**UNITED STATES DEPARTMENT OF COMMERCE**
**National Oceanic and Atmospheric Administration**
NATIONAL MARINE FISHERIES SERVICE
Northwest Region
7600 Sand Point Way N.E., Bldg. 1
Seattle, WA 98115

**Refer to NMFS No:**
**2003/01098**

April 2, 2012

William D. Gray
Area Manager
Bureau of Reclamation
Columbia-Cascades Area Office
1917 Marsh Road
Yakima, Washington 98901-2058

Re: Endangered Species Act Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the Future Operation and Maintenance of the Rogue River Basin Project (2012-2022), Rogue and Klamath River Basins (HUCs: 18010206, 17100308, 17100307), Oregon and California

Dear Mr. Gray:

The enclosed document contains a biological opinion (opinion) prepared by the National Marine Fisheries Service (NMFS) pursuant to section 7(a)(2) of the Endangered Species Act (ESA) on the effects of the Bureau of Reclamation's (Reclamation) future operation and maintenance of the Rogue River Basin Project (2012-2022), Rogue River and Klamath River basins, in Oregon and California. In this opinion, NMFS concludes that the proposed action is not likely to jeopardize the continued existence of Southern Oregon and Northern California Coasts (SONCC) coho salmon (*Oncorhynchus kisutch*) or result in the destruction or adverse modification of designated critical habitat for SONCC coho salmon. The NMFS also concluded that the proposed action is not likely to adversely affect southern distinct population segment Pacific eulachon (*Thaleichthys pacificus*), southern distinct population segment North American green sturgeon (*Acipenser medirostris*), or critical habitat designated for eulachon. The effects of this action would all occur outside the geographic range of designated critical habitat for green sturgeon.

As required by section 7 of the ESA, NMFS is providing an incidental take statement with the opinion. The incidental take statement describes reasonable and prudent measures NMFS considers necessary or appropriate to minimize the impact of incidental take associated with this action. The take statement sets forth nondiscretionary terms and conditions, including reporting requirements, that Reclamation must comply with to carry out the reasonable and prudent measures. Incidental take from actions that meet these terms and conditions will be exempt from the ESA's prohibition against the take of listed species.

This document also includes the results of our analysis of the action's likely effects on essential fish habitat (EFH) pursuant to section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA), and includes twelve conservation recommendations to avoid, minimize, or otherwise offset potential adverse effects on EFH. Six of these conservation recommendations are a subset of the ESA take statement's terms and conditions. Section 305(b) (4) (B) of the MSA requires Federal agencies to provide a detailed written response to NMFS within 30 days after receiving these recommendations.

If the response is inconsistent with the EFH conservation recommendations, the Federal action agency must explain why the recommendations will not be followed, including the scientific justification for any disagreements over the effects of the action and the recommendations. In response to increased oversight of overall EFH program effectiveness by the Office of Management and Budget, NMFS established a quarterly reporting requirement to determine how many conservation recommendations are provided as part of each EFH consultation and how many are adopted by the action agency. Therefore, we request that in your statutory reply to the EFH portion of this consultation, you clearly identify the number of conservation recommendations accepted.

If you have questions regarding this consultation, please contact Ken Phippen, Branch Chief of the Oregon Coast Habitat Branch, at 541.957.3385.

Sincerely,

Michael Tehan for

William W. Stelle, Jr.
Regional Administrator

cc: Carol Bradford, Medford Irrigation District
Chris Eder, Bureau of Reclamation
Brian Hampson, Rogue River Irrigation District
Jim Pendleton, Talent Irrigation District
Scott Willey, Bureau of Reclamation

# Endangered Species Act Biological Opinion
# and
# Magnuson-Stevens Fishery Conservation and Management Act
# Essential Fish Habitat Response
# for the

Future Operation and Maintenance of the Rogue River Basin Project
Rogue and Klamath River Basins (HUCs: 18010206, 17100308, 17100307)
Oregon and California

NMFS Consultation Number: 2003/01098

Federal Action Agency: Bureau of Reclamation

Affected Species and Determinations:

| ESA-Listed Species | ESA Status | Is the action likely to adversely affect this species or its critical habitat? | Is the Action likely to jeopardize this species? | Is the action likely to destroy or adversely modify critical habitat for this species? |
|---|---|---|---|---|
| Southern Oregon and Northern California Coasts coho salmon | T | Y | N | N |
| Southern distinct population segment North American green sturgeon | T | N | N | N |
| Southern distinct population segment Pacific eulachon | T | N | N | N |

| Fishery Management Plan that Describes EFH in the Action Area | Would the action adversely affect EFH? | Are EFH conservation recommendations provided? |
|---|---|---|
| Pacific Coast Salmon | Y | Y |
| Pacific Coast Groundfish | N | N |
| Coastal Pelagic Species | N | N |

Consultation Conducted By: National Marine Fisheries Service
Northwest Region

Issued by:

for William W. Stelle, Jr.
Regional Administrator

Date: April 2, 2012

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## Acronyms and Abbreviations

| | |
|---|---|
| BA | Biological Assessment |
| cfs | cubic feet per second |
| CSRI | Coastal Salmon Recovery Initiative |
| DPS | Distinct population segment |
| DQA | Data Quality Act |
| EFH | Essential fish habitat |
| ESA | Endangered Species Act |
| ESU | Evolutionarily significant unit |
| HUC | Hydrologic Unit Code |
| IFIM | In-stream Flow Incremental Methodology |
| IGD | Iron Gate Dam |
| IP | Intrinsic potential |
| KIP | Klamath Irrigation Project |
| km | Kilometers |
| mg/L | milligrams per liter |
| MID | Medford Irrigation District |
| MSA | Magnuson-Stevens Fishery Conservation and Management Act |
| NMFS | National Marine Fisheries Service |
| O&M | Operation and maintenance |
| ODFW | Oregon Department of Fish and Wildlife |
| opinion | Biological Opinion |
| PAHs | polycyclic aromatic hydrocarbons |
| PCEs | Primary constituent elements |
| Project | Bureau of Reclamation’s Rogue River basin project |
| Reclamation | Bureau of Reclamation |
| RM | River mile |
| RPA | Reasonable and prudent alternative |
| RRVID | Rogue River Valley Irrigation District |
| SONCC | Southern Oregon and Northern California Coasts |
| TID | Talent Irrigation District |
| TRT | Technical Recovery Team |
| URR | Upper Rogue River |
| USFWS | U.S. Fish and Wildlife Service |
| WUA | Weighted usable area |

# 1. INTRODUCTION

This Introduction section provides information relevant to the other sections of this document and is incorporated by reference into Sections 2 and 3 below.

## 1.1 Background

Congress, by the Act of August 20, 1954 (68 Stat. 752, Public Law 83-606), authorized the Secretary of the Interior to construct the Rogue River Basin Project Talent Division (hereafter referred to as the Project), consisting of "two principal reservoirs at the Howard Prairie and Emigrant sites, together with other necessary works for the collection, impounding, diversion, and delivery of water, the generation and transmission of hydroelectric power and operations incidental thereto." The 1954 Act was amended by the Act of October 1, 1962 (76 Stat 677, Public Law 87-727) to authorize construction of Agate Dam and Reservoir, a diversion dam, feeder canals, and related facilities as a part of the Talent Division. Fish and wildlife facilities and minimum basic recreation facilities were also authorized. Under the provisions of the Rehabilitation and Betterment Act of October 7, 1949 (63 Stat. 724, Public Law 81-335), as amended, Medford Irrigation District (MID) and Rogue River Valley Irrigation District (RRVID) are eligible to undertake the rehabilitation of some of their existing facilities.

Typically, Congress authorizes the Bureau of Reclamation (Reclamation) to design and construct Project facilities and to operate and maintain them for a period of time. After that period of time, Reclamation enters into an agreement with the beneficial user (*e.g.*, an irrigation district), transferring the operation and maintenance (O&M) responsibilities to that user. These facilities are referred to as transferred works; however, these agreements do not transfer ownership of the facilities. Only Congress can authorize transfer of title of facilities out of Federal ownership. The irrigation districts maintain the transferred works of the Project. With the exception of Green Springs Powerplant, the Districts have the responsibility for maintenance of all Project facilities. Occasionally, Reclamation does not transfer O&M responsibilities to the beneficial user for specific reasons. These un-transferred facilities are referred to as reserved works and are staffed, operated, and maintained by Reclamation. The only reserved works in the Project are the Green Springs Powerplant and its appurtenant facilities (Cascade Tunnel inlet, Cascade Tunnel, penstock/wasteway control valves, penstock).

The biological opinion (opinion) and incidental take statement (ITS) portions of this document were prepared by the National Marine Fisheries Service (NMFS) in accordance with section 7(b) of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531, *et seq*.), and implementing regulations at 50 CFR 402. The NMFS also completed an Essential Fish Habitat (EFH) consultation. It was prepared in accordance with section 305(b)(2) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) (16 U.S.C. 1801, *et seq*.) and implementing regulations at 50 CFR 600. The opinion and EFH conservation recommendations are both in compliance with section 515 of the Treasury and General Government Appropriations Act of 2001 (Public Law 106-5444) ("Data Quality Act") and underwent pre-dissemination review.

## 1.2 Consultation History

Reclamation, Columbia-Cascade Area Office, Washington, proposes to authorize and carry out the continued operation and expected routine maintenance of actions associated with the storage and delivery of irrigation water in the Rogue River basin by the Project.

### 1.2.1 History

In response to a settlement agreement (*Oregon Natural Resources Council and Northcoast Environmental Center v. John W. Keys III*), Reclamation initiated informal consultation with NMFS in order to assess the potential effects of authorizing and implementing the continued operation and expected routine maintenance actions of the Project. Reclamation submitted a draft biological assessment (BA) in May 2003, and finalized the 2003 BA in August. On September 3, 2003, Reclamation requested formal consultation. NMFS reviewed the final 2003 BA and on September 30, 2003, requested additional information and clarification in a joint letter with the U.S. Fish and Wildlife Service (USFWS). An inter-agency field trip was conducted on October 30 and 31, 2003. Monthly meetings were conducted between November 2003 and January 2004. Reclamation responded to NMFS' information request letter in a January 27, 2004 letter. Monthly coordination meetings continued through March and then occurred periodically through May 2005. The Districts were included in these meetings, although they were never formally recognized by Reclamation as applicants as defined by ESA consultation regulations, 50 C.F.R. § 402.02.

In their 2003 BA, Reclamation concluded that the authorization of the continued operation and routine maintenance actions associated with the Project is "likely to adversely affect" Southern Oregon and Northern California Coasts (SONCC) coho salmon (*Oncorhynchus kisutch*). The 2003 BA also concluded the Project is likely to "adversely modify" designated SONCC coho salmon critical habitat in the Rogue River basin. The 2003 BA also concluded authorization of the Project is likely to adversely affect EFH for coho salmon and Chinook salmon (*O. tshawytscha*). Reclamation's conclusions were based on the proposed action degrading summer stream temperatures, fish passage, and baseline hydrology in the Little Butte Creek and Bear Creek watersheds. They concluded their proposed action was likely to adversely affect most life stages of SONCC coho salmon in the Rogue River basin.

The NMFS transmitted a draft biological opinion to Reclamation in March 2006, which concluded the action, as proposed, would likely result in the adverse modification and destruction of SONCC coho salmon critical habitat, and likely jeopardize the continued existence of SONCC coho salmon (*Oncorhynchus kisutch*). The 2006 draft opinion provided a reasonable and prudent alternative (RPA) for Reclamation to implement. Since that time, Reclamation has conducted additional assessments to evaluate the crafting and implementation of the RPA. A draft supplement to the 2006 BA was submitted to NMFS in January 2009. NMFS reviewed the supplemental 2006 BA, which contained elements and assessments of a new proposed action. Due to inconsistencies between the analysis presented in the 2003 BA and this supplemental 2006 BA, the NMFS recommended Reclamation integrate the two assessments into one stand-alone BA.

Oregon Wild (formerly the Oregon Natural Resources Council) filed suit against the Acting Commissioner of Reclamation seeking injunctive relief and an order compelling the defendant to undertake formal consultation pursuant to section 7 (a) (2) of the ESA. In response, a settlement agreement between Reclamation and Oregon Wild required Reclamation to provide a new BA by October 16, 2009 to NMFS, with the expectation of an issued biological opinion by March 1, 2010. The new proposed action incorporated some components of the March 2006 RPA, but the 2009 BA analyzed, compared, and made conclusions regarding the biological effects of the revised proposed action relative to the action proposed in the 2003 BA, rather than analyzing the effects of continuing to operate the Project. The proposed action in the 2009 BA did not incorporate the 2006 RPA.

NMFS transmitted a draft opinion to Reclamation on December 23, 2010. The draft opinion concluded that the proposed action results in the jeopardy and adverse modification of critical habitat for SONCC coho salmon. This conclusion was due to the adverse effects of the action on the Upper Rogue River (URR) population of SONCC coho salmon and their critical habitats within the Rogue River basin. The draft opinion included an RPA to avoid jeopardizing SONCC coho salmon or adversely modifying their critical habitat. Reclamation outlined concerns regarding NMFS' findings in detail in February and March of 2011. On May 13, 2011, Reclamation provided NMFS with a final letter outlining its concerns with the December 23, 2010 draft opinion. On May 27, 2011, NMFS transmitted a new draft opinion to Reclamation concluding that the proposed action would likely result in the jeopardy and adverse modification of critical habitat for SONCC coho salmon.

Following completion of the May 2011 opinion, NMFS and Reclamation recognized the hydrological data used in the analysis could be improved. The 2006 and 2011 opinions relied on a Reclamation model constructed in 2003 with data dependent on visual observations requiring travel to remote stations. This methodology resulted in data with many gaps and other errors. On July 22, 2011, NMFS, Reclamation, and the Districts met to discuss construction of a new model that incorporates more reliable data with resolution to analyze daily statistics. NMFS, Reclamation, and the Districts met weekly between July 2011, and February 2012, working cooperatively and collaboratively to build this model and an analytical process to determine effects of the proposed action.

The proposed action involves the management of water in the Klamath River Basin and affects the SONCC coho salmon ESU in the Klamath River Basin. Therefore, it may affect the tribal rights or trust resources of the Indian tribes of the Klamath River Basin. NMFS corresponded with the Karuk Tribe, Hoopa Valley Tribe, and Yurok Tribe, by letters dated October 29, 2012, in which NMFS provided the details of the proposed action, particularly in the Klamath Basin, and invited tribal comment and involvement. NMFS staff discussed technical matters relevant to the consultation with technical representatives of the Yurok Tribe on November 17, 2011. NMFS solicited further requests for comments by phone on March 9, 2012, but the call was not returned.

These recent meetings and letters, together with an analysis of the information provided to NMFS since the consultation's inception in 2003, culminated in this final opinion. The NMFS analysis relied on information provided throughout the consultation and any additional relevant information available, such as available hydrograph information, fish abundance surveys, technical reports, and other NMFS analyses required to support an adequate effects analysis.

### 1.2.2 Key Revisions for this Opinion

Following the continued consultation between NMFS and Reclamation to consider NMFS draft opinion of May, 2011, NMFS determined that it was appropriate to revise its draft opinion to reflect new information and action proposals received from Reclamation and its contractors. Although there are many significant revisions that are evident throughout this opinion, a few are listed below for clarity:

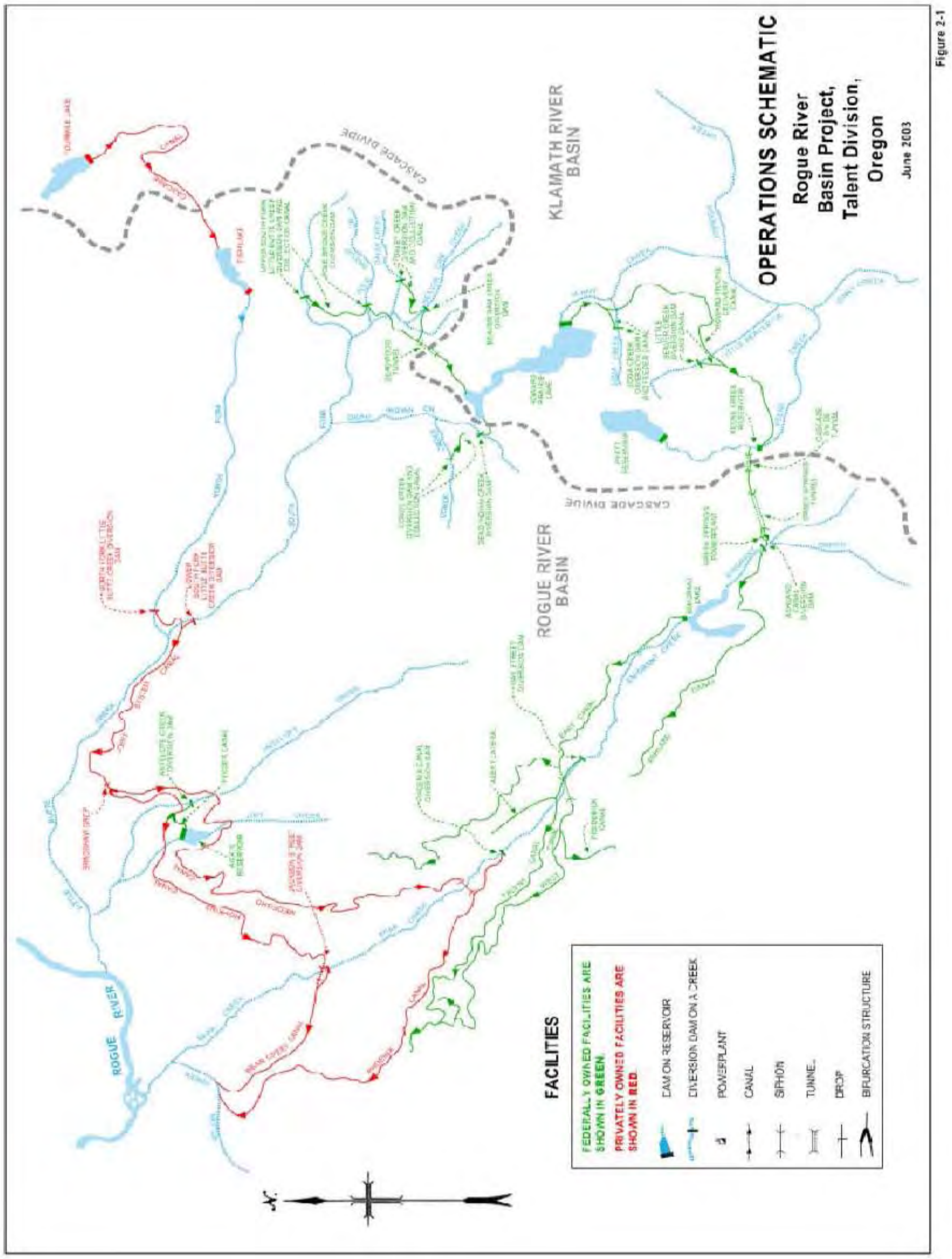
- Reclamation provided a new biological assessment with a revised proposed action for operation and maintenance of the Project leading NMFS to evaluate that proposed action as a substitution for its RPA proposed in the May draft Opinion.
- The modeling of flows was updated from the 2003 hydrologic modeling available for the May draft Opinion with a new 2011 MODSIM model, as more fully explained below in §2.4 and Appendix A of Reclamation's 2012 BA. The improved modeling resulted in a refinement for in-stream flow estimates that NMFS finds are a better description of likely actual flows. Although the flow measurements have changed, NMFS finds that the effects of the flow objectives in the current proposed action are commensurate with the 2011 draft RPA flow objectives.
- The May draft Opinion compared the in-stream flows of the proposed action with flows of an "unregulated scenario" which estimated flows without Project diversions, storage, deliveries, or non-Federal diversions through Project facilities, but including other diversions from non-Federal water use. This terminology changed for this Opinion such that proposed flows were compared to a "without Reclamation scenario" which represents the same flows as the "unregulated scenario" of the draft Opinion. Other than this change of terminology, the comparison remains the same.
- The objective of the May draft RPA for minimum flows, in § 2.7.1.1, was to provide no less than 80% of the highest amount of habitat available at the range of flows modeled during median and high flow years, and 70% during low flow years. The RPA included additions of large wood to increase the amount of habitat, but could not put a numerical value on this benefit. In this 2012 Opinion, the benefits from large wood additions were calculated such that they could be incorporated into the amount of habitat provided by the proposed action. Thus, the objective in the 2012 proposed action includes flow and wood, not just flow as in the 2011 RPA. For this reason, the objective was raised to 90% during median and high flows and 80% during dry years. NMFS finds the habitat objectives in the current proposed action are commensurate with the 2011 draft RPA habitat objectives.
- The 2011 draft RPA proposed objectives for spawning habitat. Following an analysis of the amount of spawning habitat provided by the proposed action, NMFS focused the 2012 analysis on rearing habitat. Under the proposed action, the amount of spawning habitat provided in the affected reaches of Bear Creek and Little Butte Creek is greater than that needed to meet recovery targets for the URR population in the draft recovery plan. Therefore, no specific habitat objectives were applied for spawning habitat in the 2012 analysis.

### 1.3 Description of the Proposed Action

The proposed action is for Reclamation, pursuant to contracts with TID, MID, and RRVID, to divert, store, and deliver water and operate and maintain Federal Project facilities in the future consistent with authorized purposes and routine O&M activities. Elements of the proposed action are distributed across multiple watersheds in Oregon, including: (1) Little Butte Creek drainage, which includes South Fork Little Butte Creek (SF Little Butte Creek), Antelope Creek, and Dry Creek, (2) Bear Creek, which includes Emigrant Creek; and (3) the Klamath River basin (Jenny Creek) (Figure 1). A detailed explanation of the action's facilities and O&M is provided in Rogue River Basin Project Talent Division, Oregon Facilities and Operations report (Vinsonhaler 2002). In addition to the O&M of the Federal Project facilities, Reclamation proposes to implement the following:

- Minimum in-stream flow requirements
- Large wood additions
- Ramping rate procedures
- Modifications of structures to improve fish passage
- Riparian zone restoration

**Figure 1.** Operation Schematic for Rogue River Basin Project.



### 1.3.1 Operations and Maintenance

**Water Collection Facilities.** The SF Little Butte Creek water collection facilities are operated and maintained under contract by TID. The purpose of these facilities is to transfer water from the Rogue Basin to the neighboring Klamath Basin. Although the facilities can operate year round, most diversions occur during winter and spring months until the needs of downstream senior natural flow rights in the Little Butte Creek drainage take precedent. The average annual amount of water collected from SF Little Butte Creek to transfer to the Klamath River basin for water years 2001 to 2011 was about 14,800 acre-feet (2012 BA, page 15).

Streamflow in the SF Little Butte Creek is diverted near its headwaters by the upper South Fork Diversion Dam into the South Fork Collection Canal (Figure 1). Approximately four miles from its origin, the South Fork Collection Canal intercepts flow from Pole Bridge Creek. At mile 7.4, South Fork Collection Canal merges with the Daley Creek Collection Canal that collects runoff from Daley Creek and Beaver Dam Creek. At mile 8.6, the South Fork Collection Canal has a capacity of 130 cubic feet per second (cfs). Having collected these inputs from the Rogue River basin, the South Fork Collection Canal enters Deadwood Tunnel and conveys the collected runoff to the Klamath River basin. In the Klamath Basin, the Deadwood Tunnel discharges into the natural channel of Grizzly Creek and the flows are carried into Howard Prairie Reservoir.

Two other headwater tributaries of SF Little Butte Creek are diverted into the Klamath River basin. Conde Creek flows are diverted at Conde Creek Diversion Dam into the Conde Creek Canal that terminates at Dead Indian Creek. The combined flow is then diverted into Dead Indian Creek Canal. This canal, with a capacity of the 86 cfs, crosses the Cascade Divide and discharges into Howard Prairie Reservoir in the Klamath River basin.

In the Jenny Creek drainage of the Upper Klamath River basin, collection facilities divert water from Jenny Creek and Jenny Creek tributaries. This water is stored in Howard Prairie Reservoir, Hyatt Reservoir and Keene Creek Reservoir. The average annual amount of water collected from Jenny Creek to transfer to upper Emigrant Creek for water years 2003 to 2011 was about 24,400 acre-feet (2012 BA, page 20).

RRVID operates the Antelope Creek Diversion Dam and Agate Dam and Reservoir in the Rogue River basin. Antelope Creek Diversion Dam is on Antelope Creek at RM 7.0. It diverts up to 50 cfs into Antelope Feeder Canal extending about 0.1-mile to Hopkins Canal and then diverted at a bifurcation structure via Agate Feeder Canal into Agate Reservoir. An estimated 1,400 acre-feet is diverted annually from Antelope Creek (2012 BA, page 25).

**Water Storage Facilities.** Refer to Section 2.3 of the 2012 BA for detailed descriptions of the water storage facilities. The storage facilities in the SF Little Butte Creek Area and Bear Creek Area include: Howard Prairie Dam and Reservoir (Lake), Hyatt Dam and Reservoir, and Keene Creek Dam and Reservoir in Klamath River basin, and Emigrant Dam and Reservoir (Lake) on Bear Creek drainage in the Rogue River basin (Figure 1). Contracts between Reclamation and TID, MID, and RRVID provide for these reservoirs to be operated as a pooled system with a total active capacity of 115,000 acre-feet. The Districts have the right to carry stored water over from one year to the next as long as the stored water does not exceed its assigned reservoir space. TID operates and maintains the SF Little Butte Creek and Bear Creek water storage facilities.

Agate Dam and Reservoir (active capacity: 4,670 acre-feet), is on Dry Creek in the Rogue River basin about 11 miles northeast of Medford, Jackson County, Oregon (Figure 1). Agate Reservoir stores and re-regulates co-mingled water from Antelope Creek, natural flows of Dry Creek, and water conveyed from North and South Forks of Little Butte Creek. The dam and reservoir are operated by RRVID as a storage/re-regulating facility. Water is released from Agate Dam into Dry Creek and flows a short distance downstream, where it is diverted into Hopkins Canal for irrigation uses on RRVID lands on the east and west sides of Bear Creek. Any excess flow within Dry Creek flows into Antelope Creek downstream, then into Little Butte Creek at RM 3.2, downstream from Eagle Point. Releases from Agate Reservoir of one cfs for streamflow maintenance in Dry Creek are made when inflow is equal to or greater than that amount. If inflow is less than one cfs, the entire flow is released for streamflow maintenance.

**Water Conveyance Facilities.** Water conveyance facilities involved in this Project move water: (1) From upper SF Little Butte Creek into the Jenny Creek drainage in the Upper Klamath River basin; (2) from Jenny Creek into the upper Emigrant Creek drainage; (3) from the Antelope Creek drainage to the Bear Creek drainage; (4) from Emigrant Creek to TID canals via the Oak Street diversion; and (5) from Bear Creek to MID canals via the Phoenix diversion. Refer to Section 2.3 of the 2012 BA for detailed descriptions of the water conveyance facilities. The average annual amount of water transferred from SF Little Butte Creek to the Klamath River basin for water years 2001 to 2011 was about 14,800 acre-feet (2012 BA, page 15). The amount of water transferred annually from Jenny Creek to upper Emigrant Creek is the sum of the SF Little Butte Creek water and the approximately 24,000 acre-feet of Jenny Creek water.

**Inspection and Maintenance.** Reclamation examines dams as often as every three years with an underwater inspection by divers of the outlet works and spillway stilling basins typically every six years. Such inspections may prevent Reclamation from fully satisfying the in-stream flow targets identified below Emigrant Dam. Inspections and routine maintenance may result in reductions in flows to no lower than 2 cfs for no longer than 48 hours.

### 1.3.2 Minimum In-stream Flow Requirements

**Identification of Reaches**. To facilitate discussion of the proposed action and its effects, this opinion will partition Emigrant Creek and Bear Creek into six reaches and Little Butte Creek into three reaches (Table 1, Figure 2). Each of these nine reaches is represented by a Reclamation hydrologic and meteorologic (Hydromet) monitoring station. The Hydromet station ID will be used to identify the stream reaches throughout this opinion.

**Table 1.** Stream reaches affected by the minimum in-stream flow requirements and their representative Reclamation Hydromet station.

| Hydromet Station | Stream | Upstream Extent | Downstream Extent |
|---|---|---|---|
| EMI | Emigrant Creek | Emigrant Dam | Beginning of Bear Creek |
| BCAO | Bear Creek | Beginning of Bear Creek | Oak Street Diversion Dam |
| BASO | Bear Creek | Oak Street Diversion Dam | Valley View Road |
| BCTO | Bear Creek | Valley View Road | Phoenix Diversion Dam |
| MFDO | Bear Creek | Phoenix Diversion Dam | Jackson Street Diversion Dam |
| BCMO | Bear Creek | Jackson Street Diversion Dam | Rogue River |
| GILO | South Fork Little Butte Creek | Impassable Barrier | Mouth at Little Butte Creek |
| LBCO | Little Butte Creek | South Fork Little Butte Creek | Antelope Creek |
| LBEO | Little Butte Creek | Antelope Creek | Rogue River |

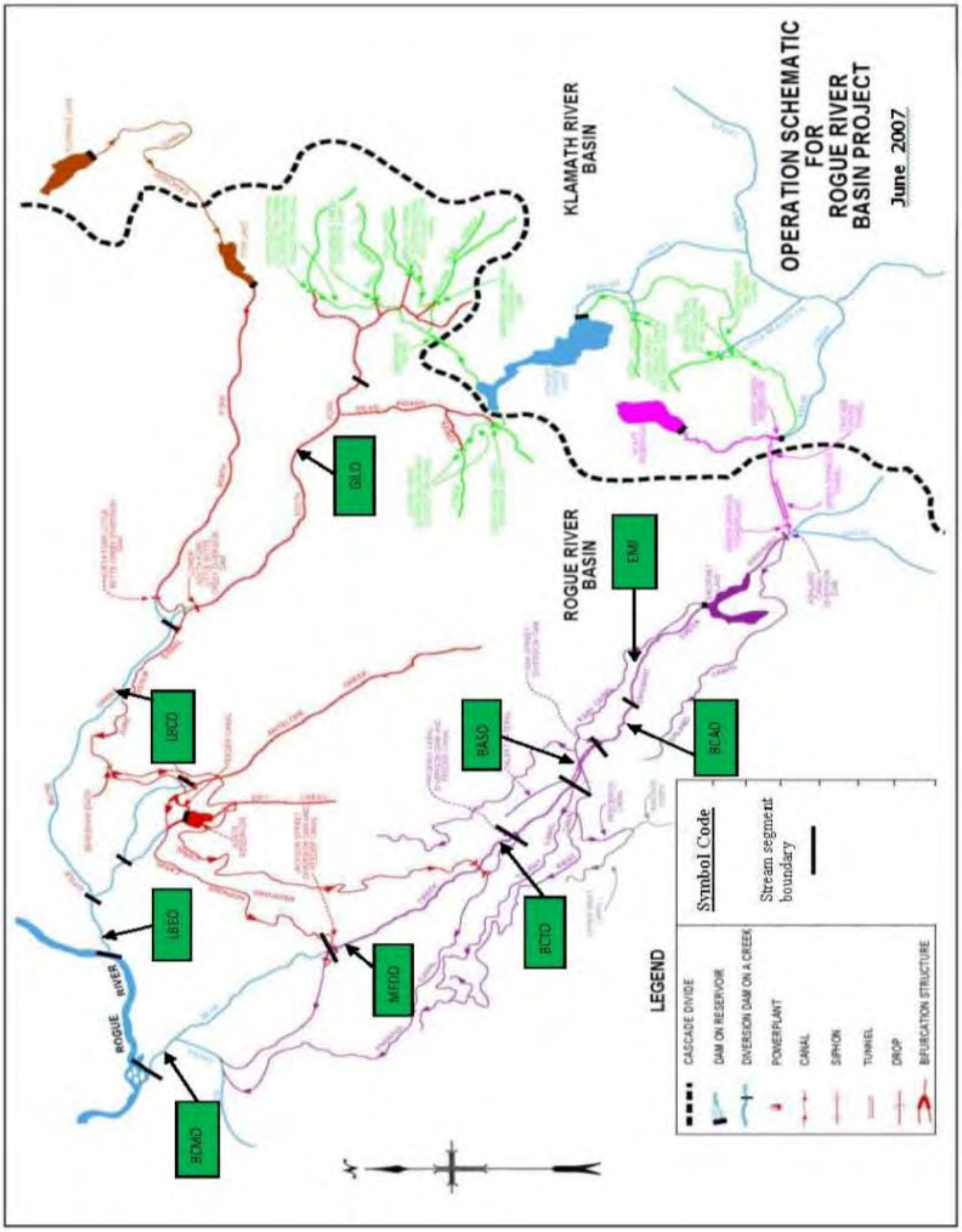



**Figure 2.** Reference Reaches for the Rogue River Basin Project.

**Determination of System State.** The in-stream flow targets identified below differ between wet, median, and dry hydrologic system states. Reclamation estimates system state using a total reservoir storage method (GeoEngineers 2008). Under the total reservoir storage method, Reclamation compares the sum of the daily storage values of Howard Prairie, Hyatt, and Emigrant reservoirs to historic values at similar times during the year. Where storage is within 15,000 acre-feet of average total storage, the system is in a median hydrologic state. Wet and dry hydrologic states are those values greater than 15,000 acre-feet above or below the median. Figure 3 identifies the system state thresholds using daily storage values from 1992 to 2010 (2012 BA, Figure 2-3). The Districts calculate the state of the system daily to determine if the hydrologic conditions are wet, median, or dry (see Appendix D of the 2012 BA for a more detailed explanation).

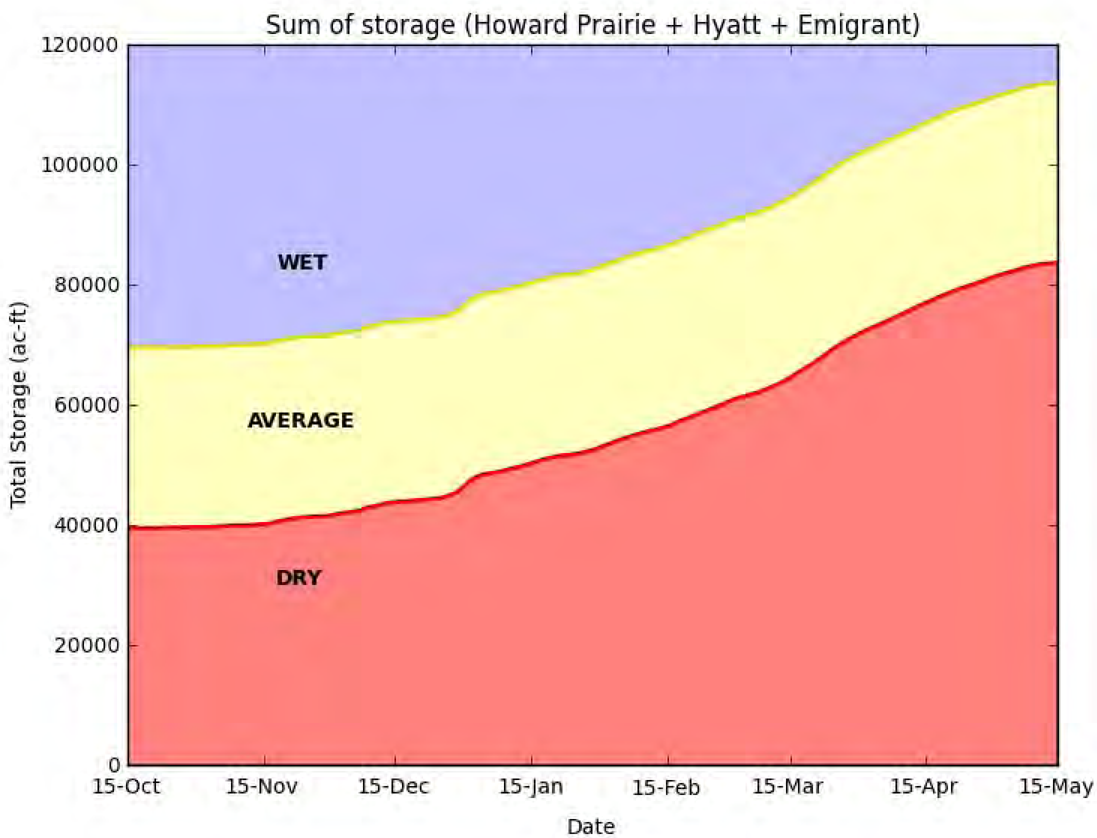



**Figure 3.** Plot to determine wet, median, and dry hydrologic system state (2012 BA).

**Minimum In-stream Flows.** Reclamation will institute minimum in-stream flow requirements (Table 2) for the operations of Emigrant Dam, Oak Street Diversion Dam, Phoenix Diversion Dam, and the South Fork Little Butte Creek collection facilities. In-stream flow targets were established according the total reservoir storage method of determining water availability condition (system state), with greater in-stream flow targets during wet conditions and lower in-stream targets during dry conditions. Reclamation will monitor in-stream flows at the closest Hydromet station downstream of each facility. In-stream flow targets do not apply when a facility is not operating (*e.g.* at a diversion dam outside of the irrigation season).

**Table 2.** In-stream flow targets for Hydromet stations downstream of Emigrant Dam, Oak Street Diversion, Phoenix Diversion, and the South Fork Little Butte Creek Collection Facilities.

| | **EMI** Emigrant Dam | | | **BASO** Oak Street Diversion | | **BCTO** Phoenix Diversion | | **GILO** SF Little Butte Cr. Collection Facilities | |
|---|---|---|---|---|---|---|---|---|---|
| | 3 hour minimum (cfs) | | | 7 day daily average (cfs) /3 hour minimum (cfs) | | | | 7 day daily average (cfs) | |
| **System State** | **Wet** | **Median** | **Dry** | **Wet & Median** | **Dry** | **Wet & Median** | **Dry** | **Wet & Median** | **Dry** |
| **Oct** | 6 | 3 | 2 | 8/5 | 3/2 | 12/8 | 8/5 | 10 | 8 |
| **Nov** | 10 | 6 | 2 | | | | | 15 | 10 |
| **Dec** | 12 | 10 | 2 | | | | | 20 | 15 |
| **Jan** | 12 | 10 | 2 | No Operations | | | | 25 | 15 |
| **Feb** | 12 | 10 | 2 | | | | | 25 | 20 |
| **Mar** | 12 | 10 | 2 | | | | | 55 | 25 |
| **Apr** | 12 | 9 | 2 | 30/20 | 25/15 | 40/20 | 30/15 | 75 | 40 |
| **May** | 10 | 9 | 2 | 30/20 | 25/15 | 20/10 | 20/10 | 60 | 40 |
| **Jun** | 6 | 3 | 2 | 20/15 | 15/8 | 12/6 | 10/5 | 25 | 15 |
| **Jul** | 6 | 3 | 2 | 12/10 | 5/3 | 10/5 | 8/5 | 15 | 10 |
| **Aug** | 6 | 3 | 2 | 6/4 | 3/2 | 8/5 | 5/3 | 12 | 8 |
| **Sep** | 6 | 3 | 2 | 6/4 | 3/2 | 8/4 | 5/3 | 10 | 8 |

**Emigrant Dam/EMI Station.** To meet in-stream flow targets at the EMI station, TID will release water from Emigrant Dam. Emigrant Dam operates year round, thus targets apply for every month. Minimum in-stream flow targets vary for wet, median, and dry system states. Because the facilities at Emigrant Dam are easily accessible, easily adjustable, and close in proximity to the EMI station, targets were set as 3-hour minimums.

**South Fork Little Butte Creek/GILO.** To meet in-stream flow targets at the GILO station, TID will reduce cumulative diversions of water from SF Little Butte Creek and its tributaries. Diversions from the SF Little Butte Creek drainage operate year round, thus targets apply for every month. Minimum in-stream flow targets are equal for wet and median system states, but lower for dry system states. Because the headwater facilities in SF Little Butte Creek are numerous, dispersed, hard to access, and distant in proximity to the GILO station, targets were set as 7-day average minimums. TID has no storage facilities on SF Little Butte Creek, thus their ability to meet minimum flow requirements is limited when recent precipitation volume departs from what the system state predicts. Due to low precipitation, there may not be sufficient natural flow to satisfy the in-stream flow targets when the system state indicates median or wet condition flows. In addition, TID diverts 2 to 3 cfs during winter months to prevent snow or ice buildup from impairing operational capacity of the canals and diversion facilities.

**Oak Street Diversion Dam/BASO and Phoenix Diversion Dam/BCTO.** To meet in-stream flow targets at the BASO and BCTO stations, TID will release water from Emigrant Dam and/or the Districts will reduce flow in the canals from these diversion dams. These diversion dams only operate during irrigation season (April 1 to October 15), thus no targets apply over the winter. During the storage season, Reclamation will bypass all natural flow at these facilities. Minimum in-stream flow targets are equal for wet and median system states, but lower for dry system states.

The flow targets specified in Table 2 are set as a 7-day average because private diversion activity renders more detailed management of Bear Creek impracticable. At times, flows in Bear Creek can rapidly and unexpectedly decline to very low levels. This is most likely attributable to the combined and uncoordinated withdrawals of water by private water users. To avoid increasing the frequency of very low flow events, the Districts will adjust operations of Oak Street and Phoenix diversion dams so as not to cause a three-consecutive-hour low flow event below the three-hour targets in Table 2.

**Monitoring and Reporting.** If in-stream flows fall below the targets specified in Table 2, Reclamation will, within 12 hours of the event, provide NMFS with a report containing a record of flows for all Hydromet stations in the affected stream(s) and canal(s); and a record of associated operational changes. In this report, Reclamation will provide data for the prior 72 hours for in-stream flow targets measured as a 3-hour minimum, and 10 days for in-stream flow targets measured as a 7-day average. Following transmittal of such report, Reclamation will coordinate with NMFS in assessing the impact, if any, of the low flow event on listed fish. Reclamation will also provide an annual report to NMFS detailing compliance measures by February 15 of each year.

### 1.3.3 Large Wood Additions

Reclamation used a process to predict the amount of habitat (measured as weighted useable area, WUA) created by installing large wood into stream (described in detail in section 2.5.2.1 and in Appendix C in the 2012 BA). This process allows Reclamation to commit to providing a numerical amount of habitat prior to installation design. Reclamation will design and install as much large wood as necessary to increase WUA of rearing habitat within the Bear Creek and Little Butte Creek watersheds as presented in Table 3. Reclamation has committed to meet targets for both median and dry flow conditions in two reaches. In those instances, Reclamation will install enough large wood to meet both targets. Within one year of the completion of this opinion, Reclamation will complete an implementation design and schedule identifying the locations and amounts of large wood to be installed, the anticipated increase in WUA from those installations, a prioritized schedule of installation, and a description of monitoring and reporting requirements. Reclamation intends to implement 70 percent of this plan by 2017 and 100 percent by 2020 assuming a continuation of historical funding levels. NMFS assumes Reclamation will achieve this timeline.

**Table 3.** Proposed in-stream habitat improvement targets for Emigrant Creek, Bear Creek, and South Fork Little Butte Creek.

| | **Increase in Habitat ($ft^2$ WUA)** | | |
|---|---|---|---|
| **Location** | **Median Flow (50% exceedence)** | **Low Flow (80% exceedence)** | **Targeted Life Stage** |
| Emigrant Creek/Neil Creek | 7,100 | 15,700 | Winter rearing habitat |
| Bear Creek/Ashland Creek | 8,600 | 3,000 | Winter rearing habitat |
| Bear Creek below BASO | 5,100 | None required | Summer rearing habitat |
| South Fork Little Butte Creek | 6,500 | None required | Winter rearing habitat |

### 1.3.4 Flow Ramping Procedures

**Storage Season.** During the storage season, Reclamation proposes ramping procedures at Emigrant dam. A ramping rate protocol for Oak Street or Phoenix Diversion canals is not proposed because they do not function during the storage season. When adjusting flow releases from Emigrant Reservoir during non-flood rule conditions, flows will not increase (up ramp) more than 100 percent nor decrease (down ramp) more than 50 percent from the previous 24-hour period. Flood control activities are non-discretionary and set by the Corps of Engineers (Corps) flood control rule curve. Therefore, no ramping procedures are proposed during flood control periods. However, Reclamation will make efforts to maintain the 50 percent down-ramping protocol even during periods of flood control.

**Irrigation Season.** The proposed ramping protocol considers critical flows in each affected stream reach. Critical flows were determined by Reclamation to define the low flow threshold condition at which down ramping may have the greatest impact on fish stranding. Table 4 presents Reclamation's proposed critical flow volumes for the Hydromet stations of interest. Flows above the defined critical flow rates in each stream can withstand a more rapid ramping condition.

**Table 4.** Critical flow values for EMI, BASO, BCTO, and GILO (2012 BA).

| Hydromet station | Critical Flow (cfs) |
|---|---|
| EMI | 10 |
| BASO | 20 |
| BCTO | 20 |

***Emigrant Reservoir.*** When not under a flood rule condition, up ramping from Emigrant Reservoir during the irrigation season is based on an up-ramping analysis of the rating curve at EMI and will be managed to minimize potential increases of water surface elevation of more than two inches per hour at EMI, according to the following schedule:

- When streamflow at EMI is between 2 and 6 cfs, flow increases from Emigrant Dam will not exceed 8 cfs per hour.
- When streamflow at EMI is between 6 and 20 cfs, flow increases from Emigrant Dam will not exceed 10 cfs per hour
- When streamflow at EMI is between 20 and 40 cfs, flow increases from Emigrant Dam will not exceed 15 cfs per hour.
- When streamflow at EMI is between 40 and 100 cfs, flow increases from Emigrant Dam will not exceed 20 cfs per hour.
- When streamflow is greater than 100 cfs at EMI, flow increases from Emigrant Dam will not exceed 30 cfs per hour.

Reclamation will manage down ramping rates from Emigrant Reservoir to not exceed 50 percent of the previous 24-hour average. When flows at EMI drop at or below the critical flow of 10 cfs, down ramping will be limited to a maximum change of 5 cfs per hour to minimize the potential for a decrease of more than two inches per hour in the water surface elevation at EMI and the corresponding reach.

***Oak Street and Phoenix Diversion Dams.*** Reclamation will manage down ramping in Bear Creek downstream of the two diversion dams based on diversion rates into their associated canals. To minimize the potential for a decrease of more than 2 inches per hour in Bear Creek water surface elevation below the diversions, Reclamation will implement the following:

- When streamflow at BASO is below the critical flow of 20 cfs, increases of diversion flow rates at the Oak Street Diversion will not exceed 5 cfs per hour.

- When streamflow at BASO is between 20 and 70 cfs, increases of diversion flow rates at the Oak Street Diversion will not exceed 10 cfs per hour.
- When streamflow at BASO is greater than 70 cfs, increases of diversion flow rates at the Oak Street Diversion will not exceed 20 cfs per hour.
- When streamflow at BCTO is below the critical flow of 20 cfs, increases of diversion flow rates at the Phoenix Diversion will not exceed 5 cfs per hour.
- When streamflow at BCTO is between 20 and 80 cfs, increases of diversion flow rates at the Phoenix Diversion will not exceed 10 cfs per hour.
- When streamflow at BCTO is greater than 80 cfs, increases of diversion flow rates at the Phoenix Diversion will not exceed 20 cfs per hour.

The 2-inch threshold in water surface elevation decrease in Bear Creek below these structures was determined through an analysis of the rating curves at BASO and BCTO, the closest downstream Hydromet stations (Appendix E 2012 BA).

### 1.3.5 Fish Passage Improvements

**Oak Street Diversion.** The proposed action includes improvement of the Oak Street diversion fish passage structure in accordance with current NMFS fish passage criteria (NMFS 2008) to resolve existing passage issues. Reclamation is confident the fish passage improvements for this facility are reasonably likely to be completed by the fall of 2015. In the 2012 BA, Reclamation described this work as follows for the Oak Street Diversion:

> When construction commences, a cofferdam would be constructed to isolate Bear Creek from the construction area near the existing fish ladder. This would allow removal of all or part of the original ladder and construction of the modified section of ladder or replacement with a new fishway to be completed "in the dry." This would prevent contamination of the creek from concrete, silt, welding slag, sandblasting abrasive, or other contaminants, and prevent physical harm to aquatic life. Upon completion of construction tasks, the cofferdam would be removed.
>
> All construction work would be accomplished during the ODFW-established in-water work period of June 15 to September 15 for Bear Creek (ODFW 2008). Work is estimated to take from 3 to 4 weeks for modification to the existing ladder structure and between 5 to 7 weeks for replacement with a new fishway (McGowan 2008).
>
> At this site, a gravel parking area exists on the left side of the creek and a gravel O&M road exists on the right side of the creek, including a small area of riparian vegetation. Less than an acre of riparian habitat in the project area would be affected by construction-related activities.

As additional conservation measures, Reclamation will salvage all fish out of the isolation area and replant all disturbed riparian vegetation.

**Ashland Creek Diversion.** Both juvenile and adult coho salmon passage problems at the Ashland Creek Diversion site would be corrected as part of the proposed action. Reclamation will improve juvenile fish passage survival by installing a screen on the diversion that conforms to NMFS criteria. Reclamation will improve juvenile and adult fish passage survival by installing passage structures at the dam to meet NMFS fish passage criteria. At this time, Reclamation has prepared a final pre-design technical memorandum and will be preparing the final engineering design specifications for this fish passage structure. Reclamation is confident the fish passage improvements for this facility are reasonably likely to be completed by the fall of 2015. Reclamation will consult with NMFS fish passage experts through this process to ensure compliance with current criteria. Construction steps would be similar to those outlined for Oak Street; however, access to this site is more difficult so some additional disturbance to riparian habitat may be needed to gain access to the site.

### 1.3.6 Riparian Zone Restoration

Reclamation proposes to implement riparian zone restoration actions along three miles of streambank within the Bear Creek watershed. Proposed management actions will focus on vegetation plantings along Emigrant, Neil, and Bear Creeks in areas above and below the Oak Street Diversion Dam near Ashland, Oregon. Areas selected for vegetation plantings will focus on stream zones where vegetation growth can provide shade, food resources, and eventual stream structural elements to the stream channel. Within one year, Reclamation will complete an implementation plan in cooperation with NMFS. The plan will describe the schedule, amount, timing, and composition of vegetation proposed for planting. The objective of the riparian zone management plan is to improve the utility of existing habitat. Reclamation will coordinate with NMFS to ensure riparian zone planting actions provide short- and long-term benefits to aquatic habitat in general and coho salmon in particular. It is Reclamation's intent that elements of the Riparian Management Plan will be phased in over the period of 2012-2017, contingent on availability of funding. Reclamation considers this a reasonably attainable timeframe for implementation based on Reclamation ESA program needs and priorities and assuming a continuation of historical funding levels.

## 1.4 Interrelated Actions and Interdependent Actions

Regulations implementing section 7 of the ESA require that NMFS consider the effects of activities that are interrelated and interdependent to the proposed Federal action (50 CFR section 402.02). Interrelated actions are those that are part of a larger action and depend on the larger action for their justification. Interdependent actions are defined as actions with no independent utility apart from the action under consideration. Interdependent and interrelated activities are assessed by applying the "but for" test, which asks whether any action and its associated impacts would occur "but for" the Proposed Action.

The Hopkins Canal, Phoenix Canal and Jackson Street Diversion Dam and Feeder Canal are privately owned facilities and are considered interrelated and interdependent due to the co-mingling of water delivered under Federally and non-Federally controlled water rights. While these facilities could operate without the proposed action, their operations would necessarily be entirely different in the absence of the proposed action (Reclamation's 2003 BA, Tables 2-1, 2-2, and 2-3).

The NMFS and the USFWS sent Reclamation a letter (September 30, 2003) requesting more information regarding potential interrelated and interdependent actions to this consultation. In Reclamation's January 27, 2004, response letter, Reclamation provided the following information regarding the Four-Mile Reservoir and Cascade Canal facilities:

> During the preparation of the BA (Assessment), we (Reclamation) investigated the interrelated nature of private facilities including Cascade Canal and Fish Lake and Four-Mile Reservoirs. Fourmile Dam was privately constructed in 1922 and Fish Lake was in use prior to that time. Federal irrigation development in the Rogue River basin was initiated by the Act of August 20, 1954 (68 stat.752), authorizing the construction of the Talent Division of the Rogue River Basin Project. Subsequent legislation was enacted on October 1, 1962 (67 Stat. 677) for construction of Agate Dam and Reservoir. This legislation permitted the rehabilitation of specific private facilities under the provisions of the Rehabilitation and Betterment Act of 1943 (63 Stat. 724). Using the "but for" test from the USFWS and NMFS consultation handbook (1988), the question is, "would the Operation and Maintenance of Cascade Canal and Fish Lake and Fourmile Reservoirs occur "but for" the Proposed Action?" Our conclusion is that these facilities do not depend on the proposed action for their justification, have independent utility from the proposed action, and thus are not interrelated or interdependent.

Based on this information, NMFS will not consider the Cascade Canal, Fish Lake, or Four-mile Reservoir operation and maintenance as interrelated and interdependent actions in this document.

**1.5 Action Area**

Action area means all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02). For this consultation, the action area is within the Klamath River and Rogue River basins of Southern Oregon and Northern California (Figure 1). Activities of the proposed action occur in three $5^{th}$-field watersheds, but the effects extend downstream of those watersheds to the Pacific Ocean. A reduction in water, no matter how small, will reduce water in the river systems down to the ocean. Therefore, the action area includes five 4th-field watersheds and twenty 5th-field watersheds (Table 5). The action area specifically includes the Bear Creek watershed, the Little Butte Creek watershed (with the exception of the North Fork of Little Butte Creek), the mainstem Rogue River downstream of Little Butte Creek, the Jenny Creek watershed, and the mainstem Klamath River downstream of Jenny Creek.

**Table 5.** Hydrologic unit codes and their corresponding names comprising the action area within the Klamath River and Rogue River basins.

| Basin | Watershed name (5th field HUC) | HUC number |
|---|---|---|
| Rogue River basin | Little Butte Creek | 1710030708 |
| Rogue River basin | Bear Creek | 1710030801 |
| Rogue River basin | Rogue River-Gold Hill (Mainstem Rogue River only) | 1710030802 |
| Rogue River basin | Rogue River-Grants Pass (Mainstem Rogue River only) | 1710030804 |
| Rogue River basin | Rogue River-Hellgate Canyon (Mainstem Rogue River only) | 1710031001 |
| Rogue River basin | Rogue River-Horseshoe Bend (Mainstem Rogue River only) | 1710031004 |
| Rogue River basin | Rogue River-Stair Creek (Mainstem Rogue River only) | 1710031005 |
| Rogue River basin | Rogue River-Shasta Costa Creek (Mainstem Rogue River only) | 1710031006 |
| Rogue River basin | Lower Rogue River (Mainstem Rogue River only) | 1710031008 |
| Klamath River basin | Jenny Creek | 1801020604 |
| Klamath River basin | Klamath River-Iron Gate Reservoir (Mainstem Klamath River only) | 1801020605 |
| Klamath River basin | Klamath River-Bogus Creek (Mainstem Klamath River only) | 1801020606 |
| Klamath River basin | Klamath River-Humbug Creek (Mainstem Klamath River only) | 1801020608 |
| Klamath River basin | Klamath River-Horse Creek (Mainstem Klamath River only) | 1801020610 |
| Klamath River basin | Klamath River-Seiad Creek (Mainstem Klamath River only) | 1801020611 |
| Klamath River basin | China Peak (Mainstem Klamath River only) | 1801020901 |
| Klamath River basin | Ukonom Creek (Mainstem Klamath River only) | 1801020905 |
| Klamath River basin | Rock Creek (Mainstem Klamath River only) | 1801020907 |
| Klamath River basin | Bluff Creek (Mainstem Klamath River only) | 1801020908 |
| Klamath River basin | Ah Pah Creek (Mainstem Klamath River only) | 1801020909 |

The Rogue River basin portion of the action area and the Klamath River basin below Iron Gate Dam are used by SONCC coho salmon and are designated as critical habitat. Adult SONCC coho salmon use the Rogue Basin portion of the action area as migration and spawning habitat and juveniles use the action area as migration and rearing habitat. In the Klamath River basin, access above Iron Gate Dam is blocked to passage by SONCC coho salmon and is not designated as critical habitat. The NMFS listed SONCC coho salmon as threatened under the ESA on June 28, 2005 (70 FR 37160 (previously listed on May 6, 1997 [62 FR 24588])), critical habitat was designated on May 5, 1999 (64 FR 24049), and protective regulations were issued under Section

4(d) of the ESA on June 28, 2005 (70 FR 37160 (previously issued on July 18, 1997 [62 FR 38479])). The action area includes habitat designated as EFH for coastal pelagics (PFMC 1998), Pacific salmon (PFMC 1999), and Pacific Coast groundfish (PFMC 2005).

Two other species listed under the ESA occur in the action area, however NMFS found the proposed action is not likely to adversely affect (NLAA) them or their critical habitat. NMFS listed the southern distinct population segment Pacific eulachon (*Thaleichthys pacificus*)(hereafter referred to as 'eulachon') as threatened under the ESA on March 18, 2010 (75 FR 13012). NMFS has not issued protective regulations for eulachon, but did designate critical habitat for eulachon on October 20, 2011 (76 FR 65324), in which the lowest 10.7 miles of the Klamath River are designated. The NMFS listed the southern distinct population segment of North American green sturgeon (*Acipenser medirostris*)(hereafter referred to as 'green sturgeon') as threatened under the ESA on April 7, 2006 (71 FR 17757), designated critical habitat on November 9, 2009 (74 FR 52300), and issued protective regulations on June 2, 2010 (75 FR 30714). Because no portion of the geographic range designated for green sturgeon as critical habitat occurs within the action area, this opinion will not address it further.

## 2. ENDANGERED SPECIES ACT BIOLOGICAL OPINION AND INCIDENTAL TAKE STATEMENT

The ESA establishes a national program for conserving threatened and endangered species of fish, wildlife, plants, and the habitat on which they depend. Section 7(a)(2) of the ESA requires Federal agencies to consult with the U.S. Fish and Wildlife Service, NMFS, or both, to ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species or adversely modify or destroy their designated critical habitat. Section 7(b)(3) requires that at the conclusion of consultation, the Service provide an opinion stating how the agencies' actions will affect listed species or their critical habitat. If incidental take is expected, Section 7(b)(4) requires the provision of an ITS specifying the impact of any incidental taking, and including reasonable and prudent measures to minimize such impacts.

### 2.1 Introduction to the Biological Opinion

Section 7(a)(2) of the ESA requires Federal agencies, in consultation with NMFS, to insure that their actions are not likely to jeopardize the continued existence of endangered or threatened species, or adversely modify or destroy their designated critical habitat. The jeopardy analysis considers both survival and recovery of the species. The adverse modification analysis considers the impacts to the conservation value of the designated critical habitat.

"To jeopardize the continued existence of a listed species" means to engage in an action that would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 CFR 402.02).

This opinion does not rely on the regulatory definition of "destruction or adverse modification" of critical habitat at 50 CFR 402.02. Instead, we have relied upon the statutory provisions of the ESA to complete the following analysis with respect to critical habitat.[1]

We will use the following approach to determine whether the proposed action described in Section 1.3 is likely to jeopardize listed species or destroy or adversely modify critical habitat:

- *Identify the rangewide status of the species and critical habitat likely to be adversely affected by the proposed action*. This section describes the current status of each listed species and its critical habitat relative to the conditions needed for recovery. For listed salmon and steelhead, NMFS has developed specific guidance for analyzing the status of the listed species' component populations in a "viable salmonid populations" paper (VSP; McElhany *et al*. 2000). The VSP approach considers the abundance, productivity, spatial structure, and diversity of each population as part of the overall review of a species' status. For listed salmon and steelhead, the VSP criteria therefore encompass the species' "reproduction, numbers, or distribution" (50 CFR 402.02). In describing the range-wide status of listed species, we rely on viability assessments and criteria in technical recovery team documents and recovery plans, where available, that describe how VSP criteria are applied to specific populations, major population groups, and species. For SONCC coho salmon we use the Technical Recovery Team's framework for assessing viability (Williams *et al*. 2008). We determine the rangewide status of critical habitat by examining the condition of its physical or biological features (also called "primary constituent elements" or PCEs in some designations) – which were identified when the critical habitat was designated. Species and critical habitat status are discussed in Section 2.2.

- *Describe the environmental baseline for the proposed action*. The environmental baseline includes the past and present impacts of Federal, state, or private actions and other human activities *in the action area*. It includes the anticipated impacts of proposed Federal projects that have already undergone formal or early section 7 consultation and the impacts of state or private actions that are contemporaneous with the consultation in process. The environmental baseline is discussed in Section 2.3 of this opinion.

- *Describe any cumulative effects.* Cumulative effects, as defined in NMFS' implementing regulations (50 CFR 402.02), are the effects of future state or private activities, not involving Federal activities, that are reasonably certain to occur within the action area. Future Federal actions that are unrelated to the proposed action are not considered because they require separate section 7 consultation. Cumulative effects are considered in Section 2.4 of this opinion.

- *Analyze the effects of the proposed actions*. In this step, NMFS considers how the proposed action would affect the species' reproduction, numbers, and distribution by considering, in the case of salmon and steelhead, their VSP characteristics. NMFS also

[1] Memorandum from William T. Hogarth to Regional Administrators, Office of Protected Resources, NMFS (Application of the "Destruction or Adverse Modification" Standard Under Section 7(a)(2) of the Endangered Species Act) (November 7, 2005).

evaluates the proposed action's effects on critical habitat features. NMFS will add the effects of the action to the environmental baseline (Section 2.3) and the cumulative effects (Section 2.4). The effects of the action are described in Section 2.5 of this opinion.

- *Integrate and synthesize the above factors to assess the risk that the proposed action poses to species and critical habitat.* In this step, NMFS will assess whether the action, when added to the baseline and cumulative effects could reasonably be expected to: (1) appreciably reduce the likelihood of both survival and recovery of the species in the wild by reducing its numbers, reproduction, or distribution; or (2) reduce the value of designated or proposed critical habitat for the conservation of the species. These assessments are made in full consideration of the status of the species and critical habitat (Section 2.2). Integration and synthesis occurs in Section 2.6 of this opinion.

- *Reach jeopardy and adverse modification conclusions*. Conclusions regarding jeopardy and the destruction or adverse modification of critical habitat are presented in Section 2.7. These conclusions flow from the logic and rationale presented in the Integration and Synthesis Section (2.6).

- *If necessary, define a reasonable and prudent alternative to the proposed action.* If, in completing the last step in the analysis, NMFS determines that the action under consultation is likely to jeopardize the continued existence of listed species or destroy or adversely modify designated critical habitat, NMFS must identify a reasonable and prudent alternative (RPA) to the action (2.7). The RPA must not be likely to jeopardize the continued existence of ESA-listed species nor adversely modify their designated critical habitat and it must meet other regulatory requirements.

In this opinion, NMFS concludes that the proposed action is NLAA green sturgeon, eulachon, and designated critical habitat for eulachon (see Section 2.11 for details). NMFS also finds that while the action area includes the middle and lower Rogue River and the lower Klamath River 4th field watersheds, the proposed action will not significantly affect SONCC coho salmon within them adversely. The only effect of the proposed action transferred to these reaches is related to water quantity. In the Klamath River, flows at the base of IGD will be reduced by 1.3% (2012 BA, page 203). By the time the Klamath River reaches the Lower Klamath River 4$^{th}$ field watershed (Siead Valley) inflows from tributaries, including Shasta River and Scott River, diminish this percentage to immeasurable. In the Rogue River, flows at the mouth of Little Butte Creek will be reduced by approximately 0.8% (calculated as the total reduction during a median flow year at LBEO (data from Table 23) divided by the average annual flow at the Raygold USGS gage). The changes this reduction has on the mainstem cannot be measured in terms of depth or velocity. The relative influence of the proposed action on total flows, water quality, and related parameters diminishes further as the Rogue River and Klamath River approach the Pacific Ocean. Therefore, since no effects from the proposed action will be transferred to these reaches in measurable amounts, the lower Klamath River and mainstem Rogue River will not be discussed further.

## 2.2 Rangewide Status of the Species and Critical Habitat

The summaries that follow describe the status of the ESA-listed species, and their designated critical habitats, that occur within the geographic area of this proposed action and are considered in this opinion. More detailed information on the status and trends of these listed resources, and their biology and ecology, can be found in the listing regulations and critical habitat designations published in the Federal Register previously noted, as well as the public draft of the SONCC coho salmon recovery plan (NMFS 2012).

### 2.2.1 Status of the Species

Major activities identified as responsible for the decline of SONCC coho salmon in Oregon and California include logging, road building, grazing, mining, urbanization, stream channelization, dams, wetland loss, beaver trapping, artificial propagation, over-fishing, water withdrawals, and unscreened diversions for irrigation (62 FR 24588). Enlarged populations of terns, seals, sea lions, and other aquatic predators in the Pacific Northwest have been identified as factors that may be limiting the productivity of some Pacific salmon and steelhead populations (Bottom *et al.* 2005, Fresh *et al.* 2005).

**SONCC Coho Salmon.** This species includes all naturally-spawned populations of coho salmon in coastal streams between Cape Blanco, Oregon, and Punta Gorda, California, and progeny of three artificial propagation programs. The SONCC Technical Recovery Team (TRT) identified 50 populations[2] that were historically present based on consideration of historical distribution, geographic isolation, dispersal rates, genetic data, life history information, population dynamics, and environmental and ecological diversity (Williams *et al.* 2006). In some cases, the SONCC-TRT also identified groups of populations referred to as “diversity strata” largely based on the geographical arrangement of the populations and basin-scale environmental and ecological characteristics. Of those 50 populations, two diversity strata and four populations will be focused on in this analysis (Table 6) because they are the only ones with potential to be adversely affected.

**Table 6.** SONCC coho salmon diversity strata and populations potentially adversely affected within the action area.

| Diversity Stratum | Population | Historical Classification |
|---|---|---|
| Rogue River Basin – Interior sub-basins | Upper Rogue River | Functionally Independent |
| Klamath River Basin – Interior sub-basins | Scott River | Functionally Independent |
| Klamath River Basin – Interior sub-basins | Shasta River | Functionally Independent |
| Klamath River Basin – Interior sub-basins | Upper Klamath River | Functionally Independent |

[2] "An independent population is a group of fish of the same species that spawns in a particular lake or stream (or portion thereof) at a particular season and which, to a substantial degree, does not interbreed with fish from any other group spawning in a different place or in the same place at a different season." NOAA Technical Memo NMFS-NWFSC-42,"Viable Salmonid Populations and the Recovery of Evolutionarily Significant Units" (June 2000).

The 2012 BA summarizes several viability assessments completed since the listing of SONCC coho salmon. This summary includes assessments by the 2005 biological review team (Good *et al.* 2005), Oregon Department of Fish and Wildlife (2005), NMFS' TRT (Williams *et al*. 2008) and GeoEngineers (2008a). On August 15, 2011, NMFS announced the results of a 5-year review for SONCC coho salmon (76 FR 50447). After reviewing new information on the viability of this species, ESA section 4 listing factors, and efforts being made to protect the species, NMFS concluded this species should retain its threatened listing classification. NMFS Southwest Region released a public draft of the SONCC coho salmon recovery plan on January 5, 2012 (NMFS 2012). Public comments will close on May 5, 2012. Finalization of recovery goals, recovery actions, and the plan in general is not expected until early 2013. However, the underlying data and information the draft plan relies on is unlikely to change and all the methods used to derive conclusions are commonly accepted. Therefore, the draft recovery plan constitutes the best available scientific and commercial data. This opinion uses information from the public comment draft recovery plan for the status of the species and limiting factors analysis.

The draft recovery plan identified ESU viability criteria intended to ensure representation of the diversity throughout the ESU, buffer the ESU against potential catastrophic risks, and provide sufficient connectivity among populations to maintain long-term demographic and genetic processes. In order for the SONCC coho salmon ESU to be viable, every diversity stratum needs at least 50%of its independent populations to be viable, and the abundance of these viable independent populations collectively must be at least 50 percent of the total abundance modeled for all of the independent populations in that stratum (NMFS 2012). The independent populations chosen to meet the population viability criteria are called "core." All four of the populations in this analysis are designated as core in the recovery plan and therefore play a significant role in their diversity stratum and the recovery of the ESU.

Because the extinction risk of an ESU depends upon the extinction risk of its constituent independent populations (Williams et al. 2008) and the population abundance of most independent populations are below their high risk threshold, the SONCC coho salmon ESU is at high risk of extinction and is not viable (NMFS 2012). SONCC coho salmon have declined substantially from historic levels. Several populations in California are extirpated (Bear River, Middle Fork Eel River) or are nearly so. The recovery plan found 25 of the 30 independent and potentially independent populations had a high extinction risk with the remaining at a moderate risk. Productivity appears to be negative for most, if not all SONCC coho salmon populations. Negative productivity means the year classes of individuals are not replacing themselves.

Factors limiting the ESU-wide recovery of SONCC coho salmon (identified as stresses in the recovery plan) include adverse hatchery-related effects, impaired water quality, degraded riparian forest conditions, increased disease/predation/competition, altered sediment supply, lack of floodplain and channel structure, altered hydrologic function, barriers, adverse fishery-related effects, and impaired estuary/mainstem function (NMFS 2012). The recovery plan clarified which of these factors were most limiting for each population. The limiting factors for each affected population are detailed below.

#### 2.2.1.1 Introduction to Population Analysis

The TRT developed a framework for assessing viability of SONCC coho salmon (Williams *et al.* 2008). This framework is intended to provide the viability assessment for determining viable salmonid populations (VSP). The primary purpose of the document is to produce biologically based viability criteria to guide the establishment of recovery goals. The TRT identified viability criteria for each population (Williams *et al*. 2008). Recovery strategies to achieve viable SONCC coho salmon must address multiple levels of biological organization, that is, they must address populations, diversity strata, and the species as a whole (Williams *et al.* 2008). Sufficient quantitative data was not available to complete a risk assessment for the entire SONCC coho salmon species; however the TRT was able to determine the current viability of the URR population. The effect of the action on the viability of those populations is useful in evaluating any change in risk to the ESU's survival and recovery. The TRT's framework will continue to guide and inform development of current viability and recovery objectives for all populations. This framework was also established to guide and inform future monitoring efforts to highlight data gaps and monitoring needs.

The SONCC viability framework developed by the TRT incorporates concepts from several different viability methodologies (Williams *et al.* 2008). The basic concept of viability usually addresses four parameters; abundance, productivity, diversity, and spatial structure. The TRT framework uses five criteria as surrogates for these parameters: (1) Effective population size/total population size, (2) population decline, (3) catastrophic population decline, (4) spawner density, and (5) hatchery influence (Table 7). Data on the last four generations of coho salmon informs this assessment and several of the criteria. The TRT established extinction thresholds for high, moderate and low risk with the ultimate goal of achieving low risk for each category (Table 7). Within each criterion, several approaches may be used, for instance, the population decline criterion is assessed applying a linear regression to spawner abundance of the last four generations along with a plot of the running average of the last four generations. The overall extinction risk of a population is equal to the highest risk category of any individual criterion (Williams *et al.* 2008).

**Table 7.** Viability assessment criteria for the SONCC coho salmon population as described by the Technical Recovery Team (1996-2007) (Williams *et al.* 2008) with low risk threshold criteria.

| Criterion | High Risk Threshold | Moderate Risk Threshold | Low Risk Threshold |
|---|---|---|---|
| Effective Population Size/Total Population Size | Generation size less than 250 | Generation size between 250 and 2,500 | Generation size > 2,500 |
| Population Decline | Precipitous decline | Chronic decline or depression | No decline apparent or probable |
| Catastrophic Population Decline | Order of magnitude decline within one generation | Smaller but significant decline | Not apparent |
| Spawner Density | Less than 1 spawner per IPkm[1] | Between 1 and 20 spawners per IPkm[1] | $\geq$ 20 spawners per IPkm[1] |
| Hatchery Influence | Hatchery fraction > 5% | | Hatchery fraction < 5% |

[1]IPkm is the intrinsic potential of a stream and is a modeled index of a potential habitat suitability based on the underlying geomorphology and hydrology of the watershed for rearing juvenile SONCC coho salmon. The output of this model is in terms of IP per kilometer and written as IPkm.

### 2.2.1.2 Rogue River Basin – Interior Diversity Group

**Upper Rogue River Population**

Bear Creek and Little Butte Creek are within the URR SONCC coho salmon population (Williams *et al.* 2006). The Bear Creek and Little Butte Creek watersheds contain the majority of the tributary habitat in the URR. A few additional watersheds that contain significant URR coho salmon habitat include Elk Creek, Big Butte Creek, and Evans Creek. The NMFS considers the SONCC coho salmon inhabiting these larger watersheds to be sub-populations to the URR population. The TRT identified the URR population as functionally-independent. The URR population is one of three independent populations comprising the genetic diversity substrata of the Interior Rogue basin. As functionally independent, the URR population's role in SONCC coho salmon recovery is to meet spawner abundance targets and provide recruits to nearby populations.

Peak coho salmon smolt outmigration occurs in late April (ODFW 2004). Adult coho salmon begin entering at the mouth of the Rogue River in late September to mid-October (Weitkamp *et al.* 1995). The majority of coho salmon adults migrate past the former Gold Ray Dam location between mid-October and mid-November. Nearly 90% of the adults have passed the Gold Ray Dam site before December each year.

The TRT used available data information to describe the URR population's viability (Williams *et al*. 2008). The TRT concluded the URR population was at "moderate risk of extinction" based on the risk associated with spawner density and the influence of hatcheries (Table 8). The TRT's 2008 viability assessment is based on Gold Ray Dam counting data through 2007. To assess the current viability of the URR population to the present, NMFS extended the viability assessment using the TRT framework and analysis to include Gold Ray Dam counting data from 2008 and 2009 that was not available to the TRT (Table 8). The Gold Ray Dam data set was terminated in

2009 as a result of the 2010 removal of Gold Ray Dam. The fish counts at Gold Ray Dam (2 miles downstream of the Bear Creek confluence) provide the best quantitative information available for URR SONCC coho salmon abundance. These counts do not include URR coho salmon returning to Evans Creek or Rogue River tributaries between Evans Creek and the former Gold Ray Dam site.

**Table 8.** Viability assessment of the Upper Rogue River SONCC coho salmon population as described by the Technical Recovery Team (1996-2007) (Williams *et al.* 2008) and NMFS viability assessment using the most recent data representing the last four generations (1998-2009).

| **Criterion** | **Extinction Risk Determination (TRT-2008)** | **NMFS Extinction Risk Determination (2012)** |
| --- | --- | --- |
| Effective Population Size/Total Population Size | Low Risk | Low Risk |
| Population Decline | Low Risk | Moderate Risk |
| Catastrophic Population Decline | Low Risk | Low Risk |
| Spawner Density | Moderate Risk | Moderate Risk |
| Hatchery Influence | Moderate Risk | Moderate Risk |

To identify extinction risk in 2012 (Table 8), NMFS supplemented the TRT determination with more recent data. SONCC coho salmon abundance has continued to decline since the TRT's determination in 2008 (Table 9). The TRT's 2008 viability assessment for the URR population identified the effective population size/total population size to be at low risk. Even with continued declines in 2008 and 2009, the last four generations are still above the criterion's low risk 2,500 threshold. Thus, the URRR population is at a low risk of extinction from the effective population size criterion.

**Table 9.** Counts of total (jacks, wild and hatchery adult) SONCC coho salmon at Gold Ray Dam, 1993-2009, (was located two miles downstream of the Bear Creek confluence).

| Year (counts from 9/15-1/31) | SONCC coho salmon at Gold Ray Dam |
|---|---|
| 1993-94 | 3,486 |
| 1994-95 | 10,699 |
| 1995-96 | 13,518 |
| 1996-97 | 13,599 |
| 1997-98 | 15,750 |
| 1998-99 | 6,044 |
| 1999-2000 | 7,722 |
| 2000-2001 | 28,791 |
| 2001-2002 | 32,962 |
| 2002-2003 | 34,154 |
| 2003-2004 | 17,179 |
| 2004-2005 | 21,702 |
| 2005-2006 | 14,632 |
| 2006-2007 | 11,368 |
| 2007-2008 | 8,735 |
| 2008-2009 | 2,442 |
| 2009-2010 | 2,958 |

The TRT found low risk in the population decline criterion. However, the addition of data from 2008 and 2009 changes NMFS current determination. The population trend has been negative each year of the last two generations (6 years). The population trend for the last 12-year period (four generations) has been downward based on the 3-year running average, but the population is still above 500 (Figure 4). Another linear trend line places the population on a decreasing trend (Figure 5) where the slope of the regression line is approximately negative 0.04 (-4%). A mean declining rate of greater than 10% is indicates a high extinction risk (Williams *et al.* 2008). The declining trend indicates this population is at moderate risk for extinction.

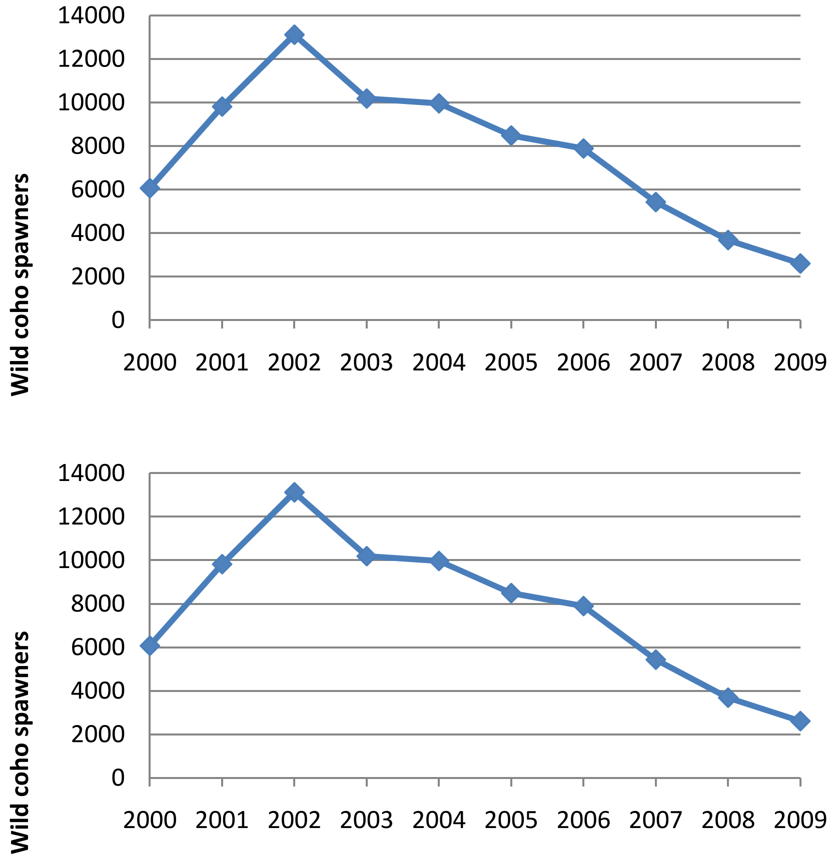
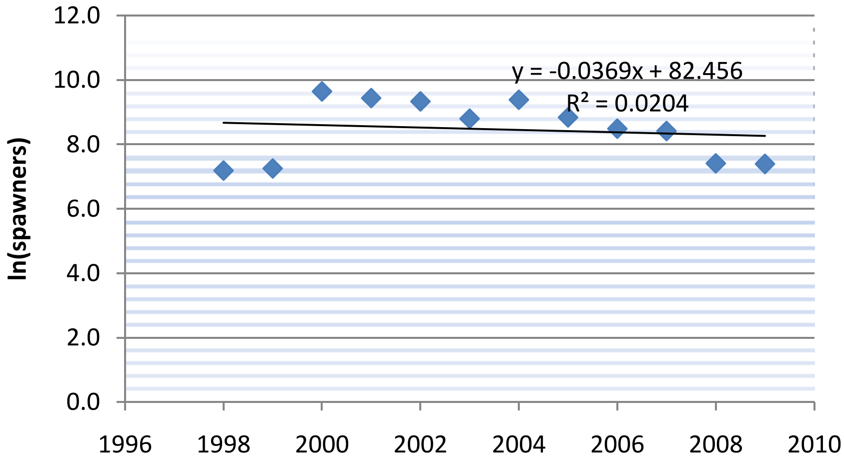



**Figure 4.** Three-year running average abundance of the Upper Rogue River SONCC coho salmon population based on available data for the last four generations (1998 to 2009).



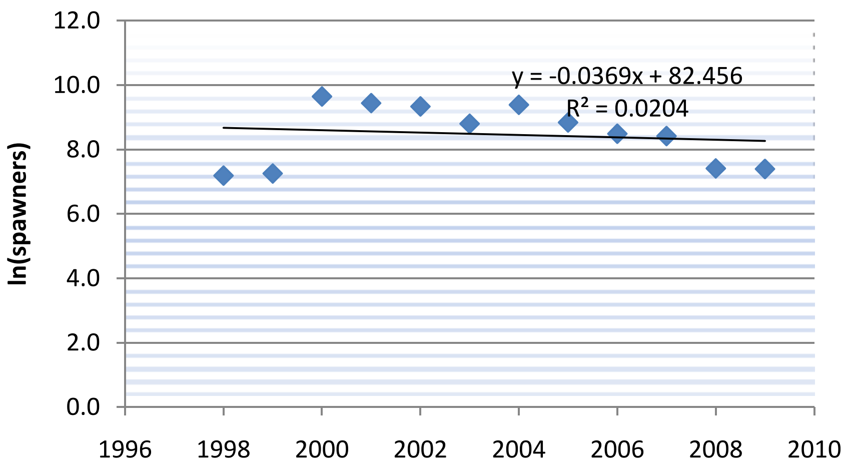



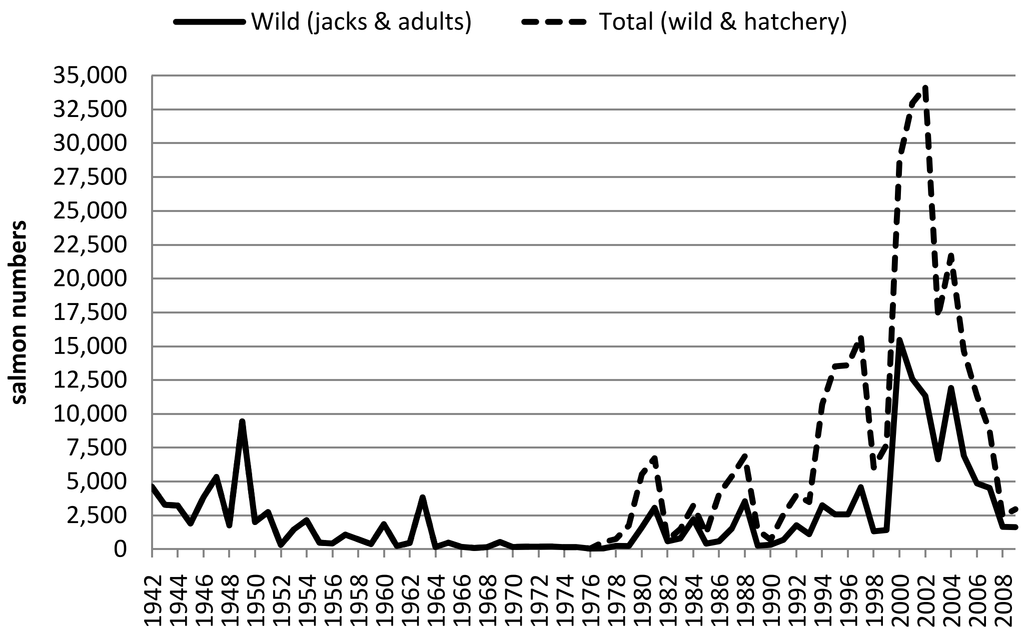

**Figure 5.** Trend in Upper Rogue River spawner abundance (ln transformed annual abundance) over the past four generations (1998 – 2009) including regression line fitted to data indicating a decreasing trend.

The TRT determined that the population was a moderate risk based on spawner density (spawners/linear distance). The TRT determined that this population had 9.8 spawners/IPkm[3] (mean from 1996 -2007 data - 7,011 spawners). The continued downward trend in population abundance has resulted in 9.3 spawners/IP km (using a mean abundance of 6,688) through 2009, which is still in the moderate risk category. The TRT determined the influence of hatchery fish spawning in the wild also placed this population at moderate risk. Hatchery influence has not changed, thus this criterion is still in the moderate risk category.

When reviewing dam count data, analyses must consider stressors impacting URR SONCC coho salmon prior to the earliest data. Anthropogenic stressors impacted the population for decades

[3] IPkm is the intrinsic potential of a stream and is a modeled index of a potential habitat suitability based on the underlying geomorphology and hydrology of the watershed for rearing juvenile SONCC coho salmon. The output of this model is in terms of IP per kilometer and written as IPkm.

prior to the earliest data collection (Gold Ray Dam counts began in 1942) (Figure 6). By the 1940s, commercial fisheries, dam construction, water conveyance structures, mining, and stream habitat alterations collectively impacted the population. Although the current status of the URR SONCC coho salmon population is improved relative to its lowest abundance in the 1960s and 1970s, the declining trend over the last four generations warrants alarm (Figures 4, 5, and 6).



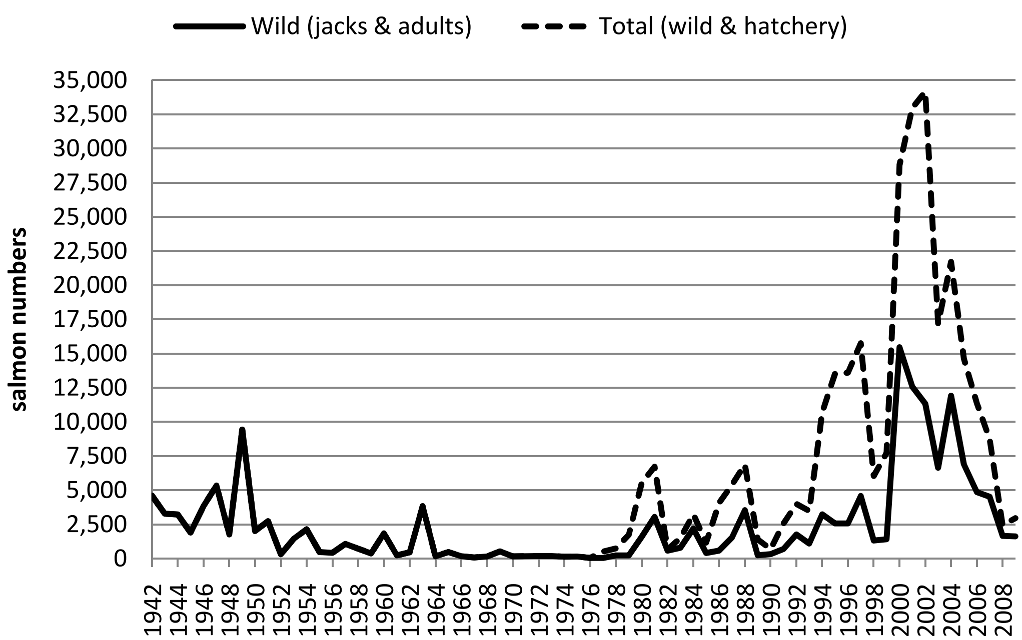




**Figure 6.** Upper Rogue River SONCC coho salmon population abundance based on the Gold Ray Dam counts from 1942 to 2009. Wild (jacks and adults) and hatchery fish are represented in the data.

The population's risk status is not only informed by the VSP criteria but also by a limiting factors assessment. Limiting factors for coho salmon in the Rogue River basin have been identified three times. In 2006, the Rogue Basin Coordinating Council performed a limiting factors assessment for all watersheds in the Rogue River Basin (Bredikin *et al.* 2006). In 2008, ODFW convened a panel of fisheries and watershed science experts as an initial step in the State of Oregon's development of a recovery plan (ODFW 2008). NMFS' 2012 public draft SONCC coho salmon used these two sources of information, along with other data, to determine which factors were the principal stresses. Because the recovery plan incorporated the previous assessments and several other sources, this opinion will use its results.

For the URR population, the public draft recovery plan found the juvenile life stage the most limited and specifically mentioned winter rearing habitat. Altered hydrologic function, degraded riparian forest conditions, impaired water quality, lack of floodplain, channel structure and barriers are the key limiting factors. Degraded riparian forest conditions are closely linked with the lack of floodplain and channel structure. The value of these factors are reduced due to stream channelization and manipulation, wetland fill, and riparian vegetation removal, all of which are attributed to agricultural practices, urbanization, forest management, and transportation infrastructure. Hydrologic functions have been altered by the many storage and irrigation projects in the basin. Many of the dams associated with these projects are fish passage issues. The most pervasive water quality concern is summer stream temperature, which has been impaired by poor riparian conditions (reduced shade), irrigation withdrawal (reduced flow volume), and poor channel structure (reduced pool depths). The actions resulting in these conditions, if they continue into the foreseeable future; and, when added to other anthropogenic activities and ecological factors that may continue over the coming decades, could increase the threats this species faces.

#### 2.2.1.3 Klamath River Basin – Interior Diversity Group

The Klamath River mainstem between IGD and Seiad Valley is used by three populations, Upper Klamath River, Shasta River, and Scott River, which comprise the majority of the Interior Klamath Basin diversity group. All three populations were classified as functionally independent by the TRT (Williams *et al.* 2006). The Upper Klamath River population uses the mainstem for adult spawning and migration and juvenile rearing and migration. The Shasta River and Scott River populations use the mainstem mainly for migration, but some juvenile rearing may occur there as well.

**Upper Klamath River Population**

The Upper Klamath River population is functionally independent and occupies approximately 64 miles of the mainstem Klamath River and numerous tributaries between Portuguese Creek and the base of IGD. As functionally independent, the Upper Klamath River population's role in SONCC coho salmon recovery is to meet spawner abundance targets and provide recruits to nearby populations. The draft recovery plan designated this population as non-core. As a non-core population, sufficient spawner densities are needed to maintain connectivity and diversity within the stratum and continue to represent critical components of the evolutionary legacy of the

ESU. The Upper Klamath River also provides refugia and mainstem habitat function supporting migration and rearing habitat for Scott River and Shasta River juveniles, smolts, and adults.

The TRT did not have enough information in 2008 to support a quantitative viability assessment similar to the URR population. However, the draft recovery plan found the Upper Klamath River population has a high extinction risk. Data reported in the draft recovery plan for population size places the effective population size/total population size criterion in the moderate risk category. The recovery plan found the Upper Klamath River population has a negative population growth rate, which puts the risk for the two population decline criteria in the moderate to high risk categories. The recovery plan analyzed all current population abundance information and believed the annual spawner population is below 425 fish, which equates to less than 1 fish per IPkm. Thus, the spawner density criterion is in the high risk category. The risk due to hatchery influence is also high because, as the draft recovery plan found, strays from the Iron Gate Hatchery make up a substantial portion of the overall population abundance.

For the Upper Klamath River population, the draft recovery plan found that juvenile and smolt are the most limited life stages, which is due to the key limiting factors of barriers, impaired water quality, and altered hydrologic function. The most significant barrier within the watershed is Iron Gate Dam, which has blocked upstream access to approximately 58 miles of coho salmon habitat, including much of the high IP habitat, for several decades. Diversion dams, low flow conditions, and poorly functioning road/stream crossings also block passage in several mainstem tributaries. In late spring, water quality becomes impaired, especially in the mainstem Klamath River, where the combination of elevated water temperatures and high nutrient loads create stressful conditions and reduces survival of juvenile coho salmon. Water temperatures can exceed lethal thresholds above 77°F. The Klamath Irrigation Project (KIP) and PacifiCorp Hydroelectric Project have severely altered the natural timing and volume of flows in the mainstem Klamath River. This manipulation has led to altered life-history adaptations and degraded rearing and migratory conditions critical to juvenile coho salmon survival.

**Shasta River Population**

The Shasta River population is a functionally independent population in the Klamath River interior stratum occupying the Shasta River basin. Adult and smolt coho salmon from the Shasta River population use the mainstem Klamath River within the action area as a migration corridor. There may be some use of the mainstem Klamath River by juveniles from this population for rearing. As functionally independent, the Shasta River population's role in SONCC coho salmon recovery is to meet spawner abundance targets and be a source population for adjacent populations and provide connectivity and diversity within the stratum.

The TRT did not have enough information in 2008 to support a quantitative viability assessment similar to the URR population. However, the draft recovery plan found the Shasta River population has a high extinction risk. Between 2001 and 2008, an average of 167 adults returned to Shasta River (NMFS 2012) placing the effective population size/total population size criterion in the moderate risk category. The recovery plan found the Shasta River population has a negative population growth rate, which puts the risk for the two population decline criteria in the moderate to high risk categories. The annual spawner population is well below the below 531 fish needed to exceed 1 fish per IPkm. Thus, the spawner density criterion is in the high risk category. The risk due to hatchery influence is also high because, as the draft recovery plan found, strays from the Iron Gate Hatchery make up a greater than five percent of overall population abundance.

In the Shasta River population, the draft recovery plan found the juvenile life stage most limited. The key limiting factors are impaired water quality and lack of floodplain and channel structure. Impaired water quality is a very high stress for all coho salmon life stages. Stream temperatures caused by low stream flows and decreased riparian cover approach lethal levels during summer months (North Coast Regional Water Quality Control Board 2006). The disconnection of the floodplain from the mainstem Shasta River and the conversion of riparian corridors to agricultural pastures have altered in-stream channel morphology through accretion of sediment, increased winter flows, loss of pools, and reduction of large wood recruitment. These impacts collectively limit the development of complex stream habitat necessary to sustain spawning and rearing throughout much of the high IP areas of the Shasta River Valley.

**Scott River Population**

The Scott River population is a functionally independent population in the Klamath River interior stratum occupying the Scott River basin. Adult and smolt coho salmon from the Scott River population use the mainstem Klamath River within the action area as a migration corridor. There may be some use of the mainstem Klamath River by juveniles from this population for rearing. As a functionally independent population, the Scott River population’s role in SONCC coho salmon recovery is to meet spawner abundance targets and be a source population for adjacent populations and provide connectivity and diversity within the stratum.

As with other Klamath River populations, the TRT did not have enough information in 2008 to complete a quantitative viability assessment. The draft recovery plan found the Scott River population has a high extinction risk. Between 2007 and 2010, an average of 673 adults returned to Scott River (NMFS 2012) placing the effective population size/total population size criterion in the moderate risk category. However, one brood year lineage dominates these numbers. In 2007 and 2010, this brood year lineage supplied 1,622 and 927 adults. In 2008 and 2009, only 63 and 81 adults returned, respectively. The recovery plan found the Scott River population is chronically low but static which puts the risk for the two population decline criteria in the moderate risk categories. Two out of three years, the annual spawner population is less than 25% of the 441 fish needed to exceed 1 fish per IPkm. Thus placing the spawner density criterion is in the high risk category. The risk due to hatchery influence is low, with very few observations of hatchery fish on spawning grounds.

For the Scott River population, the draft recovery plan found the juvenile life stage most limited. The key limiting factors are altered hydrologic function and degraded riparian forest conditions. Water diversions and withdrawals occur throughout the Scott River basin, decreasing summer flows, increasing water temperature to lethal levels, and extending the duration of surface flow disconnection with the mainstem. Agriculture and historic mining have degraded most of the riparian forests in the Scott River Valley. These impacts limit the fitness and survival of juvenile coho salmon throughout the Scott River basin.

### 2.2.2 Status of the Critical Habitat

Climate change, as described in the above, is likely to adversely affect the quality and function of the physical and biological features of designated critical habitats in the Pacific Northwest. These effects are likely to include, but are not limited to, depletion of cold water habitat and other variations in quality and quantity of tributary spawning, rearing and migration habitats and estuarine areas. The quality of critical habitat considered in the opinion has generally declined during the era of European settlement the due to depletion of cold water habitat and other variations in quality and quantity of spawning, rearing and migration habitats associated with development of riverine and estuarine areas (NMFS 2012).

, Critical habitat for SONCC coho salmon includes all areas accessible to any life-stage up to long-standing, natural barriers and adjacent riparian zones (64 FR 24049). Habitat impairments recognized as factors leading to decline of the species were included in the original listing notice for SONCC coho salmon: (1) Channel morphology changes; (2) substrate changes; (3) loss of in-stream roughness; (4) loss of estuarine habitat; (5) loss of wetlands; (6) loss/degradation of riparian areas; (7) declines in water quality; (8) altered streamflows; (9) fish passage impediments; and (10) elimination of habitat (62 FR 24588). The critical habitat designation listed the need for special management considerations or protection may be needed. Included among the activities that may require special management considerations were irrigation water withdrawals and returns, along with, dam operation and maintenance (64 FR 24049).

The specific critical habitat analyzed in this opinion is the designated critical habitat for SONCC coho salmon within the Bear Creek watershed (HUC 1710030801), Little Butte Creek watershed (HUC 1710030708), and the Klamath River mainstem from IGD downstream to the Seiad Valley. The SONCC coho salmon life cycle can be separated into five essential habitat types: (1) Juvenile summer and winter rearing areas; (2) juvenile migration corridors; (3) areas for growth and development to adulthood; (4) adult migration corridors; and (5) spawning areas (Table 10). Within these areas, essential features of SONCC coho salmon critical habitat are included in Table 10. Critical habitat affected by the action provides the essential physical and biological features that provide for the conservation of several different SONCC coho salmon populations.

**Table 10.** Physical and biological features of critical habitats designated for SONCC coho salmon, and corresponding species life history events.

| Physical and Biological Features | | Species Life History Event |
|---|---|---|
| **Site** | **Site Attribute** | |
| Spawning and juvenile rearing areas | Cover/shelter<br>Food (juvenile rearing)<br>Riparian vegetation<br>Space<br>Spawning gravel<br>Water quality<br>Water quantity | Adult spawning<br>Embryo incubation<br>Alevin development<br>Fry emergence<br>Fry/parr growth and development<br>Fry/parr smoltification<br>Smolt growth and development |
| Juvenile migration corridors | Cover/shelter<br>Food<br>Riparian vegetation<br>Safe passage<br>Space<br>Substrate<br>Water quality<br>Water quantity<br>Water temperature<br>Water velocity | Fry/parr smoltification<br>Smolt growth and development<br>Smolt seaward migration |
| Areas for growth and development to adulthood | Ocean areas – not identified | Adult growth and development<br>Adult sexual maturation<br>Smolt/adult transition |
| Adult migration corridors | Cover/shelter<br>Riparian vegetation<br>Safe passage<br>Space<br>Substrate<br>Water quality<br>Water quantity<br>Water temperature<br>Water velocity | Adult sexual maturation<br>Adult “reverse smoltification”<br>Adult upstream migration |

Within the Rogue River basin, the designated critical habitat supports the conservation of the URR independent population and the potential subpopulations residing in the Bear Creek and Little Butte Creek watersheds. Previous reviews of relative habitat values and priorities provide information for a critical habitat analysis. The Southwest Oregon salmon restoration initiative, as part of the Coastal Salmon Recovery Initiative (CSRI) described “coho salmon core” areas and “high value” areas (RVCOG 1997). Core areas contain high quality habitat capable of sustaining coho salmon spawning and rearing year around. High value areas are stream sections that appear suitable for coho salmon spawning and rearing, whether or not fish are present. Within the Little Butte Creek watershed, the SF Little Butte Creek sub-watershed was identified as a coho salmon core area by ODFW. It is also a Key Watershed in the Northwest Forest Plan for Federal land management. SF Little Butte Creek comprises 58% of the coho salmon core stream miles identified in the URR population. This core area is also approximately 16% of the total core area identified in the Rogue River basin. This sub-watershed is identified as a priority for maintaining and protecting coho salmon populations (RVCOG 1997). Approximately 47% of the URR population’s high value coho salmon areas are located in the Bear Creek watershed. The Bear Creek high value habitat comprises approximately 26% of all the high value areas identified in the Rogue River basin. This information leads us to conclude that the critical habitat within the Rogue River basin has high conservation value.

Within the Klamath River, the effects of the action on designated critical habitat are limited to mainstem Klamath River. The essential features within the mainstem of the Klamath River provide for the conservation of three functionally independent SONCC coho salmon populations that use the mainstem river from IGD downstream to the Seiad Valley. Within the action area, the PCEs in the mainstem Klamath River include those that support juvenile and adult migration, as well as seasonal rearing habitat and spawning (NMFS 2010). The PCEs, such as, water quality and quantity, hydrologic flow patterns, available spawning substrate, fish passage, cover, and substrate composition that provide conservation of SONCC coho salmon have all been modified in the mainstem Klamath River (NMFS 2010). Because of its importance as a migration corridor, the critical habitat in the mainstem Klamath River has high conservation value.

### 2.3 Environmental Baseline

The “environmental baseline” includes the past and present impacts of all Federal, state, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of state or private actions which are contemporaneous with the consultation in process (50 CFR 402.02). The environmental baseline for the species affected by the proposed action includes the effects of activities that occur across the action area considered in this opinion. The status of the species described above is a consequence of those effects. In the following discussion, we provide an overview of the relevant actions that are considered part of the environmental baseline.

The Project’s existence and past operation have affected SONCC coho salmon and its habitat over the years leading up to this consultation. Altered flow patterns have impacted all life stages of coho salmon in the action area. These historical Project effects are part of the environmental baseline for this consultation.

It is also likely that climate change will play an increasingly important role in determining the abundance of ESA-listed salmonid species, and the conservation value of designated critical habitats, in the Pacific Northwest. During the last century, average regional air temperatures increased by 1.5°F, and increased up to 4°F in some areas (USGCRP 2009). Warming is likely to continue during the next century as average temperatures increase another 3 to 10°F (USGCRP 2009). Overall, about one-third of the current cold-water fish habitat in the Pacific Northwest is likely to exceed key water temperature thresholds by the end of this century (USGCRP 2009).

Precipitation trends during the next century are less certain than for temperature but more precipitation is likely to occur during October through March and less during summer months, and more of the winter precipitation is likely to fall as rain rather than snow (ISAB 2007, USGCRP 2009). Where snow occurs, a warmer climate will cause earlier runoff so stream flows in late spring, summer, and fall will be lower and water temperatures will be warmer (ISAB 2007, USGCRP 2009).

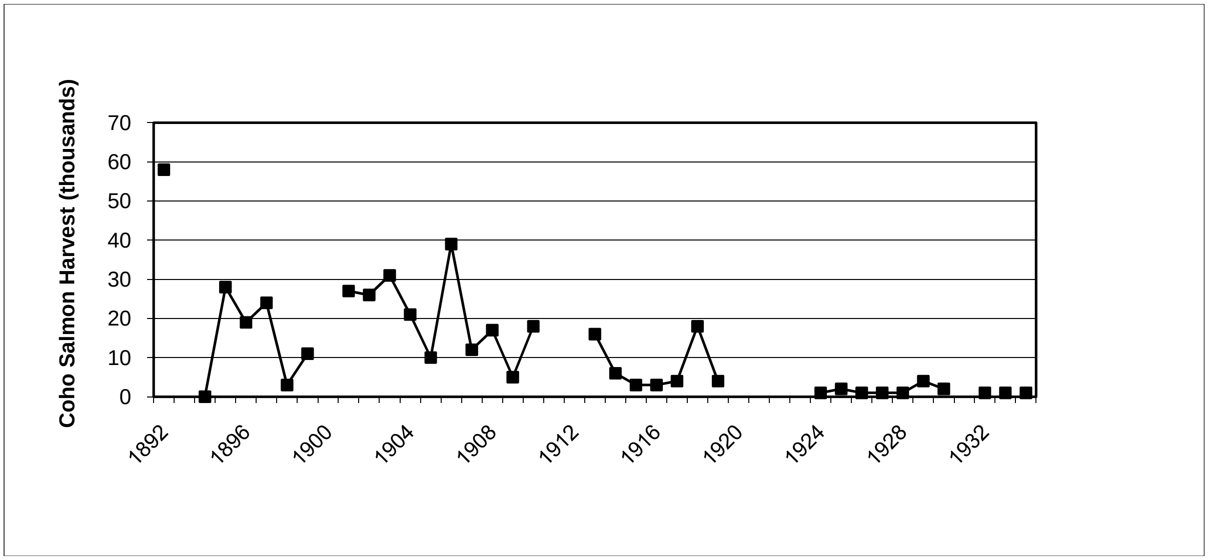
Higher winter stream flows increase the risk that winter floods in sensitive watersheds will damage spawning redds and wash away incubating eggs (USGCRP 2009). Earlier peak stream flows will also flush some young salmon and steelhead from rivers to estuaries before they are physically mature, increasing stress and the risk of predation (USGCRP 2009). Lower stream flows and warmer water temperatures during summer will degrade summer rearing conditions, in part by increasing the prevalence and virulence of fish diseases and parasites (USGCRP 2009). Other adverse effects are likely to include altered migration patterns, accelerated embryo development, premature emergence of fry, and increased competition and predation risk from warm-water, non-native species (ISAB 2007).

The earth's oceans are warming, with considerable inter-annual and inter-decadal variability superimposed on the longer-term trend (Bindoff *et al.* 2007). Historically, warm periods in the coastal Pacific Ocean have coincided with relatively low abundances of salmon and steelhead, while cooler ocean periods have coincided with relatively high abundances (Scheuerell and Williams 2005, Zabel *et al.* 2006, USGCRP 2009). Ocean conditions adverse to salmon and steelhead may be more likely under a warming climate (Zabel *et al.* 2006).

### 2.3.1 Species within the Action Area

#### 2.3.1.1 Upper Rogue River SONCC coho salmon

The history of the URR population of SONCC coho salmon and how they have reached this at-risk status is typical of many other SONCC coho salmon populations. SONCC coho salmon from the URR population were substantially impacted by many threats resulting from the development of the landscape for agricultural use, urbanization, and various resource extractive activities. Estimates of the coho salmon run in 1800s were over 100,000 for the Rogue River (Meengs and Lackey 2005). Two of the most intensive early threats included commercial fisheries harvest in the river and dam building. Construction of a cannery on the Rogue River was begun in 1876, when rumors of a large salmon run reached operators in the Columbia River (Meengs and Lackey 2005). SONCC coho salmon were commercially harvested from the Rogue River as early as the 1870s and significant harvest continued until the river fishing was closed after 1934 (Meengs and Lackey 2005, Mullen 1981). In 1892, the highest reported annual harvest, an estimated 58,000 coho salmon, were harvested and canned from the Rogue River (Figure 7). Although this harvest occurred in the lower estuary due to access and product quality, coho salmon from the action area were certainly harvested in that fishery. Intensive harvest spanned three decades, which NMFS concludes had a substantial effect on the coho salmon populations of the Rogue River, including the URR population. Commercial ocean and recreational harvest of SONCC coho salmon was finally reduced in 1993.



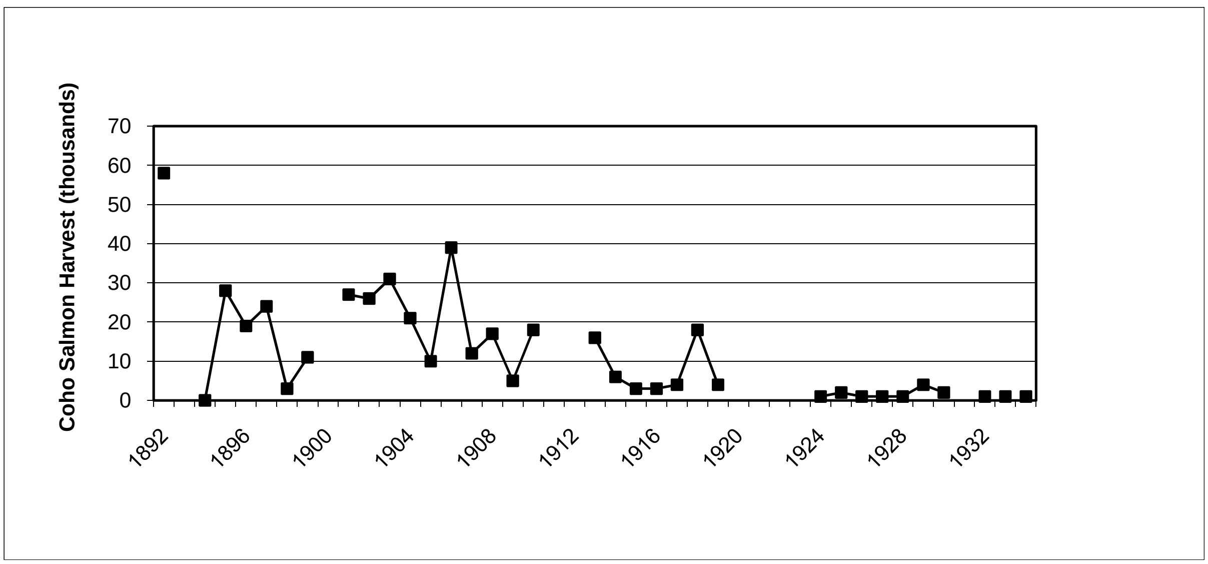




**Figure 7.** Annual commercial harvest of coho salmon in the Rogue River estimated from cannery data (data from Mullen 1981).

Construction of dams, such as Savage Rapids Dam, Gold Hill Dam, and Gold Ray Dam, all on the mainstem Rogue River, created additional challenges for the returning adult spawners and the outmigrating smolts (USFWS 1981). All URR coho salmon had to migrate past Savage Rapids Dam to reach the ocean and to return to their natal stream. Nearly all URR coho salmon also had to migrate past Gold Hill Dam and Gold Ray Dam. These specific dam sites had substantial impacts on URR coho salmon. Historically, direct mortality of adults, juveniles, and smolts occurred at these dams and others within watersheds in the action area. An estimated 22% of the URR SONCC coho salmon population was killed each year by Savage Rapids Dam (USFWS 1981). Unscreened diversions and poorly functioning fish ladders associated with dams had additional impacts on juvenile and adult life stages, reducing the number of coho salmon surviving to reproduce. The Lost Creek Dam, which began operation in 1977, eliminated access to suitable coho salmon habitat.

Over the years, the Districts have completed fish passage and screening projects to reduce impacts on coho salmon of the action area. However, fish passage problems continue. Only a few of these are directly related to Reclamation's proposed action, such as previous work at Oak Street Diversion and Ashland Creek Diversion. Savage Rapids and Gold Hill Dams were removed from the Rogue River in 2009 and 2008, respectively, improving migration in the mainstem and reducing the direct mortality of SONCC coho salmon in the action area. Gold Ray Dam was removed in the summer of 2010. Elk Creek Dam, located outside of the action area, but affecting individuals of this population, was removed in the summer of 2008. While this work did not remove any population bottlenecks, NMFS does anticipate increased smolt, juvenile, and adult survival resulting from safer passage past the dams. However, no information is yet available to estimate the change in survival across URR population life stages from dam removal, nor whether these changes will be measureable against changing ocean and climatic conditions.

Additional habitat alterations started in the 1800s, with the development of the upper Rogue River valley and continue with the development of water diversions, floodplain development, stream channelization, riparian forest removal, timber management, road building, increased pollutants from urbanization and subsequent stormwater runoff, introduction of non-native species such as predators and competitors, and floodplain gravel mining. The alteration of the low gradient stream-channel functions, such as lost side channels, reduced in-stream wood, and riparian trees shading the stream, all led to substantially reduced coho salmon spawning and rearing habitat. Increased sedimentation reduced the quality of the spawning substrate, as well as, altering forage species and their habitat. These low gradient streams with wide valleys were the easiest areas to develop and provided desirable soils and land form for agricultural development and building towns and cities. These stream channels that were once filled with wood for cover and multiple side channels were areas serving as winter refugia during the high water, winter flows common to the Western Cascades. All of these habitat altering actions served to reduce the productivity and survival of coho salmon by reducing availability of rearing and spawning habitat, reducing the function and quality of remaining habitat, and completely eliminating some habitat. Areas in the middle valley of the upper Rogue River that were once potential fringe habitat due to high summer air and possibly water temperatures became poorly suited habitat due to the loss of riparian vegetation shading the streams and the loss of associate wetlands due to filling and channelization.

Bear Creek. The URR SONCC population likely has six to eight sub-populations, one of which is the Bear Creek sub-population. Historical fisheries information for Bear Creek and its tributaries indicate a much different situation than is true currently. Early accounts of salmon populations described a market fishery collecting wagonloads of salmon to ship to California (RVCOG 2001). It is unclear what species were harvested; these were possibly Chinook salmon rather than coho salmon or, more likely, a combination of both. Whatever the species, there were large numbers of salmon in the system.

Historical data is limited for the Bear Creek coho salmon population. The 2012 BA characterized the Bear Creek watershed as having few coho salmon historically. This was supported by surveys conducted from 1949 through 1954 (USFWS circa 1955). In reviewing this old document and the survey data it is apparent considerable limitations exist with the surveys that should temper any conclusions regarding the use of any Rogue River tributaries by coho salmon, not just Bear Creek. The most obvious limitation in using these surveys for concluding the abundance and preference of Rogue River tributaries is the fact that these surveys had very low levels of effort for any individual stream. The surveys employed one to two observers for the entire middle and upper Rogue River basin resulting in most of these tributaries being visited once during the spawning season. Spawning surveys for coho salmon are difficult to conduct due to the water conditions that time of year. Water visibility is quite often limited, requiring repeat visits to sites in order to observe spawners and redds. In addition to this limited effort, conclusions for the importance of any tributary is confounded by the fact that the coho salmon runs were substantially depressed during most of the survey years. Coho salmon runs past Gold Ray Dam ranged from 320 to 9,440 adults during this survey period. A large run of coho salmon were present in 1949, which should have provided a good opportunity to observe coho salmon, but the Bear Creek watershed was only visited once in late December and in a location upstream of where coho salmon were likely to spawn. Alternatively, one substantially important piece of information contained in the report was the attempted quantification of available spawning gravels as surveyed by an earlier investigator. Of the upper Rogue River basin streams that were surveyed, Bear Creek was surpassed only by Little Butte Creek for available spawning gravels. This is an indication that Bear Creek contained substantial quantities of coho salmon spawning habitat and spawning habitat was not a limiting factor.

Another approach to assess historical population potential of a watershed is the use of the IP model. The IP model indicates Bear Creek could have supported a sizable sub-population of coho salmon (Figure 8) (Williams *et al.* 2006). Although the high IP score within Bear Creek does not necessarily predict abundance or productivity, it certainly is an indication that the stream channel characteristics under natural conditions likely supported high quality habitat that could provide for good survival, productivity, and abundance of juvenile SONCC coho salmon. Bear Creek contains approximately 23% of all of the IP stream reaches that exceed 0.66 (high IP) within the geographic area of the URR population. Some areas of the upper Rogue River Basin valley floor tributaries contained high IP values, but may have always had summer rearing habitat limitations due to high water temperatures (Williams *et al.* 2006). Even if these reaches were limited summer rearing habitat, these areas were high quality winter rearing habitat.

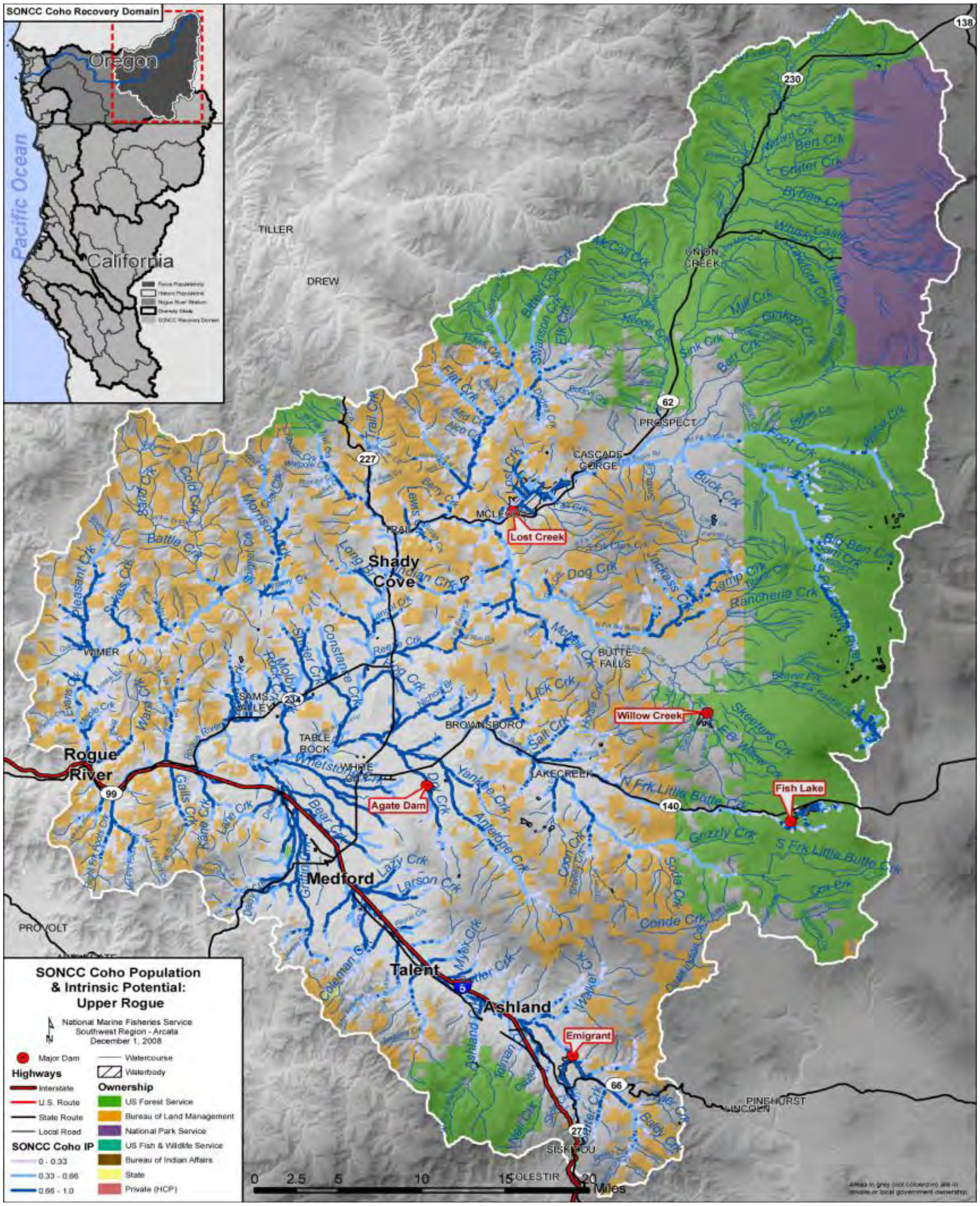



**Figure 8.** Intrinsic Potential (IP) for the Upper Rogue River population of SONCC coho salmon.[4]

[4] Email from Julie Weeder, NMFS, to Ken Phippen, NMFS (July 30, 2010) (providing draft recovery planning information for the Upper Rogue River population).

Absent specific historical population data, based on the IP model, NMFS concludes suitable habitat conditions were present in Bear Creek to support a viable population of coho salmon. Although there are differing views of whether historical low water flows were sufficient in some reaches of the Bear Creek mainstem to maintain coho salmon populations, NMFS' judgment is that historically Bear Creek maintained adequate wetland connections, hyporheic flows, deep pools, and abundant riparian vegetation to support coho salmon juveniles in some reaches of the mainstem and certainly many of the tributaries. Juvenile coho salmon can survive in isolated pools if these other habitat factors are present. Survival rate and productivity would be dependent on how many of these habitat factors are present and provide the necessary habitat requirements for low flow survival.

Wigington *et al.* (2006) identified intermittent streams in coastal Oregon as important contributors to the total availability of coho salmon habitat. Although this is not a direct transference of these research findings to this interior basin watershed, the point is clear that coho salmon life-history strategies include surviving in intermittent stream situations. Current examples of these low flow habitat conditions are common in Southwest Oregon and demonstrate coho salmon juveniles can survive similar conditions. Investigations in Bear Creek and in Klamath River identified the use of thermal refugia by juvenile coho salmon that allows them to survive in otherwise seemingly unsuitable summer habitat.

Presently, abundance of SONCC coho salmon is significantly depressed in the Bear Creek watershed. Smolt trapping surveys have demonstrated few coho salmon are surviving in the watershed. In six years, the ODFW smolt-trapping program captured 227 coho salmon smolts with half the years resulting in none captured (Table 11). ODFW discontinued the program after 2006.[5] Adult spawning counts have not occurred regularly in Bear Creek, but when they do, they have demonstrated low numbers of coho salmon spawning in the watershed.[6] The Bear Creek watershed assessment reported that production of coho salmon smolts is approximately 3.7 coho salmon smolts/mile of habitat in the Bear Creek mainstem (RVCOG 2001).

**Table 11.** Number of SONCC coho salmon smolts caught by ODFW during trapping operations on Bear Creek, 2001-2006.[6]

| Year | Bear Creek Mouth | Upper Bear Creek |
|---|---|---|
| **2001** | 0 | n/a |
| **2002** | 1 | n/a |
| **2003** | 14 | n/a |
| **2004** | 0 | n/a |
| **2005** | 0 | n/a |
| **2006** | 8 | 212 |

5 Email from Jay Doino, ODFW, to Chuck Wheeler, NMFS (July 28, 2009) (discussing smolt trapping in Bear Creek).

6 ODFW Random coho coastal spawning fish survey annual summaries.

Nickelson (2008) predicted smolt capacity for stream reaches in the Bear Creek watershed. The areas identified with the greatest potential capacity are those in the upstream portions of the watershed where suitable stream temperatures provide summer rearing survival. However, fish passage issues have been identified in the watershed and are known to have limited access some years. This included some mainstem Bear Creek diversions, such as Oak Street Diversion. The 2012 BA identified several surveys conducted by Reclamation that resulted in very few juvenile coho salmon collected in Bear Creek.

Limiting factors for the URR population were listed in Section 2.2 above. They included altered hydrologic function, degraded riparian forest conditions, impaired water quality, lack of floodplain and channel structure, and barriers. All of these population-level limiting factors apply to the Bear Creek portion of the action area. The discussion in Section 2.2 describing the poor status of these factors due to past and present impacts of human activities also applies to the environmental baseline. These limiting factors will be the focus of the effects analysis.

Little Butte Creek. The Little Butte Creek watershed is an important watershed for SONCC coho salmon in the upper Rogue River basin. This watershed is a designated coho salmon core area in the Southwest Oregon Salmon Restoration Initiative (RVCOG 1997). The Little Butte Creek watershed supports the greatest number of coho salmon smolts of the various watersheds sampled by ODFW within the Rogue River basin (Figure 9). When compared to the same watersheds sampled between 1998 and 2004, Little Butte Creek consistently produced a larger number of smolts (ODFW 2004). Although a limited number of watersheds are monitored, these are likely a good representation of the basin sub-populations. In terms of coho salmon smolts per mile, Little Butte Creek consistently produces the highest density (ODFW 2004).

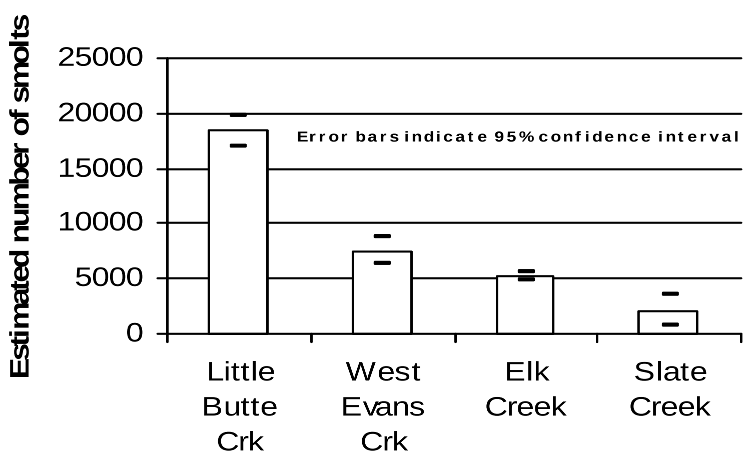



**Figure 9.** Smolt trapping results for the Rogue River basin for 2004 (ODFW 2004).

Nickelson (2008) predicted smolt capacity for the Little Butte Creek watershed. His results identified the North Fork of Little Butte Creek presently has the highest capacity for smolt production. This has yet to be verified with additional smolt trapping or other fish surveys. Based on this information, Little Butte Creek provides a substantial genetic pool for the URR population.

Limiting factors for the URR population were listed in Section 2.2. They included altered hydrologic function, degraded riparian forest conditions, impaired water quality, lack of floodplain and channel structure, and barriers. All of these population-level limiting factors apply to the Little Butte Creek portion of the action area. The discussion in Section 2.2 describing the poor status of these factors due to past and present impacts of human activities also applies to the environmental baseline. These limiting factors will be the focus of the effects analysis. These key concerns will be the focus of the effects analysis.

#### 2.3.1.2 Klamath River Basin

With the exception of urbanization, direct and indirect impacts to these Klamath River SONCC coho salmon populations have many similarities to those previously described for the URR population. Commercial fisheries, agricultural development that resulted in-stream diversions and dam building, alteration of flow regimes by development of small and large irrigation developments like the KIP, mining of gravel and gold, timber harvest, and related road developments have all had impacts.

Alterations to the natural hydrologic system began in the late 1800s, accelerating in the early 1900s, including water diversions by private water users, water diversions by the KIP, and by several hydroelectric dams operated by a private company, PacifiCorp (NMFS 2007). In 1905, Reclamation began developing the KIP near Klamath Falls, Oregon (NMFS 2010). The KIP and other facilities continued to be developed and resulted in blocking access to all upstream habitat above IGD.

As with the Rogue River coho salmon, commercial fishing had a substantial impact on the Klamath River basin populations of SONCC coho salmon (Snyder 1931). Population specific information is not available from the cannery information because, similar to the Rogue River, the commercial fishery caught fish in the estuary and impacted all populations of the Klamath River Basin. Historic records prior to 1910 were not reliable due to lack of species-specific information (CDFG 2002, Hamilton *et al.* 2005, Snyder 1931). In 1919, commercial gill netting harvested 11,162 coho salmon from the lower reaches of the Klamath River (Snyder 1931). Concerns were raised by Snyder that the logging, commercial fishery, and agricultural practices were impacting the abundance of coho salmon in the Klamath River basin. By the 1950s, long-term monitoring data had documented a substantial decrease in abundance of adult coho salmon from over-harvest and habitat loss (CDFG 2004, Weitkamp *et al.* 1995, Klamath River Basin Fisheries Task Force 1991). By 1983, annual escapement abundance of the Klamath River Basin coho salmon was estimated to be 6% of the abundance in the 1940s, which was already reduced from historical abundance levels from the habitat alterations and commercial fishing (Weitkamp *et al.* 1995, CDFG 2004, Leidy and Leidy 1984). In 1995, leading up to the listing of SONCC coho salmon as threatened under the ESA, NMFS concluded that the Klamath populations of coho salmon were diminished from historical abundances and were comprised mostly of hatchery fish (Weitkamp *et al.* 1995), suggesting that available habitat is not sustaining wild populations.

Hecht and Kamman (1996) analyzed the hydrologic records for similar water years (pre- and post-KIP) at several locations. The authors concluded that the timing of peak and base flows changed substantially after construction of the KIP, and that the operation increases flows in October and November and decreases flows in the late spring and summer as measured at Keno, Seiad, and Klamath. The Iron Gate, California, modeled dataset clearly shows a decrease in the magnitude of peak flows, a two-month shift in timing of flow minimums from September to July, as well as reduction in the amount of discharge in the summer months. Hecht and Kamman (1996) also noted that water diversions in areas outside the Project boundaries occur as well. For instance, agricultural diversions in both Shasta River and Scott River in some years, especially low water years, can virtually dewater sections of these rivers, impacting coho salmon within these streams, as well as those in the Klamath River. Furthermore, Reclamation's operation of the Rogue River Basin Project annually diverts an average of 24,000 acre-feet of water from the Klamath River basin (Jenny Creek) to the Rogue River basin (2012 BA). In general, by truncating the range of flows that led to diverse coho salmon life history strategies, changes in the annual hydrology had a pronounced negative effect on coho salmon populations.

Limiting factors for the three Klamath River populations were listed in Section 2.2. The limiting factors for the Upper Klamath River population included barriers, impaired water quality, and altered hydrologic function. All of these population-level limiting factors apply to the portion of the mainstem within the action area. Since the Shasta River and Scott River populations use the mainstem of the Klamath River below IGD, the Upper Klamath River limiting factors of impaired water quality and altered hydrologic function apply for them. The discussion in Section 2.2 describing the poor status of these factors due to past and present impacts of human activities also applies to the environmental baseline. These limiting factors will be the focus of the effects analysis. Because the action area does not extend into the Shasta River or Scott River, the limiting factors listed for those populations within those basins will not be the focus of the effects analysis.

### 2.3.2 Critical Habitat within the Action Area

#### 2.3.2.1 Rogue River Basin

Bear Creek Watershed. SONCC coho salmon use Bear Creek watershed for spawning, migration, and juvenile rearing. The physical and biological features that support these life stages are listed above in Table 10. Past and present impacts on the condition and function of the physical and biological features (described in the Species Section) have degraded the current condition of several SONCC coho salmon critical habitat in the Bear Creek watershed portion of the action area. Impacts from agriculture, forestry, grazing, irrigation impoundments and withdrawals, residential development, road building, and urbanization have degraded the following physical and biological features in Bear Creek watershed to the point they are limiting the conservation role of this critical habitat: (1) Floodplain connectivity; (2) riparian vegetation; (3) water quality; (4) water quantity; (5) water temperature; and (6) cover/shelter. These physical and biological features will be the focus of the critical habitat analysis.

Little Butte Creek Watershed. SONCC coho salmon use Little Butte Creek watershed for spawning, migration, and juvenile rearing. The physical and biological features that support these life stages are listed above in Table 10. Past and present impacts on the condition and function of the physical and biological features (described in the Species Section) have degraded the current condition of several SONCC coho salmon critical habitat physical and biological features in the Little Butte Creek watershed portion of the action area. Impacts from agriculture, forestry, grazing, irrigation impoundments and withdrawals, residential development, and road building have degraded the following physical and biological features in the Little Butte Creek watershed to the point they are limiting the conservation role of this critical habitat: (1) Floodplain connectivity; (2) riparian vegetation; (3) water quality; (4) water quantity; (5) water temperature; and (6) cover/shelter. These physical and biological features will be the focus of the critical habitat analysis.

#### 2.3.2.2 Klamath River Basin

Mainstem Klamath River. The specific critical habitat analyzed in this opinion is the designated critical habitat for SONCC coho salmon in the mainstem Klamath River from the base of IGD to the Seiad Valley (the four 5$^{th}$ field HUCs associated with the mainstem Klamath River as presented in Table 5). The SONCC coho salmon considered in this opinion use the mainstem Klamath River for spawning, rearing, and migration for adults and smolts. The physical and biological features that support these life stages and their biological needs were previously listed (Table 10) and will be the focus of the critical habitat analysis.

Past and present impacts have degraded the present condition of several SONCC coho salmon critical habitat physical and biological features in the Klamath River portion of the action area. Impacts from agriculture, forestry, grazing, irrigation impoundments and withdrawals, residential development, and road building have degraded the following physical and biological features in the Klamath River to the point they are limiting the conservation role of this critical habitat: (1) Floodplain connectivity; (2) riparian vegetation; (3) water quality; (4) water quantity; and (5) water temperature. These physical and biological features will be the focus of the critical habitat analysis.

### 2.4 Cumulative Effects

Cumulative effects are those effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation (50 CFR 402.02). Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

Human population in the action area is expected to continue to increase and result in ever increasing demand on the local environment, specifically additional water demand; increased impervious surfaces that affect stormwater quantity and water quality; increased vehicle traffic affecting roadway pollutants; and increased commercial and residential development in the foreseeable future increasing impervious surfaces and stormwater run-off. Increased commercial and residential developments often result in increased stream channelization in growth areas. Continued agricultural irrigation and residential growth will cause increasing demand for use of the non-Federal water rights. Conversion of some irrigated agricultural land-base to residential neighborhoods may somewhat mitigate this increased water demand, although additional population growth and residential development will also occur. Agricultural and forest practices on the remaining land-base are not expected to change and will carry current impacts into the future. Water quantity and quality are likely to decrease in the future due to these identified future actions and their resulting adverse environmental consequences.

Cumulative effects include the continuation of all non-Federal water diversion not related or dependent upon Project facilities. The effects from this non-Federal water are not measurable between October 15 and April 1. There are some municipal and winter storage water rights, but they are a small percent of stream flow this time of year.[7] During irrigation season (April 1 to October 15), the effects from this non-Federal water diversion increase through this period. Typically in April and May, irrigation water demand is low and availability of in-stream flow is high, thus the effect is small. Starting in June, the effects grow larger, but this time of year the Project increases stream flow due to storage releases.

This opinion will use the term "without Reclamation" to describe how much flow will be in streams after this future non-Federal water diversion. Stream flow under the without Reclamation scenario can be estimated as all natural inflow minus the cumulative non-Federal water diversion. The without Reclamation scenario is a useful tool for estimating the result of cumulative effects. This opinion's effects analysis (Section 2.5) adds the effects of the proposed action's water management activities on top of the without Reclamation scenario. To predict the amount of water in streams without Reclamation and with the proposed action, Reclamation created the 2011 Rogue Irrigation Project MODSIM model. MODSIM is a hydrologic network distribution model. It can predict streamflow under different water allocation scenarios. The 2011 MODSIM model was developed based on Reclamation's Hydromet station data from 2001 through 2010. The without Reclamation scenario in the Reclamation analysis "turns off" all diversions (Project and interrelated or interdependent non-Project diversions) through Project facilities and sets the outflow at Emigrant Dam equal to the inflow.

Reclamation estimated streamflows at the nine Hydromet stations in Bear Creek and Little Butte Creek on a daily basis using the MODSIM model. Reclamation grouped this daily data by month of the year and ranked it from smallest to largest. This allowed Reclamation to use an exceedence analysis to estimate flows under wet (20% exceedence), median (50% exceedence), and dry (80% exceedence) system states. The estimated monthly values for each Hydromet station are listed in Tables 12 through 14 by system state. It is important to note that these values represent flow over the month. The flow on any particular day may be higher or lower at any time within the month, particularly in the winter and spring months when precipitation events are highly variable.

[7] Oregon Water Resources Department, online water rights information query. Website: http://apps.wrd.state.or.us/apps/wr/wrinfo/default.aspx

**Table 12.** Wet condition monthly streamflow (20% exceedence) in cubic feet per second under the "without Reclamation" scenario at nine Hydromet stream gauges in the Bear Creek and Little Butte Creek drainages (data from 2012 BA).

| Month | Bear Creek Hydromet Station | | | | | | Little Butte Creek Hydromet Station | | |
|---|---|---|---|---|---|---|---|---|---|
| | EMI | BCAO | BASO | BCTO | MFDO | BCMO | GILO | LBCO | LBEO |
| October | 9 | 12 | 21 | 43 | 41 | 72 | 25 | 72 | 107 |
| November | 14 | 21 | 36 | 71 | 68 | 98 | 32 | 110 | 221 |
| December | 58 | 99 | 122 | 200 | 203 | 284 | 84 | 290 | 486 |
| January | 103 | 180 | 198 | 402 | 325 | 557 | 145 | 445 | 648 |
| February | 87 | 152 | 181 | 286 | 275 | 347 | 108 | 269 | 506 |
| March | 120 | 229 | 230 | 373 | 328 | 455 | 204 | 533 | 775 |
| April | 112 | 202 | 218 | 332 | 338 | 390 | 290 | 533 | 725 |
| May | 89 | 161 | 219 | 291 | 293 | 330 | 289 | 486 | 601 |
| June | 29 | 73 | 116 | 206 | 155 | 250 | 101 | 130 | 278 |
| July | 12 | 12 | 39 | 61 | 48 | 64 | 38 | 41 | 59 |
| August | 6 | 7 | 19 | 42 | 42 | 44 | 28 | 35 | 54 |
| September | 6 | 9 | 15 | 36 | 30 | 43 | 25 | 33 | 50 |

**Table 13.** Median condition monthly streamflow (50% exceedence) in cubic feet per second under the "without Reclamation" scenario at nine Hydromet stream gauges in the Bear Creek and Little Butte Creek drainages (data from 2012 BA).

| Month | Bear Creek Hydromet Station | | | | | | Little Butte Creek Hydromet Station | | |
|---|---|---|---|---|---|---|---|---|---|
| | EMI | BCAO | BASO | BCTO | MFDO | BCMO | GILO | LBCO | LBEO |
| October | 4 | 6 | 12 | 24 | 20 | 33 | 21 | 48 | 56 |
| November | 7 | 13 | 21 | 38 | 34 | 62 | 26 | 79 | 169 |
| December | 24 | 43 | 63 | 102 | 104 | 136 | 38 | 129 | 245 |
| January | 40 | 62 | 95 | 133 | 146 | 196 | 61 | 177 | 332 |
| February | 41 | 77 | 97 | 118 | 129 | 170 | 60 | 162 | 305 |
| March | 75 | 148 | 157 | 228 | 210 | 283 | 119 | 301 | 452 |
| April | 72 | 144 | 143 | 242 | 189 | 291 | 194 | 350 | 472 |
| May | 47 | 101 | 141 | 221 | 187 | 246 | 186 | 275 | 354 |
| June | 18 | 35 | 59 | 117 | 81 | 143 | 65 | 61 | 75 |
| July | 6 | 6 | 15 | 25 | 24 | 19 | 31 | 31 | 44 |
| August | 1 | 3 | 6 | 23 | 20 | 18 | 25 | 31 | 37 |
| September | 2 | 4 | 8 | 22 | 17 | 29 | 21 | 31 | 39 |

**Table 14.** Dry condition monthly streamflow (80% exceedence) in cubic feet per second under the "without Reclamation" scenario at nine Hydromet stream gauges in the Bear Creek and Little Butte Creek drainages (data from 2012 BA).

| Month | Bear Creek | | | | | | Little Butte Creek | | |
|---|---|---|---|---|---|---|---|---|---|
| | Hydromet Station | | | | | | Hydromet Station | | |
| | EMI | BCAO | BASO | BCTO | MFDO | BCMO | GILO | LBCO | LBEO |
| October | 1 | 3 | 4 | 7 | 4 | 11 | 17 | 35 | 39 |
| November | 3 | 6 | 13 | 21 | 23 | 45 | 20 | 65 | 138 |
| December | 8 | 12 | 25 | 37 | 43 | 58 | 22 | 75 | 160 |
| January | 23 | 42 | 57 | 78 | 84 | 117 | 35 | 103 | 226 |
| February | 22 | 37 | 51 | 66 | 69 | 102 | 41 | 117 | 209 |
| March | 34 | 76 | 69 | 120 | 95 | 164 | 68 | 142 | 289 |
| April | 47 | 84 | 102 | 142 | 135 | 199 | 126 | 186 | 314 |
| May | 23 | 54 | 76 | 130 | 102 | 167 | 120 | 132 | 132 |
| June | 7 | 14 | 31 | 53 | 40 | 53 | 44 | 35 | 46 |
| July | 0 | 3 | 6 | 13 | 9 | 9 | 25 | 27 | 34 |
| August | 0 | 0 | 2 | 11 | 1 | 7 | 18 | 27 | 30 |
| September | 0 | 0 | 3 | 13 | 6 | 17 | 17 | 26 | 31 |

## 2.5 Effects of the Action

Effects of the action refers the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action, that will be added to the environmental baseline (50 CFR 402.02). Indirect effects are those that are caused by the proposed action and are later in time, but still are reasonably certain to occur. Interrelated actions are those that are part of a larger action and depend on the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration.

To analyze the effects of the proposed action on the listed species and critical habitat, this opinion first assesses the extent and nature of effects on the environment generally in Section 2.5.1. Next, in Section 2.5.2, the opinion evaluates the significance of the environmental effects on the biological needs of the SONCC coho salmon. And, Section 2.5.3 extends those effects to the capacity of the critical habitat to support the listed salmon populations.

### 2.5.1 Effects on the Environment

To conduct its effects analysis, NMFS accounts for the principal life history characteristics of SONCC coho salmon. This includes attention to their geographic distribution and population structure as well as their habitat requirements for spawning, rearing and migration to and from the ocean. In particular, it is important to understand which attributes are required to move the species to the point at which protection under the ESA is no longer necessary, *i.e.* to recovery. It is equally important to understand the species' requirements for continued survival while maintaining an adequate potential for eventually achieving recovery. NMFS must evaluate the effects of the action on the potential for achieving recovery, recognizing that achieving recovery is likely beyond the time frame of the typical consultation under ESA Section 7(a)(2).

To make a well-informed judgment about whether the proposed action will result in jeopardy of the species and/or destruction or adverse modification of critical habitat, NMFS has considered the effects of continuing operations and maintenance into the future as far as available data will allow a meaningful evaluation. In this case, NMFS relied on a period equal to the record of hydrologic data since the Project was completed. This data set is appropriate because it informs Reclamation decisions and NMFS analysis. Hydrologic records from the Project began 50 years ago in 1962. Thus, NMFS is using a 50-year period, until 2062, as the period of time meaningful to make the jeopardy and critical modification determinations. Beyond that date, NMFS believes that the uncertainty is such that the available data has little relevance and projecting the effects of the action further becomes too speculative.

The principal components of effects from the proposed action include: (1) Water management; (2) large wood addition; (3) ramping rate procedures; (4) fish passage improvement; and (5) riparian zone restoration. Water management is the most complex portion of the action and includes the resulting effects from: (1) Diversion, (2) storage, (3) delivery, (4) infrastructure maintenance, and (5) minimum in-stream flow requirements.

#### 2.5.1.1 Water Management

**Rogue River Basin**

The proposed action will affect flows in Emigrant Creek and Bear Creek from Emigrant Dam to the mouth of Bear Creek at the Rogue River. It will affect flows in South Fork Little Butte Creek from the headwater collection facilities downstream to the mouth of Little Butte Creek where it enters the Rogue River.

The Reclamation 2011 MODSIM model predicted streamflows in Bear Creek and Little Butte Creek resulting from the water management elements of the proposed action, including the minimum in-stream flow requirements. The proposed action scenario predicts streamflow at each of the nine Hydromet stations given natural flows and all Project and non-Project storage releases and diversions. The prediction is the best information available on how much flow would be in the streams with Reclamation implementing the proposed action. It is important to note that these values are based on daily average flows compiled over each month. The actual flow may be higher or lower at any time within the month, particularly in the winter and spring months when precipitation events are highly variable.

As in the without Reclamation scenario, the Reclamation used an exceedence analysis to estimate flows under wet (20% exceedence), median (50% exceedence), and dry (80% exceedence) system states. The monthly values for each Hydromet station and system state are listed in Tables 15 through 23. Also listed in these tables are the without Reclamation scenario flow values from Section 2.4 and the difference between the two scenarios. This difference is the effect on the environment by implementing the water management elements of the proposed action including the minimum in-stream flow requirements.

**Table 15.** Predicted flows in Emigrant Creek (EMI Hydromet station) resulting from the proposed minimum in-stream flow requirements under the proposed action and without Reclamation scenarios. Source: 2012 BA (MODSIM model).

| | **Proposed Action Flows** | | | **Without Reclamation Flows** | | | **Effects[1]** | | |
|---|---|---|---|---|---|---|---|---|---|
| Month | Wet (cfs) | Median (cfs) | Dry (cfs) | Wet (cfs) | Median (cfs) | Dry (cfs) | Wet (cfs) | Median (cfs) | Dry (cfs) |
| October | 7 | 3 | 3 | 9 | 4 | 1 | -2 | -1 | 2 |
| November | 10 | 7 | 6 | 14 | 7 | 3 | -4 | 0 | 3 |
| December | 60 | 22 | 10 | 58 | 24 | 8 | 2 | -2 | 2 |
| January | 12 | 10 | 4 | 103 | 40 | 23 | -91 | -30 | -19 |
| February | 12 | 10 | 5 | 87 | 41 | 22 | -75 | -31 | -17 |
| March | 25 | 10 | 4 | 120 | 75 | 34 | -95 | -65 | -30 |
| April | 109 | 17 | 4 | 112 | 72 | 47 | -3 | -55 | -43 |
| May | 78 | 20 | 8 | 89 | 47 | 23 | -11 | -27 | -15 |
| June | 50 | 15 | 4 | 29 | 18 | 7 | 21 | -3 | -3 |
| July | 71 | 57 | 36 | 12 | 6 | 0 | 59 | 51 | 36 |
| August | 64 | 51 | 37 | 6 | 1 | 0 | 58 | 50 | 37 |
| September | 39 | 23 | 15 | 6 | 2 | 0 | 33 | 21 | 15 |

[1]Positive values denote streamflow increases due to the proposed action, negative values are decreases in flow.

**Table 16.** Predicted flows in Bear Creek between Emigrant Creek and the Oak Street Diversion Dam (BCAO Hydromet station) resulting from the proposed minimum in-stream flow requirements under the proposed action and without Reclamation scenarios. Source: 2012 BA (MODSIM model).

| | **Proposed Action Flows** | | | **Without Reclamation Flows** | | | **Effects[1]** | | |
|---|---|---|---|---|---|---|---|---|---|
| Month | Wet (cfs) | Median (cfs) | Dry (cfs) | Wet (cfs) | Median (cfs) | Dry (cfs) | Wet (cfs) | Median (cfs) | Dry (cfs) |
| October | 15 | 9 | 6 | 12 | 6 | 3 | 3 | 3 | 3 |
| November | 22 | 15 | 12 | 21 | 13 | 6 | 1 | 2 | 6 |
| December | 110 | 45 | 15 | 99 | 43 | 12 | 11 | 2 | 3 |
| January | 95 | 38 | 27 | 180 | 62 | 42 | -85 | -24 | -15 |
| February | 81 | 38 | 25 | 152 | 77 | 37 | -71 | -39 | -12 |
| March | 131 | 82 | 38 | 229 | 148 | 76 | -98 | -66 | -38 |
| April | 210 | 120 | 46 | 202 | 144 | 84 | 8 | -24 | -38 |
| May | 169 | 72 | 35 | 161 | 101 | 54 | 8 | -29 | -19 |
| June | 56 | 33 | 22 | 73 | 35 | 14 | -17 | -2 | 8 |
| July | 73 | 58 | 39 | 12 | 6 | 3 | 61 | 52 | 36 |
| August | 67 | 55 | 44 | 7 | 3 | 0 | 60 | 52 | 44 |
| September | 44 | 30 | 20 | 9 | 4 | 0 | 35 | 26 | 20 |

[1]Positive values denote streamflow increases due to the proposed action, negative values are decreases in flow.

**Table 17.** Predicted flows in Bear Creek between the Oak Street Diversion Dam and Valley View Road (BASO Hydromet station) resulting from the proposed minimum in-stream flow requirements under the proposed action and without Reclamation scenarios. Source: 2012 BA (MODSIM model).

| | **Proposed Action Flows** | | | **Without Reclamation Flows** | | | **Effects[1]** | | |
|---|---|---|---|---|---|---|---|---|---|
| Month | Wet (cfs) | Median (cfs) | Dry (cfs) | Wet (cfs) | Median (cfs) | Dry (cfs) | Wet (cfs) | Median (cfs) | Dry (cfs) |
| October | 20 | 15 | 9 | 21 | 12 | 4 | -1 | 3 | 5 |
| November | 35 | 25 | 19 | 36 | 21 | 13 | -1 | 4 | 6 |
| December | 125 | 63 | 27 | 122 | 63 | 25 | 3 | 0 | 2 |
| January | 113 | 66 | 44 | 198 | 95 | 57 | -85 | -29 | -13 |
| February | 103 | 63 | 37 | 181 | 97 | 51 | -78 | -34 | -14 |
| March | 141 | 94 | 46 | 230 | 157 | 69 | -89 | -63 | -23 |
| April | 192 | 97 | 48 | 218 | 143 | 102 | -26 | -46 | -54 |
| May | 190 | 89 | 42 | 219 | 141 | 76 | -29 | -52 | -34 |
| June | 81 | 43 | 29 | 116 | 59 | 31 | -35 | -16 | -2 |
| July | 53 | 43 | 32 | 39 | 15 | 6 | 14 | 28 | 26 |
| August | 44 | 35 | 23 | 19 | 6 | 2 | 25 | 29 | 21 |
| September | 25 | 17 | 10 | 15 | 8 | 3 | 10 | 9 | 7 |

[1]Positive values denote streamflow increases due to the proposed action, negative values are decreases in flow.

**Table 18.** Predicted flows in Bear Creek between the Valley View Road and Phoenix Diversion Dam (BCTO Hydromet station) resulting from the proposed minimum in-stream flow requirements under the proposed action and without Reclamation scenarios. Source: 2012 BA (MODSIM model).

| | **Proposed Action Flows** | | | **Without Reclamation Flows** | | | **Effects[1]** | | |
|---|---|---|---|---|---|---|---|---|---|
| Month | Wet (cfs) | Median (cfs) | Dry (cfs) | Wet (cfs) | Median (cfs) | Dry (cfs) | Wet (cfs) | Median (cfs) | Dry (cfs) |
| October | 48 | 36 | 29 | 43 | 24 | 7 | 5 | 12 | 22 |
| November | 81 | 51 | 40 | 71 | 38 | 21 | 10 | 13 | 19 |
| December | 206 | 110 | 41 | 200 | 102 | 37 | 6 | 8 | 4 |
| January | 374 | 109 | 64 | 402 | 133 | 78 | -28 | -24 | -14 |
| February | 228 | 89 | 52 | 286 | 118 | 66 | -58 | -29 | -14 |
| March | 279 | 163 | 79 | 373 | 228 | 120 | -94 | -65 | -41 |
| April | 325 | 208 | 86 | 332 | 242 | 142 | -7 | -34 | -56 |
| May | 270 | 165 | 77 | 291 | 221 | 130 | -21 | -56 | -53 |
| June | 161 | 68 | 28 | 206 | 117 | 53 | -45 | -49 | -25 |
| July | 37 | 30 | 21 | 61 | 25 | 13 | -24 | 5 | 8 |
| August | 34 | 31 | 26 | 42 | 23 | 11 | -8 | 8 | 15 |
| September | 33 | 25 | 22 | 36 | 22 | 13 | -3 | 3 | 9 |

[1]Positive values denote streamflow increases due to the proposed action, negative values are decreases in flow.

**Table 19.** Predicted flows in Bear Creek between the Phoenix Diversion Dam and Jackson Street Diversion Dam (MFDO Hydromet station) resulting from the proposed minimum in-stream flow requirements under the proposed action and without Reclamation scenarios. Source: 2012 BA (MODSIM model).

| | **Proposed Action Flows** | | | **Without Reclamation Flows** | | | **Effects[1]** | | |
|---|---|---|---|---|---|---|---|---|---|
| Month | Wet (cfs) | Median (cfs) | Dry (cfs) | Wet (cfs) | Median (cfs) | Dry (cfs) | Wet (cfs) | Median (cfs) | Dry (cfs) |
| October | 49 | 33 | 24 | 41 | 20 | 4 | 8 | 13 | 20 |
| November | 74 | 45 | 37 | 68 | 34 | 23 | 6 | 11 | 14 |
| December | 200 | 105 | 48 | 203 | 104 | 43 | -3 | 1 | 5 |
| January | 235 | 113 | 71 | 325 | 146 | 84 | -90 | -33 | -13 |
| February | 198 | 91 | 54 | 275 | 129 | 69 | -77 | -38 | -15 |
| March | 251 | 146 | 69 | 328 | 210 | 95 | -77 | -64 | -26 |
| April | 307 | 145 | 70 | 338 | 189 | 135 | -31 | -44 | -65 |
| May | 262 | 128 | 50 | 293 | 187 | 102 | -31 | -59 | -52 |
| June | 104 | 48 | 24 | 155 | 81 | 40 | -51 | -33 | -16 |
| July | 35 | 29 | 21 | 48 | 24 | 9 | -13 | 5 | 12 |
| August | 33 | 31 | 27 | 42 | 20 | 1 | -9 | 11 | 26 |
| September | 32 | 26 | 22 | 30 | 17 | 6 | 2 | 9 | 16 |

[1]Positive values denote streamflow increases due to the proposed action, negative values are decreases in flow.

**Table 20.** Predicted flows in Bear Creek between the Jackson Street Diversion Dam and Rogue River (BCMO Hydromet station) resulting from the proposed minimum in-stream flow requirements under the proposed action and without Reclamation scenarios. Source: 2012 BA (MODSIM model).

| | **Proposed Action Flows** | | | **Without Reclamation Flows** | | | **Effects**[1] | | |
|---|---|---|---|---|---|---|---|---|---|
| Month | Wet (cfs) | Median (cfs) | Dry (cfs) | Wet (cfs) | Median (cfs) | Dry (cfs) | Wet (cfs) | Median (cfs) | Dry (cfs) |
| October | 96 | 64 | 50 | 72 | 33 | 11 | 24 | 31 | 39 |
| November | 115 | 80 | 67 | 98 | 62 | 45 | 17 | 18 | 22 |
| December | 289 | 151 | 66 | 284 | 136 | 58 | 5 | 15 | 8 |
| January | 456 | 176 | 103 | 557 | 196 | 117 | -101 | -20 | -14 |
| February | 276 | 142 | 87 | 347 | 170 | 102 | -71 | -28 | -15 |
| March | 357 | 210 | 123 | 455 | 283 | 164 | -98 | -73 | -41 |
| April | 393 | 266 | 143 | 390 | 291 | 199 | 3 | -25 | -56 |
| May | 325 | 191 | 119 | 330 | 246 | 167 | -5 | -55 | -48 |
| June | 214 | 106 | 37 | 250 | 143 | 53 | -36 | -37 | -16 |
| July | 51 | 27 | 24 | 64 | 19 | 9 | -13 | 8 | 15 |
| August | 54 | 31 | 29 | 44 | 18 | 7 | 10 | 13 | 22 |
| September | 65 | 48 | 33 | 43 | 29 | 17 | 22 | 19 | 16 |

[1]Positive values denote streamflow increases due to the proposed action, negative values are decreases in flow.

**Table 21.** Predicted flows in South Fork Little Butte Creek between the fish passage barrier and the mouth at Little Butte Creek (GILO Hydromet station) resulting from the proposed minimum in-stream flow requirements under the proposed action and without Reclamation scenarios. Source: 2012 BA (MODSIM model).

| | **Proposed Action Flows** | | | **Without Reclamation Flows** | | | **Effects[1]** | | |
|---|---|---|---|---|---|---|---|---|---|
| Month | Wet (cfs) | Median (cfs) | Dry (cfs) | Wet (cfs) | Median (cfs) | Dry (cfs) | Wet (cfs) | Median (cfs) | Dry (cfs) |
| October | 24 | 18 | 15 | 25 | 21 | 17 | -1 | -3 | -2 |
| November | 26 | 19 | 15 | 32 | 26 | 20 | -6 | -7 | -5 |
| December | 67 | 31 | 20 | 84 | 38 | 22 | -17 | -7 | -2 |
| January | 82 | 44 | 26 | 145 | 61 | 35 | -63 | -17 | -9 |
| February | 62 | 41 | 30 | 108 | 60 | 41 | -46 | -19 | -11 |
| March | 144 | 83 | 55 | 204 | 119 | 68 | -60 | -36 | -13 |
| April | 201 | 145 | 90 | 290 | 194 | 126 | -89 | -49 | -36 |
| May | 228 | 137 | 66 | 289 | 186 | 120 | -61 | -49 | -54 |
| June | 62 | 40 | 29 | 101 | 65 | 44 | -39 | -25 | -15 |
| July | 34 | 28 | 23 | 38 | 31 | 25 | -4 | -3 | -2 |
| August | 27 | 23 | 17 | 28 | 25 | 18 | -1 | -2 | -1 |
| September | 23 | 20 | 16 | 25 | 21 | 17 | -2 | -1 | -1 |

[1]Positive values denote streamflow increases due to the proposed action, negative values are decreases in flow.

**Table 22.** Predicted flows in Little Butte Creek between South Fork Little Butte Creek and Antelope Creek (LBCO Hydromet station) resulting from the proposed minimum in-stream flow requirements under the proposed action and without Reclamation scenarios. Source: 2012 BA (MODSIM model).

| | **Proposed Action Flows** | | | **Without Reclamation Flows** | | | **Effects[1]** | | |
|---|---|---|---|---|---|---|---|---|---|
| Month | Wet (cfs) | Median (cfs) | Dry (cfs) | Wet (cfs) | Median (cfs) | Dry (cfs) | Wet (cfs) | Median (cfs) | Dry (cfs) |
| October | 70 | 48 | 33 | 72 | 48 | 35 | -2 | 0 | -2 |
| November | 100 | 73 | 59 | 110 | 79 | 65 | -10 | -6 | -6 |
| December | 271 | 122 | 75 | 290 | 129 | 75 | -19 | -7 | 0 |
| January | 403 | 164 | 92 | 445 | 177 | 103 | -42 | -13 | -11 |
| February | 237 | 136 | 100 | 269 | 162 | 117 | -32 | -26 | -17 |
| March | 486 | 255 | 117 | 533 | 301 | 142 | -47 | -46 | -25 |
| April | 485 | 295 | 158 | 533 | 350 | 186 | -48 | -55 | -28 |
| May | 448 | 229 | 90 | 486 | 275 | 132 | -38 | -46 | -42 |
| June | 96 | 37 | 29 | 130 | 61 | 35 | -34 | -24 | -6 |
| July | 34 | 29 | 26 | 41 | 31 | 27 | -7 | -2 | -1 |
| August | 33 | 30 | 27 | 35 | 31 | 27 | -2 | -1 | 0 |
| September | 32 | 30 | 26 | 33 | 31 | 26 | -1 | -1 | 0 |

[1]Positive values denote streamflow increases due to the proposed action, negative values are decreases in flow.

**Table 23.** Predicted flows in Little Butte Creek between Antelope Creek and the Rogue River (LBEO Hydromet station) resulting from the proposed minimum in-stream flow requirements under the proposed action and without Reclamation scenarios. Source: 2012 BA (MODSIM model).

| | **Proposed Action Flows** | | | **Without Reclamation Flows** | | | **Effects[1]** | | |
|---|---|---|---|---|---|---|---|---|---|
| Month | Wet (cfs) | Median (cfs) | Dry (cfs) | Wet (cfs) | Median (cfs) | Dry (cfs) | Wet (cfs) | Median (cfs) | Dry (cfs) |
| October | 104 | 54 | 37 | 107 | 56 | 39 | -3 | -2 | -2 |
| November | 214 | 162 | 133 | 221 | 169 | 138 | -7 | -7 | -5 |
| December | 464 | 231 | 155 | 486 | 245 | 160 | -22 | -14 | -5 |
| January | 618 | 319 | 214 | 648 | 332 | 226 | -30 | -13 | -12 |
| February | 484 | 278 | 199 | 506 | 305 | 209 | -22 | -27 | -10 |
| March | 720 | 408 | 274 | 775 | 452 | 289 | -55 | -44 | -15 |
| April | 682 | 400 | 257 | 725 | 472 | 314 | -43 | -72 | -57 |
| May | 583 | 279 | 100 | 601 | 354 | 132 | -18 | -75 | -32 |
| June | 252 | 54 | 38 | 278 | 75 | 46 | -26 | -21 | -8 |
| July | 55 | 40 | 32 | 59 | 44 | 34 | -4 | -4 | -2 |
| August | 53 | 36 | 29 | 54 | 37 | 30 | -1 | -1 | -1 |
| September | 49 | 39 | 31 | 50 | 39 | 31 | -1 | 0 | 0 |

[1]Positive values denote streamflow increases due to the proposed action, negative values are decreases in flow.

Based on the data from the 2012 BA, in general, the proposed action will increase the amount of water in Emigrant Creek and Bear Creek during the summer and fall months and decrease it during the winter and spring. Though, the effect sometimes varies by stream reach and system state (wet, median, dry). Because there are no storage facilities on Little Butte Creek, the effect in that drainage is always a decrease in flow. The effects in Little Butte Creek are largest in the winter and spring.

### Klamath River Basin

Effects in the Klamath River basin, below IGD, were assessed in Reclamation's 2003 BA and reiterated in the 2012 BA. This is the best available information for these proposed action effects. This analysis is prior to some recent changes in the KIP (NMFS 2010), but is the only available assessment of the effects of Jenny Creek water diversion. The 2012 BA states:

> The diversion of water from Jenny Creek will continue to slightly affect mainstem Klamath River flows below Iron Gate Dam. Approximately 24,000 acre-feet of water is diverted annually from the Jenny Creek drainage to Bear Creek in the Rogue River basin. As noted in Reclamation's 2003 BA, pre-Klamath Project estimated average annual flow at Iron Gate for a normal water year, which accounts for accretions in flow below Keno, was approximately 1.8 million acre-feet. Thus, Jenny Creek contributes approximately 1.3% of the total water balance

in the upper Klamath River basin. Average monthly percent changes in available flow at the outflow of Iron Gate Dam ranged from a low of 0 (July, August, and September) to a high of 4.7% in March. Further downstream, with the inflow of the Shasta and Scott rivers, these percentages diminish.

#### 2.5.1.2 Large Wood Additions

Because Reclamation has committed to an amount of habitat to provide, NMFS is confident we can assess the effects prior to having a final implementation design. The installation of large wood structures in Emigrant Creek, Bear Creek, Neil Creek, Ashland Creek, and SF Little Butte Creek will result in short-term construction-related impacts to rearing coho salmon. Reclamation's modeling estimated that up to 18 structures will be required in Emigrant Creek (2012 BA page 40). It is likely that a few more than that will be required in the other streams combined for a total of approximately 42. These structures will be spread out in time over several years and space over several $6^{th}$ field sub-watersheds.

**<u>Habitat Improvement</u>:** Placement of large woody debris is an established method to improve the quantity, quality, and productivity of coho salmon rearing habitat (Cederholm 1997). Some of the many benefits to stream channels include increased channel complexity, pool deepening, increased cover, increased velocity refugia, bed material sorting, increased bed and bank stability, increased invertebrates, and increased organic matter. The amount of habitat created per reach is listed in Table 3.

**<u>Suspended Sediment</u>:** Each installed structure will result in short-term pulses of suspended sediment. Suspended sediment plumes during installation will be visible, but are likely to be small in extent and low in concentration because little bed and bank material will be disturbed. Visible sediment plumes are likely to extend no further than 200 feet downstream. Plumes will last the duration of large wood installation, likely less than a day per structure. These extents, durations, and magnitudes are based on best professional judgment regarding the type and location of work proposed, anticipated flows, substrate (cobble, gravel, sands and some fines), and the intensity and magnitude of effects associated with in-channel work.

**<u>Chemical Contaminants</u>:** Operation of an excavator and other construction equipment near sensitive habitats, such as streams and wetlands, creates the potential for introduction of toxic materials (*i.e.*, fuel, lubricants) into the stream or into the adjacent riparian zone from improper storage of petrochemicals and mechanical failure, which can injure or kill aquatic organisms. Based on experience with construction activities, NMFS is reasonably certain the use of machinery will result in a small amount (a few ounces) of oil, hydraulic fluid, and other fluid being leaked during operations. Proposed conservation measures, such as, using a cofferdam to isolate passage improvement work areas from stream flow; locating the staging area approximately 150 feet away from the stream; refueling away from the stream; and inspecting and cleaning equipment will minimize the probability and extent of chemical contamination. Proposed emergency response procedures and implementation of spill containment plans will limit the magnitude and extent of any chemical contamination.

**Riparian Vegetation Removal:** Because the final and exact number and location of large wood structures will be determined through modeling, the amount of riparian vegetation disturbed is estimated for this analysis. Since riparian areas along these creeks are narrow (usually less than 50 feet), it is likely that approximately 0.5 acres of riparian vegetation will be disturbed (calculated as 42 structures multiplied by 50 feet in distance with a 10-foot wide corridor).

Riparian vegetation removal has the potential to affect stream temperatures, food resources, and stream complexity. Riparian removal increases exposure to solar radiation that can increase stream temperatures. Forage reduction is an environmental consequence of the vegetation removal, because leaves, twigs, and branches of vegetation provide nutrients and habitat for many different aquatic organisms. Forage is also reduced because riparian vegetation provides terrestrial insects. Removing riparian trees removes the possibility of them falling into the stream where they interact with streamflow to provide velocity variability.

These effects are not likely to be substantial as they affect a very small percentage of the riparian vegetation in the Bear Creek drainage. Furthermore, Reclamation will be replanting all disturbed vegetation, but there will be a recovery period until functions are completely replaced. Full recovery will vary from a year for grasses, to up to 5 years for shrubs and approximately 30 years for trees. Thus, large wood additions will reduce riparian vegetation function over approximately 0.5 acres. This effect will last for up to approximately 30 years, but will decrease over time.

#### 2.5.1.3 Ramping Rate Procedures

While the amount of flow in a stream defines the amount of usable habitat, rapid fluctuations in discharge affect the security of that habitat. Rapid dewatering of stream margins may occur when flows decline precipitously, potentially entrapping and stranding fish, particularly juvenile or young-of-year fish. Rapid increases in discharge can interrupt behaviors (e.g. feeding) and displace, or dislodge aquatic organisms. As the susceptibility of fish to rapid flow fluctuations varies by life stage, and because the proposed action provides differing constraints on flow fluctuations by operations season, this analysis considers the likely flow fluctuation effects of the proposed action on a monthly basis. The effect of flow fluctuations on fish populations varies with the severity and frequency of flow fluctuations. Hydrologic data shows that sizeable flow fluctuations occur daily during the irrigation season, particularly in the Bear Creek watershed as irrigators open or close diversions and releases from Emigrant Dam.

The rate of change in Project discharge is termed ramping rate, increasing flows are termed upramping, and decreasing flows are termed downramping. Ramping requirements place a limit on the rate that streamflow may be reduced in order to slow the dewatering rate. The proposed action includes limits on both upramping and downramping at times that Project operations would cause flow fluctuations. However, Reclamation only proposes ramping rate procedures in Emigrant Creek and Bear Creek, not in Dry Creek, Antelope Creek, or SF Little Butte Creek.

#### 2.5.1.4 Fish Passage Improvement

Because Reclamation has committed to meeting NMFS fish passage guidelines (NMFS 2008), NMFS is confident we can assess the effects prior to having final implementation designs. Construction activities associated with fish passage improvements at the Oak Street Diversion and Ashland Creek Diversion will affect the surrounding environment due to the construction activities.

**Fish Passage:** The proposed action will improve fish passage at the Ashland Creek diversion and Oak Street Diversion by providing fish passage facilities that conform to NMFS fish passage guidelines (NMFS 2008). The proposed action will also install an intake screen that meets NMFS screen criteria (NMFS 2008) at the Ashland Creek diversion.

**Work Area Isolation:** Reclamation will construct cofferdams to isolate Bear Creek from the construction areas allowing the rest of the construction to be completed in the dry. This would prevent contamination of the creek from concrete, silt, welding slag, sandblasting abrasive, and any other contaminants. Upon completion of construction tasks, Reclamation will remove the cofferdams. Reclamation did not indicate they will implement fish passage measures during construction, so NMFS assumes they are not. Reclamation has not refined these components of the proposed action to know the exact dimensions of the isolation areas. The best approximation is from similar projects on Bear Creek. The City of Central Point will isolate 3,400 square feet of channel to install a trenched water line across Bear Creek (refer to NMFS No.: 2011/05261). The NMFS is making a reasonable assumption that the two proposed actions will require isolation areas similar in size and character to the Central Point site.

**Suspended Sediment:** Each construction activity will result in short-term pulses of suspended sediment from installation and removal of cofferdams. Suspended sediment plumes during cofferdam installation will be visible, but are likely to be small in extent and low in concentration because little bed material will be disturbed. Visible sediment plumes from cofferdam installation are likely to extend no further than 100 feet downstream. Suspended sediment concentrations during cofferdam removal will be larger in extent and higher in concentration when flow is reintroduced over disturbed bed material. Visible sediment plumes from removal are likely to extend up to 200 feet downstream. The duration of visible suspended sediment plumes likely will be up to an hour during cofferdam installation and up to three hours during cofferdam removal. These extents, durations, and magnitudes are based on best professional judgment regarding the type and location of work proposed, anticipated flows, substrate (cobble, gravel, sands and some fines), and the intensity and magnitude of effects associated with in-channel work.

**Chemical Contaminants:** Operation of an excavator and other construction equipment near sensitive habitats, such as streams and wetlands, creates the potential for introduction of toxic materials (*i.e.*, fuel, lubricants) into the stream or into the adjacent riparian zone from improper storage of petrochemicals and mechanical failure, which can injure or kill aquatic organisms. Based on experience with construction activities, NMFS is reasonably certain the use of machinery will result in a small amount (a few ounces) of oil, hydraulic fluid, and other fluid being leaked during operations. Proposed conservation measures, such as, using a cofferdam to isolate the work area from stream flows; locating the staging area approximately 150 feet away from the stream; refueling away from the stream; and inspecting and cleaning equipment will minimize the probability and extent of chemical contamination. Proposed emergency response procedures and implementation of spill containment plans will limit the magnitude and extent of any chemical contamination.

**Riparian Vegetation Removal:** Reclamation proposed actions states the Oak Street diversion improvement will require less than one acre of riparian vegetation disturbance. More precisely, the NMFS used aerial photos to determine the proposed action cannot affect more than a half an acre of riparian vegetation. Riparian vegetation is significantly confined and previously impacted at this site. A parking lot on the south side precludes vegetation from 90 feet of stream from the Oak Street crossing to the downstream extent of the fish ladder. The diversion canal precludes all vegetation except invasive blackberry from 180 feet of streambank. Where there is riparian vegetation, it is a very narrow strip along the creek.

For the Ashland Creek Diversion, Reclamation did not estimate how much riparian vegetation will be removed. The proposed action description simply says, "access to this site is more difficult so some additional disturbance to riparian habitat may be needed." Riparian vegetation at the site is limited to a 100-foot strip by agricultural fields on both sides. It is reasonably likely that Reclamation will need to remove no more than 200 feet of this strip to complete this action. Therefore, NMFS assumes that no more than 0.45 acres of riparian vegetation will be affected at this site.

Riparian vegetation removal has the potential to affect stream temperatures, food resources, and stream complexity. Riparian removal increases exposure to solar radiation that can increase stream temperatures. Forage reduction is an environmental consequence of the vegetation removal, because leaves, twigs, and branches of vegetation provide nutrients and habitat for many different aquatic organisms. Forage is also reduced because riparian vegetation provides terrestrial insects. Removing riparian trees removes the possibility of them falling into the stream where they interact with streamflow to provide velocity variability.

These effects are not likely to be substantial as they affect a very small percentage of the riparian vegetation in the Bear Creek drainage. Furthermore, Reclamation will replant all disturbed ground at both sites, but there will be a recovery period until functions are completely replaced. Full recovery will vary from a year for grasses, to up to 5 years for shrubs and approximately 30 years for trees. Thus, the fish passage improvements will reduce riparian vegetation function over 0.95 acres. This effect will last for up to approximately 30 years, but will decrease over time.

#### 2.5.1.5 Riparian Zone Restoration

Reclamation will develop and implement a riparian vegetation planting plan for three miles of Bear Creek streambank. Because the narrowest riparian areas in Bear Creek are approximately 50 feet in width, NMFS assumes this restoration will occur over 18 acres (calculated as 3 miles by 50 feet). Riparian conditions throughout Bear Creek are currently degraded and contribute to high summer water temperatures and poor channel complexity. This riparian planting will reduce stream temperatures and increase food resources and stream complexity. Riparian vegetation reduces the streams' exposure to solar radiation, thus reducing stream temperatures. Planting will enhance forage resources by providing nutrients and habitat for aquatic invertebrates and by providing terrestrial insects. Once mature, riparian trees fall into the stream where they interact with streamflow to provide velocity variability and cover for SONCC coho salmon juveniles. Some benefits from riparian vegetation will be realized within a few years, but full benefits from planted trees are unlikely for up to 30 years. Thus, the proposed action will restore riparian vegetation function over 18 acres with beneficial effects accumulating over 30 years.

### 2.5.2 Effects on the Species Within the Action Area

#### 2.5.2.1 Amount of Available Habitat

**Overview**

To understand the effects of the proposed action on the amount of available SONCC coho salmon habitat, Reclamation conducted a detailed in-stream flow study using the IFIM/PHABSIM (Reclamation 2007). This model employs known use preferences for the habitat characteristics of water depth, velocity, and channel index (substrate and cover) of each life stage of interest to create suitability indices. Habitat suitability indices range from zero (unsuitable) to 1 (most preferred). IFIM/PHABSIM then combines a calibrated hydraulic model developed for the reaches of interest that estimates depths and velocities over a wide range of flows with the suitability indices to create a habitat response curve that provides an estimate of the habitat available to the species/life stage of interest at each flow modeled. The output of this model is in the form of suitability-weighted habitat area or weighted usable area (WUA). Weighted usable area is typically presented as area per specified length of stream (*e.g.*, $ft^2$ per 1,000 feet of stream).

Because they have unique preferences for depth, velocity, and channel index, the IFIM/PHABSIM model has to be run independently for each life stage of SONCC coho salmon. The critical timing of life stage use by the URR population is provided in Table 24. Some life stages of SONCC coho salmon may only last a short period (*e.g.*, spawning), while others are throughout the year (*e.g.*, juvenile rearing).

**Table 24.** SONCC coho salmon critical periods of life stage use in Bear Creek and Little Butte Creek watersheds. (Source: Reclamation 2007)

| Coho Life Stage | Critical Period |
|---|---|
| Spawning[1] | November 1 – January 31 |
| Incubation[2] | November 1 – May 31 |
| Smolt emigration/juvenile rearing[3] | February 15 – June 30 |
| Juvenile rearing[4] | July 1 – September 30 |
| Adult passage[5] | October 1 – January 31 |

Backup sources:
1 Oregon Department of Fish and Wildlife (ODFW) spawning survey data (1996-2004) provided to GeoEngineers, Inc by Briana Sounhein, ODFW Corvallis Research Office, September 2007
2 Egg incubation timing based on 700-800 temperature units (ºC) for coho salmon and temperature data from Reclamation's Hydromet Stations
3 Smolt trap data from ODFW and temperature data from Reclamation's Hydromet Stations
4 Oregon Department of Environmental Quality (ODEQ) water temperature standard and temperature data from Reclamation's Hydromet Stations
5 Gold Ray Dam ODFW fish counts and periodicity charts (Jay Doino, ODFW, personal communication, November 16 and November 17, 2006)

To estimate the fish habitat effects of the proposed action, the 2012 BA compares the WUA for the species/life stage of interest under the proposed action to the WUA under the without Reclamation scenario. The results of modeling habitat changes based on stream flow changes provide some means to evaluate the proposed action. The results of this analysis are presented in terms of overall changes per month in available habitat. This provides a predictor of changes in available habitat, thus likely effects on growth and survival of individual coho salmon due to habitat availability. For instance, research has shown that coastal coho salmon over-winter survival is highly correlated with winter habitat quality (Solazzi *et al.* 2000). Therefore losses of winter juvenile rearing habitat are likely to have fish survival and population abundance effects.

Some modeled effects have no biological meaning. For example, once spawning is completed, increases in available incubation habitat are meaningless as the eggs are stationary. There may be other habitat bottlenecks in which a prior event limits the potential for the population to benefit from subsequent increases. For example, a very low rearing habitat value in January may have population effects (*e.g.*, mortalities) that could not be overcome in subsequent months with higher habitat availability.

This analysis focuses on summer and winter rearing habitat, because. NMFS agrees with Reclamation's conclusion that spawning habitat is not limiting the population. Reclamation (2012 BA, Appendix B) found spawning habitat was sufficiently abundant to produce more coho salmon smolts and adults than the stream systems could sustain at all flow scenarios. Thus, they determined spawning habitat was not a limiting factor to coho salmon production potential. None of the limiting factor assessments, including the public comment draft SONCC coho salmon recovery plan, list spawning habitat as a limiting factor. To confirm this, NMFS looked for conditions under the proposed action that resulted in the least amount of spawning habitat, which occurred under low flow conditions in the month of January. Table 25 presents WUA reported in the 2012 BA for each of the nine affected stream reaches of Bear Creek and Little Butte Creek during January under low flow conditions. Because WUA is presented as square ft per 1,000 feet of stream, it has to be multiplied by length of the stream reach to get the total amount of spawning habitat available. The last column of Table 25 converts the total amount of spawning habitat to the number of potential redds by dividing the total available habitat by 107 square feet, a conservative number for size of a coho salmon redd (2012 BA, Appendix B).

**Table 25.** Number of potential redds in the affected reaches of Bear Creek and Little Butte Creek under conditions producing the lowest amount of habitat. (Data Source: 2012 BA)

| Reach/station | Stream | WUA ($ft^2$ per 1,000 ft) | Reach length (mi) | Total Habitat ($ft^2$) | Number of Potential Redds |
|---|---|---|---|---|---|
| EMI | Emigrant Creek | 3,571 | 3.5 | 65,992 | 613 |
| BCAO | Bear Creek | 10,612 | 3 | 168,094 | 1,562 |
| BASO | Bear Creek | 12,947 | 1.8 | 123,048 | 1,143 |
| BCTO | Bear Creek | 22,373 | 3.4 | 401,640 | 3,731 |
| MFDO | Bear Creek | 10,734 | 7.8 | 442,069 | 4,107 |
| BCMO | Bear Creek | 6,295[1] | 15.3 | 508,503 | 4,724 |
| GILO | South Fork Little Butte Creek | 7,042 | 16.6 | 617,217 | 5,734 |
| LBCO | Little Butte Creek | 25,969 | 14.1 | 1,933,340 | 17,961 |
| LBEO | Little Butte Creek | 21,801 | 2.5 | 287,773 | 2,674 |
| Total | | | | | 42,249 |

[1]This number was reported as square meters per 93 meters in the title of Table D-6 in Reclamation (2007). Because the conversion would result in $ft^2$/1,000 ft out of line with the adjacent reach, NMFS believes the title should have read square meters per 1,000 feet. Because the conversion of square meters per 1,000 feet results in a more conservative outcome for fish, NMFS assumes it is correct and used it in this analysis.

It is likely that some of the square footage of WUA is in small disconnected blocks too small for preferred coho salmon spawning, but it is unlikely such a factor accounts for more than 50% of this calculation. Thus, in the worst case scenario, the affected reaches of Bear Creek and Little Butte Creek provide approximately 21,000 square feet of potential spawning habitat. That is enough for 21,000 pairs of coho salmon or 42,000 fish. In comparison, the low risk spawner abundance threshold required of the URR population for ESU viability in the public draft recovery plan is 16,100 fish. Therefore, under the proposed action, the amount of spawning habitat provided in the affected reaches of Bear Creek and Little Butte Creek is unlikely to limit the population's ability to meet the recovery target.

**Qualitative Considerations for this Analysis**

It is important to note that these values are based on daily average streamflow compiled over each month. Because actual flow may be higher or lower at any time within the month, particularly in the winter and spring months when precipitation events are highly variable, the resulting WUA may be higher or lower. Furthermore, fish response to flow-related habitat conditions takes place over shorter time frames. It is likely that fish response, in terms of both behavior and survival, to hydrologic conditions over a 30-day period would be the aggregate of effects over shorter time frames, not a response to a constant flow. However, modeling shorter time intervals with the data at hand would be unreliable. Furthermore, Reclamation's implementation of three-hour and seven-day average minimum in-stream flows should prevent serious low fluctuations in flow. Therefore, NMFS assumes the monthly analysis is the best available information for predicting the effects to the species.

Because juvenile coho salmon are highly mobile and are known to change location within a watershed as conditions change, this analysis assumes that all changes in juvenile habitat are biologically meaningful. In other words, a change in available rearing habitat in one reach has biological meaning, even if it was limited in previous months. This is due to the ability of juvenile coho salmon to move to other areas or other streams to seek out preferred habitat.

WUA as a percentage of baseline conditions been used to develop minimum flow regimes for the conservation of anadromous salmonids in several projects (Tennant 1976, Clipperton *et al.* 2003, NMFS 2002, NMFS 2010). Clipperton *et al.* (2003) suggested flow levels in 27 stream reaches in Alberta, Canada. For most reaches, 75%-80% of unregulated flow habitat was adequate for ecosystem protection. NMFS (2002) and NMFS (2010) found 80% of unregulated flow habitat would allow populations of SONCC coho salmon to grow and prosper. However, none of these previous studies incorporated restorative activities (*e.g.* large wood, riparian planting) into their calculation of the WUA percentage. Any non-flow related habitat restoration actions would be on top of the percentage reported. For the proposed action, the target for percentage of WUA is higher because Reclamation innovated a method to account for benefits from large wood additions. The proposed action's 90% WUA is from in-stream flow and large wood additions, the previous studies' WUA were from flow alone.

After reviewing information from previous water management analyses (Tennant 1976, Clipperton *et al.* 2003, NMFS 2002, NMFS 2010), taking into account large wood additions, and considering the status and needs of the species, NMFS concluded that 90% of without Reclamation WUA will provide a wide range of habitat quality and quantity such that populations can survive and grow. NMFS determined the 90% target level for this analysis considering multiple variables. The proposed action's percentage should be higher than 80% cited in the studies above because it includes flow and large wood. It should be lower than 100% to account for the benefits from proposed activities (riparian planting, fish passage improvement) that cannot be converted to and included in WUA. After considering the resolution of hydrologic modeling (MODSIM) and habitat modeling (PHABSIM), and the imperfect relationship between physical habitat and biological response, it is unlikely that an analysis resolution less than 10% is reliable. Finally, NMFS has qualitatively considered another variable – the extent to which cumulative effects of non project diversions reduce truly unregulated flows in these streams which would be more like those under which these salmon evolved. See Section 2.4. The target levels chosen consider all of these variables.

During low flow condition, water availability is often insufficient to provide 90% of without Reclamation WUA and meet minimum Project purposes. At these times, the analysis uses a benchmark of 80% WUA. Providing 80% of without Reclamation WUA during low flow conditions may not allow population expansion. However, considering the findings of Clipperton *et al.* (2003), NMFS (2002), and NMFS (2010), it is reasonably likely to at least allow for maintenance of population levels. In modeling, Reclamation calculated low flow conditions as 80% exceedence values, which means they will occur for a total of two years each decade, on average.

NMFS is aware of the limitations of focusing solely on WUA analysis when analyzing an individual coho salmon or coho salmon population's response to an action (*e.g.* NRC 2008). For example, whether or not individuals actually occupy suitable habitat is dependent on a number of factors, including availability of individuals, connectivity to the location, and other environmental factors not considered in the model. Thus, while this analysis focuses on habitat availability, it also considers other important habitat components and how they affect coho salmon individual fitness.

**Rogue River Basin**

The 2012 BA reported the monthly PHABSIM WUA resulting from streamflows (reported in Tables 15 through 23 above) for each stream reach and flow condition in Bear Creek and Little Butte Creek. The PHABSIM modeling prediction is the best information available on how much rearing habitat would be in the streams with Reclamation implementing the proposed action. The monthly values for each Hydromet station and system state are listed in Tables 26 through 34. Also listed in these tables are the without Reclamation scenario habitat values and the difference between the two scenarios. This difference is the effect on SONCC coho salmon by implementing the proposed action, including the minimum in-stream flow requirements. Weighted usable area is presented as area per specified length of stream (*e.g.*, $ft^2$ per 1,000 feet of stream).

Reclamation will install large wood structures to increase WUA in four stream reaches. To calculate the WUA benefits from large wood, Reclamation combined PHABSIM and the Corps Hydrologic Engineering Centers River Analysis System (HEC-RAS) model (See Appendix C in the 2012 BA for details). This analysis tool will allow Reclamation to calculate how much large wood is required to increase WUA by their proposed levels (Table 3). Reclamation has completed modeling for the Emigrant Creek reach (2012 BA, Appendix C) to show the process is capable of producing results. NMFS reviewed the procedure and results and agrees that large wood additions will provide the proposed benefits.

This innovative approach allows the targeted benefits to WUA to be incorporated into Tables 26 through 34. However, the tables do not include all benefits from large wood. This reduced estimate of benefits results because Reclamation targeted certain flow conditions and coho salmon life stages that do not occur throughout the year. However, the wood installed will provide benefits all year long. Where winter rearing habitat is targeted, the benefits to summer rearing habitat was not calculated by Reclamation. Similarly, where summer habitat is targeted, the benefits during winter were not calculated. Where low flow or high flow conditions were not targeted, Reclamation did not calculate benefits to them. Therefore, the full benefit from large wood additions is larger than indicated in the tables. This is a qualitative conservative buffer in our analysis and conclusion.

**Table 26.** Predicted SONCC coho salmon juvenile rearing habitat WUA ($ft^2$/1,000 ft) in Emigrant Creek (EMI Hydromet station) resulting from flow management and large wood under the proposed action and without Reclamation scenarios. Data source: 2012 BA.

| | **Proposed Action WUA** | | | **Without Reclamation WUA** | | | **Change in WUA[1]** | | | **Percent of Without Reclamation WUA** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Month | Wet | Median | Dry | Wet | Median | Dry | Wet | Median | Dry | Wet | Median | Dry |
| October | 6,645 | 5,679 | 5,679 | 6,958 | 5,986 | 4,804 | -313 | -307 | 875 | 96 | 95 | 118 |
| November | 4,695 | 4,626[2] | 4,827[3] | 4,995 | 4,334 | 3,586 | -300 | 292 | 1,241 | 94 | 107 | 135 |
| December | 5,564 | 5,615[2] | 5,341[3] | 5,576 | 5,377 | 4,462 | -12 | 238 | 879 | 100 | 104 | 120 |
| January | 4,845 | 4,987[2] | 4,465[3] | 5,621 | 5,536 | 5,351 | -776 | -549 | -886 | 86 | 90 | 83 |
| February | 4,845 | 4,987[2] | 4,658[3] | 5,572 | 5,543 | 5,325 | -727 | -556 | -667 | 87 | 90 | 87 |
| March | 5,397 | 4,987[2] | 4,465[3] | 5,678 | 5,540 | 5,516 | -281 | -553 | -1,051 | 95 | 90 | 81 |
| April | 5,631 | 5,443[2] | 4,465[3] | 5,640 | 5,532 | 5,581 | -9 | -89 | -1,116 | 100 | 98 | 80 |
| May | 6,669 | 7,629 | 6,800 | 6,580 | 7,438 | 7,678 | 89 | 191 | -878 | 101 | 103 | 89 |
| June | 7,379 | 7,468 | 5,986 | 7,692 | 7,565 | 6,645 | -313 | -97 | -659 | 96 | 99 | 90 |
| July | 6,765 | 7,126 | 7,620 | 7,232 | 6,450 | 3,036 | -467 | 676 | 4,584 | 94 | 110 | 251 |
| August | 6,892 | 7,349 | 7,601 | 6,450 | 4,804 | 3,036 | 442 | 2,545 | 4,565 | 107 | 153 | 250 |
| September | 7,564 | 7,670 | 7,468 | 6,450 | 5,252 | 3,036 | 1,114 | 2,418 | 4,432 | 117 | 146 | 246 |

[1]Positive values denote WUA increases due to the proposed action, negative values are decreases.
[2]Includes Table 3 large wood benefits to winter rearing under median conditions converted to $ft^2$/1,000 ft.
[3]Includes Table 3 large wood benefits to winter rearing under dry conditions converted to $ft^2$/1,000 ft.

**Table 27.** Predicted SONCC coho salmon juvenile rearing habitat WUA ($ft^2$/1,000 ft) in Bear Creek (BCAO Hydromet station reach) resulting from flow management and large wood under the proposed action and without Reclamation scenarios. Data source: 2012 BA.

| | **Proposed Action WUA** | | | **Without Reclamation WUA** | | | **Change in WUA[1]** | | | **Percent of Without Reclamation WUA** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Month | Wet | Median | Dry | Wet | Median | Dry | Wet | Median | Dry | Wet | Median | Dry |
| October | 3,092 | 2,724 | 2,550 | 2,905 | 2,450 | 2,450 | 187 | 274 | 100 | 106 | 111 | 104 |
| November | 2,375 | 2,567[2] | 2,029[3] | 2,347 | 1,880 | 1,531 | 28 | 687 | 498 | 101 | 137 | 133 |
| December | 4,205 | 3,869[2] | 2,213[3] | 4,139 | 3,221 | 1,840 | 66 | 648 | 373 | 102 | 120 | 120 |
| January | 4,125 | 3,490[2] | 2,686[3] | 4,638 | 3,824 | 3,169 | -513 | -334 | -483 | 89 | 91 | 85 |
| February | 3,923 | 3,490[2] | 2,642[3] | 4,421 | 3,878 | 2,888 | -498 | -388 | -246 | 89 | 90 | 91 |
| March | 4,250 | 4,484[2] | 3,135[3] | 4,944 | 4,084 | 3,863 | -694 | 400 | -728 | 86 | 110 | 81 |
| April | 4,881 | 4,814[2] | 3,613[3] | 4,819 | 4,097 | 3,966 | 62 | 717 | -353 | 101 | 118 | 91 |
| May | 4,356 | 4,958 | 3,831 | 4,425 | 4,909 | 5,020 | -69 | 49 | -1,189 | 98 | 101 | 76 |
| June | 5,077 | 3,739 | 3,420 | 4,946 | 3,831 | 2,950 | 131 | -92 | 470 | 103 | 98 | 116 |
| July | 4,946 | 5,095 | 4,185 | 2,905 | 2,500 | 2,450 | 2,041 | 2,595 | 1,735 | 170 | 204 | 171 |
| August | 5,000 | 5,066 | 4,470 | 2,613 | 2,400 | 1,350 | 2,387 | 2,666 | 3,120 | 191 | 211 | 331 |
| September | 4,470 | 3,602 | 3,400 | 2,724 | 2,450 | 1,350 | 1,746 | 1,152 | 2,050 | 164 | 147 | 252 |

[1]Positive values denote WUA increases due to the proposed action, negative values are decreases.
[2]Includes Table 3 large wood benefits to winter rearing under median conditions converted to $ft^2$/1,000 ft.
[3]Includes Table 3 large wood benefits to winter rearing under dry conditions converted to $ft^2$/1,000 ft.

**Table 28.** Predicted SONCC coho salmon juvenile rearing habitat WUA ($ft^2$/1,000 ft) in Bear Creek (BASO Hydromet station reach) resulting from flow management and large wood under the proposed action and without Reclamation scenarios. Data source: 2012 BA.

| | **Proposed Action WUA** | | | **Without Reclamation WUA** | | | **Change in WUA**[1] | | | **Percent of Without Reclamation WUA** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Month | Wet | Median | Dry | Wet | Median | Dry | Wet | Median | Dry | Wet | Median | Dry |
| October | 3,400 | 3,629[2] | 2,724 | 3,420 | 2,905 | 2,500 | -20 | 724 | 224 | 99 | 125 | 109 |
| November | 2,772 | 2,453 | 2,262 | 2,830 | 2,347 | 1,880 | -58 | 106 | 382 | 98 | 105 | 120 |
| December | 4,297 | 3,812 | 2,497 | 4,260 | 3,812 | 2,453 | 37 | 0 | 44 | 101 | 100 | 102 |
| January | 4,218 | 3,812 | 3,274 | 4,819 | 4,078 | 3,787 | -601 | -266 | -513 | 88 | 93 | 86 |
| February | 4,142 | 3,812 | 2,888 | 4,638 | 4,104 | 3,571 | -496 | -292 | -683 | 89 | 93 | 81 |
| March | 4,396 | 4,065 | 3,424 | 4,944 | 4,421 | 3,831 | -548 | -356 | -407 | 89 | 92 | 89 |
| April | 4,738 | 4,104 | 3,473 | 4,905 | 4,105 | 4,153 | -167 | -1 | -680 | 97 | 100 | 84 |
| May | 3,163 | 5,411[2] | 3,195 | 2,685 | 4,825 | 3,860 | 478 | 586 | -665 | 118 | 112 | 83 |
| June | 4,932 | 4,951[2] | 3,568 | 4,877 | 5,112 | 3,648 | 55 | -161 | -80 | 101 | 97 | 98 |
| July | 4,975 | 4,951[2] | 3,695 | 4,185 | 3,092 | 2,550 | 790 | 1,859 | 1,145 | 119 | 160 | 145 |
| August | 4,470 | 4,368[2] | 3,445 | 3,338 | 2,500 | 2,450 | 1,132 | 1,868 | 995 | 134 | 175 | 141 |
| September | 3,472 | 3,752[2] | 2,779 | 3,092 | 2,680 | 2,450 | 380 | 1,072 | 329 | 112 | 140 | 113 |

[1]Positive values denote WUA increases due to the proposed action, negative values are decreases.
[2]Includes Table 3 large wood benefits to summer rearing under median conditions converted to $ft^2$/1,000 ft.

**Table 29.** Predicted SONCC coho salmon juvenile rearing habitat WUA (ft$^2$/1,000 ft) in Bear Creek (BCTO Hydromet station reach) resulting from flow management and large wood under the proposed action and without Reclamation scenarios. Data source: 2012 BA.

| | **Proposed Action WUA** | | | **Without Reclamation WUA** | | | **Change in WUA**[1] | | | **Percent of Without Reclamation WUA** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Month | Wet | Median | Dry | Wet | Median | Dry | Wet | Median | Dry | Wet | Median | Dry |
| October | 4,679 | 4,851 | 4,886 | 4,761 | 4,870 | 4,273 | -82 | -19 | 613 | 98 | 100 | 114 |
| November | 3,822 | 3,667 | 3,701 | 3,708 | 3,697 | 3,563 | 114 | -30 | 138 | 103 | 99 | 104 |
| December | 3,945 | 3,822 | 3,700 | 3,942 | 3,806 | 3,694 | 3 | 16 | 6 | 100 | 100 | 100 |
| January | 4,357 | 3,820 | 3,701 | 4,426 | 3,866 | 3,794 | -69 | -46 | -93 | 98 | 99 | 98 |
| February | 4,069 | 3,789 | 3,668 | 4,192 | 3,846 | 3,704 | -123 | -57 | -36 | 97 | 99 | 99 |
| March | 4,179 | 3,890 | 3,808 | 4,357 | 3,980 | 3,851 | -178 | -90 | -43 | 96 | 98 | 99 |
| April | 4,261 | 3,945 | 3,783 | 4,288 | 3,992 | 3,874 | -27 | -47 | -91 | 99 | 99 | 98 |
| May | 4,158 | 4,400 | 4,721 | 4,098 | 4,015 | 4,570 | 60 | 385 | 151 | 101 | 110 | 103 |
| June | 4,401 | 4,652 | 4,884 | 4,359 | 4,620 | 4,629 | 42 | 32 | 255 | 101 | 101 | 106 |
| July | 4,825 | 4,889 | 4,838 | 4,618 | 4,879 | 4,670 | 207 | 10 | 168 | 104 | 100 | 104 |
| August | 4,867 | 4,884 | 4,883 | 4,768 | 4,860 | 4,588 | 99 | 24 | 295 | 102 | 100 | 106 |
| September | 4,884 | 4,879 | 4,849 | 4,851 | 4,849 | 4,670 | 33 | 30 | 179 | 101 | 101 | 104 |

[1]Positive values denote WUA increases due to the proposed action, negative values are decreases.

**Table 30.** Predicted SONCC coho salmon juvenile rearing habitat WUA ($ft^2$/1,000 ft) in Bear Creek (MFDO Hydromet station reach) resulting from flow management and large wood under the proposed action and without Reclamation scenarios. Data source: 2012 BA.

| | **Proposed Action WUA** | | | **Without Reclamation WUA** | | | **Change in WUA[1]** | | | **Percent of Without Reclamation WUA** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Month | Wet | Median | Dry | Wet | Median | Dry | Wet | Median | Dry | Wet | Median | Dry |
| October | 3,451 | 3,762 | 3,924 | 3,607 | 3,987 | 3,800 | -156 | -225 | 124 | 96 | 94 | 103 |
| November | 2,553 | 2,732 | 2,758 | 2,593 | 2,758 | 2,760 | -40 | -26 | -2 | 98 | 99 | 100 |
| December | 2,735 | 2,600 | 2,730 | 2,734 | 2,597 | 2,748 | 1 | 3 | -18 | 100 | 100 | 99 |
| January | 2,751 | 2,622 | 2,570 | 2,832 | 2,680 | 2,553 | -81 | -58 | 17 | 97 | 98 | 101 |
| February | 2,720 | 2,566 | 2,692 | 2,899 | 2,660 | 2,578 | -179 | -94 | 114 | 94 | 96 | 104 |
| March | 2,850 | 2,680 | 2,578 | 2,841 | 2,755 | 2,575 | 9 | -75 | 3 | 100 | 97 | 100 |
| April | 2,823 | 2,678 | 2,570 | 2,850 | 2,712 | 2,669 | -27 | -34 | -99 | 99 | 99 | 96 |
| May | 2,677 | 2,916 | 3,432 | 2,627 | 2,790 | 2,940 | 50 | 126 | 492 | 102 | 105 | 117 |
| June | 2,938 | 3,458 | 3,924 | 2,854 | 2,969 | 3,626 | 84 | 489 | 298 | 103 | 116 | 108 |
| July | 3,700 | 3,840 | 3,969 | 3,470 | 3,924 | 4,015 | 230 | -84 | -46 | 107 | 98 | 99 |
| August | 3,762 | 3,801 | 3,867 | 3,588 | 3,987 | 2,650 | 174 | -186 | 1,217 | 105 | 95 | 146 |
| September | 3,801 | 3,870 | 3,951 | 3,820 | 4,036 | 3,886 | -19 | -166 | 65 | 100 | 96 | 102 |

[1]Positive values denote WUA increases due to the proposed action, negative values are decreases.

**Table 31.** Predicted SONCC coho salmon juvenile rearing habitat WUA ($ft^2$/1,000 ft)[1] in Bear Creek (BCMO Hydromet station reach) resulting from flow management and large wood under the proposed action and without Reclamation scenarios. Data source: 2012 BA.

| | **Proposed Action WUA** | | | **Without Reclamation WUA** | | | **Change in WUA**[2] | | | **Percent of Without Reclamation WUA** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Month | Wet | Median | Dry | Wet | Median | Dry | Wet | Median | Dry | Wet | Median | Dry |
| October | 4,498 | 4,605 | 4,767 | 4,573 | 4,896 | 4,627 | -75 | -291 | 140 | 98 | 94 | 103 |
| November | 4,605 | 4,573 | 4,670 | 4,562 | 4,681 | 4,885 | 43 | -108 | -215 | 101 | 98 | 96 |
| December | 4,261 | 4,595 | 4,670 | 4,369 | 4,595 | 4,734 | -108 | 0 | -65 | 98 | 100 | 99 |
| January | 3,917 | 4,476 | 4,573 | 3,680 | 4,455 | 4,605 | 237 | 22 | -32 | 106 | 100 | 99 |
| February | 4,379 | 4,584 | 4,573 | 4,132 | 4,508 | 4,562 | 247 | 75 | 11 | 106 | 102 | 100 |
| March | 4,110 | 4,455 | 4,616 | 3,917 | 4,379 | 4,519 | 194 | 75 | 97 | 105 | 102 | 102 |
| April | 4,046 | 4,390 | 4,584 | 4,046 | 4,369 | 4,465 | 0 | 22 | 118 | 100 | 100 | 103 |
| May | 4,024 | 4,326 | 4,530 | 4,003 | 4,304 | 4,401 | 22 | 22 | 129 | 101 | 101 | 103 |
| June | 4,326 | 4,498 | 4,885 | 4,401 | 4,476 | 4,724 | -75 | 22 | 161 | 98 | 100 | 103 |
| July | 4,756 | 4,874 | 4,853 | 4,616 | 4,799 | 4,519 | 140 | 75 | 334 | 103 | 102 | 107 |
| August | 4,724 | 4,896 | 4,885 | 4,842 | 4,777 | 4,336 | -118 | 118 | 549 | 98 | 102 | 113 |
| September | 4,616 | 4,788 | 4,896 | 4,831 | 4,896 | 4,756 | -215 | -108 | 140 | 96 | 98 | 103 |

[1]The WUA for BCMO was reported as square meters per 93 meters in the 1012 BA, and originally came from title of Table D-6 in Reclamation (2007). Because the conversion would result in $ft^2$/1,000 ft out of line with the adjacent reach, NMFS believes the title should have read square meters per 1,000 feet. Because the conversion of square meters per 1,000 feet results in a more conservative outcome for fish, NMFS assumes it is correct and used it in this analysis.
[2]Positive values denote WUA increases due to the proposed action, negative values are decreases.

**Table 32.** Predicted SONCC coho salmon juvenile rearing habitat WUA ($ft^2$/1,000 ft) in South Fork Little Butte Creek (GILO Hydromet station) resulting from flow management and large wood under the proposed action and without Reclamation scenarios. Data source: 2012 BA.

| | **Proposed Action WUA** | | | **Without Reclamation WUA** | | | **Change in WUA[1]** | | | **Percent of Without Reclamation WUA** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Month | Wet | Median | Dry | Wet | Median | Dry | Wet | Median | Dry | Wet | Median | Dry |
| October | 2,721 | 2,630 | 2,572 | 2,749 | 2,684 | 2,610 | -28 | -54 | -38 | 99 | 98 | 99 |
| November | 1,512 | 1,432 | 1,254 | 1,609 | 1,512 | 1,383 | -97 | -80 | -129 | 94 | 95 | 91 |
| December | 1,939 | 1,684 | 1,383 | 2,047 | 1,692 | 1,427 | -108 | -8 | -44 | 95 | 100 | 97 |
| January | 2,037 | 1,847 | 1,491 | 2,551 | 1,907 | 1,652 | -514 | -60 | -161 | 80 | 97 | 90 |
| February | 1,913 | 1,811 | 1,580 | 2,262 | 1,900 | 1,736 | -349 | -89 | -156 | 85 | 95 | 91 |
| March | 2,544 | 2,118 | 1,861 | 2,994 | 2,352 | 1,954 | -450 | -234 | -93 | 85 | 90 | 95 |
| April | 2,978 | 2,626 | 2,090 | 3,722 | 2,875 | 2,382 | -744 | -249 | -292 | 80 | 91 | 88 |
| May | 4,367 | 3,697 | 3,217 | 4,800 | 4,050 | 3,572 | -433 | -353 | -355 | 91 | 91 | 90 |
| June | 3,210 | 2,998 | 2,808 | 3,399 | 3,217 | 3,065 | -189 | -219 | -257 | 94 | 93 | 92 |
| July | 2,884 | 2,785 | 2,700 | 2,960 | 2,828 | 2,749 | -76 | -43 | -49 | 97 | 98 | 98 |
| August | 2,773 | 2,700 | 2,610 | 2,785 | 2,749 | 2,630 | -12 | -49 | -20 | 100 | 98 | 99 |
| September | 2,684 | 2,668 | 2,592 | 2,749 | 2,684 | 2,610 | -65 | -16 | -18 | 98 | 99 | 99 |

[1]Positive values denote WUA increases due to the proposed action, negative values are decreases.
[2]Includes Table 3 large wood benefits to winter rearing under median conditions converted to $ft^2$/1,000 ft.

**Table 33.** Predicted SONCC coho salmon juvenile rearing habitat WUA ($ft^2$/1,000 ft) in Little Butte Creek (LBCO Hydromet station reach) resulting from flow management and large wood under the proposed action and without Reclamation scenarios. Data source: 2012 BA.

| | **Proposed Action WUA** | | | **Without Reclamation WUA** | | | **Change in WUA[1]** | | | **Percent of Without Reclamation WUA** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Month | Wet | Median | Dry | Wet | Median | Dry | Wet | Median | Dry | Wet | Median | Dry |
| October | 7,079 | 6,373 | 5,446 | 7,125 | 6,373 | 5,521 | -46 | 0 | -75 | 99 | 100 | 99 |
| November | 5,514 | 5,102 | 4,773 | 5,659 | 5,196 | 4,905 | -145 | -94 | -132 | 97 | 98 | 97 |
| December | 7,016 | 5,816 | 5,102 | 7,181 | 5,889 | 5,102 | -165 | -73 | 0 | 98 | 99 | 100 |
| January | 8,090 | 6,152 | 5,398 | 8,420 | 6,231 | 5,559 | -330 | -79 | -161 | 96 | 99 | 97 |
| February | 6,768 | 5,937 | 5,514 | 7,016 | 6,139 | 5,619 | -248 | -202 | -105 | 96 | 97 | 98 |
| March | 8,833 | 6,892 | 5,750 | 9,164 | 7,264 | 5,982 | -331 | -372 | -232 | 96 | 95 | 96 |
| April | 8,833 | 7,223 | 6,125 | 9,164 | 7,685 | 6,332 | -331 | -462 | -207 | 96 | 94 | 97 |
| May | 10,062 | 8,711 | 7,466 | 10,307 | 8,985 | 8,080 | -245 | -274 | -614 | 98 | 97 | 92 |
| June | 7,551 | 5,669 | 5,073 | 8,065 | 6,836 | 5,521 | -514 | -1,167 | -448 | 94 | 83 | 92 |
| July | 5,446 | 5,073 | 4,845 | 5,892 | 5,223 | 4,960 | -446 | -150 | -115 | 92 | 97 | 98 |
| August | 5,372 | 5,149 | 4,960 | 5,669 | 5,223 | 4,960 | -297 | -74 | 0 | 95 | 99 | 100 |
| September | 5,223 | 5,149 | 4,845 | 5,372 | 5,223 | 4,845 | -149 | -74 | 0 | 97 | 99 | 100 |

[1]Positive values denote WUA increases due to the proposed action, negative values are decreases.

**Table 34.** Predicted SONCC coho salmon juvenile rearing habitat WUA ($ft^2$/1,000 ft) in Little Butte Creek (LBEO Hydromet station reach) resulting from flow management and large wood under the proposed action and without Reclamation scenarios. Data source: 2012 BA.

| | **Proposed Action WUA** | | | **Without Reclamation WUA** | | | **Change in WUA[1]** | | | **Percent of Without Reclamation WUA** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Month | Wet | Median | Dry | Wet | Median | Dry | Wet | Median | Dry | Wet | Median | Dry |
| October | 4,045 | 4,362 | 4,168 | 4,035 | 4,365 | 4,174 | 10 | -3 | -6 | 100 | 100 | 100 |
| November | 3,284 | 3,126 | 3,019 | 3,319 | 3,154 | 3,026 | -35 | -28 | -7 | 99 | 99 | 100 |
| December | 4,145 | 3,632 | 3,084 | 4,248 | 3,724 | 3,107 | -103 | -92 | -23 | 98 | 98 | 99 |
| January | 4,695 | 4,264 | 3,296 | 4,799 | 4,432 | 3,592 | -104 | -168 | -296 | 98 | 96 | 92 |
| February | 4,214 | 4,110 | 3,250 | 4,317 | 4,125 | 3,284 | -103 | -15 | -34 | 98 | 100 | 99 |
| March | 5,040 | 4,555 | 3,864 | 5,212 | 4,600 | 4,110 | -172 | -45 | -246 | 97 | 99 | 94 |
| April | 4,902 | 4,550 | 3,864 | 5,074 | 4,785 | 4,264 | -172 | -235 | -400 | 97 | 95 | 91 |
| May | 2,796 | 3,548 | 4,075 | 2,743 | 3,430 | 3,986 | 53 | 118 | 89 | 102 | 103 | 102 |
| June | 3,668 | 4,362 | 4,168 | 3,589 | 4,334 | 4,302 | 79 | 28 | -134 | 102 | 101 | 97 |
| July | 4,362 | 4,187 | 4,045 | 4,380 | 4,210 | 4,074 | -18 | -23 | -29 | 100 | 99 | 99 |
| August | 4,338 | 4,109 | 3,986 | 4,362 | 4,129 | 4,009 | -24 | -20 | -23 | 99 | 100 | 99 |
| September | 4,322 | 4,174 | 4,025 | 4,322 | 4,174 | 4,025 | 0 | 0 | 0 | 100 | 100 | 100 |

[1]Positive values denote WUA increases due to the proposed action, negative values are decreases.

For Bear Creek, in general, the proposed action provides more available habitat during the irrigation season than the without Reclamation scenario. And, it provides less available habitat during the storage season starting in January. In Little Butte Creek, because there are no storage facilities, the proposed action reduces habitat from the without Reclamation scenario throughout the year.

Time lag prior to large wood installation: Reclamation intends to implement 70% of the large wood additions by 2017, with full implementation by 2020. Thus, the benefits to rearing WUA from large wood will be delayed compared to implementation of the flow management portions of the proposed action. This will result in WUA lower than reported above for those reaches affected by large wood additions (EMI, BCAO, BCTO, and GILO) for up to eight years. However, the lag time in restoration activities will not significantly increase the severity of effects to SONCC coho salmon during these initial years. Current low juvenile coho salmon abundance compared to available habitat in Emigrant Creek, upper Bear Creek and SF Little Butte Creek indicates they are "underseeded." The amount of rearing habitat provided in them prior to large wood additions is adequate to support larger numbers of juveniles than are currently observed in these systems, particularly Emigrant Creek (2012 BA, Appendix B). Until this underseeded habitat is filled, the increased WUA from large wood addition will not be reflected in population-level effects. Reclamation recommends implementing large wood addition in SF Little Butte Creek first because it is closer than Emigrant Creek or Bear Creek to reaching fish densities at which rearing habitat will limit production (Appendix B). NMFS is reasonably certain that juvenile population abundances will not fully seed the available habitat for at least two to three life cycles by which time large wood additions will be implemented.

Effects when meeting the 90%/80% targets: NMFS concluded that meeting 90% of without reclamation WUA during median and wet conditions and 80% during dry conditions will provide a wide range of habitat quality and quantity such that populations can survive and/or grow. But, that does not mean the reductions in available habitat will not have any adverse effects compared to the without Reclamation scenario. NMFS agrees with Reclamation's finding in the 2012 BA that, "Reductions in winter rearing habitat have the potential to increase over-wintering mortality due to space limitations as well as increasing interspecies and intraspecies competition, resulting in lower growth and survival rates." These small reductions in rearing habitat compared to the without Reclamation scenario are reasonably certain to result in slightly reduced survival rates of juvenile SONCC coho salmon in the affected reaches.

Target shortfalls: At times during wet flow conditions, the proposed action does not meet 90% of the without Reclamation WUA in three reaches in the Bear Creek Drainage and in the SF Little Butte Creek reach. In Emigrant Creek the proposed action falls short in January and February. In the BCAO and BASO reaches, it falls short in those months and in March. In SF Little Butte Creek, WUA falls short from January through April. However, the effects from these wet condition shortfalls will not be significantly greater than the effects of meeting 90% of without Reclamation WUA at median conditions. In every circumstance that wet condition flow is below 90% of without Reclamation wet condition, it still provides more WUA than the target requires for 90% at median flow conditions. In other words, the percentage of without Reclamation WUA during these times is low because the without Reclamation WUA values are very high. The actual amount of habitat provided by the proposed action during wet conditions is more than median conditions require. Because of this, and the fact that wet conditions will only occur, on average, for a total of two years each decade, the effect of shortfalls during wet conditions are similar to effects from meeting the target at median flows.

In the BCAO reach during dry conditions in the month of May, Table 27 indicates the proposed action will only provide 74% of the without Reclamation WUA. However, these data do not consider the increased WUA from large wood addition. Reclamation proposed large wood additions based on winter rearing habitat and May is classified as summer rearing for the PHABSIM analysis. NMFS has no method to convert the WUA benefits based on winter rearing habitat to summer rearing benefits. Although, the additional wood will add complexity to the channel, deepen pool characteristics, and add cover, all of which enhance summer rearing habitat. Therefore, it is highly likely that placing enough large wood to increase of winter WUA by 8,600 $ft^2$ will result in more than the 1,200 $ft^2$ of summer WUA required to meet the dry condition 80% of without Reclamation target.

During median flow conditions, the proposed action will only provide 83% of the without Reclamation WUA in the LBCO reach in the month of June. There is no proposed large wood addition in this reach. A 17% reduction in habitat was classified by Reclamation as a "moderate detriment." This moderate reduction in rearing habitat is reasonably certain to result in reduced survival of juvenile SONCC coho salmon in the LBCO reach during June. Furthermore, this reduction gains significance because it occurs throughout one of the longest (14 miles) stream reaches and during a month important to juvenile rearing. June is the month when stream temperatures begin to exceed preferable levels, triggering some juveniles to migrate to other stream reaches. Any reduction in WUA in June in LBCO will likely reduce migration from downstream reaches through LBCO and from within LBCO to upstream reaches. With reduced emigration from these areas, juveniles trying to rear will be exposed to higher densities and competition for the rest of the summer. Therefore, the moderate effects extend temporally and spatially beyond the LBCO reach in June.

Increases in available habitat: The proposed action will increase summer rearing habitat WUA in Emigrant Creek and the BCAO and BASO reaches of Bear Creek. Increased juvenile rearing habitat is likely to reduce intra-species and inter-species competition and result in increased survival for juvenile coho salmon. Also, increased flows will improve connectivity between streams and reaches and juvenile migration ability. It will also facilitate habitat selection behaviors such as seeking temperature refuges. The MODSIM model predicts that without Reclamation Emigrant Creek and the BCAO reach would go intermittent under dry flow conditions during late summer. By converting these reaches to perennial streams, the proposed action would significantly increase juvenile rearing habitat.

Antelope Creek: Reclamation did not include Antelope Creek and Dry Creek in the PHABSIM analysis. According to the 2012 BA (page 204), no summertime diversions occur at Antelope Creek Diversion Dam, and therefore, the proposed action does not affect downstream summer rearing habitat. Reclamation concluded that winter rearing habitat WUA is routinely high (2012 BA, page 204 citing Figure 5-35 in Reclamation 2009). This figure shows WUA in terms of the percent maximum WUA possible and not in terms of change from the without-Reclamation scenario. This makes it difficult to draw conclusions on the effects of the action. Because the percent maximum WUA provided by the proposed action is almost always greater than 80% (Figure 5-35 in Reclamation 2009) and Reclamation releases water from Agate Reservoir for maintenance of Dry Creek, NMFS assumes the effects in Dry Creek and Antelope Creek on winter rearing habitat are similar to those analyzed for Emigrant Creek and SF Little Butte Creek.

**Klamath River Basin**

The diversions of water from the headwater streams of Jenny Creek represent the only means for affecting Klamath Basin populations of SONCC coho salmon. Jenny Creek enters the reservoir upstream of IGD, a passage barrier to SONCC coho salmon. Therefore, no coho salmon occupy Jenny Creek. The diversions from Jenny Creek must be considered for their effect on the quantity and quality of water released from IGD.

Changes in available occupied habitat within the mainstem Klamath River below IGD due to the diversion of Jenny Creek water were modeled in the 2003 BA. This modeling was specifically performed to evaluate the effects of removing Jenny Creek Rogue River Basin Project water from the Klamath River. Because no other modeling has occurred since, this still constitutes the best available information.

Reclamation evaluated the changes in available coho salmon fry habitat by comparing the differences in habitat provided by the proposed action and without Reclamation flows for five different water year types: wet; above average; average; below average; and dry. Spawning habitat modeling was not available, but Chinook salmon spawning information provided a surrogate (Reclamation 2003). For this assessment, changes of less than 10% were considered within the potential modeling error threshold (Reclamation 2003). Consequently, modeled changes in-stream habitat of less than 10% did not correspond to demonstrable changes in habitat function and are therefore identified as negligible.

<u>Rearing habitat</u>: The proposed action's effects on rearing habitat vary by water year type and include increases and decreases, but overall the changes in available habitat are 5% or less. The largest reductions in habitat occur in February and March of below average and dry water years. The magnitude of these changes falls within predicted model error threshold; therefore with available information NMFS is reasonably certain the observed changes are sufficiently small and unlikely to improve or reduce coho salmon fry survival.

<u>Adult migration and spawning</u>: SONCC coho salmon spawning is documented within the mainstem Klamath River, although degraded baseline conditions reduce spawning gravels and limit reproductive success (NMFS 2010). Reclamation concluded the changes in flow due to the proposed action results in mostly increased spawning habitat (Reclamation 2003). However, all of the modeled increases fall below the identified margin of model error.

<u>Water temperature</u>: Reclamation discussed in detail the potential for the proposed action to change water temperature in the mainstem of the Klamath River (Reclamation 2003). Reclamation (2003) concluded the diversion of the Jenny Creek water "would not likely affect

water temperature appreciably” in the mainstem of the Klamath River below IGD. The NMFS does not have any information to discount that conclusion.

#### 2.5.2.2 Loss of Flow over Redds

In Emigrant Creek, the proposed action will reduce flows significantly from December to January under all flow conditions (Table 15). This does not happen under the without Reclamation scenario. The rule curve for Emigrant Reservoir requires 20,000 acre-feet of space to be reserved for flood regulation from October through December (See Figure 2-2 in the 2012 BA). After January 1, Reclamation begins filling the reservoir by 18,500 acre-feet on a gradual straight-line basis until April 1. The filling drops flow by more than half under dry and median flow conditions, and by 80% under wet conditions. Due to inflows from tributaries, the severity of this flow drop is greatly reduced by the time water reaches the BCAO reach.

Spawning that occurs in December in Emigrant Creek may be lost. Flow reductions may dry out redds built on stream margins, killing any incubating eggs in the process. Because too little data exists to predict spawning locations within Emigrant Creek, NMFS has difficulty in accurately assessing the severity of this effect on SONCC coho salmon. The USFWS conducted some spawning surveys in the 1950s, but did not indicate where redds were located in the channel. No recent spawning surveys have occurred. Nor does NMFS have any information on the percentage of spawning that occurs prior to January.

Due to severity of the flow reductions and duration of time analyzed in this opinion, NMFS is reasonably certain that eggs and pre-emergent fry in redds will be killed by the proposed action at some point. However, NMFS is reasonably certain these effects will only affect a low number of individuals and not be measurable on a population level because: (1) The effect only occurs in 3.5 miles of the 30 miles of spawning habitat in Bear Creek; (2) Bear Creek is only one of at least six sub-populations or URR SONCC coho salmon; (3) only redds created in December will be affected; and (4) flow reductions will not compromise redds located in or near the stream thalweg.

#### 2.5.2.3 Ramping Rate Procedures

**Emigrant Creek**

<u>Storage Season:</u>
The storage season (October through May) overlaps with the flood control season for which the U.S. Army Corps of Engineers has established storage limits in Emigrant Reservoir to facilitate the storage of flood flows to minimize downstream flood damage. Operations designed to achieve and maintain this storage capacity are under the Corps’ authority and Reclamation may be obligated, at times, to adjust flows more rapidly than its proposed ramping rate criteria would allow. As Reclamation has not applied these criteria in the past, it is unknown how frequently flood control operations would require Reclamation to depart from these criteria. We anticipate that such operations could occur several times each year and would adversely affect spawning, incubating, fry and juvenile SONCC coho salmon.

<u>Upramping</u>: Reclamation proposes to limit Project-related daily flow increases to no more than 100% of the previous day's discharge. It is not possible to estimate how frequently such increases in discharge might occur, but it is unlikely that such large changes in discharge would occur unless required to return Emigrant Reservoir to the specified rule curve elevation. It should be noted that due to water storage within the stream, discharge changes that are very rapid at the dam would be continuously reduced downstream. That is, if discharge was increased by 100% at the dam instantly and caused the water level to increase by one foot immediately below the dam, the rapidity of that increase would decrease as the water moved downstream, reducing its effects on aquatic biota.

Fry and juvenile fish would likely be displaced by such increases in discharge and such displacement could reduce survival. However, in estimating the effects of the proposed action, we compare conditions under the proposed action to those that would be likely to occur absent that action. Because Emigrant Reservoir greatly attenuates flood flows and the frequency of rapid flow increases during the storage season, we consider it unlikely that operations under the proposed 100% daily increase in discharge would have a greater effect on fry and juvenile survival than would conditions absent the Project. We therefore conclude that upramping operations under the proposed action would have little if any adverse effect on SONCC coho salmon.

*Downramping:* Reclamation proposes to limit Project-related daily flow reductions to no more than 50% of the previous day's discharge. To be conservative, we assume that such changes could occur instantaneously. Rapid downramping has the potential to entrap and strand fish, particularly fry and juvenile fish. The potential for adverse effects is somewhat reduced by the fact that streamflows during the storage season are generally well above the critical flow for this stream reach, meaning that the surface area of the stream does not change rapidly with changes in discharge. Based on the hydrologic responses observed in nearby streams, absent the Project it is unlikely that streamflows would decrease at rates of 50% per day. Thus, we conclude that when flows are above the critical flow, the proposed operations would likely have small adverse effects on SONCC coho salmon. At flows below the critical flow, such operations would likely have substantial adverse effects on SONCC coho salmon, potentially including disruption of spawning behavior and entrapment and stranding of fry and juveniles. If such operations occurred during, or shortly after, fry swim-up (March, April) the effects could be severe in this reach.

Again, it should be noted that storage season operations are constrained by flood control criteria, established by the Corps. As such, flood control operations are not discretionary. Hence, Reclamation's proposal considers what is likely doable within its flood control obligations.

<u>Irrigation Season:</u>
Reclamation proposes to operate Emigrant Dam during the irrigation season such that discharge changes, both increasing and decreasing, would not result in downstream water level changes of more than two inches per hour. This is considered a fairly protective limit on ramping rates (Hunter 1992). Based on observed past operations of the Project, we anticipate that such flow fluctuations would likely occur daily during the irrigation season. Reclamation's hydrologic analysis suggests that in the without Reclamation scenario, streamflows during July and August

would often approach zero, limiting the habitat available to rearing fry and juveniles. Further, Reclamation is proposing to install habitat structures to increase juvenile habitat in this stream reach. Thus, operations within the proposed two-inch per hour ramping criteria would pose small risks to juvenile coho salmon survival that would be more than offset by providing perennial flows and habitat improvements.

**Bear Creek Downstream from Oak Street Diversion**

The Oak Street diversion would only be operated during the irrigation season (~May through October). Ramping during the storage season would be controlled at Emigrant Dam. Those effects are discussed above. Due to the attenuation of discharge pulses provided by channel storage and the influence of tributaries unaffected by the Project between Emigrant Dam and this stream reach, the rate of stream surface area change caused by changing discharge at Emigrant Dam would be greatly attenuated and the likely biological effects would be small to negligible under the proposed storage season ramping rate criteria.

Irrigation Season:
*Upramping:* Reclamation proposes to provide an upramping rate of 5 cfs per hour whenever flows are at or below the critical flow of 20 cfs at the BASO Hydromet station. This is a highly protective upramping rate, below that typically seen in nearby natural streams during this time of year. We anticipate that due to changing water demands throughout the irrigation season, upramping is likely to occur more often under the proposed action than would occur absent the Project (summer flows typically display a long recession to base flows, with only occasional spikes caused by precipitation events). However, because we anticipate that each upramping event would have negligible effects on SONCC coho salmon, we conclude that operations under this criterion would have negligible adverse effects on SONCC coho salmon survival.

When flows at the BASO Hydromet station are between 20 and 70 cfs, Reclamation proposes to limit upramping rates to 10 cfs per hour. Such ramping rates are much lower than those typically seen in nearby streams unaffected by the Project. We therefore conclude that operations under this criterion would not adversely affect SONCC coho salmon. At flows in excess of 70 cfs at the BASO Hydromet station, Reclamation proposes to operate the Oak Street diversion such that upramping rates would be limited to 20 cfs per hour. This approximates increasing flow rates typically seen in nearby rivers. We therefore conclude that upramping operations under this criterion would not adversely affect SONCC coho salmon.

*Downramping:* Reclamation proposes to provide a maximum downramping rate of two inches per hour by limiting changes in the diversion rate to 5 cfs per hour whenever flows are at or below the critical flow of 20 cfs at the BASO Hydromet station. This is a fairly protective downramping rate. Operations under this criterion are likely to have only small adverse effects on juvenile SONCC coho salmon. We anticipate that due to changing water demands throughout the irrigation season, downramping is likely to occur more often under the proposed action than would occur absent the Project (summer flows typically display a long, slow recession to base flows, with only occasional spikes caused by precipitation events). Because we anticipate that each downramping event would have small to negligible effects on SONCC coho salmon, we conclude that long-term operations under this criterion would have small adverse effects on

SONCC coho salmon survival in this reach. When flows at the BASO Hydromet station are between 20 and 70 cfs, Reclamation proposes to limit downramping rates to two inches per hour by limiting changes in the diversion rate to 10 cfs per hour. As 20 cfs is the critical flow for this stream reach, discharge reductions are predicted to have only minor effects on the surface area of the stream and the potential for entrapment and stranding. Even so, the operations under this proposed criterion would further reduce this potential. We therefore conclude that operations under this criterion would not adversely affect SONCC coho salmon.

At flows in excess of 70 cfs at the BASO Hydromet station, Reclamation proposes to operate the Oak Street diversion such that downramping rates would be limited to two inches per hour by limiting changes in the diversion rate to no more than 20 cfs per hour. Such streamflow conditions are well above the critical flow, indicating a low potential for entrapment and stranding. Even so, the operations under this proposed criterion would further reduce this potential. We therefore conclude that operations under this criterion would not adversely affect SONCC coho salmon.

**Bear Creek Downstream from Phoenix Diversion**

The Phoenix diversion would only be operated during the irrigation season (~May through October). Ramping during the storage season would be controlled at Emigrant Dam. Those effects are discussed above. Due to the attenuation of discharge pulses provided by channel storage and the influence of tributaries unaffected by the Project between Emigrant Dam and this stream reach, the rate of stream surface area change caused by changing discharge at Emigrant Dam would be greatly attenuated and the likely biological effects would be small to negligible under the proposed storage season ramping rate criteria.

<u>Irrigation Season:</u>
*Upramping:* Reclamation proposes to provide an upramping rate of five cfs per hour whenever flows are at or below the critical flow of 20 cfs at the BCTO Hydromet station. This is a highly protective upramping rate, below that typically seen in nearby natural streams during this time of year. We anticipate that due to changing water demands throughout the irrigation season, upramping is likely to occur more often under the proposed action than would occur absent the Project (summer flows typically display a long recession to base flows, with only occasional spikes caused by precipitation events). However, because we anticipate that each upramping event would have negligible effects on SONCC coho salmon, we conclude that operations under this criterion would have negligible effects on SONCC coho salmon survival.

When flows at the BCTO Hydromet station are between 20 and 80 cfs, Reclamation proposes to limit upramping rates to 10 cfs per hour. Such ramping rates are much lower than those typically seen in nearby streams unaffected by the Project. We therefore conclude that operations under this criterion would not adversely affect SONCC coho salmon. At flows in excess of 80 cfs at the BCTO Hydromet station, Reclamation proposes to operate the Oak Street diversion such that upramping rates would be limited to 20 cfs per hour. This approximates increasing flow rates typically seen in nearby rivers. We therefore conclude that upramping operations under this criterion would not adversely affect SONCC coho salmon.

*Downramping:* Reclamation proposes to provide a maximum downramping rate of two inches per hour by limiting changes in the diversion rate to 5 cfs per hour whenever flows are at or below the critical flow of 20 cfs at the BCTO Hydromet station. This is a fairly protective downramping rate. Operations under this criterion are likely to have only small adverse effects on juvenile SONCC coho salmon. We anticipate that due to changing water demands throughout the irrigation season, downramping is likely to occur more often under the proposed action than would occur absent the Project (summer flows typically display a long, slow recession to base flows, with only occasional spikes caused by precipitation events). Because we anticipate that each downramping event would have small to negligible effects on SONCC coho salmon, we conclude that long-term operations under this criterion would have small adverse effects on SONCC coho salmon survival in this reach.

When flows at the BCTO Hydromet station are between 20 and 80 cfs, Reclamation proposes to limit downramping rates to two inches per hour by limiting changes in the diversion rate to 10 cfs per hour. As 20 cfs is the critical flow for this stream reach, discharge reductions are expected to have only minor effects on the surface area of the stream and the potential for entrapment and stranding. Even so, the operations under this proposed criterion would further reduce this potential. We therefore conclude that operations under this criterion would not adversely affect SONCC coho salmon. At flows in excess of 80 cfs at the BCTO Hydromet station, Reclamation proposes to operate the Oak Street diversion such that downramping rates would be limited to two inches per hour by limiting changes in the diversion rate to no more than 20 cfs per hour. Such streamflow conditions are well above the critical flow, indicating a low potential for entrapment and stranding. Even so, the operations under this proposed criterion would further reduce this potential. We therefore conclude that operations under this criterion would not adversely affect SONCC coho salmon.

**SF Little Butte Creek Downstream from the Headwater Collection System**

Reclamation has not proposed specific ramping rates for its water collection system in the SF Little Butte Creek headwaters. Operation of this water collection system affects streamflows downstream from the diversions located in Conde Creek, Dead Indian Creek, Beaver Dam Creek, Daley Creek, Pole Bridge Creek, and the Upper SF Little Butte Creek. The diversions have aggregate effects on South Fork Little Butte Creek. The headwater diversions have a combined capacity of 216 cfs (130 cfs Deadwood tunnel and 86 cfs Dead Indian canal). Available data shows that the headwater collection system has historically been operated year-round with the highest rates of diversion occurring during the winter and spring, with very low rates of diversion during the summer and fall (~ 5cfs). This operation likely corresponds to storage limits at Project reservoirs during the flood control season and the availability of water for diversion. Because proposed operations are not well-defined in the biological assessment, we assume that operations under the proposed action would closely resemble historical operations.

By operating the headwater collection system primarily when water is abundant, the effects on streamflows and flow-related fish habitats are reduced. However, the primary collection season (roughly January through May) coincides with SONCC coho salmon juvenile rearing, egg incubation, and fry emergence. Discharge fluctuations caused by operation of the headwater collection system could adversely affect each of these life-stages. Because these operations are not well defined, we assume that flow fluctuations downstream from the headwater collection system could be severe and could therefore have adverse effects on juvenile and fry SONCC coho salmon in this reach.

**Antelope Creek Downstream from the Collection System and Dry Creek Below Agate Dam**

Reclamation has not proposed specific ramping rates for its water collection system in Antelope Creek or for Agate Dam on Dry Creek. Operation of these facilities affects streamflows in Antelope Creek and Dry Creek. An estimated 1,400 acre-feet is diverted annually from Antelope Creek. Agate Dam and Reservoir has a total capacity of 4,780 acre-feet and an active capacity of 4,670 acre-feet.

The proposed operations are not well-defined in the 2012 BA, requiring NMFS to assume that operations under the proposed action would resemble operations at other facilities. By operating the facilities primarily when water is abundant, the effects on streamflows and flow-related fish habitats are reduced. However, the primary collection season (roughly January through May) coincides with SONCC coho salmon juvenile rearing, egg incubation, and fry emergence. Discharge fluctuations that would be caused by operation of the facilities could adversely affect each of these life-stages. Because these operations are not well defined, we assume that flow fluctuations downstream from the headwater collection system could be severe and could therefore have adverse effects on juvenile and fry SONCC coho salmon in this reach.

#### 2.5.2.4 Construction-Related Effects

Construction related effects will occur from implementing the fish passage improvements and large wood installations. Because the construction activities will occur during the ODFW in-water work window (June 15 to September 15), juveniles are the only SONCC coho salmon life stage exposed to the short-term effects. The long-term consequences (up to 30 years) related to the reduction of streamside vegetation will expose all life stages to stressors such as reductions in forage, in-stream structure/cover, and shade (water temperature).

**Salvage Operations:** Fish salvage will occur after work area isolation at the Oak Street and Ashland Creek diversion sites. Although fish salvage is a conservation measure intended to reduce adverse effects from the proposed action, it will expose fish to stress and injury during capture and transfer. Capturing and transferring fish causes physiological stress, although overall effects of the procedure are generally short-term if appropriate precautions are exercised. The primary factors controlling the likelihood of stress and death from handling are water temperature (higher temperatures produce more stress on salmonids), differences in water temperatures (between the stream and transfer containers), low dissolved oxygen concentrations, the amount of time that fish are held out of the water, the water quality conditions within the isolated work area, and the extent of physical trauma.

Little data exists on densities of SONCC coho salmon juveniles in Bear Creek and no data exists for Ashland Creek. What is available for Bear Creek is documented in Oregon Department of Transportation (ODOT) salvage reports. Over the last eight years, ODOT has salvaged fish from isolation areas eleven times.[8] One of these salvage operations isolated approximately 600 square feet and captured four SONCC coho salmon. No other salvage captured SONCC coho salmon. Because it represents the worst case scenario and the likely maximum number of affected individuals, NMFS assumes the densities encountered in the one salvage that caught SONCC coho salmon are applicable to the two salvages in the proposed action.

The proposed cofferdams will disturb 3,400 square feet of Bear Creek and 3,400 feet of Ashland Creek. Based on the density found in the one salvage operation, up to 23 juvenile SONCC coho salmon may be present in each isolation area. During salvage, NMFS is reasonably certain that Reclamation will not be able to capture approximately 5% (one individual) of the SONCC coho salmon in each isolated work area. These fish will die as the isolation areas are dewatered. Of the fish captured and transferred, NMFS is reasonably certain a mortality rate of 5% (*i.e*., one individual in each isolation area) will occur due to stress (from high water temperatures and low dissolved oxygen) and injuries (NMFS 2000). Thus, the two isolation operations will capture and increase the likelihood of injury of up to 46 SONCC coho salmon juveniles and kill up to 4 of them.

**Suspended Sediment:** The construction and deconstruction of coffer dams and installation of large wood are reasonably certain to cause some increase in sedimentation. Chronic exposure to elevated suspended sediment levels can cause physiological stress responses that can increase maintenance energy and reduce feeding and growth (Lloyd 1987, Servizi and Martens 1991). However, of key importance in considering the detrimental effects of suspended sediment on SONCC coho salmon are the frequency and duration of the exposure, as well as the suspended sediment concentration. Increases in suspended sediment at a concentration of 53.5 milligrams per liter (mg/L) for a 12-hour period caused physiological stress and changes in behavior in coho salmon (Berg 1983). An increase in suspended sediment concentrations as low as 17 mg/L can result in increases of gill inflammation and can lead to respiratory stress, when juvenile coho salmon are exposed for periods of time as short as 4 hours (Berg and Northcote 1985). It is unlikely that suspended sediment concentrations generated from cofferdam construction and deconstruction will exceed the 53.5 mg/L threshold for physiological stress and changes in behavior. It is extremely unlikely that a sediment plume will exist for 12 hours because in-stream construction and deconstruction activities are unlikely to last longer than eight hours. Furthermore, salmonids have been observed to move laterally and downstream to avoid sediment plumes (McLeay *et al.* 1984, 1987, Sigler *et al.* 1984, Lloyd 1987, Scannell 1988, Servizi and Martens 1992). No prohibitions to this movement are present in this portion of Bear Creek, nor are there any factors (increased competition or predation) that would decrease juvenile survival if they temporarily move.

Therefore, while some SONCC coho salmon juveniles may be exposed during cofferdam installation and deconstruction and large wood installation, the intensity, duration, and extent of suspended sediment plumes will be so small that any resulting effect will be nonexistent or so mild that it could not be meaningfully measured, detected, or evaluated. Therefore, suspended sediment plumes are not likely to injure or kill juvenile SONCC coho salmon.

[8] E-mail from Tom Loynes, ODOT, to Chuck Wheeler, NMFS (December 9, 2011) (table of salvage actions in Bear Creek since 2003).

**Chemical Contaminants:** Petroleum-based contaminants, such as fuel, oil, and some hydraulic fluids, contain polycyclic aromatic hydrocarbons (PAHs) which can kill salmonid fish at high levels of exposure and can also cause lethal and sublethal adverse effects to aquatic organisms (Neff 1985). Because a large spill is unlikely to occur and the intensity and duration of any resulting effect from small leaks would be so mild that the effect could not be meaningfully measured, detected, or evaluated in the environment, any resulting effect to SONCC coho salmon will also be immeasurable or undetectable. Furthermore, the applicant will salvage fish from the cofferdam isolation areas prior to commencing work. Due to best management practices, NMFS is reasonably certain juvenile SONCC coho salmon will not be injured or killed by chemical contaminants.

**Temporary Fish Passage Blockage:** The two fish passage improvements require cofferdams to isolate the work area. While the cofferdams are in place, they will not allow passage. Juveniles are the only life stage of SONCC coho salmon potentially present during the work window. The cofferdams will block juveniles from moving for up to seven weeks. This will occur once at each site.

Due to high water temperatures during the summer, rearing juvenile SONCC coho salmon either find thermal refugia in Bear Creek or migrate from the mainstem. Juveniles that migrate from Bear Creek likely begin the emigration prior to the in-water work period. On average, Bear Creek exceeds the Oregon Department of Environmental Quality (ODEQ) temperature standard by June 2 at Jackson Street and by May 25 at the mouth. Juveniles near the construction sites may or may not decide to migrate during the seven weeks upstream migration is blocked. If they do decide to migrate they may decide to move downstream to Bear Creek tributaries, other thermal refugia in the mainstem, or to the Rogue River. Therefore, NMFS is reasonably certain temporary passage will only injure or kill a small number of juvenile SONCC coho salmon.

**Riparian Vegetation Removal:** Riparian vegetation removal will reduce the availability of in-stream forage (macroinvertebrates) for SONCC coho salmon. In addition, adjacent riparian zones supply terrestrial insects that fall into the water. Fewer riparian plants, such as brush or trees, result in fewer terrestrial insects being available for juvenile coho salmon. Small scale temperature increases and channel complexity decreases are also likely. Insufficient information is available to quantify the loss of forage, loss of cover for juvenile coho salmon, or potential for stream temperature. However, this action is reasonably certain to have some level of adverse effect on SONCC coho salmon near the fish passage improvement and large wood installation sites.

#### 2.5.2.5 Fish Passage

Diversion structure improvements: The Oak Street diversion dam and fish passage facility has been plagued with issues for several years, including poor flow attraction, sediment build-up, and debris clogging. Fish passage occurs, but is not efficient. The Ashland Creek diversion dam does not have a passage structure and the head gate does not have a screen. Upstream passage of juvenile SONCC coho salmon is always impaired, adult passage is impaired at lower flows. Juveniles are also lost into the canal where they likely perish.

Fixing these passage problems will result in a significant reduction in the number of juvenile SONCC coho salmon injured or killed and the number of adults delayed in their migration. Fewer juveniles will be entrained and lost into the Ashland canal. Juvenile survival will be enhanced because they will be able to migrate past these sites when downstream temperatures become too warm. Adult spawning success will be improved due to reduced energy required to pass these sites.

<u>Optimum flows for adult passage</u>: Reclamation (2007), as part of an in-stream flow study, made estimates of the flows needed to meet adult coho salmon passage needs. A range of flows through the site was modeled for each transect to determine the flow at which at least 25 percent of the transect had a minimum depth of at least 0.6 feet with at least one continuous portion meeting that criteria equal to at least 10 percent of the total width.

The proposed action provides the required flows for adult passage in Bear Creek and Little Butte Creek in the same months and flow conditions as the without Reclamation scenario. There are times, particularly in October and November, where the proposed action provides the required flow when the without Reclamation scenario would not.

The proposed action flows adversely affect adult passage conditions in Emigrant Creek and SF Little Butte Creek. In Emigrant Creek, the without Reclamation scenario provides adequate flows under wet conditions in December and January, and under median flow conditions in January. The proposed action only provides adequate flows for adult passage under wet conditions in December. In SF Little Butte Creek, the proposed action and without Reclamation scenarios both provide adequate passage in December and January under median and wet conditions. The without Reclamation scenario provides passage during November under wet conditions and January under dry conditions. The proposed action provides neither.

It is difficult for NMFS to determine the severity of these effects. These flow levels were identified as optimal, which implies that passage can occur at lower flows. The modeled flows are monthly static values. In reality, stream flow is highly variable during the winter months. It is quite likely that precipitation events will raise flows over the identified target for short periods of time each winter, allowing some passage to occur. Reclamation also concluded that safe passage conditions can be improved by the proposed action due to the planned placement of large wood structures when designed to eliminate hydraulic constriction points in the channel (2012 BA, page 211). In Emigrant Creek for example, Reclamation has identified the hydraulic control that currently restricts adult passage at flows under 31 cfs.  However, they will focus LWD structure design and placement to improve passage conditions at this location (2012 BA, page 211).

When all of these factors are considered together, NMFS is reasonably certain that while some individuals will be injured, killed, or delayed, the overall effects to the number of spawners will be small.

#### 2.5.2.6 Riparian Zone Restoration

Riparian vegetation restoration will increase the availability of forage for SONCC coho salmon from both aquatic and terrestrial invertebrates. Stream temperature decreases will benefit juveniles in two ways. The extent of uninhabitable area will be reduced and the duration of uninhabitable temperatures will be reduced. Both of these will result in significant increases in the amount of summer rearing habitat available for SONCC coho salmon use. Channel complexity increases are also likely, though they may take a few decades.

The proposed riparian improvement effort will increase stream shade and provide cover and forage. The benefits from trees, such as shade, will take years to reach full potential. Insufficient information is available to quantify the benefits to rearing juveniles. However, this action will have a positive effect on juvenile SONCC coho salmon survival near the planting reaches.

#### 2.5.2.7 Summary of Effects to SONCC Coho Salmon

Seven effect pathways are likely to result in injury or death of SONCC coho salmon. Reduction of stream flow and resulting available habitat compared to the without reclamation scenario will reduce juvenile survival rates. These effects will be minimal in all reaches except the LBCO reach of Little Butte Creek. Loss of flow over redds is likely to injure or kill a low number of incubating eggs. Ramping rate procedures will kill or injure a small number of juveniles in Emigrant Creek and Bear Creek, and a moderate amount in SF Little Butte Creek, Antelope Creek, and Dry Creek. The construction-related effect of riparian vegetation removal is likely to reduce survival of rearing juveniles. The construction-related effect of isolation operations will increase the likelihood of injury of up to 46 SONCC coho salmon juveniles and kill up to 4 of them. Temporary fish passage blockages will injure or kill a small number of juveniles. Reducing optimum flows for adult passage will injure, kill, or delay a small number of adults.

Four effect pathways are likely to result in benefits to SONCC coho salmon. Increases in available habitat during summer from increased in-stream flow are likely to increase juvenile survival rates. Large wood additions will increase WUA, which will also increase juvenile survival rates. Benefits from riparian zone restoration may take a few years before they begin to accrue, but will have long-term benefits on coho salmon survival rates. Fish passage improvements will result in a significant reduction in the number of juvenile SONCC coho salmon injured or killed and the number of adults delayed in their migration. Riparian zone restoration will benefit juvenile survival rates.

Compared to the without Reclamation scenario, the combined effects of the proposed action in the Rogue Basin combined will have a small adverse effect on the URR population of SONCC coho salmon. However, the proposed action will improve coho salmon habitat quantity and quality from those currently present in the environmental baseline. These improvements are the result of minimum in-stream flows, fish passage improvements, ramping rate procedures, and in-stream and riparian restoration. The proposed action's in-stream and riparian habitat improvement actions combined with ramping rate limitations, fish passage improvements, and minimum in-stream flow will likely result in synergistic improvements in the environmental conditions of the Bear Creek and Little Butte Creek watersheds and consequently to those sub-populations of SONCC coho salmon. Benefits to habitat conditions, most importantly winter and summer rearing habitat, will begin to accrue in the short-term and persist in the long-term.

**Limiting Factors**

NMFS identified the factors limiting production in Section 2.2. For the URR population, they are altered hydrologic function, degraded riparian forest conditions, impaired water quality, lack of floodplain and channel structure, and barriers. The limiting factors for the Klamath River populations are barriers, impaired water quality, and altered hydrologic function.

URR population: Compared to the without Reclamation scenario, flow management will alter hydrologic function, resulting in slight negative effects and slight positive effects. The negative effects are mostly during the storage season months in Emigrant Creek and SF Little Butte Creek. The positive effects are mainly during the summer in Emigrant Creek and upper Bear Creek. Added together, all the effects to hydrologic functions are slightly negative. However, with the incorporation of large wood additions, NMFS is reasonably certain that meeting 90% of without reclamation WUA during median and wet conditions will provide a wide range of habitat quality and quantity such that this population can survive and grow. NMFS is also reasonably certain that providing 80% of without reclamation WUA during dry conditions will allow this population to survive. When added to current environmental conditions, the proposed action will improve hydrologic function.

The proposed action will degrade riparian forest conditions through the construction-related activities. For each of these actions, Reclamation will replant the disturbed area (total area of 1.45 acres), but full recovery will likely take up to 30 years. In addition, Reclamation will implement a planting plan to restore 18 acres of riparian vegetation. It, too, will take up to 30 years for full benefits to be realized. For net effects, the proposed action will slightly degrade riparian forest conditions for the first decade or two and moderately improve them thereafter.

All effects to water quality will be short term. Construction activities related to large wood additions and fish passage improvements will cause short term suspended sediment plumes. These short effects will not impact population abundance, productivity, spatial structure, or diversity.

The flow management of the proposed action will affect the lack of floodplain and channel structure through changes in available habitat. Those effects were discussed under altered hydrologic functions. The proposed action will improve floodplain channel structure through large wood additions and riparian restoration.

The proposed action will moderately reduce fish passage barriers by fixing the Oak Street diversion dam, Ashland Creek diversion dam, and Ashland Creek canal screen. It will, however, cause adverse impacts from low flows during adult upstream migration. The adverse impacts are unlikely to affect enough spawners to be measurable on population-level parameters because Reclamation will focus the large wood additions to eliminate the passage limitations. There will be short-term passage blockages during the construction of the diversion dam fish passage improvements.

Klamath River populations: The proposed action will not affect barriers within the Klamath River. Reclamation found the proposed action would not appreciably affect water temperature, which is the only pathway to affect water quality. The proposed action will reduce the amount of water in the Klamath basin, but the magnitude of the changes falls within predicted model error. Therefore the proposed action it is unlikely to affect the limiting factor of altered hydrologic functions.

**Population Viability Criteria**

The URR population is at a moderate risk of extinction, the three Klamath River populations are at a high risk of extinction. After adding all the positive and negative effects of the proposed action together, NMFS concludes that the proposed action will injure or kill only a small number of SONCC coho salmon per year. The effects from flow management will be offset by benefits from large wood additions and riparian vegetation planting. The negative effects to upstream adult passage will be relieved by focused large wood additions and offset by barrier removals. Negative effects from redd de-watering in Emigrant Creek and June flow reductions in the LBCO reach are spatially limited. All other effects are mild. This amount of injury and death will not meaningfully change SONCC coho salmon abundance, productivity, distribution, or diversity on a population scale for any of the affected populations.

Furthermore, the proposed action will improve coho salmon habitat quantity and quality from those currently present in the environmental baseline. The proposed action's in-stream and riparian habitat improvement actions combined with ramping rate limitations, fish passage improvements, and minimum in-stream flow will likely result in synergistic improvements in the environmental conditions of the Bear Creek and Little Butte Creek watersheds and consequent improvements in abundance of those sub-populations of SONCC coho salmon. Therefore, NMFS concludes that the proposed action will have no measurable adverse effects on any of the population viability criteria. In fact, the proposed action is likely to allow improvement in the viability of the URR population due to the improvements from baseline conditions.

**Recovery**

The proposed action will improve coho salmon habitat quantity and quality from those currently present in the environmental baseline. It will reduce the effect of limiting factors in the Bear Creek and Little Butte Creek drainages, and allow improved viability of the URR population. The benefits from minimum in-stream flows will commence immediately. The benefits from large wood additions, riparian zone restoration, and improved fish passage will take a few years to begin, but will accelerate over time.

The resulting increase in spawner density and abundance will allow the URR population to grow in abundance and productivity. As a core population, the URR population's role in recovery of the ESU is to meet spawner abundance targets and be a source population for adjacent populations. As it grows, this population will be better capable of meeting these objectives. Therefore, the proposed action will provide for recovery.

### 2.5.3 Critical Habitat Within the Action Area

This analysis focuses on effects to SONCC coho salmon critical habitat in the Bear Creek (HUC 1710030801), Little Butte Creek (HUC 1710030708), Klamath River-Bogus Creek (HUC 1801020606), Klamath River-Humbug Creek (HUC 1801020608), and Klamath River-Horse Creek (HUC 1801020610) $5^{th}$ field watersheds. These critical habitat units provide juvenile migration and rearing and adult migration and spawning.

#### 2.5.3.1 Bear Creek $5^{th}$ Field Watershed

Elements of the proposed action occurring in the Bear Creek watershed include; O&M of the Federal Project facilities, minimum in-stream flow requirements, large wood additions, ramping rate procedures, modifications of structures to improve fish passage, and riparian zone restoration. Although coho salmon distribution in Emigrant Creek is limited to below the private Bounds Reservoir, critical habitat is designated to the base of Emigrant Dam. The likely effects of the action on physical and biological features for these life history stages are:

1. <u>Cover/Shelter (migration and rearing)</u>. Removal of riparian vegetation to provide worksite access during construction of the fish passage improvements and large wood installations is likely to reduce some available cover. Not all riparian vegetation serves as cover for coho salmon. Preferred cover is in-water woody debris or overhanging vegetation immediately adjacent to the water. The losses will be temporary, lasting until site vegetation recovers (5 – 30 years). The effects from the riparian planting plan and the resulting increased WUA from large wood additions are wholly beneficial on the cover/shelter feature.

   Cover is one of three parameters considered in the IFIM/PHABSIM study (Reclamation 2007). NMFS cannot disaggregate that information to afford a quantitative analysis of the changes in cover independently. However, the analysis of changes in WUA between the proposed action and without Reclamation scenario represents the effects to cover. Therefore, that discussion in the effects to species section can be incorporated here. When decreasing flows, the proposed action will result in the stream wetted area being reduced and reducing cover. Increases in flow, particularly during the summer, would provide a greater wetted width of the channel and increasing cover.

2. <u>Food (juvenile migration and rearing)</u>. Approximately 0.15 acres of substrate will be disturbed by the coffer dams, temporarily disrupting forage production from this area. In addition to the isolation areas, the loss of riparian vegetation leads to reduced food available to juvenile SONCC coho salmon. Riparian vegetation removal will affect availability of nutrients in the stream by reducing plant material entering the stream, which can reduce the availability of in-stream forage (macroinvertebrates) for SONCC coho salmon. In addition to in-stream forage loss, adjacent riparian zones supply terrestrial insects that fall into the water. Fewer riparian plants, such as brush or trees, result in fewer terrestrial insects being available for juvenile coho salmon. These effects are adverse, but at a small local scale. The effects from the 18 acres of riparian restoration are wholly beneficial on the food feature.

3. Riparian Vegetation (migration and rearing). Approximately 1.45 acres of riparian vegetation will be removed from the fish passage improvement activities and large wood additions. Reclamation will replant each of the construction sites, but full recovery of vegetation will vary from a year, for grasses, to 5 to 30 years for shrubs and trees. The overall result is a loss of some riparian nutrients. Reclamation's proposed riparian zone restoration component will plant approximately 18 additional acres of riparian area, with wholly beneficial effects.

4. Space (migration and rearing). Space, best measured by the amount of available habitat, was discussed at length in the effects to species section. That analysis of changes in WUA between the proposed action and without Reclamation scenario can be incorporated here. When decreasing flows, the proposed action will result in the stream wetted area being reduced and reducing available habitat. Increases in flow, particularly during the summer, would provide a greater wetted width of the channel and increasing available habitat. In that analysis, NMFS found the proposed action would provide enough habitat to allow the Bear Creek sub-population to survive during dry flow conditions, and survive and grow in median and wet flow conditions.

5. Spawning Gravel (spawning and rearing). The proposed erosion control and work area isolation conservation measures are likely to minimize suspended sediment and sedimentation. The construction components of the proposed action are not likely to have an adverse effect on spawning gravel. The proposed action will reduce available spawning habitat in some stream reaches, however it will still provide enough spawning habitat to allow full recovery of the population (see explanation in Section 2.5.2.1).

6. Water Quality (migration and rearing). Water quality will suffer from short-lived, localized degradations due to sediment inputs. These events occur at the time of the coffer dam construction and deconstruction and large wood installation.

7. Water Quantity (migration and rearing). Changes in water quantity between the proposed action and without Reclamation scenarios are reported in Tables 15 through 20. In general, the proposed action increases water quantity in the summer and fall and decreases it in the winter and spring. The effects to conservation value of critical habitat due to changes in water quantity are better described by the changes in available habitat. See discussion under the space feature for effects from available habitat.

8. Safe Passage (migration). Fish passage improvements at Oak Street Diversion and Ashland Creek Diversion will benefit the safe passage feature for juvenile and adult coho salmon. Cofferdams used for construction isolation areas will temporarily block passage at two sites for up to seven weeks. During certain months and flow conditions, the proposed action will not allow optimal upstream adult passage when the without reclamation scenario would. In the effects to the species analysis NMFS was reasonably certain that while some individuals will be injured, killed, or delayed, the overall effects to the number of spawners will not be measurable on population-level parameters (See Section 2.5.2.5). Therefore, after considering the timing, severity, and duration, the safe passage feature will not be measurably affected at the watershed scale.

9. Substrate (migration). NMFS is reasonably certain the proposed action will not change the quality and function of substrates needed for migration.

10. Water Temperature (migration). Reclamation will remove some riparian vegetation to gain access to construction sites but will replant all disturbed areas. Reclamation will also plant 18 additional acres of riparian vegetation implementing the riparian vegetation restoration component. During the juvenile outmigration season (spring) and the adult spawning migration, the proposed action would have little effect on water temperatures. Early migrating adults and late migrating juveniles may be subject to adverse water temperature conditions in the Bear Creek/Emigrant Creek watershed, but those effects appear to be unassociated with the proposed action (Reclamation 2009).

11. Water Velocity (migration). The fish passage and large wood addition elements of the proposed action will improve water velocity near each of the structures. Velocity is one of three parameters considered in the IFIM/PHABSIM study (Reclamation 2007). NMFS cannot disaggregate that information to afford a quantitative analysis of the changes in velocity independently. However, the analysis of changes in WUA between the proposed action and without Reclamation scenario represents the effects to velocity. Therefore, that discussion in the effects to species section can be incorporated here. When decreasing flows, the proposed action will generally result in reducing velocities. Increases in flow, particularly during the summer, will generally increase velocities.

#### 2.5.3.2 Little Butte Creek 5th Field Watershed

Elements of the proposed action occurring in the Little Butte Creek watershed include; O&M of the Federal Project facilities, minimum in-stream flow requirements, and large wood additions. The likely effects of the action on physical and biological features for these life history stages are:

1. Cover/Shelter (migration and rearing). The effects from resulting increased WUA from large wood additions are wholly beneficial on the cover/shelter feature. Cover is one of three parameters considered in the IFIM/PHABSIM study (Reclamation 2007). NMFS cannot disaggregate that information to afford a quantitative analysis of the changes in cover independently. However, the analysis of changes in WUA between the proposed action and without Reclamation scenario represents the effects to cover. Therefore, that discussion in the effects to species section can be incorporated here. When decreasing flows, the proposed action will result in the stream’s wetted area being reduced along with reducing cover.

2. Food (juvenile migration and rearing). NMFS is reasonably certain the proposed action will not change the quality of the food feature in this watershed.

3. Riparian Vegetation (migration and rearing). NMFS is reasonably certain the proposed action will not change the quality and function of the riparian vegetation feature in this watershed.

4. Space (migration and rearing). Space, best measured by the amount of available habitat, was discussed at length in the effects to species discussion. That analysis of changes in WUA between the proposed action and without Reclamation scenario can be incorporated here. When decreasing flows, the proposed action will result in the stream wetted area being reduced and reducing available habitat. Increases in flow, particularly during the summer, would provide a greater wetted width of the channel and increasing available habitat. In that analysis NMFS found the proposed action would provide enough habitat to allow the Little Butte Creek sub-population to survive during dry flow conditions, and survive and grow in most median and wet flow conditions. The one exception was during median flow conditions where the proposed action will only provide 83% of the without Reclamation WUA in the LBCO reach during the month of June. A 17% reduction in habitat was classified by Reclamation as a “moderate detriment.” This moderate reduction in rearing habitat is reasonably likely to result in moderate effects to the space feature in the LBCO reach during June. Furthermore, this reduction gains significance because it occurs throughout a 14-mile reach of stream and during a month important to juvenile rearing. June is the month when stream temperatures begin to exceed preferable levels, triggering some juveniles to migrate to other stream reaches. Therefore, the moderate effects extend temporally and spatially beyond the LBCO reach in June.

5. Spawning Gravel (spawning and rearing). The proposed action will reduce available spawning habitat in some stream reaches, however it will still provide enough spawning habitat to allow full recovery of the population (see explanation in Section 2.5.2.1).

6. Water Quality (migration and rearing). NMFS is reasonably certain the proposed action will not change the water quality feature in this watershed.

7. Water Quantity (migration and rearing). Changes in water quantity between the proposed action and without Reclamation scenarios are reported in Tables 21 through 23. The effects to critical habitat due to changes in water quantity are better described by the changes in available habitat. See discussion under the space feature for effects from available habitat.

8. Safe Passage (migration). During certain months and flow conditions, the proposed action will not allow optimal upstream adult passage when the without reclamation scenario would. In the effects to the species analysis, NMFS was reasonably certain that while some individuals will be injured, killed, or delayed, the overall effects to the number of spawners will not be measurable on population-level parameters (See Section 2.5.2.5). Therefore, after considering the timing, severity, and duration, the safe passage feature will not be measurably affected at the watershed scale.

9. Substrate (migration). NMFS is reasonably certain the proposed action will not change the quality of the substrate feature in this watershed.

10. Water Temperature (migration). During the juvenile outmigration season (spring) and the adult spawning migration, the proposed action would not have measurable effects on water temperatures.

11. Water Velocity (migration). The large wood addition element of the proposed action will improve water velocity near each of the structures. Velocity is one of three parameters considered in the IFIM/PHABSIM study (Reclamation 2007). NMFS cannot disaggregate that information to afford a quantitative analysis of the changes in velocity independently. However, the analysis of changes in WUA between the proposed action and without Reclamation scenario represents the effects to velocity. Therefore, that discussion in the effects to species section can be incorporated here. When decreasing flows, the proposed action will generally result in reducing velocities.

#### 2.5.3.3 Klamath River 5th Field Watersheds

Coho salmon critical habitat is designated in the mainstem of the Klamath River up to the base of IGD. The only element of the proposed action affecting the three Klamath River watersheds is O&M of the Federal Project facilities (diversion of Jenny Creek water to the Rogue River basin). The likely effects of the action on physical and biological features for these life history stages are:

1. Cover/Shelter (migration and rearing). The effects of water diversion from the Klamath River basin above IGD are unlikely to measurably change the width, depth or velocity of the Klamath River below IGD. Therefore, the proposed action is unlikely to affect the cover/shelter feature in the Klamath River watersheds.

2. Food (juvenile migration and rearing). NMFS is reasonably certain the proposed action will not change the quality of the food feature in these watersheds.

3. Riparian Vegetation (migration and rearing). The proposed action will not change the quality and function of riparian vegetation in these watersheds.

4. Space (migration and rearing). The effects of water diversion from the Klamath River basin above IGD are unlikely to measurably change the width, depth or velocity of the Klamath River below IGD. Therefore, the proposed action is unlikely to affect the space feature in the Klamath River watersheds.

5. Spawning Gravel (spawning and rearing). The proposed action will not change the quality and function of riparian vegetation in these watersheds.

6. Water Quality (migration and rearing). The proposed action will not water quality in these watersheds.

7. Water Quantity (migration and rearing). The total water balance at the base of IGD will be reduced by 1.3% (2012 BA, page 203). The effects to critical habitat due to changes in

water quantity are better described by the changes in available habitat. See discussion under the space feature for effects from available habitat.

8. Safe Passage (migration). NMFS is reasonably certain the proposed action will not change fish passage in these watersheds.

9. Substrate (migration). The proposed action will not change the quality and function of substrate  in these watersheds.

10. Water Temperature (migration). The proposed action will not change water temperature in these watersheds.

11. Water Velocity (migration). The effects of water diversion from the Klamath River basin above IGD are unlikely to measurably change the width, depth or velocity of the Klamath River below IGD. Therefore, the proposed action is unlikely to affect water velocity in the Klamath River watersheds.

#### 2.5.3.4 Summary of Effects to Critical Habitat

In the Bear Creek watershed, minimum flow requirements and large wood additions will result in amounts of available habitat sufficient to allow the population to survive and grow. Thus, the effects to the space, water quantity, water velocity and cover/shelter physical and biological features are small. Some short term effects to critical habitat physical and biological features will occur from construction related activities. One long term effect from construction, riparian vegetation removal, will be offset with long term benefits from replanting the disturbed areas and restoring an additional 18 acres. The effects from fish passage improvement are beneficial but offset from reducing upstream passage due to lower flows. All other effects to physical and biological features are small.

In the Little Butte Creek watershed, minimum flow requirements and large wood additions will result in amounts of available habitat sufficient to allow the population to survive and grow in SF Little Butte Creek and the LBEO reach of Little Butte Creek. Thus, the effects to the space, water quantity, water velocity and cover/shelter Physical and biological features are small. Effects will be moderate in the LBCO reach of Little Butte Creek because of water use in June during median flow conditions. All other effects to Physical and biological features are small.

In the Klamath River basin, effects on the cover/shelter, space, water quantity, and water velocity Physical and biological features are unlikely. The proposed action will not affect any other physical and biological features.

Each fifth-field HUC in the SONCC coho salmon ESU is important to the population or populations it supports and the likelihood of promoting species conservation across the entire SONCC coho salmon critical habitat designation area. Impacts at the fifth-field watershed level affect the range-wide conservation value of SONCC coho salmon critical habitat. The effects of the proposed action were not determined to further degrade the physical and biological features limiting the conservation value of any affected 5th-field watershed. Therefore, the effects of the proposed action will not impair the ability of the range-wide designation of critical habitat to play its intended conservation role for SONCC coho salmon.

## 2.6 Synthesis and Integration of Effects

### 2.6.1 Species

NMFS found the proposed action is not likely to adversely affect any populations except the URR population. As a core population, the URR population's role in recovery of the ESU is to meet spawner abundance targets and be a source population for adjacent populations. The status of the ESU is poor with many populations at a high risk of extinction. The URR population has declined in response to habitat degradation from many causes including dams, water diversions, floodplain development, stream channelization, and riparian forest removal. Despite these effects, the URR population is one of the five independent populations of SONCC coho salmon only moderately at risk of extinction. Effects from climate change will increase over the next 50 years. Effects from human population will also continue to increase into the future as growth expands the need for new development. All non-Federal water diversions unassociated with the Project are also likely to continue.

Compared to the without Reclamation scenario, the water management effects of the proposed action in the Rogue Basin combined will have a small adverse effect on the URR population of SONCC coho salmon. Implementing the water management elements of the proposed action has some adverse effects on all individuals of the Little Butte Creek and Bear Creek sub-populations of the URR population of SONCC coho salmon by reducing available summer and winter rearing habitat, causing some adult migration challenges, and losing flow over redds.

However, the proposed action will improve coho salmon habitat quantity and quality from those currently present in the environmental baseline. These improvements are the result of minimum flow requirements, fish passage improvements, ramping rate procedures, and in-stream and riparian restoration. The proposed action's in-stream and riparian habitat improvement actions combined with ramping rate limitations, fish passage improvements, and minimum in-stream flow will likely result in synergistic improvements in the environmental conditions of the Bear Creek and Little Butte Creek watersheds and consequently to those sub-populations of SONCC coho salmon. Benefits to habitat conditions, most importantly winter and summer rearing habitat, will begin to accrue in the short-term and persist in the long-term. The proposed action is likely to allow an increasing spawner density and abundance by reducing limiting factors related to summer and winter rearing present in the Bear Creek and Little Butte Creek watersheds. As their viability improves, these sub-populations will contribute to the population recovery goals for the URR population.

Riparian vegetation restoration increases shade, improves conditions in the watersheds for the long term, and will increase coho salmon juvenile summer rearing habitat by extending the stream reaches with suitable rearing temperatures. Despite climate change, the current degraded condition of the riparian plant community (lack of shade) will be improved with this proposed action to benefit water temperature and likely aid in reducing the predicted adverse effect of climate change on stream temperature by providing more shade than exists with baseline conditions.

Cumulative effects of all non-Federal water diversion not related or dependent upon Project facilities are not measurable outside of the irrigation season (October 15 to April 1). During the irrigation season, the effects from this non-Federal diversion are low early in the season (April and May). Starting in June, the effects of all non-Federal water diversions grow larger, but during this period of year the proposed action increases stream flow compared to the without Reclamation scenario by releasing storage water. Thus, the proposed action lessens the negative effects of this non-Federal diversion.

When considering future activities described in the cumulative effects section, combined with the predicted environmental changes due to climate change (altered hydrologic patterns and warmer stream temperatures), and the beneficial impacts to coho salmon habitat conditions afforded by the proposed action, NMFS concludes the URR population will increase in abundance and productivity. Because, the URR population is a core independent population in the Interior Rogue River strata, as it grows it will provide strays to other populations. Thus, over time, the proposed action will allow the URR population to fulfill its role in the recovery of the SONCC coho salmon ESU. All other populations affected by the proposed action will not likely be adversely affected. Therefore, NMFS finds that the proposed action, directly and indirectly, is not likely to reduce appreciably the likelihood of both the survival and recovery of the SONCC coho salmon ESU. This finding is insured by the opportunity this proposed action affords for improved salmon habitat conditions into the future.

### 2.6.2 Critical Habitat

The proposed action is not likely to adversely affect any critical habitat units outside of the Bear Creek and Little Butte Creek 5th field watersheds. As we noted in the Status of Critical Habitat section of this opinion, critical habitat in the Bear Creek and Little Butte Creek watersheds has high conservation value. The conservation role of this critical habitat is to support viable populations of SONCC coho salmon that can meet abundance and productivity goals and provide stray spawners to nearby dependent populations.

As described in our effects analysis, the proposed action will affect several physical and biological features of critical habitat within the Bear Creek and Little Butte Creek watersheds, mostly related to the amount of physical habitat available to rearing SONCC coho salmon. The proposed action will also beneficially affect several physical and biological features. The collective effects of the proposed action within the Bear Creek and Little Butte Creek watersheds will have minor and/or short-term adverse effects on designated critical habitat for SONCC coho salmon. Long-term effects will be modest but beneficial. The proposed action’s flow management is likely to reduce habitat that supports juvenile SONCC coho salmon incubation and rearing. However, the proposed action’s minimum flow requirements, combined with large wood additions, fish passage improvements, and ramping rate procedures offset the adverse effects at the watershed scale. When combined with riparian zone restoration, the proposed action will allow the Bear Creek and Little Butte Creek critical habitat units to serve their intended conservation roles.

When considering future activities described in the cumulative effects section, combined with the predicted environmental changes due to climate change (altered hydrologic patterns and warmer stream temperatures), NMFS concludes the ability of the Bear Creek and Little Butte Creek critical habitat units to serve their intended conservation role will improve over time, thereby insuring that this action will not likely destroy or adversely modify this designated critical habitat.

## 2.7 Conclusion

After reviewing the status of SONCC coho salmon and its designated critical habitat, the environmental baseline for the action area, the effects of the proposed action, and cumulative effects, NMFS concludes that the proposed action is not likely to jeopardize the continued existence of SONCC coho salmon and is not likely to destroy or adversely modify designated critical habitats.

## 2.8 Incidental Take Statement

Section 9 of the ESA and Federal regulation pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without a special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by regulation to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. For purposes of this consultation, we interpret "harass" to mean an intentional or negligent action that has the potential to injure an animal or disrupt its normal behaviors to a point where such behaviors are abandoned or significantly altered.[9] Section 7(b)(4) and Section 7(o)(2) provide that taking that is incidental to an otherwise lawful agency action is not considered to be prohibited taking under the ESA, if that action is performed in compliance with the terms and conditions of this incidental take statement.

### 2.8.1 Amount or Extent of Take

NMFS anticipates the implementation of the proposed action will result in take in the form of capture, harm, and harassment of SONCC coho salmon individuals. The action will occur within the Rogue River and Klamath River basins, but this anticipated take will only occur within the Rogue River portion of the action area. The Rogue River basin watersheds of Bear Creek and Little Butte Creek provide rearing, spawning, and migration habitat for SONCC coho salmon adults and juveniles

[9] NMFS has not adopted a regulatory definition of harassment under the ESA. The World English Dictionary defines harass as "to trouble, torment, or confuse by continual persistent attacks, questions, etc." The U.S. Fish and Wildlife Service defines "harass" in its regulations as "an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering," 50 CFR 17.3. The interpretation we adopt in this consultation is consistent with our understanding of the dictionary definition of harass and is consistent with the U.S. Fish and Wildlife interpretation of the term.

Incidental take caused by the adverse effects of the proposed action will occur in the Bear Creek and Little Butte Creek watersheds from: (1) Habitat reduction; (2) loss of flow over redds; (3) reduced adult passage; (4)rapid fluctuations in flow due to ramping rate procedures ; (5) riparian vegetation removal; (6) salvage operations; and (7) temporary passage (Table 35). The first four of these take pathways are related to flow management and will be discussed together. The last three take pathways are related to construction activities and will be addressed together.

**Table 35**. Incidental take occurrence by stream, with affected life stage of SONCC coho salmon.

| Proposed action element | Pathway (from effects to species section) | Nature of take | Klamath River | Emigrant Creek | Ashland Creek | Bear Creek | SF Little Butte Creek | Little Butte Creek | Dry/ Antelope Creek |
|---|---|---|---|---|---|---|---|---|---|
| Flow management | Meeting 90%/80% | Slight reduction of rearing habitat | | Juveniles | | Juveniles | Juveniles | Juveniles | Juveniles |
| | Missing 90%/80% | Moderate reduction of rearing habitat | | | | | | Juveniles | |
| | Redd dewatering | Killing eggs and pre-emergent fry | | Eggs/fry | | | | | |
| | Adult Passage | Migration delay | | Adults | | | Adults | | Adults |
| Ramping rates | Up/down ramping | Displacing or stranding | | Juveniles | | Juveniles | Juveniles | | Juveniles |
| Large wood Additions | Vegetation removal | Forage and cover reduction | | Juveniles | | Juveniles | Juveniles | | |
| Fish Passage Construction | Salvage operations | Capture and injury | | | Juveniles | Juveniles | | | |
| | Vegetation removal | Forage and cover reduction | | | Juveniles | Juveniles | | | |
| | Temporary passage | Migration delay | | | Juveniles | Juveniles | | | |

Quantifying take from flow management and ramping rates is difficult since the primary mechanism for take is the change in hydraulic discharge. Translating the hydrologic effect into definitive numbers of fish taken cannot be done because these effects are primarily related to reductions in available habitat, and a direct predictor of coho salmon numbers from habitat loss is not available. Here, the best available quantifiable habitat indicator for the amount of take from water management activities is stream flow. In addition to being the most practical and feasible indicator to measure, stream flow is proportional to the adverse effects of this proposed action. Reducing flows increases adverse effect.

Reclamation used the 2011 MODSIM model to predict how much stream flow will result from implementing the proposed action (Tables 15 through 23). These stream flow values are appropriate to use as amount of take indicators because they are not coextensive with the proposed action, but are the result of all the water management elements (proposing minimum flows, ramping rates, flood rule flows, irrigation flows, *etc*.). The anticipated amount of take would be exceeded if stream flows at the identified Hydromet stations are less than the predicted resulting flows and the shortfall is due to discretionary Project actions. Stream flows would be considered to be less than the resulting predicted flows if the monthly flow value falls short in more than two months per year by 20% or more. These flows are identified in the "proposed action flows" columns in Tables 15 through 23.

NMFS estimates up to 46 SONCC coho salmon juveniles will be captured during salvage from the isolation of in-water work areas for the fish passage improvements. As many as four juvenile SONCC coho salmon will be killed by the salvage.

NMFS estimated that up to 1.45 acres of riparian vegetation will be removed during fish passage improvement projects and the large wood additions. Take caused by habitat-related effects such as riparian vegetation removal cannot be quantified as a number of fish because the distribution and abundance of fish that occur within the construction area are affected by habitat quality, competition, predation, and interaction of processes that influence genetic, population, and environmental characteristics. Thus, the distribution and abundance of fish within each area where construction activities are proposed cannot be predicted on the basis of existing habitat conditions, nor can NMFS precisely predict the number of fish that are reasonably certain to be harmed or harassed if their habitat is modified or degraded by the proposed action. Therefore, the best indicator of take from riparian vegetation disturbed is the amount of riparian vegetation removed; 1.45 acres.

The amount and extent of take is represented by stream flow (identified in Tables 15 through 23), the number of juveniles likely to be harmed during salvage actions (46), and acreage of riparian vegetation removed (1.45). These are the amounts and extents of take exempted in the Bear Creek and Little Butte Creek watersheds and are also thresholds for reinitiating consultation. In the accompanying opinion, NMFS determined that this level of incidental take is not likely to jeopardize the continued existence of the SONCC coho salmon.

### 2.8.2 Reasonable and Prudent Measures

The terms and conditions described below are non-discretionary, and Reclamation or any applicant must comply with them in order to implement the reasonable and prudent measures (50 CFR 402.14). Reclamation or any applicant has a continuing duty to monitor the impacts of incidental take and must report the progress of the action and its impact on the species as specified in this ITS (50 CFR 402.14). If the following terms and conditions are not complied with, the protective coverage of section 7(o)(2) will likely lapse.

Reclamation shall:

1. Minimize incidental take from fish passage construction and large wood additions by using conservation measures to avoid or minimize disturbance to aquatic habitats.
2. Minimize incidental take from fish screen and fish passage structures at Oak Street Diversion and Ashland Creek diversion by coordinating with NMFS fish passage engineers.
3. Minimize incidental take in the LBCO reach during median flow conditions in the month of June by providing 90% of the without Reclamation WUA.
4. Minimize incidental take in Emigrant Creek from loss of flow over redds by implementing a survey and manage process.
5. Minimize incidental take in South Fork Little Butte Creek and Antelope Creek by operating the facilities to minimize flow ramping and entrapment and stranding of SONCC coho salmon. [10]
6. Ensure completion of a monitoring and reporting program to confirm that the take exemption for the proposed action is not exceeded, and that the terms and conditions in this ITS are effective in minimizing incidental take.

### 2.8.3 Terms and Conditions

1. To implement reasonable and prudent measure #1 (construction), Reclamation shall ensure:

    a. Contractor Notice. Before beginning work, all contractors working on site shall be provided with a complete list of NMFS' reasonable and prudent measures, and terms and conditions intended to minimize the amount and extent of take resulting from general construction activities and in-water work.
    b. Minimize Impact Area. Confine construction impacts to the minimum area necessary to complete the construction.
    c. Fish salvage. Before, and intermittently during, isolation of an in-water work area, fish trapped in the area must be captured using a hand-net, seine, electrofishing, or other methods as are prudent to minimize risk of injury, then released at a safe release site under the supervision of a qualified fishery biologist.

[10] At times, operations outside the bounds of this reasonable and prudent measure may be required to meet Reclamation's flood control obligations. In the event that flood control obligations require Reclamation to operate the facilities outside of the limits established by this RPM, Reclamation must conform operations to this RPM as soon as practical.

i. Do not use electrofishing if water temperatures exceed 18°C, or are expected to rise above 18°C, unless no other method of capture is available.

ii. If electrofishing equipment is used to capture fish, comply with NMFS' guidelines found at: http://www.nwr.noaa.gov/ESA-Salmon-Regulations-Permits/4d-Rules/upload/electro2000.pdf

iii. Handle ESA-listed fish with extreme care, keeping fish in water to the maximum extent possible during seining and transfer procedures to prevent the added stress of out-of-water handling.

iv. Ensure water quality conditions are adequate in buckets or tanks used to transport fish by providing circulation of clean, cold water, using aerators to provide dissolved oxygen, and minimizing holding times.

v. Release fish into a safe release site as quickly as possible, and as near as possible to capture sites.

vi. Do not transfer ESA-listed fish to anyone except NMFS personnel, unless otherwise approved in writing by NMFS.

vii. Obtain all other Federal, state, and local permits necessary to conduct the capture and release activity.

viii. Salvage Notice. Include the following notice as a permit condition:

NOTICE: If a sick, injured, or dead specimen of a threatened or endangered species is found in the project area, the finder must notify NMFS through the contact person identified in the transmittal letter for this opinion, or through the NMFS Office of Law Enforcement at 1-800-853-1964, and follow any instructions. If the proposed action may worsen the fish's condition before NMFS can be contacted, the finder should attempt to move the fish to a suitable location near the capture site while keeping the fish in the water and reducing its stress as much as possible. Do not disturb the fish after it has been moved. If the fish is dead, or dies while being captured or moved, report the following information: (a) NMFS consultation number; (b) the date, time, and location of discovery; (c) a brief description of circumstances and any information that may show the cause of death; and (d) photographs of the fish and where it was found. The NMFS also suggests that the finder coordinate with local biologists to recover any tags or other relevant research information. If the specimen is not needed by local biologists for tag recovery or by NMFS for analysis, the specimen should be returned to the water in which it was found, or otherwise discarded.

d. Fish screen. A screen meeting NMFS' fish screen criteria must be used on any pump used to dewater the work isolation area.

e. Flow reintroduction. After construction is complete, slowly reintroduce streamflow, allowing the streambed to reabsorb water and preventing sudden surface flow to unduly increase suspended sediments downstream.

f. Control pollution and erosion. Prepare and carry out a pollution and erosion control plan to avoid or minimize the adverse effects of pollution and erosion by limiting soil disturbance, scheduling work when the fewest number of fish are likely to be present, and limiting the harm that may be caused by accidental discharges of pollutants and sediment. The plan will contain the elements listed below, meet requirements of all applicable laws and regulations, and be available for inspection on request by NMFS.

i. Responsible party. The name, address, and telephone number of the person responsible for accomplishment of the pollution and erosion control plan.

ii. Hazardous materials. A description of any regulated or hazardous products or materials that will be used for the construction, including procedures for inventory, storage, handling, and monitoring.

iii. Spill containment. Spill containment and control measures, including notification procedures, specific cleanup and disposal instructions for different products, maintenance of quick response containment and cleanup supplies that will be available on the site, including a supply of sediment control materials (*e.g.*, a silt fence, straw bales),[11] procedures for disposal of spilled materials, and description of employee training for spill containment.

iv. Accidental spills. All spills or accidental discharges of pollutants and sediment within the work isolation area must be cleaned and removed prior to reintroducing flow.

g. Heavy Equipment. Restrict use of heavy equipment as follows:

i. Select equipment that will have the least adverse effects on the environment (*e.g.*, minimally-sized, low ground pressure equipment).

ii. Ensure that only enough supplies and equipment to complete a specific job will be stored on site.

iii. Complete vehicle cleaning, maintenance, refueling, and fuel storage in the vehicle staging area placed 150 feet or more from any stream, waterbody, or wetland.

iv. Inspect all vehicles operated within 150 feet of any stream or wetland daily for fluid leaks before leaving the vehicle staging area. Repair any leaks detected in the vehicle staging area before the vehicle resumes operation. Document inspections in a record that is available for review on request by NMFS.

v. Before operations begin, and as often as necessary during operation, steam clean all equipment that will be used below ordinary high water until all visible external oil, grease, mud, and other visible contaminants are removed. Complete all cleaning in the vehicle staging area.

[11] When available, certified weed-free straw or hay bales must be used to prevent introduction of noxious weeds.

2. To implement reasonable and prudent measure #2 (fish screen and passage design), Reclamation shall:

   a. Ensure the fish screen at the Ashland Creek Diversion meets NMFS fish passage criteria by coordinating with NMFS fish passage engineers at the 50% and 90% design phase, at least.
   b. Ensure the fish passage facilities at Oak Street Diversion and Ashland Creek Diversion meet NMFS fish passage criteria by coordinating with NMFS fish passage engineers at the 50% and 90% design phase, at least.

3. To implement reasonable and prudent measure #3 (LBCO June median flow WUA), Reclamation shall:

   a. Use in-stream flow and/or large wood to provide WUA equal to at least 90% of the without Reclamation scenario.

4. To implement reasonable and prudent measure #4 (loss of flow over redds), Reclamation shall:

   a. Prepare and submit a redd protection plan to NMFS prior to September 30, 2012.
   b. <u>Survey</u>. Survey spawning coho salmon in Emigrant Creek during November and December following the most recent version of ODFW's salmon spawning survey procedures[12], including:
      i. Survey intervals cannot exceed 10 days.
      ii. Walk all channels including side channels and backwater pools.
   c. <u>Mark</u>. Locate and mark all coho salmon redds.
      i. Note location of redd.
      ii. Record adequate hydraulic information for the manage portion of this plan.
   d. <u>Manage</u>. Maintain adequate flow over at least 90% of redds until March 1.[13]
      i. Use hydraulic information from each redd to determine the minimum flow necessary to maintain survival of at least 90% of the redds.
      ii. Release adequate flow from Emigrant Dam to achieve the minimum flow.

5. To implement reasonable and prudent measure #5 (flow ramping), Reclamation shall:

   a. Ensure that operation of facilities on SF Little Butte Creek and Antelope Creek do not cause flows (as measured at the closest downstream Hydromet station) to increase by more than 100% in any 24-hour period.
   b. Ensure that operation of facilities on SF Little Butte Creek and Antelope Creek do not cause flows (as measured at the closest downstream Hydromet station) to decrease by more than 50% in any 24-hour period.

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[12] Oregon Department of Fish and Wildlife's 2010 Salmon Spawning Survey Procedures can be found at: http://oregonstate.edu/dept/ODFW/spawn/pdf%20files/reports/2010_SSManual.pdf

[13] Coho salmon eggs incubate for 35 to 50 days (Shapovalov and Taft 1954). Fry emerge from the gravel 2 to 3 weeks later (Shapovalov and Berrian 1940)

c. Ensure that operation of facilities on SF Little Butte Creek and Antelope Creek between May 1 and February 28-29 do not cause the water surface elevation of the creeks (as measured at the closest downstream Hydromet station) to decrease by more than two inches per hour.

d. Ensure that operation of facilities on SF Little Butte Creek and Antelope Creek between March 1 and April 30 do not cause the water surface elevation of the creeks (as measured at the closest downstream Hydromet station) to decrease by more than 1 inch per hour.

6. To implement reasonable and prudent measure #6 (monitoring and reporting program), Reclamation shall ensure that NMFS receives an annual report by February 15 of each year according to the following:

   a. Submit monitoring reports to:

      Director, Oregon State Habitat Office
      Habitat Conservation Division
      National Marine Fisheries Service
      Attn: 2003/01098
      1201 NE Lloyd Blvd Suite 1100
      Portland, Oregon 97232-1274

   b. For any completed construction component, provide the following in the report:

      i. Implementation success. The monitoring report will describe Reclamation's success meeting the construction term and conditions (term and condition #1).

      ii. Implementation Monitoring Report Contents. The monitoring report will include the following information for each construction activity that occurred in the prior year:

         (1) Project identification.
            (a) Permittee name, permit number, and project name.
            (b) Project location by 6th field HUC and by latitude and longitude as determined from the appropriate USGS 7-minute quadrangle map.
            (c) Reclamation contact person.
            (d) Starting and ending dates for work completed.

         (2) Habitat conditions. Photos of habitat conditions at the construction site before, during, and after project completion from consistent photo points.
            (a) Include general views and close-ups showing details of the project and project area.
            (b) Label each photo with date, time, project name, photographer's name and a comment about the subject.

         (3) Project data. Include the following specific project data in the annual monitoring report:
            (a) Work dates. Dates of any in-water work.

(b) Pollution and erosion control. A summary of pollution and erosion control inspections, including any erosion control failure, contaminant release and correction effort, including cleanup activities.

(c) Action monitoring. All construction activities shall be monitored and NMFS notified immediately if circumstances warranting reinitiation of consultation become apparent.

(d) Chemical contaminant monitoring. In the event of a spill, measure chemical contamination within 75 feet of the construction area.

(e) Riparian plantings. Number, type and source of plants and seed mixes used, including width and length planted.

(f) Work area isolation and fish capture and release:

(i) Supervisory fish biologist name and address.

(ii) Size of isolation area.

(iii) Methods of work area isolation and take minimization.

(iv) Stream conditions before, during, and one week after completion of work area isolation

(v) Means of fish capture (if any).

(vi) Number of fish captured by species.

(vii) Release site and condition of all fish released.

(viii) Any incidence of observed injury or mortality of listed species.

c. For flow management related components, provide the following in the report:

i. Record of the system state for each day of the year.

ii. Record of daily flow values for each of the nine Hydromet stations.

iii. Record of monthly values for each of the nine Hydromet stations.

iv. Summary of any reporting required due to exceeding minimum flows during the previous year.

v. Summary of Reclamation's success meeting the proposed Emigrant Creek and Bear Creek ramping rate procedures.

vi. Summary of Reclamation's success meeting the LBCO term and condition (term and condition #3).

vii. Summary of Reclamation's success meeting the Emigrant Creek redd term and condition (term and condition #4).

viii. Summary of Reclamation's success meeting the South Fork Little Butte Creek, Dry Creek, and Antelope Creek ramping rate term and condition (term and condition #5).

d. To ensure NMFS analytic assumption that the effects in Dry Creek and Antelope Creek is similar to those in SF Little Butte Creek and Emigrant Creek, provide the following:

i. Prior to September 30, 2012, complete an analysis of without Reclamation WUA in Antelope Creek and Dry Creek.

ii. In the annual report include an analysis of whether or not the Project provided 90% of without Reclamation habitat during median and wet system states and 80% during dry states.

## 2.9 Conservation Recommendations

Section 7(a)(1) of the ESA directs Federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of the threatened and endangered species. The following recommendations are discretionary measures that are consistent with this obligation and therefore should be carried out by Reclamation:

1. NMFS recommends Reclamation, in partnership with the Districts, the Environmental Protection Agency, Oregon Department of Environmental Quality and the Oregon Water Resources Department develop a coordinated effort to identify common water quality and quantity goals and objectives to monitor. This effort would facilitate collecting information regarding water quality and quantity from Project-related waterways (rivers, streams, canals and return flow). This effort should use an existing monitoring and reporting system, identify additional sampling and monitoring sites to enhance our current knowledge base, and identify methods for more effective use of information collected by the existing monitoring and reporting system.
2. NMFS recommends Reclamation analyzes and quantifies the potential benefits to the Klamath Project reliability through storage and delivery of Jenny Creek flows via Iron Gate Dam. Study parameters should not focus solely on in-stream flow volumes and associated habitat values, but also consider water quality. NMFS suggests that Reclamation convene a working group consisting of Federal, state, tribal, and irrigation district representatives to assist in study design and implementation. NMFS recommends Reclamation fund the installation of stream gages within Jenny Creek watershed to accurately portray streamflow and runoff patterns.
3. NMFS recommends Reclamation assist the Districts in development of a Habitat Conservation Plan regarding the non-Federal Districts operations, maintenance and facility improvements, if the Districts seek to obtain a Habitat Conservation Plan from the NMFS and U.S. Fish and Wildlife Service.
4. To the extend practical, during the storage season Reclamation should attempt to meet a two-inch per hour downramping rate at Emigrant Dam after drafting Emigrant Reservoir to achieve the flood control rule curve elevation following a surcharge event. Reclamation should coordinate with the Corps in real-time to gradually ramp down discharges at Emigrant in light of existing and forecasted weather events. NMFS recognizes that achieving the rule curve elevation is necessary to meet flood control obligations and that metered ramping would delay meeting that objective and would not always be advisable. However, when flows are abruptly reduced following achievement of the flood control volume, severe risk of entrapment and stranding can occur. This is of particular concern during March and April when fry are emerging and are highly susceptible.

5. NMFS recommends Reclamation support the revitalization of the Rogue Basin Fish Access Team and the implementation of the Rogue Basin Fish Passage Barrier Removal Strategic Plan.
6. NMFS recommends Reclamation facilitate efforts to conserve and manage water resources within the action area by working with the Districts and other water management entities in the Rogue and Klamath River basins to assist in the conservation and recovery of SONCC coho salmon.

Please notify NMFS if Reclamation carries out any of these recommendations so that we will be kept informed of actions that are intended to improve the conservation of listed species or their designated critical habitats.

## 2.10 Reinitiation of Consultation

Reinitiation of formal consultation is required and shall be requested by the Federal agency or by NMFS where discretionary Federal involvement or control over the action has been retained or is authorized by law and: (a) If the amount or extent of taking specified in the ITS is exceeded; (b) if new information reveals effects of the action that may affect listed species or designated critical habitat in a manner or to an extent not previously considered; (c) if the identified action is subsequently modified in a manner that has an effect to the listed species or designated critical habitat that was not considered in the biological opinion; or (d) if a new species is listed or critical habitat is designated that may be affected by the identified action (50 CFR 402.16).

The conservation measures described by this opinion (not including the Conservation Recommendations of Chapter 2.9, above) and in the consultation initiation package as parts of the proposed action are intended to reduce or avoid adverse effects on listed species and their habitats. The NMFS regards these conservation measures as integral components of the proposed action and expects that all proposed Project activities will be completed consistent with those measures. We have completed our effects analysis accordingly. Any deviation from these conservation measures will be beyond the scope of this consultation. Further consultation will be required to determine what effect the modified action may have on listed species or designated critical habitats.

NMFS relied on the foregoing description of the proposed action, including all features and measures identified to reduce adverse effects, including those identified as contingent upon funding, to complete this consultation. To ensure that this consultation remains valid, NMFS expects Reclamation will timely notify NMFS of any changes to the proposed action.

Specific circumstances that would require re-initiation of consultation include, but are not limited to the following:

1. Fish passage improvements at Oak Street Diversion Dam and Ashland Creek are not completed by December 2015.
2. Large wood addition is not 70% complete by December 2017 or 100% complete by December 2020.
3. Riparian restoration is not 100% complete by December 2017.

4. Biological or physical monitoring in the action area indicates that the in-stream flows provided by Reclamation in Little Butte Creek and Bear Creek are limiting coho salmon in a manner greater than described above in this opinion.
5. Assessments, biological or physical, in the Klamath River basin determine the transfer of Jenny Creek water result in adverse effects to SONCC coho salmon.

To reinitiate consultation, contact the Oregon State Habitat Office of NMFS, and refer to the NMFS Number assigned to this consultation (2003/01098). The following framework will apply when NMFS evaluates a deviation in Reclamation's implementation of the proposed action, ITS, or when new information becomes available that is materially relevant to the effects of the PA or status of the species.

1. NMFS will request, by letter, information from Reclamation concerning any deviations from the proposed action or ITS or any new information about proposed action effects or species status.
2. Reclamation will provide in writing any and all information and analysis available regarding the proposed action or ITS deviation or new information.
3. NMFS will seek any additional information and analysis that may be available and relevant.
4. NMFS will issue a written determination whether reinitiation of consultation for this project is warranted pursuant to 50 CFR § 402.16, and, if so, provide its recommendation to Reclamation. In reaching this determination NMFS will consider all relevant factors, including:
    a. Whether a deviation from the proposed action is material, meaning that the shortfall in the implementation is likely to appreciably reduce short-term survival benefits or appreciably reduce a contribution to the long term recovery of the species, which is needed to improve species status.
    b. Whether the new information about proposed action effects or species status indicate an appreciable increase in proposed action adverse effects or appreciable decline in species status; and,
    c. Whether there are alternative measures to which Reclamation will commit to that will avoid or offset the adverse effects of the proposed action or ITS deviation or new information about effects or species status.

### 2.11 "Not Likely to Adversely Affect" Determinations

This section was prepared by NMFS pursuant to section 7(a)(2) of the ESA, implementing regulations at 50 CFR 402 and agency guidance for determining whether formal consultation for particular species or critical habitat are required or whether the proposed action is, instead, NLAA such species or habitat. The applicable standard to find that a proposed action is NLAA listed species or critical habitat is that all of the effects of the action are expected to be discountable, insignificant, or completely beneficial.[14] Discountable effects cannot be reasonably

[14] U.S Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS). 1998. Endangered Species Act Consultation Handbook: Procedures for Conducting Section 7 Consultations and Conferences. March, 1998. Final. pp. 315.

expected to occur. Insignificant effects are so mild that the effect cannot be meaningfully measured, detected, or evaluated. Beneficial effects are contemporaneous positive effects without any adverse effect to the listed species or critical habitat, even if the long-term effects are beneficial. The NMFS reviewed the information provided by Reclamation, as well as, existing relevant information for the action area and determines that Reclamation's proposed action is appropriately NLAA for eulachon, eulachon critical habitat or green sturgeon and therefore ESA § 7(a)(2) consultation for these species and habitat is concluded informally.

### 2.11.1 Species and Critical Habitat in the Action Area

Eulachon inhabit several riverine and estuarine systems along the west coast and population sizes vary between these systems. They are known to exist in the lower Klamath River and likely exist in the lower Rogue River. Eulachon critical habitat has been designated in the lower 10.7 miles of the Klamath River. Adults return to estuaries and freshwater from December to May, with peak periods of entry and spawning in February and March (WDFW and ODFW 2001). Spawning occurs in the rivers and tributaries just upstream from the estuary. Eggs hatch in 20 to 40 days (Smith and Saalfeld 1955, Parente and Snyder 1970, Berry and Jacob 1998, and Langer *et al*. 1977). As soon as eggs hatch, the stream quickly carries larvae downstream to the ocean or estuary in a matter of hours or days (Parente and Snyder 1970, Samis 1977, and Howell 2001) where they feed on phytoplankton and zooplankton. Estuarine larvae grow from April through August and, as soon as they have the ability, disperse to the ocean.

Subadult and adult green sturgeon use the Klamath River and Rogue River estuaries as habitat for growth and development to adulthood and for adult and subadult feeding. Green sturgeon are known to congregate in coastal waters and estuaries, including non-natal estuaries. Beamis and Kynard (1997) suggested that green sturgeon move into estuaries of non-natal rivers to feed. Data from Washington studies indicate that green sturgeon will only be present in estuaries from June until October (Moser and Lindley 2007). While in these estuaries, they likely seek out the deepest habitats to rest during low tides and feed on invertebrates in shallow water during high tides.

### 2.11.2 Effects to Listed Species and Critical Habitats

The biological opinion detailed effects of the action. The effects from water management are the only ones coincident with presence of eulachon or green sturgeon and which may affect designated eulachon critical habitat. The NMFS concludes that all effects of the action, as proposed, are insignificant or discountable for eulachon, green sturgeon, and eulachon critical habitat.

The only effects from the proposed action coincident with presence of eulachon, green sturgeon and eulachon critical habitat will be flow-related. However, the effects to water quantity will be undetectable in the lower Rogue River and lower Klamath River (See Section 2.1). In the Klamath River, flows at the base of IGD will be reduced by 1.3% (2012 BA, page 203). By the time the Klamath River reaches the Lower Klamath River 4$^{th}$ field watershed inflows from tributaries, including Shasta River and Scott River, diminish this percentage to immeasurable. In the Rogue River, flows at the mouth of Little Butte Creek will be reduced by approximately

0.8% (calculated as the total reduction during a median flow year at LBEO (Table 23) divided by the average annual flow at the Raygold USGS gage). The changes this reduction has on the mainstem cannot be measured in terms of depth or velocity. As these rivers approach their estuaries (where eulachon, sturgeon, and eulachon critical habitat are) the effects are reduced even further due to inflows from tributaries.

## 3. MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT

The consultation requirement of section 305(b) of the MSA directs Federal agencies to consult with NMFS on all actions or proposed actions that may adversely affect EFH. The MSA (section 3) defines EFH as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity. Adverse effects include the direct or indirect physical, chemical, or biological alterations of the waters or substrate and loss of, or injury to, benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality or quantity of EFH. Adverse effects on EFH may result from actions occurring within EFH or outside EFH, and may include site-specific or EFH-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR 600.810). Section 305(b) also requires NMFS to recommend measures that can be taken by the action agency to conserve EFH.

This analysis is based, in part, on the EFH assessment provided by the Federal action agency and descriptions of EFH contained in the fishery management plans developed by the Pacific Fishery Management Council (PFMC) and approved by the Secretary of Commerce for coastal pelagic species (PFMC 1998), Pacific salmon (PFMC 1999), and Pacific Coast groundfish ( PFMC 2005).

### 3.1 Essential Fish Habitat Affected by the Proposed action

The PFMC described and identified EFH for coastal pelagics (PFMC 1998), Pacific salmon (PFMC 1999), and Pacific Coast groundfish (PFMC 2005). The proposed action and the action area for this consultation are described in the Introduction to this document. The action area includes areas designated as EFH for various life-history stages Pacific Coast groundfish, coastal pelagics, and Pacific salmon. However, the action is unlikely to adversely affect Pacific Coast groundfish or coastal pelagic EFH. Their EFH occurs in the Klamath River estuary and the Rogue River estuary, and effects from the proposed action will be undetectable in those areas (see Section 2.1). Therefore, this EFH analysis will focus on Pacific salmon EFH.

In the 2012 BA, Reclamation determined the proposed action would not adversely affect Pacific salmon EFH. However, Reclamation compared the proposed action to historical Project actions and not what would occur without operation of the Project. The EFH determination did not reference Reclamation's likely to adversely affect SONCC coho salmon determination in the ESA portion of their document.

### 3.2 Adverse Effects on Essential Fish Habitat

The ESA portion of this opinion describes the adverse effects to SONCC coho salmon habitat from this proposed action. The EFH section of the 2012 BA adequately explained the differences between Chinook salmon and coho salmon life histories, including their timing and habitat preferences. Though some differences exist, the effects of the proposed action to Chinook salmon habitat and coho salmon habitat are similar. Thus, the effects described in the ESA portion of this document are similar to those listed below for EFH. The NMFS concludes that the proposed action will have the following adverse effects on EFH designated for Pacific salmon:

#### 3.2.1 Bear Creek 5th Field Watershed

Elements of the proposed action occurring in the Bear Creek watershed include; O&M of the Federal Project facilities, minimum in-stream flow requirements, large wood additions, ramping rate procedures, modifications of structures to improve fish passage, and riparian zone restoration. The likely effects of the action are:

1. Cover/Shelter. Removal of riparian vegetation to provide worksite access during construction of the fish passage improvements and large wood installations is likely to reduce some available cover. Not all riparian vegetation serves as cover for juvenile salmon. Preferred cover is in-water woody debris or overhanging vegetation immediately adjacent to the water. The losses will be temporary, lasting until site vegetation recovers (5 – 30 years). The effects from the 18 acres of riparian restoration and the resulting increased WUA from large wood additions are wholly beneficial on cover/shelter.

   Cover is one of three parameters considered in the IFIM/PHABSIM study (Reclamation 2007). NMFS cannot disaggregate that information to afford a quantitative analysis of the changes in cover independently. However, the analysis of changes in WUA between the proposed action and without Reclamation scenario represents the effects to cover. Therefore, that discussion in the ESA effects section (Section 2.5.2.1) can be incorporated here. When decreasing flows, the proposed action will result in the stream wetted area being reduced and reducing cover. Increases in flow, particularly during the summer, would provide a greater wetted width of the channel and increasing cover.

2. Food. Approximately 0.15 acres of substrate will be disturbed by the coffer dams, temporarily disrupting forage production from this area. In addition to the isolation areas, the loss of riparian vegetation leads to reduced food available to juvenile salmon. Riparian vegetation removal will affect availability of nutrients in the stream by reducing plant material entering the stream, which can reduce the availability of in-stream forage (macroinvertebrates) for salmon. In addition to in-stream forage loss, adjacent riparian zones supply terrestrial insects that fall into the water. Fewer riparian plants, such as brush or trees, result in fewer terrestrial insects being available for juvenile salmon. These effects are adverse, but at a small local scale. The effects from the 18 acres of riparian restoration are wholly beneficial on food resources.

3. Riparian Vegetation. Approximately 1.45 acres of riparian vegetation will be removed from the fish passage improvement activities and large wood additions. Reclamation will replant each of the construction sites, but full recovery of vegetation will vary from a year, for grasses, to 5 to 30 years for shrubs and trees. The overall result is a loss of some riparian nutrients. Reclamation will plant approximately 18 additional acres of riparian area, with wholly beneficial effects.

4. Space. Space, best measured by the amount of available habitat, was discussed at length in the effects to species discussion. That analysis of changes in WUA between the proposed action and without Reclamation scenario can be incorporated here. When decreasing flows, the proposed action will result in the stream wetted area being reduced and reducing available habitat. Increases in flow, particularly during the summer, would provide a greater wetted width of the channel and increasing available habitat. In that analysis NMFS found the proposed action would provide sufficient habitat to allow Bear Creek coho salmon abundance to survive during dry flow conditions, and survive and grow in median and wet flow conditions. The effects to Chinook salmon EFH are likely similar.

5. Spawning Gravel. The proposed erosion control and work area isolation conservation measures are likely to minimize suspended sediment and sedimentation. The construction components of the proposed action are not likely to have an adverse effect on spawning gravel. The proposed action will reduce available spawning habitat in some stream reaches, however it will still provide enough spawning habitat to allow the coho salmon population to thrive (see explanation in Section 2.5.2.1). The effects to Chinook salmon EFH are likely similar.

6. Water Quality. Water quality will suffer from short-lived, localized degradations due to sediment inputs. These events occur at the time of the coffer dam construction and deconstruction and large wood installation.

7. Water Quantity. Changes in water quantity between the proposed action and without Reclamation scenarios are reported in Tables 15 through 20. In general, the proposed action increases water quantity in the summer and fall and decreases it in the winter and spring. The effects due to changes in water quantity are better described by the changes in available habitat. See discussion under space for effects from available habitat.

8. Safe Passage. Fish passage improvements at Oak Street Diversion and Ashland Creek Diversion will benefit safe passage for juvenile and adult salmon. Cofferdams used for construction isolation areas will temporarily block passage at two sites for up to seven weeks. During certain months and flow conditions, the proposed action will not allow optimal upstream adult passage when the without reclamation scenario would.

9. Water Temperature. Reclamation will remove some riparian vegetation to gain access to construction sites but will replant all disturbed areas. Reclamation will also plant 18 additional acres of riparian vegetation. During the juvenile outmigration season (spring) and the adult spawning migration, the proposed action would have little effect on water

temperatures. Early migrating adults and late migrating juveniles may be subject to adverse water temperature conditions in the Bear Creek/Emigrant Creek watershed, but those effects appear to be unassociated with the proposed action (Reclamation 2009).

10. Water Velocity. The fish passage and large wood addition elements of the proposed action will improve water velocity near each of the structures. Velocity is one of three parameters considered in the IFIM/PHABSIM study (Reclamation 2007). NMFS cannot disaggregate that information to afford a quantitative analysis of the changes in velocity independently. However, the analysis of changes in WUA between the proposed action and without Reclamation scenario represents the effects to velocity. Therefore, that discussion in the ESA effects section (Section 2.5.2.1) can be incorporated here. When decreasing flows, the proposed action will generally result in reducing velocities. Increases in flow, particularly during the summer, will generally increase velocities. The effects to Chinook salmon EFH are likely similar.

### 3.2.2 Little Butte Creek 5th Field Watershed

Elements of the proposed action occurring in the Little Butte Creek watershed include; O&M of the Federal Project facilities, minimum in-stream flow requirements, and large wood additions. The likely effects of the action are:

1. Cover/Shelter. The effects from resulting increased WUA from large wood additions are wholly beneficial on cover/shelter. Cover is one of three parameters considered in the IFIM/PHABSIM study (Reclamation 2007). NMFS cannot disaggregate that information to afford a quantitative analysis of the changes in cover independently. However, the analysis of changes in WUA between the proposed action and without Reclamation scenario represents the effects to cover. Therefore, that discussion in the ESA effects section (Section 2.5.2.1) can be incorporated here. When decreasing flows, the proposed action will result in the stream wetted area being reduced and reducing cover.

2. Space. Space, best measured by the amount of available habitat, was discussed at length in the effects to species discussion. That analysis of changes in WUA between the proposed action and without Reclamation scenario can be incorporated here. When decreasing flows, the proposed action will result in the stream wetted area being reduced and reducing available habitat. Increases in flow, particularly during the summer, would provide a greater wetted width of the channel and increasing available habitat. In that analysis NMFS found the proposed action would provide enough habitat to allow Little Butte Creek coho salmon abundance to survive during dry flow conditions, and survive and grow in most median and wet flow conditions. The effects to Chinook salmon EFH are likely similar. The one exception was during median flow conditions where the proposed action will only provide 83% of the without Reclamation WUA in the LBCO reach during the month of June. A 17% reduction in habitat was classified by Reclamation as a “moderate detriment.” This moderate reduction in rearing habitat is reasonably likely to result in moderate effects to space in the LBCO reach during June. Furthermore, this reduction gains significance because it occurs throughout a 14-mile reach of stream and during a month important to juvenile rearing. June is the month when

stream temperatures begin to exceed preferable levels, triggering some juveniles to migrate to other stream reaches. Therefore, the moderate effects extend temporally and spatially beyond the LBCO reach in June.

3. Spawning Gravel. The proposed action will reduce available spawning habitat in some stream reaches, however it will still provide enough spawning habitat to allow the coho salmon population to thrive (see explanation in Section 2.5.2.1). The effects to Chinook salmon EFH are likely similar.

4. Water Quantity. Changes in water quantity between the proposed action and without Reclamation scenarios are reported in Tables 21 through 23. The effects due to changes in water quantity are better described by the changes in available habitat. See discussion under space for effects from available habitat.

5. Safe Passage. During certain months and flow conditions, the proposed action will not allow optimal upstream adult passage when the without reclamation scenario would.

6. Water Velocity. The large wood addition element of the proposed action will improve water velocity near each of the structures. Velocity is one of three parameters considered in the IFIM/PHABSIM study (Reclamation 2007). NMFS cannot disaggregate that information to afford a quantitative analysis of the changes in velocity independently. However, the analysis of changes in WUA between the proposed action and without Reclamation scenario represents the effects to velocity. Therefore, that discussion in the ESA effects section (Section 2.5.2.1) can be incorporated here. When decreasing flows, the proposed action will generally result in reducing velocities.

### 3.2.3 Klamath River 5th Field Watersheds

The only element of the proposed action affecting the three Klamath River watersheds is O&M of the Federal Project facilities (diversion of Jenny Creek water to the Rogue River basin). The likely effects of the action are:

1. Cover/Shelter. The effects of water diversion from the Klamath River basin above IGD are unlikely to measurably change the width, depth or velocity of the Klamath River below IGD. Therefore, the proposed action is unlikely to affect cover/shelter in the Klamath River.

2. Space. The effects of water diversion from the Klamath River basin above IGD are unlikely to measurably change the width, depth or velocity of the Klamath River below IGD. Therefore, the proposed action is unlikely to affect space in the Klamath River watersheds.

3. Water Quantity. The total water balance at the base of IGD will be reduced by 1.3% (2012 BA, page 203). The effects due to changes in water quantity are better described by changes in available habitat. See discussion under space for effects from available habitat.

4. Water Velocity. The effects of water diversion from the Klamath River basin above IGD are unlikely to measurably change the width, depth or velocity of the Klamath River below IGD. Therefore, the proposed action is unlikely to affect water velocity in the Klamath River watersheds.

### 3.3 Essential Fish Habitat Conservation Recommendations

The NMFS expects that full implementation of these EFH conservation recommendations would protect, by avoiding or minimizing the adverse effects described in Section 3.2 above, approximately 518 acres of designated EFH for Pacific salmon.

1. Minimize effects to EFH from fish passage construction and large wood additions by adhering to Term and Condition 1 in the accompanying opinion (excluding 1b and 1d).
2. Minimize effects to EFH from fish screen and fish passage structures at Oak Street Diversion and Ashland Creek Diversion by adhering to Term and Condition 2 in the accompanying opinion.
3. Minimize effects to EFH in the LBCO reach during median flow conditions in the month of June by adhering to Term and Condition 3 in the accompanying opinion.
4. Minimize effects to EFH in Emigrant Creek from loss of flow over redds by adhering to Term and Condition 4 in the accompanying opinion.
5. Minimize effects to EFH in South Fork Little Butte Creek and Antelope Creek by adhering to Term and Condition 5 in the accompanying opinion. [15]
6. Ensure completion of a monitoring and reporting program to confirm the project is meeting the objective of limiting adverse effects from permitted activities, as stated in Term and Condition 6 in the accompanying opinion.
7. NMFS recommends Reclamation, in partnership with the Districts, the Environmental Protection Agency, Oregon Department of Environmental Quality and the Oregon Water Resources Department develop a coordinated effort to identify common water quality and quantity goals and objectives to monitor. This effort would facilitate collecting information regarding water quality and quantity from Project-related waterways (rivers, streams, canals and return flow). This effort should use an existing monitoring and reporting system, identify additional sampling and monitoring sites to enhance our current knowledge base, and identify methods for more effective use of information collected by the existing monitoring and reporting system.
8. NMFS recommends Reclamation analyzes and quantifies the potential benefits to the Klamath Project reliability through storage and delivery of Jenny Creek flows via Iron Gate Dam. Study parameters should not focus solely on in-stream flow volumes and associated habitat values, but also consider water quality. NMFS suggests that Reclamation convene a working group consisting of Federal, state, tribal, and irrigation district representatives to assist in study design and implementation. NMFS recommends Reclamation fund the installation of stream gages within Jenny Creek watershed to accurately portray streamflow and runoff patterns.

[15] At times, operations outside the bounds of this conservation measure may be required to meet Reclamation's flood control obligations. In the event that flood control obligations require Reclamation to operate the facilities outside of the limits established by this measure, Reclamation must conform operations as soon as practical.

9. NMFS recommends Reclamation assist the Districts in development of a Habitat Conservation Plan regarding the non-Federal Districts operations, maintenance and facility improvements, if the Districts seek to obtain a Habitat Conservation Plan from the NMFS and U.S. Fish and Wildlife Service.
10. To the extent practical, during the storage season Reclamation should attempt to meet a two-inch per hour downramping rate at Emigrant Dam after drafting Emigrant Reservoir to achieve the flood control rule curve elevation following a surcharge event. Reclamation should coordinate with the Corps in real-time to gradually ramp down discharges at Emigrant in light of existing and forecasted weather events. NMFS recognizes that achieving the rule curve elevation is necessary to meet flood control obligations and that metered ramping would delay meeting that objective and would not always be advisable. However, when flows are abruptly reduced following achievement of the flood control volume, severe risk of entrapment and stranding can occur. This is of particular concern during March and April when fry are emerging and are highly susceptible.
11. NMFS recommends Reclamation support the revitalization of the Rogue Basin Fish Access Team and the implementation of the Rogue Basin Fish Passage Barrier Removal Strategic Plan.
12. NMFS recommends Reclamation facilitate efforts to conserve and manage water resources within the action area by working with the Districts and other water management entities in the Rogue and Klamath River basins to assist in improving Pacific salmon EFH.

### 3.4 Statutory Response Requirement

As required by section 305(b)(4)(B) of the MSA, the Federal action agency must provide a detailed response in writing to NMFS within 30 days after receiving an EFH Conservation Recommendation from NMFS. Such a response must be provided at least 10 days prior to final approval of the action if the response is inconsistent with any of NMFS' EFH Conservation Recommendations, unless NMFS and the Federal action agency have agreed to use alternative time frames for the Federal action agency response. The response must include a description of measures proposed by the agency for avoiding, mitigating, or offsetting the impact of the activity on EFH. In the case of a response that is inconsistent with NMFS Conservation Recommendations, the Federal action agency must explain its reasons for not following the recommendations, including the scientific justification for any disagreements with NMFS over the anticipated effects of the action and the measures needed to avoid, minimize, mitigate, or offset such effects, 50 CFR 600.920(k)(1).

In response to increased oversight of overall EFH program effectiveness by the Office of Management and Budget, NMFS established a quarterly reporting requirement to determine how many conservation recommendations are provided as part of each EFH consultation and how many are adopted by the action agency. Therefore, we ask that in your statutory reply to the EFH portion of this consultation, you clearly identify the number of conservation recommendations accepted.

### 3.5 Supplemental Consultation

Reclamation must reinitiate EFH consultation with NMFS if the proposed action is substantially revised in a way that may adversely affect EFH, or if new information becomes available that affects the basis for NMFS' EFH conservation recommendations, 50 CFR 600.920(l).

## 4. DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW

Section 515 of the Treasury and General Government Appropriations Act of 2001 (Public Law 106-554) (Data Quality Act) specifies three components contributing to the quality of a document. They are utility, integrity, and objectivity. This section of the opinion addresses these Data Quality Act (DQA) components, documents compliance with the DQA, and certifies that this opinion has undergone pre-dissemination review.

**4.1 Utility:** Utility principally refers to ensuring that the information contained in this consultation is helpful, serviceable, and beneficial to the intended users. The intended users are Reclamation and the Districts.

Individual copies of this opinion will be provided to Reclamation and the Districts. This biological opinion will be posted on the NMFS Northwest Region website (http://www.nwr.noaa.gov). The format and naming adheres to conventional standards for style.

**4.2 Integrity:** This consultation was completed on a computer system managed by NMFS in accordance with relevant information technology security policies and standards set out in Appendix III, 'Security of Automated Information Resources,' Office of Management and Budget Circular A-130; the Computer Security Act; and the Government Information Security Reform Act.

**4.3 Objectivity:**

*Information Product Category*: Natural Resource Plan.

*Standards*: This consultation and supporting documents are clear, concise, complete, and unbiased; and were developed using commonly accepted scientific research methods. They adhere to published standards including the NMFS ESA Consultation Handbook, ESA Regulations, 50 CFR 402.01, *et seq*., and the MSA implementing regulations regarding EFH, 50 CFR 600.920(j).

*Best Available Information*: This consultation and supporting documents use the best available information, as referenced in the Literature Cited section. The analyses in this opinion/EFH consultation contain more background on information sources and quality.

*Referencing*: All supporting materials, information, data and analyses are properly referenced, consistent with standard scientific referencing style.

*Review Process*: This consultation was drafted by NMFS staff with training in ESA and MSA implementation, and reviewed in accordance with Northwest Region ESA quality control and assurance processes.

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