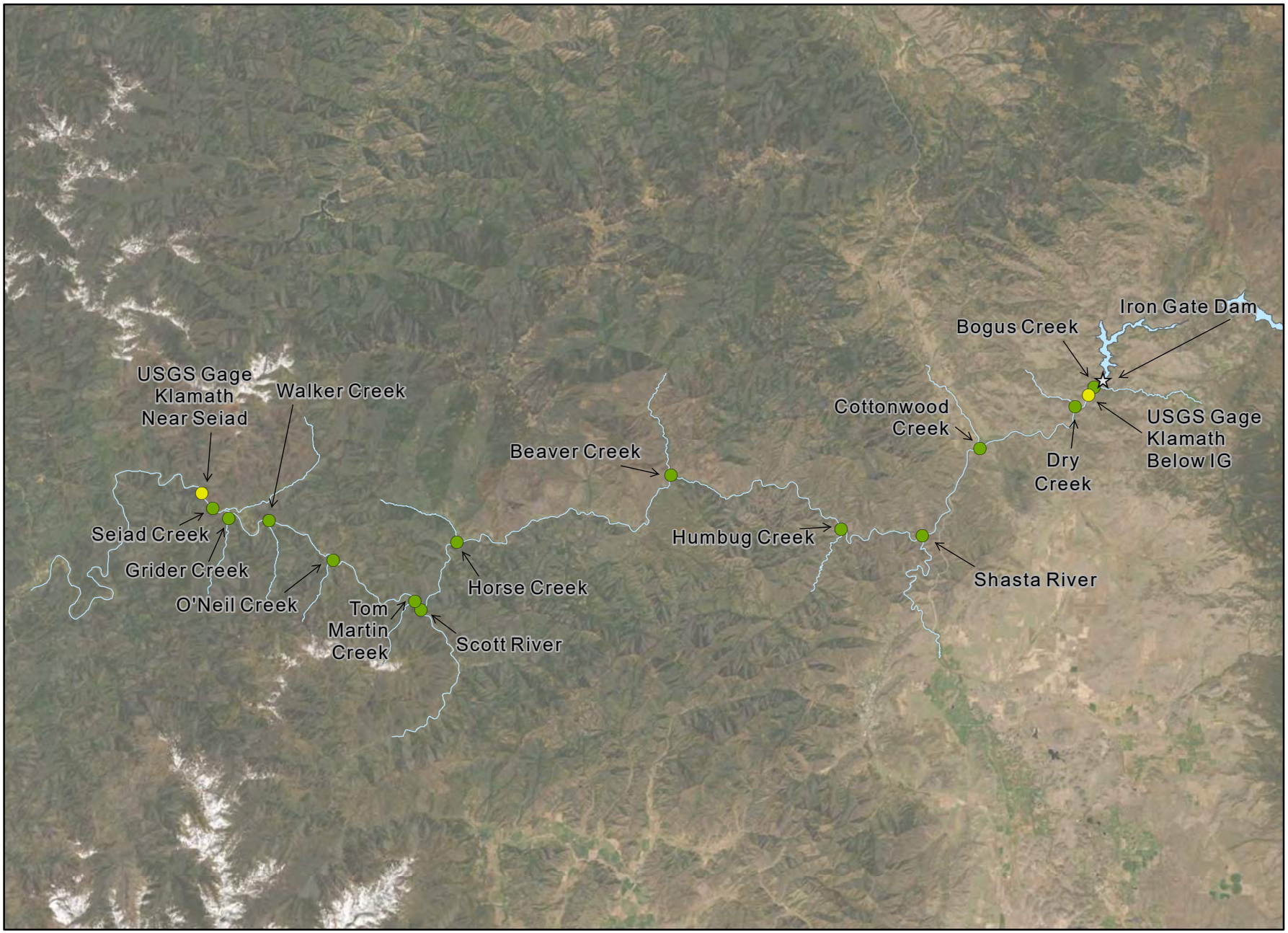
Appendix A

Detailed Map Books



KLAMATH RIVER RENEWAL CORPORATION

Lower Klamath Project

Juvenile Salmonid Plan

Figure 1. Mainstem and Tributary Water Quality Monitoring Sites

November 11, 2020

PRELIMINARY DESIGN (NOT FOR CONSTRUCTION)

Legend

- Tributary Monitoring Sites
- Mainstem Monitoring Sites
- Iron Gate Dam
- Klamath River and Tributaries
- Reservoir Boundaries

N

0 6 12 Miles

Notes

1. *Coordinate System: NAD 1983 2011 StatePlane California I FIPS 0401 Ft US*

2. *Data Sources: Monitoring Sites: RES; Klamath River: RES; Res. Bdry.: National Hydrography Dataset USGS*

3. *Background: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community*

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KLAMATH RIVER RENEWAL CORPORATION

Lower Klamath Project

Juvenile Salmonid Plan

Figure 2. Tributary Monitoring Area

Seiad Creek Monitoring Area

November 12, 2020

0 190 380 Feet

N

Legend

- Monitored Tributary
- Primary Monitoring Area

Notes

1. *Coordinate System: NAD 1983 2011 StatePlane California I FIPS 0401 Ft US*

2. *Data Sources: Salmomoid monitoring areas: RES;*

3. *Background: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS*

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KLAMATH RIVER RENEWAL CORPORATION

Lower Klamath Project

Juvenile Salmonid Plan

Figure 3. Tributary Monitoring Area

Grider Creek Monitoring Area

November 12, 2020

0 340 680 Feet

N

Legend

- Monitored Tributary
- Primary Monitoring Area
- Secondary Monitoring Area

Notes

1. *Coordinate System: NAD 1983 2011 StatePlane California I FIPS 0401 Ft US*

2. *Data Sources: Salmomoid monitoring areas: RES;*

3. *Background: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS*

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KLAMATH RIVER RENEWAL CORPORATION

Lower Klamath Project

Juvenile Salmonid Plan

Figure 4. Tributary Monitoring Area

Walker Creek Monitoring Area

November 12, 2020

0 160 320 Feet

N

Legend

- Monitored Tributary
- Primary Monitoring Area

Notes

1. *Coordinate System: NAD 1983 2011 StatePlane California I FIPS 0401 Ft US*

2. *Data Sources: Salmomoid monitoring areas: RES;*

3. *Background: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS*

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KLAMATH RIVER RENEWAL CORPORATION

Lower Klamath Project

Juvenile Salmonid Plan

Figure 5. Tributary Monitoring Area

O'Neil Creek Monitoring Area

November 12, 2020

0 160 320 Feet

N

Legend

- Monitored Tributary
- Primary Monitoring Areas

Notes

1. *Coordinate System: NAD 1983 2011 StatePlane California I FIPS 0401 Ft US*

2. *Data Sources: Salmomoid monitoring areas: RES;*

3. *Background: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS*

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KLAMATH RIVER RENEWAL CORPORATION

Lower Klamath Project

Juvenile Salmonid Plan

Figure 6. Tributary Monitoring Area

Tom Martin Creek Monitoring Area

November 12, 2020

0 110 220 Feet

N

Legend

- Monitored Tributary
- Primary Monitoring Area

Notes

1. *Coordinate System: NAD 1983 2011 StatePlane California I FIPS 0401 Ft US*

2. *Data Sources: Salmomoid monitoring areas: RES;*

3. *Background: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS*

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KLAMATH RIVER RENEWAL CORPORATION

Lower Klamath Project

Juvenile Salmonid Plan

Figure 7. Tributary Monitoring Area

Scott River Monitoring Area

November 12, 2020

0 160 320 Feet

N

Legend

- Monitored Tributary
- Primary Monitoring Area

Notes

1. *Coordinate System: NAD 1983 2011 StatePlane California I FIPS 0401 Ft US*

2. *Data Sources: Salmomoid monitoring areas: RES;*

3. *Background: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS*

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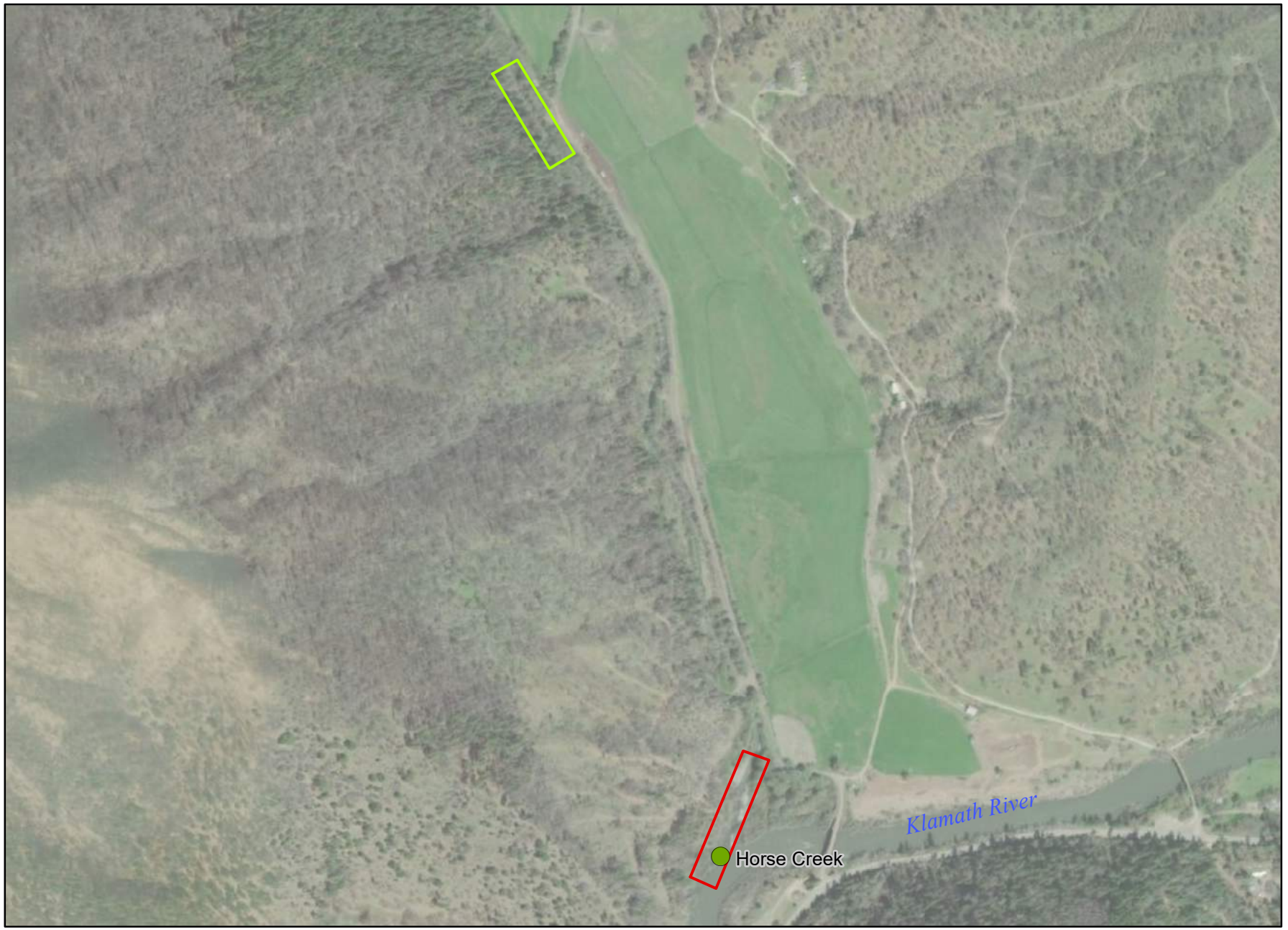

KLAMATH RIVER RENEWAL CORPORATION

Lower Klamath Project

Juvenile Salmonid Plan

Figure 8. Tributary Monitoring Area

Horse Creek Monitoring Area

November 12, 2020

0 675 1,350 Feet

N

Legend

- Monitored Tributary
- Primary Monitoring Area
- Secondary Monitoring Area

Notes

1. *Coordinate System: NAD 1983 2011 StatePlane California I FIPS 0401 Ft US*

2. *Data Sources: Salmomoid monitoring areas: RES;*

3. *Background: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS*

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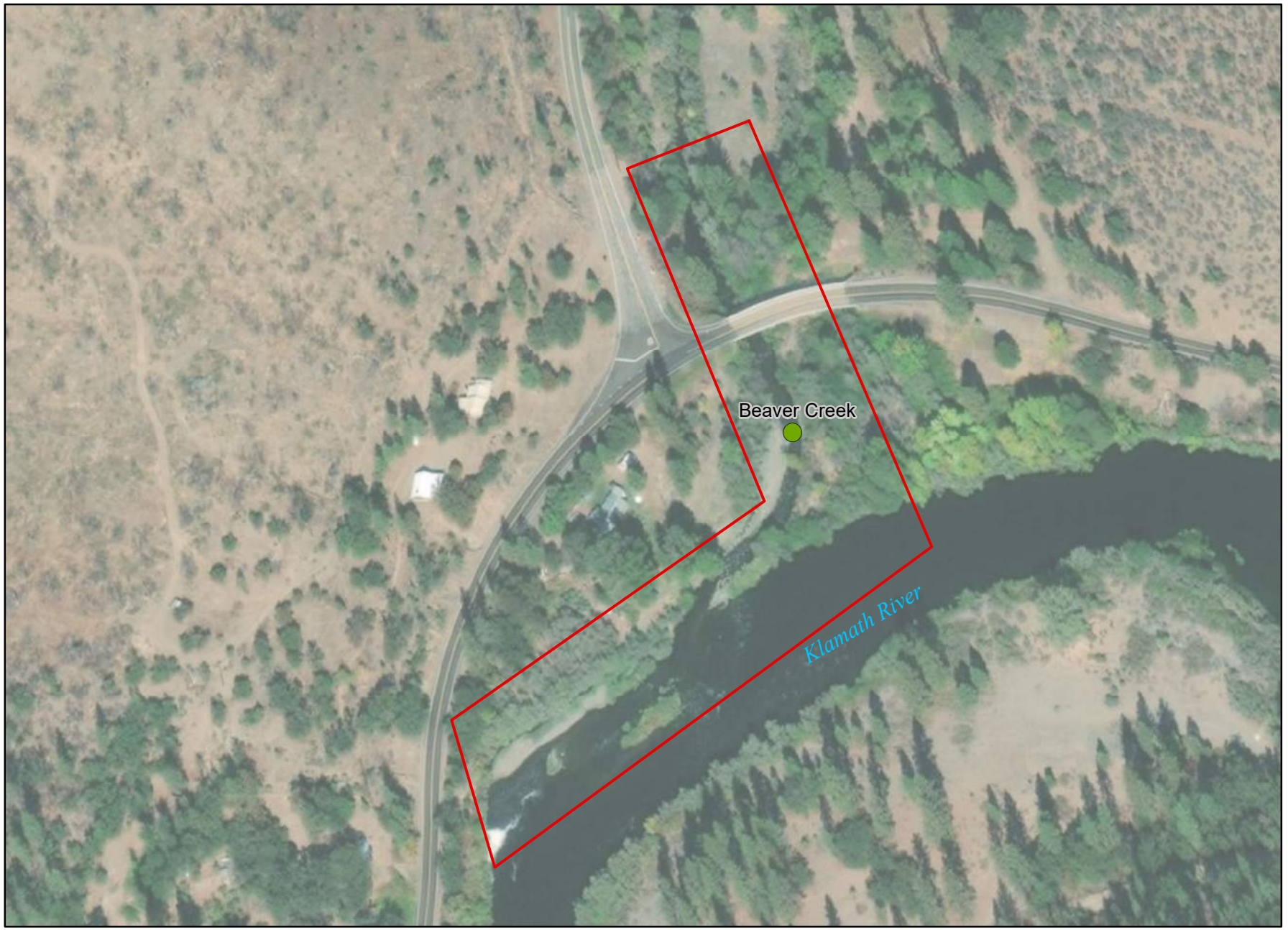

KLAMATH RIVER RENEWAL CORPORATION

Lower Klamath Project

Juvenile Salmonid Plan

Figure 9. Tributary Monitoring Area

Beaver Creek Monitoring Area

November 12, 2020

0 160 320 Feet

N

Legend

- Monitored Tributary
- Primary Monitoring Area

Notes

1. *Coordinate System: NAD 1983 2011 StatePlane California I FIPS 0401 Ft US*

2. *Data Sources: Salmomoid monitoring areas: RES;*

3. *Background: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS*

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KLAMATH RIVER RENEWAL CORPORATION

Lower Klamath Project

Juvenile Salmonid Plan

Figure 10. Tributary Monitoring Area

Humbug Creek Monitoring Area

November 12, 2020

0 160 320 Feet

N

Legend

- Monitored Tributary
- Primary Monitoring Area

Notes

1. *Coordinate System: NAD 1983 2011 StatePlane California I FIPS 0401 Ft US*

2. *Data Sources: Salmomoid monitoring areas: RES;*

3. *Background: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS*

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KLAMATH RIVER RENEWAL CORPORATION

Lower Klamath Project

Juvenile Salmonid Plan

Figure 11. Tributary Monitoring Area

Shasta River Monitoring Area

November 12, 2020

0 110 220 Feet

N

Legend

- Monitored Tributary
- Primary Monitoring Area

Notes

1. *Coordinate System: NAD 1983 2011 StatePlane California I FIPS 0401 Ft US*

2. *Data Sources: Salmomoid monitoring areas: RES;*

3. *Background: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS*

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KLAMATH RIVER RENEWAL CORPORATION

Lower Klamath Project

Juvenile Salmonid Plan

Figure 12. Tributary Monitoring Area

Cottonwood Creek Monitoring Area

November 12, 2020

0 160 320 Feet

N

Legend

- Monitored Tributary
- Primary Monitoring Area

Notes

1. *Coordinate System: NAD 1983 2011 StatePlane California I FIPS 0401 Ft US*

2. *Data Sources: Salmomoid monitoring areas: RES;*

3. *Background: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS*

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KLAMATH RIVER RENEWAL CORPORATION

Lower Klamath Project

Juvenile Salmonid Plan

Figure 13. Tributary Monitoring Area

Dry Creek Monitoring Area

November 12, 2020

0 50 100 Feet

N

Legend

- Monitored Tributary
- Primary Monitoring Area

Notes

1. *Coordinate System: NAD 1983 2011 StatePlane California I FIPS 0401 Ft US*

2. *Data Sources: Salmomoid monitoring areas: RES;*

3. *Background: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS*

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KLAMATH RIVER RENEWAL CORPORATION

Lower Klamath Project

Juvenile Salmonid Plan

Figure 14. Tributary Monitoring Area

Bogus Creek Monitoring Area

November 12, 2020

0 110 220 Feet

N

Legend

- Monitored Tributary
- Primary Monitoring Area

Notes

1. *Coordinate System: NAD 1983 2011 StatePlane California I FIPS 0401 Ft US*

2. *Data Sources: Salmomoid monitoring areas: RES;*

3. *Background: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS*

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Beaver Creek
Seiad Creek
West Grider Creek
Horse Creek
Shasta River
Cade Creek
Elk Creek
Tom Martin Creek
Scott River
Sandy Bar Creek
Stanshaw Creek
Camp Creek

Seiad Creek

Durazo Ponds
CalTrans Pond
Seiad Creek
West Grider Creek

Horse Creek

Fish Gulch Ponds
Miner's Pond
Upper Lawrence Ponds
Goodman Pond
Decorsey Pond
Lower Lawrence Pond

Beaver Creek

Beaver Creek
Marble Creek

KLAMATH RIVER RENEWAL CORPORATION

Lower Klamath Project

Juvenile Salmonid Plan

Figure 15. Coho and* O. mykiss *Young-of-the-Year Relocation Sites

November 12, 2020

PRELIMINARY DESIGN (NOT FOR CONSTRUCTION)

N

0 4 8 12 Miles

Legend

- Primary Relocation Tributaries
- Alternative Relocation Tributaries
- Tributary Relocation Sites
- Klamath River
- Tributary Relocation Reaches

Notes

1. *Coordinate System: NAD 1983 2011 StatePlane California I FIPS 0401 Ft US*

2. *Data Sources: Salmon relocation sites: RES; Klamath River: National Hydrography Dataset USGS*

3. *Background: Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community*

Happy Camp, CA
Elk Creek
Indian Creek River Access
Wingate Bar River Access
Clear Creek
Ti Bar River Access
Ti Creek
Salmon River Access
Somes Bar, CA
Orleans, CA
Camp Creek
Orleans Bar River Access
Big Bar River Access
Bluff Creek
Trinity River

Lower Klamath Project

Juvenile Salmon Plan

Figure 16. Coho Smolt and Chinook Mainstem Relocation Sites

December 8, 2020

PRELIMINARY DESIGN (NOT FOR CONSTRUCTION)

Disclaimer: This document has been prepared based on information provided by others as cited in the Notes section. McMillen Jacobs Associates has not verified the accuracy and/or completeness of this information and shall not be responsible for any errors or omissions which may be incorporated herein as a result. McMillen Jacobs Associates assumes no responsibility for data supplied in electronic format, and the recipient accepts full responsibility for verifying the accuracy and completeness of the data.

Legend

☆ Reference Points

Tributaries

- Happy Camp to Salmon River
- Salmon River to Trinity River

Relocation Sites

- Happy Camp to Salmon River
- Salmon River to Trinity River

Reaches

- Happy Camp to Salmon River
- Salmon River to Trinity River

N

0 3 6 Miles

Notes

1. *Coordinate System: NAD 1983 2011 StatePlane California I FIPS 0401 Ft US*

2. *Data Sources: Salmon relocation areas: RES; Klamath R. Reaches: RES*

3. *Background: Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community*

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Appendix B

Monitoring Data Sheets

Lower Klamath Project

Juvenile Salmonid Plan – Water Quality Monitoring Data Sheet

Date: _____

Tributary Confluence Monitoring Area: _____

Weather: _____

Air Temp. (°C): _____

Logger Offloaded: ☐

Water Temp. (°C): _____

Turbidity (NTU): _____

Length of observation period: _____

Notes and field observations, including juvenile salmonid behavior:

Date: _____

Tributary Confluence Monitoring Area: _____

Weather: _____

Air Temp. (°C): _____

Logger Offloaded: ☐

Water Temp. (°C): _____

Turbidity (NTU): _____

Length of observation period: _____

Notes and field observations, including juvenile salmonid behavior:

Date: _____

Tributary Confluence Monitoring Area: _____

Weather: _____

Air Temp. (°C): _____

Logger Offloaded: ☐

Water Temp. (°C): _____

Turbidity (NTU): _____

Length of observation period: _____

Notes and field observations, including juvenile salmonid behavior:

Lower Klamath Project

Juvenile Salmonid Plan – Capture Data Sheet

Capture Tributary:	_____	Habitat Type:	_____
Capture Date:	_____	Weather:	_____
Crew:	_____	Air Temp. (°C):	_____
Start Time:	_____	Water Temp. (°C):	_____
End Time:	_____	DO (mg/L):	_____
Gear(s) Used:	_____	Turbidity (NTU):	_____

Captured Fish				
Relocation Sites	**Life Stage**	**Species**	**Number Caught**	**Number of Mortalities**
Tributaries	YOY (fry and parr)	Coho salmon		
		O. mykiss		
Mainstem Klamath	YOY	Chinook salmon		
	Smolt	Coho salmon		
		O. mykiss		
		Chinook salmon		
Released On-Site	Ammocoete	Pacific lamprey		
	Transformer			
	Adult			

Notes and field observations:

Lower Klamath Project

Juvenile Salmonid Plan – Relocation Data Sheet

Capture Tributary: _____

Species & Life Stage: _____

Number of Coolers: _____

Prim. Relocation Site: _____

Sec. Relocation Site: _____

Crew: _____

_____

Release Date: _____

Release Time: _____

Air Temp. (°C): _____

Site Water Temp. (°C): _____

Cooler Water Temp. (°C): _____

Site DO (mg/L): _____

Site Turbidity (NTU): _____

Relocated Fish			
Life Stage	**Species**	**Number Released**	**Number of Mortalities**
	Coho salmon		
	O. mykiss		
	Chinook salmon		

Final relocation site: _____

Photo captured of relocations site: ☐

Difference between site and cooler temp: _____

Was an acclimation period needed? _____

If so, how long? _____

Temp. difference at time of release: _____

Notes and field observations:

Appendix F

Oregon AR-6 Adaptive Management Plan-Suckers

KLAMATH RIVER RENEWAL CORPORATION

Lower Klamath Project
FERC Project No. 14803

Oregon AR-6 Adaptive Management Plan - Suckers

Klamath River Renewal Corporation
2001 Addison Street, Suite 317
Berkeley, CA 94704

Prepared By:
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Sacramento, CA 95814

River Design Group, Inc.
311 SW Jefferson Avenue
Corvallis, OR 97333

December 2021

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Table of Contents

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1.0 Introduction

This Oregon AR-6[1] Adaptive Management Plan - Suckers (OR Suckers Plan) is a subplan of the Aquatic Resources Management Plan that will be implemented as part of the Proposed Action for the Lower Klamath Project (Project).

1.1 Purpose

This OR Suckers Plan describes the measures the Renewal Corporation has completed to better understand Lost River sucker (*Deltistes luxatus*) and shortnose sucker (*Chasmistes brevirostris*) (listed suckers) populations in J.C. Boyle Reservoir, and to plan the salvage and translocation of the listed suckers from the reservoir prior to reservoir drawdown and dam removal. The sampling plan described herein furthered understanding of sucker demographics and genetics, population sizes, habitat use, and successful gear types and fishing methods. Informed by sampling plan results, the Renewal Corporation will conduct sucker salvage and translocation efforts to remove Lost River and shortnose suckers from the Lower Klamath Project reservoirs prior to reservoir drawdown and dam removal.

2.0 Overview

The OR Suckers Plan entails two actions as part of the Proposed Action: Action 1: Reservoir and River Sampling, and Action 2: Sucker Salvage and Translocation which are summarized below. The Renewal Corporation has completed Action 1 activities as detailed in *Section 3.0 Action 1: Sampling Plan Methods and Results*. The Action 2 activities outlined in *Section 4.0 Action 2: Salvage and Translocation Plan* will be completed prior to reservoir drawdown. A similar plan for Copco No. 1 Reservoir and Iron Gate Reservoir is included in the California AR-6 Adaptive Management Plan - Suckers (CA Suckers Plan).

2.1 Action 1: Reservoir and River Sampling

The Renewal Corporation coordinated a sucker sampling program with U.S. Fish and Wildlife Service (USFWS), Oregon Department of Fish and Wildlife (ODFW), and the U.S. Geological Survey (USGS) from 2018 through 2020. The Renewal Corporation completed sampling in J.C. Boyle Reservoir and at the upstream end of the reservoir where the Klamath River enters the reservoir. Sampling took place over four periods between fall 2018 and spring 2020 (Renewal Corporation 2020). Sampling included placing trammel nets in the reservoir and electrofishing, which was used in the Klamath River reach entering the reservoir and to augment trammel net

[1] AR-6 is an acronym for Aquatic Resources Measure 6. This terminology was used in the 2018 Definite Plan to identify and describe the measures the Renewal Corporation would implement under the Aquatic Resources Management Plan to protect aquatic resources. Since the 2020 Definite Decommissioning Plan has superseded the Definite Plan, the “AR-6” terminology is no longer relevant. Regardless, the Renewal Corporation has retained the original name of this subplan to avoid confusion and ensure continuity during the consultation process.

sampling. Captured Lost River and shortnose suckers were identified by species and sex, marked with a PIT tag (Burdick 2013), fin clipped for genetic material, measured, and released. Klamath smallscale suckers (*Catostomus rimiculus*) were also processed in 2020 to collect genetic material for USFWS. It is the Renewal Corporation's understanding that USFWS will use the genetic material to develop genetic assays. Recaptured fish were used to estimate sucker abundance, and fin clips were provided to USFWS for genetic testing at the discretion of USFWS. Sampling was typically completed over three nights. The Renewal Corporation completed annual summary reports following each sampling effort and reports were submitted to USFWS and ODFW. The Renewal Corporation also presented sampling results to the Aquatic Technical Work Group (ATWG), a working group assembled to consult with the Renewal Corporation with respect to the development of the Aquatic Resources Management Plan. See Section 3.0 of the Aquatic Resources Management Plan for additional details regarding the ATWG. The sampling performed under Action 1 was completed in 2020.

2.2 Action 2: Sucker Salvage and Translocation

The Renewal Corporation will capture adult listed suckers in J.C. Boyle Reservoir using similar methods as those employed for the Action 1 sampling effort. In the spring or fall prior to reservoir drawdown, the Renewal Corporation will translocate captured suckers to the Klamath National Fish Hatchery, the Klamath Tribes sucker rearing facility. Other translocation sites may be used following consultation with the Aquatic Resources Group (ARG) and agreement between the Renewal Corporation, USFWS, CDFW and ODFW. If agreement is reached to use other translocation sites, the Renewal Corporation will file a report with the Federal Energy Regulatory Commission (Commission) within 14 calendar days that includes the location of the additional translocation site, the reasons for the additional translocation site, and documentation of consultation with USFWS, CDFW and ODFW. See Section 3.0 of the Aquatic Resources Management Plan for additional details regarding the ARG. The Renewal Corporation anticipates salvaging approximately 300 listed suckers from J.C. Boyle Reservoir over 7 days based on sampling catch efficiencies. The 300 listed suckers equate to between 11 and 35 percent of the mean population estimates calculated for J.C. Boyle Reservoir. A similar effort will be completed on Copco No. 1 Reservoir and Iron Gate Reservoir in California (see CA Suckers Plan). During the salvage action, the Renewal Corporation does not anticipate salvaging and translocating the entire populations of Lost River and shortnose suckers residing in J.C. Boyle Reservoir.

3.0 Action 1: Sampling Plan Methods and Results

3.1 Purpose

The Renewal Corporation coordinated a sucker sampling program with USFWS, ODFW, and the USGS from 2018 through 2020. Sampling was completed in fall 2018, spring and fall 2019, and spring 2020. Collected data were used to develop a better understanding of sucker demographics and genetics, population sizes, habitat use, and successful gear types and fishing methods for catching Lost River and shortnose suckers. The sampling performed under Action 1 was completed in 2020, and the sampling results directly informed the salvage and translocation efforts described in *Section 4.0 Action 2: Salvage and Translocation Plan*.

3.2 Previous Efforts

The Renewal Corporation reviewed previous sampling studies completed on Upper Klamath Lake, J.C. Boyle Reservoir, Copco No. 1 Reservoir (California), and Iron Gate Reservoir (California) as part of pre-sampling planning. The literature review focused on studies that evaluated Lost River and shortnose sucker habitat use and demographics in Copco No. 1 Reservoir and Iron Gate Reservoir. Studies of interest included Coots (1965), California Department of Fish and Game (CDFG) (1980), Beak Consultants (1987), Buettner and Scoppettone (1991), and Desjardins and Markle (2000). These studies documented shortnose suckers in Copco No. 1 Reservoir and Iron Gate Reservoir. Beak Consultants (1987) and Desjardins and Markle (2000) each captured one Lost River sucker in Copco No. 1 Reservoir. Buettner and Scoppettone (1991) referenced the decline of Lost River suckers from Copco No. 1 Reservoir since the 1950s as documented by previous CDFW studies (Coots 1965; CDFG 1980). Buettner and Scoppettone (1991) also noted there was no prior evidence of Lost River or shortnose suckers inhabiting Iron Gate Reservoir, although Desjardins and Markle (2000) subsequently captured shortnose suckers in Iron Gate Reservoir. Sucker spawning habitat upstream from Copco No. 1 Reservoir and Iron Gate Reservoir is limited due to short riverine reaches, coarse bed material, and fluctuating river levels (Buettner and Scoppettone 1991; Desjardins and Markle 2000). Limited juvenile rearing habitat and predation by non-native fish species also likely limit the reproductive potential of Lost River and shortnose suckers in the reservoirs (Desjardins and Markle 2000). Beak Consultants documented shortnose sucker spawning in the Klamath River in the 1-mile reach of the Klamath River upstream from Copco No. 1 Reservoir (1987), but they found few larval shortnose suckers in Copco No. 1 Reservoir (1988). Identified sucker larvae were believed to be Klamath smallscale suckers or shortnose sucker-Klamath smallscale sucker hybrids (Beak Consultants 1988).

J.C. Boyle Dam and Keno Dam have fish ladders that do not meet current sucker passage criteria (ODFW OAR 412; FishPro 2000) and potentially impede the upstream migration of Lost River and shortnose suckers from the Lower Klamath Project reach to Upper Klamath Lake (PacifiCorp 2013). Desjardins and Markle (2000) noted that J.C. Boyle Reservoir tended to have smaller adult shortnose suckers and more size sucker size classes than the downstream reservoirs. Desjardins and Markle (2000) suggested fewer non-native predatory fish species and more littoral habitat could have accounted for better juvenile recruitment compared to Copco No. 1 Reservoir and Iron Gate Reservoir.

3.3 Sampling Periods and Locations

The Renewal Corporation field crews completed sampling in J.C. Boyle Reservoir over four sampling periods (Renewal Corporation 2020). Spring sampling was completed in late March and mid-May, and fall sampling was completed in early November. Sampling typically began before dusk and ended after midnight. Sampling effort focused on habitats less than 20 ft deep as adult Lost River and shortnose suckers in Upper Klamath Lake preferentially selected habitats up to 15 ft deep (Reiser et al. 2001; Banish et al. 2009). In addition to target depth, field crews also prioritized habitats with similar depths over distances of at least 300 ft to accommodate the dimension of the deployed trammel nets. Nets were often placed to fish transitional features such as from the shallow shoreline into a submerged historical channel of a

tributary or the Klamath River. Sampling locations were generally in coves and tributary confluence areas that met the sampling habitat criteria defined by water depths less than 20 ft deep and habitats with consistent elevations over a 300 ft distance. Habitats that were successfully sampled during previous efforts, and over the course of the Renewal Corporation's work, were repeatedly sampled.

3.4 Sampling Methods

The Renewal Corporation field crews deployed sampling boats[2] with a captain and two crew members on each boat. The captain was responsible for driving the boat and assisting with data recording during fish processing. Crew members were responsible for deploying and retrieving fishing gear, and processing captured fish. Crew members used trammel nets and boat electrofishing to sample suckers. Trammel nets were most frequently used and accounted for nearly all the sampled suckers. A boat electrofisher was used in flowing portions of the Klamath River at the head end of J.C. Boyle Reservoir and in shallow reservoir margins. Table 3-1 summarizes the sampling gear employed.

Table 3-1. Gear for sampling listed suckers in J.C. Boyle Reservoir.

SAMPLING EQUIPMENT ITEM	NUMBER	SPECIFICATIONS
Sampling Boat	1 or 2	18 ft and 19 ft sampling boats with necessary safety and anti-pollution equipment
Trammel Net	6	USGS specifications - 300 feet long, 6 feet high; two 12-inch mesh outer panels; one 1.5-inch mesh (3-inch stretch) inner panel; foam-core float line; lead-core bottom line
Electrofishing Equipment	1	3250 watt generator operated boat-mounted Smith-Root Model 1.5 KVA Electrofisher

3.4.1 Trammel Nets

Netting of suckers was predominantly completed at night by one or two boats. Each boat set between two and six nets during each net set. Each trammel net included two 12-inch mesh outer panels and one 1.5-inch mesh inner panel sandwiched between the outer 12-inch mesh panels. A foam-core float line and lead-core bottom line maintained net position. Nets were clipped to an end poly rope with a mushroom or pyramid anchor secured at the bottom of the poly rope and a buoy secured to the top of the poly rope. The distance between the top of the clipped net and the buoy was based on water depth such that nets were fished on the bottom. Nets were paid out from either the bow or the side of the boat depending on the boat. A second anchor and buoy were attached to the poly rope at the end of the trammel net. Each net set

[2] Two crews conducted sampling in fall 2018, and spring and fall 2019. One crew conducted sampling in spring 2020. Sampling level of effort was comparable across the four sampling efforts.

location was documented with either a handheld or on-board GPS. During spring 2020, one sampling boat was used to deploy six trammel nets.

Nets were generally set perpendicular to the shoreline in water depths ranging from 3 ft to 50 ft, but nets were most commonly set in 20 ft or less of water. Nets were typically fished for approximately 2 hours, but up to 6 hours during the spring 2020 sampling. At the end of each net soak, the nets were retrieved, and captured fish were removed from the nets and placed in live wells for processing. Non-target species were identified, enumerated, and released.

3.4.2 Tangle Nets

The Renewal Corporation field crew deployed two tangle nets in the transitional reach at the upstream end of J.C. Boyle Reservoir. The nets included one net measuring 100 feet long by 6 feet deep with 3-inch stretch mesh size and one net measuring 50 feet by 8 feet with 3-inch stretch mesh size. Both nets were fitted with a foam core float line and lead core bottom line. Tangle nets were fished through a lower velocity reach where water depths ranged from 6 feet to 8 feet. Tangle nets were not fished upstream from Copco Reservoir or Iron Gate Reservoir due to coarse bed material or low sucker presence determined while boat electrofishing. One Klamath smallscale sucker was caught using the tangle nets.

3.4.3 Boat Electrofishing

Boat electrofishing was an added gear type for fall 2019 and spring 2020 sampling. The electrofishing equipment included dual bow-mounted anode/cathode arrays (each with a terminal 4 wire umbrella). Dual cathode arrays were hung from each side of the boat, each with 14 terminal wires. The electrofisher components were mounted on a 17-foot jet boat. The anode/cathode arrays were operated by a Smith-Root electrofisher control module (Model 1.5 KVA) with electricity provided by a gas-powered generator (Generac GP 3250) with a maximum output of 3250 running watts. The Smith-Root 1.5 KVA electrofisher has a maximum output power of 1,700 watts and can be set to pulsed AC or DC current that draws between 0 and 10 amps. The AC mode produces 60 Hz alternating current between the anode and cathode wires. The DC position produces direct current, pulsing at 120 pulses per second. There is no wattage adjustment on the Smith-Root 1.5 KVA electrofisher.

Per the USFWS Incidental Take Permit for listed suckers, only the DC setting was used. Following the user manual, the Smith-Root 1.5 KVA electrofisher controller was set to DC current and the voltage was set to the lowest setting. The electrofisher was then activated to determine the amount of current (amperage) drawn at the lowest voltage setting. Test electrofishing was conducted and the voltage was increased in a stepwise manner until the desired level of electrotaxis to facilitate capture was exhibited by the target species, while also minimizing injury and mortality of target and non-target species. The effective DC voltage for the Klamath Reservoir surveys was approximately 150 volts, which drew about 5 amps. During electrofishing, two fish netters were stationed in the bow who controlled the electrofisher via a foot switch.

3.4.4 Sucker Processing Procedures

Crew members processed captured Lost River and shortnose suckers on the boat of capture. Fish processing involved the following observations and other measurements of each captured shortnose sucker.

- Identified the fish species and sex, noting the presence of tubercles and anal fin shape as sex characteristics.
- Identified any external abnormalities including parasites, lamprey marks, and fin and scale anomalies.
- Measured fork length to the nearest millimeter using a wetted PVC measuring board.
- Collected a fin clip to serve as a genetic material sample.
- Confirmed absence of existing PIT tag, then inserted a PIT tag into the ventral musculature anterior to the pelvic girdle using pre-loaded single use 12-gauge hypodermic needles (HPT12 PLT) fitted onto an implant device (MK-25). Existing or inserted PIT tag numbers were recorded
- Collected photographs of each sucker's mouth, lateral body view, and features of concern such as lesions or parasites.

Measurement data were recorded on field sheets and photographs and GPS data were transferred from field equipment to laptop computers following sampling. Processed fish were returned to the reservoir away from the immediate sampling area to minimize repeat capture. All efforts were made to minimally handle suckers and release fish in good condition. No direct sucker mortality was observed in J.C. Boyle Reservoir.

3.4.5 Sucker Genetics

In 2020, the USFWS-Abernathy Lab compiled genetic libraries for the four Klamath sucker species including Lost River suckers, shortnose suckers, Klamath largescale suckers (*Catostomus snyderi*), and Klamath smallscale suckers (Smith et al. 2020). Genetic results suggested genetic variation within each of the four sucker species was primarily partitioned among subbasins (Smith et al. 2020). Smith et al. (2020) also determined there are potentially thousands of genetic markers for species and population differentiation that will be useful in the recovery of Lost River and shortnose suckers. It is the Renewal Corporation's understanding that USFWS will use the genetic results to develop assays that will likely allow fisheries managers to distinguish among the four Klamath Basin sucker species, providing an important tool for species conservation (Smith et al. 2020). The fin clips collected by the Renewal Corporation in the Lower Klamath Project reservoirs have been provided to the USFWS. USFWS will be responsible for determining whether assays are applied to the fin clips to determine sucker genetics.

3.5 Sampling Results

Results for the four sampling efforts completed between 2018 and 2020 on J.C. Boyle Reservoir are provided below. Results for Copco No. 1 Reservoir and Iron Gate Reservoir are provided in the CA Suckers Plan.

3.5.1 Level of Effort

Table 3-2 and Table 3-3 include the level of effort for the trammel net sets and boat electrofishing, respectively.

Table 3-2. Level of effort for trammel net sets.

METRIC	SAMPLING EVENT	NET SET VALUES
Total Net Sets (#)	Spring 2020	7
	Fall 2019	19
	Spring 2019	40
	Fall 2018	30
	Total	**96**
Total Net Soak Time (hours)	Spring 2020	49.7
	Fall 2019	36.0
	Spring 2019	55.1
	Fall 2018	57.9
	Total	**198.8**
Average Net Soak Time (hours)	Spring 2020	7.1
	Fall 2019	1.9
	Spring 2019	1.4
	Fall 2018	1.9
	Average	**3.1**

Table 3-3. Boat electrofishing level of effort for J.C. Boyle Reservoir from fall 2019 and spring 2020 sampling.

SAMPLING EVENT	BOAT ELECTROFISHING EFFORT (SECONDS)
Spring 2020	2792
Fall 2019	2999
Total	**5791**

3.5.2 Catch Composition

3.5.2.1 Trammel Nets

The Renewal Corporation field crews caught 3,645 fish during the four sampling periods using trammel nets. Fish counts and native and non-native species composition are included in Table 3-4 and Table 3-5, respectively.

Table 3-4. Total trammel net catch for J.C. Boyle Reservoir.

SAMPLING EVENT	TOTAL FISH CAUGHT
Spring 2020	1184
Fall 2019	716
Spring 2019	829
Fall 2018	916
Total	**3645**

Table 3-5. The most common native and non-native fish species caught using trammel nets in J.C. Boyle Reservoir.

NATIVE/NON-NATIVE SPECIES	SPECIES NAME	TOTAL FISH CAUGHT
Native Species	Tui Chub (*Siphatales bicolor bicolor*)	1464
	Blue Chub (*Gila coerulea*)	451
	Smallscale Sucker (*Catostomus rimiculus*)	131
	Rainbow Trout (*Oncorhynchus mykiss*)	80
	Shortnose Sucker (*Chasmistes brevirostris*)	64
	Lost River Sucker (*Deltistes luxatus*)	26
Non-native Species	Crappie (*Pomoxis* spp.)	386
	Brown Bullhead (*Ameiurus nebulosus*)	384
	Goldfish (*Carassius* spp.)	338
	Yellow Perch (*Perca flavescens*)	245
	Redear Sunfish (*Lepomis microlophus*)	23

3.5.3 Boat Electrofishing

The Renewal Corporation field crews caught 2,347 fish during fall 2019 and spring 2020 boat electrofishing. Fish counts and native and non-native species composition are included in Table 3-6 and Table 3-7, respectively.

Table 3-6. Total boat electrofishing catch for J.C. Boyle Reservoir.

SAMPLING EVENT	TOTAL FISH CAUGHT
Spring 2020	215
Fall 2019	74
Total	**289**

Table 3-7. The most common native and non-native fish species caught using boat electrofishing in J.C. Boyle Reservoir in 2019 and 2020 sampling.

NATIVE/NON-NATIVE SPECIES	SPECIES NAME	TOTAL FISH CAUGHT
Native Species	Chubb sp. (*Siphatales bicolor bicolor* and *Gila coerulea)*	218
	Rainbow Trout (*Oncorhynchus mykiss*)	14
	Smallscale Sucker (*Catostomus rimiculus*)	2
	Shortnose Sucker (*Chasmistes brevirostris*)	2
Non-native Species	Goldfish (*Carassius* spp.)	44
	Largemouth Bass (*Micropterus* sp.)	6
	Brown Bullhead (*Ameiurus nebulosus*)	3

3.5.4 Trammel Net and Boat Electrofishing Summary

Table 3-8 includes the total catch for the four sampling periods in J.C. Boyle Reservoir. Table 3-9 includes the most common native and non-native fish species caught in J.C. Boyle Reservoir using trammel nets and boat electrofishing.

Table 3-8. Total trammel net catch and boat electrofishing catch for J.C. Boyle Reservoir.

SAMPLING EVENT	TOTAL FISH CAUGHT
Spring 2020	1399
Fall 2019	790
Spring 2019	1109
Fall 2018	274
Total	**4548**

Table 3-9. The most common native and non-native fish species caught using trammel nets and boat electrofishing in J.C. Boyle Reservoir.

NATIVE/ NON-NATIVE SPECIES	SPECIES NAME	TOTAL FISH CAUGHT
Native Species	Tui Chub (*Siphatales bicolor bicolor*)	1464
	Blue Chub (*Gila coerulea*)	451
	Chubb sp. (*Siphatales bicolor bicolor* and *Gila coerulea)*	218
	Smallscale Sucker (*Catostomus rimiculus*)	133

NATIVE/ NON-NATIVE SPECIES	SPECIES NAME	TOTAL FISH CAUGHT
	Rainbow Trout (*Oncorhynchus mykiss*)	94
	Shortnose Sucker (*Chasmistes brevirostris*)	66
	Lost River Sucker (*Deltistes luxatus*)	26
Non-native Species	Brown Bullhead (*Ameiurus nebulosus*)	387
	Crappie (*Pomoxis* spp.)	386
	Goldfish (*Carassius* spp.)	338
	Yellow Perch (*Perca flavescens*)	245
	Redear Sunfish (*Lepomis microlophus*)	23

3.5.5 Sucker Catch, Size, and Condition

The Renewal Corporation caught Lost River suckers in J.C. Boyle Reservoir (Table 3-10) over the four sampling periods. Potential hybrid suckers were individuals that had intermediate characteristics suggesting hybridization with other sucker species. As noted above, the Renewal Corporation provided all fin clip samples to USFWS for genetic testing at the discretion of USFWS.

Table 3-10. Listed suckers and potential hybrid suckers caught using trammel nets and boat electrofishing J.C. Boyle Reservoir.

SPECIES[1]	SAMPLING EVENT	TOTAL SUCKERS CAUGHT
Lost River Suckers	Spring 2020	9
	Fall 2019	4
	Spring 2019	10
	Fall 2018	3
	Total	**26**
Shortnose Suckers	Spring 2020	15
	Fall 2019	9
	Spring 2019	19
	Fall 2018	21
	Total	**64**

SPECIES[1]	SAMPLING EVENT	TOTAL SUCKERS CAUGHT
Potential Hybrid Suckers	Spring 2020	0
	Fall 2019	1
	Spring 2019	1
	Fall 2018	3
	Total	**5**
Total Suckers	Spring 2020	24
	Fall 2019	14
	Spring 2019	30
	Fall 2018	27
	Total	**95**

[1]: Only includes maiden captures (i.e., first capture), does not include recaptured fish.

Lost River sucker and shortnose sucker length statistics recorded over the four sampling periods are provided in Table 3-11.

Table 3-11. Lost River and shortnose sucker length statistics for suckers caught using trammel nets and boat electrofishing in J.C. Boyle Reservoir over the four sampling periods.

SPECIES	STATISTIC	VALUE
Lost River Suckers	Count	26
	Maximum (mm)	765.0
	Median (mm)	534.5
	Mean (mm)	534.1
	Minimum (mm)	375.0
	1 SD (mm)	90.8
Shortnose Suckers	Count	64
	Maximum (mm)	520.0
	Median (mm)	428.0
	Mean (mm)	427.9
	Minimum (mm)	313.0
	1 SD (mm)	35.2

Based on length-age relationships for shortnose suckers in Upper Klamath Lake, shortnose suckers sampled in J.C. Boyle Reservoir are likely older fish. Prior to the Renewal Corporation's sampling, sucker populations downstream of Keno Reservoir had not been sampled since the late 1990s (Desjardins and Markle 2000) and early 2000s (Desjardins and Markle, unpublished data). In four sampling years, Desjardins and Markle (2000; unpublished data) caught 4 adult Lost River suckers and 61 adult shortnose suckers in J.C. Boyle Reservoir. A comparison of shortnose sucker lengths from sampling in 1998-1999 (Desjardins and Markle 2000) and 2000-2001 (Desjardins and Markle, unpublished data), and the Renewal Corporation's sampling (2018-2020) is shown in Figure 3-1.

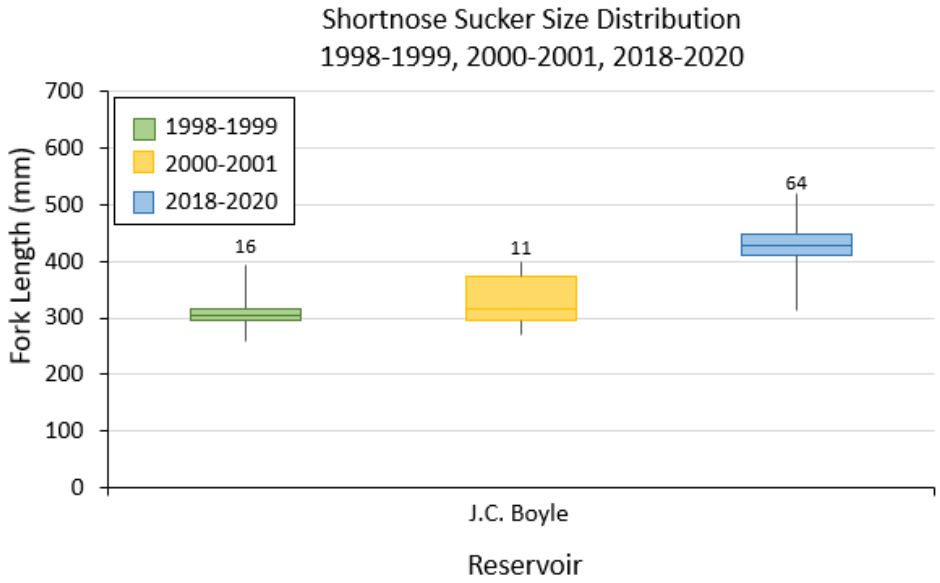

Figure 3-1. Comparison of shortnose sucker fork lengths for fish sampled by Desjardins and Markle (1998-1999 and 2000-2001) and the Renewal Corporation (2018-2020) in J.C. Boyle Reservoir. Sample sizes are posted above each box plot.

Renewal Corporation field crews noted the occurrence of wounds, deformities, and growths/tumors on listed suckers in the reservoirs. Common afflictions included worn fins, caudal fin deformities, parasites, wounds from lamprey attachment, and growths/tumors (Figure 3-2). Between 11% and 33% of suckers had afflictions across the four sampling periods. Due to small sample sizes, affliction patterns across the sampling periods were not apparent. Sucker afflictions in J.C. Boyle Reservoir included wounds, deformities, tumors, and parasites.

Figure 3-2. Example Lost River sucker (upper left) and shortnose sucker (upper right) sampled in spring 2020. Example of tumors and growths (lower left) and deformities (lower right) afflicting suckers in the Lower Klamath Project reservoirs.

3.5.6 Sucker Catch Per Unit Effort

Table 3-12 includes a comparison of catch per unit effort (CPUE) for maiden (i.e., first capture) shortnose suckers over the four sampling events, and the previous sampling completed by Desjardin and Markle in 1998 and 1999 (Desjardins and Markle 2000). Including both Lost River suckers and shortnose suckers, the CPUE in J.C. Boyle Reservoir over the four sampling periods is 0.44 fish/net-hour. The CPUE for Lost River suckers and shortnose suckers individually, was 0.13 and 0.31 fish/net-hour, respectively.

Table 3-12. Shortnose sucker catch per unit effort for the Renewal Corporation sampling and the Desjardins and Markle sampling (2000) in J.C. Boyle Reservoir.

SAMPLING EFFORT[1]	CPUE (FISH/NET-HOUR)
Desjardins and Markle – 1998 and 1999[2]	0.06
Renewal Corporation – Spring 2020	0.26
Renewal Corporation – Fall 2019	0.25
Renewal Corporation – Spring 2019	0.34
Renewal Corporation – Fall 2018	0.36
Renewal Corporation - All Events Combined	0.31

[1]: Catch per unit effort does not include recaptured fish.
[2]: Desjardins and Markle 2000

3.5.7 Sucker Population Estimate

The Renewal Corporation used recaptured suckers (trammel net data only) to develop population estimates for the three reservoirs, as well as a total population estimate across the three reservoirs. Three different methods were used to develop population estimates, all yielding comparable results.

3.5.7.1 Methods

The Renewal Corporation used the PIT tag mark-recapture data to produce abundance estimates for listed suckers inhabiting each reservoir, and for the three reservoirs combined. Due to the relatively low recapture rates, mark-recapture data for shortnose, Lost River, and potential hybrid suckers were combined. All listed sucker mark-recapture data were aggregated to determine total population estimates. Any listed sucker recaptured at least one day (or longer) after initial capture, tagging, and release was considered a recapture for the determination of the population estimates. Population estimates were then calculated using the following methods.

The Chapman method (Chapman 1951; Johnson et al. 2007) reduces small sample size bias and estimates the total population as:

$$\hat{N} = \frac{(M)(n+1)}{(m+1)}$$

Where:

$\hat{N}$ = Estimated size of the population

n = Number of fish initially marked and released

M = Number of unmarked fish captured during subsequent survey

m = Number of recaptured fish that were marked

Meridian Environmental, Inc. (Renewal Corporation subcontractor) also used a nonparametric bootstrap method (Efron and Tibshirani 1986; Manly 2007) to calculate mean population estimates and estimate variance to produce 95 percent confidence intervals. The bootstrap was run 10 times for each estimate, with 1,000 iterations per run. Population and variance estimates represent the mean of each 10-run set. The Renewal Corporation calculated the 95 percent confidence interval as the square root of the mean bootstrap variance multiplied by 1.96.

Total population estimates were also calculated using the super-population parameterization (Schwarz and Arnason 1996) of the Jolly-Seber model to estimate listed sucker abundance while accounting for subsampling for marking. Abundance is quantified by Schwarz and Arnason (1996) as the total number of gross “births” in the area of interest, which includes listed suckers present at the beginning of the study, those that move into the study area during the monitoring period, and those that do not survive to the end of the monitoring period. The super-population parameterization (Schwarz and Arnason 1996) of the Jolly-Seber model (POPAN model) was applied with the RMark package (Laake 2013) to the capture histories of each

individual PIT-tagged sucker with at least one resighting (recapture) opportunity. Intercept-only models were used for capture and survival probabilities due to the low number of recaptured individuals. Because survey occasions were distributed across a period of 18 months, the estimated abundance represents a mean for that time period. Bootstrapping was initially applied to obtain reasonable (i.e., non-negative and finite) confidence interval limits. However, bootstrapped confidence intervals resulted in unrealistically large upper bounds, so confidence intervals based on asymptotic normality were constructed.

The mark-recapture estimates include the following assumptions: 100 percent PIT tag retention (i.e., no tag loss); mortality of tagged target suckers is the same as untagged target suckers; no emigration of tagged target suckers occurs from the reservoirs between the first and last survey; and trammel net set locations are representative of habitats used by suckers in the three reservoirs. Combining shortnose sucker, Lost River sucker, and potential hybrid sucker mark-recapture data also assumes that the trammel net catchability of these three categories of fish is the same.

An additional assumption is that each sucker species identification is correct. The field teams have collected genetic samples from all shortnose sucker, Lost River sucker, and potential hybrid suckers captured during the three survey efforts, and all target suckers were PIT-tagged. As noted above, once genetic assays are available, USFWS will decide whether the genetic samples provided by the Renewal Corporation will be used to confirm sucker genetics. If they are, reservoir mark-recapture population estimates could be further refined based on species genetic assignment of each fish in the dataset.

3.5.7.2 Results

The Renewal Corporation's population estimates suggest that the total number of adult listed suckers is highest in Copco No. 1 Reservoir, slightly less in J.C. Boyle Reservoir, and lowest in Iron Gate Reservoir (Table 3-13). The 95 percent confidence intervals suggest that there are several thousand adult suckers in Copco No. 1 Reservoir and J.C. Boyle Reservoir, and several hundred adult suckers in Iron Gate Reservoir. Based on sampling results, shortnose suckers are more abundant than Lost River suckers in J.C. Boyle Reservoir, and Lost River suckers are at low population levels in Copco No. 1 Reservoir and potentially absent from Iron Gate Reservoir. Due to the low number of recaptured suckers over the sampling effort, the 95 percent confidence intervals for the population estimates are large compared to the magnitude of the population estimate (i.e., confidence interval widths greater than ±100 percent of the population estimate for Copco No. 1 Reservoir and J.C. Boyle Reservoir).

Using the Chapman Method, the Renewal Corporation estimated 4,509 listed suckers in all three reservoirs. The bootstrap method yielded a mean estimate of 5,540 listed suckers and a 95% confidence maximum estimate of 11,531 listed suckers across the three reservoirs. The Jolly-Seber model estimated 2,201 listed suckers and a 95% confidence maximum estimate of 4,615 listed suckers across the three reservoirs.

Table 3-13. Population Estimate attributes and estimates for listed and potential hybrid suckers in the Lower Klamath Project reservoirs.

POPULATION ESTIMATE ATTRIBUTES	RESERVOIRS			
	J.C. BOYLE	COPCO NO. 1	IRON GATE	RESERVOIRS COMBINED
Total Maiden Suckers Captured (Fall 2018 through Spring 2020)	95	98	29	222
Total Target Suckers PIT-tagged and Available for Recapture (Fall 2018, Spring 2019, Fall 2019, Spring 2020)[1]	71	83	27	181
Total Tagged Suckers Recaptured (Fall 2018 through Spring 2020)	3	3	2	8
Recapture Efficiency (# Recaptured / # Tagged)	4.2%	3.6%	7.4%	4.4%
Chapman Method - Population Estimate	1,727	2,078	279	4,509
Bootstrap Method - Mean Population Estimate	2,766	3,371	399	5,540
Bootstrap Method - 95% Confidence Interval	±3,730	±4,508	±544	±5,991
Jolly-Seber Model - Mean Population Estimate	864	1,235	102	2,201
Jolly-Seber Model - 95% Confidence Interval	±951	±1,374	±89	±2,414

[1]: Although all target suckers captured on the final night of sampling at each reservoir were PIT-tagged, they were not available for subsequent recapture, and therefore, they were excluded from the total number of target suckers PIT-tagged and released for the mark-recapture estimate.

4.0 Action 2: Salvage and Translocation Plan

4.1 Purpose

The Renewal Corporation will undertake salvage and translocation measures to remove adult listed suckers from J.C. Boyle Reservoir prior to reservoir drawdown and dam removal to reduce project effects on listed suckers residing in the reservoir.

During the development of the sampling and salvage plan, the Renewal Corporation coordinated with the ATWG to develop aquatic resource plan components. The Renewal Corporation initially proposed salvaging 100 Lost River and 100 shortnose suckers from each of the three reservoirs for a total of 600 suckers (Klamath River Renewal Corporation 2017). With the sampling information presented in *Section 3 Action 1: Sampling Plan Methods and Results,* the Renewal Corporation now believes the original proposal is not feasible especially for Lost River suckers which are at low numbers in Copco No. 1 Reservoir and potentially absent from Iron Gate Reservoir.

Under this OR Suckers Plan, the Renewal Corporation will salvage suckers over a 14-day period including a total of 5 days on Copco No. 1 Reservoir, 2 days on Iron Gate Reservoir, and 7 days on J.C. Boyle Reservoir. Based on catch efficiencies from the sampling effort, the Renewal Corporation anticipates catching approximately 300 listed suckers from Copco No. 1 Reservoir and Iron Gate Reservoir and approximately 300 listed suckers from J.C. Boyle Reservoir. The 300 listed suckers equate to between 11 percent and 35 percent of the sucker mean population estimates calculated for J.C. Boyle Reservoir (see *Section 3.5.7 Sucker Population Estimate*). Salvage will continue for 7 days even if the 300-sucker estimate is exceeded. Salvaged suckers caught in J.C. Boyle Reservoir will be translocated to the Klamath National Fish Hatchery, the Klamath Tribes' sucker rearing facility. Other translocation sites may be used following consultation with the ARG and agreement between the Renewal Corporation, USFWS, CDFW and ODFW. If agreement is reached to use other translocation sites, the Renewal Corporation will file a report with the Commission within 14 calendar days that includes the location of the additional translocation site, the reasons for the additional translocation site, and documentation of consultation with USFWS, CDFW and ODFW.

4.2 Regulatory Compliance

This OR Suckers Plan supports compliance with the federal Endangered Species Act of 1973 and the Oregon Department of Environmental Quality 401 Water Quality Certification pertaining to the Lost River and shortnose suckers.

4.3 Salvage Period

The Renewal Corporation will perform sucker salvage and translocation in the spring or fall prior to reservoir drawdown.

During the spring, Lost River and shortnose suckers congregate in shallower habitats in advance of and during the spring spawning period. Initiation of the Lost River and shortnose sucker spawning runs in Upper Klamath Lake coincides with water temperatures approaching or exceeding 10 °C and 12 °C, respectively, in the Williamson River (Hewitt et al. 2017). A similar temperature-related spawning migration pattern was documented by Beak Consultants (1987) for shortnose suckers in Copco No. 1 Reservoir. In the Beak Consultants study, shortnose suckers began spawning when average water temperatures exceeded 12 °C on April 15, 1987. Spawning peaked between April 22 and April 30 and spawning ended approximately May 15, 1987 (Beak Consultants 1987). Therefore, a spring salvage period would be completed between mid-April and early May. The Renewal Corporation previously sampled J.C. Boyle Reservoir in late March 2019, and mid-May 2020 and captured the target species. These previous efforts likely bracketed the primary listed suckers spawning periods.

If sucker salvage and translocation cannot be performed in the spring for any reason, the Renewal Corporation will perform this measure in the fall prior to reservoir drawdown. A fall salvage period is less dependent on water temperature-related sucker behavior and habitat use, although suckers inhabited deeper habitats in a study conducted on Upper Klamath Lake (Reiser et al. 2001). A fall salvage period takes place after water temperatures decrease to less than 16 °C and reservoir microsystin levels decline to concentrations below human health

advisory levels. A fall salvage period would occur between late October and early November. The Renewal Corporation previously sampled J.C. Boyle Reservoir in early November 2018 and 2019 and captured the target species.

4.4 Salvage Locations

J.C. Boyle Reservoir salvage locations will correspond to the previous sampling locations and include shallower habitats associated with reservoir margins, and deeper habitats associated with the historical Klamath River channel. During a spring salvage, field crews would target the upper 0.25 miles of the J.C. Boyle Reservoir where the Klamath River joins the reservoir. Similar reservoir locations would be targeted in a fall salvage period.

4.5 Salvage Methods

The Renewal Corporation will employ similar methods for processing salvaged suckers as were used during the sucker sampling effort. The Renewal Corporation will use trammel nets and boat electrofishing. While the Renewal Corporation expects to fish primarily at night, it may also use boat electrofishing during the day if the Renewal Corporation thinks that day fishing will be effective based on its professional judgment and expertise. Two boats will each deploy four trammel nets in J.C. Boyle Reservoir. Fewer nets will be deployed in J.C. Boyle Reservoir compared to Copco No. 1 Reservoir and Iron Gate Reservoir due to the abundant bycatch in J.C. Boyle Reservoir. Additional trammel nets with larger mesh openings will also be used to reduce bycatch and make fishing for the listed suckers more efficient.

The Renewal Corporation will set trammel nets sequentially and fish the nets for 2-3 hours in previously sampled reservoir habitats. Four net sets will be completed per night depending on catch efficiency and bycatch. Electrofishing will focus on shallow reservoir areas and the upstream end of J.C. Boyle Reservoir. Tangle nets may also be used in riverine reaches if congregations of shortnose suckers are encountered during electrofishing. Captured Lost River and shortnose suckers will be identified to species and sex, measured, fin clipped, photographed, and PIT tagged. Each sucker will also be scanned to detect existing PIT tags. Salvaged suckers will be held in aerated live wells and periodically transferred to net pens near boat access sites where suckers will be held until transport. If a captured sucker is identified as a hybrid based on a visual inspection of its physical characteristics, it will be released back into the salvage reservoir.

The Renewal Corporation may also use tangle nets or a resistance board weir to salvage suckers from the upstream extent of J.C. Boyle Reservoir, or in flowing portions of the Klamath River at the head end of J.C. Boyle Reservoir.

The Renewal Corporation will acquire current information on water quality to better anticipate water quality conditions in J.C. Boyle Reservoir, the Klamath National Fish Hatchery, the Klamath Tribes' sucker rearing facility, Upper Klamath Lake, and Tule Lake Sump 1A as needed. The information will be used to understand water quality conditions in the salvage and translocation sites. Water quality constituents of interest include water temperature, dissolved oxygen, salinity concentrations, and pH levels. Acquiring this information in advance of the

salvage will be necessary to condition the water in the transport live well and to plan the acclimation period at the release locations.

4.6 Transport and Translocation Methods

The Renewal Corporation will remove suckers after the third day, fifth day, and seventh day of salvage, and transport them to the translocation sites. The Renewal Corporation will remove suckers from net pens and scan them for PIT tag identification prior to loading fish into aerated live wells (approximately 200-300 gallons) for transport. The Renewal Corporation will coordinate with USFWS, CDFW, ODFW, U.S. Bureau of Reclamation, the Klamath Tribes, and the Yurok Tribe to access transport vehicles. Large live wells will be fiberglass, steel, or polyethylene and will be sized to fit in the open bed of a standard pickup truck or on a trailer. Live wells will be baffled to limit sloshing during transport. The live well will be filled to 75% capacity (about 150 gallons) with J.C. Boyle Reservoir water in the vicinity of the net pens. Transported fish will be large (>300 mm) and care will be required to minimize overstocking the live well. Densities should be the equivalent of approximately 1 lb. of fish per gallon of water. Based on an average 3.0 lb. weight, no more than 50 suckers would be transported at one time. The transport density will be adjusted as conditions and sucker response dictate. The following methods will be used to prepare the transport tanks (USBR, 2008; USFWS, unpublished report).

- Live wells are to be disinfected using a Virkon (1.3 oz/gallon) solution or other approved disinfectant. Live wells are to be disinfected daily and thoroughly rinsed following disinfection.
- Water will be pumped from J.C. Boyle Reservoir into the live well using a portable pump. A handheld YSI meter will be used to measure water quality constituents including water temperature, dissolved oxygen, salinity, and pH prior to adding suckers to the live well. The live well will be refilled at J.C. Boyle Reservoir prior to each transport.
- Water temperature will be monitored in the live well during each day's initial transport runs. Water temperature will be monitored during subsequent transport runs as necessary. Water temperature in the live well should remain within 4 °C of the initial ambient water temperature during the transport. Water temperature will be modified by chillers or heaters.
- Dissolved oxygen concentrations will be monitored in the live well during each day's initial transport runs. Dissolved oxygen levels will be monitored during subsequent transport runs as necessary. Dissolved oxygen levels should be maintained at approximately 100 percent saturation. If needed, a portable aeration system will be installed to maintain dissolved oxygen levels at approximately 100 percent saturation.
- Salinity levels should be approximately 0.5%. Coarse ground sodium chloride will be added in small increments to the live well until a 0.5% salinity level is achieved.
- The Renewal Corporation field crews transporting the listed suckers will be attentive to the condition of the equipment throughout the transport process.
- To acclimate suckers at the receiving waterbody, reservoir water in the live well will be replaced with recipient waterbody water over the course of at least an hour.

Approximately a quarter to a half of the reservoir water will be drained from the live well and replaced with recipient waterbody water that will be pumped into the live well. Tempering the live well will be important for acclimating the suckers to the recipient waterbody's water quality constituents. Live well water will be drained away from translocation sites to avoid discharging salvage reservoir water directly to these sites. Other live well discharge strategies will be coordinated with USFWS. Water quality constituents should be consistently measured during the tempering process. USFWS suggests the target suckers can tolerate a 1 °C temperature change every 15 minutes and temperature changes should not exceed 4 °C per 15 minutes. Releasing fish into the recipient waterbody after dusk is recommended to maximize survival (M. Yost, USFWS, personal communication), although this may require additional personnel to achieve.

4.6.1 Translocation Sites

The Klamath National Fish Hatchery and the Klamath Tribes sucker rearing ponds will be the translocation sites for suckers salvaged from J.C. Boyle Reservoir. Other translocation sites may be used following consultation with the ARG and agreement between the Renewal Corporation, USFWS, CDFW and ODFW. If agreement is reached to use other translocation sites, the Renewal Corporation will file a report with the Commission within 14 calendar days that includes the location of the additional translocation site, the reasons for the additional translocation site, and documentation of consultation with USFWS, CDFW and ODFW.

Salvaged suckers will first be taken to the Klamath National Fish Hatchery where they will be isolated and receive an external parasite treatment before they are integrated into hatchery groups. The Klamath National Fish Hatchery has capacity for approximately 100 salvaged adult suckers. USFWS has requested a ratio between 60:40 and 70:30 shortnose suckers to Lost River suckers be provided to the hatchery, of which, half of the salvaged shortnose suckers originate in J.C. Boyle Reservoir and half originate in Copco No. 1 Reservoir and/or Iron Gate Reservoir. All Lost River suckers are anticipated to come from J.C. Boyle Reservoir as the species is in low numbers in Copco No. 1 and Iron Gate reservoirs. The Renewal Corporation therefore anticipates providing between 30 and 35 shortnose suckers and 30 to 40 Lost River suckers from J.C. Boyle Reservoir to the hatchery.

The Renewal Corporation will translocate salvaged Lost River and shortnose suckers exceeding the Klamath National Fish Hatchery's capacity to the Klamath Tribes' sucker rearing facility east of Chiloquin, Oregon. The Klamath Tribes' rearing facility currently includes two ponds and several more ponds are planned for development in 2021-2022. The capacity for adult salvaged suckers is unknown at this time, but the Klamath Tribes could provide capacity for up to 2,000 adult suckers. Suckers delivered to the Klamath Tribes' ponds will be placed in separate ponds including one pond for Lost River suckers, one pond for shortnose suckers, and one pond for suckers that are not easily identifiable. Translocated suckers will be genetically tested and fish health investigations may be conducted by the Klamath Tribes, ODFW, or USFWS before fish are released in the future. Rearing pond effluent will be discharged to a dry basin so that no pond effluent will discharge to the Sprague River. Delivered suckers will also receive an external parasite treatment before release into the rearing ponds. The Klamath Tribes anticipate holding

translocated suckers for up to three to five years before suckers are released either into Upper Klamath Lake or another location to be determined in the future.

4.6.2 Transport Route

Travel from J.C. Boyle Reservoir to the Klamath National Fish Hatchery is approximately 22 miles. Directions include traveling east on Highway 166 to Keno (6 miles), turning south on the Keno-Worden Road (7 miles), turning east on Township Road (8 miles), then traveling north on Lower Klamath Lake Road to Klamath National Fish Hatchery (1 mile).

Travel from J.C. Boyle Reservoir to the Klamath Tribes sucker rearing facility is approximately 50 miles. Directions include traveling east on Highway 66 to Highway 97 (15 miles), turning north on Highway 97 and continuing to Chiloquin (28.3 miles), continue east on the Sprague River Highway to the Klamath Tribes' sucker rearing facility (5.1 miles).

4.7 Reporting

The Renewal Corporation will process sucker salvage data including information on the salvaged and transported suckers and water quality constituents. Sucker genetic material will be linked to the individual unique PIT tag identification numbers. The Renewal Corporation will provide the USGS and the ARG with an electronic copy of the Microsoft Excel data workbook and photographs. The genetic material will be provided to USFWS. Summary reports will be submitted to the Commission, SWRCB and ODEQ, and copied to USGS and the ARG, within three months of completing the salvage. The Renewal Corporation's sucker salvage responsibilities end once suckers are released at the prescribed translocation sites. USFWS and ODFW will maintain management responsibilities for Lost River and shortnose suckers through and after the salvage effort.

4.8 Salvage Plan Summary

The Renewal Corporation completed four sampling efforts to gain a better understanding of current sucker demographics and population sizes in the project reservoirs.

The Renewal Corporation will conduct 7 days of salvage and translocation of listed suckers from J.C. Boyle Reservoir. Based on catch efficiencies from the sampling effort, the Renewal Corporation anticipates relocating approximately 300 listed suckers from J.C. Boyle Reservoir. The Renewal Corporation will continue to coordinate sucker salvage planning with USFWS, ODFW, and the Klamath Tribes.

5.0 References

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Appendix G

Consultation Record

Consultation Record

Aquatic Resources Management Plan			
Sub-Plan	**Agency**	**Date of Agency Plan Submittal**	**Agency Comments Received Date**
Spawning Habitat Availability Report and Plan	National Marine Fisheries Service	January 22, 2021 August 13, 2021	No Comments Received September 1, 2021
	United States Fish and Wildlife Service	January 22, 2021 August 13, 2021	February 5, 2021 September 8, 2021
	California Department of Fish and Wildlife	January 22, 2021 August 13, 2021	February 3, 2021/ April 23, 2021 September 8, 2021
	California Department of Water Resources	January 22, 2021 August 13, 2021	No Comments Received No Comments Received
	California State Water Resources Control Board	January 22, 2021 August 13, 2021	April 23, 2021` September 8, 2021
	Oregon Department of Fish and Wildlife	January 22, 2021 August 13, 2021	February 6, 2021 September 8, 2021
	Oregon Department of Environmental Quality	January 22, 2021 August 13, 2021	No Comments Received No Comments Received
	Yurok Tribe	January 22, 2021 August 13, 2021	No Comments Received No Comments Received
	Karuk Tribe	January 22, 2021 August 13, 2021	No Comments Received No Comments Received
	Klamath Tribe	August 13, 2021	No Comments Received
California AR-6 Adaptive Management Plan (Suckers)[1]	United States Fish and Wildlife Service	January 22, 2021 August 13, 2021	February 5, 2021 No Comments Received
	California State Water Resources Control Board	January 22, 2021 August 13, 2021	April 23, 2021 August 30, 2021
	California North Coast Regional Water Quality Control Board	January 22, 2021 August 13, 2021	No Comments Received No Comments Received
	California Department of Fish and Wildlife	January 22, 2021	February 5, 2021/ April 15, 2021

Aquatic Resources Management Plan			
Sub-Plan	**Agency**	**Date of Agency Plan Submittal**	**Agency Comments Received Date**
		August 13, 2021	No Comments Received
	California Department of Water Resources	January 22, 2021 August 13, 2021	No Comments Received No Comments Received
Oregon AR-6 Adaptive Management Plan (Suckers)[1]	United States Fish and Wildlife Service	January 22, 2021 August 13, 2021	No Comments Received No Comments Received
	Oregon Department of Fish and Wildlife	January 22, 2021 August 13, 2021	February 6, 2021 No Comments Received
	Oregon Department of Environmental Quality	January 22, 2021 August 13, 2021	No Comments Received No Comments Received
	Bureau of Land Management – Klamath Falls	February 12, 2021 August 13, 2021	April 15, 2021 No Comments Received
	Klamath Tribe	August 13, 2021	No Comments Received
Tributary-Mainstem Connectivity Plan	United States Fish and Wildlife Service	January 22, 2021 August 13, 2021	February 5, 2021 August 28, 2021
	National Marine Fisheries Service	January 22, 2021 August 13, 2021	February 4, 2021 No Comments Received
	California State Water Resources Control Board	January 22, 2021 August 13, 2021	No Comments Received August 30, 2021
	Bureau of Land Management – Klamath Falls	February 12, 2021 August 13, 2021	April 15, 2021 No Comments Received
	California Department of Fish and Wildlife	January 22, 2021 August 13, 2021	February 5, 2021 August 30, 2021
	California North Coast Regional Water Quality Control Board	January 22, 2021 August 13, 2021	No Comments Received No Comments Received
	California Department of Water Resources	January 22, 2021 August 13, 2021	No Comments Received No Comments Received
	Oregon Department of Fish and Wildlife	August 13, 2021	No Comments Received
	Oregon Department of Environmental Quality	January 22, 2021 August 13, 2021	No Comments Received No Comments Received

Aquatic Resources Management Plan			
Sub-Plan	**Agency**	**Date of Agency Plan Submittal**	**Agency Comments Received Date**
	Yurok Tribe	January 22, 2021 August 13, 2021	No Comments Received No Comments Received
	Karuk Tribe	January 22, 2021 August 13, 2021	No Comments Received No Comments Received
	Klamath Tribe	August 13, 2021	No Comments Received
Fish Presence Monitoring Plan	United States Fish and Wildlife Service	January 22, 2021 August 13, 2021	February 5, 2021 August 28, 2021
	National Marine Fisheries Service	January 22, 2021 August 13, 2021	February 11, 2021 August 25, 2021
	Bureau of Land Management – Klamath Falls	February 12, 2021 August 13, 2021	April 15, 2021 No Comments Received
	California State Water Resources Control Board	January 22, 2021 August 13, 2021	April 23, 2021 August 31, 2021
	California Department of Fish and Wildlife	January 22, 2021 August 13, 2021	February 5, 2021/ April 15, 2021 August 30, 2021
	California Department of Water Resources	January 22, 2021 August 13, 2021	No Comments Received No Comments Received
	California North Coast Regional Water Quality Control Board	January 22, 2021 August 13, 2021	No Comments Received No Comments Received
	Yurok Tribe	January 22, 2021 August 13, 2021	No Comments Received No Comments Received
	Karuk Tribe	January 22, 2021 August 13, 2021	No Comments Received No Comments Received
	Klamath Tribe	August 13, 2021	No Comments Received
Juvenile Salmonids and Pacific Lamprey Rescue and Relocation Plan	United States Fish and Wildlife Service	January 22, 2021 August 13, 2021	February 5, 2021 August 28, 2021
	National Marine Fisheries Service	January 22, 2021 August 13, 2021	No Comments Received No Comments Received

Aquatic Resources Management Plan			
Sub-Plan	**Agency**	**Date of Agency Plan Submittal**	**Agency Comments Received Date**
	California State Water Resources Control Board	January 22, 2021 August 13, 2021	April 23, 2021 August 30, 2021
	California Department of Fish and Wildlife	January 22, 2021 August 13, 2021	February 5, 2021/ April 15, 2021 August 30, 2021
	California North Coast Regional Water Quality Control Board	January 22, 2021 August 13, 2021	No Comments Received No Comments Received
	California Department of Water Resources	January 22, 2021 August 13, 2021	No Comments Received No Comments Received
	Yurok Tribe	January 22, 2021 August 13, 2021	No Comments Received No Comments Received
	Karuk Tribe	January 22, 2021 August 13, 2021	No Comments Received No Comments Received
	Klamath Tribe	August 13, 2021 August 13, 2021	No Comments Received

[1] The California and Oregon AR-6 Adaptive Management Plans – Suckers underwent a process of consultation with the United States Fish and Wildlife Service, California Department of Fish and Wildlife, Oregon Department of Fish and Wildlife, and the Klamath Tribes through a series of informal meetings during the development of the 2021 Biological Assessment from January through March 2021. Further consultation records for these documents can be found in the Biological Assessment (Renewal Corporation 2021).

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