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Lopez Water Project Habitat Conservation Plan

PREPARED FOR

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Acronyms and Abbreviations

Acronym/Abbreviation	Definition
°C	degrees Celsius
°F	degrees Fahrenheit
ABM	Agent-Based Model
AF	acre-feet
AFY	acre-feet per year
AG Creek	Arroyo Grande Creek
AMM	avoidance and minimization measure
AMP	Adaptive Management Program
BMI	benthic macroinvertebrate
BMP	best management practice
CCC	California Conservation Corp
CDFW	California Department of Fish and Wildlife
CDPR	California Department and Parks and Recreation
cfs	cubic feet per second
cm	centimeters
cm/s	centimeters per second
CNDDB	California Natural Diversity Database
CPI	Consumer Price Index
CRLF	California red-legged frog
CWA	Clean Water Act
District	San Luis Obispo County Flood Control and Water Conservation District
DO	dissolved oxygen
DOC	Department of Commerce
DOI	Department of the Interior
DPS	distinct population segment
DSOD	Department of Safety of Dams
EA	environmental assessment
eDNA	environmental DNA
EIR	environmental impact report
EIS	environmental impact statement
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
FEMA	Federal Emergency Management Agency
ft	feet
ft^2	square feet
FTE	full-time employee
GPCD	gallons per capita per day
HCP	habitat conservation plan
HCP Handbook	Habitat Conservation Planning and Incidental Take Permitting Handbook

Acronym/Abbreviation	Definition
IDRS	Interim Downstream Release Schedule
ITP	incidental take permit
ITS	incidental take statement
LDRP	Lopez Downstream Release Plan
LRRP	Low Reservoir Response Plan
mg/L	milligram per liter
mi	mile
mi^2	square mile
mm	millimeter
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
PAD	Passage Assessment Database
PCE	primary constituent element
RM	river mile
RPA	reasonable and prudent alternative
RWQCB	Regional Water Quality Control Board
SCCC	South-Central California Coast
SSC	Species of Special Concern
SLO	San Luis Obispo
SWPT	southwestern pond turtle
SWRCB	State Water Resources Control Board
TAC	Technical Advisory Committee
TVEC	Terra Verde Environmental Consulting
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UWMP	Urban Water Management Plan
WMP	Waterway Management Program
WOTUS	waters of the U.S.
WSCP	Water Shortage Contingency Plan
WSE	water surface elevation
WTP	water treatment plant

DISCLAIMER

The San Luis Obispo County Flood Control and Water Conservation District is submitting this draft Habitat Conservation Plan (HCP) pursuant to a Preliminary Injunction Order issued by the United States District Court for the Central District of California. County staff and consultants prepared the draft HCP in accordance with Endangered Species Act (ESA) Section 10(a)(2) to support applications to the National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS) (collectively, the Services) for incidental take permits. The draft HCP follows the requirements of ESA Section 10, relevant implementing regulations that are in effect as of the date of submittal, and the Services' guidance relevant to preparation of HCPs, including guidance stating the Services will not issue incidental take permits unless incidental take is reasonably certain to occur. This draft HCP is subject to change based on further review by the County and the Services, which may include revisions to, among other things, the list of species or areas covered by the plan, the approach to calculating incidental take, and the proposed conservation measures; therefore, the draft HCP, including any statements concerning the cause or likelihood of incidental take with respect to any species covered in the draft HCP, are preliminary, subject to change, and should not be construed as admissions of or conclusions drawn by the County.

In addition, the definition of "take" under the ESA does not include any reference to habitat. The Services have defined "harm" in the definition of "take" similarly. USFWS regulations define "harm" as "an act which actually kills or injures wildlife. Such an act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering." 50 C.F.R. § 17.3. Likewise, NMFS regulations define harm as: "an act which actually kills or injures fish or wildlife. Such an act may include significant habitat modification or degradation which actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including, breeding, spawning, rearing, migrating, feeding or sheltering." 50 C.F.R. § 222.102.

In April 2025, the Services issued a joint proposed rule to rescind their respective regulatory definitions of harm. In the preamble to their proposed rule, the Services note that, while the USFWS's "harm" definition was previously upheld by the U.S. Supreme Court *Babbitt* v. *Sweet Home Chapter of Communities for a Great Oregon,* 515 U.S. 687 (1995), that case was decided based on the Supreme Court's reliance on the *Chevron* doctrine, which required federal courts, in the context of reviewing the adequacy of a rule or regulation issued by a federal agency, to uphold a federal agency's interpretation of statutes it administers, so long as those interpretations are permissible. The preamble to USFWS and NMFS proposed rule to rescind the "harm" definitions further notes that the Supreme Court recently issued a decision to overturn the *Chevron* doctrine, and instructing that federal courts—rather than federal agencies—must be the arbiter of ambiguous statutes and must decide whether an agency's regulation matches the "single, best meaning of the statute" at issue. In the preamble to the proposed rule to rescind the "harm" definitions, the Services conclude the definitions "do not match the single, best meaning of the statute." 90 Fed. Reg. 16102 (April 17, 2025). The Services further explain that the existing definitions "are inconsistent with the structure of the ESA." *Id*. Quoting the dissent of Justice Scalia in *Babbitt* v. *Sweet Home Chapter of Communities for a Great Oregon*, the Services state harm should be construed to require an "affirmative act directed immediately and intentionally against a particular animal—not an act or omission that indirectly and accidentally causes injury to a population of animals."

To date, the Services have not disclosed to the District their current position(s) regarding the scope of the definition of "harm" under the ESA as it applies to the Covered Species. While the District has worked in good faith to prepare this Draft HCP without this information, it is indisputable that an understanding of the position of the Services regarding the scope of the definition of "harm" is an absolute prerequisite for preparation of an HCP that those agencies are willing to process. Without such a clear understanding and in light of the Preliminary Injunction Order issued by the United States District Court for the Central District of California, the District proceeded on the basis of the existing regulations and existing agency guidance even as the District acknowledges that this approach is inconsistent with the contemporary legal interpretation of the ESA and the term "harm" in the definition of "take" set forth by the Services.

EXECUTIVE SUMMARY

This multi-species habitat conservation plan (HCP) is based on an extensive and thoroughly researched examination of the existing conditions of the Arroyo Grande Creek (AG Creek) watershed. The San Luis Obispo County Flood Control and Water Conservation District (District) has carefully evaluated all available information to understand the factors that are limiting the abundance and resiliency of two Endangered Species Act (ESA)-listed species, the South-Central California Coast Steelhead Distinct Population Segment (SCCC DPS) and the California red-legged frog (CRLF), and the southwestern pond turtle (SWPT) which has been proposed for listing under the ESA as a threatened species (collectively, the Covered Species). The District has used the best available scientific information to carefully evaluate the ways in which the Lopez Water Project operations and other County infrastructure and activities may impact and benefit these populations under existing conditions. Operations of the Lopez Water Project and other County infrastructure consistent with the Interim Downstream Release Schedule (IDRS) serve as the baseline against which the take and conservation measures of this HCP are measured. Notably, the baseline includes Lopez Dam, which was constructed in the late 1960s before enactment of the ESA and which was the subject of ESA Section 7 interagency consultation in the early 2000s that analyzed the effects of the dam's existence as of that time and into the future.

Accordingly, the District has developed a comprehensive and bold HCP that proposes a 30-year program to substantially improve habitat conditions to encourage increased abundance, productivity, spatial distribution, and diversity of these populations. Additionally, this HCP includes a pathway to achieve an experimental assisted migration program for steelhead at Lopez Dam, which has the potential to substantially increase the habitat available to SCCC DPS. Based on the potential of reconnecting anadromous *Oncorhynchus mykiss* (*O. mykiss)* to high quality spawning and rearing habitat, the National Marine Fisheries Service's (NMFS) Multispecies Recovery Plan (2013) identified the passage of adult steelhead upstream of Lopez Dam as a priority action to support the recovery of SCCC steelhead. For this reason, and as demonstrated in the HCP, the District is committed to exploring the ecological costs and benefits of alternative fish-passage strategies at Lopez Dam. Further, the program includes substantial measures to ensure connectivity and suitability of the habitat downstream of Lopez Dam. This includes improved flows to increase adult and smolt migration opportunities, addressing fish passage obstacles, improved flows to increase rearing suitability for juveniles, and gravel augmentation to increase spawning and rearing habitat. In addition to the measures addressing steelhead, highlights of the conservation program for the other Covered Species include habitat restoration, invasive species control, and an adaptive management framework informed by comprehensive research and monitoring to ensure the efficient use of resources to optimize the benefits for the Covered Species and their habitats and to address the uncertainty inherent in a long-term comprehensive conservation program.

Cognizant of this uncertainty, a sensitivity analysis was used to evaluate those components of the conservation program that have the least predictable outcomes or most significant gaps in knowledge. Key uncertainties include ideal flows to support fish passage while ensuring the District can carry out its obligation to provide water to its users, gravel augmentation volume and composition, and the response of Covered Species to the program. This assessment informed the extensive monitoring and adaptive management program (AMP) contemplated in the HCP and will contribute to the conservation of the Covered Species throughout the life of the HCP.

1 INTRODUCTION

The San Luis Obispo County Flood Control and Water Conservation District (District) was established in 1945 by the San Luis Obispo County Flood Control and Water Conservation District Act, with the County Board of Supervisors as the ultimate governing authority for the District. The District's Zone 3 funds the operations of Lopez Lake and Dam, Lopez Terminal Reservoir, Lopez Water Treatment Plant and Distribution System (collectively, the Lopez Water Project). The Lopez Water Project enables the District, as a wholesale supplier, to provide the primary domestic water supply to a population of approximately 50,000 residents within the communities of Arroyo Grande, Pismo Beach, Grover Beach, Oceano Community Services District, and County Service Area 12 (which includes Avila Beach Community Services District) (Zone 3 agencies), providing sustenance, public health, safety and welfare, and supplementing the local groundwater supply for the established agricultural uses in the watershed.

The District prepared this Habitat Conservation Plan (HCP) in accordance with Endangered Species Act (ESA) Section 10(a)(2) to support applications for incidental take permits (ITP). The HCP covers the threatened South-Central California Coast distinct population segment (DPS) of steelhead (*Oncorhynchus mykiss [O. mykiss]*) (SCCC DPS) under the jurisdiction of the National Marine Fisheries Service (NMFS), and the threatened California red-legged frog (CRLF, *Rana draytonii*) and proposed threatened southwestern pond turtle (SWPT, *Actinemys marmorata*) under the jurisdiction of the U.S. Fish and Wildlife Service (USFWS). The District anticipates that incidental take of SCCC DPS, CRLF, and SWPT (collectively, the Covered Species) may occur in connection with activities associated with the District's operation of the Lopez Water Project and other San Luis Obispo (SLO) County infrastructure along Arroyo Grande Creek (AG Creek), which are more fully described in Section 4 of the HCP and certain of the conservation measures described in Section 5 (collectively, the Covered Activities).

The HCP is designed to respond to the District's dual stewardship responsibilities for the AG Creek ecosystem and for the Lopez Water Project and to meet the statutory requirements of the ESA. The HCP is designed to protect and improve aquatic habitat of AG Creek for the Covered Species while ensuring the District may continue to manage municipal and agricultural water supply in accordance with its statutory mandates.

To fully understand the historical and legal context of the requested take and of the conservation program set forth in this HCP on the Covered Species, it is important to consider and define several key points in time:

Pre-dam Condition. The Pre-dam Condition is the condition of the Plan area in the decades that preceded the construction of Lopez Dam and Reservoir. Construction of Lopez Dam occurred in 1967–1968, several years prior to the enactment of the ESA (1973) and decades prior to the listing of the SCCC DPS (1997) and CRLF (1996). The Pre-dam Condition is germane to understanding the historical context within which the Covered Species existed historically within the Plan Area. The Pre-Dam condition is also important for understanding the benefits of certain conservation measures relative to the current status of the SCCC DPS by addressing historical stressors that would improve conditions for the local population and the DPS as a whole. While the Pre-Dam condition broadly informs the conservation program, it is not the baseline for this HCP.

Existing Conditions. The Existing Conditions are the condition of the Plan Area following completion of Lopez Dam and Reservoir and as it existed prior to the U.S. District Court for the Central District of California's issuance of a preliminary injunction in connection with Dam operations on December 9, 2024, which, among other things, required the District to alter operation of the Lopez Water Project by changing flow releases from Lopez Dam for the benefit of the SCCC DPS. The Existing Conditions include operation of the Lopez Water Project consistent with the Interim Downstream Release Schedule (or IDRS) and serves as the environmental baseline against which the requested take and conservation measures of this HCP are measured.

Temporary Court-Ordered Operations. Beginning on January 15, 2025, the District altered operation of the Lopez Water Project by implementing the Final Lopez Dam Flow Release Plan on an interim basis as required by the U.S. District Court for the Central District of California's Preliminary Injunction Order issued on December 9, 2024. The County appealed that order, and the appeal is presently pending. The Final Lopez Dam Flow Release Plan, which is only intended to be in place during the pendency of the action in federal court and then only if the Preliminary Injunction Order is upheld on appeal, is not included in the baseline.

The components of the Pre-Dam Condition and Existing Condition are described in greater detail below.

1.1 Pre-dam Conditions

The AG Creek watershed encompasses more than 150 square miles (mi^2) of coastal watershed in the west-central portion of SLO County. The AG Creek watershed is one of numerous watersheds along the central California coast that historically has supported runs of SCCC steelhead. AG Creek and its tributaries are an important regional waterway that has been altered since the late 1950s for flood control, water supply, and groundwater recharge purposes. The lower reaches of the watershed are primarily privately owned and have been substantially modified by agricultural and urban development. Prior to construction of the Dam, the natural flows of the lower AG Creek watershed (the portion now below the Dam) varied greatly, with flashy high flows during the rainy season in response to rainfall events, followed by very low flows (or no flows) in the summer and other dry periods. Historical records demonstrate that before construction of the Dam and Reservoir, streamflow in reaches of AG Creek would seasonally cease, with the lower sections going dry in the summer during most years. The now leveed 3-mile (mi) stretch of lower AG Creek before it reaches Arroyo Grande Lagoon was ephemeral, frequently drying out in the summer.

Prior to construction of Lopez Dam, AG Creek was intermittent during summer and early fall, likely resulting in stretches of the creek (downstream of the present Lopez Dam) running dry for weeks or months in most years (CCSE 2005). In April, although storm events were generally small, they resulted in greater flows due to the presence of substantial groundwater and subsurface flows; by May, however, storms had little effect on flow (CCSE 2005). Early winter storms tended to be flashy and generally did not have a large effect on flows because substantial precipitation must first saturate the soil (CCSE 2005), and winter peak flows on AG Creek were closely related to the duration and magnitude of storm events (SHG 2004, Stillwater Sciences 2022a).

Precipitation in AG Creek watershed typically occurs during December through April, and streamflow follows this trend with 81% of the annual Arroyo Grande streamflow occurring between December and April at the Lopez Dam site (Western Hydrologics 2021). It is thought that unimpaired[1] flow at the Lopez Dam location is highest in February and March (58–64 cfs) and typically lowest June through December (4–17 cfs, Western Hydrologics 2021). At the Arroyo Grande stream gage, located on AG Creek about 0.7 mi upstream of Hwy 101, unimpaired annual flows are similar to those occurring at Lopez Dam. The months of greatest unimpaired flows at the Arroyo Grande stream gage are typically March and April (63–66 cfs) and lowest June through December (3–15 cfs, Western Hydrologics 2021).

Historically, the lower section of AG Creek, which flows over a deep alluvial valley, likely went dry in the summer during most years, while the upper sections of AG Creek (upstream of present day Lopez Reservoir) and its tributaries remained wet and provided important habitat for steelhead (Stetson Engineers et al. 2004). Therefore, it is likely that a majority of AG Creek downstream of Lopez Dam was historically used by steelhead for juvenile rearing and as a migratory corridor for steelhead during winter and spring but did not provide juvenile summer rearing habitat. This is also supported by Boughton and Goslin (2006), which concluded that steelhead over summering habitat has a low intrinsic potential to occur downstream of approximately RM 10 (downstream of the Water Treatment Plant [WTP]) under historical unimpaired conditions (i.e., no water diversions, no agriculture, no dam, etc.).

Construction of Lopez Dam and Reservoir began in 1967 by the SLO County Flood Control and Water Conservation District, with completion of the project occurring in 1968. The Dam and Reservoir are located at the confluence of AG Creek and Lopez Creek, approximately 13 miles upstream from the mouth of AG Creek and six miles upstream from the community of Arroyo Grande. Approximately 67 mi^2 of the AG Creek watershed are located above the Dam, while 86 mi^2 are located downstream.

1.2 Existing Conditions

Following the completion of the Dam and Reservoir in 1968, the lower reach of AG Creek has seen an increase in summer flows and a decrease in winter flows compared to Pre-dam Conditions. Aside from the Dam, AG Creek is subject to a number of natural and man-made processes that play a material role in the hydrology and water quality of AG Creek, including annual rainfall, private pumping activities, private in-stream diversions, private agricultural and industrial runoff, and natural habitat-altering activity by other species in the watershed, such as beavers.

While streamflow in stretches of AG Creek can be reduced during winter months by Dam operations, it is also augmented by releases from Reservoir storage in the summer, allowing summer flow to be maintained at a higher and more stable rate than if Lopez Dam were not present. The approximately three-mile stretch of lower AG Creek before it reaches Arroyo Grande Lagoon is still considered ephemeral and frequently dries out in the summer, similar to the Pre-dam Condition.

The rest of this Section 1.2 describes the Lopez Water Project and other County infrastructure and activities under Existing Conditions, while Section 3 describes the status of the Covered Species under Existing Conditions.

[1] Flows that would have occurred without Lopez Dam based on hydrological modeling (Western Hydrologics 2021).

1.2.1 Lopez Water Project Setting

Lopez Dam, constructed from 1967–1968, was built by the District prior to the passage of the ESA. Lopez Dam is an impassable barrier for SCCC steelhead precluding access to the upper watershed; SCCC steelhead are restricted to the reach of AG Creek from the dam to the Pacific Ocean, a distance of about 13 miles. The Lopez Dam and resulting changes in instream flows downstream from Lopez Water Project operations have contributed to instream habitat alteration including reduction of natural sediment disposition and regulation of instream flows, affecting habitat for SCCC steelhead, CRLF, and SWPT.

1.2.2 Lopez Dam and Reservoir

Lopez Dam and Reservoir were constructed at the confluence of Arroyo Grande and Lopez Creeks, approximately six miles upstream from the community of Arroyo Grande. The District operates the Lopez Water Project, located on AG Creek (Figure 1-1). Lopez Reservoir supplies water for agriculture and municipal water needs for the Zone 3 agencies. The reservoir also provides recreational opportunities including boating, water-skiing, and fishing. Lopez Dam is an earthfill structure constructed in 1967–68. Its crest width is 160 feet (ft) at an elevation of 537 ft, crest length is 1,120 ft, and height is 167 ft from crest of dam to the downstream toe. The dam was constructed with an intake control structure consisting of seven intakes spaced 15 ft apart to allow for optimal water quality to be utilized for downstream use (Figure 1-2).

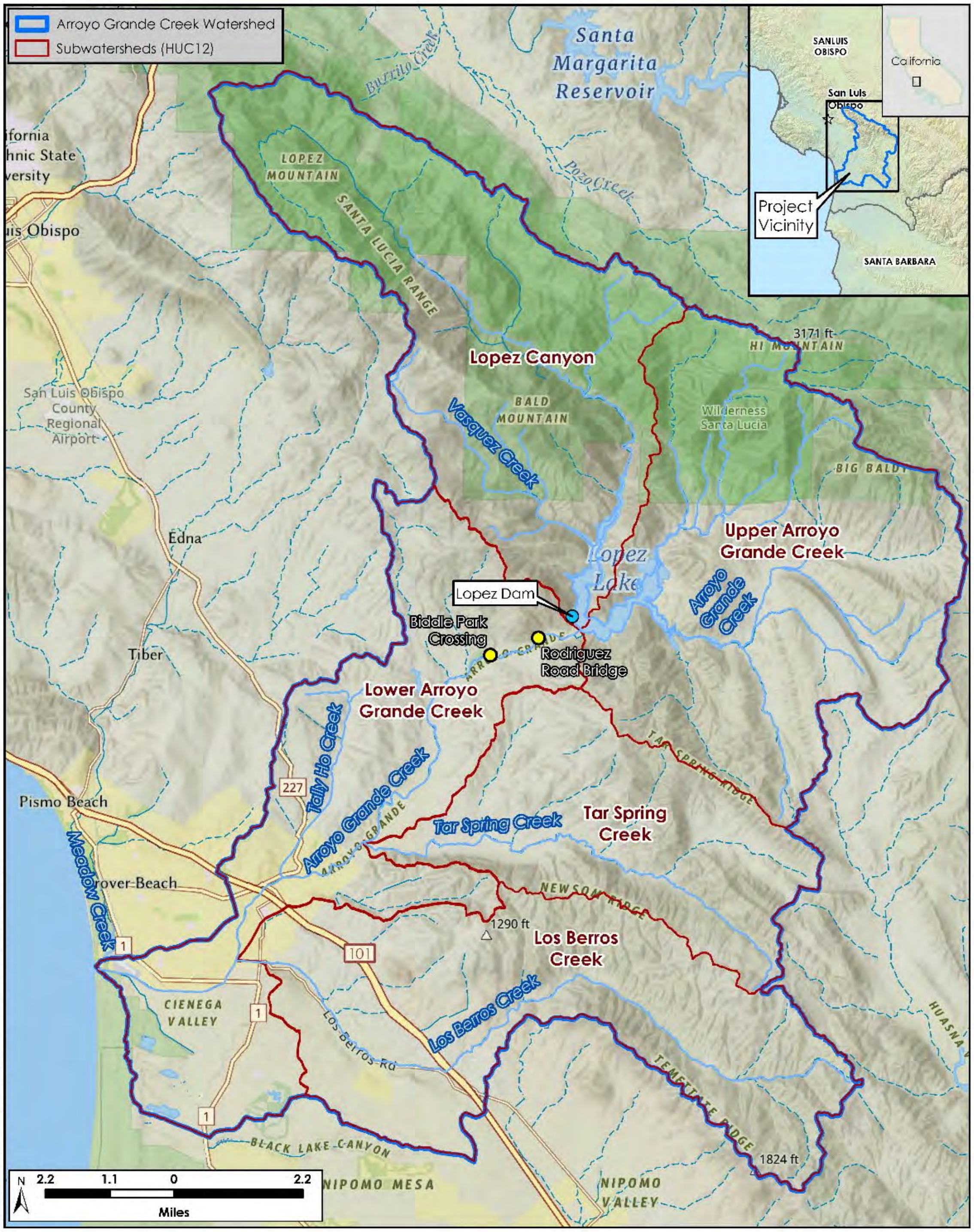

Figure 1-1. Arroyo Grande Creek and Watershed.

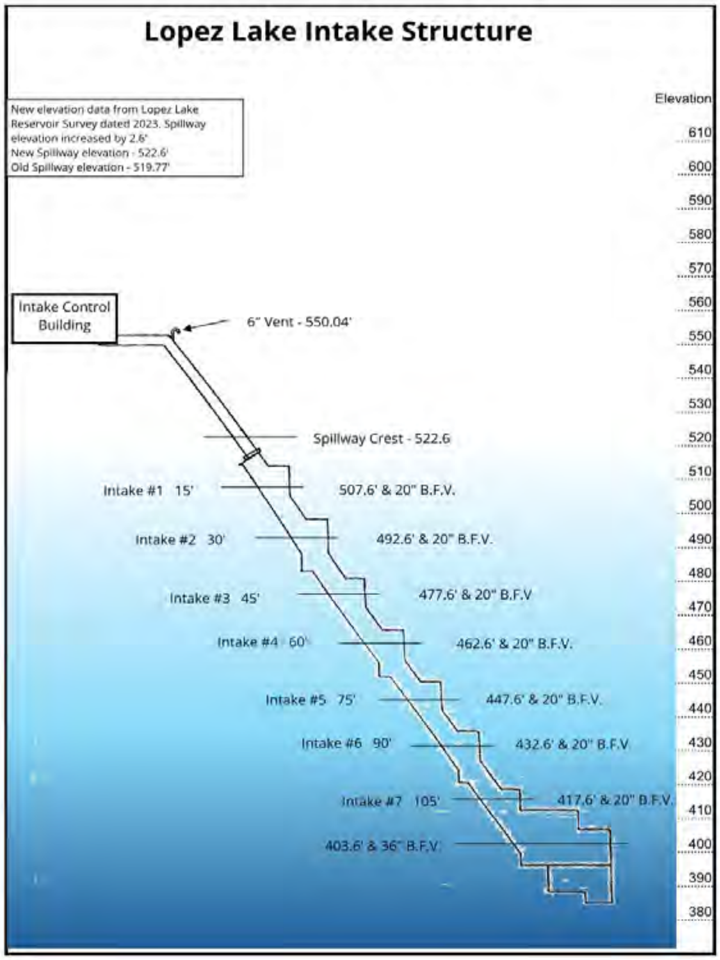

Figure 1-2. Lopez Lake Intake Structure.

The intake control structure is connected to the Outlet Control building via a 42-inch cement mortar lined concrete pipe. The Outlet Control Building (Figure 1-3) diverts water to three locations; AG Creek, the Lopez frog ponds project[2], and the WTP. The 10-inch Jet Valves and the 42-inch Knife Gate Valve (42-inch emergency release valve) are capable of releasing allowable discharge rates summarized in Table 1-1.

Table 1-1. Outlet works discharge rates.

Valve Type	Quantity	Allowable Discharge Rate
42-inch Knife Gate Valve	1	100 cfs[1]
10-inch Jet Flow Gate Valve	2	10 cfs (each)

[1] Total combined flow between municipal deliveries and environmental releases shall not exceed 100 cfs

[2] In 2003, the Lopez frog ponds project was constructed by the District as mitigation for the Lopez Dam seismic retrofit project at the base of the Lopez Dam. The purpose of the Lopez frog ponds project is to provide California red-legged frog habitat, and it is operated to keep bullfrogs from reproducing in the ponds by draining them each fall.

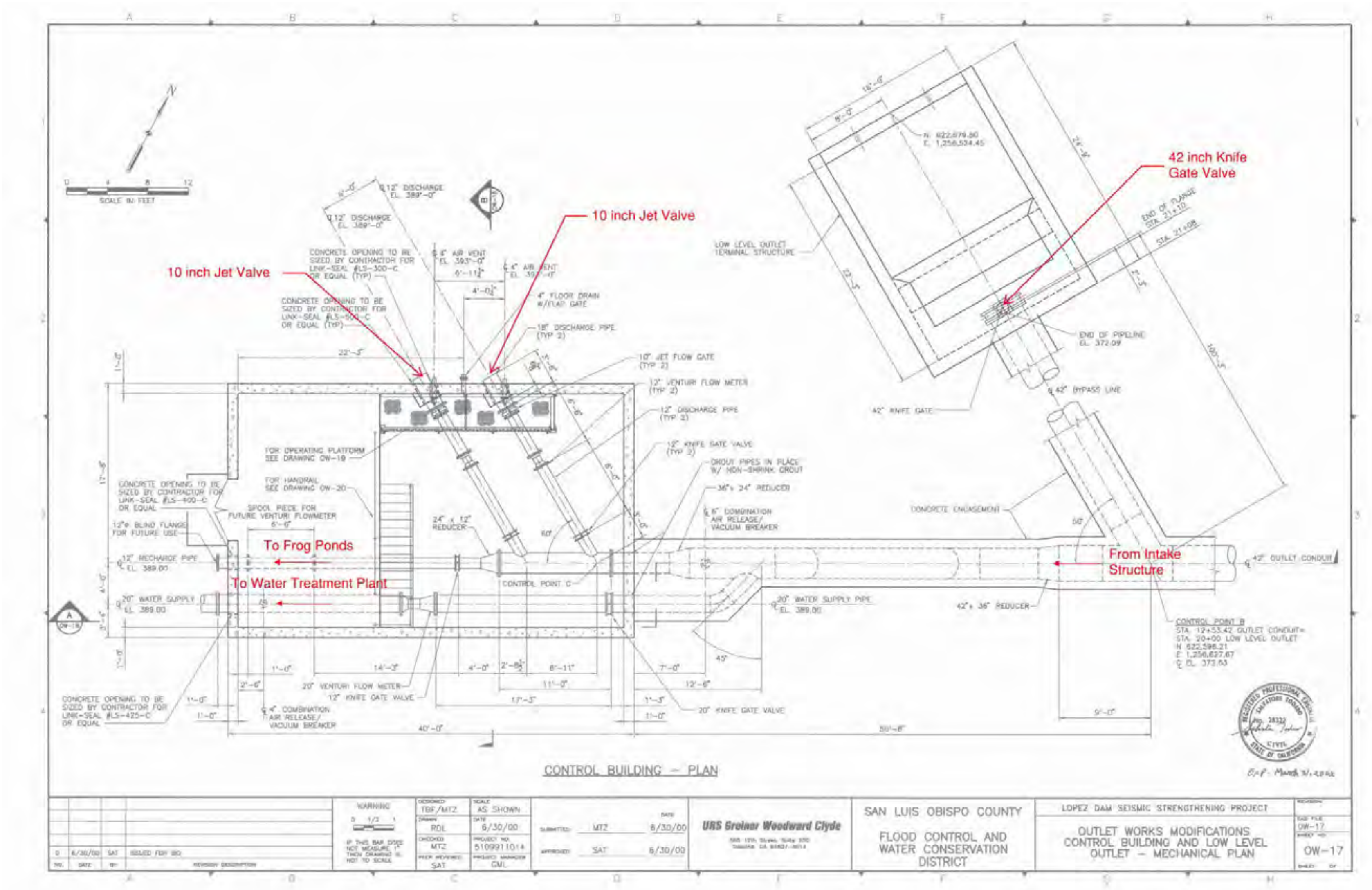

Figure 1-3. Outlet Control Building and Low-Level Outlet.

The storage capacity of Lopez Reservoir is 49,476 acre-feet (AF), lower than its original 1969 estimated capacity of 50,000 AF due to improved survey methodology and siltation over time (Bathymetric Survey 2024). An earthquake retrofit of the dam was completed in 2002 to prevent failure of the earthen dam in the event of a major seismic event.

Water from the reservoir supplies flows to AG Creek by uncontrolled spill at the dam spillway and/or controlled releases through the outlet works. For controlled releases, water leaves the reservoir via the intake structure and is released through the outlet works located at the left abutment of the dam; the intake structure is comprised of seven gates spaced every 15 ft, at elevations 415–505 ft. Water is then released to AG Creek through one of two 10in jet valves at the outlet control building. The maximum discharge capacity to AG Creek via the outlet control building is 100 cubic feet per second (cfs) although water is generally released at 10 cfs or less. Water for municipal use is separately released to the Terminal Reservoir and WTP without entering AG Creek.

1.2.3 Terminal Reservoir and Water Treatment Plant

Municipal water use is satisfied by transporting water from the Lopez Reservoir located above the 100-year floodplain, via a 17,000-ft long 20-inch diameter pipeline running from the dam outlet works to the Terminal Reservoir along Lopez Drive. A 204-ft section of the pipeline is encased in concrete and goes subsurface below AG Creek before reaching the Terminal Reservoir. There is an 18-inch diameter pipe that forks from the main 20-inch pipeline at about 295 ft elevation, which provides the option of bypassing the Terminal Reservoir to the WTP. The Terminal Reservoir (capacity: 844 AF, area: 37 acres, maximum depth: 30 ft) is adjacent to the WTP, where the water is treated. The finished water from the WTP is sent to a large clearwell reservoir (2.25 million gallons), where it is stored and then gravity to fed to a 22-mile transmission pipeline that delivers drinking water supply to the Zone 3 agencies via individual metered turnouts.

Water stored at the Lopez Terminal Reservoir is held for Division of Drinking Water regulation residence time requirements and subsequently treated onsite at the Lopez WTP before being delivered to Zone 3 agencies. The Terminal Reservoir level is controlled by a diversion valve which directs water from Lopez Reservoir into the Terminal Reservoir. The level of the reservoir is closely monitored and controlled by the WTP based on municipal demand. Any excess water directed to the Terminal Reservoir would overflow into AG Creek via the Terminal Reservoir spillway, although this has not happened yet to date. This would only occur due to a faulty valve or gage which has only happened once in the life of the Terminal Reservoir and no excess water was directed to the Terminal Reservoir during this occurrence. The Terminal Reservoir has a perimeter channel (concrete-lined) around the Terminal Reservoir that catches surface runoff and requires routine maintenance (described in Section 4.3 *Maintenance Operations*).

1.2.4 Discharge to Arroyo Grande Creek

Downstream releases from Lopez Dam are used to maintain environmental flows within AG Creek throughout the year to maintain natural seasonal variability in AG Creek for habitat and wildlife purposes and provide groundwater recharge for irrigated crop production. Water from the reservoir enters AG Creek either via controlled releases from the outlet works or from uncontrolled spill down the spillway. The outlet works discharge into an approximately 100-ft long pool, and from there water flows into a 250-ft long man-made channel before passing through culverts under a roadway and into the creek. The concrete spillway channels flow down the dam face. The end of the spillway contains large boulders set in concrete slurry for energy dissipation and a pool approximately 190 ft long and 3–4 ft deep. From there, the creek extends about 1,280 ft to a gravel pit pool (~1,770 ft long and 4–5 ft deep) (Alley et al. 1997). The gravel pits are man-made, and material was taken from them to construct the dam.

1.2.5 County Infrastructure Downstream of Lopez Dam and Within the Plan Area

The County maintains infrastructure downstream of Lopez Dam that is within the Plan Area, including, but not limited to, Rodriguez Bridge and Biddle Park Culvert (Figure 1-1). Rodriguez Bridge provides access to the outlet control structure located at the base of Lopez Dam. The bridge is maintained by the County which includes periodic inspections, road surface repairs, and structural repairs as needed. The pipeline connecting the dam to the WTP crosses AG Creek at Rodriguez Bridge and the site was remediated in 2013 to repair the pipeline crossing and improve fish passage. The Biddle Park culverts were damaged in 1998 due to severe storms. They were replaced in accordance with NMFS recommendations and have been maintained by the County to clear any blockages pre or post storms.

1.3 Previous Federal Action Relating to Lopez Water Project

Since completion of the Lopez Water Project, multiple ESA authorizations, including incidental take authority, have been approved that cover aspects of Lopez Dam, releases from the Dam, and County actions downstream of the Dam. The following sections briefly describe those authorizations.

1.3.1 Biddle Park Project

In 1998, the County obtained certain authorizations necessary to replace a culvert crossing AG Creek at Biddle Park, including a permit issued by the U.S. Army Corps of Engineers (USACE) pursuant to Section 404 of the Clean Water Act (Section 404). In compliance with Section 7 of the ESA, the Corps engaged in formal consultation with NMFS and USFWS.

On October 6, 1998, USFWS issued its biological opinion, finding that the project would not jeopardize the CRLF, as well as an incidental take statement (ITS), authorizing incidental take of the CRLF that could occur in connection with project activities. [U.S. Fish and Wildlife Service, Biological Opinion for Fifteen Projects in SLO County, California Involving Bridge and Bank Repair and Road and Waterline Construction Across Creeks and One Project in Santa Barbara County, California Involving Seismic Retrofit of a Bridge (Oct. 6, 1998).] In its ITS, USFWS identified specific measures the County was required to implement in order to minimize project impacts on the species.

On October 19, 1998, NMFS issued its biological opinion, concluding that the project would not jeopardize the SCCC DPS. NMFS also issued an ITS, authorizing incidental take of SCCC DPS in connection with project activities so long as the County implemented certain measures to minimize the impact of take on the species. [National Marine Fisheries Service, Biological Opinion: Issuance of Permit for Stream Diversion and Road Crossing Repair (Oct. 19, 1998).] In its biological opinion, NMFS noted factors adversely affecting the SCCC DPS in AG Creek included “alteration or modification of streamflow and instream habitat, passage barriers, agricultural activities, urbanization, poor water quality, and sedimentation…”

In connection with its review of the Biddle Park project, NMFS suggested design changes to better accommodate fish passage, including the removal of two existing pipes, relocation of the new pipes and the addition of a large quantity of fill, as well as minor modifications to the elevation of the new pipes. These revisions were approved by the Federal Emergency Management Agency (FEMA) and the Corps. [Office Memorandum from Ernie Del Rio, SLO County, to Ralph Cass (March 24, 1999).]

The Biddle Park project was constructed by the County during the in-water-work periods of 1998 and 1999.

1.3.2 Lopez Dam Seismic Remediation Project

In 2001, the District obtained authorizations to complete the Lopez Dam seismic remediation project, including changes to the Dam and outlet works. The Division of Safety of Dams within the California Department of Water Resources required the District to undertake the project in order to operate the Lopez Reservoir to capacity. In connection with the required seismic remediation activities, the District obtained a permit from the Corps under Section 404 on June 18, 2001. Pursuant to ESA Section 7, the Corps engaged in formal consultation with USFWS and NMFS.

On March 20, 2001, USFWS issued a non-jeopardy biological opinion and ITS regarding potential impacts of the project on CRLF. In October 2000, an *Addendum to the Biological Assessment for Lopez Dam Remediation Project Effects on California Red-Legged Frog* was issued to address the critical habitat proposed within the project area. The addendum established steps to avoid, minimize, and mitigate any adverse impacts to CRLF critical habitat.

On March 28, 2001, NMFS issued a non-jeopardy biological opinion and ITS, which contemplated both the impacts of the seismic remediation project itself and "the potential implications of extending the existing effects of the dam on [SCCC DPS] and critical habitat into the future." [National Marine Fisheries Service, Biological Opinion: Permit Lopez Dam Seismic Remediation (Corps File No. 00937-TW) (Mar. 28, 2001).] In the ITS, NMFS anticipated incidental take of no more than 100 juvenile SCCC DPS and no more than one adult associated with the remediation activities; however, NMFS stated that the ITS did not authorize take of steelhead associated with dam operations generally. The biological opinion determined that the seismic remediation project would not result in jeopardy to the South-Central California Coast DPS steelhead or cause destruction or adverse modification of designated critical habitat.

On October 15, 2002, NMFS issued a revised biological opinion and ITS based on changes in circumstances in connection with the project that necessitated the Corps to reinitiate consultation. Among other things, the revised biological opinion and ITS required the District to implement a plan to restore steelhead access to a minimum of seven miles of historical spawning and rearing habitat within SLO County.

1.3.3 Rodriguez Bridge Project

In 2012, the District obtained various authorizations to complete the Rodriguez Bridge Project where the bridge crossed AG Creek. The project was intended to stabilize a Lopez water pipeline and eliminate the potential for the pipeline to impede passage of SCCC DPS in low to moderate flow conditions. [National Marine Fisheries Service, Biological Opinion: Permit construction of a roughened channel in AG Creek to protect existing water pipeline in SLO County, California (June 6, 2012).] Among the authorizations was a permit issued by the Corps under Section 404 and related biological opinions issued by USFWS and NMFS pursuant to ESA Section 7.

On May 9, 2012, USFWS issued a biological opinion and ITS, finding that the project would not jeopardize the least Bell's vireo or CRLF. On June 6, 2012, NMFS issued a biological opinion and ITS addressing impacts on SCCC DPS in connection with the construction of a roughened channel in AG Creek downstream of the Rodriquez Bridge, which required altering the current streambed elevation to eliminate the existing vertical drop of approximately three ft at the water pipeline. The biological opinion anticipated that these activities would result in incidental take, but that the take would not result in jeopardy to the species. In connection with the project, the District agreed to create pools downstream of the pipeline to provide resting areas for SCCC DPS, along with other measures benefitting the species. While the action area analyzed by the biological opinion does not include Lopez Dam, the Dam is discussed by NMFS in various places within the biological opinion, including a detailed discussion of how the dam and releases from Lopez Reservoir affect the SCCC DPS in Section III(B)(2) (Status of Species and Critical Habitat) and Section IV (Environmental Baseline) of the biological opinion and how the Rodriguez Bridge project included design elements to support fish passage that took into account the impacts of Lopez Dam on hydrology and sediment continuity (Section VI: Effects on Steelhead). In its section integrating the conditions described in the Environmental Baseline with the effects of the Rodriguez Bridge project and cumulative effects, NMFS noted it considers AG Creek a semi-perennial creek due to "regulated flows by Lopez Dam."

1.3.4 Waterway Management Program

Around 2005, the District began planning its AG Creek Channel Waterway Management Program (WMP). The WMP is a set of actions designed to restore the capacity of the leveed lower three miles of AG Creek Flood Control Channel and the Los Berros Creek Diversion Channel to provide flood protection while enhancing water quality and sensitive species habitat within the managed channel. The District initiated environmental review of the WMP under the California Environmental Quality Act in 2008 and issued an Environmental Impact Report for the WMP in 2010.

Among the authorizations required in connection with the WMP was a permit issued by the Corps under Section 404. The Corps issued its Section 404 permit on April 29, 2019, following completion of formal consultation with USFWS and NMFS under ESA Section 7 described below.

On May 21, 2015, USFWS issued a biological opinion analyzing the effects of the WMP on CRLF and the tidewater goby and finding that the proposed project would not jeopardize those species. USFWS also issued an ITS for both species. In July 2016, NMFS determined that, as proposed, the project was likely to destroy or adversely modify critical habitat for the SCCC DPS. As a result, NMFS issued a preliminary draft of the agency's proposed reasonable and prudent alternative (RPA) to the action that would avoid jeopardy to the SCCC DPS and destruction or adverse modification of its designated critical habitat. Following issuance of the preliminary draft RPA, the Corps and District collaborated with NMFS to refine the RPA as well as certain reasonable and prudent measures, which were ultimately incorporated into NMFS' biological opinion, issued on November 27, 2017. In the 2017 biological opinion, NMFS found that implementation of the RPA would not jeopardize the SCCC DPS or destroy or adversely modify designated critical habitat. Effects of Lopez Dam, Lopez Reservoir, and releases from the same were addressed in Section 2.3 (Environmental Baseline), particularly in Section 2.3.3 (Influence of Lopez Dam on Critical Habitat), while Section 2.8.1 (Consistency of the Reasonable and Prudent Alternative with Regulations Implementing Section 7 of the ESA) states that the RPA "assumes water releases from Lopez Dam will follow current schedules" and that the RPA nevertheless is expected to "be effective in providing improved habitat conditions in the action area" and will avoid causing jeopardy to the SCCC DPS or destruction or adverse modification of its critical habitat "despite current water-release practices at Lopez Dam."

Since the issuance of the Section 404 permit and conclusion of formal consultation and issuance of the biological opinions and ITSs from USFWS and NMFS, the District has continued to work with the federal wildlife agencies to ensure adherence to the RPAs and reasonable and prudent measures. On August 18, 2023, the District requested the Corps amend the Section 404 permit for the WMP to include additional activities, including sediment removal in two additional locations, to excavate accumulated sediment to realign the channel thalweg, and restore the previously established primary channel within certain sediment management zones, and added additional rock slope protection. The Corps authorized these changes and informed USFWS and NMFS. [Letter from Antal Szijj, Team Lead, U.S. Army Corps of Engineers, to Kate Ballantyne, Deputy Director County of SLO (September 18, 2023).]

To date, the District and Corps continue to provide progress reports on the WMP to NMFS regarding implementation of the RPA. In March 2025, NMFS confirmed that the Corps and District were in compliance with the RPA. (B. Struck, National Oceanic and Atmospheric Administration [NOAA] Fisheries West Coast Region, pers. comm., to L. Bugrova, Principal Environmental Specialist, County of SLO, March 18, 2025.)

1.4 Purpose

As noted above, the purpose of the HCP is to support the District's application for ITPs from the Services that would authorize incidental take of the Covered Species in connection with the Covered Activities. The take and conservation measures set forth in this HCP take into account the District's obligations to provide water for municipal and agricultural users and to maintain Lopez Reservoir for recreational use over the 30-year Permit Term.

1.5 Plan Area

The Services' Habitat Conservation Planning and Incidental Take Permitting Handbook (HCP Handbook) (USFWS and NMFS 2016) indicates that an applicant for an ITP must identify the plan area and the permit area. The HCP Handbook states that the plan area for an HCP includes all areas that will be used for any activities described by the HCP, including covered activities and the conservation program, and includes all lands necessary for the HCP to be fully implemented (HCP Handbook at 6-1). The plan area for this HCP includes the mainstem of AG Creek from the Lopez Dam downstream to the Pacific Ocean. The plan area also includes properties owned by the County and others on which the District operates its water supply system including riparian land along AG Creek and tributaries downstream of Lopez Dam. These areas support ecological processes associated with critical habitat designation by NMFS for SCCC steelhead, and by USFWS for CRLF and SWPT, specifically. Additionally, the plan area includes the reservoir and tributaries upstream of Lopez Dam, including Lopez Creek and Wittenberg Creek (Figure 1-4).

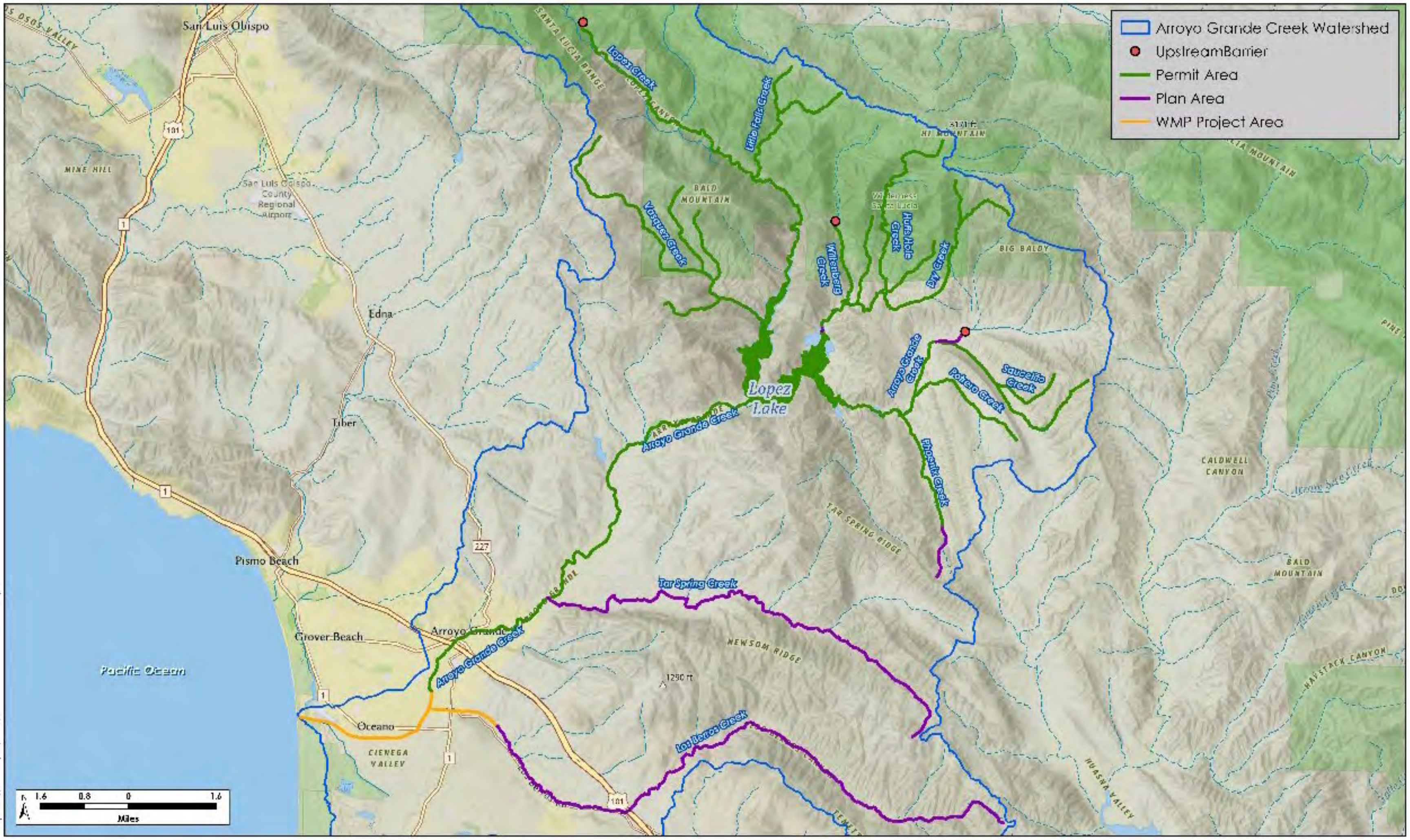

Figure 1-4. Plan and permit area for the Lopez HCP.

1.6 Permit Area

The HCP Handbook describes the permit area of an HCP as the geographic area where the impacts of the covered activities (those that will result in incidental take) will occur (HCP Handbook at 6-3). The permit area for this HCP includes approximately ten miles of the mainstem AG Creek from Lopez Dam downstream to the upstream limit of the AG Creek WMP which is generally the confluence of AG Creek and Los Berros Creek (Figure 1-4). Additionally, the permit area includes the reservoir and tributaries upstream of Lopez Dam to natural barriers of anadromy, including areas of Lopez Creek and Wittenberg Creek (Figure 1-4). The permit area also includes properties owned by the County and others on which the District operates its water supply system including riparian land along AG Creek and tributaries downstream of Lopez Dam and areas in which conservation measures implemented in connection with the HCP could result in incidental take of Covered Species.

The lower 3.5 miles of AG Creek are not included in the permit area because activities associated with Covered Activities are not reasonably certain to result in take of the Covered Species or other ESA-listed species and the majority of this area is already addressed in prior ESA Section 7 consultations, biological opinions, and ITSs regarding the AG Creek Channel WMP. Three miles of this lower reach of AG Creek are leveed for flood protection with species protections and habitat management via the WMP. The last half-mile of AG Creek and the lagoon are part of the Oceano Dunes State Vehicular Recreation Area (ODSVRA) and Pismo Dunes State Preserve (Pismo Dunes).

1.7 Covered Species

The potential for presence of listed species in the plan area (described in Section 1.6) was determined based on natural history parameters, including but not limited to, the species' range, habitat, foraging needs, migration routes, and reproductive requirements. In addition to SCCC steelhead, CRLF, and SWPT, the District initially considered other species to be covered by the HCP, including least Bell's vireo (*Vireo bellii pusillus*), tidewater goby (*Eucyclogobius newberryi),* and foothill yellow-legged frog (*Rana boylii*). Ultimately, the District selected the Covered Species based on discussions with NMFS and USFWS and consideration of whether take of each species was reasonably certain or not to occur as a result of the Covered Activities.

Covered Species under NMFS jurisdiction include steelhead (*Oncorhynchus mykiss, O. mykiss*), specifically the SCCC DPS, which is listed as threatened. Within the plan area, the segment of AG Creek downstream of Lopez Dam, and its tributary – Los Berros Creek, are designated critical habitat for the SCCC DPS (NMFS 2005).

Covered Species under USFWS jurisdiction include the CRLF (*Rana draytonii*) and SWPT (*Actinemys marmorata*). CRLF was listed by USFWS as threatened in 1996 (USFWS 1996). USFWS has also designated critical habitat for the CRLF (75 Fed. Reg. 12,816, March 17, 2010), but the Plan Area does not contain designated critical habitat. CRLF is also designated as a Species of Special Concern in California (CDFG 2011). USFWS proposed to list the SWPT as a threatened species in 2023 but has not proposed to designate critical habitat for the species (USFWS 2023a).

Additional information on the Covered Species and their critical habitats are described in Section 2 *Covered Species and Critical Habitat*. Appendix A provides an evaluation of the other species that were considered but not ultimately included for coverage in the HCP, along with the reasons for their exclusion.

1.8 HCP Planning Process

The District submitted a draft HCP and Environmental Assessment/Initial Study in spring 2004 to USFWS and NMFS. Comments provided to the District by NMFS in November of that year focused on the flow model and flow schedule proposed in that draft HCP, but NMFS comments did not address the remaining elements of the draft HCP's proposed conservation program and adaptive management provisions. A multi-decade coordination effort with the District and NMFS focused on gathering more information, revising the model calculations, and further developing the flow methodology. During this time, the District developed the IDRS to better manage releases from the Lopez Reservoir to address water supply sustainable yield metrics and to avoid impacts to sensitive species downstream of the reservoir while continuing to work with NMFS. Studies included model revisions, additional habitat surveys and mapping, water availability analyses, revisions to the downstream release program, flow measurement data related to groundwater sustainability planning, assisted migration report, downstream restoration opportunities report and continued downstream release model refinement.

The data described above, gathered in coordination with NMFS following submittal of the 2004 draft HCP, informed development of this HCP. Additionally, in connection with the development of this HCP, the District engaged in pre-application coordination with NMFS and USFWS by way of monthly meetings that occurred from May through September 2025, which also included participation from CDFW, District staff, consulting experts, and Zone 3 agency representatives. Agendas and other materials were provided to NMFS, USFWS, and CDFW at least two weeks in advance of each of these pre-application coordination meetings.

1.9 Regulatory Framework

1.9.1 Federal Endangered Species Act of 1973, As Amended

Section 9 of the ESA (Section 9) prohibits "take" of species of fish or wildlife that are listed as endangered (16 U.S.C. 1538)(a)). The term "take" is defined by Section 3 of the ESA as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." (16 U.S.C. 1532(19)). By regulation, the USFWS and NMFS may extend the take prohibition to species listed as threatened. (16 U.S.C. 1533(d)). Under Section 10(a)(2)(B) of the ESA, the Services are required to issue an ITP where the applicant has met certain statutory issuance criteria. Specifically, USFWS and NMFS must issue an ITP when they find, after an opportunity for public comment, that an application and associated HCP demonstrate that:

1. The taking will be incidental;
2. The applicant will, to the maximum extent practicable, minimize and mitigate the impacts of such taking;
3. The applicant will ensure that adequate funding for the HCP will be provided;
4. The taking will not appreciably reduce the likelihood of survival and recovery of the species in the wild;
5. The applicant will ensure that other measures that the Services may require as being necessary or appropriate will be provided; and
6. USFWS and NMFS have received such other assurances as may be required that the HCP will be implemented (16 U.S.C. 1539(a)(2)(B)).

Regulations promulgated by USFWS and NMFS also require that, in addition to the criteria set forth in ESA Section 10(a)(2)(B), an applicant must include in its HCP procedures to deal with changed and unforeseen circumstances (50 C.F.R. § 17.22(b)(2)(i)(C), 50 C.F.R. § 222.307(g)). ESA implementing regulations provide regulatory assurances to permittees that provide certainty as to their future obligations under an ITP should "changed or unforeseen circumstances" occur (50 C.F.R. §§ 17.22, 17.32, 222.307(g)).

The HCP Handbook (USFWS and NMFS 2016) provides guidance to ITP applicants and the Services regarding the preparation of HCPs and the process for obtaining an ITP. The Services acknowledge that seeking an ITP is a voluntary action by an applicant (USFWS and NMFS 2016:3-2) and that "ultimately, landowners or project proponents need to assess whether take is reasonably certain to occur as a result of their activities to inform their decision whether to seek incidental take coverage" (USFWS and NMFS 2016:3-3).

Section 7(a)(2) of the ESA requires that federal agencies ensure that actions that the agencies authorize, fund, or carry out are not likely to jeopardize the continued existence of listed species in the wild or result in the destruction or adverse modification of "critical habitat" (16 U.S.C. 1536(a)(2)). USFWS and NMFS consider their issuance of an ITP as a federal action to which the consultation requirement of ESA Section 7(a)(2) applies (USFWS and NMFS 2016: 14-24). To assist the Services with their ESA Section 7 consultation, and in accordance with the recommendation of the HCP Handbook, this HCP provides detailed information that may be useful to USFWS and NMFS in completing their intra-agency consultation concerning whether issuance of the requested ITP and implementation of the HCP is likely to jeopardize the continued existence of the Covered Species or is likely to result in the destruction or adverse modification of any critical habitat (USFWS and NMFS 2016: 7-5 and 7-17).

1.9.2 National Environmental Policy Act

USFWS and NMFS consider issuance of an ITP a federal action subject to compliance with the National Environmental Policy Act (NEPA) (42 U.S.C. 4321 et seq) (USFWS and NMFS 2016:1-10). Among other things, NEPA requires federal agencies to include in every recommendation or report on proposals for "major Federal actions significantly affecting the quality of the human environment" a detailed statement describing: (1) reasonably foreseeable environmental effects of the proposed action; (2) reasonably foreseeable adverse environmental effects that cannot be avoided as a result of the proposed action; (3) a reasonable range of alternatives to the proposed action, including an analysis of negative environmental impact of not implementing the proposed action; (4) the relationship between local short-term uses of the environment and the maintenance and enhancement of long-term productivity; and (5) any irreversible and irretrievable commitments of federal resource that would result from the proposed action. (42 U.S.C. 4332(2)(C)).

NEPA requires federal agencies to issue an environmental impact statement (EIS) for proposed agency actions that will have a reasonably foreseeable significant effect on the quality of the human environment. (42 U.S.C. 4336). Where a proposed agency action does not have a reasonably foreseeable significant effect on the quality of the human environment or if the significance of the effect is unknown, federal agencies must prepare an environmental assessment (EA), which is described as a "concise public document" setting forth the basis for an agency's finding of no significant impact or determination that preparation of an EIS is required (42 U.S.C. 4336(b)). Project sponsors are permitted by NEPA to prepare an EA or EIS under the supervision of the lead agency (42 U.S.C. 4336a(f)). In such cases, the lead agency must independently evaluate the NEPA document and take responsibility for its contents.

On July 3, 2025, the Department of the Interior (DOI) issued an interim final rule partially rescinding regulations implementing NEPA (90 Fed. Reg. 29,498) and moving most of its NEPA procedures to the *Department of the Interior Handbook: National Environmental Policy Act Implementing Procedures* (516 DM 1) and its appendices.

On July 1, 2025, the Department of Commerce (DOC) issued a notice in the Federal Register that it had updated DOC Administrative Order 216-6, *Implementing the National Environmental Policy Act*, which addresses DOC bureau-specific NEPA procedures ("Notice").

The HCP Handbook explains that, in the context of an ITP, the federal action is the proposed issuance of an ITP based on the implementation of conservation measures set forth in the HCP (USFWS and NMFS 2016:13-3). The HCP Handbook states that USFWS and NMFS "ability to exercise discretion over an ESA permit applicant's non-Federal activities is limited to ensuring the non-Federal entity's permit application meets the statutory and regulatory criteria in Section 10(a)(2)(B) of the ESA and 50 C.F.R. § 17.22(b)(1) and 17.32(b)(1)" (USFWS and NMFS 2016:13-4).

1.9.3 National Historic Preservation Act

The National Historic Preservation Act (NHPA) requires, among other things, that federal agencies consider the effects of their undertakings on cultural resources that are included, or may be eligible for inclusion, on the National Register of Historic Places (54 U.S.C. 100101 et seq.). Advisory Council on Historic Preservation regulations define a federal undertaking as a "project, activity, or program funded in whole or in part under the direct or indirect jurisdiction of a Federal agency, including those carried out by or on behalf of a Federal agency; those carried out with Federal financial assistance; and those requiring a Federal permit, license, or approval" (36 C.F.R. § 800.16(y)). According to the HCP Handbook, USFWS and NMFS consider their issuance of an ITP and an applicant's implementation of an HCP as an "undertaking and subject to compliance with section 106 of the NHPA" (USFWS and NMFS 2016:1-10). Appendix A to the HCP Handbook contains the preferred approach of the Services in complying with the NHPA in the context of the ITP process. Like NEPA, it is the obligation of federal agencies to comply with the NHPA.

1.9.4 Clean Water Act

In 1972, the U.S. Congress passed the Clean Water Act (CWA) (33 U.S.C. §1251 et seq.) to provide for the restoration and maintenance of the chemical, physical, and biological integrity of streams, lakes, and coastal waters of the U.S. (WOTUS). The Environmental Protection Agency (USEPA) has general administration, oversight, and approval authorities under the CWA, and distinct activities conducted by other federal agencies or states are subject to U.S. Environmental Protection Agency (EPA) authorities. Section 301 of the CWA generally prohibits the discharge of pollutants to WOTUS without a permit issued under Section 402 or 404. Section 404 authorizes USACE to issue permits for the discharge of dredged or fill material to WOTUS. Under Section 402 and other provisions and under its authority delegated by the USEPA, California issues National Pollutant Discharge Elimination System (NPDES) permits for discharges from municipal, industrial, and other sources. Section 401 of the CWA provides that certain permits including permits under Section 404 of the CWA may not be issued unless the state has issued certification of compliance with state water quality standards. In California, the

State Water Resources Control Board (SWRCB) and Regional Water Quality Control Boards (RWQCB) administer Section 401. Prior to implementing any Covered Activities that may result in the dredge or fill of jurisdictional WOTUS, CWA authorization would be required from the USACE and the SWRCB. In addition, certain construction activities may be subject to NPDES permits governing the discharge generated from dewatering activities and stormwater runoff.

1.9.5 California Environmental Quality Act

The California Environmental Quality Act (CEQA) (Public Resources Code [Pub. Res. Code] §21000 et seq.) applies to approvals of "projects" proposed by California public agencies, and to agency approvals of projects proposed by individuals and non-governmental entities. CEQA generally requires public agencies to consider the potential significant effects of the project on the environment, and to prepare an environmental impact report (EIR) if the agency determines that project may have a significant effect on the environment. (Cal. Pub. Resources Code, § 21151.) An EIR identifies significant effects of the project, identifies alternatives to the project, and identifies measures to reduce effects to less than significant. CEQA requires public agencies to avoid or mitigate significant effects on the environment of a project it carries out our approves "whenever it is feasible to do so." (Cal. Pub. Resources Code, § 21002.1, subd. (b). "If economic, social, or other considerations make it infeasible to mitigate one or more significant effects on the environment, the project may nonetheless be carried out or approved at the discretion of the public agency if the project is otherwise permissible under applicable laws and regulations." (Cal. Pub. Resources Code, § 21002.1, subd. (d).) Before approving a project with unavoidable significant effects, the agency is required to adopt a Statement of Overriding Considerations.

1.9.6 California Fish and Game Code Section 1600

The California Fish and Game Code generally requires notification of the California Department of Fish and Wildlife (CDFW) of an activity to:

- Substantially divert or obstruct the natural flow of any river, stream, or lake
- Substantially change or use any material from the bed, channel, or bank of any river, stream, or lake
- Deposit debris, waste, or other materials that could pass into any river, stream, or lake

If CDFW determines that the activity may substantially adversely affect an existing fish and wildlife resource, CDFW requires a Lake and Streambed Alteration Agreement including by California public agencies measures necessary to protect existing fish and wildlife resources.

2 COVERED SPECIES AND CRITICAL HABITAT

This section provides detailed information on the Covered Species and their designated critical habitat. Appendix A provides an evaluation of the other species that were considered but not ultimately included for coverage, along with the reasons for their exclusion.

2.1 South-Central California Coast Steelhead

2.1.1 Listing Status

Steelhead are anadromous *O. mykiss* that occur in the North Pacific Ocean from the Kamchatka Peninsula in Russia and along the Pacific coast of North America, as far south as at least San Juan Creek and San Luis Rey in southern California (NMFS 2023a). NMFS has listed a total of five steelhead DPSs in California (NMFS 2006, NMFS 2014a). The SCCC DPS starts at the Pajaro River in the Monterey Bay Region and continues south to Arroyo Grande in SLO Bay. The SCCC DPS was listed as threatened in 1997 (NMFS 1997), this status was reaffirmed in a 2006 status review (NMFS 2006) and updated in 2014 (NMFS 2014b). The SCCC steelhead is designated a Species of Special Concern by the state of California. With respect to the SCCC DPS, NMFS promulgated a rule (NMFS 2006) under Section 4(d) of the ESA extending Section 9 take prohibitions to the listed DPS but providing 14 exceptions from the take prohibitions for specific activities (50 C.F.R. § 223.203).

A population viability study found that there was no change in the SCCC DPS biological extinction risk category in 2023 (SWFSC 2023). Freshwater-resident *O. mykiss* (rainbow trout) co-occurs with steelhead in most coastal streams in south-central California (Clemento et al. 2008). Resident *O. mykiss* are not considered to be a part of the protected SCCC steelhead population under the ESA, despite interbreeding (Pearse et al. 2019) and being genetically similar (Clemento et al. 2008). Downstream of Lopez Dam both anadromous and resident life history *O. mykiss* occur, and since they are indistinguishable, both life histories are treated in a similar fashion by NMFS.

2.1.2 Critical Habitat

NMFS designated critical habitat for the SCCC steelhead in 2005. The Plan Area includes a portion of the SCCC DPS designated critical habitat (Figure 2-1). NMFS included AG Creek from the ocean to Lopez Dam and Los Berros Creek but did not include other tributaries to AG Creek (Figure 2-1) (NMFS 2005). As described in the critical habitat rule, the primary constituent elements (PCEs) that are essential to steelhead conservation include:

- PCE 1: freshwater spawning sites with water quality and quantity conditions and substrate supporting spawning incubation and larval development;
- PCE 2: freshwater rearing sites with water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility; water quality and forage supporting juvenile development; and natural cover such as shade, submerged and overhanging large wood, log jams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks;
- PCE 3: freshwater migration corridors free of obstruction with water quantity and quality conditions and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels, and undercut banks supporting juvenile and adult mobility and survival;

- PCE 4: estuarine areas free of obstruction with water quality, water quantity, and salinity conditions supporting juvenile and adult physiological transitions between fresh- and saltwater; natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels; and juvenile and adult forage, including aquatic invertebrates and fishes, supporting growth and maturation;
- PCE 5: nearshore marine areas free of obstruction with water quality and quantity conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation; and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels; and
- PCE 6: offshore marine areas with water quality conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation.

Covered Activities have the potential to affect PCEs 1–3; therefore, impacts to these PCEs associated with Covered Activities and the implementation of the conservation program are analyzed in detail in Section 6.1 of this HCP. Covered Activities are not expected to affect PCEs 4–6; therefore, these PCEs are not analyzed further. PCEs 4–6 encompass areas outside of the Permit Area (e.g., the estuary, nearshore and oceanic habitats). Section 2.1.5 provides additional detail on SCCC steelhead habitat requirements.

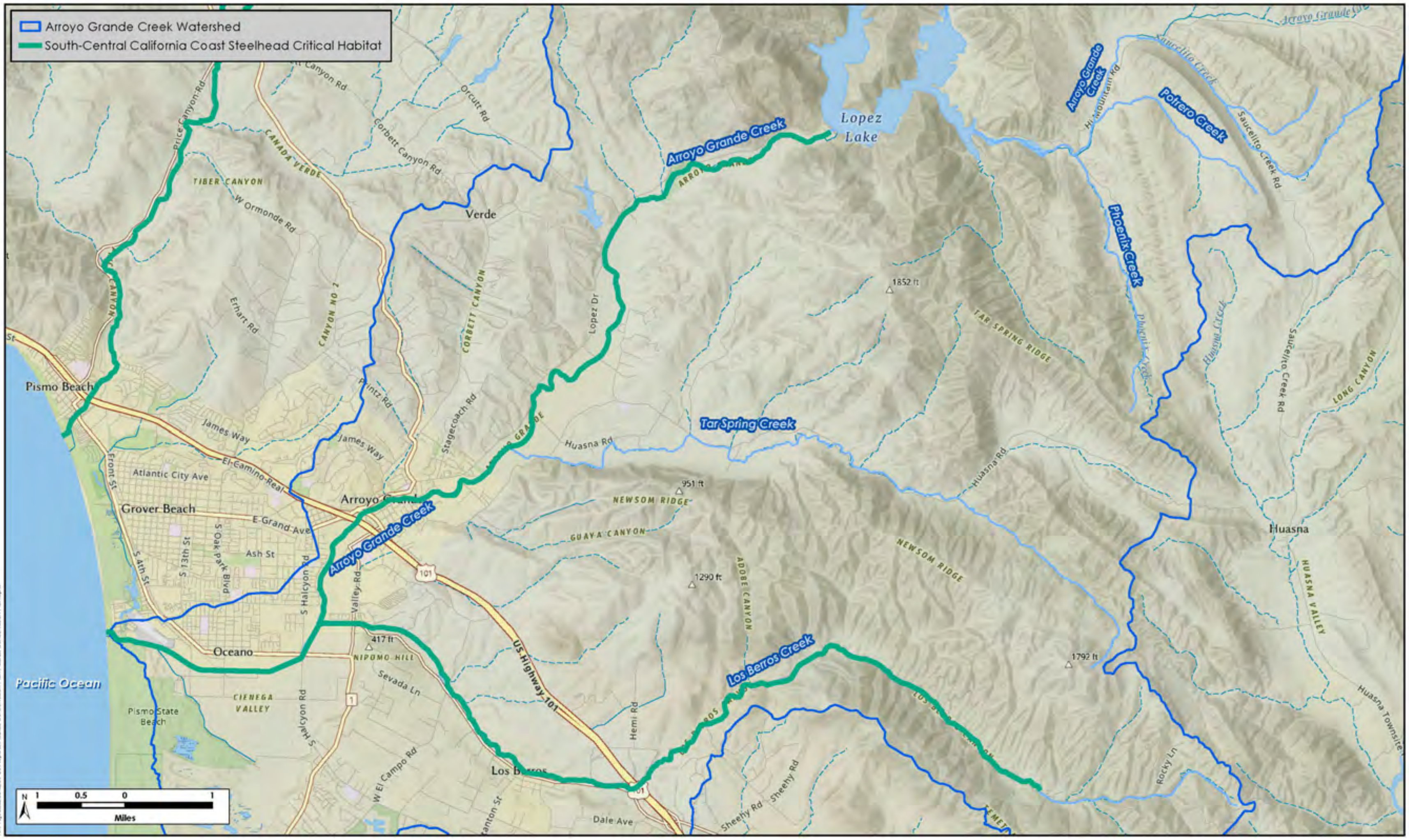

Figure 2-1. Designated Critical Habitat for SCCC steelhead in the Arroyo Grande Creek watershed.

2.1.3 NMFS Recovery Plan

NMFS released a recovery plan for the SCCC steelhead in 2013 (NMFS 2013) (SCCC steelhead Recovery Plan). AG Creek watershed is included within the SLO Terrace Biogeographic Population Group for SCCC steelhead. The stated goals of the SCCC steelhead Recovery Plan are to prevent the extinction of the SCCC DPS, ensure the long-term persistence of viable, self-sustaining populations, and to establish a sustainable SCCC steelhead sport fishery.

In the SCCC steelhead Recovery Plan, NMFS identified 11 populations as Core 1, seven as Core 2, and 11 as Core 3. The Core 1 designation means NMFS identified those populations as the highest priority for recovery, whereas Core 2 populations are generally smaller populations, and may have less diverse and complex threats than Core 1 populations, and Core 3 populations are generally the smallest populations with lowest intrinsic potential (NMFS 2013). The SCCC steelhead Recovery Plan identified AG Creek a Core 1 population. NMFS identified the following actions within AG Creek as "critical recovery actions" for the SCCC steelhead population in the AG Creek: "Develop and implement operating criteria to ensure the pattern and magnitude of groundwater extractions[3] and water releases, including bypass flows around diversions, provide the essential habitat functions to support the life history and habitat requirements of adult and juvenile steelhead. Remove or modify instream fish passage impediments, including dams and diversions, to allow steelhead natural rates of migration to upstream spawning and rearing habitats, and passage of smolts and kelts downstream to the estuary and ocean. Identify, protect, and where necessary, restore estuarine and freshwater rearing habitats, including management of artificial sandbar breaching at the river's mouth, and upstream freshwater spawning and rearing habitats" (NMFS 2013).

2.1.4 Life History

O. mykiss exhibits different life-history strategies (NMFS 2013), including anadromy, where juveniles rear in freshwater rivers and creeks, smolts migrate to the ocean where they mature to adults, and adults return to freshwater rivers and creeks to spawn. They can also exhibit a resident life history, where rearing, maturing, and spawning all occur within freshwater. Steelhead is the term used for anadromous *O. mykiss*, while rainbow trout is the term for resident *O. mykiss*. The complex life histories of *O. mykiss* are thought to arise from a combination of heritable variation (genetic factors), the expression of those traits influenced by environmental factors, and the individual's internal condition (e.g., growth rate, lipid content, and size) (Abadía-Cardoso et al. 2013, Liedvogel et al. 2011, Kendall et al. 2015, Phillis et al. 2016).

Kendall et al. (2015) reviewed available literature on the patterns and environmental factors affecting the expression of anadromy and residency in *O. mykiss*, and in general they found that researchers report an influence of flow variability and water temperature on rates of smolting (anadromy) or freshwater maturation (residency). The resident life history appears to dominate in streams with perennial cool (<64.4°F [18°C]) summer flows with high food availability, whereas rates of smolting increases in streams with warmer (>62.2°F [19°C]) summer conditions (Sloat and Reeves 2014) and high variability in flows capable of supporting adult and smolt migration (Pearsons et al. 2008).

Sogard et al. (2012) observed an anadromous life history in a warm river with stressful temperatures and little variation in managed baseflows between wet and dry seasons with primarily age 1 smolts (American River >62.2°F [19°C] during summer), while anadromy also

[3] Groundwater extractions are not a covered activity in the HCP and are beyond the District's control.

predominated in cooler coastal streams with flashy unimpaired hydrographs (Soquel and Scott creeks) with primarily age 2 smolts. Stable flows (managed with little variation between wet and dry seasons) and relatively cool water temperatures (mean of 59.4°F [15.2°C] in September, rarely exceeding 68°F [20°C]) in a reach downstream of the Comanche Dam on the Mokelumne River appeared to support high life-history diversity, with multiple age classes of resident maturing *O. mykiss*, and a presumed low proportion of anadromous individuals. Overall, research in California watersheds has shown anadromous life histories can persist in both warm and cool systems albeit at different age classes, and within both managed and unmanaged flow conditions.

In the lower Carmel River, juvenile steelhead are at risk of seasonal desiccation related to groundwater pumping. At the same time, the water temperatures in the lower reaches apparently support the fastest observed growth of juvenile steelhead in the watershed (Ohms and Boughton 2019). Ohms and Boughton (2019) found that juvenile steelhead in the Carmel River Watershed that are larger in their first year are more likely to become anadromous steelhead; smaller individuals are more likely to delay ocean migration for another year or become residents as is observed in other watersheds (Phillis et al. 2016, Satterthwaite et al. 2009, Hayes et al. 2008). Ohms and Boughton (2019) concluded that suitable summer flows and warm water temperatures in the lower Carmel River maintain a large proportion of the anadromous steelhead production in the watershed.

In California streams, these dynamics are apparent in the observed pattern of predominately resident life history in upper headwater streams often upstream of migration obstacles, with perennial flows and generally cool summer temperatures maintained by groundwater inputs and riparian shade, and primarily anadromous production in lower mainstem reaches with occasionally stressful summer water temperatures and periodic high flows (Shapovalov and Taft 1954, Sogard et al. 2012, Ohms and Boughton 2019, Satterthwaite et al. 2009, Hayes et al. 2008). The opening of sand bars at lagoons and periodic high flows during winter and spring suitable to support adult and smolt migration past natural or anthropogenic obstacles are also critical to support anadromy in California streams (Lang and Love 2014, Dagit et al. 2017).

Researchers have also discovered that a region on chromosome Omy5 is strongly associated with life history of populations of steelhead and rainbow trout (Pearse et al. 2014). Leitwein et al. (2017) showed that San Francisco Bay area *O. mykiss* populations downstream of barriers have a relatively high mean frequency of alleles associated with migratory behavior on chromosome Omy5, similar to other coastal *O. mykiss* populations and higher than San Francisco Bay area populations upstream of barriers, hatchery populations, and Central Valley populations. That said, it should be noted that above-barrier populations with large reservoirs also showed higher mean frequencies of alleles associated with migratory behavior on chromosome Omy5 with allele frequency positively correlated with reservoir size.

Most anadromous adult SCCC steelhead migrate upstream in December through April but depending on the water year type[4] may migrate upstream from late October to late July (Figure 2-2, Shapovalov and Taft 1954). Migration timing for AG Creek is based on observations from similar watersheds in the region and observations of when the Arroyo Grande Lagoon Sandbar is open (described in Section 3.4.2 *Lagoon Sandbar*) and is assumed to occur primarily December through April. Adult steelhead have an average upstream migration rate of around 7 miles per day based on observations in rivers in Oregon and Washington (English et al. 2006), and within AG Creek it is assumed that adults reach spawning habitat within 1–2 days of entry. Spawning

[4] A water year runs from October 1st to September 30th, and is classified into categories like very dry, dry, average, wet, or very wet based on total precipitation.

females dig nests (i.e., redds) in the gravel with their tails and deposit eggs, males immediately fertilize the eggs, and the females bury them with substrate (Shapovalov and Taft 1954). Unlike other species of *Oncorhynchus*, some adult steelhead can survive after spawning and then migrate downstream as "kelts" (Boughton et al. 2006).

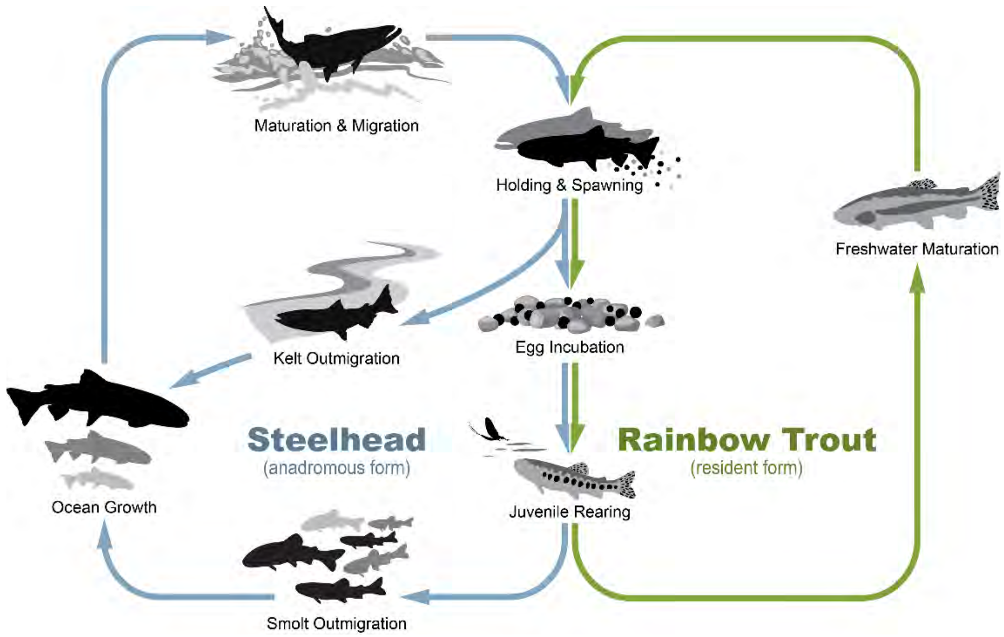

Figure 2-2. General steelhead life cycle.

After spawning, eggs incubate in the gravel for 3 weeks to 2 months prior to hatching, depending primarily on water temperature, and fry emerge 2–6 weeks post-hatch in spring or early summer (NMFS 2007). Once fry emerge from the gravels, they may remain near their natal areas or migrate to other areas in the watershed for rearing, and rear in freshwater for several months to a few years. In watersheds where lagoons form (such as AG Creek), young-of-the-year and older juveniles may also migrate downstream to rear in lagoons or estuaries for weeks to months, may travel between lagoons/estuaries and freshwater multiple times over the course of the summer, or may retreat upstream in fall when estuarine water quality declines and then migrate back downstream during the subsequent spring (Boughton et al. 2006, Hayes et al. 2011). Estuary-lagoon rearing is more prevalent in the southern end of the species' range (e.g., coastal California watersheds) because upper watersheds are often less conducive and productive for freshwater rearing; therefore, steelhead likely migrate downstream at younger ages and spend more time rearing in lagoons than those in more northern watersheds (Hayes et al. 2008). Smolts typically emigrate to the ocean in winter and spring, with the timing influenced by photoperiod, streamflow, and temperature (Bjornn and Reiser 1991, Shapovalov and Taft 1954, Booth 2020). Steelhead smolts within AG Creek are presumed to out-migrate in the spring, with peak migration occurring from March through May (based on Fukushima and Lesh 1998), consistent with the period that the lagoon sandbar is most frequently open (Section 3.4.2). Studies in nearby bar-built streams Santa Rosa and San Simeon Creeks, in 2005, showed peak outmigration occurring from late April to early May (Nelson 2005a,b). In both streams, traps were not installed until mid-April and may have missed the peak in downstream migration. However, the data that were collected showed smolt captures declined significantly after the last week of April, suggesting that migration tapers off quickly following the peak outmigration period. Similar migration timing was observed in SLO Creek during two years of migrant trapping, where peak smolt outmigration typically occurred in April, and no smolts were captured after June 1 of any survey year (Spina et al. 2005).

2.1.5 Habitat Requirements

For upstream spawning migration, steelhead generally require flows that are high enough to allow homing and passage, adequate water quality (i.e., temperature, turbidity, dissolved oxygen), and an absence of impassable physical barriers (Bjornn and Reiser 1991). Juveniles require similar conditions for downstream migration. Spawning habitat requirements include suitable substrate at adequate depths and velocities, although temperature and turbidity are also important (NMFS 2001). Survival from egg to emergence requires adequate water quality (water temperature, pH, and dissolved oxygen), water quantity (redds can be dewatered at low flow or scoured during high winter flows), and substrate. Juveniles require shelter from adverse environmental conditions and predators, and adequate food resources, water quantity and quality (NMFS 2001).

Spawning occurs in tributaries or headwater reaches with suitable spawning gravel. Permeability of spawning gravel affects incubation success; survival of embryos can be reduced if fine sediments (sand and smaller particles) fill the interstitial spaces within a nest, impeding intragravel water flow and reducing dissolved oxygen delivery to the embryos (NMFS 2013). Coble (1961) conducted field studies on spawning gravel conditions in redds affecting survival of *O. mykiss* embryos in two small streams in Oregon; ground water velocity and dissolved oxygen were positively correlated with embryo survival. Tagart (1976) found that at low permeabilities, survival could be as low as 1% for coho salmon, whereas at the highest measured permeabilities, survival exceeded 50%.

Optimal spawning gravel size varies with fish size but should meet the following criteria: <25–39% of grains finer than 6.35 millimeter (mm) diameter or <25% of grains finer than 0.85 mm diameter; and median particle size of 12.5–22 mm (Kondolf 2000; Kondolf and Wolman 1993). Minimum gravel patch size should be greater than 1.1 square meters (Trush 1991). Suitable depths (10–150 centimeters [cm]) and velocities (20–155 centimeters per second [cm/s]) must also be available during spawning and incubation (Moyle 2002).

During freshwater rearing, fry tend to use shallow, low-velocity habitats, typically foraging in open areas (Hartman 1965), then moving to mid-channel areas of greater velocity and cover by late summer or fall (Everest and Chapman 1972). High-quality summer freshwater rearing habitat includes abundant food, high pool frequency, acceptable water temperatures, and ample cover (Bell et al. 2011). Important habitat features include lower velocity habitat and deep pools with abundant cover (Bustard and Narver 1975, Sheppard and Johnson 1985, Johnson et al. 1986). During winter, juveniles of all ages typically require refuge areas to remain in an area during high flows. Although woody debris can provide velocity refuge, it appears that the presence of interstitial spaces in boulder or cobble substrate is especially critical. Studies in artificial stream channels suggest that steelhead require at least 1 to 2 times the depth of the median particle size and substrates consisting of unembedded boulder/cobble; 10% embeddedness reduced densities of 0+ juveniles by 50%, and fully embedded substrates reduced densities by 90% (Ligon et al. 2016).

Habitat segregation among different life stages may occur in intermittent streams, with spawners utilizing coarser substrates than in perennial streams, and rearing fish utilizing a mixture of habitats (Boughton et al. 2009). Intermittent tributaries can sometimes yield similar densities of young-of-the-year fish as perennial streams, and higher densities than the mainstem (Boughton et al. 2009). However, perennial tributaries tend to have greater densities of age 1+ fish (10–20 cm fork length) than mainstem or intermittent tributaries (Boughton et al. 2009).

For estuary-lagoon rearing in coastal California, beneficial habitat qualities include sufficient flows to maintain connectivity with the upper watershed, which allows steelhead to take refuge upstream at times when water quality declines due to extreme temperatures or low oxygen levels typical in late summer and fall (Hayes et al. 2008). With reduced or no flows, steelhead may be at greater risk for mortality; in the lower AG Creek and lagoon, researchers have hypothesizes that past fish kills were linked to high water temperatures (e.g., > 80.6°F [27°C] in late June), delays in downstream migration due to low spring flows and potential barriers to downstream passage from beaver dams, and sudden dewatering events in summer caused by agricultural withdrawals from wells and a heat wave (Rischbieter 2004, 2009a). For suitable lagoon summer habitat, summer flows should be low enough for a sandbar to build up and form a lagoon, but high enough that the lagoon does not leach through the sand bar leaving only a shallow or dry lagoon (Hayes et al. 2008, 2011) or breach unseasonally. Storm surges in fall can further degrade water quality, by pushing saltwater over the sandbar and causing freshwater algae in the lagoon to die and biodegrade, further reducing oxygen levels (Hayes et al. 2011). Increased flows from winter storms typically breach the sandbar, which provides connectivity for smolts to emigrate to the ocean and for adults to migrate from the ocean upstream to spawn (Stillwater Sciences 2014). Artificial breaching of lagoon sandbars can reduce the quality of rearing habitat, by stranding juvenile fish or suddenly sweeping them out to sea, and by draining the upper, highly oxygenated freshwater layer, increasing surface salinity and reducing dissolved oxygen, particularly if it occurs in summer or fall (Atkinson 2010, Rhodes 2013). It can also attract adult steelhead into the estuary without sufficient streamflow for them to migrate further upstream (D.W. Alley & Associates 2014). In short, beneficial estuary-lagoon habitat includes flows that cause seasonally appropriate breaches and sandbar closures, and sufficient summer flows to retain upstream connectivity and decent water quality.

2.1.5.1 Water Temperature

Water temperature has a strong influence on almost every steelhead life history stage due to its influence on metabolism and growth (Sullivan et al. 2000), as discussed below.

Adult Upstream Migration

Upstream migration is an aerobically challenging life history event that can become more challenging at high temperatures due to increased metabolic demands. Warm temperatures are known to impact salmonid migration rates and success, and EPA guidelines for Pacific northwest temperature standards state that average temperatures around 69.8–71.6°F (21–22°C) are expected to cause “thermal blockages” to steelhead *migration and that prologued exposure to temperatures exceeding 64.4°F (18°C)* is expected to result in reduced fitness (EPA 2003, McCullough et al. 2001). Steelhead in the Columbia River have been found to exhibit increased thermoregulatory behavior (use of thermal refuges along their migration route) at instantaneous temperatures above 66.2°F (19°C), which can result in migration delay (Keefer et al. 2009). It is important to note, however, that thermal tolerance and thermoregulatory behaviors can be stock-specific (Keefer et al. 2009, Hess et al. 2016) and most peer-reviewed studies involving steelhead migration temperatures are located in the Pacific northwest and focused on the summer-run ecotype. Thus, the findings in these studies should not be presumed pertinent to the steelhead population in AG Creek.

Spawning

Spawning is another physiologically challenging life history event that can be implicated by temperature. EPA (2003) stated that salmonid spawning is most frequently observed between 39.2–57.2°F (4–14°C). A literature review conducted by Carter (2005) found that steelhead have been observed spawning at instantaneous temperatures between 39.2–69.8°F (4–21°C) but concluded that *"preferred" spawning temperatures fall between 39.2 –55.4°F (4–13°C) and that daily average temperatures should not exceed* 55.4°F (*13°C) to be fully protective of spawning*. This review drew predominantly on data from the Pacific northwest. The California Department of Fish & Game concluded optimal spawning temperatures range between 39.2–51.8°F (4–11°C) (McEwan and Jackson 1996) though this report, like Carter (2005), relied substantially on data from the Pacific northwest in drawing this conclusion.

Embryo Incubation and Emergence

Water temperature during incubation can impact the survival rates, development rates, and growth of salmonid embryos and alevin (Murray and McPhail 1988) and thermal requirements are strain- and species-specific. Most information on steelhead egg/aelvin thermal tolerance is based on studies of hatchery strains residing in regions other than the Central Coast and suggests that embryos have the highest survival rates between 44.6–50.0°F (7.0–10.0°C) (Myrick and Cech 2001, 2004; WDOE 2002). Turner et al. (2007) found that steelhead embryos from a hatchery in California had substantially reduced survival when held at 64.4°F (18°C) compared to 46.4°F (8°C). From and Rasmussen (1991) incubated rainbow trout eggs at 41°F (5°C), 50°F (10°C), and 59°F (15°C) and found that newly fertilized eggs did not survive well at 59°F (15°C) but that 59°F (15°C) was an acceptable incubation temperature once embryos reached the eyed stage. Pankhurst et al. (1996) found embryo survival of hatchery rainbow trout to be similar at 48.2°F (9°C), 53.6°F (12°C), and 59°F (15°C) but no embryos survived when incubated at 64.2°F (18°C) or 69.8°F (21°C). *Temperatures for embryo incubation and emergence appear suitable at daily average less than 59°F (15°C).*

Rearing

Water temperature can impact rates of survival, growth, and development for juvenile steelhead. Juvenile thermal tolerance thresholds, including lethal limits and functional limits, have been more widely studied than other life stages and have been found to vary between populations and depend on an individual's thermal history (McKenzie et al. 2021; Dressler et al. 2023, 2025). Critical (lethal) thermal limits for juvenile *O. mykiss* fall between ~75.2–89.6°F (~24–32°C) depending on population and acclimation temperature (reviewed in McKenzie et al. 2021). Functional thermal limits occur at lower temperatures and chronic exposures can affect the ability of juveniles to forage, grow, compete with conspecifics, and escape predators. Myrick and Cech (2000) found that hatchery rainbow trout originating from northern California had optimal growth rates when reared at 66.2°F(19°C) (compared to 50°F [10°C] and 57.2°F [14°C]) when fed to satiation, but that growth rates declined when fish were held at 71.6°F (22°C) and some fish lost weight when held at 77°F (25°C). A wild *O. mykiss* population in Arroyo Seco (tributary to the Salinas River and the closest population to AG Creek to have undergone a thermal tolerance study) showed no evidence of physiological limitation when held overnight at average temperatures of up to 69.8°F (21°C), although aerobic capacity declined linearly with increasing temperature and it was estimated (based on linear regression) to become limited around 75.2°F (24°C). Similarly, two populations of wild juvenile steelhead in coastal Oregon had optimal aerobic capacity between 62.6–64.4°F (17–18°C) and began to experience limitations of both aerobic capacity and exercise recovery between 73.4–75.2°F (23–24°C) (Dressler et al. 2025). This window of thermal tolerance is slightly shifted for populations that routinely experience high temperatures. Tuolumne River *O. mykiss* exhibited peak swimming performance at 70°F (21°C) that declined only marginally up to 77°F (25°C) (Verhille et al. 2016) and a population from interior Oregon exhibited no significant changes in aerobic capacity or exercise recovery between 66.2°F (19°C), 71.6°F (22°C), and 78.8°F (26°C) (Dressler et al. 2025). For analysis in this HCP it was assumed that *optimal aerobic capacity occurs between daily average of 62.6–64.4°F (17–18°C), that temperatures greater than a daily average of between 73.4–75.2°F (23–24°C) would limit juvenile rearing suitability, and that instantaneous temperatures ≥86°F (30°C) could be lethal for rearing O. mykiss*.

Smolt Migration

Depressed or elevated temperatures could result in cessation or reversal of smolt transformation, physiological stress, a reduction in migration fitness, reduced swimming performance, fish seeking shelter in tributaries or other cold-water refuges, or elevated rates of mortality in smolting steelhead (McCullough et al. 2001). Most literature on water temperature effects on steelhead smolting suggest that water temperatures less than ~51.8°F (~11°C) are required for successful smoltification (Adams et al. 1975, Myrick and Cech 2001). However, the limited existing information on southern and central coast populations suggests higher thermal tolerance. For example, over the course of multiple years of studies SCWA (2016) documented steelhead smolts migrating downstream while mean daily temperature (MDT) was consistently above 59°F (15°C) and 7-day average of daily maximum (7DADM) was above 68°F (20°C). During smolt trapping efforts on the Santa Clara River in southern California from 1994–2014, 95% of smolt observations occurred when instantaneous river temperatures were between 53.6–66.2°F (12–19°C) (Booth 2020). For analysis in this HCP it was assumed that *instantaneous temperatures less than 66.2°F (19°C) are suitable for smolt migration*.

2.1.6 Abundance in Plan Area

Both historical and contemporary estimates of steelhead abundance in AG Creek are highly unreliable. There have been no systematic fishery surveys or monitoring of the steelhead population in AG Creek. In recent Status Reviews of the SCCC DPS, NMFS has noted the lack of available abundance estimates for the species (NMFS 2016a, 2023a). Historical data largely are anecdotal. The reliability of historical estimates is further confounded by the lack of differentiation between anadromous and freshwater *O. mykiss* and by stocking freshwater resident *O. mykiss* in Lopez Reservoir by CDFW going back several decades.

Prior to the construction of the Lopez Dam, Lopez [Canyon] Creek (Figure 1-1) was rated highly as a steelhead production area, with a high density of juvenile steelhead (up to 384 fish/100 m in one area) reported in August 1961, excellent spawning areas, adequate rearing habitat, and a lack of barriers and diversions (Titus et al. 2014). The creek was also stocked with juvenile *O. mykiss* beginning in the 1930s. Early fish stocking records showed that the Lopez [Canyon] Creek steelhead population was supplemented with a plant of 10,000 juveniles in 1930, 25,000 in 1932, 24,000 in 1933, and 15,000 in 1938 (Titus et al. 2014). Vasquez Creek was rated as having fair to good spawning habitat but little rearing habitat, a low density of juveniles, and had at least one significant migration barrier (cement swimming pool with a flashboard dam), based on surveys conducted in 1961. Wittenberg Creek contained suitable spawning gravel and spawning was reported in the winter of 1957–58.

AG Creek upstream of the dam provides low quality habitat due to high quantities of fine sediments, and the lower elevation reaches of Wittenberg, Huffs Hole, and Dry creeks, and upper AG Creek (>2 miles from Lopez Reservoir) and its tributaries (Saucelito, Phoenix, and Portrero creeks) do not likely contain sufficient flows to provide suitable summer and fall rearing habitat (TRPA 2011). Barriers to upstream spawning migration were noted on Lopez Creek (7.3 miles above Lopez Reservoir), Wittenberg Creek (1.7 miles above the reservoir), and AG Creek (2.6

miles above the reservoir). Relatively high numbers of *O. mykiss* were observed in Wittenberg and Lopez [Canyon] creeks; conversely, *O. mykiss* observations were relatively rare in AG Creek upstream from Lopez Dam (TRPA 2011). Recent observations of *O. mykiss* have been made in the upper reaches of AG Creek above Lopez Dam and Reservoir (Stillwater Sciences 2023). However, there have been no systematic and comprehensive annual fish surveys of the upper AG Creek watershed, and there is little information on the distribution, density, age class, size, or reproductive/mortality rate of *O. mykiss* populations in the upper watershed (NMFS 2024). There is also little quantitative information on the migratory behavior of the species, and the status of these landlocked *O. mykiss* populations is poorly understood.

Both Arroyo Grande and Los Berros creeks have lost substantial habitat complexity due to urban and agriculture related channelization and erosion and altered flow and sediment dynamics (Becker et al. 2010). Based on long-term observations by individuals familiar with the watershed, CDFW surmised that the steelhead runs in AG Creek averaged at least 1,000 fish annually prior to the sharp decline beginning in the 1940s, prior to the construction of Lopez Dam. Since the late 1940s, the runs decreased to an average of approximately 100–200 fish annually, with much of the interannual variation likely the result of variation in annual rainfall, with further declines since the late 1950s (Hinton 1961, CCSE 2009). Various surveys conducted by California Department of Fish and Game reported many juveniles in the upper stream in May 1950, hundreds of juveniles in the lagoon in May 1953, a low density of juveniles in the upper stream above the confluence with Lopez Canyon Creek in June 1959, and low densities of juveniles in the creek in May 1960 (Titus et al. 2014). Survey reports from the 1950's also noted that the creek supported one of the larger steelhead runs in the south coast, equal in magnitude to the Santa Rosa, Arroyo de la Cruz, San Simeon, and San Carpoforo creeks, that fishing pressure was often heavy, and stocking of rainbow trout occurred (Titus et al. 2014).

Titus et al. (2014) reported that the size of the run decreased from what was observed in the 1940s by the1960s, and interrupted stream flows with steelhead concentrated in pools were reported in March 1961 below the confluence with Lopez Canyon Creek. Further deterioration of AG Creek was noted in 1972 surveys, attributed to the construction of Lopez Dam blocking steelhead access to upstream spawning and rearing habitats, numerous diversions in the lower creek, and various forms of pollution. In September 1972, no juvenile steelhead were noted but some adult steelhead were reportedly caught by local residents. From electrofishing and visual surveys conducted throughout the lower creek in August–October 1978, no juvenile steelhead were seen or captured, and the creek was described as severely degraded due to channelization, water diversions, and siltation (Titus et al. 2014).

Alley (1997a,b) assessed the status of the steelhead population and aquatic habitat in the 13.2 miles of lower AG Creek from Lopez Dam downstream to, but not including the AG Creek Estuary. Juvenile steelhead were present in low densities from the Highway 1 bridge upstream to near the base of Lopez Dam but were found in very low densities in the upper 0.7 mile downstream of the dam and absent in the 0.7 mile of the exposed reach of AG Creek further downstream. Alley (1997a,b) found young-of-the-year size steelhead in densities ranging from 2 to 22.5 fish per 100 ft at the eleven sites containing steelhead. The densities of yearling steelhead ranged from 0.6 to 8.3 fish per 100 ft at all eleven sites. Of the total population estimate of juvenile steelhead detected during this survey, about half were comprised of young-of the-year sized (<75mm) fish and half of year-sized (>75mm) steelhead (Alley 1997a).

A survey of the lower AG Creek below Lopez Dam and Reservoir in 2006 recorded juvenile steelhead rearing in low densities (ranging from 0 to 10 fish per 100 ft of stream reach and averaging 2.9 fish per 100 ft) throughout most stream reaches surveyed (SHG 2008, NMFS

2024). While both juvenile rearing and adult upstream migrating steelhead have been detected in the lower reach of AG Creek below Lopez Dam, the numbers have generally been in the single or low double digits and have declined significantly since surveys in 1996 (Alley 1997a,b).

Creek Lands Conservation (2023) conducted redd surveys from 2015 through 2022 in a reach from the Bridge Street Bridge to U.S. Geological Survey (USGS) stream gage #11141500, as well as a reach from the USGS stream gage upstream to Strother Park; all downstream of Lopez Dam. Creek Lands Conservation regularly observed resident *O. mykiss* redds in both reaches. In 2021, anadromous steelhead redds were observed in the reach downstream of the USGS gage, and in 2018 steelhead redds were observed upstream of the USGS gage. Summer rearing of fry occurs throughout AG Creek (Alley 1997a, SHG 2006a). Creek Lands Conservation (2023) also conducted snorkel surveys in both reaches. Surveyors regularly observed small numbers of juveniles downstream of the USGS gage and rarely observed juveniles upstream of the gage.

Overwintering locations in the creek are unknown but overwinter survival is likely high because Lopez Dam has the effect of muting winter flows. Alley (1997a) estimated equal numbers of young-of-the-year and age 1+ and older fish in the creek, which suggests low overwinter mortality if one assumes similar recruitment for the two age classes.

Fish surveys of small areas of lower AG Creek using limited methods have been conducted since 2003 as part of the “Lower Arroyo Grande Creek and Lagoon Fishery and Aquatic Resources Monitoring Program” for the Oceano Dunes State Vehicular Recreation Area, Pismo Dunes State Preserve (Rischbieter 2003–2020; Rischbieter et al. 2020a–d, 2021a–c, 2022a–c, 2023a–e, 2024a–d, 2025). These surveys also indicate the continued presence of all life stages of *O. mykiss* in the estuary and lower reaches of the stream. However, these opportunistic observations do not provide a reliable population estimate and rarely distinguish between resident or anadromous life forms and underscore the low run size. The most recent observations of anadromous life forms occurred in 2021, when the survey documented the carcasses of two adult steelhead near the estuary (NMFS 2024).

Current estimates are comparable to estimates from the 1950s and early 1960s though all of these are unreliable. No systematic, quantitative monitoring has been conducted, and there has not been a thorough examination of the historical record of steelhead usage in the AG Creek watershed, and the actual run size, and in particular, the natural fluctuations in run size with varying ocean and freshwater conditions, is not known with any accuracy (NMFS 2024). Rischbieter (2004) speculated that dozens to a few hundred steelhead return annually to AG Creek. Others have repeated this estimate (for example, NMFS 2017).

In order to spawn in AG Creek, adult steelhead must enter via a breached sand bar at the lagoon and then migrate upstream to suitable spawning habitat. The sand bar breaches after high flow events in winter, and upstream migration generally occurs in winter and spring. Other potential spawning areas include Los Berros Creek and Tar Spring Creek (Becker and Reining 2008). Spawning in Los Berros Creek was suggested by the observation of juvenile steelhead in 2003 (Becker and Reining 2008), although these fish could be from the mainstem. Tar Spring Creek was noted as having fair spawning habitat with the greatest potential to be used in wet years (Becker and Reining 2008). Meadow Creek and lagoon do not contain suitable habitat for steelhead, due to unsuitable substrate consisting of fine silts and sediments, abundance of centrarchids and other non-native fish species, and presence of migration barriers (TVEC 2012). In dry years, reduced flows as a result of managed flow releases from the dam in winter (November–February) could have reduced connectivity, delayed adult spawning migrations, reduced availability of suitable spawning gravels, and dewatered redds (Stetson Engineers 2011).

AG Creek, from below the dam to upstream of the confluence with Los Berros and Tar Spring creeks, has a simplified narrow channel, is filled with silt (SHG 2006a), and is dominated by flatwater and shallow pools with very few riffles to produce invertebrates as a food source for juvenile steelhead (Close and Smith 2004). However, flows from Los Berros, Tar Spring, and Corbett/Carpenter creeks into AG Creek likely introduce coarse material for spawning and flush fine sediments from pools and riffles, resulting in better-quality steelhead habitat (SHG 2006a).

California State Parks has been investigating and monitoring the fishery and habitat of the lowest half-mile of AG Creek since 2003. Beginning in 2003, seasonal surveys of the waters of Pismo State Beach and Oceano Dunes State Vehicular Recreation Area were conducted to document and evaluate the status and general assemblages of fish species present and the various species' use of habitats within the State Park. Towards these goals, aquatic sampling was generally limited to the Park reach of AG Creek. Surveys were conducted using electrofishing, seining, dipnetting and direct observation, with information taken including general counts and length measurements of species captured.

A total of 90 surveys were conducted from August 2003 to February 2025, with generally four surveys per year but ranging from two to six. Steelhead were observed every year except for four: 2007, 2015, 2016, and 2021. In 2007, the absence of steelhead appeared to be related to poor habitat conditions and the absence of freshwater inflow and high lagoon temperatures. Similarly, 2015, 2016, and 2021 were drought years. Absence of flow may have prevented steelhead adult or juvenile migration through the lower reaches of AG Creek in 2015 and 2016, as migration corridor conditions were not suitable for sufficient duration and/or at appropriate times.

2.1.7 Steelhead Spawning and Rearing Habitat in the Plan Area

AG Creek appears to support the three basic life-history strategies of steelhead: fluvial-anadromous, freshwater-resident, and lagoon-anadromous (NMFS 2024) (See Section 2.1.4). Depending on rainfall and runoff patterns in the watershed, the AG Creek watershed naturally exhibits physical and hydrological characteristics that can favor either or both anadromous or non-anadromous steelhead life history forms at different times (NMFS 2024). However, surface water storage and diversion and groundwater extraction in the watershed combined with changes to the physical landscape have altered the hydrological regime in AG Creek, which in turn has the potential to have adverse impacts on migration of both adults and juveniles between the marine and freshwater environment as well as the non-anadromous form through the depletion of base flows supporting spring, summer and fall rearing.

The SCCC steelhead Recovery Plan indicates that the lower reaches of AG Creek are affected by urban and agricultural development and the associated impacts such as channelization, riparian encroachment, and a loss of natural channel conditions and processes; urban and agricultural runoff; and increased sediment supply from roads. Boughton and Goslin (2006) conducted a Geographic Information System evaluation of the potential for steelhead over-summer habitat in California watersheds south of San Francisco based on geomorphic, hydrologic, and climatic features thought to control the broad-scale suitability of stream reaches for steelhead under unimpaired conditions. Model variables include stream gradient, summer mean discharge, summer temperature, valley width relative to mean discharge, and whether the reach occurred in alluvial soils. Results are spatially explicit stream reaches categorized as either low- or high-potential for suitable over-summer habitat to occur. Results for AG Creek are shown in Figure 2-3.

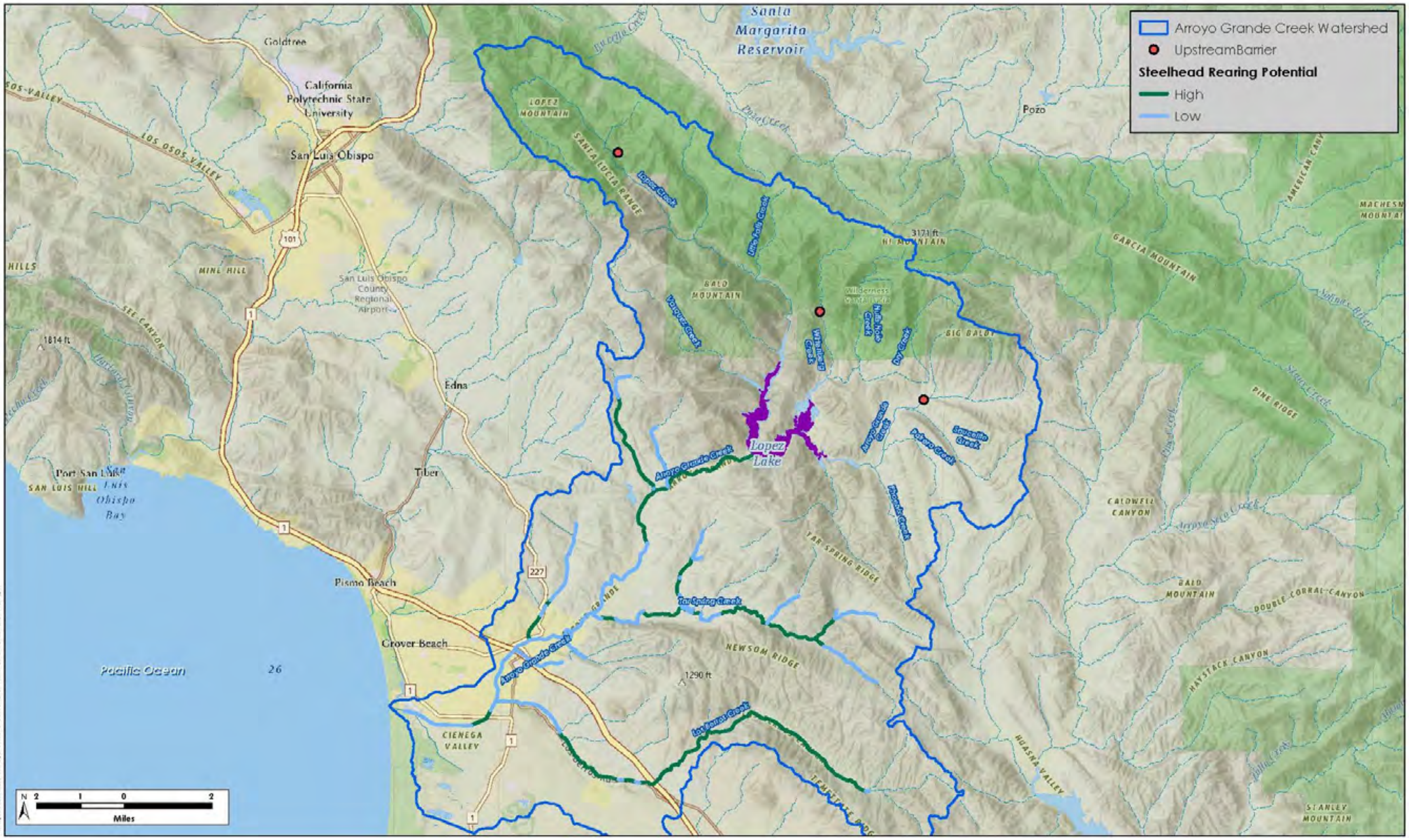

Figure 2-3. NMFS intrinsic potential (IP) habitat downstream of Lopez Dam.

In the lower AG Creek watershed, low-potential perennial summer habitat was predicted by Boughton and Goslin (2006) for the lower approximately eight miles of mainstem habitat (Figure 2-3). This transitions to high-potential perennial summer habitat for the remaining approximately 5 miles up to Lopez Dam. Additional high-potential intermittent summer habitat was predicted in Los Berros Creek and Tar Spring Creek (Table 2-1). Overall, Boughton and Goslin (2006) estimated 46.8 miles of potential intermittent and perennial rearing habitat for steelhead downstream of Lopez Dam, 10.8 miles of perennial IP habitat (Table 2-1), of which five miles was classified as high potential perennial rearing habitat.

Table 2-1. Potential for suitable steelhead rearing habitat in Arroyo Grande Creek watershed.

Stream	IP Habitat[1] Intermittent[2,3] (stream miles)	IP Habitat[1] Perennial[2,3] (stream miles)	Location and Type of Barrier	Notes
Steelhead habitat downstream of Lopez Dam				
AG Creek	8.0	4.8	Lopez Dam at RM 12.8	Low density of *O. mykiss*, high restoration potential
Tar Spring Creek	~6	~2	--	Low density of *O. mykiss*, restoration potential, and amount of perennial reaches unknown
Los Berros Creek	~9	~2	--	
Unnamed tribs	~13	~2	--	
Total downstream of Lopez Dam	**~36**	**10.8**		
Steelhead habitat upstream of Lopez Dam				
Big Falls Creek	0.0	2.2	Falls at RM 2.2	*O. mykiss* observed[3]
Dry Creek	3.0	0.0	Natural barrier at RM 3.0	No recent *O. mykiss* surveys
AG Creek (US of barrier)	2.0	0.3	Natural barrier at RM 2.6[3,4]	Low density of *O. mykiss* observed[3]
AG Creek (DS of barrier)	0.0	2.6		
Huffs Hole Creek	1.0	0.0	High gradient at RM 1.0	No recent *O. mykiss* surveys
Little Falls Creek	1.6	0.0	Falls at RM 1.6	*O. mykiss* observed[3]
Lopez Canyon Creek (US of barrier)	1.6	2.7	Falls at RM 10.0[4]	High density of *O. mykiss* observed[3]
Lopez Canyon Creek (DS of barrier)	0.7	7.3		
Phoenix Creek	1.9	0.0	High gradient at RM 1.6	No recent *O. mykiss* surveys
Potrero Creek (US of barrier)	0.7	0.0	Structure at RM 0.9[4]	
Potrero Creek (DS of barrier)	0.9	0.0		
Rock Falls Creek	1.7	0.0	High gradient at RM 1.7	
Saucelito Creek	2.4	0.0	High gradient at RM 2.4	
Vasquez Creek	4.6	0.0	High gradient at RM 4.6	
Wittenberg Creek (US of barrier)	2.1	0.0	Two crossings at RM 0.25 mi and natural barrier at 1.7[3,4]	High density of *O. mykiss* observed[3]
Wittenberg Creek (DS of barrier)	1.7	0.0		
Unnamed tributaries (US of barriers)	2.3	0.8	--	No recent *O. mykiss* surveys
Unnamed tributaries (DS of barriers)	4.7	0.0		
Total upstream of Lopez Dam	**33.4**	**15.8**		

[1] Boughton and Goslin (2006), classified as "low" or "high" potential rearing habitat
[2] Stillwater Sciences (2023)
[3] TRPA (2011)
[4] CDFW 2023
-- unknown

The upper reaches of Arroyo Grande watershed exhibit both intermittent and perennial that provide conditions that support rearing of juvenile steelhead (NMFS 2024). They also contain suitable sized spawning gravel essential for reproduction (Kondolf and Wolman 1993, Kondolf 2000, Boughton et al. 2006, 2007 as cited in NMFS 2024). Additionally, the aquatic habitats within the upper tributaries of the AG Creek watershed provide a diversity of micro-habitats that contributed to the diversity of the species which is critical to its viability (Boughton and Goslin 2006, Boughton et al. 2006, 2007, TRPA 2011).

The SCCC Steelhead Recovery Plan provides limited information on habitat conditions upstream of Lopez Dam. A substantial amount of high-potential summer habitat was identified in the upper AG Creek watershed based on assessment by Boughton and Goslin (2006), including 13 mi in Lopez Canyon Creek, 8 mi in Wittenburg and Dry creeks, 6 mi in AG Creek, and substantial habitat in other smaller tributaries for a total of over 30 mi upstream of Lopez Dam (Figure 2-4). Of this high-potential rearing habitat, 15.8 mi was classified by Boughton and Goslin (2006) as perennial (Table 2-1).

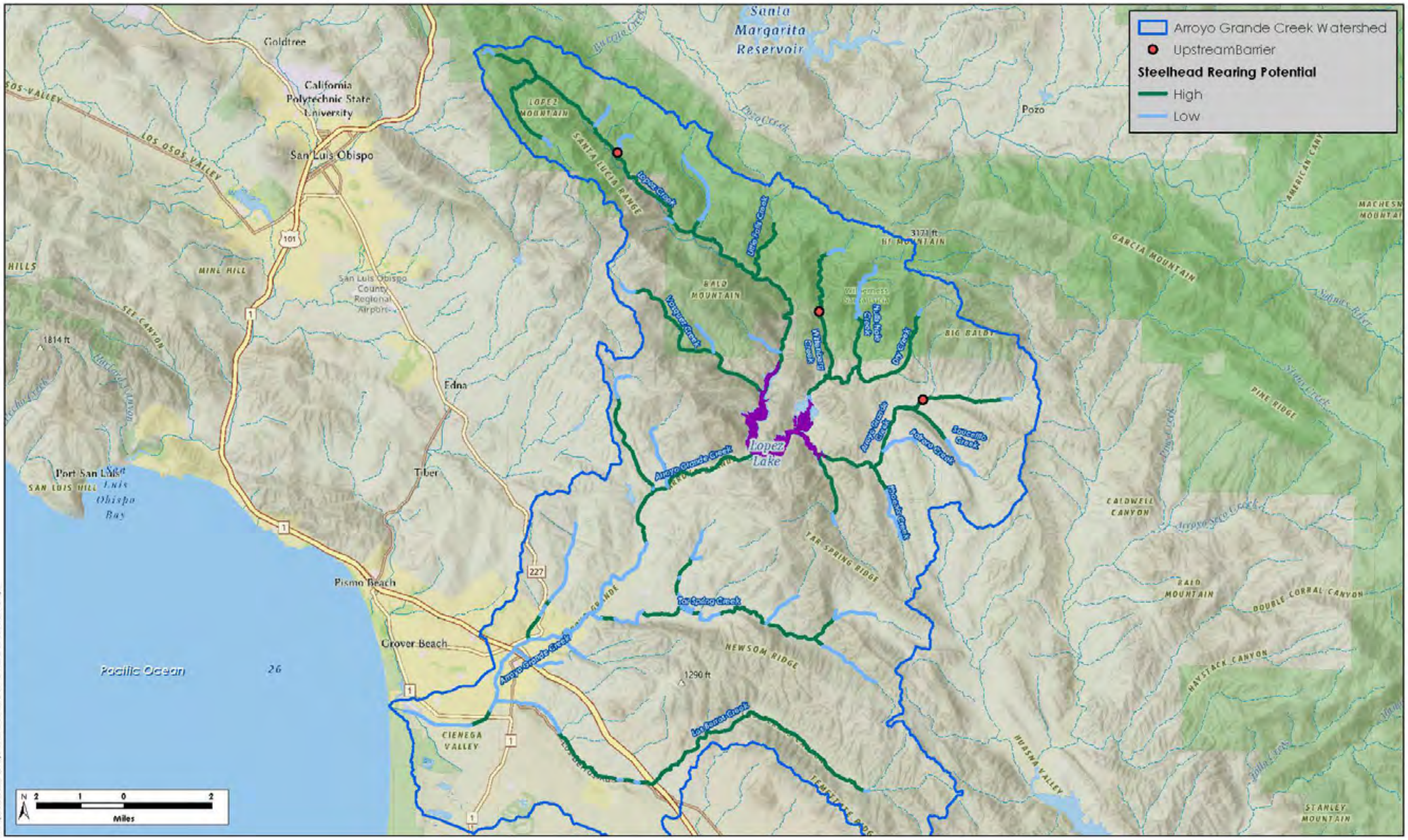

Figure 2-4. NMFS intrinsic potential (IP) habitat upstream of Lopez Dam.

2.1.7.1 Rearing Habitat

Under Existing Conditions, releases from Lopez Dam result in flows that are higher in the summer dry months than would have occurred prior to Lopez Dam (Table 2-2). During summer, flows decline in the downstream direction because of water withdrawals, groundwater pumping, and natural percolation. No comprehensive analysis has been conducted on the relationship between instream flows and rearing habitat (Section 2.1.5). In general, it appears suitable rearing conditions for steelhead under Existing Conditions during summer are more limited by habitat conditions than by instream flows downstream of Lopez Dam (Stillwater Sciences 2022a). Within the reach from Lopez Dam to Tar Spring Creek, under typical Lopez Dam release flows (>5 cfs) the channel maintains suitable water depth and velocity for rearing but is devoid of habitat complexity or productive riffles (Stillwater Sciences 2022a).

The longitudinal extent of wetted channel at 7 cfs extends to within a mile of AG lagoon (Stillwater Sciences 2022a). With 7 cfs release overall habitat conditions for juvenile steelhead are more suitable in locations downstream of Tar Spring Creek due to greater habitat complexity and higher frequency of riffle habitat. Upstream of Tar Spring Creek there is extensive uniform pool habitat created by beaver dams. These locations provide suitable depths for juvenile steelhead rearing but lack riffle habitat which provides productive benthic macroinvertebrate (BMI) habitat therefore limiting food availability for juvenile steelhead (Stillwater Sciences 2022a). Downstream of the Cecchetti Road crossing, habitat conditions include complex pool habitat separated by short riffles in locations, while upstream of the road crossing, habitat conditions become more uniform with limited riffle habitat and long shallow run habitat that provides little value for juvenile steelhead rearing. Directly downstream of Lopez Dam the majority of the stream runs through long pools that provide little value to juvenile steelhead and support predatory nonnative fish species (Stetson Engineers et al. 2004, SHG 2008).

Flows during fall are similar to what would have occurred prior to Lopez Dam and flows during winter and spring are lower than what would have occurred prior to Lopez Dam (Table 2-2). Under Existing Conditions flows are continuous downstream to the lagoon, and deep pools (>1.5 ft) suitable for providing juvenile rearing habitat are abundant (Stillwater Sciences 2022a).

Table 2-2. Summary of average daily flows (cfs) at Cecchetti Road and City of Arroyo Grande under pre-dam and existing conditions for the period of 1969–2024.

Season	Water Year Type	Average Daily Flow (cfs)			
		Cecchetti Road (RM 12.2)		City of Arroyo Grande (RM 5.7)	
		Pre-dam	Existing Conditions	Pre-dam	Existing Conditions
Summer (Jul–Sep)	Dry	0.1	4.0	0.2	4.8
	Median	0.3	4.0	0.4	4.9
	Wet	3.6	4.3	4.5	6.1
	Average for All Years	1.4	4.1	1.7	5.3
Fall (Oct–Dec)	Dry	1.1	4.9	2.0	6.1
	Median	4.7	5.1	6.1	6.9
	Wet	11.3	7.9	15.5	12.5
	Average for All Years	5.7	6.0	7.9	8.6
Winter (Jan–Mar)	Dry	10.0	3.1	11.7	4.9
	Median	28.0	6.2	36.4	14.8
	Wet	136.2	67.3	182.8	114.0
	Average for All Years	58.6	25.9	77.7	45.1

Season	Water Year Type	Average Daily Flow (cfs)			
		Cecchetti Road (RM 12.2)		City of Arroyo Grande (RM 5.7)	
		Pre-dam	Existing Conditions	Pre-dam	Existing Conditions
Spring (Apr–Jun)	Dry	4.5	4.5	5.0	5.5
	Median	6.3	3.2	7.5	4.9
	Wet	31.6	19.3	39.3	27.5
	Average for All Years	14.2	9.1	17.5	12.8

2.1.7.2 Spawning Habitat

Under Existing Conditions daily average flows during the winter spawning (Section 2.1.5) and incubation season are from 3 to 67 cfs at Cecchetti Road depending on a range of factors including water-year type (Table 2-2). No comprehensive analysis has been conducted on the relationship between instream flows and spawning habitat. Under Existing Conditions, spawning gravel is most abundant downstream of Tar Spring Creek both in the mapped total area and in the density of spawnable gravel (square feet [ft^2] per 100 ft of stream) (Stillwater Sciences 2022a). Stillwater Sciences (2022a) observed that at flows of 3–4 cfs a total of 4,849 ft^2 of suitable gravel were observed within the wetted channel downstream of Lopez Dam, and that 1,593 ft^2 of suitable gravel was within the channel but unwetted during these flows.

2.1.8 Steelhead Passage in the Plan Area

2.1.8.1 Barriers

Fish passage barriers in the Arroyo Grande Watershed range from partial or temporal impediments that may impede either adult or juvenile steelhead migrations to total barriers that prevent adult upstream passage and restrict the movement of *O. mykiss* downstream.

The CalFish Passage Assessment Database (PAD) (CDFW 2020) was queried in May 2025 for potential obstacles within the Covered Area, filtering for “Partial”, “Temporal”, “Temporal & Partial”, and “Total” barriers (Table 2-3). Given that obstacles are entered in the database at various times, it is unknown if all of these potential barriers are currently obstacles given geomorphic changes, vegetation growth, and flow conditions. Additionally, obstacles may exist that have not been reported to the PAD and information is often dated. However, the PAD is the most comprehensive assessment of fish passage barriers available at this time. Most of potential obstacles identified in the table below are not owned, operated, or controlled by the District and are not within the authority of the District to alter or remove. Potential obstacles over which the District exercises ownership or control are marked with an asterisk.

Table 2-3. Arroyo Grande Creek Watershed fish passage barriers, based on CDFW (2020).

Barrier Name	Location (River Mile, RM)	Location (Coordinates)	Barrier Status
Debris Jam/Beaver Dam	RM 0.6	35.09902, -120.620519	Temporal; An active beaver dam.
Highway 1 Bridge	RM 2.4. Near the intersection of HWY 1 and S. Halcyon Rd.	35.098192, -120.59181	Unknown; 80 ft bridge with pillars with dirt slopes, heavy foliage at outlet and inlet. California Conservation Corp (CCC) conducted a reconnaissance survey on July 21, 2021, and determined this crossing warrants a detailed survey.
Two Concrete Dams	RM 3.1. Near the intersection of Virginia Dr and Woodland Dr.	35.107437, -120.58781	Temporal; The dams seem to be nonfunctional as the creek flow has undermined the dams.
Highway 101 Bridge	RM 4.1. Where Hwy 101 crosses AG Creek.	35.120585, -120.581475	Unknown; CCC reconnaissance survey determined a detailed survey is warranted
Rip-rap Dam	RM 5.4. About 2,000 ft upstream of Arroyo Grande stream gage.	35.12513, -120.562761	Unknown; Unknown passage status
Concrete Dam	RM 6.2. About 0.2 miles downstream of the confluence with Tar Spring Creek.	35.131987, -120.553182	Partial; A barrier to juveniles migrating upstream
Cecchetti Road Culvert	RM 8.3. At Cecchetti Rd.	35.148522, -120.533618	Temporal; Meets passage criteria for adult steelhead between 7.5 cfs and 47.5 cfs but fails to satisfy passage conditions at nearly all flows for juvenile steelhead.
Rip-rap Dam	RM 9.3. Downstream from Talley Farms Rd crossing and upstream of former Cecchetti Rd crossing over AG Creek.	35.161588, -120.530477	Temporal;
Talley Vineyard Dam Footing	RM 10.2. Near the intersection of Orcutt Rd and Lopez Dr.	35.172444, -120.529215	Temporal;
Culvert at Biddle Regional Park*	RM 11.4. Near the entrance to Biddle Park from Lopez Dr.	35.180803, -120.514078	Temporal; Passage barrier at high flows.
Lopez Lake Dam*	RM 13.2. Lopez Dam	35.187305, -120.487313	Total; Complete passage barrier.
Little Falls Creek Falls	About 2.5 miles upstream of Lopez Lake. At or about RM 0.5 from the confluence with Lopez Canyon Creek.	35.251263, -120.487766	Total; Natural barrier.

Barrier Name	Location (River Mile, RM)	Location (Coordinates)	Barrier Status
Big Falls Canyon Creek Lower Falls	About 4.5 miles upstream of Lopez Lake, about 0.3 miles northeast of the Big Falls Trailhead. At or about RM 0.1 from the confluence with Lopez Canyon Creek.	35.264789, -120.511181	Total; Natural barrier
Big Falls Canyon Creek Upper Falls	About 5.2 miles upstream of Lopez Lake, and about 0.7 miles upstream of Lower Falls. At or about RM 0.8 from the confluence with Lopez Canyon Creek.	35.272996, -120.507461	Total; Natural barrier
Los Berros Creek Grade Control Structure*	About 0.4 miles upstream of the confluence with AG Creek, near the intersection of Valley Rd and Los Berros Rd.	35.103583, -120.581667	Partial; Adults steelhead are able to pass at most flows, and a complete barrier to juvenile steelhead.
Los Berros Creek Rd. Crossing/Gauging Station	About 5.9 miles upstream of the confluence with AG Creek.	35.088289, -120.51005	Temporal; The downstream channel has down cut significantly to form a barrier to fish passage.
Los Berros Creek Culvert	About 10.6 miles upstream of the confluence with AG Creek, near Upper Los Berros Rd.	35.080854, -120.447598	Partial; This could present a barrier to juveniles and under certain conditions migrating adult steelhead, but under normal flows it should be passable to adult salmonids
Corbit Canyon Creek East Branch St. Concrete Arch	About RM 0.1 from the confluence with AG Creek, near the intersection of E. Branch St and Crown Hill St.	35.124892, -120.575671	Total; There is an excessive leap requirement and overlapping water depth and velocity barriers for all fish.
Tar Spring Creek Concrete Structure	About RM 0.6 from the confluence with AG Creek at Branch Mill Rd.	35.131879, -120.542477	Total; The structure has been undermined by the active creek and most likely presents a full barrier to both adult and juvenile migrating steelhead.
Hwy 101 Culvert on Unnamed Tributary to Los Berros Creek	Located on Hwy 101 south, about 0.6 miles south of the intersection of E El Campo Rd and Hwy 101 south. At or about RM 2.1 from the confluence with Los Berros Creek.	35.106855, -120.554819	Unknown; Incomplete survey, requires a complete reconnaissance survey
Bridge with Potential Passage Constraints on Unnamed Tributary to Los Berros Creek	At or about RM 0.4 from the confluence with Los Berros Creek, at the intersection of Cabrillo Hwy 1 and Valley Rd.	35.098018, -120.581644	Unknown; CCC conducted a reconnaissance survey on July 21, 2021 and determined this crossing warrants a detailed survey.

Barrier Name	Location (River Mile, RM)	Location (Coordinates)	Barrier Status
Hwy 101 Culvert on Unnamed Tributary to Los Berros Creek	Located on Hwy 101 south, about 0.1 miles south of the intersection of Hemi Rd and Hwy 101. At or about RM 0.6 from the confluence with Los Berros Creek.	35.083219, -120.529861	Unknown
Hwy 101 Crossing on Unnamed Tributary to Los Berros Creek	Located on Hwy 101 south, about 0.1 miles south of the intersection of E El Campo Rd and Hwy 101 south.	35.110695, -120.562365	Unassessed; Needs verification and a fish passage assessment.
Concrete Pipe Culvert on Unnamed Tributary to Los Berros Creek	Located on Hwy 101 south about 0.1 miles south of the Traffic Way on-ramp.	35.115774, -120.573024	Unknown; First survey determined a detailed survey is warranted.
Concrete Pipe Culvert on Unnamed Tributary to Los Berros Creek	Located on Hwy 101 south about 0.3 miles north of the intersection of Laetitia Vineyard Rd and Hwy 101. At or about RM 1.1 from the confluence with Los Berros Creek.	35.091227, -120.541559	Unknown; First survey determined a detailed survey is warranted.
Road Crossing on Unnamed Tributary to Los Berros Creek	Located on Hwy 101 south, about 0.9 miles north of the intersection of Laetitia Vineyard Rd and Hwy 101. At or about RM 1.1 from the confluence with Los Berros Creek.	35.099654, -120.547559	Unknown; CCC conducted a reconnaissance survey on July 21, 2021, and determined this crossing warrants a detailed survey.
Lopez Reservoir Terminal Dam*	At or about RM 0.17 from the confluence with AG Creek.	35.170474, -120.533623	Total; assessed in 2021 by CDFW using aerial imagery, complete passage barrier with no fish passage structure.

* Owned and operated by the District.

2.1.8.2 Lopez Dam and Reservoir

Under Existing Conditions, Lopez Dam prevents adult steelhead from moving past the structure and accessing habitat upstream of Lopez Reservoir, which is currently occupied by *O. mykiss* (Stillwater Sciences 2023). Hatchery *O. mykiss* observed downstream from Lopez Dam in December 2023 (NMFS 2024) indicate that non-listed *O. mykiss* may move downstream from Lopez Reservoir, but the dam and resulting reservoir combined are likely a partial barrier to downstream movement of non-listed *O. mykiss* that have the potential for anadromy if they successfully migrate to the ocean unimpeded.

A feasibility analysis was conducted to assess the amount of habitat available upstream and downstream of Lopez Dam using intrinsic potential mapping and assessment of perennial versus intermittent habitat (Stillwater Sciences 2023). The analysis concluded that under Existing Conditions 40.6% (10.8 miles) of perennial intrinsic potential habitat is downstream of Lopez Dam, and 59.4% (15.8 miles) is upstream of Lopez Reservoir.

Resident *O. mykiss* that migrate or move downstream into Lopez Reservoir are subject to predation and competition from non-native game fish such as black bass (*Micropterus spp.*) that are supported by the impounded water of the reservoir (described in Section 1.1.1). *O. mykiss* that attempt to move/migrate downstream through Lopez Reservoir and past Lopez Dam are subject to a partial barrier at the dam, with the only downstream passage route through outlets designed for water releases to AG Creek and over the spillway during infrequent spill events. *O. mykiss* that pass downstream through the Lopez Dam are subject to injury or mortality while passing through outlet structures, and spill events have been limited under Existing Conditions.

Impediments to upstream and downstream movement of *O. mykiss* and the exposure to non-native predators in the reservoir limit the gene flow between *O. mykiss* upstream and downstream of Lopez Dam and reduce the resiliency of the population against environmental changes such as climate change, disease, and competition.

2.1.9 Summary of Steelhead in Plan Area

Land use and water management practices, in combination with barriers to upstream spawning and rearing (most notably Lopez Dam), have degraded steelhead habitat in AG Creek. Becker et al. (2010) identified AG Creek as one of five anchor watersheds of SLO County, though relative to the other four watersheds AG Creek had the fewest stream miles of available habitat. A model of potential over-summering habitat (the most restricted habitat type for the species) predicted that the Arroyo Grande basin has the most extensive potential habitat along the SLO coast (Cambria to Arroyo Grande) (Boughton and Goslin 2006). Much of the potential habitat mapped occurs upstream of Lopez Dam (Boughton and Goslin 2006).

Based on available information, it appears that steelhead in the Plan Area are restricted to spawning and rearing within the AG Creek watershed downstream of Lopez Dam (Figure 2-5). Conditions within this area are constrained by flows and fish passage impediments restricting adults' migratory access from the Arroyo Grande Lagoon to Lopez Dam, and for smolts from the reach downstream of the dam to the lagoon. Spawning habitat in AG Creek upstream of the Tar Spring Creek confluence (Figure 2-1) is limited by available gravel, and fry and juvenile food availability is constrained by productive macroinvertebrate habitat within cobble/gravel riffles. Invasive species are abundant and are presumed to prey upon and compete with steelhead. Invasive species are particularly prolific in degraded habitat conditions within captured gravel pits in AG Creek downstream of Lopez Dam. Restricted spatial distribution and altered flow and habitat conditions limit the populations abundance, productivity, and resiliency to disturbance (NMFS 2013).

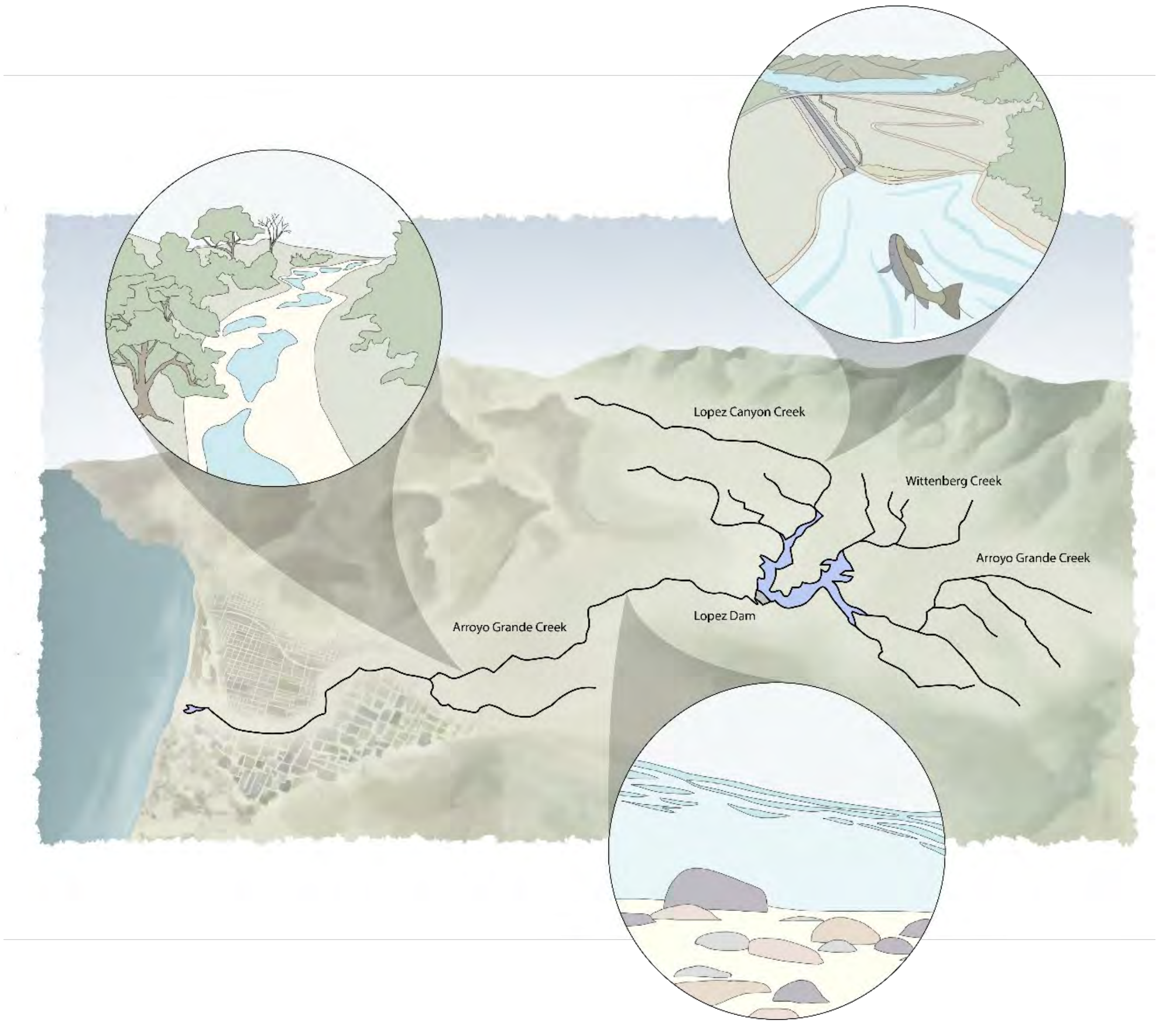

Figure 2-5. Conceptual diagram of Steelhead Life History in Arroyo Grande Creek under Existing Conditions.

2.2 California Red-legged Frog

2.2.1 Status

The CRLF was listed as threatened species in 1996 (USFWS 1996) due to extirpation from 70 percent of its former range. It is also designated as a Species of Special Concern in California (CDFG 2011). USFWS has identified threats to the species as including urban encroachment, construction of reservoirs and water diversions, non-native predators and competitors, livestock grazing, and habitat fragmentation (USFWS 1996).

Historically, CRLF was found throughout the Central Valley, the central coast, and the Sierra Nevada foothills. CRLF are known to occur in 248 streams or drainages from 23 counties, primarily in central coastal California from Marin County south to northern Baja California, Mexico, and in isolated drainages in the Sierra Nevada, northern Coast, and northern Transverse Ranges (USFWS 2002). Monterey, SLO, and Santa Barbara counties are thought to have the highest number of currently occupied drainages with SLO County containing 36 drainages known to support CRLF (USFWS 1996).

2.2.2 Critical Habitat

USFWS first designated critical habitat for the CRLF in 2006 and revised the critical habitat designation in 2010 (USFWS 2006, 2010). A portion of the CRLF critical habitat is within the Plan Area (Figure 2-6). USFWS included a portion of the upper watershed in Lopez Canyon but not the lower watershed below Lopez Dam. As described in the critical habitat rule, the PCEs that are essential to CRLF conservation include:

1. aquatic breeding critical habitat defined as standing bodies of fresh water (salinity < 7.0 parts per thousand) including: natural and manmade (e.g., stock) ponds, slow moving streams or pools within streams, other ephemeral or permanent water bodies that typically become inundated during winter rains and hold water for a minimum of 20 weeks in all but the driest years (PCE 1);
2. non-breeding aquatic critical habitat defined as fresh water habitats that may or may not hold water long enough for the frog to complete its lifecycle but that do provide for shelter, foraging, predator avoidance, and aquatic dispersal (PCE 2);
3. upland critical habitat defined as upland areas within 200 ft of the edge of riparian vegetation or dripline surrounding aquatic and riparian habitat and comprised of vegetation such as grasslands, woodlands and/or wetland/riparian plant species that provides shelter, forage, predator avoidance (PCE 3);
4. aquatic features defined as fresh-water habitats in or near lowlands or foothills with dense, shrubby, or emergent vegetation. Such areas include natural or manmade (e.g., stock) ponds, slow moving streams or pools within streams, and other ephemeral or permanent waterbodies that typically become inundated during winter rains such as plunge pools, intermittent creeks, seeps, and quiet water refugia (PCE 4); and
5. upland habitats defined as all areas that are both within 200 ft of the mean high-water mark of an aquatic feature and meet the definition of upland habitat as it applies to critical habitat (PCE 5).

Because Covered Activities have the potential to affect PCE 2, impacts of the Covered Activities and implementation of the conservation program on this PCE are analyzed in detail in Section 6.2 of this HCP. Covered Activities are not expected to affect PCEs 1 nor 3–6; therefore, these PCEs are not analyzed further.

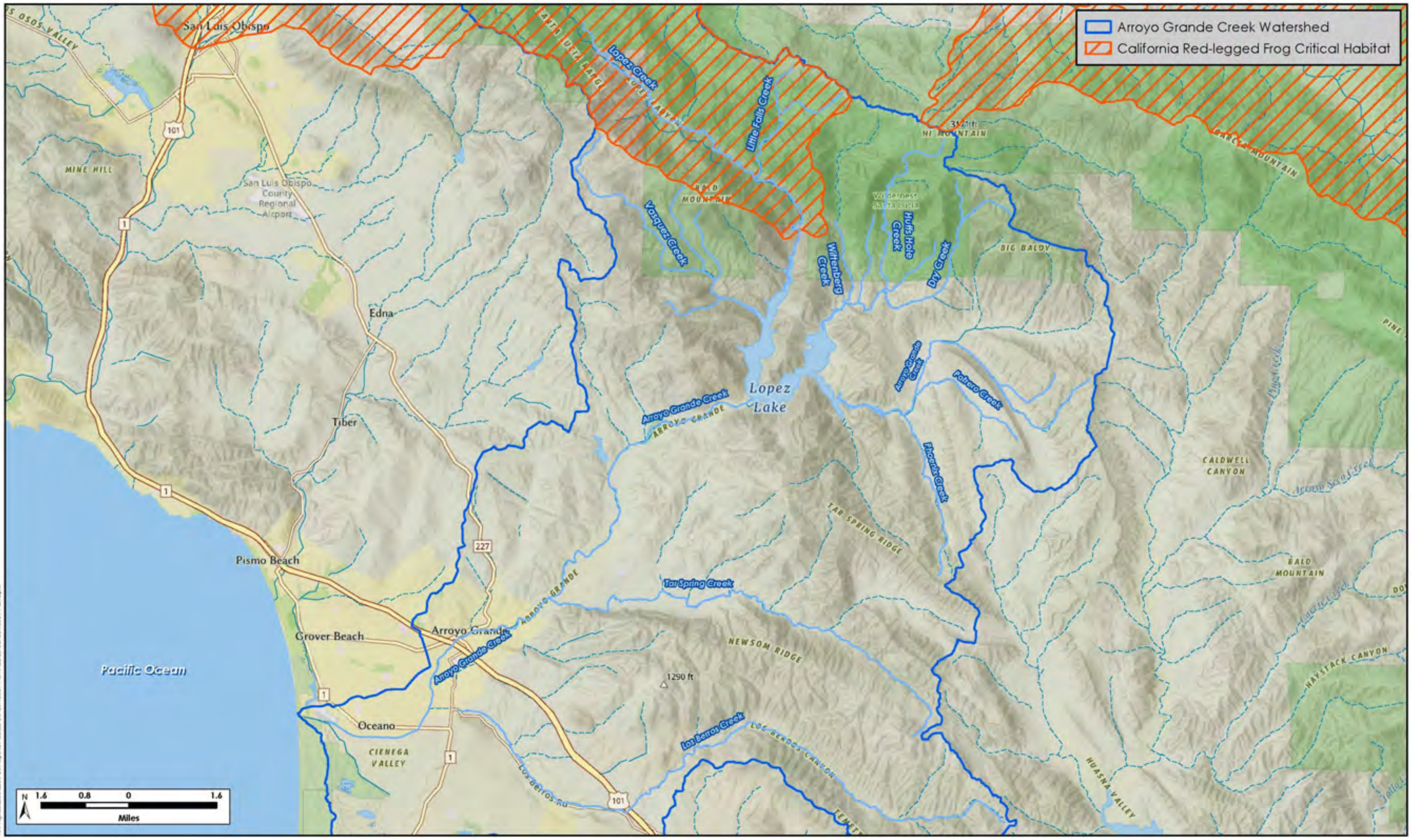

Figure 2-6. Designed critical habitat for California red-legged frogs

The California Red-legged Frog Recovery Plan (USFWS 2002) listed AG Creek as one of the core areas for focused recovery efforts. Core areas were chosen because they represent viable populations or because the locations will contribute to connectivity between habitats and populations.

2.2.3 Habitat Requirements and Life History

CRLF occurs primarily in isolated ponds or pools of intermittent or perennial stream courses where water remains long enough for breeding and development of young (Jennings and Hayes 1994). There is variation in how CRLF use their environments, with some individuals completing their entire life cycle in one habitat and others using multiple habitat types. Stream habitat requirements for CRLF include deep pools, slow water velocity, and ample cover. Habitats with the highest densities of frogs have dense emergent or overhanging riparian vegetation associated with deep (>2–3 ft), still, or slow-moving water (Jennings and Hayes 1994). The riparian vegetation that seems most structurally suitable is provided by willows (*Salix* sp.), cattails (*Typha* sp.), and bulrushes (*Scirpus* sp.) (Jennings and Hayes 1994). Juvenile frogs are commonly found in warm, open, shallow-water habitats with floating or submersed vegetation (Jennings and Hayes 1994).

All life stages of CRLF can also be found in stock ponds or pools completely devoid of vegetation as well as coastal lagoons, canals, dune ponds, and large reservoirs (USFWS 2010, Alvarez et al. 2024). Although CRLF occurs in either ephemeral or permanent streams or ponds, populations likely do not experience long-term survival in ephemeral streams where all surface water disappears (Jennings and Hayes 1994). The most secure aggregations of CRLF are in aquatic sites with substantial riparian and aquatic vegetation and no non-native predators.

In SLO County, most egg laying occurs in March and April (M. Jennings, personal communication, September 10, 2025), although the more general breeding season throughout California is November through April (USFWS 2002). Females lay eggs in ponds or backwater pools of creeks, attaching them to emergent vegetation such as *Typha* and *Scirpus* (Jennings and Hayes 1994). Eggs hatch in 6 to 14 days and metamorphosis occurs 3.5 to 7 months after hatching (Storer 1925, Jennings 1988, Jennings and Hayes 1990). Most tadpoles undergo transformation by mid-August. After metamorphosis, juveniles generally do not travel far from aquatic habitats. On the central coast of California, recently metamorphosed CRLF have been observed from June through September (Alley 1996). Sexual maturity is reached at 3 to 4 years of age (Storer 1925, Jennings and Hayes 1985), and frogs may live 8 to 10 years (Jennings et al. 1992).

The diet of CRLF is highly variable. Feeding activity probably occurs along the shoreline and on the surface of the water (Hayes and Tennant 1985). Hayes and Tennant (1985) found invertebrates to be the most common food items. Vertebrates, such as Pacific tree frogs (*Pseudacris regilla*) and California mice (*Peromyscus californicus*), represented over half of the prey mass eaten by larger frogs (Hayes and Tennant 1985). Larvae likely feed on algae (Jennings et al. 1992).

CRLF may disperse upstream, downstream, or upslope from their breeding habitat to forage and seek sheltering habitat. Access to sheltering habitat is essential for survival of CRLF within a watershed and can limit frog population numbers and survival (USFWS 1996), and the survival rate of frogs that disperse overland would be low if no suitable habitat is present. Sheltering habitat includes mammal burrows, damp leaf litter, water troughs, downed wood, other natural and manmade cover objects and dense shrubbery (USFWS 2002). During dry periods, red-legged frogs are rarely encountered far from water and spend considerable time resting, estivating, and feeding in adjacent riparian habitat when it is present. In wet periods, however, adult red-legged frogs can move long distances between aquatic habitats. Evidence from marked and radio-tagged frogs on the SLO County coast suggests that frog movements, via upland habitats, of about 1 mi are possible over the course of a wet season (USFWS 2002). A radio-tracking study in Marin County found a range of migration distances (0.02 to 0.87 mi, straight-line) (Fellers and Kleeman 2007), and migrating frogs in northern Santa Cruz County traveled straight-line distances of 0.12 to 1.74 mi (Bulger et al. 2003). The distance moved is highly site-dependent, as influenced by the local landscape (Fellers and Kleeman 2007). The USFWS (2010) considered 1 mi a more typical dispersal distance for the species in its critical habitat designation. CRLF found in coastal drainages are active year-round (Jennings et al. 1992), whereas those in interior sites may be more seasonally inactive. Seeps and springs in open grasslands can function as foraging habitat or refugia for dispersing frogs (Fellers and Kleeman 2007).

Introduced predators can be a significant threat to CRLF. These include bullfrogs (*Lithobates catesbeianus*), crayfish, and predatory fishes such as bass (*Micropterus* spp.), catfish (*Ictalurus* spp.), mosquitofish (*Gambusia affinis*), and sunfish (*Lepomis* spp.), which may feed on the larvae at higher levels than naturally co-evolved predatory species do (Hayes and Jennings 1988). Unlike CRLF larvae, bullfrog larvae grow larger, typically overwinter, and are unpalatable to predatory fish (Stebbins and McGinnis 2012), thus potentially outcompeting CRLF larvae in the same habitat where both occur. With suitable cover habitat CRLF can persist in the presence of either bullfrogs or non-native predatory fish, but the combined effects of both bullfrogs and non-native fish often leads to extirpation (USFWS 2002). Emergent vegetation, undercut banks, and semi-submerged rootwads afford cover from these predators (Fellers and Kleeman 2007).

Native predators of CRLF include raccoons, hawks, garter snakes, newts, and wading birds, such as black-crowned night herons and great blue herons (Stebbins and McGinnis 2012). Of the various life stages, larvae experience the highest mortality rates, with less than one percent of eggs laid reaching metamorphosis (Jennings et al. 1992). Larvae are particularly vulnerable to fish predation, especially immediately after hatching, when the nonfeeding larvae are relatively immobile (USFWS 2002). Larvae are also most vulnerable to high flows, since they are not adapted for swimming in fast currents and cannot move onto stream banks during high flows as can post-metamorphic frogs. The period from February through April is the most vulnerable seasonal period for early life stages (USFWS 1996). Egg predation is believed to be infrequent, possibly due to the physical nature of the egg mass jelly (USFWS 2002).

2.2.4 Occurrences and Habitat in the Plan Area

CRLF were historically documented opportunistically at many locations within the AG Creek watershed. Below Lopez Dam and Reservoir, surveys conducted in AG Creek in 1996 documented one CRLF at the gravel pit near the dam and one at Cecchetti Road, approximately 4.8 miles downstream of the dam (Alley 1996). During these surveys, no tadpoles were found in several days' trapping at the lagoon and the pools near the dam. In a 1997 fish survey, a juvenile CRLF was found in AG Creek at the mouth of an unnamed tributary near the lagoon. During surveys conducted in January 1998, one CRLF was found near Rodriguez Bridge on the access road to the dam (SAIC 2000). No CRLF were found in the gravel pit pool or near the dam during two nights of surveys in February 1999 for the Lopez Dam seismic remediation project (SAIC 2000). Numerous bullfrogs were observed in the ponds below the dam during reconnaissance surveys and from Highway 1 downstream to the estuary, as well as the middle reaches of the creek (Alley 1996).

However, recent observations of CRLF below the dam have only been within the lowermost sections around Arroyo Grande lagoon and within Tar Spring Creek (Stillwater Sciences 2022b). Within the AG Creek lagoon, all life stages of CRLF were documented during surveys conducted from 2008 through 2020 (Rischbieter 2009a,b; Cleveland Biological 2019, 2020; TVEC 2012 as cited in Stillwater Sciences 2022b). During these surveys, the presence of bullfrogs was also opportunistically documented, and a tadpole was collected (Rischbieter 2006). CRLF have also been reported just upstream of the lagoon (CNDDB 2025, Cleveland Biological 2019). The last documented occurrences of CRLF upstream of Tar Spring Creek were eight adults and one juvenile documented just below Lopez Dam in 2001 and 2002 (CNDDB 2025). No CRLF were observed during pre-construction and construction surveys for the AG Creek Channel Management Program which covered AG Creek from near the airport to just upstream of the confluence with Los Berros Creek from August 2019 through February 2021 (TVEC 2021). One adult CRLF was observed in Tar Spring Creek in June 2020 during a habitat study (Stillwater Sciences 2022a).

In the Plan Area above Lopez Dam and Reservoir, there are three CNDDB occurrences of CRLF: one individual observed in pool downstream of a bridge crossing 0.7 mile west southwest of Lopez Dam in 1998; another individual observed in a pond adjacent to the northwest side of Lopez Lake in 2001; and three adults observed in a pond 0.88 mile east southeast of Lopez Lake with one adult observed in Lopez Reservoir in 2008 (CNDDB 2025). CRLF are presumed extant in the upper watershed above the dam.

Habitat surveys were conducted in 2020 to assess conditions in AG Creek from the upstream end of the lagoon to directly downstream of Lopez Dam (Stillwater Sciences 2022a), and the following conclusions were made based on these surveys: CRLF breeding habitat was observed throughout the Study Area with extensive habitat observed within the first 1.7 miles downstream of the dam. While breeding habitat was extensive near the dam, the presence of bullfrogs and nonnative fish likely limited CRLF abundance due to predation from these species. During this survey period, beaver dams present near Strother Park backed up large stretches of stream creating slow water with inundated vegetation and provided substantial CRLF breeding habitat. Aside from the first 1.7 miles of habitat downstream of the dam and near the beaver dam at Strother Park, breeding habitat in all other study reaches was generally found in small pockets of slow water within backwater areas associated with pools or debris jams within smaller pool units. Although AG Creek has sufficient vegetative structure and cover habitat, deep pools are currently absent along most of the creek. Pool habitat is considered crucial for reproduction, especially along creeks where deeper pools provide protection from high flows. Pools appear to have not been present for several CRLF generations (Alley 1996). Under Existing Conditions, AG Creek typically has fast, flashy flows in the winter, and winter peak runoff can often be four to five orders of magnitude higher than summer baseflow (SHG 2004). Consequently, peak flows in late winter and spring most likely limit breeding activity, inhibit egg mass attachment, and have a negative impact on tadpole survival, as larvae are the life stage most affected by high flows.

The lower reaches of AG Creek including AG Creek lagoon provide marginally suitable breeding habitat for CRLF. Stream flow in these reaches can become intermittent or cease during the summer, resulting in a substantial decrease in CRLF habitat (Christopher 2010, Stillwater Sciences 2022a). Salinity of the lagoon is highly variable due to the amount of freshwater input from upstream, groundwater extraction, wave wash over during high tides or storms, and breaching of the berm separating the lagoon from the ocean (Christopher 2010). Adult CRLF can tolerate salinity levels up to about 9 ppt, whereas larvae and embryos have lower salinity tolerances, and adults may be more widely distributed in the lagoon and may occur in areas that are unsuitable for reproduction (Jennings and Hayes 1990; Smith and Reis 1997; Reis 1999, as cited in Christopher 2010). Metamorphs and juveniles probably rarely use this area and likely move upstream to shallower water with denser vegetation cover; adults may also behaviorally avoid high salinity levels in lagoons (Christopher 2010).

2.3 Southwestern Pond Turtle

2.3.1 Status

USFWS proposed to list both species of western pond turtle; the northwestern pond turtle and southwestern pond turtle (SWPT), as a threatened species in 2023 (USFWS 2023a). USFWS identified threats to both species as including habitat loss and fragmentation, altered hydrology, and predation by both native and nonnative species such as bullfrogs (USFWS 2023a). Critical habitat has not been proposed or designated for either species of the western pond turtle.

The historical range of the western pond turtle as a single species included areas in the States of Washington, Oregon, Nevada, and California, areas in British Columbia, Canada, and areas in Baja California, Mexico. The current collective range of the two species has experienced contractions within existing occupied areas including extirpation from British Columbia, Canada. The boundary between northwestern and southwestern pond turtles is the middle of the Monterey Bay coastline in California (Shaffer and Scott 2022). Individuals of both species occur along the contact zone at the edge of the southern Coast Range and Transverse Range where they meet along the floor of the Central Valley but do not overlap (Shaffer and Scott 2022).

Western pond turtles in Arroyo Grande are SWPT. The range of the SWPT includes areas of central and southern California south into Baja California, Mexico. Genetic analyses have found the SWPT to be subdivided into five groups including: (1) a Coast Range group in the central coast from roughly Monterey Bay south to northern Santa Barbara County; (2) a Ventura/Santa Barbara cluster from Point Conception to the Santa Clara River; (3) a Los Angeles group including the west-flowing Los Angeles basin drainages; (4) a Mojave group from the east-flowing Mojave River Drainage; (5) an Orange County/San Diego cluster encompassing southern coastal California from the Santa Ana river south through most of San Diego and Orange Counties; and (6) a Baja California group covering populations south of the U.S.-Mexico border (Shaffer and Scott 2022).

2.3.2 Habitat Requirements and Life History

The habitat needs considered most important for SWPT include aquatic habitat, upland habitat, and basking sites (USFWS 2023a). SWPT require both aquatic and terrestrial (upland) habitats that are within close proximity to one another. They occur in a range of permanent and ephemeral water bodies including rivers and streams, lakes, natural and constructed ponds, wetlands, marshes, vernal pools, reservoirs, settling ponds, and irrigation ditches (Spinks et al. 2003, Bury and Germano 2008, Ernst and Lovich 2009, Bury et al. 2012, McGinnis and Stebbins 2018) for breeding, feeding, overwintering, and sheltering. SWPT use terrestrial habitat for nesting and overwintering, and females require terrestrial nesting habitat to lay their eggs. While terrestrial habitat can vary across the species' ranges, it is typically characterized as having sparse vegetation with short grasses and little to no canopy cover which allows for exposure to direct sunlight (Holland 1994, Rathbun et al. 2002, Rosenberg et al. 2009, Riensche et al. 2019). SWPT also require basking sites both within water and outside water; basking is essential to thermoregulate their body temperature and for physiological functions such as metabolism, growth, and reproduction. SWPT use logs, rocks, vegetation, and shorelines located within and adjacent to aquatic habitat for emergent basking outside water (Holland 1994, Hays et al. 1999) as well on top layers of vegetative matter or in submerged vegetation such as algal mats within water.

SWPT are a long-lived species, with records of one individual living to at least 55 years of age (Bury et al. 2012). The estimated generation time for the southwestern pond turtle is approximately 25 years (USFWS 2023a), with the age at sexual maturity and breeding ranging from 2.5 to 12 years of age. Adult SWPT appear to reproduce throughout their life (Kauffmann and Garwood 2022). Courtship and mating behavior is typically observed from April through November (Holland 1991) with nesting and oviposition occurring from May through July (Bury et al. 2012). Incubation period ranges from 75 to 134 days in field studies in Oregon and northern California (Holland 1991, Geist et al. 2015, Christie and Geist 2017).

SWPT are omnivorous and consume a wide variety of food items including insect larvae, fish, tadpoles, frogs, carrion, and plants (Bury 1986, Holland 1994). Predators of SWPT include native species such as black bears (*Ursus americanus*), foxes (*Urocyon cinereoargenteus* and *Vulpes vulpes*), coyotes (*Canis latrans),* raccoons (*Procyon lotor*), skunks (*Mephitis* sp. and *Spilogale* sp.), mink (*Neogale vison*), river otters (*Lontra canadensis*), osprey (*Pandion haliaetus*), bald eagles (*Haliaeetus leucocephalus*), ravens (*Corvus corax*), American crows (*Corvus brachyrhynchos*), and herons (Order *Ciconiiformes*) (Holland 1994, Bury and Germano 2008, Ernst and Lovich 2009, Thomson et al. 2016). Nonnative predators include American bullfrogs (*Lithobates catesbeianus*), invasive fish, such as large and smallmouth bass (*Micropterus* sp.), and feral and domestic dogs (*Canis familiaris*) (Moyle 1973, Bury and Whelan 1984, Holland 1994, Ernst and Lovich 2009).

2.3.3 Occurrences and Habitat in the Plan Area

SWPT are known to occur in the AG Creek watershed. There are only three California Natural Diversity Database (CNDDB) occurrences of SWPT in the Plan Area downstream of Lopez Dam: one adult observed in 1995 in Tar Spring Creek; one adult observed in 2003 in an unnamed tributary north of Arroyo Grande, and a third adult basking above the plunge pool line at the Myrtle Street gauging station in 2007. There are no CNDDB occurrences of SWPT in the Plan Area above Lopez Dam. There is suitable aquatic, upland, and basking habitat in the AG Creek watershed, and SWPT are presumed extant, though threatened by loss of upland habitat to development (CNDDB 2025).

3 EXISTING CONDITIONS

3.1 Topography and Geography

The headwaters of AG Creek are located in the southeast portion of the Central Coast Ranges of California, in the California Coastal Chaparral Forest and Shrub Province ecoregion (Bailey 1995, Stephenson and Calcarone 1999, Keil and Hoover 2024) and include the Santa Lucia Mountains, with elevations from sea-level to over 2,800 ft (Figure 1-1).

The AG Creek watershed covers approximately a 153-square-mile area, of which approximately 86-square-miles are downstream of Lopez Dam (Western Hydrologics 2021). AG Creek flows for approximately 13 miles from Lopez Dam to the Pacific Ocean in the community of Oceano, California. Two tributaries enter AG Creek downstream of Lopez Dam: Tar Spring Creek which enters AG Creek upstream of the city of Arroyo Grande at approximately river mile (RM) 7.0 and Los Berros Creek which enters AG Creek downstream of Highway 101 at approximately RM 3.5 (Figure 1-1).

The watershed contains several sub-basins, including Meadow, Tally Ho (draining Corbett Canyon), Tar Spring, and Los Berros creeks (Figure 1-1). Meadow and Tally Ho creeks are relatively short drainages, with stream lengths of 5.3 and 4.3 miles, respectively. Meadow Creek watershed encompasses 2,900 acres, with a lower remnant marsh section, and enters the leveed flood control channel portion of AG Creek estuary after passing through Pismo Dunes. Corbett Canyon watershed encompasses 3,000 acres, with an average drainage area slope of 2.6% (CCSE 2005). Tar Spring watershed is relatively steep, starting out at 1,700 ft above sea level, encompasses approximately 12,000 acres, and has many small tributaries, which altogether contribute 1,200–1,400 AF/year (DWR 2002, as cited in CCSE 2005). Los Berros Creek watershed encompasses approximately 18,000 acres, with an average drainage slope area of 2.8%, several small tributaries, and average runoff of 800–1,100 AF/year.

The major headwater tributaries of AG Creek are characterized by steeper gradient step-pools and force-rock pools in the uppermost reaches and riffle/run stream morphology in lower gradient reaches. Upper reaches are characterized by perennial flow supported by springs and groundwater controlled by faulted and fractured rock formations (NMFS 2024).

AG Creek downstream of Lopez Dam traverses a broad alluvial valley with a lower gradient and ranges from an elevation of 522.6 ft at the spill crest of Lopez Dam, 285 ft at the outlet works of the dam, to sea level at the point of ocean entry. The watershed of AG Creek below Lopez Dam is fairly steep for the first 10 miles, opening into a more gently sloped and broad floodplain for 2.5 miles, and then crossing coastal dunes in the final half-mile before the ocean (Stetson Engineers et al. 2004). The watershed transitions between the Transverse Ranges and Coast Ranges geomorphic provinces (CCSE 2005). Near the coast, the geology consists of "a complex sequence of interfingering unconsolidated sediments", due to multiple geologies in the estuary, floodplains, marshes, shallow bay, and sand dunes (CCSE 2005).

Geology affects AG Creek flows and groundwater interactions. AG Creek traverses two groundwater subbasins: the AG Creek groundwater subbasin that includes AG Creek from Lopez Dam to approximately the Highway 101 crossing, which coincides with the Wilmar Fault, and includes Tar Spring Creek; and the Santa Maria River Valley Groundwater Basin that includes the lower reach of AG Creek west of Highway 101 and includes the lagoon (WSC 2022).

Faults have important implications on groundwater flow because faults are typically low permeability features that can restrict the movement of groundwater. The Wilmar Fault has been interpreted as a partial hydrogeologic barrier to groundwater flow from the Arroyo Grande Subbasin to the Santa Maria Subbasin (WSC 2022). This is noteworthy because releases from Lopez Dam that contribute to surface flows as well as groundwater recharge, are affected by the Wilmar Fault, which in turn affects the lowermost reach of AG Creek and the lagoon, as described in Section 3.3.2 *Existing Conditions Hydrology*.

3.2 Climate

The AG Creek watershed has a Mediterranean climate that is influenced by proximity to the coast, with wet, cool winters and dry, warm summers. There is a wide disparity in annual rainfall between coastal plains and inland mountainous areas but mean annual precipitation from the coast to inland areas ranges from 15 to 22.5 inches per year, occurring primarily between November and March (NMFS 2024) and February tends to be the wettest month (Stetson Engineers 2011, Western Hydrologics 2021). The average annual historical rainfall measured at Lopez Dam Weather Station from 1968 to 2019 is 21.18 inches, with a standard deviation of 9.28 inches: the highest annual rainfall during this period is 45.52 inches, recorded in 1998, while the lowest is 7.16 inches, recorded in 2014. (WSC 2022).

3.2.1 Climate Change

SLO faces a variety of risks from climate change, including extreme heat, drier climate, increases in extreme weather events, and sea-level rise. Annual average temperatures across the county are expected to increase by 2.1–3.9°F (1.17–2.17°C) by 2045 and 4.1–7.6°F (2.3–4.2°C) by 2085 based on projections from three global climate change models (HADCM, CSIRO, and MIROC; Koopman et al. 2010). Annual average precipitation is expected to change by -4.2 to +1.5 inches by 2045 and -4.73 to +0.88 inches by 2085. Climate models projected an additional 3.3–4.6 ft in sea level rise by 2100, with Pismo Dunes/Oceano area included in the areas most at risk (Koopman et al. 2010). However, a reservoir modeling study using the California Water Commission’s dataset for the Water Storage Investment Program applications evaluated potential impacts from climate change on Lopez Reservoir and projected an increase in inflow volume of approximately 10% per year by 2070 due to climate change-adjusted hydrology (Western Hydrologics 2021).

These consequences of climate change are anticipated to have cascading environmental effects, including increased severity and/or rates of wildfire and flood events, and impacts on wildlife. Higher temperatures and continued population growth suggest that there will be a growing demand for water while local groundwater and reservoir supplies may be shrinking. Combined with increased temperatures, more frequent heat days, and a decrease in coastal fog, coastal communities are expected also to increase electricity and water use (Koopman et al. 2010). The projected frequency and size of wildfires are expected to increase from 3.7–7.3% by 2045 and to 8.1–8.5% by 2085 (Koopman et al. 2010). Rainfall events are predicted to occur less frequently but with greater severity, posing challenges to managing runoff, sedimentation, soil water retention, and water storage. Combined, wildfire and flood events can cause severe soil erosion, sediment runoff, and mudslides (Koopman et al. 2010). Wildlife migration patterns and distributions will likely be affected and impacted by all the above.

3.3 Hydrology

The hydrology of AG Creek is or has been monitored by several stream gages operated by U.S. Geological Survey (USGS) and the District located in AG Creek watershed; these gages measure flows (cfs) or stream stage (i.e., water surface elevation) (Table 3-1). Most of the stream gages operated by the District have been used for flood monitoring, with an emphasis on real-time reporting of water surface elevation (WSE). Key stream gages used for hydrologic modeling downstream of Lopez Dam include stations 734, 735, and 736, shown in Figure 3-1.

Table 3-1. Stream Gages within Arroyo Grande Creek Watershed Operated by USGS or the District

Stream Gage	Period of Record	USGS Station ID	San Luis Obispo County Station ID
Arroyo Grande above Phoenix Creek	1968–1992	11141150	n/a
Wittenberg Creek near Arroyo Grande	1968–1975	11141160	n/a
Lopez Creek near Arroyo Grande	1968–present	11141280	n/a
Arroyo Grande near Arroyo Grande	1959–1966	11141300	n/a
Tar Spring Creek near Arroyo Grande	1968–1979	11141400	n/a
Valley Road (Bridge crossing, Los Berros diversion flood control channel)	2008–present	n/a	731
Rodriguez (Bridge crossing, AG Creek, 0.55 mi below Lopez Dam)	2006–present	n/a	733
22nd Street Bridge (Oceano)	2008–present	n/a	734
Cecchetti (Road crossing, AG Creek)	2003–present	n/a	735
Arroyo Grande at Arroyo Grande[1]	1940–present	11141500	736
Los Berros Creek near Nipomo[1]	1968–present	11141600	757

[1] Originally USGS gages, but currently operated by District

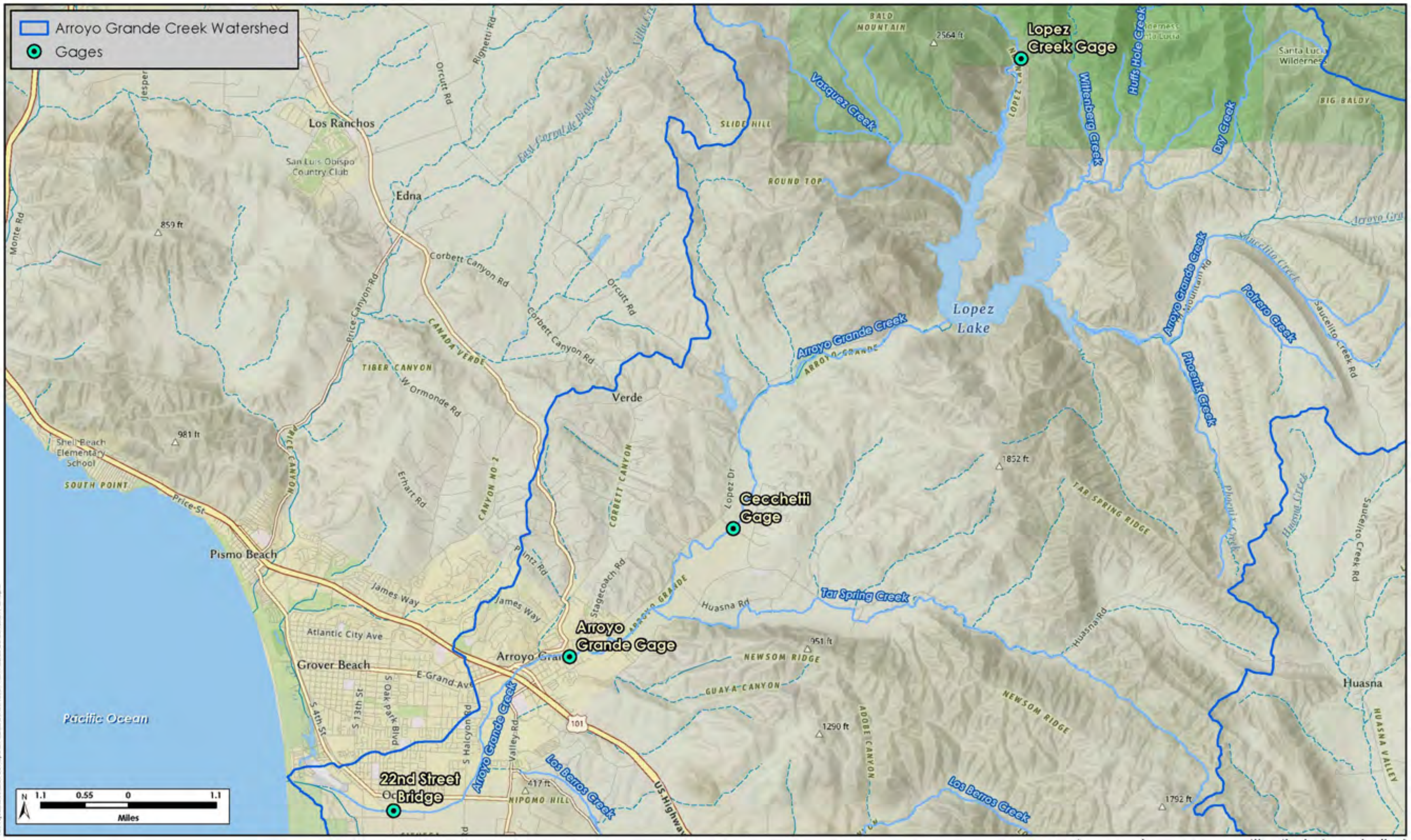

Figure 3-1. Stream gage locations in Arroyo Grande Creek.

Hydrologic modeling used to evaluate different scenarios for operations of Lopez Dam on flows in AG Creek is also supported by information from Lopez Lake storage and stream gage records (Appendix B).

After the construction of Lopez Dam in 1968, much of the original channel and major tributary channels (three miles of AG Creek, three miles of Lopez Creek, and one mile of Wittenberg Creek) above the dam were inundated by Lopez Reservoir (Schreiber 1960, as cited in NMFS 2024; Figure 1-1). Lopez Reservoir has also affected the stream flow and sediment regime in the lower reaches of Arroyo Grande Canyon Creek, Vasquez Creek, Lopez Creek, and Wittenberg Creek which have been inundated by the reservoir (NMFS 2024).

Under Existing Conditions, the magnitude of winter flows in AG Creek downstream of the dam is reduced from Pre-dam Conditions, while dry season summer flows are increased (Table 3-2) (NMFS 2024). Downstream agricultural users seasonally pump groundwater from wells in the underlying aquifer or divert surface water from the creek; in the past, sudden dewatering events were reported in the lower half-mile of AG Creek in 2004 (Stetson Engineers et al. 2004), 2007 (Becker and Reining 2008), and 2008 (Rischbieter 2009a), but these dewatering events are unlikely to occur currently due to improved monitoring. Some of these non-District activities are permitted under state or local frameworks while others are not.

Table 3-2. Summary of average monthly (January, April, July) flows at Lopez Dam under unimpaired and impaired conditions for the period of 1969–2020.

Condition	Average Flows (cfs)		
	January	April	July
Unimpaired flows (1969–2020)	47	30	6
Impaired flows (1969–2020)	13	19	8

Groundwater interaction with streams in the Arroyo Grande subbasin below Lopez Dam is not well quantified, but it is recognized as an important component of aquifer recharge in the water budget (WSC 2022). Where the water table is above the streambed and slopes toward the stream, the stream receives groundwater flow from the aquifer; this is known as a gaining reach (i.e., the stream gains flow as it moves through the reach). Because the District consistently releases some amount of flow from Lopez Dam to AG Creek to support fish populations in the stream, it is thought that the streamflow in AG Creek is in hydraulic communication with the groundwater in the surrounding aquifer, maintaining groundwater levels in the vicinity of the creek at levels approximately equivalent to the surface water levels in the creek (WSC 2022). Some areas may receive inflow from the aquifer, and some reaches may discharge to the aquifer, but along AG Creek they are always in communication.

However, along Tar Spring Creek, the water table is beneath the streambed and slopes away from the stream, resulting in the stream losing water to the aquifer, known as a losing reach (WSC 2022). During seasonal dry flow conditions, groundwater elevations are deeper than the streambed since no base flow is present in the creek. Therefore, it is generally understood that the streams in the Arroyo Grande Subbasin discharge to the underlying aquifer, at least in the first part of the wet-weather flow season (WSC 2022). If there is constant seasonal surface water flow, it is possible that groundwater elevations may rise to the point that they are higher than the stream elevation, and the creek may become a seasonally gaining stream in some reaches (WSC 2022).

Surface flows are also intermittent in Los Berros and Tar Spring creeks (CCSE 2009). Based on data from 1968 to 1978, the contribution of flows from both creeks into AG Creek was 25% and 17%, respectively, most of which occurred from January through April; however, the contribution of Los Berros Creek to AG Creek is negligible the remainder of the year due to agriculture and residential development (Stetson Engineers et al. 2004). Tally Ho Creek, which is typically dry in its lower reaches in the summer, sometimes contributes flows to AG Creek, although the amount is unknown due to lack of gaging stations (CCSE 2005). Meadow Creek also contributes flows to AG Creek; their lagoons are hydrologically connected through flapgates, and water can only drain out of the Meadow Creek Lagoon when water levels are higher than those of AG Creek, which only occurs when the Arroyo Grande Lagoon is open to the ocean (ESA PWA 2013).

Releases from Lopez Reservoir occur from January through September to meet demands for groundwater recharge and municipal uses. While most of mainstem AG Creek downstream of Lopez Dam sees stream flows above Pre-dam Conditions, the lower approximately three miles of AG Creek (downstream of Highway 1) remains ephemeral and dries out during the summer months, similar to Pre-dam Conditions (Stillwater Sciences 2022a). Streamflow[5] of AG Creek at Lopez Dam occurs through releases from Lopez Dam or reservoir spills and indicates that the majority of releases occurred during January through April (13–25 cfs) and accounts for a total of 57% of the average annual streamflow occurring below Lopez Dam (Western Hydrologics 2021).

Although the primary objective of Lopez Dam is drinking water supply and recreation, attenuation of flood flows provided by Lopez Dam creates a more stable flow regime and overall lower flood risk (Western Hydrologics 2021). The managed flow release schedule mutes flow variability in AG Creek by decreasing fall and winter peak flows and increasing summer median flows (CCSE 2005). For example, the Lopez Dam spillway was activated in March 2023 for the first time in 25 years due to above average precipitation in the 2023 water year, which still did not result in flooding within the reach upstream of Tar Spring Creek. Additionally, the valley was not significantly impacted by flood events of 1969, 1983, and 1997, most likely due to the flood storage provided by Lopez Reservoir (SHG 2006b). Flooding of hundreds of acres of farmland and several residences did occur in 2001, but this was attributed to levee failures on the south side of the creek during a moderately large storm (SHG 2006b).

Water Year Types – Wet, median and dry water year types were determined based on ranking the annual volume (AF) from the 56-year record of discharge downstream of Lopez Dam measured at the AG Creek Gage at Arroyo Grande (Table 3-3). The top third wettest years in AG Creek were considered “wet”, the median third were considered “median” and the bottom third were considered “dry” for the purposes of understanding variability in discharge and for analyzing Conservation Measure 1 (CM-1): Lopez Downstream Release Plan. Wet year discharges ranged from a high of 92,066 AF in 1983 to a low of 9,067 AF in 1993, median year discharges ranged from 8,737 AF in 1999 to 3,953 in 2002, and dry year discharges ranged from 3,557 AF in 2019 to 0 AF in 2006.

[5] Outflows of Lopez Dam that occurred historically, determined through stream gage records (Western Hydrologics 2021).

Table 3-3. The 56-year record of discharge in Arroyo Grande Creek (water years 1969–2024) ranked from wettest to dryest based on annual volume in AF measured at the Arroyo Grande Creek Gage at Arroyo Grande.

Rank from Wettest to Driest	Annual Volume (AF) at the AG Creek Gage at Arroyo Grande	Years	Wet, Median and Dry Year Classifications
1	92066	1983	Wet 1/3
2	81383	1998	Wet 1/3
3	63988	1997	Wet 1/3
4	25558	2023	Wet 1/3
5	24016	1969	Wet 1/3
6	23025	1978	Wet 1/3
7	22850	1980	Wet 1/3
8	21262	1995	Wet 1/3
9	18019	1974	Wet 1/3
10	16567	2011	Wet 1/3
11	15704	1996	Wet 1/3
12	14620	2001	Wet 1/3
13	10687	1973	Wet 1/3
14	10627	2008	Wet 1/3
15	10625	2024	Wet 1/3
16	10132	1982	Wet 1/3
17	10055	1984	Wet 1/3
18	9113	1986	Wet 1/3
19	9067	1993	Wet 1/3
20	8737	1999	Median 1/3
21	8618	2017	Median 1/3
22	7922	2000	Median 1/3
23	6565	1970	Median 1/3
24	5283	2010	Median 1/3
25	5132	1992	Median 1/3
26	5011	1991	Median 1/3
27	4944	1979	Median 1/3
28	4872	2005	Median 1/3
29	4703	2012	Median 1/3
30	4555	1981	Median 1/3
31	4511	1971	Median 1/3
32	4502	2007	Median 1/3
33	4186	2013	Median 1/3
34	4008	1975	Median 1/3
35	3980	2009	Median 1/3
36	3959	2003	Median 1/3
37	3953	2002	Median 1/3
38	3557	2019	Dry 1/3

Rank from Wettest to Driest	Annual Volume (AF) at the AG Creek Gage at Arroyo Grande	Years	Wet, Median and Dry Year Classifications
39	3303	1972	Dry 1/3
40	3279	2004	Dry 1/3
41	3228	2014	Dry 1/3
42	2939	1976	Dry 1/3
43	2748	1985	Dry 1/3
44	2642	1989	Dry 1/3
45	2568	1977	Dry 1/3
46	2221	1987	Dry 1/3
47	2190	1994	Dry 1/3
48	2117	1990	Dry 1/3
49	2081	1988	Dry 1/3
50	1695	2018	Dry 1/3
51	1439	2016	Dry 1/3
52	1423	2015	Dry 1/3
53	1319	2020	Dry 1/3
54	1078	2021	Dry 1/3
55	916	2022	Dry 1/3
56	0	2006	Dry 1/3

3.3.1.1 Current Municipal and Downstream Releases

Key water supply operations (Figure 3-2) include the direct diversion to reservoir storage of up to ~50,000 AF from October 1 to July 1 and bypass of excess inflow from July 2nd to September 30. In practice, the District must manage the reservoir water supply by balancing essential domestic use with downstream releases for ecosystem needs and agricultural demands. Releases are adjusted (increased or decreased) as necessary in response to changing municipal needs, agricultural needs, weather conditions, and/or other factors that may influence surface flows within the creek system.

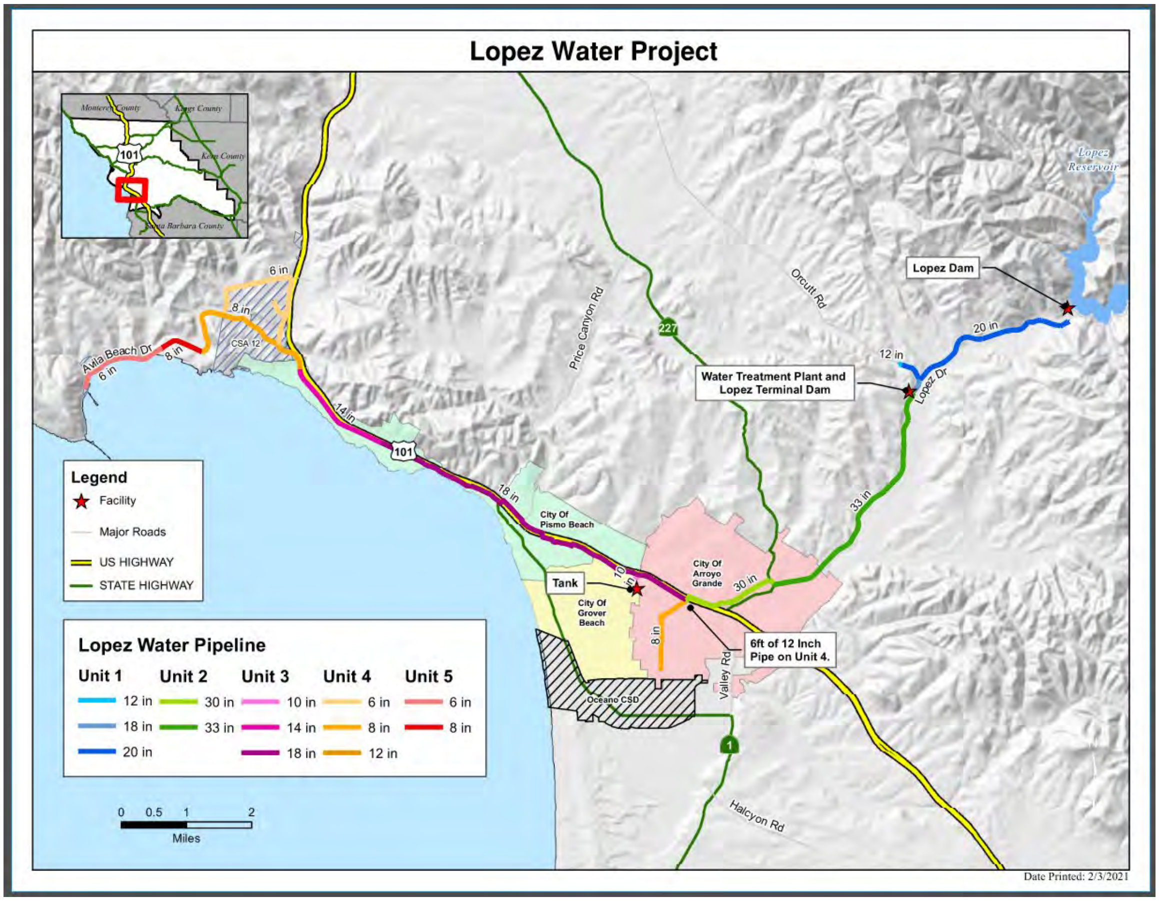

Figure 3-2. Lopez Water System Map.

Water reaches AG Creek below the Lopez Dam by uncontrolled spills at the dam spillway and/or controlled releases through the outlet works. For controlled releases, water leaves the reservoir via the intake structure and is released through the outlet control building located at the bottom of the left abutment of the dam. Water is then released to AG Creek through one of two 10-inch jet valves at the outlet control building, generally released at 10 cfs or less. The maximum discharge capacity to AG Creek is 100 cfs through a 42-inch emergency relief valve. Water can also be released to the Terminal Reservoir and WTP via a 20-inch pipeline from the outlet control building. Water quality is determined by weekly (April–September) and monthly (October–March) sampling to develop a limnology profile of the reservoir to select the appropriate intake for municipal and downstream water quality.

The water release operations and maintenance program, known as the IDRS, has been in effect since 2007. The IDRS was developed to provide a plan for managing downstream releases from Lopez Dam and matching municipal deliveries to safe yield[6] by reducing annual downstream release. The primary objectives of the IDRS are to:

- Allow the project to continue to meet its water supply obligations

[6] Safe yield is defined in water right permits as the dependable supply that can be developed from a source under given operating criteria and hydrologic conditions.

- Maximize the potential for interim "surplus" water generation
- Result in no discernable impacts to steelhead.
- Meet agricultural needs
- Generate data and information that can be used to supplement HCP development and/or assist in implementing an approved HCP

Under the IDRS, initial release reductions begin in January after winter rains have saturated the valley and stream flow measurements show the stream to be gaining flow from the Lopez Dam to the Pacific Ocean. At that point a release reduction of 0.5 cfs will be made, with any consequent effects on stream flow noted. Absent any substantial negative stream effects after 24 hours, additional reductions in 0.5 cfs increments are made, following the same measurement protocol (one step in each 24-hour period). If flow reductions reach 4.8 cfs without negative stream effects, the release rate will be “held” for a period of at least five days, with ongoing stream monitoring, to ensure that the program remains in compliance with its stated objectives. Barring unusual weather patterns, at the end of the wet season (April 1) release rates are stepped up in 1 cfs/day increments to 6 cfs. Analysis of data continues through the summer season and necessary adjustments to the next winter’s release rates are made.

Municipal water contract deliveries total 4,530-acre ft per year (AFY). The District also makes downstream releases to AG Creek to ensure adequate recharge of riparian aquifers to support agricultural wells. Agricultural releases have historically averaged 2,335 AFY, although at the time the dam was constructed downstream releases were anticipated at 4,200 AFY. The District also currently releases 3 to 7 cfs into AG Creek from the outlet works at Lopez Dam pursuant to informal agreements with state and federal resource agencies, which may be updated upon USFWS and NMFS approval of the HCP. The adaptive release into AG Creek under the IDRS was established to ensure that no “take” of steelhead would occur *under dry season conditions* and to protect the safe yield of the Lopez Reservoir. These annual downstream releases (2007–2024) averaged 3,515 AFY. Additional summertime agricultural releases total 60 AFY. It should be noted that agricultural releases and releases to benefit SCCC steelhead are conjunctive; therefore, during most months the release for steelhead is sufficient to supply agricultural needs.

Implementation of the IDRS remained consistent until January 15, 2025, when a court-ordered preliminary injunction necessitated a deviation from the established schedule, as described in Section 2.0 above.

3.3.1.2 Low Reservoir Response Plan

The Low Reservoir Response Plan (LRRP) was developed jointly by the District, and the Zone 3 agencies in 2014. It is incorporated in the 2015, 2020, and 2025 Urban Water Management Plans (UWMP) and the Water Shortage Contingency Plans (WSCP), as required by California Water Code §10610-10656 and §10608. The LRRP outlines actions that would be taken if the total volume of storage in the Lopez Reservoir were to fall below 20,000 AF, as measured on April 1st of any given year. Because of the number of variables that could precipitate a low reservoir level, the LRRP does not establish specific release rates that would be adopted in the event of a low reservoir condition, rather, the LRRP provides a methodology that would be used to develop an appropriate release rate. The LRRP is intended to conserve water within Lopez Reservoir during periods of low storage (below 20,000 AF), ensuring availability above the lowest intake for 3 to 4 years under continuous drought conditions. Municipal diversions and downstream releases are detailed in the tables below.

Upon enactment of the LRRP, the initial prescribed actions dictate that municipal diversions are to be reduced according to the reduction strategy described in Table 34, which includes Reduction Triggers, reduction percentages and resulting municipal diversions. This municipal diversion reduction strategy may be modified through adaptive management.

Table 3-4. Historical Municipal Reductions and Associated Trigger Points.

Amount of Water in Storage (AF)	Municipal Diversion Reduction	Municipal Diversion (AFY)
20,000	0%	4,530
15,000	10%	4,077
10,000	20%	3,624
5,000	35%[1]	2,941
4,000	100%	0

[1] The 35% reduction provides sufficient water to supply 55 gallons per capita per day (GPCD) for the estimated population of the Zone 3 agencies (47,081 in 2020 per the 2020 Zone 3 UWMP. 55 GPCD is the target residential indoor water usage standard used in California Department of Water Resource's 2020 UWMP Method 4 Guidelines.

Upon enactment of the LRRP, the initial prescribed actions dictate that downstream releases are to be reduced according to the reduction strategy described in Table 35, which includes Reduction Triggers, reduction percentages and resulting downstream releases. The Initial Prescribed Downstream Release Reduction Strategy was developed through a collaborative process that included input from the District and agriculture and municipal stakeholders. The resulting downstream releases represent the maximum amount of water that can be released. The District controls the timing of the reduced releases to meet the needs of the agricultural stakeholders and to address environmental requirements. This downstream release reduction strategy may be modified through adaptive management.

Table 3-5. Historical Downstream Release Reductions and associated trigger points.

Amount of Water in Storage (AF)	Downstream Release Reduction	Downstream Releases (AFY)[1]
20,000	9.5%	3,800
15,000	9.5%	3,800
10,000	75.6%	1,026
5,000	92.9%	300
4,000	100.0%	0

[1] These downstream releases represent the maximum amount of water that can be released. Actual releases may be less if releases can be reduced while still meeting the needs of the agricultural stakeholders and addressing the environmental requirements.

To exit the LRRP, the District must make a determination that Lopez Reservoir has risen above 20,000 AF. Additionally, winter rains, time of year, and other factors may require the District to continue operating under the LRRP. These various factors are considered to prevent the District from entering and exiting the LRRP prematurely if the capacity is hovering around 20,000 AF. Upon existing the LRRP, the District reverts to releases at the rate and schedule of the IDRS.

3.3.1.3 Water Entitlements

The Lopez Reservoir is a reliable water supply source for urban and agriculture water uses (WSC 2022). Raw water from Lopez Reservoir is treated at Lopez WTP, and potable water is delivered to the Zone 3 agencies). The District also discharges raw water to the AG Creek for aquatic habitat conservation and groundwater recharge (WSC 2022). During an average water year, the Lopez Project is able to reliably deliver 8,730 AFY to meet the contract entitlements (totaling 4,530 AFY to Contract Agencies), and reserve up to 4,200 AFY for downstream releases to AG Creek to maintain varying flows for environmental needs and agricultural interests along the creek (WSC 2021). The District typically has been able to deliver full entitlements to Contract Agencies, except during the longest drought periods on record (2015/2016), when the District was operating in accordance with the LRRP. In response to 2015/2016 drought conditions and declining reservoir levels, entitlements were reduced by 10% in 2015 through April 2017 (WSC 2022).

In December 2020, the water levels in the Lopez Reservoir dropped to just below 20,000 AF, which is one of the two triggers in the LRRP (WSC 2022). As part of the completion of the UWMP WSC 2022), the District completed a comprehensive WSCP adhering to the reductions in the LRRP to address reliability in the event of a water shortage (allowable under CWC Section 10632(a)(3)(B)). Depending on the amount of storage in Lopez Reservoir, the WSCP provides the reduction strategy for deliveries to municipalities and to downstream releases to AG Creek (see Tables 8-1 and 8-2 in WSC 2022) in accordance with the LRRP.

3.4 Geomorphology and Sediment Transport

3.4.1 Sediment

Since the mid-1900s, urbanization and agriculture increased sediment yields and caused bank erosion in AG Creek (SHG 2004). The greatest sources of erosion include head-cutting in tributaries, bank erosion on the mainstem, agricultural fields and roads, and landslides following fires. Without the connection to the floodplain, there is little opportunity for sediment deposition upstream or in the tributaries, so sediments tend to transport downstream and deposit in the flood control reach, aggrading the reach and increasing flooding risk (SHG 2004), despite the presence of Lopez Dam that mutes flows of the creek (ESA PWA 2013). The high sedimentation rates and lower base flows encourage more vegetative growth (especially willows) in the stream, which further reduces flows and increases sedimentation (ESA PWA 2013). Head-cutting in tributaries is promoted by downcutting in the mainstem and runoff from the tributaries; this is exacerbated by the elimination of coarse sediment supply from tributaries upstream of Lopez Dam.

The geomorphic and sediment supply conditions in AG Creek are altered by the influence of Lopez Dam on seasonal flow fluctuations and reductions in sediment supply (Stillwater Sciences 2023). The operation of Lopez Dam and Reservoir disrupts the natural delivery of sediment to the lower reaches of AG Creek which can modify channel morphology and related biological functions (Baxter 1977, Nilsson and Berggren 2000, Schmidt and Wilcock 2008 as cited in NMFS 2024). Additionally, water released from the reservoir may pick up downstream sediment, eroding banks and increasing downstream channel incision, which is evidenced by incised channels and a lack of gravel and sand bars in the AG Creek channel downstream of Lopez Dam (Stillwater Sciences 2023). However, incising in AG Creek may be amplified as a result of land use practices including grazing and agriculture along the adjacent floodplain and tributaries, and a lack of sediment supply due to long-term retention of sediments in Lopez Lake (Stillwater Sciences 2023).

The mainstem below Lopez Dam is characterized by a finer grained substrate (including sands and gravels) and naturally irregular surface flow (significantly influenced by ground water pumping and by regulated releases from Lopez Dam and Reservoir (Ernstrom 1984, Rischbieter and Glick 2019, City of Arroyo Grande 2024). While historic floodplain deposits are widespread throughout the valley below Lopez Dam, soils are currently dominated by sandy loam or loamy sand (USDA-SCS 1977, as cited in CCSE 2005). Coarse sediment from tributary input increases in the middle reaches of AG Creek downstream of Lopez Dam. The resulting simplification of channel geomorphology can result in the artificial and deleterious accumulation of fine sediments (NMFS 2024).

3.4.2 Lagoon Sandbar

Historically, AG Creek below Lopez Dam may have been multi-threaded and dynamic throughout a wide active floodplain and constricted to a single channel near bedrock outcrops. An extensive back barrier marsh complex was present at the terminus of Pismo, Meadow, and AG creeks behind the beach/dunes at Pismo Beach (ESA PWA 2013). The outlet to the ocean was generally closed seasonally, and the back barrier habitat was likely a freshwater to brackish marsh (ESA PWA 2013). This lower section of AG Creek (downstream of Lopez Dam) likely went dry in the summer during most years (Stillwater Sciences 2022a), and historical accounts indicate that the valley floor was a “thicket of swamp and willow and cottonwood.”

Much of this same area has now been developed and only 20% of historical estuary at the bottom of AG Creek remains (NMFS 2013, 2017). In the late 1800s and early 1900s, the floodplains and riparian areas were converted to agricultural fields and the channel was straightened, becoming deeper and more confined, and other tributaries such as Tar Spring and Tally Ho creeks were also modified and straightened (SHG 2004). The current floodplain is much smaller than the historic floodplain; there were 4,685 acres of floodplains in 1939 and only 722 acres in 2002 (CCSE 2005).

Today, AG Creek is an incised single channel from the Lopez Dam to the ocean with no connection to the floodplain (SHG 2004). Within the last few miles to the ocean, AG Creek flows through an alluvial agricultural valley and then forms Arroyo Grande lagoon behind the beach.

The seasonal beach morphodynamics at the mouth of AG Creek likely follow the typical cycles of beach destruction (winter) and construction (summer) in response to the seasonal wave climate, observed and documented along the California coast (Haines et al. 2006, Behrens et al. 2013, Rich and Keller 2013). These seasonal dynamics, in conjunction with seasonal differences in creek flow, contribute to an open lagoon mouth condition during a portion of the winter months and closed condition during the summer, the latter occurring in response to build up of a sand bar, which closes the lagoon most summers. High creek flows in winter will cause the sandbar/creek mouth to breach to the sea.

To assess conditions related to when the Arroyo Grande Lagoon sand bar was open or closed, the best available record (2013–2024) of tidal data from the nearest tide gage (Port San Luis) (NOAA 2025) was examined, as well as observations from CA State Park surveys (Rischbieter 2003–2020; Rischbieter et al. 2020a–d, 2021a–c, 2022a–c, 2023a–e, 2024a–d, 2025). the WSE data from Arroyo Grande Lagoon (County of SLO 2025) and Google Earth imagery. The tidal and WSE data was plotted to determine whether the lagoon water levels were apparently influenced by tidal fluctuations. If the lagoon WSE changed with the tides, it was assumed the sand bar was open, conversely, if the lagoon water levels did not change with tidal influence, it was assumed the sand bar was closed. Google Earth imagery was used (when available) to independently confirm whether the sand bar was open or closed. Figure 3-3 is an example of how a combination of Google Earth images, Arroyo Grande Lagoon WSE, and Port San Luis Tidal WSE were used to determine when the sand bar was open (January through April) versus closed (May through December) in 2013. It was observed that the sand bar is generally closed from spring (April or May) until late fall/early winter (October or November) and open from winter (November or December) until spring (March or April). These patterns, however, changed in 2023, 2024, and 2025, when the sand bar remained open nearly all year. Table 3-6 shows when the sand bar was open (white) versus closed (black) for each year studied.

Table 3-6. The months the Arroyo Grande Lagoon sandbar was assumed to be open (“O”, white) and closed (“C,” gray) from 2013 to 2025.

	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
2013	O	O	O	C	C	C	C	C	C	C	C	C
2014	C	O	O	C	C	C	C	C	C	C	C	O
2015	C	C	C	C	C	C	C	C	C	C	C	O
2016	O	O	O	C	C	C	C	C	C	C	C	C
2017	O	O	O	O	O	C	O	C	C	C	C	O
2018	O	C	O	O	C	C	C	C	C	C	C	C
2019	O	O	O	O	C	C	C	C	C	C	C	O
2020	O	C	O	O	O	C	C	C	C	C	C	C
2021	O	O	O	C	C	C	C	C	C	C	C	C
2022	C	C	C	C	C	C	C	C	C	C	C	C
2023	O	O	O	O	O	O	O	O	O	O	C	O
2024	O	O	O	O	O	O	O	O	O	C	O	O
2025	O	O	O	O	O	O	O	C	C			

Additionally, historic flow data from AG Creek (AG Creek gage, USGS 11141500) was examined for the years 2013 to 2024 to determine what flows are generally associated with sand bar breaching/open. This was conducted by examining the peak flows in the months that the sand bar was observed to open each year (determined using the methods above). In the years 2013 to 2016, flows of 10 cfs or greater were associated with bar opening, typically in January or February. From 2017 to 2020, flows of 20 to 25 cfs were associated with bar breaching, typically in February or March. (Note: in 2017 the bar appears to open briefly in July and December. However, this is likely the result of a large tidal influence rather than a high flow event.) For the years 2021 and 2022, the opening of the sand bar was associated with flows of 35 and 60 cfs, respectively. Once the bar breached in 2022, it appears to stay open through the majority of 2023 and 2024 with flows as low as zero and typically around 5 cfs.

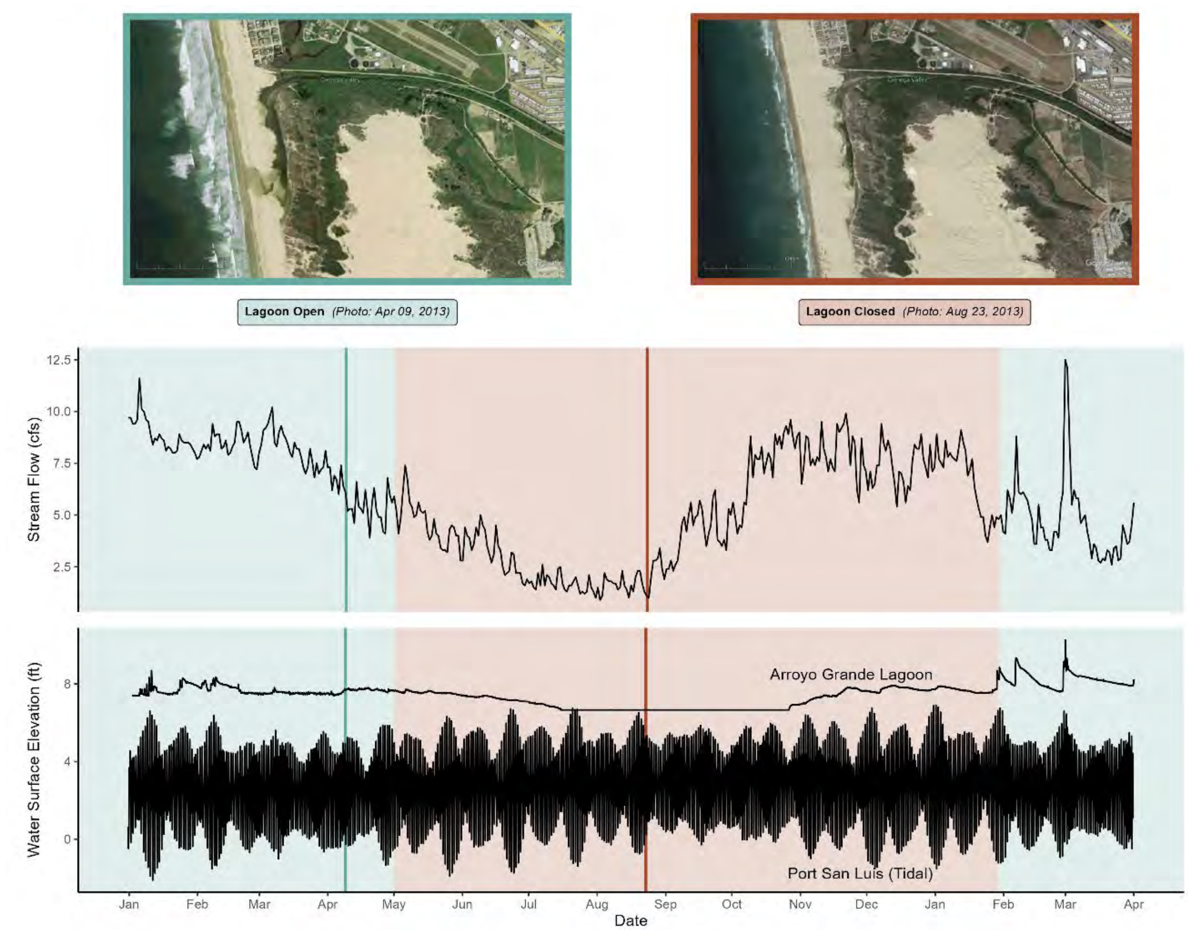

Figure 3-3. Example of conditions associated with Arroyo Grande Lagoon sand bar open and closed in 2013, based on Arroyo Grande Lagoon stage data, Port San Luis tidal data and Google Earth imagery.

3.5 Water Quality

The District conducts water quality profile monitoring in Lopez Lake, the source water for AG Creek, as follows:

- April 1 through September 30: Weekly reservoir profile sampling
- October 1 through March 30: Monthly reservoir profile sampling

Each water quality profile monitoring survey includes evaluation of water temperature, dissolved oxygen (DO), pH, and turbidity, with additional samples collected at intakes 1–6 (Figure 3-4) for iron, manganese, and algae. Based on these profiles, intakes are selected for downstream releases to AG Creek and the Terminal Reservoir based on providing appropriate water quality parameters to meet water quality needs for the treatment plant as well as for AG Creek. Lopez Lake normally develops a thermocline at a depth of 20 to 40 ft during the summer months, affecting water quality in the reservoir that changes with depth, with higher algae, DO, pH and temperature above the thermocline, and lower DO, pH, temperature and algal concentration at depth. During summer, the intake locations (depths) are selected based on water quality survey results to balance DO, temperature, algae, pH and turbidity. Epilimnion water below the surface algae and above the thermocline is preferred for delivery to the Terminal Reservoir. Before release to AG Creek, water leaving the jet valves, is aerated when released onto a concrete structure with riprap. In the cooler months, the surface water temperature drops and the reservoir "turns over." The colder and denser surface water sinks and blends with the bottom water which contains less dissolved oxygen and more dissolved metals.

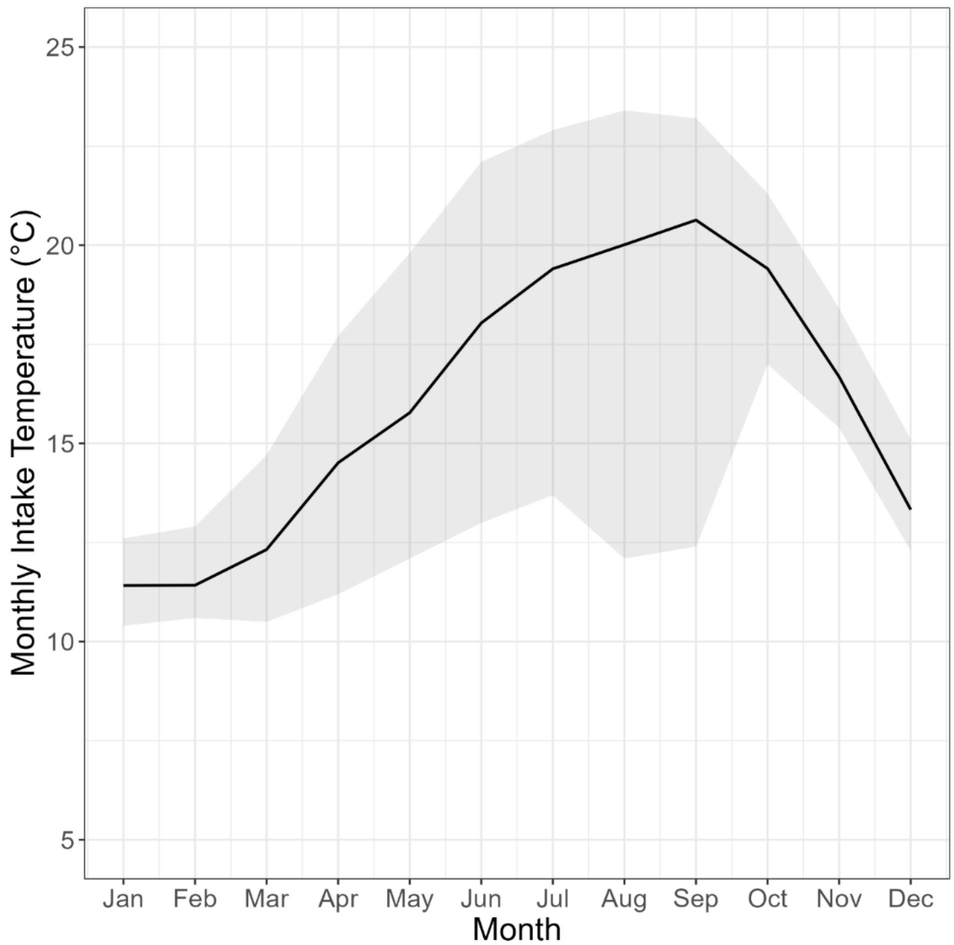

Figure 3-4. Mean (solid black line), minimum and maximum (gray shading) monthly temperatures from active Lopez Lake intake sites between 2011–2025.

3.5.1 Water Temperature

To assess water temperatures under Existing Conditions, mean, minimum, and maximum monthly temperatures were measured at active intake locations at Lopez Dam from 2011 through spring 2025. Although the data are not direct measurements of temperature in AG Creek, they represent approximate temperatures that were discharged into AG Creek from Lopez Reservoir. Overall water temperatures at the intake are higher on average in April through November and lower December through March. Intake temperatures ranged from 50.7–74.1°F (10.4–23.4°C). Maximum intake temperatures occurred between July and September at Intake 5 and coldest intake temperatures occurred between January and March at Intakes 3, 4, 5 and 6.

Water temperatures fluctuate throughout AG Creek. In 2020, temperature recorders were placed along AG Creek during the summer, indicating the warmest temperatures (up to a 73.°F [23°C] daily maximum and 71.4°F [21.9°C] daily mean) occurred at the upstream-most reach nearest to the Lopez Dam outflow (RM 13.8) (Figure 3-5), while daily average water temperatures there ranged from 66.4–71.4°F (19.1–21.9°C) in June through September (Stillwater Sciences 2022a). Surface water temperatures cool substantially as water moves downstream from Lopez Dam. In 2020, water temperatures briefly exceeded 68°F (20°C) during late August and early September at RM 10.4 and RM 9.1 but remained below 68°F (20°C) at RM 5.7 and RM 4.2 for the entirety of the summer. Tar Spring Creek was cooler than the mainstem sites for the majority of the summer with a maximum temperature of only 63.9°F (17.7°C) in August (Figure 3-5; see also Stillwater Sciences 2022a).

Based on these data, temperatures approach thermal limits (73.4°F [23°C], see Section 2.1.5.1) for juvenile *O. mykiss* near the output from Lopez Dam during the summer months. Data from the summer of 2020 showed a cooling trend where water temperatures decreased at loggers farther downstream from the dam. Temperatures for *O. mykiss* rearing were not limiting, and most often were within a optimal range for aerobic capacity (62.6–64.4°F [17–18°C]), but this study represents only one year of data collection. Based on intake temperatures and the observation that temperatures cool as water flows farther downstream from the dam, it is unlikely that temperature is limiting for adult steelhead migration, spawning, egg incubation, juvenile rearing, and smoltification from December through early April (intake temperatures generally remained below 59°F [15°C] during this time). However, intake temperatures were as high as 63.9°F (17.7°C) by late April, and as high as 67.6°F (19.8°C) by mid-May in some years, which could impact spawning activity and/or developing embryos of late spawners depending on cooling as flows travel downstream.

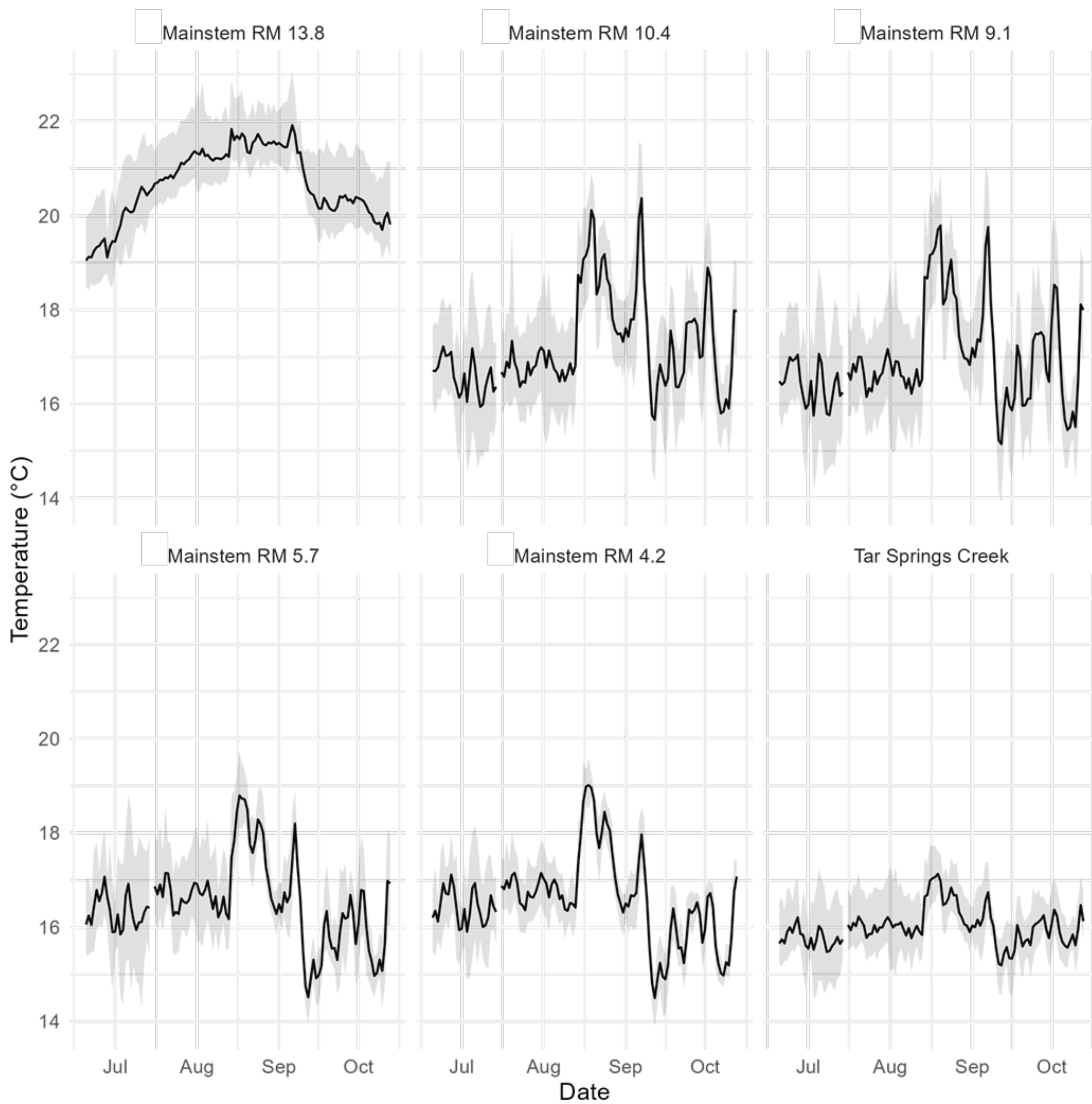

Figure 3-5. Daily mean (solid black line), minimum and maximum (gray shading) temperatures at 5 sites along the mainstem Arroyo Grande Creek and 1 site on the Tar Spring Creek tributary during the summer of 2020.

Historically, the lower section of AG Creek, which flows over a deep alluvial valley, likely went dry in the summer during most years. Therefore, it is likely that a majority of AG Creek downstream of Lopez Dam was historically warmer than it is now during summer and fall. This is also supported by Boughton and Goslin (2006), which concluded that steelhead over summering habitat has a low intrinsic potential to occur downstream of approximately RM 10 (downstream of Lopez Dam) under historical unimpaired conditions.

The District conducted monthly depth-stratified water quality monitoring at several stations in Arroyo Grande Lagoon from April 2023 to February 2024 at approximately 0.5 ft intervals from near surface to the bottom: temperature ranged from 48.2 to 71.6°F (9 to 22°C) as measured at the bottom of the water column (Stillwater Sciences 2024a). During this time, salinity ranged from 1 to 61 ppt (Stillwater Sciences 2024a).

3.5.2 Dissolved Oxygen

Dissolved oxygen levels were taken in 2000 and were typically high (>6 milligram per liter [mg/L]) for most sampling locations in AG Creek from monitoring conducted in January, April, and July, with the exception of Beaver Pool just below the dam, and at Oceano Lagoon (Stetson Engineers et al. 2004). Surface runoff is increasing due to urban development, and pesticide concentrations may also be increasing (CCSE 2005). Chemical analyses of grab samples using EPA protocols were not notable, as most concentrations were below detectable levels (Stetson Engineers et al. 2004), and nutrient levels in the creek are not typically elevated (CCSE 2005). However, elevated levels of total dissolved solids and chloride, sulfate, and fecal coliform at the 22nd St. Bridge in Oceano have been reported (CCSE 2005). In addition, water quality in the lower half mile of the creek is degraded by disrupted surface flows and dewatering from agricultural withdrawals of groundwater (Rischbieter 2004, 2009a). The lagoon frequently experiences summer algal blooms, an indicator of eutrophication (artificially enriched with nutrients, primarily nitrogen and phosphorus), likely due to agricultural and urban runoff (ESA PWA 2013). Water quality is likely better (e.g., cooler water temperatures and higher dissolved oxygen levels) in the upstream reaches of the lagoon versus the lower, due to deeper depths and shading from riparian and emergent vegetation (ESA PWA 2013).

The District conducted monthly depth-stratified water quality monitoring at several stations in Arroyo Grande Lagoon from April 2023 to February 2024 at approximately 0.5 ft intervals from near surface to the bottom: dissolved oxygen ranged from 5 to 22 mg/L (Stillwater Sciences 2024a).

3.5.3 Suspended Sediment and Turbidity

Although it is known that development and agriculture in the lower AG Creek have increased erosion and sedimentation, turbidity data for the creek are not available. Total Maximum Daily Loads are not considered for the creek due to its relatively high water quality; the creek's dynamics are not unlike that of other urban streams, where the tendency is to have a high influx of sediment that drops quickly back to baseline levels (CCSE 2005). However, as a result of urban development, Tally Ho Creek has contributed a considerable amount of sediment to AG Creek (CCSE 2005).

3.6 Land Management/Land Uses

The Lopez Dam was built and operated conjunctively to provide an additional water supply to reduce the reliance on groundwater and provides boating, fishing, day-use, and overnight camping recreational opportunities (SLO County Flood Control and Water Conservation District 2020). Land uses in the watershed include 17.6% urban areas, 45.6% agricultural, 17.91% open space, 5.02% recreation, and 13.82% rural lands (County of SLO n.d.).

Historically, the AG Creek watershed had a substantial floodplain that was reduced by about 85% due to flood control and urban development and agriculture that began as early as the mid-1800's (CCSE 2005). Currently, a substantial portion of the upper part of the watershed above Lopez Dam and Reservoir (including Arroyo Grande, Wittenberg, and Lopez Canyon subbasins) is both publicly and privately owned: most of the upper Arroyo Grande subbasin streams flow through valleys that are privately owned and managed for agriculture and/or grazing. The Wittenberg subbasin streams are within the Los Padres National Forest and Santa Lucia Wilderness area, under the U.S. Forest Service jurisdiction. The upper half of Lopez Canyon subbasin and its principal tributaries all occur within the U.S. Forest Service land (Santa Lucia Wilderness area), but the lower file miles of Lopez Canyon Creek flows along a road with numerous private residences (TRPA 2011).

Existing land uses below Lopez Dam primarily consist of agricultural fields on either side of the creek for the majority of its length (WSC 2022), with streamside vegetation confined to narrow bands along the creek (SHG 2004). Water reaches downstream agricultural users via flow releases directly from Lopez Dam, which provides flow into AG Creek and passively recharges groundwater. The users pump the recharged groundwater via wells for irrigation.

Approximately three miles of the lower reach of the creek is confined in a flood control channel between levees with a freeboard designed to provide residential areas with flood protection up to a 20-year flood event, while simultaneously enhancing water quality and sensitive species habitat. The AG Creek Channel WMP includes a comprehensive set of actions including capital improvement projects, long-term maintenance activities, active restoration and enhancement projects, mitigation measures, performance monitoring, monitoring of implemented projects, programmatic elements, and adaptive management (Dvorsky 2010).

The last half-mile of AG Creek and the lagoon are part of the ODSVRA and Pismo Dunes State Preserve (Pismo Dunes). The California Department of Parks and Recreation drafted a HCP in 2020 for the ODSVRA for potential effects on federally listed species as a result of park operations, visitor use, and resource protection measures (CDPR 2022). Adjacent to this reach of creek are a municipal airport and wastewater treatment plant that discharges treated effluent to the ocean.

3.7 Biological Resources

3.7.1 Vegetation

The open dunes and dune scrub habitats (active coastal dunes), central foredunes, and central dune scrub along the immediate coast provide potential habitat for rare plants including surf thistle (*Cirsium rhothophilum*), Pismo clarkia (*Clarkia speciosa ssp. immaculate*), branching beach aster (*Corethrogyne leucophylla*), dune or Blochman's larkspur (*Delphinium parryi ssp. blochmaniae*), beach spectaclepod (*Dithyrea maritima*), Blochman's leafy daisy (*Erigeron blochmaniae*), Nipomo Mesa lupine (*Lupinus nipomensis*), crisp monardella (*Monardella crispa*), SLO monardella (*Monardella frutescens*), and black-flowered figwort (*Scrophularia atrata*). These species have potential to occur in the dune complexes and dune scrub habitat in the westernmost portion of the Proposed Plan area. Reconnaissance field surveys have indicated crisp monardella growing on dune ridges in the Proposed Plan area approximately 500 ft south of AG Creek and 0.75 miles inland from the coast.

Dune lakes, also called dune slack ponds, are rare wetland habitats which provide potential habitat for rare plants including marsh sandwort (*Aernaria paludicola*), La Graciosa thistle (*Cirsium loncholepis*), and Gambel's watercress (*Nasturtuim gambelii*). Most recorded occurrences in the region are around dune lakes a few miles south of AG Creek including Jack Lake, Lettuce Lake, Oso Flako Lake, Black Lake, and others. Dune lakes immediately north and south of AG Creek, which appear to be artificially created or enhanced by levees, provide low to moderate potential habitat for these rare species. Within the corridor of the Proposed Plan area there is also known population of La Graciosa thistle, along the eastern shore of the large lake at Oceano Memorial Park.

Ancient dune formations, old sand hills, and consolidated sandstone and shale outcrops inland from the coast provide potential habitat for several rare plants including Santa Margarita manzanita (*Arctostaphylos pilosula*), sand mesa manzanita (*Arctostaphylos rudis*), Well's manzanita (*Arctostaphylos wellsii*), Pismo clarkia, Indian Knob mountainbalm (*Eriodictyon altissimum*), and Kellogg's horkelia (*Horkelia cuneata ssp. sericea*). These unique soil types and rock outcrops extend from near the coast to beyond Lopez Lake. Sand mesa manzanita, Well's manzanita, Pismo clarkia, and Kellogg's horkelia occur near the coast around Arroyo Grande. Indian Knob mountainbalm, Mesa horkelia (*Horkelia cuneata ssp. puberula*) and SLO County lupine (*Lupinus ludovicianus*) occur farther inland. Santa Margarita manzanita, associated with shale outcrops, has CNDDB occurrences near the coast and farther inland just east of Lopez Lake. Of these species, Well's manzanita and Pismo clarkia have recorded CNDDB occurrences in or adjacent to the study corridor and numerous additional occurrences north and south of the study corridor. Potential habitat in the study area for all the species listed above occurs on hillsides bordering the AG Creek Valley where sandstone outcrops and sandy soils exist. These species would not occur on the 100-year floodplain terraces bordering AG Creek since these are alluvial soils deposited from upstream rather than sandy soils deposited along the coast and uplifted through time.

Scattered serpentine outcrops and areas with serpentine-derived or heavy clay soils near AG Creek provide potential habitat for several rare plants including San Luis mariposa lily (*Calochortus obispoensis*), Brewer's spineflower (*Chorizanthe breweri*), Chorro Creek bog thistle (*Cirsium fontinale var. obispoense*), SLO dudleya (*Dudleya abramsii ssp murina*), Blochman's dudleya (*Dudleya blochmaniae*), Jones' layia (*Layia jonesii*), and adobe sanicle (*Sanicula maritima*). Only San Luis mariposa lily and Brewer's spineflower have CNDDB occurrence records in the vicinity, both concentrated north of the project area. Potential habitat for these species in the study area occurs on hillsides bordering AG Creek Valley where serpentine outcrops exist. These species would not occur on the 100-year floodplain terraces bordering AG Creek since these are non-serpentine alluvial soils.

The non-native annual grasslands provide potential habitat for only one rare plant species, Obispo Indian paintbrush (*Castilleja densiflora ssp. obispoensis*), which is restricted to SLO County between Arroyo Grande and SLO across an elevation range of 30 to 1,200 ft. There are no CNDDB occurrence records for Obispo Indian Paintbrush, but the annual grassland hillside habitats in the Plan Area, especially north of AG Creek, provide potential habitat for this species.

3.7.2 Fish and Wildlife

In addition to steelhead, AG Creek supports California native fish populations downstream of Lopez Dam including tidewater goby (*Eucyclogobius newberryi*), California roach (*Hesperoleucus symmetricus*), prickly sculpin (*Cottus asper*), stickleback (*Gasterosteus* sp.), and speckled dace (*Rhinichthys osculus*) (Alley 1997a). Reptiles and amphibian species in addition to CRLF and SWPT include the Pacific gopher snake (*Pituophis catenifer catenifer*), western terrestrial garter snake (*Thamnophis elegans*), Pacific treefrog (*Pseudacris regilla*), and western toad (*Anaxyrus boreas*).

Wildlife species occurring in the Plan Area, most commonly observed in the less developed upper watershed, include mule deer (*Odocoileus hemionus*), coyote (*Canis latrans*), gray fox (*Urocyon cinereoargenteus*), striped skunk (*Mephitis mephitis*), raccoon (*Procyon lotor*), and bobcat (*Lynx rufus*), desert cottontail (*Sylvilagus auduboni*), dusky-footed woodrat (*Neotoma fuscipes*), deer mouse (*Peromyscus maniculatus*), and California pocket mouse (Chaetodipus *californicus*) (SAIC 2000). Species in upland areas near Lopez Reservoir include California quail (*Callipepla* *californica*), California towhee (*Melozone crissalis*), California thrasher (*Toxostoma redivivum*), and wrentit (*Chamaea fasciata*), western toad, California whiptail (Aspidoscelis *tigris mundus*), coast horned lizard (*Phrynosoma blainvillii*), and northern California legless lizard (*Anniella pulchra*). Oak woodlands in the area provide habitat for various salamanders, Pacific tree frogs, acorn woodpeckers (*Melanerpes formicivorus*), California scrub jays (*Aphelocoma californica*), northern house wrens (*Troglodytes aedon*), red-tailed hawks (*Buteo jamaicensis*), red-shouldered hawks (*Buteo lineatus*), Cooper's hawks (*Accipiter cooperii*), and American kestrels (*Falco sparverius*). Botta's pocket gophers (*Thomomys bottae*) and California ground squirrels (*Otospermophilus beecheyi*) are common in surrounding grasslands.

Lopez Reservoir provides habitat for waterbirds such as the common loon (*Gavia immer*), eared grebe (*Podiceps nigricollis*), western and Clark's grebes (*Aechmophorus occidentalis* and *A. clarkii*), double-crested cormorant (*Nannopterum auritus*), mallard (*Anas platyrhynchos*), gadwall (Mareca *strepera*), pied-billed grebe (*Podilymbus podiceps*), American coot (*Fulica americana*), green-winged teal (*Anas crecca*), bufflehead, (*Bucephala albeola*) ruddy duck (*Oxyura jamaicensis*), great blue heron (*Ardea herodias*), green heron (*Butorides virescens*), black-crowned night heron (*Nycticorax nycticorax*), snowy egret (*Egretta thula*), and great egret (*Ardea alba*) (SAIC 2000). Lake-breeding species include pied-billed grebes, American coot, mallards, and ruddy ducks. The osprey (*Pandion haliaetus*) and bald eagle (*Haliaeetus leucocephalus*), though not abundant, are also regular visitors to the lake throughout the year. Non-native fish species abound in the reservoir and are described in Section 3.7.3 below.

Riparian woodlands and other habitats along AG Creek downstream of Lopez Dam provide habitat for many of the upland habitat observed species including mule deer, coyote, bobcat, desert cottontailit, raccoon, gray squirrel (*Sciurus griseus*), deer mouse, muskrat (*Ondatra zibethicus*) and California pocket mouse. The AG Creek corridor also provides habitat for a variety of songbirds and raptors. Further downstream near the lagoon, wading birds (e.g., herons and egrets), shorebirds (black-necked stilts (*Himantopus mexicanus*) and American avocets (*Recurvirostra americana*), and gulls (*Larus* sp.) have been observed.

AG Creek supports a population of beaver (*Castor canadensis*). Although exact numbers of beavers in AG Creek are unknown, they have been documented throughout the lower reaches of the creek and in the lagoon (Christopher 2010; Rischbieter 2007, 2008, 2012, 2013, 2014) as well as in the middle reaches (Close and Smith 2004, Stillwater Sciences 2022a) and near Lopez Dam (Stillwater Sciences 2022a).

3.7.3 Non-Native Species

Several non-native species occur within the Covered Area, as a result of historical State stocking for angling purposes and stocking by anglers for bait fish. Non-native species not only prey upon native species but also compete for resources, affecting growth and condition (Swales 2006). The non-native fish species that occur within the Action Area are generally more tolerant of warm water than native steelhead. It is known that non-native aquatic species that have the potential to prey on or compete with SCCC steelhead occur in AG Creek, but there is limited existing data on the species present, their abundances, and their distributions. Current information is based on incidental observations during surveys and fish rescues conducted by Terra Verde Environmental Consulting (TVEC), Cleaveland Biological, California Department and Parks and Recreation (CDPR 2022), and Stillwater Sciences (Table 3-7). Based on these observations, the District anticipates that non-native predatory and competitor species assemblages include largemouth bass (*Micropterus nigricans*), mosquito fish (*Gambusia affinis),* hatchery rainbow trout (*O. mykiss*), bullhead catfish (*Ameiurus spp*), bluegill (*Lepomis macrochirus*) and/or other sunfish

(*Lepomis spp*), and American bullfrog (*Lithobates catesbeianus*). Largemouth bass have been observed in Meadow Creek lagoon (TVEC 2012), which is connected to AG Creek lagoon to form the lagoon complex (Stillwater Sciences 2022b) and between the Highway 1 lagoon crossing and the Tar Spring Creek confluence (Stillwater Sciences 2024b). Sunfish have been observed in the Meadow Creek lagoon (TVEC 2012) and in unspecified locations in AG Creek (Stetson Engineers et al. 2004). Bullhead catfish have also been observed in the mainstem between the Highway 1 lagoon crossing and the Tar Spring Creek confluence, and bullfrogs and/or their tadpoles have been observed in the lagoon complex and in the mainstem of the creek near the lagoon (Rischbieter 2006, Cleveland Biological 2020, Stillwater Sciences 2022b). Many non-native fish have been observed in Lopez Reservoir and could potentially occur in AG Creek downstream of Lopez Dam, including smallmouth bass (*Micropterus dolomieu*) and black crappie (*Pomoxis nigromaculatus).*

Table 3-7. Locations of non-native species with potential for steelhead predation or competition that have been observed in Arroyo Grande Creek to date.

Common Name	Scientific Name	Location(s) Observed	Source
American bullfrog	*Lithobates catesbeianus*	Lagoon complex, mainstem and AG Creek to HWY 1	Rischbieter 2006, Cleveland Biological 2020, Stillwater Sciences 2022b
Sunfish (e.g., bluegill, redear, green)	*Lepomis spp*	Lagoon complex, Lopez Reservoir	TVEC 2012, CDPR 2022
Bullhead catfish	*Ameiurus spp*	Mainstem AG Creek between HWY 1 and HWY 101, Lopez Reservoir	Stillwater Sciences 2024b
Largemouth bass	*Micropterus nigricans*	Lagoon complex, mainstem AG Creek between Highway 1 and HWY 101, Lopez Reservoir	TVEC 2012, Stillwater Sciences 2024b, CDPR 2022
Mosquito fish	*Gambusia affinis*	AG Creek mainstem	CDPR 2022
Black bass	*Micropterus salmoides*	Lagoon complex, Lopez Reservoir	CDPR 2022, County website screenshot, Fishing at Lopez Lake Recreation Area
Hatchery rainbow trout	*O. mykiss*	Lopex Reservoir, and AG Creek downstream of Lopez Dam	NMFS 2024), County website screenshot, Fishing at Lopez Lake Recreation Area
Smallmouth bass	*Micropterus dolomieu*	Lopez Reservoir	County website screenshot, Fishing at Lopez Lake Recreation Area
Black crappie	*Pomoxis nigromaculatus*	Lopez Reservoir	County website screenshot, Fishing at Lopez Lake Recreation Area

When Lopez Reservoir spills during period of high reservoir elevation, it is possible that non-native predatory fish (and/or stocked rainbow trout) may move from the Lopez Reservoir to AG Creek downstream of Lopez Dam. Under Existing Conditions spills are common in wet years, and on average occur for at least one day in around 30% of years. For years in which spill occurs, on average there will be 84 days of spill.

4 COVERED ACTIVITIES

4.1 Introduction

This section provides an illustrative description of existing and future District activities and infrastructure associated with the Lopez Water Project, for which the District is seeking incidental take coverage under Section 10 of the ESA. These activities, together with activities associated with the conservation program described in Section 5 and monitoring and adaptive management program described in Section 7.4 that may cause incidental take, are collectively referred to as C*overed Activities*.

Covered Activities are the specific actions and operations carried out by the District in the permit area that could result in take of the Covered Species. Covered Activities fall into the following broad categories:

1. Water Supply Operations. Water supply operations provide for municipal, agricultural, and ecosystem needs.
2. Maintenance and Operations. Maintenance and operations activities include those associated with Lopez Water Project, as well as activities upstream of the Dam and Reservoir.
3. Supporting infrastructure. Supporting infrastructure is needed to facilitate implementation of the HCP, including roads, stream crossings, boat dock, etc.
4. HCP implementation activities. HCP implementation activities are associated with the Conservation Program (Section 5), and Monitoring and Adaptive Management (Section 7.4).
5. Emergency Responses. The District response promptly to all emergencies and takes every action necessary to ensure that human health and safety are protected and that the safety and reliability of the water supply are quickly restored if disrupted.

4.2 Water Supply Operations

To meet the District's annual contract entitlement obligations of 4,530 AF for municipal users, in addition to providing water for agriculture users, and releases to AG Creek, water is removed from Lopez Reservoir through the intake control structure located within the reservoir and/or by spill events when the reservoir is full. Depending on water quality and the depth of water in the reservoir, the District selects an appropriate intake to withdraw water from. This process includes maintaining valves and calibrating meters so the appropriate water release occurs each day; records are kept at the outlet control building at the base of Lopez Dam where the jet valves are located. The jet valves release water to AG Creek over a concrete structure and riprap that provides aeration and energy dissipation. Water quality is addressed through selection of the appropriate intake valve within the reservoir. In summer, as the water elevation drops, air and water temperatures increase and tributary inflow decreases, the reservoir's thermocline strengthens, resulting in water with lower pH and temperature below the thermocline and higher temperatures and algae counts above the thermocline. The intakes are selected to maintain water quality by balancing water removed from intakes above the thermocline but deep enough to provide appropriate levels of DO, temperature, pH and algal counts for both municipal water supply and releases into AG Creek. This is determined by vertical profile water quality monitoring (limnology) that occurs weekly from approximately April through September, then monthly from October through March. If needed, the District may treat algae to reduce algae counts in Lopez Reservoir and/or Lopez Terminal Reservoir under Statewide General National

Pollutant Discharge Elimination System (NPDES) Permit for Residual Aquatic Pesticide Discharges to Waters of the United States From Algae and Aquatic Weed Control Applications (SWRCB Order 2022-0056).

In the summer, a visual inspection of the depth and width of AG Creek is taken at 22nd Street Bridge to verify that the stream gage is reading correctly and that there is water present at the gage. Based on this observation, releases from Lopez Reservoir may be increased.

4.3 Maintenance and Operations

4.3.1 Maintenance Activities Associated with Lopez Dam, Reservoir, and Perimeter Channel

- **Periodic shutoff of flows (planned outlet maintenance outage)**

  Maintenance of the 42-inch emergency release valve located at the base of the dam (Section 1.2.2, Figure 1-3) requires shutting off flows from Lopez Dam for 2–4 hours on a single day in accordance with the Department of Safety of Dams (DSOD) valve cycling requirements. This operation can occur every two years at the request of DSOD. The first step is to stop all flow from Lopez Dam by closing all intakes below the water surface elevation, closing the two jet cone valves, and then opening the 42-inch Knife Gate Valve and draining the line. As the jet valves are closed, the Knife Gate Valve is opened, so typically there is not a complete cessation of flow. Although flow is shut off momentarily to dewater the line, the 42-inch line has water in it from the regular operation of the pipeline. This momentary stoppage of flows has not resulted in an observed change in AG Creek flow or elevation at any of the downstream gages. When the jet valves are closed, they are inspected, and any required maintenance is performed. If damaged, repairs would be made as soon as possible to limit down time. In the past twelve years, only one repair was needed.
- **Maintaining on-site drainage facilities including ditches and drains**

  Ditches on Lopez Dam are cleaned out once per year (typically in the summer before rains start in fall) by shoveling them out by hand and pressure washing the underdrains. The ditch in the perimeter channel of the Terminal Reservoir is graded and cleaned by tractor: this channel discharges to AG Creek and is cleaned out as needed.
- **Structure repair and vegetation removal**
  - **Lopez Dam**

    Soil slippage or settlement is repaired annually. Vegetation around the dam face and toe is removed annually by goats or flail mower. Upon completion ditch maintenance is conducted.
  - **Lopez Dam Spillway**

    DSOD requires removal of woody vegetation on the spillway and riprap on the water side and downstream side of the spillway. Vegetation removal is by machine and/or goats. The log boom is inspected and repaired as needed. Inspection and repairs are done by staff in a boat while the log boom is in place.
  - **Terminal Reservoir and perimeter channel**

    The perimeter channel is mowed and vegetation is removed annually. Recently, the perimeter channel needed repairs to broken sections of the concrete V-ditch which is located along the centerline of the channel. The Terminal Reservoir has a berm that protects it from surface water runoff. The berm failed in 2023 and was rebuilt with no effect on AG Creek.

- **On-site flow channels below the Lopez Dam outlet**

  Vegetation is removed, broken concrete portions are repaired, and rip-rap is repaired or replaced annually. Typically, rip-rap replacement is not needed but the storm event in 2024 required some replacement of the rip rap at the exit of the spillway flip bucket on the main Dam (not the Terminal Reservoir). Channels are cleaned and inspected annually.

- **Access roads on and to the dam including associated drainage structures**

  Once a week Lopez Dam and the perimeter channel are inspected, and main roads are inspected after storm events. If required, vegetation is removed by hand, goats or brush mowers. Drainage from the roads does not enter AG Creek; the roads on the dam are Class 2 base, roads around the perimeter channel native soil, and there is an asphalt road to the outlet control building. Minor grading is used to fix eroded roads, with addition of road base, gravel or dirt to reestablish eroded surfacing. Adjacent ditches are cleared of debris by means of shovels or tractors, and concrete lined ditches are repaired if damaged.

- **Fences, gates and other elements necessary for the security of the site**

  On a weekly basis security is checked and vegetation is cleared and damaged materials are replaced.

- **Intake structure, log boom, outlet control structures, piping, appurtenances, access and buildings**

  The intake control building and associated intake control valves are inspected weekly to make sure the actuators are operational and that intake valves can be changed depending on water quality. The intake valves are only inspected when the lake elevation drops and the valve is accessible above the water line.

  The log boom is inspected and repaired as needed. Inspection and repairs are done by staff in a boat while the log boom is in place.

- **Stream gages and monitoring stations**

  Daily weather and manometer readings are taken. There are continuous gages with high and low flow alarms that indicate discharge down the creek and to the Terminal Reservoir, recorded on SCADA. Flow data stops if there is a power outage at Lopez Dam. Elevation readings are automated and put on the County Public Works Water Resources website and the manometer (bubble gage) is read every morning.

  The Water Resources Division operates and maintains the County's stream gages making sure they are calibrated, and the information is transmitted to the County webpage at wr.slocountywater.org. Gages are mounted to bridges and are maintained at the gage itself and not within the creek.

4.3.2 Maintenance Activities Associated with Lopez Water Treatment Plant and Distribution System

- **Rodriguez Bridge and waterline crossing** – Routine inspection and maintenance of the bridge and waterline crossing will be performed to ensure bridge and waterline crossing are functional and not damaged. Vegetation upstream and downstream of the bridge will be managed to ensure debris caught against the bridge does not accumulate and cause damage to structure or waterline.

- **Lopez WTP and Distribution system** is routinely monitored, inspected and maintained to ensure functional and operating in accordance with drinking water standards. Routine maintenance includes replacement of equipment and flushing of water lines. Flushing of waterlines and appurtenant facilities (hydrants, blowoffs, etc.) may result in a drinking water system release and may be performed as needed under Statewide NPDES Permit for Drinking Water System Discharges to Waters of the United States (SWRCB General Order No. CAG140001). Distribution system pipelines and appurtenant structures are generally not located within the creek but may be in areas adjacent or nearby.

4.3.3 Maintenance Activities Upstream of Lopez Dam

Within Lopez Reservoir the District treats the reservoir for algae, conducts repair and maintenance of the log booms at both the intakes and the spillway, conducts periodic concrete repair of the spillway, tule removal/weed abatement of the upstream dam face, repair and maintenance of the intake valves and structure, repair and maintenance of the reservoir level bubblers, and conduct regular water quality testing within the reservoir.

Upstream of Lopez Reservoir, and within watersheds that could provide steelhead spawning and rearing habitat (i.e., Lopez Canyon Creek and Wittenberg Creek watersheds), the County of SLO maintains several former U.S. Forest Service roads. This includes 6.46 miles of paved road (Road 2098), and 3.95 miles of gravel road (Road 2035 and Road 2310) plus an additional 0.41 miles of un-maintained gravel road. Collectively the roads contain 19 culverts and 8 Arizona-type concrete-lined water crossings. Regular maintenance activities include clearing landslides, trash cleanup, filling potholes, grading, tree removal, repairs of storm damage, sign replacement, tree trimming, mowing, culvert inspection, and culvert vacuuming. All roads experience seasonal closures from winter conditions, no vehicles traffic occurs under County jurisdiction when roads are flooded, and no grading of gravel roads occurs within the riparian zone. Any repair of road sections, culverts, or stream crossings would be implemented consistent with NMFS' Guidelines for Salmonid Passage at Stream Crossings in California (NMFS 2023b). There would be no increase in the number of road miles, or in the number of culverts or stream crossings during the duration of the permit.

4.4 Supporting Infrastructure

The road system described above is necessary for providing access for operations at Lopez Dam, implementation of the Conservation Program, and for monitoring and adaptative management of the HCP. The County Maintained Road System in the permit area will be routinely maintained, including vegetation management upstream and downstream of bridges crossing AG Creek and its tributaries, and along roadways to provide safe clearance and site distance needed for vehicular traffic. These roadways and bridges are needed to support access to the permit area as well as sometimes support stream gages. The road system for the permit area is in place, with no mileage expected to be added during the duration of the permit.

4.5 Emergency Responses

Given the nature of District facilities and operations, emergencies may arise that could have extremely detrimental and potentially life-threatening and/or property-threatening consequences. The District responds promptly to all emergencies and takes every action necessary to ensure that human health and safety are protected and that the safety and reliability of the water supply are quickly restored if disrupted. Weather and other natural hazards are the most common trigger for emergency responses by the District. Regardless of the cause, emergencies may require the immediate replacement of infrastructure, clearing vegetation in order to provide access to areas requiring repair or other intervention, accessing AG Creek, Lopez Reservoir, or other locations within the permit area in order to limit and ameliorate impacts associated with the relevant emergency, clearing debris including in areas containing habitat for one or more Covered Species, and temporary shut down of water or electricity within the permit area.

Depending on the nature and magnitude of the emergency response, typical avoidance and minimization measures and best practices may be impractical or imprudent for responding swiftly and effectively to an emergency. Nevertheless, because emergency responses by the District are both rare and involve other aspects of the Covered Activities, the District believes the take requested for other of the Covered Activities adequately capture the extent of take and impacts that may arise from emergency responses over the permit term.

4.6 HCP Implementation Activities

The Conservation Program (Section 5) and Monitoring and Adaptive Management (Section 7.4) are activities required as part of the HCP's conservation strategy and that have the potential to result in the take of one or more of the Covered Species, as described in the relevant sections of the HCP.

5 CONSERVATION PROGRAM

The HCP conservation program is the program strategy and the conservation actions that the District will implement over the permit term to minimize and mitigate the impacts of take of Covered Species to the maximum extent practicable. Specific components of the conservation program are described in detail below.

5.1 Conservation Program Approach (Strategy)

The conservation strategy is composed of two primary components that are closely linked: the biological goals and objectives and a set of conservation measures. The biological goals and objectives, described in Section 5.2 *Biological Goals and Objectives,* reflect the expected ecological outcomes of implementation of the HCP. The biological goals set out the broad principles used to guide the development of the conservation program; the biological objectives describe the specific conservation commitments. Objectives are measurable and quantitative, and they clearly state a desired result and will collectively achieve the biological goals. Biological goals and objectives are the foundation of the conservation strategy and are intended to provide the following functions:

- Describe the desired biological outcomes of the conservation strategy and how those outcomes will provide for the conservation of Covered Species and their habitats.
- Provide quantitative commitments and timeframes for achieving the desired outcomes.
- Serve as benchmarks by which to measure progress in achieving those outcomes across multiple temporal and spatial scales.
- Provide metrics for the monitoring program that will evaluate the effectiveness of the conservation measures and, if necessary, provide a basis to adjust the conservation measures to achieve the desired outcomes.

To achieve the biological goals and objectives, the District commits to implementing the conservation measures described in Section 5.4 *Conservation Measures*. The conservation measures are the actions the District will implement to meet the biological goals and objectives described in the HCP.

5.2 Permit Term

The permit term under the Lopez Water Project HCP and associated ITP is 30 years. The 30-year permit term was selected based on several key factors:

1. **Long-Term Project Certainty**: A 30-year term provides essential regulatory certainty for the District. This is crucial for a large-scale public infrastructure project that requires significant, multi-year investments in operations, maintenance, and capital improvements. A 30-year permit term eliminates the administrative burden and uncertainty of repeatedly applying for short-term permits, allowing the District to focus on effective long-term adaptive management and conservation.
2. **Financial Investment**: The proposed conservation measures, such as the Assisted Migration Program (see CM-2, Section 5.4.2, below), require substantial upfront and ongoing financial commitments. A 30-year permit term provides the necessary assurance for the District to secure the funding for these costly actions, knowing they will be authorized to continue their operations over a predictable period. This long-term financial commitment is a strong argument for a long-term permit.

3. **Co-Manager and Stakeholder Support**: A 30-year term for the ITP provides the necessary certainty of commitment necessary to ensure the support and sustained engagement of state and federal co-managers, landowners, and other key recovery partners.
4. **Effectiveness Monitoring and Adaptive Management**: A 30-year permit term facilitates a robust adaptive management framework. For complex ecological systems, like those involving anadromous-fish recovery and complex dam operations, it takes decades to collect enough data to resolve the response of the species and their habitat from the fluctuations expected from environmental variability, stochastic events, and climate change. A shorter-term permit would not allow enough time to gather the requisite data and analyses to inform adaptive management
5. **Species Recovery and Biological Goals**: A 30-year term for the ITP is aligned with the recovery goals of SCCC steelhead, as well as the Biological Goals and Objectives of this HCP (see Section 5.2, below). Steelhead have complex life cycles that include both freshwater and marine phases, and their populations can fluctuate significantly from year-to-year due to natural environmental variables, like ocean conditions and drought. A longer-term permit is necessary to avoid aliasing effectiveness monitoring results over shorter temporal scales which could potentially lead to erroneous conclusions about the effectiveness of conservation measures. A 30-year timeframe allows for the observation of multiple steelhead generations across a range of freshwater and marine environmental conditions, thus affording a more accurate assessment of whether the conservation measures are contributing to the species' long-term survival and recovery.
6. **Unforeseen Circumstances**: A 30-year term for the ITP associated with this HCP is consistent with the USFWS and NMFS No Surprises rule (63 FR 8859: February 23, 1998; 50 C.F.R. § 17.22(b)(5); 50 C.F.R. § 222.307(g)). The No Surprises rule states that USFWS and NMFS "will not require without the consent of the permittee, the commitment of additional land, water or financial compensation or additional restrictions on the use of land, water, including quantity and timing of delivery, or other natural resources beyond the level otherwise agreed upon for the species covered by the conservation plan." The rule further clarifies that if unforeseen circumstances do arise, USFWS and NMFS will still honor the "no surprises" assurances provided the permittee is implementing the terms and conditions of the HCP and ITP in good faith.

5.3 Biological Goals and Objectives

Lopez Water Project operations and resulting changes in instream flows downstream have contributed to instream habitat alteration for steelhead, CRLF, and SWPT and may result in direct or indirect take over the 30-year permit term. As described in detail in Section 1.1, Lopez Dam has been identified as impassable to fish, impedes distribution of coarse materials to the downstream reaches for fish habitat, and has resulted in flow modifications that affect the downstream reaches of the Covered Species.

As part of the "Five Point" Policy adopted by USFWS and NMFS in 2000, HCPs must identify biological goals and objectives (USFWS and NMFS 2000). Biological goals are broad, guiding principles for the operating conservation program in a HCP that are consistent with the conservation and recovery goals established for the species covered by the HCP (65 FR 35251). Biological objectives, on the other hand, are the different components to achieve a given biological goal (65 FR 35251). Biological goals and objectives are developed based upon the species' biology, threats to the species, the potential effects of the Covered Activities, and the scope of the HCP and ultimately inform conservation measures of the plan. The biological goals and objectives for the Lopez Water Project HCP are to:

1. **Biological Goal 1**: Improve habitat for steelhead, CRLF, and SWPT in AG Creek to encourage persistence of populations within the plan area.
   - Biological Objective 1A: Release at least 3 cfs from Lopez Dam to provide rearing habitat for steelhead in AG Creek between Lopez Dam and Cecchetti Road crossing.
   - Biological Objective 1B: Manage pulse releases between January 1 and May 31 to support upstream attraction for adult steelhead in AG Creek upstream of the Tar Spring Creek confluence and downstream smolt outmigration.
   - Biological Objective 1C: Provide release reduction rates for managed pulse releases to minimize risk of stranding steelhead redds and fry, and CRLF eggs and larvae.
2. **Biological Goal 2**: Provide improvements to habitat for steelhead CRLF, and SWPT in AG Creek between Lopez Dam and the confluence with Tar Spring Creek.
   - Biological Objective 2A: Improve CRLF habitat by reducing habitat suitability for bullfrogs and predatory fish and restoring riparian vegetation.
   - Biological Objective 2B: Improve steelhead migration corridors by removing and minimizing passage barriers.
   - Biological Objective 2C: Restore channel functions and improve habitat conditions for steelhead, CRLF, and SWPT by converting ponds to stream habitat, large wood inputs, sediment augmentation, excavation, and tributary habitat enhancement.
3. **Biological Goal 3**: Investigate feasibility of an assisted migration program for steelhead in the AG Creek watershed (both upstream and downstream of Lopez Dam).
   - Biological Objective 3A: Develop an experimental assisted migration program that includes a Technical Advisory Committee (TAC) to inform implementation, review results of initial efforts, and guide next steps.
   - Biological Objective 3B: Address critical uncertainties, with guidance from TAC, potentially including assessing *O. mykiss* population structure upstream of Lopez Dam, and potential impacts to the resident population with removal of individuals (even if experimental).
   - Biological Objective 3C: Install and operate experimental downstream migrant and adult upstream migrant traps with TAC guidance in an adaptive management framework to examine effectiveness of experimental program.

5.4 Conservation Measures

The HCP Handbook explains that biological objectives are met through implementation of one or more *conservation measures*. Conservation measures can include actions that do any of the following to meet the goals and objectives of the HCP.

- Avoid effects on the Covered Species (called *avoidance measures*)
- Reduce or minimize effects of take on the Covered Species (called *minimization measures*)
- Offset effects on the Covered Species (called *mitigation*)

The conservation program (i.e., all conservation measures together) is intended to meet the applicable regulatory standards of ESA section 10 to do the following:

- Minimize and mitigate the impacts of the take to the maximum extent practicable
- Not appreciably reduce the likelihood of survival and recovery of the Covered Species in the wild

This section describes the conservation measures the District will implement to meet the biological goals and objectives described in Section 5.2 *Biological Goals and Objectives.* Based on the direction of the NMFS Recovery Plan (2013), Conservation Measures in this HCP are focused on providing sufficient dam releases to ensure during the permit term migratory opportunities to and from Lopez Dam for steelhead adults and smolts; an assisted migration program to reconnect anadromous populations with upstream habitat; and suitable conditions (e.g., flows, habitat conditions, BMI production) for downstream rearing juveniles, adult spawning, and CRLF and SWPT. Based on these goals, there are nine conservation measures in total described below.

- **Conservation Measure 1 (CM-1)**. Lopez Downstream Release Plan (LDRP)
- **Conservation Measure 2 (CM-2)**: Assisted Migration for Steelhead at Lopez Dam
- **Conservation Measure 3 (CM-3)**: Habitat Restoration
- **Conservation Measure 4 (CM-4)**: Biddle Park Culvert Maintenance
- **Conservation Measure 5 (CM-5)**: Predator Control Program
- **Conservation Measure 6 (CM-6)**: Fish Rescue and Relocation During Localized Construction Dewatering
- **Conservation Measure 7 (CM-7)**: Maintaining Flow Gaging Stations
- **Conservation Measure 8 (CM-8)**: Best Management Practices (BMPs)
- **Conservation Measure 9 (CM-9)**: Interagency Technical Advisory Committee

Most of the conservation measures address several biological goals and objectives. As a result of the timeframe over which the HCP will be implemented, the conservation measures are also designed to be flexible and allow adaptive management with increasing knowledge over time. The flexibility provided by the adaptive management program (AMP) (Section 7.4 *Monitoring and Adaptive Management Program*) is an important component of the conservation strategy.

5.4.1 Conservation Measure 1: Lopez Downstream Release Plan (LDRP)

To meet the biological goals of the HCP, a Lopez Downstream Release Plan (LDRP) has been developed to improve baseflows for rearing, migrating, and spawning steelhead, as well as improved migration flows to improve opportunities for adults and smolts to migrate from AG Creek to the Ocean as compared to Existing Conditions. Both the baseflow and migration flow components are described below.

5.4.1.1 Baseflows

The LDRP includes baseflows to increase seasonal flow variability, improve rearing conditions for juvenile steelhead and spawning conditions for adult steelhead, especially in the reach from Lopez Dam downstream to Tar Spring Creek confluence (Table 5-1). In AG Creek downstream of Tar Spring Creek confluence flows are heavily influenced by accretion from Tar Spring Creek and non-District water withdrawals. Reductions in releases will occur at rates of less than 2 inches/hour. Lopez Dam baseflow releases under the LDRP are summarized in Table 5-1, and include the following:

- Summer minimum baseflow
- Fall baseflow increase over summer
- Winter baseflow increase over fall
- Spring baseflow decrease from winter to summer baseflow

Table 5-1. Lopez Downstream Release Program Baseflow.

Season	Timing	Minimum Flow (cfs)
Summer baseflow	June 2–Dec 1	3
Fall baseflow	Dec 2–Jan 1	5
Winter baseflow	Jan 2–Feb 1	8
	Feb 2–Mar 15	8
Spring baseflow	Mar 15–Apr 1	7
	Apr 2–May 1	5
	May 2–Jun 1	4

5.4.1.2 Migration Flows

The LDRP includes migration flows to increase connectivity of habitat downstream of Lopez Dam to the Ocean for adult and smolt steelhead migration. The LDRP is focused on flows within the reach from Lopez Dam downstream to Tar Spring Creek. Downstream of Tar Spring Creek confluence, migration flows in AG Creek are heavily influenced by accretion from Tar Spring Creek. Lopez Dam migration releases under the LDRP are summarized in Table 5-2, and include the following:

- Up to 2 migration releases in the winter
- Each migration release is at least 10 days in duration
- Maximum 20 cfs migration release from Lopez and higher during spill
- Spills increase migration releases, and count towards release
- Migration release triggers:
  - berm at the beach is open providing connectivity between the AG Creek lagoon and the ocean, and
  - flow at AG gage (RM 7) at 25 cfs for >48 hours to ensure migration flows are synchronized with natural flow events in watershed.
- Rates in reduction (ramping rates) will be ≤2 inches in WSE/hour
- Constraints:
  - Low Reservoir Response Plan (2014)
    - No migration releases if reservoir falls below 20,000 AF (baseflows remain the same)
  - Flood risk reduction plan (County of SLO 2024)
    - No migration releases during early-season conditions (watershed unsaturated & Lopez not yet full/spilling) if:
      - Minimum 24-hour rainfall total of three inches measured at Lopez Dam; and
      - Minimum projected rainfall intensity of 0.25 in/hr (from the Oxnard NOAA National Weather Service).

- No migration releases during mid-season conditions (watershed saturated, Lopez spilling) if:
  - Lopez Dam is spilling 20 cfs or greater; or
    - Minimum storm accumulation of one inch measured at Lopez Dam; and
    - Minimum projected rainfall intensity of 0.25 in/hr for 2 or more hours *after* minimum storm total (from the Oxnard NOAA National Weather Service).

Table 5-2. LDRP migration releases.

Season	Timing	Daily Average Flow (cfs)	Frequency	Trigger
Winter migration flows	Dec 1–May 1 Each migration release 10 days	10-10-15-15-20 20-15-15-10-10	Minimum is 0. Max is 2 per year (20 days total)	Flow at Arroyo Grande gage (RM 7) at 25 cfs for >48 hours Berm open No migration release if spilling 20 cfs of greater No migration release if reservoir is <20,000 AF

5.4.2 Conservation Measure 2: Assisted Migration for Steelhead at Lopez Dam

Under Existing Conditions most of the suitable steelhead habitat is upstream of Lopez Dam, particularly within Lopez Canyon and Wittenburg creeks. The current anadromous steelhead population is restricted to less suitable spawning and rearing habitat downstream of Lopez Dam and within Tar Spring Creek.

McMillen (2025) conducted a Feasibility Assessment Report to evaluate engineering solutions to enable volitional fish passage for steelhead trout at Lopez Dam (Appendix C). Through a collaborative, transparent process involving NMFS, USFWS, CDFW, and a structured quantitative evaluation, the report identifies and ranks fish passage alternatives based on technical, biological, operational, environmental, and economic criteria. Five alternatives, two upstream and three downstream, were evaluated using a detailed scoring matrix across seven categories: Biological Efficiency, Constructability, Operation, Design Approach, Environmental Impact, Regulatory Compliance, and Financial Criteria. Among upstream options, a trap-and-haul system ranked highest, while for downstream passage, in-tributary trap-and-haul facilities located in Lopez Canyon and Wittenberg creeks were found to be most viable. Other alternatives were determined to be not practicable due to dam safety risks, excessive water flow requirements, high costs, or lack of proven performance. Based on these findings, McMillen (2025) recommends implementing a seasonal trap-and-haul system for upstream and downstream passage.

The goal of an assisted migration program in the AG Creek watershed would be to reconnect the anadromous steelhead population and increase access to suitable spawning habitat for anadromous adults and provide opportunities for the *O. mykiss* population upstream of Lopez Dam to express an anadromous life history consistent with NMFS position (see NMFS 2023a) that remediating fish passage barriers to upstream habitat would substantially improve steelhead population viability primarily as a result of increased smolt abundance, increased spatial structure, and increased genetic diversity.

There are many biological and logistical uncertainties regarding the efficacy of an assisted migration program including: the numbers of adults that could be captured downstream of Lopez Dam; whether adults released in Lopez Canyon Creek will spawn or instead attempt to migrate downstream; how many juveniles can be captured migrating downstream in tributaries; risks of predation on potential smolts in Lopez Reservoir; potential risks of transferring diseases upstream or downstream; if juveniles released downstream of Lopez Dam will survive and migrate as smolts to the ocean or residualize within AG Creek, as well as other issues that are unknown at this time. In addition, there will be additional and potentially significant regulatory implications in releasing a listed species upstream of Lopez Dam, including under the ESA, and within an area where CDFW regulates angling. The biological, logistical, and regulatory uncertainties will be evaluated by implementing an experimental assisted migration program that will provide opportunities to modify or expand the commitment of the program, or provide explicit opportunities to discontinue the program and redirect efforts towards habitat restoration downstream of Lopez Dam (CM-3, Pond Reach Restoration), as described in the following steps:

Step 1: Engage the TAC (see CM-9) to inform implementation, review results of initial efforts, and guide subsequent steps. This step will include developing an Effectiveness Monitoring Program and associated Decision Framework with quantitative performance measures that would trigger a TAC recommendation to the District to cease/continue/modify the assisted migration program at the 5- and 10-year Decision Points. The Decision Framework will include measures like survival rates of adult spawners passed above Lopez Dam, number of redds observed, observed smolt production levels above Lopez Dam, collection efficiency of outmigrating smolts above Lopez Dam, estimated survival of outmigrating smolts below Lopez Dam, etc. The Effectiveness Monitoring Program would detail the specific monitoring that would need to occur to collect data on these measures with the appropriate accuracy, precision, statistical power, etc. The Effectiveness Monitoring Program data would inform modifications to the program that would improve its effectiveness, especially within the first five years.

Step 2: Develop a complete and detailed experimental assisted migration program, including addressing critical uncertainties to be tested during implementation.

Step 3: Conduct research and monitoring to address critical uncertainties, as guided by the TAC, potentially including assessing *O. mykiss* population structure (i.e., abundance, age structure, genetics) upstream of Lopez Dam (Section 7.4.1, MM-10), and assess the potential impacts to the resident population with transport of downstream migrating individuals to downstream locations (even if experimental).

Decision Point 1: After completion of Steps 1–3, or by year 5 of HCP implementation, whichever comes first, the TAC will explicitly advise the District whether available information indicates that continuing pursuing the assisted migration program is warranted, or whether identified constraints outweigh opportunities, per the established Decision Framework (Step 1, above). Critically, in order for the District to implement an assisted migration program, it may be necessary for the District to obtain authorizations under the ESA and/or other federal or state law. If the District is unable to obtain such authorizations by year 5 of HCP implementation, then the District would cease its efforts under CM-2 and implement the Pond Reach Restoration project under CM-3. Similarly, if the TAC recommends discontinuing the program, the District will initiate the implementation of increased habitat restoration downstream of Lopez Dam, pursuant to the Pond Reach Restoration project described in CM-3. In this process, the TAC is an advisory body that will make recommendations to the District. The ultimate responsibility for decisions will remain with the District in coordination with the NMFS and USFWS.

Step 4: Install experimental downstream migrant trap (rigid weir) in Lopez Canyon Creek. Operate trap during spring downstream migration to evaluate numbers of migrants encountered and environmental conditions associated with downstream migration. Smolts collected in the trap could be released downstream of trap site or downstream of Lopez Dam depending on TAC guidance (Considered Year 1 of a 5-year experimental assisted migration study). Step 4 could occur concurrently with the monitoring activities described in Step 3, as directed by the TAC.

Step 5: Monitor downstream migration behavior and ocean-entry success of smolts released downstream of Lopez Dam using tagging and telemetry (passive integrated transponder, acoustic, or radio). Use information from tagging study to evaluate migration success and how and if migration is related to Lopez Dam releases (Years 2–5 of experimental assisted migration study).

Step 6: Install adult upstream migrant trap (rigid weir) downstream of Lopez Dam. Operate trap during adult migration season when adults could potentially occur. Transport all captured adults to Lopez Canyon Creek. If no adults are captured after several years, consider locating trap further downstream. Relate flows to adult captures (Years 3–5 of experimental assisted migration study).

Step 7: If adult releases are successful, conduct redd surveys to identify spawning locations and infer spawning success of adults released in Lopez Canyon Creek. Use additional population-level surveys in Lopez Canyon Creek to gather pre-implementation, baseline data on population genetics and abundance (Years 3–5 of experimental assisted migration study).

Decision Point 2: Use information from Steps 4–7 to determine effectiveness of assisted migration program and for the District to make decisions regarding expansion of an assisted migration program to include other downstream migrant trap locations in other tributaries upstream of Lopez Dam. Advise regarding the effectiveness of the experimental program would be made by the TAC and subsequent appropriate recommendations for continuation or expansion would be proposed (Year 7 of experimental assisted migration study). After completion of Steps 4–7, or by year 10 of HCP implementation, whichever comes first, the TAC will explicitly advise District if monitoring of experimental assisted migration results indicates that continuing pursuing the assisted migration program is warranted. If the TAC recommends the District discontinue the program, the District will initiate the implementation of increased habitat restoration downstream of Lopez Dam, pursuant to the Pond Reach Restoration project described in CM-3. If assisted migration moves forward as a permanent measure, there would be no requirement for alternate conservation, but the District could agree to consider using outside funding sources for projects supported by the TAC.

Data collection is essential for evaluating the effectiveness of assisted migration at the individual and population level. Following release upstream of Lopez Dam, adult movements, survival, reproductive success, and genetic contributions would be monitored using one or more of a variety of available techniques including redd surveys, telemetry, and genetic approaches. Specific methods used would be determined by the District in collaboration with the TAC. Redd surveys can be conducted following release of adult steelhead to determine spawning location and implied spawning success. For adult monitoring, the District will initially rely on spawner/redd surveys to monitor the movements and success of adults released upstream of Lopez Dam because these surveys are non-invasive. Telemetry using PIT or radio tags for monitoring adults could be considered by the TAC in the future, depending on specific goals.

Understanding the population-level effects of assisted migration is another key factor to evaluate. Adult female steelhead have high fecundity compared to resident *O. mykiss* (Moyle 2002), and therefore, have the potential to influence population demographics as well as genotypic and phenotypic diversity of a recipient population. For example, increased gene flow from adult steelhead could increase genetic diversity and increase allelic frequency of the Omy5 allele that is associated with anadromy (Pearse et al. 2014). Genetic studies on steelhead have been used to infer population origin, ancestry (Adabia-Cardoso et al. 2016), and genetic divergence among populations above and below barriers (Clemento et al. 2008). Clemento et al. (2008) compiled genetic samples from *O. mykiss* populations throughout the Central Coast DPS and Southern California DPS and used microsatellite DNA markers to assess ancestry and population genetic differentiation both within and between river basins. In AG Creek, samples were collected from the mainstem below Lopez Dam and from Lopez Canyon above the dam. Samples were also collected from Los Berros Creek, a tributary that joins AG Creek in the lower watershed below Lopez Dam. Results indicate that hatchery fish planted in Lake Lopez had not reproduced with native fish enough to cause significant genetic introgression in this population. In addition, although significant genetic differentiation was found between the different sample sites in this watershed and in most of the watersheds within this study, this differentiation does not appear to be attributed to separation by migration barriers in the Arroyo Grande watershed, suggesting "recent common ancestry…and/or contemporary gene flow (through downstream migration or transplantation in either direction)". Overall, *O. mykiss* populations within this study exhibited relatively low levels of genetic diversity compared to those previously measured in northern California *O. mykiss*. Compared to other populations within this study, however, AG Creek *O. mykiss* exhibited relatively high levels of genetic diversity, and Lopez Canyon fish had the highest measured genetic diversity (as indicated by allelic richness and number of observed alleles).

Recently, the use of Parentage Based Tagging (PBT) has proven effective as an alternative to conventional tags (e.g., Coded Wire Tags) for monitoring steelhead population dynamics (Anderson and Garza 2006). Using genetic techniques, a single fin clip can be used to develop a better understanding of steelhead biology in the AG Creek watershed and to monitor the effects of an assisted migration program.

All adults captured from below Lopez Dam will have tissue samples (caudal fin clip) taken for genetic analysis of microsatellite or single nucleotide polymorphisms (Adabia-Cardoso et al. 2011). These tissue samples will used to identify population origin and sex of adult migrants trapped in lower AG Creek. In addition, when combined with genetic samples taken from the population of *O. mykiss* above Lopez Dam, PBT would be used for identification of offspring from adult steelhead passed upstream and identification of spawning locations. Sampling over time will provide a means of monitoring population-level effects of assisted migration on *O. mykiss* upstream of Lopez Dam.

In addition to adult monitoring, smolt monitoring upstream of Lopez Dam will be conducted. The goals of smolt monitoring would be to evaluate: (1) movement patterns and migration success, (2) the influence of release location, and (3) conditions that facilitate successful downstream migration. All smolts released downstream would be PIT tagged (assuming they are large enough) and their movements monitored using fixed PIT antenna arrays. Three antenna arrays will be monitored during experimental assisted migration studies—one location immediately downstream from the release site (to confirm initiation of downstream movements), one location in the vicinity of the AG gage (to confirm more extensive downstream movements indicative of true migration), and a third location near the tidal influence of the lagoon (to confirm ocean entry). An added benefit to operation of PIT antennas is that they would also detect any PIT-tagged smolts that return as adults. If large enough numbers of downstream migrants are trapped and released during the experimental phase, the use of radio telemetry could be considered to monitor more fine scale movement patterns after release because radio telemetry arrays are more flexible in terms of deployment locations and tend to have increased detection efficiency in dynamic environments compared to PIT antennas. Data from smolt movement patterns would be related to individual smolt characteristics (e.g., size, Omy5 haplotype) and environmental conditions (e.g., flow, temperature, season) in AG Creek to understand conditions that facilitate downstream migration. The influence of different experimental release locations could also be evaluated using telemetry and return rates of adults.

5.4.3 Conservation Measure 3: Habitat Restoration

Based on the channel morphology downstream of Lopez Dam (described in Section 3.4), the primary habitat restoration approach for AG Creek downstream of Lopez Dam is augmenting sediment supply to reduce glide habitat, improve riffle formation, spawning habitat, and productive macroinvertebrate production, as described below for a Sediment Augmentation Plan. In addition, a habitat restoration of a pond reach downstream of Lopez Dam may be implemented, depending on the outcome of the assisted migration conservation measure (CM-2).

5.4.3.1 Sediment Augmentation Plan

Downstream of Lopez Dam, AG Creek has been transformed into an incised channel with limited spawning gravel and extensive fine sediment on the bed. A sediment management plan will be developed to assess the best approach to improve steelhead and aquatic habitat in the creek. Within 9 months of both ITP issuances, the District shall, in coordination with the TAC, prepare a Sediment Augmentation Plan to address sediment supply and transport disruptions, and support elements of steelhead critical habitat that are maintained by sediment and geomorphic processes, including spawning gravel quality and availability and rearing habitat. The Sediment Management Plan will evaluate the current condition of the channel to develop a gravel augmentation program and describe the potential for supplemental flows to mobilize gravel. The gravel augmentation program will adjust the size distribution of gravel to ensure that the sediment distribution is: 1) within the suitable size range for steelhead spawning, and 2) mobilized during spill events or releases from Lopez Dam. Because Lopez Dam spills infrequently and spills are often low magnitude (spill exceeded 100 cfs in only 3 years between 2000 and 2024), the Sediment Management Plan will explore how supplemental geomorphic flow releases (up to a maximum of 100 cfs through existing dam infrastructure) could help to maintain habitat in AG Creek. If analysis shows that spawning gravel mobilization is only possible during infrequent spill events, the Sediment Management Plan may explore supplemental geomorphic flow releases from Lopez Dam to support gravel mobility.

The Sediment Augmentation Plan will be developed to periodically place sediment downstream of Lopez Dam in the reach from Lopez Dam to Tar Spring and monitor the rate and volume of sediment transport relative to flows. To date, there has not been sufficient data on the size distribution and composition of sediment in the channel to complete a sediment transport modeling analysis to determine appropriate volume and composition of augmented sediment. Designing a gravel augmentation program will require cross section surveys downstream of the dam to explore gravel mobility thresholds and the potential for mobilizing fine sediment deposited in the channel, and updated channel bed mapping to identify conditions where gravel is stable, and where fine sediment deposition is limited.

The Sediment Management Plan will include a monitoring program to track the effectiveness of the plan in meeting its goals. This monitoring is likely to include tracking augmented gravel using tracer rocks, repeated mapping of the channel bed, and long-term cross section monitoring. This monitoring program will be used to update the Sediment Management Plan.

At a minimum, the District will ensure the Sediment Augmentation Program initially includes at least 500 CY of sediment (composition to be determined by the District in coordination with the TAC) placed within the Pond Restoration Reach (CM-1), monitored annually, and replenished to initial volume at least every five years. All additional sediment augmentation would occur within Pond Restoration Reach, or other locations downstream. Sediment augmentation would continue on at least a 5-year replenishment scheduled for up to 30 years. The duration of the program may change and will be evaluated in the AMP by the TAC. Sediment loads for initial placement and replenishment would be delivered by trucks, transported on conveyer belts, and placed using standard construction equipment.

5.4.3.2 Potential Pond Restoration Reach

The primary conservation measure proposed to increase steelhead access to suitable spawning and rearing habitat is assisted migration, described in CM-2. However, there are two explicit “decision points” described in CM-2: after five years of both ITP issuances/HCP implementation and again after ten years of implementation. The decision points provide the TAC (see CM-9) the opportunity to evaluate the effectiveness of the assisted migration program. Based on the scientific analysis of the accumulated effectiveness monitoring data, the TAC may recommend that the District continue to pursue assisted migration, or instead, recommend discontinuing that program, and prioritize habitat restoration downstream of Lopez Dam in the form of a pond restoration reach project. Likewise, CM-2 recognizes that federal and/or state authorizations may be necessary to implement assisted migration and that such authorizations may not be granted in a timeframe that is practicable for assisted migration. In either case, the pond restoration reach project described below will be implemented where the District determines that the best available scientific information demonstrates that downstream habitat restoration would be more beneficial to steelhead recovery than continued investment in assisted migration, or if there is no state and federal approval of the assisted migration program.

Over time, AG Creek expanded to include several remnant gravel pits on private property, resulting in ponds in the pond restoration reach (Figure 5-1). These ponds slow water velocity and reduce suitable steelhead habitat by increasing water temperatures (Stetson Engineers et al. 2004, Stillwater Sciences 2022a), reducing cover for rearing juvenile steelhead, and eliminating cobble riffle habitat that would provide spawning habitat and macroinvertebrate production (primary source of food for rearing juvenile steelhead). The ponds also currently provide suitable habitat for nonnative predatory aquatic species including largemouth bass, bluegill, green sunfish, and bullfrogs, which are known to prey on juvenile steelhead and native CRLF (Stetson Engineers et al. 2004, Stillwater Sciences 2022a).

Figure 5-1. Pond 3 downstream of Lopez Dam.

Restoration of riverine habitat within the ponds would improve habitat conditions for steelhead by increasing spawning habitat, providing cover and increased habitat complexity, increasing shallow water fry rearing habitat, increased productive macroinvertebrate habitat within substrate, and increased feeding opportunities for juveniles from increased water velocities adjacent to resting pools. Habitat suitable for rearing would also be improved by reduced water temperatures. Under current conditions water temperatures are highest in the reaches immediately downstream of Lopez Dam (Stillwater Sciences 2022a). Replacing the ponds with stream habitat will improve (lower) water temperatures in downstream reaches of AG Creek by reducing hydraulic residence time and associated warming in the open-water ponds. Reduced warm and deep pools will decrease suitable habitat for invasive species and improve the ability for steelhead to compete with and avoid non-native predators.

The approach to restoring the pond reach includes collecting detailed topography, creating 2D hydraulic models of the reach, and developing conceptual designs in collaboration with the TAC. Based on input from the TAC, 50% and 90%, and a basis-of-design report will be developed. Final designs and a bid package will be produced for construction to occur.

In general, it is anticipated that this habitat restoration opportunity involves filling the existing ponds (referred to as Pond 3 and Pond 4) with native material, planting native riparian and emergent aquatic vegetation, and installation of anchored large wood structures (Figure 5-2 and 5-3). Fill material for this feature would be graded to emulate a geomorphically stable natural system, with appropriate sinuosity, pool-riffle sequencing, and floodplain flow pathways designed to accommodate Lopez Dam releases. Large wood features would be placed and anchored throughout newly constructed channels to provide habitat benefits and geomorphic stability.

Because Lopez Dam attenuates seasonal variations in stream flows, restoration of the ponds should focus on creating channel complexity representing historical conditions suited to the existing channel slope. Without large variability in dam release flows, the stream channel below Lopez Dam is not expected to undergo normal geomorphic processes to the same extent including sediment transport, natural formation of pool-riffle sequences, and topographic variability along bank transition zones and floodplain that typically maintain off-channel habitat features in stream channels. One major design element of restoring the existing ponds to stream channel habitat is to create a design that emulates a natural stream channel, as opposed to other methodology such as light touch, process-based restoration or stage zero approaches (e.g., Cluer and Thorne 2013), both of which are highly dependent on unimpaired variation in stream flows.

Field investigations and site topography at ponds 3 and 4 indicate large volumes of fill material are available from remnant levees or berms adjacent to the ponds. Filling the ponds with the levee or berm material will achieve on-site material balancing and reduced cost and impacts compared to importing material for filling of the ponds. Sinuosity and riffle-pool sequences should be designed to enhance habitat suitability for steelhead and degrade habitat for non-native, predatory aquatic species. Areas with pool habitat of three or more feet deep should be maintained in some locations for CRLF. Proposed modifications should target less than a 1-foot rise in the base flood elevation compared to existing conditions to stay in compliance with FEMA requirements for development in mapped flood zones.

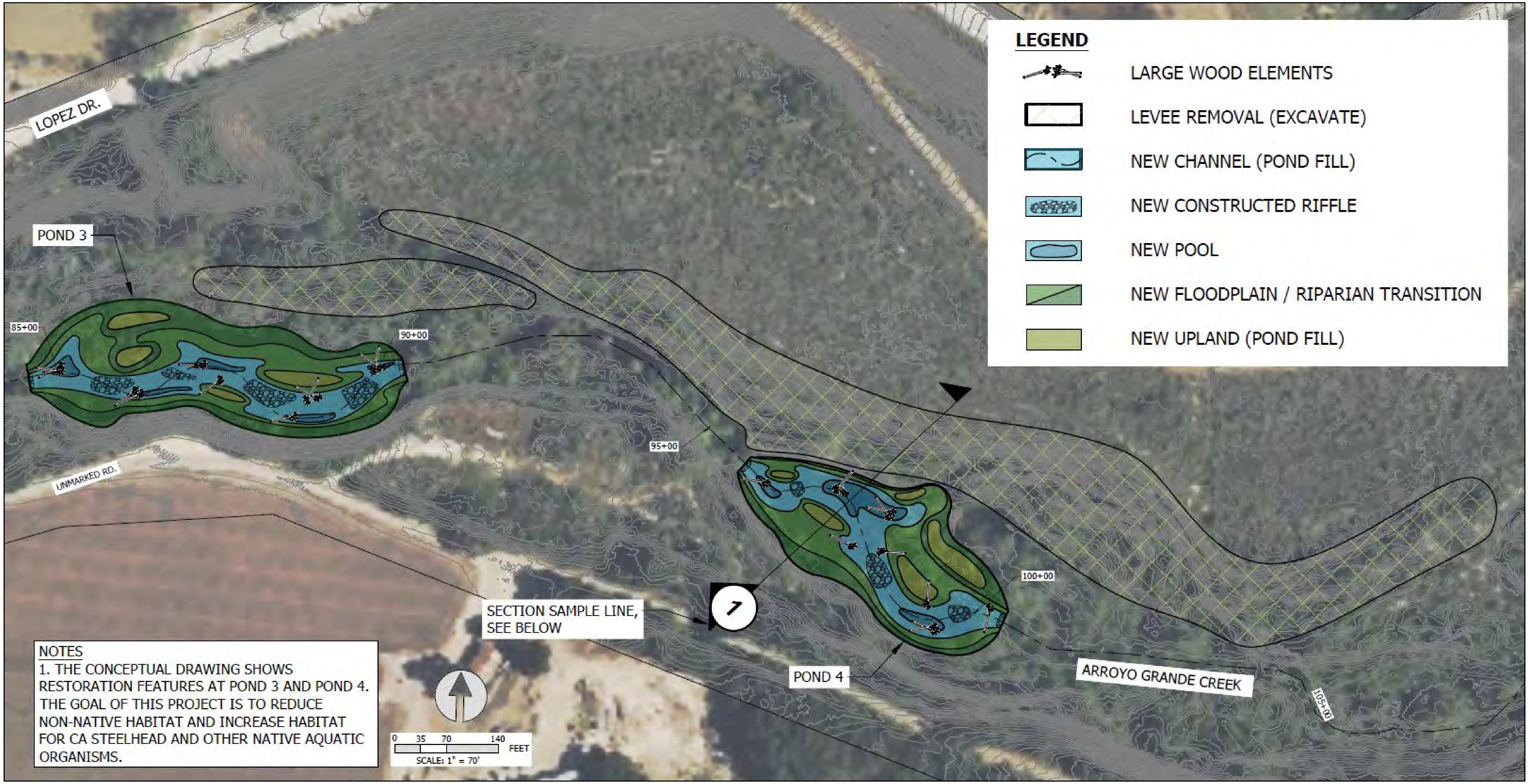

Figure 5-2. Detail of conceptual Pond Conversion to Stream Habitat – Plan View.

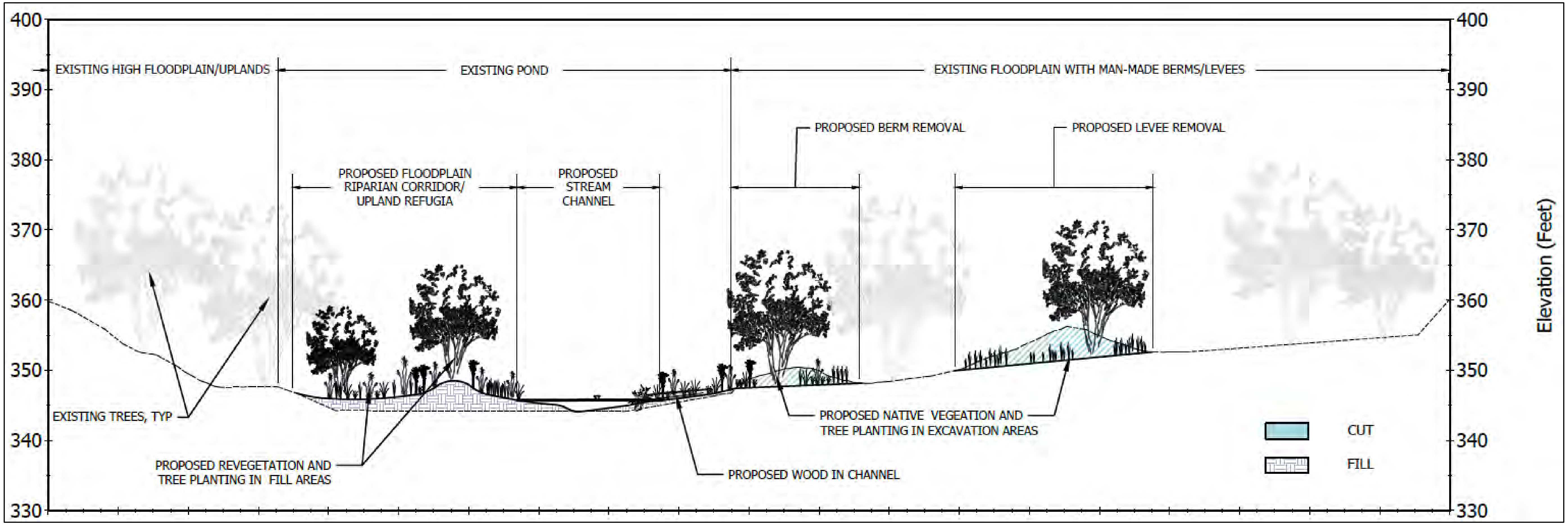

Figure 5-3. Detail of conceptual Pond Conversion to Stream Habitat – Section View.

5.4.4 Conservation Measure 4: Biddle Park Culvert Maintenance

Under this Conservation Measure, the Biddle Park Culvert (identified in the CDFW PAD), will be maintained for fish passage. Under existing conditions sediment and debris collect at the culvert inlet (Figure 5-4), potentially creating an impediment to adult steelhead migration. The District will regularly check, maintain, and clean the culvert of accumulated sediment and debris if necessary to maintain suitable migration conditions. District staff will survey the culvert within 24 hours of the initiation of migration releases (CM-1), and at least once more during the release. Conditions will be described and photographed prior to and following efforts to remove sediment and debris.

Figure 5-4. Biddle Park Culvert.

5.4.5 Conservation Measure 5: Predator Control Program

This Predator Removal Program includes measures for controlling steelhead predators and competitors recommended in NMFS's (2013) Steelhead Recovery Plan, such as development and implementation of a watershed-wide plan to assess the impacts of non-native species and develop control measures, a non-native species monitoring program, and a public educational program on non-native species impacts. This program includes recommended methods for assessing and removing non-native species that may predate on or compete with native *O. mykiss* within the mainstem of AG Creek downstream of Lopez Dam, a monitoring program to determine the predatory species that are present in this area and their distribution, and a description of management strategies that would reduce their populations and their potential to impact *O. mykiss*.

While it is known that non-native species with the potential to predate on and/or compete with *O. mykiss* exist in the AG Creek watershed, data on specific species, their abundance, and distribution is lacking. The general approach of this program involves first describing survey methods that will characterize the identities and distributions of these species within the mainstem from just below the dam to Tar Spring Creek, from the confluence with Tar Spring

Creek to the Highway 1 lagoon crossing, and the lagoon complex that includes both AG Creek lagoon and Meadow Creek lagoon. The program then proposes potential management strategies that could be implemented depending on the results of the monitoring surveys. The final step of this program is to develop a public information program, including installing informational signs in public access locations.

Current information is based on incidental observations during surveys and fish rescues conducted by TVEC, Cleaveland Biological, California Department and Parks and Recreation (CDPR 2022), and Stillwater Sciences. Based on these observations, the District anticipates that non-native predatory and competitor species assemblages include largemouth bass (*Micropterus salmoides*), black bass *(Micropterus salmoides)*, mosquito fish (*Gambusia affinis)*, hatchery rainbow trout (*O. mykiss*), bullhead catfish (*Ameiurus spp*), bluegill (*Lepomis macrochirus*) and/or other sunfish (*Lepomis spp*), and American bullfrog (*Lithobates catesbeianus*). Sunfish have been observed in the Meadow Creek lagoon (TVEC 2012) and in unspecified locations in AG Creek (Stetson Engineers et al. 2004). Bullhead catfish have also been observed in the mainstem between the Highway 1 lagoon crossing and the Tar Spring Creek confluence, and bullfrogs and/or their tadpoles have been observed in the lagoon complex and in the mainstem of AG Creek (Cleaveland Biological 2020, Stillwater Sciences 2022b). Many non-native fish have been observed in Lopez Reservoir and could potentially occur in AG Creek downstream of Lopez Dam, including smallmouth bass and black crappie. To better understand the extent of predatory and competitive non-native species in AG Creek, field and desktop surveys will be conducted. This information will establish appropriate habitat and species-specific treatments. The output from this monitoring effort will include maps to identify predatory species' distribution and hotspots to target removal efforts.

Environmental DNA (eDNA) sampling and laboratory analysis will be used to characterize the composition of the fish and Covered Species community and the distribution of bullfrogs in AG Creek. eDNA surveys will help elucidate whether predatory species are present throughout the entire AG Creek mainstem or if they are concentrated in specific reaches.

5.4.5.1 Mechanical Removal of Predatory Fishes

Predatory species like largemouth bass, bullhead, and *Lepomis* tend to flourish in low-velocity warm-water habitats and are more likely to outcompete steelhead in these types of habitats compared to higher-velocity, cooler habitats preferred by *O. mykiss*. Several ponds have been identified in the mainstem of AG Creek downstream of Lopez Dam that provide suitable habitat for non-native predatory species. Aside from these ponds, there may also exist deep, low-velocity glide habitat within the mainstem AG Creek that could also favor predatory species. Identifying the full extent of this habitat will allow for predator removal to be targeted in areas most likely to favor these species. To identify this habitat, a visual survey of the watershed will be conducted using available aerial and LIDAR imagery to obtain a course level of habitat designation (i.e., pool, riffle, glide). Results will be used to identify locations of deep pools and glides that are likely to support non-native predators, and to describe appropriate habitat-specific control strategies. In addition to aerial imagery, opportunistic observational data from any current activities in the watershed (e.g., if a fish rescue happens or a project that involves moving fish) will also be used as a source of information on non-native species presence and distribution and location of habitats likely to favor these species.

Mechanical techniques for removing non-native predatory fishes may involve manual removal of fish from invaded waterways, as opposed to chemical techniques that involve implementing a fish toxicant or biological techniques that involve introducing a specialist predator or Trojan Y gene

(Meronek et al. 1996, Thresher et al. 2014). Methods may include electrofishing, in association with fish rescue and relocation (CM-6), and index site juvenile steelhead monitoring (MM-07). All non-native invasive species captured during these activities will be removed and humanely euthanized. No other direct mechanical removal of predators will occur.

Several non-native fish species have been introduced to AG Creek (Table 3-7) and now pose a threat to native steelhead. In many instances, non-native fish, such as goldfish or bass, are released by members of the public for angling, or other reasons. The Predator Removal Plan will include a program to provide informational signage in public access areas to communicate the risks of releasing fish or amphibians into AG Creek. The plan will include at least four informational signs posted on existing public notice boards and public fish access locations in Arroyo Grande Lagoon, within the city of Arroyo Grande, Biddle Park, and Lopez Reservoir. Signage will educate the public on the specific risks that releasing fish or amphibians into waterways can have on native steelhead and provide links for additional information and resources.

5.4.5.2 Bullfrog Management

Initial eDNA and visual surveys will identify stream and lagoon reaches occupied by bullfrogs as well as areas of suitable bullfrog habitat. Sites will be assessed during preliminary surveys to determine bullfrog occupancy (i.e., presence/absence) and reproduction (i.e., presence of egg masses or tadpoles). Preliminary surveys will also assess bullfrog breeding phenology in the region as well as the presence of native herpetofauna or other sensitive species that could potentially be affected or benefited by bullfrog removal efforts. Since there is a concern about the repopulation of habitats where bullfrog removal efforts have taken place, initial surveys will assess the feasibility of the complete and permanent removal of bullfrogs from AG Creek, documenting source populations within 6 miles of the watershed and assessing the likeliness of repopulation. If it is determined that there is no feasible method for permanently removing bullfrogs from the watershed through the eradication of source populations or creating buffer zones, no bullfrog removal efforts will be conducted.

If the District determines that initial surveys determine that the eradication of source populations or the establishment of adequate buffer zones is a possibility for AG Creek, the District will begin bullfrog removal efforts upon issuance of regulatory permits. Nocturnal pedestrian surveys will be conducted to mechanically remove the species from the area. During pedestrian surveys, adult and juvenile bullfrogs will be spotlighted using a 200+ lumen flashlight and then captured by hand, dipnet, gig or Hawaiian sling spear, or pellet rifle/.22 rifle where allowable. Egg masses will be removed from the water via dipnet or bucket and allowed to dry on land. Seine nets, tadpole traps, or hoop traps may be implemented to capture tadpoles and juveniles in pools. Mechanical removal will be paired with vegetation removal to reduce cover and breeding habitat where appropriate and permitted. One or more qualified biologists will be on site during removal activities to identify and dispatch any captured American bullfrogs. Bullfrogs captured incidentally during the mechanical removal of non-native fish will similarly be identified and dispatched by a qualified biologist. Humane dispatch of American bullfrogs will follow the American Veterinary Medical Association Guidelines for the Euthanasia of Animals: 2020 Edition. Euthanasia methods to be implemented may include, but are not limited to, manual application of blunt force trauma, cervical dislocation, maceration, pithing, application of topical benzocaine gel, and immersion in Tricaine methanesulfonate (MS 222). Any requirements specified by CDFW and local authorities regarding the implementation of specific methods will be followed.

If bullfrog removal is recommended, pedestrian surveys will begin before the bullfrog reproduction window to limit the reproductive ability of the resident population — in southern California, breeding season for bullfrogs can begin as early as March and extend through August. Further visits throughout the spring and summer will aim to eliminate egg masses and remaining adults or juveniles in the area. Since tadpoles take two years to metamorphose, and tadpoles are the most difficult life stage to completely eradicate from a landscape, it is anticipated that at least three years of surveys will be necessary to eliminate bullfrogs from AG Creek.

In addition to direct removal methods, opportunities to reduce bullfrog habitat through seasonal draining of ponds where bullfrog are documented to occur (County of SLO 2004) and restoring riverine habitat from pond condition to reduce suitability for bullfrog, will be pursued.

A detailed plan will be developed to describe the implementation of the Predator Control Program and will be distributed to the TAC for review and input within six months of permit issuance. The Program will be implemented within two months of approval of the Plan by the TAC.

5.4.6 Conservation Measure 6: Fish Rescue and Relocation during Localized Construction Dewatering

Elements of the Conservation Program will involve localized dewatering and fish rescue efforts during construction, such as for pond restoration (CM-3). For these projects a selected construction contractor will be required to prepare and submit a detailed dewatering and fish rescue plan for review by NMFS and CDFW and approval 20 calendar days prior to initiation of activities associated with localized dewatering in AG Creek (e.g., prior to placement of a cofferdam, dike, stream bypass, dewatering pump, etc.). Standard fish protection measures will be used to reduce potential harm to fish during extended dewatering events. Details of the measures that will be required to protect fish during the localized dewatering occurrences will depend on the approach taken by the construction contractor to manage water at these locations but will generally incorporate relevant elements of the requirements for fish relocation and dewatering activities included in NMFS' (2016b) Programmatic Biological Opinion for restoration projects in NOAA Restoration Center's Central Coast region. These requirements address details of dewatering and fish rescue such as flow routing; screening pumps; debris management; and fish capture, handling, and relocation methods. If steelhead rescue and relocation is needed during dewatering activities, the District will utilize or hire qualified fisheries biologists that will follow NMFS electrofishing guidelines (NMFS 2000).

Concurrent with fish rescue and relocation, any adult CRLF and SWPT will be rescued and relocated, as detailed by a dewatering and CRLF and SWPT rescue plan for review by USFWS and CDFW, and approval 20 days prior to initiation of activities associated with dewatering. The rescue plan will use standard USFWS and CDFW measures and protocols. The District will utilize or hire qualified biologists that will follow these protocols.

5.4.7 Conservation Measure 7: Gaging Stations

There are several real-time District-maintained gaging stations in the AG watershed (Cleath-Harris Geologists 2021) (Figure 3-1). Several of these stations are required to monitor real-time flows following implementation of the HCP, including:

- Lopez Dam releases,
- Cecchetti Road,
- AG Gage at AG, and

- 22nd Bridge.

The District will develop accurate flow rating curves for each gage. This will include monthly site visits to collect flow measurements, especially at flows within the range of baseflows (3 to 10 cfs) until a rating curve is developed, and to establish stable controls. Once the ratings are developed, gages will continue to be checked up to 10 times a year to make sure equipment is working correctly as well as checking the rating to make sure the measured flow matches the gage readings, especially at flows less than 20 cfs. Each of these stations will provide real-time flow data online to inform the LDRP.

5.4.8 Conservation Measure 8: Best Management Practices (BMPs)

During HCP implementation, the District will implement a range of best management practices (BMPs) to minimize adverse effects on the environment including steelhead and steelhead habitat, CRLF and SWPT. Under Existing Conditions, District BMPs are generally used for maintenance and construction projects and are detailed in the 2003 Stormwater Best Management Practices Handbook (CASQA 2003). Table 5-3 outlines the most relevant BMPs that apply to the HCP.

Table 5-3. Best Management Practices relevant to the Lopez Dam HCP.

Handbook BMPs	Description
SC-10: Non-Stormwater Discharges	Would reduce water quality impacts by effectively eliminating non-stormwater discharges to the drainage system
SC-11: Spill Prevention, Control and Clean-up	Would reduce water quality impacts by minimizing the accidental discharge of pollutants
SC-20: Vehicle and Equipment Fueling	Would reduce water quality impacts by preventing fuel spills and leaks
SC-21: Vehicle and Equipment Cleaning	Would reduce water quality impacts by preventing or reducing the discharge of pollutants
SC-22: Vehicle and Equipment Repair	Would reduce water quality impacts by preventing or reducing the discharge of pollutants
SC-30: Outdoor Loading/Unloading	Would reduce water quality impacts by preventing or reducing the discharge of pollutants
SC-31: Outdoor Container Storage	Would reduce water quality impacts through proper storage to reduce accidental release of pollutants
SC-32: Outdoor Equipment Maintenance	Would reduce water quality impacts by reducing the amount of waster created and covering equipment
SC-33: Outdoor Storage of Raw Materials	Would reduce water quality impacts through proper material storage and runoff prevention
SC-34: Waste Handling and Disposal	Would reduce water quality impacts through proper waste management and runoff prevention
SC-41: Building and Grounds Maintenance	Would reduce water quality impacts by minimizing fertilizer and pesticide runoff
SC-43: Parking/Storage Area Maintenance	Would reduce water quality impacts by preventing or reducing discharge of pollutants from parking/storage areas
SC-50: Over Water Activities	Would reduce water quality impacts by reducing over-water maintenance and keeping waste out of the water
SC-70: Road and Street Maintenance	Would reduce water quality impacts by reducing pollutants in stormwater runoff from roads and streets
SC-71: Plaza and Sidewalk Cleaning	Would reduce water quality impacts from pollutants by pollution prevention and good housecleaning practices

Handbook BMPs	Description
SC-72: Fountain and Pool Maintenance	Would reduce harmful impacts to aquatic life by preventing the discharge of chemical algaecides and chlorine to storm water drainage systems
SC-73: Landscape Maintenance	Would reduce water quality impacts by minimizing the discharge of pesticides, herbicides and fertilizers to the storm drain system
SC-74: Drainage System Maintenance	Would reduce water quality impacts through proper maintenance to remove pollutants, prevent clogging and ensure the stormwater conveyance system functions properly
SC-76: Water and Sewer Utility Maintenance	Would reduce the discharge of pollutants from public utilities through proper maintenance, inspection and cleaning
TC-11: Infiltration Basin	Would help maintain low flows in stream systems by infiltrating stormwater, removing pollutants and recharging groundwater
TC-20: Wet Pond	Would reduce water quality impacts by treating stormwater runoff through settling and biological uptake of pollutants
TC-21: Constructed Wetland	Would reduce water quality impacts by treating stormwater runoff through settling and biological uptake of pollutants
TC-22: Extended Detention Basin	Would reduce water quality impacts by detaining stormwater runoff to allow particles and associated pollutants to settle
TC-30: Vegetated Swale	Would reduce water quality impacts by trapping pollutants, promoting infiltration and reducing flow velocity of stormwater runoff
TC-31: Vegetated Buffer Strip	Would reduce water quality impacts by slowing runoff velocities, allowing sediment and pollutants to settle and providing infiltration
TC-32: Bioretention	Would reduce water quality impacts by removing pollutants, slowing runoff velocity, and exfiltration of stored water
TC-40: Media Filter	Would reduce water quality impacts by filtering out particles and other pollutants from stormwater runoff
TC-50: Water Quality Inlet	Would reduce water quality impacts by promoting sedimentation of coarse materials and separation of free oil from stormwater
MP-20: Wetland	Would reduce water quality impacts by removing harmful nutrients and dissolved pollutants from stormwater runoff
MP-50: Wet Vault	Would reduce water quality impacts by removing sediment from stormwater runoff
MP-51: Vortex Separator	Would reduce water quality impacts by removing suspended sediments and pollutants from stormwater runoff
MP-52: Drain Insert	Would reduce water quality impacts by removing sediment and debris from stormwater runoff

5.4.8.1 General Avoidance and Minimization Measures

The HCP will also employ the general and species-specific avoidance and minimization measures (AMMs) designed to address anticipated effects of maintenance operations and activities, and standard BMPs. The following general measures will be implemented to avoid and minimize impacts on Covered Species:

- **Personnel Training**
  - Employees and contractors performing construction and/or maintenance activities associated with Covered Activities and Conservation Measures in potential Covered Species habitats will receive environmental sensitivity training. Training will include

review of AMMs that must be followed by all personnel to reduce or avoid effects on Covered Species during construction, operation, and/or maintenance activities.

- Environmental tailboard trainings will take place on an as-needed basis in the field. The environmental tailboard trainings will include a brief review of the biology of the Covered Species and guidelines that must be followed by all personnel to reduce or avoid negative effects on these species during construction, operation, and/or maintenance activities. District employee Directors, Managers, Superintendents, and the crew foremen and forewomen will be responsible for ensuring that crewmembers comply with the guidelines.
- The training will consist of a brief presentation by persons knowledgeable in the biology of the Covered Species (NMFS and/or USFWS-permitted biologist) to District staff, contractors and their employees, and any agency personnel involved in the relevant Covered Activity. The training will include: a description of the Covered Species and their habitat needs; any reports of occurrences in the project area; an explanation of the listing status of each Covered Species and requirement to comply with the terms of the ITP and relevant measures of the HCP, and a list of measures relevant to the project that must be taken to reduce effects on the Covered Species during project implementation. Fact sheets conveying this information and an educational brochure containing color photographs of all listed species in the work area(s) will be prepared for distribution to the above-mentioned people and anyone else who may enter the Project area. A list of employees who attend the training sessions will be maintained by the District to be made available for review by the USFWS and NMFS upon request. Contractor training will be incorporated into construction contracts and will obligate all contractors to comply with these AMMs.

- **Environmental and Wildlife Disturbance**
  - Pipes, culverts, and similar materials greater than four inches in diameter will be stored so as to prevent Covered Species from using these as temporary refuges, and these materials will be inspected each morning for the presence of animals prior to being moved.
  - Erosion control measures will be implemented to reduce sedimentation in wetland habitat occupied by Covered Species when activities are the source of potential erosion problems. Plastic monofilament netting (erosion control matting) or similar material containing netting shall not be used at the Project. Acceptable substitutes include coconut coir matting or tackified hydroseeding compounds.
  - Stockpiling of material will occur such that direct effects on Covered Species are avoided. Stockpiling of material in riparian areas will occur outside of the top of bank, and preferably outside of the outer riparian dripline and will not exceed 30 days.
  - Grading will be restricted to the minimum area necessary.
  - Prior to ground disturbing activities in sensitive habitats, project boundaries and access areas will be flagged and temporarily fenced during construction/maintenance to reduce the potential for vehicles and equipment to stray into adjacent Covered Species habitats.
  - Significant earth-moving activities will not be conducted in riparian areas within 24 hours of predicted storms or after major storms (defined as one inch of rain or more).
  - Trenches will be backfilled as soon as possible. Open trenches will be searched each day prior to construction to ensure no Covered Species are trapped. Earthen escape ramps will be installed at intervals prescribed by a qualified biologist.

5.4.8.2 Species-specific Avoidance and Minimization Measures

The following AMMs pertain to both the CRLF and SWPT and will be incorporated into the HCP for all Covered Activities that have the potential for take of CRLF and SWPT.

- At least 15 days prior to any Covered Activities within potential CRLF and/or SWPT habitats, the applicant will submit to the USFWS for review and approval the qualifications of the proposed qualified biologist and a relocation plan for CRLF and SWPT. A qualified biologist means any person who has completed at least 4 years of university training in wildlife biology or a related science and has demonstrated field experience in the identification and life history of CRLF and SWPT. The relocation plan will include trapping and relocation methods, relocation sites, and post relocation monitoring (*relocation for fish is detailed under CM-6 Fish Rescue and Relocation during Localized Construction dewatering*).
- A USFWS-approved qualified biologist will conduct pre-activity surveys no more than twenty-four (24) hours prior to Covered Activities in potential CRLF and SWPT habitats. The survey will consist of walking the work limits and within the work site to ascertain the possible presence of the species. The USFWS-approved qualified biologist will investigate all potential areas that could be used by the CRLF and/or SWPT for feeding, breeding, sheltering, movement, and other essential behaviors. This includes an adequate examination of mammal burrows, such as California ground squirrels or gophers. If any adults, subadults, juveniles, tadpoles, or eggs are found, the USFWS-approved qualified biologist will contact the USFWS to determine if moving any of the individuals is appropriate. If individuals of CRLF and/or SWPT are found during pre-activity surveys or during Covered Activities, work will not begin until they leave the work zone on their own or are moved out of the work zone by the USFWS-approved qualified biologist to a relocation site per the USFWS-approved relocation plan. If at any point, Covered Activities cease for more than 5 consecutive days, additional pre-activity surveys will be conducted prior to the resumption of these activities.
- A USFWS-approved qualified biologist will stake and flag an exclusion zone prior to initiation of the ground disturbing Covered Activities. The exclusion zone will be fenced with orange construction zone and erosion control fencing (to be installed by construction or maintenance crew). The exclusion zone will encompass the maximum practicable distance from the work site and at least 500 ft from the aquatic feature wet or dry. The work area shall be delineated with high visibility temporary fencing at least 4 ft in height, flagging, or other barrier to prevent encroachment of construction or maintenance personnel and equipment outside of the work area. Such fencing shall be inspected and maintained daily until completion of the Covered Activity. The fencing will be removed only when all equipment is removed from the site.
- A USFWS-approved qualified biologist will remain on-site during implementation of construction a Covered Activities in or adjacent to habitat for CRLF and/or SWPT. The USFWS-approved qualified biologist will be given the authority to stop any work that would be likely to result in the take of individual CRLF and/or SWPT, including eggs and tadpoles. If the USFWS-approved qualified biologist(s) exercises this authority, the USFWS will be notified by telephone and electronic mail within one working day. The USFWS-approved qualified biologist will be the contact for any employee or contractor who might inadvertently kill or injure a CRLF or SWPT or anyone who finds a dead, injured, or entrapped individual. The USFWS-approved qualified biologist will possess a working wireless/mobile phone whose number will be provided to the USFWS.
- Only USFWS-approved qualified biologists will conduct surveys and move CRLF and/or SWPT.

- All vegetation obscuring the observation of wildlife movement within the affected areas containing or immediately adjacent to potential CRLF and/or SWPT habitats will be completely removed by hand just prior to the initiation of ground disturbing activities to remove cover that might be used by CRLF and/or SWPT. The USFWS-approved qualified biologist will survey these areas immediately prior to vegetation removal to find, capture, and relocate any observed CRLF or SWPT per the relocation plan.
- To prevent the accidental entrapment of CRLF or SWPT during Covered Activities, all excavated holes or trenches deeper than six inches will be covered at the end of each work day with plywood or similar materials. Construction or maintenance personnel will inspect open trenches in the morning and evening for trapped CRLF or SWPT. If a CRLF or SWPT is found, the USFWS-approved qualified biologist will immediately be notified in order to relocate the trapped CRLF or SWPT to the approved relocation site per the relocation plan. Foundation trenches or larger excavations that cannot easily be covered will be ramped at the end of the workday to allow trapped animals an escape method. Prior to the filling of such holes, these areas will be thoroughly inspected for CRLF and SWPT by the USFWS-approved qualified biologist. In the event of a trapped animal is observed, activities will cease until the individual has been relocated to an appropriate location per the relocation plan.
- All trash and debris within the work area will be placed in containers with secure lids before the end of each workday in order to reduce the likelihood of predators being attracted to the site by discarded food wrappers and other rubbish that may be left on-site. Containers will be emptied as necessary to prevent trash overflow onto the site and all rubbish will be disposed of at an appropriate off-site location.
- All construction activities must cease one half hour before sunset and should not begin prior to one half hour after sunrise. There will be no nighttime construction or maintenance activities.
- Grading and construction in potential CRLF and SWPT habitat will be limited to the dry season, typically May–October.
- The District will ensure that a readily available copy of these AMMs are maintained by the construction foreman/manager on the work site whenever Covered Activities are taking place. The name and telephone number of the construction foreman/manager will be provided to the USFWS prior to any groundbreaking.
- The District shall ensure that the spread or introduction of invasive exotic plant species shall be avoided to the maximum extent possible. When practicable, invasive exotic plants in the work areas shall be removed.
- Work sites shall be revegetated with an appropriate assemblage of native riparian wetland and upland vegetation suitable for the area. A species list and restoration and monitoring plan shall be included with the project proposal for review and approval by the USFWS . [*Revegetation plans are detailed under CM-3 Habitat Restoration.*]
- If a work site is to be temporarily dewatered by pumping, intakes shall be completely screened with wire mesh not larger than 5 mm. Water shall be released or pumped downstream at an appropriate rate to maintain downstream flows during Covered Activities. Upon completion of Covered Activities, any barriers to flow shall be removed in a manner that would allow flow to resume with the least disturbance to the substrate.
- The USFWS-approved qualified biologist shall permanently remove, from within the work area, any individuals of exotic species, such as bullfrogs, to the maximum extent possible. The District shall have the responsibility to ensure that its activities are in compliance with

the California Fish and Game Code. [*Predator removal plans are detailed under CM-5 Predator Control Program.*]

5.4.9 Conservation Measure 9: Interagency Technical Advisory Committee

The District, NMFS, and USFWS staff will form an interagency TAC to discuss and inform implementation of the Conservation Program and Adaptive Management Plan described in this HCP. The TAC will meet regularly to review and discuss, the status of HCP implementation, including the effectiveness of the LDRP and non-flow related Conservation Measures, and review results of monitoring activities (see Section 7.4) and provide guidance on appropriate actions. Additionally, the TAC will inform implementation, review results of initial efforts, and make recommendations regarding subsequent steps relating to the assisted migration program for SCCC steelhead at Lopez Dam, as described in Section 5.4.2. At its discretion, and with the input of USFWS and NMFS, the District may include representatives from federal, state, or local agencies or other experts on the TAC to provide input on specific aspects of HCP implementation within the expertise of that representative. Discussions and recommendations of the TAC relating to HCP implementation will give specific consideration to the requirements of the ESA, the terms and conditions of the ITP, and the provisions of this HCP.

6 EFFECTS OF COVERED ACTIVITIES

The specific steps of the Effects Analysis process are outlined in Chapter 12 of the HCP Handbook and include the following:

1. Determine the type and amount of take.
2. Describe the impacts of the taking.
3. Describe the expected benefits of the conservation program.
4. Determine the net effects to Covered Species.

This section begins with an account of the type and amount of anticipated take and the impact of the taking pursuant to ESA Section 10(a)(1)(B) for all Covered Species. The District has first identified and considered all components of the Covered Activities in order to assess which activities result in stressors that would trigger a negative response in one or more individuals of the Covered Species, if exposed to the stressor. All negative impacts that have the potential to rise to the level of take are then aggregated to determine the amount of take reasonably certain to occur from each Covered Activity. The amount and type of anticipated take is then evaluated to determine the impact of the taking on the Covered Species.

Once the impact of the taking has been assessed and disclosed, the benefits of the Conservation Program are applied to determine the net effects of the anticipated take and Conservation Program on each of the Covered Species. The benefits of avoidance and minimization measures of the Conservation Program are accounted for by reducing the amount or extent of anticipated take, while the benefits of mitigation measures are used to offset the negative impacts associated with the anticipated take.

The following sections apply this process for steelhead, CRLF, and SWPT to assess whether the HCP meets the issuance criteria for each species. More details on the regulatory framework and take definitions of the ESA are provided in Section 1.9.1 *Endangered Species Act.*

6.1 Steelhead

6.1.1 Population Abundance Estimates to Inform Take

Consistent with the SCCC steelhead Recovery Plan (NMFS 2013), the SCCC Steelhead DPS is used as the population for the analysis of impacts of the taking of steelhead in the AG Creek watershed. To estimate the amount of take, some understanding of the population size of SCCC steelhead in AG Creek is needed. However, because there are no reliable estimates of abundance of steelhead in AG Creek watershed under Existing Conditions as we explain in section 2.1.6, the abundance during the 30-year permit term was inferred from the best available data in the following sections.

6.1.1.1 Adult Steelhead

Historical and existing steelhead abundances in the Plan Area are unreliable as described in Section 2.1.6. To estimate future abundance of migrating adult steelhead across the life of the permit term (30 years) the District adopted an approach from Boughton et al. (2006) who estimated population viability for the SCCC steelhead populations. The District used both historical data specific to AG Creek in conjunction with parameters from other populations in the DPS to inform abundance predictions. Populations are assumed to grow logistically and are bound by current abundance and carrying capacity. An initial abundance of two individuals was selected based on the most recent counts of adult migrating steelhead (NMFS 2024). Under this HCP, which considers reconnecting habitats upstream of the Lopez Dam, the average annual escapement within the first ten years of implementation is projected to be 3 adults per year (Table 6-1), with a carrying capacity (e.g., the number of steelhead that the watershed can support) of up to 200 migrating adult steelhead, which is informed by run size estimates during the Pre-dam Condition but taking into account the influence of anthropogenic factors. This estimate assumes that adult abundance and carrying capacity increases during the permit term from either increased habitat access through assisted migration, or from increased habitat restoration downstream of Lopez Dam (see Section 5.4). In reality, annual run sizes vary considerably based on environmental conditions, drought, marine productivity, and many other factors outside the control of the District. A theoretical carrying capacity of 200 adults is assumed in this HCP for the purpose of estimating take.

Carmel Valley is the only population within this DPS with a time series of adult run size long enough to sufficiently characterize population parameters (Boughton et al. 2006, NMFS 2023a). For comparison, the carrying capacity was estimated to be 800 fish in Carmel Valley creeks (Arriaza et al. 2017). While the Carmel Valley watershed is larger than Arroyo Grande (254 vs. 145 mi^2), one analysis grouped these watersheds and ranked them as having a similar viability score, based on coarse-scale analysis suggesting they both have substantial suitable habitat (Boughton et al. 2006). Boughton et al. (2006) also notes that viability is positively and strongly correlated with potential carrying capacity and population growth rates. The Carmel Valley population has an estimated population growth rate of between 0.3 and 0.7 (Boughton et al. 2006). To estimate the annual abundance of adult steelhead in AG Creek across the length of the permit term (30 years), the District used a logistic population growth model given by,

$$N_{t+1} = N_t \, (1 + r \, (1 - \left(\frac{N_t}{K}\right)))$$

where the abundance of adult steelhead in AG Creek at the next time step (N_{t+1}) is a function of the number of individuals at the previous time step (N_t), as well as the intrinsic growth rate parameter (r) which are conservatively estimated to be 10%, and the carrying capacity (K). The estimate of potential future abundance assumes a population growth rate of 0.1, which is the lower limit of population growth rates tested in Boughton et al. (2006) for this DPS. This is a reasonable assumption for this analysis, based on the current uncertainty in adult abundance in the watershed, and the overall low growth rates observed in the DPS (NMFS 2013). Based on these assumptions, this HCP estimates that a total of 308 adult steelhead would enter the AG Creek and attempt to migrate upstream during the 30-year permit term (Table 6-1).

Unlike other Pacific salmon species, steelhead are iteroparous and capable of repeat spawning. Once an adult steelhead has spawned and survived, it can become a kelt and migrate back to the ocean. Based on multi-decadal monitoring data from the Santa Clara River population of Southern California steelhead (south of AG Creek, Booth 2016), it is assumed that around 19 percent of adult steelhead in AG Creek will exhibit a kelt life history (Table 6-1).

As described in Section 7.4 *Monitoring and Adaptive Management*, substantial data collection will be conducted to monitor adult abundance, which will support improved estimates of adult production in the watershed during the permit term. Results of monitoring will be presented to the TAC and implications of abundance trends will be addressed collaboratively with Adaptive Management Actions.

Table 6-1. Assumed Potential Annual Adult Steelhead Population Increase in Arroyo Grande Creek Watershed Over the 30-year Permit Team

	Years 1–10	Years 11–20	Years 21–30	Total	Annual Average
Average annual population of migrating adults, by time period	3	8	20	NA	10
Total population of migrating adults, by time period	32	80	196	308	NA
Percent of adults observed as kelts	19%	19%	19%	19%	19%
Total population of migrating kelts, by time period	6	15	37	58	NA

6.1.1.2 Steelhead Smolts

To assess the number of steelhead smolts potentially subject to take, the abundance of steelhead smolts within the Arroyo Grande watershed during the 30-year permit term was estimated with assumptions similar to adults. There is no available data on smolt production from AG Creek. The best available data is from migrant trapping in nearby SLO Creek by Spina et al. (2005) from 2001 through 2002. In SLO Creek, smolt captures in 2001-2002 ranged from 11 to 103, with trap efficiency of around 38% to 55%. Although the study was not designed to estimate smolt production, assuming the lowest trap efficiency and the highest smolt captures, it appears that there could have been around 270 smolts produced from SLO watershed in 2001 (Spina et al. 2005). While the SLO Creek watershed is smaller than Arroyo Grande (83 vs. 145 mi^2), these watersheds are grouped and ranked as having a similar viability score, as they both have substantial suitable habitat (Boughton et al. 2006). For the purpose of this HCP, it is assumed that the starting point of smolt production is 250 as the average annual number of smolts, and the population grows up to an average of 100 each decade (Table 6-2) because steelhead habitat conditions are expected to improve relative to Existing Conditions as a result of the Conservation Program (Section 5 *Conservation Program*). The assumed potential increase in smolt abundance is an informed estimate based on progeny assumed to result from both anadromous and resident adult spawning. Predictions for production during the first 10 to 20 years are based on observations in a nearby watershed, and predictions further into the future are increasingly speculative. As described in Section 7.4 *Monitoring and Adaptive Management*, substantial monitoring will be conducted to monitor smolt abundance which will support improved estimates of smolt production in the watershed during the permit term. Results of monitoring will be presented to the TAC and implications of abundance trends will be addressed collaboratively with Adaptive Management Actions.

Table 6-2. Assumed potential steelhead smolt production increase over the 30-year permit term in Arroyo Grande Creek Watershed

	Years 1–10	Years 11–20	Years 21–30	Total	Annual Average
Avg. annual population of migrating smolts, by time period	250	350	450	NA	750
Total population of migrating smolts, by time period	2,500	3,500	4,500	10,500	NA

6.1.2 Effects of Maintenance Activities Associated with Lopez Water Project

Maintenance extends to operations associated with the Lopez Water Project (Lopez Dam, Lopez Reservoir, and the Perimeter Channel including cleaning out ditches on Lopez Dam), structure repair, and vegetation management. In accordance with this HCP, activities associated with maintenance will include use of BMPs (described in Section 5.4.8) and are not anticipated to result in direct take of individual steelhead or measurable effects on water temperature, turbidity, or flows, that could indirectly result in take.

Maintenance of the 42-inch emergency release valve, located at the base of Lopez Dam (Section 1.2.2), requires shutting off flows from Lopez Dam for 2–4 hours on a single day according to the (DSOD valve cycling requirements. This operation does not result in a measurable change in flow downstream of Lopez Dam and thus is unlikely to directly or indirectly take steelhead, as there will be no measurable effect on the species. As described in Section 7.4 *Monitoring and Adaptive Management*, substantial flow monitoring will be conducted to ensure that the HCP Program, including periodic shutoff of flows, does not result in substantial flow reductions. Results of monitoring will be presented to the TAC.

Assisted migration (CM-2) would result in listed adult steelhead and their progeny occurring in tributaries upstream of Lopez Dam. Under Existing Conditions there are several County low water crossings and culverts upstream of Lopez Dam that could serve as potential impediments to adult steelhead upstream migration, should that population be reconnected. There are also around four miles of seasonally used County roads that are closed during winter. The use of these roads by wheeled vehicles results in potential water crossings ("fording") at eight locations along Lopez Canyon Creek or Wittenberg Creek, including two on paved roads and six on gravel roads. Vehicle passage through streams can damage fish habitat, destroy redds, create barriers to fish migration, and introduce plumes of turbidity (Weaver et al. 2015). Unless it has a bedrock foundation and hardened approaches, stream fording can lead to increased erosion. The piled-up sand and gravel that can result from fording can create a potential fish migration impediment at low flows. Due to extreme weather during winter, the use of gravel roads is seasonally restricted, and as a practical matter, use is limited to wheeled vehicles from May through December. Because fording only occurs outside of the January—March spawning season, the primary potential impacts associated with stream fording are increased erosion that increases fine sediment and potential juvenile fish migration barriers. Maintenance of these roads and culverts will include use of BMPs (described in Section 5.4.8) and are not anticipated to result in direct take of individual steelhead or measurable effects on water temperature, turbidity, or flows, that could result in indirect take.

6.1.3 Effects of Maintenance Activities Upstream of Lopez Dam and Reservoir

The maintenance and repair of existing roads, culverts, and stream crossings upstream of Lopez Dam and Reservoir would not result in an increase in impacts to steelhead or their habitat. Road maintenance activities would not be expected to alter large wood recruitment, stream temperatures, sedimentation, nor the introduction of contaminants through stormwater runoff. As noted in Section 4.3.2, any repair of road sections, culverts, or stream crossings would be implemented consistent with NMFS' Guidelines for Salmonid Passage at Stream Crossings in California (NMFS 2023b), likely resulting in improvements in fish passage relative to the baseline conditions. It is therefore expected that the impact of maintenance and repair activities on roads, culverts and stream crossings upstream of Lopez Dam and reservoir would be neutral to a net benefit to steelhead and their habitat.

6.1.4 Effects of Supporting Transportation Infrastructure

As noted in Section 4.3, the road system for the permit area is in place, with no mileage expected to be added by the District during the duration of the permit. Maintenance of these roads and culverts will include use of BMPs (described in Section 5.4.8) and are not anticipated to result in direct take of individual steelhead or measurable effects on water temperature, turbidity, or flows, that could result in indirect take. As such, the existing system of roads, culverts, and stream crossings are expected to have a neutral effect relative to the baseline.

6.1.5 Conservation Measures

Although AMMs for Covered Activities are designed to provide benefits that offset the adverse effects of Covered Activities, the AMMs also have effects on the Covered Species described in this section.

6.1.5.1 Conservation Measure 1: Lopez Downstream Release Plan (LDRP)

As described in detail in Appendix B, Western Hydrologics developed a model of daily average flows in AG Creek at several locations downstream of Lopez Dam to assess various potential Lopez Dam release operations. This model accounts for groundwater losses that are known to occur, especially in the reach between Lopez Dam downstream to Cecchetti Road, and downstream of Highway 101 (Cleath-Harris Geologists 2021). The model also includes groundwater and tributary accretion, especially in the reach from Cecchetti Road downstream to Highway 101. The flow model predictions are influenced by the accuracy of the available gage data from the watershed. There is uncertainty associated with these predictions. However, whatever inaccuracies exist would be equivalent for all scenarios evaluated, and so the model maintains the utility of comparing Pre-Dam Scenario with proposed LDRP for example. Conservation Measure 7 (Section 5.4.7) will support accurate flow monitoring during the permit term, especially in the range of the LDRP. In addition, the monitoring program (Section 7.4.1) includes MM-01 to continue extensive monitoring of flows downstream of Lopez Dam.

To evaluate the effects of the LDRP on steelhead, three analytical scenarios constituting different flow conditions are used as points of comparison in order to account for the full range of potential effects of LDRP on Covered Species, the resulting impacts of the anticipated taking, and benefits derived from the instream flows component of the Conservation Program. The three scenarios are:

1. The **Pre-dam Flow Conditions, as described in Section 1.1.** The Pre-dam Condition represents the instream flow conditions in AG Creek as they would have been prior to construction of the dam and prior to the listing of steelhead. This scenario provides a theoretical context by which to assess the level of anticipated take associated with the proposed program (i.e., effects of Lopez Dam operations that modify instream flows) relative to a theoretical alternative where creek flows during the permit term mimic flows absent the Lopez Project. This scenario is based on measured flows from 1968 to 2024 in the watershed, without agricultural or municipal water deliveries, and without consideration for reservoir operations.
2. The **Existing Flow Conditions Scenario (Baseline), as described in Section 3.3.** The Existing Flow Conditions scenario represents the operations, and flow conditions as they currently exist, prior to implementation of the Temporary Court-ordered Operations described in Section 1. This scenario is based on measured flows from 1968 to 2024 in the watershed and assumes existing agricultural and municipal water deliveries.

3. The **Proposed Flow Operations Scenario (Lopez Downstream Release Plan, LDRP)** represents the proposed releases and instream flow operations of the LDRP as described in Section 5.4.1, taking into account the Assisted Migration program described in Section 5.4.2 and improved habitat conditions as described in Section 5.4.3. This scenario is based on measured flows from 1968 to 2024 in the watershed and assumes existing agricultural and municipal water deliveries and incorporates the LRRP.

The use of multiple analytical scenarios in the HCP helps evaluate potential take that may occur from the Covered Activities and to reflect the benefits of the Conservation Program set forth in the HCP. The use of a Pre-Dam Scenario is only meant as a theoretical evaluation point to identify and cover all potential incidental take and describe the impact of the taking under Section 10. It does not establish the environmental baseline or the status of steelhead within the plan area, as USFWS and NMFS have already considered the continued existence of Lopez Dam in connection with prior ESA section 7 consultations (described in Section 1.3.2).

To establish the type and amount of potential take as well as the impact of the potential take of SCCC steelhead associated with implementing the LDRP, the Proposed Operations Scenario (LDRP) is compared with the Pre-Dam Scenario. To assess whether the impact of anticipated taking would appreciably reduce the likelihood of survival and recovery of SCCC steelhead, the effects and benefits of the LDRP are compared with the Existing Conditions Scenario. While take of SCCC steelhead may occur under the LDRP and is addressed in this section, as described in greater detail below, implementation of the LDRP is likely to improve conditions overall for SCCC steelhead relative to Existing Conditions. Therefore, implementation of the LDRP is not likely to appreciably reduce the likelihood of survival and recovery of SCCC steelhead in the wild and, in fact, is likely to increase the likelihood of survival and recovery. However, even a flow scenario that improves conditions may result in some incidental take, for which the District seeks ESA coverage through an ITP as well as No Surprises Assurances guaranteed when an HCP meets issuance criteria and an ITP is issued.

Adult Migration

As described in detail in Section 5.4.1, the proposed HCP includes Lopez Dam migration releases. Flow modeling described above indicates that during wet years there are frequent and long durations with flows exceeding 10 cfs in AG Creek upstream of Tar Spring Creek, and flow exceeding 20 cfs downstream of Tar Spring Creek (e.g., 2023 shown in Figure 6-1), and in all wet water years there would be at least two migration releases. The overall hydrograph during the adult steelhead migration season is flashy and variable, mimicking a natural central California coastal watershed hydrograph in a wet water year. In most (~74%) wet years (e.g., 2023), spill accounts for some of the high (>20 cfs) flows observed.

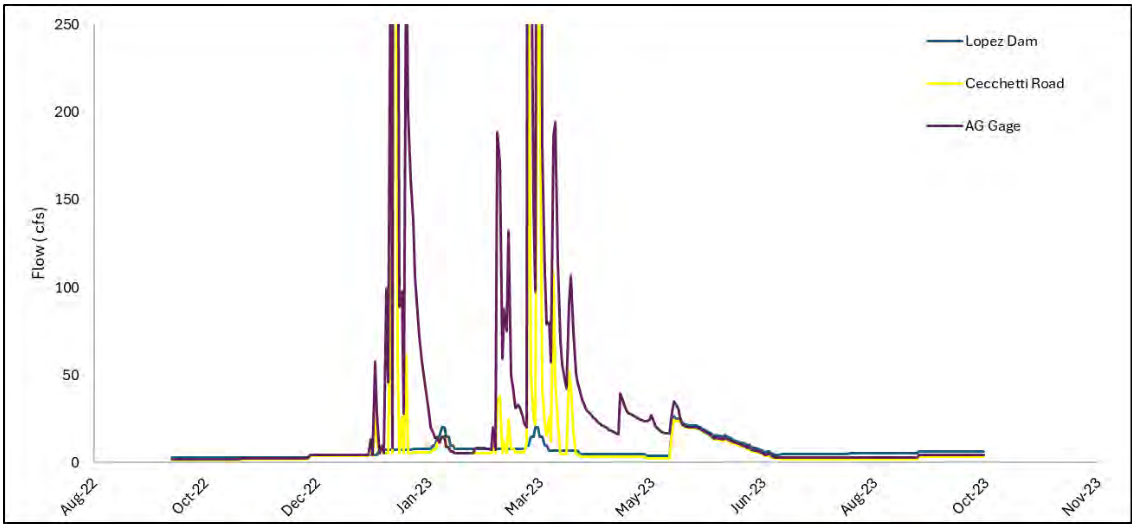

Figure 6-1. Example of a modeled wet year (2023) under the proposed LDRP, based on flow modeling 1968 to 2024.

Flow modeling of the LDRP indicates that during median water years there are periods with flows exceeding 10 cfs in AG Creek upstream of Tar Spring Creek, and flow exceeding 20 cfs downstream of Tar Spring Creek (e.g., 2010 shown in Figure 6-2). There are typically one or two migration releases during median water years (two are shown in Figure 6-2), and the overall hydrograph during the adult steelhead migration season is moderately variable, mimicking a natural central California coastal watershed hydrograph during a median water year. In some (~11%) median years, spill accounts for some of the high (>20 cfs) flows observed (but not in the example 2010 water year in Figure 6-2).

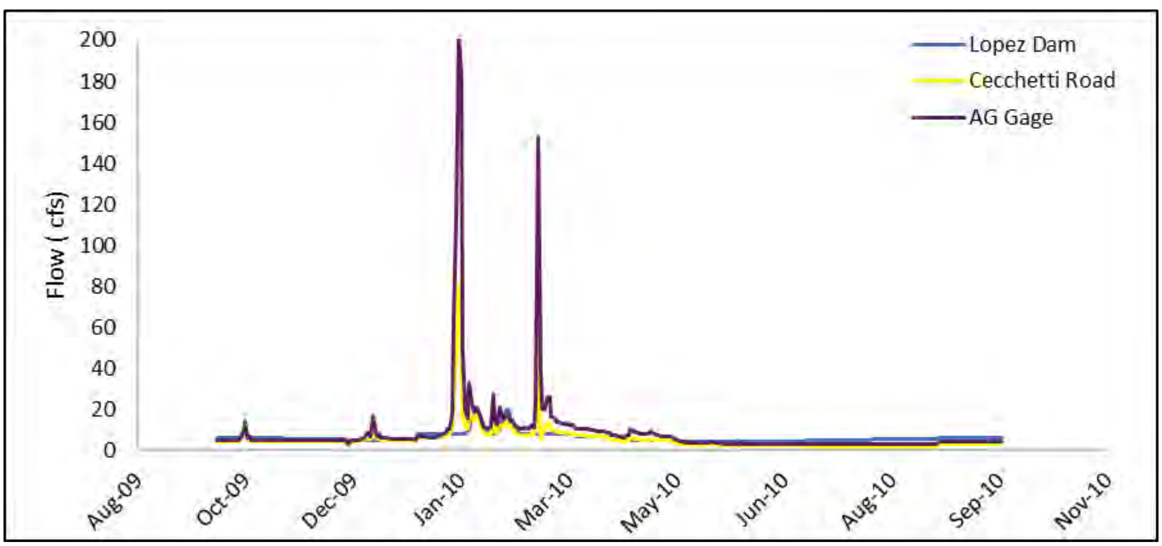

Figure 6-2. Example of a modeled median year (2010) under the proposed LDRP, based on flow modeling 1968 to 2024.

Flow modeling of the LDRP indicates that during dry water years there are only short periods with flows exceeding 10 cfs in AG Creek upstream of Tar Spring Creek, and short duration of flow exceeding 20 cfs downstream of Tar Spring Creek (e.g., 2020 shown in Figure 6-3). There are typically few migration releases during dry water years (one is shown in Figure 6-3), and the overall hydrograph during the adult steelhead migration season is not highly variable, mimicking a natural central California coastal watershed hydrograph during a dry water year. In some dry water years (e.g., 2022), there are no flows greater than 10 cfs that occur in the watershed. Spills rarely occur during dry water years (~5% of dry years).

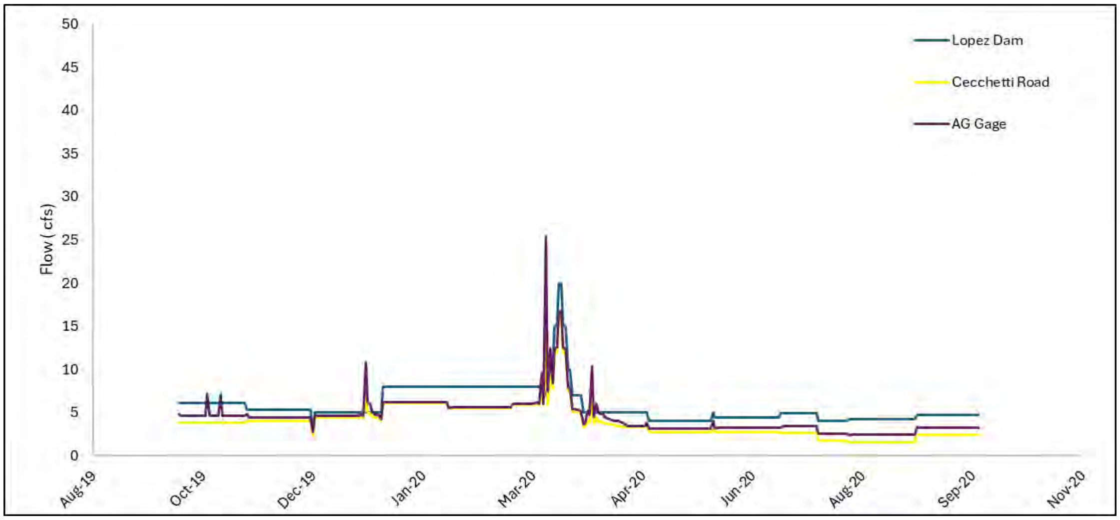

Figure 6-3. Example of a modeled dry water year (2020) under the proposed LDRP, based on flow modeling 1968 to 2024.

Overall, the release of migration flows synchronized with Tar Spring Creek flows under the proposed LDRP would result in an increase in adult steelhead migration opportunities (days with flows providing fish passage) relative to Existing Conditions. Flows under the HCP (Proposed LDRP Scenario) would increase the number of days during the annual December–April adult migration period in which conditions for upstream passage would be suitable in the lower reach of AG Creek from the lagoon to Tar Spring Creek confluence, especially in dry years, and especially in the reach from Tar Spring Creek confluence to Lopez Dam (Table 6-3).

Table 6-3. Summary of annual average days achieving migration flows during the adult steelhead migration season (December–April) under the LDRP based on flow modeling; Adult upstream steelhead migration is achieved at 6 cfs at Cecchetti Road, and 15 cfs at City of Arroyo Grande.

Season	Water Year Type	Annual Average Days					
		Flows greater than 6 cfs at Cecchetti Road (RM 12.2)			Flows greater than 15 cfs at City of Arroyo Grande (RM 5.7)		
		Pre-dam	Existing Conditions	LDRP	Pre-dam	Existing Conditions	LDRP
Migration Season (Dec–Apr)	Dry	30	3	*46*	18	4	*7*
	Median	68	16	*73*	54	19	*26*
	Wet	98	65	*95*	108	81	*91*
	Average for All Years	65	28	*71*	59	35	*41*

Suitable conditions for adult upstream migration would also be suitable for kelts migrating downstream after spawning. The increase in annual upstream passage days results mostly from increases in depth at critical riffles upstream of Tar Spring Creek confluence. The improved passage conditions are predicted to occur in all water year types, and especially dry water years (Table 6-3). The migration flows will result in more migration days each year for adult steelhead, as well as an increase in the temporal distribution of suitable flows, so that among years there will be potential migration opportunities in January, February, March, and April.

Agent-based Modeling Approach

To evaluate adult steelhead upstream migration in the Permit area, an Agent-Based Model (ABM) was developed for the watershed. Agent-based modeling is a computational tool that can be useful for studying interactions between migrating animals and their environment when empirical data are lacking (Tang and Bennett 2010, Weber et al. 2025). This ABM was developed to simulate steelhead adult migration under three Lopez Dam release scenarios, including (1) Pre-dam Flow Scenario, (2) Existing Conditions Scenario (Baseline), and (3) Proposed Operations Plan Scenario (LDRP). The model presented herein simulates the migration of individual adult steelhead in AG Creek by assigning movement rules based on steelhead migration biology and river flow patterns during all water years from 1969–2024. This model was developed to compare relative levels of migration success among operational scenarios under dry, normal, and wet water years. The model is intended to serve as a flexible tool that can be applied to evaluate the effects of alternative water management actions on steelhead migrations; perform sensitivity analyses to identify parameters with the strongest influence on migration and, in parallel, identify uncertainty in model parameters and inputs that influence results and require additional study; and identify actions that can improve migration success under an adaptive management process.

The adult ABM is seeded with 100 simulated individuals that are tracked on an hourly basis until they either reach Lopez Dam or the simulation ends. Adults randomly initiate migration from the ocean within a simulated distribution of days of the water year. A mean “lagoon arrival date” of February 14th, with normal distribution between December 1st and April 30th was assumed based on the timing of adult migration (Shapalov and Taft 1954). Based on this information a distribution of dates for adults to begin migrating from the ocean was generated (Figure 6-4). A single distribution was selected and standardized across model runs (i.e., the migration timing distribution did not vary among operational scenarios and water years). Migration timing sensitivity was assessed in the sensitivity analysis (see *ABM Sensitivity* below).

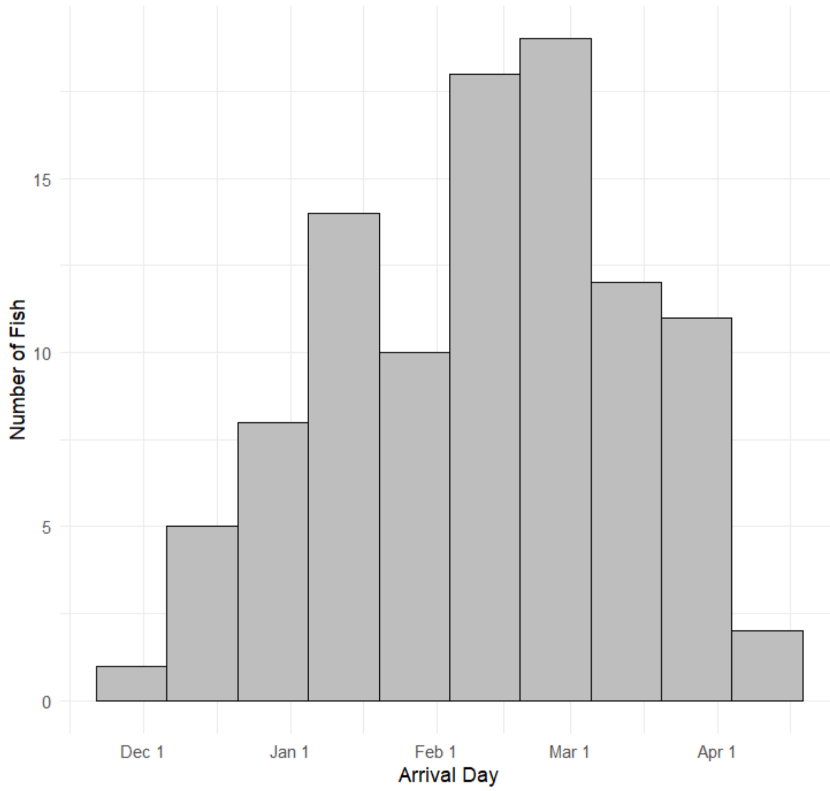

Figure 6-4. Mean "lagoon arrival date" of February 14th, with a generated normal distribution between December 1st and April 30th.

Within the adult ABM, fish move successively from the ocean through each reach based on hourly flow inputs (i.e., modeled flows described above) and reach-specific movement rules (Figure 6-5). If movement rules are not met, fish can hold location until the movement rules are met (e.g., when another flow event occurs) for a maximum of five days. If flows do not improve within five days of holding, it is assumed that migration would end and that spawning would occur at the location of holding. A period of five days is likely on the shorter range of holding times. For example, Shapalov and Taft (1954) observed spawning migration to occur over a period of weeks, with holding for several days occurring when flows were stable.

The adult ABM assumes that fish move at an average rate of 6.3 mi/day (English et al. 2006), such that they can make it as far upstream as Tar Spring Creek in 1 day if flow criteria are met. For adults to migrate from the ocean into the lagoon, the lagoon sandbar must be open. The lagoon sandbar is assumed to require flows of at least 25 cfs (measured at 22nd Street Bridge) for at least 24 hours to open. Once these conditions are met, the lagoon is assumed to stay open until flows drop below 5 cfs for at least 24 hours. If these conditions are met at a fish's arrival date/time, that fish is able to move into Reach 1. To move through Reaches 1 and 2, flow must be at least 15 cfs (measured at 22nd Street Bridge for Reach 1 and at the Tar Spring Creek confluence for Reach 2; Stillwater Sciences 2022a). To move through Reach 3 and Reach 4, flows must be at least 6 cfs (measured at Cecchetti Rd for Reach 3 and at Lopez Dam for Reach 4; Stillwater Sciences 2022a)

Upon entry to a new reach, each fish is subjected to the rules of that reach. If a fish records a movement distance that is beyond the beginning of the next reach during an hour, the fish is conservatively "bounced back" to the start of that reach at the end of the hour to ensure all reach-specific rules are applied (i.e., to prevent fish from skipping reaches). If conditions do not allow a fish to reach the Lopez Dam within the model time frame, the individual fish is assumed to spawn at the last location the fish is recorded. Final model outputs include the final location of each fish in RMs and the amount of time that each fish spent migrating.

In summary, model assumptions include fish arrival date distribution, fish movement rate, flow requirements for movement and for lagoon opening, and maximum holding duration. Each of these assumptions was assessed via sensitivity analysis to determine their relative influence on model results.

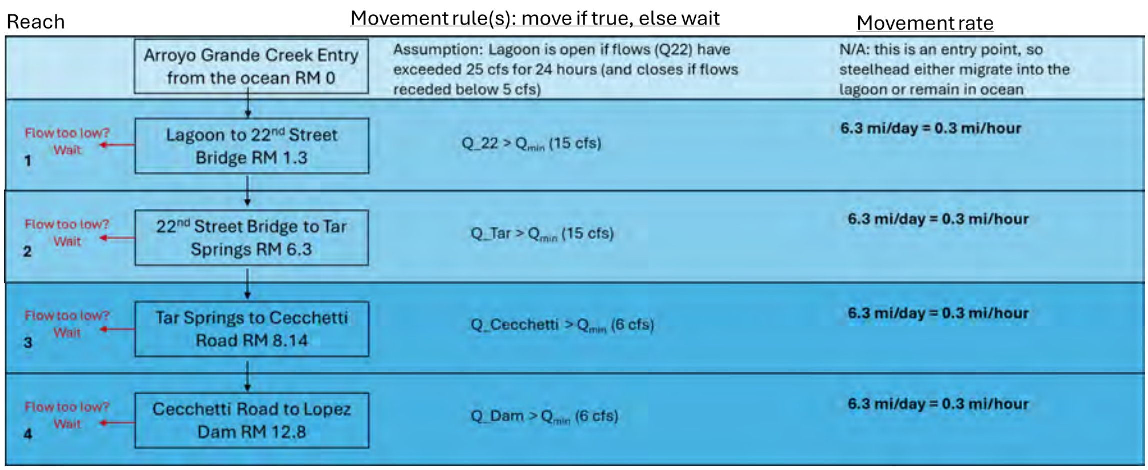

Figure 6-5. River reaches and their descriptions, respective RM, and adult steelhead movement rules on the Arroyo Grande Creek, CA.

ABM Results

In some dry years, ABM results of modeled flows indicate that flows would be insufficient for adult steelhead to access AG Creek for spawning. The proportion of years that this occurred differed based on scenario (Table 6-4). Notably, the only years where this occurred in the Pre-Dam scenario were recent dry years (within the last ~10 years; 2013, 2014, 2015, and 2022). Under the LDRP there would be an increase in years when steelhead would have access to the watershed, an increase in the years that more than half the population has access to the watershed, and a substantial increase in the years more than half the population can migrate as far upstream as Lopez Dam, relative to Existing Conditions (baseline).

Table 6-4. Proportion of modeled years where adult fish had no access to Arroyo Grande Creek, where at least 50% of adult fish were able to enter Arroyo Grande Creek, and where at least 50% of adult fish had full access to Arroyo Grande Creek from the ocean to Lopez Dam.

	Pre-dam Flow Conditions	Existing Flow Conditions (Baseline)	LDRP
No Access	9%	34%	32%
≥50% Access to watershed	59%	29%	36%
≥50% Access to Lopez Dam	55%	9%	34%

In addition to increasing the number of days that migration is possible, under the HCP proposed LDRP, adult steelhead would have increased access to suitable spawning habitat in AG Creek upstream of Tar Spring Creek confluence, to Cecchetti Road, and to Lopez Dam (Table 6-5). The pattern of increased access to AG Creek is apparent in the example wet water year of 1996 for example, when under baseline (existing) conditions 52% of simulated fish do not access the creek, and only 11% have access all the way to Lopez Dam, whereas under the LDRP, only 46% have no access, and 54% have access to Lopez Dam (Figure 6-6).

Table 6-5. Average proportion (across water years) of simulated fish to reach various locations along the migration route.

	Pre-dam Flow Conditions	Existing Flow Conditions (Baseline)	LDRP
22nd Street Bridge	55%	28%	32%
Tar Spring Creek Confluence	52%	26%	31%
Cecchetti Road Crossing	52%	24%	31%
Lopez Dam	52%	11%	30%

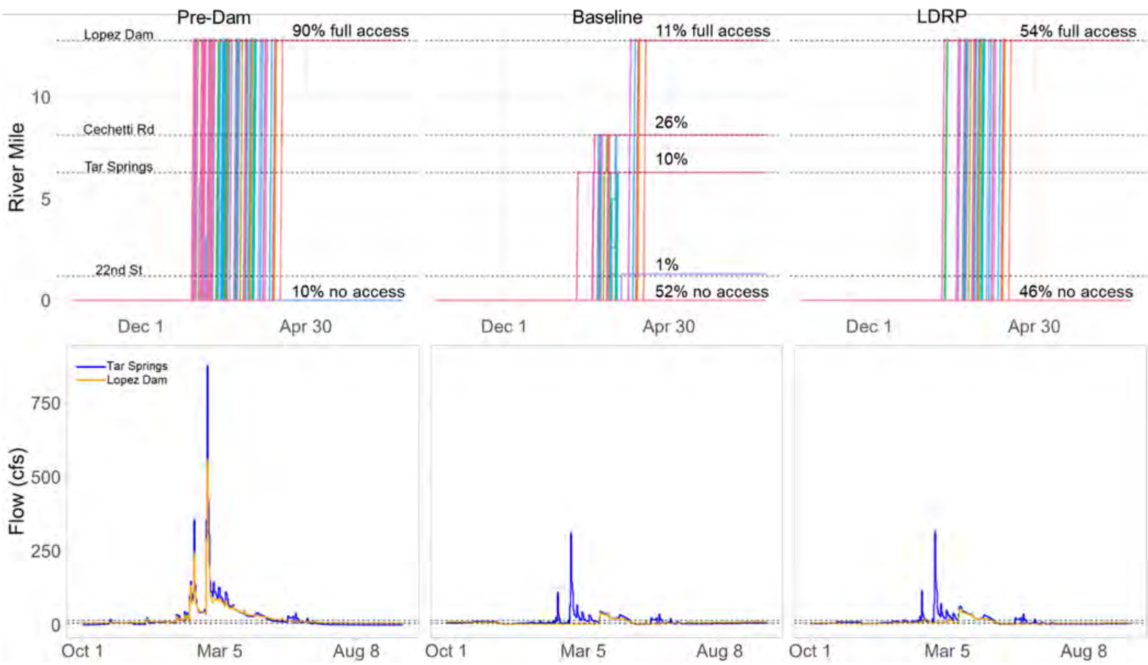

Figure 6-6. An example of simulated fish migration paths (top row) and modeled flows at Tar Spring Creek and at Lopez Dam (bottom row) for all scenarios during a wet water year (1996).

In a median water year, such as 2010, two migration pulse flows would occur under HCP proposed releases, and these modeled migration conditions indicate that 27% of the simulated run reach Lopez Dam, rather than 0% under existing conditions (Figure 6-7).

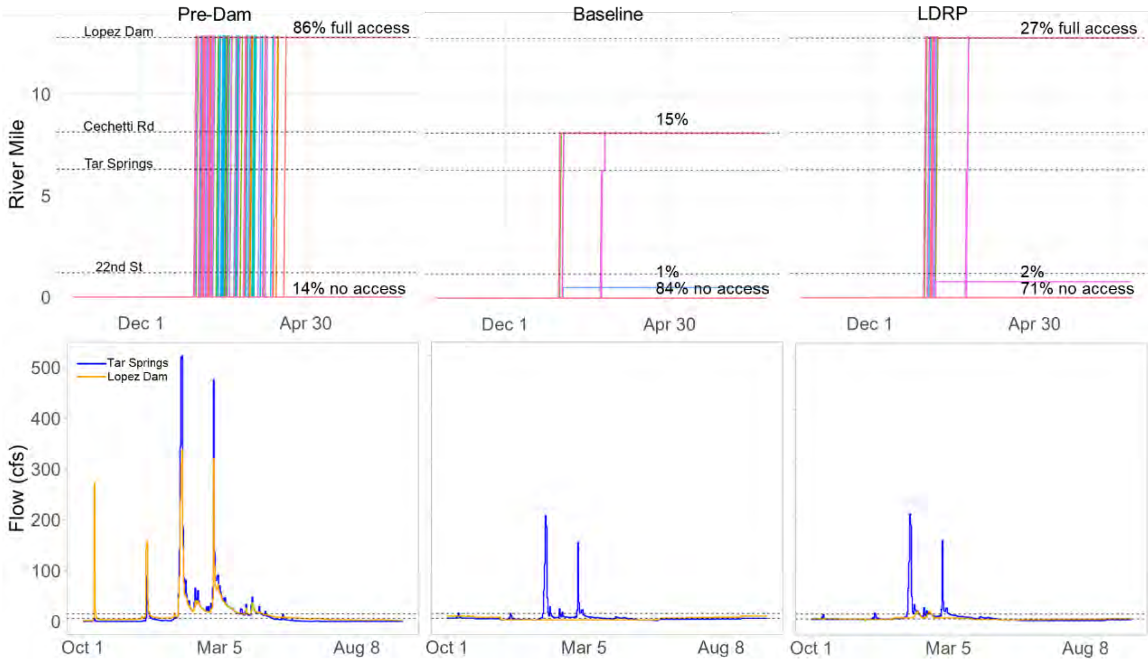

Figure 6-7. An example of simulated fish migration paths (top row) and modeled flows at Tar Spring Creek and at Lopez Dam (bottom row) for all scenarios during a median water year (2010).

In a dry water year, such as 1994, one migration pulse flow is released under the LDRP, and overall 13% of the simulated run has access to reach Lopez Dam, whereas under Existing Conditions only 9% have access to watershed, and none are simulated to reach Lopez Dam (Figure 6-8). Note that even under Pre-Dam conditions 61% of the simulated run do not have access to the watershed.

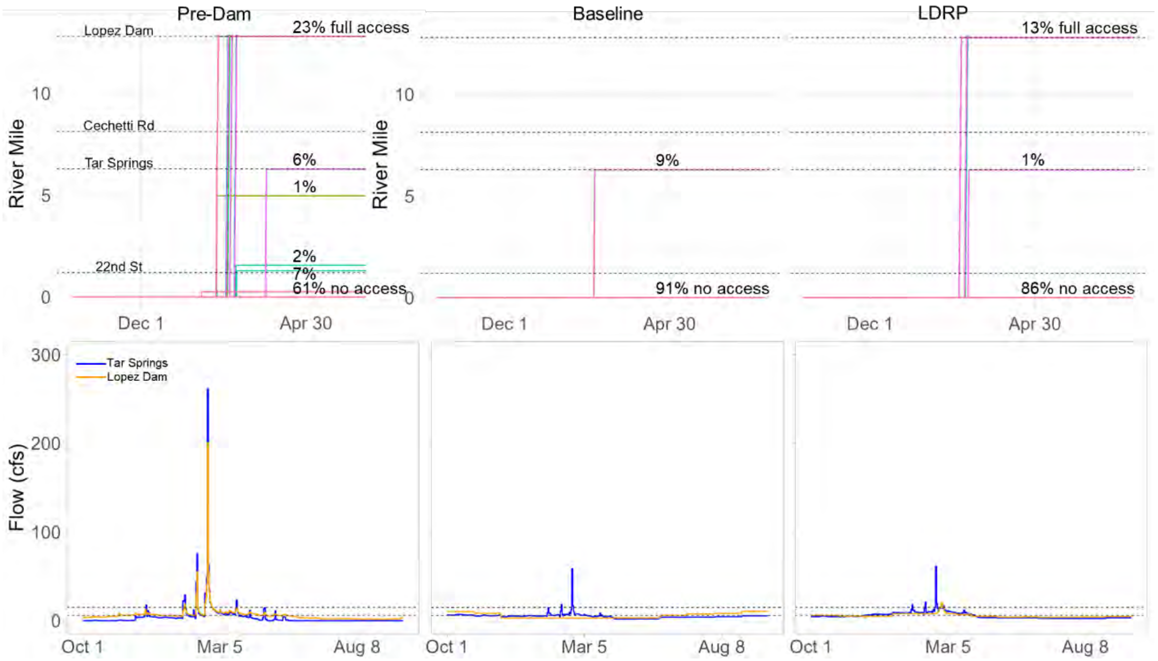

Figure 6-8. An example of simulated fish migration paths (top row) and modeled flows at Tar Spring Creek and at Lopez Dam (bottom row) for all scenarios during a dry water year (1994).

ABM Sensitivity Testing

Sensitivity analysis is critical for the development and evaluation of decision support models, such as the smolt ABM. It involves systematically varying model input parameters to determine their impact on key model outputs and behavior (Saltelli et al. 2000, Pianosi et al. 2016). Sensitivity analysis was used on the adult ABM to evaluate the impact of key parameters on model output (i.e., mean migration distance and proportion of fish to reach Lopez Dam) The sensitivity analysis focused on key parameters that were assumed to influence adult migration:

- **Median arrival date of fish to AG Lagoon**. The default median arrival date was February 14th, based on Shapalov and Taft (1954). Values were tested from a median arrival of December 16th to April 16th in increments of 30 to determine how sensitive successful fish migration was to varying median arrival date timing.
- **Migration rate.** The default value of 6.3 mi/day was used, based on English et al. (2006). Values of 3, 6, 9, and 15 mi/day were tested, based on many researchers reporting faster migration rates (English et al. 2006).
- **Minimum flow for fish movement**. The default flow in the model is 15 cfs downstream of Tar Spring Creek confluence, and 6 cfs upstream to Lopez Dam, based on Stillwater Sciences (2022a). Values for Tar Spring Creek to Lopez Dam of 5, 6, 10, and 12 cfs were tested, and for the Lagoon to Tar Spring Creek including 10, 15, 20, and 25 cfs.
- **Maximum wait duration.** The assumed amount of time that an adult steelhead will hold prior to migrating further upstream ("wait duration") in the model is five days. After five days, the model assumes fish spawn at their location. Values of 1, 3, 5, 7, and 9 days of waiting were tested.

- **Lagoon sandbar breach flow.** The assumed sandbar breach requirement is 25 cfs for 24 hours at 22nd Street Bridge. Required flows to breach sandbar with values of 15, 20, 25, 30, and 35 cfs were tested.

For each of the parameters, the specified range of values above was tested while holding the other parameters at their default values. Results are presented as mean ± Standard Error of the Mean (SEM) migration distance of the fish that successfully enter the river and mean ± SEM proportion of fish that are able to access the entire migration reach up to Lopez Dam across all modeled water years under each of the 3 operational scenarios. Analyzing these results will provide insight into which parameters the model is most sensitive to and whether reducing uncertainty would be of benefit.

Sensitivity analysis indicates that median arrival date influences migration distance and ability to reach Lopez Dam, especially under the Existing Conditions scenario (Figure 6-9); with early arriving fish less likely to experience suitable migration flows than fish arriving during typical winter high flow period. Since the Existing Conditions scenario is more sensitive to arrival date than Pre-dam or LDRP scenarios, it is important that the ABM model estimate mean arrival date as realistically as possible. In addition, the result indicates that synchronizing migration releases (as proposed) will improve the chances of releasing flows when adults are naturally migrating and improve the potential for improved access to spawning habitat under the LDRP. For this reason, the HCP monitoring program includes spawning surveys to evaluate migration timing MM-07, as described in Section 7.4.1.

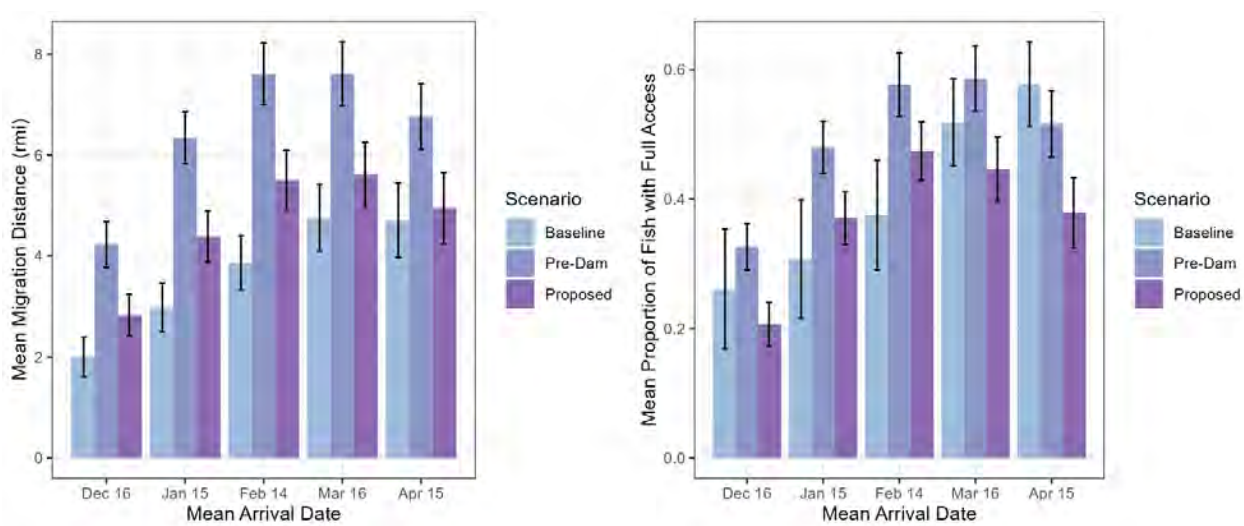

Figure 6-9. Agent based model sensitivity testing the effect of mean arrival date on mean migration distance (RM), and mean proportion of fish with full access to Lopez Dam.

Sensitivity analysis indicates that assumed average fish speed (migration rate) does not have a strong influence on migration distance and ability to reach Lopez Dam (Figure 6-10). This is likely due to the relatively short distance of Lopez Dam from the ocean, relative to the duration of migration flows.

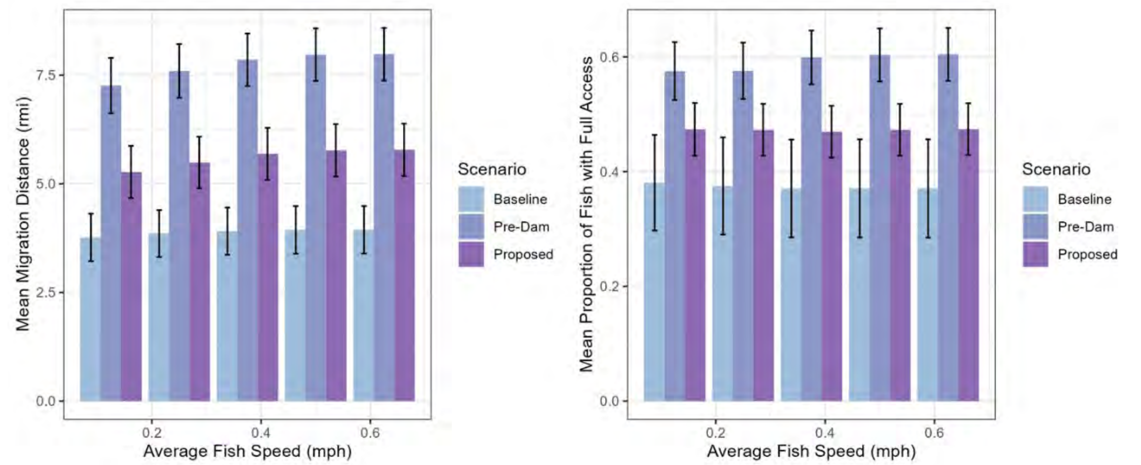

Figure 6-10. Agent based model sensitivity testing the effect of migration rate (average fish speed in mph) on mean migration distance (RM), and mean proportion of fish with full access to Lopez Dam.

Sensitivity analysis indicates that minimum fish passage flow requirements from Lopez Dam downstream to Tar Spring Creek confluence does not substantially influence migration distance and ability to reach Lopez Dam under pre-dam scenario (since flows are generally higher than tested minimum flows), or under baseline (since flows are nearly always lower than tested minimum flows) (Figure 6-11). Under the LDRP, slightly higher minimum flows do not influence migration distance, but if minimum flow requirements were double the default minimum, the adult steelhead would have a lower mean migration distance, and fewer would reach Lopez Dam. Under the HCP program, monitoring will include assessing minimum fish passage flow requirements in the reach from Lopez Dam to Tar Spring (MM-03), as described in Section 7.4.1.

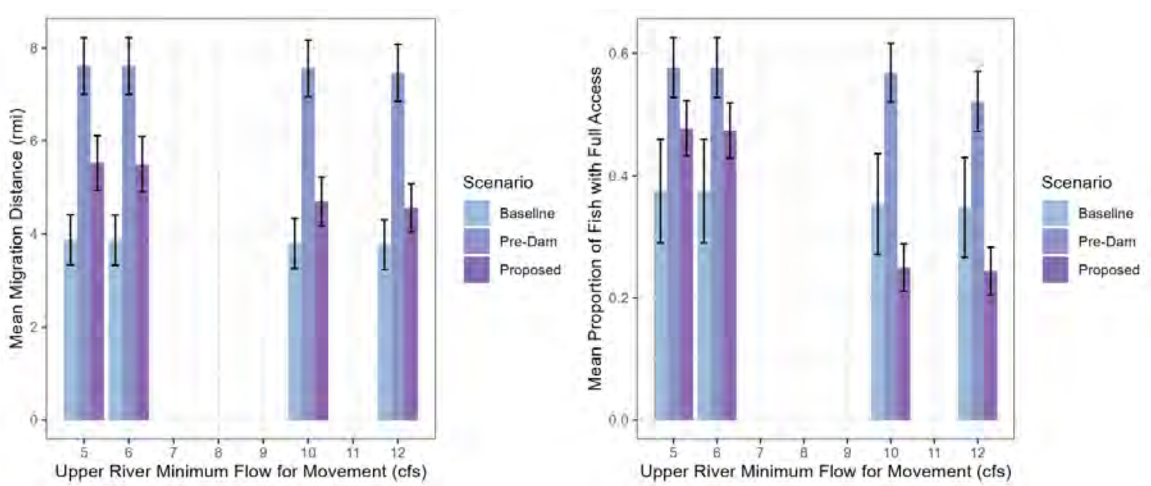

Figure 6-11. Agent based model sensitivity testing the effect of minimum flows required for fish passage from Lopez Dam downstream to Tar Spring on mean migration distance (RM), and mean proportion of fish with full access to Lopez Dam.

Sensitivity analysis indicates that minimum fish passage flow requirements from Tar Spring Creek confluence downstream to the AG Creek lagoon does influence migration distance and ability to reach Lopez Dam under the pre-dam scenario; if flows requirements were lower migration distance and access to Lopez Dam would be substantially higher, but if flow requirements were higher it would not substantially reduce access (Figure 6-12), since when flows occur they tend to be relatively high. Under the baseline scenario, access is not highly sensitive to minimum flows in this reach, since access is generally limited by conditions upstream of Tar Spring Creek under Existing Conditions. Under the LDRP, higher minimum flows do not influence migration distance, since when migration flows occur they are generally over 25 cfs. Under the HCP program, monitoring will include assessing minimum fish passage flow requirements in the reach from Lopez Dam to Tar Spring Creek (MM-03), as described in Section 7.4.1.

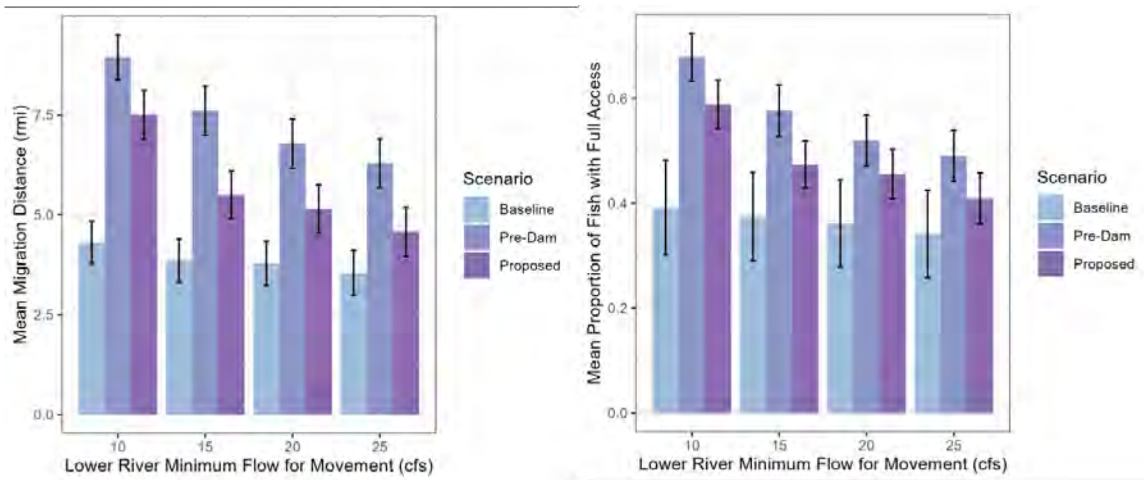

Figure 6-12. Agent based model sensitivity testing the effect of minimum flows required for fish passage from Tar Spring to Arroyo Grande Lagoon on mean migration distance (RM), and mean proportion of fish with full access to Lopez Dam.

Sensitivity analysis indicates that mean migration distance is sensitive to maximum wait duration, where allowance of greater wait durations leads to increases in mean migration distances (Figure 6-13). Therefore, it is important to use realistic values. Mean proportion of fish with access to the full migration reach up to Lopez Dam is insensitive to wait duration under the Existing Conditions, highlighting that even if the model assumed a wait duration of to nine days it is unlikely that a suitable migration flow will occur.

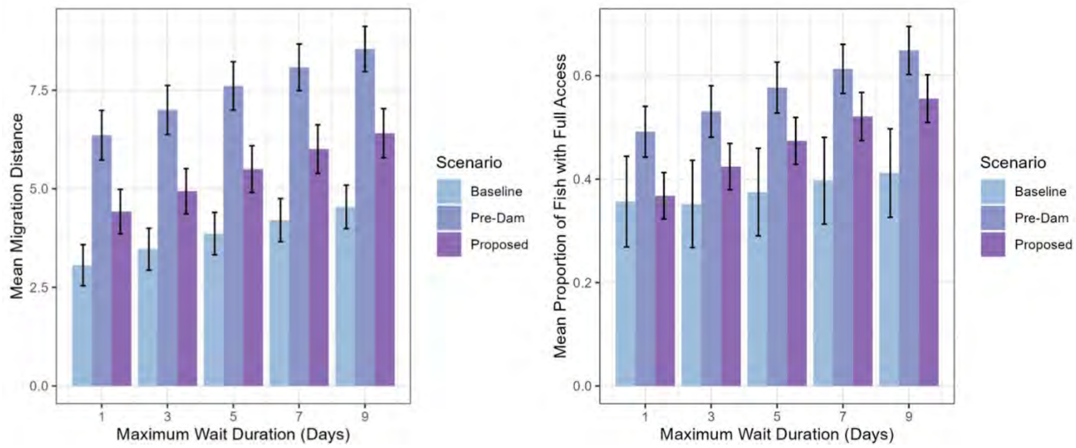

Figure 6-13. Agent based model sensitivity testing the effect of maximum wait duration (holding time) on mean migration distance (RM), and mean proportion of fish with full access to Lopez Dam.

ABM model results indicate that assuming a flow requirement to breach the lagoon and allow adults and smolts access to and from the ocean of at least 15 cfs for 24 hours constrains predicted migration opportunities in the watershed, and therefore is an important model parameter. Sensitivity analysis indicates breach flow requirements less than or greater than the assumed 25 cfs does influence migration distance and ability to reach Lopez Dam under all flow scenarios; if breach requirements were lower or higher, access would not be significantly increased or reduced under all scenarios (Figure 6-14). Under the HCP program, monitoring will include monitoring conditions under which the sandbar breaches (MM-01), as described in Section 7.4.1.

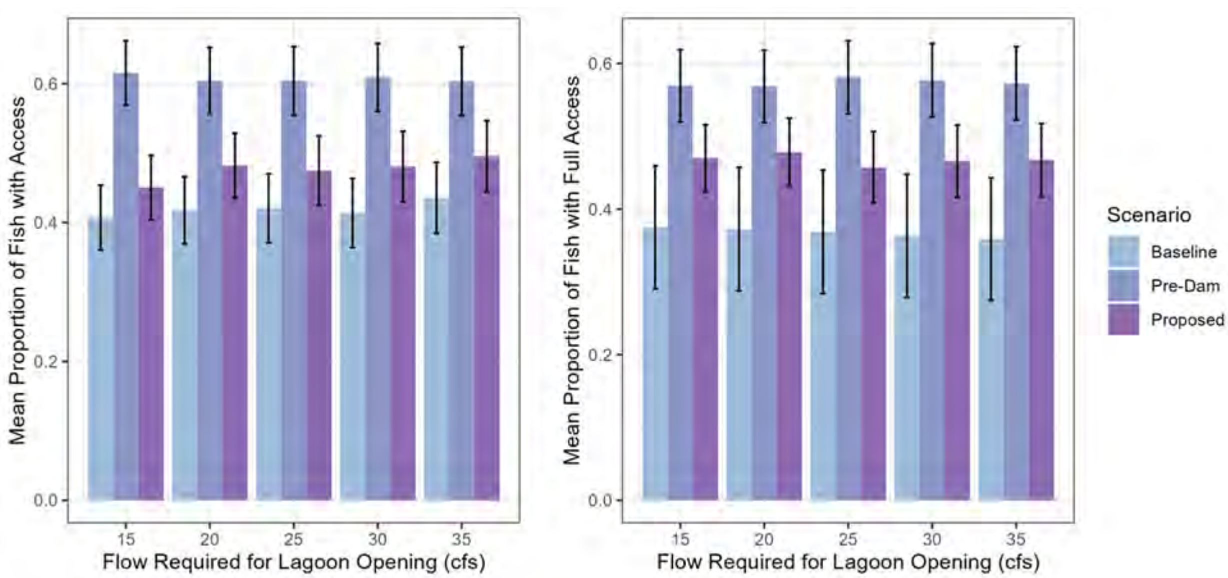

Figure 6-14. Agent based model sensitivity testing the effect of assumed lagoon sandbar breach flow requirements on mean migration distance (RM), and mean proportion of fish with full access to Lopez Dam.

Estimate of Take and Habitat Surrogates

To estimate potential take of adult steelhead as a result of implementation of the LDRP during the permit term, we modeled adult steelhead access both to AG Creek and to AG Creek upstream of Tar Springs Creek and assumed there is take of adults if they would have accessed AG Creek or the reach of AG Creek upstream of Tar Spring Creek but for implementation of the LDRP. We did not evaluate whether the adults prevented from spawning downstream of Lopez Dam would migrate and spawn successfully downstream in the AG Creek watershed or in a different watershed, or whether their probability of survival is higher or lower as a result.

The ABM results comparing the LDRP to a Pre-Dam condition estimate that 23% more adults would access AG Creek under Pre-Dam conditions. This proportion of the assumed annual adult population (Table 6-1) equates to an average annual take of 2.4 adults (308 adults*0.23=71 over 30 years averages 2.37 adults), and a total for the permit term (30 years) of 71 adults that hypothetically could access AG Creek but for the effects of LDRP.

The ABM results further estimate that 22% more adults hypothetically could access AG Creek as far upstream as Lopez Dam under Pre-Dam conditions. This proportion of the assumed annual adult population (Table 6-1) equates to an average annual take of 2.2 adults, and a total for the permit term (30 years) of 67.8 adults that hypothetically could access the reach upstream of Tar Spring Creek to Lopez Dam but for the effects of LDRP.

These estimates of take are based on assumed population abundance over the permit term, and the results of the ABM model. However, it is not realistic or feasible to actually observe and measure adults that do not enter AG Creek, or to differentiate those adults that would have migrated further upstream than Tar Spring Creek. While the model has utility as a tool to assess potential impacts of different operational regimes on steelhead, its reliability is constrained by the limited data available on steelhead population dynamics in AG Creek and the assumptions that are necessary to run the model and generate estimates. In the absence of information sufficient to estimate and quantify specific numbers of individuals that may be harmed, a surrogate approach was applied to estimate impacts to steelhead. Joint USFWS and NMFS regulations implementing ESA section 7 authorize the use of surrogate measures as a means to express the impact of incidental take in the context of interagency consultation (50 C.F.R. § 402.14(i)). Likewise, the HCP Handbook recognizes that “it is not always practical” to quantify the impacts that may result in connection with take authorized pursuant to an ITP and allows HCPs to utilize a surrogate measure or “measurable ecological condition” to express take and impacts. Because adult migration is dependent on minimum flows within the watershed, this HCP uses as a surrogate the measurable ecological condition of observed flow rates that occur in the permit area downstream of Lopez Dam. Measurements of flow will serve as the surrogate based on the assumption that impacts to steelhead are proportional to volumes of flow that can be tracked in real time. Use of this surrogate is based on the best science currently available.

As described in Section 7.4 *Monitoring and Adaptive Management*, substantial monitoring and adaptive management will be conducted during the permit term to ensure that the LDRP results in sufficient flows to support adult steelhead migration, including flow monitoring (MM-01; Section 7.4.1.1), fish passage flows monitoring (MM-03; Section 7.4.1.2), and spawning surveys (MM-07; Section 7.4.1.3). Adult migration measurable objectives and monitoring are included in the AMP that includes assessing and reporting on frequency, duration, water depths, and magnitude of migration opportunities (Table 7-1). Results of monitoring will be presented to the TAC, and deficiencies in adult migration conditions will be addressed collaboratively with Adaptive Management Actions that could include revised releases or other actions to improve migration conditions.

Adult Steelhead Migration Effects Summary

Adult upstream migration conditions under the LDRP will support and improve conditions within AG Creek to enable growth of the steelhead population. Unlike winter-run steelhead in coastal Pacific Northwest rivers, where perennially open river-mouths and generally high instream flows maintain passage potential (Groot and Margolis 1991), natural riverine geomorphic features and low flows often limit migration in the SCCC DPS (NMFS 2016a). Steelhead have adapted to these environments by responding rapidly and opportunistically to flow events that support suitable passage conditions in upstream riverine reaches (Shapovalov and Taft 1954, Moyle 2002). The LDRP will provide substantially improved opportunities for adult upstream migration relative to Existing Conditions. These increases include more days per year of migration, greater temporal distribution, and fewer years with no access. For a DPS adapted to opportunistically and quickly migrate when conditions are suitable, increased temporal distribution of migration opportunities will ensure that adults may migrate and spawn anytime between January and April depending on the climatic conditions that vary annually, increasing the resilience of the population to climate change and other disturbances. Overall, these increases are sufficient to protect and enhance steelhead and their critical habitat, since during all years there will be migration opportunities exceeding those that occur in Existing Conditions.

Minimum Releases

Proposed baseflows are summarized in Section 5.4.1 (Table 5-1). Depending on the season, there are both losses to groundwater, and accretion of flows downstream of Lopez Dam, such that under most conditions baseflows in AG Creek are typically slightly higher or lower than the Lopez Dam releases. Table 6-6 summarizes average daily flows modeled for pre-dam (i.e., flows that would occur without the dam in place), Existing Conditions (baseline), and under the LDRP seasonally, based on flows for the period of 1969 through 2024 as predicted to occur at Cecchetti Road (RM 8.1), and the City of Arroyo Grande (RM 5.7)

Table 6-6. Average daily flows in Arroyo Grande Creek at Cecchetti Road (RM 8.1) and near the City of Arroyo Grande (RM 5.7).

Season	Water Year Type[1]	Average Daily Flows (cfs)					
		Cecchetti Road (RM 8.1)			City of Arroyo Grande (RM 5.7)		
		Pre-dam	Existing Conditions	LDRP	Pre-dam	Existing Conditions	LDRP
Summer (July–September)	Dry	0.1	4.0	2.5	0.2	4.8	3.4
	Average	0.3	4.0	2.7	0.4	4.9	3.6
	Wet	3.6	4.3	2.9	4.5	6.1	4.7
	All years	1.4	4.1	2.7	1.7	5.3	3.9
Fall (October–December)	Dry	1.1	4.9	4.7	2.0	6.1	5.9
	Average	4.7	5.1	5.0	6.1	6.9	6.9
	Wet	11.3	7.9	8.4	15.5	12.5	13.1
	All years	5.7	6.0	6.0	7.9	8.6	8.6
Winter (January–March)	Dry	10.0	3.1	6.6	11.7	4.9	8.5
	Average	28.0	6.2	9.7	36.4	14.8	18.3
	Wet	136.2	67.3	70.1	182.8	114.0	116.8
	All years	58.6	25.9	29.2	77.7	45.1	48.4

Season	Water Year Type[1]	Average Daily Flows (cfs)					
		Cecchetti Road (RM 8.1)			City of Arroyo Grande (RM 5.7)		
		Pre-dam	Existing Conditions	LDRP	Pre-dam	Existing Conditions	LDRP
Spring (April–June)	Dry	4.5	4.5	4.7	5.0	5.5	5.7
	Average	6.3	3.2	3.8	7.5	4.9	5.5
	Wet	31.6	19.3	18.7	39.3	27.5	26.8
	All years	14.2	9.1	9.2	17.5	12.8	12.8

Source: Western Hydrologics 2021

[1] Water year types are from Western Hydrologics 2021 which includes driest 1/3 of years on record, the middle 1/3 of years on record, and the wettest 1/3 of years on record for the period of 1969–2020 (described in Section 3.3.2).

Under Existing Conditions downstream of Lopez Dam in AG Creek, there is an increase in summer flows and a decrease in winter flows compared to Pre-dam Conditions. Summer releases from Lopez Reservoir occur for groundwater recharge and municipal uses, which have led to increased stream flows above historical conditions in most of mainstem AG Creek downstream of the dam; however, the lower approximately 3 miles of AG Creek (downstream of Highway 1) remains ephemeral and dry out during the summer months, similar to historical conditions. Winter peak flows on AG Creek were historically flashy and closely related to the duration and magnitude of storm events (SHG 2004). Construction of Lopez Dam and Reservoir has reduced the magnitude of winter flows in AG Creek downstream of the dam relative to a Pre-Dam condition.

Spawning and Incubation

Baseflows during the winter spawning and incubation period are higher under the LDRP than under Existing Conditions, especially during dry years, and especially in the reach of AG Creek upstream of Tar Spring Creek confluence to Lopez Dam (Table 6-6). In addition, the pulse flows proposed to increase migration will also increase suitable conditions for spawning. Overall, flow conditions under the LDRP would improve suitable spawning and incubation conditions relative to Existing Conditions.

Under Existing Conditions, spawning gravel is most abundant downstream of Tar Spring Creek both in the total area mapped (and in the density of spawnable gravel (ft^2 per 100 ft of stream) (Stillwater Sciences 2022). At flows of 3–4 cfs a total of 4,079 ft^2 was observed to be wetted downstream of Tar Spring Creek (15.7 ft^2 per 100 ft), and 750 ft^2 (6 ft^2 per 100 ft) were wetted upstream of Tar Spring Creek to Lopez Dam. During the survey, most of the spawning gravel observed was within the wetted channel with limited amounts of spawning gravel observed in dry locations along the channel margins. Average spawning gravel-quality ranged from fair to good based on small particle size and material embeddedness. The highest average quality spawning gravel was observed directly downstream of Lopez Dam, and the lowest quality spawning gravel was observed in the reach downstream of Biddle Park.

The existence of Lopez Dam was considered in the NMFS 2001 Lopez Dam seismic retrofit BiOp (described in Section 1.3.2), including the potential implications of extending the existing effects of the dam on the SCCC DPS and critical habitat into the future. Effects of the dam on sediment transport are considered within these effects. It is assumed that spawning gravel availability downstream of the confluence with Tar Spring Creek, and the unimpeded contribution of gravel from that tributary, approximates what spawning habitat would be upstream of Tar Spring Creek if sediment were not interrupted by Lopez Dam. Based on the observation that spawning habitat between Lopez Dam and Tar Spring Creek (34,320 ft) is 6 ft^2 per 100 ft, whereas the volume is 15.7 ft^2 per 100 ft downstream, the amount of spawning gravel upstream of Tar Spring Creek would be around 5,388 ft^2 in the absence of Lopez Dam (rather than the 750 ft^2) estimated under Existing Conditions. While the effects of Lopez Dam on Arroyo Grande Creek watershed and steelhead were covered under the 2001 BiOp, conservation measures included in this HCP nevertheless have the potential to increase spawning habitat for steelhead and therefore address more than just the effects of the HCP's Covered Activities and may contribute to the recovery of the DPS.

Under the HCP over 5,388 ft^2 of spawning habitat will be maintained through LDRP winter releases (CM-1) and gravel augmentation, substantially improving spawning habitat conditions relative to existing conditions. Measurements of suitable spawning gravel will be monitored to evaluate the effectiveness of the conservation measure.

As described in Section 7.4 *Monitoring and Adaptive Management*, substantial monitoring and adaptive management will be conducted to ensure that the HCP Program results in increased steelhead spawning habitat. A spawning habitat measurable objective of 5,388 ft^2 and monitoring are included in the Adaptive Management Program (AMP) that includes assessing and reporting on water depth, velocity, temperature, and substrate conditions. Results of monitoring will be presented to the TAC, and deficiencies in spawning conditions will be addressed collaboratively with Adaptive Management Actions that could include revised releases or additional gravel augmentation to improve spawning conditions.

Spawning Habitat Summary

Improvements in spawning area and quality are anticipated to result from habitat restoration downstream of Lopez Dam resulting from the Sediment Augmentation Program (Section 5.4.3.1). In the event the biological, logistical, and regulatory uncertainties associated with an assisted migration program are resolved and the District is able to fully implement that conservation measure (CM-2), the provision of assisted migration of adults to habitat upstream of Lopez Reservoir would provide access to the highest quality and most abundant spawning habitat in the watershed, primarily in Lopez Canyon Creek. Collectively, these measures could benefit individual adult spawning steelhead by providing substantial spawning habitat and contributing to population viability within the AG Creek watershed by providing sufficient spawning habitat to support an abundant population within the watershed. A natural spawning population of this magnitude could be potentially greater in abundance than what occurs in any watershed in the region. Thus, this could benefit the population viability of the SCCC DPS in addition to the AG Creek watershed viability.

Fry and Juvenile Rearing

The effect of flows under the LDRP on the availability of suitable steelhead fry and juvenile rearing habitat in AG Creek would vary seasonally. Under the LDRP, the daily average flows would be lower during summer than Existing Conditions, more similar to Pre-dam Conditions. Daily average flows would be similar during fall and spring to existing conditions, and higher during winter, more closely matching a natural Mediterranean hydrograph pattern of high winter flows, and low summer flows.

In southern coastal California, temperature is a critical component of water quality that affects steelhead habitat. Section 2.1.5.1 describes the best available science relative to temperature thresholds for steelhead behavior and physiology. Under the HCP operations, water temperatures are anticipated to remain similar to the suitable conditions observed under Existing Conditions, as described in Section 3.5.1. Under the HCP, continuous monitoring of water temperature will be conducted to ensure suitable conditions are maintained (MM-02).

Because of groundwater losses/gains, agriculture diversions, and accretion from tributaries, the flows that will occur in AG Creek downstream of Lopez Dam will be either higher or lower (generally higher) than the releases from Lopez Dam, as summarized in Table 6-6. Therefore, the discussion of suitable habitat for steelhead below discusses the habitat response to the minimum releases from Lopez Dam, considering the conditions as they generally occur with flow losses and gains.

Although no quantitative assessment of the relationship between instream flows and suitable steelhead rearing habitat has been conducted, habitat throughout AG Creek was comprehensively surveyed, photographed, and evaluated for steelhead suitability at all proposed baseflow releases (Stillwater Sciences 2022, Appendix D). In general, the amount of suitable rearing habitat appears to be more limited by habitat complexity and productive riffles than by water depth and velocity.

During the lowest proposed summer baseflows of 3 cfs, there are continuous flows downstream as far as the 22nd Bridge, deep pools (> 1.5 ft) suitable for providing juvenile rearing habitat are maintained, and fry rearing habitat is plentiful (Figure 6-15). In the reach between Lopez Dam and Tar Spring Creek confluence, productive riffles appear limited by suitable sediment, and much of the reach is relatively deep glide habitat.

Figure 6-15. Example of suitable fry and juvenile rearing habitat in Arroyo Grande Creek downstream of Lopez Dam near Las Ventanas Road, with 3 cfs release from Lopez Dam, at around 3 cfs on location.

Under the proposed release, flows during fall increase (5 cfs minimum). At these releases, flows are continuous downstream as far as the 22nd Bridge or the lagoon, deep pools (> 1.5 ft) suitable for providing juvenile rearing habitat are maintained, and fry rearing habitat is plentiful (Figure 6-16). Riffles do not become more productive at these flows and appear more limited by suitable substrate than water depth and velocity.

Figure 6-16. Example of suitable juvenile rearing habitat in Arroyo Grande Creek downstream of Lopez Dam near Arroyo Grande, with 5 cfs release from Lopez Dam and 2 cfs on location.

Under the proposed release, flows during winter increase (minimum 8 cfs). At these releases, flows are continuous downstream to the lagoon, and deep pools (> 1.5 ft) suitable for providing juvenile rearing habitat are abundant (Figure 6-17). Spawning habitat is available in places and appear more limited by suitable substrate than water depth and velocity.

Figure 6-17. Example of suitable juvenile rearing habitat in Arroyo Grande Creek downstream of Lopez Dam near Cecchetti Road, with 8 cfs release from Lopez Dam and 8 cfs on location.

Under the LDRP, flows during spring will be a 4 cfs minimum. At these releases, during spring flows are continuous downstream to the lagoon, and deep pools (> 1.5 ft) suitable for providing juvenile rearing habitat are abundant (Figure 6-18). Productive BMI habitat in riffles is available in places and appear more limited by suitable substrate than water depth and velocity.

Figure 6-18. Example of suitable juvenile rearing habitat in Arroyo Grande Creek downstream of Lopez Dam near City of Arroyo Grande, with 3 cfs release from Lopez Dam and 7 cfs on location.

The LDRP includes a ramping rate restriction of 2 inches/hour. In general, the faster the rate of decline in water surface elevation, the more likely fish and CRLF are to be stranded (Phinney 1974, Bauersfeld 1978, Halleraker et al. 2003). Fluctuations within natural river environments are typically less than 2 inches/hr (Hunter 1992), and flow reductions under the LDRP are not anticipated to increase the risk of steelhead and CRLF stranding downstream of Lopez Dam.

Under the LDRP releases from Lopez Dam will never be less than 3 cfs. However, due to groundwater pumping (non-District operations) and natural hydrology in the watershed, there are times, particularly in dry water years, when flows in reaches of AG Creek will likely be less than 3 cfs, and the channel could become dry during late summer, particularly in the reach from Highway 101 to the lagoon (Stillwater Sciences 2022). When this occurs, any rearing steelhead within this reach would become stranded within isolated pools if they have not made it to the estuary, or would be stranded in dry channel, and would likely perish. Historically, the lower section of AG Creek, which flows over a deep alluvial valley, likely went dry in the summer during most years. Therefore, it is likely that a majority of AG Creek downstream of Lopez Dam was historically used by steelhead for juvenile rearing and as a migratory corridor for steelhead during winter and spring but did not provide juvenile summer rearing habitat. This is also supported by Boughton and Goslin (2006), who concluded that steelhead over summering habitat has a low intrinsic potential to occur downstream of approximately RM 10 (downstream of the WTP), even under historical unimpaired conditions. Therefore, stranding of steelhead resulting from low stream flows downstream of Lopez Dam is not considered an impact of the LDRP.

Estimates of Take and Habitat Surrogate

The LDRP has the potential to influence instream flows downstream of Lopez Dam for a short distance prior to the substantial groundwater extraction and other factors that impact the hydrology of AG Creek that are not within the control of the District (Section 3.3). Operations under the LDRP are anticipated to maintain or increase baseflows and rearing habitat above Existing Conditions for steelhead and are not anticipated to result in negative impacts relative to the baseline to the species. It is not practicable to measure the specific influence of baseflows on juvenile steelhead rearing. In the absence of information sufficient to estimate and quantify specific numbers of individuals influenced by baseflows, a surrogate approach was applied. Because juvenile rearing is dependent on minimum flows within the watershed, the best available indicator of health from the LDRP during the permit term will be use of a measurable ecological condition as a surrogate based on observed flow rates that will occur in the permit area downstream of Lopez Dam. Measurements of flow as the surrogate is premised on the assumption that juvenile rearing health is proportional to volumes of flow, and flow volume can be tracked in real time. It is acknowledged that use of a measurable ecological condition as a surrogate for take is likely to overstate impacts for steelhead because the population does not occupy all habitat available to it. Nevertheless, use of flow measurements as a surrogate for take of fry and individual juvenile steelhead represents the best available science.

As described in Section 7.4 *Monitoring and Adaptive Management*, substantial monitoring and adaptive management will be conducted to ensure that the HCP Program results in sufficient steelhead fry and juvenile rearing habitat. Rearing habitat measurable objectives and monitoring are included in the AMP that includes assessing and reporting on suitable rearing habitat, and monitoring of steelhead rearing abundance and health. Results of monitoring will be presented to the TAC, and deficiencies in rearing conditions will be addressed collaboratively with Adaptive Management Actions that could include additional habitat restoration or revised releases to improve rearing conditions.

Fry and Juvenile Rearing Effects Summary

Under the LDRP, fry and juvenile rearing habitat is predicted to remain similar to Existing Conditions, since conditions appear more limited by habitat complexity and available sediment rather than by water depth and velocity. However, substantial improvements in fry and juvenile rearing area and quality are anticipated to result from a sediment augmentation program that will improve rearing, BMI, and spawning habitat (CM-3, Section 5.4.3). In the event it is practicable to address biological, logistical, and regulatory uncertainties, the provision of assisted migration of adults to habitat upstream of Lopez Reservoir (CM-2, Section 5.4.2) would provide access to the highest quality and most abundant rearing habitat in the watershed, primarily in Lopez Creek. Collectively, these measures would benefit individual rearing steelhead fry and juveniles by providing substantial rearing habitat, and the population viability within the AG Creek watershed by providing sufficient rearing habitat. This would also benefit the population viability of the SCCC DPS by supporting a substantial source of suitable fry and juvenile rearing habitat within the southern portion of the DPS.

Smolt Migration

Juvenile steelhead downstream migration (smolt migration) is achieved in AG Creek upstream of Tar Spring Creek during flows of approximately 3 cfs or greater and downstream of Tar Spring Creek during flows of 5 cfs or greater (Stillwater Sciences 2022). Under the proposed LDRP, smolt migration opportunities (days that fish passage is supported) during the smolt migration season (March through May) is increased substantially relative to Existing Conditions, especially during dry and median water years, and especially in the reach from Lopez Dam downstream to Tar Spring Creek confluence (represented by flows at Cecchetti Road (Table 6-7).

Table 6-7. Summary of migration flow during the smolt migration season (March–May); Average days greater than 3 cfs at Arroyo Grande Creek at Cecchetti Road (RM 12.2) and average days greater than 5 cfs near the City of Arroyo Grande (RM 5.7). (smolt downstream steelhead migration is achieved at 3 cfs at Cecchetti Road, and 5 cfs at City of Arroyo Grande)

Season	Water Year Type	Annual Average Days					
		Flows greater than 3 cfs at Cecchetti Road (RM 12.2)			Flows greater than 5 cfs at City of Arroyo Grande (RM 5.7)		
		Pre-dam	Existing Conditions	LDRP	Pre-dam	Existing Conditions	LDRP
Migration Season (Mar–May)	Dry	32	9	61	26	10	34
	Median	68	27	69	62	34	53
	Wet	90	72	84	90	80	83
	Average for All Years	63	36	71	59	42	57

Agent-based Modeling Approach

The main objective of the smolt ABM is to model smolt movement through AG Creek and estimate rates of smolt migration *success*, which is defined as the proportion of smolts that successfully migrate from Lopez Dam and tributary habitats to the ocean. The smolt ABM tracks simulated individual fish along their migration route in AG Creek beginning at the dam and ending at the ocean. The migration route is divided into five migration reaches to account for differences in conditions, mainly flow and habitat conditions (minimum flow requirements), along the route (Figure 6-19 and Figure 6-20). Downstream of the dam (12.8 RM from ocean) is the most upstream reach that could produce smolts, and a successful assisted migration program would likely release smolts within this reach as well and thus was selected as the starting point.

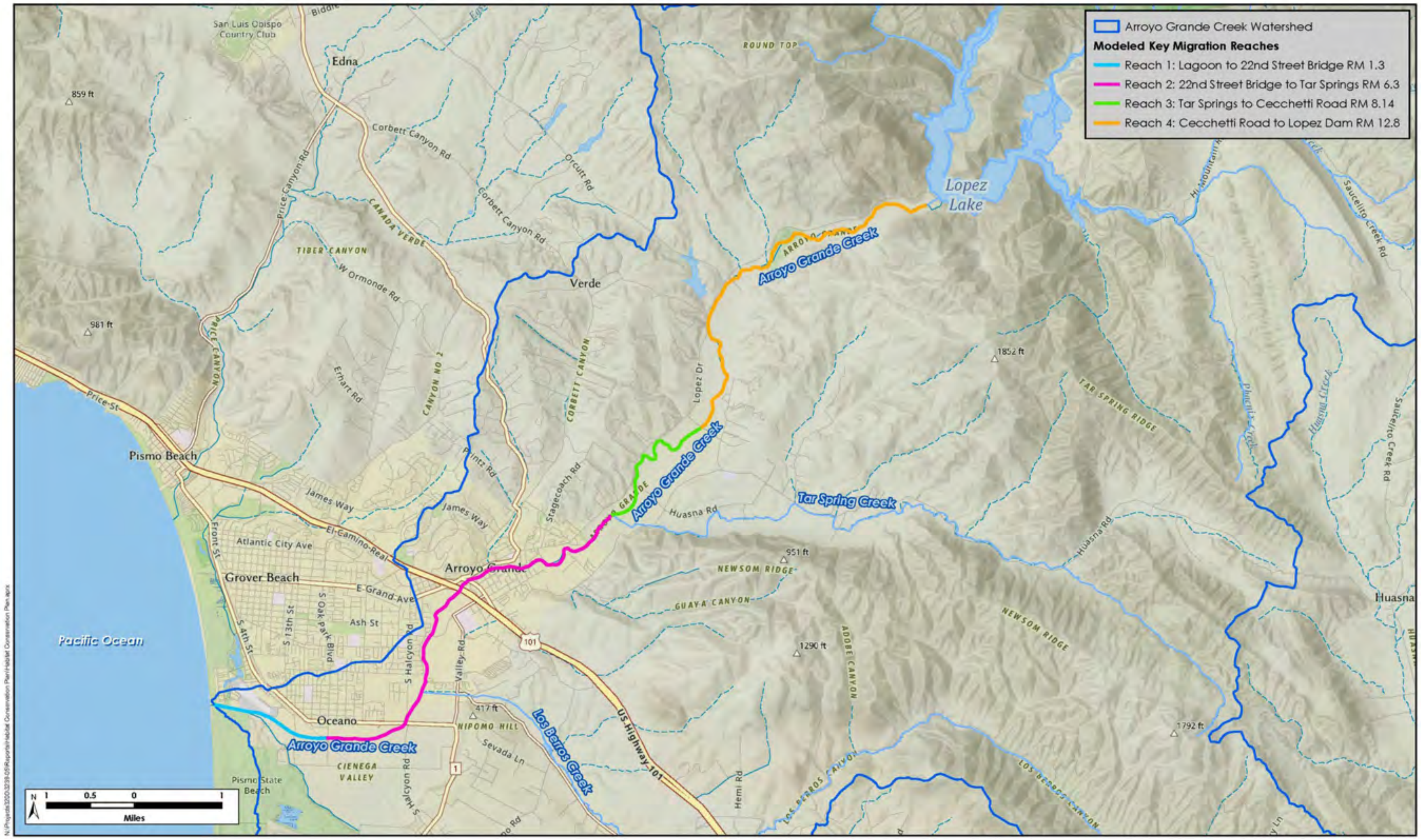

Figure 6-19. Key migration river reaches along Arroyo Grande Creek from the ocean to Lopez Dam.

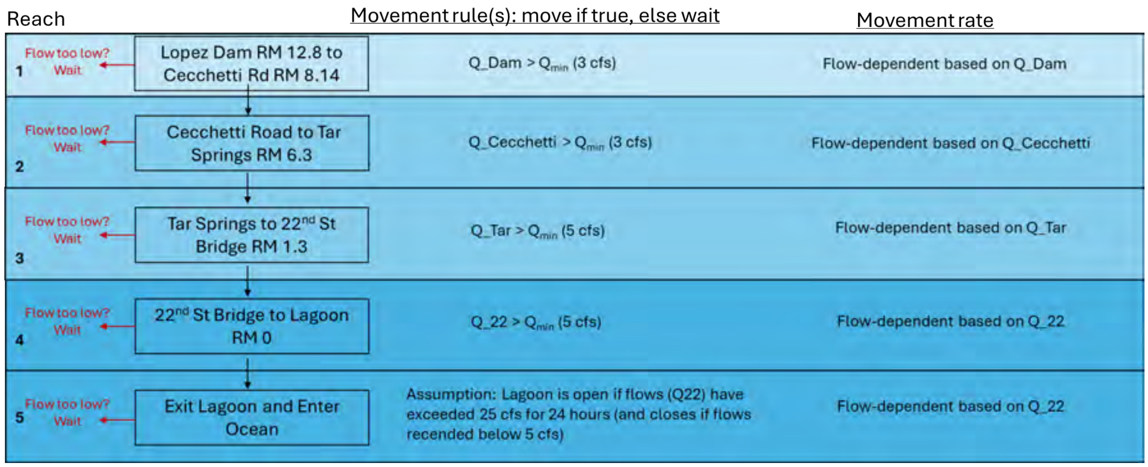

Figure 6-20. River reaches and their descriptions, respective RM, and steelhead smolt movement rules on the Arroyo Grande Creek, CA.

The smolt ABM is seeded with (n = 100) individuals that are tracked on an hourly basis until they either reach the ocean or the simulation ends. Smolts initiate migration from the dam within a simulated distribution of days of the water year. A mean smolt migration initiation date of April 12 was assumed based on Fukushima and Lesh (1998). A single distribution was selected and standardized across model runs (i.e., the migration timing distribution did not vary among operational scenarios and water years) (Figure 6-21). Migration timing sensitivity was assessed in the sensitivity analysis as described below.

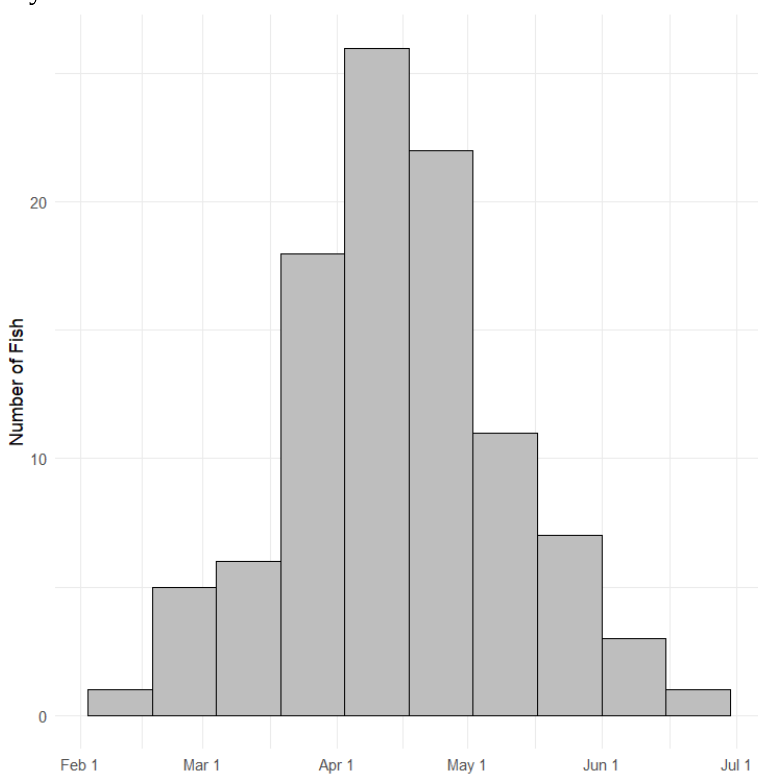

Figure 6-21. Histogram of the selected smolt migration initiation date distribution of 100 migrating steelhead smolts in Arroyo Grande Creek.

Within the smolt ABM, fish move successively from the first reach to the ocean based on hourly flow inputs (i.e., hydrology modeled flows, see Section 3.3) and reach-specific movement rules. If movement rules are not met, a fish can hold in its location until the movement rules are met (e.g., when another flow event occurs that provides sufficient flows) or until the simulation ends. Upon entry to a new reach, the fish is subjected to the rules of that reach. If a fish records a movement distance that is beyond the beginning of the next reach during an hour, the fish is conservatively "bounced back" to the start of that reach at the end of the hour to ensure all reach-specific rules are applied (i.e., to prevent fish from skipping reaches). Smolts are additionally subjected to an hourly, flow-based survival probability. At or above flows of 25 cfs (upstream of Tar Spring Creek) and 50 cfs (downstream of Tar Spring Creek), fish have a 99% chance of surviving each hour. Below these thresholds, a beta distribution was used to fit a function for each reach where probability of survival declines with decreasing flow. The rationale for this is that the longer it takes for smolts to migrate, the more likely they are to be exposed to predation and this risk compounds at lower flows. So, although smolts can wait indefinitely for the next flow event if modeled flows do not meet movement requirements, longer wait times are associated with lower survival probability. Fish that "die" by this rule within the model are classified as "unsuccessful" and stop movement at their location of death. Smolts that are unable to reach the ocean within the model time frame due to flow conditions are also classified as "unsuccessful. Model outputs include final locations and passage time by reach for all successful and unsuccessful migrants.

Smolt downstream movement rates are based on average daily steelhead smolt migration rates that were reported in the literature and adjusted for flow. An average migration rate of 7.33 mi/day (0.31 mph) was assumed based on studies from Central and Southern California (Manning et al. 2005, Kelley 2008, Sandstrom et al. 2013). To account for known increases in migration rate with increasing flow (Smith et al. 2002), a movement-flow relationship was developed by relating water velocity measurements taken over a range of flow to fish migration rate using a beta distribution (Figure 6-22).

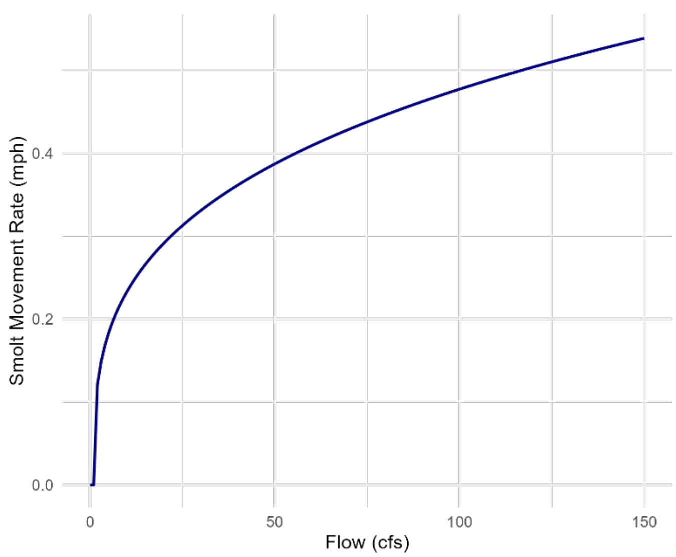

Figure 6-22. Assumed smolt movement rate/flow relationship.

Passage requirements for smolts are ≥3 cfs for passage from Lopez Dam to Tar Spring Creek confluence, and ≥5 cfs for Tar Spring Creek confluence to the ocean. The same lagoon opening rule applied to the adult ABM was applied here: The lagoon sandbar is assumed to require flows of at least 25 cfs (measured at 22nd Street Bridge) for at least 24 hours to open. Once these conditions are met, the lagoon is assumed to stay open until flows drop below 5 cfs for at least 24 hours. If these conditions are met when a smolt arrives, it can hold indefinitely in the lagoon while continuing to be subjected to the hourly survival function.

ABM Results

ABM results of modeled flows indicate that flows are sufficient for smolts to migrate from AG Creek to the ocean during most years (Table 6-8). Under the LDRP there would be an increase in years when steelhead smolts would have access to migrate to the ocean from the watershed, and an increase in the years that more than half the smolt population has access from the watershed, relative to Existing Conditions.

Table 6-8. Proportion of modeled years where no smolts outmigrated, proportion of years where at least 50% of smolts outmigrated, and average proportion of smolts that were able to complete their outmigration under each scenario.

	Pre-dam Flow Conditions	Existing Flow Conditions	LDRP
No Outmigration	7%	16%	0%
≥50% Outmigration	59%	29%	34%
Average % Outmigration	61%	32%	38%

Under the LDRP, there is an increase in the number of days that downstream migration is supported relative to Existing Conditions (Table 6-8). The pattern of increased downstream access to the ocean is apparent in the example wet water year of 1996 for example, when under Existing Conditions 70% of simulated fish have access to the ocean, whereas under the LDRP, 74% have access to the ocean (Figure 6-23).

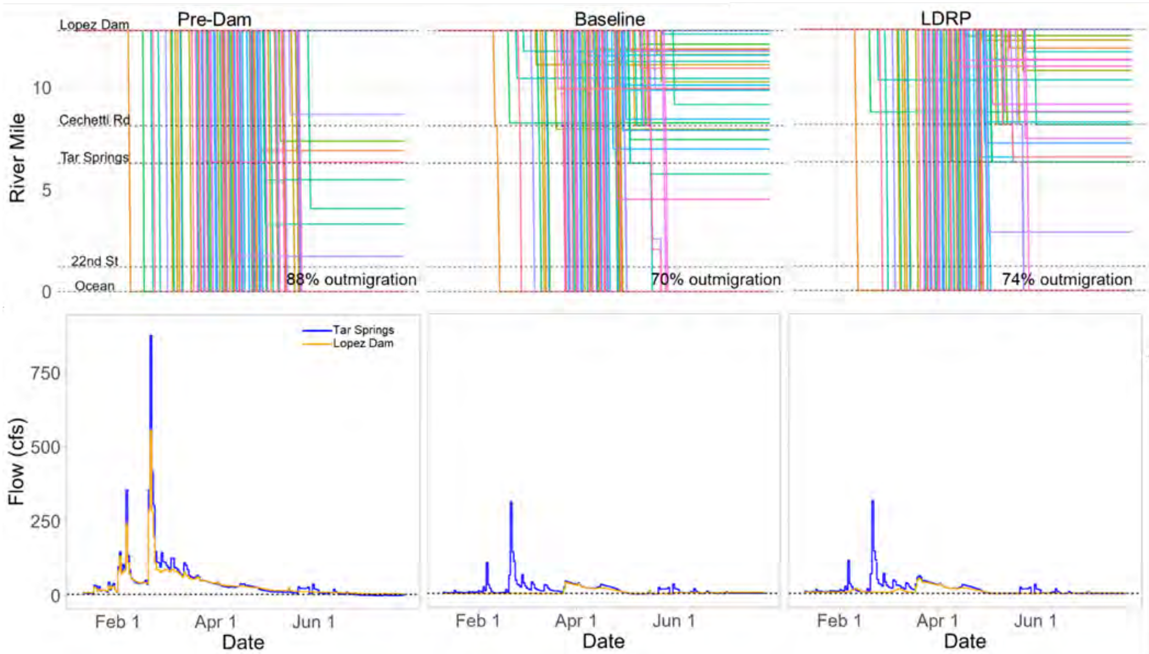

Figure 6-23. An example of simulated fish migration paths (top row) and modeled flows at Tar Spring Creek and at Lopez Dam (bottom row) for all scenarios during a wet water year (1996).

In a median water year, such as 2010, two migration pulse flows would occur under HCP proposed releases, and migration conditions are modeled to provide access to 37% of the simulated run from the watershed, rather than 27% under existing conditions (Figure 6-24).

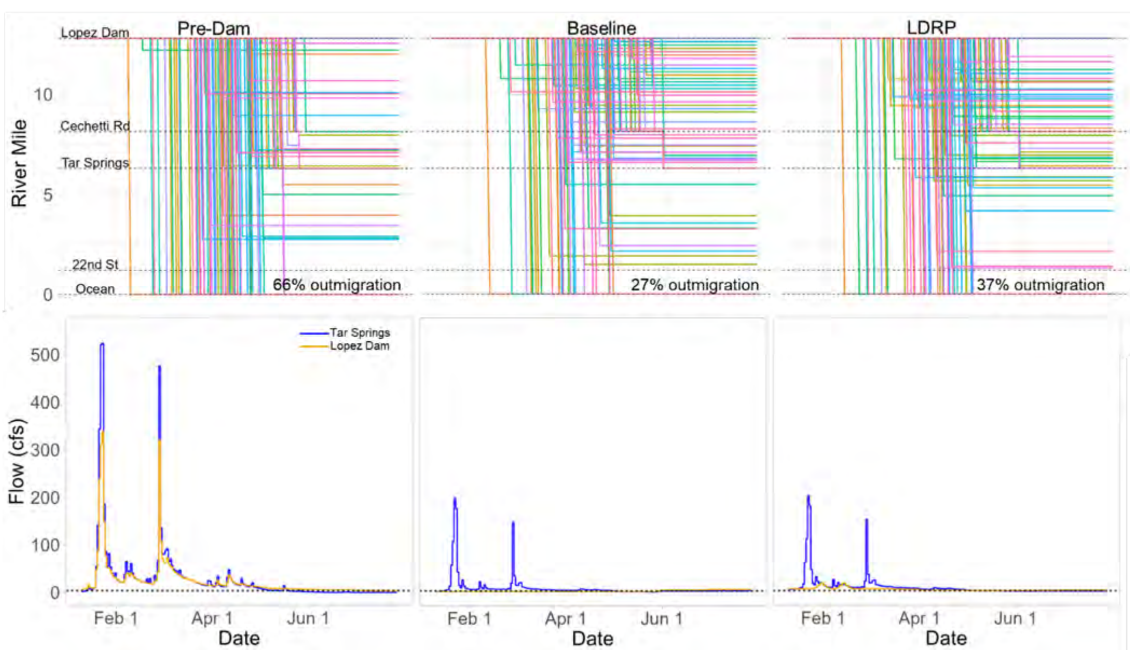

Figure 6-24. An example of simulated smolt migration paths (top row) and modeled flows at Tar Springs Creek and at Lopez Dam (bottom row) for all scenarios during a median water year (2010).

In a dry water year, such as 1994, one migration pulse flow is released under the HCP proposed LDRP, in addition to baseflows that provide suitable downstream migration conditions for much of the winter and early spring, and overall 17% of the simulated run has access to the ocean, whereas under existing conditions only 5% have access from the watershed (Figure 6-25).

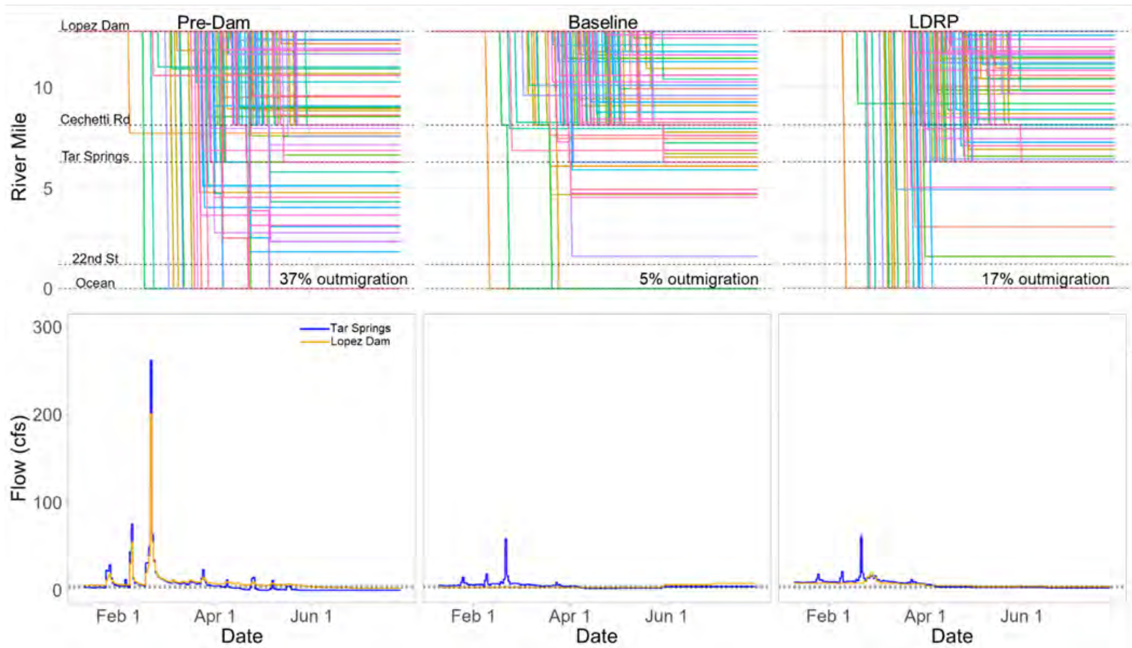

Figure 6-25. An example of simulated smolt migration paths (top row) and modeled flows at Tar Springs Creek and at Lopez Dam (bottom row) for all scenarios during a dry water year (1994).

During dry and very dry years under the Pre-Dam scenario there are years when flows are too low to support smolt migration (e.g., 2013, 2014, 2015, and 2022). Under the LDRP scenario, flow releases ensure that at least a small number of smolts would be able to reach the ocean under all modeled water years (see Figure 6-26 for an example of a recent dry year where smolts were able to migrate under LDRP but not under Pre-Dam conditions).

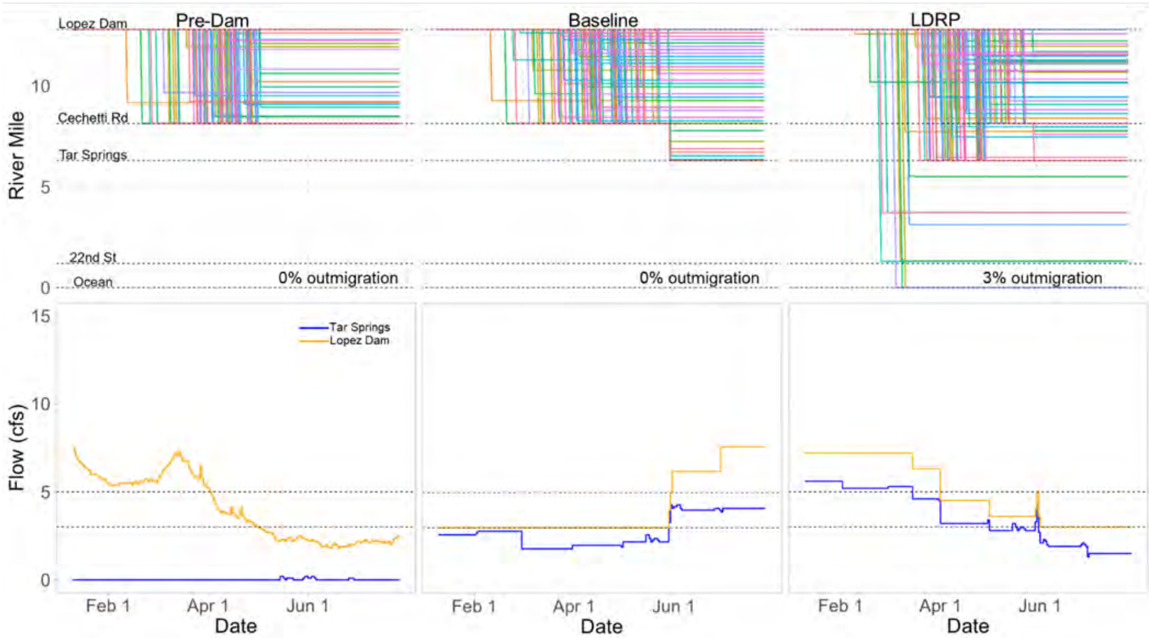

Figure 6-26. An example of simulated fish migration paths (top row) and modeled flows at Tar Spring Creek and at Lopez Dam (bottom row) for all scenarios during a dry year (2022).

ABM Sensitivity Testing

Sensitivity analysis is critical for the development and evaluation of decision support models, such as the smolt ABM. It involves systematically varying model input parameters to determine their impact on key model outputs and behavior (Saltelli et al. 2000, Pianosi et al. 2016). Sensitivity analysis was used on the smolt ABM to evaluate the impact of varying key parameters on model output, i.e., smolt outmigration success. The sensitivity analysis focused on four key parameters that were assumed to influence smolt survival to the ocean:

1. **Movement criteria.** Default flow in the smolt model for fish to be able to move from Lopez Dam to Tar Spring was 3 cfs, and from Tar Spring the ocean was 5 cfs, based on Stillwater Sciences (2022a). Values tested for the upstream reach included 1, 3, and 6 cfs; and for the downstream reach 2, 5, 7, and 10 cfs to determine how sensitive fish survival to the ocean was to a range of minimum fish passage flow values.
2. **Median smolt initiation date**. The default median smolt migration initiation date was day 195 of the hydrologic year (April 12), estimated from Fukushima and Lesh (1998). Values were tested from 135 to 255 in increments of 30 to determine how sensitive fish survival was to varying migration timing.
3. **The scalar for the movement/flow relationship**. The default value for the scalar in the movement function is 1.1; however, values of 0.9, 1.0, 1 .2, and 1.3 were tested to determine model sensitivity to this relationship.
4. **Lagoon Sandbar Opening.** The assumed sandbar breach requirement is 25 cfs for 24 hours at 22nd Street Bridge. Required flows to breach sandbar with values of 15, 20, 25, 30, and 35 cfs were tested.

For each of the four parameters, the specified range of values above was tested while holding the other parameters at their default values. Results are presented as mean ± SEM proportion of smolts that reach the ocean under all modeled water years under each of the 3 operational scenarios. Analyzing these results will provide insight into which parameters the model is most sensitive to and whether reducing uncertainty would be of benefit.

The smolt ABM assumes that smolt migration velocity increases logarithmically with increasing flow (aka fish velocity initially increases rapidly with increasing flow and then the rate of increase slows down as flows get higher) (Figure 6-27). To test this assumption, four additional curves were assessed (Figure 6-27).

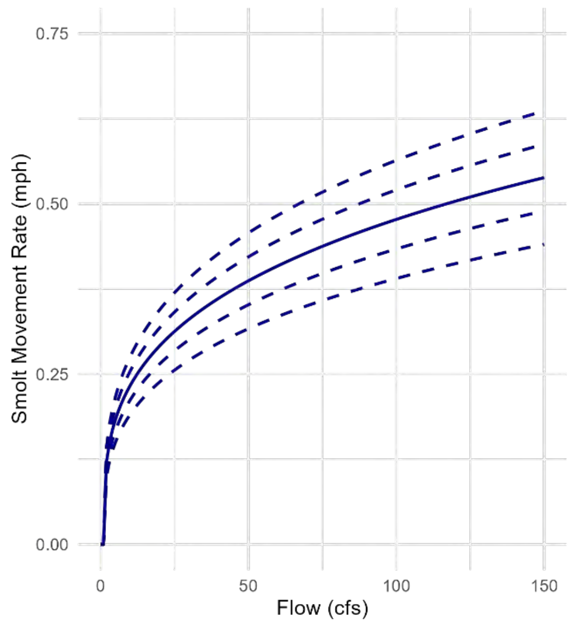

Figure 6-27. Smolt movement rate relationships tested in sensitivity analysis.

Based on sensitivity testing, the mean proportion of successful smolt outmigrants only increases marginally when fish are assumed to move faster at lower flows. However, relationships between scenarios do not appear to change significantly between movement scalar values (Figure 6-28), and therefore, this variable does not have a large influence on interpretation of model results.

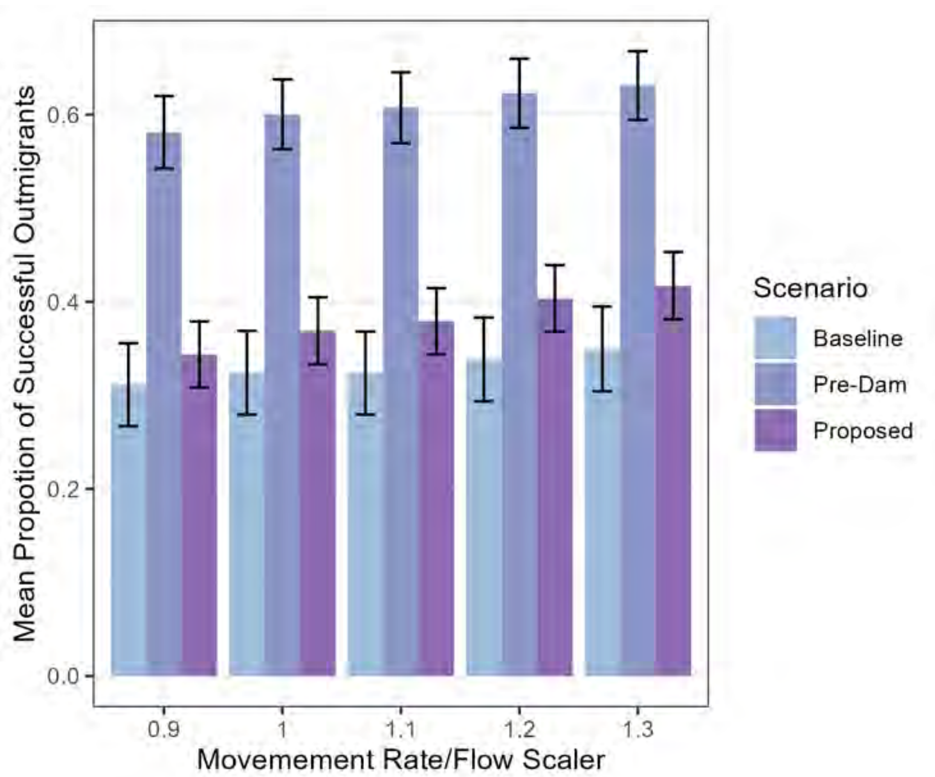

Figure 6-28. Agent based model sensitivity testing the effect of movement rate on mean proportion of successful outmigrants.

The smolt ABM assumes that for the lagoon sandbar to open, 22nd Street flows must reach or exceed 25 cfs for at least 24 hours. To test the sensitivity of model outputs to this assumption, required flows of 15, 20, 25, 30, and 35 cfs for 24 hours to breach the lagoon sand bar were tested (Figure 6-29). Within the tested range, it does not appear that lagoon breach flow requirements significantly alter model outcomes.

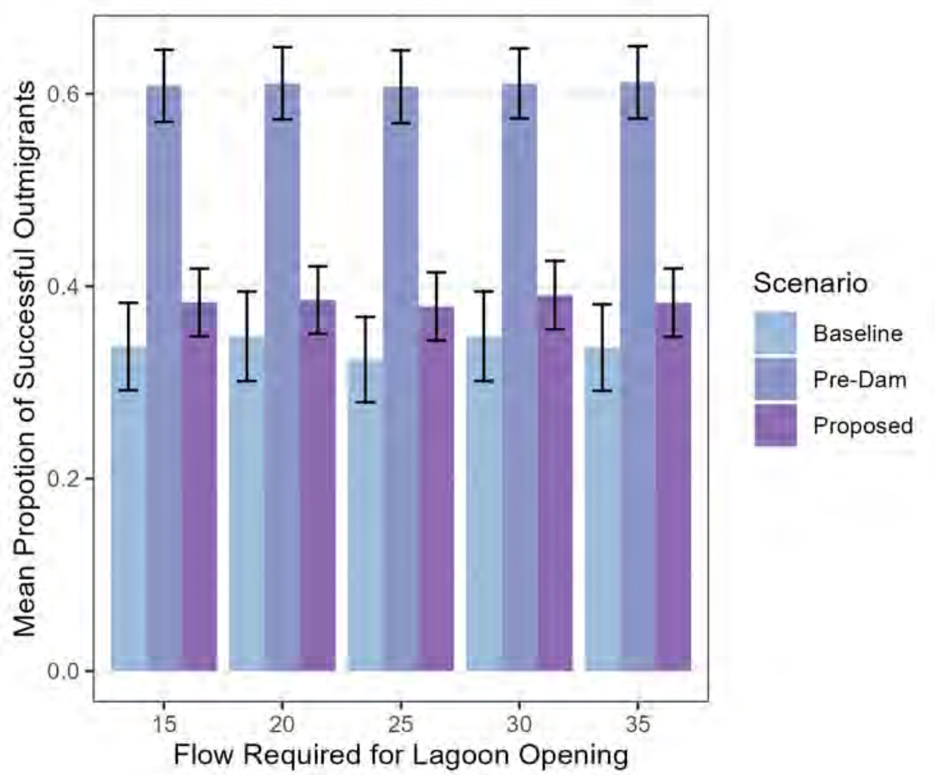

Figure 6-29. Agent based model sensitivity testing the effect of flow requirements for lagoon opening on mean proportion of successful outmigrants.

The smolt ABM assumes that flow must be at least 3 cfs for smolts to successfully migrate downstream from Lopez Dam to Tar Spring Creek. To test the sensitivity of model outputs to this assumption, minimum flows of 1, 3, and 6 cfs were tested (Figure 6-30). If minimum flow requirements are assumed to be as high as 6 cfs, the model would still predict an improvement relative to Existing Conditions, albeit less of an improvement. Under the HCP program, monitoring will include assessing minimum fish passage flow requirements in the reach from Lopez Dam to Tar Spring Creek (MM-03), as described in Section 7.4.1.

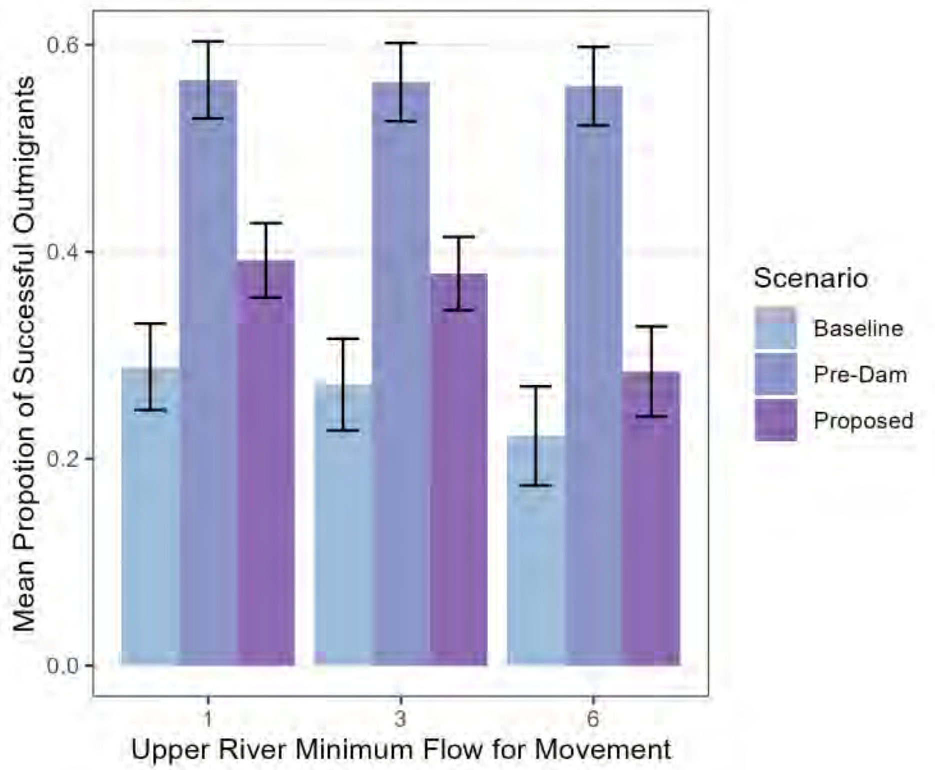

Figure 6-30. Agent based model sensitivity testing the effect of minimum smolt migration flows assumed for the reach from Lopez Dam downstream to Tar Spring Creek.

The smolt ABM assumes that flow must be at least 5 cfs for smolts to successfully migrate downstream from Tar Spring Creek to the lagoon. To test the sensitivity of model outputs to this assumption, minimum flows of 2, 5, 7, and 10 cfs were tested (Figure 6-31). If minimum flow requirements are assumed to higher than 7 cfs, the model would still predict an improvement relative to Existing Conditions, albeit less of an improvement. Under the HCP program, monitoring will include assessing minimum fish passage flow requirements in the reach from Tar Spring Creek to the Lagoon (MM-03), as described in Section 7.4.1.2.

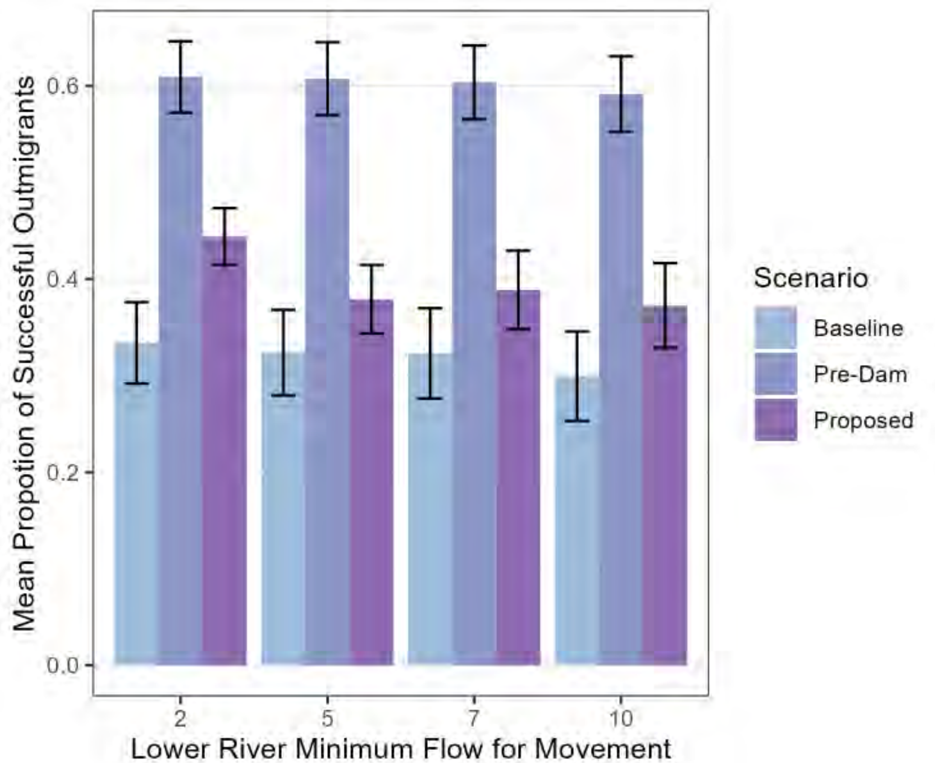

Figure 6-31. Agent based model sensitivity testing the effect of minimum smolt migration flows assumed for the reach from Tar Spring Creek downstream to Arroyo Grande Lagoon.

Estimate of Take and Habitat Surrogates

To estimate potential take of steelhead smolts as a result of implementation of the LDRP during the permit term, we modeled smolt migration from the base of Lopez Dam and assumed that there is take of smolts if they would have migrated from AG Creek to the lagoon during pre-dam conditions but not under LDRP. We did not evaluate whether the simulated smolts prevented from migrating downstream would smolt the following season or remain resident in AG Creek and whether their probability of survival is higher or lower as a result.

Based on the ABM results, the LDRP results in a 23% average annual reduction in smolt production relative to if the LDRP were not modifying releases from Lopez Dam (Table 6-8). This proportion of the assumed annual and total smolt population (Table 6-2) equates to an average annual take of 80.5 smolts, and a total for the permit term (30 years) of 2,415 smolts that would be produced from AG Creek but for the effects of LDRP. This is a conservative estimate (high estimate, and protective of the resource), since any smolts initiating migration further downstream than Lopez Dam would in actuality would experience higher survival, since the migration distance, flow requirements, and predation risk would be lower.

As described in Section 7.4 *Monitoring and Adaptive Management*, substantial monitoring and adaptive management will be conducted to ensure that the Lopez Release Program results in sufficient flows to support steelhead smolt migration. Smolt migration measurable objectives and monitoring are included in the AMP (Table 7-1) that includes assessing and reporting on frequency, duration, water depths, and magnitude of migration opportunities. Results of monitoring will be presented to the TAC, and deficiencies in smolt migration conditions will be addressed collaboratively with Adaptive Management Actions that could include revised releases or other actions to improve migration conditions.

Summary of Smolt Migration

Similar to adult upstream migration opportunities, outmigration opportunities for steelhead juveniles/smolts in AG Creek would increase under the proposed LDRP during the permit term compared to baseline conditions. Compared to baseline conditions, the annual median number of suitable passage days for juvenile outmigration would be increased slightly (Table 6-8).

In addition, there would be an increase in the temporal distribution of smolt out migration opportunities, with flows occurring in March, April, and May depending on annual conditions. Climate change has resulted in an observed mismatch between ocean entry of salmonid smolts and the productivity of prey species (Wilson et al. 2023). Increased diversity of smolt migration opportunities may increase steelhead population resiliency to climate change (Carr-Harris et al. 2018).

These increases in migration opportunities will provide sufficient migration opportunities to support the AG Creek population, since there will be extensive opportunities every year, including dry water years, to support downstream migration. Under the LDRP, migration opportunities for smolts in all years is a substantial improvement over Existing Conditions, is similar to pre-dam conditions, and therefore results in an overall benefit to steelhead and their critical habitat.

Ecological Function and Flow Variability

Under the LDRP, flow variability will increase substantially above Existing Conditions. As illustrated in Figure 6-32, drier water years have much lower peak flows, and fewer pulses than wetter water years, reflecting annual variation in precipitation that occurs in the Mediterranean climate of this DPS. Differences are apparent between years even within the same water year type in the magnitude of baseflows, and the frequency, timing, and duration of peak flow events. This inter-annual flow variability will support increased spatial distribution of spawning by supporting adults accessing different portions of the watershed in different years (e.g., Tar Spring Creek, Los Berros Creek, and throughout the mainstem), and geomorphic processes such as spawning gravel deposition and floodplain maintenance (Poff et al. 1997, Kondolf et al. 2013) in conjunction with sediment augmentation (CM-3, Section 5.4.3). Under the LDRP, ecological functions of a natural hydrograph, such as winter and spring pulse flows, occur more often and are of higher magnitude than occur under baseline conditions, increasing adult steelhead migration opportunities relative to baseline conditions. Wet-season peak flows continue to occur in most years January through March, and are of higher frequency and magnitude than occur under baseline conditions, likely contributing to geomorphic processes. Wet-season and dry-season baseflows are similar to baseline conditions and will continue to provide summer steelhead rearing downstream of Lopez Dam where during most years none would have occurred under Existing Conditions. Inter-annual and intra-annual flow variability could be higher under the LDRP than occurs under Existing Conditions. It is predicted that under the LDRP there will be substantial differences in occurrence of peak flows between dry and wet water years, with some variation in baseflows between years based on water year type (Figure 6-32). Intra-annual flow variability under the HCP will be increased in comparison with baseline conditions, with peak migration flows occurring primarily during the wet season, but with little variation in baseflows between the wet and dry season (Figure 6-32). Seasonality of baseflows improves under the LDRP, with low summer flows and high winter flows, cited by Yarnell et al. (2015) as crucial to prevent suitable conditions for non-native species (Kiernan and Moyle 2012) and to reduce accumulation of silt and improve habitat diversity (Moyle and Mount 2007). In addition, under the LDRP, downstream of Lopez Dam to Tar Spring Creek will have relatively low temperatures well suited for steelhead rearing (Section 2.1.5.1) and experience periodic high flows that support conditions more favorable for native species. In addition, proposed habitat restoration (CM-3, Section 5.4.3) will address channel simplification within this reach that appears related more to a reduction in sediment supply than to high baseflows during the dry season (Section 2.1.7). Therefore, there likely will be no measurable impact of the seasonal patterns in baseflows under the LDRP on steelhead.

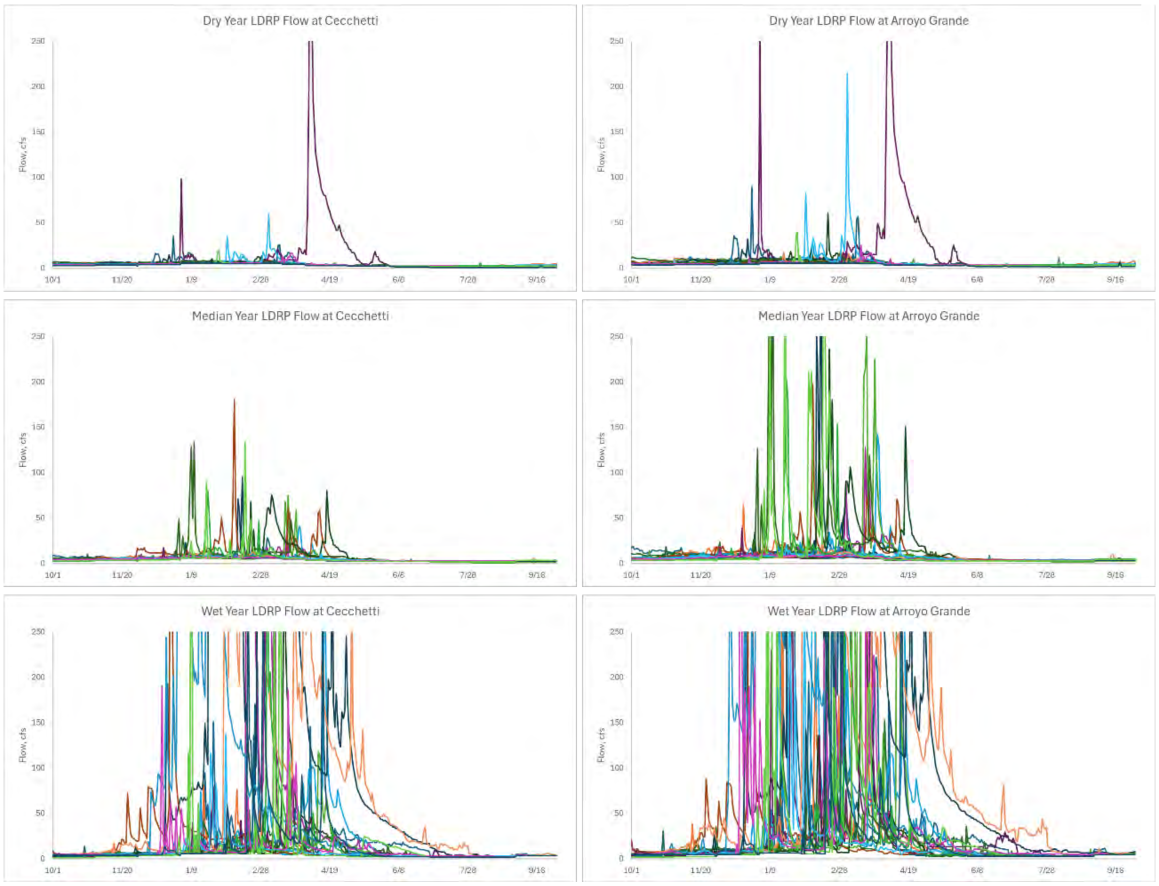

Figure 6-32. Daily average flow (cfs) during dry, median, and wet water years (1968 to 2024) under the proposed LDRP in Arroyo Grande Creek at Cecchetti Road and Arroyo Grande Gage.

Flow variability is even more pronounced further downstream near Tar Spring Creek confluence, where accretion from tributaries results in pronounced flow variability (Figure 6-32). Downstream of Tar Spring Creek baseflows are substantially higher in winter than summer, and there are frequent precipitation-driven high flow events during winter and spring, with noticeable differences in baseflows and increased frequency and duration of high flows between drier and wetter years (Figure 6-32).

Overall, predicted flow variability under the LDRP appears sufficient to maintain key elements of a variable and natural hydrograph, and will benefit steelhead life history overall. As described by Poff et al. (1997), mimicking key attributes of the natural hydrograph, and certain geomorphic processes, provides ecological benefits. There are many functions of instream flows that support steelhead throughout the year, including sufficient flow for adult and smolt migration, spawning, winter and summer rearing, and essential geomorphic processes (CEFWG 2021). Under the LDRP, intra-annual flow variability will be increased, including increased minimum adult and smolt migration flows, sufficient to support and improve flow function for the anadromous life history (Kendall et al. 2015).

Pre-Dam Flow Comparison

As noted in Section 1.8, the District submitted a draft HCP to NMFS in 2004, which included among other things a dam release proposal developed by the District. NMFS provided detailed analysis and evaluation of that proposal in a letter to the District (NMFS 2004). In connection with the development process for this HCP, the District coordinated closely with USFWS and NMFS on various key components of the HCP, including specifically the LDRP. During those discussions, NMFS suggested that the LDRP account for the concerns and recommendations presented in NMFS' 2004 letter. The HCP addresses the recommendations set forth in NMFS 2004 letter in the following ways:

- For a "Pre-impact" scenario the District analyzed "Pre-Dam" flow conditions, which represents the instream flow conditions in AG Creek as they would have been prior to construction of the dam and prior to the listing of steelhead.
- Rather than the "Post-impact" scenario that does not take into account the proposed HCP operations, the scenario analyzed is the current LDRP since that is the release plan proposed in this HCP.
- Rather than utilizing the approach suggested by NMFS in 2004 of using monthly data from 1940 to 1967 compared with monthly data from 1969 to 2000 to inform flow, the HCP uses a flow model (Section Appendix B) based on hydrology from 1969 through 2024 to compare these two conditions. Using the same hydrology for analysis removes potential biases, such as changes in hydrology that could have occurred from climate change.
- In addition to analyzing mean monthly data, the District also analyzed mean daily data.
- In addition to modeling flows at the location of Lopez Dam, the District also analyzed the comparison at the Arroyo Grande gage to evaluate conditions downstream of Lopez Dam.

The results indicate that the LDRP flows at the Dam are slightly less than the February, March and April 25% Quartile Pre-Dam flow, but equal or exceed those flows for the rest of the year. Figure 6-33 presents monthly data comparing the LDRP flows, shown in green, to the Pre-Dam condition, shown in orange, against the 25–75% Quartile flow range, shown as black vertical lines. This comparison is similar to the analysis performed by NMFS (2004). The analysis was also performed with daily data, shown in Figure 6-34. The median LDRP flow at the Dam is shown in purple and the Pre-Dam condition flow is shown in orange. The 25% to 75% Quartile LDRP daily flows are shown as a dark gray area. Most of the time the purple line overlies the dark gray area, however, there are occurrences in the February through April period where flows exceed the median. The 25% to 75% Quartile Pre-Dam daily flows are shown as a light gray area. This representation provides more information about the flow variability than the monthly data. Median LDRP flows are higher than the median Pre-Dam flows from July through October.

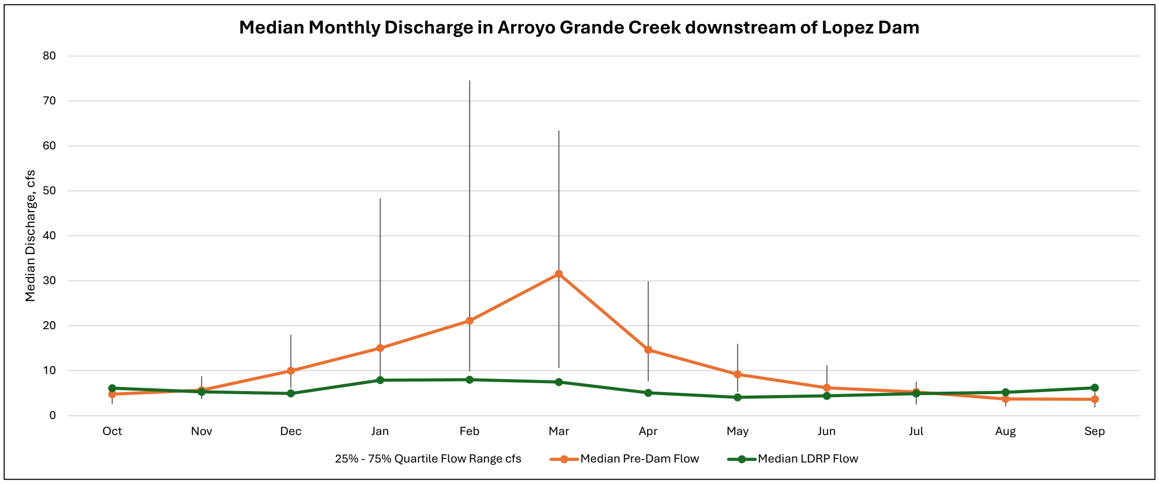

Figure 6-33. Median monthly flow in Arroyo Grande Creek downstream of Lopez Dam, following NMFS (2004) analytical approach. LDRP flows, shown in green, Pre-Dam condition, shown in orange, are plotted against the 25%–75% quartile flow range, shown as black vertical lines.

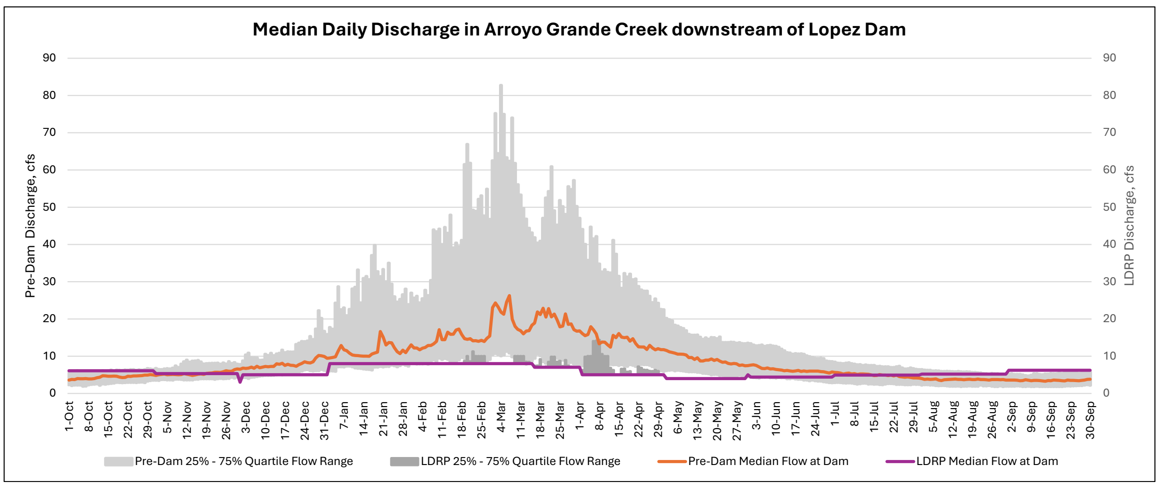

Figure 6-34. Median daily flow in Arroyo Grande Creek downstream of Lopez Dam, following NMFS (2004) analytical approach. Median LDRP flow at the Dam is shown in purple and the Pre-Dam condition flow is shown in orange. The 25% to 75% quartile LDRP daily flows are shown as a dark gray, and the 25% to 75% quartile Pre-Dam daily flows are shown as a light gray area.

The results also indicate that the LDRP flows at the Arroyo Grande gage are always within 25–75% Quartile flow. Figure 6-35 presents monthly data comparing the LDRP flows, shown in green, to the Pre-Dam condition, shown in orange, against the 25%–75% Quartile flow range, shown as black vertical lines. The analysis was also performed with daily data, shown in Figure 6-36. The median LDRP flow is shown in purple and the Pre-Dam condition flow is shown in orange. The 25% to 75% Quartile LDRP daily flows are shown as a dark gray area. The 25% to 75% Quartile Pre-Dam daily flows are shown as a light gray area. At the Arroyo Grande gage, the LDRP flows are always within the 25–75% Quartile flow range. Median LDRP flows are higher than the median Pre-Dam flows from June through December.

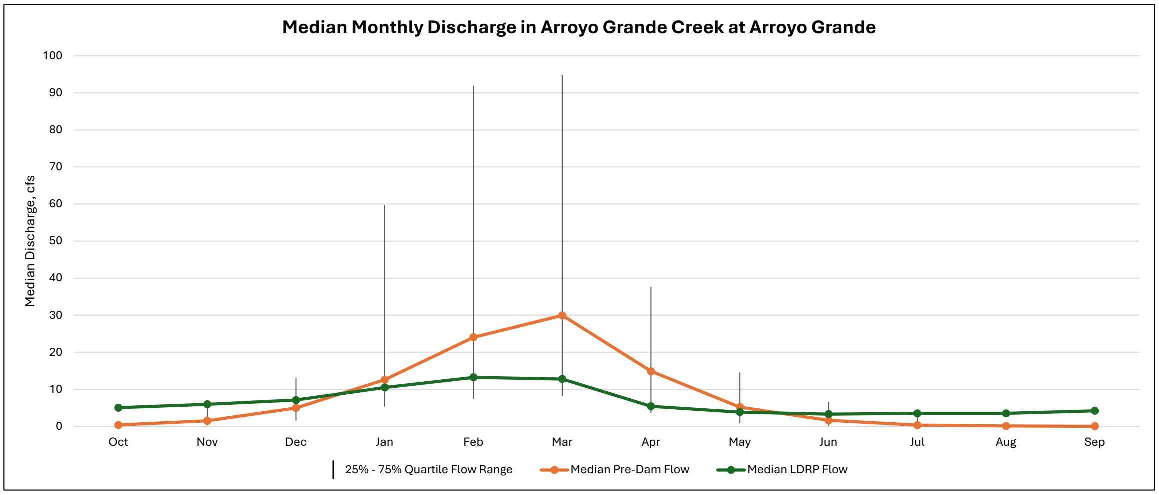

Figure 6-35. Median monthly flow in Arroyo Grande Creek at Arroyo Grande gage, following NMFS (2004) analytical approach. The LDRP flows are shown in green, Pre-Dam condition is shown in orange, plotted against the 25%–75% quartile flow range, shown as black vertical lines.

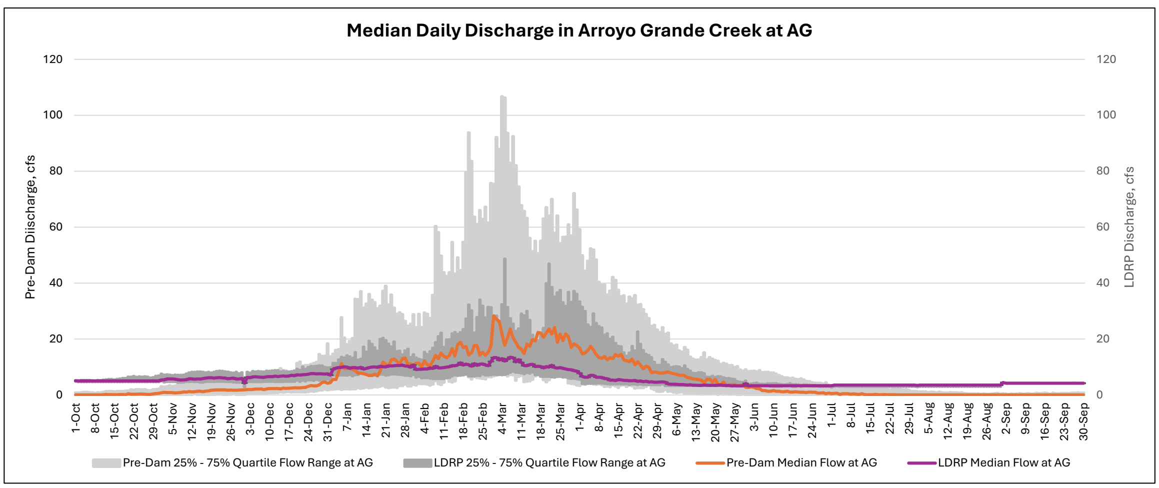

Figure 6-36. Median daily flow in Arroyo Grande Creek downstream of Lopez Dam at Arroyo Grande Gage, following NMFS (2004) analytical approach. The median LDRP flow is shown in purple and the Pre-Dam condition flow is shown in orange. The 25% to 75% quartile LDRP daily flows are shown as a dark gray area, and the 25% to 75% quartile Pre-Dam daily flows are shown as a light gray area.

6.1.5.2 Conservation Measure 2: Assisted Migration for Steelhead at Lopez Dam

Under the HCP, assisted migration of steelhead, if practicable, would be achieved at Lopez Dam through trapping juvenile and adult fish (CM 2 Section 5.4.2). Very few assisted migration programs have been implemented for steelhead in California watersheds. There are substantial uncertainties to consider in an experimental program at Lopez Dam, including how many adults could be captured downstream of Lopez Dam, if adults released in Lopez Canyon Creek will spawn or instead attempt to migrate downstream, how many juveniles can be captured migrating downstream, whether potential smolts can be successfully trapped within tributaries prior to entering Lopez Reservoir, whether juveniles released downstream of Lopez Dam will migrate as smolts to the ocean or residualize within AG Creek, permitting and regulatory challenges, and other uncertainties.

In addition, there are factors outside the scope of this HCP and the control of the District that could potentially impact an anadromous steelhead population, if one were reconnected to habitat upstream of Lopez Dam. NMFS (2024) contends that because of the relatively undisturbed conditions and perennial cool water in the headwater streams of Lopez Canyon Creek and other tributaries to Lopez Lake, a majority of the most suitable and reliable steelhead over-summering/refugia habitat within AG Creek watershed is located within these tributaries. However, there are several low-water crossings and culverts in Wittenberg Creek, Lopez Canyon Creek, and AG Creek described in Stillwater Sciences (2023) and NMFS (2024) that are not likely barriers to migration but could be seasonal restrictions or impediments to upstream migration. There are also portions of Lopez Canyon Creek that intersect with a seasonal road. In addition, there is a high potential for predation on smolts in Lopez Lake, if they migrated downstream and were not captured at trap(s) upstream of the reservoir. A multitude of factors may limit the capacity of the upstream habitat to benefit steelhead and will therefore be carefully evaluated in the assisted migration program.

Because of the uncertainty in reconnecting a steelhead population with habitat upstream, this approach includes establishing a TAC composed of District and agency experts to inform implementation, review results of initial efforts, and guide next steps. A phased approach would provide opportunities to evaluate key uncertainties, inform future actions under an adaptive management framework, and distribute costs over time.

Estimate of Take

Assisted migration of adult steelhead, if successful, will result in take via capture and handling adult fish at an upstream migration weir and transporting them in a vehicle for upstream release. The upstream migration weir may also incidentally capture juvenile or sub-adult steelhead, which will be removed from the trap and placed downstream. Stress induced from assisted migration programs have been shown to reduce disease resistance, swimming ability, osmoregulatory ability, and can increase pre-spawn mortality (Maule et al. 1988, as cited in Moyle and Lusardi 2017; Kock et al. 2021). Fallback is another potential effect of assisted migration programs, although fallback past Lopez Dam is unlikely because flows high enough to support migration over the spillways are rare. Fallback to the reservoir and/or reservoir holding could cause migration delay, or adults that end up in the reservoir could fail to find suitable spawning habitat. On the Carmel River, the assisted migration program at Los Padres Dam has shown high survival rates of adult steelhead after being transported upstream (Boughton et al. 2020). Steelhead entering the downstream trap are held for up to 24 hours prior to being transported to Los Padres Reservoir. Boughton et al. (2020) found that of 84 PIT tagged adults released upstream of Los Padres Dam, 83 were subsequently detected upstream of Los Padres Reservoir. Spawning surveys conducted after the release of these steelhead indicate that steelhead are successfully spawning in the Carmel River above Los Padres Reservoir, and pre-spawn mortality associated with assisted migration appears to be low. Based on the observations at Los Padres Dam, of all the steelhead captured and handled, less than 5 percent injury and 2 percent mortality is expected for all life stages.

Based on ABM results (Section 6.1.5.1), it is estimated that on average, 77.6% of the annual adult migration run could reach Lopez Dam, and therefore potentially be captured in the upstream migration facility. This proportion of the assumed annual and total adult population (Table 6-1) equates to 7.8 adults on average per year, and a total of 239 adults throughout the 30-year permit term that hypothetically could be captured and transported in the assisted migration facility. This equates to annual average injury of 0.39 adults and annual average mortality of 0.16 adults; and a total injury of 12 adults and total mortality of 4.8 adults during the permit term.

Assisted migration of juvenile/smolt steelhead, if successful, will result in take via capture and handling juvenile/smolt steelhead at downstream migration weirs and transporting them in a vehicle for downstream release. The downstream migration weir may also incidentally capture fry or resident life history *O. Mykiss*, which will be removed from trap and placed downstream of the trap. There are no estimates of smolt production from Lopez Creek or other tributaries upstream of Lopez Dam available. Based on the watershed area of Lopez Creek upstream of Lopez Reservoir (~21 mi^2) combined with watershed area of Wittenberg Creek (~3 mi^2), and based on the smolt production estimated in nearby Chorro Creek (~ 229–396 smolts in 2025, Stillwater Sciences et al. 2025) with a watershed area of 43 mi^2, it is roughly approximated that up to around 200 smolts could be produced on average annually in Lopez Creek and captured at a downstream migration facility, or 6,000 smolts during the permit term.

Injury and mortality are never intentional during assisted migration programs, but can occur when capturing, handling, and moving fish (Lusardi and Moyle 2017). For these reasons, downstream assisted migration programs continue to optimize operations to reduce stress to juveniles during transport. While stress cannot be completely avoided, it will be minimized, for example, by using water-to-water transfers, monitoring and making appropriate adjustments in temperature and dissolved oxygen during transport, using flow through technology, and allowing recovery before releasing fish to the downstream environment (Kock et al. 2021).

In the San Joaquin River Restoration pilot study (Sutphin et al. 2018), pre-transport survival of captured juvenile Chinook salmon was 70.6% in 2014, increased to 97.6% in 2015, and 95.1% in 2016 after the installation of a flow diffusing box and second capture box to improve post-capture flow refugia. In-transport survival of Chinook salmon was >99% across all years. These examples suggest that assisted migration programs can achieve high survival rates when implementing appropriate design elements and best management practices (Kock et al. 2021). Incidental take is expected to be less than 5 percent injury and 2 percent mortality of captured/handled/transported steelhead of all life stages. This equates to an annual average injury of 10 smolts and annual average mortality of 4 smolts; and a total injury of 300 smolts and total mortality of 120 smolts during the permit term. Based on the proportion of non-smolts captured in migrant traps in Chorro Creek, up to 93 non-smolting fry or juveniles (parr), and up to 6 migratory resident adults are expected to be captured and released adjacent to the trap annually, or 2,790 parr and 180 resident adults during the permit term. The District would notify NMFS immediately upon discovery that lethal take has occurred.

In addition to potential effects from the capture of smolts, there is also the potential for downstream migrating smolts to avoid the downstream migrant trap and enter Lopez Reservoir. For example, Ohms et al. (2022) observed that 80% of tagged smolts entering Los Padres Reservoir from an upstream tributary were lost (predation, angling, or other factors). Based on trap efficiencies measured in a nearby watershed in the same DPS (Chorro Creek, Stillwater Sciences 2025), it is assumed that a rigid weir full channel spanning trap(s) would have nearly 100% capture efficiency, but that during high flows or other conditions capture ability may be reduced, and on average, 90% of downstream migrants would be captured. Based on the assumed 200 average annual smolts (discussed above), there would be an additional 22 smolts each year on average that would avoid the trap(s) and enter the reservoir. It is assumed that most of these smolts entering the reservoir would perish from predation or angling. However, under Existing Conditions, any downstream migrating juveniles or smolts from tributaries to Lopez Reservoir are subject to the same fate if they migrate to the reservoir, and it is not certain if this would be an increase or a decrease in effects to the population.

Assisted migration will not have adverse effects on critical habitat or any of the primary constituent elements identified by NMFS in the final critical habitat rule. Downstream migrant traps will be placed upstream of designated critical habitat. Upstream migrant traps would be set up and checked frequently to ensure fish can migrate with minimal delay and would not be placed in areas with high quality spawning or rearing habitat.

There are many biological uncertainties regarding the efficacy of an experimental assisted migration program (Section 5.4.2), and these uncertainties will be evaluated by implementing robust monitoring in association with the assisted migration program. Monitoring will include:

- Tissue sampling for genetic analysis and PIT tagging of all adults transported upstream: 239 during permit term;
- Radio tagging subsample of adults transported upstream: 10 during permit term;
- Tissue sampling for genetic analysis and PIT tagging of all smolts transported downstream: 6,000 during permit term; and
- Radio tagging subsample of smolts transported downstream: 100 during permit term.

No intentional lethal take of steelhead will occur while monitoring assisted migration. However, capture and handling, sampling, and tagging may result in lethal and sub-lethal take. Incidental take is expected to be less than 5 percent injury and 2 percent mortality of handled, sampled, and tagged steelhead of all life stages.

Assisted Migration Summary of Effects

Under current conditions most of the suitable steelhead habitat in the AG Creek watershed is upstream of Lopez Dam, particularly within Lopez Canyon and Wittenburg creeks (e.g., NMFS estimates 15.8 miles intrinsic potential perennial habitat upstream of the dam). The current anadromous steelhead population is restricted to approximately 10.8 miles of high potential perennial spawning and rearing habitat downstream of Lopez Dam and within Tar Spring Creek (Stillwater Sciences 2023).

Based on this potential for habitat upstream to aid the recovery of the DPS, the NMFS's Multispecies Recovery Plan (2013) identified providing adult upstream steelhead passage at Lopez Dam as one of the highest priority actions to support the recovery of SCCC steelhead. This was reiterated by NMFS (2024), which strongly supported an experimental steelhead reconnection plan for Lopez Dam. Anadromous adults are more fecund than resident adults, and the overall influence of increased anadromous life history resulting from actions taken under the HCP may result in an increase in abundance and, in conjunction with a connected resident life history, improved resilience of the population to persist through time (Araki et al. 2007, Bell et al. 2011, NMFS 2013, Dagit et al. 2017). If this occurs, the AG Creek steelhead population and the AG Creek *O. mykiss* population in general would be more resilient over the long-term under the HCP. Since steelhead within this DPS stray, it is possible that individuals from other watersheds within the DPS would benefit from increased migration opportunities and increased smolt production, thus benefiting the population viability of the SCCC DPS as well.

Providing for upstream and downstream movement of *O. mykiss* has strong potential to increase the gene flow between *O. mykiss* upstream and downstream of Lopez Dam. Larger and more connected populations benefit from more genetic diversity making populations more resilient to selective pressures such as disease and acute environmental disasters (e.g., fire, flood, and debris flows) all of which are more likely with climate change. There is evidence that propensity for anadromy can be influenced by relatively small amounts of gene flow between resident and anadromous populations (Kobayashi et al. 2024), such as what would occur with a trap-and-haul facility. Increasing genetic diversity within the steelhead population would result in a population that is more resilient than under Existing Conditions (Fluker et al. 2014, Fraik et al. 2021, Winans et al. 2018). While the goal of an assisted migration program is to increase steelhead population viability in the watershed and in the DPS would be substantially improved with assisted migration, primarily as a result of increased smolt abundance, increased spatial structure, and increased genetic diversity (Stillwater Sciences 2023), there are other factors outside the District's control that operate to limit population growth. Nevertheless, assisted migration will improve steelhead habitat connectivity within the plan area relative to Existing Conditions, and create the opportunity for substantial benefits to the population and the DPS.

6.1.5.3 Conservation Measure 3: Habitat Restoration

Sediment Augmentation

The sediment augmentation program will place substantial (> 500 cy) volumes of sediment downstream of Lopez Dam for mobilization further downstream. This will support elements of steelhead critical habitat that are maintained by sediment and geomorphic processes, including spawning gravel quality, BMI habitat, and rearing habitat. The Sediment Augmentation Program will follow best management practices to avoid and minimize effects to steelhead, including working within applicable in-water work periods, monitoring water quality, and placement of sediment outside of the wetted channel. Despite these precautions, turbidity may increase temporarily following sediment placement but would likely return to background levels soon after. Gravel composition, volume, and placement frequency will be determined to mimic and partially restore natural coarse sediment transport processes in AG Creek. The transport and deposition of course sediment is predicted to increase spawning gravel and increase bed elevation, and therefore, the inundation of channel margin habitat at typical baseflows.

As part of the HCP AMP − Validation monitoring of gravel quality and quantity using substrate particle size measurements will be conducted at gravel augmentation sites at five-year intervals or following channel forming flow events (e.g., bank full flow) to verify the sites are functional for spawning and to monitor the longevity of the augmented site.

Overall, implementation of the Sediment Augmentation Program is anticipated to benefit the steelhead population by improving spawning and rearing habitat quantity and quality. The HCP will improve sediment dynamics within the Permit Area relative to baseline conditions, and monitor and adapt to ongoing effects, thus benefiting steelhead.

Pond Conversion

Based on the channel morphology downstream of Lopez Dam (described in Section 3.4), the primary habitat restoration approach for AG Creek downstream of Lopez Dam is augmenting sediment supply. In the event assisted migration is not fully implemented (see Section 5.4.2, CM-2), the District will engage in habitat restoration of a pond reach downstream of Lopez Dam.

Implementation of a pond restoration project will follow best management practices (CM-8) to avoid and minimize effects to steelhead, including working within applicable in-water work periods, monitoring water quality, and careful fish rescue and relocation during any dewatering that will occur, as described in CM-6. The effects of pond conversion habitat restoration will include temporary construction impacts such as localized dewatering/diverting around project construction sites, fish rescue, and relocation (covered under CM-6). All take to individual steelhead associated with the construction of habitat restoration is described in CM-6 Fish Rescue and Relocation.

This Conservation Measure would restore and enhance steelhead habitat by restoring riverine habitat, returning the creek to its historical channel, and adding ecological enhancements to the channel and floodplain. Under Existing Conditions, the ponds increase water temperature during warm months (typically July through September). Filling the ponds will reduce water temperatures in the restored creek channel and downstream, with the greatest improvement when flows are less than 10 cfs. Because the ponds will no longer heat water and discharge the heated water to the creek, the temperature of creek water downstream of the ponds is anticipated to decrease to levels similar to the temperatures occurring upstream of the ponds. The reduction in creek water temperatures will benefit steelhead by providing more suitable rearing habitat. In addition to removing or ameliorating the adverse effects of the ponds, additional objectives of this Conservation Measure are to expand the extent of suitable spawning and rearing habitat for steelhead to a roughly 1,000-ft-long reach of AG Creek.

Based on conceptual designs for the Pond CM-3, should this conservation measure be implemented, over 1,000 ft of channel will be restored, over 5,000 ft^2 of spawning habitat area will be created, and over 5,500 ft^2 of juvenile rearing habitat enhanced with increased habitat complexity, and over 3,500 ft^2 of shallow water for fry rearing in inundated margin habitat at typical spring and summer flows would be created/restored (approximately 3 to 5 cfs). Overall, steelhead are anticipated to benefit from improvements to spawning and rearing habitat relative to Existing Conditions from decreased warm-water conditions conducive to non-native species habitat, and increased spawning and rearing habitat. Habitat restoration is not likely to result in measurable negative impacts to steelhead or destroy or adversely modify their critical habitat.

6.1.5.4 Conservation Measure 4: Biddle Park Culvert Maintenance

Maintenance of the culvert at Biddle Park will follow best management practices (CM-8) to avoid and minimize effects to steelhead, including working within applicable in-water work periods, monitoring water quality, and careful fish rescue and relocation during any dewatering that will occur (if warranted for sediment or debris removal), as described in CM-6. The effects of culvert maintenance may include temporary construction impacts such as localized dewatering/diverting around project construction sites, fish rescue, and relocation (covered under CM-6). Take of individual steelhead associated with the culvert maintenance is described in CM-6 Fish Rescue and Relocation.

Maintaining the Biddle Park Culvert as described in CM-4 will improve conditions for adult and juvenile steelhead migration and habitat connectivity within the Plan Area relative to Existing Conditions, thus benefiting steelhead in the watershed and DPS.

6.1.5.5 Conservation Measure 5: Predator Control Program

Predator management in the Plan Area is anticipated to include mechanical techniques for removing non-native predatory bullfrog and fish. Methods will include electrofishing, in association with fish rescue and relocation (CM-6), and index site juvenile steelhead monitoring (MM-07). All non-native invasive species captured during these activities will be removed and humanly euthanized. No other direct mechanical removal of predators will occur. No intentional lethal take of steelhead will occur. Impacts of the predator control program on SCCC steelhead relating to removal activities are covered under CM-6 and MM-07.

Under the HCP, assisted migration (CM-2, Section 5.4.2) will provide *O. mykiss* that are migrating downstream from tributaries upstream of Lopez Reservoir an alternative to migrating into Lopez Reservoir where invasive species are abundant. Habitat restoration projects downstream of Lopez Dam described in Section 5.4.3 and increased outmigration flows will improve refuge and migration habitat for steelhead to avoid predators.

Collectively, implementation of assisted migration, in conjunction with habitat restoration downstream of Lopez Dam is anticipated to benefit the steelhead population by reducing predation and competition with non-native species. Likewise, predator management will not have negative impacts on critical habitat. It is anticipated that implementation of Conservation Measure 5 will reduce the impact of non-native species on steelhead in comparison to Existing Conditions.

6.1.5.6 Conservation Measure 6: Fish Rescue and Relocation during Localized Dewatering

Various elements of the Conservation Program will involve localized dewatering and fish rescue and relocation efforts during construction, including pond restoration (CM-3) if it occurs, and Biddle Park Culvert Maintenance (CM-4). Although fish rescue and relocation will minimize effects to steelhead by moving them out of harms' way, rescue operations are likely to adversely affect fish through electrofishing, capture, crowding, and acute stress from relocation. Capture efforts will include electrofishing and seine nets to capture all remaining steelhead.

No intentional lethal take of steelhead will occur. In a fish rescue and relocation effort in AG Creek downstream of Tar Spring Creek in 2024, Stillwater Sciences (2024) captured a total of 14 subadult steelhead (no injuries or mortalities occurred) in a 250 ft reach, for an approximate abundance of 6 subadults for every 100 ft of channel. Assuming around 2,100 ft of dewatering for the pond restoration, and up to 250 ft for potential Biddle Park Culvert maintenance, up to 141 steelhead subadults could be captured and handled temporarily before being relocated to suitable habitat. Incidental take is expected to be less than 5 percent injury and 2 percent mortality of encountered steelhead. If lethal take occurs, NMFS and CDFW will be notified immediately upon District discovery of the same.

The localized fish rescue and relocation is not anticipated to negatively impact critical habitat and will minimize any effects to steelhead by relocating them to suitable conditions prior to potential lethal effects from dewatering. Fish rescue during localized dewatering will not destroy or adversely modify critical habitat.

6.1.5.7 Conservation Measure 7: Maintain Flow Gaging Stations

The Conservation Program will include maintaining several gaging stations in AG Creek. The District will develop accurate flow rating curves for each gage. This measure is anticipated to benefit the steelhead population and critical habitat relative to Existing Conditions by providing data that will support real-time management of conditions to ensure suitable fish passage and rearing habitat. No negative impacts to SCCC steelhead or their habitat are anticipated.

6.1.5.8 Conservation Measure 8: Interagency Technical Advisory Committee (TAC)

Organization and implementation of an interagency TAC will provide a structure for fisheries agencies to guide and manage the implementation of the conservation measures and post-permit issuance operations described above. Interagency involvement is anticipated to increase the efficacy and success of Lopez Water Project operations, and benefit steelhead and their critical habitat. No negative effects to steelhead or their critical habitat are expected from the TAC.

6.1.5.9 Conservation Measure 9: Best Management Practices

Most of the BMPs are avoidance and/or minimization measures for other activities that may result in incidental take or modify steelhead habitat, but the BMPs themselves are not expected to adversely affect steelhead or their habitat. This measure is anticipated to benefit the steelhead population and critical habitat relative to existing conditions ensuring measures are used to reduce impacts to steelhead and their habitat.

6.1.6 Monitoring Program

In the process of juvenile rearing monitoring (MM-08), up to 200 juveniles could be captured and handled per year, or approximately 6,000 juveniles over the permit term (Table 6-9). The District intends to PIT tag 100 of these captured juveniles per year from within index sites for the first five years of the permit term, for a total of 500 juveniles in the permit term.

In the process of genetic analysis (MM-10), up to 50 juveniles could be captured and handled upstream, and 50 juveniles downstream of Lopez Dam, or approximately 100 juveniles over the permit term (Table 6-9). The District intends to collect tissue samples for genetic analysis from each of these 100 captured juveniles.

In the process of operating downstream migrant traps for assisted migration (CM-2), up to 25 smolts could be radio tagged (or equivalent technology) and monitored each year, for three years, for a total of 75 smolts in the permit term. All captured smolts (up to 200 annually) will be PIT tagged for the first five years of the permit term, for a total of 1,000 PIT tagged smolts. (Note that total capture in traps is discussed in Section 6.1.5.2 and only take resulting from monitoring is discussed here.)

In the process of operating an upstream migrant adult trap for assisted migration (CM-2), up to 2 adults could be radio tagged (or equivalent technology) and monitored each year, for three years, for a total 6 adults in the permit term. All captured adults (up to 5 annually) will be PIT tagged for the first five years of the permit term, for a total of 25 PIT tagged adults. (Note that total capture in the traps is discussed in Section 6.1.5.2 and only take resulting from monitoring is discussed here.)

Monitoring, while intended to provide a benefit to steelhead and fill key data gaps for Covered Species, would result in take of individuals through harassment (electrofishing, handling, tissue sampling, and tagging) with these monitoring activities anticipated to result in up to 5 percent injury and 2 percent mortality of tagged adults and 5 percent injury and 2 percent mortality of tagged smolts overall. The level of take during monitoring activities will be minimized to the extent possible by using highly trained and experienced staff to conduct the activity and implementation of best management practices in carrying out the methods and protocols.

Table 6-9. Summary of take from monitoring activities.

Covered Activity	Type of Take	Estimated Take – Adults	Estimated Take - Smolts	Estimated Take – Other Juveniles
MM-08 Juvenile Rearing	Capture	0	0	6,000
	PIT tag	0	0	500
	Injury	0	0	5% of captured/tagged fish
	Mortality		2% of captured/tagged fish	2% of captured/tagged fish
MM-10 Genetics	Capture	0	0	100
	Tissue sample	0	0	100
	Injury		0	5% of captured/tagged fish
	Mortality		0	2% of captured/tagged fish
CM-03 Monitoring Assisted Migration[1]	Radio tags	6	75	0
	PIT tags	25	1,000	100
	Injury	5% of captured/tagged fish	5% of captured/tagged fish	5% of captured/tagged fish
	Mortality	2% of captured/tagged fish	2% of captured/tagged fish	2% of captured/tagged fish

[1] Take from capture in the traps is discussed in Section 6.1.5.2 and only take resulting from monitoring is discussed here.

6.1.7 Summary of Take, Impacts of the Taking, and Benefits of the Conservation Program

To fully consider the proposed conservation program, a summary of estimated SCCC steelhead take associated with the Covered Activities and the impacts therefrom is provided below, followed by a summary of the benefits of the program to SCCC steelhead, and an overall conclusion as to the program's merits.

6.1.7.1 Summary of Take

Estimated take of SCCC DPS steelhead over the permit term is summarized in Table 6-10. While this HCP provides estimates of take associated with the LDRP, it is important to note that these estimates were, of necessity, based on limited scientific data and, thus, likely overestimates take of steelhead that will occur over the permit term. Implementation of the LDRP would alter the AG Creek hydrology downstream of Lopez Dam, resulting in fewer potential opportunities for upstream and downstream steelhead migration than would occur but for the LDRP. In most years, the effect is fewer days of migration opportunity and reduced spatial distribution to the reach downstream of Lopez Dam, compared to a pre-dam scenario.

The consequence of fewer migration opportunities is the decrease in anadromous life history production in AG Creek compared to what would be possible under pre-dam hydrology. Anadromous adults are more fecund than resident adults, and the overall effect of reduced adult migratory opportunities can be a potential reduction in the abundance and resilience of the population to persist through time (Bell et al. 2011, NMFS 2013, Dagit et al. 2017). This is apparent in watersheds such as the Santa Maria River and Topanga Creek, where consecutive years of blocked anadromous access occur even during normal or moderate water years, corresponding with a predominant resident life history (Stillwater Sciences and Kear Groundwater 2012, Dagit et al. 2017). Even under the pre-dam scenario 7 percent of years had no migratory access to AG Creek. However, under the LDRP operations, during nearly most years (80 percent) migratory access will occur for at least several days, supporting an anadromous life history in the watershed.

Adults prevented from migrating are exposed to increased risk of mortality, but may remain in the population, either by delaying migration into AG Creek or other watershed until the following year (Moyle et al. 2008) or straying to another watershed in the region (Clemento et al. 2008, Donohoe et al. 2021, Garza et al. unpubl. data, National Marine Fisheries Service, Southwest Fisheries Science Center, Santa Cruz, California). Adult steelhead that are prevented from migrating may contribute to the DPS if they can locate suitable migration conditions in an alternative watershed in the region. Straying of adult steelhead appears to be common in the SCCC DPS (Clemento et al. 2008, Donohoe et al. 2021, Garza et al. unpublished data, National Marine Fisheries Service, Southwest Fisheries Science Center, Santa Cruz, California), which plays an important role in population spatial structure and genetic diversity, both of which support population viability (McElhaney et al. 2000). Adults that are prevented from migrating upstream in AG Creek may migrate up Pismo Creek, SLO Creek (continuous migratory access from perennial open bar), Chorro Creek (perennial access), or several other watersheds in the DPS. Selecting an alternative watershed for migration could increase the risk of exposure to predation, or exhaustion, potentially resulting in mortality.

Table 6-10. Estimated average annual potential take of steelhead during permit term.

<table>
<tr><th>Covered Activity</th><th colspan="2">Type of Take</th><th>Estimated Potential Take (average annual) – Adults</th><th>Estimated Potential Take (average annual) – Smolts</th><th>Estimated Potential Take (average annual) – Other Juveniles</th></tr>
<tr><td>CM-1 Lopez Downstream Release Plan</td><td colspan="2">Harm</td><td>4.6</td><td>80.5</td><td>0</td></tr>
<tr><td rowspan="9">CM-2 Assisted Migration</td><td colspan="2">Capture, handle, tissue sample, transport</td><td>8.0</td><td>200</td><td>6 resident adults, and 93 non-smolt parr</td></tr>
<tr><td rowspan="2"></td><td>Injury</td><td>5% of captured, sampled fish</td><td>5% of captured, sampled fish</td><td>5% of captured, sampled fish</td></tr>
<tr><td>Mortality</td><td>2% of captured, sampled fish</td><td>2% of captured, sampled fish</td><td>2% of captured, sampled fish</td></tr>
<tr><td colspan="2">Reservoir predation (mortality)</td><td>0</td><td>22</td><td>0</td></tr>
<tr><td colspan="2">Radio tags</td><td>10 (total)</td><td>100</td><td>0</td></tr>
<tr><td colspan="2">PIT tags</td><td>239 (total)</td><td>6,000</td><td>0</td></tr>
<tr><td rowspan="2"></td><td>Injury</td><td>5% of tagged fish</td><td>5% of tagged fish</td><td>5% of tagged fish</td></tr>
<tr><td>Mortality</td><td>2% of tagged fish</td><td>2% of tagged fish</td><td>2% of tagged fish</td></tr>
</table>

Covered Activity	**Type of Take**		**Estimated Potential Take (average annual) – Adults**	**Estimated Potential Take (average annual) – Smolts**	**Estimated Potential Take (average annual) – Other Juveniles**
CM-6 Fish Rescue and Relocation	Capture, handle		0	0	141 total
		Injury	0	0	5% of captured fish
		Mortality	0	0	2% of captured fish
MM-08 Monitoring Juvenile Rearing	Capture, handle		0	0	6,000 total
	PIT tag		0	0	500 total
		Injury	0	0	5% of captured/tagged fish
		Mortality	0	0	2% of captured/tagged fish
MM-10 Monitoring Genetics	Capture, handle, tissue sample		0	0	100 total
		Injury	0	0	5% of captured/sampled fish
		Mortality	0	0	2% of captured/sampled fish

Adults may delay migration and remain in the ocean until the next migratory opportunity within the AG Creek. Moyle et al. (2008) suggested relatively large southern California steelhead may be the result of additional years of ocean rearing due to droughts that preclude upstream migration in some years. Thus, the elimination of migration opportunities that may result from the LDRP may not directly translate into recruitment loss. Several authors have suggested that resident populations that exhibit polymorphic traits for anadromy are important for long term viability in response to dynamic environmental conditions (Moyle et al. 2008, McEwan 2001). Moyle et al. (2008) predicted that a relatively high percentage of steelhead would mature and migrate after one year in the ocean during wet years, rather than marine rearing for the more typical two or three years, to take advantage of migration opportunities when available. These fish would be smaller than those with additional years of ocean rearing, and thus likely have lower fecundity. Each of the life history traits of polymorphism and shortened or lengthened ocean rearing is a "bet-hedging" response to environmental variability such as lost migration opportunities (Moyle et al. 2008) and a means to sustain population viability.

Take of steelhead is associated with activities that are required to conduct habitat restoration, operate fish passage facilities, remove barriers, control predators, and implement the monitoring program and, although these benefit the steelhead population, there is likely still take that would be reasonably certain to occur. The impact of injury or mortality of juvenile steelhead related to these activities would be a decrease in the anadromous production of smolts potentially impacting the returns of adult steelhead to the AG Creek watershed. The impact of injury or mortality of adult steelhead would be a decrease in adult steelhead in the SCCC but this would be outweighed by the net benefits of the Conservation Program compared with Existing Conditions.

6.1.7.2 Summary of Benefits

NMFS has stated that anadromous production in AG Creek could help support the recovery of the entire DPS. The NMFS Recovery Plan (2013) and NMFS (2024) identified the highest priority actions in AG Creek to support recovery of the DPS as addressing fish passage barriers and developing a plan for diversion and dam operations. This HCP includes these high priority actions, as well as several other key conservation measures, that will provide extensive benefits for steelhead by improving conditions for steelhead so that the species has the opportunity for increased viability of the population, as described by McElhaney et al. (2000), including improved abundance, productivity, spatial distribution, and diversity.

The LDRP will provide substantially improved opportunities for adult upstream migration relative to Existing Conditions. These increases include more days per year of migration, greater temporal distribution, and fewer years with no access. For a DPS adapted to opportunistically and quickly migrate when conditions are suitable, increased temporal distribution of migration opportunities will provide improved conditions so that adults may migrate and spawn anytime between January and April depending on the climatic conditions that vary annually, contributing to the resilience of the population to climate change and other disturbances.

Similar to adult migration opportunities, under the LDRP increased smolt migration opportunities will provide sufficient migration opportunities to support the AG Creek population, since there will be extensive opportunities every year, including dry water years, to support downstream migration. Migration opportunities for smolts in all years is a substantial improvement over Existing Conditions, is similar to pre-dam conditions, and therefore operates to protect and enhance steelhead and their habitat, since during all years there will be migration opportunities far exceeding what occurs under Existing Conditions. The LDRP will also protect suitable juvenile rearing conditions downstream of Lopez Dam and sediment augmentation measures under the HCP will further enhance spawning and rearing conditions.

Should the assisted migration program be fully implemented, it will provide anadromous adults access to the highest quality spawning habitat in the watershed. Anadromous adults are more fecund than resident adults, and the overall influence of increased anadromous life history under the HCP is anticipated to be an increase in abundance and, in conjunction with a resident life history, improved resilience of the population to persist through time (Araki et al. 2007, Bell et al. 2011, NMFS 2013, Dagit et al. 2017). Together, the conservation program of this HCP would establish conditions to allow the AG Creek steelhead population and the AG Creek *O. mykiss* population to be more resilient over time. Since steelhead within this DPS stray, it is possible and likely that individuals from other watersheds within the DPS would benefit from increased migration opportunities and increased smolt production, thus benefiting the population viability of the SCCC DPS as well.

Steelhead are also anticipated to benefit from improvements to habitat relative to Existing Conditions as a result of habitat restoration measures under the HCP, including increased productive riffle, spawning, and rearing habitat. If the assisted migration program is successful, increased habitat access sediment augmentation will drive improved habitat conditions, while if the pond restoration project is adopted rather than assisted migration, habitat improvements from that restoration will be substantial. Implementation of the Sediment Augmentation Program is anticipated to benefit the steelhead population by improving spawning and rearing habitat quantity and quality. The HCP will improve sediment dynamics within the Permit Area relative to Existing Conditions.

It is likely that under the HCP the upstream portions of AG watershed, upstream of Lopez Reservoir, will continue to support a resident life history through phenotypic plasticity because of groundwater dominated cool water habitat and reaches with perennial flows (Stillwater Sciences 2023). As with other populations upstream of barriers with access to reservoirs, genetic alleles associated with anadromy likely remain in these populations (Leitwein et al. 2017). With assisted migration (CM-2, Section 5.4.2), these individuals could have an opportunity to migrate downstream to the ocean.

Providing for upstream and downstream movement of *O. mykiss* would increase the gene flow between *O. mykiss* upstream and downstream of Lopez Dam. Larger and more connected populations benefit from more genetic diversity making populations more resilient to selective pressures such as disease and acute environmental disasters (e.g., fire, flood, and debris flows) all of which are more likely with climate change. There is evidence that propensity for anadromy can be influenced by relatively small amounts of gene flow between resident and anadromous populations (Kobayashi et al. 2024), such as what would occur with a trap-and-haul facility. Therefore, under the HCP the steelhead population would be more resilient than under existing conditions (Fluker et al. 2014, Fraik et al. 2021, Winans et al. 2018). Steelhead population viability in the watershed and in the DPS would be substantially improved with assisted migration, primarily as a result of increased smolt abundance, increased spatial structure, and increased genetic diversity (Stillwater Sciences 2023).

A number of uncertainties exist for SCCC steelhead life history and the District would be addressing several of these uncertainties through the monitoring program. The monitoring and AMP are also intended to address uncertainties identified in the HCP as well as addressing basic biological questions identified by NMFS in the Recovery Plan, such as the genetic structure, abundance, life history timing, growth rates, predator risk, and distribution of the anadromous and resident steelhead in the watershed.

Overall, the conservation program described in this HCP represents a robust approach to conservation of the DPS that will materially improve conditions for the species (Figure 6-37). While implementation of assisted migration is an important component of the conservation program and is intended to assist NMFS in the recovery of the species, the District does not believe its implementation is necessary to meet the requirements of ESA section 10. The other conservation measures set forth in this HCP, including habitat restoration, barrier removal, and improved flows downstream of Lopez Dam, will benefit the steelhead population by improving spawning and rearing habitat quantity and quality, and increase opportunities for upstream migration well above Existing Conditions.

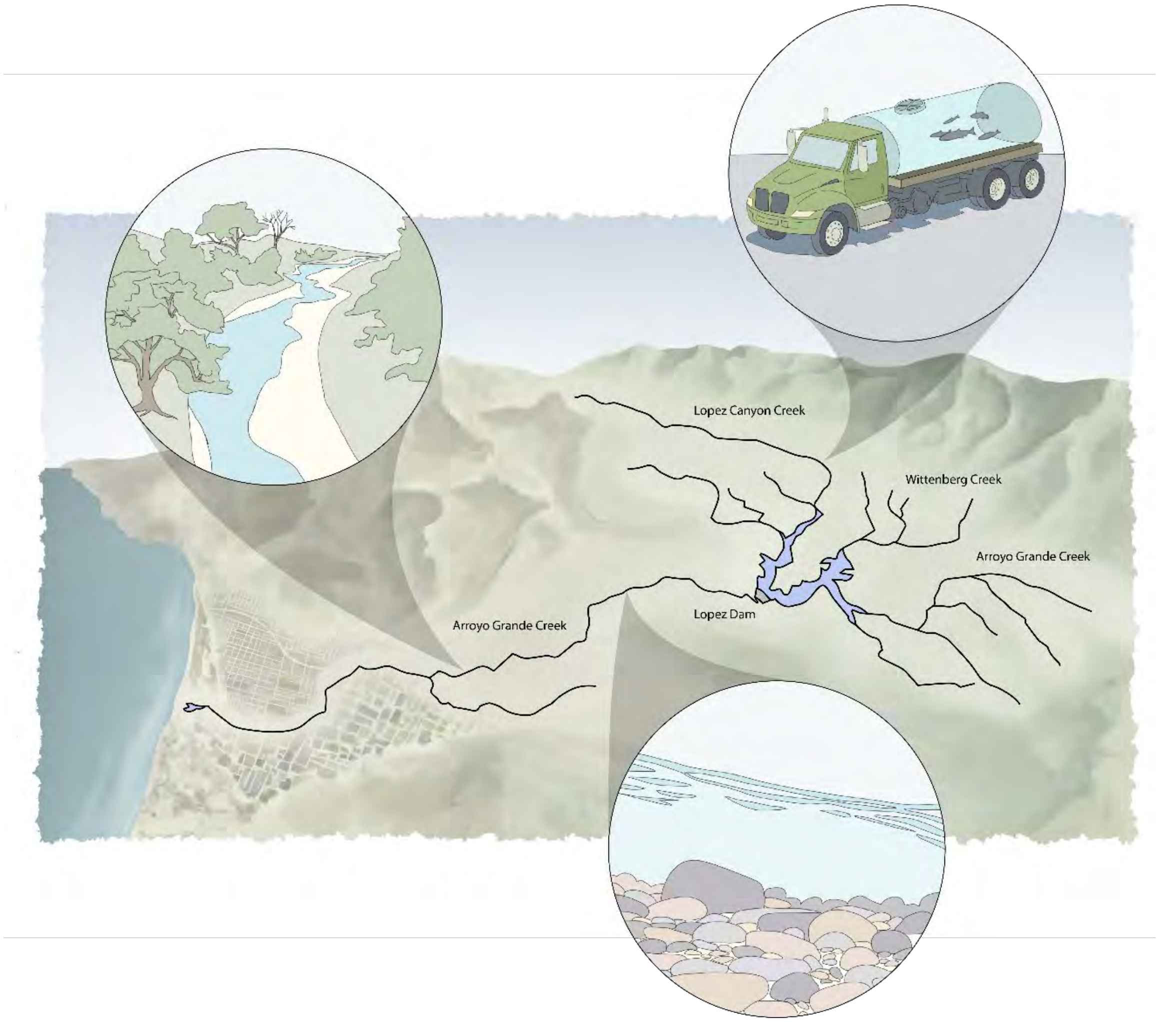

Figure 6-37. Conceptual diagram of steelhead life history following implementation of the HCP.

6.1.7.3 Conclusion and Discussion

As noted in Section 6.1.5.1, this HCP uses two points of comparison to estimate the amount of potential take of steelhead that may occur as a result of implementing the proposed LDRP. First, it provides an estimate of the amount of potential take in comparison to the Pre-dam Flow Conditions. Second, it provides an estimate of the habitat benefits of the HCP in comparison to Existing Conditions. It should be noted, however, that the Pre-dam Flow Condition does not represent an appropriate environmental baseline as this condition has not occurred since long before NMFS listed the south central coast California steelhead DPS as threatened (and even before the enactment of the ESA itself), and NMFS issued a biological opinion in 2001 that analyzed the effects of the dam on steelhead. For additional discussion about the appropriate baseline for this HCP, please refer to Section 1 of this HCP.

While there is less migratory opportunity overall and fewer anadromous steelhead compared to Pre-dam Flow Conditions, the LDRP, along with the other conservation measures set forth in this HCP constitute a significant improvement from Existing Conditions as identified in the effects analysis. To the extent assisted migration is fully implemented throughout the permit term, resident life history *O. mykiss* occur in the headwaters of several tributaries and with assisted migration will be capable of reproducing offspring that can realize an anadromous life history and therefore, be counted as “steelhead” buffering the anadromous form (steelhead) from extinction by acting as a “natural hatchery” that can produce more steelhead. As summarized in Table 7-1, the anticipated effects of all Covered Activities in this HCP are addressed with measurable objectives, conservation measures, monitoring measures, and a net positive outcome for steelhead. Together these factors demonstrate that NMFS authorization of incidental take of steelhead and District implementation of the HCP, would not appreciably reduce the likelihood of survival and recovery of SCC steelhead.

6.2 California Red-legged Frog

The following analysis of effects of the HCP on CRLF is organized by Covered Activities and conservation measures. Individual analysis of each of the Covered Activities provides the most meaningful assessment of effects, and where there are interactions between the activities, those are noted. The analysis of effects to CRLF is narrative, as the population in the Arroyo Grande watershed has not been thoroughly documented and quantified. CRLF are known to be present but are rarely observed, and accurately extrapolating or estimating the number of CRLF affected from isolated observations is not possible given the limited information about the actual size of the population.

6.2.1 Maintenance and Operations

Lopez Dam maintenance and operations (Section 4.3 *Maintenance and Operations*) are a Covered Activity under the HCP. Maintenance and operation activities may include cleaning out ditches on Lopez Dam, structure repair, vegetation management, sediment removal, and access road and fence repair. Direct impacts to CRLF associated with maintenance operations may include trampling by construction personnel or equipment, roadkill caused by the construction and vehicular use in and around works areas, and direct or indirect mortality resulting from the loss of dispersal habitat and refugia due to accessing maintenance sites (e.g., vegetation is removed to reach a gage) or as a result of implementing an operations and maintenance projects (e.g., sediment removal). Maintenance operations are not anticipated to have measurable effects on water temperature, turbidity, or flows, that could result in harm to CRLF.

Maintenance of the 42-inch emergency release valve requires shutting off flows from Lopez Dam for 2–4 hours on a single day according to the DSOD valve cycling requirements. This operation does not result in a measurable change in flow downstream of Lopez Dam. As described in Section 7.4 *Monitoring and Adaptive Management*, substantial flow monitoring will be conducted to ensure that the HCP Program, including periodic shutoff of flows, does not result in substantial flow reductions. Results of monitoring will be presented to the TAC.

Dry-back of channels may also occur due to maintenance activities, although this occurrence is not common. For example, it may be necessary to reduce releases from Lopez Reservoir during repairs. However, repairs of downstream diversions are likely to be implemented while maintaining some flow in the channel. If dry-back of channels reduces flow in channels, direct or indirect impacts including exposure to predation, temporary loss of refugia habitat may occur.

All maintenance and operations are required to implement the AMMs for CRLF and SWPT in Section 5.4.8. By implementing these AMMs, direct effects on CRLF should be minimal if not absent.

Maintenance and operations are not anticipated to affect CRLF critical habitat which is designated in the upper Arroyo Grande watershed.

6.2.2 Conservation Measures

6.2.2.1 Conservation Measure 1: Lopez Downstream Release Plan

Indirect effects of instream flow operations to CRLF include the alteration of habitat due to changes in flow. The LDRP will cause seasonal fluctuations in flow and WSE. Where seasonal fluctuations and changes in water depth result from natural events, they may be considered as circumstances that have helped create the ecological niche to which CRLF have adapted over time. If the timing or magnitude of seasonal fluctuations are a result of manmade conditions that deviate substantially from natural conditions, and exceed the ecological tolerance of CRLF, these fluctuations would be viewed as having an adverse impact on the species.

Due to their preference to breed in ponds and instream pools, CRLF populations can experience a loss of reproductive effort if natural stream flows are too low and/or they fluctuate rapidly during incubation. Under Existing Conditions, the District has implemented the IDRS (described above) to avoid this circumstance. Extremely low water levels at the onset of breeding have the potential to force frogs to deposit eggs where waters will become deeper than preferred for developing tadpoles once winter flows are initiated. Extremely high-water levels during breeding have the potential to force females to deposit eggs higher along the shoreline vegetation where egg masses can become stranded or larval development can be delayed. Increasing water levels during egg incubation has the potential to set egg masses adrift and expose eggs and larvae to predation. Decreasing water levels in spring or rapidly decreasing water levels in summer have the potential to leave eggs and young tadpoles exposed to predation and desiccation. Extremely low water levels in the fall and winter have the potential to also force juvenile and adults to move to uncovered areas or pools where predation can be high, such as near the gravel pit ponds near Lopez Dam where bullfrogs are known to be present.

The LDRP establishes target minimum flow releases for AG Creek that will serve the purpose of decreasing summer baseflows and increasing winter baseflows to reflect a more natural hydrology for the watershed. The LDRP has the potential to exacerbate natural injury or mortality by increasing the magnitude and frequency of winter migration releases compared to Existing Conditions during breeding season (February 1 to April 1). As described in Section 2.2.2 *Habitat Requirements and Life History*, female CRLF lay eggs in ponds or backwater pools of creeks, attaching them to emergent vegetation. These attached egg masses or newly hatched larvae risk being scoured out of breeding pools or knocked off aquatic vegetation by rapid variations in stream flow that result from winter migration releases under the LDRP. Adult, juvenile, and more developed larval CRLF may also be affected but have more mobility to seek refuge in environmental changes such as increased flow. However, individuals forced to move out of cover in search of new cover may temporarily be exposed to a higher risk of predation.

Rapidly changing flow conditions that affect scour or desiccation are not expected to occur under the LDRP. Under the LDRP, there could be a maximum of two winter migration releases between December 1 to May 1. Each migration release would have a duration of 10 days, thus only overlapping a maximum of 20 days with CRLF breeding season which is typically ~60 days in

SLO County. The majority of CRLF reproduction on this part of the Central Coast of California occurs during March and April (M. Jennings, personal communication, September 9, 2025) and given the triggers proposed to ensure migration flows are synchronized with natural flow events in the watershed, there would be less overlap between the (up to) two winter migration releases and peak CRLF breeding months of March and April, as most of the precipitation in the watershed occurs between November and March, with February typically being the wettest month. Spring baseflows gradually step down from winter (8 cfs) to summer (3 cfs) baseflows between March 15 and June 1 and would not trigger a rapid dry-back in AG Creek, particularly between Lopez Dam and the confluence with Tar Spring Creek.

The change in WSE at AG Creek gage at Arroyo Grande for the change from winter to summer baseflow (i.e., from 8 cfs to 3 cfs) is expected to be < 3 inches, and WSE change from peak migration release (20 cfs) to lowest spring baseflow (5 cfs) is expected to be on the order of < 4.5 inches (Jeff Meyer, personal communication, email to Sharon Kramer, August 21, 2025). Throughout their range, CRLF generally experience high mortality rates at each life stage until adulthood (USFWS 2022). In freshwater streams, sources of mortality for eggs and larvae include burial by siltation or desiccation from aquatic habitat loss, but predation of eggs is likely the most significant mortality factor, particularly if invasive predators such as bullfrogs are in the area (USFWS 2022). Over the timeline of the permit term, it is possible that some CRLF eggs or larvae may be lost to stranding and desiccation due to natural fluctuations in hydrology, particularly in AG Creek downstream of the Tar Spring Creek confluence, but it is not likely to be proximately caused by LDRP releases from Lopez Dam, as the lower approximately three miles of AG Creek (downstream of Highway 1) typically remains ephemeral and dries out during the summer months, similar to Pre-dam Conditions (Stillwater Sciences 2022a).

Positive effects can also occur if hydrologic changes reduce or mitigate natural fluctuations and conditions that were averse to CRLF survival. Non-native predatory species like bullfrogs currently flourish in low-velocity warm-water habitats and have been identified in several ponds in the mainstem of AG Creek downstream of Lopez Dam. Under the LDRP, the decrease of summer flow rates and increase of winter flows to reflect a more natural hydrology is likely to create a more heterogeneous habitat that is less suitable for bullfrogs. Combined with the implementation of a predator control program (CM-5) and potential habitat restoration project (CM-3), the instream flow operations will most likely be beneficial to CRLF by reducing the risk of predation and competition with non-native species and increasing suitable habitat for refugia, aquatic foraging, and breeding opportunities.

The LDRP is not anticipated to affect CRLF critical habitat which is designated in the upper Arroyo Grande watershed.

6.2.2.2 Conservation Measure 2: Assisted Migration for Steelhead at Lopez Dam

Steelhead assisted migration could directly affect CRLF. Direct effects of steelhead assisted migration include the alteration or loss of habitat due to construction or disturbance or the unintentional injury or killing of individuals by construction activities, although a trap and haul operation will have fewer effects on CRLF than would other methods of volitional fish passage (e.g., fish ladder construction). Implementation of trap and haul would not result in any changes to flows and would require the least construction of new infrastructure. Existing roads for moving fish from downstream of the dam to the upstream end of the reservoir would be utilized, and access would be sited to avoid sensitive habitat to the extent feasible.

To trap adult steelhead, a collection facility at Lopez Dam would be required ,which would require a portable collection system (rigid weir) placed in the creek downstream of Lopez Dam. Access to the creek and staging for placement of the system may result in some temporary alterations to the creek bank and removal of riparian vegetation present, which may temporarily disturb CRLF or decrease suitable habitat and could result in trampling by pedestrian or vehicular traffic. However, non-native predatory species like bullfrogs currently flourish in several ponds in the mainstem of AG Creek downstream of Lopez Dam, and likely as a result, CRLF have not been documented upstream of Tar Spring Creek since 2002 (CNDDB 2025). It is unlikely that CRLF would be directly impacted by the installation of a rigid weir near the dam, and the use of AMMs detailed in CM-8 will reduce or prevent direct impacts on CRLF during construction and implementation of steelhead assisted migration.

The HCP conservation program may result in an increase in numbers of juvenile steelhead in AG Creek and lagoon, and juvenile steelhead are one of many native and non-native fish predators on CRLF. While an increase in steelhead abundance could result in increased predation on CRLF, the potential for steelhead predation on CRLF to have a population-level impact is low, particularly compared to the likely impacts of predacious non-native fish species and bullfrogs.

CRLF have been documented upstream of Lopez Dam, and critical habitat has been designated along some of the upper tributaries including Lopez Creek (Figure 2-6). Assisted migration of steelhead (CM-2, Section 5.4.2) may also affect CRLF and CRLF critical habitat there associated with trapping in tributaries. In addition, reintroduction of steelhead through assisted migration may increase the number of juvenile *O. mykiss* that could be predators on larval CRLF. Resident *O. mykiss* occurs in tributaries upstream of Lopez Reservoir, however, an increase in numbers of juvenile steelhead is unlikely to have a significant increase in predation rates on larval CRLF. Water bodies free of bullfrogs and nonnative predatory fish are optimal, but CRLF populations can persist in the presence of one or the other of these predators (Kiesecker and Blaustein 1998, Lawler et al. 1999, Cook and Jennings 2007).

6.2.2.3 Conservation Measure 3: Habitat Restoration

Sediment Augmentation Program

Lopez Dam and Reservoir capture sediment (i.e., sands and gravels) much of which would otherwise be naturally transported to the reaches below the dam. In addition, large woody debris such as trees and large rocks accumulate behind the dam while a portion of the very fine sediment entering the reservoir remains in suspension and is able to pass through the reservoir outlet to AG Creek. The result is a combination of altered hydrology and altered sediment transport which affects downstream habitat quality.

The combination of gravel embeddedness and flow changes below the dam can affect food production and transport. Fine sediment embeddedness can inhibit the development of the BMIs which serve as prey for CRLF, and fine sediments accumulate in low velocity runs and ponds, reducing the general productivity of the aquatic system. Non-native predators such as bullfrogs are able to persist in these conditions, as has been documented in the gravel pit ponds just downstream of Lopez Dam.

Under the Sediment Augmentation Program proposed in CM-3, at least 500 CY of sediment (composition to be determined with the TAC) will be placed just downstream of Lopez Dam, monitored annually, and replenished to initial volume at least every five years. Placement of excavated and processed gravel in downstream reaches could increase turbidity, and increased fine sediments may also cover and thus affect egg laying substrate for CRLF. The deposited sediment becomes mobile during spill events and any flow releases at various reaches downstream of Lopez Dam or supplemental flow releases that will help to support gravel mobility. These releases may coincide with or be independent of storm events and will increase turbidity at and downstream of the release points, and flow rate will affect how quickly suspended sediments would be anticipated to settle out of the water column. Depending on timing, this release of sediment may partially cover CRLF egg masses deposited downstream of the dam. To minimize the severity and extent of increased turbidity, gravel will be cleaned prior to being deposited downstream of reservoirs, and gravel placement will also avoid the CRLF breeding seasons, where possible.

CRLF have not been documented in AG Creek upstream of Tar Spring Creek since 2002 (CNDDB 2025). Thus, it is unlikely that CRLF would be directly impacted by sediment augmentation near the dam. Over the course of the permit term, it is possible that CRLF may be documented upstream of Tar Spring Creek, and the use of AMMs detailed in CM-8 will reduce or prevent direct impacts on CRLF during the sediment augmentation program. Additionally, non-native predatory species like bullfrogs currently flourish in several ponds just downstream of Lopez Dam where the sediment augmentation would occur. It is likely that the sediment augmentation in this reach will reduce habitat suitability for non-native predators and thereby create more hospitable conditions for CRLF to the extent they expand their distribution into the area.

Potential Pond Habitat Restoration

Breeding habitat for CRLF has been documented throughout AG Creek, including in the gravel pit ponds downstream of Lopez Dam (Christopher 2010). While the gravel pit ponds that currently exist may provide potential breeding habitat for CRLF, they have a number of related impacts including:

- Emergent and submergent vegetation, if flooded, may be covered by fine sediments, and may die off affecting availability of vegetation appropriate for attaching CRLF egg masses.
- CRLF may be affected by higher rates of predation due to low velocity flows and lack of cover which provide suitable habitat for non-native predators, such as bullfrogs.

CRLF have not been documented in AG Creek upstream of Tar Spring Creek since 2002 (CNDDB 2025), and it is unlikely the gravel pit ponds are a viable breeding ground due to the presence of bullfrogs. In the event the District implements pond habitat restoration as a result of a determination that assisted migration for steelhead is not practicable (see Section 5.4.2), and instead engages in pond restoration, restoration of riverine habitat within the ponds would improve habitat conditions for CRLF by decreasing suitable habitat for bullfrogs and invasive species, providing cover and increased habitat complexity, and improving the ability of CRLF to compete with and avoid non-native predators. Some habitat restoration activities may temporarily and adversely affect CRLF or their habitat. For example, the filling of gravel pond and planting emergent vegetation could temporarily impact CRLF occupying the pond. CRLF could also be at risk of being crushed by moving or heavy equipment. However, with methods detailed in CM-3 such as maintaining pool habitat, the restoration of riverine habitat within the ponds would improve habitat conditions for CRLF in the long term. Also, the AMMs provided in CM-8 will minimize or avoid the temporary adverse effects to CRLF during the restoration activities.

Neither the sediment augmentation program nor potential pond habitat restoration are anticipated to affect CRLF critical habitat which is designated in the upper Arroyo Grande watershed.

6.2.2.4 Conservation Measure 4: Biddle Park Culvert Maintenance

Direct impacts to CRLF may result from Biddle Park Culvert Maintenance activities including sediment and debris removal. Sediment and debris removal have the potential of increasing turbidity and the release of fine sediments downstream of the removal site. Maintenance of the Biddle Park Culvert will coincide with winter migration releases and will increase turbidity at and downstream of the culvert, and flow rate will affect how quickly suspended sediments would be anticipated to settle out of the water column. Depending on timing, this release of sediment may partially cover CRLF egg masses deposited downstream, and juvenile and adult CRLF inhabiting the area may be temporarily affected by loss of habitat during maintenance activities.

Under Existing Conditions sediment and debris collect at the culvert inlet reducing connectivity, and potentially creating low-velocity, suitable habitat for non-native predators such as bullfrogs. Maintaining and cleaning the Biddle Park Culvert will improve habitat complexity and streamflow within the Action Area relative to baseline conditions and can benefit CRLF in the watershed by reducing suitable habitat for non-native predators.

Maintaining and cleaning the culvert at Biddle Park will follow best management practices and species-specific AMMs in CM-8 to avoid and minimize effects to CRLF, including working within applicable in-water work periods and monitoring water quality. Any impacts are expected to be temporary, and following species-specific AMMs will minimize or avoid effects on CRLF.

Biddle Park culvert maintenance is not anticipated to affect CRLF critical habitat which is designated in the upper Arroyo Grande watershed.

6.2.2.5 Conservation Measure 5: Predator Control Program

Non-native predatory species like bullfrogs tend to flourish in low-velocity homogeneous habitats and are more likely to outcompete CRLF in these types of habitats compared to heterogeneous habitats preferred by CRLF. Currently, several ponds have been identified in the mainstem of AG Creek downstream of Lopez Dam that provide suitable habitat for non-native predatory species.

Identifying the full extent of this habitat will allow for predator removal to be targeted in areas most likely to favor these species. Mechanical techniques for removing bullfrogs from invaded waterways include capture by hand, dipnet, gig or Hawaiian sling spear, or pellet rifle/.22 rifle where allowable. Egg masses will be removed from the water via dipnet or bucket and allowed to dry on land. Seine nets, tadpole traps, or hoop traps may be implemented to capture tadpoles and juveniles in pools. Mechanical removal will be paired with vegetation removal to reduce cover and breeding habitat where appropriate and permitted. Also, species-specific AMMs for CRLF in CM-8 will be followed to avoid or minimize effects of these predator removal efforts on these species. When possible, predator removal efforts will be conducted strategically with habitat restoration efforts, as these combined efforts are more likely to afford CRLF a competitive advantage compared to each effort on its own. Methods, timing and frequency of mechanical removal efforts will be determined based on the species assemblages and habitat associations identified in this program.

A detailed plan will be developed to describe the implementation of the Predator Control Program and will be distributed to the TAC for review and input within six months of permit issuance. The Program will be implemented within two months of approval of the Predator Control Program by the TAC.

While the Predator Control Program is not anticipated to directly impact CRLF critical habitat which is located in the upper watershed, the implementation of a predator control program downstream of Lopez Dam in conjunction with habitat restoration (CM-3) is anticipated to benefit CRLF and critical habitat by reducing predation and competition with non-native species.

6.2.2.6 Conservation Measure 6: Fish Rescue and Relocation During Localized Dewatering

Elements of the Conservation Program will involve localized dewatering and fish rescue efforts during construction, including potential pond restoration (CM-3). Adult CRLF rescue and relocation will be conducted concurrently with fish rescue and relocation operations, as detailed in a CRLF and SWPT rescue plan using USFWS and CDFW measures and protocols, and are therefore unlikely to significantly impact CRLF but may result in temporary disturbance. Species-specific AMMs for CRLF in CM-8 will be followed to avoid or minimize these effects. Overall, the localized fish rescue and relocation is not anticipated to impact CRLF or their critical habitat.

6.2.2.7 Conservation Measure 7: Maintain Flow Gaging Stations

The Conservation Program will include maintaining gaging stations in AG Creek. The District will develop accurate flow rating curves for each gage. This measure is not anticipated to impact CRLF or their critical habitat but may benefit the population relative to existing conditions by providing data that will support real-time management of habitat conditions.

6.2.2.8 Conservation Measure 8: Best Management Practices

Most of the BMPs are avoidance and minimization measures associated with other activities that may cause incidental take or modification of habitat for Covered Species, but the BMPs themselves are not expected to cause take or result in measurable adverse effects to CRLF. Implementation of best management practices is anticipated to benefit the CRLF population relative to Existing Conditions, as their purpose is to reduce impacts to all Covered Species and their habitats, including the CRLF.

6.2.2.9 Conservation Measure 9: Interagency Technical Advisory Committee

Organization and implementation of an interagency TAC will provide a structure for fisheries agencies to guide and inform the implementation of the conservation program and AMP described above. Interagency involvement is anticipated to increase the efficacy and success of the Lopez Water Project, and benefit Covered Species and their habitats. No adverse effects to CRLF are expected from implementation of the TAC.

6.2.3 Monitoring Program

eDNA sampling and laboratory analysis will be used to monitor CRLF presence and distribution in AG Creek. Sampling involves will involve collecting and filtering water samples, which will be conducted during low flow conditions (e.g., summer months) and is not anticipated to impact CRLF or their critical habitat but may benefit the population relative to existing conditions by providing data that will support real-time management of habitat conditions.

6.2.4 Impacts of the Taking and Benefits of the Conservation Program

The effects of the HCP on CRLF can occur directly through maintenance activities described in Section 4 *Covered Activities* and indirectly through changes in hydrology described in Section 5 *Conservation Program.* Direct effects of maintenance activities can be minimized by implementing the species-specific AMMs described in Section 5.4.8 *Best Management Practices*. HCP conservation measures may result in changes to water depths in habitat occupied or potentially occupied by CRLF, and in some cases could be detrimental to CRLF because they temporarily reduce or eliminate habitat availability. In other cases, the changes brought about by the conservation measures are beneficial because they are anticipated to increase habitat suitability for CRLF. The LDRP (CM-1) will cause seasonal fluctuations in flow and WSE. Seasonal fluctuations and changes in water depth are natural events that may help create the ecological niche to which CRLF have adapted over time and not necessarily considered impacts. However, seasonal fluctuations can be considered adverse impacts if their timing or magnitude deviates substantially from natural conditions and exceeds the ecological tolerance of CRLF. Positive impacts can also occur if hydrologic changes reduce or mitigate natural fluctuations and conditions that were averse to CRLF survival.

Potential take of CRLF may occur as a result of Covered Activities and implementation of the conservation measures. Although the conservation measures are anticipated to benefit CRLF overall, there is a possibility that some degree of take nevertheless could occur. The proposed LDRP (CM-1) operations altering the AG Creek hydrology downstream of Lopez Dam would be the Covered Activity with the greatest potential for take.

The LDRP represents a potential tradeoff between management for SCCC steelhead habitat and management for CRLF habitat within AG Creek. A more dynamic and increased winter flow regime to support steelhead migration may cause loss of habitat or injury to CRLF through the potential for deposited egg masses or early developing larvae to be scoured out or knocked off by rapid variations in stream flow resulting from winter migration releases under the LDRP. The impact of injury or mortality of juvenile and adult CRLF related to the LDRP operations would be the potential for individuals to temporarily be exposed to a higher risk of predation if they are forced to move out of cover in search of new cover during increased flows proposed in the LDRP.

The LDRP is expected to have a limited overall impact on CRLF because the timing of flow releases will reflect a more natural hydrology. The LDRP includes improved baseflows and migration releases to increase seasonal flow variability, rearing conditions for juvenile steelhead, and spawning conditions for adult steelhead, especially in the reach from Lopez Dam downstream to Tar Spring Creek. Under the LDRP, there could be a maximum of two winter migration releases between December 1 to May 1. Each migration release would have a trigger (i.e., the berm at the beach is open and measured flow at 22nd Street Bridge (RM 1.3) for 24 hours to ensure migration flows are synchronized with natural flow events in watershed. Seasonal fluctuations (including higher winter flows) can cause adverse impacts if their timing or magnitude deviates substantially from natural conditions and exceeds the ecological tolerance of CRLF. However, downstream of Tar Spring Creek confluence, flows are heavily influenced by accretion from Tar Spring Creek, and when flows in AG Creek are high enough to trigger a migration release, CRLF within the reaches of Tar Spring Creek and in AG Creek downstream to the lagoon will already be experiencing the effects of natural seasonal high flow.

Impacts of the LDRP on CRLF are also expected to be limited due to the low likelihood of CRLF presence and breeding near the dam where increased flows or a spill would first occur. CRLF breeding habitat has been documented just downstream of the dam, but the presence of bullfrogs and nonnative fish likely limit CRLF abundance due to predation from these species. Recent observations of CRLF have only been within the lowermost sections around AG Creek lagoon and within Tar Spring Creek (Stillwater Sciences 2022b). The last documented occurrences of CRLF upstream of Tar Spring Creek were in 2001 and 2002 (CNDDB 2025). Under the LDRP, winter migration flows would have a maximum duration of 10 days, thus only overlapping a maximum of 20 days with CRLF breeding season (typically January through April), with only small (< 4.5 inches) changes in WSE (J. Meyer, personal communication email to Sharon Kramer, August 21, 2025). Additionally, the majority of CRLF reproduction on this part of the Central Coast of California occurs during March and April (M. Jennings, personal communication, September 10, 2025) and given the triggers proposed for winter migration releases in the LDRP there would be less overlap between the (up to) two winter migration releases and peak CRLF breeding months of March and April, as most of the precipitation in the watershed occurs between November and March, with February typically being the wettest month. Potential take of CRLF is associated with the District's proposed LDRP operations and activities that are required to conduct sediment augmentation and potential habitat restoration. Although these measures will benefit the CRLF population, there is a possibility that some amount of take could occur.

Activities involving maintenance or construction of structures within the creek or riparian areas (e.g. maintenance operations, steelhead assisted migration, habitat restoration) may also directly affect CRLF. These activities have the potential of releasing fine sediment and debris into the downstream reaches of the creek and increasing turbidity. Depending on timing, this release of sediment may partially cover CRLF egg masses deposited downstream, and juvenile and adult CRLF inhabiting the area may be temporarily affected by loss of habitat during maintenance activities. Increased turbidity may also affect adult CRLF by inhibiting foraging, but adults have more mobility to access other habitats in environmental changes such as increased turbidity. However, individuals forced to move out of cover in search of new cover may temporarily be exposed to a higher risk of predation. Flow rate will generally affect how quickly suspended sediments would be anticipated to settle out of the water column. In addition, adult CRLF will be rescued and relocated prior to any dewatering activities, minimizing impacts to CRLF.

Activities that involve construction or removal of riparian vegetation such as the potential conversion of gravel pit ponds to riverine habitat (CM-3) could result in the removal of potential breeding sites for CRLF and may not allow individuals to complete their life cycles in this habitat. Any adverse effects of habitat restoration activities are expected to be temporary and would be outweighed by long-term net benefits to CRLF.

Benefits to CRLF can occur if maintenance and construction activities reduce current conditions that are averse to CRLF survival. Currently, non-native predatory species including bullfrogs, flourish in low-velocity, warm-water habitats and have been identified in several ponds downstream of Lopez Dam. Combined with the implementation of the LDRP and a predator control program (CM-5) and following species-specific AMMs (CM-8), construction activities included in potential habitat restoration (CM-3) and Biddle Park Culvert Maintenance (CM-4) would improve habitat conditions for CRLF by decreasing suitable habitat for bullfrogs and invasive species, providing cover and increased habitat complexity, and improving the ability of CRLF to compete with and avoid non-native predators.

In consideration of the above, USFWS authorization of take as proposed by the HCP and District implementation of the conservation program under the HCP will not appreciably reduce the likelihood of survival or recovery of CRLF in the wild. While negative impacts to CRLF may occur, it is anticipated that, overall, impacts associated with HCP implementation would benefit the species.

6.3 Southwestern Pond Turtle

Similar to CRLF, the following analysis of effects of the HCP on SWPT is organized by Covered Activities and conservation measures. Individual analysis of each activity provides the most meaningful assessment of effects, and where there are interactions between the activities, those are noted. The analysis of effects to SWPT is narrative, as the population in the Arroyo Grande watershed has not been thoroughly documented and quantified. SWPT are known to be present but are rarely observed, and with only three CNDDB occurrences of SWPT in the watershed below Lopez Dam, accurately extrapolating or estimating the number of SWPT affected from these isolated observations is not possible.

6.3.1 Maintenance and Operations

Lopez Dam maintenance operations (Section 4.3 *Maintenance and Operations*) are a Covered Activity under the HCP. Maintenance activities may include sediment removal, access road and fence repair, and vegetation clearing. Direct impacts to SWPT associated with maintenance operations can occur while accessing maintenance sites (e.g., vegetation is removed to reach a gage) or as a result of implementing operations and maintenance projects (e.g., sediment removal).

Maintenance of the 42-inch emergency release valve requires shutting off flows from Lopez Dam for 2–4 hours on a single day according to the DSOD valve cycling requirements. This operation does not result in a measurable change in flow downstream of Lopez Dam nor potential effects on SWPT. As described in Section 7.4 *Monitoring and Adaptive Management*, substantial flow monitoring will be conducted to ensure that the HCP Program, including periodic shutoff of flows, does not result in substantial flow reductions. Results of monitoring will be presented to the TAC.

Dry-back of channels may also occur due to maintenance activities, although this occurrence is not common. For example, it may be necessary to reduce reservoir releases during repairs. However, repairs of downstream diversions are likely to be implemented while maintaining some flow in the channel.

Although unlikely based on the species low abundance within the watershed, maintenance and operations including cleaning out ditches on Lopez Dam, structure repair, and vegetation management may result in direct take of SWPT through crushing individuals during access to work areas or injuring SWPT that may be aestivating in mud and sediment in ditches at the end of summer. However, there would be no measurable effects on SWPT as a result of water temperature, turbidity, or flows. Because SWPT may be present within these work areas, all project proponents are required to implement the AMMs for CRLF and SWPT in Section 5.4.8 *Best Management Practices*. By implementing these AMMs, direct effects on SWPT should be minimal if not absent.

6.3.2 Conservation Measures

6.3.2.1 Conservation Measure 1: Lopez Downstream Release Plan

Indirect effects of instream flow operations to SWPT include the alteration of habitat due to changes in flow. The LDRP will cause seasonal fluctuations in flow and WSE. Where seasonal fluctuations and changes in water depth result from natural events, they may be considered as circumstances that have helped create the ecological niche to which SWPT have adapted over time. If the timing or magnitude of seasonal fluctuations is a result of manmade conditions and deviates substantially from natural conditions, and exceeds the ecological tolerance of SWPT, these fluctuations would be viewed as having an adverse impact on the species.

The LDRP establishes target minimum flow releases for AG Creek that will serve the purpose of decreasing summer flow rates and increasing winter flows to reflect a more natural hydrology for the watershed. The LDRP has the potential to exacerbate natural injury or mortality by increasing the magnitude and frequency of winter migration releases compared to existing conditions. However, rapidly changing flow conditions are not expected to occur under the LDRP, nor are significant changes in WSE. The change in WSE at AG Creek gage at Arroyo Grande for the change from winter to summer baseflow (i.e., from 8 cfs to 3 cfs) is expected to be < 3 inches, and WSE change from peak migration release (20 cfs) to lowest spring baseflow (5 cfs) is expected to be on the order of <4.5 inches (Jeff Meyer, personal communication email to Sharon Kramer, August 21, 2025).

Direct impacts of instream flow operations to SWPT are expected to be minimal due to the ability of SWPT to move through the stream habitat during these operations. SWPT have sufficient mobility to seek refuge during environmental changes such as increased flow. However, individuals forced to move out of cover in search of new cover may temporarily be exposed to a higher risk of predation. Such effects are expected to be minimal both because of the modest increase in flow and because the change in WSE during winter migration flow operations will be limited to 4.5 inches and would not appreciably reduce cover used by SWPT for predator avoidance.

Winter migration flows are not expected to affect SWPT nesting. SWPT build nests and lay eggs from May through July and hatching is completed prior to the initiation of winter migration flows in December. While SWPT may rarely use levees alongside streams as nesting substrate, most nests are greater than 16 meters from the water's edge (Jennings 1992). The USFWS identifies altered hydrology as a potential risk to eggs; specifically, if inappropriately timed increases in flows cause eggs and nets to be saturated with water (USFWS 2023). However, winter migration flows take place after SWPT eggs have hatched. Additionally, winter migration flows will only result in an expected increase of 4.5 inches to WSE. This elevation change would not be large enough to affect a SWPT nest even in the rare cases where a nest is placed in a levee adjacent to the stream.

Similarly, winter migration flows are not expected to affect SWPT basking habitat, as the overall change in WSE is expected to be up to 4.5 inches, with a 2 inches/hour ramping rate. This limited change in WSE would not be large enough to remove basking habitat.

Positive impacts for SWPT can occur if hydrologic changes reduce or mitigate natural fluctuations and conditions that were averse to SWPT survival. Non-native predatory species like bullfrogs currently flourish in low-velocity warm-water habitats and have been identified in several ponds in the mainstem of AG Creek downstream of Lopez Dam. Under the LDRP, the decrease of summer flow rates and increase of winter flows to reflect a more natural hydrology is likely to create a more heterogeneous habitat that is less suitable for bullfrogs; the instream flow operations will most likely be beneficial to SWPT by reducing the risk of predation and competition with non-native species.

6.3.2.2 Conservation Measure 2: Assisted Migration for Steelhead at Lopez Dam

Steelhead assisted migration could both directly and indirectly affect SWPT. Direct effects of steelhead assisted migration include the temporary alteration or permanent loss of SWPT habitat due to construction or disturbance or the unintentional injury or killing of individuals by construction activities. A trap and haul operation will have the least effect on SWPT when compared to other methods of volitional fish passage (e.g., fish ladder construction). This approach would not result in any changes to flows and would require the least construction of new infrastructure. Efforts for moving fish from downstream of the dam to the upstream end of the reservoir would utilize existing roads, and access would be sited to avoid sensitive SWPT habitat to the extent practicable.

To trap adult steelhead, a collection facility at Lopez Dam would be required, which would require a portable collection system (rigid weir) placed in the creek downstream of Lopez Dam. Access to the creek and staging for placement of the system may result in some temporary alterations to the creek bank and removal of riparian vegetation present, which may temporarily disturb SWPT or their habitat. SWPT have not been documented near Lopez Dam, and impacts of steelhead assisted migration are expected to be limited due to the low likelihood of SWPT presence. Additionally, the use of AMMs detailed in CM-8 will reduce or prevent direct impacts on SWPT during construction and implementation of steelhead assisted migration.

6.3.2.3 Conservation Measure 3: Habitat Restoration

Sediment Augmentation Program

Lopez Dam and Reservoir capture sediment (i.e., sands and gravels) that would otherwise be naturally transported to the reaches below the dam. In addition, large woody debris such as trees and large rocks accumulate behind the dam while a portion of the very fine sediment entering the reservoir remains in suspension is able to pass through the reservoir outlet works to AG Creek. The result is a combination of altered hydrology and altered sediment transport which affects downstream habitat quality.

The combination of gravel embeddedness and flow changes below the dam can affect food production and transport. Fine sediment embeddedness can inhibit the development of the BMIs which support SWPT prey, and fine sediments accumulate in low velocity runs and ponds, reducing the general productivity of the aquatic system. Non-native predators such as bullfrogs are able to persist in these conditions, as has been documented in the gravel pit ponds just downstream of Lopez Dam.

Under the Sediment Augmentation Program proposed in CM-3, at least 500 CY of sediment (composition to be determined with the TAC) will be placed just downstream of Lopez Dam, monitored annually, and replenished to initial volume at least every five years. Placement of excavated and processed gravel in downstream reaches could result in mechanical crushing of SWPT and could increase turbidity. The deposited sediment becomes mobile during spill events and any flow releases at various reaches downstream of Lopez Dam or supplemental flow releases that will help to support gravel mobility. These releases may coincide with or be independent of storm events and will increase turbidity at and downstream of the release points, and flow rate will affect how quickly suspended sediments would be anticipated to settle out of the water column. Depending on timing, this release of sediment may temporarily inhibit SWPT foraging, but impacts to eggs are not expected as SWPT generally nest away from the water. To minimize the severity and extent of increased turbidity, gravel will be cleaned prior to being deposited downstream of reservoirs, and to minimize potential for mechanical crushing, the use of AMMs detailed in CM-8 and rescue and relocation detailed in CM-6 will reduce or prevent direct impacts on SWPT during the sediment augmentation program.

Additionally, non-native predatory species like bullfrogs currently flourish in several ponds just downstream of Lopez Dam where the sediment augmentation would occur. It is likely that the sediment augmentation in this reach will reduce habitat suitability for non-native predators and thereby create more hospitable conditions for SWPT to the extent they occur in the area.

SWPT could also be at risk of being crushed by moving or heavy equipment. Implementing the AMMs provided in CM-8 and rescue and relocation in CM-6 will minimize or avoid the adverse effects to SWPT during the restoration activities.

Potential Pond Habitat Restoration

SWPT have not been documented near Lopez Dam, and it is unknown if the gravel pit ponds are currently utilized by SWPT. While the gravel pit ponds that currently exist may provide potential foraging or basking habitat for SWPT, the presence of non-native predatory species such as bullfrogs likely inhibits the viability of the ponds for SWPT use.

Should implementation of this conservation measure occur, restoration of riverine habitat within the ponds would improve habitat conditions for SWPT by decreasing suitable habitat for bullfrogs and invasive species, providing cover and increased habitat complexity, and improving the ability of SWPT to compete with and avoid non-native predators. Some habitat restoration activities may temporarily and adversely affect SWPT or their habitat. For example, the filling of gravel pond and planting emergent vegetation could temporarily impact any SWPT occupying the pond. SWPT could also be at risk of being crushed by moving or heavy equipment. Implementing the AMMs provided in CM-8 and rescue and relocation in CM-6 will minimize or avoid the temporary adverse effects to SWPT during the restoration activities, and the restoration of riverine habitat within the ponds is anticipated to improve habitat conditions for SWPT in the long term.

6.3.2.4 Conservation Measure 4: Biddle Park Culvert Maintenance

Direct impacts to SWPT may result from Biddle Park Culvert Maintenance activities which include sediment and debris removal. Sediment and debris removal have the potential of increasing turbidity and the release of fine sediments downstream of the removal site. Maintenance of the Biddle Park Culvert will coincide with winter migration releases and will increase turbidity at and downstream of the culvert, and flow rate will affect how quickly suspended sediments would be anticipated to settle out of the water column. This release of sediment may temporarily impact SWPT foraging and/or loss of habitat, but impacts to eggs are not expected as SWPT generally nest away from the water. Direct impacts of Biddle Park Culvert Maintenance activities to SWPT are expected to be minimal due to the ability of SWPT to move through the stream habitat during these operations. SWPT have the mobility to seek refuge in environmental changes such as increased turbidity. However, individuals forced to move out of cover in search of new cover may temporarily be exposed to a higher risk of predation.

Under Existing Conditions sediment and debris collect at the culvert inlet reducing connectivity, and potentially creating low-velocity, suitable habitat for non-native predators such as bullfrogs.

Maintaining and cleaning the Biddle Park Culvert will improve habitat complexity and streamflow within the Action Area relative to baseline conditions and can benefit SWPT in the watershed by reducing suitable habitat for non-native predators.

Maintaining and cleaning the Biddle Park Culvert will follow BMPs and species-specific AMMs in CM-8 to avoid and minimize effects to SWPT, including monitoring water quality. Any impacts are expected to be temporary.

6.3.2.5 Conservation Measure 5: Predator Control Program

Non-native predatory species like bullfrogs tend to flourish in low-velocity homogeneous habitats and are likely to predate on young SWPT in these types of habitats compared to heterogeneous habitats. Several ponds have been identified in the mainstem of AG Creek downstream of Lopez Dam that provide suitable habitat for non-native predatory species.

Identifying the full extent of this habitat will allow for predator removal to be targeted in areas most likely to favor these species. Mechanical techniques for removing bullfrogs from invaded waterways include capture by hand, dipnet, gig or Hawaiian sling spear, or pellet rifle/.22 rifle where allowable. Egg masses will be removed from the water via dipnet or bucket and allowed to dry on land. Seine nets, tadpole traps, or hoop traps may be implemented to capture tadpoles and juveniles in pools. Mechanical removal will be paired with vegetation removal to reduce cover and breeding habitat where appropriate and permitted. Also, species specific AMMs for SWPT in CM-8 will be followed to avoid or minimize effects of these predator removal efforts on these species. When possible, predator removal efforts will be conducted strategically with habitat restoration efforts, as these combined efforts are more likely to minimize adverse effects on SWPT compared to each effort on its own. Methods, timing and frequency of mechanical removal efforts will be determined based on the species assemblages and habitat associations identified in this program.

A detailed plan will be developed to describe the implementation of the Predator Control Program and will be distributed to the TAC for review and input within six months of permit issuance. The Program will be implemented within two months of approval of the Plan by the TAC.

Collectively, implementation of a predator control program downstream of Lopez Dam in conjunction with habitat restoration (CM-3) is anticipated to benefit SWPT by reducing predation and competition with non-native species.

6.3.2.6 Conservation Measure 6: Fish Rescue and Relocation During Localized Dewatering

Elements of the Conservation Program will involve localized dewatering and fish rescue efforts during construction, including potential pond restoration (CM-3). SWPT rescue and relocation will be conducted concurrently with fish rescue and relocation operations, as detailed in a CRLF and SWPT rescue plan using USFWS and CDFW measures and protocols, and are therefore unlikely to significantly impact SWPT but may result in temporary disturbance. Species-specific AMMs for SWPT in CM-8 will be followed to avoid or minimize these potential effects. Overall, the localized fish rescue and relocation is not anticipated to impact SWPT.

6.3.2.7 Conservation Measure 7: Maintain Flow Gaging Stations

The Conservation Program will include maintaining gaging stations in the AG Creek. The District will develop accurate flow rating curves for each gage. This measure is not anticipated to impact SWPT but may benefit the population relative to Existing Conditions by providing data that will support real-time management of habitat conditions.

6.3.2.8 Conservation Measure 8: Best Management Practices

Most of the BMPs are avoidance and minimization measures associated with other activities that may result in incidental take or modification of habitat for Covered Species, but the BMPs themselves are not expected to cause take or result in measurable adverse effects to SWPT. Implementation of BMPs is anticipated to benefit SWPT relative to Existing Conditions, as their purpose is to reduce impacts to all Covered Species and their habitats, including the SWPT.

6.3.2.9 Conservation Measure 9: Interagency Technical Advisory Committee

Organization and implementation of an interagency TAC will provide a structure for fisheries agencies to guide and inform the implementation of the conservation and AMP described above. Interagency involvement is anticipated to increase the efficacy and success of the Lopez Water Project and benefit Covered Species and their habitats. No adverse effects to SWPT are expected from implementation of the TAC.

6.3.3 Monitoring Program

eDNA sampling and laboratory analysis will be used to monitor SWPT presence and distribution in AG Creek. Sampling involves will involve collecting and filtering water samples, which will be conducted during low flow conditions (e.g., summer months) and is not anticipated to impact SWPT but may benefit the population relative to Existing Conditions by providing data that will support real-time management of habitat conditions.

6.3.4 Impacts of the Taking and Benefits of the Conservation Program

The impacts of the HCP on SWPT can occur directly through maintenance activities described in Section 4 *Covered Activities* and indirectly through changes in hydrology described in Section 5 *Conservation Program.* Direct effects of maintenance activities will be minimized by implementing the species-specific AMMs described in Section 5.4.8 *Best Management Practices*. HCP conservation measures may result in changes to water quality or depth in habitat occupied or potentially occupied by SWPT, and in some cases can theoretically have negative impacts on SWPT where the measures temporarily reduce habitat quality. Direct impacts of the LDRP to SWPT are expected to be minimal due to the ability of SWPT to move through the stream habitat during these operations. SWPT have the mobility to seek refuge in environmental changes such as increased flow. However, individuals forced to move out of cover in search of new cover may temporarily be exposed to a higher risk of predation. The LDRP is not expected to affect SWPT nesting as this species seeks nest sites to lay eggs in uplands away from the water.

The LDRP is also expected to have a limited overall impact on SWPT because of timing of flow releases to reflect a more natural hydrology. The LDRP includes improved baseflows and migration releases to increase seasonal flow variability, rearing conditions for juvenile steelhead, and spawning conditions for adult steelhead, especially in the reach from Lopez Dam downstream to Tar Spring. The LDRP will cause seasonal fluctuations in flow and WSE. Seasonal fluctuations and changes in water depth are natural events that may help create the ecological niche to which

SWPT have adapted over time and not necessarily considered impacts. While there are few documented occurrences of SWPT in the Arroyo Grande watershed downstream of the dam, the changes brought about by the conservation measures are expected to be beneficial because they may decrease habitat suitability for non-native predators such as bullfrogs and thereby increase habitat suitability for SWPT through reduced predation and competition.

Activities involving maintenance or construction of structures within the creek or riparian areas (e.g., maintenance operations, steelhead assisted migration, habitat restoration) may affect SWPT habitat. These activities have the potential of releasing fine sediment and debris into the downstream reaches of the creek and increasing turbidity. This release of sediment should not impact SWPT eggs as SWPT generally nest away from the water but may impact SWPT foraging and/or habitat. Direct impacts to juvenile and adult SWPT due to increased turbidity are expected to be minimal due to the ability of SWPT to move through the stream habitat in environmental changes such as increased turbidity. Additionally, SWPT could also be at risk of being crushed by moving or heavy equipment; however, this risk is minimized due to the low incidence of occurrence of SWPT below the dam. Implementing the AMMs provided in CM-8 and rescue and relocation in CM-6 will further minimize or avoid adverse effects to SWPT during maintenance and construction activities.

Other habitat restoration and maintenance activities may directly affect SWPT should they be present in the plan area. For example, the potential filling of gravel ponds and planting emergent vegetation (CM-3) could impact any SWPT occupying the pond. SWPT could be at risk of being crushed by moving or heavy equipment. While impacts to SWPT associated with these conservation measures is dependent upon SWPT being present, implementing the AMMs provided in CM-8 will further minimize or avoid the adverse effects to SWPT during these restoration and maintenance activities.

Any adverse effects of maintenance and conservation measures from potential habitat restoration are expected to be temporary and would be outweighed by long-term net benefits to SWPT. Benefits to SWPT can occur if maintenance and construction activities reduce current conditions that are averse to SWPT survival. Currently, non-native predatory species including bullfrogs, flourish in low-velocity, warm-water habitats and have been identified in several ponds downstream of Lopez Dam. Combined with the implementation of the LDRP and a predator control program (CM-5) and following species-specific AMMs (CM-8), construction activities included in potential habitat restoration (CM-3), rescue and relocation (CM-6) and Biddle Park Culvert Maintenance (CM-4) would improve habitat conditions for SWPT by decreasing suitable habitat for bullfrogs and invasive species, providing cover and increased habitat complexity, and improving the ability of SWPT to compete with and avoid non-native predators.

Therefore, the conservation program established by the HCP, including specifically the LDRP and maintenance and construction activities would not appreciably reduce the likelihood of survival of SWPT in the watershed. Any negative impacts are anticipated to be offset by improvements in habitat conditions in AG Creek downstream of Lopez Dam relative to Existing Conditions.

7 PLAN IMPLEMENTATION

This section describes how the HCP will be implemented, including the following:

- HCP administration responsibilities
- Changed and unforeseen circumstances
- Amendments to the ITPs
- Suspension, revocation, relinquishment, and termination of ITPs
- Renewal or transfer of ITPs

If there is a direct contradiction between the terms of the ITPs and the HCP, the terms of the ITPs shall control. In all other cases, the terms of the ITPs and HCP shall be interpreted to be supplementary to each other. Additionally, it is anticipated that the District, NMFS, and USFWS will enter into an implementation agreement to support the efforts of the HCP.

7.1.1 Administrative Structure for Implementation

Implementation and administration of the HCP, under the conditions of the ITPs, will follow the reporting requirements and adaptive management decision-making process described in Section 7.4.2 below. It is through these mechanisms that USFWS and NMFS will be involved in the implementation of the HCP.

7.2 Role of National Marine Fisheries Service and United States Fish and Wildlife Service

NMFS and USFWS evaluate the ITP application and HCP pursuant to the issuance criteria in section 10(a)(2) of the ESA and 50 C.F.R. § 222.307 (NMFS) and 50 C.F.R. § 17.22 and 50 C.F.R. § 17.32 (USFWS). After an application and HCP are submitted and determined to be complete pursuant to applicable regulations, NMFS and USFWS will publish a notice of receipt of the application in the *Federal Register*, making the documents available for public review and comment. NMFS will also post the notice and application materials on their Incidental Take Permit webpage. NMFS and USFWS will use the information provided in the application and HCP to determine whether the application meets the criteria of ESA section 10(a)(1)(B). NMFS and USFWS will also review all comments received during the public comment period and request that the applicant provides any required information to support responses to comments. Final decision concerning permit issuance or denial by NMFS and USFWS will be based on the contents of the application, HCP, public comments, and related analyses and consultations under NEPA, ESA section 7, and any other applicable laws or requirements. Once the ITPs are issued, NMFS will post its ITP on the Incidental Take Permit webpage and identify the issuance and expiration date. USFWS will post its ITP on ECOS. NMFS and USFWS will continue to provide support and technical assistance throughout the duration of the ITPs, including participation in the TAC.

While NMFS and USFWS biologists provided detailed guidance and technical assistance throughout the HCP development process, the District prepared this proposed HCP and is applying for the ITPs. Once the ITPs have been issued, the District is bound by the terms and conditions of ITPs. While the requested ITPs have a 30-year permit term, the District may work with NMFS and USFWS to renew the ITPs, at the District's discretion.

7.3 Monitoring and Adaptive Management

The HCP includes monitoring and AMP intended to meet the requirements of ESA section 10 and relevant implementing regulations. Monitoring and reporting are mandatory elements of all HCPs (HCP Handbook) and will determine whether:

- a permittee is in compliance with their ITP and HCP,
- progress is being made toward meeting an HCP's biological goals and objectives,
- the HCP's conservation program is effective at minimizing and/or mitigating impacts, and
- there is a need for adjusting measures to improve the HCP's Conservation Program.

The goal of the adaptive management component of the program is to outline a system for adjusting the HCP management strategy using the monitoring results. HCP monitoring and adaptive management actions will be applied by the District in coordination with the TAC (Section 5.4.9). The following describes the monitoring and adaptive management elements that will be implemented during the HCP implementation.

7.3.1 Monitoring

As discussed in the HCP Handbook (USFWS and NMFS 2016), monitoring and reporting are mandatory elements of all HCPs. When properly designed and implemented, monitoring programs should provide the information needed to:

- Ensure compliance with the terms and conditions of the ITP;
- Evaluate the effectiveness of HCP conservation measures for their support of steelhead survival and recovery in AG Creek; and
- Biological monitoring to guide implementation of adaptive management actions, including but not limited to those associated with implementation of the conservation measures.

Details of compliance, effectiveness, and biological monitoring are described below (Table 7-1).

Table 7-1. Monitoring components and associated HCP goals, objectives, triggers, and potential management actions.

Action (HCP Section)	Goals	Objectives	Monitoring Type and Methods	Triggers	Potential Management Actions	Monitoring Period and Frequency
Lopez Downstream Release Plan (5.4.1)	Maintain flows in AG Creek that support steelhead year-round	Maintain minimum of 3 cfs during summer, 5 cfs during fall, 8 cfs during winter, and from 4 to 7 cfs during spring	Compliance monitoring. Monitor Lopez releases year-round. (MM-01)	Minimum releases not met on required dates	TAC evaluates annual monitoring information, and District may modify operations protocols to comply with minimum releases.	Continuous year-round monitoring; annual reporting.
	Provide steelhead migration flows	Up to 2 migration releases each winter, each release is at least 10 days in duration, ranging in flow from 10 to 20 cfs from Lopez Dam.	Compliance monitoring. Monitor releases from Lopez Dam, flow at AG gage, and flow 22nd Street Bridge. (MM-01)			
		Increase in minimum number of adult upstream passage days to Lopez Dam over baseline. Equivalent to an average (based on a five-year rolling average minimum of 30 days per year to AG gage, and 20 days to Lopez Dam.	Effectiveness monitoring. Monitor streamflow at Cecchetti and AG Gage from December to April; assumes that flows greater than 6 cfs at Cecchetti and flows greater than 15 cfs at AG Gage provide passage to Lopez Dam. (MM-01)	Objectives for minimum migration passage days not met.	TAC evaluates annual monitoring information for a minimum of 7 years or the period necessary to obtain information about wet, normal and dry years. Based on that evaluation, the District may modify release management such as magnitude, frequency, or duration or adjust the migration release to attain measurable objectives.	Continuous monitoring during adult migration release period (December through April); annual reporting.

Action (HCP Section)	Goals	Objectives	Monitoring Type and Methods	Triggers	Potential Management Actions	Monitoring Period and Frequency
Lopez Downstream Release Plan (5.4.1) (cont.)	Provide sufficient water depth during adult migration	Migration flows releases for attraction and migration (>6 cfs upstream of Tar Spring Creek, >15 cfs Tar Spring Creek to Lagoon) provide water depth >0.7 ft over 25% of entire channel cross section and 10% of continuous cross section at critical riffles.	Effectiveness monitoring. Following CDFW SOP at TAC identified critical riffles in AG Creek. (MM-03)	Adult migration water depth objectives not met at critical riffles during migration releases.	TAC evaluates migration flow monitoring information for HCP implementation for Years 1, 3, 5 and 10 after implementation, and after any modification to migration flow regime. Based on that evaluation, the District may identify refinements to attraction flow magnitude, including modify Lopez releases for steelhead migration, or modify passage obstacles.	Within 1 year of implementation and/or when a migration flow is released, in Years 1, 3, 5, and 10 of HCP and after any modification to migration flow magnitude or duration for the duration of the HCP.
	Reduce risk of stranding	Lopez releases decrease such that WSE measured at Cecchetti gage is less than or equal to 2 inches/hour	Compliance monitoring. Monitor Lopez releases year-round. (MM-01)	Release rate of decline greater than 2 inches/hour.	TAC evaluates annual monitoring information, and District may modify operations protocols to comply with or modify ramping rate restrictions.	Continuous year-round monitoring; annual reporting.
Water Quality (3.5)	Maintain suitable water quality during the summer baseflow period	Suitable water temperature (< 73.4°F [23°C]); Dissolved oxygen (< 6.0 mg/l) downstream of Lopez Dam to Tar Spring Creek	Compliance monitoring. Monitor water quality parameters at the outlet at Lopez Dam. (MM-02)	Water temperature in excess of criteria, DO less than criteria	TAC to evaluate water quality criteria annually. Based on evaluation, the District may identify and make annual refinements to releases, or elevation of releases.	Immediately after implementation, annually for the duration of the HCP.

Action (HCP Section)	Goals	Objectives	Monitoring Type and Methods	Triggers	Potential Management Actions	Monitoring Period and Frequency
Potential Lopez Ponds Restoration CM (5.4.3.2)	Restore riverine function, enhance rearing habitat, BMI habitat, and reduce habitat for non-native species (if it occurs)	Restore over 1,000 ft of channel. Maintain over 5,000 ft^2 of suitable juvenile rearing habitat, and over 3,000 ft^2 of fry rearing habitat at typical spring flows (5 cfs). Over 5,000 ft^2 of suitable spawning habitat at typical winter flows (8 cfs). (if it occurs)	Effectiveness monitoring. Annual monitoring at design flows to determine the success of the project at achieving restoration objectives, and to inform maintenance. (MM-04) (if it occurs)	Rearing or spawning habitat less than objectives. (if it occurs)	TAC to evaluate annual monitoring information for a period of at least 10 years to determine if habitat measurable objectives continue to be met. Based on evaluation, the District may implement Sediment Augmentation program or other appropriate maintenance or restoration activities to maintain habitat measurable objectives. (if it occurs)	Annual monitoring for ten years following implementation. (if it occurs)
Sediment Augmentation (5.4.3.1)	Supplement sediment and spawning gravels downstream of Lopez Dam	Augment at least 500 cy of sediment downstream of Lopez Dam.	Effectiveness monitoring. Monitor augmentation location and replenish to initial volume at least every five years. (MM-05)	Sediment transport is occurring and volume at augmentation site is less than X cy or sediment transport is not occurring.	TAC to evaluate annual monitoring information for a period of at least 5 years to determine if augmented gravel is mobilizing and being transported downstream. Based on evaluation, District may replenish sediment to initial volume, adjust release of high flows, or conduct other maintenance or restoration activities to maintain the measurable objectives.	Monitored annually and replenished to initial volume at least every five years.

Action (HCP Section)	Goals	Objectives	Monitoring Type and Methods	Triggers	Potential Management Actions	Monitoring Period and Frequency
Biological Monitoring (8.4.1.3)	Individual and population diversity	Spatial diversity of spawning and rearing from Lopez Dam downstream to lower AG Creek	Biological monitoring. Monitor spawning abundance and distribution. (MM-06) Monitor juvenile rearing distribution. (MM-07)	Infrequent or no spawning or rearing observed upstream of Tar Spring	TAC to evaluate annual monitoring information for a period of at least 5 years to determine where spawning and rearing is or is not occurring. Based on evaluation, District may adjust restoration efforts, flows, gravel augmentation, or barrier remediation.	Within one year after implementation, and annually for the duration of the HCP
		Multiple age classes of rearing juveniles	Biological monitoring. Monitor fall juvenile rearing relative abundance at index sites. (MM-07)	Low/no abundance of age 0+ and 1+, and infrequent 2+ or older juveniles observed.	TAC to evaluate annual monitoring information for a period of at least 5 years to evaluate juvenile rearing. Based on evaluation, District may revise restoration efforts, or other actions.	Within one year after implementation, and annually for the duration of the HCP
		Support anadromous and resident life histories	Biological monitoring. Monitor spawning. (MM-06)	Evidence of only one life history observed	TAC to evaluate annual monitoring information for a period of at least 5 years to determine life history of spawning activity. Based on evaluation, District may adjust restoration efforts, or gravel augmentation.	Within one year after implementation, and annually for the duration of the HCP
		Native steelhead genetics occur, without hatchery introgression	Biological monitoring. Assess genetics of *O. mykiss* population upstream and downstream of Lopez Dam. (MM-09)	Little to no native *O. mykiss* genetics observed	TAC to evaluate genetics of population and consider implications for fish passage, hatchery stocking practices, and other management in the watershed.	Within one year after implementation.

Action (HCP Section)	Goals	Objectives	Monitoring Type and Methods	Triggers	Potential Management Actions	Monitoring Period and Frequency
Biological Monitoring (8.4.1.3) (cont.)	Successful reproduction	Spawning by anadromous and resident adults	Biological monitoring. Monitor evidence of spawning (e.g., observations of adults, redds, fry) by anadromous and resident adults. (MM-06; MM-10)	Infrequent or no anadromous or resident spawning observed	TAC to evaluate annual monitoring information for a period of at least 5 years to determine if spawning is occurring. Based on evaluation, District may adjust restoration efforts, or gravel augmentation.	Within one year after implementation, and annually for the duration of the HCP
	Population abundance	Stable or increasing abundance of juveniles	Biological monitoring. Monitor fall juvenile rearing abundance at index sites. (MM-07)	Decreasing trends in abundance.	TAC to evaluate annual monitoring information for a period of at least 5 years to evaluate juvenile rearing. Based on evaluation, District may revise restoration efforts, or other actions.	Within one year after implementation, and annually for the duration of the HCP
	Individual growth	Moderate individual growth rates and large smolts	Biological monitoring. PIT tag mark and capture, and migrant trap monitoring. (MM-08)	Low growth rate of juveniles, and/or small smolts observed.	TAC to evaluate annual monitoring information for a period of at least 5 years to evaluate growth rates. Based on evaluation, District may revise restoration efforts, or other actions.	Within one year after implementation, and annually for at least five years
	Species composition	Increase in native species and Covered Species relative to non-native	Biological monitoring. Annual monitoring of species composition in index reaches, and eDNA sampling. (MM-10)	Continued low abundance of native species and Covered Species relative to non-native species	TAC to evaluate annual monitoring information for a period of at least 5 years to evaluate species composition. Based on evaluation, District may revise predator removal programs, restoration efforts, or other actions.	Within one year after implementation, and annually for at least five years

7.3.1.1 Compliance Monitoring

Compliance monitoring will be applied to track District compliance with the HCP and ITPs. Table 7-1 details the time, duration, and frequency of compliance monitoring. Figure 7-1 shows the locations of compliance monitoring in AG Creek watershed for flow-related measures. Monitoring of non-flow conservation measures will be for compliance and will be qualitative in nature. If compliance monitoring reveals that HCP actions are not being implemented or are not performing as planned, the District will work with the TAC to identify and implement corrective actions. Compliance monitoring results and triggers, including corrective actions implemented or proposed for future implementation will be provided to resource agencies, including NMFS, in annual reports.

MM-01: Release, Flow, and Water Surface Monitoring
Releases will continue to be monitored at Lopez Dam and flows will be measured at stream flow gages, including at Cecchetti Road, AG Creek gage at the City of Arroyo Grande, and 22nd Street Bridge (Figure 7-1). In addition, WSE will be monitored in AG Creek lagoon. Data will be collected and evaluated at 15-minute intervals, continuously year-round.

Analysis of the monitoring data will include summaries of daily minimum and average releases from Lopez Dam, ramping rates (inches/hour), and minimum and daily average flows at all locations. Fish passage opportunities will be summarized at each gage location; calculated as the number of days flows exceed identified minimum fish passage flow requirements for each station location for the adult and smolt migration periods (fish passage flows are evaluated in MM-03). This will provide compliance monitoring of the Lopez Dam minimum releases, and effectiveness monitoring of fish passage opportunities. In addition, WSE in the lagoon will be evaluated to assess lagoon berm open or closed status in relation to Lopez Dam releases and flows at 22nd Street Bridge. Results will be summarized in an annual report, distributed to the TAC, and discussed in an annual TAC meeting.

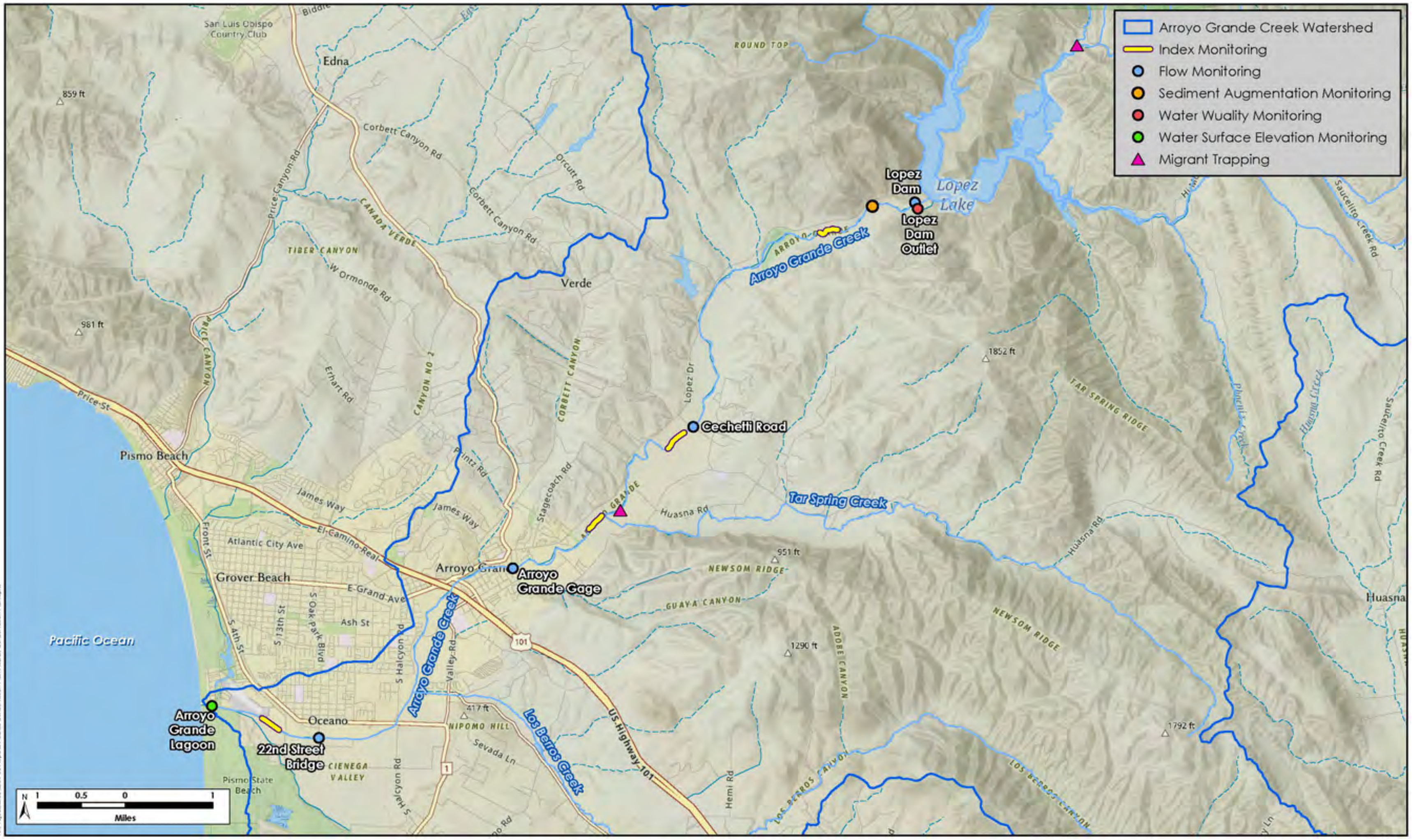

Figure 7-1. Monitoring locations.

MM-02 Water Quality Monitoring
The District will monitor water quality in AG Creek downstream of Lopez Dam. Water temperature and DO data will be collected using DO loggers and continuous water temperature loggers. The temperature loggers have a water detection capability that records when the logger is "in" versus "out" of the water, which District personnel will use to identify when sample reaches have been dewatered and to differentiate between water temperature and air temperature data. Lopez Reservoir monitoring will occur through vertical profiles used to calculate cold water pool volumes present within the reservoir. Water quality will be monitored directly downstream of Lopez Dam, Cecchetti Road, AG Creek gage, and 22nd Street Bridge (Figure 7-1).

Analysis of the water quality monitoring data will include summaries of daily minimum, average, and maximum water temperatures and DO for all monitoring locations. Analysis will include comparing results with suitability criteria of HCP Covered Species. Results will be summarized in an annual report, distributed to the TAC, and discussed in an annual TAC meeting.

7.3.1.2 Effectiveness Monitoring

Effectiveness monitoring assesses the biological performance of the HCP. The District will implement effectiveness monitoring to assess the efficacy of the conservation program established by the HCP in meeting the biological goals and objectives thereof, including conservation measures supporting juvenile and adult steelhead passage, and quality habitat for all life stages of steelhead, CRLF and SWPT. Effectiveness monitoring involves monitoring migration flows for adequate depth and for salmonid migration, and gravel augmentation as described in detail below.

MM-03 Fish Passage Flows
The LDRP is based on assumed sufficient minimum fish passage flows, based on existing information. To inform and continually refine the LDRP, monitoring will include assessing minimum fish passage flow requirements in the reach of AG Creek from Lopez Dam to Tar Spring Creek confluence, and in the reach from Tar Spring Creek to the lagoon.

The District will survey AG Creek downstream of Lopez Dam and identify critical riffles (shallow riffles which are particularly sensitive to changes in stream flow due to diminished water depth). All riffle locations will be identified in collaboration with the TAC. Minimum fish passage flows for steelhead adults and smolts will be determined for key reaches (22nd Street Bridge to Tar Spring Creek; Tar Spring Creek to Cecchetti Road; Cecchetti Road to Lopez Dam) based on measurements at identified critical riffles, following CDFW's most recent Standard Operating Procedure (SOP) at time of survey. This process will be conducted following significant flow/spill events in the watershed (>100 cfs from Lopez Dam, or 250 cfs at Arroyo Grande Gage), or at least every five years following issuance of an ITP to the District. Results will be reported and distributed to the TAC and presented to the TAC in an annual meeting and used to inform adaptive management of the LDRP.

MM-04 Habitat Restoration Monitoring
Habitat restoration projects are intended to increase steelhead rearing and spawning habitat, and BMI habitat. If habitat restoration projects occur (e.g., pond conversion to riverine habitat), then effectiveness monitoring will inform site maintenance and, if needed, adaptive management. Habitat monitoring will be conducted at typical winter baseflows (8 cfs) and summer baseflows (3 cfs) to determine the success of projects at achieving restoration objectives, and to inform maintenance. During each monitoring event suitable BMI, fry, juvenile, and spawning habitat will be mapped on the basemap of the reach, based on habitat suitability criteria, and observations of

CRLF and SWPT will be documented. Monitoring will include various components and will occur for up to 5 years post-construction. Results will be reported to the TAC and used to inform maintenance of the project.

MM-05 Sediment Augmentation Monitoring

The Sediment Management Plan (Section 5.4.3.2) will include a monitoring program to track the effectiveness of the plan in meeting its goals. This monitoring is likely to include tracking augmented gravel using tracer rocks, repeated mapping of the channel bed, and long-term cross section monitoring. This monitoring program will be used to update the Sediment Management Plan, and results will be reported to TAC and used to inform future implementation.

7.3.1.3 Biological Monitoring

The District will conduct long-term biological monitoring to assess the ecosystem responses to management actions and/or habitat conditions. The District has developed a monitoring program consistent with the approaches of CDFW Bulletin 182 (Boughton et al. 2022) that is summarized below. The monitoring program in the HCP is intended to contribute toward establishing fisheries and Covered Species population status and trends over the permit term and will include coordination with the TAC. Table 7-2 (below) summarizes long-term trend monitoring components.

Table 7-2. Summary of long-term biological monitoring.

Parameters	Analysis	Monitoring Method	Timing	Reporting
Adult steelhead abundance	Occurrence and trend analysis	Redd surveys, upstream migrant weir	Fall–winter	10-year trend data as available input to inform adaptive management decisions
Juvenile steelhead trends in abundance and condition	Occurrence, abundance, density and size distribution	Index reach electrofishing surveys, steelhead collected will be visually inspected to assess conditions in addition to a length-weight analysis	Fall	
Juvenile steelhead outmigration	Timing and abundance	Stationary PIT antenna arrays to detect PIT tagged fish; migrant traps operated in tributaries to Lopez Reservoir, and mainstem AG Creek	Winter–Spring	
Steelhead population genetics	Population diversity and genetic markers for anadromy	Tissue sampling upstream and downstream of Lopez Dam	Fall	
Fish and Covered Species (CRLF and SWPT) composition	Composition of native and non-native species in watershed	Index reach electrofishing surveys and eDNA	Fall	

MM-06 Spawning surveys

To identify whether steelhead are migrating to available upstream spawning habitat downstream of Lopez Dam, observations of steelhead spawning gravel and redd surveys will be conducted at reaches identified as containing suitable spawning gravel the lagoon upstream to Lopez Dam, including both downstream and upstream of the confluence with Tar Spring Creek. The specific objective of employing redd surveys is to determine spatial spawning distribution to assess steelhead migration behavior in response to the LDRP. Redd surveys will be conducted using the methods outlined by Gallagher (2007).

A baseline spawning gravel map will be developed within three months of HCP issuance. Redd surveys will be conducted within all identified suitable spawning gravel within two weeks of the occurrence of migration flows of at least 25 cfs at AG gage. Anadromous redds will be distinguished from resident redds to the extent feasible. Surveys will be conducted annually during the term of the HCP, unless replaced by an improved method of monitoring adult migration timing and adult abundance. Results will be summarized in an annual report, distributed to the TAC, and discussed in an annual TAC meeting.

MM-07 Juvenile Rearing

Monitoring to evaluate the presence, abundance, density, movement, survival and growth of juvenile steelhead will be conducted during HCP implementation. Juvenile monitoring will occur in all years. Juvenile monitoring will be conducted using an index reach sampling design and will include water quality sampling, fish processing (e.g., measuring and weighing), PIT tagging of suitably sized steelhead, and following a period of recovery, release of fish back into the reach from which they were captured.

Index reaches will be established at four locations (Figure 7-1) in coordination with the TAC. It is anticipated that locations will include within the vicinity of 1) Rodriguez Road Bridge, 2) Cecchetti Road, 3) Strother Park, and 4) Kiwanis Park. Two of these locations are upstream of the confluence with Tar Spring, and two are located downstream of Tar Spring. Two additional reaches will be considered optional, including near the Terminal Reservoir channel, and downstream of Highway 101.

Index reach sampling will occur during the fall. Sampling reach length will be determined in coordination with the TAC and will be adjusted so that approximately two reaches can be feasibly sampled in a day. It is anticipated that reaches will target lengths of around 30 meters (98 ft) and include at least two distinct habitat types. Multiple-pass electrofishing will be conducted following methods by Pollock and Otto (1983), wherein captured fish are temporarily removed from the sample site during sequential passes and returned to the stream once sampling is completed. Block nets will be installed at the upstream and downstream extent of each index reach to prevent migration into or out of the site and facilitate an accurate assessment of sample populations. Biologists with backpack electrofishers and two or three netters will begin at the downstream block net and proceed upstream, working closely together. As fish are captured, they will be placed in buckets with aerated stream water until the completion of the pass. A minimum of three passes will be conducted within each index reach. If there is poor depletion after three passes, a fourth pass will be performed.

Captured fish will be identified to species and measured (standard length and fork length). Additional methods to be employed during juvenile rearing sampling include collection of tissue and scale samples. These samples will be collected from a subset of captured steelhead and, like other methods applied during sampling events (e.g., electrofishing, fish processing), will apply standard practices to minimize injury and harm to individuals. Collection by backpack electrofishing will be used to capture fish during the fall sampling window weather and stream flow permitting.

The District will compare abundance, density, and fish lengths and evaluate trends by comparing present-year juvenile rearing capture data to previous years' data. Recaptured PIT tagged fish will provide individual growth rates. Additionally, recaptured fish in subsequent years of juvenile rearing sampling will be assessed for a relative yearly growth rate. Results will be summarized in an annual report, distributed to the TAC, and discussed in an annual TAC meeting.

MM-08 Juvenile Migration

Monitoring to evaluate migration of adult steelhead into and out of AG Creek, and smolts out of AG Creek, will be conducted during HCP implementation. To study migration, juvenile steelhead captured during juvenile rearing monitoring will be tagged with PIT tags (see Juvenile Rearing above). Three antenna arrays will be monitored—one location in AG Creek downstream of Lopez Dam (as described in Section 6.1.5.2 above), one location in the vicinity of the Arroyo Grande gage (to confirm more extensive downstream movements indicative of true migration), and a third location near the tidal influence of the lagoon (to confirm ocean entry). An added benefit to operation of PIT antennas is that they would also detect any PIT tagged smolts that return as adults. The precise locations of antenna locations will be determined by the District in collaboration with the TAC. Data will be downloaded at least every two weeks from October 1 to June 30. Antenna monitoring will be conducted for at least five years. Results will be summarized in an annual report, distributed to the TAC, and discussed in an annual TAC meeting.

MM-09 Genetics

Propensity for anadromy is influenced by genetics, and because the *O. mykiss* population upstream of Lopez Reservoir has been landlocked since the late 1960s, it is possible the population has undergone selection for resident genotypes. Genetic differentiation has been observed in formerly anadromous populations in nearby watersheds that have restricted ocean access due to dams or due to being outplanted above waterfalls (Hayes et al. 2012, Pearse et al. 2014). Propensity for anadromy is also influenced by habitat and resource-related factors like growth rate (which is influenced by genetic underpinnings and resource availability) and fish density within pool habitat. Juvenile *O. mykiss* with higher growth rates have been found to be more likely to become residents, whereas juveniles with lower growth rates (and higher densities) are more likely to have higher rates of anadromy (Kendall et al. 2015). The District will use snorkel surveys and genetic analysis of collected tissue to assess genetic propensity for anadromy, and to estimate fish densities within Lopez Creek and compare results with other nearby watersheds to describe the likelihood of the existing steelhead population to produce smolts. Results will be summarized in a report, distributed to the TAC, and discussed in an annual TAC meeting.

MM-10 Species Composition

eDNA sampling and laboratory analysis will be used to characterize the composition of the fish and Covered Species community and the distribution of bullfrogs in AG Creek. eDNA surveys will help elucidate whether predatory species are present throughout the entire AG Creek mainstem or concentrated in specific reaches. Sampling will be conducted during low flow conditions, typically summer months, to minimize eDNA transport between reaches. Briefly, this method will involve collecting and filtering water samples using methods outlined in Laramie et al. (2015) and Goldberg and Strickler (2017). DNA metabarcoding will be used to identify the species of fish, CRLF, and SWPT in each sample to characterize fish and Covered Species community composition in each of the AG Creek reaches. This approach will utilize an assay developed by Miya et al. (2015), that should effectively detect most fish species expected to occur in AG Creek, as well as bullfrogs, CRLF and SWPT. eDNA sampling will occur in the lagoon complex (both AG Creek and Meadow Creek lagoons) and the mainstem Reaches 1 and 2 with the goal of detecting bass, catfish, sunfish, and any additional fishes that could predate on or compete with steelhead, CRLF and SWPT. In addition to fish and Covered Species DNA metabarcoding, a species-specific quantitative PCR assay (Lin et al. 2019) will be conducted on the samples to test specifically for bullfrog eDNA at each site. Following restoration or predator removal efforts, annual eDNA sampling will continue at all sample sites to track distribution of remaining predators. Results will be summarized in a report, distributed to the TAC, and discussed in an annual TAC meeting.

7.3.2 Adaptive Management Program

AMPs are recommended for programmatic HCPs and those with data gaps or scientific uncertainty that could affect how species are managed during implementation. The HCP Handbook (USFWS and NMFS 2016) describes adaptive management as a method for addressing uncertainty in natural resource management and states that management must be linked to measurable biological goals and monitoring. Conservation measures proposed in Section 5 *Conservation Program* could be adapted in response to new information within an adaptive management framework if the commitments defined under the HCP's regulatory assurances (Section 7 *Plan Implementation*) are maintained.

The biological goals and objectives for the Lopez Water Project HCP are to:

1. **Biological Goal 1:** Improve habitat for steelhead, CRLF, and SWPT in AG Creek to encourage persistence of populations within the plan area.
2. **Biological Goal 2:** Provide improvements to habitat for steelhead, CRLF, and SWPT in AG Creek between Lopez Dam and the confluence with Tar Springs Creek.
3. **Biological Goal 3:** Determine feasibility of an assisted migration program for steelhead in the AG Creek watershed (both upstream and downstream of Lopez Dam).

If monitoring indicates that HCP goals and objectives for steelhead and habitat are not being met, adaptive management actions will be implemented. To support HCP adaptive management implementation, the District will establish a multi-agency TAC (Section 5.4.9). Potential adaptive management actions will be developed by the District for review by the TAC and selected adaptive management actions will be prioritized for implementation by the District. Additionally, the adaptive management approach allows the District, with TAC coordination, to develop and implement additional adaptive management actions, as long as they promote achieving the overall goals of the HCP and are within defined constraints applicable to Lopez Water Project operations. To meet the mission and purpose of the Lopez Dam Operations, the District is required to maintain a "Safe Yield" of 8,730 AF annually. Maintenance of Safe Yield is the starting point for District Operations. There may be circumstances during the permit term where operating within Safe Yield will not, as a result of factors outside the District's control (e.g., drought, state mandated curtailments, regulatory directives), allow the District to comply with operational and supply requirements. In such cases, the District will work closely with the TAC to identify appropriate response measures. To the degree the District, NMFS, and USFWS enter into an implementation agreement relative to the HCP and ITPs, the implementation agreement may address specific aspects of adaptive management, including adaptive management actions taken in response to maintenance of Safe Yield. While the District will not provide any additional water than within the "Safe Yield," the District could shift water releases in time, magnitude or duration to improve habitat and migration conditions, based on results of monitoring and with guidance from the TAC.

The adaptive management approach will use monitoring data (see Section 7.4.1) and other best-available information to inform the development and implementation of any adaptive management actions. The District will synthesize and analyze monitoring and implementation data, assess the HCP's progress towards achieving biological goals and objectives, and develop potential adaptive management actions. The TAC will make decisions for selecting and implementing adaptive management actions by consensus and includes review and coordination with NMFS and USFWS members of the TAC. Considerations for adaptive management decision making will include inter-annual and seasonal variation in hydrologic conditions, other constraints and limiting factors affecting achievement of the overall management objectives.

The TAC will meet annually prior to the beginning of the water year (October 1). Materials for discussion and proposed adaptive management actions will be provided to the TAC at least 30 days in advance of the meeting. The purpose of the meeting is to decide on adaptive management actions so that they can be implemented prior to the migration flow release period. Additional meetings may be required with the TAC to address specific decision points for the assisted migration conservation measure (CM-2, Section 5.4.2).

7.4 Changed and Unforeseen Circumstances

No Surprises assurances regulations (50 C.F.R. §§ 17.22, 17.32, 222.307(g)) provides assurances to ITP holders that, so long as an ITP is properly implementing the HCP and ITP, NMFS and USFWS will not require the commitment of additional land, water, or financial compensation; or additional restrictions on the use of land, water, or other natural resources beyond the level otherwise agreed to in the HCP without the consent of the permittee. Permittees may provide additional mitigation, but only voluntarily. No Surprises assurances remain in place if the HCP is being properly implemented.

In order to receive the benefits of No Surprises assurances, the HCP Handbook instructs that HCPs must address changed and unforeseen circumstances. Where changed circumstances addressed by the HCP occur, the permittee is required to implement the measures specified in the HCP to respond to this change. HCP permittees are not required to implement remedial actions for any unforeseen circumstances. These terms are defined and explained below.

7.4.1 Changed Circumstances

50 C.F.R. § 17.3 and 50 C.F.R. § 222.102 define changed circumstances as “changes in circumstances affecting a species or geographic area covered by a[n HCP] plan that can reasonably be anticipated by [HCP] developers and [NMFS and USFWS] and that can be planned for (e.g., the new listing of species, a fire, or other natural catastrophic event in areas prone to such events).” Under the federal regulations (50 C.F.R. § 17.22(b)(2)(5)(i), (ii) and 50 C.F.R. § 222.307(g)(1), (2)), if additional conservation and mitigation measures are deemed necessary to respond to changed circumstances, and these additional measures are provided for in the HCP, then the District will implement those measures. However, if additional measures deemed necessary to respond to changed circumstances are not provided for the HCP, NMFS and USFWS will not require these additional measures without the consent of the permittee, provided the permittee continues to properly implement the HCP.

The District assessed potential changed circumstances, including those identified in Table 7-3, and several others that were ultimately excluded due to the lack of effect on Covered Species, including climate change. The potential variables related to Covered Species, particularly steelhead, as a result of climate change are accounted for in the conservation program, the effectiveness monitoring and adaptive management framework, and the effects analysis. Measurable effects to the Covered Species as a result of climate change are not anticipated to occur because of the implementation of Covered Activities and the conservation program under the HCP. Reasonably foreseeable circumstances for which the District will implement specific remedial measures, should they occur, are listed in Table 7-3.

Table 7-3. Potential changed circumstances and remedial measures.

Changed Circumstances	Remedial Measures
Listing of a Covered Species	If NMFS, or USFWS, lists a Covered Species during the permit term, that species will be subject to incidental take coverage for the federal ITPs at the time of listing. The terms and conditions of the HCP and ITPs will not change.
Delisting of a Covered Species	If NMFS or USFWS delists a Covered Species, the District may, in its discretion, amend the HCP, ITP, and any implementing agreement to remove the delisted species from the list of Covered Species and strike some or all of the provisions of these documents pertaining to the delisted species. NMFS or USFWS rationale for delisting, as published in the relevant final delisting rule, will determine the extent to which the District may retire future obligations relating to the delisted species.
Listing of a non-covered species or expansion of non-covered listed species into plan area	During the permit term, NMFS or USFWS may list a non-covered species, or an existing non-covered listed species could expand its distribution into the plan area. This changed circumstance will have occurred when NMFS or USFWS publishes a proposed rule in the Federal Register to list a new species that occurs within the plan area. Should this occur, the listing agency shall notify the District of the occurrence of this Changed Circumstance. Within 90 days of such notification, the District will provide information to the listing agency assessing the impact of Covered Activities on the newly proposed listed species. With this assessment, the District will notify the listing agency whether the District intends to seek an amendment to address the newly listed species. The District and the listing agency will work together to identify measures to avoid take, including those measures that may already be included in the HCP and can support the amendment of the ITP(s) without need of further commitments of District resources. The District may also implement additional or amended measures in order to allow the Services to approve an amendment to the HCP to cover the newly listed species.
New or expanded Designated Critical Habitat	During the permit term, NMFS or USFWS may newly designate or expand designated critical habitat for a covered species in the plan area. This changed circumstance will have occurred when NMFS or USFWS publishes a proposed rule in the Federal Register to designate new or expanded critical habitat within the plan area. Should this occur, the listing agency shall notify the District of the occurrence of this Changed Circumstance. Within 90 days of such notification, the District will provide information to the listing agency assessing the impact of Covered Activities on the newly proposed critical habitat designation. With this assessment, the District will notify the listing agency whether the District intends to seek an amendment to address expanded or newly designated critical habitat. The District and the listing agency will work together to identify measures to avoid adverse effects, including those measures that may already be included in the HCP and can support the amendment of the ITP(s) without need of further commitments of District resources. The District may also implement additional or amended measures in order to allow the Services to approve an amendment to the HCP to cover the expanded or newly designated critical habitat. In the event the new or expanded designated critical habitat is for a covered species, then to the maximum extent allowed by law, USFWS and NMFS agree not to impose any additional or amended measures that would require further commitments of District resources.
Earthquake	Following an earthquake that results to damage to District infrastructure, the District will assess infrastructure and report to the TAC any damages that prevent or hinder the implementation of the HCP within 2 weeks of the earthquake, with a timeline for repairs and suggested alternatives for meeting HCP objectives. For health and safety concerns, coordination with the DSOD and the DDW will be required. To the extent an earthquake results in damage to District infrastructure requiring immediate action on the part of the District to preserve public health and safety or the integrity of the damaged infrastructure, such action is considered an emergency action under Covered Activities. However, regional large earthquakes such as may occur on the San Andreas Fault that result in large-scale regional damage will be considered an unforeseen circumstance.

Changed Circumstances	Remedial Measures
Drought	Periods of drought extending for up to 3 consecutive years may have an adverse effect on the habitat restoration areas, including aquatic and riparian vegetation stress, habitat conversion (e.g., from predominantly hydrophytes to upland-adapted species), and invasion by exotic invasive species. Long periods of drought that result in Lopez Reservoir levels falling below 20,000 AF, as measured on April 1st, will result in the LRRP for AG Creek releases as described in Section 3.3.1.2. The District will prepare a specific response plan as part of the annual meeting process under the AMP for the incidence of drought based on the resulting effects to the habitat restoration areas, which may include monitoring, invasive species removal, or revegetation with native species lost to the drought. Following approval by the USFWS and NMFS, the response plan would be implemented. Any drought for more than 4 successive years is considered an unforeseen circumstance.
Facility repairs or maintenance due to severe storm damage	Damage to the facility resulting from severe storms may require repair and rehabilitation of facility infrastructure and/or sediment and debris removal. Storms at or below the 100-year event are reasonably likely within the 30-year permit term. Storm events resulting in runoff up to the 100-year flood elevation, as determined by the FEMA, as well as events resulting in excessive sediment and debris load (e.g., events following a wildfire), have the potential to damage facilities, requiring immediate maintenance. Damage to facilities resulting from severe storms may include: damage or failure of County roads and bridges due to hydraulic forces, debris loading, and erosion; loss of reservoir capacity due to excessive sediment and debris loading that may occur in a single year or over several years; significant changes to water quality due to sedimentation, debris loading, organics, etc,, requiring increased monitoring, testing and treatment and impacts can occur in single year or for several years; dam or spillway damages caused by scour, erosion, or debris. Severe storm damage may occur during the steelhead migration season. The District will assess any damage as soon as is feasible and develop a plan for repair, including the materials and equipment necessary to complete the repairs, and conservation measures to be implemented to avoid Covered Species, for implementation as conditions permit. The outcome of repairs and conservation measures will be documented and included in required monthly and annual reports. Damage caused by flooding larger than a 100-year event is considered unforeseen.
Aquatic, riparian, and native upland habitat impacts resulting from flood and/or fire	Vegetation scour due to channel-forming flood events is considered to be a natural occurrence, and regeneration of the habitat within the river is anticipated to occur naturally. Similarly, wildfires are a natural occurrence in the region, and there is potential for these events to result in impacts to the riparian habitat restoration area, as well as surrounding native upland habitat, during the permit term. Major wildfires in SLO County have ranged from several hundred acres to the largest wildfire in 1996 that was over 100,000 acres. The District does not propose active revegetation of the habitat restoration areas, but rather the ongoing monitoring and reporting associated with the conservation program will document natural recruitment and passive restoration of these habitats following flood and/ or fire. Should monitoring indicate that the habitat restoration is occurring at a pace or in a manner that is likely to result in impacts to Covered Species not otherwise addressed in the HCP, and should the District, in coordination with the TAC, determine that such areas would benefit from active management (e.g., invasive exotic species control), the District will prepare a specific response plan as part of the annual meeting process under the adaptive management framework to be implemented following approval by the USFWS and NMFS. Any large wildfire, defined by the EPA as greater than 1,000 acres (EPA 2016), is considered an unforeseen circumstance.
Aquatic, riparian, and native upland habitat impacts resulting from unanticipated maintenance needs	Both routine and non-routine maintenance activities identified in Section 4 are confined to known areal extents; however, should more extensive maintenance become necessary due to severe and unexpected damage to the facility, and should these activities occur in aquatic, riparian, and native upland habitats at a time or place that measurable negative impacts to Covered Species are reasonably likely to occur, the District will provide mitigation for aquatic, riparian, and native upland habitat impacts. Planning and implementation of mitigation for impacts will be coordinated with NMFS and USFWS and will conform to the standards of the habitat restoration program to the extent feasible.

Changed Circumstances	Remedial Measures
Aquatic, riparian, and native upland habitat impacts resulting from unanticipated maintenance needs or required facility improvements required by changes in regulations or specific requirements from the Division of Safety of Dams (DSOD).	Both routine and non-routine maintenance activities identified in Section 4 are confined to known areal extents; however, should more extensive maintenance or facility improvements become necessary due to changes in regulations, requirements or corrective actions from DSOD, such as seismic retrofit, structure repairs as designated by periodic dam inspection, and should such actions be determined by the District to have a reasonable likelihood of having measurable negative impacts on Covered Species, the District will provide mitigation for aquatic, riparian, and native upland habitat impacts. Planning and implementation of mitigation for habitat impacts will be coordinated with NMFS and USFWS and will conform to the standards of the habitat restoration program to the extent feasible.
Aquatic, riparian, and native upland habitat impacts resulting from unanticipated maintenance needs or required facility improvements required by changes in regulations or specific requirements from the Division of Drinking Water (DDW).	Both routine and non-routine maintenance activities identified in Section 4 are confined to known areal extents; however, should more extensive maintenance or facility improvements become necessary due to changes in regulations, requirements or corrective actions from DDW, and should such actions be determined by the District to have a reasonable likelihood of having measurable negative impacts on Covered Species, the District will provide mitigation for aquatic, riparian, and native upland habitat impacts. Planning and implementation of mitigation for habitat impacts will be coordinated with NMFS and USFWS and will conform to the standards of the habitat restoration program to the extent feasible.

7.4.2 Unforeseen Circumstances

Unforeseen circumstances are changes in circumstances that affect a species or geographic area covered by an HCP that could not reasonably be anticipated by the ITP applicant and USFWS and NMFS at the time of HCP development and that result in a substantial and adverse change in status of a Covered Species (50 C.F.R. § 17.3, 50 C.F.R. § 222.102). USFWS and NMFS have the burden of demonstrating unforeseen circumstances exist and must base that determination on the best scientific and commercial data available. USFWS and/or NMFS, as relevant, shall notify the District in writing of any unforeseen circumstances the agency(ies) believe to exist.

The No Surprises Rule states if additional conservation and mitigation measures are deemed necessary to respond to unforeseen circumstances, USFWS and NMFS may require additional conservation measures of a permittee as a result of unforeseen circumstances "only if such measures are limited to modifications within conserved habitat areas, if any, or to the conservation plan's operating conservation program for the affected species, and maintain the original terms of the conservation plan to the maximum extent possible." Importantly, the No Surprises Rule states that such additional conservation and mitigation measures ""will not involve the commitment of additional land, water, or financial compensation or additional restrictions on the use of land, water, or other natural resources otherwise available for development or use under the original terms of the conservation plan without the consent of the permittee." (50 C.F.R. § 17.22(b)(5)(iii), 50 C.F.R. § 222.307(g)). The District will consider requests by USFWS and NMFS to amend or supplement conservation measures in response to unforeseen circumstances.

The District as the permittee is only responsible for the changed circumstances as defined and described in the HCP. Unforeseen circumstances are circumstances that are highly unlikely and not reasonably foreseeable to occur during the permit term and, as determined by the federal No Surprises regulations, are not the management, monitoring, or funding responsibility of the District as the permittee.

The federal No Surprises regulation does not limit or constrain USFWS or NMFS or any federal, state, local, or tribal government agency, or private entity, from taking additional actions at its own expense to protect or conserve Covered Species. The federal No Surprises regulation also does not prevent USFWS or NMFS from asking the District to voluntarily undertake additional mitigation on behalf of the affected species. The refusal of the District to concede to requests for additional mitigation or other measures shall not be a basis for USFWS or NMFS to make a finding that the District is not in compliance with the HCP or the terms and conditions of the ITP.

7.5 Amendments

From time to time, the District may need to clarify or amend the HCP, ITP, or related documents (e.g., implementing agreement). The HCP Handbook contemplates varying levels of changes to the HCP, ITP, and related documents (HCP Handbook at 17-6), and the District and NMFS or USFWS, as applicable, must agree in writing to any such changes. Based on the guidance of the HCP Handbook, the District anticipates three types of changes to the HCP, ITP, and related documents: clarifications, minor amendments, and major amendments. Clarifications are referred to by the HCP Handbook as "Interpretations, Corrections, Clarifications, or Missing Detail" which address "small errors, omissions, or language that may be too general or too specific for practical application." (HCP Handbook at 17-6). Clarifications are generally administrative, do not change the substance of the HCP or ITP, and do not require additional analysis by NMFS or

USFWS under NEPA or ESA section 7. An example of a clarification would be changing the due date for submitting an annual report or updating contact information for the permittee. Where the District, NMFS, or USFWS determines a clarification may be needed, that party may request a clarification in writing to the other party or parties, with an explanation as to why the clarification is needed or desired. A clarification is approved with and becomes effective upon the written agreement of all parties to the relevant ITP. The clarification will be appended to the version of the document to which clarification applies in District, NMFS, and/or USFWS records. The remaining two types of changes—minor modifications and major amendments—are described in the follow subsections. Minor modifications and major amendments shall be processed in accordance with all applicable legal requirements for ESA ITPs.

7.5.1 Minor Modifications

Minor modifications will be administratively incorporated into the HCP when the District and NMFS, or the District and USFWS (as applicable based on species), agree on the modification. Minor modifications are changes to the HCP or ITPs that do not modify the scope or nature of activities or actions covered by the ITPs, result in operations under the HCP that are significantly different from those contemplated or analyzed in connection with the HCP as approved, result in adverse impacts on the environment that are new or significantly different from those analyzed in connection with the HCP as approved, or result in additional take not analyzed in connection with the HCP as approved. Examples of minor modifications include, but are not limited to: (1) corrections of typographic, grammatical, and similar editing errors that do not change the intended meaning; (2) correction and updates to reflect previously approved changes in an ITP or the HCP; (3) minor changes to survey, monitoring, or reporting protocols; (4) clarifications of vague or undefined language or phrases; (5) minor changes to the HCP actions that do not diminish the conservation value of the HCP to Covered Species, including but not limited to changes or adjustments to conservation measures determined by monitoring and recommended through the AMP; (6) making changes to funding sources; (7) changing the names or addresses of responsible officials; and (7) other modifications to the HCP proposed by the District that USFWS and NMFS (as applicable) agree are minor modifications.

Under this HCP and the ITPs, the District, NMFS, or USFWS may submit a request for a minor modification. The request must be submitted to the appropriate representatives of each agency for review and consideration. If the applicable Service and the District concur with the proposed minor modification in writing, it becomes effective. If a party objects to a proposed minor modification, the proposal is not approved as a minor modification but may be processed as a major amendment.

7.5.2 Major Amendments

Major amendments are changes in the HCP that may affect the impact analysis or conservation strategy and requires amending the HCP and the ITP through a formal review process. This may include evaluation under NEPA and/or CEQA, public notice, and ESA Section 7 consultation by USFWS and/or NMFS. Examples of changes that would require this type of amendment include those listed below:

1. Significant alterations in plan area or permit area boundary
2. The addition of new Covered Species
3. Changes to Covered Activities not previously addressed
4. Material increases in the level of take or material changes to the form of take

5. Significant changes to the conservation strategy, including to the mitigation measure, that results in a materially negative impact on the Covered Species
6. Extending the duration of the permit except as provided below in a permit renewal.

Pursuant to ESA regulations at 50 C.F.R. § 13.23 and 50 C.F.R. § 222.306, and in accordance with all applicable legal requirements, the District or the USFWS or NMFS may submit a request for a major amendment. The request must be submitted to the appropriate representatives at NMFS and/or USFWS and the District for review and consideration. Any major amendment must have approval of NMFS, USFWS, and the District.

Any major amendment will generally follow the same process as the original permit application and will require: (1) an amendment to the HCP addressing the new circumstance, (2) a Federal Register notice, (3) NEPA and CEQA compliance, and (4) compliance with ESA section 7.

7.6 Permit Suspension, Revocation, Relinquishment, and Termination

Pursuant to ESA regulations at 50 C.F.R. § 13.27, 13.28 and 50 C.F.R. § 222.306, the Services may suspend or revoke ITPs as a result of a failure to implement the HCP properly or comply with the terms of the HCP or ITPs. Prior to taking any action to suspend, revoke, or terminate an ITP, the Services shall meet and confer with the District to attempt to resolve the need to suspend, revoke, or terminate the ITP. Any such suspension or revocation will apply only to the specifically identified Covered Species, Covered Activities, or portions of the Permit Area.

Pursuant to ESA regulations at 50 C.F.R. § 13.26 and 50 C.F.R. § 222.306(d), the District may relinquish one or more of the ITPs, or a portion thereof, in accordance with regulations in effect on the date of such relinquishment. Unless later modification of these regulations dictate otherwise, to relinquish an ITP, the District shall, within thirty (30) calendar days of discontinuing incidental take and the exercise of other rights granted by the ITP, return the ITP to USFWS or NMFS as applicable, at the Service’s issuing office, together with a written statement surrendering the ITP for cancellation. Relinquishment of an ITP will result in the termination of the District’s responsibilities and obligations to Covered Species listed and either or both (as applicable) of the Services’ responsibilities and obligations as provided for in the ITP.

Any termination, relinquishment, or revocation of an ITP automatically terminates the District’s and USFWS or NMFS’s obligations and responsibilities under the HCP as related to the subjects of the specific ITP. Activities thereafter conducted by the District will be subject to all applicable provisions of the ESA and related regulations as if the ITP had never been issued. A termination or revocation by either USFWS or NMFS limited to one or more species, but less than all of the Covered Species then provided for in an ITP, shall apply only to the affected species. The ITPs shall continue in full force and effect as to all other Covered Species.

7.7 Renewal of Incidental Take Permits

The District seeks a renewable ITP from NMFS and USFWS with an initial term of 30 years from the date of issuance. The District requests NMFS and USFWS indicate on their respective ITPs that the ITPs are renewable. Pursuant to ESA regulations at 50 C.F.R. § 13.22 and 50 C.F.R. § 222.304, where the District files a request for renewal of the ITPs at least 30 days prior to permit expiration, the ITPs will remain valid while NMFS and USFWS, as applicable, processes the request. If the District fails to file a renewal request at least 30 days prior to ITP expiration, the relevant ITP will become invalid on the stated expiration date. Any changes to the HCP, ITP, or related documents needed to implement the renewal will be processed by NMFS and USFWS in accordance with the provisions described in Section 7 of the HCP. The District anticipates NMFS and USFWS may publicly notice any ITP renewals in the Federal Register for at least 30 days.

7.8 Permit Transfer

Pursuant to ESA regulations at 50 C.F.R. § 13.24(b), (c) and 50 C.F.R. § 222.305 (a)(3), in the event of sale or transfer of one or more of the District's facilities associated with the Covered Activities during the life of the permit, a new permit application, permit fee, and an Assumption Agreement would be submitted to NMFS and/or USFWS, as applicable. The ITPs and each of its covenants and conditions shall be binding on and shall inure to the benefit of the new owner(s) and their respective successors and assigns. The new owner(s) will commit to all requirements regarding the take authorization and conservation measure obligations of this HCP and agreed to in advance with NMFS and/or USFWS.

8 COSTS AND FUNDING

8.1 Financial Summary

The District's HCP involves four programs to be funded by the District:

1. Habitat Conservation Program
2. Monitoring Program
3. Adaptive Management Program
4. Program Administration

In compliance with ESA section 10(a)(2)(A), this section describes the estimated costs associated with implementing the HCP and the funding mechanisms that will be available for HCP implementation, as described in the previous sections of this HCP.

8.2 Estimate of HCP Costs

Tables 8-1 and 8-2 present the projected funding requirements for implementation of the HCP over the 30-year permit term. Additional details regarding the cost assumptions and methodologies is provided in the discussion below. Table 8-1 provides a summary of estimated costs associated with implementation of the Assisted Migration conservation measure, while Table 8-2 provides the corresponding summary associated with the Increased Habitat Restoration adaptive management strategy. As described in Section 5.4.2, decision points are scheduled no later than Years 5 and 10, at which time the effectiveness and feasibility of Assisted Migration will be evaluated. Should the conservation measure be discontinued at either of these times, implementation would thereafter transition to the adaptive management strategy and costs would follow the financial framework established for Increased Habitat Restoration.

Table 8-1. HCP financial summary with assisted migration.

Habitat Conservation Plan Financial Summary with Assisted Migration	
Program	**2025 Dollars (30 Year Total)**
Conservation Program	$ 20,900,950.00
Monitoring and Reporting	$ 5,040,000.00
Adaptive Management	$ 1,464,555.45
Administration	$ 12,979,773.17
Total Estimated Cost	**$ 40,385,278.62**

Table 8-2. HCP financial summary with increased habitat restoration.

Habitat Conservation Plan Financial Summary with Increased Habitat Restoration		
Program	**2025 Dollars (30 Year Total)**	
Conservation Program	$	9,900,950.00
Monitoring and Reporting	$	5,040,000.00
Adaptive Management	$	6,564,555.45
Administration	$	12,979,773.17
Total Estimated Cost	**$**	**34,485,278.62**

8.2.1 Conservation Program

The following conservation measures are described in detail in Section 5.4. Table 8-3 below identifies costs in 2025 dollars to implement each conservation measure including both pathways.

Table 8-3. Estimated implementation and operations costs.

Conservation Measure Project Costs						
Conservation Measure	**Total Project Cost**		**Estimated Annual Operating Cost w/ Assisted Migration (2025 Dollars)**		**Estimated Annual Operating Cost w/ Increased Habitat Restoration(2025 Dollars)**	
Lopez Dam Release Plan	$	-	$	20,000.00	$	20,000.00
Assisted Migration	$	460,000.00	$	440,000.00	$	-
Habitat Restoration	$	990,000.00	$	50,000.00	$	50,000.00
Biddle Park Culvert Maintenance	$	49,500.00	$	10,000.00	$	10,000.00
Predator Control Program	$	105,950.00	$	15,000.00	$	15,000.00
Fish Rescue and Relocation during Localized Construction dewatering	$	14,300.00	$	10,000.00	$	10,000.00
Gaging Stations	$	57,200.00	$	90,000.00	$	90,000.00
Best Management Practices (BMPs)	$	26,800.00	$	20,000.00	$	20,000.00
Interagency Technical Workgroup	$	12,200.00	$	10,000.00	$	10,000.00
	$	**1,715,950.00**	**$**	**665,000.00**	**$**	**225,000.00**

8.2.2 Monitoring and Reporting

Costs for the monitoring program are shown in Table 8-4. The monitoring activities are described in Section 7.4

Table 8-4. Yearly monitoring costs.

Monitoring Costs				
Monitoring	**Year 1 (2025 Dollars)**	**Years 2-5 Average Annual Cost (2025 Dollars)**	**Years 6-30 Average Annual Cost (2025 Dollars)**	**Notes**
Compliance Monitoring				
MM-01: Release, flow, and water surface monitoring	$ 20,000.00	$ 20,000.00	$ 20,000.00	This is cost for analysis and reporting of the annual flow monitoring data. The costs of the stations are covered in CM 7 gaging stations.
MM-02 Water Quality Monitoring	$ 50,000.00	$ 10,000.00	$ 10,000.00	Year 1 costs include equipment, and following implementation it is analysis and reporting
Effectiveness Monitoring				
MM-03 Fish passage flows	$ 65,000.00	$ 25,000.00	$ -	Year 1 includes identifying CRs with TAC and analysis. After five years it is assumed that passage flows will be established.
MM-04 Habitat restoration monitoring	$ 65,000.00	$ 20,000.00	$ -	These costs will only be incurred if habitat restoration occurs. Year 1 costs might be five years or more following HCP implementation, depending on other CMs.
MM-05 Sediment augmentation and geomorphic flows monitoring	$ 40,000.00	$ 40,000.00	$ 8,000.00	First few years require annual monitoring, and after five years it is relatively routine.
Biological Monitoring				
MM-06 Spawning surveys	$ 65,000.00	$ 45,000.00	$ 45,000.00	Assumes surveys following migration flow events (average 1.5 per year, 15 days on average), duration of permit.
MM-07 Juvenile Rearing	$ 70,000.00	$ 45,000.00	$ 45,000.00	Assumes crew of four, first year includes equipment, occurs annually for permit duration
MM-08 Juvenile Migration	$ 150,000.00	$ 35,000.00	$ -	Five-year effort
MM-09 Genetics	$ 65,000.00	$ -	$ 5,000.00	One-time effort, could occur again in year 10 or 15
MM-10 Species composition	$ 40,000.00	$ -	$ 5,000.00	One-time effort, could occur again in year 10 or 15
Total	$ 630,000.00	$ 240,000.00	$ 138,000.00	

8.2.3 Adaptive Management

The elements of the AMP are described in Section 7.4.2 of this HCP. The costs set forth in this section are illustrative as actual future costs associated with adaptive management are dependent on information not yet available. Two financial pathways, as described earlier in this section, are dependent on decisions to be made at a future date. These two pathways are shown in Tables 8-5 and 8-6. The District shall commit to a fixed baseline with a contingency percentage based on the current Consumer Price Index (CPI). The CPI shall be applied to the HCP total estimated cost by year. See Tables 8-5 and 8-6.

Table 8-5. Adaptive Management costs with assisted migration.

Adaptive Management w/ Assisted Migration					
Structure	Year 1 (2025 Dollars)	Years 2-5 Average Annual Cost (2025 Dollars)	Year 6 Average Annual Cost (2025 Dollars)	Years 7-10 Average Annual Cost (2025 Dollars)	Years 11-30 Average Annual Cost (2025 Dollars)2
Base	$ 100,000.00	$ 50,000.00	$ 25,000.00	$ 25,000.00	$ 25,000.00
Assisted Migration	$ -		$ -	$ -	$ -
Contingency[1]	$ 13,300.00	$ 13,978.43	$ 14,684.27	$ 15,433.32	$ 19,696.21
Total	$ 113,300.00	$ 63,978.43	$ 39,684.27	$ 40,433.32	$ 44,696.21
1. Consumer Price Index (CPI) multiplied by CM Annual Total Operating Cost (CPI = 2% min)					

Table 8-6. Adaptive Management costs with increased habitat restoration.

Adaptive Management w/ Increased Habitat Restoration					
Structure	Year 1 (2025 Dollars)	Years 2-5 Average Annual Cost (2025 Dollars)	Year 6 Average Annual Cost (2025 Dollars)	Years 7-10 Average Annual Cost (2025 Dollars)	Years 11-30 Average Annual Cost (2025 Dollars)2
Base	$ 100,000.00	$ 50,000.00	$ 25,000.00	$ 25,000.00	$ 25,000.00
Habitat Restoration	$ -	$ -	$ 1,467,500.00	$ 808,125.00	$ 20,000.00
Contingency[1]	$ 13,300.00	$ 13,978.43	$ 14,684.27	$ 15,433.32	$ 19,696.21
Total	$ 113,300.00	$ 105,913.73	$ 1,507,184.27	$ 894,858.28	$ 438,924.16
1. Consumer Price Index (CPI) multiplied by CM Annual Total Operating Cost (CPI = 2% min)					

8.2.4 Administration

Administration of the HCP will be carried out by the District, serving as the Implementing Entity. The District, funded through Zone 3 water rates, already employs staff to operate and maintain the Zone 3 project. The HCP will be integrated into the Zone 3 budget, with District staff assigned to oversee its implementation and management. Responsibilities will include executing the Conservation Measures outlined in Section 5.4, conducting Monitoring and Reporting as described in Section 7.4.1, and applying the Adaptive Management Strategies presented in Section 7.4.2.

The administrative function will be carried out by District staff across engineering, environmental, and administrative disciplines. While responsibilities will be distributed among multiple staff members, the overall level of effort is expected to be equivalent to one full-time staff position (1.0 full-time employee [FTE]) dedicated to HCP implementation. Administrative responsibilities will include:

- Ensuring compliance with all terms and conditions of the ITPs.
- Coordinating with NMFS and USFWS on implementation, reporting, and adaptive management decisions.
- Overseeing contracts with biological consultants, engineers, and other technical specialists supporting conservation measures.
- Preparing and submitting required annual compliance reports, financial summaries, and related documentation.
- Maintaining records of conservation activities, monitoring data, and agency correspondence.

- Serving as the primary point of contact for stakeholders, including participating agencies and the public.

Administrative costs are expected to consist of the following elements:

- District Staff Time: Equivalent to one full-time staff member (1.0 FTE) annually, comprised of proportional effort from engineering, environmental, and administrative staff. This includes salary and benefits.
- Overhead: Office expenses, meeting support, and general District administration allocated to the HCP program.

Consultant Support: Periodic assistance from biological, legal, and engineering consultants for technical analyses, permit coordination, and specialized tasks.

Reporting and Audit Costs: Preparation of required annual reports, financial summaries, and compliance audits.

For planning purposes, the District estimates annual administrative costs at approximately $319,950 in 2025 dollars. This figure reflects the equivalent of one full-time staff member plus overhead and includes allowances for consultant support and specialized reporting. Administrative costs are expected to increase at an assumed annual rate of 2% to account for inflation. Over the 30-year permit term, this escalation results in steadily rising costs that ensure adequate resources remain available to support ongoing HCP implementation.
The overall administrative costs of the HCP are approximately $12,979,773.

8.2.5 Operations and Maintenance

The cost of operations and maintenance of existing District facilities is not included in this HCP. The cost of operations and maintenance of improvements or other structures undertaken in direct response to the conservation program established by this HCP is part of the allocation of funds hereunder.

8.3 Program Funding

Funding for the HCP will be generated from water sale revenue collected on behalf of Zone 3. Each spring, the District’s Board of Supervisors adopts an annual budget for Zone 3 based on anticipated costs and revenues. The annual budget is a public document and is available online. Any increase in water rates collected by the District may require the agencies to undergo the Proposition 218 assessment process. Commitments made in the HCP will be included in the annual budget requests to Zone 3. Further, the District understands that permit coverage would be at risk, and federal and state enforcement measures would be possible, if adequate funding is not provided for implementation of the HCP’s Conservation Program measures. Additionally, over the 30-year life of the HCP, some additional funds not currently calculated in the HCP may be derived from a variety of other sources, including state, federal, or other grants or donations.

8.3.1 District Constraints Associated with Funding

The District recognizes that changes in the allocation of funds from one project to another might be necessary during the 30-year term of the HCP. At times, reallocation of funds may be necessary to realize the best possible conservation outcome. The decisions will be made by the

District but will consider the advice given by the TAC. The following constraints will ensure that water rate revenue allocated to the HCP is not exceeded.

- The total funding must adhere to the commitments in Tables 8-1 or 8-2.
- The annual increments of funding must adhere to the schedule in Table 8-7 or 8-8.
- Funds can be reallocated within projects and conservation measures but may limit the ability to meet those projects or conservation measures those funds are derived from.
- Funds derived from grants or other revenue sources shall provide relief to the water rate payer, not add to the total cost of the HCP.

8.3.2 Scheduled Funding Increments

The District has carefully distributed the HCP investments over the 30-year timeframe to achieve habitat conservation benefits to accommodate meaningful conservation measures, valuable monitoring and reporting, and adaptive management contingencies to structure the impacts on water ratepayers. The total funding allocated permit term is shown in Figures 8-1 and 8-2 dependent on the decisions made in year 5. The District will incorporate the higher of the two projections into its 30-year budget as a means to conservatively ensure availability of funding.

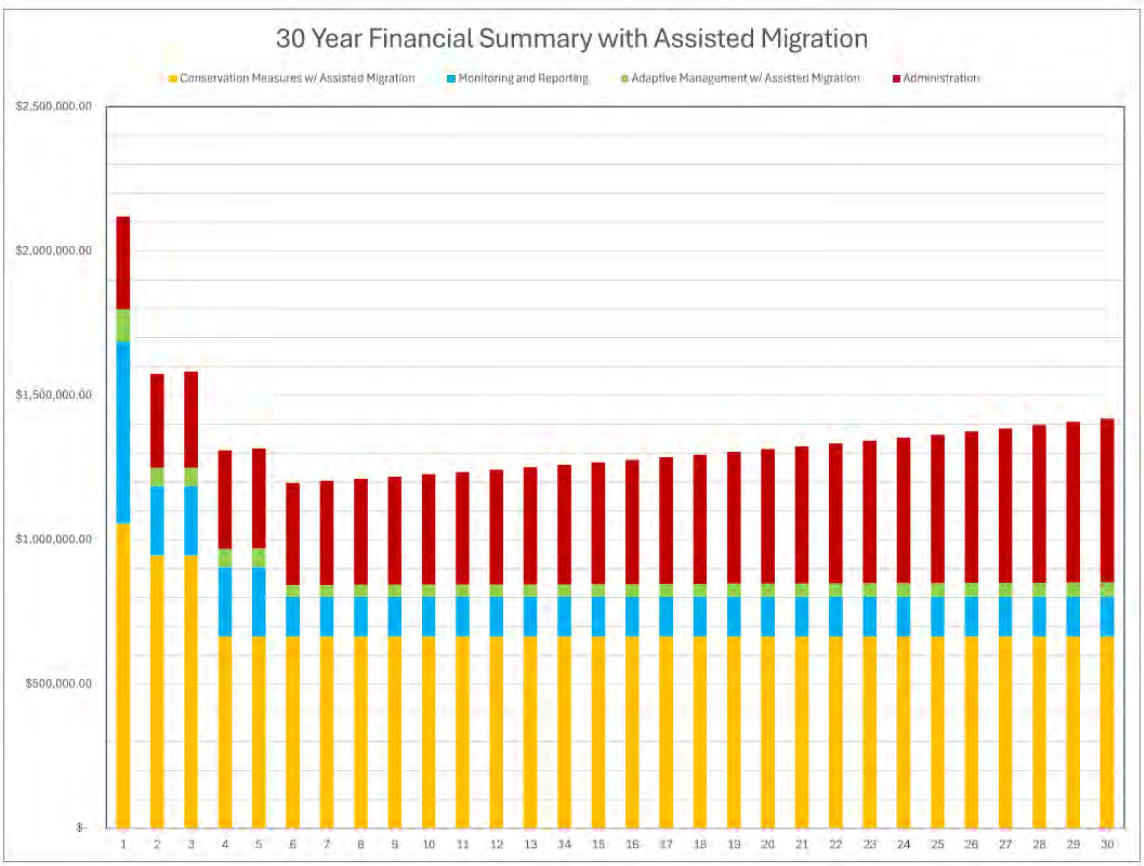

Figure 8-1. 30-Year financial summary with assisted migration

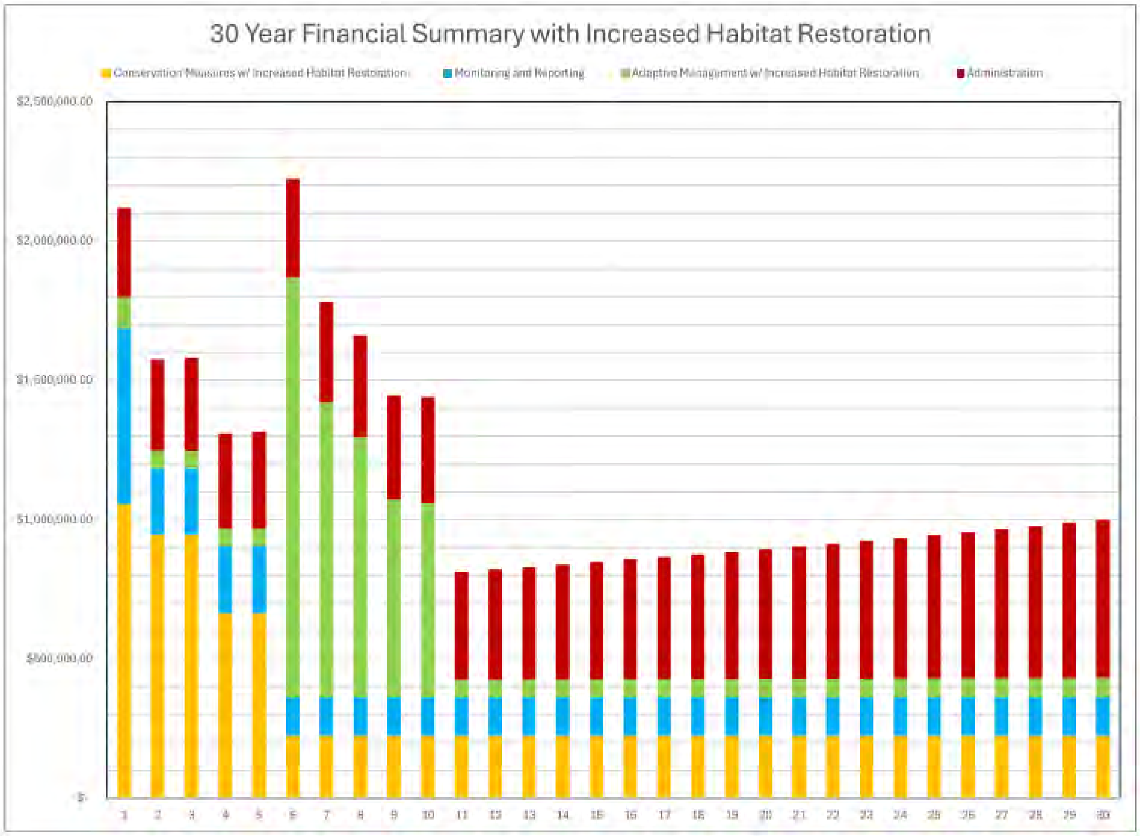

Figure 8-2. 30-Year financial summary with increased habitat restoration

8.3.3 Summary of Costs and Income

The estimated annual costs and anticipated income over the 30-year permit term are summarized in Figure 8-3. This financial projection tracks the higher of the two potential pathways identified in Section 5.4 to provide a conservative estimate of program funding needs. The HCP implementation cost is projected at $40,465,278.62, which will require a 15% initial cost increase and then an overall average cost increase of 3.5% over the 30-year period when compared to current baseline expenditures. These projected costs will be incorporated into the District's Zone 3 financial plan and annual budgeting. The District provides regional water resource and flood control services. Specific projects and programs benefit Zone 3 and operations are budgeted in the Zone 3 budget. Each Zone 3 contractor (water rate payer) will need to implement future water rate studies and Proposition 218 processes, ensuring that Zone 3 revenues collected, in accordance with water supply agreements with the District, remain aligned with both regulatory compliance and the District's obligations as the Implementing Entity.

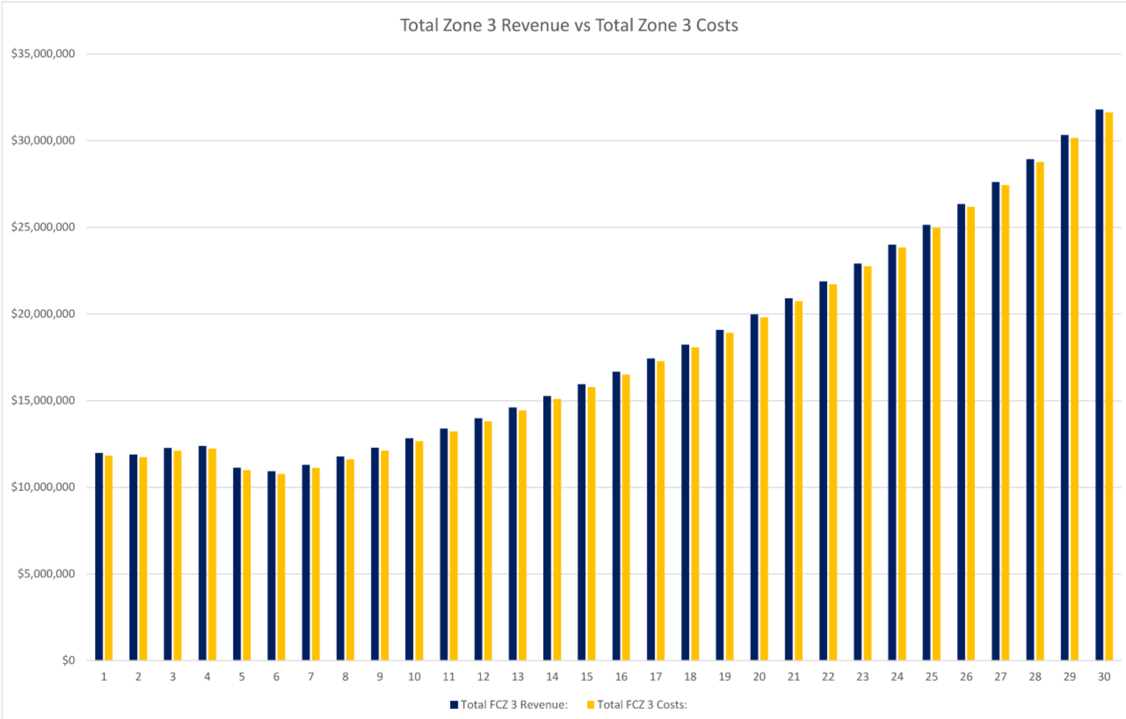

Figure 8-3. 30-Year revenue vs. costs.

The budget projection is intended not only to capture near-term operational costs but also to provide transparency and predictability for Zone 3 contractors over multiple decades. Integrating the HCP costs into upcoming rate studies will create a mechanism for gradual cost recovery, distributing the financial burden equitably among beneficiaries and allowing flexibility should adaptive management measures change the ultimate funding track.

The projection herein does not capture other long-term operational costs and revenue needs associated with Lopez Dam maintenance, water treatment and water distribution services. Future unanticipated costs could include seismic retrofits of essential facilities, unit process upgrades as mandated by the Department of Drinking Water, and various other infrastructure improvements that could impact the District’s ability to fund various projects.

9 ALTERNATIVES

ESA section 10(a)(2)(A) requires that HCPs include a description of the "alternative actions to such taking the applicant considered and the reasons why such alternatives are not being utilized." This section of the HCP discusses alternatives to the take proposed by the HCP that were considered, including a no HCP alternative, and the reasons such alternatives were not selected. In addition to the alternatives set forth in this section, the District recognizes there are a number of other potential alternatives that could be available, but fail to meet the District's purpose and need or would otherwise be infeasible. The alternatives considered in this section were those that had the potential to meet District's purpose and need or otherwise had some level of feasibility.

9.1 No HCP Alternative

Under the No HCP Alternative, the District would neither seek an ITP covering the Lopez Water Project nor implement the conservation program described in the HCP. Instead, the District would comply with the ESA on a case-by-case basis, taking into account whether or not a given activity under the District's jurisdiction and control are "reasonably certain to result in take." (See HCP Handbook at 3-2). Where the District determined that incidental take associated with one or more District activities is reasonably certain to result in take of one or more ESA-listed species, the District would either modify the activity to avoid the reasonable certainty of take or seek authorization for such take under ESA section 7 or 10, as appropriate. For the reasons set forth below, the District determined that the No HCP Alternative does not meet the District's needs relative to the Lopez Water Project.

To the extent the District seeks individual ESA authorization for specific activities, these authorizations would create administrative burdens on the District, USFWS, and NMFS staff, could require compliance with NEPA, CEQA, and other federal and state laws, and could result in delays that create significant health and safety implications for the Zone 3 agencies and downstream users. Further, without an ITP and HCP, it would be difficult for the District and Zone 3 agencies and others to engage in long-term planning for addressing the needs of water users within their jurisdictions.

Under the No HCP Alternative, the District would not be obligated to conduct the conservation measures described in the HCP, including but not limited to implementation conservation measures associated with fish passage, sediment augmentation, or long-term implementation the LDRP. While the District may, at its discretion, elect to implement conservation actions benefitting steelhead, CRLF, or SWPT, there is no affirmative obligation under the ESA for a non-federal entity to undertake conservation for ESA-listed or unlisted species. Additionally, to the extent the District sought individual ESA authorizations for individual future District activities, it is not likely such authorizations would result in measures that would comprehensively address primary stressors to multiple covered species in the Arroyo Grande Creek watershed.

Finally, implementation of the No HCP Alternative would put the District at increased risk of litigation brought by third parties challenging operations of the Lopez Water Project, including the risk of a court issuing a temporary or permanent injunction requiring the District to operate the Lopez Water Project in a manner that jeopardizes the delivery of sufficient water to its downstream users or the long-term viability of Lopez Dam and Reservoir.

9.2 Shorter Permit Term Alternative

The District considered as an alternative to the proposed HCP an alternative that would involve a 10-year rather than a 30-year permit term. Under this alternative, the District would seek an ITP for a 10-year term and would implement the HCP for that shorter term. While an HCP with a shorter duration has some benefits including a significant reduction in the take of steelhead anticipated, for the following reasons, the District determined that a permit with a 30-year term best meets the District's needs and furthers the conservation of the species covered by the proposed HCP.

While implementation of this alternative would provide some of the same benefits as the proposed HCP, under this alternative, full implementation of fish passage would be impracticable as there would not be sufficient time to gather data, obtain requisite federal and state approvals, fully implement the trap and haul program, monitor outcomes and evaluate benefits to the population. Moreover, because reducing the permit term to 10 years (rather than 30) would result in less regulatory certainty and the potential need for additional ESA authorizations in the future, it would not be practicable for the District to commit to the level of minimization and mitigation measures that are provided in the proposed HCP. For example, it will require a longer permit term to implement habitat restoration measures such as gravel augmentation, and observe sufficient annual flow variability to measure and record beneficial outcomes for channel morphology and steelhead habitat. Accordingly, an HCP associated with an ITP issued for a 10-year permit term would include a substantially scaled back conservation program.

Like the No HCP Alternative, the Shorter Permit Term Alternative would create an increased burden on District, USFWS, and NMFS staff in connection with any ESA authorizations sought after the 10-year ITP expired.

Finally, an ITP with a 10-year permit term would complicate long-range planning for water sustainability for the District and Zone 3 agencies, which could, in turn, create an increased risk of state and federal litigation.

9.3 Additional Covered Species Alternative

Under the Additional Covered Species Alternative, the District would include the federally endangered tidewater goby (*Eucyclogobius newberryi*) as a covered species. Currently, potential tidewater goby habitat is limited to AG Lagoon upstream to the point where AG Creek transitions from ponded or low flow areas to fast moving riffles, with the only known potential population of tidewater goby occurring in AG Lagoon. Under the proposed HCP, the permit area includes approximately ten miles of the mainstem AG Creek from Lopez dam downstream to the upstream limit of the Arroyo Grande Creek Channel Waterway Management Program (WMP). The AG Creek WMP already affords Section 7 ESA coverage to tidewater goby via USFWS Biological Opinion 8-8-15-F-4, therefore, the proposed HCP excludes the areas downstream of the WMP containing or potentially containing tidewater goby. Under the Additional Covered Species Alternative, the permit area would be extended beyond the upstream limits of the WMP to encompass AG Lagoon. Under this alternative, the District would be authorized to take tidewater goby in connection with District activities and would commit to certain minimization and mitigation measures to benefit the tidewater goby and meet the requirements of ESA section 10. The District closely reviewed the potential for the proposed HCP to cause incidental take of tidewater goby, including the potential for the HCP to contribute to an increased population of juvenile steelhead in AG Creek and AG Lagoon which could then prey on tidewater goby, and concluded that there was no reasonable certainty of take of the species (see Appendix A).

Additionally, the District determined that take of tidewater goby by the County in connection with the WMP is already addressed by an incidental take statement and biological opinion issued by USFWS in connection with Clean Water Act permitting associated with the District's WMP.

Given incidental take of the tidewater goby associated with the WMP is already authorized by USFWS, and given incidental take of tidewater goby is not reasonably certain to occur in connection with implementation of the proposed HCP, the District rejected the Additional Species Alternative.

9.4 Reduced Covered Activities Alternative

Under the Reduced Covered Activities Alternative, the District would limit covered activities only to those associated with water supply operations and would not cover maintenance and operations of the Lopez Water Project or supporting infrastructure. Like the No HCP Alternative, under the Reduced Covered Activities Alternative, the District would evaluate individual activities to determine whether incidental take of listed species is reasonably certain to occur, whether potential take could be avoided through modifications to the activity, or whether activity-specific incidental take authorization should be sought pursuant to ESA Section 10 or ESA Section 7.

These activity-specific authorizations would create administrative burdens on the District, USFWS, and NMFS staff, could require compliance with NEPA, CEQA, and other federal and state laws, and could result in delays that create significant health and safety implications for the Zone 3 agencies and downstream users. Further, without an ITP and HCP, it would be difficult for the District and Zone 3 agencies and others to engage in long-term planning for addressing the needs of water users within their jurisdictions. Additionally, activity-specific incidental take authorization would be unlikely to provide an avenue for comprehensive conservation, as under the proposed HCP.

Finally, implementation of the Reduced Covered Activities Alternative would put the District at increased risk of litigation brought by third parties challenging operations of the Lopez Water Project, including the risk of a court issuing a temporary or permanent injunction requiring the District to operate the Lopez Water Project in a manner that jeopardizes the delivery of sufficient water to its downstream users or the long-term viability of Lopez Dam and Reservoir.

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Appendices