

# V. Fish Passage Program

**Introduction:** The duration of the proposed action is more than two decades. The long time horizon of the consultation requires NMFS to anticipate long-term future events, including increased water demand and climate change. The effects analysis in this Opinion highlights the difficulty of managing cold water aquatic species below impassible barriers, depending entirely on a fluctuating and often inadequate cold water reservoir pool. The analysis shows that even after all discretionary actions are taken to operate Shasta and Folsom reservoirs to reduce adverse effects of water operations on listed anadromous fish, the risk of temperature-related mortality of fish and eggs persists, especially in critically dry years. This mortality can be significant at the population level. The analysis also leads us to conclude that due to climate change, the frequency of these years will increase.

Therefore, NMFS believes it is necessary for Reclamation, in cooperation with NMFS, other fisheries agencies, and DWR, to undertake a program to provide fish passage above currently impassible artificial barriers for Sacramento River winter-run, spring-run, and CV steelhead, and to reintroduce these fish to historical habitats above Shasta and Folsom Dams. Substantial areas of high quality habitat exist above these dams: there are approximately 60 mainstem miles above Lake Shasta and 50 mainstem miles above Lake Folsom. These high-elevation areas of suitable habitat will provide a refuge for cold water fish in the face of climate change.

An RPA requiring a fish passage program has recently been issued by the Northwest Region of NMFS, as part of the Willamette Projects Biological Opinion (NMFS 2008). This jeopardy biological opinion resulted from the operation of a series of Federal projects in Oregon. That RPA represents the state-of-the-art program to address passage concerns such as residualism (failure to complete the downstream migration) and predation. The following suite of actions is similar, but not identical, to those in the Willamette projects Opinion. There are several designs available for passage, and some are likely to be more effective in some locations than others. Consequently, while NMFS suggests that Reclamation learn from the Willamette experience, the actions allow Reclamation to follow different critical paths, particularly with respect to the construction of a downstream passage prototype.

The Fish Passage Program includes a fish passage assessment for evaluating steelhead passage above Goodwin, Tulloch, and New Melones Dams on the Stanislaus River. The assessment will develop information necessary for consideration and development of fish passage options for the Southern Sierra Diversity Group of CV steelhead. Although pilot testing of passage in the Stanislaus is encouraged, it is not specifically required.

The Fish Passage Program Action includes several elements that are intended to proceed in phases. The near-term goal is to increase the geographic distribution and abundance of listed species. The long-term goal is to increase abundance, productivity, and spatial distribution, and to improve the life history and genetic diversity of the target species. Several actions are included in this program, as indicated in the following outline of the program:

# NEAR-TERM FISH PASSAGE ACTIONS

## NF 1. Formation of Interagency Fish Passage Steering Committee

**Objective:** To charter, and support through funding agreements, an interagency steering committee to provide oversight and technical, management, and policy direction for the Fish Passage Program.

**Action:** By December 2009, Reclamation shall establish, chair and staff the Interagency Fish Passage Steering Committee. The Committee shall be established in consultation with and the approval of NMFS and shall include senior biologists and engineers with experience and expertise in fish passage design and operation, from Reclamation, NMFS, DWR, CDFG, and USFWS. The Steering Committee also shall include academic support by including at least one academic member from a California University with an established fishery program. The committee shall be limited to agency membership unless otherwise approved by Reclamation and NMFS. Steering committee membership shall include one lead member and one alternate.

**Rationale:** Interagency coordination and oversight is critical to ensuring the success of the fish passage program.

## NF 2. Evaluation of Salmonid Spawning and Rearing Habitat Above Dams

**Objective:** To quantify and characterize the location, amount, suitability, and functionality of existing and/or potential spawning and rearing habitat for listed species above dams operated by Reclamation.

**Action:** Beginning in January 2010 and continuing through January 2012, Reclamation, shall conduct habitat evaluations to quantify and characterize the location, amount, suitability, and functionality of existing and/or potential spawning and rearing habitat for listed species above the project reservoirs. Reclamation shall obtain the Steering Committee's assistance in designing and implementing the habitat evaluations. Evaluations shall be conducted using established field survey protocols such as the USFS Region 5 Stream Condition Inventory, Field Intensive and Field Extensive protocols; and habitat models including the Salmon Habitat Integrated Resource Analysis (Shiraz) in combination with the Distributed Hydrology Soil Vegetated Model (DHSVM) or RIPPLE. Shiraz is a life-cycle model that incorporates stream flow and temperature inputs from DHSVM to develop future projections of salmon population sizes. Ripple uses digital terrain information with aquatic habitat and biological data to identify habitat limitations that affect salmon production. Both modeling approaches have been applied in the Washington and Oregon assess the value of providing passage to salmonids to historically available habitat.

**Rationale:** The condition and suitability of historical habitats located above impassable barriers is likely to have changed considerably since last occupied by anadromous fish. The location, quantity, and condition of habitat must be inventoried and assessed in order to evaluate the current carrying capacity and restoration potential. This information is essential

to determine where passage and reintroduction, if feasible, are most likely to improve reproductive success for listed fish.

### **NF 3. Development of Fish Passage Pilot Plan**

**Action:** From January 2010 through January, 2011, Reclamation, with assistance from the Steering Committee, shall complete a 3-year plan for the Fish Passage Pilot program. The plan shall include: (1) a schedule for implementing a 3-year Pilot Passage program on the American River above Nimbus and Folsom dams, and on the Sacramento River above Keswick and Shasta dams; and (2) a plan for funding the passage program. This plan and its annual revisions shall be implemented upon concurrence by NMFS that it is in compliance with ESA requirements. The plan shall include, but not be limited to, the following:

- 1) Identify any operational requirements needed for the passage and re-introduction program.
- 2) Identify protocols for optimal handling, sorting, and release conditions for ESA-listed fish collected at Reclamation or partner agency-funded fish collection facilities when they are constructed.
- 3) Identify the number, origin, and species of fish to be released into habitat upstream of Reclamation dams, incorporated into the hatchery broodstock, or taken to other destinations.
- 4) Identify fish collection and transportation requirements (*e.g.*, four wheel-drive vehicles, smooth-walled annular tanks, large vertical slide gates, provisions for tagging/marking, *etc.*) for moving fish from below project dams to habitats above reservoirs, avoiding the use of facilities or equipment dedicated for other purposes (*e.g.*, existing transport trucks).
- 5) Identify optimal release locations for fish, based on access, habitat suitability, disease concerns, and other factors (*e.g.*, those which would minimize disease concerns, recreational fishery impacts, interbreeding with non-native *O. mykiss* strains, regulatory impacts, special authorities for studies/construction, complications from upstream dams, *etc.*).
- 6) Identify and evaluate options for providing tailored ESA regulatory assurances for non-Federal landowners above the dams where species could be re-introduced.
- 7) Identify interim downstream fish passage options through reservoirs and dams with the objective of identifying volitional downstream passage scenarios and alternatives for juvenile salmon and steelhead migrating through or around project reservoirs and dams. If these options are not considered feasible, identify interim non-volitional alternatives. Near-term operating alternatives that are determined to be technically and economically feasible and biologically justified shall be identified by Reclamation and the steering committee agencies.
- 8) Describe scheduled and representative types of unscheduled, maintenance of existing infrastructure (dams, transmission lines, fish facilities, *etc.*) that could adversely impact listed fish, and describe measures to minimize these impacts.
- 9) Describe procedures for coordinating with Federal and state resource agencies in the event of scheduled and unscheduled maintenance.
- 10) Describe protocols for emergency events and deviations.

Reclamation and partner agencies shall annually revise and update the Fish Passage Pilot

Plan. The revisions and updates shall be based on results of Fish Passage Pilot Plan activities, construction of new facilities, recovery planning guidance, predicted annual run size, and changes in hatchery management. By January 15 of each year, Reclamation shall submit a revised draft plan to NMFS. By February 15, NMFS shall advise Reclamation and partner agencies whether it concurs that the revised Fish Passage Plan is likely to meet ESA requirements. Reclamation and partner agencies shall release a final updated Fish Passage Pilot Plan by March 14 of each year.

**Rationale:** The Fish Passage Pilot Plan is a critical link between measures in the Proposed Action and this RPA and the long-term fish passage program. The plan will provide a blueprint for obtaining critical information about the chances of successful reintroduction of fish to historical habitats and increasing the spatial distribution of the affected populations. By including emergency operations within the Plan, field staff will have a single manual to rely on for all fish-related protocols, including steps that should be taken in emergency situations to minimize adverse effects to fish.

#### **NF 4. Implementation of Pilot Reintroduction Program**

**Objective:** To implement short-term fish passage actions that will inform the planning for long-term passage actions.

**Actions:** From January 2012 through 2015, Reclamation shall begin to implement the Pilot Reintroduction Program (see specific actions below). The Pilot Program will, in a phased approach, provide for pilot reintroduction of winter-run and spring-run to habitat above Shasta Dam in the Sacramento River, and CV steelhead above Folsom Dam in the American River. This interim program will be scalable depending on source population abundance, and will not impede the future installation of permanent facilities, which require less oversight and could be more beneficial to fish. This program is not intended to achieve passage of all anadromous fish that arrive at collection points, but rather to phase in passage as experience with the passage facilities and their benefits is gained.

**Rationale:** The extent to which habitats above Central Valley dams can be successfully utilized for the survival and production of anadromous fish is currently unknown. A pilot reintroduction program will allow fishery managers to incrementally evaluate adult reintroduction locations, techniques, survival, distribution, spawning, and production, and juvenile rearing, migration. The pilot program also will test juvenile collection facilities. This action requires facility improvements or replacements, as needed, and establishes dates to complete work and begin operation. In some cases, work could be initiated sooner than listed above, and NMFS expects Reclamation and partner agencies to make these improvements as soon as possible.

Because these facilities will be used in lieu of volitional fish passage to provide access to historical habitat above the dams, this measure is an essential first step toward addressing low population numbers caused by decreased spatial distribution, which is a key limiting factor for Chinook salmon and CV steelhead.

Upstream fish passage is the initial step toward restoring productivity of listed fish by using large reaches of good quality habitat above project dams. Restriction to degraded habitat below the dams has significantly impaired reproductive success and caused steep declines in abundance.

#### **NF 4.1. Adult Fish Collection and Handling Facilities**

Beginning in 2012, Reclamation, with assistance from the Steering Committee, shall design, construct, install, operate and maintain new or rebuilt adult fish collection, handling and transport facilities at the sites listed below. The objective is to provide interim facilities to pass fish above project facilities and reservoirs.

Reclamation and partner agencies shall incorporate NMFS' Fish Screening Criteria for Anadromous Salmonids (NMFS 1997a) and the best available technology. During the design phase, Reclamation and partner agencies shall coordinate with NMFS to determine if the design should accommodate possible later connection to improved facilities, if necessary in years beyond 2015.

Reclamation and partner agencies shall complete all interim steps in a timely fashion to allow them to meet the following deadlines for completing construction and beginning operation of the facilities listed below. These steps may include completing plans and specifications. Reclamation and partner agencies shall give NMFS periodic updates on their progress. The order in which these facilities are completed may be modified with NMFS' concurrence, based on interim analyses and biological priorities.

- 1) Sacramento River Fish Facility – Collection facility shall be operational no later than March 2012.
- 2) American River Fish Facility – Collection facility shall be operational no later than March 2012.

#### **NF 4.2. Adult Fish Release Sites above Dams and Juvenile Fish Sites Below Dams**

Reclamation shall provide for the safe, effective, and timely release of adult fish above dams and juvenile fish below dams. The Fish Passage Plan must identify and release sites. Fish transport and release locations and methods shall follow existing State and Federal protocols. With assistance from the Steering Committee, and in coordination with applicable landowners and stakeholders, Reclamation shall complete construction of all selected sites by March 2012.

#### **NF 4.3. Capture, Trapping, and Relocation of Adults**

By March 2012, Reclamation shall implement upstream fish passage for adults via “trap and transport” facilities while it conducts studies to develop and assess long-term upstream and downstream volitional fish passage alternatives. At least one fish facility must be in place at terminal upstream passage points for each river that is subject to this measure. Facilities to capture adults currently exist at or below Keswick and Nimbus Dams, though these may need

to be upgraded. The Pilot Program is a first step in providing anadromous fish passage to historical habitat above Project dams but will not be sufficient by itself.

The number of fish that shall be relocated is expected to vary depending on the source population, source population size, and the results of fish habitat evaluations and modeling of carrying and production capacity. The Steering Committee will work in consultation with the NMFS Southwest Fishery Science Center to develop adult relocation source populations and abundance targets. The Steering Committee shall evaluate the use of wild and hatchery sources and develop strategies that minimize risk to existing wild populations.

NMFS considers volitional passage via a fish ladder or other fishway to be the preferable alternative in most circumstances. In the short term, upstream passage can be provided with fish trap and transport mechanisms, while Reclamation evaluates program effectiveness and passage alternatives.

#### **NF 4.4. Interim Downstream Fish Passage through Reservoirs and Dams**

Beginning in 2012, following the emergence of the first year class of reintroduced fish, and until permanent downstream passage facilities are constructed or operations are established at Project dams, Reclamation shall carry out interim operational measures to pass downstream migrants as safely and efficiently as possible through or around Project reservoirs and dams under current dam configurations and physical and operational constraints, consistent with authorized Project purposes.

Near-term operating alternatives shall be identified, evaluated, and implemented if determined to be technically and economically feasible and biologically justified by Reclamation and partner agencies, within the framework of the Annual Operating Plan updates and revisions, and in coordination with the Fish Passage Plan Steering Committee. Interim devices shall be constructed to collect emigrating juvenile salmonids and emigrating post-spawn adult steelhead from tributaries, main stems above project reservoirs, or heads of reservoirs. Fish shall be safely transported through or around reservoirs as necessary and released below currently impassible dams.

Reclamation and partner agencies shall evaluate potential interim measures that require detailed environmental review, permits, or Congressional authorization as part of the Fish Passage Plan. Reclamation shall complete this component of the Plan by April 30, 2011, including seeking authorization (if necessary) and completing design or operational implementation plans for the selected operations. Measures to be evaluated include, but are not limited to, partial or full reservoir drawdown during juvenile outmigration period, modification of reservoir refill rates, and using outlets, sluiceways, and spillways that typically are not opened to pass outflow.

#### **NF 4.5. Juvenile Fish Collection Prototype**

**Objective:** To determine whether the concept of a head-of-reservoir juvenile collection facility is feasible, and if so, to use head-of-reservoir facilities in Project reservoirs to

increase downstream fish survival. Safe and timely downstream passage of juvenile Chinook salmon and juvenile and adult post-spawn steelhead is a critical component to the success of the Fish Passage Program.

Beginning in January, 2010, with input from the CVP/SWP operations Fish Passage Steering Committee, Reclamation shall plan, design, build, and evaluate a prototype head-of-reservoir juvenile collection facility above Shasta Dam. Construction shall be complete by September 2013.

Because the head-of-reservoir fish collection concept is virtually untested, it would be imprudent to require such facilities without prior field studies, design, and prototype testing to validate the concept. For this measure, NMFS defines “prototype” to refer to temporary facilities intended for concept evaluation, not long-term operations. Further, “prototype” does not necessarily refer to a single concept; multiple concepts may be tested simultaneously. Possible options include, among others: (1) floating collectors in the reservoir near the mouths of tributaries, (2) use of curtained or hardened structures near mouths of tributaries, that block surface passage into reservoirs, (3) fish collection facilities on tributaries above the reservoir pools, and (4) a combination of the above to maximize collection in high flow and low flow conditions.

By the end of 2010, Reclamation, with assistance from the Fish Passage Steering Committee and concurrence by NMFS, shall identify a preferred location(s) and design(s) for construction of the prototype(s). Construction of the prototype facility(s) must be completed in time to conduct two years of biological and physical evaluations of the head-of-reservoir prototype collection facilities by the end of 2016. The Fish Passage Steering Committee shall have opportunity to comment on study proposals and a draft report on the effectiveness of the facilities, including recommendations for installing full-scale head-of-reservoir facilities at this and other reservoirs. By December 31, 2016, after receiving concurrence from NMFS and USFWS on the draft report, Reclamation and partner agencies shall make necessary revisions to the draft report and issue a final report. The report shall recommend technically and biologically feasible head-of-reservoir facilities, capable of safely collecting downstream migrating fish, and capable of increasing the overall productivity of the upper basins, then Reclamation and partner agencies shall include such facilities in the design alternatives that they consider in the Fish Passage Plan studies.

#### **NF 4.6. Pilot Program Effectiveness Monitoring and Evaluation**

From 2012 to 2015, Reclamation shall study, and provide annual reports on, the elements of the pilot program, including adult reintroduction locations, techniques, survival, distribution, spawning, and production; and juvenile rearing, migration, recollection, and survival. The objective is to gather sufficient biological and technical information to assess the relative effectiveness of the program elements and determine the feasibility of long-term passage alternatives. A final summary report of the 5-year pilot effort shall be completed by December 31, 2015.

#### **NF 4.7. Stanislaus River Fish Passage Assessment**

**Objective:** To develop information needed in order to evaluate options for achieving fish passage on the Stanislaus River above Goodwin, Tulloch, and New Melones Dams.

**Action:** By March 31, 2011, Reclamation shall develop a plan to obtain information needed to evaluate options for fish passage on the Stanislaus River above Goodwin, Tulloch and New Melones Dams and shall submit this plan to NMFS for review. This plan shall identify reconnaissance level assessments that are needed to support a technical evaluation of the potential benefits to CV steelhead that could be achieved with passage above the dams, a general assessment of logistical and engineering information needed, and a schedule for completing those assessments by December 31, 2016. Reclamation is encouraged to use information developed for the American and Sacramento Rivers in Action NF 3 above, when also applicable for the Stanislaus River.

By December 31, 2016, Reclamation shall submit a report, including the results of the assessments and proposed options for further consideration, to NMFS. By December 31, 2018, Reclamation shall include recommendations for fish passage on the Stanislaus River in the Comprehensive Feasibility Report (Action NF 6.) The report will outline the costs of potential projects, their biological benefits and technical feasibility, potential alternatives, and steps necessary to comply with all applicable statutes and regulations.

**Rationale:** This assessment process will develop foundational information necessary for consideration and development of fish passage options above New Melones Reservoir to relieve unavoidable effects of project operations on the Southern Sierra Diversity Group of CV steelhead and on adverse modification of critical habitat.

#### **NF 5. Comprehensive Fish Passage Report**

**Objective:** To evaluate the effectiveness of fish passage alternatives and make recommendations for the development and implementation of long-term passage alternatives and a long-term fish passage program.

**Action:** By December 31, 2016, Reclamation shall prepare a Comprehensive Fish Passage Report. The Report shall include preliminary determinations by Reclamation and partner agencies regarding the feasibility of fish passage and other related structural and operational alternatives. The report should include specific recommendations for improvements to highest priority sub-basins and/or features and to include recommendations for major operational changes. It will also include identification and evaluation of high priority actions and may suggest modifying the scope or timelines of these high priority actions, based on the predicted outcome of long-term efforts.

**Re-initiation trigger:** If the downstream fish passage improvements are determined not likely to be technically or biologically feasible at this milestone, then Reclamation and the Steering Committee shall identify other alternatives that would be implemented within the same timelines as those identified in this RPA. Reclamation and partner agencies shall

submit specific implementation plans for alternative actions to NMFS, and NMFS shall evaluate whether the actions proposed in the implementation plans are likely to have the biological results that NMFS relied on in this Opinion. The alternatives must be within the same Diversity Group as the affected population, identify high elevation habitats above dams that provide similar habitat characteristics in terms of water temperatures, habitat structure (sufficient pool depths and spawning gravels), ability to withstand long-term effects of climate change, and must demonstrate an ability to support populations that meet the characteristics of a population facing a low risk of extinction according to the population parameters identified in Lindley *et al.* (2007), “Framework for Assessing Viability of Threatened and Endangered Chinook Salmon and Steelhead in the Sacramento-San Joaquin Basin.” If Reclamation and partners believe that the proposed passage locations may not be feasible, the Fish Passage Steering Committee should be directed to develop early assessments of alternative actions that meet the performance standards described above in order to maintain the schedule proposed in this action. NMFS shall notify Reclamation and partner agencies as to whether the proposal is consistent with the analysis in this Opinion. If not, Reclamation will request re-initiation of consultation.

## **LONG-TERM FISH PASSAGE ACTIONS**

In the event that the decision is made by 2016 to pursue a comprehensive fish passage program, the following actions will be implemented.

### **LF 1. Long-term Funding and Support to the Interagency Fish Passage Steering Committee**

If the Comprehensive Fish Passage Report indicates that long-term fish passage is feasible and desirable, Reclamation shall continue to convene, fund, and staff the Fish Passage Steering Committee.

### **LF 2. Action Suite: Long-Term Fish Passage Plan and Program**

**Objective:** Provide structural and operational modifications to allow safe fish passage and access to habitat above and below Project dams in the Central Valley.

**Actions:** Based on the results of the Comprehensive Fish Passage Report, Reclamation, with assistance from the Steering Committee, shall develop a Long-term Fish Passage Plan and implement a Long-term Fish Passage Program. Reclamation and partner agencies shall submit a plan to NMFS on or before December 31, 2016, which shall describe planned longterm upstream and downstream fish passage facilities and operations, based on the best available information at that time. The plan shall include a schedule for implementing a long-term program for safe, timely, and effective anadromous fish passage by January 31, 2020.

The Long-term Fish Passage Plan and Program shall target the following performance

standards: (1) demonstrated ability to withstand long-term effects of climate change, (2) must support populations in the target watersheds that meet the characteristics of a population facing a moderate risk of extinction by year 5 (2025) and a low risk of extinction by year 15 (2030), according to the population parameters identified in Lindley *et al.* (2007), “Framework for Assessing Viability of Threatened and Endangered Chinook Salmon and Steelhead in the Sacramento-San Joaquin Basin.”

The structural and operational modifications needed to implement the program shall be developed as high priority measures in the plan. The plan shall include an evaluation of a range of structural and operational alternatives for providing fish passage above Reclamation dams in the Sacramento, American, and Stanislaus River watersheds. Reclamation and process, ESA recovery planning (including life cycle modeling developed as part of the recovery planning process), university studies, local monitoring efforts public comment, and other relevant sources, to determine which alternative(s), will provide the most cost-effective means to achieve adequate passage benefits to avoid jeopardy to ESA-listed fish from the water projects in the long term. Reclamation and partner agencies shall proceed with the action(s) that sufficiently address the adverse effects of the Project, in the context of future baseline conditions. Reclamation and DWR shall submit specific implementation plans to NMFS, and NMFS shall evaluate whether the actions proposed in the implementation plans meet ESA requirements, consistent with this Opinion. NMFS will notify Reclamation and partner agencies as to whether the proposal is consistent with ESA obligations.

Reclamation and DWR also shall analyze structural and operational modifications to provide downstream fish passage as part of the plan, following the same process as that for providing upstream passage.

The time frame for implementing the long-term passage measures may extend beyond the time frame of this Opinion. However, Reclamation and DWR must begin some actions during the term of this Opinion, including as investigating feasibility, completing plans, requesting necessary authorization, and conducting NEPA analysis

**Rationale:** This suite of actions ensures that fish passage actions will be taken by specified dates, or that the Project will be re-analyzed based upon new information. As noted in this Opinion, lack of passage is one of the most significant limiting factors for the viability of the affected populations of Chinook salmon and steelhead. As described in the effects analysis of the biological opinion, this also exposes populations to additional and significant stressors from project operations that also limits their viability and ability to survive below dams. Providing fish passage to historical spawning and rearing habitats would effectively mitigate for unavoidable adverse impacts of the projects on listed fish.

NMFS chose the passage in the Sacramento and American rivers based on the best available information at the time of this Opinion. The choice of location of passage facilities, as well as the method of passage, may change based on additional information, including additional assessment of necessity and feasibility of passage in the Stanislaus River. Passage methods may vary based on the specific requirements of each site, as well as fish behavior at a specific location. If information indicates that a different location or passage method is

preferable, then Reclamation and DWR must coordinate with the Fish Passage Plan committee and obtain NMFS' concurrence that a proposed change is likely to meet ESA obligations.

Long-term fish passage should significantly increase abundance and spatial distribution of winter-run, spring-run, and CV steelhead because the fish will have access to upstream spawning and rearing habitat, and the juveniles will have access downstream to the ocean for growth to maturity. This action will address the Habitat Access pathway of critical habitat by improving access past physical barriers, thereby improving the status of PCEs for spawning, rearing, and migration of winter-run, spring-run, and CV steelhead populations.

### **LF 2.1. Long-term Adult and Juvenile Fish Passage Facilities**

Based on the results of the Comprehensive Fish Passage Report and the Fish Passage Plan, and with the assistance of the Steering Committee, Reclamation shall construct long-term fish passage facilities necessary to successfully allow upstream and downstream migration of fish around or through project dams and reservoirs on the Sacramento and American Rivers by 2020, and Stanislaus River depending on results of study provided for in Action NF 4.7.

### **LF 2.2. Supplementation and Management Plan**

Based on the results of the Comprehensive Fish Passage Report and the Fish Passage Plan, and with the assistance of the Steering Committee, in consultation with the NMFS Southwest Fishery Science Center, Reclamation shall develop and implement a long-term population supplementation plan for each species and fish passage location identified in V. *Fish Passage Program*, with adult recruitment and collection criteria developed with consideration for source population location, genetic and life history diversity, abundance and production. The purpose is to ensure that long-term abundance and viability criteria are met for all reintroduced populations, with contingencies for supplementing populations with wild and/or conservation hatchery fish if necessary. The plan shall be developed by 2020. The plan shall identify wild and/or hatchery sources for adult reintroductions and long-term supplementation, and the specific NMFS-approved hatchery management practices that qualify a hatchery for conservation purposes. Species-specific conservation hatchery programs may be developed to supplement reintroductions and maintain long-term performance standards for abundance and viability.

### **LF 2.3. Long-term Fish Passage Monitoring and Evaluation**

Reclamation, through the Steering Committee shall develop a Long-term Fish Passage Monitoring and Evaluation Plan by 2020, to monitor all elements of the Long-term Fish Passage Program including adult reintroduction locations, techniques, survival, distribution, spawning, and production; and juvenile rearing, migration, recollection, and survival. The objective is to gather sufficient biological and technical information to assess the relative effectiveness of the program elements and determine the feasibility of long-term passage alternatives. Annual reports shall be submitted to NMFS by September 30 of each year.