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T. JAMES DAVIS
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Public Utility District No. 1 of Douglas County

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Via Electronic Filing

Honorable Kimberly D. Bose
Secretary
Federal Energy Regulatory Commission
888 1st Street N.E.
Washington, D.C. 20426

July 2, 2013

Subject: **Wells Hydroelectric Project No. 2149**
Wells Steelhead Hatchery and Genetic Management Plan – License Article 404

Dear Secretary Bose:

Pursuant to Article 404 of the new license for the Wells Hydroelectric Project, the Public Utility District No. 1 of Douglas County (Douglas PUD) hereby submits for approval the Wells Complex Upper Columbia River Summer Steelhead Hatchery and Genetic Management Plan (Wells Steelhead HGMP).

Article 404 requires Douglas PUD to file the Wells Steelhead HGMP within one year of issuance of the license following consultation with the parties to the Anadromous Fish Agreement and Habitat Conservation Plan for the Wells Project (Wells HCP).

The final Wells Steelhead HGMP is attached as Exhibit A to this letter and was developed, reviewed and approved by the parties to the Wells HCP and more specifically the members of the Wells HCP Hatchery Committee.[1] Parties to the Wells HCP and HCP Hatchery Committee include the National Marine Fisheries Service (NMFS), United States Fish and Wildlife Service (USFWS), Washington State Department of Fish and Wildlife (WDFW), the Confederated Tribes of the Colville Reservation (CCT), the Confederated Tribes and the Bands of the Yakama Nation (YN) and Douglas PUD.

The enclosed Wells Steelhead HGMP is consistent with the terms of the Wells HCP and consistent with the terms of the FERC license for the Wells Project. The pre-filing consultation record supporting the Wells HCP Hatchery Committee's approval of the Wells Steelhead HGMP is attached as Exhibit B to this letter.

[1] The Wells HCP Hatchery Committee is the committee tasked with administering hatchery-related activities associated with the implementation of the Wells HCP under the supervision of the Wells HCP Coordinating Committee.

Douglas PUD respectfully requests that the FERC approve the enclosed Wells Steelhead HGMP prior to October 2, 2013. The existing Wells Steelhead HGMP and associated steelhead hatchery incidental take permit under the Endangered Species Act (Permit No. 1395) expire on this date and the new HGMP enclosed will need to be approved by the FERC by that date in order for Douglas PUD to fully implement the new hatchery activities proposed in the enclosed HGMP.

If you have any questions or require further information regarding the Wells Steelhead HGMP, please feel free to contact me at (509) 881-2208, sbickford@dcpud.org.

Sincerely,

Shane Bickford
Natural Resources Supervisor

Enclosures: 1) Exhibit A – Wells Steelhead Hatchery and Genetic Management Plan.
2) Exhibit B – Pre-filing consultation record for Wells Steelhead HGMP.

Cc: Wells HCP Hatchery Committee
Rob Jones – NMFS
Craig Busack – NMFS
Greg Mackey – Douglas PUD
Tom Kahler – Douglas PUD

EXHIBIT A

WELLS STEELHEAD HATCHERY AND GENETIC MANAGEMENT PLAN

HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

Hatchery Program:	Wells Complex Summer Steelhead Program
Species or Hatchery Stock:	Upper Columbia River Summer Steelhead (*Oncorhynchus mykiss*)
Agency/Operator:	Douglas PUD and Washington Department of Fish and Wildlife
Watershed and Region:	Methow Sub-basin/Columbia Cascade Province Okanogan Sub-basin/ Columbia Cascade Province
Date Submitted:	April 06, 2011
Date Last Updated:	March 31, 2011

Table of Contents

List of Tables

List of Figures

List of Appendices

ACRONYM LIST

µg/L	micrograms per liter
AHA	All-H Analyzer
ad-clip	adipose fin clip
BAMP	Biological Assessment and Management Plan
BKD	bacterial kidney disease
BY	brood year
C	Celsius
CBFWA	Columbia Basin Fish and Wildlife Authority
CCT	Colville Confederated Tribes
cfs	cubic feet per second
Chelan PUD	Public Utility District No. 1 of Chelan County
cm	centimeter
CV	Coefficient of Variance
CWT	coded-wire tag
Douglas PUD	Public Utility District No. 1 of Douglas County
DPS	Distinct Population Segment
EDT	Ecosystem Diagnostic and Treatment
ELISA	enzyme-linked immunosorbent assay
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
F	Fahrenheit
f/r	fish per redd
FCRPS	Federal Columbia River Power System
FDA	U.S. Food and Drug Administration
FERC	Federal Energy Regulatory Commission
FH	Fish Hatchery
FL	Fork Length
FPA	Federal Power Act
fpp	fish per pound
fte	full-time equivalent
g	gram
GCFMP	Grand Coulee Fish Maintenance Project
Grant PUD	Public Utility District No. 2 of Grant County
gpm	gallons per minute
HxH	hatchery by hatchery
HxW	hatchery by wild
HCP	Habitat Conservation Plan
HETT	Hatchery Evaluation Technical Team
HGMP	Hatchery Genetic Management Plan
HOB	hatchery-origin broodstock
HOR	hatchery-origin recruit
HOS	hatchery-origin spawner

HRR	hatchery replacement rate
HSRG	Hatchery Scientific Review Group
ICTRT	Interior Columbia Basin Technical Recovery Team
IHNV	Infectious Hematopoietic Necrosis Virus
IHOT	Integrated Hatchery Operations Team
INAD	Investigational New Animal Drug
IPNV	Infectious Pancreatic Necrosis Virus
JFP	Joint Fisheries Parties
Km	kilometer
M&E	Monitoring and Evaluation
MCMCP	Mid-Columbia Mainstem Conservation Plan
mg/L	milligrams per liter
MGD	millions of gallons per day
ml/L	milliliters per liter
mm	millimeter
MOA	Memorandum of Agreement
MPG	major population group
Ne	effective population size
NPDES	National Pollution Discharge Elimination System
NFH	National Fish Hatchery
NMFS	National Marine Fisheries Service
NNI	No Net Impact
NOAA	National Oceanic and Atmospheric Administration
NOB	natural-origin broodstock
NOR	natural-origin recruit
NOS	natural-origin spawner
NPDES	National Pollutant Discharge Elimination System
NRR	natural replacement rate
NTTOC	non-target taxa of concern
OBMEP	Okanogan Basin Monitoring and Evaluation Program
ODFW	Oregon Department of Fish and Wildlife
O&M	operation and maintenance
OLAFT	Off-Ladder Adult Fish Trap
pHOS	percent hatchery-origin spawners
pNOB	percent natural-origin broodstock
POH	Posterior Orbit (to) Hypural (plate)
PIT	passive integrated transponder
PNFHPC	Pacific Northwest Fish Health Protection Committee
PNI	Proportionate Natural Influence
PRCC	Priest Rapids Coordinating Committee
PRCC	Priest Rapids Coordinating Committee Hatchery Subcommittee
PRD	Priest Rapids Dam
RCW	Revised Code of Washington
Recovery Plan	Upper Columbia Spring Chinook Salmon and Steelhead Recovery Plan
Rkm	river kilometer

S/S	spawner to spawner
SAR	smolt to adult returns
SIWG	Species Interaction Work Group
SSA	Salmon and Steelhead Agreement
TL	Total Length
UCR	Upper Columbia River
UCRTT	Upper Columbia Regional Technical Team
UCSRB	Upper Columbia Salmon Recovery Board
USFS	U.S. Forest Service
USFWS	U.S Fish and Wildlife Service
VIE	visual implant elastomer
VSP	Viable Salmonid Populations
WxW	wild by wild
WDFW	Washington Department of Fish and Wildlife
Wells HCP	Wells Hydroelectric Project Anadromous Fish Agreement and Habitat Conservation Plan
WNFH	Winthrop National Fish Hatchery
WRIA	Water Resource Inventory Area
YN	Yakama Nation

SUMMARY

This document is the Hatchery Genetic Management Plan (HGMP) for the Wells Complex summer steelhead program funded by Public Utility District No 1 of Douglas County (Douglas PUD), and is submitted as a requirement to support Endangered Species Act (ESA 1973) compliance for the operation of the program. This document includes details about the program's operation and facilities, as well as information on the potential effects of the program on ESA-listed fish species and measures to avoid, minimize or eliminate any negative effects of the program while amplifying the positive attributes of hatchery supplementation. The document is organized as follows:

- Section 1 describes the program in general, including contact information, justification for the program, and performance standards.
- Section 2 provides information on expected and potential effects on ESA-listed salmonid populations from the program.
- Section 3 relates the program to other management objectives for the species.
- Sections 4 through 10 describe the mechanics of fish handling, rearing, collection, and release.
- Section 11 discusses the monitoring and evaluation necessary to maintain the program.
- Section 12 summarizes ongoing or future research related to the program, including a spawning (reproductive) success study required under the Wells HCP.
- Section 13 includes attachments and citations.

The Wells Complex summer steelhead program receives long-term ESA coverage under Permit Number 1395. Permit 1395 authorizes annual take of adult and juvenile, ESA listed Upper Columbia River (UCR) spring Chinook salmon and UCR steelhead through broodstock collection activities, hatchery operations, juvenile fish releases, and monitoring and evaluation activities associated with UCR steelhead artificial propagation programs in the UCR region. Permit 1395 is necessary to support the seven percent hatchery compensation requirement of the Wells Hydroelectric Project Anadromous Fish Agreement and Habitat Conservation Plan (HCP) (DCPUD 2002). The decision-making body for hatchery issues under the Wells HCP is the Wells HCP Hatchery Committee, which provides oversight and recommendations for the programs as part of the HCP implementation process. The Hatchery Committee has developed the program described in this HGMP to support the current biological, agency, and program goals. Decisions made by the HCP Hatchery Committee are dynamic and adaptive; thus, future updates to this HGMP may be necessary during the ongoing implementation of the HCP.

The goal of the program is the restoration of naturally reproducing populations of Methow River summer steelhead in their native habitats using locally adapted broodstock, while maintaining genetic and ecologic integrity, and supporting harvest where and when consistent with restoration objectives. The purpose of the program is to meet No Net Impact (NNI) passage loss mitigation and Fixed Hatchery Compensation (harvest) established in the Wells HCP in a manner consistent with the objective of rebuilding natural populations.

The Douglas PUD Wells Complex summer steelhead program is necessary for providing mitigation fish as compensation for losses of juvenile summer steelhead resulting from operation of Wells Dam. Currently the survival rate for juvenile steelhead passing through the Wells Hydroelectric Project is 96.3%, requiring the production of 3.7% NNI mitigation, which is currently equivalent to 47,571 steelhead smolts. Douglas PUD will release its NNI fish in the Twisp River, Methow Basin. Additionally, the Fixed Hatchery Compensation specified in the Wells HCP requires the release of 300,000 steelhead smolts intended to mitigate for lost fishery access due to the construction of Wells Dam.

In 2009, about 324,000 Wells Hatchery steelhead smolts were released into the Methow Basin and about 146,633 Wells Hatchery steelhead smolts were released into the Okanogan River. Historically up to 550,000 smolts have been released annually above Wells Dam from the Wells Hatchery, Winthrop National Fish Hatchery (WNFH), and the Grant PUD and Colville Confederated Tribes (CCT) programs. In the future, up to 750,000 hatchery steelhead smolts may be released into Wells Project if all proposed programs achieve full capacity. This HGMP substantially reduces the number of steelhead released into the Methow Basin from the Wells Complex, and emphasizes locally-adapted broodstock and management strategies designed for recovery of the steelhead populations upstream of Wells Dam.

Natural and hatchery run escapement sizes for the Methow River are given in the table below. The estimated adult steelhead run escapement to the Methow River basin has averaged (geometric mean) 3,162 hatchery-origin (range 361–12,956) and 509 natural-origin (range 65–1,442) steelhead for brood years 1996 to 2010.

Methow River hatchery- and natural-origin summer steelhead run escapements for BYs 1996 to 2010. Data from Snow et al. (2008) and Andrew Murdoch (WDFW unpublished data).

Brood Year	Hatchery Run Escapement	Natural Run Escapement
1996	361	65
1997	1,789	166
1998	2,286	76
1999	1,429	145
2000	1,831	285
2001	3,338	369
2002	10,210	615
2003	4,775	555
2004	5,019	718
2005	4,713	544
2006	3,538	472
2007	3,137	407
2008	3,110	696
2009	4,751	779
2010	12,956	1,442
15-Yr geometric means	3,162	509

The Wells Complex summer steelhead program comprises one integrated component intended to rebuild the natural population in the Methow Basin, a safety-net component for the Methow Basin, and a safety-net component for steelhead populations upstream of Wells Dam that is also capable of providing harvest opportunities. All three components of the Methow program are designed to work together to meet the stated goals of this HGMP: 1) The Twisp integrated program serves as a recovery program, 2) The Lower Methow component serves as a safety-net for the Methow Basin, and incorporates hatchery-origin broodstock from the Twisp, and 3) The Columbia Mainstem program functions as a safety-net for the populations upstream of Wells Dam, to segregate fish that were formerly released in the Methow, and will also provide harvest opportunity.

In addition to raising fish to meet Douglas PUD's mitigation obligations in the Methow and mainstem Columbia River, the Wells Hatchery will also be used to raise up to 100,000 smolts for Grant PUD's steelhead mitigation for Upper Columbia steelhead passage losses. Please see the Okanogan Basin Summer Steelhead Conservation Program HGMP (submission to NOAA pending) for additional information on the Grant PUD steelhead program at the Wells Fish Hatchery.

The interim conservation goal is to meet a minimum run escapement of 2,500 Methow steelhead above Wells Dam while maximizing the proportionate natural influence (PNI) of the wild environment on the mean phenotypic values and genetic constitutions of wild and integrated-recovery hatchery fish.

In 2011 and 2012, Wells Complex steelhead releases will be combined with Winthrop NFH releases to ensure a 350,000 smolt total release in the Methow Basin. The combined releases in the upper Methow watershed will comprise 47,571 integrated wild-by-wild NNI smolts in the Twisp River, and 100,000 wild-by-hatchery smolts each in the Chewuch and upper Methow rivers. The remainder of the fish (100,000) will be released below Wells Dam, or up to 100,000 in the Okanogan Basin, if requested by the Colville Confederated Tribes. The 2011 and 2012 phase of the program is a transitional period when broodstock collection and fish rearing facilities will be adjustment in order to implement the long-term program.

In 2013 and beyond, Douglas PUD will release its NNI fish (currently 47,571) in the Twisp River, a major tributary of the Methow River. Douglas PUD's Fixed Hatchery Compensation steelhead (300,000 total) will be divided into a safety-net component (100,000 smolts) in the Lower Methow River, and a component with releases in the mainstem Columbia (200,000 smolts) below Wells Dam that will serve as a safety-net, where effective segregation from wild and integrated stocks can be achieved while still supporting harvest. Up to 200,000 smolts may be released from acclimation ponds in the Columbia River mainstem, upstream of the Okanogan River, should acclimation ponds and adult extraction capabilities be developed, by others.

Up to 100,000 (+-10%) smolts will be produced at Wells Hatchery for Grant PUD. The program will rear locally-adapted Okanogan fish and Okanogan Basin safety-net fish. The number of Okanogan smolts reared at Wells Hatchery will be progressively reduced, concurrent with a gradual increase in adult collection associated with the phased implementation of the Colville Tribal locally-adapted steelhead program funded by BPA and authorized under a separate HGMP; however, the overall Grant PUD production at Wells Hatchery will remain at 100,000 smolts but will be transitioned from a portion being Okanogan Basin integrated fish to entirely an Okanogan safety-net program.

The Twisp River Integrated (WxW) component will collect up to 26 NORs collected at the Twisp Weir. In most years, a “proportion of natural-origin broodstock” (pNOB) of 1.0 is expected given adequate natural-origin run sizes. Spawning and incubation will be done at the Methow or Wells hatcheries. The fish will be reared at the Wells Hatchery, marked with a CWT, and then transferred for acclimation at the Twisp Acclimation Pond adjacent to the Twisp Weir. Natural-origin steelhead broodstock collected for the Twisp River Integrated (WxW) component may be live-spawned so that they could be reconditioned and released.

The Lower Methow Safety-Net (HxH) component will use up to 52 hatchery-origin adults collected at the Twisp Weir, Winthrop NFH, Methow Hatchery, or by other means. Spawning and rearing will occur at the Wells Hatchery. Some spawning may occur at Methow Hatchery with green eggs transported to Wells Hatchery for incubation and rearing. The fish will be adipose-clipped, and transported to the Methow Hatchery-Pond 13 for acclimation immediately after spring Chinook have been released from this pond. Alternative release strategies under an adaptive management framework have been defined for this component.

The Mainstem Columbia Segregated (HxH) component will use up to 104 hatchery-origin adults collected at 1) Methow Hatchery volunteer trap, and 2) Wells Hatchery volunteer channel or Wells Dam. Spawning, incubation, rearing, and acclimation will occur at the Wells Hatchery. Fish will be marked with adipose and ventral clips and released directly from Wells Hatchery. Some spawning may occur at Methow Hatchery with green eggs transported to Wells Hatchery for incubation and rearing.

The Grant PUD Program will use up to 56 hatchery- or natural-origin adult steelhead collected from the Okanogan River Basin, Wells Hatchery volunteer channel, or Wells Dam fishway traps. Spawning and rearing will occur at Wells Hatchery. Locally-adapted Okanogan steelhead used for the Okanogan Basin integrated program will be spawned and reared separately from the Okanogan safety-net fish. Up to 100,000 Okanogan safety-net smolts may be released wholly, or in part, directly to the Columbia River from Wells Hatchery, or in the Similkameen, mainstem Okanogan, or the Columbia River upstream of the Okanogan River confluence (requires acclimation and adult management capability, to be developed by others). The locally-adapted fish will be released in the Okanogan River Basin. Additional information on Grant PUD’s steelhead program at the Wells Hatchery can be found in the Okanogan Basin Summer Steelhead Conservation Program HGMP.

The Methow Basin will be managed for steelhead recovery by gradually boosting overall average PNI to 0.50 in the short term, and to 0.67 or higher in the long term. Several methods will be used to attain a desired PNI in the Methow Basin. First, the Wells Complex Hatchery smolt releases in the basin will be limited to 147,000. Second, conservation fisheries will be used to reduce the number of excess hatchery spawners. Third, excess hatchery steelhead will be removed at the Twisp Weir, Methow Hatchery outfall trap, and Winthrop NFH outfall trap. In years of high returns, fish may be removed at the Wells Hatchery volunteer channel and at Wells Dam during planned assessment activities. All Mainstem Columbia segregated adult returns to the Wells volunteer trap, Twisp Weir, or Methow volunteer trap will be removed in years when combined Methow natural-and hatchery-origin spawners are estimated to exceed 1,000. In years when this total is estimated to be below 1,000 spawners, the Mainstem Columbia segregated returns may be allowed to pass upstream in numbers sufficient to boost the number of spawners in the Methow Basin to approximately 1,000.

Twisp Component hatchery-origin fish will be allowed upstream of the Twisp Weir in numbers equal to the natural-origin returns passed upstream of the Twisp Weir (after broodstock collection). Hatchery fish from outside the Twisp will not be allowed upstream, except in years when there are too few hatchery fish to fulfill the 1:1 ratio (see Appendix A, Wells Steelhead Spawning Success Study Design). Adult management for the Lower Methow component will be achieved through conservation fisheries and by removal of surplus adults at the Methow Hatchery volunteer trap, Winthrop NFH, and Twisp Weir.

Conservation fisheries in the Methow River and Columbia mainstem will be used to reduce the number of surplus hatchery-origin steelhead in the Methow Basin. However, empirical evidence and modeling indicates that conservation fisheries alone will be insufficient to address the over-escapement of hatchery steelhead in some years. In the fall of 2009, WDFW implemented experimental fishing regulations aimed at improving the removal rate of adult hatchery fish from the Methow River. Although early creel surveys indicated improved removal rates, insufficient data are available to determine whether or not those regulations will prove successful over time.

Roles and responsibilities for the program are as follows: The Wells HCP Hatchery Committee is responsible for making adjustments in the hatchery programs based upon the results of the M&E Plan (HCP HC 2007) and Wells Steelhead Spawning Success Study (Appendix A). The Wells HCP Hatchery Committee is also responsible for approving yearly M&E implementation plans. Douglas PUD funds the following: facility improvements, HCP HC approved changes to artificial production programs, monitoring and evaluation of programs as identified in the M&E Plan and the yearly M&E implementation plans, permit(s), and implementation of the HCP. Douglas PUD's designated agent and joint permit holder (currently the Washington Department of Fish and Wildlife [WDFW]) implements the M&E plan and operates the hatchery facilities at the direction of Douglas PUD and according to the terms of the Wells HCP Section 8 "Hatchery Compensation Plan," the ESA Section 10 permit(s) in consultation with the National Marine Fisheries Service (NMFS), and the Priest Rapids Coordinating Committee Hatchery Subcommittee, as necessary. Grant PUD is currently a co-funder of the Wells Complex Hatchery Program and accompanying M&E Program. WDFW provides funding and facilities for the Ringold Springs Hatchery.

1.0 GENERAL PROGRAM DESCRIPTION

1.1 Name of Hatchery or Program.

Wells Complex Summer Steelhead Program.

1.2 Species and Population (or Stock) under Propagation, and Endangered Species Act (ESA) Status

Upper Columbia River Summer Steelhead (*Oncorhynchus mykiss*)
ESA Status: Threatened

1.3 Responsible Organization and Individuals

Name (and title): William C. Dobbins, General Manager
Agency or Tribe: Public Utility District No. 1 of Douglas County (Douglas PUD)
Address: 1151 Valley Mall Parkway, East Wenatchee, WA 98802
Telephone: (509) 884-7191
Fax: (509) 884-0553
Email: bdobbins@dcpud.org

Name (and title): Phil Anderson, Director
Agency or Tribe: Washington Department of Fish and Wildlife (WDFW)
Address: (main office) Natural Resources Building, 1111 Washington Street, SE, Olympia, WA 98501-2200; (mailing address) 600 Capitol Way N., Olympia, WA, 98501-1091
Telephone: (360) 902-2720
Fax: (360) 902-2947
Email: Philip.anderson@dfw.wa.gov

Douglas PUD (as the owner of the Wells Complex and funder of hatchery facilities, operation and maintenance [O&M], and hatchery program monitoring and evaluation [M&E]) and WDFW (as Douglas PUD's current hatchery operator and implementing contractor for the M&E Plan) are joint permit holders for the Wells Complex Summer Steelhead Program. Future contractors for Douglas PUD, whether for operating the Wells Complex or for implementing Douglas PUD's hatchery M&E Program, would also jointly hold the permit with Douglas PUD. Grant PUD is also a joint permit holder because of the summer steelhead produced by Douglas PUD at Wells Hatchery specifically to fulfill Grant PUD's mitigation responsibility for the Priest Rapids Hydroelectric Project. Grant PUD co-funds the steelhead program and M&E implementation in proportion to their use of Wells Hatchery.

Other agencies, Tribes, co-operators, or organizations involved, including contractors, and extent of involvement in the program:

- National Marine Fisheries Service (NMFS): Co-manager; HCP Hatchery Committee representative; administration of the Endangered Species Act
- U.S. Fish and Wildlife Service: Co-manager (USFWS); HCP Hatchery Committee representative; administration of the Endangered Species Act
- Washington Department of Fish and Wildlife: Co-manager; HCP Hatchery Committee representative; current contracted hatchery operator
- Confederated Tribes of the Colville Reservation (CCT): Co-manager; HCP Hatchery Committee representative
- Confederated Tribes and Bands of the Yakama Nation (YN): Co-manager; HCP Hatchery Committee representative
- Public Utility Districts No. 2 of Grant County (Grant PUD): current co-funder of hatchery programs

1.4 Funding Source, Staffing Level, and Annual Hatchery Program Operational Costs

The funding source for the Twisp, Lower Methow and Methow safety-net programs is Douglas PUD; Grant PUD currently reimburses Douglas PUD for up to 100,000 steelhead reared for them at Wells Hatchery. The staffing level at Wells Hatchery is 6.8 full-time-equivalent (FTE) staff; and the Wells Hatchery budgeted operational costs for fiscal year 2009-2010 are $1,158,500. Costs are inclusive of all programs at Wells Hatchery and cannot be broken out for individual programs. Additionally, facility upgrades, repairs, and rehabilitation costs for Fiscal Year 2009-2010 are $405,000. For calendar year 2010, the budgeted costs for contracted M&E activities for all HCP programs funded by Douglas PUD are $994,400. These costs include M&E activities for both Methow spring Chinook and steelhead and are equally divided between the spring Chinook and steelhead programs funded by Douglas PUD. Funding and staffing levels are expected to change in the future as necessary to implement decisions of the HCP Hatchery Committee and to accommodate changes in other budgeted items (i.e. fish food, labor rates, etc.).

1.5 Location(s) of Hatchery and Associated Facilities

Table 1-1. Hatchery facility locations associated with the Methow and Wells summer Steelhead program (located in Water Resource Inventory Areas [WRIAs] 48 and 49 and the Mainstem Columbia River, WRIA 47).

Activity	Facility
Broodstock collection location	• Twisp River weir • Winthrop National Fish Hatchery • Methow Hatchery volunteer channel • Methow Basin (hook and line) • Wells Hatchery volunteer channel and Dam ladder traps
Adult holding location	Wells Hatchery and Methow Hatchery
Spawning location	Wells Hatchery and Methow Hatchery
Incubation location	Wells Hatchery and Methow Hatchery
Rearing location	Wells Hatchery
Acclimation facilities	• Twisp Acclimation Pond • Methow Hatchery-Pond 13 • Wells Hatchery-Pond 3 and 4

1.6 Type of Program

The Wells Complex summer steelhead program consists of the integrated Twisp component, the safety-net Lower Methow component, and the Columbia Mainstem safety-net component. In addition, Grant PUD's mitigation for passage losses at the Priest Rapids Project for steelhead in the Okanogan Basin is included in this Hatchery Genetic Management Plan (HGMP). Initially Grant's program at Wells Hatchery will be composed of an Okanogan Basin integrated and an Okanogan Basin safety-net program. Once the BPA steelhead hatchery is constructed in the Okanogan Basin, then all of Grant PUD's 100,000 steelhead smolts raised at the Wells Hatchery will be transitioned into an Okanogan Basin safety-net program. The release sites and adult management of this program is described in the Okanogan Basin Summer Steelhead Conservation Program HGMP (submission to NOAA pending).

Other summer steelhead programs (CCT's Okanogan Basin Summer Steelhead Conservation Program, the USFWS Winthrop National Fish Hatchery (WNFH) integrated recovery, and the WDFW Ringold Fish Hatchery segregated harvest steelhead program) are discussed in this HGMP to the extent needed for context and ESA take considerations.

Section 1.8.2 provides more detail on the program.

1.7 Goal and Purpose of Program

1.7.1 Goal

The goal of the program is the rebuilding and recovery of naturally reproducing populations of Methow River summer steelhead, in their native habitats using locally adapted broodstock, by maintaining or improving population size, productivity, spatial distribution, and diversity. The program will also support harvest where and when consistent with restoration objectives.

1.7.2 Purpose

The purpose of the program is to meet the Wells Hydroelectric Project Anadromous Fish Agreement and Habitat Conservation Plan (HCP) No Net Impact (NNI) passage-loss mitigation and Fixed Hatchery Compensation for harvest in a manner consistent with the objective of rebuilding natural populations. In addition to providing mitigation for passage losses at Wells Dam, the Wells Hatchery program also provides NNI mitigation for Grant PUD in accordance with the Priest Rapids Salmon and Steelhead Agreement (SSA).

1.8 Justification for the Program.

The Upper Columbia River (UCR) steelhead Distinct Population Segment (DPS) was listed as threatened on June 18, 2009 (court decision). The best scientific information presently available demonstrates that a multitude of factors, past and present, have contributed to the decline of west coast salmonids. In the UCR Region, habitat destruction (e.g., stream channelization, bank armoring, and floodplain disconnection; migration barriers; unscreened diversions; land-use practices), past over-harvest in fisheries, hydropower facilities, and some hatchery practices are the major causes of population declines (UCSRB 2007). Poor ocean conditions prior to 2000 suppressed fish survival, and vastly increased avian predation in the Columbia River estuary, further affected the basin's steelhead populations.

The Wells Complex summer steelhead program specifically addresses the unavoidable loss of juvenile summer steelhead associated with the operation of Wells Dam and a portion of the unavoidable losses associated with operation of Wanapum and Priest Rapids dams, and has the potential to contribute to the long-term persistence of ESA-listed UCR steelhead through increases in the abundance of the ESA-listed population (UCSRB 2007; HSRG 2009).

While the proposed artificial propagation program has the potential to cause deleterious direct and indirect effects on the ESA-listed species, such as maladaptive genetic, physiological, or behavioral changes in donor or target populations (Hard et al. 1992), the implementation of the proposed program includes special provisions to ensure the program contributes to the recovery of ESA-listed steelhead in the Methow Basin. Protocols for broodstock collection will be annually developed by WDFW, and approved by the Hatchery Committee and submitted to NMFS prior to retention of adult steelhead to ensure that the activities do not pose a substantial risk to recovery. Other risk-management steps include annual consideration of run size and composition, measures to purposefully manage returning artificially propagated adult steelhead, long-term monitoring and evaluation of the efficacy of the programs, and a means to adaptively manage the programs through the HCP Hatchery Committees. When implemented, these measures will minimize the risk of genetic and/or ecological hazards to ESA-listed species and specifically support the recovery of ESA-listed steelhead, while mitigating for the unavoidable losses of juvenile steelhead associated with the operation of Wells, Wanapum, and Priest Rapids hydroelectric projects. The Joint Fisheries Parties (JFP) have determined that any risks associated with the Wells Complex summer steelhead hatchery program are outweighed by the benefits of the program to the DPS.

1.8.1 Legal Agreements and Requirements

This HGMP includes actions required of Douglas PUD pursuant to its Wells HCP (and Grant PUD pursuant to their SSA), as well as other adult-management[1] actions that are beyond Douglas PUD's HCP obligations but represent important fishery management activities that may be implemented by WDFW and the other JFPs (please see Section 3.2 for a description of management coordination by Hatchery Committee members and US v. OR signatory fishery co-managers.). This section is intended to provide background and context to aid in the interpretation and application of the terms and obligations of this HGMP. Specifically, this section (1) identifies and describes the purposes and objectives of the Wells HCP relevant to this HGMP; (2) outlines certain responsibilities and obligations of Douglas PUD based on the commitments and assurances provided in the Wells HCP; and (3) describes certain obligations and responsibilities under the terms of this HGMP.

1.8.1.1 Douglas PUD's Wells HCP

Included in the license for the Wells Project (Federal Energy Regulatory Commission [FERC] No. 2149) is a Wells HCP, detailing the long-term adaptive management of Plan Species and their habitat as affected by the Wells Project. Parties to these agreements include: Federal (USFWS, NMFS), a State agency (WDFW), and Tribal governments (CCT, YN). Section 8 of the Wells HCP details the objectives, responsibilities, and requirements of hatchery programs required as mitigation for the operation of the Wells Project, as follows:

> *8.1 Hatchery Objectives*[2]
> *8.1.1 The District shall provide hatchery compensation for all of the Permit Species, including: a) spring Chinook salmon, b) summer/fall Chinook salmon, c) sockeye salmon, d) summer steelhead as further described in Section 8* [of the Wells HCP] *(Hatchery Compensation Plan). The District shall also provide hatchery compensation for coho salmon should they become established under the criteria set forth in Section 8.4.5.1 (Coho)*[3]*.*
>
> *8.1.2 The District shall implement the specific elements of the hatchery program consistent with overall objectives of rebuilding natural populations, and achieving NNI. Species specific hatchery program objectives developed by the JFP may include contributing to the rebuilding and recovery of naturally reproducing populations in their native habitats, while maintaining genetic and ecologic integrity, and supporting harvest. This compensation may include Measures to increase the off-site survival of naturally spawning fish or their progeny (i.e. Sockeye Enhancement Decision Tree, Section 14, Figure 3* [of the Wells HCP]*).*

[1] The term "adult management," (and other references to the management of hatchery adult returns) as used throughout this document, is defined as the selective removal of excess hatchery-origin summer steelhead by means of harvest, translocation, culling, or other method of physical removal of returning adult fish for purposes other than broodstock collection or HCP Hatchery Committee-approved monitoring and evaluation activities
[2] Taken from page 27 of the Wells HCP.
[3] Coho were approved as a Plan Species requiring mitigation by the Hatchery Committees in December 2007.

1.8.1.2 Adaptive Management and Section 10 Permits

The Wells Hatchery summer steelhead program receives long-term ESA coverage under Permit Number 1395. Permit 1395 authorizes annual take of adult and juvenile, ESA-listed UCR spring Chinook salmon and UCR steelhead through broodstock collection activities, hatchery operations, juvenile fish releases, and monitoring and evaluation activities associated with UCR steelhead artificial propagation programs in the UCR region. Permit 1395 is necessary to support the seven percent hatchery compensation requirement of the HCP (Wells HCP 2002).

Douglas PUD's Wells summer steelhead hatchery program obligations under the HCP are implemented through an adaptive-management process set forth in the HCP under the direction of the HCP Hatchery Committee. Specifically, the HCP Hatchery Committee may periodically adjust Douglas PUD's hatchery production levels (see HCP Sections 8.4.4 and 8.4.5) and make program modifications to achieve program objectives, including changes to facilities, release methods, and rearing strategies necessary to achieve and maintain NNI pursuant to the HCPs (see HCP at Section 8.6). The adaptive-management processes established under the HCP are integral to the summer steelhead programs described in this HGMP.

Adaptive Management (see Crawford, et al. 2005; Johnson 1999; Williams et al. 2009) is an iterative and rigorous process (Figure 1-1) used to achieve biological goals and objectives. In the context of this HGMP, this process is intended to improve the management of summer steelhead in order to achieve the desired goals and objectives as effectively and efficiently as possible. The process first involves developing management objectives, indicators of success, and options for management actions, identifying key uncertainties, and developing alternative hypotheses that relate to the management actions. Actions are designed with predicted outcomes and these actions are implemented. The implementation of the actions is monitored for deviations from the design, and to assess the effectiveness of the actions. Based on monitoring, the most effective actions are identified, and hypotheses are accepted or rejected. Uncertainties and hypotheses are revised and information is shared. The management actions described in this HGMP will be managed adaptively as described, and management decisions will be based on the assessment of those actions as they relate to management objectives and hypotheses. The process used by the HCP HC is more fully described in the Conceptual Approach to Monitoring and Evaluation for Hatchery Programs (2007; see Figure 1-2).

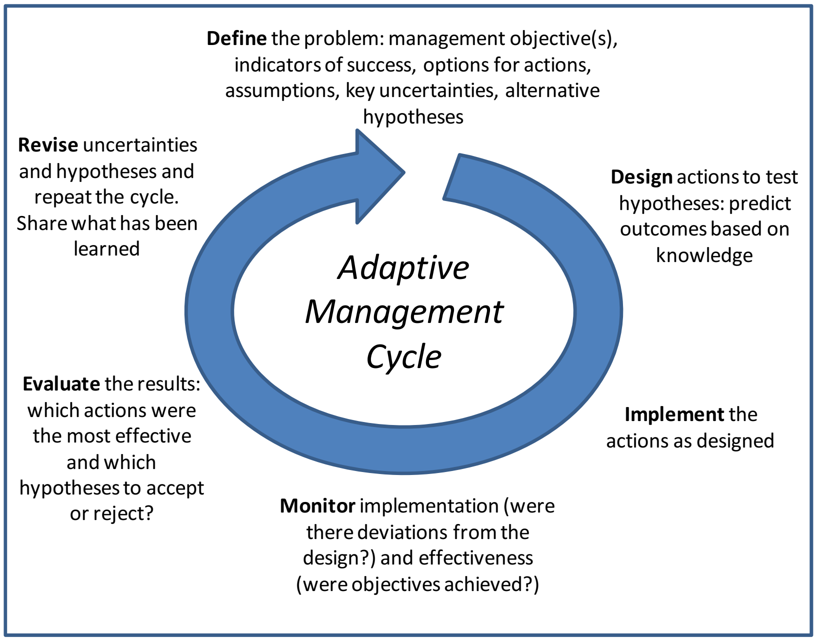

Figure 1-1. The general adaptive management cycle.

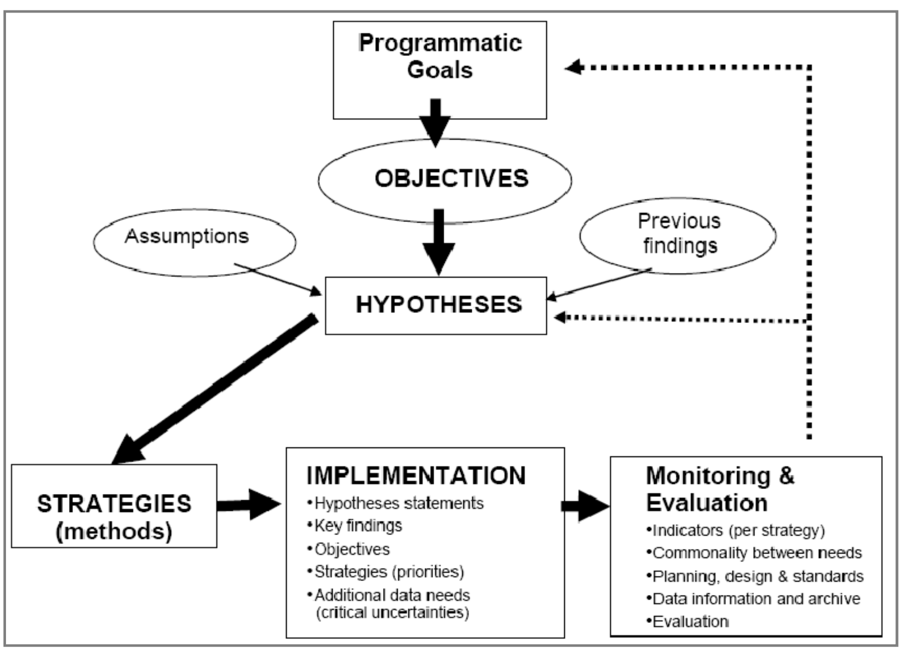

Figure 1-2. Adaptive management framework from the Conceptual Approach to Monitoring and Evaluation for Hatchery Programs (2007).

Any updated Section 10 permit and associated environmental reviews should incorporate, rely on, and anticipate compliance with the adaptive-management provisions of the HCP as described above. This practice will minimize the need for future modification of the Section 10 permit for normal, ongoing program-oversight decisions of the HCP Hatchery Committee, recognizing that NMFS will play an integral role in determining any future program modifications as a member of the HCP Hatchery Committee.

Douglas PUD HGMP Actions Implementing the HCP

Within this HGMP, the following are Douglas PUD obligations intended to implement the requirement of the Wells HCP to provide up to 7% hatchery compensation for unavoidable passage losses (currently 3.7% as adjusted per the 96.3% survival of yearling steelhead measured by four years of survival studies conducted in 1998, 1999, 2000, and 2010, and subject to readjustment):

- Provide water sources and implement risk-aversion measures as described or similar to those described in Section 4 “Water Source.”
- Provide facility capacity to rear the fish as described in Section 5 “Facilities.”
- Provide broodstock collection facilities—Wells Dam fishways, Wells Hatchery outfall, Methow Hatchery outfall, and the Twisp River weir, as well as hook-and-line collection in the Methow Basin, and funding for operators for hook-and-line and trap broodstock collection as described in Section 6 “Broodstock Origin and Identity” and Section 7 “Broodstock Collection.”
- Provide funding for an operator to perform the activities described in Section 8 “Mating,” Section 9 “Incubation and Rearing,” and Section 10 “Release.”
- Provide funding for implementation of the hatchery M&E Plan as approved and modified by the HCP Hatchery Committee.
- Under the terms of this HGMP, Douglas PUD via their hatchery operator and/or M&E contractor (currently WDFW) is also obligated to complete and submit all hatchery Section 10 permit reporting associated with Douglas PUD’s hatchery obligations.
- Douglas PUD will provide one FTE for adult-management activities (for both steelhead and spring Chinook hatchery programs) associated with Douglas PUD’s NNI hatchery compensation. This FTE will be responsible for adult management to the point where fish are placed in a holding container.

WDFW HGMP Actions

WDFW is the funding source for elements of the hatchery program that are not Douglas, or Grant PUDs’ obligations under the HCPs or respective hydroelectric licenses. In particular, WDFW is responsible for the management of adults returning that are in excess of program needs or are strays from segregated programs into priority habitats. In addition to funding the removal of excess adults beyond the one FTE that will be provided by Douglas PUD, WDFW shall also be responsible for all adult returns from the point at which fish are placed in a holding container when manually removed or for a conservation fishery (not part of this program or explicitly included in this HGMP). The Co-Managers will determine the disposition of the fish placed in the holding container. WDFW is responsible for coordinating the disposition of surplus hatchery fish.

1.8.2 Program Description

The Wells Complex summer steelhead program is described in the subsequent subsections and includes: (1) broodstock collection and program size; (2) spawning, incubation, rearing, residual management[4], and release of juvenile summer steelhead; (3) escapement and management of returning adults; and (4) monitoring and evaluation.

The Wells Complex summer steelhead program comprises one integrated component intended to rebuild the natural population in the Twisp Basin, a safety-net program for the Methow Basin, and a safety-net component for the populations upstream of Wells Dam, but also capable of providing harvest opportunity. The Douglas PUD HCP production is currently 47,571 NNI fish and 300,000 fixed hatchery compensation fish, for a total of 347,571 smolts. In addition, the Wells Hatchery also provides rearing support for up to 100,000 Okanogan Basin smolts (both integrated and safety-net programs) for Grant PUD's Upper Columbia steelhead mitigation requirements. The interim conservation goal is to meet a minimum run escapement of 2,500 Methow steelhead above Wells Dam while maximizing the proportionate natural influence (PNI)[5] of the wild environment on the mean phenotypic values and genetic constitutions of wild and integrated-recovery hatchery fish. Please see the Okanogan Basin Summer Steelhead Conservation Program HGMP for information on Okanogan Basin management objectives.

1.8.2.1 Douglas PUD Program Description for 2011 and 2012

Wells Complex steelhead releases will be combined with Winthrop NFH releases to ensure a 350,000 smolt total release in the Methow Basin. The combined releases in the upper Methow watershed will comprise 47,571 integrated NNI smolts in the Twisp River, and 100,000 smolts each in the Chewuch and upper Methow rivers. The remainder of the fish (100,000) will be released below Wells Dam, or up to 100,000 in the Okanogan Basin, if requested by the Colville Confederated Tribes. The 2011 and 2012 phase of the program is a transitional period when broodstock collection and fish rearing facilities will be adjustment in order to implement the long-term program described in Section 1.8.2.3.

[4] The term "residual management," as used throughout this document, is defined as the removal and disposition of non-migrating steelhead from the hatchery environment for the purposes of precluding their entry to anadromous fish habitats. As relevant here, it includes the removal of non-migrating fish at levels agreed to by the HCP Hatchery Committees and legal disposition of such fish as agreed to by the HCP Hatchery Committees.

[5] Mathematically, PNI = pNOB/(pHOS + pNOB), where pNOB is the proportion of natural-origin fish in the hatchery broodstock and pHOS is the proportion of hatchery-origin fish on the spawning grounds. Biologically, PNI is an approximation of the relative influences of the natural and hatchery environments on the genetic constitution and mean phenotypic values of hatchery and wild fish when gene flow occurs between them.

1.8.2.2 Douglas PUD Program Description for 2013 and beyond

Douglas PUD will release its NNI fish (currently 47,571) in the Twisp River, a major tributary of the Methow River. Douglas PUD's Fixed Hatchery Compensation steelhead (300,000 total) will be divided into a safety-net component (100,000 smolts) in the Lower Methow River, and a safety-net component with releases in the mainstem Columbia (200,000 smolts) below Wells Dam, where effective segregation from wild and integrated stocks can be achieved (Table 1-2). Up to 100,000 of the Mainstem Columbia production could be moved to the Okanogan Basin provided that there are effective means to segregate the fish from wild and integrated stocks, or up to 200,000 smolts may be released from acclimation ponds in the Columbia River mainstem, upstream of the Okanogan River, should acclimation ponds and adult extraction capabilities be developed, by others.

Table 1-2. Douglas PUD Hatchery Program HGMP components.

Program	Component	Type	Hatchery	Population	Release Water Body	Smolts	Comments
Douglas	Twisp NNI Integrated	Integrated	Methow and Wells	Twisp	Twisp River from Twisp Acclimation Pond	47,571	Current release level based upon 96.3% project survival
Douglas	Lower Methow	Safety-Net	Wells	Lower Methow natural- and hatchery-origin	Methow River from Methow Hatchery	100,000	
Douglas	Mainstem Columbia	Safety-Net	Wells	Methow, Wells stock	Columbia River, from Wells Hatchery	200,000	Provision for possible release in Okanogan or Columbia upstream of the Okanogan confluence
Total Douglas PUD NNI and Fixed Hatchery Compensation (safety-net) Releases						***347,571***	

1.8.2.3 Lower Methow Component

The Lower Methow component will be managed as a safety-net for the Winthrop NFH and Twisp conservation programs under the adaptive management framework described in Section 1.8.1.2. Smolts will be reared at the Wells Hatchery and acclimated at the Methow Hatchery in the spring, and the Methow Hatchery volunteer trap will be used as an adult management facility (see Sections 1.8.2.5, 1.8.5.2, and 10.6). Successful achievement of the management objective for this component is contingent upon the successful control of excess hatchery escapement through potential conservation fisheries in the Methow River and adult management at various removal sites (Wells Hatchery volunteer channel, Wells Dam, Twisp Weir, Winthrop NFH volunteer trap, Methow Hatchery volunteer trap, and the conservation fishery). Assessment of the effectiveness of the Lower Methow Component will be based on the management of returning adult hatchery steelhead to the Methow Basin to make reasonable progress towards a PNI of 0.67 and control of straying into the Chewuch River and Methow River upstream of Foghorn Dam. Assessment will begin with the 2012 smolt release cohort acclimated at Methow Hatchery. If straying to these reaches is determined by the HCP HC to be unacceptably high after spring 2015, one or more of the following alternative acclimation and/or release strategies will be implemented: 1) overwinter acclimation at the Methow Hatchery to increase homing fidelity, 2) alternate acclimation sites such as Carlton Pond (Methow River) or the Terry O'Reilly Ponds (Twisp River), and 3) release in a lower Methow Basin tributary(ies) such as Beaver Creek or Gold Creek. The HCP HC will also consider additional measures if the management alternatives described above are not successful in alleviating risk to the Methow steelhead population. These measures may include reduction, termination, or relocation of the Lower Methow Component.

Please see Section 3.2 for a description of management coordination by Wells HCP Hatchery Committee members and the US v. OR signatory fishery co-managers.

The summer steelhead artificial propagation activities will include the (1) biological sampling and release of adult UCR steelhead for annual run evaluation; (2) management of adult returns of UCR steelhead from artificial propagation programs; (3) collection, holding, and artificial spawning of adult UCR steelhead; (4) transfers of UCR steelhead eggs and/or juveniles to appropriate locations; (5) incubation and rearing of UCR steelhead fertilized eggs through the smolt stage; (6) release of propagated UCR steelhead juveniles into the UCR Basin and mid-Columbia River; (7) monitoring and evaluation of the UCR steelhead artificial propagation program; and (8) implementation of a spawning (reproductive) success study in the Methow Basin.

1.8.2.4 Grant PUD Components

Up to 100,000 (+-10%) smolts will be produced at Wells Hatchery for Grant PUD. The program will rear integrated Okanogan fish and Okanogan safety-net fish. The number of Okanogan smolts reared at Wells Hatchery will be progressively reduced, concurrent with adult collection associated with the implementation of the Colville Tribal locally-adapted steelhead program funded by BPA and authorized under a separate HGMP; however, the overall Grant PUD production at the Wells Fish Hatchery will remain at 100,000 smolts. Grant PUD production from Wells Hatchery that is not released in the Okanogan River Basin for implementation of the Colville Tribes locally-adapted steelhead program will be released, wholly or in part, in the mainstem Columbia River at Wells Hatchery, Similkameen River, mainstem Okanogan River, or released from acclimation ponds in the mainstem Columbia River above the confluence of the Okanogan River should acclimation ponds and adult extraction capabilities be developed by others (Table 1-3). Please see the Okanogan Basin Summer Steelhead Conservation Program (submission to NOAA pending) for more information on this program.

Table 1-3. Grant PUD Hatchery Program HGMP components.

Program	Component	Type	Hatchery	Population	Release Water Body	Smolts	Comments
Grant	Okanogan Integrated	Integrated	Wells	Okanogan	Okanogan Basin	20,000 to 30,000	This will eventually transition out of Wells Hatchery
Grant	Okanogan	Safety-Net	Wells	Okanogan, Wells	Columbia, Okanogan	80,000 to 100,000	
Total Grant PUD Releases						***100,000***	

1.8.2.5 Artificial Propagation Activities

Broodstock Collection and Program Size

Numerical goals for broodstock collection were developed based on the intended outcome of the release group, average fecundity, egg-to-smolt survival, and an assumed equal sex ratio. All three components of the Methow program are designed to work together to meet recovery objectives: 1) The Twisp integrated program serves as a recovery program, 2) The Lower Methow component serves as a safety-net for the Methow Basin, and incorporates hatchery-origin broodstock from the Twisp, and 3) The Columbia Mainstem program functions as a safety-net for the populations upstream of Wells Dam, to segregate fish that were formerly released in the Methow, and will also provide harvest opportunity. The maximum extraction rate of natural-origin fish collected for broodstock will not exceed 33% of the natural-origin recruits (NORs) to the Methow Basin or to the Twisp River (see Table 1-4).

Twisp River Integrated (WxW): 47,571 smolts will be produced from up to 26 NORs collected at the Twisp Weir (Table 1-4). In most years, a “proportion of natural-origin broodstock” (pNOB) of 1.0 is expected given adequate natural run sizes. Collections will occur in the spring, shortly before spawning. Returning adult progeny of Twisp hatchery-origin WxW crosses may be used to meet the broodstock need if there are insufficient NORs.

Lower Methow Safety-Net (HxH): 100,000 smolts produced from up to 52 hatchery-origin adults (Table 1-4). Collection of broodstock will occur throughout the run. Twisp WxW hatchery-origin returns will be used for up to 25% of the broodstock (up to 13 fish), to the extent they are available after broodstock and spawning escapement objectives for the Twisp program have been met. Hatchery-origin fish collected at the Winthrop National Fish Hatchery, Methow volunteer channel, or by other means, will also be used. Fish will be collected, in preferential order, at the 1) Twisp Weir (hatchery-origin only), 2) Winthrop National Fish Hatchery, 3) Methow Hatchery volunteer channel (release site), and 4) by hook-and-line in the Methow Basin. Other methods of broodstock collection may be developed for the Methow River, including purse seine, beach seine, trap net, electric fence, or other means to more benignly and efficiently collect Methow-origin broodstock. USFWS has plans to construct a weir in the Methow Basin. If this facility is constructed, it could be used for broodstock collection.

Mainstem Columbia Safety-Net (HxH): 200,000 smolts, produced from HxH crosses of 104 hatchery-origin adults collected at 1) Methow Hatchery volunteer trap, and 2) Wells Hatchery volunteer channel or Wells Dam (Table 1-4). Collections will occur throughout the run. Hatchery-origin (HxW) returns collected at the Methow Hatchery volunteer channel will be used preferentially for broodstock after broodstock and spawning escapement objectives have been met for the Lower Methow component.

Grant PUD Program: Up to 100,000 Okanogan Basin integrated and safety-net smolts will be produced. Up to 56 hatchery- or Okanogan Basin natural-origin adult steelhead will be collected from the Okanogan River Basin, Wells Hatchery volunteer channel, or Wells Dam fishway traps (Table 1-4). Please see the Okanogan Basin Summer Steelhead Conservation Program HGMP (submission to NOAA pending) for details on broodstock collection and composition.

All natural-origin steelhead adults returning to Wells Dam, Wells Hatchery, Methow Hatchery, and the Twisp River weir that are not needed for broodstock will be passed upstream. NORs removed for broodstock will not exceed 33% of the overall natural-origin run size at Wells Dam, Methow Hatchery, the Twisp Weir, or the Methow River.

Table 1-4. Wells Complex steelhead broodstock collection targets, location, and methods by component or program. Programs shaded in gray are not Douglas PUD programs, but utilize Wells-origin broodstock, and Wells FH and Wells Dam infrastructure, and are covered by separate HGMPs.

Component	Type	Population	Total	Hatchery-Origin	Natural-Origin	Brood Collection Location	Collection Method
Twisp Integrated	Integrated	Twisp natural-origin	26	0	26	Twisp Weir	weir trap
Lower Methow	Safety-Net	Methow	52	52	0	Methow Basin	Weir trap, volunteer channels, hook-and-line
Mainstem Columbia	Safety-Net	Wells stock	104	104	0	Methow Hatchery, Wells Hatchery and Dam	volunteer channels, fishway trap
Total broodstock for Douglas PUD programs			*182*				
Grant PUD Phase I	Integrated & Safety-Net	Okanogan & Wells stock	56	See the Okanogan Basin Summer Steelhead Conservation Program HGMP		Okanogan Basin, Wells Hatchery or Dam	
Grant PUD Phase II	Safety-Net	Okanogan & Wells stock	56	See the Okanogan Basin Summer Steelhead Conservation Program HGMP		Okanogan Basin, Wells Hatchery or Dam	
Ringold	Segregated harvest	Wells stock	104*	104*	0	Wells Hatchery, Wells Dam	volunteer channel, Wells Dam-trap
Winthrop	Transitional, integrated	Wells stock	60**	30**	30**	Methow, Wells Hatchery, Wells Dam	volunteer channel, Wells Dam-trap
Total broodstock for Douglas PUD and other programs utilizing Wells Hatchery			402				

*Phasing out.
**Number as needed until WNFH transitions entirely to Methow Basin broodstock collection.

The collection of broodstock at Wells Hatchery for the current WDFW Ringold program will be phased out starting in brood year 2012. The Ringold program was historically sustained by surplus egg production from earlier spawning broodstock from the Wells Hatchery steelhead program, resulting from an attempt to realign the spawn timing of hatchery steelhead with the natural-origin steelhead in the Methow and Okanogan basins. Over-collection of broodstock has been used to aid in the selection of later spawning adults for the Wells Hatchery releases, while the progeny of the earlier spawners were transferred to Ringold Hatchery. Broodstock for releases to the Methow and Twisp rivers components will be collected from those rivers in the spring, and thus there will be no need to collect broodstock from the ladder traps at Wells Dam throughout the run. Consequently broodstock will no longer be collected in excess of production needs to select for later spawning steelhead.

The USFWS steelhead program at WNFH currently comprises progeny of broodstock collected at Wells Hatchery, but is transitioning to the use of broodstock from the Methow Basin, and thus the collection of broodstock at Wells for the USFWS program will no longer be necessary when the transition to broodstock collected in the Methow Basin is complete.

Details of broodstock collection will be determined by the *Upper Columbia River Salmon and Steelhead Broodstock Objectives and Site-Based Broodstock Collection Protocols* developed by WDFW annually, approved by the HCP Hatchery Committee, and submitted to NMFS, which accounts for changes in various factors that may affect broodstock needs. Therefore, these broodstock numbers are subject to change annually pending approval of the broodstock collection protocols. These objectives and protocols may be adjusted in-season to meet changes in the abundance, composition, and location of adult returns, and to minimize impacts on non-target fish. The protocol described below will be used to facilitate the collection of broodstock for the Douglas PUD hatchery program throughout the run while achieving the target extraction rate and ensuring full broodstock collection.

1. WDFW will estimate the Methow Basin steelhead run size.
2. The Twisp program will collect broodstock in the spring, shortly before spawning.
3. The Lower Methow program will collect fish throughout the run for adult management and broodstock purposes. WDFW will develop weekly broodstock collection goals.
4. The Columbia Mainstem program will collect fish throughout the run for adult management and broodstock purposes. WDFW will develop weekly broodstock collection goals.

When in operation, trapping facilities will be checked and emptied daily with adults to be used as broodstock transported to the Wells or Methow fish hatcheries for holding and spawning, and all other fish released upstream of the dam or weir trap(s), or removed to control the “proportion of hatchery-origin spawners” (pHOS). When hook-and-line collection of broodstock is employed, handling stress of adult steelhead captured by hook-and-line will be minimized. Direct mortality from broodstock collection activities has historically been extremely low.

The following procedures will be employed to minimize potential adverse impacts on steelhead associated with broodstock collection activities:

- All species will be held for a minimal duration in the traps (less than 24 hours).
- Traps and holding areas will be locked or secured against tampering or vandalism.
- All natural-origin steelhead in excess of broodstock goals will be released upstream immediately without harm.
- Natural-origin broodstock collection will not exceed 33% of the run.
- Hatchery-origin steelhead, consistent with demographic and pHOS run escapement objectives, will be released upstream immediately without harm.
- Steelhead will be transferred using water-to-water techniques.
- Hook-and-line collections will employ barbless lures/flies and will be conducted by, and/or under strict management oversight by WDFW staff.

Spawning, Incubation, Juvenile Rearing, Planting, and Residualism

Spawning for the Twisp Integrated program will be done at the Methow Hatchery and/or Wells Hatchery, and green eggs will be either retained at Methow Hatchery for incubation to the eyed-egg stage and then transferred to Wells Hatchery, or transported to Wells Hatchery for incubation and rearing. Spawning, incubation, and rearing will follow biosecurity measures at both facilities to minimize risk to the program and other programs (see Sections 7.7 and 9.2). Natural-origin broodstock may be live-spawned so that they could be reconditioned and released. The fish (smolts) will be transferred for acclimation to the Twisp Acclimation Pond adjacent to the Twisp Weir. Volitional release practices to the Twisp River will be employed to selectively release active migrants while retaining non-migratory steelhead (Viola and Schuck 1995).

Spawning and rearing for the Lower Methow safety-net program will occur at the Wells Hatchery. Some spawning may occur at Methow Hatchery with green eggs transported to Wells Hatchery for incubation and rearing. The fish (smolts) will be transported to the Methow Hatchery-Pond 13 for acclimation immediately after spring Chinook have been released from this pond. The fish will be acclimated in Pond 13 until early May, and will be volitionally release until May 25. Volitional release practices to the Methow River will be employed to selectively release active migrants while retaining non-migratory steelhead (Viola and Schuck 1995). See Section 1.8.2.3 for a discussion of adaptive management of the Lower Methow releases.

WDFW will collect non-migratory steelhead remaining in the acclimation pond(s) after the volitional release period and will distribute them to selected area waters that are isolated from anadromous fish populations to provide for resident fisheries, as approved by the HCP Hatchery Committees. The Douglas PUD HCP hatchery production obligations will be fulfilled through a combination of volitionally migrating smolts and non-migrants that have been planted for resident fisheries.

Spawning, incubation, rearing, and acclimation for the Mainstem Columbia Safety-Net releases will occur at the Wells FH (surface and ground water sources). Fish will be released directly from Wells FH by May 25. Some spawning may occur at Methow Hatchery with green eggs transported to Wells Hatchery for incubation and rearing.

Grant PUD steelhead will be spawned and reared at Wells Hatchery. Locally-adapted Okanogan steelhead will be spawned and reared separately from the safety-net fish. Up to 100,000 safety-net smolts may be released wholly, or in part, directly to the Columbia River from Wells Hatchery, or in the Similkameen, mainstem Okanogan, or the Columbia River upstream of the Okanogan River confluence (requires acclimation and adult management capability, to be developed by others). The locally-adapted fish will be released in the Okanogan River Basin (see Section 1.8.2.4). Please see the Okanogan Basin Summer Steelhead Conservation Plan HGMP (submission to NOAA pending) for more information on acclimation and release locations.

The HCP Hatchery Committees may elect to acclimate in and release fish from additional acclimation sites developed by others, provided that Douglas PUD relinquishes responsibility for and receives mitigation credit (as appropriate) for those fish when they leave Douglas PUD facilities. In addition, such acclimation sites shall not reduce the efficacy of adult management that is already in place.

Any acclimation sites considered by the HCP Hatchery Committees shall meet the minimum flow and density indices, and predator-protection criteria of the HCP Hatchery Committees, and shall be non-consumptive users of water. Additionally, the HCP Hatchery Committees will assess on a case-by-case basis the magnitude of the withdrawal or diversion for each acclimation facility (as appropriate) relative to the instantaneous discharge of the water course to which it is appurtenant, and may reject any facility or condition its use for summer steelhead based upon their assessment of the impacts of that water withdrawal or diversion on Plan Species or non-target taxa of concern. Acclimation sites which by default have a natural flow through design and no means to artificially divert water will not be subject to such an assessment.

1.8.2.6 Escapement Goals for Natural Spawning Areas

In areas above Priest Rapids Dam (PRD), several methods have been used to estimate the number of steelhead spawners and juveniles that the available habitat may be capable of supporting. These estimates for the UCR Basin ranged from 1,603 to 8,281 depending on the estimation method (Ford et al. 2001). More recently, the Interior Columbia Basin Technical Recovery Team (ICTRT 2007; Table 1-5) assigned the Methow steelhead population an Intermediate size classification, and recommended a minimum spawn escapement of 1,000 to provide the number of spawners necessary to achieve ICTRT viability standards. However, the application of the coarse-scale ICTRT abundance thresholds to the Methow does not consider any basin-specific analysis that may provide a more accurate estimate of production capacity. Unfortunately, there is insufficient spawner/recruit information for the Methow steelhead to help define the upper limit of productivity available from existing habitat. The HSRG (2009) states a habitat capacity for the Methow Basin of 1,962 spawners based on Ecosystem Diagnostic and Treatment (EDT) analysis.

Table 1-5. Minimum abundance thresholds by historical population size (spawning area) for extant Interior Columbia Basin steelhead populations (ICTRT 2007). Median weighted area and corresponding spawners per kilometer (calculated as a ratio with the corresponding threshold) are provided for populations in each size category.

Population Size Category	Threshold	Median Weighted Area (m X 10,000)	Spawners per km (weighted)
Basic	500	141	3.4
Intermediate	1,000	382	2.6
Large	1,500	743	2.0
Very Large	2,250	1,175	1.9

The minimum run escapement to the Methow Basin was calculated with the following assumptions. Based on counts of fish ascending Wells Dam and subsequent redd counts, the 19% average reported by Keefer et al. (2008) was used to approximate a pre-spawn mortality adjustment factor. The difference between adult counts over Wells Dam and subsequent numbers of redds is due in part to difficulty in observing all redds due to poor access, sub-optimum water quality/quantity and viewing conditions, etc. (Snow et al. 2009). Broodstock collection was assumed to be 78 fish (26 Twisp, 52 Lower Methow). Potential fallback below Wells Dam has not been accounted for to date, but PIT tag antennae coming on line may help resolve that potential portion of the pre-spawn “mortality”. The 19% adjustment will be refined, and target run sizes as better information becomes available.

Combining pre-spawn mortality (0.19) and broodstock needs (78) with the ICTRT abundance threshold for the Methow (1,000) yields a minimum run-escapement value of 1,312 for the Methow Basin:

$$[1{,}000 / 0.81] + 78 = 1{,}312$$

This combined minimum-escapement goal assumes 78 fish for broodstock, 234 pre-spawn mortalities, and 1,000 spawners. The number of broodstock required for the program(s) and the locations of broodstock collection (e.g., Twisp Weir, Methow Hatchery, hook-and-line, etc.) may affect the required escapement above Wells Dam.

Escapement necessary to fully seed the habitat in the Methow Basin based on HSRG habitat capacity in the Methow (1,962):

$$[1{,}962 / 0.81] + 78 = 2{,}500$$

The ICTRT (2007) minimum spawning-escapement value for the Methow Basin (1,000 natural-origin spawners [NOS]) has been achieved once (2010) during the last 12 brood years. Natural-origin steelhead run sizes have ranged from 166 to 1,442 since brood year 1996, and natural-origin returns (NORs) to the Methow (based on a telemetry model’s results applied to Wells Dam counts) currently average 509 (12 year geometric mean). This plan proposes an approach that should meet the goals and objectives for steelhead recovery consistent with the Upper Columbia Salmon and Steelhead Recovery Plan (Recovery Plan; UCSRB 2007), based on All-H

Analyzer (AHA) modeling results as noted by the HSRG (2009), by pursuing a 12-year geometric mean of a minimum of 1,000 natural-origin spawners and an improved PNI over time, with a goal of at least PNI=0.67. However, changes in the Upper Columbia steelhead programs make forecasting population response highly speculative at this point. Careful monitoring and adaptive management will be necessary to respond to the effects of the new steelhead programs.

Intrinsic steelhead spawning habitat in the Methow Basin was estimated by the ICTRT. Percentages of the overall basin represented by key sub-basins were approximated as follows: Chewuch 28.3%; Methow River 25.9%; and Twisp River 16.1%. Table 1-6 lists sub-basin escapement apportionment based on the minimum and full-seeding escapement goals noted above. These interim values may be used to aid in evaluating smolt planting levels and adult management schemes.

Table 1-6. Summer steelhead spawning escapement goals for Methow River sub-basins.

Sub-Basin	Minimum	Full Seeding
Chewuch	283	555
Upper Methow River	259	508
Twisp River	161	316
other	297	582

Escapement goals for the Methow population will be reassessed through the adaptive management process (see Section 1.8.1.2) as new data are collected and analyzed. Adjustments will be made as necessary to accurately represent spawning escapement goals and set management objectives and strategies.

1.8.3 Key Assumptions

1.8.3.1 Homing Fidelity

Homing fidelity is greatly influenced by the water source used to rear or acclimate smolts. For instance, Kenaston et al. (2001) found that 97% of steelhead homed to a small tributary where they were acclimated. All Methow and mainstem Columbia smolt production will be acclimated in their respective release locations. Therefore, the vast majority of the returning Methow-origin hatchery adults are expected to have high homing fidelity, providing sufficient abundance to seed available habitat under almost all expected smolt to adult returns (SARs) and enhanced opportunity to use adult management when appropriate. Smolts acclimated at the Methow Hatchery and then released directly from the Methow Hatchery outfall channel into the Methow River are expected to exhibit high homing fidelity to the Methow Hatchery outfall channel volunteer trap. Smolts acclimated and then released directly from the Twisp Acclimation Pond into the Twisp River are expected to exhibit high homing fidelity to the Twisp River and Twisp Weir. Hatchery fish reared, acclimated and then released directly from Wells FH into the mainstem Columbia are expected to exhibit high homing fidelity to the hatchery outfall volunteer channel. Future releases of Douglas PUD Fixed Hatchery Compensation and/or Grant PUD fish to the Okanogan Basin or the mainstem Columbia upstream of the Okanogan confluence are contingent upon the development (by others) of release/acclimation and adult management facilities.

1.8.3.2 Hatchery Smolt to Adult Survival (SAR)

We anticipate smolt-to-adult-return (SAR) rates sufficient to achieve the basin-wide interim escapement objective when combining hatchery-origin returns (HORs) and natural-origin returns (NORs) at SAR rates of average or greater (Table 1-7). Based on hatchery steelhead SARs for the Methow Basin (see Table 1-13) (geomean 0.0099; range 0.0027-0.0207), hatchery steelhead returns to the Methow Basin from a 147,000 smolt program should be approximately 1,479 fish, and range from 404 to 3,093. The Columbia mainstem release from Wells Hatchery should return 1,980 adults (range 540-4140).

Table 1-7. Expected hatchery returns for the Twisp and Lower Methow components, and the total Methow Basin releases based on 1996-2010 brood year SARs.

		Twisp	Lower Methow	Total
	SAR	47,000 smolts	100,000 smolts	147,000 smolts
low	0.0027	127	277	404
geomean	0.0099	465	1,014	1,479
high	0.0207	973	2,120	3,093

1.8.3.3 Hatchery Steelhead Productivity

Productivity of hatchery-origin steelhead may be less than that of natural-origin steelhead. The results of recent work (Araki et al. 2007, 2009) in the Hood River, Oregon suggest that WxW hatchery-origin adults will be more productive than HxW or HxH origin adults (see also Chilcote et al. 1986; Leider et al. 1990; and Kostow et al. 2003). Specifically, Araki et al. (2007) found a significant reduction in the reproductive success of hatchery-origin steelhead spawning in the wild as compared to natural-origin steelhead. Furthermore, they were able to document that this reduction was significant after just a single generation of hatchery culture. While the results from a Methow hatchery steelhead reproductive success study will not be available for a numbers of years, (see Appendix A), the results of Araki et al. (2007) support the use of WxW hatchery fish for the integrated-recovery program component in the Twisp River.

1.8.4 Marking Strategy

The following is the proposed marking plan for steelhead juveniles for the Douglas PUD program. The plan may need to be adapted to meet regional marking goals. Please see Section 3.2 for a description of management coordination by Hatchery Committee members and US v. OR signatory fishery co-managers. The goal of the marking plan is to provide unique marks for the Twisp, Lower Methow, and Mainstem Columbia releases to facilitate broodstock collection, adult management, and assessment. All hatchery smolts will be given an external mark agreed to by the HCP Hatchery Committee to distinguish specific hatchery program and crosses, and to facilitate removal of hatchery-origin fish in selective fisheries or locations where adult-management actions will occur. All steelhead smolts directly released or planted into the mainstem Columbia River will receive an adipose fin clip and a ventral clip. The Lower Methow component will be marked with an adipose fin clip. Twisp Integrated fish will not be adipose fin-clipped, but will receive a coded-wire tag.

1.8.5 Management of Excess Hatchery Fish

Hatchery programs are critical to the maintenance of natural populations until factors limiting the productivity of natural populations are corrected. However, excess spawning escapement of hatchery fish in relation to wild spawners and habitat capacity pose genetic and ecological risks to the natural population. Escapement of hatchery fish to the Methow Basin will be balanced with the goal of adequately seeding available habitat and to achieve a PNI in the Twisp of 0.67 or greater over time, and to maximize PNI in the remainder of the Methow Basin with a goal of achieving a PNI = 0.5 in the near-term, and greater than 0.67 over time (see section 1.8.2.3 and 1.8.3). Under low abundance and high demographic risk, managing aggressively for PNI may not be possible or appropriate; nevertheless, steps should be taken to begin managing PNI in preparation for future opportunities. In the short term (next 5 years), after meeting broodstock collection goals, the interim priority will be to fully seed the Methow Basin while maximizing PNI, and achieving a minimum natural-origin spawning escapement of 1,000.

The integrated strategy for controlling surplus hatchery returns is:

1. Relocation of some hatchery releases to areas where adult management can be effective.
2. Acclimation and release of fish using facilities with adult management capabilities.
3. Removal at the Methow Hatchery volunteer trap
4. Removal at the Twisp Weir
5. Removal at Wells Hatchery volunteer trap
6. Removal at Wells Dam
7. Removal at Winthrop NFH outfall trap
8. Columbia mainstem and in-river conservation fisheries[6]

See Section 1.8.1 for a description of the roles and responsibilities for adult management.

1.8.5.1 Management decision-making

The HCP Hatchery Committee will oversee the removal of excess hatchery fish based on pre-season and in-season natural and hatchery run-size estimates using the rules presented below under an adaptive management framework (Section 1.8.1.2). The primary program objective is to provide demographic and genetic resiliency to facilitate recovery by attempting to achieve threshold PNI levels and fully seed the habitat in the Methow Basin, while limiting density dependent and hatchery effects due to over-escapement of hatchery steelhead.

[6] Selective fisheries in the Upper Columbia may affect the treaty/non-treaty harvest balance which must be addressed by the relevant co-managers.

1.8.5.2 Management of Methow Basin Steelhead

The Methow Basin will be managed for steelhead recovery by gradually boosting overall average PNI to 0.50 in the short term, and to 0.67 or higher in the long term (see Section 1.8.3 for analysis of pHOS and PNI). Several methods will be used to attain a desired PNI in the Methow Basin. First, the Wells Complex smolt releases in the basin will be limited to 147,000. Second, conservation fisheries will be used to reduce the number of excess hatchery spawners. Third, excess hatchery steelhead will be removed at the Twisp Weir, Methow Hatchery outfall trap, and Winthrop NFH outfall trap. In years of high returns, fish may be removed at the Wells Dam volunteer channel and at Wells Dam during planned assessment activities. USFWS has plans to construct a weir in the Methow Basin. If this facility is constructed, it could be used for adult management purposes.

Twisp River (Twisp Integrated Component)

Removals of excess hatchery-origin fish at the Twisp Weir will be used to control hatchery fish spawning escapement in the Twisp River to achieve a 1:1 ratio with natural-origin spawners. The presence of a weir and smolt trap on the Twisp River provides an opportunity to fully assess the potential increase in population productivity in a system managed for PNI. Furthermore, a spawning success study is underway in the Twisp River that requires adult management as part of the study design (see Appendix A). Hatchery-origin escapement (Twisp River program fish) in the Twisp will be controlled to achieve pHOS = 0.50 and PNI = 0.67 (Table 1-8). This is consistent with the HSRG where pNOB should be (at least) twice pHOS. Hatchery fish from outside the Twisp program will be removed, except in years of very low abundance when they may be used to achieve the pHOS target. All natural-origin returns will be allowed upstream of the weir, except for those collected as broodstock. Hatchery-origin Twisp integrated fish removed at the Twisp Weir, because they are in excess of escapement needs, will be used to partially meet the broodstock requirement for the Lower Methow program.

Table 1-8. Range of spawning escapement and PNI parameters for the Twisp River under the adult management scenario with pHOS = 0.5 and pNOB = 1.

NOR	NOS	HOS	NOB	HOB	Total Spawners	pHOS	pNOB	PNI
50	34	34	17	9	67	0.50	1.00	0.60
100	74	74	26	0	148	0.50	1.00	0.67
150	124	124	26	0	248	0.50	1.00	0.67
200	174	174	26	0	348	0.50	1.00	0.67
250	224	224	26	0	448	0.50	1.00	0.67
300	274	274	26	0	548	0.50	1.00	0.67
350	324	324	26	0	648	0.50	1.00	0.67
400	374	374	26	0	748	0.50	1.00	0.67
450	424	424	26	0	848	0.50	1.00	0.67
500	474	474	26	0	948	0.50	1.00	0.67

Action: Twisp-origin hatchery fish will be allowed upstream of the Twisp Weir in numbers equal to the natural-origin returns passed upstream of the Twisp Weir (after broodstock collection). Hatchery fish from outside the Twisp will not be allowed upstream, except in years when there are too few hatchery fish to fulfill the 1:1 ratio. Effectiveness in achieving goals and alternatives to this action will be evaluated through the adaptive management process (see Section 1.8.1.2).

Methow River (Lower Methow Component)

The removal rate of safety-net hatchery-origin steelhead returning to the Methow Hatchery volunteer trap will be determined based on estimated hatchery- and natural-origin run sizes, and broodstock collection. We expect high homing fidelity of the Lower Methow component to this trap, and this will be the primary means of adult management for this component, coupled with the conservation fishery.

Lower Methow fish may be removed through the conservation fishery, Methow Hatchery volunteer trap, Twisp Weir, Winthrop Hatchery volunteer trap, and at Wells Hatchery or Dam in years of extremely high abundance. Lower Methow fish removed at adult management facilities will be used to meet some or all of the broodstock requirement for the Columbia Mainstem program, to the extent these fish are available.

Action: Lower Methow returns surplus to management needs will be removed when encountered at the Wells Hatchery trap, through conservation fisheries, at the Methow Hatchery volunteer trap, Winthrop NFH volunteer trap, and at the Twisp Weir.

Effectiveness in achieving goals and alternatives to this action will be evaluated through the adaptive management process (see Section 1.8.1.2).

1.8.5.3 Management of Adult Steelhead at Wells Hatchery and Dam

The Safety-Net Mainstem Columbia component released below Wells Dam will be managed primarily at the Wells Hatchery volunteer channel (also, see the section on Conservation Fisheries, below). Steelhead released from Wells Hatchery are known to home to this channel, and the volunteer channel is expected to be effective in controlling excess escapement of these fish. The objective of adult management of the Safety-Net Mainstem Columbia component is to prevent returns of this component from moving into natural spawning areas. This will be accomplished through in-river harvest and removal of volunteers to the Wells Hatchery outfall.

Adult management at Wells Dam will generally be limited to removal of the Safety-Net Mainstem Component fish released below Wells Dam only. Proximate control of escapement to the Methow and Okanogan basins will be accomplished through conservation fisheries and other adult removal opportunities in the basins.

Action: All Mainstem Columbia Safety-Net adult returns to the Wells volunteer trap, Twisp Weir, or Methow volunteer trap will be removed in years when combined Methow natural-and hatchery-origin spawners are estimated to exceed 1,000. In years of high returns, fish may also be removed at the Wells Dam during planned assessment activities. In years when this total is estimated to be below 500 spawners, the Mainstem Columbia Safety-Net returns may be allowed to pass upstream in numbers sufficient to boost the number of spawners to approximately 1,000. Effectiveness in achieving goals and alternatives to this action will be evaluated through the adaptive management process (see Section 1.8.1.2).

See Section 1.8.1 for a description of the roles and responsibilities for adult management.

Conservation Fishery

When appropriate, conservation fisheries in the Methow River and Columbia mainstem will be used to reduce the number of surplus hatchery-origin steelhead in the Methow Basin. However, empirical evidence and modeling indicates that conservation fisheries alone will be insufficient to address the over-escapement of hatchery steelhead in some years. In the fall of 2009, WDFW implemented experimental fishing regulations aimed at improving the removal rate of adult hatchery fish from the Methow River. Although early creel surveys indicate improved removal rates, insufficient data are available to determine whether or not those regulations will prove successful over time.

Okanogan

Adult management in the Okanogan Basin is discussed in the Okanogan Basin Summer Chinook Conservation Program HGMP (submission to NOAA pending).

1.8.5.4 Distribution of Surplus Hatchery Fish

Live fish removed at Wells Dam, Wells Hatchery, Methow Hatchery, and Twisp Weir will be provided to WDFW, and WDFW will assume responsibility for their disposition. The distribution of excess hatchery origin fish will be agreed upon by the relevent co-managers. Options under consideration for these fish include providing harvest opportunities elsewhere, distribution to tribes and public entities, or use for nutrient enhancement in tributaries. The need for nutrient enhancement was identified in the Recovery Plan (UCSRB 2007) and in the Upper Columbia Regional Technical Team (UCRTT) Biological Strategy (Appendix H to the Recovery Plan). Distributions of surplus HORs to tribes and public entities would follow attainment of the brood collection, escapement, and fisheries objectives.

See Section 1.8.1 for a description of the roles and responsibilities for adult management.

1.8.5.5 Permit Holder

Although Douglas PUD as a funder and WDFW as a contract operator/implementer are joint permit holders for the Wells Complex summer steelhead program, Douglas PUD is not a fish-management agency with authority over fisheries or for determining the disposition of fish surplus to program needs, and thus cannot hold a permit for such activities. Therefore, WDFW will obtain and hold the necessary permit(s) for adult management activities beyond the point at which summer steelhead are removed at Wells Hatchery, Wells Dam, the Twisp River weir, or other Douglas PUD facility where removal of steelhead might occur, and placed in holding containers or transport vessels.

1.9 List of Program "Performance Standards"

See Tables 1-9 and 1-10 in Section 1.10.

1.10 List of Program "Performance Indicators", Designated by "Benefits" and "Risks"

1.10.1 "Performance Indicators" Addressing Benefits

1.10.1.1 Viable Salmonid Population and Proportionate Natural Influence Measures

Viable Population Size Guidelines

A population should be large enough to have a high probability of surviving environmental variation of the patterns and magnitudes observed in the past and expected in the future.

The Methow Basin has a 12-year geometric mean of 502 natural-origin spawners and 3,700 hatchery-origin spawners. The combined number of spawners exceeds the 1,000 spawner minimum set by the ICBTRT, but the number of natural-origin spawners is about half the number required to meet the minimum escapement identified for recovery. At this level, the risk of depensatory effects should be reduced. The current number of spawners suggests less than a 10% chance of extinction over the next 100 years according to ICBTRT analyses.

A reduction in the number of natural-origin spawners is possible when this HGMP is implemented, at least temporarily, due to reduced numbers of hatchery spawners. However, the natural population is expected to increase over time due to improved genetic and ecological management.

A population should have sufficient abundance for compensatory processes to provide resilience to environmental and anthropogenic perturbation.

A population should be sufficiently large to maintain its genetic diversity over the long term

A population should be sufficiently abundant to provide important ecological functions throughout its life-cycle.

Population status evaluations should take uncertainty regarding abundance into account.

These parameters are addressed by the minimum population size of 1,000 fish set by the recovery team. This HGMP seeks to achieve PNI goals that will theoretically allow the population to eventually meet and exceed this threshold with a higher proportion of wild fish.

Critical Population Size Guidelines

A population would be critically low if depensatory processes are likely to reduce it below replacement.

A population would be critically low if it is at risk from inbreeding depression or fixation of deleterious mutations.

A population would be critically low in abundance when productivity variation due to demographic stochasticity becomes a substantial source of risk.

Population status evaluations should take uncertainty regarding abundance into account.

The Methow Basin has a geomean of 502 natural-origin spawners over the last 12 years. At this level, the risk of depensatory effects should be reduced. The number of effective wild spawners is unknown. In addition, large numbers of hatchery fish spawn in the river (88% hatchery). Therefore, it is unlikely that inbreeding depression or allele fixation is occurring (at a rate that would be of concern) in the wild.

A reduction in the number of natural-origin spawners is possible, at least temporarily, due to reduced numbers of hatchery spawners. This could reduce the effective population size, but it is unknown to what extent. Alternatively, reduction in hatchery-origin fish may increase natural productivity, resulting in either a steady or increasing state of natural-origin spawners.

The minimum recovery population size of 1,000 natural-origin spawners addresses the issues associated with critically low populations. This HGMP is designed to avoid a critically low population in the Methow Basin through the use of safety net programs but also is intended to increase PNI and the abundance of naturally reproducing steelhead.

Population Growth Rate and Related Parameters Guidelines

A population's natural productivity should be sufficient to maintain its abundance above the viable level.

A viable salmonid population that includes naturally spawning hatchery fish should exhibit sufficient productivity from naturally-produced spawners to maintain population abundance at or above viability thresholds in the absence of hatchery subsidy.

A viable salmonid population should exhibit sufficient productivity during freshwater life history stages to maintain its abundance at or above viable thresholds—even during poor ocean conditions.

The ICBRT has set the desired productivity for the Methow at 1.1. Currently, the NRR is well below this level. The Methow geomean NRR of 0.17 (1996-2003) indicates that natural spawners are not replacing themselves (Figure 1-3), and that the NRR is well below the 0.9 minimum guideline suggested for VSP. The spawning escapement is overwhelmingly hatchery-origin fish (88% geomean 1998-2009 broodyears), suggesting that the high proportion of hatchery spawners could be depressing NRR due to relative reproductive success differences or density dependence.

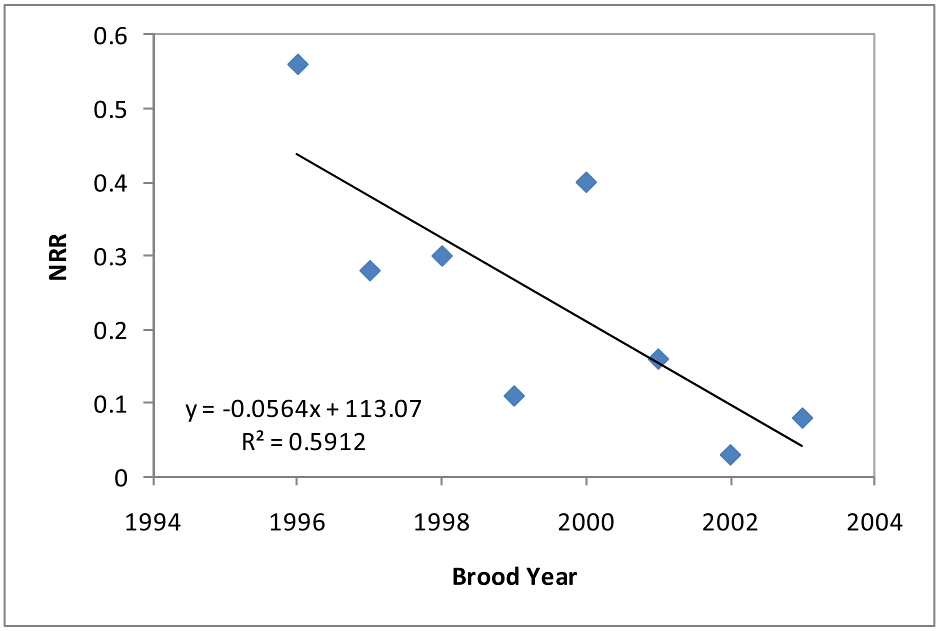

Figure 1-3. Natural replacement rates of steelhead in the Methow Basin, 1996-2003.

This HGMP is intended to foster greater productivity of natural fish by decreasing the proportion of hatchery-origin spawners, theoretically providing a fitness and ecological.

A viable salmonid population should exhibit sufficient productivity during freshwater life history stages to maintain its abundance at or above viable thresholds—even during poor ocean conditions.

The ability of the Methow population to maintain viable abundance during poor ocean conditions is unknown. However, current NRR suggests that freshwater productivity is well below levels needed for self-sustaining populations.

This HGMP specifies reduction of the proportion of hatchery-origin spawners. This may increase freshwater productivity through decreased density dependence, and reducing the number of hatchery fish with lower reproductive fitness, providing increased resilience to declines in marine survival.

A viable salmonid population should not exhibit sustained declines in abundance that span multiple generations and affect multiple broodyear-cycles.

We have no information of the ability of the wild population to sustain multiple-generation declines. However, the HGMP attempts to improve conditions for the natural populations, so this should help the resiliency, or provide the opportunity to develop the resiliency, of the population.

A viable salmonid population should not exhibit trends or shifts in traits that portend declines in population growth rate.

We can assume this has already occurred given the status of the population. This HGMP seeks to halt and reverse this trend.

Population status evaluations should take into account uncertainty in estimates of population growth rate and productivity-related parameters.

The Methow steelhead population has some of the better data available to address this. This HGMP includes the Monitoring and Evaluation Plan for Douglas PUD, a plan that is expressly designed to estimate and track VSP parameters (Appendices B, C, D).

Spatial Structure Guidelines

Habitat patches should not be destroyed faster than they are naturally created.

The HGMP does not address habitat issues.

Natural rates of straying among subpopulations should not be substantially increased or decreased by human actions.

The HGMP does not affect the spatial relationship of the steelhead populations. Stray rates of hatchery-origin fish will be addressed by acclimation and adult management strategies, and will be assessed by our M&E program.

Some habitat patches should be maintained that appear to be suitable or marginally suitable, but currently contain no fish.

This HGMP does not address this type of issue, except through management of stocking practices. A large proportion of hatchery fish historically released in the Methow Basin will be moved to a safety-net program in the Columbia mainstem, where effective adult management can be exerted. This will emancipate some habitat in the Methow Basin that has previously experienced a very high number of hatchery-origin spawners. In addition, the Twisp River will be managed for lower hatchery spawner escapement (pHOS = 0.5), effectively improving that river for wild fish.

Source subpopulations should be maintained.

The ICBRT identified the Twisp, Chewuch, Beaver, and Upper Methow as major spawning areas. The minimum number of redd within each major spawning area should be either 5% of the total, or at least 20 redds, whichever is greater.

The management in the HGMP for the Methow will directly promote spawners in the Twisp. It will allow natural-origin spawners in the upper Methow and Chewuch to experience reduced numbers of hatchery spawners. Beaver Creek, will likely receive hatchery spawners, although smolts will not be released directly into Beaver Creek. Spawning is assessed for the entire basin by intensive redd counts.

The steelhead populations upstream of Wells Dam (Methow and Okanogan) have been managed as a panmictic population for decades by collecting broodstock at Wells Dam, rearing the fish as a single population, and releasing fish in both the Methow and Okanogan basins. This HGMP will manage the populations separately. The Methow will be managed with integrated programs using local broodstock. Over time the Okanogan Basin will also be managed with an integrated program using local brood stock. Please see the Okanogan Basin Summer Steelhead Conservation Plan HGMP (submission to NOAA pending) for a description of locally-adapted management of steelhead in that basin.

Analyses of population spatial processes should take uncertainty into account.

This HGMP seeks to manage the steelhead populations with our current best understanding of their historical spatial structure.

<u>Diversity Guidelines</u>

Human-caused factors such as habitat changes, harvest pressures, artificial propagation, and exotic species introduction should not substantially alter variation in traits such as run timing, age structure, size, fecundity, morphology, behavior, and molecular genetic characteristics.

The populations (Methow and Okanogan) upstream of Wells Dam have been managed as a panmictic population for decades. This HGMP seeks to allow the genetic diversity that still persists to be preserved by managing the Methow and Okanogan basins separately. Furthermore, the Twisp River within the Methow will be managed using local broodstock, allowing genetic diversity to be maintained. Locally collected broodstock will be used for these programs.

Natural processes of dispersal should be maintained. Human-caused factors should not substantially alter the rate of gene flow among populations.

Stray rates of Wells steelhead to populations downstream of Wells Dam are thought to be very low. This HGMP develops programs based on local broodstock and acclimation in the natal basin. In addition, the Mainstem Columbia program is expected to have effective adult management via the Wells Hatchery volunteer channel and recreational fisheries. Wells steelhead are known to have high fidelity to the volunteer channel. The M&E program will track straying of Wells fish into other populations using PIT-tags. The current rate of straying between the Methow and Okanogan hatchery releases is not known. However, the fish have been managed as one population, so straying of hatchery-origin fish would not have had significant genetic effect.

Natural processes that cause ecological variation should be maintained.

This HGMP does not address these types of issues, except that management of the Methow Basin with local broodstock and controlled hatchery spawner escapement will allow ecological process to operate under a reduced regime of potentially deleterious hatchery effects.

Population status evaluations should take uncertainty about requisite levels of diversity into account.

Evaluations will use the best available information to draw conclusions.

ESU Viability Guidelines

ESUs (i.e. DPSs) should contain multiple populations.

The Methow and Okanogan populations have been managed as one population for decades. In the new HGMP, they will be managed as two separate populations, contributing to preserving and promoting the number of populations being managed separately in the DPS. The HGMP will promote greater diversity at the DPS level.

Some populations in an ESU (i.e. DPS) should be geographically widespread.

The Methow and Okanogan Rivers are at the upper spatial extent of the range of the DPS. Therefore, the management of these as separate populations supports the concept of geographically widespread populations in a DPS.

Some populations should be geographically close to each other.

The Methow and Okanogan Rivers are geographically close to each other. The HGMP will manage these rivers as separate populations, supporting connectivity among separate populations, as opposed to current management, which homogenizes the populations.

Populations should not all share common catastrophic risks.

Managing the Methow and Okanogan as separate populations will reduce risks associated with correlated catastrophes at the DPS level.

Populations that display diverse life-histories and phenotypes should be maintained.

This HGMP specifies locally-collected broodstock that will increase the likelihood of maintaining current genetic diversity. The HGMP will also manage populations so they can diverge and adapt to local conditions. In particular, the Methow and Okanogan basins are quite different from each other. Within these basins there is also a diversity of habitat conditions. Managing the populations separately and reducing the number of hatchery-origin fish in the Methow Basin should facilitate local adaptation and retention of genetic diversity.

Some populations should exceed VSP guidelines.

None of the populations in the DPS exceed VSP guidelines, currently. However, this HGMP sets forth a management plan that would allow the Methow population to achieve VSP parameters.

Evaluations of ESU status should take into account uncertainty about ESU-level processes.

Evaluations will use the best available information to draw conclusions.

Proportionate Natural Influence (PNI)

This HGMP seeks to improve the PNI in the Methow Basin while also addressing demographic issues. The typical PNI under current management is approximately 0.29. This is well below the minimum 0.67 PNI recommended by the HSRG. This HGMP address the PNI issue in two ways: 1) the number of hatchery smolts released is reduced to 147,000 from a mean of 383,295 from the 1992-2007 broods, and 2) adult management will be used to control surplus hatchery-origin spawners in the Methow Basin. The Twisp River will be managed for PNI of 0.67. The PNI in the rest of the Methow Basin will be dependent on the number of natural-origin returns and the actual effectiveness of adult management. However, we expect measurable improvement in PNI under the new management regime, and as the natural-origin population improves over time, PNI should be able to meet or exceed the HSRG recommendation of 0.67.

Performance indicators

The performance indicators in Tables 1-9 and 1-10 are sourced from the M&E Plan for Douglas PUD programs developed and approved by the HCP Hatchery Committees and designed to track VSP parameters, titled *Conceptual Approach to Monitoring and Evaluation for Hatchery Programs funded by Douglas PUD* (HCP-HC 2007).

Table 1-9. Performance indicators addressing benefits.

Performance Standards	Performance Indicators	Monitoring and Evaluation
1. Increase the number of naturally spawning and naturally produced adults of the target population relative to a non-supplemented population and the changes in the natural replacement rate (NRR) of the supplemented population (reference population) are similar to that of the non-supplemented population.	Natural Replacement Rate (NRR). Ho: Δ Total spawners $_{\text{Supplemented population}}$ > Δ Total spawners $_{\text{Non-supplemented population}}$ Ho: Δ NOR $_{\text{Supplemented population}}$ $\geq$ Δ NOR $_{\text{Non-supplemented population}}$ Ho: Δ $_{\text{NRR Supplemented population}}$ $\geq$ ΔNRR $_{\text{Non-supplemented population}}$	Spawning escapement and spawning origin composition of supplemented and non-supplemented (reference) populations.
2. Maintain run timing, spawn timing, and spawning distribution of endemic populations.	Ho: Migration timing $_{\text{Hatchery}}$ = Migration timing $_{\text{Naturally produced}}$ Ho: Spawn timing $_{\text{Hatchery}}$ = Spawn timing $_{\text{Naturally produced}}$ Ho: Redd distribution $_{\text{Hatchery}}$ = Redd distribution $_{\text{Naturally produced}}$	Monitor and evaluate supplemented and non-supplemented (reference) population run-timing, spawn timing and redd distribution.
3. Maintain endemic population genetic diversity, population structure, and effective population size. Additionally, determine if hatchery programs have caused changes in phenotypic characteristics of natural populations.	Ho: Allele frequency $_{\text{Hatchery}}$ = Allele frequency $_{\text{Naturally produced}}$ = Allele frequency $_{\text{Donor population}}$ Ho: Genetic distance between subpopulations $_{\text{Year x}}$ = Genetic distance between subpopulations $_{\text{Year y}}$ Ho: Δ Spawning Population = Δ Effective Spawning Population Ho: Age at Maturity $_{\text{Hatchery}}$ = Age at Maturity $_{\text{Naturally produced}}$ Ho: Size at Maturity $_{\text{Hatchery}}$ = Size at Maturity $_{\text{Naturally produced}}$	Periodic (every 5 years) genetic analysis of hatchery and naturally produced adult and juvenile fish in the supplemented population Monitor and evaluate run timing, spawn timing, redd distribution, size and age at maturity, and effective population size of hatchery- and natural-origin fish.
4. Achieve/maintain adult-to-adult survival (i.e., hatchery replacement rate) that is equal to or greater than the natural adult-to-adult survival (i.e., natural replacement rate) and equal to or greater than the program specific HRR expected value based on survival rates listed in the BAMP (1998).	Ho: HRR $_{\text{Year x}}$ $\geq$NRR $_{\text{Year x}}$ Ho: HRR $\geq$ Expected value per assumptions in BAMP (note that the BAMP is not a definitive standard for comparison).	Monitor and evaluate hatchery and natural adult-to-adult replacement rate in the supplemented populations.

Performance Standards	Performance Indicators	Monitoring and Evaluation
5. Maintain the stray rate of hatchery fish below the acceptable levels to maintain genetic variation between stocks.	Ho: Stray rate Hatchery fish < 5% of total brood return. Ho: Stray hatchery fish < 5% of spawning escapement of other independent populations. Ho: Stray hatchery fish < 10% of spawning escapement of any non-target streams within independent population.	Monitor and evaluate hatchery stray rates and proportional contribution to natural spawning aggregates.
6. Provide release of hatchery fish consistent with programmed size and number.	Ho: Hatchery fish Size = +/- 10% of Programmed Size Ho: Hatchery fish Number = +/- 10% of Programmed Number	Monitor fish size and number at release.
7. Maintain the proportion of hatchery fish on the spawning grounds at a level that minimizes negative affects to freshwater productivity (i.e., number of smolts per redd) of supplemented streams when compared to non-supplemented streams with similar adult seeding levels.	Ho: Δ smolts/redd $_{\text{Supplemented population}}$ > Δ smolts/redd $_{\text{Non-supplemented population}}$.	Monitor and evaluate annual smolt production in supplemented and non-supplemented populations. Monitor and evaluate redd construction in supplemented and non-supplemented populations.
8. Objective 8 of the M&E Plan is not applicable to the Wells Hatchery summer steelhead program.	NA	NA
9. Objective 9 of the M&E Plan is not applicable to the Wells Hatchery summer steelhead program	NA	NA
10. Minimize adverse impacts to non-target taxa of concern (NTTOC)	Ho: NTTOC abundance $_{\text{Year x through y}}$ = NTTOC abundance $_{\text{Year y through z}}$ Ho: NTTOC distribution $_{\text{Year x through y}}$ = NTTOC distribution $_{\text{Year y through z}}$ Ho: NTTOC size $_{\text{Year x through y}}$ = NTTOC size $_{\text{Year y through z}}$	This is a regional objective, the implementation of which requires collaboration among all parties to the Wells HCP. This collaboration has been initiated, including the complicated process for determining the potential for and magnitude of impacts of target species on NTTOC.

1.10.2 "Performance Indicators" addressing risks

Table 1-10. Performance indicators addressing risks.

Performance Standards	Performance Indicators	Monitoring and Evaluation
1. Artificial propagation activities comply with ESA responsibilities to minimize impacts and/or interactions to ESA listed fish.	Program complies with Section 10 permit conditions including juveniles are raised to yearling smolt-sizes (approximately 6.0 fish/lb). WDFW hatchery evaluations staff are currently investigating different marking techniques that will be used in conjunction with, or in place of, the standard adipose fin clip to evaluate upper Columbia River steelhead recovery programs. The results of these investigations will be presented as information becomes available in subsequent brood year annual progress reports.	As identified in the HGMP: Monitor size, number, date of release and mass mark quality. Additional monitoring metrics include straying, instream evaluations of juvenile and adult behaviors, NOR/HOR ratio on the spawning grounds, fish health documented. Required data are generated through the M & E plan and provided to NOAA Fisheries as required per annual report compliance.
2. Ensure hatchery operations comply with state and federal water quality and quantity standards through proper environmental monitoring.	All facilities meet WDFW water-right permit compliance and National Pollution Discharge Elimination System (NPDES) requirements (NPDES permit No.WAG-5011).	Flow and discharge reported in monthly NPDES reports. Environmental monitoring of total suspended solids, settle-able solids, in-hatchery water temperatures, in-hatchery dissolved oxygen, nitrogen, ammonia, and pH will be conducted and reported as per permit conditions.
3. Water intake systems minimize impacts to listed wild salmonids and their habitats.	Water withdrawal – permits have been obtained to establish water rights for each hatchery facility. Intake screens – designed and operated to assure approach velocities and operating conditions provide protection to wild salmonid species.	Intake system designed to deliver permitted flows. Operators monitor and report as required. Hatcheries participating in the programs will maintain all screens associated with water intakes in surface water areas to prevent impingement, injury, or mortality to listed salmonids.
4. Artificial production facilities are operated in compliance with all applicable fish health guidelines, facility operation standards and protocols including IHOT, Co-managers Fish Health Policy and drug usage mandates from the Federal Food and Drug Administration.	Hatchery goal is to prevent the introduction, amplification or spread of fish pathogens that might negatively affect the health of both hatchery and naturally reproducing stocks, and to produce healthy smolts that will contribute to the goals of this facility.	

Performance Standards	Performance Indicators	Monitoring and Evaluation
5. The risk of catastrophic fish loss due to hatchery facility or operation failure is minimized.	Staffing allows for rapid response for protection of fish from risk sources (water loss, power loss, etc.). Backup generators to provide an alternative source of power to supply water during power outages. Protocols in place to test standby generator and all alarm systems on a routine basis. Multiple rearing sites or footprints for captive broodstock rearing. Alarm systems installed and operating at each rearing vessel to detect loss of or reduced flow and reduced operating head in rearing vessels. Densities at minimum to reduce risk of loss to disease. Sanitation – all equipment is disinfected between uses on different lots of fish including nets, crowders, boots, raingear, etc.	
6. Broodstock collection and juvenile hatchery releases minimize ecological effects on listed wild fish.	Steelhead reared to sufficient sizes such that smoltification occurs within nearly the entire population, reducing residence time in streams after release (CV length ≤ 10%, condition factor 0.9 – 1.0). All listed fish encountered in hatchery broodstock collection operations will be held for a minimal duration in the traps; generally less than 24 hrs and follow permit protocols. Listed fish trapped in excess of broodstock collection goals will be released upstream or returned to natal streams immediately. Smolts acclimated and imprinted on surface water from the natal stream to enhance smoltification and reduce residence time in the tributaries and mainstem migration corridors.	

1.11 Expected Size of Program

The release goal for the Methow (Twisp [47,571] and Lower Methow [100,000]) components is 147,000 yearling smolts into the Methow Basin.

The release goal for the Mainstem Columbia is 200,000 yearling smolts.

The Grant PUD program is up to 100,000 smolts spawned and reared at Wells Hatchery. See the Okanogan Basin Summer Steelhead Conservation Plan HGMP (submission to NOAA pending) for more information.

See Section 1.8.2 for a more complete description of the program.

1.11.1 Proposed Annual Broodstock Collection Level (maximum number of adult fish)

See Section 1.8.2.1 for a discussion of this topic.

1.11.2 Proposed Annual Fish Release Levels (maximum number) by Life Stage and Location

Table 1-11. Proposed annual fish release levels by life stage and location.

Life Stage	Release Location	Annual Release Level
Yearling Smolts	Twisp River	47,571
	Lower Methow River	100,000
	Mainstem Columbia River	200,000
	Total	**347,571**

1.12 Current Program Performance, Including Estimated Smolt-to-Adult Survival Rates, Adult Production Levels, and Escapement Levels. Indicate the Source of these Data

The following discussion is primarily based on data that have been reported in the 2009 Annual M&E Report for Douglas County PUD-funded hatchery programs as compiled by Snow et al. (2009). See Section 1.8.3 for additional analysis of SARs, returns, and PNI.

From Brood Years (BY) 1999 to 2007, the average number of smolts released per year to the Methow Basin from Wells Hatchery has been 311,137 (range 264,110 [BY 2002]–414,880 [BY 1999]) (Table 1-12).

Table 1-12. Number of steelhead smolts drop-planted into the Twisp, Chewuch, and Methow Rivers, 2000-2008.

Brood Year	Release Year	Number of Smolts
1999	2000	414,880
2000	2001	326,270
2001	2002	264,110
2002	2003	319,238
2003	2004	276,330
2004	2005	264,726
2005	2006	326,565
2006	2007	315,534
2007	2008	292,580
2008	2009	308,512
Mean		**311,137**

The hatchery SAR for steelhead artificial propagation programs above Wells Dam is estimated from detection of tagged fish in a sampling program at Wells Dam. The SAR, adjusted for tag loss, has averaged 0.99 (geometric mean) from BY 1996 to 2004 (Table 1-13). Based on an average release of 310,875 smolts for BY 1999 to 2008, the adult production from this program averaged 3,080 adults per brood year. (Note: the SAR calculations are made more difficult because steelhead smolt releases from the Winthrop NFH since about 1996 are similarly marked as PUD/WDFW smolts.)

Table 1-13. Hatchery summer steelhead SARs, HRRs, natural-origin Methow steelhead NRRs, and overall recruits/spawner for BYs 1996 to 2004. Data from Snow et al. (2008) and Andrew Murdoch (WDFW unpublished data).

Brood Year	Hatchery SAR (Goal: 1.00%)	Adjusted HRR[1] (Goal: 19.3)	Adjusted NRR[1] (Goal: 1.2)	Recruits / Spawner[2] (Goal: 1.2)
1996	0.52	13.4	0.56	1.24
1997	0.87	14.9	0.28	0.43
1998	1.58	37.3	0.30	0.34
1999	2.06	47.4	0.11	0.13
2000	0.27	6.3	0.40	0.48
2001	2.07	40.5	0.16	0.18
2002	0.79	15.9		
2003	1.31	26.9		
2004	1.04	17.9		
Geomeans	**0.99%**	**20.7**	**0.26**	**0.36**

Notes:
[1] Return Rate adjusted to include returns harvested in fisheries. Note that this metric is a rate, whereas R/S is a ratio.
[2] Original Spawners denominator adjusted downward by the number of fish harvested.

The estimated adult steelhead run escapement to the Methow Basin has averaged (geometric mean) 3,162 hatchery-origin (range 361–12,956) and 363 natural-origin (range 65–1,442) for BY 1996 to 2010 (Table 1-14). These estimates were used to calculate natural-origin recruits per spawner (natural replacement rates [NRR]) that averaged 0.26 for the first six of those brood years (see Table 1-13), about 1/5 the goal of 1.2. For the most recent eight completed brood-year returns for the Wells broodstock (1996 to 2003), hatchery replacement rates (HRR), adjusted for tag loss, have averaged 20.7 (range 6.3–47.4), 79 times the NRR.

Table 1-14. Methow River hatchery- and natural-origin summer steelhead run escapements for BYs 1996 to 2010. Data from Snow et al. (2008) and Andrew Murdoch (WDFW unpublished data).

Brood Year	Hatchery Run Escapement	Natural Run Escapement (Goal: 1,260 includes pre-spawn mortality and broodstock)
1996	361	65
1997	1,789	166
1998	2,286	76
1999	1,429	145
2000	1,831	285
2001	3,338	369
2002	10,210	615
2003	4,775	555
2004	5,019	718
2005	4,713	544
2006	3,538	472
2007	3,137	407
2008	3,110	696
2009	4,751	779
2010	12,956	1,442
15-Yr Geomeans	3,162	363

Hatcheries have increased total summer steelhead run sizes, and from 1984 through 1999 contributed 90% of lower river returns and 75% of upriver returns (WDFW and ODFW 2000). In the case of the UCR Steelhead DPS, hatchery fish have comprised between 71 and 91% of the returns between 1986 and 2008 (Table 1-15). The steelhead return at PRD over the 21-year period from 1986 to 2008 has averaged 81.5% hatchery fish. Total run size estimates for steelhead have been estimated at PRD since 1974. Within the UCR Steelhead DPS, hatchery steelhead will continue to be used for recovery efforts, as well as to provide other biological and societal needs.

Table 1-15. Priest Rapids Dam adult steelhead returns and stock composition summary for run cycles 1986 to 2008.

Passage Year	Artificially Propagated		Naturally Produced		Total Run
	Number	Proportion	Number	Proportion	
1986	20,022	0.8953	2,342	0.1047	22,364
1987	9,955	0.7104	4,058	0.2896	14,013
1988	7,530	0.7382	2,670	0.2618	10,200
1989	8,033	0.7495	2,685	0.2505	10,718
1990	6,252	0.7978	1,585	0.2022	7,837
1991	11,169	0.7996	2,799	0.2004	13,968
1992	12,102	0.8821	1,618	0.1179	13,720
1993	4,538	0.8360	890	0.1640	5,428
1994	5,880	0.8731	855	0.1269	6,735
1995	3,377	0.7728	993	0.2272	4,370
1996	7,757	0.9020	843	0.0980	8,600
1997	8,157	0.9122	785	0.0878	8,942
1998	4,919	0.8413	928	0.1587	5,847
1999	6,960	0.8335	1,390	0.1665	8,350
2000	8,951	0.7940	2,322	0.2060	11,273
2001	24,407	0.8115	5,670	0.1885	30,077
2002	12,196	0.8090	2,879	0.1910	15,075
2003	14,316	0.8340	2,850	0.1660	17,166
2004	14,532	0.7760	4,795	0.2240	18,727
2005	9,529	0.7640	2,943	0.2360	12,472
2006	8,784	0.8440	1,624	0.1560	10,408
2007	12,160	0.7970	3,097	0.2030	15,597
2008	13,607	0.8170	3,048	0.1830	16,655
Geomeans	9,215	81.5%	1,977	17.5%	11,314

Notes: 1. A return cycle is the combined total of steelhead passing Priest Rapids Dam (PRD) from 1 June – 30 Nov during Year X, plus steelhead passing PRD between April 15 – May 31 in Year X+1.
2. Fish Passage Center; DART fishway data adjusted by PRD steelhead sampling information beginning in 2002.

1.13 Watersheds Targeted by Program.

Methow Basin/Columbia Cascade Province (WRIA 48), the mainstem Columbia River (portions of WRIAs 47-50), and Okanogan Basin (WRIA 49).

1.14 Date Program Started (years in operation), or is Expected to Start

The Wells Hatchery steelhead program began in 1968.

1.15 Expected Duration of Program

The duration of the program will be consistent with the term of the Wells HCP and the new long-term license for the Wells Hydroelectric Project FERC license(s). The Wells HCP agreement is a 50-year agreement that expires in 2054. The Wells HCP also stipulates that the artificial propagation production level will be adjusted for population dynamics in 2013, and every ten years thereafter. The program can also be adjusted based on updated survival study results.

1.16 Indicate Alternative Actions Considered for Attaining Program Goals, and Reasons Why those Actions are not Being Proposed

The Wells summer steelhead hatchery program is adaptively managed by the Wells HCP Hatchery Committee, which has agreed to the collective goal of recovery and sustainability of the population within the context of meeting the HCP standard of NNI. The Wells HCP Hatchery Committee therefore aims for a program of adequate size and characteristics to meet this goal. During the development and implementation of the HCP, many alternatives have been, and will continue to be considered for this program. The Wells HCP Hatchery Committee has concluded that a larger program would not be consistent with the HSRG's recommendations (HSRG 2009) to reduce the negative influences of artificial production in the Methow Basin, while failing to produce any hatchery fish in the Methow Basin might fail to support recovery as described in the Recovery Plan (UCSRB 2007; AHA modeling results and HSRG 2009). Thus, the Wells HCP Hatchery Committee has developed the program described in this HGMP to meet the current biological, agency, HCP, and recovery plan goals.

2.0 PROGRAM EFFECTS ON NMFS ESA-LISTED SALMONID POPULATIONS

(USFWS ESA-Listed Salmonid Species and Non-Salmonid Species are addressed in Addendum A)

2.1 List all ESA Permits or Authorizations in Hand for the Hatchery Program

2.1.1 Section 10(a)(1)(B) Permit Number: 1395-Permit Type

Direct Take (artificial propagation of listed steelhead) authorizes the WDFW, the Chelan PUD, and the Douglas PUD annual take of ESA-listed adult and juvenile, endangered, naturally produced and artificially propagated UCR steelhead and UCR spring Chinook salmon associated with the implementation of UCR steelhead artificial propagation enhancement programs in the UCR region. The programs are intended to supplement naturally spawning UCR steelhead production occurring upstream from PRD on the mainstem Columbia River, including the Wenatchee, Methow, and Okanogan Rivers, and their tributaries. This permit expires October 2, 2013.

2.1.2 Wells Habitat Conservation Plan

In 2002, the Wells HCP was signed by WDFW, USFWS, NOAA Fisheries, and the CCT, and approved by FERC in June of 2004. The Yakama Nation signed the HCP in March of 2005. The overriding goal of the HCP is to achieve NNI on anadromous salmonids as they pass Wells Dam. One of the main objectives of the hatchery component of NNI is to provide species-specific hatchery programs that may include contributing to the rebuilding and recovery of naturally reproducing populations in their native habitats, while maintaining genetic and ecologic integrity, and supporting harvest.

The Wells HCP is intended to be a comprehensive 50-year adaptive-management plan for anadromous salmonids and their habitat as affected by the Wells Project. The Wells HCP was designed to address Douglas PUD requirements for relicensing and as such included all of the parties' terms, conditions and recommended measures related to regulatory requirements to conserve, protect and mitigate plan species pursuant to ESA, the Federal Power Act, the Fish and Wildlife Coordination Act, the Essential Fish Habitat provisions of the Magnuson-Stevens Fishery Conservation and Management Act, the Pacific Northwest Electric Power Planning and Conservation Act and Title 77 RCW of the State of Washington. The HCP also obligates the parties to work together to address water quality issues.

2.2 Provide Descriptions, Status, and Projected Take Actions and Levels for NMFS ESA-listed Natural Populations in the Target Area

2.2.1 Description of NMFS ESA-listed Salmonid Population(s) Affected by the Program

2.2.1.1 Adult Age Class

Methow Spring Chinook MPG

Most Columbia River adult spring Chinook spend two years in the ocean before migrating back to their natal streams (Mullan 1987; Fryer et al. 1992; Chapman et al. 1995; Snow et al. 2008). Both female and male adults sampled from Upper Columbia tributaries predominantly spend two years in the ocean, and are four years old. The estimates of age of adult spring Chinook sampled in the Upper Columbia comport well with those for fish sampled at Bonneville Dam and other Columbia Basin tributaries. These data suggest that over 50% of spring Chinook in the Columbia River Basin spend one year in fresh water and two in salt water (1.2), and from 20-40% spend three years in salt water before returning to the river. Most stream-type Chinook throughout their geographic range average approximately four years of age, except those from the Yukon River, Alaska.

In the Methow Basin, the average age class for naturally produced adults since 2001 has been approximately 7% age 3, 56% age 4, and 37% age 5 (Table 2-1). Age structure does not appear to vary much between major spawning areas, ranging between approximately 3-10% for age 3, 53-57% for age 4, and 37-40% for age 5 (Table 2-1).

Table 2-1. Age structure of Methow Basin spring Chinook salmon per major spawning area (based on Chapter 5 Appendices D-J, Snow et al. 2008).

Sub-basin/year		Number				Percent		
		1.1	1.2	1.3	Total	1.1	1.2	1.3
Methow								
	2001	16	286	292	594	2.7	48.1	49.2
	2002	1	21	64	86	1.2	24.4	74.4
	2003	5	1	2	8	62.5	12.5	25.0
	2004	3	196	0	199	1.5	98.5	0.0
	2005	0	182	39	221	0.0	82.4	17.6
	2006	0	101	27	128	0.0	78.9	21.1
	2007	6	42	104	152	3.9	27.6	68.4
Average		**4**	**118**	**75**	**198**	**10.3**	**53.2**	**36.5**
Chewuch								
	2001	8	641	83	732	1.1	87.6	11.3
	2002	0	23	55	78	0.0	29.5	70.5
	2003	4	2	19	25	16.0	8.0	76.0

Sub-basin/year		Number 1.1	1.2	1.3	Total	Percent 1.1	1.2	1.3
	2004	0	46	0	46	0.0	100.0	0.0
	2005	2	206	11	219	0.9	94.1	5.0
	2006	0	86	49	135	0.0	63.7	36.3
	2007	1	14	59	74	1.4	18.9	79.7
Average		**2**	**145**	**39**	**187**	**2.8**	**57.4**	**39.8**
Twisp								
	2001	18	439	49	506	3.6	86.8	9.7
	2002	66	115	181	362	18.2	31.8	50.0
	2003	6	4	15	25	24.0	16.0	60.0
	2004	16	227	0	243	6.6	93.4	0.0
	2005	0	73	14	87	0.0	83.9	16.1
	2006	0	45	20	65	0.0	69.2	30.8
	2007	2	0	38	40	5.0	0.0	95.0
Average		**15**	**129**	**45**	**190**	**8.2**	**54.4**	**37.4**
Total Basin								
	2001	42	1366	424	1832	2.3	74.6	23.1
	2002	67	159	300	526	12.7	30.2	57.0
	2003	15	7	36	58	25.9	12.1	62.1
	2004	19	469	0	488	3.9	96.1	0.0
	2005	2	461	64	527	0.4	87.5	12.1
	2006	0	232	96	328	0.0	70.7	29.3
	2007	9	56	201	266	3.4	21.1	75.6
Average		**22**	**393**	**160**	**575**	**6.9**	**56.0**	**37.0**

Methow Summer Steelhead MPG

Chapman et al. (1994) summarized information for 459 naturally produced adult steelhead collected at Wells Dam, Wells Reservoir, and the Methow River between 1987 and 1993 (Table 2-2). They found that the majority of both males and females had spent two years in the ocean (see Table 2-2, Figure 2-1). Between 1997 and 2006, 478 naturally produced fish were sampled at Wells Dam. The majority of these fish had spent one year in the ocean (see Table 2-2, Figure 2-1). We are uncertain why this inconsistency exists, although saltwater ageing was estimated from otoliths between 1987-1993, and with scales between 1997-2006.[7] In addition, sample sizes were small in many of the years.

In previous summaries of hatchery-origin age structure (Mullan et al. 1992a; Chapman et al. 1994), most hatchery-origin fish were designated as 1-salt. While this still appears to be true for males, females appear to have shifted to more 2-salt, which is more similar to wild fish between 1987-1993 (Table 2-3).

[7] It is unlikely that saltwater age estimation would be affected by the differing methods. However, freshwater age estimation may be underestimated using scales for steelhead (Peven 1990, Mullan et al. 1992a).

Table 2-2. The number and percentage of steelhead by saltwater age and sex from Chapman et al. (1994) for years 1987-1993, and Snow et al. (2008) for years 1997-2006.

	Male				Female				
	1-salt		2-salt		1-salt		2-salt		
Brood year	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**	**Total**
1987	12	16.9	8	11.3	16	22.5	35	49.3	71
1988	9	13.4	12	17.9	9	13.4	37	55.2	67
1989	16	18.2	25	28.4	16	18.2	31	35.2	88
1990	5	5.7	24	27.3	12	13.6	47	53.4	88
1991	16	22.5	9	12.7	28	39.4	18	25.4	71
1992	2	5.9	8	23.5	1	2.9	23	67.6	34
1993	5	12.5	13	32.5	3	7.5	19	47.5	40
Total	**65**	**14.2**	**99**	**21.6**	**85**	**18.5**	**210**	**45.8**	**459**
1997	18	31.6	10	17.5	14	24.6	15	26.3	57
1998	5	41.7		0.0	4	33.3	3	25.0	12
1999	5	18.5	4	14.8	5	18.5	13	48.1	27
2000	13	31.7	4	9.8	13	31.7	11	26.8	41
2001	14	53.8	2	7.7	7	26.9	3	11.5	26
2002	3	16.7	1	5.6	5	27.8	9	50.0	18
2003		0.0	9	33.3		0.0	18	66.7	27
2004	53	45.3		0.0	55	47.0	9	7.7	117
2005	15	22.7	9	13.6	15	22.7	27	40.9	66
2006	21	24.1	16	18.4	8	9.2	42	48.3	87
Total	**147**	**30.8**	**55**	**11.5**	**126**	**26.4**	**150**	**31.4**	**478**

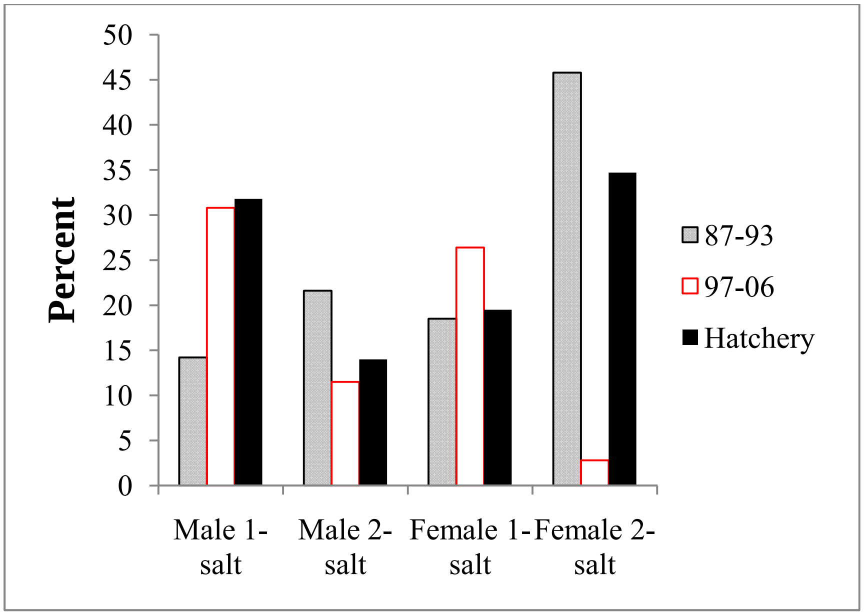

Figure 2-1. Comparison of saltwater age structure of naturally produced steelhead sampled between1997-2006 and naturally produced and hatchery-origin fish, 1987-1993, based on Tables 2-2 and 2-3.

Table 2-3. Numbers and percentages of steelhead by sex, saltwater age, and origin sampled at Wells Dam between 1997 and 2006 (based on Appendix C, Chapter 1 of Snow et al. 2008).

	Male				**Female**				
	1-salt		**2-salt**		**1-salt**		**2-salt**		
Brood year	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**	**Total**
1997	145	46.5	20	6.4	94	30.1	53	17.0	312
1998	122	28.2	64	14.8	78	18.0	169	39.0	433
1999	123	33.2	41	11.1	66	17.8	141	38.0	371
2000	113	34.7	28	8.6	87	26.7	98	30.1	326
2001	12	5.7	27	12.8	66	31.3	106	50.2	211
2002	106	28.3	68	18.2	50	13.4	150	40.1	374
2003	30	11.2	89	33.1	17	6.3	133	49.4	269
2004	183	59.0	3	1.0	118	38.1	6	1.9	310
2005	93	29.5	53	16.8	31	9.8	138	43.8	315
2006	98	32.6	58	19.3	22	7.3	123	40.9	301
Total	**1,025**	**31.8**	**451**	**14.0**	**629**	**19.5**	**1,117**	**34.7**	**3,222**

Methow Core Area Bull Trout

Mullan et al. (1992a) reported some populations of bull trout (*Salvelinus confluentus*) in the Methow Basin where maturation did not occur until 9 years of age. They found that headwater male bull trout (potentially a non-migratory ecotype) in the Methow River began to mature at age 5, and were all mature by age 6. Females from the same area began to mature at age 7 and were all mature by age 9. The bull trout that Mullan et al. (1992a) found that did not mature until 9 years of age are the oldest (at first maturity) reported within the literature. The oldest bull trout sampled in the Methow River was 12 years (Mullan et al. 1992a).

2.2.1.2 Sex Ratio

Methow Spring Chinook MPG

Mullan (1987) presented data compiled from Howell et al. (1985) on the number of returning male and female hatchery spring Chinook in the mid-Columbia. From those data, we calculated the sex ratios for Leavenworth, Entiat, and Winthrop populations. The range (female to male) for the three stocks was 1.27:1 to 1.86:1.

Estimates of sex ratio ranged (males to females) from 1.5:1 to 1.9:1 for hatchery fish and 1.1:1 to 1.5:1 for wild fish sampled at Wells Dam in 2007 and 2008 (C. Snow,WDFW, personal communication). It is important to note that determining sex of fish from Wells Dam months prior to sexual maturity is not considered accurate for spring Chinook, which may explain the difference between these data and those described above from Chapman et al. (1994).

Methow Summer Steelhead MPG

Based on the most recent information available (Appendix C, Chapter 1 of Snow et al. 2008), the female to male ratio for hatchery-origin and naturally produced fish is 1.2:1 and 1.3:1, respectively. This is similar to what has been reported previously (Mullan et al. 1992a; Chapman et al. 1994).

Methow Core Area Bull Trout

In Mullan et al. (1992a), the overall female to male ratio was 1.11:1, but for mature fish, they found almost twice the percentage of the population of males was mature (14.6% of the females and 24.3% of the males).

2.2.1.3 Fecundity

Methow Spring Chinook MPG

Fecundity from wild and hatchery spring Chinook salmon has been measured in recent years as part of the hatchery supplementation evaluation program. In the Methow Basin, fecundity (hand counted) averaged 5,100 (range: 2,600-8,100) between 1992 and 1994 (Chapman et al. 1995). Since 2000, four-year-old wild females averaged 4,000 eggs, while five-year-old wild fish averaged 4,800 eggs (Table 2-4). For hatchery fish, four-year-old fish averaged 3,800 eggs, and five-year-old fish averaged 4,400 (see Table 2-4). In general, hatchery fish for a given age have a lower fecundity than wild fish. As shown in Table 2-4, there are gaps between years, primarily for wild fish, especially five-year-olds.

Table 2-4. Fecundity of Methow Basin spring Chinook (from Chapter 1, Appendix D of Snow et al. 2008).

	Age 4		Age 5	
Stock/year	**Wild**	**Hatchery**	**Wild**	**Hatchery**
Met Comp				
2000		3,759		
2001	3,753	3,949		
2002		3,905		3,318
2003		3,795		4,839
2004	3,565	3,510		3,510
2005	3,823	3,475		3,261
Average	3,714	3,732		3,732
Twisp				
2000		3,820		5,292
2001	4,720	3,922	4,941	4,469
2002		4,653		
2003		3,195		5,867
2004	3,811	3,496		
2005	4,216		4,745	4,745
Average	4,249	3,817	4,843	5,093
Average for Basin				
	3,981	3,771	4,843	4,413

Methow Summer Steelhead MPG

For fish sampled at Wells Dam between 2000 and 2006, 1-salt naturally produced fish average fecundity was higher than hatchery-origin 1-salt fish, while for 2-salt fish, hatchery-origin fish had slightly higher fecundity (Table 2-5).

Table 2-5. Mean fecundity by salt-age and origin of 2006 brood summer steelhead sampled at Wells Complex hatchery facilities (Appendix D, Chapter 1 from Snow et al. 2008).

	1-salt		2-salt	
Year	**H**	**W**	**H**	**W**
2000	4,837	5,760	6,049	
2001	4,356	3,865	6,624	6,714
2002	4,786	4,721	6,744	6,586
2003	4,241		6,545	6,954
2004	4,543	4,517	5,865	4,832
2005	4,547	5,370	6,575	6,627
2006	4,652	4,203	6,858	6,397
Average	**4,566**	**4,739**	**6,466**	**6,352**

Methow Core Area Bull Trout

Fecundity of bull trout varies with size. Fraley and Shepard (1989) found that fecundity averaged almost 5,500 eggs (up to over 12,000 in one individual) for migratory bull trout from the Flathead River. Martin et al. (1992) noted females between 271-620 mm long produced 380 to over 3,000 eggs in southeastern Washington streams. Mullan et al. (1992a) found one 300 mm bull trout in the Methow Basin that had a fecundity of fewer than 200 eggs.

2.2.1.4 Size Range

Methow Spring Chinook MPG

Juveniles

In 2007, wild smolt length averaged just over 100 mm FL (Table 2-6). Wild parr (fall-run) averaged almost 91 mm FL. Little variation occurs between years in smolt length (C. Snow, personal communication).

Table 2-6. Summary of length and weight of migrating Chinook juveniles in the Methow River in 2007 (from Chapter 3, Table 1 Snow et al. 2008).

Brood	Origin/stage	Fork length (mm)			Weight (g)			K-factor
		Mean	*N*	SD	Mean	*N*	SD	
2005	Wild smolt	100.7	395	8.6	11.6	393	2.9	1.1
2005	Hatchery smolt	129.9	186	17.5	186	186	11.2	1.3
2006	Wild fall parr	90.7	67	10.8	67	67	3.1	1.2

Adults

Length measurements (fork length) from wild and hatchery spring Chinook salmon has been measured in recent years as part of the hatchery evaluation program (Table 2-7). There appears to be little difference between streams or between wild and hatchery fish (see Table 2-7).

Table 2-7. Mean fork length by age, sex and brood year of spring Chinook collected for the Methow Hatchery program, 1998-2005 (from Chapter 1, Appendix C of Snow et al. 2008).

	Age - 3		Age - 4		Age - 5	
Stock/sex/year	**H**	**W**	**H**	**W**	**H**	**W**
Met Comp - male						
1998	54.0	52.0	79.0	74.9	94.0	92.7
1999	52.0		78.0	76.4		100.0
2000	52.1		73.3			
2001	60.0		80.6			
2002	48.3		79.0		100.0	
2003	49.0	51.0			96.7	
2004	48.3		72.0			
2005	52.1		72.3			
Average	*52.0*	*51.5*	*76.3*	*75.7*	*96.9*	*96.4*
Met Comp - female						
1998			76.3	76.1	87.2	89.0
1999			78.0	77.6		86.5
2000			74.5			
2001			76.9			
2002			76.3		87.3	
2003			75.3			
2004			73.4	75.0	76.0	
2005			74.3	71.0	81.0	
Average			*75.6*	*74.9*	*82.9*	*87.8*
Twisp - male						
1998			79.5		87.0	
1999	50.8					
2000	52.0	45.0	71.0			98.0
2001	63.0	52.5	79.3	75.3		
2002	46.3					
2003	50.7	50.0		67.0		
2004	49.0	45.7	72.2	71.6		
2005	49.6			82.0		
Average	*51.6*	*48.3*	*75.5*	*74.0*	*87.0*	*98.0*
Twisp - female						
1998			77.0		90.5	
1999				78.5		89.3
2000			75.1			91.0
2001			76.9	79.6	92.5	88.0
2002			75.0			

Stock/sex/year	Age - 3		Age - 4		Age - 5	
	H	**W**	**H**	**W**	**H**	**W**
2003			70.7			93.4
2004			73.0	75.8		
2005				81.0		88.5
Average			*74.6*	*78.7*	*91.5*	*90.0*
Total Basin Average - male						
1998	54.0	52.0	79.3	74.9	90.5	92.7
1999	51.4		78.0	76.4		100.0
2000	52.1	45.0	72.2			98.0
2001	61.5	52.5	80.0	75.3		
2002	47.3		79.0		100.0	
2003	49.9	50.5		67.0	96.7	
2004	48.7	45.7	72.1	71.6		
2005	50.9		72.3	82.0		
Average	*52.0*	*49.1*	*76.1*	*74.5*	*95.7*	*96.9*
Total Basin Average - female						
1998			76.7	76.1	88.9	89.0
1999			78.0	78.1		87.9
2000			74.8			91.0
2001			76.9	79.6	92.5	88.0
2002			75.7		87.3	
2003			73.0			93.4
2004			73.2	75.4	76.0	
2005			74.3	76.0	81.0	88.5
Average			*75.3*	*77.0*	*85.1*	*89.6*

Methow Summer Steelhead MPG

Juveniles

In the Upper Columbia Basin, naturally produced steelhead smolts sampled at Rock Island Dam have averaged between 163-188 mm FL (Peven and Hays 1989; Peven et al. 1994). In the Methow Basin, smolt trapping has been ongoing since the mid-1990s, and in general length frequency of juveniles does not vary greatly between years (C. Snow, personal communication), and averages between from approximately 130-180 mm FL (this includes "transitional" juveniles that may or may not be smolting; Table 2-8).

Table 2-8. **Mean length and weight at migration age of wild transition and smolt summer steelhead captured at the Methow (A) and Twisp (B) smolt traps in 2007 (Tables 2 and 4, respectively, from Chapter 3 of Snow et al. 2008).**

A

Age	*N* (%)	Fork (mm)			Weight (g)			K-factor
		Mean	*N*	SD	Mean	*N*	SD	
1	6 (4.3)	138.7	6	17.8	32.6	6	14.4	1.2
2	122 (86.5)	175.2	122	20.1	55.3	117	20.1	1.0
3	12 (8.5)	181.5	12	22.4	58.4	10	22.7	1.0
4	1 (0.7)	174.0	1	- -	51.3	1	- -	0.9

B

Age	*N* (%)	Fork (mm)			Weight (g)			K-factor
		Mean	*N*	SD	Mean	*N*	SD	
1	7 (2.4)	128.6	7	14.6	24.3	6	7.8	1.1
2	231 (80.8)	162.2	229	17.4	42.7	226	12.9	1.0
3	43 (15.0)	180.6	43	20.5	58.6	43	17.7	1.0
4	5 (1.7)	177.2	5	9.6	56.8	5	11.1	1.0

Adults

Chapman et al. (1994) reported that female steelhead sampled at Wells from 1982-1992 ranged from 57-81 cm and 67-75 cm for fish spending one and two years in the ocean, respectively. Males ranged from 59-66 cm and 69-77 for one and two ocean fish.

The length frequency of broodstock captured in 2006 for the steelhead supplementation program comports well with previous sampling at Wells Dam above (Table 2-9). In general, hatchery-origin fish are similar in size to naturally produced fish.

Table 2-9. Mean fork length (cm) of steelhead by saltwater age, sex, and origin for broodstock sampled at Wells Hatchery Complex facilities, 1997-2006 (Chapter 1, Appendix C from Snow et al. 2008).

	Male				Female			
	1-salt		2-salt		1-salt		2-salt	
Brood year	**H**	**W**	**H**	**W**	**H**	**W**	**H**	**W**
1997	64.2	63.8	76.6	74.5	62.3	61.6	71.9	74.3
1998	64.8	65.6	79.3		62.1	64.0	75.3	74.3
1999	63.3	64.0	80.0	80.8	62.3	61.8	74.3	73.8
2000	63.4	62.9	77.8	76.0	61.4	62.5	73.8	76.8
2001	61.2	60.9	76.1	82.5	60.2	59.4	72.9	73.3
2002	64.3	63.7	78.3	76.0	62.9	63.8	73.6	74.7
2003	61.9		78.6	81.6	60.4		74.7	75.8
2004	60.9	64.2	73.0		60.1	62.2	67.5	73.4
2005	60.4	62.1	74.0	75.6	59.4	62.5	71.8	73.4
2006	60.3	65.2	75.6	77.4	59.7	61.4	70.9	72.7
Average	**62.5**	**63.6**	**76.9**	**78.1**	**61.1**	**62.1**	**72.7**	**74.3**

Methow Core Area Bull Trout

Juveniles

Length at age of bull trout found in Methow River tributaries by Mullan et al. (1992a) were the shortest by age group of any other lengths reported in the literature (Goetz 1989; Wydoski and Whitney 2003). Table 2-10 shows the age range of all bull trout sampled by Mullan et al. (1992a) in the 1980s. Considering that males began maturing at age 5 and females by age 7 (see above), all lengths shown in Table 2-10 for fish age 5 and younger can be considered juveniles, and all of those older than that may be juveniles or adults (assume that older than age 8 would be adults). Mean length of juveniles ranged from 51 to 195 mm FL.

Table 2-10. Mean fork length[8] (mm) of bull trout sampled in the Methow Basin (Mullan et al. 1992a).

	Age											
Stream	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Methow R				188.0	257.0							
Gold Cr					230.5							
Wolf Cr	58.3	86.8		168.2	199.5		229.5	250.0				
Early Winters Cr	52.6	89.7	124.0	136.2	174.5	198.0	200.0	186.0	210.0	188.7		205.0
Lake Cr	49.0				152.0							
WF Methow R	50.8	82.4			190.0		207.0					
Chewuch R						255.0						
EF Buttermilk Cr	48.3	87.4	112.0	130.0	204.0	231.0				324.0		
Monument Cr	42.3				179.0							
Lost Cr				195.0								
Cedar Cr	51.6				172.0							
Twisp R	58.3	97.6	120.5	163.8								
South Cr			116.0									
Average	*51.4*	*88.8*	*118.1*	*163.5*	*195.4*	*228.0*	*212.2*	*218.0*	*210.0*	*256.4*		*205.0*

Adults

BioAnalysts (2002) compared a sample of resident and fluvial fish from the Methow Basin and found that the fluvial fish were two to three times larger than resident fish of the same age. BioAnalysts (2004) tagged adult migratory bull trout at Rock Island, Rocky Reach, and Wells Dam in 2001-2003. For fish tagged in 2002 at Wells Dam, bull trout averaged 57.3 cm FL. Most of the fish tagged at Wells Dam eventually headed to the Methow Basin (some fish tagged at both Rocky Reach and Rock Island also headed in some years to the Methow Basin).

2.2.1.5 Migration Timing

<u>Methow Spring Chinook MPG</u>

Mainstem Columbia River

Adult spring Chinook destined for areas upstream from Bonneville Dam (upriver runs) enter the Columbia River beginning in March and reach peak abundance (in the lower river) in April and early May (WDF and ODFW 1994). Fifty percent of the spring Chinook run passes Priest Rapids and Rock Island dams by mid-May, while most pass Wells Dam somewhat later (Howell et al. 1985; Chelan and Douglas PUD, unpublished data). Chinook that pass Rock Island Dam are considered "spring-run" fish from the beginning of counting (mid-April) through approximately the third week of June (Mullan 1987).

[8] Mullan et al. (1992a) reported bull trout length in Appendix K (their Table 4) by temperature units, so there may be multiple measurements per age class per stream. This table combined (averaged) each age class per stream.

Methow River

The Methow Basin spring Chinook migrate past Wells Dam and enter the basin in May and June, peaking after mid-May. Differences in migration timing have been observed between, but not within age classes. Hatchery three year olds migrated to Wells Dam later than hatchery four and five year olds as well as wild five year olds (Snow et al. 2008), which has likely contributed to a decline in 5-year-old returns because the fishery below Bonneville Dam routinely commences during the earliest part of the run.

<u>Methow Summer Steelhead MPG</u>

Mainstem Columbia River

Adults return to the Columbia River in the late summer and early fall. A portion of the returning run over-winters in the mainstem reservoirs, ascending the Upper Columbia River dams in April and May of the following year.

In 2006, naturally produced fish began their migration earlier than hatchery-origin fish (Table 2-11). The run timing observed in 2006 followed a typical beginning (July) and ending (October) for a calendar year. However, it is important to reiterate that a portion of the fish that spawned upstream of Wells Dam pass the dam in the following spring after over-wintering in the mainstem Columbia River.

Table 2-11. Migration of hatchery and wild steelhead to Wells Dam between 31 July and 26 October, 2006 (Table 6, Chapter 4 from Snow et al. 2008).

Origin	*N*	Cumulative migration date			
		25%	50%	75%	100%
Hatchery	6,002	7-Sept	19-Sept	28-Sept	26-Oct
Wild	489	27-Aug	11-Sept	28-Sept	26-Oct

Methow River

There is no Methow-specific information on run timing, but steelhead are known to enter the river in late summer (August), through the following May, based on observations from trout and steelhead fisheries and radio telemetry studies (English et al. 2001, 2003).

<u>Methow Core Area Bull Trout</u>

The focus of the discussion below regards migratory (not resident) bull trout.

Bull trout were tagged by BioAnalysts (2004) between May 1 and the first week of June in their 3-year study. Most bull trout entered the Methow by the end of June and were found in possible spawning locations (usually in August) well before the initiation of spawning. Most tagged trout left tributary streams by late November.

During the study period (2001-2003) bull trout entered mid-Columbia tributaries from April to September, but most (94%) entered tributaries during May, June, and July. At the time bull trout entered tributary streams the mean daily temperatures in the mainstem Columbia River varied from 5.4°C to 19.6°C. Similarly, tributary mean daily temperatures ranged from 7.5°C to 17.2°C. Most bull trout (92.3%) entered tributaries before the Columbia River reached a mean temperature of 15°C.

2.2.1.6 Spawning Range

Methow Spring Chinook MPG

Methow Basin spring Chinook spawn primarily in the upper reaches of the Chewuch, Twisp and Methow rivers, including the Lost River, Early Winters and Wolf Creek tributaries; in order of decreasing redd numbers: the mainstem Methow, Twisp, Chewuch, Lost River, and Early Winters Creek. No significant differences have been detected in the distribution of hatchery and wild carcasses (females) within each sub-basin (Snow et al. 2008).

Methow Summer Steelhead MPG

In the Methow River, steelhead currently spawn in the Twisp River, mainstem Methow River, Early Winters Creek, Lost River, Chewuch River, Beaver Creek, Black Canyon Creek, Lost River, and Buttermilk, Boulder, Eight-Mile, Suspension, Little Suspension, and Lake creeks (Snow et al. 2008).

Methow Core Area Bull Trout

Bull trout are currently known to spawn in the Lost, Chewuch, West Fork Methow, and Twisp Rivers, and Little Bridge, Early Winters, Goat, Wolf, East Fork Buttermilk, Blue Buck (in Beaver Creek watershed), Gold, and Lake Creeks (Gene Shull, USFS, personal communication).

2.2.1.7 Spawning Timing

Methow Spring Chinook MPG

Spawning occurs from late July through mid-September. There have been no significant differences in spawn timing between hatchery and wild fish (females) within or among sub-basins, although it appears hatchery fish spawn earlier than wild fish (Snow et al. 2008).

Methow Summer Steelhead MPG

Spawning occurs in the late spring of the calendar year following entry into the river, and usually ranges from mid-late March through May. Spawn timing within the index areas shows that the peak spawn timing in 2007 in the Chewuch sub-basin occurred during the week of 15 April. Peak spawning in the remaining three sub-basins all occurred between 15 and 30 April. Differences in spawn timing between hatchery and wild fish has not been assessed because many hatchery fish do not possess an externally visible mark (i.e., ad clip[9]), thus confounding the surveyors' ability to determine the origin of spawning adults (Snow et al. 2008).

Methow Core Area Bull Trout

Bull trout are strongly influenced by water temperature during all life stages and for all ecotypes. Most bull trout spawn from mid-September through October, with timing related to declining water temperatures. Spawning sites are commonly found in areas of ground water interchange, both from the sub-surface to the river, and from the river to the sub-surface. Association with areas of ground water interchange can promote oxygen exchange and mitigate severe winter temperatures including the formation of anchor ice.

Within the Methow Basin, spawning begins in headwater streams in late September and continues through October, with commencement closely tied to water temperature between 11 and 9°C (Brown 1992a). After spawning, fluvial and adfluvial kelts return to their more moderate environments, while resident forms seek winter refuge. In Methow drainage tributaries, bull trout spawning and early rearing is confined to streams cold enough (less than 1,600°C annual temperature units) to support them in areas below barrier falls (Mullan et al. 1992a). In most cases such reaches are very short (less than 5 miles).

2.2.1.8 Juvenile Life History Strategy

Methow Spring Chinook MPG

Fry emerge the spring following spawning, and are assumed to smolt as yearlings, although fall parr migrations from upper reaches have been observed (Hubble 1993; Hubble and Harper 1999, Snow et al. 2008). Where these fall migrants rear prior to smolting the next spring is still unknown.

Fryer et al. (1992) summarized age information of spring Chinook sampled at Bonneville Dam from 1987 through 1991. They found no adult scales with two stream annuli (2.x), although in every year there were some fish estimated to have entered the ocean in their first year of life (0.x; probably from the Snake River basin). Adults sampled in the Upper Columbia tributaries have shown no 0.x or 2.x life histories.

Individuals that never migrated to the sea make up some portion of the spawning population (Healey 1991; Mullan et al. 1992a). Mullan et al. (1992a) indicate that precocious maturation of male spring Chinook is common in the mid-Columbia basin and is characteristic of both hatchery and wild stocks. Generally the largest males show evidence of early maturity (Rich 1920). This may explain why large numbers of hatchery fish mature precociously, since they are typically larger than their wild counterparts.

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[9] All hatchery origin fish are externally marked, but a portion have only elastomer tags, which would not be readily visible to surveyors. It is also important to note that since steelhead are iteroparous, and they spawn during a period of increasing stream discharge, examination of carcasses, as in the case of spring Chinook salmon, is not possible.

The proportion of males that mature precociously is mostly unknown. Mullan et al. (1992a) examined 20,000 wild juvenile Chinook in tributaries of the mid-Columbia River during 1983-1988 and found that precocious males made up about 1% of the sample. However, if jacks (age-2 males that return after 1 year in the ocean) are included, the percentage of males that mature precociously would be much greater than 10%.

The extent that precocious males contribute to reproduction is unknown. In the Upper Columbia Basin, males that mature in freshwater during their first or second summer may contribute to reproduction, and may contribute more than jacks under certain conditions. For example, Leman (1968) and Mullan et al. (1992b) observed only precocious males attending large female Chinook in small headwater streams that were accessible only at high water. In Marsh Creek and Elk Creek, Idaho, precocious males occurred most frequently where there was active spawning (Gebhards 1960). These fish usually lay within the depression of the redd with an adult female, or male and female pair. Gebhards (1960) reports seeing between 4 and 30 precocious males within redds. Apparently these fish frequent spawning areas to reproduce, not to forage on eggs. Gebhards (1960) analyzed the stomach contents of several precocious males and found that only 5% had consumed eggs. Furthermore, most (85.1%) of the dead precocious males that he found were partly or completely spent.

The mechanism that dictates the life history tactic of Chinook is not well understood (Gross 1991); however, recent studies have indicated that growth rate can be a large factor determining the incidence of precocial and residualism rates in hatchery fish (Larsen et al. 2004, 2006; Sharpe et al. 2007). In the wild, juvenile size is determined by many variables, such as genotype, egg size, time of hatching, water flow, water temperature, territory quality, stream productivity, predation pressure, and population density. Changes in these variables may therefore affect the life history of Chinook.

Precocious males may play a significant role in reproduction in the Upper Columbia Basin, spawning successfully not only as "sneakers" in the presence of older males, but as the sole male present in some areas and in some years when spawner numbers are very low. They probably play a greater role in spawning in years such as 1994 and 1995, when numbers of spawners were so low that adult females were widely dispersed.

Methow Summer Steelhead MPG

The life history pattern of steelhead in the Upper Columbia Basin is complex (Chapman et al. 1994). In the Upper Columbia region, Peven et al. (1994) observed smolt ages ranging from 1-7 years, with the highest percentages at ages 2 and 3. Female smolts (63% of fish sampled) were older, and larger within most age classes than males.

Steelhead can residualize in tributaries and never migrate to sea, thereby becoming resident rainbow trout. Conversely, progeny of resident rainbow trout can migrate to the sea and thereby become steelhead. This dynamic expression of life-history characteristics makes *O. mykiss* very challenging to understand and manage. It is difficult to summarize one life history strategy (anadromy) without due recognition of the other (non-migratory). The two strategies co-mingle on some continuum with certain stream residency at one end, and certain anadromy on the other.

Upstream distribution is limited by low heat budgets (about 1,600 temperature units) (Mullan et al. 1992). The response of steelhead/rainbow complex in these cold temperatures is residualism, presumably because growth is too slow within the time window for smoltification. However, these headwater rainbow trout contribute to anadromy via emigration and displacement to lower reaches, where warmer water improves growth rate and subsequent opportunity for smoltification.

Methow Core Area Bull Trout

Migratory juveniles usually rear in natal streams for 1-4 years before emigration (Goetz 1989; Fraley and Shepard 1989; Pratt 1992). Methow Basin juvenile bull trout rear in the coldest headwater locations until they reach a size that allows them to compete with other fish (75-100 mm; Mullan et al. 1992). Non-migratory forms above barrier falls probably contribute a limited amount of recruitment downstream; nevertheless, this recruitment contributes to fluvial and adfluvial productivity. The fluvial forms migrate to the warmer mainstem Methow and Columbia rivers (e.g., Twisp River, Wolf Creek), while the adfluvial populations (e.g., Lake Creek, Cougar Lake) migrate to nearby lakes.

2.2.1.9 Smolt Emigration Timing

Methow Spring Chinook MPG

Smolt trapping has occurred in the Methow Basin since the mid-1990s as part of the hatchery evaluation program. In general, yearling spring Chinook (smolts) migrate down the Methow River between early March and the end of May to early June. The peak of the migration in 2007 appeared later in the Twisp River compared to the Methow River site (Figures 2-2 and 2-3), although trap efficiencies and periods when traps are inoperable may influence the absolute numbers of fish caught on a given date.

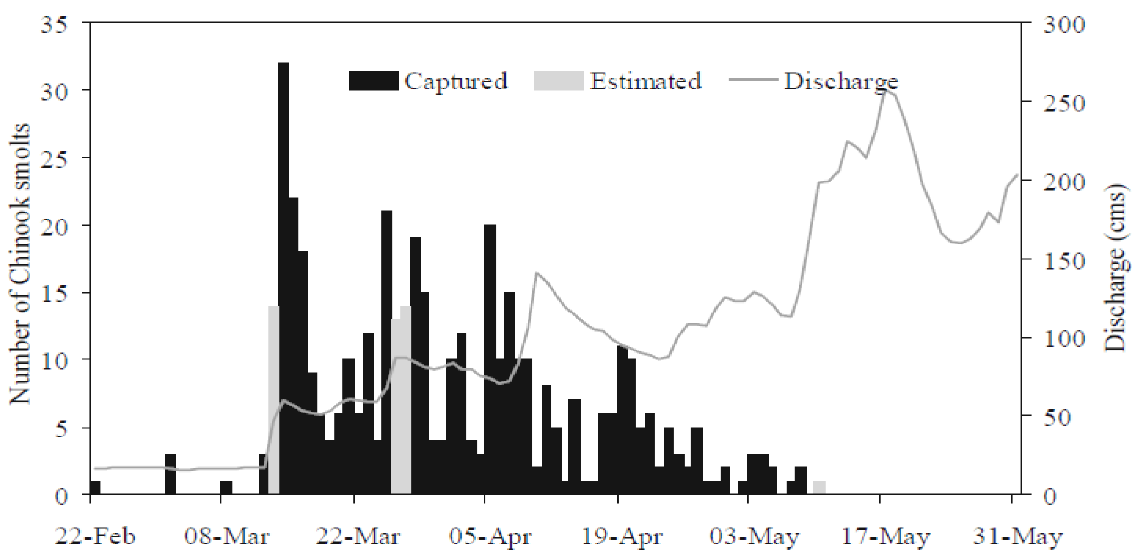

Figure 2-2. Daily capture of wild Chinook salmon smolts from the Methow River trap in 2007 (Figure 3, Chapter 3 from Snow et al. 2008).

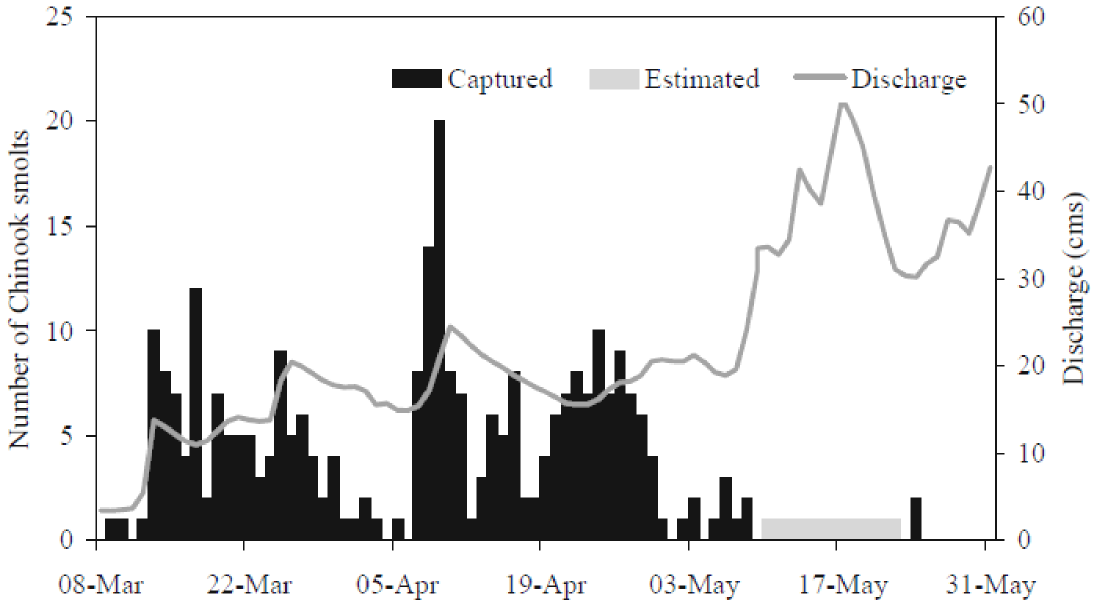

Figure 2-3. **Daily capture of wild Chinook salmon smolts from the Twisp River trap in 2007 (Figure 6, Chapter 3 from Snow et al. 2008).**

As previously stated, a substantial parr migration occurs within the Methow Basin, and appears in two main phases; throughout the summer and then again in the fall (Figure 2-4).

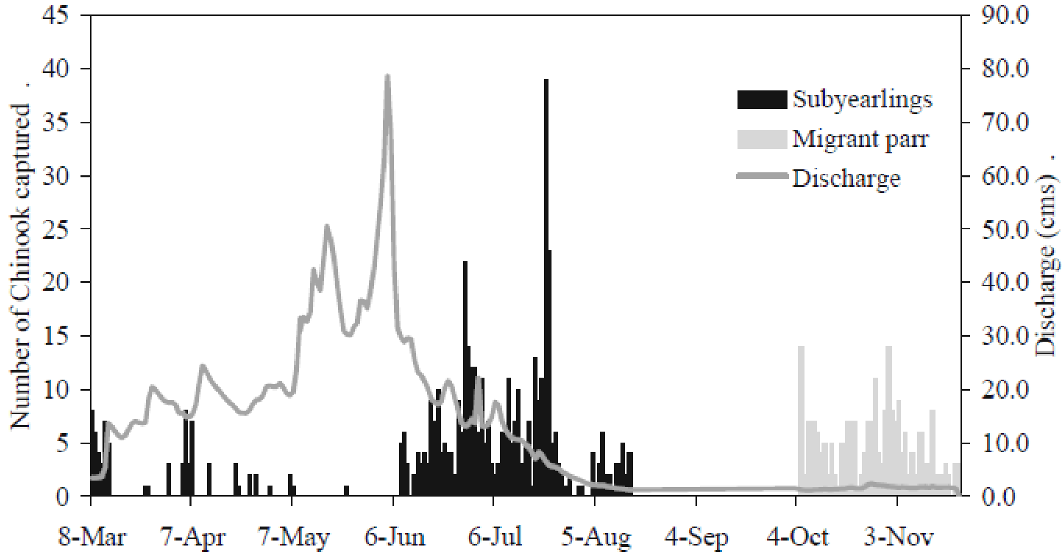

Figure 2-4. Daily capture of subyearling wild spring Chinook and migrant parr at the Twisp River trap in 2007 (Figure 7, Chapter 3 from Snow et al. 2008).

<u>Methow Summer Steelhead MPG</u>

Smolt trapping has occurred in the Methow Basin since the mid-1990s as part of the hatchery evaluation program. In general, *O. mykiss* juveniles[10] migrate down the Methow River between early March and the end of May to early June. The peak of the migration in 2007 appeared later in the Twisp River compared to the Methow River site (Figures 2-5 and 2-6), although trap efficiencies and periods when traps are inoperable may influence the absolute numbers of fish caught on a given date.

[10] Because it is not possible to determine whether juvenile *O. mykiss* are "trout" or "steelhead", we refer to them by their scientific nomenclature.

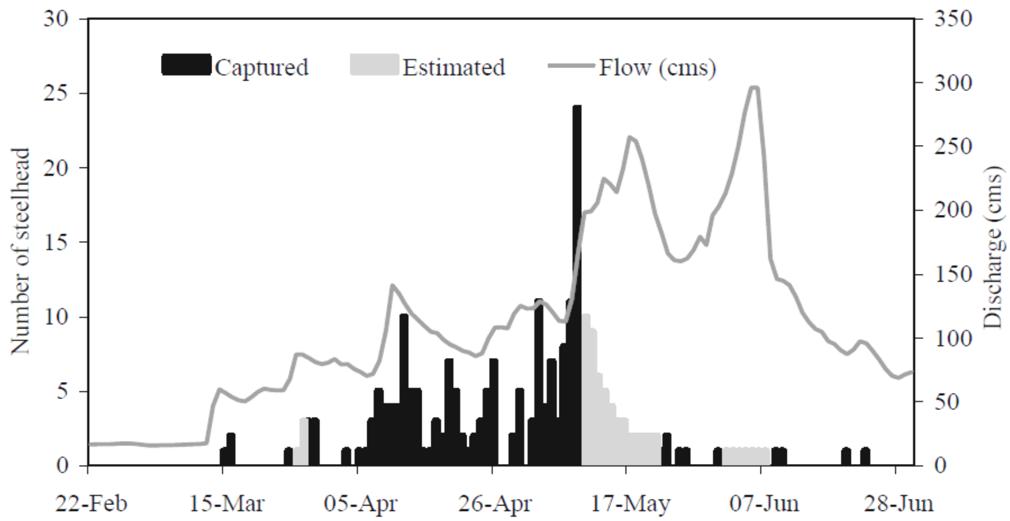

Figure 2-5. **Daily capture of wild steelhead smolts and transitional parr from the Methow River trap in 2007 (Figure 5, Chapter 3 from Snow et al. 2008).**

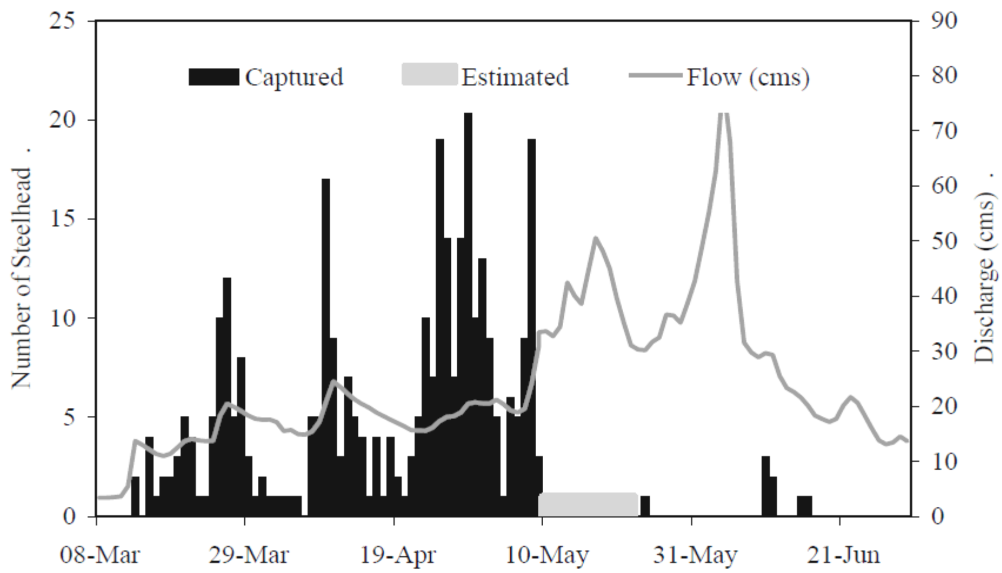

Figure 2-6. **Daily capture of wild steelhead smolts and transitional parr from the Twisp River trap in 2007 (Figure 8, Chapter 3 from Snow et al. 2008).**

As previously stated, a substantial parr migration occurs within the Methow Basin, and appears in two main phases; throughout the summer and then again in the fall (Figure 2-7).

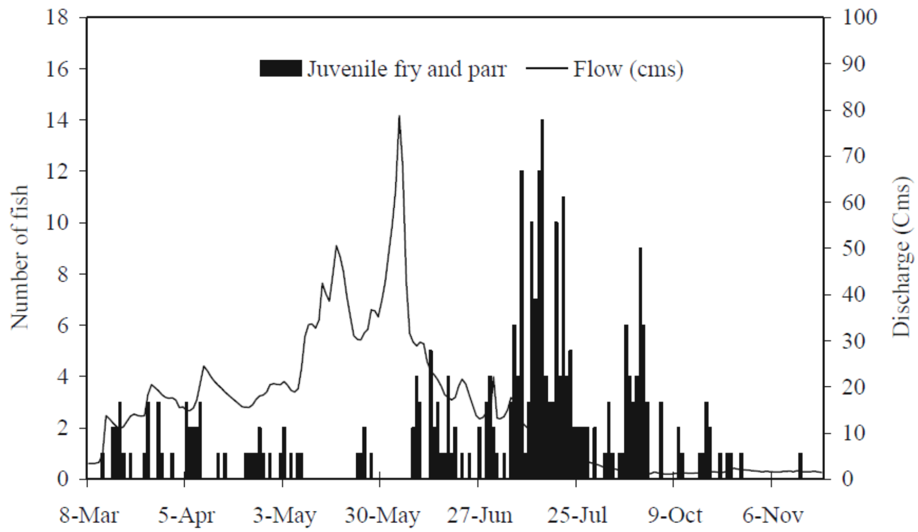

Figure 2-7. Daily capture of wild steelhead fry and parr at the Twisp River trap in 2007 (Figure 9, Chapter 3 from Snow et al. 2008).

Methow Core Area Bull Trout

All of the fish that BioAnalysts (2004) tagged in their 3-year study appeared to have spent at least three years in their natal stream prior to migrating to the Columbia River.

2.2.1.10 Spatial and Temporal Distribution of Spawners in Relation to Fish Release Location

Methow Spring Chinook MPG

Snow et al. (2008) found no significant differences in spawn timing between hatchery- and natural-origin fish (females) within or among sub-basins. However, hatchery fish tended to spawn earlier than naturally produced fish, except in the Twisp River (which had the lowest proportion of hatchery-origin spawners).

Snow et al. (2008) found no significant differences in the distribution of hatchery and natural-origin carcasses (females) within each major spawning area. However, hatchery fish tended to spawn lower in each of the spawning areas than naturally produced fish.

Methow Hatchery spring Chinook salmon are typically released in three locations in the Methow Basin. All of the acclimation sites use surface water for rearing prior to release to increase homing fidelity. Despite this, an estimated 49% of the Twisp-released fish spawning in the Methow Basin spawned in areas other than the Twisp River. However, because abundance of Twisp-stock fish is relatively low, their prevalence typically comprises a small proportion of the escapement within other spawning areas (i.e., Methow and Chewuch rivers). Similarly, an estimated 60% of the Chewuch-released fish spawned in areas other than the Chewuch River, but because release numbers are much greater, contribution of these fish to other spawning areas can be high. Conversely, an estimated 28% of Methow-released fish spawned in areas other than the Methow River (Snow et al. 2008).

Methow Summer Steelhead MPG

Previously there was no way to differentiate steelhead by origin on the spawning grounds, and therefore there is no current information. However, in 2009 in the Twisp River, hatchery and wild steelhead were Floy-tagged at the Twisp Weir and identified during spawner surveys, providing early information on spatial and temporal distribution of spawning in the Twisp among these groups. In addition, females were PIT-tagged in the body cavity, where tags are likely to be expelled with eggs. In-stream detection of PIT tags in or near redds indicated spawning location. The lack of this ability (to determine origin on the spawning grounds) has been identified by the UC Regional Technical Team as an important data gap.

Methow Core Area Bull Trout

There are currently no hatchery programs for bull trout in the Methow River.

2.2.1.11 Identify the NMFS ESA-listed population(s) that will be directly affected by the program

Methow Spring Chinook MPG

Common Name	Endangered Species Act	Natural population targeted for integration
Spring Chinook salmon (Upper Columbia River)	Endangered	Methow spring Chinook

Methow Summer Steelhead MPG

Common Name	Endangered Species Act	Natural population targeted for integration
Steelhead trout (Upper Columbia River)	Threatened	Methow River summer steelhead

Methow Core Area Bull Trout

There are currently no hatchery programs for bull trout in the Methow River.

2.2.1.12 Identify the NMFS ESA-listed population(s) that may be incidentally affected by the program

Methow Spring Chinook MPG

Common Name	Endangered Species Act
Spring Chinook salmon (Upper Columbia River)	Endangered
Steelhead trout (Upper Columbia River)	Threatened
Bull trout (Columbia River)	Threatened

Methow Summer Steelhead MPG

Common Name	Endangered Species Act
Spring Chinook salmon (Upper Columbia River)	Endangered
Steelhead trout (Upper Columbia River)	Threatened
Bull trout (Columbia River)	Threatened

Methow Core Area Bull Trout

There are currently no hatchery programs for bull trout in the Methow River.

2.2.2 Status of NMFS ESA-listed Salmonid Population(s) Affected by the Program

2.2.2.1 Describe the Status of the Listed Natural Population(s) Relative to "Critical" and "Viable" Population Thresholds

Methow Spring Chinook MPG

The ICTRT (2007) has classified the Methow River spring Chinook as a "Very Large" population in size based on its historic habitat potential. A "Very Large" population is one that requires a minimum abundance of 2,000 wild spawners and an intrinsic productivity of greater than 1.75 spawner to spawner (S/S) to be viable. The Recovery Plan (UCSRB 2007) incorporated the abundance goal of 2,000 naturally produced spawners (geometric mean over 12 years), but incorporated an earlier recommendation from the ICTRT of an intrinsic productivity of 1.2.

Regardless of which productivity metric is used, the Methow spring Chinook currently are considered to have a greater than 25% chance of becoming extinct within 100 years.

Methow Summer Steelhead MPG

The ICTRT (2007) has classified the Methow River summer steelhead as an "Intermediate" population in size based on its historic habitat potential. An "Intermediate" population is one that requires a minimum abundance of 1,000 wild spawners and an intrinsic productivity of greater than 1.1 spawner to spawner (S/S) to be viable. The Recovery Plan (UCSRB 2007) incorporated the abundance goal of 1,000 naturally produced spawners (geometric mean over 12 years) and an intrinsic productivity of 1.1.

Methow summer steelhead currently are considered to have a greater than 25% chance of becoming extinct within 100 years.

Methow Core Area Bull Trout

Because of a lack of detailed information on the population dynamics of bull trout in the Upper Columbia Basin, a different approach was used to estimate Viable Salmonid Population (VSP) parameters for bull trout in UCSRB (2007). Bull trout abundance was estimated as the number of redds times 2.0 to 2.8 fish per redd. This approach provided a range of abundance estimates for bull trout within each core area (USFWS 2004, 2005). Productivity was based on trends in redd counts, while diversity was based on general life-history characteristics of bull trout (resident, fluvial, and adfluvial) within each core area. Although these parameters were less rigorous than the parameters used to estimate status of spring Chinook and steelhead, they provide relative indices of abundance, productivity, and diversity.

In the final listing rule (63 FR 31647), the U.S. Fish and Wildlife Service identified eight bull trout subpopulations in the Entiat, Wenatchee, and Methow River basins (USFWS 1998): Lake Wenatchee, Ingalls Creek, Icicle Creek, Entiat system, Methow River, Goat Creek, Early Winters Creek, and Lost River. The Service considered half of these to be "at risk of stochastic extirpation" due to: a) their inability to be re-founded, b) presence of a single life history form, c) limited spawning areas, and d) relatively low abundance.

In the 5-year review (USFWS 2008), the USFWS determined that the Methow core area was at high risk of extinction.

2.2.2.2 Provide the Most Recent 12 Year (e.g. 1988-present) Progeny-to-Parent Ratios, Survival Data by Life-stage, or other Measures of Productivity for the Listed Population. Indicate the Source of these Data.

Methow Spring Chinook MPG

During the period 1960 to 1999, returns per spawner for spring Chinook in the Methow Basin ranged from 0.05 to 5.21 (UCSRB 2007). The 12-year geometric mean of returns per spawner during this period ranged from 0.41 to 1.02. The geometric mean at the time of listing (1999) was 0.51.

Since 1999, the natural replacement rate (the number of recruits from successive return years that originated from the same brood year, and dividing the sum by the number of spawners for that brood year) has varied, but remains low, especially in the Methow River spawning area (Table 2-12). The most recent geometric mean of productivity remains near 0.51, similar to the time of listing for the Chewuch and Twisp spawning areas. However, productivity is approximately half that amount in the Methow spawning area, which coincidentally has the highest proportion of hatchery-origin spawners.

Table 2-12. The natural replacement rate of Methow Basin spring Chinook between the 1992 and 2001 brood years (data from Chapter 5, Appendix A from Snow et al. 2008).

	NRR		
Year	**Chewuch**	**Methow**	**Twisp**
1992	0.09	0.09	0.28
1993	0.49	0.21	0.11
1994	0.26	0.16	0.28
1995	5.46	2.79	3.20
1996			
1997	7.47	3.48	10.17
1998			
1999	0.10	0.06	0.30
2000	0.81	0.40	1.27
2001	0.11	0.03	0.15
Geometric mean	*0.50*	*0.26*	*0.60*

Methow Summer Steelhead MPG

In UCSRB (2007), the returns per spawner were expressed as either a hatchery spawner effectiveness of 100% or 0%. The geometric mean of returns per spawner if hatchery spawner effectiveness was 100% = 0.09, and 0.84 if hatchery spawner effectiveness was 0% up to the 1996 brood.

More recently, Snow et al. (2008) estimated that the total (not accounting for hatchery spawner effectiveness) average return per spawner as 0.30 for brood years 1996-2001 (Table 2-13). This value is in between the two reported in UCSRB (2007).

Table 2-13. The natural replacement rate of Methow Basin steelhead between the 1996 and 2001 brood years (data from Chapter 4, Table 16 from Snow et al. 2008).

Parent Brood	Recruits	NRR
1996	315	0.56
1997	684	0.28
1998	730	0.30
1999	167	0.11
2000	848	0.40
2001	595	0.16
Average	***557***	***0.30***

Methow Core Area Bull Trout

Numbers of redds counted in the Methow Basin appear to have increased since the mid-1990s. However, this trend is an artifact of changing survey methods. Looking at recent years (2000-2007), when survey methods were similar, there may be a short-term increasing trend in redds, ranging from 147 in 2000 to 231 in 2007 (see below and Table 2-16).

2.2.2.3 Provide the Most Recent 12 Year (e.g. 1988-1999) Annual Spawning Abundance Estimates, or any other Abundance Information. Indicate the Source of these Data.

Methow Spring Chinook MPG

From 1960 to 2003, abundance of age 3+ naturally produced spring Chinook in the Methow Basin ranged from 33 to 9,904 adults. During this period the 12-year geometric mean of spawners in the basin ranged from 480 to 2,231 adults. The geometric mean at the time of listing (1999) was 480 spawners (UCSRB 2007).

More recently (1992-2007), the estimated escapement of naturally produced spring Chinook has ranged from approximately 45 (1995) to 1,832 fish (2001), with a geometric mean of 368 (Table 2-14).

Table 2-14. Estimated escapement of spring Chinook in the Methow River, 1992-2007 (based on App. A and D, Chapter 5 from Snow et al. 2008).

	Estimated Escapement							
Return	**Chewuch**		**Methow**		**Twisp**		**Total**	
Year	**H**	**W**	**H**	**W**	**H**	**W**	**H**	**W**
1992		422		924		316		1,662
1993		184		537		426		1,147
1994		63		172		74		309
1995		6		27		12		45
1996								
1997		123		155		72		350
1998								
1999		21		70		25		116
2000	52	83	546	611	235	256	833	950
2001	1,761	732	6,994	594	384	506	9,139	1,832
2002	588	78	1,644	86	60	181	2,292	345
2003	465	25	596	8	18	25	1,079	58
2004	289	46	622	199	98	243	1,009	488
2005	289	219	526	221	34	87	849	527
2006	378	135	942	128	100	65	1,420	328
2007	203	74	541	152	65	40	809	266
Geometric mean	***335***	***84***	***943***	***157***	***82***	***97***	***1440***	***368***

Methow Summer Steelhead MPG

See Section 1.12 and Table 1-17 for information on this topic.

Methow Core Area Bull Trout

Bull trout redd surveys in the Methow Basin began in the early 1990s. Total numbers of redds within the basin have ranged from 4 to 231 (Table 2-15). Following the UCSRB (2007), using 2.0 and 2.8 fish per redd equates to a range of abundance between 8 and 647 fish per year in the Methow Basin (Table 2-16).

Table 2-15. Bull trout redds from the Methow Basin between 1992 and 2007 (personal communication, Barb Kelly (USFWS) and Gene Shull (USFS).

Stream/ watershed	**Methow Basin**															
	1992	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**
Lower Methow watershed					2	2	1	0		0	1	0		14	4	4
Twisp watershed	4	5	4	25	0	2	86	101	105	76	93	86	101	87	89	108
Chewuch watershed				22	13	9	8	0	18	31	22	20	10	43	54	46
Upper Methow watershed	7			28	29	18	40	30	42	47	79	21	58	71	63	73
Redd Total:	**11**	**5**	**4**	**75**	**44**	**31**	**135**	**131**	**165**	**154**	**195**	**127**	**169**	**215**	**210**	**231**
Miles Surveyed Total:				**18.7**	**25.6**	**20.2**	**26.7**	**27.8**	**22.9**	**42.5**	**28.7**	**30.6**	**30.7**	**33.3**	**32.3**	**32.8**

Note: Not all bull trout redd counts were complete, and length of stream surveyed has varied between some surveys, in many cases with new survey reaches being added in recent years. Please refer to the annual spawning survey reports for more complete information.

Lower Methow includes Crater Creek, Middle Methow includes Wolf and Goat Creeks, Upper Methow includes the upper mainstem sub-basin, Early Winters sub-basin, and lower Lost River sub-basin.

Table 2-16. The number of bull trout estimated to spawn in the Methow Basin between 1992 and 2007, based on Table 2-15 and using either 2.0 or 2.8 fish per redd (f/r).

Year	Total Redds	Fish @ 2.0 f/r	Fish @ 2.8 f/r
1992	11	22	31
1993	5	10	14
1994	4	8	11
1995	75	150	210
1996	44	88	123
1997	31	62	87
1998	135	270	378
1999	131	262	367
2000	165	330	462
2001	154	308	431
2002	195	390	546
2003	127	254	356
2004	169	338	473
2005	215	430	602
2006	210	420	588
2007	231	462	647

2.2.2.4 Provide The Most Recent 12 Year (e.g., 1988-1999) Estimates of Annual Proportions of Direct Hatchery-Origin and Listed Natural-Origin Fish on Natural Spawning Grounds, if Known.

Methow Spring Chinook MPG

The percentage of hatchery-origin fish on the spawning grounds has been rising since 2001, in particular in the Chewuch and Methow spawning areas since 2005 (Table 2-17). Except for 2007, the percentage of hatchery-origin fish spawning in the Twisp has remained consistently below 30% (Table 2-17).

Table 2-17. Percentages of hatchery-origin spring Chinook spawners in the Methow Basin, based on Table 2-14.

	Percentages							
	Chewuch		Methow		Twisp		Total	
Return Year	H	W	H	W	H	W	H	W
2001	41.4	58.6	48.0	52.0	30.1	69.9	42.1	57.9
2002	46.9	53.1	48.7	51.3	24.9	75.1	45.7	54.3
2003	48.7	51.3	49.7	50.3	29.5	70.5	51.4	48.6
2004	46.9	53.1	48.7	51.3	19.9	80.1	43.0	57.0
2005	56.9	43.1	70.4	29.6	28.1	71.9	61.7	38.3
2006	86.3	13.7	75.8	24.2	28.7	71.3	65.4	34.6
2007	73.3	26.7	78.1	21.9	61.9	38.1	69.5	30.5
Average	*57.2*	*42.8*	*59.9*	*40.1*	*31.9*	*68.1*	*54.1*	*45.9*

Methow Summer Steelhead MPG

Using the percentage of wild fish sampled at Wells Dam as a surrogate for the percentage of wild fish on the spawning grounds shows that the percentage of hatchery steelhead on the spawning grounds is typically greater than 90% (Figure 2-8). The long term average percentage of naturally produced fish sampled at Wells Dam is approximately 8% (Figure 2-8).

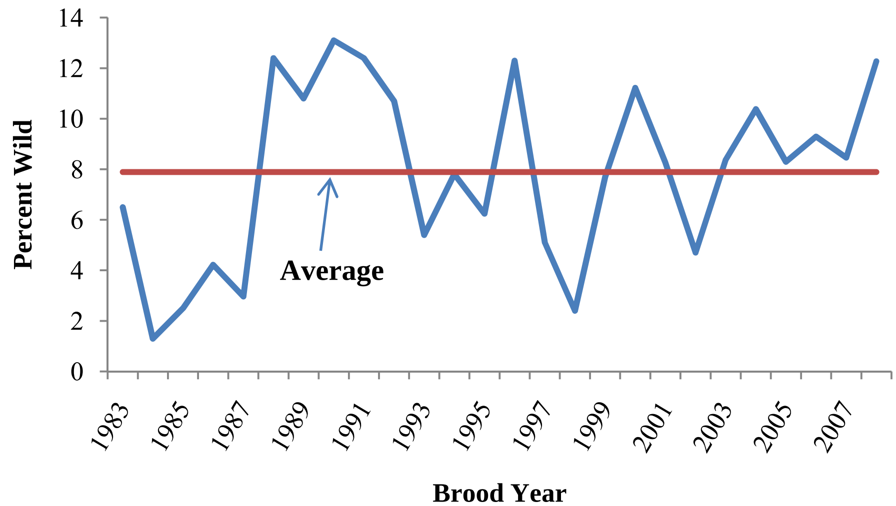

Figure 2-8. Percent of naturally produced steelhead sampled in the run at large at Wells Dam for the 1983-2008 brood years. Data from UCSRB (2007) and C. Snow, personal communication.

Methow Core Area Bull Trout

There are currently no bull trout hatchery programs in the Methow Basin.

2.2.3 Describe Hatchery Activities, including Associated Monitoring and Evaluation and Research Programs, that May Lead to the Take of NMFS Listed Fish in the Target Area, and Provide Estimated Annual Levels of Take.

2.2.3.1 Describe Hatchery Activities that May Lead to the Take of Listed Salmonid Populations in the Target Area, including How, Where, and When the Takes May Occur, the Risk Potential for their Occurrence, and the Likely Effects of the Take.

Information for this section was taken from the Section 10 Direct Take Permit (No. 1395), WDFW Application for Permit No. 1395 and ESA Section 7 Consultation for Permit No. 1395 (2002), and modified to exclude elements specific to the Wenatchee Basin program(s) and to otherwise match the proposed Wells Complex summer steelhead program.

Activities approved through the Section 10 Direct Take Permit (No. 1395) that will lead to the intentional take of the listed population include:

- Removal of adults through trapping operations at Wells FH, Wells Dam, Methow FH, Twisp River, and Methow River basin by hook-and-line for hatchery broodstock or adult management, and future reproductive success studies of natural-origin and hatchery adults.
- Removal of adults in the Methow River or Columbia River for broodstock or adult management through the use of in-river traps or other fish capture devices such as Merwin traps, guided fence traps, picket weirs or other similar devices, purse seine, electric fence, beach seine.
- Holding and artificial spawning of adults at the Wells FH and Methow FH.
- Incubation and propagation from fertilized eggs through the smolt life stage at the Wells FH.
- Removal from the system of returning adult hatchery-origin fish that are excess to spawning and other recovery needs through use of direct removal at fishways or weirs and conservation fisheries (see the first two bullets above).
- Hatchery monitoring and research activities that may lead to take include: broodstock collection, stock assessment, spawning (reproductive) success studies, smolt trapping, adult enumeration and management (including harvest fisheries), juvenile snorkel surveys, and spawning surveys.

See Tables 2-19 and 2-20 for take information for UCR summer steelhead and UCR spring Chinook as related to this HGMP.

Broodstock Collection

Broodstock collection of returning adults constitutes an intentional take of the listed species, and the fish will not be allowed to spawn naturally. Broodstock collection and spawning activities may also affect the genetic integrity and long-term fitness of the naturally spawning steelhead populations through excessive straying of broodstock program progeny, collection of broodstock from the wrong stock, alteration of the donor stock genome through domestication selection, and exacerbation of genetic drift and reduction of genetic diversity through reduction of the effective population size (MCMCP 1997).

The steelhead program for the Methow Basin uses broodstock collections at the Methow Hatchery, Twisp River weir, Winthrop National Fish Hatchery, Wells Hatchery, Wells Dam, and from the Methow Basin. See Section 1.8.2.1 for more information.

Collections will be proportional to return timing between July 1 and November 12 at Wells Hatchery or Dam for the Mainstem Columbia component, September through June at the Methow Hatchery and Winthrop National Fish Hatchery, late-February through June at the Twisp Weir, and September through June by hook-and-line in the Methow Basin. Hatchery adults of unknown parental-cross will be excluded from the broodstock collection. Parental origins of hatchery steelhead will be determined through evaluation of scales, and external and internal tags during collection. The ability to identify the river-of-origin may be developed using elemental scale analysis, or other methods. Adult return composition including number, origin, age structure, and sex ratio will be assessed in-season at Priest Rapids, Rocky Reach, and Wells dams. Adjustments in broodstock collection may result from this in-season monitoring and evaluation.

Broodstock collection targets will be based on the limitations, program needs, and the assumptions listed in Table 2-18 below. Actual broodstock take will depend on variability in fecundity (currently 5,400) and average egg-to-smolt survival (currently 0.75).

Table 2-18. Program assumptions used to determine adult broodstock collection required to meet steelhead production.

Program assumption	Standard
Pre-spawn survival	97%
Female to male ratio	1.0:1.0
Fecundity	5,400
Propagation survival	
Fertilization to eyed egg	87%
Eyed egg to yearling release	86%[1]
Fertilization to yearling release	75%[1]

[1] Not applicable to Ringold Springs Fish Hatchery

Broodstock collection methods may stress or injure captured fish, leading to pre-spawning mortality. Nine-year average pre-spawning survival of steelhead collected through the Wells Hatchery program has been 96.7% (C. Snow, WDFW data). A pre-spawning mortality of approximately 3.3% of the annual total number of adults collected at Wells Complex can therefore be expected.

Stock Assessment

Priest Rapids Dam

Stock assessment activities at PRD are expected to handle between 246 and 1,918 Upper Columbia DPS-origin steelhead each year (range from 1986 to 2008) representing 6 to 11% of the steelhead population. Ten percent of the entire upriver steelhead run is the target for sampling at Priest Rapids. The sample is collected through operation of the trap in one ladder at the dam an average of 1.5 days per week; therefore, most of the returning steelhead are allowed to pass unimpeded, and no additional take of Upper Columbia steelhead is anticipated through this sampling program. In 16 years of operation, WDFW personnel have not experienced any mortalities of adult steelhead collected for this program at PRD (L. Brown, Art Viola, WDFW, K. Truscott, personal communications). Trapping and sampling at PRD in future years is unlikely to lead to immediate mortality of listed steelhead. Completion of the state of the art Off-Ladder Adult Fish Trap (OLAFT) at PRD in 2006 has greatly improved fish handling characteristics over the previous traps. Listed steelhead collected at PRD will be briefly held in a trap, anesthetized, sampled, tagged, revived, and released live upstream. No steelhead mortalities have been observed as a result of the sampling program at PRD. However, stress, de-scaling, and possible injury to captured fish are possible, which may lead to delayed mortality or decreased potential for successful spawning.

Wells Dam

Stock assessment sampling at Wells Dam, similar to PRD, is expected to result in direct mortality of equal to or less than five adult steelhead annually. Stock assessment is performed during broodstock collection and typically results in sampling 4-7% of the run. Sampling is not normally done outside of broodstock collection efforts. Typically, one day per week fish are sampled for length, sex, scales, hatchery mark, and all released fish are PIT-tagged. On subsequent days only unmarked fish are scale-sampled to determine origin.

<u>Reproductive Success Study</u>

Evaluation of the relative reproductive success of hatchery versus natural-origin steelhead is a requirement of the current HCP for the Douglas PUD hydroelectric project. No additional take of UCR summer steelhead or UCR spring Chinook as a result of this study is expected. Trapping, sampling and observing fish in this study are part of the standard procedures of the Douglas PUD Monitoring and Evaluation Plan for operation of the Twisp Weir and conducting steelhead spawner surveys. The study design is included as Appendix A.

<u>Juvenile Monitoring / Smolt Trapping</u>

Juvenile monitoring of hatchery production will include routine growth and health sampling on about a monthly basis. This activity will likely result in handling stress, but is not expected to alter the long-term survival of the population. Occasional lethal sampling will occur for health monitoring and to collect tissue samples. To the extent possible, fish sacrificed for sampling will be used for multiple data collection objectives, minimizing overall fish handling and lethally sampled animals.

Monitoring of artificially propagated juvenile steelhead after release will be done using a variety of techniques depending on the investigative objective. Extent and impact of residualism will be assessed using standard angling and non-lethal sampling techniques, and migration rate and tributary productivity will be monitored using juvenile fish traps.

The capture and handling process is likely to cause some stress on ESA-listed fish. Typically, fish recover rapidly from handling procedures. The primary factors that contribute to stress and mortality from handling are excessive doses of anesthetic, differences in water temperature, low dissolved oxygen conditions, the amount of time that fish are held out of water, and physical trauma. Stress on salmonids increases rapidly from handling when water temperature exceeds 18°C (64.4°F) or dissolved oxygen is below saturation. Also, stress can occur if there are more than a few degrees difference in water temperature between the stream/river and the holding tank.

The potential for unexpected injuries or mortalities to ESA-listed fish will be mitigated in a number of ways. Using wet hands and keeping fish submerged while measuring will minimize scale and slime removal. Study protocols include only handling fish during appropriate water temperatures to avoid adding any additional stress and ensuring revival prior to release. The use of sanctuary nets when transferring fish to holding containers will avoid potential injuries.

Appropriate anesthetics will be used to calm fish subjected to collection of biological data; captured fish will be allowed to fully recover before being released back into the stream and will be released only in slow water areas.

Tagging, such as PIT-tagging, of natural-origin UCR steelhead juveniles will be used to determine trap efficiency and to assess juvenile seaward migration rates. Adult survival will be determined based on tag detections at dams, or recoveries on spawning grounds or in broodstock collections. The information gained is expected to be very valuable in increasing our understanding of UCR steelhead populations and life strategies. NMFS has found the measures above for minimizing the impacts of the proposed activities adequate to protect the UCR steelhead DPS.

Juvenile fish traps are generally operated to achieve a sample efficiency of 4 to 20% of the total run. Depending on river size, mortality is expected to be less than 2% of target species. For the largest estimate of UCR Basin steelhead natural production capacity of 276,048 smolts (Ford et al. 2001), a trap efficiency of 20% and mortality of 2% equals a take of 1,104 smolts. Converting this to adult equivalents (3% survival smolt-to-adult; Ford et al. 2001) results in a maximum loss of up to 33 adult UCR steelhead. Based on the highest adult capacity estimate of 8,281 (Ford et al. 2001), the loss of 33 adult steelhead is not likely to substantially impact the DPS as whole. It is likely mortality from juvenile fish trapping would be much lower than this estimate.

Genetic Effects

Various deleterious effects (both environmental and genetic) to wild anadromous fish populations may occur as a result of hatchery supplementation. Some potential genetic effects, such as loss of fitness due to domestication selection and reduction in genetic variability, may occur as a function of hatchery breeding and rearing, or hatchery and wild interactions in the natural environment. Studies continue on the Wenatchee and Methow Rivers to assess the extent of hatchery smolt emigration, residualism, and precocity, as well as monitoring of productivity, spawning, and life history characteristics of hatchery and wild steelhead populations as locally adapted steelhead stocks are being developed through supplementation efforts from Wells, Eastbank, and Turtle Rock Hatchery releases.

The genetic risks to naturally produced populations from artificial propagation include reduction in the genetic variability (diversity) among and within populations, genetic drift, selection, and domestication, which can contribute to a loss of fitness for the natural populations (Hard et al.1992; Cuenco et al. 1993). Broodstock collection for the enhancement programs shall consider the composition of the run-at large with respect to migration timing, age class, and morphology. Collection decisions will maximize natural population recovery efforts by representing the natural variability in the hatchery broodstock.

Although upper Columbia River hatchery steelhead are genetically similar to natural-origin fish (Blankenship et al. 2009), there is potential risk in allowing a disproportionately high level of hatchery fish to spawn. WDFW addresses this concern in the *Wild Salmonid Policy* (WDFW 1997), which states that even with a high level of genetic similarity between hatchery and wild fish, the hatchery component (pHOS) should not comprise more than 10% of the naturally spawning population, except in the case of supplementation programs intended to sustain the stock for reasons other than harvest (e.g., habitat degradation, hydropower dams, unforeseen catastrophic loss). More recently, the HSRG has recommended long term average PNI levels of 0.67 or higher, and an average pHOS of less than 0.34.

Under present circumstances, pHOS is rarely less than 75% in the upper Columbia River tributaries, and is often much higher (see Section 1.8.3 and Figure 2-8). Conversely, if hatchery steelhead are "essential for recovery," the degree of use of hatchery fish must be reassessed to accommodate hatchery strategies. This includes reducing the number of hatchery fish released that will home or stray into tributary populations, collecting broodstock to represent the run- and spawn-timing and age structure of the natural population(s), the use of acclimation ponds to imprint juvenile steelhead to return as adults to specific sites, and the removal of excess hatchery fish by a combination of methods, including adult removal at fish passage and collection facilities, and conservation fisheries.

Ecological Effects on Natural Populations

Ecological effects on natural fish by hatchery steelhead smolts released into the region through the supplementation program may also lead to take in the tributaries, the Columbia mainstem, and in the estuary. These effects can include predation, competition, behavioral modification, and disease transmission.

a) Predation – The Species Interaction Work Group (SIWG 1984) reported that there is an unknown level of risk of predation by hatchery steelhead on wild steelhead juveniles where they interact in freshwater migration areas. Although the risk to wild fish is unknown, the group noted that predation may be greatest when large numbers of hatchery smolts encounter newly emerged fry or fingerlings, or when hatchery fish are large relative to wild fish. Due to their location in the upper portions of the drainages and later time of emergence (late spring through August [MCMCP 1997]), wild steelhead fry are not likely to be vulnerable to predation by hatchery smolts. Smolts from the hatcheries are predominantly planted in mainstem river areas in April and May, which separates them spatially and temporally to a significant degree from newly-emerging steelhead fry. Witty et al. (1995) concluded that predation by hatchery production on wild salmonids does not significantly impact naturally-produced fish survival in the Columbia River migration corridor.

   Predation by residual hatchery steelhead on wild salmonids may impact the health of wild steelhead populations (Pearsons et al. 1994). The rate of steelhead residualism is thought to average 5 to 10% of the number of fish released (NMFS 1995). Martin et al. (1993) reported a residualism rate of 8.6% for a mid-April release group in the Tucannon River. Piscivorous behavior of steelhead and trout is reported to increase markedly when the fish exceed 250 millimeters (mm) in total length, which is a size commonly exceeded by residual steelhead in Columbia River Basin migration corridors (Witty et al. 1995). Although residual steelhead of this size are present in migration corridors, they are not considered to be major predators of juvenile salmonids, as most that are observed are in poor condition and are thought not to survive long enough to become piscivorous (Witty et al. 1995).

Practices employed at the WDFW hatcheries to minimize numbers of steelhead that will residualize should reduce the potential for residual hatchery steelhead predation on wild steelhead in the region. Preliminary results from WDFW Merwin FH research on the Lewis River in the lower Columbia River region indicate low levels of hatchery steelhead smolt predation on salmonids. In a sample of 153 out-migrating hatchery-origin steelhead smolts captured through seining in the Lewis River between April and June 24, 1997, 12 fish (7.8%) were observed to have consumed juvenile salmonids (S. Hawkins, WDFW, personal communication, July 1997). The juvenile salmonids contained in the steelhead stomachs appeared to be Chinook fry. Sampling in this study indicated that no emergent wild produced steelhead or trout fry (30-33 mm fork length) were consumed during the first two months of sampling. The vast majority steelhead released had likely migrated from the river prior to the emergence of wild steelhead fry in 1997. Large concentrations of hatchery steelhead released into the Upper Columbia tributaries may affect wild juvenile steelhead by stimulating predatory responses from bird and non-salmonid fish predators (Steward and Bjornn 1990). This potential increase in predation on wild fish is most likely to occur at the heads of reservoirs, faces of dams, turbine spillways, or bypass discharge areas.

b) Competition – SIWG (1984) reported a high risk of ecological resource competition between hatchery steelhead and wild steelhead juveniles in freshwater. Impacts from competition are assumed to be greatest in spawning and nursery areas, and at release locations where fish densities are highest. These impacts likely diminish as hatchery smolts disperse, but resource competition may continue to occur at some unknown but lower level as smolts move downstream through the migration corridor. Steward and Bjornn (1990), however, concluded that hatchery fish kept in the hatchery for extended periods before release as smolts (e.g. yearling salmon) may have different food and habitat preferences than wild fish, and that hatchery fish will be unlikely to out-compete wild fish.

Pearsons et al. (1994) reported that competition experiments in small enclosures within the North Fork Teanaway River suggested that competition between hatchery-reared steelhead and naturally produced rainbow trout adversely impacted rainbow trout growth. Results from four successive annual experimental releases of 33,000 hatchery steelhead into a tributary of the river, however, showed no impacts to the sizes or densities of sympatric wild trout (Pearsons et al. 1994). Hatchery-produced smolts emigrate seaward soon after liberation, minimizing the potential for competition with wild fish (Steward and Bjornn 1990). Competition between upper Columbia River hatchery-origin salmonids and wild salmonids, including steelhead, in the mainstem corridor was judged not to be a significant factor (Witty et al. 1995). Rearing and release strategies at all WDFW salmon and steelhead hatcheries are designed to limit adverse ecological interactions through minimizing the duration of interaction between newly liberated hatchery salmon and steelhead, and naturally produced fish.

c) Behavioral effects – High fish densities resulting from hatchery steelhead releases may cause displacement of wild steelhead juveniles, leading to abandonment of advantageous feeding areas, or premature out-migration by wild juvenile steelhead. Pearsons et al. (1994) reported displacement of juvenile wild rainbow trout from discrete sections of streams by hatchery steelhead released into an upper Yakima River tributary. No large-scale displacements of trout were detected, however. Small-scale displacements and agonistic interactions that were observed between hatchery steelhead and wild trout resulted from the larger size of hatchery steelhead, which behaviorally dominated most contests. They noted that these behavioral interactions did not appear to significantly impact the trout populations examined, and the population abundance of wild salmonids did not appear to be negatively affected by releases of hatchery steelhead.

Release of only smolts from the hatchery programs will minimize temporal overlap between hatchery-released fish and juvenile wild steelhead in the individual rivers and in the Columbia River mainstem, and decrease density-dependent effects on wild fish, such as niche displacement. Releases of hatchery smolts coincident with managed releases of water from dams (water budget releases) will help accelerate downstream migration of hatchery released salmonids, further reducing spatial and temporal overlaps with wild fish.

d) Disease transmission – Interaction between hatchery and natural-origin listed steelhead in the tributaries and mainstem areas may lead to fish pathogen transmission. Pathogen transmission has the potential to occur downstream from release locations, throughout the migration corridor. Although hatchery populations are considered to be reservoirs for disease pathogens because of their elevated exposure to high rearing densities and stress, there is little evidence to suggest that diseases are routinely transmitted from hatchery to wild fish (Steward and Bjornn 1990). Chapman et al. (1994) concluded that disease transmittal is probably not a major factor affecting wild steelhead. To address concerns of potential disease transmission from hatchery to natural fish, the Pacific Northwest Fish Health Protection Committee (PNFHPC) has established guidelines to ensure hatchery fish are released in good condition, thus minimizing impacts to natural fish. Also, the IHOT (1995) developed detailed hatchery practices and operations designed to prevent the introduction and/or spread of any fish diseases with the Columbia River Basin. Hatcheries in the Columbia River Basin generally follow fish health protocols in accordance with PNFHPC and IHOT recommended guidelines. WDFW has implemented both disease prevention and disease control programs to maximize production of healthy fish. Adult broodstock are injected with Food and Drug Administration (FDA) approved antibiotics for furunculosis and cold water disease under the control of a certified Fish Pathologist. Spawned adults are evaluated for the presence of viral and bacterial pathogens following accepted standard procedures set forth by the Pacific Northwest Fish Health Protection Committee (PNFHPC 1989).

Two methods significantly decrease the likelihood for transfer of disease from hatchery salmon to wild steelhead: 1) Hatchery liberations coincident with water budget releases, and 2) rapid out-migration of volitionally migrating hatchery smolts limit the duration of interaction with wild fish. Adherence to fish disease control and minimization policies have been set forth for WDFW hatcheries (see IHOT [1995] Policy 403 - "Salmonid Disease Control Policy of the Fisheries Co-managers of Washington State").

Residualism

Steelhead remaining after July 1 are classified as residual, although some may emigrate the following spring. A smolt recapture survey in 2003 on the Twisp River indicated 276 marked steelhead remained during the summer out of 95,390 fish released during the spring (0.3%). Hook-and-line sampling on the Twisp River indicated that 15.6% and 84.4% of the residual component observed in the Twisp River were a product of volitional and forced truck releases, respectively. Volitional release strategies will be used to reduce residualization of hatchery fish. In addition, acclimation sites will be implemented for all program components to enhance rapid downstream migration of released smolts, and reduce interactions of hatchery and natural fish. Juvenile steelhead with demonstrated readiness for seaward migration will be released into the upper tributary areas. Smolt releases will also be timed with flow augmentation releases from upstream dams to further accelerate rapid downstream movement (WDFW 1997).

Investigations of the propensity and the causes of residualism of artificially propagated steelhead will be part of the research, monitoring, and evaluation program developed by the HCP Hatcheries Committees. If monitoring indicates that a hatchery population may have a tendency to residualize at a higher than expected rate, alternate management practices will be investigated/implemented to reduce residualism and measures implemented to control interaction between hatchery and natural-origin components.

Migration Corridor/Ocean

Dawley et al. (1986) reported that movement rates of steelhead through the estuary and into the ocean are higher than observed migration rates from release sites to the estuary. They reported that this finding generally indicates that the use of the Columbia River estuary by juvenile salmonids originating from upstream areas is limited in duration compared to that of other west coast estuaries. Chapman et al. (1994) also reported that steelhead smolts move rapidly through the Columbia estuary. The minimal overlap of hatchery and wild steelhead in the estuary reduces the likelihood for adverse effects through competition, predation, or disease transmission. In evaluating the potential impacts due to competition, Witty et al. (1995) determined that increasing the number of hatchery steelhead in or just upstream of the estuary is unlikely to affect natural populations of anadromous fish.

Hatchery and natural populations have similar ecological requirements and can potentially be competitors where critical resources are in short supply. A total of about 1.1 million steelhead smolts will be annually released into the Wenatchee, Methow, and Okanogan River basins. The artificial propagation programs will be managed to produce only juvenile steelhead ready for seaward migration. Proposed maximum production for these facilities is the same as when the Columbia Basin annual production ceiling was established in 1995 (NMFS 1995; WDFW 1997). The Columbia Basin annual production ceiling was based on the information on the effects of hatchery fish on listed fish in the migration corridor and ocean, and is intended to address ecological interactions between hatchery and wild fish. Reviews of the potential effects of hatchery fish in the migration corridor and ocean are provided by NMFS (1995), and CBFWA (1996). NMFS (1995) found the only way to address potential ecological interactions between hatchery and natural fish in the Columbia River Basin is through the production ceiling, which limits the number of hatchery fish released into the basin. A total of about 72 million anadromous salmonid smolts are released from artificial propagation programs annually. The effects of the 1.1 million steelhead smolts cannot be separated from all other smolt releases, nor can the effects of the entire salmonids hatchery programs be determined at this time. NMFS concluded that the production ceiling protects ESA-listed species and finds that based on the best available information of adverse impacts in the migration corridor and ocean, the proposed programs have only minor transitory effects.

Adult Management Activities

Take of hatchery- and natural-origin steelhead may occur as a result of management of adult hatchery steelhead to meet spawner escapement objectives (abundance and hatchery/natural-origin proportion on the spawning grounds).

See Section 1.8.1 for a description of the roles and responsibilities for adult management.

Conservation Fishery

Conservation fisheries are one tool to remove hatchery-origin fish that are excess to spawning escapement and stock recovery needs, and to meet PNI objectives. Conservation fisheries are unlikely to unilaterally control hatchery adult escapement . Therefore, relocation of hatchery smolt releases, adult management at trapping facilities, and conservation fisheries will be used in concert to control hatchery spawner escapement. Lethal take of natural-origin fish will be managed to be 2.0% or less of the natural-origin run by rigorous monitoring (creel survey) and real-time adjustment of conservation fisheries.

The decision to open a conservation fishery in the Methow River and mainstem Columbia River above Wells Dam will be made on an annual basis until such time as the natural-origin fish are de-listed. The pre-season estimate will be made by September 15 and emergency fishing regulations drafted for an October 1 opener.

Any fishery will be subject to all-day creel surveys that include a minimum of three weekdays and one weekend-day check per week. A stratified sampling schedule will be set up to sample weekdays and weekends consistent with roving creel survey methodologies (Malvestuto 1996), and will include ground counts of daily angler or other fishers (e.g. tribal) to determine fishing effort. Weekdays will be chosen at random while weekend days will alternate between Saturday and Sunday. Effort and catch statistics will be summarized on a monthly basis. The purposes and conservation objectives of any fishery will be publicized in the local media prior to every opener. Monitoring the potential take of ESA-listed fish is the most important feature of the survey.

Surveyors will interview all fishers encountered during the sampling period. Information will include effort; number of fish caught; origin of fish, number of fish released; and length, weight, and sex of any steelhead kept. Snouts will be taken from all adipose-absent coded wire-tagged fish. Fishers will be asked if they or anyone else caught and released any Chinook salmon or bull trout while fishing for steelhead.

Monthly and cumulative assessment of the fishery impact to natural-origin steelhead will be used to manage the fisheries consistent with take authorization. In-season (monthly/cumulative) natural-origin steelhead take (mortality) will be estimated similarly to previously implemented UCR steelhead fisheries (i.e., total estimated number of natural-origin steelhead encountered [monthly] x estimated post-release mortality [5%] + illegal harvest = total monthly mortality). The total natural-origin encounter will be estimated consistent with estimated run composition derived from Wells Dam steelhead stock assessment/broodstock data or as the ratio of marked and unmarked steelhead encountered in the fishery, should all hatchery-origin steelhead be fin-clipped.

Fisheries enforcement will be present throughout the authorized fishery, both within and outside the authorized fishery areas. Results of enforcement activities related to any upper Columbia Basin steelhead fisheries will be reported in the monthly and final fishery report(s) to NOAA Fisheries.

Adult Removal at Volunteer Channels, Dams or Weirs

Up to 100% of excess hatchery fish may be removed at a weir or dam trap, such as the Twisp Weir, Methow Hatchery volunteer channel, Wells Hatchery volunteer channel, or Wells Dam. In the process of sorting and removing excess hatchery fish, recovery fish will also be handled (depending on the specifics of the trap). This may result in take of incidental recovery fish, but is expected to be at extremely low levels. See Table 2-19 for estimated maximum annual levels of take.

Adult Monitoring (hatchery)

Adult sampling will be coordinated with spawning activities where fish are humanely killed as part of the spawning process. Therefore, this sampling will not increase the level of take or have adverse impacts on the species. Morphometric samples, sex, mark, tag data, and biological samples such as scales, kidney, spleen, and other tissues may be collected.

Adult Monitoring (in natural environment)

Adult steelhead are sampled during broodstock collection at Wells Dam for biological data collection and released upstream. Approximately 4 to 7% of the run is handled. Sampling is not normally done outside of broodstock collection efforts. Typically, fish are sampled one day per week for length, sex, scales, hatchery mark, and all released fish are PIT-tagged. On subsequent days only unmarked fish are scale-sampled to determine origin.

Monitoring of adult steelhead on the spawning grounds conducted by air, foot, or float surveys is expected to result in minimal take of UCR steelhead in the form of harassment or collection of tissues from steelhead carcasses. Potential research or monitoring activities also include in-water observation of steelhead (i.e., snorkeling). Direct observation is the least disruptive and simplest method of determining presences/absence of the species, and can be used to estimate relative abundance. During some activities, redds may be visually inspected, but no redds will be walked on or otherwise disturbed. UCR steelhead could potentially experience take in the form of harassment as defined above. However, most activities would not disrupt or injure UCR steelhead. The proposed observation methods, and collection of biological data and tissue samples from carcasses of ESA-listed fish will benefit the species as a whole since the information gained through these activities will be used to protect, recover, and manage UCR and other steelhead ESUs.

Take Tables

Table 2-19. Estimated levels of take of UCR Summer Steelhead by hatchery activity.

Listed species affected: UCR Summer Steelhead ESU/Population: Methow and Okanogan Population Activity: Implement Hatchery Program

Location of hatchery activity: Wells Hatchery, Methow Hatchery, Twisp Acclimation Pond, Twisp Weir, Wells Dam, Twisp & Methow screw traps and other M&E activities/locations Dates of activity: Broodstock collection: August-October (Wells Dam/Hatchery, Methow Basin) and March-May (Methow Basin, Twisp Weir); screw traps spring thaw to ice up. Hatchery program operator: Currently WDFW

	Annual Take of Listed Fish By Life Stage (*Number of Fish*)			
Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harass a)	Up to 10%	Up to 10%	Up to 100%	Up to 100%
Collect for transport b)	Up to 300,000 eggs		Up to 33% of NORs, plus HORs	
Capture, handle, and release c)		Up to 493,000 hatchery smolts (110% of target production)	Up to 100% of the natural + hatchery origin adult returns	Up to 100%
Capture, handle, tag/mark/tissue sample, and release d)	Trap of up to 20% from any tributary	Trap of up to 20% of natural and hatchery populations from any tributary	Up to 100% of the natural + hatchery origin returns	Up to 100%
Removal (e.g. broodstock) e)			Up to 33% of NORs, plus HORs	
Intentional lethal take f)			Up to 33% of NORs, plus HORs	
Unintentional lethal take g)	Up to 10% of captured Up to 10% in hatchery	Up to 10% of captured Up to 10% in hatchery	Up to 10% of broodstock; Up to 10% of run; up to 10% of kelts	
Other Take (specify) h)			Adult management of surplus HORs, up to 100%.	

a. Contact with listed fish through stream surveys, carcass and mark recovery projects, or migrational delay at weirs.
b. Take associated with weir or trapping operations where listed fish are captured and transported for release, or when transported between programs or hatcheries.
c. Take associated with weir or trapping operations where listed fish are captured, handled and released upstream or downstream.
d. Take occurring due to tagging and/or bio-sampling of fish collected through trapping operations prior to upstream or downstream release, or through carcass recovery programs.
e. Listed fish removed from the wild and collected for use as broodstock.
f. Intentional mortality of listed fish, usually as a result of spawning as broodstock.

g. Unintentional mortality of listed fish, including loss of fish during transport or holding prior to spawning or prior to release into the wild, or, for integrated programs, mortalities during incubation and rearing.
h. Other takes not identified above as a category.

Table 2-20. Estimated levels of take of UCR Spring Chinook by hatchery activity.

Listed species affected: UCR Spring Chinook ESU/Population: Methow Population Activity: Implement Hatchery Program				
Location of hatchery activity: Methow Hatchery, Wells Dam, Twisp Weir, Twisp and Methow rivers screw traps and other M&E activities/locations, Dates of activity: Broodstock collection: August-October (Wells Dam/Hatchery, Methow Basin) and March-May (Methow Basin, Twisp Weir); screw traps spring thaw to ice up. Hatchery program operator: Currently WDFW				
	Annual Take of Listed Fish By Life Stage (*Number of Fish*)			
Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harass a)				
Collect for transport b)				
Capture, handle, and release c)				
Capture, handle, tag/mark/tissue sample, and release d)		Trapping of up to 20% of the natural + hatchery population in the Twisp and Methow rivers		
Removal (e.g. broodstock) e)				
Intentional lethal take f)				
Unintentional lethal take g)		Up to 2% of the fish captured		
Other Take (specify) h)				

a. Contact with listed fish through stream surveys, carcass and mark recovery projects, or migrational delay at weirs.
b. Take associated with weir or trapping operations where listed fish are captured and transported for release.
c. Take associated with weir or trapping operations where listed fish are captured, handled and released upstream or downstream.
d. Take occurring due to tagging and/or bio-sampling of fish collected through trapping operations prior to upstream or downstream release, or through carcass recovery programs.
e. Listed fish removed from the wild and collected for use as broodstock.
f. Intentional mortality of listed fish, usually as a result of spawning as broodstock.
g. Unintentional mortality of listed fish, including loss of fish during transport or holding prior to spawning or prior to release into the wild, or, for integrated programs, mortalities during incubation and rearing.
h. Other takes not identified above as a category.

3.0 RELATIONSHIP OF PROGRAM TO OTHER MANAGEMENT OBJECTIVES

3.1 Describe Alignment of the Hatchery Program with any ESU-Wide Hatchery Plan or other Regionally Accepted Policies. Explain Any Proposed Deviations from the Plan or Policies.

The steelhead artificial propagation objectives of this program are established in the Wells HCP, and described above in Section 1. Implementation of the HCP is a cornerstone of recovery efforts for the UCR summer steelhead and as such, has been embedded in the Upper Columbia Spring Chinook Salmon and Steelhead Recovery Plan (UCSRB 2007). The Upper Columbia Salmon Recovery Board (UCSRB) lead the development of the Recovery Plan, which was adopted by NOAA as a final ESA recovery plan for upper Columbia spring Chinook and steelhead on October 9, 2007. The UCSRB coordinates recovery planning in the Upper Columbia region with funding from the Washington State Governor's Salmon Recovery Office. The NOAA webpage describing the plan is at http://www.nwr.noaa.gov/Salmon-Recovery-Planning/Recovery-Domains/Interior-Columbia/Upper-Columbia/Index.cfm.

Section 5.3.1 of the Recovery Plan describes the hatchery programs currently being implemented in the Upper Columbia DPS. Implementing Entities include the CCT, YN, USFWS, WDFW, and Douglas County, Chelan County, and Grant County PUDs. Coordinating and technical bodies have been established to guide implementation of Douglas, Chelan and Grant County PUDs' hatchery programs (Coordinating Committees and Hatchery Committees), required by the PUD HCPs and by Grant County PUD's Biological Opinion (NMFS 2008b). The HCP and Priest Rapids Coordinating and Hatchery Committees include participation by the relevant PUD(s) and CCT, YN, USFWS, NOAA, and WDFW. This HGMP will also be consistent with the direction provided by the HRSG on UCR summer steelhead artificial supplementation programs (HSRG 2009). Such modifications will be reflected in the program production size and duration, monitoring and evaluation, and in the artificial production strategies.

3.2 List All Existing Cooperative Agreements, Memoranda of Understanding, Memoranda of Agreement, or other Management Plans or Court Orders Under Which the Program Operates.

3.2.1 Wells Habitat Conservation Plan

In April 2002, pursuant to Section 10(a)(1)(B) of the ESA, negotiations on the *Anadromous Fish Agreement and Habitat Conservation Plan Wells Hydroelectric Project FERC License No. 2149* with Douglas PUD for the operation of Wells Dam (Public Utility District No.1 of Douglas County et al. 2002) were concluded. A Biological Opinion with incidental take statements (ITSs) on the operation of the Wells Hydroelectric Project was issued consistent with the HCP (NMFS 2003a, 2003b, 2003c). Incidental Take Permit No. 1395 was issued in 2004 for the operation of steelhead artificial production facilities necessary to meet NNI provisions of the HCP (NMFS 2004). WDFW and Chelan PUD are joint permit holders with Douglas PUD of Permit 1395. The parties to the Wells HCP include Douglas PUD, WDFW, NMFS, USFWS, CCT, YN, and the Wells Project

Power Purchasers. The artificial propagation activities of this program are included within Douglas PUD's HCP; see Sections 1.7 and 1.8 for more detailed information regarding the HCPs. The production levels specified in this HGMP were adjusted in 2010 from the original production levels based on survival study results, and are consistent with the Wells HCP.

3.2.2 2008-2017 / United States v. Oregon / Management Agreement

The purpose of this Management Agreement is to provide a framework within which the signatory fishery co-managers can use their authorities to protect, rebuild, and enhance UCR fish runs while fairly sharing harvestable fish between Treaty and non-Treaty fisheries. Several of the signatory parties to the Wells HCP are also signatory fishery co-managers who will coordinate HCP Hatchery Committee management decisions with the *US v. Oregon* Management Agreement. The Management Agreement specifies harvest limits and artificial production measures for stocks of salmon and steelhead originating above Bonneville Dam. The *US v. Oregon* production programs are implemented and/or adjusted based on modifications to productions levels through processes established under the mid-Columbia HCPs, the Priest Rapids Salmon and Settlement Agreement, and discussions associated with Part III. H of the Management Agreement. The Management Agreement is entered as an order of the 7th U.S. District Court in *US v. Oregon* and, as such, its terms are binding on the parties.

3.2.3 Hatchery Scientific Review Group – Upper Columbia Review

The HSRG, as part of the Pacific Salmon Hatchery Reform Project, has completed a review of over 178 hatchery programs and 351 salmonid populations in the Columbia River Basin. The project was conducted by the Columbia River HSRG, composed of 14 members, nine of whom were affiliated with agencies and tribes in the Columbia River Basin. The remaining five members were unaffiliated biologists. The objective was to produce recommendations that are based on broad policy agreements and are supported by consistent technical information about hatcheries, habitat, and harvest. The Upper Columbia Hatchery Programs Regional Review began in April 2008. The HSRG recommendations were published on January 31, 2009, in Appendix E to the Columbia River Hatchery Reform System-Wide Report (HSRG 2009). While the HSRG recommendations are not binding, the principles of the recommendations were used in the development of this HGMP.

3.3 Relationship to Harvest Objectives

Fisheries in the UCR Basin are currently limited by the need to protect ESA-listed UCR spring Chinook salmon and UCR steelhead. Fisheries in the migration corridor and ocean are also limited to protect these populations, and to minimize harvest impacts on other listed salmon and steelhead returning to other Columbia River Basin and Snake River Basin areas as noted above. NMFS evaluates and authorizes annual fisheries proposed by the co-managers in the action area each year through separate Section 7 biological opinions.

Steelhead returning to the Methow River basin will be managed in a manner consistent with recovery goals to enhance natural-origin populations. Three methods may be used to reduce the number of artificially-propagated UCR steelhead in the spawning areas to increase the proportion of the natural-origin steelhead in the tributary spawning populations: 1) artificially propagated (hatchery) steelhead releases may be relocated, 2) returns may be removed at trapping sites, and 3) conservation fisheries may be used to reduce the number of adipose fin-clipped hatchery-reared steelhead that may spawn naturally.

3.3.1 Describe Fisheries Benefitting from the Program, and Indicate Harvest Levels and Rates for Program-Origin Fish for the Last Twelve Years (1988-99), if Available

Recreational steelhead fisheries were terminated in the Methow Basin after the 1997 brood year. Revision of the ESA Section 10 permit allowed limited fisheries to resume in 2003 where take of the listed stock was capped, and catch of both hatchery and natural-origin steelhead was closely monitored. Fisheries were resumed in 2003 (when natural-origin run size allowed) primarily as a means to help control the number of hatchery fish in the spawning population (Table 3-1).

A conservation fishery in the Methow River and Columbia River benefits from the Wells steelhead program. This fishery has mean extraction rate of 8.7% (range 2-22.6%, Table 3-1)) and is capped at 2% of natural origin fish (assumes 5% hooking mortality on released natural-origin fish). See Section 1.8.5 for more information.

Table 3-1. Methow River steelhead harvests, passage years 1997 to 2010.

Passage Year	Harvest Statistics			
	Hatchery-Origin	Natural-Origin	Total Harvest	Harvest Rate[1]
1996	166	2	168	
1997	306	1	307	
1998	75	0	75	
1999	0[2]	0	0	
2000	20	0	20	
2001	12	0	12	
2002	0	0	0	
2003	106	13	119	0.021
2004	199	13	212	0.040
2005	180	11	191	0.048
2006	0	0	0	
2007	463	15	478	0.081
2008	1,507	15	1,522	0.196
2009 [3]	4,565	32	4,597	0.226
12-Year Mean	594	8.25	602	0.087

Notes:
1 Fraction of the estimated total Methow River steelhead run that was harvested.
2 Zeroes represent years where NOR run size was inadequate to allow any fishery.
3 Values estimated for the whole season based on creel data through November, 2009.

3.4 Relationship to Habitat Protection and Recovery Strategies

Although habitat in many of the upper reaches of the Methow Basin is in near pristine condition, habitat complexity, connectivity, water quantity, and riparian function have been compromised due to human activities in parts of the Methow Basin. The Recovery Plan (UCSRB 2007) details specific objectives and actions for habitat protection and restoration necessary for the recovery of UCR salmon and steelhead populations. These habitat actions are occurring at the same time as hatchery programs are supplementing natural production, while preserving important genetic resources. Douglas PUD is actively coordinating with its cooperators to ensure that hatchery actions do not impact the ability to monitor the effectiveness of habitat restoration activities.

Douglas PUD also provides funding for projects for the protection and restoration of HCP Plan Species habitat, including the Methow and Okanogan watersheds and Columbia River watershed [from Chief Joseph Dam tailrace to Wells Dam tailrace]. Douglas PUD provides this funding as a requirement of the Wells HCP in order to compensate for up to 2% unavoidable project mortality. This HCP requirement, combined with the survival standards and hatchery compensation, effectively mitigates for passage losses due to the operation of Wells Dam. The goal of this tributary program is to protect and restore habitat; a goal that is shared with the recently signed 10-Year Memoranda of Agreement (MOAs) between by the Federal Columbia River Power System (FCRPS) Action Agencies and four treaty tribes that provides for habitat improvements in the Columbia Basin (FCRPS/Three Treaty Tribes MOA 2008; FCRPS/CCT MOA 2008). A recovered summer steelhead population will be able to occupy improved and re-connected habitat that will likely follow implementation and completion of these initiatives. The Wells HCP Tributary and Hatchery committees are managing both the habitat and hatchery programs so that they provide VSP benefits that will trend toward recovery of Upper Columbia summer steelhead.

3.5 Ecological Interactions

Potential effects of the Wells Complex summer steelhead program on salmonids and non-salmonids as well as the physical environment, and potential effects of other supplementation programs, natural-origin fish, and other species on this summer steelhead hatchery program, were evaluated in the NMFS Biological Opinion (2003b) and Environmental Assessment (NMFS 2003) for a multi-year authorization for an annual take of UCR spring Chinook salmon and UCR steelhead associated with summer steelhead supplementation program (Permit 1395). Potential effects from the program are regulated by existing policies regarding hatchery operations, maintenance protocols, fish health practices, genetic effects, ecological interactions, and fish cultural practices, as prescribed in the 1994 Integrated Hatchery Operations Team annual report (IHOT 1995).

3.5.1 Populations that Could Negatively Impact the Program

The survival of hatchery steelhead released in the Methow Basin could be affected as a result of predation. Fish, mammals, and birds are the primary natural predators of steelhead in the Upper Columbia Basin. Several fish species may consume steelhead. Both introduced (e.g. walleye, *Sander vitreus vitreus* and smallmouth bass, *Micropterus dolomieu*) and native predators (e.g. northern pikeminnow, *Ptychocheilus oregonensis*) consume large numbers of juvenile salmonids in the Columbia River system (Poe et al. 1991; Rieman et al. 1991; Tabor et al. 1993). Exacerbating this impact of predation are observations that northern pikeminnow are able to rapidly adjust their diet and foraging habits to key in on the opportunity presented by the release and seaward migration of large numbers of hatchery fish (Shively et al. 1996). Furthermore, pikeminnow predation is typically concentrated downstream of mainstem hydropower facilities where juvenile fish are less dispersed than normal, and potentially disoriented and/or stressed following navigation through the hydro facility. Ongoing programs designed to control the size of predator populations and to redesign juvenile bypass facilities to avoid the aggregation of large numbers of predators below mainstem dams are attempting to minimize the impacts of predation and increase the survival of seaward migrating juvenile salmonids. Adult salmonids within the Upper Columbia Basin are opportunistic feeders and are also therefore capable of preying on juvenile steelhead. Those likely to have some effect on the survival of juvenile salmonids include (in order of greatest likely impact) adult bull trout (*Salvelinus confluentus*), rainbow trout (*Oncorhynchus mykiss*), cutthroat trout (*Oncorhynchus clarki*), brook trout (*Salvelinus fontinalis*), and brown trout (*Salmo trutta*).

Predation and delayed mortality for returning adult steelhead as a result of wounding by marine mammals may negatively affect UCR steelhead. In addition, predation by piscivorous birds on juvenile salmonids may also represent a large source of mortality. NMFS (2000) identified gulls (*Larus* spp.), cormorants (*Phalacrocorax* spp.), and Caspian terns (*Sterna caspia*) as the most important avian predators in the Columbia River Basin. In the Columbia River estuary, avian predators consumed an estimated 16.7 million smolts (range, 10-28.3 million smolts), or 18% (range, 11-30%), of the smolts reaching the estuary in 1998 (Collis et al. 2000). Caspian terns consumed primarily salmonids (74% of diet mass), followed by double-crested cormorants (*P. auritus*) (21% of diet mass) and gulls (8% of diet mass). Antolos et al. (2005) noted that predation rates on juvenile steelhead were higher than those on yearling Chinook salmon in two years of study. Furthermore, the degree of predation risk during the transition from freshwater to ocean environments is associated with individual development and migratory behavior (Schreck et al.

2006; Kennedy et al. 2007), with those individuals most ready to physiologically adapt to the ocean the least susceptible to avian predation. By releasing fish that are developmentally competent (as measured by rapid downstream migration and other indicators of smoltification) hatchery programs can minimize losses due to avian predation.

Competition for food and space with other hatchery released fish (e.g., coho and Chinook salmon) and natural-origin fish throughout the Columbia Basin may occur as hatchery steelhead migrate downstream through the Methow River and the Columbia River system.

3.5.2 Populations that Could be Negatively Impacted by the Program

The potential ecological effects of Wells Complex summer steelhead on natural salmonid populations is broken down into three sections: a) effects associated with juvenile releases, b) effects associated with adult returns, and c) effects associated with both juveniles and adults. Effects on non-salmonid species (i.e., Pacific lamprey) are unknown at this time, but will be addressed as part of Objective 10 of the Douglas PUD M&E Plan (HCP HC 2007).

3.5.2.1 Juvenile Releases

Direct competition for food and space between hatchery and natural fish may occur in the Methow Basin and the Columbia River as hatchery steelhead smolts migrate through the Columbia River system. However, these impacts are assumed to diminish as hatchery smolts disperse (BAMP 1998). Although the release of large numbers of hatchery fish in a small area may increase competitive effects, the release of hatchery smolts that are physiologically ready to migrate, as determined by a volitional migratory behavior performance indicator, is expected to minimize competitive interactions as they should quickly migrate out of the spawning and rearing areas (Viola and Schuck 1995). The Twisp and Lower Methow summer steelhead hatchery components combined smolt release target is 147,000 smolts (6 fish per pound [fpp]). Target release sizes of “about six fish per pound” for hatchery-origin steelhead smolts are specified in the in the Wells HCP.

To reduce the effect of hatchery programs on natural-origin salmonids, the HSRG has developed hatchery management guidelines for minimum conditions that must be met for each type of hatchery program as a function of the biological significance of the natural populations they affect (HSRG 2009). This HGMP reflects the HSRG recommendations. Inter- and intra-specific competition between juvenile hatchery and natural-origin salmonids has the potential to negatively impact natural populations through density-dependent or density-independent mechanisms. Whether the release of steelhead smolts from this program negatively impacts natural-origin salmonids is not completely understood, but it is thought to be minimal as fully-smolted hatchery fish emigrate rapidly. Flagg et al. (2000) recommend hatchery practices to minimize competition between natural-origin and hatchery reared salmonids. Generally these strategies involve reducing the habitat and diet overlap between hatchery- and natural-origin fish. Releasing hatchery salmonids as true smolts that rapidly migrate downstream to the estuary and marine environment is one way to minimize or eliminate competition with natural-origin fish rearing in streams, rivers, and lakes.

For segregated programs, where keeping hatchery and natural populations separate is vital, ensuring that fish are properly imprinted and can return to their natal hatchery or collection point allows fish managers to minimize the opportunity for them to introgress or compete with natural-origin salmonids. Interactions can be further reduced by locating hatcheries or segregated program acclimation sites away from natural spawning areas. Managers can also consider increasing the spatial and temporal separation between hatchery- and natural-origin fish by releasing hatchery fish so that they remain spatially and temporally separated from natural-origin salmon in estuarine and oceanic habitat. Possible approaches include producing large fish that do not utilize the same microhabitat as smaller natural-origin salmonids, releasing hatchery fish after natural-origin salmonids have moved out of estuarine habitats, and releasing hatchery fish in habitat downstream of that used by rearing natural-origin salmonids.

3.5.2.2 Adult Returns

Little is known about interactions between summer steelhead released into the Columbia River system from this hatchery program and other salmonids between the time they leave the estuary and return as adults to spawn. Available information is obtained through PIT-tag and ocean harvest data. Based on these data, steelhead harvest is assumed to be zero; few steelhead are caught in ocean fisheries (NMFS 2008b). These data, however, do not provide insight into fish behavior, nor inter- or intra-specific interactions among stocks in the ocean. However, given the assumed zero harvest of Methow steelhead in ocean fisheries, the Methow steelhead hatchery program is not a factor in determining ocean harvest regulations and quotas that could affect listed species.

Returning adult hatchery steelhead that stray to natural spawning areas may compete for mates, spawning locations, and/or breed with native fish, potentially reducing fitness of natural-origin fish. Guidance on acceptable stray rates of hatchery fish is less than or equal to 10% of total brood return. Antenna arrays designed to detect PIT-tags in returning adult salmonids were installed in the Methow and Twisp Rivers in 2008. These arrays will assist in determining the ultimate fate of stray fish passing Wells Dam. Annual monitoring and evaluation, as required in the HCP, will be used to direct future hatchery program operations to avoid exceeding the acceptable levels of strays from this hatchery program.

3.5.2.3 Both Juveniles and Adults

Wells and Methow FH surface water intakes are screened to current criteria. Negative effects to other species that may result from the Wells Complex steelhead program could occur from impacts to water quality. Water quality will be affected by effluent from the hatchery, but the hatchery facility is required to operate under National Pollutant Discharge Elimination System (NPDES) permits issued by Washington State Department of Ecology. Hatchery effluent standards and state criteria for point-source discharge are set forth in the permit to protect aquatic life, and the habitat in the area below the discharge points. Considering that the effluent produced from the hatchery facility complies with U.S. Environmental Protection Agency (EPA) standards, coupled with the low percentage of effluent to discharge (dilution factor), there is probably minimal impacts to other species.

3.5.3 Populations that have a Positive Impact on the Program

Chinook, steelhead, and coho carcasses of both hatchery- and natural-origin deposited within the Methow Basin are likely to have a positive influence on nutrient levels within the basin. Increased nutrient levels are likely to provide a more productive environment within which the natural- and hatchery-origin steelhead can rear and migrate. Marine-derived nutrients brought to the Methow Basin by adult steelhead should benefit all species (Stockner 2003).

3.5.4 Populations Positively Impacted by the Program

The goals of the Wells summer steelhead hatchery program include supporting the recovery of ESA-listed species by increasing the abundance of the natural adult population, while ensuring appropriate spatial distribution, genetic stock integrity, and adult spawner productivity. As abundance and spatial diversity objectives are achieved, the Methow Basin native fish assemblage is expected to benefit from nutrients derived from carcasses of returning adult steelhead at dispersed locations in the basin. The dispersed carcasses and the nutrients derived from these carcasses will likely have a positive effect on bull trout, resident rainbow trout, and westslope cutthroat trout populations scattered throughout the Methow Basin (Stockner 2003) because these salmonids will consume steelhead eggs, fry, parr, and flesh from carcasses, as well as benefiting indirectly from increased nutrients.

4.0 WATER SOURCE

4.1 Provide a Quantitative and Narrative Description of the Water Source (Spring, Well, Surface), Water Quality Profile, and Natural Limitations to Production Attributable to the Water Source

Wells Hatchery uses surface water from the Columbia River and ground water from areas surrounding the hatchery. Douglas PUD has six groundwater rights with a combined 17,060 gallons per minute (gpm) for use by Wells Hatchery. Wells Hatchery groundwater temperatures peak at 14°C by September and October, then cool to 8.0 to 9.0°C by spring. Elevated water temperatures in the fall and winter exacerbate already early spawn timing of hatchery-origin fish; thus, water chilling is necessary to synchronize incubation and early rearing with the natural environment. Surface water is provided via a 150-cubic-feet-per-second (cfs)-capacity water line from the forebay of Wells Dam. Surface-water temperatures peak at 19.4°C in August and September, and cool to 2.2°C by February. Surface water is used in various stages of rearing, once fungal load and temperatures decline in late fall / early winter. Surface water used by the hatchery is included under the surface-water right for power generation by Wells Dam.

Methow Hatchery has both groundwater and surface water supplies. The facility was built with four wells capable of producing the full groundwater right of 10 cubic feet per second (cfs) (4,500 gallons per minute [gpm]). Groundwater temperatures are steady at 8.9°C year round. Maintenance on the four wells in 1995 and 1996 revealed that the total output of the wells had declined to 8.8 cfs (4,000 gpm). Thus, a fifth well was added in 1999, and a sixth well in 2007, restoring groundwater production capacity to 4,500 gpm. Methow Hatchery also has senior uninterruptible rights to 7 cfs (3,142 gpm) of surface water and 18 cfs of junior interruptible water rights, both diverted from

Foghorn Irrigation Ditch. This water is used primarily for final rearing, but can be used for any rearing stage after incubation. The 7 cfs surface-water right is held by USFWS, but granted to Douglas PUD by USFWS under the terms of a Memorandum of Understanding in exchange for improvements to the intake structure of the Foghorn Ditch plus improvements to the ladder at Foghorn Dam.

Steelhead will be acclimated using the Twisp Pond, Methow Hatchery Pond 13, and in ponds at the Wells Hatchery. Methow Hatchery also has two acclimation ponds associated with it: one each on the Twisp and Chewuch rivers. The Chewuch Pond may be considered for acclimation in the future, but acclimation of steelhead is not currently planned. Both ponds are used for final rearing and acclimation of smolts in these drainages. The water right for each pond is 6 cfs during the period of February 1 through May 31. Water for the Twisp Pond is diverted from the Twisp Valley Power and Irrigation Company ditch, and water for the Chewuch Pond is diverted from the Chewuch Canal Company irrigation ditch. The easements from both canal companies are for delivery of water from February 1 through May 1 (Chewuch) and May 31 (Twisp). Neither site is suitable for late-summer rearing because (1) low flow conditions persist in both the Twisp and Chewuch rivers in late summer, and (2) existing water demands on the irrigation ditches would compete with acclimation use.

4.2 Indicate Risk Aversion Measures that will be Applied to Minimize the Likelihood for the Take of Listed Natural Fish as a Result of Hatchery Water Withdrawal, Screening, or Effluent Discharge.

Water withdrawal for use in hatcheries is monitored through the Washington State Department of Ecology and the Washington State chapter 90.03 Revised Code of Washington (RCW) water code. None of the hatchery facilities employed to carry out the proposed artificial propagation programs de-water river reaches used by listed fish for migration, spawning, or rearing. The screen on the surface-water intake for Wells Hatchery was replaced in early 2008. The new screen complies with the 1995 NMFS screening criteria and as per the 1996 addendum to those criteria (NMFS 1996).

All WDFW hatcheries monitor their discharge in accordance with the NPDES permit. This permit is administered in Washington by the Washington State Department of Ecology under agreement with the EPA. The permit was renewed effective August 1, 2010 and will expire August 1, 2015. Hatchery wastewater discharge is monitored monthly at each of the steelhead production facilities in the Upper Columbia Basin. The WDFW-operated facilities include Methow Hatchery and Wells Hatchery (as well as Eastbank Hatchery, Chiwawa Ponds, Chelan Hatchery and Turtle Rock Hatchery). No violations of the NPDES permit limits occurred during the reporting period June 1, 2009, through May 31, 2010. Facilities are exempted from sampling during any month that pounds of fish on hand fall below 20,000 pounds, and pounds of feed used fall below 5,000 pounds, with the exception of offline settling basin discharges, which are to be monitored once per month when ponds are in use and discharging to receiving waters.

Sampling at permitted facilities includes the following parameters:

FLOW	Measured in millions of gallons per day (MGD) discharge.
SS EFF	Average net settleable solids in the hatchery effluent, measured in milliliters per liter (ml/L).
TSS COMP	Average net total suspended solids, composite sample (6 x/day) of the hatchery effluent, measured in milligrams per liter (mg/L).
TSS MAX	Maximum daily net total suspended solids, composite sample (6 x/day) of the hatchery effluent, measured in mg/L.
SS PA	Maximum settleable solids discharge from the pollution abatement pond, measured in ml/L.
SS %	Removal of settleable solids within the pollution abatement pond from inlet to outlet, measured as a percent. No longer required under permit effective June 1, 2000.
TSS PA	Maximum total suspended solids effluent grab from the pollution abatement pond discharge, measured in mg/L.
TSS %	Removal of suspended solids within the pollution abatement pond from inlet to outlet, measured as a percent. No longer required under permit effective June 1, 2000.
SS DD	Settleable solids discharged during drawdown for fish release. One sample per pond drawdown, measured in ml/L.
TRC	Total residual chlorine discharge after rearing vessel disinfection and after neutralization with sodium thiosulfate. One sample per disinfection, measured in micrograms per liter (µg/L).

5.0 FACILITIES

5.1 Broodstock collection facilities (or methods)

Broodstock collection facilities consist of the Wells Dam east and west fish ladder traps, the Wells Hatchery volunteer channel, the Methow Hatchery volunteer channel, and the Twisp Weir. Hook-and-line capture will be used in the Methow Basin to collect natural- and hatchery-origin broodstock. Additional broodstock collection actions may be proposed for the Methow to optimize broodstock collection for the Lower Methow Component. The WDFW develops annual broodstock collection and spawning protocols which are approved by the HCP Hatchery Committees and submitted to NMFS to allow for consideration of annual variation in run sizes, ages, and origins (natural and hatchery). See Section 1.5 for hatchery facility locations and Section 1.8.2.1 for more details on broodstock collection. Appendix E provides the 2009 broodstock collection protocols for UCR hatchery programs.

5.2 Fish Transportation Equipment (Description of Pen, Tank Truck, or Container Used)

Fish transportation follows the Integrated Hatchery Operations Team (IHOT) guidelines.

Table 5-1. Fish transportation equipment.

Equipment Type	Capacity (gallons)	Supp. Oxygen (Y/N)	Temp. Control (Y/N)	Normal Transit Time (minutes)	Chemicals Used	Dosage (ppm)
Trailer Tank (adult hauling)	150	Y	N	10	None	None
Tanker Truck	1,300	Y	N	60	None	None
Flatbed with Tank	600	Y	N	60	None	None
Flatbed with Tank	750	Y	N	60	None	None
Flatbed with Tank	350	Y	N	60	None	None

5.3 Broodstock Holding and Spawning Facilities

Steelhead broodstock are held and spawned in an adult holding pool at the Wells Hatchery and Methow Hatchery (Table 5-2).

Table 5-2. Broodstock holding and spawning facilities.

Ponds (No.)	Pond Type	Volume (cu. ft)	Length (ft)	Width (ft)	Depth (ft)	Available Flow (gpm)
1	Wells Concrete Adult Holding Pond	4,680	78	10	6	2,500
1	Methow Covered Adult Holding Pond	3,560	80	8	4	300

5.4 Incubation Facilities

Table 5-3. Incubation facilities.

Incubator Type	Units (number)	Flow (gpm)	Volume (cu. ft)	Loading-Eyeing (eggs/unit)	Loading-Hatching (eggs/unit)
Heath Vertical – 52 Half Stack Units at 7 trays per ½ Stack	52	3 - 4		1 female	6,500

5.5 Rearing Facilities.

Table 5-4. Rearing facilities.

Ponds (No.)	Pond Type	Volume (cu. ft)	Length (ft)	Width (ft)	Depth (ft)	Flow (gpm)	Max. Flow Index	Max. Density Index
8	Concrete Raceways	2,474	93.5	9.8	2.7	500		
1	Earthen-Sand Pond (DP-3)	208,000	520	100	4.0	2,500		
1	Earthen-Sand Pond (DP-4)	204,160	464	110	4.0	2,500		

5.6 Acclimation/Release Facilities.

Steelhead smolts will be acclimated in an acclimation pond in the Twisp watershed, at the Methow Hatchery (Pond 13), and an earthen pond at the Wells Hatchery. Also, see Section 4.1, Table 5-4 in Section 5.5. Additional acclimation facilities may be used by agreement of the HCP HC. Okanogan integrated fish will be acclimated under strategies developed by CCT and Grant PUD in the Okanogan Basin. Okanogan safety-net fish will be acclimated at an earthen pond at the Wells Hatchery, or as directed by CCT and Grant PUD. See the Okanogan Basin Summer Steelhead Conservation Program HGMP for further information.

5.7 Describe Operational Difficulties or Disasters that Led to Significant Fish Mortality

None known or reported.

5.8 Indicate Available Back-Up Systems, and Risk Aversion Measures that Will be Applied, that Minimize the Likelihood for the Take of Listed Natural Fish that May Result from Equipment Failure, Water Loss, Flooding, Disease Transmission, or other Events that Could Lead to Injury or Mortality

Potential adverse impacts identified with the physical operation of hatchery facilities include impacts from water withdrawal, release of hatchery effluent and facilities failure (NMFS 1999). Hatchery effluent may transport pathogens (disease) out of the hatchery and infect natural-origin fish. Aside from the potential impacts on water flow and quality, operational failures due to power/water loss, flooding, freezing, vandalism, predation, and disease may result in catastrophic losses to rearing adults and juveniles.

Flow reductions, flooding, and poor fish-culture practices may all cause hatchery facility failure or the catastrophic loss of listed fish under propagation. To protect endangered steelhead, all efforts should be made to ensure the survival of adult steelhead held for broodstock at the hatchery facility. A variety of measures to address risks associated with operational failures will be used, including:

- Protection of fish from vandalism and predation is provided by fencing, locks, and security lights at all hatchery facilities.
- Rapid response in the event of power and water loss or freezing is provided by a combination of staffing and automated alarm paging systems.
- Equipping hatchery facilities to ensure reliable power to provide water to rearing fish during power outages. Wells FH was recently equipped with diesel backup generation to the dual power supplies (local dam feed to most facilities, plus Chelan PUD feed to the lower rearing ponds) to ensure reliable power to provide water to rearing fish even during a dual power outage.

6.0 BROODSTOCK ORIGIN AND IDENTITY

6.1 Source

From 1964 to 1983, steelhead broodstock were obtained at PRD and their progeny were propagated at Chelan Hatchery (BAMP 1998). These broodstock were a mixture of natural-origin steelhead from any of the upper river habitats upstream of PRD, plus some returns of fish that had been cultured at the Chelan Hatchery.

From 1984 through 1995, broodstock for the steelhead production throughout the entire Mid-Columbia Region was derived from Wells Dam and Wells FH (BAMP 1998). These broodstock were collected at Wells Dam and again included a mixture of natural-origin fish produced within the Methow and Okanogan basins, plus returns from smolts produced at, and released from Wells FH.
WDFW initiated changes in mitigation hatchery steelhead production in 1996, which re-directed artificial production programs toward development of locally-adapted broodstocks and improvement in the perceived fitness of the Wells FH population (BAMP 1998). Broodstock collections at Wells Dam were adjusted to maximize the proportion of natural-origin steelhead, but the source of these natural-origin fish again could have been from either the Methow or Okanogan basins.

See Section 1.8.2 for a description of the broodstock for this HGMP.

6.2 Supporting information

6.2.1 History

For history, see Sections 6.1 and 6.2.3.

Methow summer steelhead are considered a Primary Population within the Threatened UCR Summer Steelhead DPS. The population is at high risk of extinction, and fails to meet most VSP criteria (ICTRT 2007).

6.2.2 Annual size

See Section 1.8.2.

6.2.3 Past and proposed level of natural fish in broodstock

Steelhead collected and propagated at Wells FH originated from a mix of indigenous upper Columbia Basin stocks intercepted through the Grand Coulee Fish Maintenance Project (GCFMP). The current stock was developed in the early 1960s from naturally spawning populations intercepted at fish passage facilities upstream of PRD (MCMCP 1997). Historically, the program obtained mixed-origin (hatchery and wild) fish, selected randomly from the run at large, spaced throughout the entire run time period, with retention of broodstock by proportional return time. These broodstock collection strategies provided a highly variable natural-origin proportion within the broodstock, limiting meaningful proportions of natural gene flow into the hatchery component.

Beginning with BY 2004, the Wells steelhead program began targeting 33% natural-origin broodstock for Methow smolt production. The increase in proportion of natural-origin fish in the broodstock provided a 100% HxW parental crosses for brood years 2004 and 2006, substantially increasing the natural-origin gene flow in the Methow hatchery component.

The overall hatchery program will be consistent with the smolt production necessary to fulfill the hatchery compensation requirements for NNI and Fixed Hatchery Compensation described in the Wells HCP and as modified by the HCP Hatchery Committee. Between 76 and 100% of brood year 2004 through 2007 smolts planted from Wells Hatchery into the Methow River were the progeny of HxW crosses of broodstock trapped at Wells (Table 6-1).

Table 6-1. Percentage of the Wells Steelhead Brood Collection and Methow Basin smolt plants composed of HxW crosses, BYs 1997 to 2007.

Brood Year	Number of NOB in Broodstock	Percentage of Brood Stock as HxW	Percentage of Methow Plants as HxW
1997	21	46.3	41.2
1998	12	28.3	39.9
1999	29	68.3	100.0
2000	41	58.8	100.0
2001	26	67.6	100.0
2002	18	18.1	24.0
2003	27	25.0	30.1
2004	118	100.0	100.0
2005	69	87.0	100.0
2006	91	100.0	100.0
2007	44	50.9	76.5
2008	90	100.0	NA

See Section 1.8.2 for description of the proposed level of natural fish to be incorporated into the broodstock.

6.2.4 Genetic or ecological differences

A recent genetic analysis was conducted on summer steelhead samples collected between 1995 and 2007 from Wells FH broodstock and throughout the tributary basins above Wells Dam (Blankenship et al. 2009). Although "substantial genetic diversity was observed," the results from the natural-origin adult collections showed no "statistically different allele frequencies when compared to each other, and showed no evidence of population structure." "These results suggest all natural adult collections were drawn from a single underlying population, and can be combined for subsequent genetic analysis." On the other hand, "there was slight genetic differentiation observed between some natural adult and HxH collections, but the differences were quite small." These findings suggest the many years of stock compositing for broodstock has resulted in a very high degree of homogenization, but also suggest that there may still be the potential for differentiation of natural- and hatchery-origin stocks, given time.

Although upper Columbia River hatchery steelhead are genetically similar to wild fish, there is potential risk in allowing a disproportionately high level of hatchery fish to spawn. WDFW addresses this concern in the *Wild Salmonid Policy* (WDFW 1997), which states that even with a high level of genetic similarity between hatchery and wild fish, the hatchery component should not comprise more than 10% of the naturally spawning population, except in the case of supplementation programs intended to sustain the stock for reasons other than harvest (e.g., habitat degradation, hydropower dams, unforeseen catastrophic loss). Under present circumstances, the proportion of hatchery fish is typically close to 90% in the Methow Basin. Conversely, if hatchery steelhead are "essential for recovery," the degree of use of hatchery fish must be reassessed to accommodate hatchery strategies. This includes selecting fish to reflect the most appropriate return and spawn timing, the use of acclimation ponds to imprint juvenile steelhead to return as adults to specific sites or reaches, and the removal of excess hatchery fish by a combination of methods including conservation harvest, and removal at trapping facilities. The 10% level identified in the *Wild Salmonid Policy* may be useful as a guideline, but cannot be given strict adherence when wild fish cannot currently replace themselves.

Typically, Wells hatchery-origin steelhead held at Wells FH spawn earlier than natural-origin steelhead. Early maturation of hatchery fish in the hatchery may indicate a propensity for these fish to spawn early in the natural environment as well, and may have a negative effect on hatchery spawner success and fitness of wild fish should they introgress. In an effort to minimize impacts from early maturation, the Wells Hatchery program has selected later spawning fish. However, this practice will be halted once hatchery spawn timing is similar to natural-origin.

6.2.5 Reasons for choosing

The goal of the program is the restoration of naturally reproducing populations of Methow River summer steelhead in their native habitats using locally adapted broodstock, while maintaining genetic and ecologic integrity, and supporting harvest where and when consistent with restoration objectives. Although these populations exhibit low genetic differentiation, the program is designed to allow divergence and local adaptation. Natural-origin broodstock will be collected from the Twisp River and Methow Basin. The Safety-Net Mainstem Columbia Component will use a mix of Methow and Wells stock HxH broodstock collected in the Methow Basin, and at Wells Hatchery and Wells Dam.

6.3 Indicate Risk Aversion Measures that Will be Applied to Minimize the Likelihood for Adverse Genetic or Ecological Effects to Listed Natural Fish that May Occur as a Result of Broodstock Selection Practices

Measures to reduce genetic or ecological risk to listed natural-origin and propagated steelhead as a result of broodstock selection:

- The risk of loss of genetic diversity among populations through out-breeding depression will be minimized by collection of broodstock from local populations (Twisp and Lower Methow components). The Mainstem Columbia Safety-Net component will be composed of HxH parents that include Methow-origin broodstock to minimize domestication and divergence for the natural population(s).
- The most discrete population units possible will be targeted for supplementation after balancing logistical limitations of terminal area collection and release of progeny,

maintenance of genetic integrity and local adaptation, and management of discrete populations.
- Founding broodstocks will be established through collection of a representative sample of the total population to lessen the risk of a genetic bottleneck.

7.0 BROODSTOCK COLLECTION

7.1 Life-History Stage to be Collected (Adults, Eggs, or Juveniles)

Only adults will be collected.

7.2 Collection or Sampling Design

Adult steelhead will be collected for broodstock at the Twisp River Weir, Methow FH, Winthrop NFH, Wells FH, Wells Dam, and by hook-and-line in the Methow Basin (see Section 1.8.2.1, Section 2.2.3.1, and Section 6.3). Okanogan Basin fish for the Grant PUD program will be collected at Wells Dam, Wells FH, Omak Creek or by hook-and-line in the Okanogan Basin.

7.2.1 Bio-Sampling

All (natural- and hatchery-origin) steelhead broodstock will be DNA tissue-sampled. In addition to DNA sampling, all carcasses (including pre-spawn mortalities) will be bio-sampled for sex, fork length, POH length, and disposition (spawned or morts). Pituitaries will be collected from spawned fish and stored for possible future use. Further, otoliths and scales (5 from each side in "key" area) will be collected from all natural-origin (adipose present) broodstock. The otoliths will allow more precise estimations of life history than scales alone, and are superior to scales for determining saltwater ages of mature broodstock. These data will be used to assess broodstock composition and inform future broodstock collection protocols.

7.3 Identity

Although there apparently is only one homogeneous population of natural-origin steelhead in the Methow Basin (Blankenship et al. 2009), natural-origin broodstock collected in the Twisp or Methow Rivers will be identified by the presence of an adipose fin plus no other marks or tags, and will be held and spawned as two discrete groups based on capture location in the spring. Pre-smolt progeny of all hatchery groups (WxW, HxW, HxH) will be uniquely marked (adipose fin clip plus CWT or other mark or fin clip) to distinguish them from natural-origin adults (see Section 1.8.4 for a discussion of marking).

7.4 Proposed Number to be Collected

7.4.1 Program Goal (Assuming 1:1 Sex Ratio for Adults)

See Section 1.8.2.1. Adult broodstock collection protocols are developed annually and approved by NMFS and the HCP Hatchery Committees prior to implementation, and are considered an interim and dynamic hatchery broodstock collection plan, which may be altered following joint fishery party (JFP) discussions. As such, there may be significant in-season changes in broodstock numbers, locations, or collection times, brought about through continuing co-manager consultation and in-season monitoring of the anadromous fish runs to the Columbia River above PRD.

7.4.2 Broodstock Collection Levels for the Last Twelve Years (e.g. 1988-99), or for Most Recent Years Available

As shown in Table 7-1, meeting combined escapement goals for areas above Wells Dam has been achieved in 13 of 14 years. In earlier years no effort was made to determine the sex of fish retained for broodstock which led to sex ratio problems. This has been resolved through greater attention to sex determination when fish are retained.

Table 7-1. Steelhead passage and broodstock collection statistics at Wells Dam, 1995-2008*.

Passage Year	Number Collected		Number Spawned		Totals[2]		Number Passed Upstream		Total Passed	Run Fractions		Run Size to Wells
	NOR[1]	HOR	NOB	HOB	Collected	Spawned	NOR	HOR		Brood	Passed	
1995	0	521	0	379	521	379	116	308	424	0.401	0.599	945
1996	21	313	21	336	334	357	214	3,579	3,793	0.087	0.913	4,127
1997	12	437	12	437	449	449	95	3,563	3,658	0.109	0.891	4,107
1998	32	384	29	383	416	412	173	2,079	2,252	0.154	0.846	2,668
1999	44	348	41	334	392	375	358	2,807	3,165	0.105	0.895	3,557
2000	33	365	26	323	398	349	488	5,394	5,882	0.056	0.944	6,280
2001	19	384	18	374	403	392	850	17,230	18,080	0.021	0.979	18,483
2002	55	246	27	274	301	301	738	8,436	9,174	0.032	0.968	9,475
2003	117	253	118	319	370	437	900	8,693	9,593	0.044	0.956	9,963
2004	104	280	69	316	384	385	668	8,265	8,933	0.041	0.959	9,317
2005	124	276	91	310	400	401	546	6,257	6,803	0.056	0.944	7,203
2006	48	320	44	344	368	388	532	5,774	6,306	0.058	0.942	6,674
2007	90	270	90	270	360	360	965	6,895	7,860	0.046	0.954	7,860
2008[3]	37	314	37	314	351	351	1,137	8,670	9,807	0.036	0.964	9,808

Notes:
*Totals in Table 7-1 are for the entire Wells steelhead program, not broken out to only a Methow portion.
1: 33% of a 366-fish broodstock goal is 122 fish.
2: Extra fish may be retained to accommodate pre-spawn mortality
3: Preliminary, pending scale analysis.

7.5 Disposition of Hatchery-Origin Fish Collected in Surplus of Broodstock Needs

Natural-origin broodstock that are not used for spawning (immature or in excess of egg take needs) will be returned to the Twisp River, upstream of the Twisp Weir (Twisp component). Natural-origin broodstock are not intended to be used in other components, but would be returned to their river of capture if the situation occurs. Hatchery fish that are excess to brood collection goals and that are not needed to meet minimum escapement objectives will be surplused (see Sections 1.8.2.6 and 1.8.5).

7.6 Fish Transportation and Holding Methods

See Table 5.1 for fish transportation specifications.

See Table 5-2 for adult holding specifications.

7.7 Describe Fish Health Maintenance and Sanitation Procedures Applied

Adult steelhead are held at Wells FH on well water in the covered raceway pond until spawning. Formalin treatments to control fungus begin in November and continue daily for one hour at a concentration of 1:7,500 through April. Fish are initially held in well water with an average temperature of 11.1°C. Columbia River water is blended with well water beginning around December 1 to achieve approximately 48°F during fish maturation, and this continues through mid-April. Formalin treatments are administered every day during the adult summer steelhead holding period.

Adult Steelhead are held at Methow FH on well water in the covered raceway pond until spawning. Formalin treatments to control fungus begin upon arrival and continue daily for one hour at a concentration of 1:7,500 through April. Methow River water is blended with well water to achieve approximately 45oF during fish maturation, and this continues through mid-April. Integrated Hatchery Operations Team (IHOT), Pacific Northwest Fish Health Protection Committee (PNFHPC), WDFW's Fish Health Manual (1996), or Co-manager guidelines are followed. The adult holding area is generally separated from all other hatchery operations. All equipment and personnel use disinfection including chlorine or iodophor procedures upon entering or exiting the area. Formalin treatments are administered every day during the adult summer steelhead holding period.

At both facilities, Integrated Hatchery Operations Team (IHOT), Pacific Northwest Fish Health Protection Committee (PNFHPC), WDFW's Fish Health Manual (1996), or Co-manager guidelines are followed. The adult holding area is generally separated from all other hatchery operations; however, at times the adults receive 100% re-use water from upper juvenile rearing areas. All equipment and personnel use disinfection including chlorine or iodophor procedures upon entering or exiting the area.

Kidney and spleen samples are collected from all lethally spawned steelhead to detect for Infectious Hematopoietic Necrosis (IHNV) and pancreatic (IPNV) viruses. Ovarian fluid is also collected from all females in 5-fish pools for additional viral monitoring. Viral diagnostic samples are taken from each sex. One-to-one crosses yield the greatest safety factor in case of a positive viral detection. Egg pooling (thus pooled viral sample) presents a higher fish health demographic risk in the event of a positive sample. Some occurrence of IPNV and IHNV in Upper Columbia steelhead at Wells FH can be expected, and un-pooled viral samples with individual family incubation may reduce the chances of cross-contamination from virus-positive gametes. The spawning plan represents a reasonable compromise between potential genetic or demographic recovery benefits and fish health uncertainty.

7.8 Disposition of Carcasses

Steelhead carcasses will be used for stream nutrient enhancement, buried on-station or at an appropriate landfill after completion of spawning.

7.9 Indicate Risk Aversion Measures that Will be Applied to Minimize the Likelihood for Adverse Genetic or Ecological Effects to Listed Natural Fish Resulting from the Broodstock Collection Program

Measures to reduce genetic or ecological risk to listed natural-origin and propagated steelhead as a result of broodstock collection:

- Broodstock collection will not exceed 33% of natural-origin returns for each managed population. Actual extraction rates are set at 20% for the Lower Methow Component, and are expected to average 15%.
- Collection of adult broodstock at traps for supplementation programs shall be random, and representative of the run-at-large with respect to natural and hatchery parentage, migration timing, age structure, morphology, and sex ratio.
- An effective population size (Ne) of at least 50 adults per generation is required to reduce the risk of inbreeding depression and genetic drift in the short term (fewer than five salmon generations) (BAMP 1998), an Ne of 500 fish per population per generation should be the long term program production objective to maintain an adequate genetic base. Currently, demographic concerns outweigh the risks of small effective population size in the Twisp and Lower Methow components; however, Methow natural-origin spawning escapement has averaged 576 over the last twelve years. When combined with the more plentiful hatchery-origin spawners, this suggests that effective population size is not an immediate concern.

To minimize direct impacts broodstock collection protocols will include limits on the number of days and hours of trap operation. Specific handling procedures and reporting requirements will also be defined. In general, broodstock collection activities will occur with the following sideboards:

- Broodstock will be collected throughout the duration of the run.
- Traps will be checked and all fish removed at least daily.
- Trapping at Wells Dam, Wells Hatchery, Methow Hatchery, and Twisp Weir may occur up to a maximum of seven days per week, including both east and west ladder traps of Wells Dam operating concurrently.
- Fish will be anesthetized prior to handling.
- Water-to-water transfers will be utilized whenever possible.
- Trapping will cease at water temperatures exceeding 21°C.
- Steelhead captured during broodstock collection and not required for broodstock or not removed for adult management purposes will be fully recovered and released upstream from the capture site within 24 hours.
- Tributary trapping strategies will be developed/implemented to provide for basin-specific broodstock sources upon positive feasibility and risk assessments.

8.0 MATING

8.1 Selection method

Selection of hatchery- and natural-origin adults will follow annual broodstock collection protocols for Wells Hatchery and Dam, Methow Hatchery, Twisp Weir, and hook-and-line capture. Broodstock of either origin will be removed uniformly across the natural run-timing, as noted earlier. Matings will be randomly made from the pools of hatchery- and natural-origin adults as they mature. The priority for the integrated Twisp recovery program component will be WxW crosses using natural-origin steelhead trapped at the Twisp River weir. Matings for the Lower Methow safety-net component will be HxH crosses. The Mainstem Columbia River Safety-Net Component will be HxH crosses. Natural-origin broodstock may be live-spawned so that they may be reconditioned and released.

8.2 Males

Mating is performed at a 1:1 ratio or in a factorial design, with additional males used as back-up to ensure the highest likelihood of fertilization. One backup hatchery male is used in crosses where a natural-origin female is crossed with a hatchery male. Jack or precocious steelhead (less than 20-inch total length [TL]) are generally not seen in the population. In past years females occasionally outnumbered males by as much as 2:1 at the Wells Hatchery. When males are limiting, natural-origin males may be used twice as primary and twice as backup (physically crossed twice, with sperm split for primary and backup each time), versus a single use of hatchery males. Use of males is tracked with opercle punches and/or Floy tags.

8.3 Fertilization

Factorial matings may be done by dividing male and/or female gametes among crosses. Because of the small program size of the integrated recovery Twisp component, factorial matings will be used to minimize genetic effects of low effective population size. Factorial or 1:1 matings will be used in the Lower Methow HxH component. For the Mainstem Columbia Safety-Net Components, broodstock numbers are sufficiently large to accommodate a 1:1 non-factorial mating scheme (Table 8.1).

Table 8.1. Program Components and Mating Schemes

Component	Type	Population	Mating Scheme	Preferred Broodstock Ancestry	Cross: 1st choice	Cross: 2nd choice
Twisp Integrated	integrated	Twisp	factorial	natural-origin	WxW	HxW
Lower Methow	safety-net	Methow	1:1, factorial as needed	natural- and hatchery-origin	HxH	
Mainstem Columbia	safety-net	Wells stock	1:1	hatchery-origin	HxH	

Ovarian fluid from 60 females is sampled during spawning for regulated and reportable viral pathogens. Kidney and spleen samples from all males and female spawners are examined for regulated viral pathogens, and other pathogens as necessary. The eggs from an individual female are fertilized with milt from the primary male, milt and eggs mixed, then later milt from the backup male is added to the mix. Eggs are water hardened in iodophor in pathogen-free well water, according to standard fish health protocol. Individual egg lots are incubated in isolation until pathogen testing has confirmed them free of pathogens. Any egg lots with regulated viral pathogens are destroyed in accordance with fish health protocols.

8.4 Cryopreserved gametes.

Cryopreserved gametes are not used.

8.5 Indicate Risk Aversion Measures that Will be Applied to Minimize the Likelihood for Adverse Genetic or Ecological Effects to Listed Natural Fish Resulting from the Mating Scheme

Broodstock are trapped over the course of the migration, and spawning occurs as the fish mature naturally. A factorial mating scheme is used for the Twisp integrated recovery program to maximize effective population size given the low number of breeders. The mating scheme of WxW crosses for the Twisp component will be used in conjunction with pHOS control to increase PNI. The Lower Methow component is designed to allow effective adult management for pHOS control to pursue improved PNI, and will serve as a safety-net when spawning escapement is low. HxH parental crosses will be used for the safety-net components in the Columbia and Okanogan Rivers. Releasing the Columbia Mainstem component from Wells Hatchery affords an effective means of segregating this component from the programs directed at recovery in the Methow and Okanogan basins.

Synthetic sGnRHa hormone, or other options such as salmonid pituitary, may be used for accelerating maturation to increase the opportunity to perform specified mating schemes and meet program goals. Acceleration of gamete maturation occurs only when natural-origin males are needed to maintain HxW pairings, or to accelerate natural-origin females to ensure attainment of size of the subsequent progeny to meet program goals. Synthetic sGnRHa hormone implants are used in accordance with guidelines established by the manufacturer and the Investigational New Animal Drug (INAD) governing its application and dosage.

9.0 INCUBATION AND REARING

9.1 Incubation

9.1.1 Number of eggs taken and survival rates to eye-up and/or ponding

Totals below (Table 9-1) include the entire Wells steelhead egg take and are not broken out to the Methow steelhead program only. From the total egg take, Wells FH retained approximately 515,000 eyed-eggs for its programs and transferred another 365,000 eyed-eggs to other programs. The permit level broodstock goal is based on a mean fecundity of 5,400. In some years, mean fecundity has averaged 6,232 with 2-salt female fecundity at 6,858, and 1-salt female fecundity at 4,837 (Table 9-2). Also see the annual reports required as part of the Permit No. 1395 conditions, and HGMP Section 9.2.1.

Table 9-1. Wells Hatchery steelhead egg take and survival data, 1995-2007 (WDFW Wells Hatchery unpublished data).

Spawn Year	Egg Take	Green-Eyed Survival (%)	Eyed-Ponding Survival (%)
1995	1,806,500	84.3	~99.0
1996	1,526,600	82.3	~99.0
1997	1,090,000	89.9	~99.0
1998	1,357,400	85.8	~99.0
1999	1,248,000	75.7	~99.0
2000	1,099,700	84.6	~99.0
2001	916,900	86.2	~99.0
2002	1,039,050	85.3	N/A
2003	1,018,000	82.1	96.9
2004	984,500	86.1	81.2
2005	1,094,500	87.1	97.2
2006	1,133,000	89.9	72.2
2007	1,017,500	83.6	95.0
2008	828,500	82.0	

Table 9-2. Mean fecundity of Wells Complex hatchery broodstocks by total age and origin. See Snow et al. (2008) for additional statistics.

	Age 4 (1-salt)		Age 5 (2-salt)	
	Hatchery	Naturals	Hatchery	Naturals
2006	4,652	4,203	6,858	6,397
2005	4,547	5,370	6,575	6,627
2004	4,543	4,517	5,865	4,832
2003	4,241	--	6.545	6,954
2002	4,786	4,721	6,744	6,586
2001	4,356	3,865	6,624	6,714
2000	4,837	5,760	6,049	--

9.1.2 Cause for and disposition of surplus egg takes

Due to care in meeting broodstock collection plans and goals, surplus eggs are not taken. If surplus eggs do occur in the program, they would likely be raised to yearling smolts in one or more of the regularly-scheduled hatchery programs that are intended to enhance mainstem Columbia harvest opportunity.

9.1.3 Loading Densities Applied During Incubation

Each female/mating (WxW, WxH and HxH crosses) will be individually incubated at one female per Heath Techna Incubator (16 tray) vertical stack incubator tray. Eggs from individual females (14 to 26 oz; 3,696 to 7,020 eggs) are incubated individually. The flow rate to each incubator tray is maintained at 2 to 4 gpm throughout the incubation period. After eggs reach the eyed-egg stage, they are incubated at 7,500 eggs per tray.

9.1.4 Incubation conditions.

Individual egg lots are kept separated throughout incubation at the Wells Hatchery. Incubation, as with rearing, will occur with pathogen free, sediment free, 52 to 55^{o}F well water. A chiller is used on all egg takes to manipulate temperature units. The well water is reduced to 42 to 45^{o}F. Emergency backup water is available for incubation, as well as an alarm to alert hatchery personnel of electrical failure or water flow/elevation changes. An oxygen system has also been installed for safety precautions through power failures. Influent and effluent gas concentrations at the hatcheries and within the acclimation ponds, including dissolved oxygen concentration, are kept within parameters optimal for juvenile salmonid production and survival.

9.1.5 Ponding

Fish will be fed after all are buttoned up (usually 1 to 3 days post swim-up). Fish will rear in troughs until July or when fish reach 100/lb, at which time they will be transferred to outside raceways. Ponding generally occurs after the accumulation of 1,650 to 1,750 temperature units. Unfed fry are transferred to the ponds from early May through early June. The normal weight for fry initially ponded at Wells FH for BYs 1989-1995 was 0.45 grams (1,000 fish per pound). Fry fork length was 36 to 40 mm.

9.1.6 Fish Health Maintenance and Monitoring

Eggs will be examined daily by hatchery personnel. Prophylactic treatment of eggs for the control of fungus is prescribed by fish health specialists, and may include treatment with formalin or other accepted fungicides. Non-viable eggs and sac-fry will be removed by bulb syringe. Adherence to WDFW, PNFHPC, and IHOT (1995) fish disease control policies reduces the incidence of diseases in fish produced and released.

9.1.7 Indicate Risk Aversion Measures that Will be Applied to Minimize the Likelihood for Adverse Genetic and Ecological Effects to Listed Fish During Incubation

Eggs will be incubated in pathogen-free, silt-free, well water to ensure maximum egg survival and minimize potential loss from disease. In order to minimize the likelihood for adverse genetic and ecological effects as a result of fish mortality, an emergency backup generator for supplying power to the pumps is provided, as well as an alarm to alert hatchery personnel of electrical failure or water flow/elevation changes. An oxygen system has also been installed for safety precautions in case of power failures.

9.2 Rearing

9.2.1 Provide Survival Rate Data by Hatchery Life Stage (Fry to Fingerling; Fingerling to Smolt) for the Most Recent Twelve Years (1988-99), or for Years Dependable Data are Available

The hatchery program has survival performance standards for each life stage, from adult collection to spawning, egg incubation and survival from ponding to release. In most years, the in-hatchery survival of adult Wells/Methow steelhead has met or exceeded the survival standards for collection to spawning and eyed-egg to ponding, but is below the standard for other stages, and, overall, falls well below the survival standard for unfertilized egg to release (Table 9.3). Table 9-3 illustrates the egg fertilization averages for eggs 30 days after ponding, 100 days after ponding, and at release. Additional annual survival statistics are presented in Table 9-4.

Table 9-3. Developmental stage survivals in the hatchery environment for Wells steelhead, BYs 2003 to 2007.

Brood Year	Collection to Spawning		Unfertilized Egg to Eyed	Eyed Egg to Ponding	30 Days after Ponding	100 Days after Ponding	Ponding to Release	Transport to Release	Unfertilized Egg to Release
	Female	Male							
Average 2003-07	95.2	93.3	86.6	99.5	92.7	89.8	80.4	----	69.3
Standard	*90.0*	*85.0*	*92.0*	*98.0*	*97.0*	*93.0*	*90.0*	*95.0*	*81.0*

Table 9-4. Average and median percent survival of juvenile and adult steelhead held at Wells Hatchery, 2002-2007 (WDFW Wells Hatchery unpublished data).

	Brood Year									
	2002	2003	2004	2005	2006	2007	2008	Average	Median	Range
Green to Eyed	82.2	83.5	86.2	87.4	86.6	80.8	86.1	84.7	86.1	80.1 – 87.4
Pre-spawn Mort.	2.6	1.7	3.0	4.4	5.7	5.9	10.0[1]	3.9	3.8	1.7 – 10.0
Fecundity	6,232	6,312	4,704	6,191	6,377	5,108	5,981	5,821	5,541	4,704 – 6,377
Male:Female	0.83:1	0.74:1	1.21:1	0.80:1	0.93:1	0.74:1	0.95:1	0.875:1	0.975:1	0.74:1 – 1.21:1
Age 1:2-salt+	42:58	16:84	96:4	41:59	38:62	78:22	76:24	52:48	56:44	

Notes:
1: High mortality may have been caused by strong reaction to CO_2 anesthesia, causing broken backs seen in the lost females.

9.2.2 Density and Loading Criteria (Goals and Actual Levels)

Hatched fry are transferred from the Heath incubation trays to fiberglass rearing tanks for start feeding and reared at a density no greater than 2.2 lbs/gpm. Advanced fry are moved to concrete raceways for continued rearing and marking to a maximum of 3.0 lbs/gpm (0.22 lbs/ft^3). The tanks and raceways have flow-through water circulation. After marking or tagging the juveniles are transferred to earthen ponds for rearing until release. Maximum poundage at release may reach 17.9 lbs/gal/min; however, the density index has been very low at 0.03 lbs/gpm.

9.2.3 Fish Rearing Conditions

Influent and effluent gas concentrations at the hatchery, including dissolved oxygen concentrations, are within parameters optimal for juvenile salmonid production.

9.2.4 Indicate Bi-weekly or Monthly Fish Growth Information, Including Length, Weight, and Condition Factor Data Collected During Rearing, if Available

Table 9-5. Typical steelhead hatchery growth data, Wells Hatchery, 2008 production year.

Rearing Period	Length (mm)	Weight (fpp)	Condition Factor (C)
June	30	1724	0.098
July	39	772	0.099
August	49	392	0.098
September	68	148	0.098
October	86	72	0.099
November	117	28.5	0.099
December	135	19.0	0.097
January	156	12.2	0.098
February	160	11.3	0.098
March	165	10.4	0.097
April	186	7.2	0.098
May	187	7.1	0.098

9.2.5 Indicate Monthly Fish Growth Rate and Energy Reserve Data, if Available.

Information not collected at Wells Hatchery.

9.2.6 Indicate Food Type Used, Daily Application Schedule, Feeding Rate Range (e.g. % B.W./Day and Lbs/Gpm Inflow), and Estimates of Total Food Conversion Efficiency During Rearing

Table 9-6. Recent Wells Hatchery steelhead average feed statistics.

Rearing Period	Food Type	Application Schedule (No. Feedings/day)	Feeding Rate Range (% B.W./d)	Pounds Fed per GPM of Inflow	Food Conversion During Period
Start to 200 fpp	Moore Clark Nutra Plus	6 - 8	2.5 – 3.0	0.06	0.5:1.0 to 0.7:1.0
200-75 fpp	Moore Clark Nutra Plus	U	1.75 – 2.5	0.08	0.8:1.0
75-5.0 fpp	Moore Clark Trout AB	U	0.75 – 2.0	0.21	0.9:1.0 to 1.2:1.0

9.2.7 Fish Health Monitoring, Disease Treatment, and Sanitation Procedures

Standard fish health monitoring will be conducted by a fish health specialist at frequencies appropriate to the life stage and susceptibility to disease. Significant fish mortality attributable to unknown cause(s) will be sampled appropriately for study (i.e., viral assay, bacterial culture, histopathology). Fish health maintenance strategies are described in IHOT (1995). Incidence of viral pathogens in steelhead broodstock will be determined by sampling fish at spawning in accordance with the Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State. Populations of adults of particular concern may be sampled at the 100% level and may require segregation of eggs/progeny in early incubation or rearing.

Fish are monitored daily by staff during rearing for signs of disease, through observations of feeding behavior and monitoring of daily mortality trends. A fish-health specialist will monitor fish health as often as determined necessary. More frequent care will be provided as needed if disease is noted. Hatchery Specialists under the direction of the Fish-Health Specialist will provide treatment for disease. Sanitation will consist of raceway cleaning as necessary by brushing, and disinfecting equipment. Fish-health examinations are performed on all steelhead production lots throughout the rearing period and pre-release.

All equipment (nets, tanks, boots, etc.) is disinfected with iodophor between different fish/egg lots. Tank trucks are disinfected between the hauling of adult and juvenile fish. Foot baths containing disinfectant are strategically located on the hatchery grounds to prevent spread of pathogens.

The general policy is to bury dead juvenile fish and eggs to minimize the risk of disease transmission to natural fish. Adult steelhead carcasses will be buried or disposed of in an approved landfill if individuals have been treated with antibiotics and died within the withdrawal period identified by the U.S Food and Drug Administration (FDA). All adults injected with maturation accelerating hormones (such as sGnRHa implants) will be disposed of in an approved landfill, consistent with INAD requirements.

9.2.8 Smolt Development Indices (e.g., Gill ATPase Activity), if Applicable

Smolt condition is assessed through visual external examination and assigning a numeric value to each sampled fish based on four different stages of development. Numeric values are designated for fish assessed as smolts = 1, transitional fish = 2, parr = 3, and residual = 4.

9.2.9 Indicate the Use of "Natural" Rearing Methods as Applied in the Program

Camouflage covers over the outside raceways may be used to help maintain a fright response. Earthen rearing ponds provide a somewhat more natural setting than hatchery raceways. Demand feeders may also be used where possible to limit human disturbance or habituation to humans. The Twisp acclimation pond and Methow Hatchery Pond 13 afford in-basin acclimation of pre-smolts to the Twisp and Methow rivers.

9.2.10 Indicate Risk Aversion Measures that Will be Applied to Minimize the Likelihood for Adverse Genetic and Ecological Effects to Listed Fish Under Propagation

Fish will be propagated in pathogen-free, silt-free well water to ensure maximum survival and minimize potential loss from disease. In order to minimize the likelihood for adverse genetic and ecological effects as a result of fish mortality, an emergency back-up generator for supplying power to the pumps is provided, as well as an alarm to alert hatchery personnel of electrical failure or water flow/elevation changes. An oxygen system has also been installed for safety precautions through power failures.

10.0 RELEASE

10.1 Proposed fish release levels

See Section 1.8.2.

10.2 Specific Location(s) of Proposed Release(s)

Stream, river, or watercourse: Twisp River, WRIA 48
Release point: Twisp Acclimation Pond
Major watershed: Methow River
Basin or Region: Upper Columbia River

Stream, river, or watercourse: Methow River, WRIA 48
Release point: Methow Hatchery
Major watershed: Methow River
Basin or Region: Upper Columbia River

Stream, river, or watercourse: Columbia River
Release point: Columbia River, river km 829 (Wells Hatchery)
Major watershed: Columbia River
Basin or Region: Upper Columbia River

Stream, river, or watercourse: Okanogan River Basin, WRIA 49
Release point: See the Okanogan Basin Summer Steelhead Conservation Program HGMP (submission to NOAA pending).
Major watershed: Columbia River
Basin or Region: Upper Columbia River

10.3 Actual Numbers and Sizes of Fish Released by Age Class Through the Program

See Table 10-1. Source: WDFW, unpublished Hatchery Program data.

10.4 Actual Dates of Release and Description of Release Protocols

See Table 10-1. See Section 10.6 for release protocols.

Table 10-1. Wells Hatchery steelhead smolt plants in the Methow Basin, 1995-2008.

	Methow River Plants			Chewuch and Twisp River Plants			
Release Year	**Number**	**Date**	**Ave. Size (fpp)**	**Release Year**	**Number**	**Date**	**Ave. Size (fpp)**
1995	226,520	May 18-26	5.8	1995	Unknown	--	--
1996	238,500	May 1-24	5.0	1996	Unknown	--	--
1997	310,480	Apr 25-May 23	6.5	1997	Unknown	--	--
1998	127,020	Apr 29-May 22	5.8	1998	126,000 to Twisp	Apr 27-May 22	7.0
				1998	125,300 to Chewuch	Apr 24 – May 22	7.0
1999	350,431	Apr 21-June 8	6.9	1999	127,515 to Twisp	Apr 21- June 8	5.1
				1999	96,225 to Chewuch	Apr 21 – June 7	5.5
2000	165,900	Apr 11 – May 24	6.8	2000	136,681 to Twisp	Apr 25-May 23	6.3
				2000	138,300 to Chewuch	Apr 25 – May 23	6.3
2001	116,830	Apr 27 – May 22	7.4	2001	109,950 to Twisp	May 1-22	5.9
				2001	99,490 to Chewuch	May 1-22	5.9
2002	94,020	Apr 29 – May 23	6.0	2002	84,475 to Twisp	Apr 29 – May 23	5.8
				2002	85,615 to Chewuch	May 1-23	6.0
2003	100,035	Apr 23 – May 5	6.1	2003	105,323 to Twisp	May 1-8	6.0
				2003	117,495 to Chewuch	Apr 23 – May 16	6.2
2004	80,580	Apr 21 – May 6	6.4	2004	97,105 to Twisp	Apr 23 – May 7	7.3
				2004	78,205 to Chewuch	Apr 21 – May 6	7.3
2005	86,041	Apr 25 – May 11	5.4	2005	96,405 to Twisp	Apr 25 – May 11	5.0
				2005	82,280 to Chewuch	Apr 25 – May 11	5.4
2006	99,820	May 5-19		2006	107,245 to Twisp	May 1-18	
				2006	119,500 to Chewuch	May 3-22	

	Methow River Plants				Chewuch and Twisp River Plants		
Release Year	Number	Date	Ave. Size (fpp)	Release Year	Number	Date	Ave. Size (fpp)
2007	96,219	May 4-23		2007	111,768 to Twisp	Apr 25 – May 23	
				2007	107,545 to Chewuch	Apr 30 – May 22	
2008	99,464	Apr 21 – May 28		2008	100,446 to Twisp	Apr 21 – May 28	
				2008	76,575 to Chewuch	Apr 21 – May 28	

10.5 Fish transportation procedures, if applicable.

See Table 5.1.

10.6 Acclimation procedures (methods applied and length of time)

Twisp Acclimation Pond: The pond will be shared with spring Chinook yearling smolts. Steelhead will be introduced to the pond no later than April 25. Fish will be allowed to exit volitionally until as late as May 25. The extent to which fish can be held in the pond is dependent on river and water conditions. Fish may need to be released earlier in the event of high discharge. Acclimation time will range from approximately 15-60 days. Non-migrants will be collected (see below).

Methow Hatchery-Acclimation Pond 13: The pond will be populated with steelhead from Wells Hatchery shortly after April 15, once spring Chinook have been released. Fish will be allowed to exit volitionally starting the first week of May until as late as May 25. Acclimation will range for approximately 15-30 days. Non-migrants will be collected (see below). See Section 1.8.2.3 for adaptive management strategies for the Lower Methow Component.

Wells Hatchery-Pond 3: Steelhead will be reared in the pond from September (when large enough to mark) through direct release into the Columbia starting around April 15. Fish will be released by May 25. Acclimation time will be approximately 7-8 months.

WDFW will collect non-migratory steelhead remaining in the acclimation pond(s) after the volitional release period and will distribute them to selected area waters that are isolated from anadromous fish populations to provide for resident fisheries, as approved by the HCP Hatchery Committees. The Douglas PUD HCP hatchery production obligations will be fulfilled through a combination of volitionally migrating smolts and non-migrants that have been planted for resident fisheries.

Other acclimation sites may be used with concurrence from the HCP Hatchery committee.

10.7 Marks Applied, and Proportions of the Total Hatchery Population Marked, to Identify Hatchery Adults

See Section 1.8.4. Additional marks such, as PIT tags or CWTs, may be used for specific assessment objectives.

10.8 Disposition Plans for Fish Identified at the Time of Release as Surplus to Programmed or Approved Levels

Broodstock and egg collections will be designed to minimize the potential for egg surpluses. Egg surpluses, if any, will be culled (see Section 9.1.2). Surplus smolts are not expected. However, ESA Section 10 Permit No. 1395 allows for a 10% overage to the programmed production level. Juvenile production that is within the 10% overage will be released in the basins above Wells Dam. Disposition of juvenile production in excess of the 10% overage will be culled from the population in a manner consistent with achieving program goals.

10.9 Fish health certification procedures applied pre-release.

Fish health and disease condition are continuously monitored in compliance with the requirements of the "Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State" (Fisheries Co-managers 2006), requirements of the Section 10 ESA permit issued, and guidelines of IHOT (1995). Steelhead are monitored daily by staff during rearing for signs of disease, through observations of feeding behavior and monitoring of daily mortality trends. A fish health specialist monitors fish health at least monthly; these inspections must adhere to the disease prevention and control guidelines established by the PNFHPC. More frequent care will be provided as needed if disease is noted. Prior to release, the hatchery smolt population's health and condition is established by the Area Fish Health Specialist. This is commonly done one to three weeks pre-release, and up to 6 weeks pre-release on systems with pathogen-free water and little or no history of disease.

10.10 Emergency Release Procedures in Response to Flooding or Water System Failure

Fish must be released at a uniform size and state of smoltification that ensures that the fish will migrate seaward without delay after release. Variance from this smolts-only release requirement will only be allowed in the event of an emergency, such as flooding, water loss to raceways, or vandalism that necessitates early release of ESA-listed steelhead to prevent catastrophic mortality. Any emergency steelhead releases made by the action agencies shall be reported immediately to the NMFS Salmon Recovery Division in Portland, OR. Fish would be released via exit pipe to the Columbia River from Wells Hatchery; to the Twisp River from the Twisp acclimation pond; and to the Methow River from the Methow Hatchery. The exit system at Wells Hatchery was not constructed with emergency fish releases as a paramount design requirement. Thus, a major release could cause mechanical injury to fish. If time permitted, fish for the Methow components would be pumped from the Wells Hatchery ponds into tanker trucks, and transported to the Methow or Twisp rivers and directly out-planted.

10.11 Indicate Risk Aversion Measures that Will be Applied to Minimize the Likelihood for Adverse Genetic and Ecological Effects to Listed Fish Resulting from Fish Releases

The risk of ecological hazards to listed species resulting from liberations of hatchery-origin steelhead will be minimized through the following measures:

- Hatchery steelhead will be reared to sufficient size such that smoltification occurs within nearly the entire population, reducing residence time in the streams after release and promoting rapid seaward migration.
- All Twisp Integrated, Lower Methow Safety-Net, and Mainstem Columbia Safety-Net will be acclimated in their respective release locations to facilitate adult management and reduce straying.
- Steelhead smolt releases will be timed with releases from Columbia River dams to further accelerate seaward migration, to improve survival at mainstem dams, and to reduce the duration of interactions with wild fish.
- Release sites are chosen to either return fish to a site for spawning recruitment, broodstock collection, or to return hatchery adults to areas where they may be most readily harvested and less likely to enter spawning areas.
- Acclimation in natal stream water will contribute to smoltification, reducing the residence time in the rivers and mainstem corridors.
- Hatchery steelhead smolts will be released when environmental conditions exist that promote rapid emigration.
- Total number of smolts released with expected adult contribution to natural spawning will be calibrated to be within the tributary carrying capacity when historical productivity has been restored.
- All artificially propagated UCR steelhead juveniles shall be externally or internally marked prior to release.
- Adherence to WDFW, PNFHPC, and IHOT (1995) fish disease control policies will reduce the incidence of diseases in hatchery fish produced and released.

Variance from a smolts-only release requirement shall only be allowed in the event of an emergency as detailed in Section 10.10.

11.0 MONITORING AND EVALUATION OF PERFORMANCE INDICATORS

11.1 Monitoring and Evaluation of "Performance Indicators" Presented in Section 1.10.

The HCP Hatchery Committee has developed a rigorous Monitoring and Evaluation Plan (M&E Plan) for the Methow Basin and Wells Hatchery summer steelhead program (see Appendix B; HCP HC 2007). Douglas PUD funds an M&E program based upon that M&E Plan and a companion document called the "Analytical Framework" (Hayes et al. 2007), which describes the necessary data and analytical rules by which to assess the performance of the program relative to the specific objectives in the M&E Plan. The Analytical Framework is attached as Appendix C. Implementation of the M&E Plan is guided by an annual M&E Implementation Plan (Murdoch and Snow 2008) prepared by Douglas PUD's M&E contractor (currently WDFW) and approved by the HCP Hatchery Committee (Appendix D). The M&E program is subject to review by the HCP Hatchery Committee at least every five years (or as needed), and it is within the purview of the HCP Hatchery Committee to review and modify the M&E Plan and Analytical Framework (and thus, the M&E program) at any time (adaptive management). The program monitors survival and growth within the hatchery and the effects of hatchery fish on population productivity, genetic diversity, run and spawn timing, spawning distribution, and age and size at maturity. This information is collected directly from or derived from spawning ground surveys, broodstock sampling, stock composition sampling (stock assessment), hatchery juvenile sampling, smolt trapping, PIT tagging, elastomer tagging, adipose clipping, genetic sampling, disease sampling, and snorkeling. The Monitoring and Evaluation Program is consistent with the draft monitoring and evaluation plan prepared by NOAA Fisheries for the Recovery Plan (see Appendix P to the Recovery Plan; UCSRB 2007) and the Ad Hoc Supplementation Monitoring and Evaluation Workgroup recommendations (Galbreath et al. 2008).

11.1.1 Describe Plans and Methods Proposed to Collect Data Necessary to Respond to Each "Performance Indicator" Identified for the Program

The M&E Plan and Analytical Framework were developed by the Hatchery Evaluation Technical Team (HETT; ad hoc technical subcommittee to the HCP Hatchery Committees and PRCC Hatchery Subcommittee). The objectives within the M&E Plan and Analytical Framework were developed to assess progress toward achieving the hatchery program goals defined by the JFP in the M&E Plan. The Wells HCP Hatchery Committee approved the initial 2005 M&E Plan at the July 2005 HCP Hatchery Committee meeting and approved the updated version in September of 2007. The Wells HCP Hatchery Committee may modify the M&E Plan to ensure that the program goals are being appropriately monitored.

The M&E Plan for the Wells Complex steelhead program intends to use reference streams for comparative analysis (i.e., to tease out hatchery effects). Availability, feasibility, and viability of using reference streams continue to be evaluated by the HETT. Because of the difficulty in finding suitable reference streams (summer steelhead systems similar to the Methow, but with no hatchery influence) and the ability to detect impacts, the HCP Hatchery Committee has tentatively accepted this approach while the HETT conducts the necessary analyses to identify reference streams and validate the approach.

The M&E Plan and Analytical Framework (Appendices B and C) thoroughly describe the program objectives, their respective hypotheses, measured variables, derived metrics, and analyses.

11.1.2 Indicate Whether Funding, Staffing, and Other Support Logistics are Available or Committed to Allow Implementation of the Monitoring and Evaluation Program

Douglas PUD funds the M&E activities for this program. WDFW, as a contractor to Douglas PUD, currently provides the personnel and equipment for conducting these activities. Copies of the Annual Report on M&E activities are routinely and regularly provided to NMFS through its representative on the Wells HCP Hatchery Committee.

11.2 Indicate Risk Aversion Measures that Will be Applied to Minimize the Likelihood for Adverse Genetic and Ecological Effects to Listed Fish Resulting from Monitoring and Evaluation Activities

11.2.1 Juvenile Monitoring

Injury to steelhead, spring Chinook salmon, and bull trout may occur through trapping, handling, and marking procedures. Primary injury and mortality events are associated with debris accumulation in the trap live-box, reaction to anesthesia, handling stress, over-crowding in the live-box, predation in the live-box, and increased predation post release. Injury and mortality will be minimized through diligent trap attendance. Traps will be checked a minimum of once a day in the morning and more often as needed (as determined by capture rate, debris loading, discharge, etc.). Injury and mortality associated with handling stress and post-release predation will be addressed by applying MS-222 (or other anesthetic approved by WDFW and/or NMFS) to all fish handled, and allowing full recovery of fish before release. Other risk aversion measures include:

- No more than 20% of the natural or hatchery emigrants may be captured.
- Lethal take may not exceed 2% of the natural or hatchery fish captured.
- Tissue sampling shall be minimized to the extent possible.
- Fish must be kept in water to the maximum extent possible. Adequate water circulation and replenishment of water in holding units is required.
- Fish must be moved using equipment that holds water during transfer.
- Fish must not be handled if water temperatures exceed 69.8°F (21°C) at the capture site.
- The incidence of capture, holding, and handling effects shall be minimized and monitored.
- Visual observation protocols must be used instead of intrusive sampling methods whenever possible.

The Section 10 Permits No. 1395 and 1196 describe the risk aversion measures required of the current M&E activities for steelhead and spring Chinook, respectively.

11.2.2 Adult Monitoring

No injury or mortalities are expected during steelhead spawning ground surveys. Field staff will minimize disturbance to any spawning steelhead by identifying spawning sites and using a land route around their location. In addition, wading is restricted to the extent practical to minimize disturbance, and extreme caution is used to avoid adults and redds when wading is required.

During sampling at Twisp Weir, Methow Hatchery, and Wells Dam, injury to steelhead may occur through trapping, handling, and sampling procedures. Primary injury and mortality events are associated with reaction to anesthesia, handling stress, and over-crowding in collection areas. Injury and mortality will be minimized through diligent trap attendance. Traps will be checked a minimum of once a day in the morning or more often as needed. Injury and mortality associated with handling stress, anesthetizing, and sampling will be addressed by applying MS-222 (or other anesthetic approved by WDFW and/or NMFS) to all fish handled, and allowing full recovery of fish before release. Procedures and trapping equipment have been rigorously tested and refined over the last 5 years. Potential sources of injury have been identified and corrected by Douglas PUD staff.

Additionally, WDFW submits annual reports as conditioned by Section 10 Permit No. 1395 covering the period from January 1 - December 31 each year per permit Reporting and Annual Authorization Requirements; Sections C.1 to C.9. Specifically, the annual reports include detailed activities as per requirements including monitoring of performance indicators identified for the program. A summary documenting the M&E activities associated with threatened UCR summer steelhead hatchery supplementation program is included in annual progress reports submitted to NOAA Fisheries. Monitoring activities have already been approved by the permit. Any additional harm to listed fish beyond the permit allowances are communicated immediately to NOAA Fisheries by the WDFW ESA response lead in the area for review or needed changes.

12.0 RESEARCH

Douglas PUD provides the funding for the M&E Program (Murdoch and Snow 2008). Staffing and funding are committed through the HCP to allow most of the data collection, and M&E. Additional funding and staff may be necessary to carry out some of the M&E objectives subsequently identified in the HCP or as identified and prioritized through continued evaluation work.

The Wells HCP requires the Wells Hatchery Committee to plan and Douglas PUD to implement a study to investigate the natural spawning (reproductive) success of hatchery reared steelhead relative to wild steelhead (Douglas PUD, et al. 2002; Section 8.5.3). This study has been planned and approved by the HCP Hatchery Committee. A copy of the study design is attached as Appendix A.

The summer steelhead program also includes both research and enhancement activities as conditioned by Section 10 Permit No. 1395. Research is directed at determination of supplementation program contribution rates, and ecological and genetic effects of the program on the natural population. It is within the purview of the Hatchery Committees to review and approve such studies that may use or impact Plan Species, and/or that will inform the science behind current knowledge of Plan Species.

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14.0 CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

"I hereby certify that the information provided is complete, true and correct to the best of my knowledge and belief. I understand that the information provided in this HGMP is submitted for the purpose of receiving limits from take prohibitions specified under the Endangered Species Act of 1973 (16 U.S.C.1531-1543) and regulations promulgated thereafter for the proposed hatchery program, and that any false statement may subject me to the criminal penalties of 18 U.S.C. 1001, or penalties provided under the Endangered Species Act of 1973."

Name, Title, and Signature of Applicant:

Name: William C Dobbins
Title: General Manager PUD No 1 of Douglas County
Date: April 1, 2011

Name: MARK A. KIMBEL FOR HEATHER BARTLETT
Title: WDFW HATCHERIES DIVISION MGR
Date: APRIL 6, 2011

Appendix A

Wells Steelhead Spawning Success Study Design

STEELHEAD SPAWNING SUCCESS STUDY DESIGN WELLS HCP

1 February 2010

Prepared by:
Greg Mackey, Tom Kahler, Shane Bickford
Public Utility District No. 1 of Douglas County

Introduction

The Wells HCP specifies that Douglas County PUD will "…investigate the natural spawning (reproductive) success of hatchery reared steelhead relative to wild steelhead. This study should utilize a statistically valid number of fish necessary to develop baseline DNA profiles for Methow River steelhead." Douglas PUD has prepared a study design to meet this charge and provide meaningful information to improve steelhead management in the Methow River. Management of steelhead and Pacific salmon to enhance fisheries and to supplement wild (hereafter wild refers to naturally-reared fish) populations that are at low abundance has been driven by the use of hatcheries. In cases where hatchery fish are used as a conservation tool to supplement wild populations, the assumption is that hatchery fish will increase production in the wild population, but this assumption may not be valid. Numerous studies have found that hatchery salmonids, particularly steelhead, have lower reproductive success (i.e. fitness) relative to wild fish (Chilcote et al. 1986, Leider et al. 1990, McClean at al. 2003, 2004; Araki et al. 2007) and therefore, may not afford the expected demographic benefit to the supplemented population. However, most studies have focused on nonlocal, domesticated hatchery stocks, as opposed to local stocks, and have not compared programs explicitly designed to integrate hatchery and wild fish (but see Araki et al. 2007a).

Integrated programs, where wild fish are incorporated into the hatchery program, have been recommended by the Hatchery Scientific Review Group (HSRG, 2009) and follow population genetics theory to minimize divergence between hatchery and wild fish. In a program where hatchery broodstock consists entirely of locally collected wild fish, the hatchery population should essentially be identical to wild fish, but may experience domestication selection and relaxed natural selection through lack of mate choice, early life history experience of progeny in the hatchery environment, and survival regimes that differ from the natural state. The assumption is that an integrated program will produce fish that perform more similarly to wild fish in the natural environment and pose minimal genetic risk (see Lynch and O'Hely 2001, and Ford 2002 for discussion of the genetic risks).

The Methow Basin is dominated by hatchery steelhead released for both harvest and supplementation. The hatchery program for the Twisp River currently uses hatchery by wild crosses (HxW), but is planned to shift to an integrated conservation program (WxW) with control of hatchery spawner escapement in an effort to increase the likelihood of recovery and reduce the genetic and ecological risks associated with past hatchery practices (draft Wells Steelhead HGMP, 2009). The preponderance of information from population level studies suggests that the progeny of the current hatchery steelhead program in the Methow Basin will exhibit lower reproductive success than their wild counterparts. Fitness of hatchery verses wild fish will be measured by Relative Spawning Success (RSS): the ratio of the reproductive fitness of hatchery to wild fish. The proposed fully-integrated Twisp steelhead program offers the possibility of increasing the reproductive performance of the hatchery program to a level similar to wild fish. However, the effectiveness of the proposed integrated steelhead program remains unclear. Critical gaps in knowledge that this study will address include: 1) the RSS of hatchery fish compared to wild fish in the Twisp River, 2) the environmental and genetic contribution to potential differences in RSS between hatchery and wild fish, and 3) traits associated with differences in RSS.

The goals of this study are to estimate the RSS of hatchery and wild steelhead across two generations in the wild, and identify factors that affect RSS. The study is designed to address genetic and environmental factors. Specifically, we will estimate the RSS of hatchery fish compared to wild fish spawning upstream of a weir on the Twisp River. We will evaluate the RSS of hatchery-origin fish spawning in the wild in the first generation, and also track the RSS of their wild-born descendents (second generation) to their returning progeny. Decreased fitness (as measured by RSS) carrying over into the second generation in the wild indicates a genetic component to hatchery-induced fitness loss, posing a risk of declining fitness, over time, in the wild population. Fitness similar to wild fish suggests that hatchery fish can contribute to recovery by increasing production in the wild population while minimizing fitness loss. We may be able to assess the effect of sex-directional crosses (MxF vs. FxM) between hatchery and wild fish, which can provide further insight into maternal and genetic effects on fitness. In addition, we will attempt to identify phenotypic and behavioral traits that influence reproductive performance and relate these to management practices. These include age, origin, size, time of arrival of adults, and spatial and temporal distribution of spawning.

The weir on the Twisp River allows sampling of upstream migrating adults. The efficiency of the weir appears to be high. In 2009, the first year the weir was operated for steelhead, all adults were Floy-tagged before being released upstream. During intensive weekly spawner surveys, almost all fish spotted on the spawning grounds were Floy-tagged, indicating that the weir captured a high percentage of the upstream migrating adults (Charlie Snow, WDFW, personal communication). Downstream migrants (kelts) may be captured opportunistically to obtain samples from any potential parents (or progeny) that may have been missed due to high water.

The Twisp River steelhead population will be managed to achieve an average Proportionate Natural Influence (PNI) of at least 0.67 over time (draft Wells Steelhead HGMP, 2009). Therefore, the proportion of Hatchery Origin Spawners (pHOS) will be controlled at the Twisp weir by adjusting the hatchery spawner escapement based on the wild spawner escapement to achieve a desired pHOS. Maintaining a 1:1 ratio of hatchery to wild spawners with a proportion of Natural Origin Broodstock (pNOB) of 1 results in PNI = 0.67. Balanced hatchery and wild spawner escapement is optimal for RSS analysis. The RSS estimated in this study will therefore be the product of carefully managed spawner escapement ratios of hatchery and wild fish under HxW and WxW hatchery programs.

The assumption of the PNI approach is that hatchery and wild spawners produce offspring (contribute genetically) in proportion to the spawning escapement of the two groups. Substantial deviations from this would affect the genetic contribution of one group over the other. This may affect both PNI and the demographic expectations of such management. We will assess the efficacy of the proposed HSRG management approach in achieving offspring in similar proportion to pHOS and its effects on PNI.

The primary hypotheses of this study are given below. Most tests will be one-tailed because, 1) we are particularly interested to determine whether hatchery fish have lower fitness than wild fish, and 2) one-tailed tests provide greater power, increasing the ability to detect smaller differences. Hatchery and wild fish may be more similar to each other in this study than observed in some other studies because, 1) hatchery fish have been used in the Methow Basin for decades and are numerically dominant relative to the wild fish, and 2) the natal stocks of the upper Columbia are thought to have been homogenized, leaving no true “wild” stocks.

Hypothesis 1: RSS of first generation (f1) wild-spawning hatchery-origin fish
Ho1: Hatchery fish spawning success = Wild fish spawning success
Ha1.1: Hatchery fish spawning success < Wild fish spawning success

Hypothesis 2: RSS of second generation (f2) wild-spawning, wild-born progeny of hatchery-origin fish
Ho1: Hatchery-pedigree fish spawning success = Wild fish spawning success
Ha1.1: Hatchery-pedigree fish spawning success < Wild fish spawning success

Hypothesis 3: Cross (sex-specific) RSS
Ho2: HxW spawning success = WxW spawning success = HxH spawning success
Ha2.1: HxH spawning success < HxW spawning success < WxW spawning success

Hypothesis 3: pHOS to proportion of offspring
Ho3: Proportion of H:W spawners = Proportion of H:W progeny
Ho3: Proportion of H:W spawners ≠ Proportion of H:W progeny

Study Design

The study will run from 2010 (incorporating 2009 samples and field data) to 2021. The study is designed to perform an adult-to-adult pedigree analysis of the RSS of hatchery-origin fish (f1) and their wild-born descendents (f2) compared to wild fish (Figures 1 and 2). Analysis will focus on the RSS of six parental brood years (f1: 2009-2011, and f2: 2014-2016) across two generations of hatchery-origin fish reproducing in the wild (Figure 2). However, samples will be collected and analyzed for all potential parents and progeny in 2009-2021 (Figure 1). Analyses of progeny will focus on the dominant 5 year-old age class, accounting for 52% of a cohort according to age structure data from Chapman et al. (1994) (Table 1). The study will straddle the release of the first integrated (WxW) Twisp smolts, expected in spring 2011 or 2012, with the first adult returns to the Twisp in 2013 or 2014. Therefore, brood year sampling in 2014-2016 should include WxW hatchery fish.

Returning adults will be sampled at an existing weir on the Twisp. An attempt will be made to sample all adults that ascend upstream of the Twisp weir. In years when fish are known to have ascended without being sampled, we may attempt to capture kelts as they descend. Additional data will be collected on both parents and offspring, including size, sex, age, origin, date of arrival, spawning location, and spawn timing, if possible, plus a small fin clip for genetic analysis (Murdoch and Snow 2008). Steelhead spawn during a time of ascending hydrograph; therefore, some data collection may be curtailed by stream conditions.

1. The study will run from 2009-2021, allowing a two-generation pedigree analysis of the 2009-20011 f1 and the 2014-2016 f2 brood years (Figure 1). Progeny will be sampled through 2021. The 2009 genetic samples and field data have already been collected.

2. All upstream migrating adults will be sampled at an existing weir on the Twisp River. Kelts may be sampled opportunistically if adults are known to have ascended into the study reach without being sampled.

3. Parents and offspring will be tissue sampled for genotyping (small fin clip). Parentage analysis will be performed via DNA microsatellites using a suite of markers with appropriate resolving power.

4. Phenotypic, behavioral and environmental data will be collected during spawning season such as: age, size, origin, number and location of redds, and arrival and spawn dates.

5. Statistical analyses of hatchery verses wild RSS will be done using permutation tests (Araki and Blouin, 2005), GLM, or other appropriate techniques. Additional analyses of phenotypic traits will be performed using GLM, ANOVA, regression, or other appropriate techniques.

6. Analyses will test stated hypotheses and explore other factors related to fitness (spawn date, fish size, etc.).

7. We will attempt to make inferences that inform the adaptive management needs of the Twisp and Methow steelhead program, and contribute to the general knowledge of use of hatcheries for salmonid population recovery.

Figures and Tables

Table 1. Ages, counts and percent composition of adult steelhead (freshwater age + saltwater age + spawn year) sampled at Wells Dam, Wells reservoir, and Methow River, 1978-92 (adapted from Chapman et al., 1994).

age	4	5	6	7	8	9	10
n	105	298	139	22	6	2	2
percent	18.3	51.9	24.2	3.8	1.0	0.3	0.3

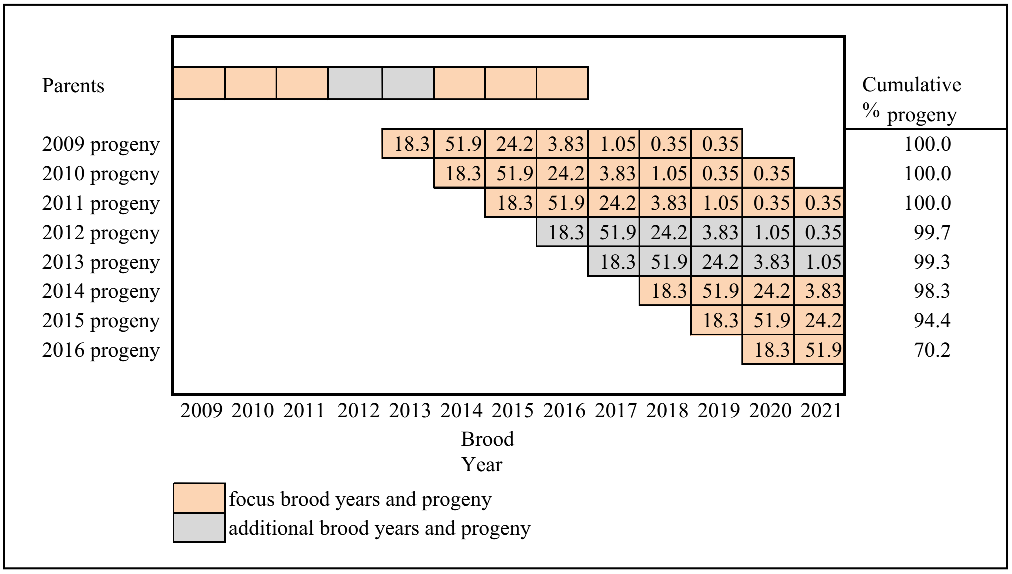

Figure 1. Timeline of parent and progeny sampling and percent representation of progeny by cohort age class at the Twisp Weir. Progeny ages range from 4-10, including freshwater, saltwater, and spawn year. Numbers in progeny cells indicate the percentage of a cohort expected to spawn at that age (Chapman et al. 1994), with the cumulative percentage represented in the sampling.

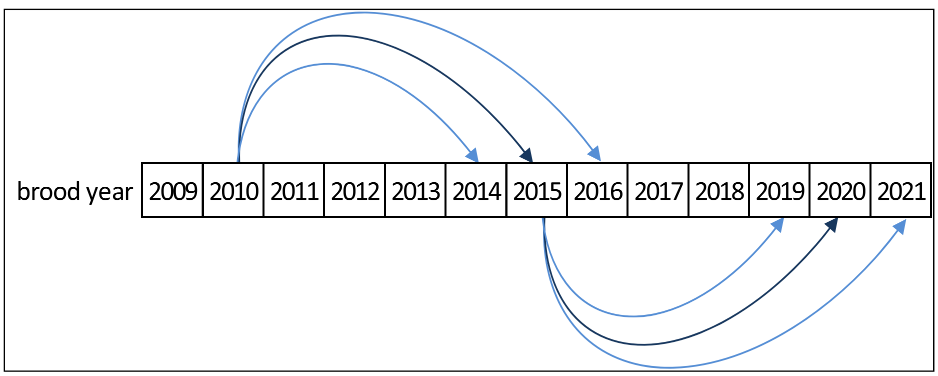

Figure 2. Example of two generation sampling starting in 2010: hatchery origin fish (f1, 2010), their wild-born progeny (f2, 2014-2016), and their f3 progeny (grandchildren of f1, 2019-2021). Age 4-6 progeny are sampled. Curved lines represent parent to progeny relationships. (Adapted from Araki et al. 2009).

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Appendix B

Conceptual Approach to Monitoring and Evaluation for Hatchery Programs

Conceptual Approach to Monitoring and Evaluation for Hatchery Programs

funded by Douglas County Public Utility District

Prepared for:
Douglas PUD Habitat Conservation Plan Hatchery Committee

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Table of Contents

Abstract

Public Utility District No. 1 of Douglas County (Douglas PUD) implements hatchery programs as part of the Habitat Conservation Plan (HCP) agreement relating to the operation of the Wells Hydroelectric Project. The HCP defines the goal of achieving no net impact (NNI) to anadromous fish species affected by operation of Wells Dam. The HCP identifies general program objectives as "contributing to the rebuilding and recovery of naturally reproducing populations in their native habitats, while maintaining genetic and ecologic integrity, and supporting harvest. The HCP further establishes a Hatchery Committee charged with defining specific hatchery program objectives and developing a monitoring and evaluation (M & E) program to determine if the hatchery objectives are being met. The HCP specifies that this plan will be reevaluated and adjusted, if need be, every five years. The purpose of this plan is to provide the conceptual framework to monitor and evaluate the success of the hatchery programs. This will in turn provide information to the HCP Hatchery Committee to manage these programs.

Introduction

In April 2002, negotiations on the Wells Habitat Conservation Plan (HCP) were concluded (DPUD 2002). The HCP is a long-term agreement between Douglas PUD, National Marine Fisheries Service (NOAA Fisheries), the Washington Department of Fish and Wildlife (WDFW), the U. S. Fish and Wildlife Service (USFWS), the Confederated Tribes of the Colville Reservation (Colville Tribes) and the Confederated Tribes and Bands of the Yakama Nation (Yakama Nation) [11]. The HCP objective is to achieve No Net Impact (NNI) for each plan species (spring Chinook salmon, summer/fall Chinook salmon, sockeye salmon, steelhead, and coho salmon of upper Columbia River (UCR) Basin) affected by the hydroelectric project. NNI consists of two components: (1) 91% combined adult and juvenile project survival achieved by project passage improvements implemented within the geographic area of the Project, (2) up to 9% compensation for unavoidable project mortality provided through hatchery and tributary programs, with a maximum 7% compensation provided through hatchery programs and 2% compensation provided through tributary programs. The signatory parties intend these actions to contribute to the rebuilding of tributary habitat production capacity and basic productivity and numerical abundance of plan species. Previous artificial propagation commitments to compensate for habitat inundation are carried forth in the HCP[12].

The Joint Fisheries Parties (JFP) include fishery resource managing agencies that are signatories to the HCP agreements and responsible for developing species-specific hatchery program goals. At this time, the WDFW, the USFWS, the Colville Tribes, the Yakama Nation and NOAA Fisheries constitute the JFP in regards to the HCP agreements. The JFP has agreed that hatchery programs for anadromous salmonid tributary populations (Methow and Okanogan) will attempt to follow the concepts and

[11] The Yakama Nation signed the HCP on March 24, 2005.
[12] For further information on the HCPs, and the creation and role of the Hatchery Committees, please see the HCP (DPUD 2002).

strategies of supplementation as defined and outlined in RASP (1992) and Cuenco et al. (1993). While hatchery programs for those salmonid population(s) that are released directly into the Columbia River will follow conventional hatchery practices associated with harvest augmentation. The Entiat River has been selected as a potential reference stream (population) for hatchery evaluations purposes, and as such, no new HCP hatchery supplementation programs will be initiated in that watershed. Conversely, conventional hatchery practices will continue to be utilized for plan species released into the mainstem Columbia River. The primary goal of these hatchery programs continues to be both inundation compensation and harvest augmentation.

The HCP Hatchery Committee (HCP HC) is responsible for developing a monitoring and evaluation (M&E) plan to assess overall performance of Douglas PUD's hatchery programs in achieving the general program objective of *"contributing to the rebuilding and recovery of naturally reproducing populations in their native habitats, while maintaining genetic and ecologic integrity, and supporting harvest as well as defining and monitoring specific hatchery program objectives".* The HCP HC has developed and adopted goals for specific hatchery programs. The various goals of those programs are outlined below:

1. Support the recovery of ESA listed species[13] by increasing the abundance of the natural adult population, while ensuring appropriate spatial distribution, genetic stock integrity, and adult spawner productivity.

   Hatchery Programs: Methow spring Chinook; Methow steelhead; and Okanogan steelhead

2. Increase the abundance of the natural adult population of unlisted plan species, while ensuring appropriate spatial distribution, genetic stock integrity, and adult spawner productivity. In addition, provide harvest opportunities in years when **spawning escapement** is sufficient to support harvest.

   Hatchery Programs: Methow summer/fall Chinook; Okanogan sockeye[14]

3. Provide salmon for harvest and increase harvest opportunities, while segregating returning adults from natural spawning populations.

   Hatchery Programs: Wells summer/fall Chinook

As previously mentioned, Douglas PUD's hatchery program encompasses two different hatchery strategies that address different goals due in part to the purpose in which the program was created. The main focus and an important goal of the hatchery program is

[13] While the HCP is not a recovery plan into itself, the hatchery component of it must be consistent with hatchery goals and objectives through the ESA, and as such should aid in the recovery of listed fish.
[14] Evaluation of the Douglas PUD Okanogan Sockeye obligation is conducted through the implementation of the Fish-Water Management Tool Program.

to increase the natural production of fish in the tributaries that will aid in the achievement of no net impact (NNI) and in the recovery of ESA listed stocks. This is accomplished through the strategy of supplementation. Simple put, supplementation uses broodstock for the hatchery program from a target stream or area, the offspring of which are reared in a hatchery and released back to the target stream or area. Fish will be reared and released in a manner that ensures appropriate spatial distribution and genetic integrity of the populations being supplemented. Subsequently, these juvenile hatchery fish will return as adults to supplement the natural spawning population with the intent of increasing the natural production of the population.

The fundamental assumption behind the theory of supplementation is that hatchery fish returning to the spawning grounds are “reproductively similar” to naturally produced fish. There is some information that suggests that this may not be true. Therefore, one of the questions that will be answered through this M&E plan is how effective are hatchery-origin salmon and steelhead at reproducing in the natural environment.

One of the important aspects of this Plan is to compare changes in productivity of a supplemented population to a non-supplemented population. Potential reference streams (e.g., Entiat) should have similar biotic and abiotic components as experimental streams. Preliminary determinations regarding the suitability of potential reference streams or areas within streams will be made based on the following criteria (these criteria are not considered all inclusive at this time):

- No recent (within last 5-10 years; two generations) hatchery releases directed at target species
- Similar information of hatchery contribution on the spawning grounds
- Similar fluvial-geomorphologic characteristics
- Similar out of subbasin effects
- Similar historic records of productivity
- Appropriate scale for comparison
- Similar in-basin biological components, based on analysis of empirical information

The question of how effective hatchery-origin salmon and steelhead are at reproducing in the natural environment will be answered in separate studies (i.e., DNA pedigree) that will eventually be added to this plan. Results from ongoing reproductive success studies (Wenatchee spring Chinook) as well as future studies (Upper Columbia steelhead) will be incorporated into the Plan on a continual basis. This plan recognizes that it is important to manage the numbers of hatchery fish spawning in the wild and the proportion of naturally produced fish in the broodstock. The further development of goals to achieve these mutual management actions will be developed by the HCP HC in the future and will be incorporated within the M&E plan at that time.

The second strategy is intended to increase harvest opportunities. This is accomplished primarily with releases of hatchery fish into the mainstem of the Columbia River or other terminal areas with the intent that the returning adults be harvested.

Additionally non harvest fish should remain segregated, from the naturally spawning populations.

Conceptual Framework of the Monitoring and Evaluation Plan

It is important that the M&E Plan has obtainable goals, and that the objectives and strategies are clearly linked to those goals. Figure 1 depicts the generalized conceptual model that this M&E Plan will follow. The hypotheses that will be tested under the objectives will be based on previous monitoring and evaluation information (i.e., key findings), and from the Biological Assessment and Management Plan (BAMP, 1998). Strategies, and the subsequent research, monitoring and evaluation, will clearly link to and provide feedback for the objectives.

The HCP specifies that the M&E Plan will be reevaluated, and revised if necessary every five years. It is important that information is collected through the evaluation plan that will enable the committee to make changes if needed. One of the challenges presented in developing the M&E Plan is to develop quantifiable metrics that support the goals of the hatchery programs. As such, it will be necessary to develop a conceptual framework for not only the M&E Plan, but for each objective to determine what types of information is required. A hierarchal approach to accomplishing the objectives would optimize data collection, analysis, and resources required to implement the Plan. Some of the data collection tasks will not need to be performed unless a data gap appears from other monitoring efforts.

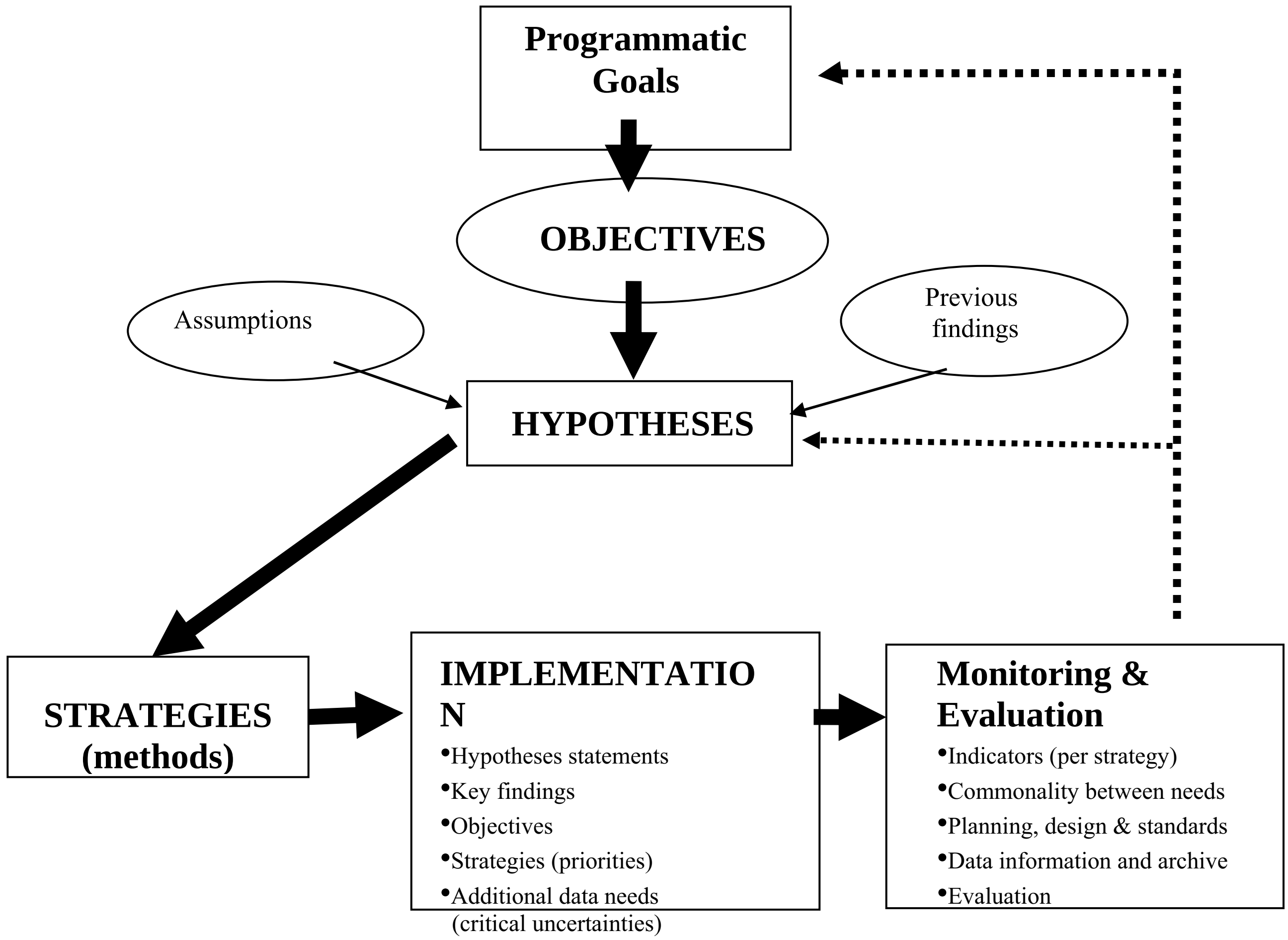

Figure 1. Conceptual model of how goals, objectives, strategies, and monitoring and research interrelate.

Monitoring and Evaluation Plan Objectives

The objectives (and subsequent hypotheses) of the Plan are generated in part from existing evaluations plans, the BAMP, and support the Hatchery Program Goals as defined by the HCP HC.

Objective 1: Determine if supplementation programs have increased the number of naturally spawning and naturally produced adults of the target population relative to a non-supplemented population (i.e., reference stream) and the changes in the natural replacement rate (NRR) of the supplemented population is similar to that of the non-supplemented population.

Hypotheses:

- Ho: Δ Total spawners $_{\text{Supplemented population}}$ > Δ Total spawners $_{\text{Non-supplemented population}}$

- Ho: Δ NOR[15] $_{\text{Supplemented population}} \geq \Delta$ NOR $_{\text{Non-supplemented population}}$
- Ho: Δ NRR $_{\text{Supplemented population}} \geq \Delta$ NRR $_{\text{Non-supplemented population}}$

<u>Objective 2:</u> Determine if the run timing, spawn timing, and spawning distribution of both the natural and hatchery components of the target population are similar.

Hypotheses:

- Ho: Migration timing $_{\text{Hatchery}}$ = Migration timing $_{\text{Naturally produced}}$
- Ho: Spawn timing $_{\text{Hatchery}}$ = Spawn timing $_{\text{Naturally produced}}$
- Ho: Redd distribution $_{\text{Hatchery}}$ = Redd distribution $_{\text{Naturally produced}}$

<u>Objective 3:</u> Determine if genetic diversity, population structure, and effective population size have changed in natural spawning populations as a result of the hatchery program. Additionally, determine if hatchery programs have caused changes in phenotypic characteristics of natural populations.

Hypotheses:

- Ho: Allele frequency $_{\text{Donor}}$ = Allele frequency $_{\text{Naturally produced}}$ = Allele frequency $_{\text{Hatchery}}$
- Ho: Genetic distance between subpopulations $_{\text{Year x}}$ = Genetic distance between subpopulations Structure $_{\text{Year y}}$
- Ho: Δ Spawning Population = Δ Effective Spawning Population
- Ho: Ho: Age at Maturity $_{\text{Hatchery}}$ = Age at Maturity $_{\text{Naturally produced}}$
- Ho: Size at Maturity $_{\text{Hatchery}}$ = Size at Maturity $_{\text{Naturally produced}}$

<u>Objective 4</u>: Determine if the hatchery adult-to-adult survival (i.e., hatchery replacement rate, HRR)[16] is greater than the natural adult-to-adult survival (i.e., natural replacement rate, NRR) and equal to or greater than the program specific HRR expected value (BAMP1998).

[15] Natural Origin Recruits.
[16] See Table 1 for HRR.

Hypotheses:

- Ho: $HRR_{Year\ x} \geq NRR_{Year\ x}$
- Ho: HRR ≥ Expected value per assumptions in BAMP

Objective 5: Determine if the stray rate of hatchery fish is below the acceptable levels to maintain genetic variation between stocks.

Hypotheses:

- Ho: Stray rate $_{Hatchery\ fish}$ < 5% total brood return
- Ho: Stray hatchery fish < 5% of spawning escapement of other independent populations [17]
- Ho: Stray rate $_{Hatchery\ fish}$ < 10% total within independent populations [18]

Objective 6: Determine if hatchery fish were released at the programmed size and number.

Hypotheses:

- Ho: Hatchery fish $_{Size}$ = Programmed $_{Size}$
- Ho: Hatchery fish $_{Number}$ = Programmed $_{Number}$

Objective 7: Determine if the proportion of hatchery fish on the spawning grounds affects the freshwater productivity (i.e., number of smolts per redd) of supplemented streams when compared to non-supplemented streams.

Hypotheses:

- Ho: Δ smolts/redd $_{Supplemented\ population}$ > Δ smolts/redd $_{Non\text{-}supplemented\ population}$

[17] This stray rate is suggested based on a literature review and recommendations by the ICTRT. It can be re-evaluated as more information on naturally-produced Upper Columbia salmonids becomes available. This will be evaluated on a species and program specific basis and decisions made by the HCP HC. It is important to understand the actual spawner composition of the population to determine the potential effect of straying.

[18] This stray rate is suggested based upon a literature review. It can be re-evaluated as more information on naturally produced Upper Columbia salmonids becomes available. The selected values will be evaluated on a species and program specific basis and decision.

Objective 8: Determine if harvest opportunities have been provided using hatchery returning adults where appropriate.

Hypotheses:

- Ho: Harvest rate ≤ Maximum level to meet program goals

Regional Objectives

Two additional objectives will be included within the total framework of this plan because they are related to the goals of the programs funded by Douglas PUD and other hatchery programs throughout the region. These regional objectives will be implemented at various levels into all M&E plans in the upper Columbia Basin region (Douglas PUD, Chelan PUD, Grant PUD, USFWS, and CCT). These objectives may be more suitable for a specific hatchery or subbasin, the results of which could be transferred to other locations. As such, the HCP HC should ensure that these efforts are coordinated throughout the region so resources are used efficiently. Other objectives that are deemed more regional in nature, per HCP HC, could also be included in the section.

Objective 9: Determine whether BKD management actions lower the prevalence of disease in hatchery fish and subsequently in the naturally spawning population. In addition, when feasible, assess the transfer of Rs infection at various life stages from hatchery fish to naturally produced fish.

Monitoring Questions:

Q1: What is the effect of BKD disease management on BKD disease prevalence?

Q2: Are study fish exposed to hatchery effluent infected to a greater extent than control fish?

Q3: Is Rs infection transferred at various life stages from hatchery fish to naturally produced fish or appropriate surrogates?[19]

Hypotheses Q1:

- Ho_1: Rearing density has no effect on survival rates of hatchery fish.
- Ha_1: Rearing density has an effect on survival rates of hatchery fish.

- Ho_2: Antigen level has no effect on survival rates of hatchery fish.
- Ha_2: Antigen level has an effect on survival rates of hatchery fish.

- Ho_3: Interaction between antigen level and rearing density has no effect on survival rates of hatchery fish.

[19] Hypothesis statements for these monitoring questions will be developed.

- $Ha_{3:}$ Interaction between antigen level and rearing density has an effect on survival rates of hatchery fish.

Hypothesis Q2:

- o Ho_1: Rs infection is not transferred from hatchery effluent to study fish.
- o Ha_1: Rs infection is transferred from hatchery effluent to study fish.

Objective 10: Determine if the release of hatchery fish impact non-target taxa of concern (NTTOC) within acceptable limits.

Hypotheses:

- Ho: NTTOC abundance $_{\text{Year x}}$ = NTTOC abundance $_{\text{Year y}}$
- Ho: NTTOC distribution $_{\text{Year x}}$ = NTTOC distribution $_{\text{Year y}}$
- Ho: NTTOC size $_{\text{Year x}}$ = NTTOC size $_{\text{Year y}}$

Detailed Objectives

Below, we detail the objectives, generate hypotheses, and describe the importance of each objective in accomplishing goals of the plan.

Objective 1: Determine if supplementation programs have increased the number of naturally spawning adults of the target population relative to a non-supplemented population

At the core of a supplementation program is the objective of increasing the number of spawning adults (both naturally produced and hatchery fish) in order to affect a subsequent increase in the number of returning naturally produced fish or natural origin recruits (NOR). This is measured as the Natural Replacement Rate (NRR). All other objectives of the M&E Plan either directly support this objective or minimize impacts of the supplementation program to non-supplemented population. Specific hypotheses tested under this objective are:

Ho: Δ Total spawners $_{\text{Supplemented population}}$ > Δ Total spawners $_{\text{Non-supplemented population}}$

Ho: Δ NOR $_{\text{Supplemented population}} \geq \Delta$ NOR $_{\text{Non-supplemented population}}$

Ho: Δ NRR $_{\text{Supplemented population}}$ > Δ NRR $_{\text{Non-supplemented population}}$

The supplementation program should in all cases increase the number of spawning adults (i.e., hatchery origin). If the supplementation program does not increase the number of spawners, the subsequent increase in natural produced fish cannot occur. Under this scenario, poor survival or high stray rates of the hatchery fish will prevent the objectives and goals of the hatchery program from being met.

When an increase in the spawning population has been observed, the subsequent increase in naturally produced retuning adults is determined by comparing the natural replacement rate of the treatment population to a reference population (i.e., non-supplementation fish). If supplementation fish do have a similar reproductive success as naturally produced fish, then the trend of the NRR of both populations should not differ over time. Should divergence of the NRRs occur and the treatment population NRR does decline over time, the level or strategy of supplementation will be reevaluated by the HCP HC and appropriate adjustments to the program would be recommended.

If reference streams are not available for all hatchery programs or are not suitable due to 1) effects of other hatchery programs or 2) biotic or abiotic conditions are different from the treatment stream, an alternate experimental design needs to be considered to examine this important aspect of the Plan. Relative productivity of hatchery and naturally produced fish can be empirically measured using DNA pedigree approach study design. This approach may not be logistically feasible for all programs (i.e., too many fish to sample or poor trap efficiency). Alternatively, a temporal rather than a spatial reference stream can be used. This approach would involve not releasing hatchery fish in a specific stream for at least one generation and determine if a change in the NNR is observed without hatchery fish present on the spawning grounds. Regardless of the approach or experimental design used, this component of the Plan is crucial and must be examined in order to determine if supplementation will result in an increased number of naturally produced adults.

Another important comparison, with or without reference streams, can be made by looking at different parental crosses (treatments) and what affects these crosses may have on NRR and HRR.

Objective 2: Determine if the run timing, spawn timing, and spawning distribution of both the natural and hatchery components of the target population are similar.

Supplementation is an integrated hatchery program. Hatchery and naturally produced fish are intended to spawn together and in similar locations. Run timing, spawn timing, and spawning distribution may be affected through the hatchery environment (i.e., domestication). If supplemented fish are not fully integrated into the naturally produced spawning population, the goals of supplementation may not be achieved. Hatchery adults that migrate at different times than naturally produced fish may be subject to differential survival. Hatchery adults that spawn at different times or locations than naturally produced fish would not be integrated into the naturally produced spawning population (i.e., segregated stock). Specific hypotheses tested under this objective are:

Ho: Migration timing $_{\text{Hatchery}}$ = Migration timing $_{\text{Naturally produced}}$

Ho: Spawn timing $_{\text{Hatchery}}$ = Spawn timing $_{\text{Naturally produced}}$

Ho: Redd distribution $_{\text{Hatchery}}$ = Redd distribution $_{\text{Naturally produced}}$

Broodstock collection and spawning protocols should ensure appropriate run timing and spawn timing of the supplemented fish, respectively. Observed differences in these indicators would suggest that protocols be reevaluated. Differences in redd distributions will be evaluated based upon the location that carcasses were recovered during spawning ground surveys. However, freshets or fall floods may limit the utility of these data. If the accuracy of carcass recovery location is questionable (i.e., floods), a more precise, although more labor intensive, indicator for redd distribution would involve determining the origin of actively spawning fish.

Objective 3: Determine if genetic diversity, population structure, and effective population size have changed in natural spawning populations as a result of the hatchery program. Additionally, determine if hatchery programs have caused changes in phenotypic characteristics of natural populations.

The genetic component of the Plan specifically addresses the long-term fitness of supplemented populations. Fitness, or the ability of individuals to survive and pass on their genes to the next generation in a given environment, includes genetic, physiological, and behavioral components. Maintaining the long-term fitness of supplemented populations, per the HCP Hatchery Program goals, requires a comprehensive evaluation of genetic and phenotypic characteristics. Evaluation of some phenotypic traits (i.e., run timing, spawn timing, spawning location and stray rates) is already addressed under other objectives.

Theoretically, a supplementation program should maintain genetic variation present in the original donor population, and as a program proceeds, genetic variability in hatchery- and naturally-produced fish in the supplemented population should be similar. Loss of within-population variation is a genetic risk of artificial production programs, and genetic divergence between hatchery and natural components of a supplemented population may lead to a loss of long-term fitness.

Differences in genetic variation among neighboring populations maintain the genetic population structure of drainages, basins, and regions. Mixing of populations in the hatchery (e.g., improper broodstock collection) or in the natural environment (e.g., excessive straying of hatchery fish) may lead to outbreeding depression and a loss of long-term fitness. Loss of between-population variation is also a genetic risk of artificial production programs, and can lead to long-term fitness loss at a scale larger than the population targeted for supplementation. Specific hypotheses tested under this objective for these issues are:

H_o: Allele frequency $_{\text{Hatchery}}$ = Allele frequency $_{\text{Natural}}$ = Allele frequency $_{\text{Donor}}$

H_o: Genetic distance between subpopulations $_{\text{Year x}}$ = Genetic distance between subpopulations $_{\text{Year y}}$

Supplementation should increase spawning population abundance as a result of high juvenile survival in the hatchery. Associated with an increase in returning spawner abundance should be an increase in effective population size (i.e., the number of actual breeders that produce successful offspring; N_e). The relative proportion of hatchery-origin spawners that participate in natural spawning is an important factor in realizing improvements in $N_{e.}$ A disproportionate number of hatchery spawners may cause inbreeding depression if their level of relatedness is relatively high due to expected high juvenile survival. A decrease in reproductive success and thus lowered N_e is an expected result of inbreeding. Lowered genetic variability is also expected. Achieving a larger N_e in a supplemented population should improve long-term fitness. The specific hypothesis tested under this objective for this issue is:

H_o: Spawning Population Size Change = Effective Population Size Change

Results of domestication selection may be expressed through changes in life history patterns. Changes in phenotypic traits can result from inadvertent selection during artificial propagation and rearing. Persistence of selection effects will be influenced by the genetic basis of a trait. Age and size at maturity are two important phenotypic traits that have not been already addressed in the Plan. Should domestication selection be found, changes in broodstock collection protocols and hatchery operations would be required. Specific hypotheses tested under this objective for this issue are:

H_o: Age at Maturity $_{\text{Hatchery}}$ = Age at Maturity $_{\text{Naturally produced}}$

H_o: Size at Maturity $_{\text{Hatchery}}$ = Size at Maturity $_{\text{Naturally produced}}$

<u>Objective 4:</u> Determine if the hatchery adult-to-adult survival (i.e., hatchery replacement rate) is greater than the natural adult-to-adult survival (i.e., natural replacement rate) and equal to or greater than the program specific expected value (BAMP 1998).

The survival advantage from the hatchery (i.e., egg-to-smolt) must be sufficient to overcome the survival disadvantage after release (i.e., smolt-to-adult) in order to produce a greater number of returning adults than if broodstock were left to spawn naturally. If a hatchery program cannot produce a greater number of adults than naturally spawning fish the program should be modified or discontinued. Production levels were initially developed using historical run sizes and smolt-to-adult survival rates (BAMP 1998). Using the stock specific NRR and the values listed in the BAMP, comparisons to actual survival rates will be made to ensure the expected level of survival has been achieved. Specific hypotheses for this objective are:

Ho: $HRR_{\text{year x}} \geq NRR_{\text{year x}}$

Ho: HRR ≥ Expected value per assumptions in BAMP

Using five-year mean and determining trends in survival of specific programs would address interannual variability in survival. Although annual differences among programs would still be analyzed to detect within year differences, which could explain some the variability among programs. Specific recommendations to increase survival would be provided for programs in which the HRR do not exceed the NRR or the expected values.

Table 1. The expected smolt to adult (SAR) and hatchery replacement rates (HRR) for Wells Complex programs based on assumptions provided in BAMP (1998).

Program	SAR	HRR
Methow spring Chinook	0.0030	4.5
Chewuch spring Chinook	0.0030	4.5
Twisp spring Chinook	0.0030	4.5
Wells summer Chinook (yearlings)	0.0030	4.9
Wells summer Chinook (subyearlings)	0.0012	3.0
Wells steelhead	0.0100	19.5

<u>Objective 5:</u> Determine if the stray rate of hatchery fish is below the acceptable levels to maintain genetic variation between stocks

Maintaining locally adapted traits of fish populations requires that returning hatchery fish have a high rate of site fidelity to the target stream. Hatchery practices (e.g., acclimation, release methodology and location) are the main variables that affect stray rates. Regardless of the adult returns, if adult hatchery fish do not contribute to the donor population the program will not meet the basic condition of a supplementation program. Fish that do stray to other independent populations should not comprise greater than 5% of the spawning population. Likewise, fish that stray within an independent population should not comprise greater that 10% of the spawning population. Specific hypothesis for this objective is:

Ho: Stray rate $_{\text{Hatchery fish}}$ < 5% total brood.

Ho: Stray rate $_{\text{Hatchery fish}}$ < 10% within independent populations

Stray rates should be calculated using the estimated number of hatchery fish that spawned in a stream and CWTs were recovered. Recovery of CWT from hatchery traps or broodstock may include "wandering fish" and may not include actual fish that spawned. Special consideration will be given to fish recovered from non-target streams in which the sample rate was very low (i.e., sample rate < 10%). Expansion of strays from spawning ground surveys with low sample rates may overestimate the number of strays (i.e., random encounter).

The rate and trend in strays from hatchery programs will be used to provide recommendations that would lead to a reduction in strays. Depending on the severity, hatchery programs with fish straying out of basin will be given high priority, followed by strays among independent populations, and finally strays within an independent population.

<u>Objective 6</u>: Determine if hatchery fish were released at the programmed size and number.

The HCP outlines the number and size of fish that are to be released to meet NNI compensation levels. Although many factors can influence both the size and number of fish released, past experience with these stocks should assist in minimizing impacts to the program. Specific hypotheses for this objective are:

Ho: Hatchery fish $_{\text{Size}}$ = Programmed $_{\text{Size}}$

Ho: Hatchery fish $_{\text{Number}}$ = Programmed $_{\text{Number}}$

Understanding causes of not meeting programmed release size or goal is important for the continued success of the program. Systematic problems must be identified and managed properly to achieve the objective(s) and goal of the program. Annual and some stock specific issues may be addressed via changes in hatchery operations.

A review of broodstock collection protocols every five years should occur concurrently with an evaluation of the number of fish released from each hatchery. In addition, the assumptions under pinning the HCP size at release goals should be evaluated and if necessary should be adjusted based upon the best scientifically based conclusions. In the absence of such studies, the HCP size at release goal should be the target for each hatchery program.

Objective 7: Determine if the proportion of hatchery fish on the spawning grounds affect the freshwater productivity (i.e., number of smolts per redd) of supplemented streams when compared to non-supplemented streams.

Out of basin effects (e.g., smolt passage and ocean productivity) have a strong influence on survival of smolts after they migrate from the tributaries. These effects introduce substantial variability into the adult-to-adult survival rates (NRR and HRR), which may mask in-basin effects (e.g., habitat quality, density related mortality, and differential reproductive success of hatchery and naturally produced fish). The objective of smolt monitoring programs in the Upper Columbia ESU is to determine the egg-to-smolt survival of target stocks. Smolt production models generated from the information obtained through these programs will provide a level of predictability with greater sensitivity to in-basin effects than spawner-recruitment models that take into account all effects.

A critical uncertainty with the theory of supplementation is the reproductive success of hatchery fish. Given the dependence of hatchery fish to assist in achieving program and recovery goals, monitoring smolt production with respect to the proportion of hatchery fish on the spawning grounds is critical in understanding subsequent adult-to-adult survival. While some factors that affect freshwater production require years or decades to detect change in productivity (e.g., habitat quality and quantity), other factors (e.g., spawner density and number of hatchery fish) can be adjusted annually in most tributaries.

The number of smolts per redd (i.e., smolt production estimate divided by total number of redds) will be used as an index of freshwater productivity. While compensatory mortality in salmonid populations cause survival rates to decrease as the population size increases, inferences regarding the reproductive success of hatchery fish may be possible by carefully examining and understanding this relationship. Inherent differences in productivity are expected among tributaries (spatial), changes in relative differences among years (temporal) would suggest differences in spawner productivity. Negative effects could then be minimized through actions take by the management agencies. Specific hypothesis for this objective is:

Ho: Δ smolts/redd $_{\text{Supplemented pop.}}$ > Δ smolts/redd $_{\text{Non-supplemented pop.}}$

Robust smolt production models derived from basin specific data are critical to this objective. In addition, accurate estimates of the proportion of hatchery fish on the spawning grounds will be needed. Inferences regarding the freshwater productivity cannot be made until both of these requirements are satisfied. Alternatively, DNA pedigree studies can be used to assess the relative freshwater production of hatchery and naturally produced fish within a tributary.

Objective 8: Determine if harvest opportunities have been provided using hatchery returning adults where appropriate.

In years when the expected returns of hatchery adults are above the level required to meet program goals (i.e., supplementation of spawning populations and/or broodstock requirements), surplus fish are available for harvest (i.e., target population). Harvest or removal of surplus hatchery fish from the spawning grounds would also assist in reducing genetic impacts to naturally produced populations (loss of genetic variation within and between populations). Specific hypotheses for this objective are:

Ho: Harvest rate ≤ Maximum level to meet program goals

A robust creel program on any fishery would provide the precision needed to ensure program goals are met. In addition, creel surveys would be used to assess impacts to non-target stocks.

Regional Objectives

Objective 9: Determine whether BKD management actions lower the prevalence of disease in hatchery fish and subsequently in the naturally spawning population. In addition, when feasible, assess the transfer of Rs infection at various life stages from hatchery fish to naturally produced fish.

The hatchery environment has the potential to amplify diseases that are typically found at low levels in the natural environment. Amplification could occur within the hatchery population (i.e., vertical and horizontal transmission) or indirectly from the hatchery effluent or commingling between infected and non-infected fish (i.e., horizontal transmission). Potential impacts to natural populations have not been extensively studied, but should be considered for programs in which the hatchery fish are expected to commingle with natural fish. This is particularly important for supplementation type programs. Specifically, the causative agent of bacterial kidney disease (BKD), *Renibacterium salmoninarum* (Rs), could be monitored at selected acclimation ponds, both in the water and fish, in which the risk and potential for transmission from the hatchery is highest. Although it is technologically possible to measure the amount of Rs in water or Rs DNA in smolts and adults non-lethally sampled, the biological meaning of these data are uncertain. Currently, the only metric available for M & E purposes is measuring the antigen level from kidney/spleen samples (i.e., ELISA). When available, non-lethal sampling may replace or be used in concert with lethal sampling.

Implementation of this objective will be conducted in a coordinated approach within the hatchery and natural environment. BKD management within the hatchery population (e.g., broodstock or juveniles) has the potential to reduce the prevalence of disease through various actions (e.g., culling or reduced rearing densities). BKD management must also take into account and support other relevant objectives of the M & E program (e.g., Hatchery Return Rate [HRR], number of smolts released). Hence, the goal of BKD management is to decrease the prevalence of disease and maintain hatchery production objectives (i.e., number and HRR).

As previously discussed, disease transmission from hatchery to naturally produced fish may occur at various life stages and locations. Of these, horizontal transmission from hatchery effluent, vertical transmission on the spawning grounds, and horizontal transmission in the migration corridor have been identified as disease interactions that could be examined under this objective, although others may also be relevant. Experimental designs addressing this objective may require technology not yet available, although in some instances samples may be collected, but not analyzed until a link can be established between bacteria levels in samples and disease prevalence.

Developing a complete set of questions and hypotheses statements for this objective may not be practical at this time, because there is currently no BKD Management Plan. However, while developing experimental designs for this objective, it may be feasible to incorporate both hatchery and natural environment monitoring under a single study design. Integration of the different aspects of the objective would likely result in a more robust approach into understanding the effectiveness of disease management strategies.

Monitoring Questions:

- Q1: What is the effect of BKD disease management on BKD disease prevalence?
- Q2: Are study fish exposed to hatchery effluent infected to a greater extent than control fish?
- *Q3: Is Rs infection transferred at various life stages from hatchery fish to naturally produced fish or appropriate surrogates?*[20]

Target Species/Populations:

- Q1 and Q2 both apply to spring Chinook (primary focus) and summer Chinook programs.

Hypotheses Q1:

- Ho_1: Rearing density has no effect on survival rates of hatchery fish.
- Ha_1: Rearing density has an effect on survival rates of hatchery fish.

- Ho_2: Antigen level has no effect on survival rates of hatchery fish.
- Ha_2: Antigen level has an effect on survival rates of hatchery fish.

[20] Hypothesis statements for these monitoring questions will be developed.

- Ho_3: Interaction between antigen level and rearing density has no effect on survival rates of hatchery fish.
- Ha_3: Interaction between antigen level and rearing density has an effect on survival rates of hatchery fish.

Hypothesis Q2:
- o Ho_1: Rs infection is not transferred from hatchery effluent to study fish.
- o Ha_1: Rs infection is transferred from hatchery effluent to study fish.

Measured Variables:
- Hypotheses Q1:
  - o Numbers of fish (at different life stages)

- Hypothesis Q2:
  - o Numbers of Rs+ fish

Derived Variables:
- Survival rates
- SARs
- HRRs

Spatial/Temporal Scale:
- o Hypotheses Q1:
  - o Analyze annually based on brood year.
- o Hypothesis Q2:
  - o Analyze annually.

Statistical Analysis:
- Hypotheses Q1: either 2-way ANOVA or response-surface design.
- Hypothesis Q2: ANOVA.

Analytical Rules:
- This is a monitoring indicator that will be used to support management decisions.
- Type I Error of 0.05.
- Effect sizes will be reported annually.

<u>Objective 10:</u> Determine if the release of hatchery fish impact non-target taxa of concern (NTTOC) within acceptable limits.

Supplementation of any stock or species will increase demand for resources and the potential of species interactions. The benefits gained from supplementation must be balanced with the ecological costs of the releasing hatchery fish into the ecosystem. Resource managers must be aware of and monitor potential impacts of supplementation related activities to non-target taxa. This is more important when supplementation activities involving more than one taxon are occurring simultaneously. For example, within the Methow Basin supplementation programs (i.e., spring Chinook, summer/fall Chinook, and steelhead), a spring Chinook harvest augmentation program and a coho reintroduction program release fish annually. At full program, the number of hatchery fish released into the Methow Basin would be approximately 2.4 million. Theoretical or realized benefits from supplementation activities may be at a cost to other taxa that are too great for the program to be deemed successful. In extreme cases, the costs of such activities may negate benefits of similar activities within the same subbasin. For example, predation by residualized hatchery steelhead may reduce the abundance of naturally produced spring Chinook fry that may subsequently result in a lower number of naturally produced adult spring Chinook.

In the Upper Columbia River ESU, a target species in one program is likely a non-target species in another program. The extent of spatial overlap is a decisive factor in determining the potential for ecological interactions and the associated risk. Consideration must be given to those fish that pose the greatest risk to NTT. Busack et al. (1997) categorized NTT into two classes. Strong interactor taxa (SIT) are those species that potentially could influence the success of the program through predation, competition, disease transmission or mutualistic relationships. Other NTT are classified as stewardship or utilization taxa (SUT), which are important ecologically or have high societal value.

Monitoring and evaluation plans concentrate efforts on the target species with little effort pertaining to the direct or indirect impacts to non-target species. In the Upper Columbia River ESU, a target species in one program is likely a non-target species in another program. There are also some stocks and species in which no artificial propagation programs have been initiated and as a result are non-target for all existing hatchery programs. While impacts to non-target taxa are often preconceived to be negative (e.g., competition, predation, behavioral, and pathogenic), positive impacts may also occur (e.g., nutrient enhancement and prey). Monitoring efforts will be concentrated on those interactions that pose the highest risk of limiting the success of the programs and deemed important for ecological reasons. Specific hypotheses for this objective are:

Ho: NTTOC abundance $_{\text{Year x}}$ = NTTOC abundance $_{\text{Year y}}$

Ho: NTTOC distribution $_{\text{Year x}}$ = NTTOC distribution $_{\text{Year y}}$

Ho: NTTOC size $_{\text{Year x}}$ = NTTOC size $_{\text{Year y}}$

If changes in abundance, distribution, and size of NTTOC occur, other information will need to be considered before attributing the changes to the hatchery program.

Strategies

The hypotheses and strategies that have been created in this plan were developed from the objectives of the hatchery program (Figure 1). As such, it is important to consider the goals and how they relate to the overall vision of the hatchery program, which is to meet NNI. The strategies outlined in this plan form the basis for how information will be collected and analyzed.

Commonalities among certain strategies and hypotheses will provide efficiencies in data collection and analysis. A detailed explanation of each strategy employed in the Plan is provided in the appendices to ensure repeatability in protocols, data collection, and analysis.

Other strategies and potentially hypotheses may be developed after information is collected and analyzed through the five-year review as specified in the HCP.

Indicators

An important function of the Plan is to define the indicators and methods used to measure the effect of hatchery fish on naturally spawning populations, guide hatchery operations and subsequent M&E activities. The indicators in the M&E Plan describe the biological data of interest. The protocols describe the strategy or methodologies used to measure or calculate the indicator. These are found in the appendices. The M&E Plan will also enable the hatchery committee to assess the progress toward meeting the goals and objectives of the hatchery program. The plan will be used to assure that the proper information is collected, and can be used to reevaluate hatchery production levels in 2013. In order to do this, each objective must have a:

- **Indicator**: A description of the biological data of interest. Each indicator must have a standardized methodology or protocol to ensure accuracy and precision are consistent spatially and temporally.

- **Baseline condition**: Each indicator must have a measurement or range of measurements (spatially and temporally) against which future conditions will be compared.

- **Target**: A scientifically defendable value that when obtained would lead to meeting the objective(s).

- **Performance Gap**: The difference in the baseline condition of an indicator and the target.

In order to refine the monitoring and evaluation plan with an appropriate detail, indicators are distributed into three categories: 1) the primary indicators that will be used initially to quantitatively assess if the objectives of the programs are being achieved (i.e., was the target reached or exceeded); 2) secondary indicators that will be used to collect information annually and may be used to calculate the primary indicator or assess whether the objectives are being reached in conjunction with the primary indicators; and 3) tertiary indicators that will be used when secondary indicators fail to explain some critical uncertainties in reaching the target. Primary indicators may reflect performance on a longer (temporal) or larger (spatial) scale where secondary and tertiary indicators are often used to drive smaller scale adjustments and refinements in operations to improve the likelihood of meeting the target.

To the extent possible, the objectives of this Plan must be quantifiable. The HC specified the capability to assess if the goals are being achieved. To assess this, indicators were developed that have targets associated with them that enable the HC to determine if the hatchery program is meeting objectives (see Tables 3 and 4).

Due to the variability in survival, monitoring and reporting will be conducted annually but evaluation of most objectives will be conducted over a five-year period. Measurements will center on the established indicators and whether the targets are being met. Trends in the primary indicators rather than simply the five-year mean will be important in determining if objectives are being achieved. Primary and secondary indicators will be calculated when needed (as dictated by the information obtained). However, in the event that these indicators fall below the agreed to target values, tertiary indicators may be required to explain the differences observed (uncertainty) and also a possible course of action.

Realistic targets for the indicators need to be identified. Targets set too low may lead to a perceived short-term success, but may ultimately result in the long-term failure of the hatchery program. Conversely, targets that are too high may lead to an unnecessary use of resources and a low cost-benefit ratio. The proposed initial targets for indicators appear in Table 3.

Supplementation is a strategy used in most of the hatchery programs (except Wells summer/fall Chinook) and will be the focus of discussion. As mentioned earlier, supplementation by definition implies that naturally spawning hatchery fish possess a similar reproductive potential as naturally produced fish. This critical uncertainty associated with the theory of supplementation is a primary focus of the M&E Plan and logically a majority of the primary indicators in this plan are related to testing this uncertainty. Thus, the targets of many of the indicators are based on measurements taken from naturally produced populations, both temporally and spatially (i.e., Before-After-Control-Impact Design or BACI). Under this statistical design, inferences can be made regarding the effectiveness of supplementation in achieving the goals of the hatchery program. Without the use of a control or reference population, changes in the indicators over time could not be attributed to the supplementation fish. Due to potential multiple treatment effects, a direct comparison of the indicators may be invalid. Instead, a comparison in the change of the indicators over time may be more appropriate. For example, if indicator A showed a 15% increase in the reference population in the first five years, a similar 15% increase in the treatment population would also be expected

Thus, any decrease in the change of the treatment population relative to the reference population could be attributed to the presence or abundance supplementation fish.

All primary and a proportion of the secondary indicators have a target. Those indicators that are influenced by out of basin causes (e.g., ocean productivity) or density dependent factors (e.g., egg-to-smolt survival) do not have a target identified in this Plan because the ability to change these indicators fall outside the control of the HC. All primary and secondary indicators will be calculated on an annual basis. Tertiary indicators would only be measured or calculated when required. Most primary indicators will be analyzed at the five-year scale. All secondary and tertiary indicators would be analyzed on an annual basis. The relationship between indicators and the methods used to calculate them is listed in Table 4. A list of appendices with detailed methodologies for each strategy is listed in Table 5.

Table 2. Relationship of hypotheses and strategies (methods) used in monitoring and evaluation plan.

Methods	*Relative increase in spawners of supplemented stream is greater than non-supplemented stream*	*NRR of supplemented stream is equal to that of non-supplemented stream*	*Run timing, spawn timing, and redd distribution of supplemented fish is equal to that of naturally produced fish*	*No loss of within or between genetic variability* *Size and age at maturity of hatchery fish is equal to that of naturally produced fish*	*Effective population size of supplemented stream increases in relation to spawning population*	*HHR is greater than NRR* *HRR is equal or greater than expected value*
Spawning ground survey	X	X	X	X	X	X
Creel surveys	X	X	X	X	X	X
Broodstock sampling	X	X	X	X	X	X
Hatchery juvenile sampling				X	X	X
Smolt trapping				X	X	X
Residual sampling				X	X	X
Precocity sampling				X	X	X
PIT tagging	X		X	X	X	X
CWT tagging	X	X	X	X	X	X
Radio tagging	X	X	X			
Genetic sampling	X			X	X	
Disease sampling						
Snorkel surveys		X	X			
Redd capping		X				
	Stray rates of hatchery fish are less than 5%	*Hatchery fish are released at programmed number and size*	*Hatchery fish have not increased the prevalence of disease in the supplemented stream or hatchery and naturally produced populations*	*Impacts to NTTOC (size, abundance, and distribution) are within acceptable levels*	*Supplemented streams have equal ratio of smolts/redd than non-supplemented streams*	*Harvest of hatchery fish is at or below the desired level to meet program goals*
Spawning ground surveys	X		X		X	X
Creel surveys	X					X
Broodstock sampling	X	X	X			X
Hatchery juvenile sampling		X	X			
Smolt trapping		X	X	X	X	
Residual sampling		X	X	X	X	
Precocity sampling		X	X	X	X	
PIT tagging		X		X	X	
CWT tagging	X	X	X			
Radio tagging	X					
Genetic sampling						
Disease sampling			X	X	X	
Snorkel surveys				X	X	
Redd capping				X	X	

Table 3. A list of primary indicators and targets used in the M&E Plan (S=supplementation; H=harvest augmentation). Data will be collected annually and analyzed when required (minimum every 5 years). The HC will reevaluate objectives and results and make recommendations. See Glossary for definition of indicators.
[1] Derived from plug numbers in BAMP

Objective #	Program	Indicator	Target	Preliminary results
1	S	Natural replacement rate	≥ Non-supplemented pop.	> 10 yrs
2/3	S	Run timing	= Naturally produced run timing	5 yrs
2/3	S	Spawn timing	= Naturally produced spawn timing	5 yrs
2/3	S	Redd distribution	= Naturally produced spawning distribution	5 yrs
3	S	Genetic variation	= Donor population	5 yrs
3	S	Genetic structure	= Baseline condition	5 yrs
3	S	Effective population size	Δ Spawning population size	5 yrs
3	S	Size and age at maturity	= Naturally produced fish	5 yrs
4	S/H	Hatchery replacement rate	≥ Expected value[1]	5 yrs
5	S/H	Stray rate	< 5% of adult returns	5 yrs
6	S/H	Number and size of fish	± 10% of production level	5 yrs
7	S	Smolts/redd	≥ Non-supplemented pop.	> 10 yrs
8	H	Harvest	≤ Maximum level	5 yrs
9	S/H	Disease	< Baseline values	> 5 yrs
10	S/H	NTTOC	Various (0-40%)	> 5 yrs

Table 4. Indicators that will be used in the monitoring and evaluation plan, indicator level (primary, secondary, and tertiary), and the strategies used to calculate the indicator.

Specific Indicators	Level	Strategies														
		Spawning ground surveys	*Creel surveys*	*Broodstock collection*	*Hatchery spawning*	*Hatchery juvenile sampling*	*Smolt trapping*	*Residual sampling*	*Precocity sampling*	*PIT tagging*	*CWT tagging*	*Radio tagging*	*Genetic sampling*	*Disease sampling*	*Snorkel surveys*	*Redd capping*
Natural replacement rate	1	X	X	X	X					X	X					
Spawning escapement	2	X						X	X	X	X	X	X	X	X	X
Spawning composition	2	X		X	X											
Sex ratio	2	X	X	X	X											
Recruits	2	X	X	X	X					X	X					
Number of redds	2	X														
Run timing	1			X						X		X				
Spawn Timing	1	X														
Redd Distribution	1	X														
Genetics variation/structure	1	X		X	X	X	X						X			
Effective pop. Size	1	X		X	X								X			
Broodstock composition	2			X	X											
Age at maturity	1	X	X	X	X											
Size at maturity	1	X	X	X	X											
Hatchery replacement rate	1	X	X	X	X	X		X	X	X	X			X		

Table 4. Continued.

Specific indicators	LLevel	*Strategies*														
		Spawning ground surveys	*Creel surveys*	*Broodstock collection*	*Hatchery spawning*	*Hatchery juvenile sampling*	*Smolt trapping*	*Residual sampling*	*Precocity sampling*	*PIT tagging*	*CWT tagging*	*Radio tagging*	*Genetic sampling*	*Disease sampling*	*Snorkel surveys*	*Redd capping*
Smolt-to-adult	2	X	X	X	X	X	X	X	X	X	X			X		
Number of broodstock	2			X	X											
Precocity rates	2					X	X		X							
Residualism rates	2						X	X	X	X	X					
Stray rate	1	X	X	X	X					X		X	X			
Days of acclimation	2					X				X	X					
Number juveniles released	1			X	X	X				X				X	X	
Fecundity	2			X	X											
Broodstock survival	2			X	X											
In-hatchery survival	2					X				X	X			X		
Size of juveniles released	1			X	X	X		X	X	X	X			X	X	
Growth rates	2				X	X										
Incubation timing	3				X	X										
Disease	1					X								X		
Density index	2					X										
Flow index	2					X										

Table 4. Continued.

Specific Indicators	LLevel	*Strategies* Spawning ground surveys	*Creel surveys*	*Broodstock collection*	*Hatchery spawning*	*Hatchery juvenile sampling*	*Smolt trapping*	*Residual sampling*	*Precocity sampling*	*PIT tagging*	*CWT tagging*	*Radio tagging*	*Genetic sampling*	*Disease sampling*	*Snorkel surveys*	*Redd capping*
Pathogen values	2					X								X		
Hatchery effluent	2					X								X		
Smolts per redd	1	X					X								X	X
Egg-to-smolt	2	X					X								X	X
Egg-to-parr	3	X					X								X	X
Parr-to-smolt	3	X					X								X	X
Smolt-to-smolt	3	X					X			X						
Egg-to-fry	3	X														X
NTTOC (A,S,D)	1						X	X	X	X					X	
Harvest rate	1	X	X	X	X						X					

Table 5. List of appendices outlining the methodologies for calculating indicators used in the M & E plan.

Appendix	Strategy	Indicator(s)	
		Primary	Secondary and/or tertiary
A	Broodstock protocols	Not applicable	Broodstock number
B	Broodstock collection	Run timing	Broodstock number, male to female ratio, run composition, run timing, trap efficiency, extraction rate
C	Hatchery evaluations	Number and size of fish released	Age at maturity, length at maturity, spawn timing, fecundity, broodstock survival, juvenile hatchery survival, rearing density index, incidence of disease
D	Post-release survival and harvest	HHR Exploitation rate	SAR, harvest rates
E	Smolt trapping	Smolts per redd	Smolt production, egg-to-smolt survival, overwinter survival, size at emigration
F	Spawning ground surveys	NRR Spawn timing Redd Distribution	Spawning escapement, redd count, spawning composition, age structure, size at maturity, stray rates,
G	Relative abundance	NRR	Recruits
H	Genetics	Genetic variation Stock structure Effective pop. size	Broodstock composition, spawning composition, stray rates
I	NTTOC	NTTOC	Size, abundance, and distribution
J	Disease sampling	Naturally produced fish incidence of disease Hatchery fish incidence of disease	Flow index, hatchery effluent

Implementation

A statement of work based on this document will be developed annually that outlines and prioritizes proposed M&E activities for the upcoming field season. This document will be reviewed by the HCP HC for approval before being finalized prior to the field season. The draft statement of work should be completed no later than July 1 and approved by the HCP HC no latter than September 1, unless otherwise agreed to by the HCP HC.

The annual plan will serve two purposes; allow the HCP HC to determine whether the monitoring efforts are prioritized correctly and to determine costs of the program for budgeting.

Reporting

A yearly comprehensive report, in the form of a technical memorandum, will be completed for HC review. A draft of the report will be ready for distribution by March 1 of the year following the monitoring efforts. A final report will be completed by the middle of May of the same year.

Within the annual report, all indicators that were measured for that particular year will be displayed. This will include topics such as smolt trapping information, run timing, spawn timing, redd distribution, stray rates, and all other information that is generated by additional analyses, like smolt-to-adult survival, NRR, HRR, etc. Tables 3 and 4 should be used as guidance on what indicators are reported, as well as the yearly statement of work that is agreed upon by the HC.

It will also be important to maintain cumulative information that is updated yearly as appendices to the technical memorandum.

Glossary

The following is a definition of terms used throughout the M&E Plan:

<u>Age at maturity</u>: the age of fish at the time of spawning (hatchery or naturally)

<u>Augmentation</u>: a hatchery strategy where fish are released for the sole purpose of providing harvest opportunities.

<u>Adult-to-Adult survival (Ratio)</u>: the number of parent broodstock relative to the number of returning adults.

<u>Broodstock</u>: adult salmon and steelhead collected for hatchery fish egg harvest and fertilization.

<u>Donor population</u>: the source population for supplementation programs before hatchery fish spawned naturally.

Effective population size (N*e*): the number of reproducing individuals in an ideal population (i.e., N*e* = N) that would lose genetic variation due to genetic drift or inbreeding at the same rate as the number of reproducing adults in the real population under consideration (Hallerman 2003).

ESA: Endangered Species Act passed in 1973. The ESA-listed species refers to fish species added to the ESA list of endangered or threatened species and are covered by the ESA.

Expected value: a number of smolts or adults derived from survival rates agreed to in the Biological Assessment and Management Plan (BAMP 1998).

Extraction rate: the proportion of the spawning population collected for broodstock.

Genetic Diversity: all the genetic variation within a species of interest, including both within and between population components (Hallerman 2003).

Genetic variation: all the variation due to different alleles and genes in an individual, population, or species (Hallerman 2003).

Genetic stock structure: a type of assortative mating, in which the gene pool of a species is composed of a group of subpopulations, or stocks, that mate panmictically within themselves (Hallerman 2003).

HCP: Habitat Conservation Plan is a plan that enables an individual or organization to obtain a Section 10 Permit which outlines what will be done to "minimize and mitigate" the impact of the permitted take on a listed species.

HCP-HC Habitat Conservation Plan Hatchery Committee is the committee that directs actions under the hatchery program section of the HCP's for Chelan and Douglas PUDs.

HRR: Hatchery Replacement Rate is the ratio of the number of returning hatchery adults relative to the number of adults taken as broodstock, both hatchery and naturally produced fish (i.e., adult-to-adult replacement rate).

Long-term fitness: Long-term fitness is the ability of a population to self-perpetuate over successive generation.

Naturally produced: progeny of fish that spawned in the natural environment, regardless of the origin of the parents.

NRR: Natural replacement rate is the ratio of the number of returning naturally produced adults relative to the number of adults that naturally spawned, both hatchery and naturally produced.

(NTTOC) Non-target taxa of concern: species, stocks, or components of a stock with high value (e.g., stewardship or utilization) that may suffer negative impacts as a result of a hatchery program.

Productivity: the capacity in which juvenile fish or adults can be produced.

Reference population: a population in which no directed artificial propagation is currently directed, although may have occurred in the past. Reference populations are used to monitor the natural variability in survival rates and out of basin impacts on survival.

Segregated: a type of hatchery program in which returning adults are spatially or temporally isolated from other populations.

(SAR) Smolt-to-adult survival rate: smolt-to-adult survival rate is a measure of the number of adults that return from a given smolt population.

Size-at-maturity: the length or weight of a fish at a point in time during the year in which spawning will occur.

Smolts per redd: the total number of smolts produced from a stream divided by the total number of redds from which they were produced.

Spawning Escapement: the number of adult fish that survive to spawn.

Stray rate: the rate at which fish spawn outside of natal rivers or the stream in which they were released.

Supplementation: a hatchery strategy where the main purpose is to increase the relative abundance of natural spawning fish without reducing the long-term fitness of the population.

Target population: a specific population in which management actions are directed (e.g., artificial propagation, harvest, or conservation).

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Appendices

APPENDIX A

Broodstock Collection Protocols

The Broodstock Collection Protocol is intended to be implemented over a five-year period, consistent with the M & E plan. This protocol will be updated annually base don the yearly run size estimates by the HCP-HC. This appendix provides the methodology to determine where and when the actual broodstock would be collected and allows for in-season escapement estimates. Appendix B (broodstock collection) provides the broodstock composition and numbers and will be used annually to adjust the broodstock collection composition.

This protocol was developed for hatchery programs associated with the Wells Habitat Conservation Plan. Hatchery programs or facilities operated by other agencies or tribes are not addressed in the document. Trapping facilities associated with these programs have been operated in a similar manner without modifications for an adequate period of time to allow baseline data collection. Using the actual trap extraction efficiencies broodstock collection protocols could be developed under a large range of run escapement scenarios. This adult broodstock collection protocol is intended for implementation over a five-year period, consistent with the M & E plan. After which, the Hatchery Committee could modify the protocol where appropriate to ensure collection goals are met while maintaining consistency with the overall program goals. As trap modifications are completed in the Methow Basin (Twisp trap in 2005, Chewuch trap in 2006), trap efficiencies and extraction rates for the new facilities would be calculated.

The general approach in developing this protocol involved analyzing the last five years of run timing and trapping data. Using the trapping period outlined in the 2004 protocol, stock specific daily and cumulative passage dates (i.e. 25%, 50%, 75%) were calculated (Table 1). Weekly collection goals were calculated based on the proportion of the broodstock goal expected to migrate upstream of the collection location (Table 2). Weekly collection values would differ if the broodstock goal was not expected to be obtained for a given stock. Using pre-season escapement estimates and the five-year trap extraction efficiencies (Table 3), the probability of achieving the broodstock collection goal can be estimated assuming the following general guidelines:

- **Very high probability** - If the required trap extraction efficiency (broodstock goal/estimated escapement) is below the observed five-year minimum trap extraction efficiency.

- **High probability** - If the required trap extraction efficiency (broodstock goal/estimated escapement) is below the observed five-year average trap extraction efficiency.

- **Moderate probability** - If the required trap extraction efficiency (broodstock goal/estimated escapement) is below the observed five-year maximum trap extraction efficiency.

- **Low probability** - If the required trap extraction efficiency (broodstock goal/estimated escapement) is above the observed five-year maximum trap extraction efficiency.

As previously mentioned, in-season escapement estimates will also be used to estimate the probability of achieving broodstock collection goals. When the probability of achieving the broodstock goal is estimated to be moderate or low, modifications to the collection protocol, broodstock composition, or production level would occur on a stock specific basis (See flow charts).

Table 1. Cumulative passage dates of salmon and steelhead stocks based on the trapping period.

Stock	Cumulative passage dates during trapping period[1]			
	25%	50%	75%	100%
MEOK summer	12 Jul	22 Jul	08 Aug	14 Sept
MEOK steelhead	29 Aug	15 Sep	28 Sep	31 Oct
Met comp. spring	10 May	21 May	2 Jun	28 Jun
Twisp spring[1]	10 May	21 May	2 Jun	28 Jun

[1] To be determined at Twisp Weir following operation of new weir.

Table 2. Weekly collection quotas for spring Chinook, summer Chinook and steelhead.

Week	MetComp[1]	Twisp spring		Wells Summer		MEOK Steelhead	
		H	NP	H	NP	H	NP
07 May	24		12				
14 May	32		16				
21 May	42		21				
28 May	44		22				
04 Jun	24		12				
11 Jun	20		10				
18 Jun	16		8				
25 Jun	14		7				
02 Jul	10		5				
09 Jul	8		4				
16 Jul	4		2	232	26		
23 Jul	2		1	195	22		
30 Jul	1		1	195	22		
06 Aug				195	22	15	6
13 Aug				154	17	20	8
20 Aug				69	8	32	11
27 Aug				37	4	32	11
03 Sep						32	11
10 Sep						32	11
17 Sep						51	21
24 Sep						36	12
01 Oct						28	11
08 Oct						25	10
15 Oct						15	6
22 Oct						5	4
29 Oct						3	1
31 Oct							
07 Nov							
Total	242	0	121	1077	121	326	123

[1] A combination of hatchery and wild fish collected at Methow FH, Foghorn and Chewuch weir.

Table 3. Historical trap extraction rates and required escapement levels to achieve broodstock goal under average extraction rates.

Stock	Broodstock goal		Required escapement		Observed extraction rate[1]		
	W	H	W	H	Mean	Min	Max
Wells summer	121	1077					
MEOK steelhead	123	326					
Twisp spring	121	0					
Met comp	121	121					

Methow River Basin Spring Chinook

The spring Chinook collection protocols will target specific populations of fish in the Methow Basin through broodstock collections in tributary locations and the remainder collected at Methow Hatchery. Fish will be collected from tributaries in an attempt to increase the number of natural origin fish incorporated into the broodstock and to improve local tributary survival attributes.

Consistent with the BAMP (1998), Biological Opinion for ESA Section 10 Permit 1196; Permit 1196; and the Biological Opinion for Section 7 Consultation on the Interim Operations for the Priest Rapids Hydroelectric Project (FERC N0. 2114), WDFW proposes to collect broodstock consistent with the production level of 550,000 smolts, development of local tributary attributes and in a manner that reduces the Carson lineage within the supplementation production.

The collection protocol outlines trapping at the Methow FH outfall and tributary trapping on the Methow, Chewuch, and Twisp rivers. Site specific broodstock collection numbers and origin may vary due to unknown tributary trap efficiency, origin composition and extent of the return; however, the maximum number of broodstock spawned will not exceed 363 fish (assuming a 50:50 sex ratio). If sex ratios are skewed toward the male component, additional females may be targeted for broodstock collection. Accurate sex determination is difficult early in the collection period; therefore, any shortfall in the number of females required for full production will likely be known toward the latter stages of broodstock collection. Additional collection at this time will require release of excess males in an effort to maintain a total spawning population no greater than 363 fish. All fish released will be retuned to the tributary of collection. Three hundred and sixty-three fish (182 females) accounts for a 15% reduction expected due to ELISA culling, 5% pre-spawn mortality and maximum facility production of 550,000 smolts. The number of natural origin fish available for broodstocking purposes will be revised "in-season" and will be proportional, based on the initial forecast provided in Table 2 of the 2005 upper Columbia River Salmon and Steelhead Escapement and Broodstock Forecast.

Current estimates have 4,573 Chinook destine above Wells Dam, 33% or 1,528 are expected to be natural origin (TAC forecast have no effect on this estimate, since the estimate was derived from hatchery releases, hatchery SARs, and natural production (R/S estimates) and not based on the TAC estimate). "In-season" estimates of natural origin Chinook to individual tributaries will be estimated based on proportion natural origin returns to Twisp, Chewuch and upper Methow (Table 2 of the 2004 upper Columbia River Salmon and Steelhead Escapement and Broodstock Forecast) and 33% proportion of natural origin fish in the total return past Wells Dam. Natural origin fish inclusion into the broodstock will be a priority, with natural origin fish specifically being targeted; however, natural origin fish collections will not exceed 33% of the projected or in-season estimated return to any tributary spawning population.

Methow FH Spring Chinook

Biological Assumptions

Production level	550,000 yearling smolts
Propagation survival	90% fertilization to release
Maximum broodstock require	363
Natural origin/hatchery broodstock composition	90% / 10%
Pre-spawn survival	95%
Female to male ratio	1 to 1
Fecundity	4,200 eggs/female
ELISA cull rate	15%

Winthrop NFH spring Chinook program (BAMP):

Production Objective	600,000 yearling smolts
Broodstock required	352 (BAMP)

Trapping Locations

Methow River

Foghorn Dam 1 May – 30 July

Trap 7-days/week- Operated by WDFW personnel. Adipose present Chinook will be retained at this site. All fish collected at this site will be held at the Methow FH. Up to 121 fish (9.9% of the 1,228 fish projected to return to the mainstem Methow River) may be retained for broodstock purposes. One hundred percent (121 fish) may be natural origin (29.5% of the 410 natural origin fish projected to return to the mainstem Methow River). If other trap locations at the Methow FH, and Fulton Dam experience collection shortfalls, additional fish may be collected over and above the 121 fish to effectively minimize the shortfall.

In-season estimates of natural origin fish returning to the upper Methow River will be provided through initial estimates provided in Table 2 of the 2005 escapement and broodstock forecast and observed passage at Wells Dam. Overall broodstock collection and number of natural origin fish retained will be modified, in-season, as necessary to maintain a collection protocol that removes no more than 33% of the return. Fish collected at from the Methow River will be held at the Methow FH.

Chewuch River

Fulton Dam Trap 1 May – 30 July

Trap 7-days/week- Operated by WDFW personnel. The WDFW will also attempt to seine broodstock once a week at locations determined to be effective and where fish can be safely transported to Methow Hatchery. Angling will be used as a last resort if all other methods do not provide adequate broodstock.

Adipose present spring Chinook will be retained from the Chewuch River. Up to 121 fish (7.9% of the 1,524 fish projected to return to the Chewuch River) may be retained for broodstock purposes, of which, up to 121 natural origin fish (17% of the 680 natural origin fish projected to return to the Chewuch River) may be retained for broodstock purposes. If other trap locations at the Methow FH and Foghorn Dam experience collection shortfalls, additional fish may be collected over and above the 121 fish to effectively minimize the shortfall.

In-season estimates of run size and origin of spring Chinook to the Chewuch River will be made, similar to that described for the Methow River. The collection protocols will be modified as necessary to maintain an extraction of no more than 33% of the projected return. Fish collected at the Chewuch trap will be held at the Methow FH.

The trapping efficiency of the Fulton facility averaged 30% between 1992 and 1994, ranging from a low of 9.2 in 1992 to a high of 58.2% in 1993. Significant river flows in 1996 and 1997 disrupted the configuration of the dam, likely reducing the potential trapping efficiencies from those observed between 1992 and 1994. Maintenance work completed in the spring of 2001 was expected to return trapping efficiencies to approximately 60%. Unfortunately, the 2001 trapping efficiencies were approximately 3.5%, significantly less than anticipated. During the late winter/early spring of 2002, minor construction was again performed at the Fulton Dam site, seeking improvements to trapping efficiencies. Trapping efficiencies during the 2002 broodstock collection fell to just 0.3%, a clear indication that the modifications completed in 2001 and 2002 failed to return the trap to pre-1994 trapping efficiencies.

Current snow-pack in the Methow River Basin is low and reminiscent of conditions in 2001. Based on current snow-pack conditions, WDFW expects flow in the Chewuch basin to be similar to 2001 and therefore, expects trap extraction rates to be similar to 2001 (approximately 3.5%). WDFW anticipates the Fulton Dam trap to provide approximately 24 natural origin and 29 hatchery origin fish. Based on the anticipated collection at Fulton Dam, collections at the Methow FH will be required to address the shortfall in adult collections at Fulton Dam.

Twisp River

Twisp Weir 1 May – 30 July

Trap 7-days/week- Operated by WDFW personnel. A floating weir on the Twisp River provides for collection of Twisp stock spring Chinook. Historically, trap efficiency at this facility has been low, averaging 16% (range 10.4% – 23.7%) between 1992 and 1994. During the 2001 trapping season, the trap efficiency was just 6% and fell to just 0.2% in 2002. A modified V-trap installed along the weir sill, adjacent to the trap entrance, increased the trap efficiency in 2003 to 42%; however the 2004 trap efficiency was estimated at 19.2%. The installation of the permanent V-trap will allow trapping over a greater range of stream flows and should provide greater extraction potential than observed in 2004. To guard against extracting more than 33% of the natural origin return, WDFW assumes the weir to have 100% extraction potential. Based on an assumed 100% extraction potential, one of three natural origin fish captured will be retained for broodstock, effectively limiting the extraction to 33%.

Based on an escapement estimate of 1,167 fish, including 445 natural origin and 722 hatchery origin fish (2005 escapement and broodstock forecast), up to 121 fish (10.4% of the projected return to the Twisp River.) may be retained for broodstock purposes, of which a collection goal of 121 fish (27% of the projected natural origin return to the Twisp River) may be natural origin. In-season estimates of run size and origin of spring Chinook to the Twisp River will be made, similar to that described for the Methow River. The collection protocols will be modified as necessary to maintain an extraction of no more than 33% of the projected return. Twisp origin spring Chinook trapped at this site will be held at the Methow FH.

The Twisp weir poses several operating constraints, including stranding of steelhead and spring Chinook on the weir pickets during upstream and downstream movement. The new weir design is capable of submerging the pickets to allow stranded fish to swim off the pickets. The weir will be manned 24-hours/day to facilitate operation to minimize impact to steelhead kelts and spring Chinook fallback. If the new weir design and operation cannot adequately address kelt migration or spring Chinook fallback, trapping will cease and the weir removed (pending appropriate flow conditions).

Methow FH

Methow FH Outfall Trap 01 May – 30 July

Collection at the Methow Fish Hatchery outfall will be variable and dependent upon success of tributary collections. Outfall trapping will be used in conjunction with tributary traps, seining and angling to achieve a production level of 550,000 ESA-listed upper Columbia River spring Chinook smolts.

Winthrop NFH

Trapping is expected to occur at the Winthrop NFH and will be consistent with collection protocols provided by the USFWS. Additional adult collection at Winthrop NHF may occur, if required to meet broodstock collection shortfalls at the Methow FH, Foghorn Dam and Fulton Dam.

Wells Dam

No spring Chinook trapping at Wells Dam will occur unless the total annual adult return to Wells Dam is predicted to be 668 or less as identified in Section 10 Permit 1196.

Columbia River Mainstem below Wells Dam

Wells Hatchery Summer Chinook

Biological Assumptions

Wells program	320,000 yearling smolts (182 adults)
	484,000 subyearlings (266 adults)
Lake Chelan program	100,000 green eggs (44 adults)
Rocky Reach program	200,000 yearling smolts (114 adults)
	628,000 subyearlings (345 adults)
	450,000 accel. subyearling (247 adults)
Broodstock required	1,198
Broodstock composition	10% natural origin from west ladder
Pre-spawn survival	90%
Female to male ratio	1 to 1
Fecundity	5,000 eggs per female
Propagation survival	81% unfertilized egg to 0+ release
	78% unfertilized egg to 1+ release

Trapping Assumptions

Trapping period	14 July – 28 August (hatchery origin)
	01 July – 14 September (natural origin)
# Days/week	3
# Hours/day	16 (Monday-Wednesday)
Broodstock composition	10% natural origin from west ladder
Broodstock number	Not to exceed 33% of the population

The goal of the Wells/Turtle Rock summer Chinook program is to provide harvest augmentation. Those fish that are not harvested have the potential and have been documented to spawn in tributaries where supplementation is currently ongoing. Until a terminal fishery is developed or methods to reduce the number of Wells/Turtle Rock fish that spawn in tributaries are found, infusing natural origin genes into the broodstock will minimize the risk of inbreeding depression, genetic drift, and domestication selection. This is consistent with the objectives of the Harvest and Genetic Reserve program as outlined by NOAA Fisheries (Rob Jones, NOAA Fisheries, personal communication).

Collect 1,198 run-at-large summer Chinook from the volunteer ladder trap at Wells Fish Hatchery outfall (1,077 hatchery fish) and west ladder (121 natural origin fish). The 3-year old component will be limited to 10% of the broodstock collection to minimize the potential of reduced production as a result of a strong 3-year-old age class, as was the case in 2001. In the event excess fish are collected, they will be returned to the Columbia River below Wells Dam.

Methow / Okanogan River Basins

Wells Hatchery Steelhead

Biological Assumptions

Wells HCP (Methow/Okanogan)	349,000 yearling smolts (178 adults)
Grant PUD BiOp (Methow/Okanogan)	100,000 yearling smolts (52 adults)
WNFH transfer (Methow River)	100,000 smolts (55 adults)
Ringold transfer (Columbia River)	180,000 smolts (88 adults)
Grant PUD Survival Studies	147,000 yearling smolts (76 adults)
Broodstock required	449 Adults
Natural origin/hatchery broodstock composition	
Wells Production [1/]	33% / 67%
Survival Studies	0% / 100%
Pre-spawn survival	97%
Female to male ratio	1 to 1
Fecundity	5,400 eggs per female
Propagation survival	87% fertilization to eyed egg
	86% eyed egg to yearling release
	75% fertilization to yearling release

[1/]- Includes Wells HCP, Grant PUD BiOp, Winthrop NFH and Ringold production.

Trapping Assumptions

Trapping period	01 July – 29 October
# Days/week	3
# Hours/day	16
Broodstock number/composition	
Wells Production	373 - (33% natural / 67% hatchery)
Survival Studies	76 - (0% natural / 100% hatchery)
Total Broodstock	449 – (27% natural / 735 hatchery)

Trapping efforts will selectively retain 449- steelhead at Wells Dam (East and West ladder collection), to attain a 33% natural origin component within the “Wells production” broodstock (123 natural origin steelhead) and 100% hatchery origin within the survival study production components. Overall collection will not exceed 33% of the expected return (hatchery or natural origin). Increasing the natural origin component within the broodstock to near 33% will provide opportunities to increase the HxW and WxW parental cross proportion from what has occurred previously under random run-at-large collections. Increasing the number of HxW and WxW parental crosses within the Wells Program is consistent with management objectives described in WDFW’s ESA Section 10 Permit 1395 Application and consistent with other upper Columbia River summer steelhead supplementation efforts. Collection within the “Wells Production” component will also be selective for adipose present hatchery origin steelhead (HxW parental crosses), consistent with production objectives. The east and west ladder traps at Wells Dam will be operated concurrently, three days per week, up to 16 hours per day. Trapping on the east ladder will be commensurate with summer Chinook brood stocking efforts through 14 September and will continue through 29 October, concurrent with west ladder collections. All steelhead excluded from the broodstock will be directly passed upstream at the trapping site or captured, examined and released upstream from the trap site.

Adult return composition including number, origin, age structure, and sex ratio will be assessed in-season at Priest Rapids and Wells dams. Broodstock collection adjustments will be made consistent with the estimated return of natural origin steelhead to Wells Dam and production objectives

APPENDIX B

Broodstock Collection

Task 1: Collect the required number of broodstock that represent the demographics of the donor population with minimal injuries and stress to target and non-target fish. (*Broodstock number, male to female ratio, run composition, run timing, trap efficiency, extraction rate*)

Task 1-1. Develop broodstock trapping protocol based on program goal, estimated escapement, number and age classes of returning wild fish, minimum proportion of wild fish required in the broodstock, and demographics of the donor population to achieve production levels (Table 1).

a. Ensure broodstock collection protocols are consistent with Section 10 Permits.

b. Reexamine and modify assumptions of the broodstock protocol to reflect recent data (e.g., male to female ratio, fecundity, prespawn survival, egg to smolt survival).

Table 1. Annual broodstock collection worksheet for Wells Complex programs.

Stock	Estimated escapement		Broodstock goal		Required extraction rate		Observed extraction rate			Estimated broodstock	
	W	H	W	H	W	H	Avg	Min	Max	W	H
Wells summer			121	1,077							
Wells steelhead			76	153							
Met comp. spring			242	0							
Twisp spring			121	0							

Task 1-2. Monitor operation of adult traps in the Twisp River, Chewuch River, Fulton Dam, Methow Hatchery, Wells Hatchery and Wells Dam. Ensure compliance with established broodstock collection protocols and Section 10 permits for each station.

a. Record date, start time, and stop time of trapping operations.

Task 1-3. Conduct in-season run forecasts and modify broodstock protocols accordingly (Table 2).

a. Monitor run timing at Columbia River dams and make comparisons using previous years data.

b. Determine run timing and size using PIT tag detections at Columbia River Dams.

c. Make recommendations to broodstock collection protocols to increase probability of collecting broodstock goal.

Table 2. In-season Chinook and steelhead escapement worksheet.

Stock	Pre-season run estimate	Cumulative passage dates during trapping period[1]				In-season run estimate
		25%	50%	75%	100%	
MEOK summer		12 Jul	22 Jul	08 Aug	14 Sept	
MEOK steelhead		29 Aug	15 Sep	28 Sep	31 Oct	
Met comp. springer		10 May	21 May	2 Jun	28 Jun	
Twisp spring[1]		10 May	21 May	2 Jun	28 Jun	

[1] To be determined at Twisp Weir following operation of new weir.

Task 1-4. Monitor timing, duration, composition, and magnitude of the salmon and steelhead runs at adult collection sites.

a. Maintain daily records of trap operation and maintenance, number and condition of fish trapped, and river stage.

b. Record species, origin, and sex of all fish collected for broodstock.

c. Record species, origin, and sex of all fish not collected for broodstock (i.e., passed upstream).

d. Collect biological information on trap-related moralities. Determine the cause of mortality if possible.

Task 1-5. Evaluate the efficacy of the broodstock protocol in achieving collection goals.

a. Summarize results and review assumptions, escapement estimates, extraction rates, and broodstock goals.

b. Calculate trapping efficiency (TE).

$$TE = \text{Number of fish trapped/Estimated spawning escapement}$$

c. Calculate extraction rate (ER).

$$ER = \text{Number of fish collected/Estimated spawning escapement}$$

d. Ensure broodstock collections follow weekly collections quotas.

e. Calculate trap operation effectiveness (TOE).

$$TOE = \frac{\text{Number of hours trap operated}}{\text{Maximum number of hours trap could operate per protocol}}$$

f. Calculate estimated maximum trap efficiency (i.e., TOE = 1).

$$\text{Estimated Max. TE} = \frac{\text{Number of fish trapped/TOE}}{\text{Estimated spawning escapement}}$$

g. Provide recommendations on means to improve adult trapping and refinements to broodstock collection protocols for each stock.

APPENDIX C

Hatchery Evaluation

Task 2: Conduct spawning operations and collect biological data from broodstock (*Age at maturity, length at maturity, spawn timing, fecundity)*

Task 2-1. Collect biological data from all broodstock during spawning including mortality (i.e., date, origin, scales, fork length and POH, DNA, CWT, and PIT tags).

a. All females are sampled for disease (i.e., kidney, spleen, ovarian fluid).

Task 2-2. Ensure proper mating schemes are followed that is consistent with the program objectives and per broodstock protocol.

a. One female per incubation tray unless physically separated within tray.

b. All egg lots will be run through an egg counter to determine fecundity

Task 3: Monitor growth and health during rearing and determine life stage survival rates for each stock at each of the Wells Hatchery Complex facilities. (*Broodstock survival*, j*uvenile hatchery survival, rearing density index, size at release, incidence of disease*)

Task 3-1. Monitor growth of juvenile fish during rearing and prior to release.

a. Collect end of month length and weight data.

1. Whenever possible, crowd fish and dip net into 500-1000 fish into a net pen.
2. Measure and record fork length on 100 fish to the nearest millimeter.
3. Dip net approximately 200 fish into a bucket and record weight. Calculate grams/fish by dividing total weight by number.
4. Repeat weight sample three times and calculate average weight of fish.

b. Collect length and weight data prior to release.

1. Whenever possible, crowd fish and dip net into 500-1000 fish into a net pen.
2. Measure and record fork length (nearest millimeter) and weight (nearest 0.1 g) on 200 fish.

c. Analyze data to ensure fish were released at the proper fork length, condition factor, and size distribution (i.e., CV of fork length).

Task 3-2. Calculate end of month density indices for juvenile fish.

a. Use end of month length and weight data and the total rearing volume to calculate rearing density index (DI).

$$DI = \frac{(\text{Population size* mean weight (lbs)})/\text{total rearing volume } (ft^3)}{\text{Mean fork length (inches)}}$$

Task 3-3. Monitor fish health, specifically as related to cultural practices that can be adapted to prevent fish health problems.

a. Standard hatchery fish health monitoring will be conducted monthly by fish health specialist, with intensified efforts to monitor presence of specific pathogens that are known to occur in the donor populations. Significant fish mortality of unknown cause(s) will be sampled for histopathological study.

b. Collect biological information on all adult broodstock moralities. Determine the cause of mortality whenever possible.

c. The incidence of viral pathogens in salmon and steelhead broodstock will be determined by sampling fish at spawning in accordance with the Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State. Stocks of particular concern may be sampled at the 100% level and may require segregation of eggs/progeny in early incubation or rearing.

d. Determine antigen levels of *Renibacterium salmoninarum* (Rs, causative agent of bacterial kidney disease) in Chinook salmon broodstock by sampling fish at spawning using the enzyme-linked immunosorbent assay (ELISA).

e. If required, provide recommendations to hatchery staff on means to segregate eggs/progeny based on levels of Rs antigen, protecting “low/negative” progeny from the potential horizontal transmission of Rs bacteria from “high” progeny.

f. Autopsy-based condition assessments (OSI) or other physiological assessments deemed valuable would be used to assess hatchery-reared salmon smolts at release. If needed, perform assessments at other key times during hatchery rearing.

g. Provide recommendations on fish cultural practices at Wells Complex hatcheries and satellite stations on monthly basis. Summarize results for presentation in annual report or technical memorandum if applicable.

Task 3-4. Calculate various life stage survival rates for broodstock and juvenile fish (Table 3).

a. Use the stock inventory at time of tagging to recalculate population sizes and life stage survival rates.

Task 3-5. Summarize broodstock collection, spawning, rearing survival, and release information in an annual technical memorandum.

a. Where applicable, provide recommendations to increase survival rates of life stages that were lower than the survival standard or recommend studies to investigate causes of poor survival.

Task 4: Determine if broodstock collections and hatchery survival was adequate to achieve smolts releases at the programmed production levels (*Number of fish released, size at release*).

Task 4-1. Calculate the number of fish released from Wells FH Complex facilities.

a. If release numbers are within ± 10% of the production levels no further action required (Table 4).

b. If release numbers are not within ± 10% of the production levels determine what factors contributed to the shortage/overage.

Task 4-2. Calculate the size of fish released from Wells FH Complex facilities.

a. If size at release numbers is within ± 10% of the target no further action required (Table 5).

b. If size at release is not within ± 10% of the target determine what factors contributed to the shortage/overage.

Table 3. Hatchery life stage survival rate standards, 5 year mean (SD), and survival achieved for current brood year.

Life stage	Survival standard	Wells steelhead		Wells summer Chinook		Methow spring Chinook		Chewuch spring Chinook		Twisp spring Chinook	
		Mean (95%)	Survival achieved	Mean (95%)	Survival achieved	Mean (95%)	Survival achieved	Mean (95%)	Survival achieved	Mean (95%)	Survival achieved
Collection-to-spawning	*90.0 Female*										
Collection-to-spawning	*85.0 Male*										
Unfertilized egg-to-eyed	92.0										
Eyed egg-to-ponding	98.0										
30 d after ponding	97.0										
100 d after ponding	93.0										
Ponding-to-release	*90.0*										
Transport-to-release	95.0										
Unfertilized egg-to-release	*81.0*										

Italics are revised survival standards

Table 4. Summary of the number of fish released from Wells FH Complex.

Stock	Target	5-year min.	5-year max.	5-year mean	Number released
Wells yearling summer Chinook	320,000	185,200	45,770	321,060	
Wells subyearling summer Chinook	484,000	370,617	498,500	416,369	
Methow spring Chinook	183,024	66,454	218,499	155,570	
Chewuch spring Chinook	183,023	0	261,284	143,092	
Twisp spring Chinook	183,024	15,470	75,704	53,668	
Wells steelhead	348,858	390,965	694,765	539,768	

Table 5. Size at release targets for fish released from Wells FH Complex.

Stock	Target		Actual	
	Fork length (CV)	Weight	Fork length (CV)	Weight
Wells yearling summer	176 (9.0)	45.4		
Wells subyearling summer	140 (9.0)	22.7		
Methow spring Chinook	154 (9.0)	30.2		
Chewuch spring Chinook	154 (9.0)	30.2		
Twisp spring Chinook	154 (9.0)	30.2		
Wells steelhead	198 (9.0)	75.6		

APPENDIX D

Post-release Survival and Harvest

Task 5: Determine whether the survival from release-to-adult of fish from the Wells Hatchery Complex is sufficient to achieve the program goal. (*Smolt to adult survival, hatchery replacement rate, exploitation rate, harvest rate*)

Task 5-1. Mark (i.e., adipose fin clip) and tag (i.e., coded-wire tag or elastomer) each stock subjected to ocean fisheries or mainstem Columbia River commercial, sport, or tribal fisheries with sufficient coded-wire tags (CWT) to estimate harvest contribution.

a. Provide summary of marked and unmarked smolt releases from the Wells Hatchery Complex.

b. Determine the statistical requirements to provide reliable estimates of escapement and harvest contribution. Determine the number of coded-wire tags and other marks needed in relation to the number of recoveries expected.

Task 5-2. Summarize information at time of release that may influence post-release survival and performance.

a. Calculate mean fork length (FL) at release, FL coefficient of variation (CV), and condition factor (K) for all stocks released from Wells Complex.

b. Summarize fish health information (e.g., reports, OSI, precocity rates).

c. Calculate the number of days rearing on well and river water. Calculate the number of days reared at acclimation sites.

Task 5-3. When applicable, estimate travel time and smolt-to-smolt survival rates of hatchery and wild fish using PIT tag recaptures.

a. Compare smolt-to-smolt survival, emigration rate, and duration with rearing water source, duration of acclimation, and size at emigration.

Task 5-4. Estimate the harvest contribution for each stock released from the Wells Hatchery Complex.

a. Compile CWT recovery data from Wells Hatchery releases for inclusion in reports.

b. Recover heads from marked (adipose fin clipped) returns to Wells Fish Hatchery Facilities during routine spawning operations. Transfer heads to WDFW tag recovery lab in Olympia, Washington.

c. Conduct statistically valid creel surveys during sport fisheries in the mid-Columbia River to estimate harvest and adult returns of hatchery stocks from Wells Complex releases.

d. For each brood year and run year, calculate exploitation rate and harvest rates in commercial, tribal, and sport fisheries.

Task 5-5. Estimate the contribution to spawning escapement for each stock released from the Wells Hatchery Complex.

a. Provide a summary of the number of fish contributing to spawning escapement, broodstock, commercial, sport, and tribal fisheries.

b. Calculate stray rates for all stocks released form Wells FH Complex facilities and compare with rearing water source and duration.

Task 5-6. Determine the smolt to adult survival rates (SAR) for each stock.

a. Determine the total estimated the number of hatchery adults recovered in all fisheries, hatcheries, and spawning ground surveys using CWT data.

b. To calculate SAR for salmon, use the estimated number of smolts released divided by the estimated number of hatchery adults.

c. To calculate SAR for steelhead, use the estimated number of smolts released divided by the estimated number of adults migrating pass Priest Rapids Dam

d. Examine the influence of size, fish health, rearing location, and acclimation on survival and straying.

e. Compare SARs using CWT recoveries and PIT tag recaptures of adults, when applicable.

Task 5-7. Determine the expected and actual hatchery replacement rate for each brood year (Table 6).

a. Calculate HRR by dividing the number of broodstock collected by the estimated number of returning adults.

b. For stocks that fail to meet or exceed the expected hatchery replacement rate determine the life history stage that limited survival.

Table 6. The expected and actual smolt to adult (SAR) and hatchery replacement rates (HRR) or adult to adult survival rates for Wells FH Complex programs.

Program	Number of broodstock	Smolts released	SAR	Adult equivalents	# smolts/ adult	HRR
Wells yearling summer Chinook						
Expected	182	320,000	0.003	960	333	5.3
Actual						
Wells subyearling summer Chinook						
Expected	266	484,000	0.0012	581	833	2.2
Actual						
Twisp spring Chinook						
Expected	121	183,024	0.003	549	333	4.5
Actual						
Methow spring Chinook						
Expected	121	183,024	0.003	549	333	4.5
Actual						
Chewuch spring Chinook						
Expected	121	183,023	0.003	549	333	4.5
Actual						
Wells steelhead						
Expected	229	348,858	0.010	3,489	100	15.2
Actual						

Appendix E

Smolt Production

Task 6: Calculate freshwater production estimates of anadromous salmonids from selected river systems (*Egg-to-smolt survival, smolts per redd, emigration timing, size at emigration*)

Task 6-1. Install and operate a rotary smolt trap(s) in a location downstream from the majority of the spawning areas and that allows operation throughout the emigration period.

Task 6-1-1. Identify potential trap positions based on variation in flows. Large variations in discharge may require alternate trap locations.

Task 6-1-2. Operate trap continuously throughout the emigration period.

a. During the first year of operation at a new location determine the extent of emigration during daylight hours. Significant emigration during the daylight hours will require trap efficiency trails to be conducted during both the day and night.

b. Trap should be checked at a minimum every morning of operation. Remove fish from the live box and place in an anesthetic solution of MS-222. Identify fish to species and enumerate.

c. Determine sample size requirements of target and nontarget species for biological sampling.

d. All fish should be allowed to fully recover in fresh water prior to being released in an area of calm water downstream from the smolt trap.

e. Pressure wash trap and clean debris from cone and live box prior to leaving.

Task 6-2. Collect daily environmental and biological data.

a. Record the time the trap was checked, water temperature, river discharge, and trap position, if applicable.

b. Identify species and enumerate all fish captured to include life stage for non-anadromous species (e.g., fry, juvenile, and adult) or degree of smoltification for anadromous species (i.e., parr, transitional, or smolt). Parr have distinct parr marks, transitional fish have parr marks that are fading and not distinct, and smolts do not have parr marks and exhibit a silvery appearance, often with a black band on the posterior edge of the caudal fin.

c. Examine all fish for external marks as a result of trap efficiency trails and record them as recaptures.

d. Record fork length and weight measurements for all fish, or per designated sample size. All fish to be used in mark/recapture efficiency trials will be measured and weighed, and again as subsequent recaptures. Fork length is measured to the nearest millimeter and weight to the nearest 0.1 g.

e. Scales samples should be randomly collected throughout the emigration period from species with multiple year class smolts (i.e., steelhead and sockeye).

Task 6-3. Conduct mark-recapture trials for target species to develop a discharge-trap efficiency linear regression model to estimate daily trap efficiency.

Task 6-3-1. Conduct mark/recapture efficiency trials throughout the trapping season at the largest range of discharge possible.

a. No less than 100 fish should be used for each trial.

b. Parr and smolts can be marked by clipping the tip of either the upper or lower lobe of the caudal fin. Alternate fin clip location for each trial. Fry should be marked with dye.

c. All marked fish should be allowed to recover in a live pen for at least 8 h before being transported to a release site at least 1 km upstream of the trap. Release marked fish across the width of the river, when possible, or equally along each bank in pools or calm pockets of water.

d. Nighttime efficiency trials should be conducted after sunset. Daytime efficiency trials should be conducted after sunrise.

e. The following assumptions should be valid for all mark-recapture trials:

1. All marked fish passed the trap or were recaptured during time period *i*.

2. The probability of capturing a marked or unmarked fish is equal.

3. All marked fish recaptured were identified.

4. Marks were not lost between the time of release and recapture.

f. Calculate trap efficiency using the following formula.

Trap efficiency = $E_i = R_i / M_i$

Where E_i is the trap efficiency during time period i; M_i is the number of marked fish released during time period i; and R_i is the number of marked fish recaptured during time period i.

Task 6-3-2. Perform linear regression analysis using discharge (independent variable) and trap efficiency (dependent variable) data from the mark-recapture trails to develop a model to estimate trap efficiency on days when no mark-recapture trials were conducted. Separate models should be developed for each trap position and target species.

Task 6-4. Estimate daily migration population by dividing the number of fish captured by the estimated daily trap efficiency using the following formula:

Estimated daily migration = $\hat{N}_i = C_i / \hat{e}_i$

where N_i is the estimated number of fish passing the trap during time period i; C_i is the number of unmarked fish captured during time period i; and e_i is the estimated trap efficiency for time period i based on the regression equation.

Task 6-5. Calculate the variance for the total daily number of fish migrating past the trap using the following formulas:

Variance of daily migration estimate = $$\mathrm{var}\left[\hat{N}_i\right] = \hat{N}_i^2 \frac{\mathrm{MSE}\left(1 + \frac{1}{n} + \frac{\cdots}{(n-1)s_X^2}\right)}{\hat{e}_i^2}$$

where X_i is the discharge for time period i, and n is the sample size. If a relationship between discharge and trap efficiency was not present (i.e., $P <$ 0.05; $r^2 \lessapprox 0.5$), a pooled trap efficiency was used to estimate daily emigration:

Pooled trap efficiency = $E_p = \sum R / \sum M$

The daily emigration estimate was calculated using the formula:

Daily emigration estimate = $\hat{N}_i = C_i / E_p$

The variance for daily emigration estimates using the pooled trap efficiency was calculated using the formula:

Variance for daily emigration estimate = $\mathrm{var}\left[\hat{N}_i\right] = \hat{N}_i^2 \frac{E_p(1-E_p)/\sum M}{E_p^2}$

Task 6-6. Estimate the total emigration population and confidence interval using the following formulas:

Total emigration estimate = $\sum N_i$

95% confidence interval = $1.96 \times \sqrt{\sum \mathrm{var}\lfloor N_i \rfloor}$

Task 7: Calculate survival rates at various life stage for target species.

Task 7-1. Calculate the total estimated egg deposition for the selected river.

a. When possible, estimated egg deposition should be based on the average fecundity of the spawning population. Hatchery broodstock randomly collected from the run should provide a representative sample of the spawning population.

b. Multiply the average fecundity by the total number of redds upstream of the trap location to estimate the total egg deposition.

Task 7-2. Calculate the egg-to-emigrant or egg-to-smolt survival of the target species, dependent on the trap location in the watershed and life history of the target species.

a. Egg-to-emigrant survival rates are calculated by dividing the total estimated number of subyearling and yearling fish of the same brood year by the total estimated number of eggs deposited.

b. Egg-to-smolt survival rates are calculated by dividing the total estimated number of smolts of the same brood year by the total estimated number of eggs deposited. For species with multiple year class smolts, the egg-to-smolt survival may require several years of trapping data.

Task 7-3. Calculate egg-to-parr and parr-to-smolt (i.e., overwinter) survival for target species.

a. Egg-to-parr survival rates are calculated by dividing the total estimated number of parr the total estimated number of eggs deposited. Parr estimated are derived independently using snorkel methodologies described in Hillman and Miller (2002).

b. Parr-to-smolt survival rates are calculated by dividing the overwinter population by the total estimated number of smolts that emigrated that following spring. The overwinter population is calculated by subtracting the estimated number of parr that emigrated following the completion of the summer parr estimate.

c. To estimate the parr-to-smolt survival rate of those parr that emigrated, representative samples of subyearling and yearling emigrants should be PIT tagged (*N* = 5,000/group). Subsequent PIT tag survival analysis would provide the relative survival of the two groups. The estimated number of parr could be converted to smolts based on the reduced survival. Subsequently, an egg-to-smolt survival estimate (versus and egg-to-emigrant) could be calculated.

Appendix F

Spawner Escapement and Distribution

Task 7: Determine the stock demographics, spawn timing, redd distribution, redd abundance, and estimate the spawning escapement of selected streams (*spawner escapement, proportion of hatchery fish, fish per redd, number of precocial fish, sex ratio, redd distribution, spawn timing, stray rate*).

Task 7-1. Delineate survey reaches of all available spawning habitat. Whenever possible, use historical reaches for comparisons across years.

a. Reaches should not take longer than one day to survey.

b. Historical reaches can be subdivided if required.

c. Beginning and end points of reaches should be fixed locations (e.g., confluence with a stream or bridge).

Task 7-2: Conduct comprehensive spawning ground surveys of all available spawning habitat and count all redds within a selected stream (i.e., total redd count).

a. Conduct weekly surveys of all reaches by foot or raft. The survey period should begin at the earliest known date of spawning and continue until no new redds have been observed within a reach.

   1. One person can conduct surveys on small stream were both stream margins are easily observed. Two people should conduct surveys whenever both stream margins cannot be easily observed from a location.

   2. When a raft is used to conduct surveys, two observers should be in a elevated position at the front of the raft while one person navigates the raft.

b. Individually number all completed redds.

   1. In areas with low spawner density, flagging can be placed on the nearest vegetation. Data on flag should include unique redd number, distance from flag to redd, and date. Data recorded in field notes should include date, water temperature, reach, and redd number. If applicable, the number and origin of the fish on the redd should be recorded.

2. In areas with medium and high spawner density, mapping of redds is required. Site specific (e.g., a single riffle), area specific (e.g., section of stream between two power lines), or aerial photographs can be used to annotate redds. Redds should be uniquely number on the map(s). Different symbols should be used complete, incomplete, and test redds.

3. All completed redds should have the correct redd morphology (i.e., well developed tailspill and pit or the appropriate size for the target species). Incomplete redds have fish actively constructing a redd, but no completed. Test digs are disturbed areas of substrate that do not have the correct morphological characteristics for the target species.

Task 7-3: Conduct index spawning ground counts and estimate the total number of redds in a selected stream.

Task 7-3-1: Identify index reaches in selected tributaries.

a. Index reaches should overlap historical reaches whenever possible.

b. Index reaches should be identified in streams with known or suspected spawning populations.

c. Index reaches should be located in the core spawning locations of the stream.

d. Multiple index areas should be identified for streams when any of the following apply:

1. Potential spawning habitat of target species cannot be surveyed in one day for any reason.

2. Large tributaries enter the stream that may affect visibility.

3. Significant gradient changes that may affect visibility.

Task 7-3-2: Conduct comprehensive spawning ground surveys and count all redds within an index area (See Task 5-2).

Task 7-3-3: Conduct a final survey of the entire reach(s) at the end of spawning or after peak spawning if poor water conditions are expected (n_{total}).

a. Count all redds in each reach. Marking redds is not required.

b. A different surveyor should survey within the index area. Count only redds that are visible.

c. Calculate an index expansion factor (*IF*) by dividing the number of visible redds in the index by the total number of redds in the index area.

$$IF = n_{visible} / n_{total}$$

d. Expand the non-index area redd counts by the proportion of visible redds in the index to estimate the total number of redds in the entire reach (*RT*).

$$RT = n_{non-index} / IF$$

e. Estimate the total number of redds (*TR*) by summing the reach totals.

$$TR = \sum RT$$

Task 7-4: Conduct comprehensive modified-peak spawning ground surveys and estimate the total number of redds in a selected stream.

Task 7-4-1: Establish index areas per Task 5-3-1.

Task 7-4-2: Conduct comprehensive spawning ground surveys and count all redds within an index area (See Task 5-2).

Task 7-4-3: Conduct comprehensive peak spawning ground surveys within non-index and index areas.

a. Different survey crew must perform the index area total counts and the index area peak counts.

b. Count all visible redds within the non-index area, but do not individually mark the redds.

Task 7-4-4: Calculate an index peak expansion factor (*IP*) by dividing the peak number of redds in the index by the total number of redds in the index area.

$$IP = n_{peak} / n_{total}$$

Task 7-4-5: Expand the non-index area peak redd counts by the *IP* to estimate the total number of redds in the entire reach (*RT*).

$$RT = n_{peak} / IP$$

Task 7-4-6: Estimate the total number of redds (*TR*) by summing the reach totals.

$$TR = \sum RT$$

Task 7-5: Conduct carcass surveys on selected streams and collect biological data from a representative sample (i.e., 20%) of the spawners.

a. Determine the sampling protocol based on escapement and effort. A sampling rate of 100% of all carcasses encountered is normally required, the exception is for sockeye.

b. Collect biological data from all carcasses sampled, including:

   1. Sex.
   2. Fork and post orbital-to-hypural length (cm).
   3. Scales.
   4. Remove snout including the eyes for CWT analysis is adipose fin-clipped or if origin is undetermined.
   5. Number of eggs in body cavity, if body cavity is intact.
   6. DNA tissue (5 hole punches from opercle) if applicable.

c. All biological information should be recorded on the scale card to include:

   1. Date.
   2. Stream.
   3. Reach.
   4. Stream survey tag number if snout was collected.
   5. DNA sample number if tissue was collected.

d. All sampled carcasses must have the tail removed (posterior of the adipose fin) and placed back into the stream after data have been recorded.

Task 7-6: Conduct snorkel surveys on redd to determine the incidence of precocial fish spawning in the wild.

a. Determine sampling protocol based on escapement and personnel.

b. Survey crews should consist of two snorkelers.

c. Snorkel surveys should be conducted only on active redds (i.e., presence of spawning female).

d. Snorkel surveys should be conducted in an upstream direction.

e. Record the number of males by size (e.g., adult, jack, or precocial) and origin (e.g., wild or hatchery).

Task 7-7: Determine the spawning distribution of wild and hatchery fish in a selected stream.

a. Assume the carcass recovery location (i.e., reach) is also the spawning location.

b. Calculated the proportion of the spawning population that spawned in each reach and compare with historical values (i.e., before supplementation).

c. Compare the proportion of each component (i.e., wild and hatchery) that spawned in each reach.

Task 7-8: Calculate a sex ratio and fish per redd ratio (i.e., redd expansion factor) for a selected stream.

a. Sex ratios for spawning populations should be calculated for the hatchery broodstock if the broodstock was randomly collected from the run-at-large.

b. If broodstock stock was not collected randomly from the run-at-large, trapping records can be used in conjunction with the broodstock to develop a random sample provided sex was recorded for those fish trapped and released.

c. Once a sex ratio has been determined for a stock (e.g., 1 female: 1.5 males) a redd expansion factor can be calculated by summing the ratio (e.g., 1 female: 1.5 males = 2.5 fish per redd).

    1. Assumptions associated with this methodology include: a female constructs only one redd and male fish only spawn with one female.

d. This redd expansion factor can be applied to stocks without a hatchery broodstock, but have similar age compositions.

e. An alternative method (Meekin 1967) involves using previously calculated adults per redd values (i.e., 2.2 adults/redd for spring Chinook and 3.1

adults/redd for summer Chinook) and adjusting for the proportion of jacks in the run (e.g., jack spring Chinook comprise 10% of the run. The redd expansion factor = 2.2 x 1.1 = 2.4 fish/redd).

Task 7-9: Calculate the proportion of hatchery fish (target and non-target or strays) on the spawning grounds.

a. The proportion of hatchery on the spawning grounds is determined via scale analysis from carcasses randomly collected over the spawning period and all available habitat.

b. Stray rates are calculated from CWT recoveries divided by tag rate and sample rate.

Task 7-10: Summarize length-at-age and age-at-maturity data for the spawning population.

Appendix G

Relative Spawner Abundance Monitoring

Task 8: Determine if the relative abundance of supplemented populations is greater than non-supplemented populations and the influence the relative proportion of hatchery origin spawners may have on the abundance (*NRR, recruits*).

Task 8-1. Calculate the adult-to-adult survival rates or natural replacement rate (NRR) for selected stocks using the formula

$$NRR = r_{i+1} + r_{i+2} + r_{i+3} + \cdots / S_i$$

a. Estimate the number of spawners (*S*) from redd counts during year *i* by expanding the total redd count by a redd expansion value. When comparing across years, the number of spawners should be calculated using the same methodologies.

   1. When available, use the sex ratio of broodstock randomly collected from the run as the redd expansion factor.

   2. The alternate method would be the modified Meekin method that is calculated using a 2.2 adults/redd values expanded for the proportion of jacks within the run.

b. Estimate the number of recruits (*r*). When applicable, use the age composition derived from broodstock randomly collected from the run in stock reconstruction. Age composition data derived from spawning round surveys may bias towards larger and older fish.

   1. Exploitation rate of hatchery fish (indicator stock) may be used for naturally produced fish provided the stock was not subjected to selected fisheries. In which case, a hooking mortality should be applied and recruits adjusted accordingly.

   2. Stocks without a hatchery component (i.e., reference streams) may use exploitation rate of supplemented stock provide there is no difference in run timing or probability of harvest.

c. Conduct spawner-recruit analysis to explain density dependent effects within each of the supplemented and reference stream and correlate with the proportion of hatchery spawners for each brood year.

Task 8-2. Compare NNR of supplemented stream and reference stream to detect differences due to supplementation program.

a. When possible, establish baseline conditions (i.e., before supplementation) for supplemented and reference streams. Ensure spawning data is comparable across years and calculated using similar methodologies for each stream, preferably both streams.

b. High variability in SAR may preclude use of NRR.

Task 8-3. Compare the relationships of the number of smolts per redd (independent variable) and NRR (dependent variable) of the supplemented and reference streams.

a. Conduct regression analysis using number of smolts per redd and NRR of both the supplemented stream and reference stream. Adjust the number of smolts per redd variable for differences in the number of Columbia River hydro projects between the supplemented and reference streams.

b. Perform statistical analysis to determine if the slope of the two regression equations is similar.

Task 8-4. Conduct statistical analysis to determine what influence hatchery fish may have on relative abundance.

a. Examine the relationship between the proportion of hatchery fish on the spawning grounds and NRR.

b. Examine the relationship between the proportion of hatchery fish on the spawning grounds and egg-to-emigrant survival.

c. Examine the relationship between the proportion of hatchery fish on the spawning grounds and the number of smolts per redd.

d. Examine the relationship between the proportion of hatchery fish on the spawning grounds and smolt-to-adult survival.

Appendix H

Genetics

Task 9: Determine if genetic variation of hatchery-origin fish is similar to that of donor population and naturally produced fish in supplemented populations (*Genetic variation, proportionate natural influence*).

Task 9-1. Establish a genetic sampling and analysis schedule for programs in the Wells FH Complex.

a. Prioritize programs for evaluation relative to recovery monitoring needs. An example scheme is shown in Table 7.

b. Determine if adequate genetic samples (N= 50 to 100 per year for at least 2 years) of donor population per program have been collected.

c. If necessary, design a sampling plan to collect additional donor population samples.

d. Determine whether suitable DNA markers are available or need to be developed for target species.

e. Determine the number of genetic samples from current wild population(s) and hatchery-origin adults that need to be collected each year of an evaluation period (period length depends on species).

f. Develop annual schedule of laboratory analysis and reporting with agency genetics staff.

g. Conduct analyses and evaluate results.

h. Determine the frequency of analysis necessary for long-term monitoring of genetic variation in naturally produced and hatchery-origin populations.

Table 7. Example of prioritized genetic sampling and analysis scheme for evaluation of Wells FH programs (D=Donor population pre-hatchery program, H=hatchery, NP=naturally produced).

Stock	Origin	Last samples collected			Priority	Start year
		Year(s)	*N*	Stage		
Twisp spring Chinook	D				1	2006
	H				1	2006
	NP				1	2006
MetComp spring Chinook	D				2	2007
	H				2	2007
	NP				2	2007
Wells Steelhead	D				3	2008
	H				3	2008
	NP				3	2008
Wells summer Chinook	D				4	2009
	H				4	2009
	NP				4	2009

Task 9-2. In conjunction with genetic sampling schedule, conduct evaluation of phenotypic traits that serve as indicators of potential domestication impacts of hatchery programs

a. Determine availability and applicability of historical phenotypic data from donor populations. If data are not adequate, develop plan to acquire appropriate contemporary data.

b. Determine availability and extent of phenotypic data from current hatchery and natural populations and whether sample sizes from annual samples are adequate. Phenotypic data sets should extend over a series of years to account for effects of environmental variability. Plan data collection schedule if necessary for current populations.

c. Conduct data analysis using appropriate statistical methods.

d. Where available spawning ground survey data are suitable, calculate recent and historical proportionate natural influence (PNI; formula shown below) for target stocks. Develop survey protocol where data are unavailable, and collect spawning ground data for target stocks throughout evaluation period in order to calculate PNI.

$$\text{PNI} = \frac{\text{proportion of natural produced fish in the broodstock (pNOB)}}{\text{pNOB + proportion of hatchery fish on the spawning grounds (pHOS)}}$$

Task 10: Determine if genetic stock structure of within-basin natural populations has changed due to effects of hatchery programs.

Task 10-1. Establish a sampling and analysis schedule for potentially affected populations in the Upper Columbia Basin.

a. Based on program prioritization established in Task 9-1, determine if adequate historical genetic samples (N= 50 to 100 per year for at least 2 years) of potentially affected populations are available.

b. If necessary, design and conduct a sampling plan to collect appropriate within-basin population samples. An example scheme is shown in Table 8 relative to the Chiwawa spring Chinook program.

c. Depending on baseline data available (historical and/or recent), develop data analysis plan to assess temporal variability of with-in basin genetic population structure over meaningful time frames.

d. Develop schedule of laboratory analysis and reporting with agency genetics staff.

e. Conduct analyses and use results to determine subsequent evaluation needs.

Task 10-2. Establish a field sampling and data analysis program to verify and monitor impacts from hatchery programs on affected within-basin populations.

a. Based on genetic results from Task 10-1, design a sampling plan to enumerate hatchery-origin strays within non-target, affected populations and to collect genetic samples of naturally produced fish of pertinent brood years from these populations.

b. Conduct genetic laboratory and statistical analyses and evaluate results.

c. Determine the frequency of analysis necessary for long-term monitoring of genetic effects of hatchery supplementation fish on non-target natural populations.

Table 8. Example of genetic sampling and analysis scheme for evaluation of effect of Methow spring Chinook supplementation program on within-basin population structure (NP=naturally produced).

Stock	Origin	Last samples collected			Priority	Year
		Year	*N*	Stage		
Twisp spring Chinook	NP				1	2006
Methow spring Chinook	NP				1	2006
Chewuch spring Chinook	NP				1	2006
Entiat R. spring Chinook	NP				1	2006

Task 11: Determine if effective population size (N_e) of target natural spawning populations increases at rate expected given an increase in hatchery-origin fish on the spawning grounds.

a. In order to estimate current or baseline N_e, assess whether temporal samples of naturally spawning populations planned in Task 9-1(e) provided the necessary genetic data from natural-origin adults of same brood year from at least three brood years. (Indirect estimates of N_e are made from temporal variation of gene frequencies or genetic linkage disequilibrium in cohorts).

b. If adult (by brood year) sample sizes are adequate, estimate N_e for the base period using genetic methods.

c. If adult (by brood year) sample sizes are not adequate, design and conduct genetic sampling of same brood year naturally produced juveniles for at least a three year period.

d. Conduct laboratory analyses to collect genetic data from juvenile samples and estimate $N_{e.}$

e. Compare N_e results to spawning ground survey estimates of annual spawner population census sizes, and proportions of naturally spawning hatchery- and wild-origin fish.

f. At least one generation later, assuming supplementation program is providing large proportions of hatchery-origin fish and their natural adult progeny on spawning grounds, ensure that sampling for other evaluation and monitoring purposes includes adequate temporal genetic samples of same-brood year natural adults.

g. Conduct laboratory analyses to collect genetic data from adult samples *if* these data are not being collected to accomplish another evaluation task.

h. Estimate N_e for the later period using genetic methods and compare results to survey data on census size and hatchery/wild proportions.

Appendix I

Monitoring non-target taxa of concern

Task 12: Monitor non-target taxa of concern (NTTOC) to determine if impacts are within acceptable levels.

Task 12-1. Identify NTTOC for each target stock and define acceptable level of impact associated with hatchery program (Table 9).

Task 12-2. Identified the most probable interactions (Table 10) that would impact NTTOC as described by Pearsons et al. (19XX).

Task 12-3. Conduct risk assessment to prioritize monitoring effort (Table 11).

Task 12-4. Monitor size, distribution, and abundance of NTTOC as it relates to target stock and determine impact levels.

a. Monitor size and abundance of NTTOC using smolt traps.

b. Monitor distribution of NTTOC using snorkel surveys.

c. If impact levels exceed acceptable levels determine if changes in NTTOC are correlated to changes in production levels, size of fish released from hatchery, or location hatchery fish are released.

   1. Determine if changes in abundance are a result from predation, disease, or competition.

   2. Determine if changes in size are a result of competition.

   3. Determine if changes in distribution are a result of predation, disease, or competition.

Task 12-5. Develop and implement specific research studies to determine causation of impacts to NTTOC.

Table 9. NTTOC containment objectives for hatchery programs in the Upper Columbia River ESU. Impacts are defined as the decline in one or more variables (size, abundance, and distribution) that can be attributed to hatchery fish.

Target Species/Stock	NTTOC	Containment Objective
Common to all programs	Bull trout	No impact (0%)
	Pacific lamprey	No impact (0%)
	Mountain sucker	Very low impact (≤ 5%)
	Leopard dace	Very low impact (≤ 5%)
	Westslope cutthroat	Low impact (≤ 10%)
	Resident *O. mykiss*	Low impact (≤ 10%)
	Mountain whitefish	Moderate impact (≤ 40%)
	Other native species[1]	High impact (≤ Maximum)
Twisp spring Chinook	Methow steelhead	No impact (0%)
	Twisp spring Chinook	No impact (0%)
	Methow summer Chinook	Low impact (≤ 10%)
Metcomp spring Chinook	Methow spring Chinook	No impact (0%)
	Chewuch spring Chinook	No impact (0%)
	Methow steelhead	No impact (0%)
	Methow summer Chinook	Low impact (≤ 10%)
Methow steelhead	Methow spring Chinook	No impact (0%)
	Chewuch spring Chinook	No impact (0%)
	Twisp spring Chinook	No impact (0%)
	Methow steelhead	No impact (0%)
	Methow summer Chinook	Low impact (≤ 10%)
Methow summer Chinook	Methow spring Chinook	No impact (0%)
	Methow steelhead	No impact (0%)
	Methow summer Chinook	Low impact (≤ 10%)
Okanogan summer Chinook	Okanogan steelhead	No impact (0%)
	Okanogan summer Chinook	Low impact (≤ 10%)
Wells summer Chinook	Methow spring Chinook	No impact (0%)
	Methow steelhead	No impact (0%)
	Okanogan steelhead	No impact (0%)
	Methow summer Chinook	Low impact (≤ 10%)
	Okanogan summer Chinook	Low impact (≤ 10%)

1/ Native species refers to all other species endemic to the subbasin. Impacts to should not exceed a level required to maintain a sustainable population.

Table 10. Species interactions between hatchery programs and NTTOC (C=competition, F=Prey for predators, P=Predation, D=disease).

Hatchery program	NTTOC	Interaction			
		Type	Risk	Potential	Uncertainty
Methow/Twisp spring Chinook	Steelhead	C, F, D	Low	Low	Mod.
	Spring Chinook	C, F, D	High	Mod	High
	Bull trout	C, F, D	Low	Low	Low
	WCT	C, F, D	Low	Low	Low
	Resident *O. mykiss*	C, F, D	Mod	Mod	Mod
	Mountain sucker	C, F, D	Low	Low	Low
Wells steelhead	Spring Chinook	C, P, D	Mod	Mod	Low
	Summer Chinook	C, P, D	Mod	Mod	Low
	Sockeye	C, P, D	Low	Low	Low
	Bull trout	C, P, D	Low	Low	Low
	WCT	C, P, D	Mod	Mod	Low
	Resident *O. mykiss*	C, P, D	Mod	High	Mod
	Mountain sucker	C, P, D	Low	Low	Low
	Pacific lamprey	C, P, D	Low	Low	Low
	Leopard dace	C, P, D	Low	Low	Low
Wells summer Chinook	Spring Chinook	C, F, D	High	Mod	Mod
	Steelhead	C, F, D	Low	Low	Low
	Bull trout	C, F, D	Low	Low	Low
	WCT	C, F, D	Low	Low	Low
	Resident *O. mykiss*	C, F, D	Low	Low	Low
	Mountain sucker	C, F, D	Low	Low	Low
	Pacific lamprey	C, F, D	Low	Low	Low
	Leopard dace	C, F, D	Low	Low	Low

Table 11. Risk assessment of target and nontarget taxa for hatchery programs.

Target species	Interactors	Life stage	Interaction	Risk Assessment
Spring Chinook	Steelhead	Fry, parr	F, C	Low
	Spring Chinook	Fry, parr, smolt	C, D	Low
	Bull trout	Fry, parr	F, C	Low
Steelhead	Spring Chinook	Fry, parr, smolt	P, C, D	High
	Summer Chinook	Fry, parr, smolt	P, C, D	High
	Steelhead	Fry, parr, smolt	P, C, D	Mod
Summer Chinook	Spring Chinook	Smolt	C, D	Low
	Steelhead	Fry, parr, smolt	P, C, D	Mod

Appendix J

Disease monitoring of hatchery programs

Task 13: Determine if hatchery programs have influenced incidence or magnitude of disease in hatchery and naturally produced fish.

Task 13-1. Monitor disease in broodstock and juvenile fish.

a. Sample all female broodstock for disease per WDFW Fish Health protocols.

   1. Monitor density and flow index in adult holding pond.

   2. Examine relationship between holding conditions and disease.

b. Sample juvenile fish monthly and prior to release to develop disease profile (*N*=30).

   1. Monitor density and flow index during rearing.

   2. Examine relationship between holding conditions and disease.

c. Sample naturally produced fish monthly, both upstream and downstream of acclimation ponds or release sites (*N*=30).

d. Sample naturally produced fish monthly from a population without hatchery program (*N*=30).

Task 13-2. Examine the influence between the incidence of disease in the broodstock and progeny.

Task 13-3. Monitor incidence of disease in hatchery effluent and natural environment.

a. Collect monthly water samples from hatchery effluent and upstream and downstream of acclimation ponds.

b. Determine if acclimation ponds increase disease load in river.

Appendix C

Analytical Framework for Monitoring and Evaluating PUD Hatchery Programs

ANALYTICAL FRAMEWORK FOR MONITORING AND EVALUATING PUD HATCHERY PROGRAMS

Final

September 20, 2007

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Analytical Framework for Monitoring and Evaluating PUD Hatchery Programs

This document is a supplement to the Monitoring and Evaluation Programs for the Mid-Columbia PUDs Hatchery Programs (e.g., Murdoch and Peven 2005; Cates et al. 2005). The analyses and data used to support the information contained in this document are subject to change as new information becomes available. Any changes to these programs are subject to the approval of the HCP Hatchery Committees or PRCC Hatchery Subcommittee as appropriate.

There are currently 10 objectives associated with monitoring the effectiveness of hatchery programs funded by the mid-Columbia PUDs (Murdoch and Peven 2005; Cates et al. 2005). For each objective specific data are needed to assess the risks to the resource and to determine if the hatchery programs are meeting their goals. Effectiveness monitoring requires analytical rules that guide statistical analyses and management decisions. In many cases these rules come directly from agreements between the agencies and the PUDs. Other rules are made outside the directives of the agreements, but nonetheless are necessary in managing hatchery programs and guiding effectiveness monitoring. Identified below are descriptions of analytical rules that need to be made in developing a hatchery monitoring program.

Effect Size—Effect size refers to the size of change in a variable that constitutes the level of acceptable change. More formally, it is the amount of departure of the data from the null hypothesis (i.e., that the treatment or management action has resulted in no important change in the variable) that is needed before accepting the alternative hypothesis (i.e., that the treatment or management action has resulted in an important or unacceptable change in the variable). Effect size should be identified before conducting effectiveness monitoring and is usually identified in binding agreements (e.g., number and size of hatchery smolts produced) or is a policy decision associated with the risk or scientific uncertainty in the parameter of interest.

Minimum Detectable Difference (a.k.a. Minimum Detectable Effect Size)—The size of change in the variable of interest (e.g., the difference between the treatment and reference condition) that can be detected statistically at the specified significance level, power, and sample size. The minimum detectable difference could be greater than the effect size identified by management.

Type I Error—A Type I Error occurs when one concludes that there is a difference between treatment and reference condition when in fact there is no difference. This error may be costly to funding entities, because one may conclude that the hatchery program is not successful when in fact it is. Committing a Type I Error may result in additional studies or management actions that are not necessary. This error is under the control of the investigator and is set before conducting effectiveness monitoring. In this plan, we follow the generally accepted standard of $P < 0.05$ (i.e., a 5% chance of committing a Type I error).[21]

Type II Error—A Type II Error occurs when one concludes that there is no difference when in fact there is a real difference. This error may be harmful to the resource, because one may conclude that the hatchery program is successful when in fact it is not. This error can be reduced by selecting the appropriate sample size needed to detect a biological or practical effect size (see below).

Power—Power is the probability that a statistical test will result in a significant difference (reject the hypothesis of no difference when there is truly a difference—a correct decision). More technically, it is the probability of detecting a specified treatment effect when it is present. This is the intent of all monitoring programs. Power is calculated as 1 – Type II Error.

Sample Size—Sample size indicates the number of replicates (in space or time) that is needed to avoid making a Type II error (failing to reject the hypothesis of no difference). Typically, a larger sample size is needed to increase power (or reduce the probability of a Type II error).

The monitoring program is set up so that the null hypothesis is stated as “no difference.” Therefore, in some but not all cases, the null hypothesis will be stated such that the supplementation program has no harmful effect on the natural population (or that hatchery goals have been met). The alternative hypothesis is that supplementation has harmed the natural population. In this case, failure to reject the null hypothesis leads to the conclusion that there is no real evidence that supplementation has harmed the natural population. In other words, the data have to provide “evidence” that the supplementation program is harmful. The supplementation program is “innocent” until proven “guilty.”[22]

A primary goal of supplementation is to contribute to the rebuilding and recovery of naturally reproducing populations within their native habitat. In this plan, natural replacement rates (NRR), recruitment of naturally produced fish (NOR), and juvenile productivity (juveniles/redd) are important indicators for assessing the success of supplementation. However, these indicators are difficult to measure precisely and are

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[21] In this plan we do not attempt to make an experiment-wide error-rate adjustment. Our analyses are predicated on the idea that all of the null hypotheses are true. Making an adjustment effectively penalizes us for conducting multiple tests, because the standard for rejection of the null hypothesis increases as more tests are conducted. Yet it is the pattern of which particular tests are rejected that is important in this program. Adjusting the error-rate may cause us to throw out this important information (see Gotelli and Ellison (2004) for a discussion on error-rate adjustments). We do, however, avoid excessive statistical tests that are not independent of one another.

[22] The alternative is to state the null hypothesis so that the supplemented population and reference population are not equivalent (the concept of bioequivalence). In this case the data have to provide evidence that the null hypothesis is not true before the populations are declared to be equivalent (i.e., supplementation has no harmful effects). Thus, an adverse effect is assumed unless the data suggest otherwise.

quite variable in space and time (i.e., these measures can carry high uncertainty).[23] Therefore, this plan identifies several other indicators that will be measured to help explain some of the uncertainty associated with productivity indicators. These monitoring indicators, which are either directly or indirectly affected by the hatchery programs, can be evaluated to determine if changes (or no changes) in productivity were related to the hatchery programs or other unexplained factors. These indicators include stray rates, hatchery replacement rates, genetics, run timing, spawn timing, spawning distribution, age-at-maturity, and size-at-maturity.

The relationship between supplementation hatchery programs and indicators can be viewed in a chain-of-causation (Figure 1). That is, management actions within hatchery programs affect the status of monitoring indicators, which influence productivity indicators. Non-supplementation programs, such as harvest-oriented programs, include many of the same factors.

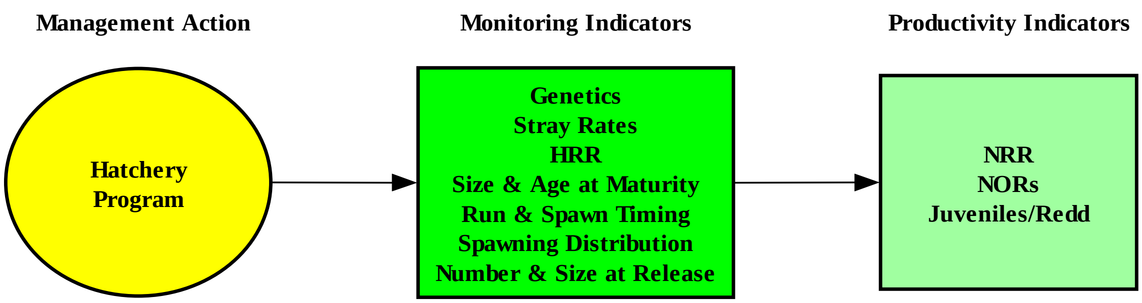

Figure 1. The relationship of indicators to the assessment of supplementation programs viewed in a chain-of-causation. In the chain-of-causation, the hatchery program affects monitoring indicators, which influence productivity indicators. Data may be available in the future that identify monitoring indicators having greater influence on productivity.

Both monitoring and productivity indicators will be used to evaluate the success of hatchery programs. In the event that productivity indicators cannot be measured with enough precision (e.g., 95% certain that the point estimates fall within some specified range of the true value) to make sound decisions, some of the monitoring indicators may be used instead.

Identified below are the types of indicators (monitoring or productivity) associated with each objective described in Murdoch and Peven (2005). For each indicator we identified monitoring questions, specific populations and species associated with each indicator, hypotheses, measured variables, derived variables, spatial and temporal scales of analysis, and statistical analyses. Lastly, we identified draft analytical rules for each indicator. We included effect sizes and statistical rules for each indicator.

[23] Natural replacement rates are affected by many factors that are independent of the hatchery programs. For example, natural replacement rates are affected by climatic conditions; mainstem, estuary, and ocean conditions; predators and competitors; different fisheries; and habitat. These factors add variability (uncertainty) to estimates of productivity.

Objective 1: Determine if supplementation programs have increased the number of naturally spawning and naturally produced adults of the target population relative to a non-supplemented population (i.e., reference stream) and if the change in the natural replacement rate (NRR) of the supplemented population is similar to that of the non-supplemented population.

At the core of a supplementation program is the objective of increasing the number of spawning adults (i.e., the combined number of naturally produced and hatchery fish) in order to affect a subsequent increase in the number of returning naturally produced fish or natural origin recruits (NOR). This is measured as the Natural Replacement Rate (NRR) or the ratio of NOR to the parent spawning population. The proportion of the hatchery origin spawners that will increase natural production without creating adverse effects to the genetic diversity or reproductive success rate of the natural population is not known. All other objectives of the M&E Plan either directly support this objective or seek to minimize impacts of the supplementation program to non-target stocks of concern.

Differences in carrying capacities of supplemented and non-supplemented streams can confound the effects of supplementation on total number of spawners returning to the streams. For example, if the supplemented population is at carrying capacity and the non-supplemented population is not, the total number of spawners returning to the non-supplemented population may show an increasing trend over time, while the supplemented population would show no increasing trend. To avoid concluding that the supplementation program has no effect or perhaps a negative effect on total spawners, the capacity of the habitats must be estimated and removed from the analyses. The Supplementary Hypotheses offered under each “regular” hypothesis are designed to remove the confounding effects of different carrying capacities from the analyses.

1.1 Adult Return Rates of Hatchery Fish (*Monitoring Indicator*)

Monitoring Questions:
Q1: Is the annual number of hatchery fish that spawn naturally greater than the number of naturally and hatchery produced fish taken for broodstock?

Target Species/Populations:
- Q1 applies to all supplemented species and populations.

Hypothesis:
- Ho_1: The annual number of hatchery produced fish that spawn naturally is less than or equal to the number of naturally and hatchery produced fish taken for broodstock.
- Ha_1: The annual number of hatchery produced fish that spawn naturally is greater than the number of naturally and hatchery produced fish taken for broodstock.

Measured Variables:
- Number of hatchery produced fish on spawning grounds annually
- Number of naturally and hatchery produced fish removed for broodstock annually

Derived Variables:
- No derived variables needed for the analysis

Spatial/Temporal Scale:
- Analyzed annually based on return year.
- On a five-year period analyze return years for patterns that correlate with extraneous factors such as ocean conditions.

Statistical Analysis:
- No statistical test is needed for hypothesis 1.
- Additional analysis over time may include correlating (regressions analysis) escapements with other extraneous variables (e.g., ocean conditions, climatic effects, etc.).
  - o Analysis may include the use of reference areas.

Analytical Rules:
- This indicator is simply used to document whether or not the annual number of hatchery fish that return and spawn is greater than the number of naturally and hatchery produced fish taken for broodstock.
- No statistical analysis is needed.

1.2 Hatchery Contribution to Recruitment of Naturally Produced Fish (*Productivity Indicator*)

Monitoring Questions:
Q1: Is the annual change in the number of natural origin recruits (NORs) produced from the supplemented population greater than or equal to the annual change in NORs in a non-supplemented population?

Target Species/Populations:
- Q1 applies to all supplemented species and populations assuming reference populations are available.

Hypothesis:
- Ho_1: ΔNOR/Max Recruitment $_{\text{Supplemented population}}$ ≥ ΔNOR/Max Recruitment $_{\text{Non-supplemented population}}$
- Ha_1: ΔNOR/Max Recruitment $_{\text{Supplemented population}}$ < ΔNOR/Max Recruitment $_{\text{Non-supplemented population}}$
    - o These hypotheses incorporate carrying capacity.[24]

Measured Variables:
- Number of hatchery and naturally produced fish on spawning grounds
- Number of naturally produced fish harvested

Derived Variables:
- Number of naturally produced recruits by brood year for both naturally produced parents and hatchery parents (≥age-3).
- May include ratio or difference scores of NORs (requires reference area).
- Spawner-recruit ratios (in part rely on data from Objective 7).

Spatial/Temporal Scale:
- Analyzed annually based on brood year.
- Analyze as a time series (initially as a 5-year period; i.e., 5-year mean of annual change).
- Ho_1 will be used for both temporal scales.

Statistical Analysis:
- Two-sample t-test (other tests may include RIA, ARIMA, or other tests) to evaluate difference scores or ratios over time (initial 5-year period).
    - On a five-year period analyze brood years for patterns that correlate with extraneous factors such as ocean conditions.
        - o Analysis may include the use of reference areas.

[24] At this time, estimates of carrying capacity (maximum recruits) is unknown at this time for all populations within the Upper Columbia.

Analytical Rules:

- This is a productivity indicator that will be used to assess the success of the supplementation program.
- Type I Error of 0.05.
- Interim analytical rules will be based on effect sizes reported in Table 1.

1.3 Natural Replacement Rates of Supplemented Populations (*Productivity Indicator*)

Monitoring Questions:
Q1: Is the change in natural replacement rates (NRRs) within the supplemented population greater than or equal to the change in natural replacement rates in a non-supplemented population?

Target Species/Populations:

- Q1 applies to all supplemented species and populations.

Hypothesis 1.3:

- Ho_1: Δ NRR $_{\text{Supplemented population}} \geq \Delta$ NRR $_{\text{Non-supplemented population}}$
- Ha_1: Δ NRR $_{\text{Supplemented population}} < \Delta$ NRR $_{\text{Non-supplemented population}}$

Measured Variables:

- Number of hatchery and naturally produced fish on spawning grounds.
- Number of hatchery and naturally produced fish taken for broodstock.
- Number of hatchery and naturally produced fish taken in harvest (if recruitment is to the Columbia).

Derived Variables:

- NORs (number of naturally produced recruits (total recruits) by brood year for both naturally produced parents and hatchery parents (≥age-3)).
- NRRs (calculated as NORs/spawner).
- May include ratio or difference scores of NRRs (requires reference area).

Spatial/Temporal Scale:

- Analyzed annually based on brood year.
- Analyze as a time series (initially as a 5-year period and to the extent possible use pre-2006 data; i.e., 5-year mean of annual change).
- Ho_1 will be used for both temporal scales.

Statistical Analysis:

- Two-sample t-test (other tests may include RIA, ARIMA, or other tests) to evaluate difference scores or ratios over time (initial 5-year period).
  - On a five-year period analyze brood years for patterns that correlate with extraneous factors such as ocean conditions.

  - o The testing is appropriate if populations are below carrying capacity and density-dependent factors are not regulating the populations at high spawner abundances.

Analytical Rules:
- This is a productivity indicator that will be used to assess the success of the supplementation program.
- Type I Error of 0.05.
- Interim analytical rules will be based on effect sizes reported in Table 1.

Objective 2: Determine if the run timing, spawn timing, and spawning distribution of both the natural and hatchery components of the target population are similar.

Inherent in the supplementation strategy is that hatchery and naturally produced fish are intended to spawn together and in similar locations. Run timing, spawn timing, and spawning distribution may be affected through the hatchery environment (i.e., domestication). If supplemented fish are not fully integrated into the naturally produced spawning population, the goals of supplementation may not be achieved. Hatchery adults that migrate at different times than naturally produced fish may be subject to differential survival. Hatchery adults that spawn at different times or locations than naturally produced fish would not be integrated into the naturally produced spawning population (i.e., segregated stock).

2.1 Migration Timing (*Monitoring Indicator*)

Monitoring Questions:
Q1: Is the migration timing of hatchery and naturally produced fish from the same age class similar?

Target Species/Populations:
- Q1 applies to all supplemented species and populations.

Hypothesis 2.1:
- Ho: Migration timing $_{\text{Hatchery Age X}}$ = Migration timing $_{\text{Naturally produced Age X}}$
- Ha: Migration timing $_{\text{Hatchery Age X}}$ ≠ Migration timing $_{\text{Naturally produced Age X}}$

Measured Variables:
- Ages of hatchery and naturally produced fish sampled via pit tags or stock assessment monitoring.
- Time (Julian date) of arrival at Bonneville, Priest Rapids, Wells, and within tributaries (e.g., Tumwater, Dryden, weirs).

Derived Variables:
- Mean Julian date for a given age class.

Spatial/Temporal Scale:
- Analyzed annually based on return year and age class.
- Analyze as a time series (initially as a 5-year period and to the extent possible use pre-2006 data).

Statistical Analysis:
- ANOVA by age and origin

Analytical Rules:
- This is a monitoring indicator that will be used to support management decisions.
- Type I Error of 0.05.
- Effect sizes will be reported annually.

2.2 Timing of Spawning (*Monitoring Indicator*)

Monitoring Questions:
Q1: Is the timing of spawning (measured as the time female salmon carcasses are observed) similar for hatchery and naturally produced fish? (Timing of spawning of hatchery and naturally produced steelhead may be evaluated if marking or tagging efforts provide reasonable results)

Target Species/Populations:
- Q1 applies to all supplemented species and populations.

Hypothesis 2.2:
- Ho: Spawn timing $_{\text{Hatchery}}$ = Spawn timing $_{\text{Naturally produced}}$
- Ha: Spawn timing $_{\text{Hatchery}} \neq$ Spawn timing $_{\text{Naturally produced}}$

Measured Variables:
- Time (Julian date) of hatchery and naturally produced salmon carcasses observed on spawning grounds within defined reaches.
- Time (Julian date) of ripeness of steelhead captured for broodstock.

Derived Variables:
- Mean Julian date.
- Elevations (covariate)

Spatial/Temporal Scale:
- Analyzed annually based on return year.
- Analyze as a time series (initially as a 5-year period and to the extent possible use pre-2006 data).

Statistical Analysis:
- ANOVA by sex and location

Analytical Rules:

- This is a monitoring indicator that will be used to support management decisions.
- Type I Error of 0.05.
- Effect sizes will be reported annually.

2.3 Distribution of Redds (*Monitoring Indicator*)

Monitoring Questions:
Q1: Is the distribution of redds similar for hatchery and naturally produced fish?

Target Species/Populations:

- Q1 applies to all supplemented species and populations.

Hypothesis 2.3:

- Ho: Redd distribution $_{\text{Hatchery}}$ = Redd distribution $_{\text{Naturally produced}}$
- Ha: Redd distribution $_{\text{Hatchery}}$ ≠ Redd distribution $_{\text{Naturally produced}}$

Measured Variables:

- Location (GPS coordinate) of female salmon carcasses observed on spawning grounds. (The distribution of hatchery and naturally produced steelhead redds may be evaluated if marking or tagging efforts provide reasonable results)

Derived Variables:

- Location of female salmon carcass in RKm (0.01).
- Calculate percent overlap in distribution across available spawning habitat.

Spatial/Temporal Scale:

- Analyzed annually based on return year (ANOVA).
- Analyze as a time series (initially as a 5-year period and to the extent possible use pre-2006 data).

Statistical Analysis:

- ANOVA by origin and sex

Analytical Rules:

- This is a monitoring indicator that will be used to support management decisions.
- Type I Error of 0.05.
- Effect sizes will be reported annually.

Objective 3: Determine if genetic diversity, population structure, and effective population size have changed in natural spawning populations as a result of the hatchery program. Additionally, determine if hatchery programs have caused changes in phenotypic characteristics of natural populations.

The genetic component of the M&E Plan specifically addresses the long-term fitness of supplemented populations. Fitness, or the ability of individuals to survive and pass on their genes to the next generation in a given environment, includes genetic, physiological, and behavioral components.[25] Maintaining the long-term fitness of supplemented populations requires a comprehensive evaluation of genetic and phenotypic characteristics. Evaluation of some phenotypic traits (i.e., run timing, spawn timing, spawning location, and stray rates) is addressed under other objectives.

Assessing the genetic component of the hatchery program does not require annual sampling. Meeting stray-rate targets (hypotheses tested under Objective 5) should prevent significant changes in population genetics. Therefore, testing statistical hypotheses associated with genetic components (Hypotheses 3.1, 3.2, and 3.3) should be conducted every three to five years, depending on the type of hatchery program. More frequent genetic sampling may be necessary if actual stray rates exceed targets.

3.1 Allele Frequency (*Monitoring Indicator*)

Monitoring Questions:
Q1: Is the allele frequency of hatchery fish similar to the allele frequency of naturally produced and donor fish?

Target Species/Populations:

- Q1 applies to all supplemented species and populations.

Hypothesis 3.1:

- Ho: Allele frequency $_{\text{Hatchery}}$ = Allele frequency $_{\text{Naturally produced}}$ = Allele frequency $_{\text{Donor pop.}}$
- Ha: Allele frequency $_{\text{Hatchery}}$ ≠ Allele frequency $_{\text{Naturally produced}}$ = Allele frequency $_{\text{Donor pop.}}$ or
- Ha: Allele frequency $_{\text{Hatchery}}$ = Allele frequency $_{\text{Naturally produced}}$ ≠ Allele frequency $_{\text{Donor pop.}}$ or

[25] These metrics are difficult to measure, and phenotypic expression of these traits may be all we can measure and evaluate.

- Ha: Allele frequency $_{\text{Hatchery}}$ ≠ Allele frequency $_{\text{Naturally produced}}$ ≠ Allele frequency $_{\text{Donor pop.}}$

Measured Variables:
- Microsatellite genotypes

Derived Variables:
- Allele frequency

Spatial/Temporal Scale:
- Analyze as a time series, initially comparing pre- and post-hatchery samples and thereafter every 3-5 years.
- Compare samples within drainages.

Statistical Analysis:
- Population differentiation tests, analysis of molecular variance (AMOVA), and relative genetic distances.

Analytical Rules:
- This is a monitoring indicator that will be used to support management decisions.
- Type I Error of 0.05.
- Effect sizes will be reported annually.

3.2 Genetic Distances Between Populations (*Monitoring Indicator*)

Monitoring Questions:
Q1: Does the genetic distance among subpopulations within a supplemented population remain the same over time?

Target Species/Populations:
- Q1 applies to all supplemented species and populations.

Hypothesis 3.2:
- Ho: Genetic distance between subpopulations $_{\text{Year x}}$ = Genetic distance between subpopulations $_{\text{Year y}}$
- Ha: Genetic distance between subpopulations $_{\text{Year x}}$ ≠ Genetic distance between subpopulations $_{\text{Year y}}$

Measured Variables:
- Microsatellite genotypes

Derived Variables:
- Allele frequencies

Spatial/Temporal Scale:
- Analyze as a time series, initially comparing pre- and post-hatchery samples and thereafter every 3-5 years.
- Compare samples among drainages.

Statistical Analysis:
- Population differentiation tests, AMOVA, and relative genetic distances.

Analytical Rules:
- This is a monitoring indicator that will be used to support management decisions.
- Type I Error of 0.05.
- Effect sizes will be reported annually.

3.3 Effective Spawning Population (*Monitoring Indicator*)

Monitoring Questions:
Q1: Is the ratio of effective population size (N_e) to spawning population size (N) constant over time?

Target Species/Populations:
- Q1 applies to all supplemented species and populations.

Hypothesis 3.3:
- Ho: $(N_e/N)_{t0} = (N_e/N)_{t1}$ for each population
- Ha: $(N_e/N)_{t0} \neq (N_e/N)_{t1}$ for each population

Measured Variables:
- Microsatellite genotypes

Derived Variables:
- Allele frequencies

Spatial/Temporal Scale:
- Analyze as a time series, initially comparing pre- and post-hatchery samples and thereafter every 3-5 years.
- Compare samples among drainages.

Statistical Analysis:
- Population differentiation tests, relative genetic distances, statistics to calculate effective population size (e.g., harmonic means).

Analytical Rules:
- This is a monitoring indicator that will be used to support management decisions.

- Type I Error of 0.05.
- Effect sizes will be reported annually.

3.4 Age at Maturity (*Monitoring Indicator*)

Monitoring Questions:
Q1: Is the age at maturity of hatchery and naturally produced fish similar?

Target Species/Populations:
- Q1 applies to all supplemented species and populations.

Hypothesis 3.4:
- Ho: Age at Maturity $_{\text{Hatchery}}$ = Age at Maturity $_{\text{Naturally produced}}$
- Ha: Age at Maturity $_{\text{Hatchery}}$ ≠ Age at Maturity $_{\text{Naturally produced}}$

Measured Variables:
- Age of hatchery and naturally produced salmon carcasses collected on spawning grounds.
- Age of broodstock.
- Age of fish at stock assessment locations (e.g., Dryden, Tumwater, Wells, Priest Rapids).

Derived Variables:
- Saltwater ages

Spatial/Temporal Scale:
- Analyzed annually based on brood year.
- Analyze as a time series (initially as a 5-year period and to the extent possible use pre-2006 data).

Statistical Analysis:
- Chi-square or ANOVA by origin and gender.
  - o Whenever possible age at maturity will be measured at weirs or dams near the spawning stream to avoid the size-related carcass recovery bias on spawning grounds (carcass sampling).

Analytical Rules:
- This is a monitoring indicator that will be used to support management decisions.
- Type I Error of 0.05.
- Effect sizes will be reported annually.

3.5 Size at Maturity (*Monitoring Indicator*)

Monitoring Questions:
Q1: Is the size (length) at maturity of a given age and sex of hatchery fish similar to the size at maturity of a given age and sex of naturally produced fish?

Target Species/Populations:
- Q1 applies to all species and populations.

Hypothesis 3.5:
- Ho: Size (length) at Maturity $_{\text{Hatchery Age X and Gender Y}}$ = Size (length) at Maturity $_{\text{Naturally produced Age X and Gender Y}}$
- Ha: Size (length) at Maturity by age and gender $_{\text{Hatchery}}$ ≠ Size (length) at Maturity by age and gender $_{\text{Naturally produced}}$

Measured Variables:
- Size (length), age, and gender of hatchery and naturally produced salmon carcasses collected on spawning grounds.
- Size (length), age, and gender of broodstock.
- Size (length), age, and gender of fish at stock assessment locations (e.g., Dryden, Tumwater, Wells, Priest Rapids).

Derived Variables:
- Calculate total age and saltwater age

Spatial/Temporal Scale:
- Analyzed annually based on brood year.
- Analyze as a time series (initially as a 5-year period and to the extent possible use pre-2006 data).

Statistical Analysis:
- ANOVA by origin, gender, and age

Analytical Rules:
- This is a monitoring indicator that will be used to support management decisions.
- Type I Error of 0.05.
- Effect sizes will be reported annually.

<u>Objective 4</u>: Determine if the hatchery adult-to-adult survival (i.e., hatchery replacement rate) is greater than the natural adult-to-adult survival (i.e., natural replacement rate) and equal to or greater than the program specific HRR expected value based on survival rates listed in the BAMP (1998).

The survival advantage from the hatchery (i.e., egg-to-smolt) must be sufficient to overcome the survival disadvantage after release (i.e., smolt-to-adult) in order to produce a greater number of returning adults than if broodstock were left to spawn naturally. If a hatchery program cannot produce a greater number of adults than naturally spawning fish the program should be modified or discontinued. Production levels were initially developed using historical run sizes and smolt-to-adult survival rates (BAMP 1998). Using the stock specific NRR and the values listed in the BAMP, comparisons to actual survival rates will be made to ensure the expected level of survival has been achieved.

4.1 Hatchery Replacement Rates (HRRs) (*Monitoring Indicator*)

Monitoring Questions:
Q1: Is the adult-to-adult survival rate of hatchery fish (HRR) greater than or equal to the adult-to-adult survival rate (NRR) of naturally produced fish?
Q2: Is the adult-to-adult survival rate of hatchery fish (HRR) greater than or equal to the value in BAMP (Table 6 in Appendix D; includes sum of adults harvested, taken for broodstock, and adults on spawning grounds)?

Target Species/Populations:
- Q1 applies to all species and populations.
- Q2 applies to all species and populations.

Hypothesis 4.1:
- Ho_1: $HRR_{\text{Year x}} \geq NRR_{\text{Year x}}$
- Ha_1: $HRR_{\text{Year x}} < NRR_{\text{Year x}}$
- Ho_2: HRR ≥ BAMP value (preferred)
- Ha_2: HRR < BAMP value

Measured Variables:
- Number of hatchery and naturally produced fish on spawning grounds
- Number of hatchery and naturally produced fish harvested
- Number of hatchery and naturally produced fish collected for broodstock.
- Number of broodstock used by brood year (hatchery and naturally produced fish).

Derived Variables:
- Number of hatchery and naturally produced adults by brood year (≥age-3).
- HRR (number of returning adults per brood year/broodstock)
- NRR (from above)

Spatial/Temporal Scale:
- Analyzed annually based on brood year.
- Analyze as a time series (initially as a 5-year period but include pre-2006 data to the extent possible).

Statistical Analysis:

- For Q1 a two-sample t-test to compare HRR to NRR
- For Q2 a one-sample t-test to evaluate HRR.
    - On a five-year period analyze brood years for patterns that correlate with extraneous factors such as ocean conditions.

Analytical Rules:

- This is a monitoring indicator that will be used to support management decisions.
- Type I Error of 0.05.
- Effect sizes will be reported annually.

Objective 5: Determine if the stray rate of hatchery fish is below the acceptable levels to maintain genetic variation between stocks.

Maintaining locally adapted traits of fish populations requires that returning hatchery fish have a high rate of site fidelity to the target stream. Hatchery practices (e.g., rearing and acclimation water source, release methodology, and location) are the main variables thought to affect stray rates. Regardless of the adult returns, if adult hatchery fish do not contribute to the donor population the program will not meet the basic condition of a supplementation program. Fish that do stray to other independent populations should not comprise greater than 5% of the spawning population. Likewise, fish that stray within an independent population should not comprise greater than 10% of the spawning population.

5.1 Stray Rates among Populations for Brood Return (*Monitoring Indicator*)

Monitoring Questions:
Q1: Is the stray rate of hatchery fish less than 5% for the total brood return?

Target Species/Populations:

- Q1 applies to all species and populations.

Hypothesis 5.1:

- Ho: Stray rate $_{\text{Hatchery fish}}$ ≥ 5% of total brood return
- Ha: Stray rate $_{\text{Hatchery fish}}$ < 5% of total brood return

Measured Variables:

- Number of hatchery carcasses found in non-target and target spawning areas.
- Number of hatchery fish collected for broodstock.
- Number of hatchery fish taken in fishery.

Derived Variables:

- Hatchery carcasses and take in fishery estimated from expansion analysis.
- Locations of live and dead strays (used to tease out overshoot).

Spatial/Temporal Scale:

- Analyzed annually based on brood year.
- Analyze as a time series (initially as a 5-year period and to the extent possible use pre-2006 data).

Statistical Analysis:

- A simple statistical approach is to use a one-sample t-test to compare the actual stray rate with the target (5%) stray rate.

Analytical Rules:

- This is a monitoring indicator that will be used to support management decisions.
- Type I Error of 0.05.
- Effect sizes will be reported annually.

5.2 Stray Rates among Populations for Return Year (*Monitoring Indicator*)

Monitoring Questions:
Q1: Is the stray rate of hatchery fish less than 5% of the spawning escapement within other independent populations?

Target Species/Populations:

- Q1 applies to all species and populations.

Hypothesis 5.2:

- Ho: Stray hatchery fish ≥ 5% of spawning escapement (based on run year) within other independent populations
- Ha: Stray hatchery fish < 5% of spawning escapement (based on run year) within other independent populations [26]

[26] This stray rate is suggested based on a literature review and recommendations by the ICTRT. It can be re-evaluated as more information on naturally-produced Upper Columbia salmonids becomes available. This will be evaluated on a species and program specific basis and decisions made by the HCP HC. It is important to understand the actual spawner composition of the population to determine the potential effect of straying.

Measured Variables:

- Number of hatchery carcasses (PIT tagged steelhead) found in non-target and target spawning areas.

Derived Variables:

- Hatchery salmon carcasses (PIT tagged steelhead) estimated from expansion analysis.

Spatial/Temporal Scale:

- Analyzed annually based on return year.
- Analyze as a time series (initially as a 5-year period and to the extent possible use pre-2006 data).

Statistical Analysis:

- A simple statistical approach is to use a one-sample t-test to compare the actual proportion of strays with the target of 5% strays

Analytical Rules:

- This is a monitoring indicator that will be used to support management decisions.
- Type I Error of 0.05.
- Effect sizes will be reported annually.

5.3 Stray Rates within the Population (*Monitoring Indicator*)

Monitoring Questions:

Q1: Is the stray rate of hatchery fish less than 10%[27] of the spawning escapement within other spawning aggregations within the target independent population?

Target Species/Populations:

- Q1 applies to all species and populations.

Hypothesis 5.3:

- Ho: Stray hatchery fish ≥ 10% of spawning escapement (based on run year) of any non-target streams within independent population
- Ha: Stray hatchery fish < 10% of spawning escapement (based on run year) of any non-target streams within independent population

Measured Variables:

- Number of hatchery carcasses (possibly PIT tagged steelhead) found in non-target and target spawning aggregates.

[27] This value should be reviewed annually by the Hatchery Committee. See footnote 5 for additional information.

Derived Variables:

- Hatchery salmon carcasses (possibly PIT tagged steelhead) estimated from expansion analysis.

Spatial/Temporal Scale:

- Analyzed annually based on return year.
- Analyze as a time series (initially as a 5-year period and to the extent possible use pre-2006 data).

Statistical Analysis:

- A simple statistical approach is to use a one-sample t-test to compare the actual proportion of strays with the target of 10% strays.

Analytical Rules:

- This is a monitoring indicator that will be used to support management decisions.
- Type I Error of 0.05.
- Effect sizes will be reported annually.

Objective 6: Determine if hatchery fish were released at the programmed size and number.

The HCP outlines the number and size of fish that are to be released to meet NNI compensation levels. Although many factors can influence both the size and number of fish released, past hatchery cultural experience with these stocks should assist in meeting program production levels.

6.1 Size of Hatchery Fish (*Monitoring Indicator*)

Monitoring Questions:
Q1: Is the size of hatchery fish released equal to the program goal?

Target Species/Populations:

- Q1 applies to all species and populations.

Hypothesis 6.1:

- Ho: Hatchery fish $_{\text{Size at release}}$ = Programmed $_{\text{Size}}$
- Ha: Hatchery fish $_{\text{Size at release}}$ ≠ Programmed $_{\text{Size}}$

Measured Variables:

- Length and weights of random samples of hatchery smolts.

Derived Variables:

- CVs.

Spatial/Temporal Scale:

- Analyzed annually.
- Analyze as a time series (initially as a 5-year period and to the extent possible use pre-2006 data).

Statistical Analysis:

- A simple statistical approach is to use a one-sample t-test to compare the actual size of hatchery fish at time of release with the program goal.

Analytical Rules:

- This is a monitoring indicator that will be used to support management decisions.
- Type I Error of 0.05.
- Effect sizes will be reported annually.

6.2 Number of Hatchery Fish (*Monitoring Indicator*)

Monitoring Questions:
Q1: Is the number of hatchery fish released equal to the program goal?

Target Species/Populations:

- Q1 applies to all species and populations.

Hypothesis 6.2:

- Ho: Hatchery fish $_{\text{Number}}$ = Programmed $_{\text{Number}}$
- Ha: Hatchery fish $_{\text{Number}}$ ≠ Programmed $_{\text{Number}}$

Measured Variables:

- Numbers of smolts released from the hatchery.

Derived Variables:

- NA

Spatial/Temporal Scale:

- Review annually.

Statistical Analysis:

- No statistical analysis needed.

Analytical Rules:

- This is a monitoring indicator that will be used to support management decisions.
- No statistical analysis is necessary.

Objective 7: Determine if the proportion of hatchery fish on the spawning grounds affects the freshwater productivity (i.e., number of smolts per redd) of supplemented streams when compared to non-supplemented streams.

Out-of-basin effects (e.g., smolt passage through the hydro system and ocean productivity) have a strong influence on survival of smolts after they migrate from the tributaries. These effects introduce substantial variability into the adult-to-adult survival rates (NRR and HRR), which may mask in-basin effects (e.g., habitat quality, density related mortality, and differential reproductive success of hatchery and naturally produced fish). The objective of long-term smolt monitoring programs in the Upper Columbia ESU is to determine the egg-to-smolt or egg-to-juvenile survival of target stocks. Smolt production models generated from the information obtained through these programs will provide a level of predictability with greater sensitivity to in-basin effects than spawner-recruitment models that take into account all effects.

Differences in carrying capacities of supplemented and non-supplemented streams can confound the effects of supplementation on numbers of juveniles per redd. For example, if the supplemented population is at or above carrying capacity and the non-supplemented population is not, numbers of juveniles per redd in the non-supplemented population may be significantly greater than the number of juveniles per redd in the supplemented population. To avoid concluding that the supplementation program has no effect or perhaps a negative effect on juveniles per redd, the capacity of the habitats must be included in the analyses. The Supplementary Hypotheses are designed to address the confounding effects of different densities on the analyses.

7.1 Juvenile Productivity (*Productivity Indicator*)

Monitoring Questions:
Q1: Is the change in numbers of juveniles (smolts, parr, or emigrants) per redd in the supplemented population greater than or equal to that in the non-supplemented population?
Q2: Does the number of juveniles per redd decrease as the proportion of hatchery spawners increases?[28]

Target Species/Populations:
- Q1 applies to all supplemented species and populations (depending on reference areas).
- Q2 applies to all supplemented species and populations.

[28] Information is needed to estimate the effects of density dependence on these questions.

Hypothesis 7.1:

- Ho_1: Slope of Ln(juveniles/redd) vs redds $_{\text{Supplemented population}}$ = Slope of Ln(juveniles/redd) vs redds $_{\text{Non-supplemented population}}$
- Ha_1: Slope of Ln(juveniles/redd) vs redds $_{\text{Supplemented population}}$ ≠ Slope of Ln(juveniles/redd) vs redds $_{\text{Non-supplemented population}}$
- Ho_2: The relationship between proportion of hatchery spawners and juveniles/redd is ≥ 1.
- Ha_2: The relationship between proportion of hatchery spawners and juveniles/redd is < 1.

Measured Variables:

- Number of hatchery and naturally produced fish on spawning grounds.
- Numbers of redds.
- Number of juveniles (smolts, parr [not appropriate for all populations], and emigrants).

Derived Variables:

- Number of juveniles per redd.

Spatial/Temporal Scale:

- Analyzed annually based on brood year.
- Analyze as a time series (initially as a 5-year period and to the extent possible use pre-2006 data).

Statistical Analysis:

- Two-sample t-test to evaluate differences between treatment and reference slopes (initial 5-year period).
  - Regression analysis to examine relationships between hatchery adult composition and juveniles/redd.

Analytical Rules:

- This is a productivity indicator that will be used to assess the success of the supplementation program.
- Type I Error of 0.05.
- Interim decisions will be based on effect sizes reported in Table 1.

<u>Objective 8</u>: Determine if harvest opportunities have been provided using hatchery returning adults where appropriate (e.g., Turtle Rock program).

In years when the expected returns of hatchery adults are above the level required to meet program goals (i.e., supplementation of spawning populations and/or brood stock requirements), surplus fish may be available for harvest (i.e., target population). The M&E Plan specifically addresses harvest and harvest opportunities upstream from Priest Rapids Dam. Harvest or removal of surplus hatchery fish from the spawning grounds would also assist in reducing potential adverse genetic impacts to naturally produced populations (loss of genetic variation within and between populations).

8.1 Harvest Rates (*Monitoring Indicator*)

Monitoring Questions:
Q1: Is the harvest on hatchery fish produced from harvest-augmentation programs high enough to manage natural spawning but low enough to sustain the hatchery program?
Q2: Is the escapement of fish from supplementation programs in excess of broodstock and natural production[29] needs to provide opportunities for terminal harvest?

Target Species/Populations:
- Q1 applies to summer Chinook reared at Turtle Rock.
- Q2 applies to all supplemented stocks.

Hypothesis 8.1:
- Ho_1: Harvest rate ≤ Maximum level to meet program goals
- Ha_1: Harvest rate > Maximum level to meet program goals
- Ho_2: Escapement ≤ Maximum level to meet supplementation goals
- Ha_2: Escapement > Maximum level to meet supplementation goals

Measured Variables:
- Numbers of hatchery fish taken in harvest.

Derived Variables:
- Total harvest by fishery estimated from expansion analysis.

Spatial/Temporal Scale:
- Reviewed annually.

Statistical Analysis:
- A one-sample t-test can be used to compare harvest rates with the level needed for program goals.

Analytical Rules:
- This is a monitoring indicator that will be used to support management decisions.
- Type I Error of 0.05.
- Effect sizes will be reported annually.

Regional Objectives

Hatchery programs have the potential to increase diseases that typically occur at low levels in the natural environment (Objective 9). In addition, hatchery fish can reduce the

[29] At this time, the escapement of adults needed to fully seed habitat in the Upper Columbia is unknown.

abundance, size, or distribution of non-target taxa through ecological interactions (Objective 10). These are important objectives that will be monitored at a later time. Analytical rules will be established for these objectives before monitoring activities begin.

Objective 9: Determine whether BKD management actions lower the prevalence of disease in hatchery fish and subsequently in the naturally spawning population. In addition, when feasible, assess the transfer of Rs infection at various life stages from hatchery fish to naturally produced fish.

The hatchery environment has the potential to amplify diseases that are typically found at low levels in the natural environment. Amplification could occur within the hatchery population (i.e., vertical and horizontal transmission) or indirectly from the hatchery effluent or commingling between infected and non-infected fish (i.e., horizontal transmission). Potential impacts to natural populations have not been extensively studied, but should be considered for programs in which the hatchery fish are expected to commingle with natural fish. This is particularly important for supplementation type programs. Specifically, the causative agent of bacterial kidney disease (BKD), *Renibacterium salmoninarum* (Rs), could be monitored at selected acclimation ponds, both in the water and fish, in which the risk and potential for transmission from the hatchery is highest. Although it is technologically possible to measure the amount of Rs in water or Rs DNA in smolts and adults non-lethally sampled, the biological meaning of these data are uncertain. Currently, the only metric available for M & E purposes is measuring the antigen level from kidney/spleen samples (i.e., ELISA). When available, non-lethal sampling may replace or be used in concert with lethal sampling.

Implementation of this objective will be conducted in a coordinated approach within the hatchery and natural environment. BKD management within the hatchery population (e.g., broodstock or juveniles) has the potential to reduce the prevalence of disease through various actions (e.g., culling or reduced rearing densities). BKD management must also take into account and support other relevant objectives of the M & E program (e.g., Hatchery Return Rate [HRR], number of smolts released). Hence, the goal of BKD management is to decrease the prevalence of disease and maintain hatchery production objectives (i.e., number and HRR).

As previously discussed, disease transmission from hatchery to naturally produced fish may occur at various life stages and locations. Of these, horizontal transmission from hatchery effluent, vertical transmission on the spawning grounds, and horizontal transmission in the migration corridor have been identified as disease interactions that could be examined under this objective, although others may also be relevant. Experimental designs addressing this objective may require technology not yet available, although in some instances samples may be collected, but not analyzed until a link can be established between bacteria levels in samples and disease prevalence.

Developing a complete set of questions and hypotheses statements for this objective may not be practical at this time, because there is currently no BKD Management Plan.

However, while developing experimental designs for this objective, it may be feasible to incorporate both hatchery and natural environment monitoring under a single study design. Integration of the different aspects of the objective would likely result in a more robust approach into understanding the effectiveness of disease management strategies.

Monitoring Questions:
Q1: What is the effect of BKD disease management on BKD disease prevalence?
Q2: Are study fish exposed to hatchery effluent infected to a greater extent than control fish?
Q3: *Is Rs infection transferred at various life stages from hatchery fish to naturally produced fish or appropriate surrogates?*[30]

Target Species/Populations:
- Q1 and Q2 both apply to spring Chinook (primary focus) and summer Chinook programs.

Hypotheses Q1:
- Ho_1: Rearing density has no effect on survival rates of hatchery fish.
- Ha_1: Rearing density has an effect on survival rates of hatchery fish.

- Ho_2: Antigen level has no effect on survival rates of hatchery fish.
- Ha_2: Antigen level has an effect on survival rates of hatchery fish.

- Ho_3: Interaction between antigen level and rearing density has no effect on survival rates of hatchery fish.
- $Ha_{3:}$ Interaction between antigen level and rearing density has an effect on survival rates of hatchery fish.

Hypothesis Q2:
- o Ho_1: Rs infection is not transferred from hatchery effluent to study fish.
- o Ha_1: Rs infection is transferred from hatchery effluent to study fish.

Measured Variables:
- Hypotheses Q1:
  - o Numbers of fish (at different life stages)

- Hypothesis Q2:
  - o Numbers of Rs+ fish

Derived Variables:
- Survival rates
- SARs
- HRRs

[30] Hypothesis statements for these monitoring questions will be developed.

Spatial/Temporal Scale:

- o Hypotheses Q1:
  - o Analyze annually based on brood year.
- o Hypothesis Q2:
  - o Analyze annually.

Statistical Analysis:

- Hypotheses Q1: either 2-way ANOVA or response-surface design.
- Hypothesis Q2: ANOVA.

Analytical Rules:

- This is a monitoring indicator that will be used to support management decisions.
- Type I Error of 0.05.
- Effect sizes will be reported annually.

Adaptively Managing Monitoring Results

Because of naturally large variation in productivity indicators, several years of data may be required before statistical inferences can be made regarding the effects of hatchery fish on productivity of naturally produced fish. Furthermore, given the large natural variation of productivity indicators, productivity could decrease as a result of the hatchery programs before a difference is detected statistically. In the interim, risk associated with supplementation programs and the productivity of naturally produced fish can be quantified based on observed natural variation in the indicator of interest (Table 1). If large differences in rates of change between supplemented and reference populations are observed, management actions may be required earlier than anticipated (every five years).

Assuming hatchery programs do not negatively affect the productivity of naturally produced fish, the observed difference in rates of change between the supplemented and reference populations should decrease over time as more of the natural variation within and between populations is incorporated into these data. More simply, as the number of years increases, the acceptable observed difference in the indicator(s) decreases. The value of the difference at any point in time would determine if management actions are warranted.

Table 1. Average differences between supplemented and reference conditions that represent different levels of management concerns. Large differences (red) indicate the need for relatively quick management changes, moderate differences (yellow) indicate that indicators need to be reviewed carefully before making management changes, and small differences (green) indicate that management changes are not currently necessary. Average differences corresponding to each level of concern are scaled to reflect the increasing risk associated with multiple brood years that show differences between supplemented and reference conditions. These differences are currently based on the temporal variability associated with each productivity indicator and will change as more information becomes available (i.e., information on the variability in difference scores between treatment and reference conditions).

Indicator	Number of Brood Years	No Concern	Warning	Concern
NRR	1	0-50%	51-100%	>100%
	2	0-40%	41-80%	>80%
	3	0-30%	31-60%	>60%
	4	0-20%	21-40%	>40%
	5	0-10%	11-20%	>20%
NOR	1	0-50%	51-100%	>100%
	2	0-40%	41-80%	>80%
	3	0-30%	31-60%	>60%
	4	0-20%	21-40%	>40%
	5	0-10%	11-20%	>20%
Juv/Redd	1	0-100%	101-200%	>200%
	2	0-80%	81-160%	>160%
	3	0-70%	71-140%	>140%
	4	0-60%	61-120%	>120%
	5	0-50%	51-100%	>100%

Appendix D

Implementation of Comprehensive Monitoring and Evaluation of Hatchery Programs

IMPLEMENTATION OF COMPREHENSIVE MONITORING AND EVALUATION OF HATCHERY PROGRAMS FUNDED BY DOUGLAS COUNTY PUD

Submitted to

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Introduction

The Douglas County PUD Monitoring and Evaluation Plan (M&E Plan; Wells HCP Hatchery Committee 2007) describes eight objectives specific to the hatchery programs funded by Douglas County PUD and two regional objectives that are related to artificial propagation. These same objectives have been identified in the M&E Plan for Chelan County PUD (Murdoch and Peven 2005) and are designed to address key questions regarding the use of supplementation as mitigation for mortality associated with the operation of Wells Hydroelectric Project. All objectives have specified indicators (i.e., primary) that will be measured and compared against target values established in the M&E Plan. Specific tasks and methodologies to be used in accomplishing the objectives are provided in the M&E Plan.

The primary focus of this proposal is the first eight objectives outlined in the M&E Plan, but additional regional objectives are included where warranted. Both disease (Objective 9) and non-target taxa (Objective 10) monitoring have been identified as important components of the M&E Plan. These regional objectives will be implemented once experimental designs have been developed and approved by the Wells HCP Hatchery Committee.

Successful implementation of the M&E Plan requires a continuation and potential expansion of existing relationships between the WDFW and other entities conducting similar field work in the Upper Columbia River Basin. Certain objectives require data to be collected from both target and reference populations. Field activities (i.e., data collection) not conducted by the WDFW, that are also required to implement the M&E Plan (i.e., reference populations) are not included in this proposal.

Addressing all the objectives within the M&E Plan will require multiple years of data collection. Several objectives may be adequately addressed after one year or five years (Table 1), and may require only periodic monitoring (e.g., every five or ten years). This proposal and budget encompasses one year of work in which WDFW will furnish all supervision, labor, services, materials, tools, and equipment necessary to implement the Monitoring and Evaluation Plan of hatchery programs funded by Douglas County PUD. All statistical analyses will be conducted consistent with the Analytical Framework for Monitoring and Evaluating PUD Hatchery Programs (Hays et al. 2007).

Table 1. A potential long-term implementation schedule of objectives outlined in the Douglas County PUD M&E Plan.

Objective	Year of implementation									
	1-4	5	6-9	10	11-14	15	16-19	20	21-24	25
1	X	X	X	X	X	X	X	X	X	X
2	X	X		X		X		X		X
3	X				X				X	
4	X	X	X	X	X	X	X	X	X	X
5	X	X	X	X	X	X	X	X	X	X
6	X	X	X	X	X	X	X	X	X	X
7	X	X	X	X	X	X	X	X	X	X
8	X	X		X		X		X		X
9	Experimental design not complete									
10	Experimental design not complete									

Reference Streams

Reference streams or populations are a critical component of the M&E Plan (Goodman 2004; ISRP & ISAB 2005). Data collected from reference populations will be included in the analysis for objectives 1 and 7. Depending on the reference population, data collected may also be included in the analysis for objectives 3, 4, 5, and 8. Suitability of a population as a reference or control for target populations for ongoing hatchery programs funded by Douglas County Public Utility District (DCPUD) has not yet been determined. The Hatchery Evaluation Technical Team (HETT) is currently evaluating potential spatial reference streams for all supplemented populations in the Methow and Okanogan Rivers. The HETT will recommend to the Wells HCP HC, reference populations that should be incorporated into the M&E Plan. Historical data may or may not exist for some proposed reference populations. If data has been collected, an assessment of the methodology used must also be conducted to determine if the historical data is suitable for inclusion in the analysis. As part of the M&E Plan, future data collection activities in the reference populations should use similar methodologies and metrics as those used in treatment populations.

WORK PLAN BY OBJECTIVE

Objective 1: Determine if a) supplementation programs have increased the number of naturally spawning and naturally produced adults of the target population relative to a non-supplemented population (i.e., reference stream) and b) the changes in the natural replacement rate (NRR) of the supplemented population are similar to that of the non-supplemented population.

Hypotheses:

- Ho_1: Number of hatchery fish that spawn naturally > number of naturally and hatchery produced fish taken for broodstock.
- Ha_1: Number of hatchery fish that spawn naturally ≤ number of naturally and hatchery produced fish taken for broodstock.
- Ho_2: ΔNOR/Max recruitment $_{\text{Supplemented population}}$ ≥ ΔNOR/Max recruitment $_{\text{Non-supplemented population}}$
- Ha_2: ΔNOR/Max recruitment $_{\text{Supplemented population}}$ < ΔNOR/Max recruitment $_{\text{Non-supplemented population}}$
- Ho_3: Δ NRR $_{\text{Supplemented population}}$ ≥ Δ NRR $_{\text{Non-supplemented population}}$
- Ha_3: Δ NRR $_{\text{Supplemented population}}$ < Δ NRR $_{\text{Non-supplemented population}}$

General Approach

Spawning ground, broodstock, and harvest data (e.g., selective fisheries) will be the source of all abundance, composition, and productivity information required for this objective. Identification of suitable non-supplemented populations will be problematic in the Upper Columbia Basin because some species/races do not have populations that have not been either supplemented or influenced by hatchery fish (e.g., summer Chinook). For those supplemented populations without a suitable spatial reference population, temporal references may be used (i.e., prior to hatchery intervention). Temporal reference populations may also be initiated if deemed necessary, by discontinuing hatchery releases in a target population for a predetermined period of time (i.e., at least one generation minimum).

Methodology

Standard spawning ground survey methodology outlined in Appendix F of the M&E Plan (Spawning ground surveys) and data analysis outlined Appendix G of the M&E Plan (Relative Abundance) will be used under this objective. WDFW will coordinate with other Agencies (i.e., USFWS, USFS, Tribes) that conduct spawning ground surveys to ensure methodologies and sample rates are consistent with methodologies used in this objective (Table 2). Spawning/carcass surveys will be conducted for Methow Basin spring Chinook (WDFW); Methow Basin steelhead (WDFW); and Okanogan steelhead (CCT). The use of a composite spring Chinook broodstock in the Methow and Chewuch Rivers suggests that the Methow and Chewuch spawning aggregates be treated as a single group. The combined group (i.e., MetChew) is supported by genetic data, which concluded that both spawning aggregates are very closely related (Snow et al. 2007). However, differences in spawner abundance and carrying capacity of the two subbasins may require that each subbasin be treated independently for data analysis purposes.

Table 2. Methodologies used to determine biological information used in Objective 1.

Population	Spawning ground methodology	Spawner composition	Age composition
Methow steelhead	Expanded index	Wells Dam	Wells Dam
Twisp steelhead	Total ground	Twisp weir	Twisp weir
Okanogan steelhead [a]	Total ground	Wells Dam	Wells Dam
Methow sp. Chinook	Total ground	Carcasses	Wells Dam
Chewuch sp. Chinook	Total ground	Carcasses	Wells Dam
Twisp sp. Chinook	Total ground	Carcasses	Wells Dam

[a] Conducted by CCT.

Schedule of Activities

Table 3. Schedule for conducting spawning ground surveys and data analysis (D = data collection; A = data analysis).

Target population	J	F	M	A	M	J	J	A	S	O	N	D
Methow/Okanogan steelhead	A	A	D	D	D	D	A	A	A	A	A	A
Methow Basin spring Chinook	A	A	A	A	D	D	D	D	D	A	A	A

Objective 2: Determine if the run timing, spawn timing, and spawning distribution of both the natural and hatchery components of the target population are similar.

Hypotheses:

- Ho_4: Migration timing $_{\text{Hatchery Age X}}$ = Migration timing $_{\text{Naturally produced Age X}}$
- Ha_4: Migration timing $_{\text{Hatchery Age X}}$ ≠ Migration timing $_{\text{Naturally produced Age X}}$
- Ho_5: Spawn timing $_{\text{Hatchery}}$ = Spawn timing $_{\text{Naturally produced}}$
- Ha_5: Spawn timing $_{\text{Hatchery}}$ ≠ Spawn timing $_{\text{Naturally produced}}$
- Ho_6: Redd distribution $_{\text{Hatchery}}$ = Redd distribution $_{\text{Naturally produced}}$
- Ha_6: Redd distribution $_{\text{Hatchery}}$ ≠ Redd distribution $_{\text{Naturally produced}}$

General Approach

A properly integrated hatchery program produces fish that have similar life history traits as naturally produced fish. Differences in any of these behavioral life history traits may affect progeny survival. Migration timing in the Columbia River of both juvenile and adult fish will be assessed using PIT tags when available. Migration timing into spawning tributaries will be assessed at broodstock collection locations, or using in-stream PIT antenna arrays. In 2009, in-stream antenna arrays were installed in the lower Methow and Twisp rivers to assess the distribution and migration timing of adult hatchery and wild steelhead. These antennas, in conjunction with arrays installed by other researchers (i.e., USGS) will be used to assess steelhead and spring Chinook run timing and distribution throughout the Methow Basin.

Spawn timing and redd distribution data for spring Chinook will be collected during spawning ground surveys. We propose selecting index reaches to evaluate spawn timing in reaches where similar proportions of hatchery and naturally produced fish are expected to spawn (based on carcass recovery data). The use of index reaches will eliminate any potential bias in spawn timing due to differences in spawning locations. For fish that are not adipose fin clipped, the female carcass recovery date will allow for a comparison of the relative spawn timing. Carcass recovery locations will be used as a surrogate for spawning location.

For summer steelhead, WDFW will conduct an evaluation in the Twisp River using visual observation of spawning fish to evaluate spawn timing and location. All steelhead sampled at the Twisp River weir in 2011 will be externally Floy-tagged based on stock and origin, and surveyors will conduct intensive surveys to quantify redd distribution and collect observational data from Floy-tagged fish. Additionally, adult female steelhead will be PIT-tagged in the body cavity to maximize the likelihood that PIT tags will be expelled into redds. Redds will be scanned with portable PIT tag antennas to confirm the origin of females observed spawning, and to provide spawn timing information for redds where no visual observations of spawners were made. Further, temporary in-stream PIT antennas will be installed in selected Methow Basin tributaries to assess whether surveys are conducted in all spawning areas, and to estimate spawner abundance in areas where conducting systematic surveys is problematic (e.g., Lost River). Funding for increased spawning ground surveys, PIT tag monitoring, and Floy Tag detections above baseline Douglas PUD M&E activities will be funded by the Bonneville Power Association (BPA) through contracts 49080 and 47950.

Methodology

Migration Timing

As previously stated, when available, PIT tags will be used to evaluate differences in migration timing in the Columbia River. During broodstock collection activities at mainstem dams, tributary traps, and the Twisp River weir, PIT tags will be inserted in all fish captured and released in excess of broodstock requirements so that data on migration timing to spawning tributaries can be collected (Table 4). Migration timing into spawning tributaries will be assessed using PIT antenna arrays deployed at long-term sites in the lower Methow and Twisp rivers, utilizing antennas installed by other researchers within the Methow and Okanogan Basins (e.g., USGS), and using PIT antennas installed on a temporary basis in selected tributaries.

Table 4. Methods and locations used for evaluating differences in migration timing between hatchery and naturally produced salmon and steelhead.

Target population	Migration timing	
	Columbia River*	Spawning tributary
Methow spring Chinook	Wells Dam, PIT tags, CWTs	Twisp Weir, Chewuch PIT array
Methow steelhead	Wells Dam, PIT tags, VIE	Twisp Weir, PIT arrays in select tribs
Okanogan steelhead	Wells Dam, PIT tags, Ad clip	Omak Cr. Weir/Zosel Dam

* PIT tags will be used when available (i.e., in conjunction with other objectives).

Spawn Timing

All spawn timing information necessary for evaluating differences between hatchery and naturally produced salmon and steelhead will be collected during spawning ground surveys (M&E Plan Appendix F). Specific spawn timing information will only be collected within index spawning areas. Index areas identified are likely to have a similar proportion of hatchery and naturally produced fish spawning based on carcass recoveries between 2003 and 2006 (Table 5). Carcass recovery date of female spring Chinook salmon will be used to examine relative differences in spawn timing.

Determining the relative spawn timing of steelhead in the natural environment is problematic because not all hatchery fish are adipose fin clipped. In 2011, an evaluation of steelhead spawn timing in the Methow Basin will be conducted utilizing female steelhead Floy-tagged at the Twisp River weir. Floy tag colors will be alternated every other year between hatchery and wild fish to control for any potential color effects on reproductive success. In 2011, male and female hatchery fish will be tagged with red and pink tags, and males and female wild fish with blue and chartreuse tags, respectively. Approximately 85% of the steelhead in the Twisp River spawn upstream of the Twisp River weir (mean 2003-2005). Steelhead will be captured and tagged at the Twisp River weir between 1 March and 15 June. All fish captured will be examined to determine origin (VIE, PIT, CWT, or eroded fins), age, and tagged with colored anchor tags depending on stock and origin. Surveyors will record the tag color and date of all female steelhead observed during surveys and record GPS locations of all redds. Surveyors will also record the incidence of non Floy-tagged fish upstream of the Twisp River weir to determine weir capture efficiency. Because redd residence time of steelhead can be very low, female steelhead will be PIT-tagged in the body cavity to encourage tag expulsion into the redd. Surveyors will periodically scan completed redds for PIT tags to confirm female origin, or to identify female origin for redds where no visual observations of spawners occurred. Sampling at the Twisp River weir will be accomplished in conjunction with an on-going relative reproductive success study of steelhead in the Twisp River which receives funding through this implementation plan, and BPA contract No. 49080.

Table 5. Potential tributary index areas identified for each respective target population used for evaluating differences in spawn timing between hatchery and naturally produced salmon and steelhead.

Target population	Historical reach(s)
Twisp spring Chinook	Twisp River (T5 - T6)
Chewuch spring Chinook	Chewuch River (C4 - C6)
Methow spring Chinook	Methow River (M9 - M11)
Twisp steelhead	Twisp River (T4 - T10)

Spawning Distribution

Redd distribution data will also be collected during spawning ground surveys (M&E Plan Appendix F). The origin of spawners will be identified from carcasses (i.e., scales or CWT), and carcass recovery location (i.e., rkm) of female spring Chinook will be used to determine redd distribution. Overall steelhead redd distribution will be determined from GPS location information for each redd observed. Distribution by origin of spawning adult steelhead cannot be determined without application of an additional mark (e.g., floy tag) because not all hatchery steelhead were adipose fin-clipped. Steelhead spawning distribution by origin of spawning adults will be assessed at the Twisp River weir in 2011. Surveys will be conducted at least weekly in the Twisp River to assess distribution of Floy-tagged females and to scan for PIT tags as previously described. Resident rainbow, residual hatchery steelhead, and cutthroat trout females will also be PIT-tagged in the body cavity to determine if these species or resident stages contribute to steelhead redd count estimates. Additionally, temporary in-stream PIT tag antenna arrays will be placed in selected tributaries to assist with spawning distribution evaluation. These arrays are expected to provide a reliable, cost-effective means of corroborating current survey methodologies with observed steelhead use, and assessing steelhead spawning distribution (if any) in locations where spawning is presumed to not occur, or where surveys are difficult to conduct.

Schedule of Activities

Table 6. Schedule for conducting migration timing, spawn timing, and spawning distribution field activities and data analysis (D = data collection; A = data analysis).

Target population	J	F	M	A	M	J	J	A	S	O	N	D
Methow steelhead	A	A	D	D	D	D	D	D	D	D	A	A
Methow spring Chinook	A	A	A	A	D	D	D	D	D			

Objective 3: Determine if genetic diversity, population structure, and effective population size have changed in natural spawning populations as a result of the hatchery program. Additionally, determine if hatchery programs have caused changes in the phenotypic characteristics of natural populations.

Hypotheses related to the genetic diversity, population structure, and effective population size (Ho 7-9) were addressed in the 2008-2010 work plans and will not be addressed in 2011. Hypotheses for 2011:

- Ho_{10}: Age at Maturity $_{\text{Hatchery}}$ = Age at Maturity $_{\text{Naturally produced}}$
- Ha_{10}: Age at Maturity $_{\text{Hatchery}}$ ≠ Age at Maturity $_{\text{Naturally produced}}$
- Ho_{11}: Size (length) at Maturity $_{\text{Hatchery Age X and Gender Y}}$ = Size (length) at Maturity $_{\text{Naturally produced Age X and Gender Y}}$
- Ha_{11}: Size (length) at Maturity by age and gender $_{\text{Hatchery}}$ ≠ Size (length) at Maturity by age and gender $_{\text{Naturally produced}}$

General Approach

Genotypes of hatchery and naturally produced populations will be sampled and monitored based upon the schedule outlined in Appendix H of the Douglas PUD M&E Plan. Priority of analysis was based upon recovery needs or relative risk a hatchery program may have on the naturally produced population. Differences in phenotypic characteristics that may arise as a result of hatchery programs (i.e., domestication) will be measured using historical (i.e., prior to current hatchery programs) and recent data collected from wild fish and broodstock or carcasses recovered on the spawning grounds. Data related to additional important phenotypic characteristics will be collected and analyzed as part of Objective 2 (e.g., run timing, spawn timing, and spawning location), Objective 4 (e.g., fecundity), and Objective 7 (e.g., size and age at smolt migration).

Methodology

Data for monitoring phenotypic characteristics (i.e., age at maturity and size at maturity) will be collected annually as part of the broodstock collection protocol (M&E Plan Appendix B). Broodstock for all programs are not collected randomly from the run at large with respect to sex, origin, or age. Trapping activities do provide an opportunity to collect data from a random sample from the run at large (i.e., those fish collected during broodstock trapping and released upstream). Historically, information related to the spawning population was derived from broodstock, carcasses, or a combination of both. Recent data suggest that these methods are biased and additional sampling at broodstock collection sites is required (Zhou 2002; Murdoch et al. 2005). Broodstock collection sites are located near or below a majority of the spawning locations (Table 7). All fish trapped, or a random sample depending on the stock, will be sampled to determine origin, age, and size. Additionally, PIT tags may be inserted into adult fish released upstream of Wells Dam to address other M&E Plan objectives (i.e., migration timing, Objective 2; stray rates, Objective 5).

Table 7. Broodstock collection locations for stock assessment and phenotypic characterization of hatchery and naturally produced fish.

Stock	Primary location	Secondary location
Methow Basin spring Chinook	Wells Dam	Twisp weir
Methow/Okanogan steelhead	Wells Dam	Twisp weir / Priest Rapids Dam

Schedule of Activities

Table 8. Schedule for conducting size and age at maturity comparisons (D = data collection; A = data analysis).

Target population	J	F	M	A	M	J	J	A	S	O	N	D
Methow/Okanogan steelhead	D	D	D	D	A	A	D	D	D	D	D	D
Methow spring Chinook	A	A	A	A	D	D	D	D	D			

Objective 4: Determine if the hatchery adult-to-adult survival (i.e., hatchery replacement rate) is greater than the natural adult-to-adult survival (i.e., natural replacement rate) and equal to or greater than the program specific expected value (BAMP 1998).

Hypotheses:

- Ho_{12}: $HRR_{\text{Year x}} \geq NRR_{\text{Year x}}$
- Ha_{12}: $HRR_{\text{Year x}} < NRR_{\text{Year x}}$
- Ho_{13}: HRR ≥ BAMP value (preferred)
- Ha_{13}: HRR < BAMP value

General Approach

The survival advantage from the hatchery (i.e., egg-to-smolt) must be sufficient to overcome lower post-release survival (i.e., smolt-to-adult) in order to produce a greater number of returning adults than if broodstock were left to spawn naturally. If a hatchery program cannot produce a biologically significant greater number of adults than naturally spawning fish, the program should be modified or discontinued. More simply, the hatchery replacement rate should always be greater than the natural replacement rate.

Hatchery programs in the Upper Columbia River were initially designed based on observed mean survival rates for each stock (BAMP 1998). Performance of the hatchery programs will be assessed using those expected survival rates and the number of broodstock collected on a brood year basis. Harvest augmentation hatchery programs will only be compared to the expected HRR value because a corresponding NRR is not available or applicable (e.g., Wells summer Chinook).

Methodology

Smolt to adult (SAR) and HRR values will be calculated for each stock. SAR values are currently calculated using CWT recoveries from all locations (harvest, hatcheries, and spawning grounds), except for steelhead, which is calculated based on sampling that occurs at Priest Rapids Dam or Wells Dam. HRR values that fall below the expected values or NRR (M&E Plan Appendix G) will be evaluated to determine whether in-hatchery (M&E Plan Appendix C) or out of hatchery (M&E Plan Appendix D) factors contributed to the reduced survival.

Schedule of Activities

Table 9. Schedule of activities for hatchery evaluation activities (D = data collection; A = data analysis).

Target population	J	F	M	A	M	J	J	A	S	O	N	D
Methow/Okanogan steelhead	A/D	A/D	D	D	D	D	D	D	D	D	D	D
Wells summer Chinook	A/D	A/D	D	D	D	D	D	D	D	D	D	D
Methow Basin spring Chinook	A/D	A/D	D	D	D	D	D	D	D	D	D	D

Objective 5: Determine if the stray rate of hatchery fish is below the acceptable levels to maintain genetic variation.

Hypotheses:

- Ho_{14}: Stray rate $_{\text{Hatchery fish}}$ < 5% of total brood return
- Ha_{14}: Stray rate $_{\text{Hatchery fish}}$ ≥ 5% of total brood return
- Ho_{15}: Stray hatchery fish < 5% of spawning escapement (based on run year) within other independent populations
- Ha_{15}: Stray hatchery fish ≥ 5% of spawning escapement (based on run year) within other independent populations
- Ho_{16}: Stray hatchery fish < 10% of spawning escapement (based on run year) of any non-target streams within independent populations
- Ha_{16}: Stray hatchery fish ≥ 10% of spawning escapement (based on run year) of any non-target streams within independent populations

General Approach

Excessive strays from hatchery programs pose significant genetic risk (loss of genetic variation between populations) and must be monitored in order to determine the magnitude of the problem and develop reasonable and appropriate recommendations. Stray rates will be monitored using CWT recoveries from Chinook spawning ground surveys. The Regional Mark Information System (RMIS) database will provide all necessary CWT information needed when calculating stray rates for each brood year or within and outside basin stray rates based on spawning escapement estimates.

Brood year stray rates will require multiple year CWT recoveries (i.e., all age classes) from broodstock and carcass recoveries on the spawning grounds. The estimated number of strays for the entire brood year will be calculated by dividing the number of strays by the total number of hatchery fish that returned. Stray rates within, and between independent populations will be calculated in a similar manner as brood year stray rates, except on an annual basis and based on the estimated spawning escapement.

Collecting stray rate information for steelhead poses the greatest challenge because carcasses are not available for examination. When available, radio tag information and/or adult PIT tag monitoring may provide adequate information for evaluating stray rates. Some data needed for evaluating stray rates for the Methow/Okanogan steelhead will be collected during broodstock trapping activities at Wells Dam (M&E Plan Appendix B), and through operation of the Twisp River weir when assessing spawn timing (see Objective 2). Stray rates in other tributaries may need to be calculated by other types of sampling (i.e., PIT tags, radio tags, hook and line, electroshocking) if warranted. Antenna arrays installed by WDFW and other researchers should provide tributary stray rate information, provided that adequate numbers of juvenile fish are PIT tagged prior to release (hatchery fish) or within natal streams (wild fish). Tagging of hatchery steelhead under Objective 7 (see Table 14) should satisfy within-basin and out-of-basin stray rate monitoring goals of fish destined for release in the Methow Basin.

Methodology

Stray rates will be calculated using procedures outlined in the spawning ground survey methodology (M&E Plan Appendix F). As stated previously, information needed to evaluate steelhead stray rates will occur during broodstock collection activities at Wells Dam, operation of the Twisp weir and antenna array, and through other proposals. However, direct observations on the spawning grounds by other Agencies (e.g., USFWS, CCT, or USGS) or via PIT tags may be required in non-target streams (Table 10).

Table 10. Proposed methodologies used to evaluate stray rates for target and non-target streams.

Hatchery program	Target stream	Method
Methow steelhead	Methow, Twisp, Chewuch	PIT/Observation/creel*
Okanogan steelhead	Okanogan, Similkameen	PIT/Observation/creel*
Methow Basin spring Chinook	Methow, Twisp, Chewuch	CWT
Wells summer Chinook	Wells Hatchery	CWT

***** The number of strays will also be estimated during broodstock collection activities or PIT tag detections at Columbia River or tributary dams/detectors where applicable.

Schedule of Activities

Table 11. Schedule for data analysis to determine stray rates of hatchery fish (D = data collection; A = data analysis).

Target population	J	F	M	A	M	J	J	A	S	O	N	D
Methow steelhead	A	A	D	D	D	D						
Okanogan steelhead	A	A	D	D	D	D						
Methow Basin spring Chinook	A	A						D	D			
Wells summer Chinook	A	A								D	D	

Objective 6. Determine if hatchery fish were released at the programmed size and number.

Hypotheses:

- Ho_{17}: Hatchery fish $_{\text{Size at release}}$ = Programmed $_{\text{Size at release}}$
- Ha_{17}: Hatchery fish $_{\text{Size at release}}$ ≠ Programmed $_{\text{Size at release}}$
- Ho_{18}: Hatchery fish $_{\text{Number released}}$ = Programmed $_{\text{Number released}}$
- Ha_{18}: Hatchery fish $_{\text{Number released}}$ ≠ Programmed $_{\text{Number released}}$

General Approach

The HCP outlines the number and size at which fish of each program are to be released. The programmed size and number of fish for each program will be compared to actual values at release each year. The number of broodstock collected and the assumptions (i.e., sex ratio, fecundity, and survival) in the broodstock collection protocol are important components that need to be considered. A program's failure to meet the HCP standards (e.g., over or under program goals) will be evaluated taking into account the number of broodstock and assumptions. The size of fish will be compared using a representative sample collected immediately prior to release.

Methodology

The number and size of fish released will be calculated according to methodologies outlined in the M&E Plan (Appendix C). An annual review of size and number of fish from each program will be compared to those values defined in the HCP. If release targets were achieved within acceptable levels (i.e., 10% +/- of HCP defined values) then no change would be recommended. If release targets are not achieved then causation will be determined and recommendations will be made based upon the results of the evaluation. A review of the broodstock protocols will occur every five years (or more frequently if necessary) concurrently with an evaluation of the number of fish released from each program.

Schedule of Activities

Table 12. Schedule of activities to determine the number and size of fish released (D = data collection; A = data analysis).

Target population	J	F	M	A	M	J	J	A	S	O	N	D
Wells steelhead	D	D	D	D	D	A	D	D	D	D	D	D
Wells summer Chinook	D	D	D	D	D	D	D	A	D	D	D	D
Methow spring Chinook	D	D	D	D	D	A	D	D	D	D	D	D

Objective 7: Determine if the proportion of hatchery fish on the spawning grounds affects the freshwater productivity (i.e., number of smolts per redd) of supplemented streams when compared to non-supplemented streams.

Hypotheses:

- Ho_{19}: Slope of Ln(juveniles/redd) vs redds $_{\text{Supplemented population}}$ = Slope of Ln(juveniles/redd) vs redds $_{\text{Non-supplemented population}}$
- Ha_{19}: Slope of Ln(juveniles/redd) vs redds $_{\text{Supplemented population}}$ ≠ Slope of Ln(juveniles/redd) vs redds $_{\text{Non-supplemented population}}$
- Ho_{20}: The relationship between proportion of hatchery spawners and juveniles/redd is ≥ 1.
- Ha_{20}: The relationship between proportion of hatchery spawners and juveniles/redd is < 1.

General Approach

Supplementation should result in an increase in the natural production of the target stock. Given variability in abundance of adult salmonid populations in the Upper Columbia River Basin, monitoring juvenile production (e.g., smolts/redd) should provide a direct assessment of the efficacy of hatchery fish in rebuilding natural populations. Monitoring the freshwater production of both supplemented and non-supplemented populations may provide an early indication of the reproductive success of hatchery fish on the spawning grounds (i.e., no out of basin effects on survival). Conversely, without a smolt monitoring program, changes in smolt production may be masked by out of basin effects. Thus, subsequent recommendations concerning hatchery program modifications may be misdirected.

Smolt monitoring programs are currently ongoing for most treatment streams (Table 13). Coordination with the Agencies operating the various traps is ongoing to ensure similar levels of effort and methodologies are used.

Table 13. Population and location of smolt traps that may be used in examining the influence of hatchery fish on freshwater productivity.

Population	Smolt trap	Size	Agency
Methow Basin spring Chinook	Methow	1 - 8 ft trap; 1 - 5 ft trap	WDFW
Twisp spring Chinook	Twisp	1 - 5 ft trap	WDFW
Methow Basin steelhead	Methow	1 - 8 ft trap; 1 - 5 ft trap	WDFW
Twisp steelhead	Twisp	1 - 5 ft trap	WDFW
Okanogan steelhead	Okanogan	1 - 8 ft trap; 1 – 5 ft trap	CCT

Comparisons between supplemented and unsupplemented populations require extensive data sets, with potentially high annual variability that may require years before the efficacy of the program can be determined. Furthermore, the Wells steelhead program began decades before the HCP was signed and pretreatment data may not be available.

Methodology

Procedures for this objective are outlined in Appendix E of the M&E Plan. Juvenile monitoring requires an extensive trapping period (Table 15) over many successive generations due to the diverse life history of spring Chinook (subyearling and yearling emigrants) and summer steelhead (multiple age class smolts). Random scale samples must be collected for all stocks with multiple age class smolts in order to calculate the number of smolts produced from each brood year. Whenever possible, direct measurements of the proportion of hatchery fish on the spawning grounds will be conducted (i.e., Twisp weir).

Current estimates of egg to smolt survival for Methow spring Chinook are much lower than expected. Based on scale analysis of returning Chinook adults, we assumed that at the Methow smolt trap all yearling emigrants were spring Chinook and subyearling emigrants were summer Chinook. Results of DNA sampling at the Methow River trap during the fall of 2006 and 2007 indicated that the majority of subyearling Chinook captured were spring Chinook. Because of this, fall trapping and DNA sampling will be conducted at the Methow smolt trap. Provided no unmarked subyearling hatchery fish are released prior to trapping, we propose to conduct DNA sampling during the spring period to determine the extent of subyearling spring Chinook spring emigration at the Methow smolt trap. Sampling and analysis needs will be assessed annually to determine whether adequate information has been collected to identify typical composition trends of spring and fall Chinook migrants.

The low abundance of steelhead and yearling Chinook captured at smolt traps in the Methow Basin limits the sample size to conduct migration timing comparisons and life stage survival estimates (e.g., PIT tag recaptures). The installation of PIT tag antenna arrays in the lower Twisp and Methow rivers will provide additional opportunities to assess migration behavior and survival, provided an adequate number of fish are PIT tagged. We propose to conduct additional PIT tagging of juvenile steelhead and Chinook that are encountered during ongoing sampling activities. These fish would be captured via hook-and-line angling, seine netting, backpack electroshocker, or rescued from de-watering areas via traps, nets, or electroshocking equipment. Additional effort for steelhead tagging conducted in the Twisp River will address sample size requirements for an on-going relative reproductive success study funded under BPA contract # 49080. Tagging methodologies will be consistent with ongoing activities in the Wenatchee and Entiat basins following protocols developed under the ISEMP (Table 14).

For life-stage survival comparisons and to monitor stray rates, migration patterns, rate, and speed within the basin, we propose that comparison groups of hatchery steelhead be tagged at Wells Hatchery prior to release (Table 14). Comparison groups of hatchery spring Chinook and steelhead were historically tagged at each smolt trap, but tag rates were likely too low to provide meaningful comparisons. Further, PIT tagging at the Methow trap likely incorporated fish from hatchery programs not covered under the M&E Plan (i.e., WNFH) because release time and hatchery mark are often the same for steelhead and spring Chinook released from WDFW and USFWS hatcheries in the Methow Basin. Since releases of similar fish from these hatcheries have exhibited different survival rates (Townsend and Skalski 2004), tagging should occur at the hatchery of origin to ensure that evaluations are conducted with target stocks.

Table 14. PIT tagging goals for remote sampling (wild fish) and in-hatchery tagging (hatchery fish) in the Methow Basin.

Target population	Wild fish		Hatchery fish	
	Steelhead	Age-0 Chinook	Target population	Steelhead
Methow	500	500	Methow (ad-clipped)	10,000
Twisp	2,000[a]	500	Methow (non-clipped)	10,000
Chewuch	500	500		
Misc. tribs	500			
Total	3,500	1,500		20,000

[a] *Includes 1,500 fish tagged and funded though BPA contract No. 49080.*

Schedule of Activities

Table 15. Schedule of activities for smolt monitoring programs in the Methow Basin (D = data collection; A = data analysis).

Target population	J	F	M	A	M	J	J	A	S	O	N	D
Methow Basin steelhead	A	D/A	D/A	D	D	D	D	D	D	D	D	D/A
Twisp steelhead	A	D/A	D/A	D	D	D	D	D	D	D	D	D/A
Methow Basin spring Chinook	A	D/A	D/A	D	D	D	D	D	D	D	D	D/A
Twisp spring Chinook	A	D/A	D/A	D	D	D	D	D	D	D	D	D/A
Methow summer Chinook	A	D/A	D/A	D	D	D	D	D	D	D	D	D/A

Objective 8: Determine if harvest opportunities have been provided using hatchery returning adults where appropriate (e.g., Wells Chinook salmon).

Hypotheses:

- Ho_{21}: Harvest rate ≤ Maximum level to meet program goals
- Ha_{21}: Harvest rate > Maximum level to meet program goals
- Ho_{22}: Escapement ≥ Maximum level to meet supplementation goals
- Ha_{22}: Escapement < Maximum level to meet supplementation goals

General Approach

In years when the expected returns of hatchery adults are above the levels required to meet program goals (i.e., broodstock, natural escapement), surplus fish may be available for harvest. Harvest of returning adults is the goal of some programs (e.g., Wells summer Chinook) and an ancillary benefit of other programs (e.g., Methow/Okanogan steelhead). Contribution to fisheries, whether incidental or directed, will be monitored using CWT recoveries on a brood year basis. Target harvest rates have not been outlined in the M&E Plan. Hence, a qualitative assessment of the contribution rates of hatchery fish to fisheries versus broodstock or spawning grounds is required to determine if the objective has been met.

One approach, based on the goal of the hatchery program, is to compare CWT recoveries by recovery location (i.e., broodstock, fisheries, or spawning grounds). For example, a majority of the CWT recoveries for harvest augmentation programs should occur in fisheries. Conversely, supplementation programs should have a majority of the CWT recoveries occur on the spawning grounds.

Methodology

Robust statistically valid creel programs will be conducted for all sport fisheries in the Upper Columbia River to estimate harvest of hatchery fish from Douglas County PUD funded hatchery programs (M&E Plan Appendix D). Creel survey programs will be designed and implemented by WDFW Fish Management staff. Creel surveys in the Upper Columbia River are also an important component in calculating the HRR (Objective 4) because most CWT recoveries occur within the Upper Columbia River, the exception being summer Chinook. Significant time lags in reporting CWT recovery data to the Regional Mark Information System (RMIS) database requires a continual requerying of recovery data until the number of estimated fish does not change. The number of fish and proportion by brood year for CWT recoveries will be summarized in several categories (Table 16).

Table 16. Categories for CWT recoveries of hatchery fish released from Douglas County PUD funded programs.

Category		Estimated number of fish (%)	
Broodstock	Total	Target stream	Nontarget streams
Spawning ground	Total	Target stream	Nontarget streams
Fisheries	Total	Commercial	Sport
Commercial	Ocean	Columbia River Treaty	Columbia River non-Treaty
Sport	Ocean	Columbia River	Terminal

Schedule of Activities

Table 17. Schedule of activities to determine harvest rates of hatchery fish (D = data collection; A = data analysis).

Target population	J	F	M	A	M	J	J	A	S	O	N	D
Methow/Okanogan steelhead	D	D	D	A	A	A		D	D	D	D	D
Wells summer Chinook	A	A					D	D	D	D		
Methow basin spring Chinook	A	A										

DELIVERABLES

Annual Reports: A draft annual report will be provided to the District by 1 April. A final report will be provided to the HCP HC within 30 days of receiving comments on the draft report. The annual report will summarize all field activities conducted during the contract period. The format of the report will be similar to the 2009 annual report that have been provided to the District, with each task reported in a separate chapter. Primary indicators and the data used in calculations during each task will also be presented in each chapter. Secondary and tertiary indicators will be reported if needed to calculate the primary indicator.

Chapter 1. Hatchery Brood Report

a. Broodstock
   - Number collected
   - Age composition
   - Size at maturity

b. Juvenile
   - Number released
   - Size at release

c. Hatchery replacement rates

Chapter 2. Harvest

a. Hatchery fish
   - Number
   - Location

Stray rates

b. Wild fish

Number

Location

Chapter 3. Smolt Monitoring

a. Smolt production

Number of smolts (captured and total estimate)

Smolts/redd

Size at emigration

Age at emigration

b. Survival

Egg to emigrant survival

Number of fish PIT tagged

Smolt to smolt survival

c. Remote PIT tagging

Number tagged

Chapter 4. Steelhead Spawning Ground Surveys

a. Migration timing

b. Spawn timing

c. Redd distribution

Number of redds

Spawning escapement

Spawner composition

Number of NOR

NRR

Stray rates

Chapter 5. Chinook Spawning Ground Surveys

a. Migration timing

b. Spawn timing

c. Redd distribution

Number of redds

Spawning escapement

Spawner composition

Number of NOR

NRR

Stray rates

Five-Year Summary Report: In addition to the annual report, a draft five-year summary report will be developed and provided to the District no later than 1 July 2011, depending on the completion of reference stream analysis. A final report will be provided to the HCP HC within 30 days of receiving comments on the draft report. The format of the five-year summary report will be similar to the M&E Plan and results will be presented by objective, not by task as in the annual reports.

Statistical analysis of data will be based on the statistical design that is currently under development. All raw data used in the statistical analysis will also be presented in the report.

Recommendations: Recommendations to modify the M&E Plan or reporting will occur on an annual basis and again at the five-year summary. Initially, changes to protocols or methodologies may be necessary to ensure the data required in the M&E Plan is collected. Changes to the M&E Plans' implementation or hypotheses will be included in the five-year summary report. Recommendations will be consistent with the hatchery program goals and will be included in a separate section of the summary report.

Presentations: A formal presentation (i.e., power point format) of the M&E Plan results will be provided to Douglas PUD or the HCP HC at their convenience. Presentations will include the status of all hatchery programs in meeting their objectives, potential problems and recommendations. Similar presentations of annual results from field activities can be requested and provided if warranted.

COORDINATION BETWEEN DOUGLAS PUD AND HATCHERY STAFF

The WDFW Supplementation Research Team (a.k.a. Methow Field Office) has been directly involved in the evaluation, development, and implementation of the hatchery programs since 1992. Currently, the WDFW is contracted by Douglas PUD not only to operate its hatcheries, but also to implement the Evaluation Plan developed when the Methow Hatchery program came online.

Coordination with hatchery staff has been a continual process. Hatchery staff conducts routine sampling at the hatcheries and data is provided to us for inclusion in monthly reports. However, special meetings with the hatchery staff are typically conducted prior to significant events (i.e., broodstock collection, spawning, release of juveniles) to ensure proper methodologies are used and critical data is collected. Evaluation staff is present at all significant events and collect data needed for evaluation purposes.

Additional coordination between evaluation staff, hatchery staff, and the WDFW ESA Permitting biologist is often required to ensure that conditions of ESA Section 10 permits are not violated. The ESA permitting biologist is co-located with evaluation staff, which allows for efficient and effective communication on a daily basis in order to ensure compliance with existing permits. Currently, all ESA reporting related to the hatchery programs is the responsibility of the WDFW Permitting Biologist (0.5 FTE). Given the limited resources dedicated to ESA Permit reporting and the extensive workload required to meet reporting requirements, this relationship is critical to ensuring hatchery programs operate within the conditions of the permit.

Monthly reports have served as a primary mode of coordination and are used to keep Douglas PUD as well as HCP Committee members and co-managers informed on all hatchery and evaluation related activities. Unless otherwise requested by Douglas PUD, the role of monthly reports will remain the same. Upon request, additional information can be included in the monthly reports.

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Appendix E

2010 UCR Salmon and Steelhead Broodstock Objectives and Protocols

STATE OF WASHINGTON
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Mid-Columbia Field Office
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April 14, 2010

To: HCP-Hatchery Committee

From: Mike Tonseth, WDFW

Subject: **DRAFT 2010 UPPER COLUMBIA RIVER SALMON AND STEELHEAD BROODSTOCK OBJECTIVES AND SITE-BASED BROODSTOCK COLLECTION PROTOCOLS**

The attached protocol was developed for hatchery programs rearing spring Chinook salmon, sockeye salmon, summer Chinook salmon and summer steelhead associated with the mid-Columbia HCPs, spring Chinook salmon and steelhead programs associated with the 2008 Biological Opinion for the Priest Rapids Hydroelectric Project (FERC No. 2114) and fall Chinook consistent with Grant County Public Utility District and Federal mitigation obligations associated with Priest Rapids and John Day dams, respectively. These programs are funded by Chelan, Douglas, and Grant County Public Utility Districts (PUDs) and are operated by the Washington Department of Fish and Wildlife (WDFW). Additionally, the Yakama Nation's (YN) Coho Reintroduction Program broodstock collection protocol, when provided by the YN, will be included in this protocol due to the overlap in trapping dates and locations.

This protocol is intended to be a guide for 2010 collection of salmon and steelhead broodstocks in the Methow, Wenatchee, and Columbia River basins. It is consistent with previously defined program objectives such as program operational intent (i.e., conservation and/or harvest augmentation), mitigation production levels (HCPs, Priest Rapids Dam 2008 Biological Opinion) and to comply with ESA permit provisions.

Notable in this years protocols are:

- Methow spring Chinook broodstock protocol targeting natural-origin spring Chinook at Wells Dam and at the Twisp River weir.

- Utilization of genetic sampling/assessment to differentiate Twisp River and non-Twisp River natural-origin adults collected at Wells Dam and CWT interrogation during spawning of hatchery spring Chinook collected at the Twisp Weir, Methow FH and Winthrop NFH to differentiate Twisp and Methow Composite hatchery fish for discrete management of Twisp and Methow Composite production components.

- The collection of hatchery-origin spring Chinook for the Methow River Basin program in excess of production requirements, for BKD management.

- Wenatchee spring Chinook broodstock collection strategies targeting Chiwawa hatchery-origin Chinook at Tumwater Dam, intended to provide improved hatchery-origin broodstock collection and to reduce the number of Leavenworth NFH strays into other Wenatchee basin UCR spring Chinook spawning aggregates.

- The use of ultrasonography to determine sex of Wenatchee summer Chinook, Wenatchee sockeye, Wenatchee summer steelhead, Chiwawa spring Chinook and Methow/Okanogan summer Chinook at collection to achieve a 1:1 male to female ratio in the broodstock.

- Collection of summer Chinook adults sufficient to meet a 600K yearling juvenile Turtle Rock Program.

- Collection of 26 natural origin steelhead at the Twisp Weir in spring 2011

- The potential collection of natural-origin summer Chinook adults for the Okanogan summer Chinook program via purse seine (CCT proposal yet to be developed and agreed upon by the HCP-HC).

- The collection of Wells summer Chinook to support the USFWS, Entiat NFH summer Chinook program (SOA approved by the HCP-HC at the 3/17 meeting with edits).

- The potential collection of Wells summer Chinook to support the Yakama Nation (YN) summer Chinook re-introduction program in the Yakima River Basin (requires agreement of the HCP Hatchery Committee).

These protocols may be adjusted in-season, based on actual run monitoring at mainstem dams and/or other sampling locations.

Above Wells Dam

Spring Chinook

Inclusion of natural-origin fish in the broodstock will be a priority, with natural-origin fish specifically being targeted. Collections of natural-origin fish will not exceed 33% of the MetComp and Twisp natural-origin run escapement at Wells Dam.

To facilitate BKD management, comply with ESA Section 10 permit take provisions, and to meet programmed production, hatchery-origin spring Chinook will be collected in numbers excess to program production requirements. Based on historical Methow FH spring Chinook ELISA levels above 0.12, the hatchery origin spring Chinook broodstock collection will include hatchery origin spring Chinook in excess to broodstock requirements by approximately 8.4%.

For purposes of BKD management and to comply with maximum production levels and other take provisions specified in ESA Section 10 permit 1196, culling will include the destruction of eggs from hatchery-origin females with ELISA levels greater than 0.12 and/or that number of hatchery origin eggs required to maintain production at 550,000 yearling smolts. Culling of eggs from natural-origin females will not occur unless their ELISA levels are determined by WDFW Fish Health to be a substantial risk to the program. Progeny of natural-origin females, with ELISA levels greater than 0.12, will be differentially tagged for evaluation purposes. Annual monitoring and evaluation of the prevalence and level of BKD and the efficacy of culling in returning hatchery- and natural-origin spring Chinook will continue and will be reported in the annual monitoring and evaluation report for this program.

Recent WDFW genetic assessment of natural-origin Methow spring Chinook (Small et al. 2007) indicated that Twisp natural-origin spring Chinook can be distinguished, via genetic analysis, from non-Twisp spring Chinook with a high degree of certainty. The Wells HCP Hatchery Committee accepted that Twisp-origin fish could be genetically assigned with sufficient confidence that natural origin collections can occur at Wells Dam. Scale samples and non-lethal tissue samples (fin clips) for genetic analysis will be obtained from adipose-present, non-CWT, non-ventral-clipped spring Chinook (suspected natural-origin spring Chinook) collected at Wells Dam, and origins assigned based on that analysis. Natural-origin fish retained for broodstock will be PIT tagged (dorsal sinus) for cross-referencing tissue samples/genetic analyses. Tissue samples will be preserved and sent to WDFW genetics lab in Olympia Washington for genetic/stock analysis. The spring Chinook sampled will be retained at Methow FH and will be sorted as Twisp or non-Twisp natural-origin fish prior to spawning. The number of natural-origin Twisp and Methow Composite (non-Twisp) spring Chinook retained will be dependent upon the number of natural-origin adults returning and the collection objective limiting extraction to no greater than 33% of the natural-origin spring Chinook return above Wells Dam. Based on the broodstock-collection schedule (3-day/week, 16 hours/day), extraction of natural-origin spring Chinook is expected to be approximately 33% or less.

Weekly estimates of the passage of Wells Dam by natural-origin spring Chinook will be provided through stock-assessment and broodstock-collection activities. This information will facilitate in-season adjustments to collection composition so that extraction of natural-origin spring Chinook remains less than 33%. Twisp and Methow Composite hatchery-origin spring Chinook will be captured at the Twisp Weir, and Methow FH outfall. Trapping at the Winthrop NFH will be included if needed because of broodstock shortfalls.

Pre-season run-escapement of Methow-origin spring Chinook above Wells Dam during 2009 are estimated at 3,620 spring Chinook, including 2,702 hatchery and 918 natural origin Chinook (Table 1 and Table 2). In-season estimates of natural-origin spring Chinook will be adjusted proportional to the estimated returns to Wells Dam at weekly intervals and may result in adjustments to the broodstock collection targets presented in this document.

The following broodstock collection protocol was developed based on current juvenile rearing capacity at Methow FH, programmed production levels (550,000 smolts), BKD management strategies, projected return for BY 2010 Methow Basin spring Chinook at Wells Dam (Table 1 and Table 2), and assumptions listed in Table 3.

The 2010 Methow spring Chinook broodstock collection will target 358 adult spring Chinook. Based on the pre-season run forecast, Twisp fish are expected to represent 4% of the adipose present, CWT tagged hatchery adults and 8% of the natural origin spring Chinook passing above Wells Dam (Tables 1 and 2). Based on this proportional contribution and a collection objective to limit extraction to no greater than 33%, the 2009 Twisp origin broodstock collection will be predominantly hatchery origin and total 33 fish (25 wild and 33 Hatchery), representing 90% of the broodstock necessary to meet Twisp program production of 100,000 smolts. Methow Composite fish are expected to represent 40% of the adipose present CWT tagged hatchery adults and 92% of the natural origin spring Chinook passing above Wells Dam (Tables 1 and 2). Based on this proportional contribution and a collection objective to limit extraction to no greater than 33%, the 2010 Methow Composite (combined Methow and Chewuch river spawning aggregates) broodstock collection will be predominantly natural origin and total 300 spring Chinook (277 wild and 23 Hatchery). The broodstock collected for the Methow Composite production represents 100% of the broodstock necessary to meet Methow Composite program production of 450,000 smolts (combined Methow and Chewuch production), and sufficient to backfill the expected shortfall of 10,000 Twisp River spring Chinook. The Twisp River releases will be limited to releasing progeny of broodstock identified as wild Twisp and or known Twisp hatchery origin fish, per ESA Permit 1196. The Chewuch Pond and Methow FH releases will include progeny of broodstock identified as wild non-Twisp origin and known Methow Composite hatchery origin fish.

Table 1. Brood year 2005-2007 age class-at-return projection for wild spring Chinook above Wells Dam, 2010.

Brood year	Smolt Estimate		Age-at-return: Twisp Basin				Age-at-return: Methow Basin				
	Twisp[1/]	Methow Basin[2/]	Age-3	Age-4	Age-5	Total	Age-3	Age-4	Age-5	Total	SAR[3/]
2005	5,372	55,381	1	19	**9**	30	15	201	**93**	309	0.005581
2006	18,580	198,400	5	**67**	31	104	55	**720**	332	1,107	0.005581
2007	9,715	99,417	**2**	35	17	54	**27**	361	167	555	0.005581
Estimated 2010 Return			**2**	**67**	**9**	**78**	**27**	**720**	**93**	**840**	

[1/]-*Smolt estimate is based on sub-yearling and yearling emigration (Charlie Snow, personal communication).*
[2/]-*Estimated Methow Basin smolt emigration based on Twisp Basin smolt emigration, proportional redd deposition in the Twisp River and Twisp Basin smolt production estimate.*
[3/]- *Mean Chiwawa spring Chinook SAR to the Wenatchee Basin (BY 1998-2003; WDFW unpublished data).*

Table 2. Brood year 2005-2007 age class and origin run escapement projection for UCR spring Chinook at Wells Dam, 2010.

	Projected Escapement											
	Origin								Total			
	Hatchery				Wild				Methow Basin			
Stock	**Age-3**	**Age-4**	**Age-5**	**Total**	**Age-3**	**Age-4**	**Age-5**	**Total**	**Age-3**	**Age-4**	**Age-5**	**Total**
MetComp	288	699	81	**1,068**	27	720	93	**840**	315	1,419	174	**1,908**
%Total				40%				92%				53%
Twisp	27	74	2	**103**	2	67	9	**78**	29	141	11	**181**
%Total				4%				8%				5%
Winthrop (MetComp)	437	972	122	**1,531**					437	972	122	**1,531**
%Total				56%								42%
Total	752	1,745	205	**2,702**	29	787	102	**918**	781	2,532	307	**3,620**

Table 3. Assumptions and calculations to determine the number of broodstock needed for BY 2010 production of 550,000 smolts.

Program Assumptions	Standard	Methow FH program
Smolt Release		**550,000**
Fertilization-to-release survival	*84%*	
Total egg take target		**662,444**
Egg take (production)		**611,111**
Cull allowance[1/]	8.4%	**51,000**
Fecundity	*3,900*[2/]	
Female Target		**170**
Female to male ratio	*1:1*	
Broodstock target		**340**
Pre-spawn survival	*95%*	
Total broodstock collection		**358**

[1/]-Hatchery origin MetComp. component only, and is based on the projected natural origin collection and assumption that all Twisp (hatchery and wild) and wild MetComp. fish will be retained for production.
[2/]-Based on historical age-4 fecundities and expected 2010 return age structure (Table 1).

Trapping at Wells Dam will occur at the East and West ladder traps beginning on 03 May, or at such time as the first spring Chinook are observed passing Wells Dam and continue through 24 June 2009. The trapping schedule will consists of 3-day/week (Monday-Wednesday), up to 16-hours/day. Two of the three trapping days will be concurrent with the stock assessment sampling activities authorized through the 2010 Douglas PUD Hatchery M&E Implementation Plan. Natural origin spring Chinook will be retained from the run, consistent with spring Chinook run timing at Wells Dam (weekly collection quota). Once the weekly quota target is reached, broodstock collection will cease until the beginning of the next week. If a shortfall occurs in the weekly trapping quota, the shortfall will carry forward to the following week. All natural origin spring Chinook collected at Wells Dam for broodstock will be held at the Methow FH.

To meet Methow FH broodstock collection for hatchery origin Methow Composite and Twisp River stocks, adipose-present coded-wire tagged hatchery fish will be collected at Methow FH, Winthrop NFH and the Twisp Weir beginning 01May or at such time as spring Chinook are observed passing Wells Dam and continuing through 21 August 2010. Natural origin spring Chinook will be retained at the Twisp weir as necessary to bolster the Twisp program production so long as the aggregate collection at Wells Dam and Twisp River weir does not exceed 33% of the estimated Twisp River natural origin return past Wells Dam. All hatchery and natural origin fish collected at Methow FH, Twisp Weir and Winthrop NFH for broodstock will be held at the Methow FH.

Steelhead

Steelhead mitigation programs above Wells Dam (including the USFWS steelhead program at Winthrop NFH) utilize adult broodstock collections at Wells Dam and incubation/rearing at Wells Fish Hatchery (FH). The Wells Steelhead Program also provides eggs for UCR steelhead reared at Ringold FH, not as a mitigation requirement, but rather an opportunity to reduce the prevalence of early spawn hatchery steelhead in the mitigation component above Wells Dam. In an effort to minimize impacts from early maturation, the Wells Hatchery program has transferred eggs from the earliest spawn hatchery steelhead to Ringold FH. Preliminary evaluations indicate that the mean spawn timing of HxH steelhead at Wells FH has shifted to later in the season and may be a function of these actions. Based on these preliminary evaluations, WDFW proposes to continue the transfer eggs from early spawn hatchery origin steelhead to Ringold FH.

The following broodstock collection protocol was developed based on mitigation program production objectives (Table 4), program assumptions (Table 5), and the probability that sufficient adult steelhead will return in 2010 to meet production objectives absent a preseason forecast at the present time.

Trapping at Wells Dam will selectively retain 327 steelhead (east and west ladder collection) and will be comprised of no greater than 33% natural origin broodstock for the mitigation programs and 100% hatchery origin within the Ringold FH production component. Additionally, in the spring of 2011, 26 wild steelhead will be targeted at the Twisp Weir. Overall collection for the program will be 353 fish and limited to no more than 33% of the entire run or 33% of the natural origin return. Hatchery and natural origin collections will be consistent with run-timing of hatchery and natural origin steelhead at Wells Dam. The east and west ladder trapping at Wells Dam will begin on 01 August and terminate by 31 October and will be operated concurrently, three days per week, up to 16 hours per day, if required to meet broodstock objectives. Trapping will be concurrent with summer Chinook broodstocking efforts through 15 September on the west ladder. If insufficient steelhead adults are encountered on the west ladder, the east ladder trap may be considered. Adult return composition including number, origin, age structure, and sex ratio will be assessed in-season at Priest Rapids and Wells dams. Broodstock collection adjustments may be made based on in-season monitoring and evaluation. If collection of adults from the east ladder trap is necessary, access will be coordinated with staff at Wells Dam due to the rotor rewind project.

Table 4. Adult steelhead collection objectives for programs supported through adult steelhead broodstock collected at Wells Dam and the Twisp Weir.

Program	# Smolts	# Green eggs	% Wild	# Wild	# Hatchery	Total Adults
DCPUD[1/]	349,000	465,333	33%	59	119	178
GCPUD[1/]	80,000	106,667	33%	14	27	41
USFWS[1/]	50,000	66,667	33%	8	17	25
Sub-total	**479,000**	**638,667**	33%	**81**	**163**	**244**
Ringold	180,000	285,714	0%	0	109	109
Sub-total	**180,000**	**285,714**	**0%**	**0**	**109**	**109**
Grand Total[2/]	**659,000**	**924,381**	**23%**	**81**	**272**	**353**

[1/]*-Above Wells Dam releases. Target HxW parental adults as the hatchery component.*

[2/]*- Based on steelhead production consistent with Mid-Columbia HCP's, GCPUD BiOp and Section 10 permit 1395.*

Table 5. Program assumptions used to determine the number of adults required to meet steelhead production objectives for programs above Wells Dam and at Ringold Springs Fish Hatchery.

Program assumptions	Standard
Pre-spawn survival	97%
Female : Male ratio	1.0:1.0
Fecundity	5,400
Propagation survival	
Fertilization-to-eyed egg	87%
Eyed egg-to-yearling release	86%[1/]
Fertilization-to-yearling release	75%[1/]

[1/]*-Not applicable to Ringold Springs Fish hatchery.*

Summer/fall Chinook

Summer/fall Chinook mitigation programs above Wells Dam utilize adult broodstock collections at Wells Dam and incubation/rearing at Eastbank Fish Hatchery. The total production level target is 976,000 summer/fall Chinook smolts for two acclimation/release sites on the Methow and Similkameen rivers (Carlton Pond and Similkameen Pond, respectively).

The TAC 2010 Columbia River UCR summer Chinook return projection to the Columbia River (Appendix A) and BY 2006, 2007 and 2008 spawn escapement to tributaries above Wells Dam indicate sufficient summer Chinook will return past Wells Dam to achieve full broodstock collection for supplementation programs above Wells Dam. The following broodstock collection protocol was developed based on initial run expectations of summer Chinook to the Columbia River, program objectives and program assumptions (Table 6).

For 2010, WDFW will retain up to 556 natural-origin summer/fall Chinook at Wells Dam west ladder, including 278 females. Collection will be proportional to return timing between 01 July and 15 September. Trapping will occur 3-days/week, 16 hours/day.

In collaboration with the Colville Tribes, in 2010 an attempt will be made to collect up to 50% (N=167) of the natural origin adults needed to meet the Similkameen summer Chinook program will be attained through the CCT purse seine efforts as a means to evaluate the efficacy of collecting and survival to spawn of natural origin adults for broodstock for their future programs. There is still uncertainty as to how the logistics will work to transport these fish from the loading dock near Brewster to Eastbank FH for adult holding through spawning. If logistics become prohibitive to engaging in this collection activity this season, broodstock collection for the balance will revert back to Wells Dam. In addition, if broodstock collection through the CCT's purse seining efforts falls behind by any more than 25%, the difference between the fish collected to date and what should have been collected, will be made up at Wells Dam west ladder trap. Fish collected through the CCT trapping effort will be uniquely tagged from fish collected at Wells Dam to evaluate relative differences in disease, mortality, spawn timing, among other metrics.

To better assure achieving the appropriate female equivalents for program production, the collection will utilize ultrasonography to determine the sex of each fish retained for broodstock. If the probability of achieving the broodstock goal is reduced based on passage at the west ladder or actual natural-origin escapement levels, broodstock collections may be directed to the east ladder trap and/or origin composition will be adjusted to meet the broodstock collection objective. If collection of adults from the east ladder trap is necessary, access will be coordinated with staff at Wells Dam due to the rotor rewind project.

Table 6. Assumptions and calculations to determine the number of broodstock needed for summer/fall Chinook production goals in the Methow and Okanogan river basins.

Program Assumptions	Standard	Carlton Pond	Similkameen Pond	Total
Smolt release		**400,000**	**576,000**	**976,000**
Fertilization-to-release survival	81%			
Eggtake target		**493,827**	**711,111**	**1,204,938**
Fecundity	5,000			
Female target		**103**	**148**	**250**
Female:male ratio	1:1			
Broodstock target		**206**	**296**	**502**
Pre-spawn survival	95%			
Total collection target		**222**	**334**	**556**

Columbia River Mainstem below Wells Dam

Summer/fall Chinook

Summer/fall Chinook mitigation programs that release juveniles directly into the Columbia River between Wells and Rocky Reach dams are supported through adult broodstock collections at Wells Dam and the Wells Hatchery volunteer channel. The total production level supported by this collection is 920,000 yearling and 484,000 sub-yearling Chinook. Upon agreement in the HCP-HC, the 2010, summer Chinook broodstock collections at Wells FH may also include 250,000 green eggs to support the Yakama Nation (YN) reintroduction of summer Chinook to the Yakima River Basin and up to 60 adult summer Chinook pairs for the USFWS Entiat program. If approved by the HCP Hatchery Committee, the YN eggs will be the last eggs taken and will be the responsibility of staff associated with the YN program. Collection of adults for the USFWS will occur over a two-week period at the volunteer channel. Adults for that program will be transferred to Entiat NFH by USFWS staff.

Adults returning from the Wells and Turtle Rock programs are to support harvest opportunities and are not intended to increase natural production and have been termed segregated harvest programs. These programs have contributed to harvest opportunities; however, adults from these programs have been documented contributing to the adult spawning escapement in tributaries upstream and downstream from their release locations. Because adults from these programs contribute to the natural spawn escapement, the broodstock collection will incorporate up to10 percent natural-origin fish into the broodstock to reduce the potential genetic risk to the naturalized summer/fall Chinook stocks in the upper Columbia River region. The following broodstock collection protocol was developed based on mitigation objectives and program assumptions (Table 7).

WDFW will collect 1,211 run-at-large summer Chinook including 1,122 hatchery fish from the volunteer ladder trap at Wells Fish Hatchery outfall and up to 89 natural-origin fish from the Wells Hatchery outfall, and/or Wells Dam west ladders. Overall extraction of natural-origin fish passing Wells Dam (Wells program and above Wells Dam summer/fall Chinook programs) will not exceed 33 percent. If natural origin fish returns fall below expectations, any natural origin collections will be prioritized for supplementation programs (Carlton/Similkameen). Shortfalls in natural origin collections for Wells will be made up with hatchery fish through the volunteer channel. West ladder collections will begin 01 July and completed by 15 September and will be consistent with run timing past Wells Dam. If collection of adults from the east ladder trap is necessary, access will be coordinated with staff at Wells Dam due to the rotor rewind project. Due to fish health concerns associated with the volunteer collection site (warming Columbia River water during late August), the volunteer collection will begin 11 July and terminate by 31 August. The 3-year old “jack” component will be limited to 10 percent of the broodstock collection.

Table 7. Assumptions and calculations to determine the number of broodstock needed for summer/fall Chinook production goals for Wells and Turtle Rock Island/Chelan Falls programs.

Program Assumptions	**Standard**		**Wells FH**		**Turtle Rock FH**	**YN[2/]**	**USFWS[3/]**	
	Sub-yearling	**Yearling**	**Sub-yearling**	**Yearling[1/]**	**Yearling**	**Green eggs**	**Adults**	**Total**
Smolt release			**484,000**	**320,000**	**600,000**			**NA**
Green egg-to-release survival	73%[4/]	78%						NA
Eggtake target			**663,014**	**410,256**	**769,230**	**250,000**		**2,092,500**
Fecundity	4,600	4,600						
Female target			**144**	**89**	**168**	**55**	**60**	**516**
Female:Male ratio	1:1	1:1						
Broodstock target			**288**	**248[4/]**	**336**	**110**	**120**	**1,102**
Pre-spawn survival	90%	90%						
Total collection target			**320**	**276**	**373**	**122**	**120**	**1,211**

[1/]-Green eggs for YN reintroduction program in the Yakima River Basin.
[2/]-Adult collection only. For USFWS summer Chinook program in the Entiat River Basin.
[3/]-Based on increased loss due to coagulated yolk as a result of the lack of chilled incubation water.
[4/]-Includes 70 adults collected for the Lake Chelan triploid Chinook program.

Coho

Yakama Nation will provide broodstock collection objectives for the coho reintroduction program in the Methow River basin. WDFW will work collaboratively with the Yakama Nation to facilitate coho collections at Wells Dam. If collection of adults from the east ladder trap is necessary, access will be coordinated with staff at Wells Dam due to the rotor rewind project.

Wenatchee River Basin

Spring Chinook

The Eastbank Fish Hatchery (FH) rears spring Chinook salmon for the Chiwawa River acclimation pond located on the Chiwawa River. The HCP HC approved program production level target for 2010 is 298,000 smolts, requiring a total broodstock collection of 178 spring Chinook (85 natural and 93 hatchery origin; Table 8).

Table 8. Assumptions and calculations to determine the number of broodstock needed in an anticipated 2010 Chiwawa program release of 298,000 smolts.

Program Assumptions	Standard	Conservation	Safety Net	Full program
Smolt Release		**150,000**	**148,000**	**298,000**
Fertilization-to-release survival	*83%*			
Total egg take target				**380,449**
Egg take (production)		180,595	178,441	**359,036**
Cull allowance	*12%*		199,854	**21,413**
Fecundity	*4,400*			
Female Target		41	45	**86**
Female to male ratio	*1:1*			
Broodstock target		82W	90H	**172**
Pre-spawn survival	*97%*			
Total broodstock collection		**85W**	**93H**	**178**

Inclusion of natural origin fish into the broodstock will continue to be a priority, with natural origin fish specifically being targeted. Consistent with ESA Section 10 Permit 1196, natural origin fish collections will not exceed 33 percent of the return to the Chiwawa River and will provide, at a minimum, 33 percent of the total broodstock retained.

In addition to production levels and ESA permit provisions, the 2010 broodstock collection, will again, as in 2009, target hatchery origin Chiwawa spring Chinook at Tumwater Dam. Also in 2010, an interim measure will include extraction of adipose clipped non-coded wire tagged adult spring Chinook, as a strategy to reduce straying of Leavenworth NFH spring Chinook to the upper Basin habitat.

Pre-season estimates project 4,985 spring Chinook are destined for the Chiwawa River, of which 534 (10.7%) and 4,451 fish (89.3%) are expected to be natural and hatchery origin spring Chinook, respectively (Table 9 and 10). Based on the projected 2010 Chiwawa River run-size and origin composition, and provisions in ESA Section 10 Permit 1196, WDFW will retain up to 178 spring Chinook for broodstock purposes, representing 100% of the program broodstock objective. Up to 85 natural origin spring Chinook will be retained at the Chiwawa Weir and up to 93 adipose-clipped, CWT hatchery origin spring Chinook will be collected at Tumwater Dam. In-season assessment of the magnitude and origin composition of the spring Chinook return above Tumwater Dam will be used to provide in-season adjustments to hatchery/wild composition and total broodstock collection, consistent with ESA Section 10 Permit 1196.

Table 9. BY 2005-2007 age class return projection for wild spring Chinook above Tumwater Dam during 2010.

Brood year	Smolt Estimate[1/]		Chiwawa Basin[2/]				Wenatchee Basin above Tumwater Dam[2/]				
	Chiwawa	Wen. Basin	Age-3	Age-4	Age-5	Total	Age-3	Age-4	Age-5	Total	SAR[3/]
2005	140,737	338,079	51	581	**153**	785	124	1,396	**367**	1,887	0.005581
2006	86,579	153,918	32	**357**	94	483	56	**636**	167	859	0.005581
2007	65,539	103,460	**24**	271	71	366	**38**	427	112	577	0.005581
Estimated 2010 Return			**24**	**357**	**153**	**534**	**38**	**636**	**367**	**1,041**	

[1/]-Smolt production estimate for Chiwawa River derived from juvenile smolt data (Hillman et al. 2009); smolt production estimate for Wenatchee Basin is based upon proportional redd disposition between Chiwawa River and Wenatchee River basin and the Chiwawa smolt production estimate.
[2/]-Based upon average age-at-return (return year 2005-2009) for natural origin spring Chinook above Tumwater Dam (WDFW unpublished data).
[3/]-Mean Chiwawa spring Chinook SAR to the Wenatchee Basin (BY 1998-2003; WDFW unpublished data).

Table 10. BY 2005-2007 age class return projection for Chiwawa hatchery spring Chinook above Tumwater Dam during 2010.

Brood	Smolt Estimate	Adult Returns				
Year	Chiwawa[1/]	Age-3[2/]	Age-4[2/]	Age-5[2/]	Total	SAR[3/]
2005	494,012	1,260	2,845	**143**	4,248	0.0086
2006	612,482	1,563	**3,528**	176	5,267	0.0086
2007	305,542	**780**	1,760	88	2,628	0.0086
Estimated 2010 Return		**780**	**3,528**	**143**	**4,451**	

[1/]-Chiwawa smolt release (Hillman et. al. 2009).
[2/]-Based on average age-at-return for hatchery origin spring Chinook above Tumwater Dam, 2005-2009 (WDFW, unpublished data) and total estimated BY return.
[3/]-Mean Chiwawa hatchery spring Chinook SAR to the Wenatchee Basin (BY 1997-2002).

Trapping at Tumwater Dam will begin 01 May and will be concurrent with trapping for the Spring Chinook Reproductive Success Study. Collection at both Tumwater Dam and Chiwawa Weir will be based on weekly quotas, consistent with average run timing at Tumwater Dam. If the weekly quota is attained prior to the end of the week, retention of spring Chinook for broodstock will cease. If the weekly quota is not attained, the shortfall will carry forward to the next week. The number of hatchery origin fish retained at Tumwater Dam will be adjusted in-season, based on estimated Chiwawa River natural-origin returns provided through extrapolation of returns past Tumwater Dam. If hatchery origin Chinook are retained in excess to that required to maintain a minimum 33% natural origin composition in the broodstock, excess fish will be sampled, killed and either used for nutrient enhancement or disposed of in a landfill depending upon fish health staff recommendations.

Throughout broodstock collection at Tumwater Dam, adipose absent, non-CWT spring Chinook will be extracted, putatively classified as LNFH strays and provided to USFWS as a measure to reduce the prevalence of non-endemic spring Chinook above Tumwater Dam. It is likely that some proportion of the adipose clipped non-CWT fish are ESA-listed hatchery adults that have shed their tags. Based on the BY 2005, 2006, and 2007 tag rate for Chiwawa spring Chinook and the projected 2010 Chiwawa hatchery return to Tumwater Dam, the extraction of adipose clipped non-CWT spring Chinook may include up to 61 Chiwawa spring Chinook, representing just 1.9% of the projected 4,451 returning Chiwawa hatchery origin spring Chinook. The 2009 extraction of LNFH fish at Tumwater dam was 66 fish or 1.5% of the hatchery fish intercepted. Logistics for 2010 extraction activities will be coordinated between USFWS, WDFW and CPUD.

Broodstock collection at the Chiwawa Weir will begin 01 June and terminate no later than 11 September. Spring Chinook trapping at the Chiwawa Weir will follow a 4-days up and 3-days down schedule, consistent with weekly broodstock collection quotas that approximate the historical run timing and a maximum 33 percent retention of the projected natural-origin escapement to the Chiwawa River. If the weekly quota is attained prior to the end of the 4-day trapping period, trapping will cease. If the weekly quota cannot be accomplished with a 4-days up and 3-days down schedule, a 7-day per week schedule may be implemented to facilitate reaching the collection objectives. Under the 7-day per week schedule, no more than 33% (1 in 3) of the fish collected will be retained for broodstock. If the weekly quota is not attained within the trapping period, the shortfall will carry forward to the next week.

All spring Chinook in excess of broodstock needs and all bull trout trapped at the Chiwawa weir will be transported by tank truck and released into a resting/recovery pool at least 1.0 km upstream from the Chiwawa River Weir.

Steelhead
The steelhead mitigation program in the Wenatchee Basin use broodstock collected at Dryden and Tumwater dams located on the Wenatchee River. Per ESA section 10 Permit 1395 provisions, broodstock collection will target 50% natural origin fish and 50% hatchery origin fish, not to exceed 33% of the natural origin steelhead return to the Wenatchee Basin. Based on these limitations and the assumptions listed below (Table 11), the following broodstock collection protocol was developed.

WDFW will retain 208 mixed origin steelhead at Dryden and Tumwater dams, including 104 natural origin and 104 hatchery origin steelhead. Collection will be proportional to return timing between 01 July and 12 November. Collection may also occur between 13 November and 3 December at both traps, concurrent with the Yakama Nation coho broodstock collection activities. Early spawn hatchery x wild parental cross and unknown hatchery parental cross adults will be excluded from the broodstock collection. Hatchery steelhead parental origins will be determined through evaluation of VIE tags and PIT tag interrogation during collection. Adult return composition including number, origin, age structure, and sex ratio will be assessed in-season at Priest Rapids and at Dryden Dam. In-season Broodstock collection adjustments may be made based on this monitoring and evaluation. To better assure achieving the appropriate females equivalents for program production, the collection will utilize ultrasonography to determine the sex of each fish retained for broodstock.

In the event steelhead collections fall substantially behind schedule, WDFW may initiate/coordinated adult steelhead collection in the mainstem Wenatchee River by hook and line. In addition to trapping and hook and line collection efforts, Tumwater and Dryden dams may be operated between February and early April the subsequent spring to supplement broodstock numbers if the fall trapping effort provides fewer than 208 adults.

Table 11. Assumptions and calculations to determine the number and origin of Wenatchee summer steelhead broodstock needed for Wenatchee Basin program release of 400,000 smolts.

Program Assumptions	Standard	Wenatchee program
Smolt Release		**400,000**
Fertilization-to-release survival	*75%*	
Egg take target		**533,333**
Fecundity	*5,400*	
Female Target		**99**
Female to male ratio	*1:1*	
Broodstock target		**198**
Pre-spawn survival	*95%*	
Total broodstock collection		**208**
Natural:Hatchery ratio	1:1	
Natural origin collection total		**104**
Hatchery origin collection total		**104**

<u>Summer/fall Chinook</u>

Summer/fall Chinook mitigation programs in the Wenatchee River Basin utilize adult broodstock collections at Dryden and Tumwater dams, incubation/rearing at Eastbank Fish Hatchery (FH) and acclimation/release from the Dryden Acclimation Pond. The total production level target for BY 2010 is 864,000 smolts.

The TAC 2010 Columbia River UCR summer Chinook return projection to the Columbia River (Appendix A) and BY 2006, 2007 and 2008 spawn escapement to the Wenatchee River indicate sufficient summer Chinook will return to the Wenatchee River to achieve full broodstock collection for the Wenatchee River summer Chinook supplementation program. Review of recent summer/fall Chinook run-timing past Dryden and Tumwater dam indicates that previous broodstock collection activities have omitted the early returning summer/fall Chinook, primarily due to limitations imposed by ESA Section 10 Permit 1347 to minimize impacts to listed spring Chinook. In an effort to incorporate broodstock that better represent the summer/fall Chinook run timing in the Wenatchee Basin, the broodstock collection will front-load the collection to account for the disproportionate collection timing. Approximately 43% of the summer/fall Chinook passage to the upper Basin occurs prior to the end of the first week of July; therefore, the collection will provide 43% of the objective by the end of the first week of July. Weekly collection after the first week of July will be consistent with run timing of summer/fall Chinook during the remainder of the trapping period. Collections will be limited to a 33% extraction of the estimated natural-origin escapement to the Wenatchee Basin. Based on these limitations and the assumptions listed below (Table 12), the following broodstock collection protocol was developed.

WDFW will retain 492 natural-origin, summer Chinook at Dryden and Tumwater dams, including 246 females. To better assure achieving the appropriate females equivalents for program production, the collection will utilize ultrasonography to determine the sex of each fish retained for broodstock. Trapping at Dryden Dam will begin 01 July and terminate no later than 15 September and operate up to 7-days/week, 24-hours/day. Trapping at Tumwater Dam may begin 15 July and terminate no later than 15 September and operate 3-days/week, 8-hours/day.

If the probability of achieving the broodstock goal is reduced, based on the estimated escapement levels, broodstock composition (e.g. incorporation of hatchery origin fish) will be adjusted to meet the broodstock collection objective of 492 summer Chinook.

Table 12. Assumptions and calculations to determine the number of Wenatchee summer Chinook salmon broodstock needed for Wenatchee Basin program release of 864,000 smolts.

Program Assumptions	**Standard**	**Wenatchee program**
Smolt Release		**864,000**
Fertilization-to-release survival	*78%*	
Egg take target		**1,107,692**
Fecundity	*5,000*	
Female Target		**222**
Female to male ratio	*1:1*	
Broodstock target		**443**
Pre-spawn survival	*90%*	
Total broodstock collection		**492**

<u>*Sockeye*</u>

Sockeye Salmon mitigation in the Wenatchee River Basin utilizes adult broodstock collections at Tumwater Dam, incubation/rearing at Eastbank Fish Hatchery (FH) and rearing/pre-smolt releases from the net pens in Lake Wenatchee. The total production level for the 2010 BY is 200,000 pre-smolts.

The TAC 2010 UCR sockeye return projection to Columbia River (Appendix A) indicates sufficient Lake Wenatchee sockeye will be available to meet broodstock collection objectives. Based on TAC projected returns, 100% natural-origin broodstock composition and assumptions listed below (Table 13), the following broodstock collection protocol was developed.

WDFW will retain 260 natural origin sockeye, proportional to run timing at Tumwater Dam. Due to highly variable sex ratios in previous years, ultrasonography will be used to collect an equal number of males and females. Trapping may begin on 15 July and terminate by 15 August. Trapping will occur no more than 3-days/week, 8- hours/day.

Table 13. Assumptions and calculations to determine the number of Wenatchee sockeye salmon broodstock needed for Wenatchee Basin program release of 200,000 pre-smolts.

Program Assumptions	Standard	Wenatchee program
Smolt Release		**200,000**[1/]
Fertilization-to-release survival	*78%*	
Egg take target		**256,410**
Fecundity	*2,615*	
Female Target		**99**
Female to male ratio	*1:1*	
Broodstock target		**198**
Pre-spawn survival	*76%*	
Total broodstock collection		**260**

1/- Chelan HCP Hatchery Committee has agreed to future production level of 280,000 fish, pending appropriate infrastructure improvements.

Coho

Yakama Nation will provide broodstock collection objectives and program assumptions for the coho reintroduction program in the Wenatchee River basin. WDFW will work collaboratively with the Yakama Nation to facilitate coho broodstock collections at Dryden and Tumwater Dam.

White River Spring Chinook Captive Brood

Smolt production associated with the White River Captive Broodstock Program (150,000 smolts) will be separate from the smolt production objective associated with the Chiwawa River adult supplementation program. Spawning, incubation, rearing acclimation and release will be consistent with provisions of ESA Permit 1592.

Broodstock collection efforts for brood year 2010 will be addressed in a future document separate from this 2010 broodstock collection/protocol document and developed through the Priest Rapids Coordinating Committee Hatchery Committee (PRCC HC).

Priest Rapids Fall Chinook

Collection of fall Chinook broodstock at Priest Rapids Hatchery will generally begin in early September and continue through mid November. Smolt release objectives specific to Grant PUD (5,000,000 sub-yearlings) and Federal (1,700,000 sub-yearlings) mitigation commitments and biological assumptions are detailed in Table 14.

Table 14. Assumptions and calculations to determine the number of fall Chinook salmon broodstock needed for the Priest Rapids program release of 6,700,000 sub-yearling fall Chinook.

Program Assumptions	Standard	Program objective
Juvenile Production Level		
Grant PUD Mitigation-PUD Funded		**5,000,000**
John Day Mitigation-Federally Funded		**1,700,000**
Fertilization-to-release survival	*87%*	
Egg take target		**7,700,000**
Fecundity	*4,500*	
Female Target		**1,711**
Female to male ratio	*1:1*	
Broodstock target		**3,422**
Pre-spawn survival	*88%*	
Total broodstock collection		**3,888**

Appendix A

Columbia River Mouth Fish Returns – Actual and Forecasts**

			2009 Forecast	2009 Return	2010 Forecast
Spring Chinook	**Total Spring Chinook**		353,700	221,350	559,900
	Willamette		37600	39,400	62,700
	Sandy		5,200	2,700	3,700
	Cowlitz*		4,100	4,900	12,500
	Kalama*		900	350	900
	Lewis*		2,200	1,900	6,000
	Select areas		4,800	2,800	4,100
	Lower River Total		**54,800**	**52,050**	**89,900**
	Wind*		6,900	4,600	14,000
	Drano Lake*		9,600	10,700	28,900
	Klickitat*		2,000	1,500	4,500
	Yakima*		15,900	7,500	16,600
	Upper Columbia	Total	23,100	17,400	57,300
	Upper Columbia	*Wild*	*2,700*	*1,800*	*5,700*
	Snake River Spring/Summer	Total	179,200	92,000	272,000
	Snake River	*Wild*	*29,700*	*20,900*	*73,400*
	Upriver Total		**298,900**	**169,300**	**470,000**
Summer Chinook	**Upper Columbia**	**Total**	**70,700**	**53,900**	**88,800**
Sockeye					
	Wenatchee		18,300	32,100	14,300
	Okanogan		164,900	145,400	110,300
	Snake River		600	1,400	600
	Total Sockeye	**Total**	**183,800**	**179,000**	**125,200**
Steelhead					
Winter			15,200	11,400	20,100
Upriver Summer	Upper Skamania Index	**Total**	**16,000**	**13,900**	**NYA**
(to Bonneville Dam)		*Wild*	*4,200*	*3,500*	
	Group A-run Index	**Total**	**278,900**	**543,100**	**NYA**
		Wild	*75,400*	*154,000*	
	Group B-run Index	**Total**	**56,900**	**44,500**	**NYA**
		Wild	*10,300*	*13,700*	
	Total Upriver Steelhead	**Total**	**351,800**	**601,600**	
		Wild	*89,900*	*171,300*	

*Return to tributary mouth.

**Totals may not sum due to rounding.

EXHIBIT B

PRE-FILING CONSULTATION RECORD FOR WELLS STEELHEAD HATCHERY AND GENETIC MANAGEMENT PLAN

FINAL HATCHERY COMMITTEE MEETING MINUTES

December 16, 2009

ANCHOR QEA
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Seattle, Washington 98101
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FINAL MEMORANDUM

To:	Wells, Rocky Reach, and Rock Island HCP Hatchery Committees	**Date:**	February 2, 2010
From:	Michael Schiewe, Chair, HCP Hatchery Committees		
Cc:	Ali Wick, Greg Mackey		
Re:	Final Minutes of December 16, 2009 HCP Hatchery Committees Meeting		

The Wells, Rocky Reach, and Rock Island Hydroelectric Projects Habitat Conservation Plans (HCPs) Hatchery Committees met at Chelan PUD in Wenatchee, Washington, on Wednesday, December 16, 2009, from 9:30 am to 3:00 pm. Attendees are listed in Attachment A to these Meeting Minutes.

ACTION ITEM SUMMARY

- Greg Mackey will provide a copy of the Douglas PUD PowerPoint presentation provided at the December Hatchery Committee Meeting that summarized the key points of the Wells Steelhead Hatchery Genetic Management Plan (HGMP) (Item II-A).
- The Hatchery Committees will provide comments to Douglas PUD on the spring Chinook and steelhead HGMPs by January 15 (note that the steelhead Reproductive Spawning Success (RSS) study plan included in the steelhead HGMP has been updated and re-submitted on 12-23-09 per discussion at the December meeting) (Items II-A and II-B).
- The Hatchery Committee will provide comments on the proposed adult RSS study plan in time for the January 15 conference call to discuss this and the Committees' HGMP edits (Item II-C).
- Greg Mackey will investigate and report back to the Hatchery Committees on proposed modifications to the west ladder fish return pipe (Item II-D).
- Keely Murdoch will check with Kris Petersen to verify Endangered Species Act (ESA) coverage to test multi-species acclimation of steelhead and coho salmon in Rohlfings Pond, Nason Creek (Item III-A).

- Keely Murdoch will obtain additional information from Columbia River Inter-Tribal Fish Commission (CRITFC) staff on the configuration of the new Zosel Dam passive integrated transponder tag (PIT-tag) array and will send it to Joe Miller (Item III-D).
- Mike Schiewe will check with Kris Petersen regarding ESA coverage for Chelan Falls yearling summer/fall Chinook program (Item III-F).

DECISION SUMMARY

- The Rock Island HCP Hatchery Committee approved the Statement of Agreement (SOA) "Reduction of Chiwawa Spring Chinook Production Levels to 298,000 Smolts" (Item V-A; Attachment B).

I. Welcome, Agenda Review, Meeting Minutes

The Hatchery Committees approved the November 18 Hatchery Committees meeting minutes as revised. Ali Wick will send the final minutes to the Committees.

II. Douglas PUD

A. Wells Steelhead HGMP

Greg Mackey provided the committee with an overview of the draft Wells steelhead Hatchery Genetic Management Plan (HGMP) that was sent to the Hatchery Committees on December 15. He provided a short PowerPoint presentation summarizing the key features of the HGMP. The Committee discussed several proposed changes to the program, including alternative release locations. The Committee discussed the potential for straying of mainstem releases of steelhead into the Methow or Okanogan rivers. Shane Bickford said that Douglas PUD is aware of this potential and mentioned several measures that could be put into place to remedy this, should the monitoring and evaluation (M&E) program detected unacceptable rates of straying. Greg Mackey will provide today's PowerPoint presentation to the Committees, and the Committees agreed to provide comments on the draft HGMP prior to the January 15 conference call, with a goal of final approval at the January 20 meeting. There will be a conference call on January 15 from 9:00 to 11:00 am to discuss Committees' comments.

B. Methow Spring Chinook HGMP

Tom Kahler presented a table summarizing key features of the draft Methow River spring Chinook HGMP. He described the two components of the program—Twisp and

Methow/Chewuch—that would be managed separately because of their distinguishing genetic differences, and the higher proportion of NORs and the capacity to control percent hatchery-origin spawners (pHOS) in the Twisp River. Kahler briefly outlined the management objectives for the Twisp component, which are focused on the achievement of the HSRG genetic objectives. He then pointed out that for the Methow/Chewuch component it is not possible to meet Proportion Natural Influence (PNI) goals with the current numbers of natural origin returns (NORs). Shane Bickford added that, using NORs only, it is also not possible to meet No Net Impact (NNI) mitigation for the five Mid-Columbia dams, as required by the current licenses for those projects. As a result, in most years hatchery fish will have to be used to meet the NNI requirements for the five PUD dams. He said that National Marine Fisheries Service (NMFS) guidance to Douglas PUD has been to first ensure adequate seeding of the available habitat with returning natural origin fish. Douglas PUD's proposed HGMP focuses on maintaining a minimum number of NORs in the river; however, because of the low numbers of NORs in most years, there is a low probability of meeting the NOR escapement objectives while also meeting mitigation goals for the hatchery program and achieving PNI objectives. Bickford said that Douglas PUD's plans are to develop the HGMP for Committees' review with a program that meets the mitigation requirements for all three PUDs while still maintaining adequate NOR escapement. Douglas PUD anticipates working through as many remaining issues as possible in Committee prior to submission to NMFS. The Committees agreed with this path forward. Douglas PUD will send this HGMP to the Committees by the end of this week, and the Committees will provide comments prior to the next meeting, and will discuss these on the January 15 conference call.

C. Steelhead Reproductive Success Study

Greg Mackey provided a short presentation summarizing Douglas PUD's recent work on a steelhead reproductive success study (RSS) plan. Mackey noted that Douglas PUD's previously discussed study plan required more wild fish than were likely available in order to produce a statistically valid study, and therefore a new study plan has been developed. The plan identifies a 10-year study beginning in 2010 focusing on adult-to-adult RSS, hatchery versus wild comparisons, and covariates of fitness. Also, the study will provide data that may be used to assess genetic influences. The results of the study will relate findings to management. Hypotheses include those looking at overall RSS, sex-specific RSS, and pHOS to proportion of offspring. This proposed study is Appendix B of the steelhead HGMP that the Hatchery Committees will review in coming weeks. Tom Kahler noted that he recently learned that Washington Department of Fish and Wildlife (WDFW) will be conducting a study on steelhead reproductive success on the Twisp River. Greg Mackey will meet with Andrew Murdoch to discuss coordination of the two studies. Following these discussions, Douglas PUD will submit a revised RSS study plan to the HCP HC (Note that the revised RSS study plan was sent to the Hatchery Committees for review on December 23, 2009). The Committees will discuss this item on the January 15 call as well.

D. Discussion of Design for Modification of West Ladder Fish Return Pipe

Tom Kahler distributed design drawings for modification of the west ladder fish return pipe. The Hatchery Committees expressed interest in additional information on how the system will be operated, and in particular, desired a clearer understanding of the number of fish to be released per truck, the number of fish to be released per day, and any procedures to minimize stress in the truck. Greg Mackey will find this information and report back to the Committees.

III. Yakama Nation

A. Update on Steelhead Acclimation at Rohlfings Pond

Keely Murdoch said that the Yakama Nation (YN) and WDFW met to discuss steelhead acclimation at Rohlfings Pond. Initially, the YN was planning to PIT-tag steelhead at the pond, but has since learned that the segregation needed to do this tagging would not be feasible. Hence, it may not be possible to estimate steelhead survival from release to McNary Dam or to estimate smolt-to-adult returns (SARs) from PIT-tag returns. Accordingly, the YN proposes to focus on testing in-pond performance this first year, acclimating 10,000 wild-by-wild (WxW) steelhead in the pond, of which approximately 700 would be PIT-tagged. Performance metrics would include in-pond survival, growth and condition, immigration from the pond, and any residualism in the pond. This test of in-pond performance would be used to decide whether to tag a greater proportion of steelhead in future years in order to estimate SARs and other longer-term metrics. Murdoch confirmed that the test would not appreciably affect the rearing density in the pond because the YN will be reducing coho numbers in the pond this year. She also said that she will check with Kris Petersen to confirm ESA coverage. The Hatchery Committees discussed this plan and agreed that it was consistent with the previously agreed-upon plan for YN acclimation sites.

B. Steelhead at Wells and Kelt Reconditioning

Keely Murdoch said that the YN has heard indirectly that Douglas PUD will not be supporting adult holding and live spawning of steelhead kelts at Wells Hatchery at this time. She asked Tom Kahler to comment on whether this was true. Kahler said that there were insufficient resources at Wells to accommodate the segregation of family groups necessitated by live spawning. Additionally, the proposed changes in Douglas' steelhead programs would substantially reduce the availability of wild steelhead for any kelt-reconditioning program. When asked about a rumor that Douglas PUD would not allow any new programs at Wells Hatchery, Kahler stated that higher level management at Douglas PUD is reviewing the use of Wells Hatchery, and is concerned about the widespread use of the hatchery for programs other than those required by the Wells HCP or authorized through formal agreements. Bill Gale suggested that the YN get in touch with U.S. Fish and Wildlife Service (USFWS) about potentially using Winthrop Hatchery for this program.

C. Spring Chinook Forecast and Removal of Hatchery Fish at Tumwater Dam

Keely Murdoch brought up the topic of removal of surplus fish at Tumwater Dam. She asked for an update from Joe Miller on his discussions with Court Hill (engineer at Chelan PUD) on some conceptual drawings that she said he agreed to create after the last Tumwater Working Group meeting. Murdoch said that the YN would not be against watershed distribution of carcasses as a use of these surplus fish, but before agreeing to that, they would want to explore possibilities for human consumption as opposed to carcass outplants. Miller responded that for 2010, the 1196 permittees do not have the "take" authority toimplement adult management/remove excess hatchery fish as described in the HGMP. He then said that he would be meeting with Hill next week to examine possibilities discussed at the past Working Group meetings. Miller said that he planned to reconvene the Working Group in early 2010.

D. PIT-Tag Detection at Zosel Dam

Keely Murdoch updated the group that next spring, CRITFC will be installing a PIT-tag detection array at Zosel Dam. Joe Miller asked whether she knew about the configuration of this array. She said she would contact Jeff Fryer at CRITFC for additional details, and would send this information to Joe Miller.

IV. WDFW

A. *Impact of Tiered vs. Open Fisheries on pHOS Control*

Bob Pfeifer reviewed with the Hatchery Committees a series of spreadsheets and graphs that showed estimated changes in PNI that are possible under a variety of harvest assumptions and historic run sizes in the Wenatchee and Methow basins. He said that Jeff Korth wanted the Committees to be aware that it is theoretically achievable to meet PNI levels at or near the 0.67 goal when harvest and removal of hatchery fish at dams are implemented together. Pfeifer will send these files to the Committees for their information.

V. Chelan PUD

A. *DECISION ITEM: Rock Island HCP Hatchery Committees SOA on Reduction of Chiwawa Spring Chinook Production Level to 298,000 Smolts*

Joe Miller introduced the Rock Island Hatchery Committee SOA for reduction of Chiwawa spring Chinook production levels to 298,000 smolts. Keely Murdoch had provided some edits and the Hatchery Committees discussed these. The Committees approved the SOA with these edits and others suggested at today's meeting (Attachment B).

B. *Hatchery Program Summary*

Joe Miller updated the group that Chelan PUD will be providing a memo to the HCP Hatchery and Tributary Committees stating that the PUD anticipates removing the cobble accumulated immediately upstream of the Dryden Facility. Chelan PUD had previously informed the Committees that bedload from Highway 97 washouts has accumulated at the right bank of the Wenatchee River just downstream of the confluence of Peshastin Creek, causing potential passage issues at low flows.

C. *Review of Monthly Monitoring and Evaluation (M&E) Reports*

There were no issues to discuss at today's meeting.

D. *Discussion of Future Chiwawa Water Right*

Joe Miller updated the group on a future water right for the Chiwawa acclimation ponds and hatchery. He provided a summary memo describing the water right need as 16 cubic feet per second (cfs) during fall and early spring and 21 cfs for the remainder of the year. The current water right is 12 cfs in fall and early spring with intermittent increases. He said that the next steps are for him to check with NMFS habitat staff and then to ask for each HCP signatory party to send a letter of support to Washington State Department of Ecology (Ecology) following the next Hatchery Committees meeting.

E. Moving 200,000 WxW steelhead from Turtle Rock to Chiwawa Hatchery

Joe Miller said that when space is available at Chiwawa Hatchery, Chelan PUD would like the Hatchery Committees to consider moving 200,000 WxW steelhead from Turtle Rock to the Chiwawa Hatchery for acclimation and release. This move would bring the total steelhead count at Chiwawa up to 240,000 (currently, 40,000 steelhead are being reared at the Chiwawa Facility in a pilot water re-use study). Kirk Truscott questioned whether or not rearing 200,000 steelhead at Chiwawa Facility would compromise the ability to addresses segregated rearing of higher ELISA spring Chinook and whether or not dividing one of the two existing ponds at Chiwawa to rear higher ELISA spring Chinook and steelhead was still a consideration by the PUD. Miller responded that it was still a option, but that the PUD did not have a formal PUD position in regards to the pond division. The Committees agreed to consider this when the space is available.

F. Chelan Falls Facility and Yearling Chinook

At the last meeting, Petersen agreed to evaluate options for ESA coverage for the construction and operation of the Chelan Falls yearling Chinook Acclimation project. (Petersen was unable to attend today's meeting.) Joe Miller indicated that Chelan PUD wanted to make sure the Hatchery Committees continued to support this program, and wanted to be able to use this support to encourage NMFS to expedite permitting. The Committees confirmed that they continue to support this program. Mike Schiewe agreed to check with Petersen to verify progress on this last meeting's action item.

VI. Colville Tribes

E. Update on Summer Chinook at Bonaparte Pond

Kirk Truscott updated the group that summer Chinook currently on station at Bonaparte Pond have been treated for bacterial gill disease. Truscott said that fish densities and flow dynamics in the pond may have contributed to the mortality, even though the loading densities were within acceptable rearing criteria. The pond initially held 200,000 fish this year; that number is now 193,000. Last year, there were 100,000 fish in the pond.

VII. HCP Administration

A. Next Meetings

The next scheduled Hatchery Committees meetings will occur as follows: January 20, February 17, and March 17, all at the Chelan PUD offices in Wenatchee. There will be a conference call on January 15th to discuss the Twisp steelhead RSS, Wells steelhead HGMP and Methow spring Chinook HGMP.

List of Attachments

Attachment A – List of Attendees

Attachment B – Rock Island HCP Hatchery Committees SOA on Reduction of Chiwawa Spring Chinook Production Level to 298,000 Smolts

Attachment A
List of Attendees

Name	Organization
Mike Schiewe	Anchor QEA, LLC
Ali Wick	Anchor QEA, LLC
Joe Miller *	Chelan PUD
Kirk Truscott *	Colville Confederated Tribes
Tom Kahler *	Douglas PUD
Shane Bickford *	Douglas PUD
Greg Mackey	Douglas PUD
Todd Pearsons (by phone)	Grant PUD
Bill Gale *	USFWS
Bob Pfeifer *	WDFW
Mike Tonseth (morning only)	WDFW
John Penny	WDFW
Keely Murdoch *	Yakama Nation

* Denotes Hatchery Committees member or alternate

FINAL HATCHERY COMMITTEE MEETING MINUTES

December 15, 2010

ANCHOR QEA

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REVISED MEMORANDUM

To:	Wells, Rocky Reach, and Rock Island HCP Hatchery Committees	**Date:**	January 20, 2011
From:	Michael Schiewe, Chair		
Cc:	Carmen Andonaegui		
Re:	Final Minutes of December 15, 2010 HCP Hatchery Committees Meeting		

The Wells, Rocky Reach, and Rock Island Hydroelectric Projects Habitat Conservation Plans (HCPs) Hatchery Committees met at the Chelan PUD offices in Wenatchee, Washington, on Wednesday, December 15, 2010, from 9:30 am to 11:30 am. Attendees are listed in Attachment A to these Meeting Minutes.

ACTION ITEM SUMMARY

- Josh Murauskas will provide to the Hatchery Committees a written list of improvements that have been identified as necessary and agreed to by Cory Kamphaus (Yakama Nation) and Travis Maitland (WDFW) (Item I).
- Douglas PUD will provide a revised draft Wells steelhead HGMP for distribution to the Hatchery Committees prior to the January 2011 Committees meeting (Item II-A).
- Rob Jones and Craig Busack will provide a copy of NMFS' comments to the USFWS on the Winthrop NFH programs to Carmen Andonaegui for distribution to the Hatchery Committees (Item II-A).
- Joe Miller will provide a draft 2011 Chelan PUD Action Plan to Carmen Andonaegui for distribution to the Hatchery Committees prior to the January meeting (Item II-E).
- Joe Miller will provide to the Hatchery Committees a table showing HCP Plan Species survival study results for Rocky Reach and Rock Island Projects (Item III-A).
- Carmen Andonaegui will distribute Kirk Truscott's memo to the Hatchery Committees regarding summer Chinook mortalities at Bonaparte Pond (Item IV-A).

REVIEW ITEMS

- Draft 2009 Douglas PUD M&E Report: 60-day review period with comments due February 7, 2011.

- Draft Wells HCP 2011 Action Plan: comments due prior to the next Hatchery Committees meeting January 19.
- Draft Wells HCP 2010 Hatchery Compliance Report: comments due prior to the next Hatchery Committees meeting January 19.

I. Welcome, Agenda Review, Meeting Minutes, and Action Items

The Hatchery Committees reviewed the agenda and the November 17 meeting minutes. Greg Mackey added a discussion of the Wells HCP 2011 Action Plan and the Draft Wells HCP Hatchery Compliance Report to the agenda. Josh Murauskas reported he had spoken with both by Cory Kamphaus (Yakama Nation) and Travis Maitland (WDFW) and that he will provide a written list of Tumwater Facility improvements agreed upon. The Hatchery Committees approved the November 17 meeting minutes, as revised. Busack informed the Committees that NMFS would not be able to participate in the Committees meetings in person every month, but will participate in monthly meetings by phone. Mike Schiewe suggested NMFS try to attend the meetings in-person at least a couple of times per year. Carmen Andonaegui will finalize meeting minutes and distribute them to the Committees.

II. Douglas PUD

A. DECISION ITEM: Wells Steelhead HGMP Key Points One-pager – vote on agreement-in-principle (Greg Mackey)

Greg Mackey reported that he had incorporated all edits from the December 7 conference call into the revised Hatchery and Genetics Management Plan (HGMP) one-page summary (Attachment B). He said Douglas PUD is seeking buy-in on the key points of the HGMP before editing the full draft HGMP, and submitting it back to the HCP HC for final review. Mike Schiewe reiterated that an agreement-in-principle, during today's meeting, of the HGMP key points contained in the one-page summary does not imply approval of the full HGMP. He asked that if there were items in the draft HGMP that Committees' members would like Douglas PUD to approach differently, they should provide those comments as early as possible to Greg Mackey.

Schiewe asked for comments on the HGMP summary. All present provided their agreement-in-principle with the one-page summary with the exception of Craig Busack, who abstained from voting but remarked that NMFS had previously provided guidance in the development of the HGMP. Kirk Truscott, who was not present, provided his agreement in principle by email on December 14. Bill Gale said he would provide help to Douglas PUD in drafting the section of the HGMP concerning how the Wells steelhead program relates to the existing Winthrop National Fish Hatchery (NFH) programs. Keely Murdoch said Steve Parker (Yakama Nation) would like adaptive management language included in the HGMP similar to what is in the Wenatchee steelhead HGMP regarding balancing adult escapement with PNI.

Schiewe asked if the Wells steelhead HGMP would propose harvest as a tool for managing PNI, and if so, how would it be addressed. Mike Tonseth said the Wenatchee spring chinook HGMP used an addendum to described management of PNI. The Wenatchee steelhead HGMP contains a paragraph that allows for the use of recreational harvest as a tool to manage surplus hatchery fish. Mackey said conservation fisheries are discussed in the current draft HGMP as a method for meeting PNI, including text about the effectiveness of the method.

Schiewe summarized that the Committees had approved in principle the key points of the HGMP one-page summary, and that Douglas PUD would now begin drafting the revised HGMP to reflect the changes agreed to in the steelhead HGMP one-pager. The Hatchery Committees should expect a new, full draft HGMP in time for the January meeting for approval at the February Committees' meeting. If approved, Douglas PUD will transmit the draft HGMP to NMFS. Rob Jones said NMFS had a very productive meeting last week with the USFWS regarding the Winthrop NFH programs. He agreed to provide a copy of NMFS comments on the Winthrop NFH programs to Carmen Andonaegui for distribution to the Committees.

B. Update: Methow Hatchery Surplus Spring Chinook – status of the pond on the Chewuch River near Eightmile Creek (Greg Mackey)

Reading from Charlie Snow's November Monitoring and Evaluation (M&E) report, Greg Mackey reported that 11,379 excess Methow composite spring chinook were transferred on November 22 from the Methow Hatchery to a side channel pond on the Chewuch River upstream of the Eightmile Creek confluence. About 496 of the transferred fish were PIT-tagged prior to release. Pat Phillips said that he and Rick Alford, Yakama Nation, had examined the site and determined it would provide good egress; it was about four-ft deep with groundwater influence keeping the head-end of the side channel open in winter. The water temperature in the side channel was about 37 degrees; the fish were acclimated for about one hour prior to release.

C. Update: Wells Survival Study Summer Chinook release (Greg Mackey)

Greg Mackey stated that he provided a memo on the disposition of the Wells survival study summer Chinook to Carmen Andonaegui for distribution to the Hatchery Committees (Attachment C). He reiterated that because the study would not be implemented, the summer Chinook juveniles were folded into the general Wells Hatchery yearling Chinook release. The Wells survival study summer Chinook are in excess of the normal release, representing an additional 100,000 yearling Chinook for release. There are currently a total of 440,000 yearling summer chinook on-hand.

D. Update: Twisp Steelhead Acclimation Plans for 2011 (Greg Mackey)

Greg Mackey said Keely Murdoch had requested an update on Douglas PUD's plans for Twisp steelhead acclimation. He said Douglas PUD staff had talked about using the Twisp Pond for acclimation of both steelhead and spring Chinook. They examined the pond in the early fall, discussing how the pond might be divided for acclimation use in the spring. Mackey said Douglas PUD will need to have an HCP HC-approved Wells steelhead HGMP prior to release of steelhead into Twisp Pond. If approved, he said Douglas PUD believes they can have the pond ready for acclimation in 2011 using a net structure to partition the pond.

E. Wells HCP Action Plan (Greg Mackey)

Greg Mackey said Douglas PUD is looking for comments on the 2011 Action Plan (Attachment D) prior to the next Hatchery Committees meeting, so that it could be approved at the January meeting. He said the purpose of the Action Plan is to provide a concise list of planned actions for 2011. Mike Schiewe said the Action Plan had also been provided to the Coordinating Committees at their December meeting. Schiewe and Joe Miller discussed Chelan PUD's Action Plan. Miller will provide a draft 2011 Chelan PUD ActionPlan to Carmen Andonaegui for distribution to the Hatchery Committees prior to the January meeting.

F. Wells HCP Annual Hatchery Compliance Report (Greg Mackey)

Greg Mackey said the HCP Hatchery Compliance Report (Attachment E) is intended to document how Douglas PUD has met their HCP hatchery obligations for the past year. The report provides production numbers achieved relative to production targets. Douglas PUD would like comments prior to the January Hatchery Committees meeting, so the report can be approved at the January meeting. Mackey said he has added a row for coho under NNI compensation stating that NNI was achieved through 2017 via a payment to the Yakama Nation for the Yakama Nation Coho Restoration Program. Bill Gale suggested that Osoyoos sockeye should be handled in a similar fashion by stating that NNI compensation is met by funding the Fish and Water Management Tool. Mackey agreed to edit the row in the Hatchery Compliance Plan for the Fish Water Management Tool Program that provides NNI for sockeye. Schiewe said production levels achieved will be included in the Wells Project 2010 annual report, which is submitted to FERC in the spring.

III. Chelan PUD

A. Update: Survival Study Reports (Josh Murauskas)

Joe Miller reported that the Coordinating Committees had approved Statement of Agreements (SOAs) on Phase III Standards Achieved designations for yearling Chinook and for steelhead at Rock Island Dam at 10 percent spill. He provided handouts of the approved SOAs to the Hatchery Committees. Mike Schiewe said that a third SOA had been approved by the Coordinating Committees last year designating sockeye as Phase III Standards Achieved at 10 percent spill. Schiewe said that Chelan PUD had achieved Phase III Designation for Plan Species at 20 percent spill at Rock Island by 2006 and that the HCP allows for an option to test HCP Plan species survival at a reduced spill level. The reduced spill survival study results will be used in the recalculation of hatchery production levels for Rock Island. Murauskas reported that Chelan PUD is planning survival studies for yearling Chinook at Rocky Reach Dam, the last species for which Chelan PUD has yet to demonstrate Phase III Standard Achieved, beginning in 2011. Currently yearling Chinook at Rocky Reach Dam are designated Phase III Additional Tools. Murauskas reported that the Coordinating Committees approved restarting survival testing of yearling Chinook in 2011 for up to 3 additional years. Miller said Chelan PUD will provide to the Hatchery Committees a table showing HCP Plan Species survival study results for Rocky Reach and Rock Island Projects.

IV. CCT

A. Update: Acclimation Fish at Bonaparte Pond (Kirk Truscott)

Mike Schiewe said that Kirk Truscott could not be present at today's meeting but that he had provided by email a memo regarding summer Chinook mortalities at Bonaparte Pond

(Attachment F). Carmen Andonaegui will distribute the memo to the Hatchery Committees. Mike Tonseth reported that there has been an outbreak of Bacterial Gill Disease (BGD) in Bonaparte Pond. WDFW initiated Chloramine-T treatments following initial treatments with Potassium Permanganate, which were unsuccessful. Yesterday's daily loss at the pond was 158 fish. Of a total of 200,000 summer Chinook juveniles, about 17 percent have been lost to-date. WDFW considers the disease to be under control at this time. Tonseth said difficulties with acclimation at Bonaparte Pond are associated with its design to serve primarily as an irrigation settling pond. He said BGD has routinely been a problem at Bonaparte Pond, even at 100,000-fish density. Densities were increased to 200,000 summer Chinook juveniles three years ago.

V. HETT

A. Update (Carmen Andonaegui)

Carmen Andonaegui reported that the the Hatchery Evaluation Technical Team (HETT) met on November 23 and discussed the following items:

NTTOC Analysis

- The Risk Assessment data sheets were reviewed and updated and outstanding data gaps were identified. HETT members were assigned to compile data and add to the Risk Template.
- Model runs will begin when the templates are completed. Grant PUD has identified a staff person to conduct the model runs for all the risk assessment species except for coho. Keely Murdoch has agreed to conduct the model run for coho. Model runs will start with spring Chinook as soon as the risk templates are complete.
- Todd Pearsons is working through the reviewer comments on the NTTOC Risk Manuscript. He will prepare a response and distribute it to the HETT for their help in addressing the comments. The response is due to the review committee December 28, 2010.

Control Group Analysis

- <u>Spring Chinook and summer Chinook</u>. Tracy Hillman has completed the control/treatment group evaluation for the Chiwawa spring Chinook population and is starting the Wenatchee summer Chinook evaluation. Tracy will begin the Grant

PUD and Douglas PUD control/treatment group evaluations for their hatchery programs as soon as contracts are in place. The evaluations are due February 2011.

- Steelhead: the identification of control populations for supplemented steelhead populations are on hold until reliable abundance information for target steelhead populations is available.
- Sockeye: no suitable reference populations are available.

The next HETT meeting will be December 21. Mike Schiewe asked how the model runs are related to the NTTOC expert panel review. Greg Mackey said the model runs are intended as preliminary exercises to work any bugs out of the models prior to sending requests to Delphi Panel members.

VI. HCP Administration

A. Next Meetings

The next scheduled Hatchery Committees meetings will occur as follows: January 19, February 16, and March 16, all in Wenatchee.

List of Attachments

Attachment A – List of Attendees
Attachment B – Revised Hatchery and Genetics Management Plan (HGMP) one-page summary
Attachment C – Wells Survival Study Summer Chinook Disposition Memo
Attachment D – Draft 2011 Wells HCP Action Plan
Attachment E – Draft 2010 Wells HCP Hatchery Compliance Report
Attachment F – Bonaparte Pond Summer Chinook mortality Memo

Attachment A
List of Attendees

Name	Organization
Mike Schiewe	Anchor QEA, LLC
Carmen Andonaegui	Anchor QEA, LLC
Joe Miller*	Chelan PUD
Josh Murauskas*	Chelan PUD
Tom Kahler*	Douglas PUD
Greg Mackey*	Douglas PUD
Craig Busack (phone)	NOAA
Rob Jones* (phone)	NOAA
Russell Langshaw (phone)	Grant PUD
Pat Phillips	WDFW
Bill Gale*	USFWS
Mike Tonseth*	WDFW
Keely Murdoch*	Yakama Nation

* Denotes Hatchery Committees member or alternate

FINAL HATCHERY COMMITTEE CONFERENCE CALL MINUTES

March 7, 2011

ANCHOR QEA

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FINAL MEMORANDUM

To:	Wells, Rocky Reach, and Rock Island HCPs Hatchery Committees	**Date:**	March 16, 2011
From:	Michael Schiewe, Chair		
Cc:	Carmen Andonaegui		
Re:	Final Minutes of March 7, 2011 HCP Hatchery Committees conference call		

The Wells, Rocky Reach, and Rock Island Hydroelectric Projects Habitat Conservation Plans (HCPs) Hatchery Committees met via conference call on Monday, March 7, 2011, from 9:00 am to 10:30 am. Attendees are listed in Attachment A to these Meeting Minutes.

ACTION ITEM SUMMARY

- Greg Mackey will revise the draft Statement of Agreement (SOA) and draft Hatchery and Genetics Management Plan (HGMP) and provide a redline final draft HGMP to the Hatchery Committees by close of business March 8 (Item II-A).
- Hatchery Committees' members will provide final comments on the revised HGMP to Douglas PUD by close of business March 14 (Item II-A).
- Joe Miller will provide the Hatchery Committees with a revised SOA and analysis regarding the Chelan PUD's proposed changes in Methow spring Chinook production levels and relocating production to the Chiwawa facility (Item III-A).

DECISION SUMMARY

- The Hatchery Committees approved the draft SOA for the Wells Steelhead HGMP, with revisions and subject to a final review of the HGMP by close of business March 14 (Item II-A).
- The Hatchery Committees agreed to postpone the vote on the Chelan PUD SOA for changes in Wenatchee steelhead production levels until the March 16 Hatchery Committees meeting (Item III-A).

I. Welcome

Mike Schiewe opened the call by stating that the purpose of the meeting was to discuss and vote on approval of Douglas PUD's draft Wells Steelhead HGMP SOA (Attachment B), and

Chelan PUD's request for adjustment of Chelan PUD's Wenatchee steelhead production levels and moving the release to the Chiwawa facility in the Wenatchee Basin (Attachment C).

II. Douglas PUD

A. SOA for the Draft Wells Steelhead HGMP (Greg Mackey)

Greg Mackey introduced the topic by summarizing recent changes to the draft Wells Steelhead HGMP. He incorporated all edits from the Committees that were discussed in the last Committees' meeting, and made a few minor editorial changes in the SOA. He indicated that he talked with Kirk Truscott and Bill Gale this morning regarding additional edits to the draft SOA and HGMP.

Based on his conversation with Truscott, Mackey will insert the text, "act as a safety-net," into the sentence describing the 300,000 smolt segregated component of the program in the Statement section of the draft SOA to make it consistent with the draft HGMP. Mackey also will replace "enhancement" with "safety-net" in the second-to-last sentence and replace the word "segregated" with "safety-net" elsewhere in the SOA.

Regarding his conversation with Bill Gale prior to this morning's meeting, Mackey said Gale expressed concern with acclimating 100,000 smolts at the Methow Hatchery for only a couple of weeks in the spring before volitional release. In response, Mackey said Douglas PUD developed an adaptive management approach and timeline for evaluating the effect of the abbreviated Methow Hatchery acclimation and release on homing fidelity. Briefly, steelhead released between 2012 and 2013 will be marked and homing fidelity and strays rates will be analyzed.

The Committees will review the assessment data in 2015 to determine whether the short-term acclimation at the Methow Hatchery is acceptable. If the Committees determine that it is not, Douglas PUD will either overwinter the steelhead at the Methow Hatchery or explore alternate release sites in the lower Methow Basin. These might include Carlton Pond or possibly in a tributary in the lower Methow, such as Beaver Creek. Mackey said by 2015, one- and two-year ocean adults would have returned, and these fish would be used as the basis for making any changes to the acclimation strategy beginning in 2016. Mackey said a third possible alternative to overwintering at the Methow Hatchery or at alternate, available lower Methow River sites, is to shift the lower Methow Basin steelhead component out of the Methow Basin and release the fish into the Columbia River. Mackey said the decision would be made by the Committee. Craig Busack recommended keeping this alternative in the HGMP to avoid the potential to have to reinitiate consultation if implemented. Mike Schiewe suggested adding a statement in the HGMP to the effect that the Committee would consider measures in addition to release from the lower Methow, including moving fish out of the basin, to reduce straying. Mackey agreed to make this change to the draft HGMP. Gale and Keely Murdoch asked that language be added to the HGMP to say overwintering at the Methow Hatchery would be considered if space becomes available.

Schiewe asked the Committee members if there were any other concerns or issues with the draft HGMP that had not already been considered. Truscott asked that Mackey review the SOA, the HGMP, and the one-page document to confirm that all three documents are consistent. Schiewe asked for a vote on approval of the SOA, subject to the changes made today. The Committees approved the SOA, subject to today's revisions, and with the opportunity to review the final version prior to submittal to the National Oceanic and Atmospheric Administration (NOAA). Mackey agreed to make the final changes in red-line format and send to Carmen Andonaegui for distribution to the Committees by close of business March 8. Schiewe said that any issues related to the final draft HGMP must be raised by Committees' members no later than close of business March 14; otherwise, it will be considered final and approved.

III. Chelan PUD

A. SOA for Adjustment of Chelan PUD Steelhead Production Levels and Transfer of Acclimation to the Wenatchee Basin (Joe Miller)

Joe Miller reported that he received a proposed change to the Wenatchee steelhead SOA from Mike Tonseth (on behalf of the Joint Fisheries Parties [JFP]). The alternate proposal was to produce 247,300 smolts for 2011 and 2012 rather than the 206,849 smolts proposed in Chelan PUD's SOA. Miller said that Chelan PUD has no objections to the alternate proposal (Attachment D); with the caveat that if there is an issue with high ELISA fish, the 247,300 steelhead production would have to be proportionately reduced.

Keely Murdoch said that although the Yakama Nation will likely approve the Washington State Department of Fish and Wildlife (WDFW) alternate proposal, and are supportive of an early, interim reduction, she wanted to defer voting on the SOA until later this week after Chelan PUD and Yakama Nation have a chance to meet. Mike Tonseth said a delay until the Committees' regularly-scheduled meeting on March 16 would not be problematic with regard to broodstock collection scheduling. Miller said he will also request a vote for approval of the spring Chinook SOA, which was originally separated from the steelhead SOA so the steelhead SOA could move forward. He said he would like both to be considered for approval on March 16. Gale said it may be advantageous in *US v OR* to link steelhead and spring Chinook; however, he needs to understand how Chelan's proposed changes to the Methow spring Chinook program might impact the Winthop National Fish Hatchery (NFH) spring Chinook production program and Methow spring Chinook in its entirety. Miller said Chelan PUD will provide the Committees with additional analysis regarding the potential effect of Chelan PUD's proposed changes in Methow spring Chinook production levels and potential effects of the proposed relocation of Methow spring Chinook production to the Chiwawa facility. The Committees agreed to postpone the vote on the SOA until March 16.

Schiewe encouraged all Committees' members with additional questions on Chelan PUD's proposed changes to the steelhead program or the Methow spring Chinook program to alert Chelan PUD in advance of the meeting so there can be a productive discussion. Schiewe said the two SOAs will be separately considered for approval. Busack asked how the proposed changes in production levels might affect what is included in the Methow spring Chinook HGMP, and specifically, how it might affect the number of adults expected to return to the Basin. Gale said Methow Hatchery is now focused on an integrated program. The Winthrop NFH program would also function as a safety-net program for the Methow Hatchery program; however, Gale said in order to provide a safety-net function, there needs to be certainty that the conservation program would be returning enough adults for broodstock to support the program. Gale said this is why Methow Basin spring Chinook production as a whole needs to be considered when deciding whether to relocate all of the Chelan PUD Methow spring Chinook production out-of-basin.

Kirk Truscott stated that initial Chelan PUD Methow spring Chinook production is 288,000 with a recalculated production level of 90,000. The 90,000 smolt production level is for the expected post-2013 production. He said Chelan PUD's proposal only asks for consideration of what impact moving 90,000 spring Chinook smolts out of the Methow Basin will have on the remaining spring Chinook production programs. For example, if the proposed relocation action is approved, will this affect the number of returning adults such that the remaining conservation programs cannot be supported? Josh Murauskas said a 90,000-smolt release is estimated to be equivalent to about 100 returning adults. Miller said he will provide an analysis of potential impacts to Methow spring Chinook programs after the Chelan PUD discussion with the Yakama Nation. He said he will distribute an amended steelhead SOA based on today's discussions.

List of Attachments

Attachment A – List of Attendees
Attachment B – Draft Wells Steelhead HGMP SOA
Attachment C – Chelan PUD Methow Steelhead SOA
Attachment D – WDFW Methow Steelhead Alternate Proposal

Attachment A
List of Attendees

Name	Organization
Mike Schiewe	Anchor QEA, LLC
Carmen Andonaegui	Anchor QEA, LLC
Joe Miller*	Chelan PUD
Josh Murauskas*	Chelan PUD
Shane Bickford	Douglas PUD
Tom Kahler*	Douglas PUD
Greg Mackey*	Douglas PUD
Craig Busack*	NOAA
Kirk Truscott*	CCT
Bill Gale*	USFWS
Mike Tonseth*	WDFW
Keely Murdoch*	Yakama Nation

* Denotes Hatchery Committees member or alternate

STATEMENT OF AGREEMENT FOR WELLS STEELHEAD HATCHERY AND GENETIC MANAGEMENT PLAN

March 9, 2011

Wells HCP Hatchery Committee
Statement of Agreement
Wells Hatchery Steelhead Hatchery Genetics Management Plan
March 9, 2011

Statement

The Wells HCP Hatchery Committee approves the Hatchery Genetic Management Plan (HGMP) for the Wells Hatchery Summer Steelhead Program, dated March 7, 2011.

The HGMP for the Wells steelhead program includes three components: 1) an integrated hatchery component for the Twisp River to satisfy the No Net Impact (NNI) requirements of the Wells HCP (current production for NNI is 47,571 smolts), 2) a 300,000 smolt component intended to act as a safety-net and support steelhead harvest without negatively affecting the three proposed integrated steelhead programs upstream of Wells Dam (Twisp, Winthrop and Colville), and 3) up to 100,000 smolts for Grant PUD.

Background

The Wells HCP requires Douglas PUD to produce hatchery steelhead toward achieving the NNI goal of the HCP. Steelhead passage survival at Wells has been measured to average 96.3% during four years of survival study (1998, 1999, 2000 and 2010). The new NNI release goal of 47,571 steelhead smolts is mitigation for the unavoidable loss of 3.7% of the juvenile steelhead migrating through the Wells Project.

The Wells HCP also requires Douglas PUD to produce 300,000 steelhead smolts to satisfy fixed hatchery production requirements in the Wells Project license. Currently, all 300,000 of these smolts are released into the Methow and Okanogan rivers.

Grant PUD is required to produce up to 100,000 steelhead smolts toward achievement of current NNI goals for the Priest Rapids Hydroelectric Project. Douglas PUD will rear up to 100,000 steelhead smolts on behalf of Grant PUD under a hatchery sharing agreement.

Smolt release levels in this HGMP will initially transition from the current release levels, and then remain constant thereafter. In 2011 and 2012, Wells Hatchery steelhead releases will be sized to ensure a Methow Basin total release of 350,000 smolts, including Winthrop NFH releases. This will include the 47,571 Twisp integrated release, and a lower Methow release sized to meet the 350,000 Methow Basin smolt target. The remaining up to 200,000 smolts produced at Wells Hatchery will be released directly from Wells Hatchery downstream of Wells Dam. Up to 100,000 of these fish may be released in the Okanogan Basin at the request of the Colville Confederated Tribes.

Beginning with the 2013 release year, 150,000 Wells Hatchery steelhead smolts will be released annually in the Methow Basin. This will include the 47,571-smolt Twisp integrated release, and approximately 100,000 safety-net smolts released in the lower Methow (Methow Hatchery). Assessment of the Lower Methow component will begin in 2012, with a management decision in 2015 regarding acclimation strategy and/or release location. The remaining up to 200,000 safety-net smolts will be released from Wells Hatchery downstream of Wells Dam. At the request of the Colville Confederated Tribes, up to 100,000 of the Wells Hatchery safety-net fish may be released in the Okanogan Basin, or up to 200,000 may be released from acclimation facilities with adult extraction capabilities in the Columbia River upstream of the Okanogan River confluence, provided these facilities are developed by others.

FINAL HATCHERY COMMITTEE MEETING MINUTES

March 16, 2011

ANCHOR QEA
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FINAL MEMORANDUM

To:	Wells, Rocky Reach, and Rock Island HCPs Hatchery Committees	**Date:**	April 25, 2011
From:	Michael Schiewe, Chair		
Cc:	Carmen Andonaegui		
Re:	Final Minutes of March 16, 2011, HCP Hatchery Committees Meeting		

The Wells, Rocky Reach, and Rock Island Hydroelectric Projects Habitat Conservation Plans (HCPs) Hatchery Committees met at the Douglas PUD Headquarters Building in East Wenatchee, Washington, on Wednesday, March 16, 2011, from 9:30 am to 3:30 pm. Attendees are listed in Attachment A to these Meeting Minutes.

ACTION ITEM SUMMARY

- Josh Murauskas will provide Carmen Andonaegui with a final Methow spring Chinook Statement of Agreement (SOA) for distribution to the Hatchery Committees 10 days prior to the March 29 conference call (Item II-A).
- Carmen Andonaegui will set up a conference call line for March 29 at 9:30 am to vote on Chelan PUD's revised Methow spring Chinook SOA (Item II-A).
- Mike Tonseth, Greg Mackey, and Keely Murdoch will develop a plan for co-acclimation of Chinook and steelhead in the Twisp Pond in 2011 (Item III-B).
- Mike Tonseth will review and confirm summer Chinook broodstock needs (Item III-C).
- By March 31, Mike Tonseth will provide the Hatchery Committees with the draft 2011 Broodstock Collection Protocols for review (Item IV-A).
- Keely Murdoch will provide Mike Tonseth with coho broodstock collection protocols as soon as possible (Item IV-A).
- Mike Tonseth will make changes to the draft Hatchery Production Management Plan as agreed to at today's meeting and send the revised draft to Carmen Andonaegui for distribution to the Hatchery Committees for comments (Item IV-B).
- Bill Gale will forward Steve Lewis' email regarding Washington Department of Fish and Wildlife's (WDFW) Section 6 permit coverage for operations at Tumwater Dam (TWD) to Carmen Andonaegui for distribution to the Hatchery Committees (Item IV-C).

- Hatchery Committees' comments on the draft TWD Operations Plan are due to Mike Tonseth by April 6 (Item IV-C).
- Mike Tonseth will provide a revised draft TWD Operations Plan to the Hatchery Committees by April 15 for consideration at the next meeting (Item IV-C).
- Craig Busack will provide monthly updates on the progress of Mid-Columbia Hatchery and Genetics Management Plans (HGMPs) at future Committees meetings (Item V-A).
- The Hatchery Committees will be prepared to discuss factors affecting smolt-to-adult return (SAR) rates for Mid-Columbia hatchery programs at the next meeting. Carmen Andonaegui will compile the information for use by the Committees (Item V-B).

DECISION SUMMARY

- The Hatchery Committees approved the Chelan PUD Wenatchee Steelhead SOA (Item II-B).
- The Hatchery Committees approved the Wells Steelhead HGMP. (Note: the draft HGMP was approved during a March 7 Hatchery Committees conference call with the condition that comments would be accepted until March 14. No additional comments were received; therefore, the approval is final.)

REVIEW ITEMS

- Draft 2011 Broodstock Collection Protocols – comments due by the next Hatchery Committees meeting to Mike Tonseth
- Draft Hatchery Production Management Plan – comments due prior to next Hatchery Committees meeting to Mike Tonseth
- Draft Tumwater Dam Operations Plan – comments due by April 6 to Mike Tonseth

I. Welcome, Agenda Review, Meeting Minutes, and Action Items

Mike Schiewe welcomed the Hatchery Committees and reviewed the agenda. Josh Murauskas requested that Chelan PUD's Wenatchee steelhead program modifications SOA be added to the agenda as a decision item. He also requested that Chelan PUD's TWD agenda item be held for discussion as part of WDFW's TWD agenda item. Bill Gale requested discussion of 2011 broodstock collection at Wells Dam for the Entiat NFH be added to the agenda. Keely Murdoch requested an HGMP consultation and permitting update from National Marine Fisheries Service (NMFS), and a discussion of SAR rates at Upper Columbia hatcheries be added to the agenda.

Both the February 16, 2011, Hatchery Committees meeting minutes and the March 7, 2011, Committees conference call minutes were reviewed and approved with minor revision. Carmen Andonaegui will finalize the minutes and distribute them to the Committees.

II. Chelan PUD

A. Methow Spring Chinook SOA (Josh Murauskas)

Josh Murauskas provided an update on the draft Methow Spring Chinook SOA requesting reallocation of Methow spring Chinook production from Methow Hatchery to the Wenatchee Basin and the Chiwawa Ponds Facility. He said that based on a meeting with the Yakama Nation, Chelan PUD has added a provision agreeing to a minimum production level of 200,000 Chiwawa spring Chinook salmon smolts in the future, unless directed otherwise by the Hatchery Committees or by NMFS as a condition of their Endangered Species Act (ESA) hatchery permit.

Kirk Truscott said the Colville Confederated Tribes (CCT) were concerned about the potential effect that moving Chelan PUD's spring Chinook production out of the Methow subbasin could have on Methow broodstock availability for their programs at Chief Joseph Hatchery. Specifically, Truscott said the CCT's Okanogan spring Chinook reintroduction program will require enough broodstock for a 200,000 egg-take from the Methow Basin. Truscott said that in reviewing target smolt release numbers for Methow spring Chinook programs, an adult return to the Winthrop NFH with an average SAR of 0.0015 would return about 600 adults. However, there are no data available to estimate how many of the 600 adults would return to the Winthrop NFH outfall and hence be available for collection as broodstock. The Committees discussed possible alternatives for adult collection, including Wells Dam. However, the fish are not externally marked and cannot be distinguished at Wells. Greg Mackey noted that Douglas PUD would be concerned if the proposed changes caused additional risk, complications, or cost to the Douglas program(s). Truscott said the CCT cannot support the SOA without knowing its effect on broodstock availability. Bill Gale noted similar concerns regarding adequate broodstock for Winthrop NFH programs. Murauskas agreed that it is also in Chelan PUD's interest to make sure enough broodstock are available given their funding of the CCT Chief Joseph spring Chinook program. Truscott and

Murauskas agreed to further evaluate the potential effect on broodstock availability as a result of moving Chelan PUD's spring Chinook program out of the Methow subbasin. Mike Tonseth noted that with an increase in natural juvenile production, there could be an associated decrease in broodstock needs. Truscott said moving the Chelan PUD spring Chinook program out of the Methow subbasin may also affect Upper Columbia River spring Chinook recovery.

The Committees agreed to a conference call on March 29 at 9:30 am to further consider and vote on the Chelan PUD spring Chinook SOA, as revised based on today's discussion. Murauskas will provide Carmen Andonaegui with a final Methow spring Chinook SOA for distribution to the Hatchery Committees 10 days prior to the March 29 conference call. In the meantime, Chelan PUD, CCT, and the USFWS agreed to further evaluate the potential effects of Chelan PUD's proposed change to the Methow program on broodstock collection and recovery. Carmen Andonaegui will set up a conference call line for March 29 at 9:30 am.

Mike Tonseth said the 2011 Broodstock Collection Protocols are due April 15 and if the SOA is approved, the change in broodstock collection would be incorporated.

B. Wenatchee Steelhead SOA (Josh Murauskas)

Josh Murauskas said WDFW requested a change to the Wenatchee Steelhead SOA to allow for maximum smolt production at the Chiwawa Facility. The change is reflected in the March 7, 2011, version of the SOA up for approval today. Mike Schiewe asked for questions from the Committees. There were no questions and the SOA was approved.

C. 2013 NNI Recalculation SOA (Josh Murauskas)

Josh Murauskas said the draft NNI Recalculation SOA was distributed by email along with a paper explaining the 2013 recalculation methods (Attachment B). He summarized the approach and recommended program sizes using a PowerPoint presentation (Attachment C). He said Chelan PUD is proposing to use monitoring and evaluation (M&E) data to estimate smolt production where data is available. They propose using similar techniques to the Biological Assessment and Management Plan (BAMP) method if M&E data is not available, but only when smolt estimates using the BAMP method do not exceed the estimated carrying capacity. Murauskas referred to the estimated carrying capacities in the

Quantitative Analytical Report (QAR). He said the QAR carrying capacity estimates are consistent with estimates based on M&E data in the case of Wenatchee River Basin spring Chinook.

Murauskas summarized Chelan PUD's analyses by showing comparisons of smolt production estimates for spring Chinook and steelhead programs using the BAMP method, carrying capacity, and M&E data. He indicated that carrying capacity based on M&E data were Chelan PUD's preferred basis for estimating spring Chinook and steelhead smolt production, but that SARs and adult escapement provided the only estimates for summer/fall Chinook smolt production given the available data. Bill Gale noted that the summer/fall Chinook smolt production estimates assume no mainstem spawning. The Hatchery Committees discussed adjusting summer/fall Chinook estimates to include mainstem spawning production and a means to estimate mainstem production. The Committees also discussed the extent to which smolt production estimates lead to mitigating for mitigation production.

Keely Murdoch asked why dam counts are not used rather than spawning escapement numbers in the BAMP calculations, given that adult mortality occurs between the dam counts and the spawning ground counts. Murauskas said they used the SARs generated from M&E data and reported in the M&E reports. The Committees discussed what goes into calculating SARs and the reliability or application of SARs. Murauskas said Chelan PUD's 2013 recalculation methods paper provides SARs for all Mid- and Upper-Columbia hatchery programs, and that the proposed smolt production estimates are included in the draft 2013 recalculation SOA. Mike Tonseth asked if the smolt production estimates from Chelan and Douglas PUDs will be reconciled if they are not consistent as a result of using different recalculation methods. As an example, he provided production estimates from the BAMP for Methow spring Chinook compared to carrying capacity estimates generated from M&E data (1,029,216 and 375,921, respectively). Tonseth asked that if estimated smolt numbers arriving at a projects differed as a result of using differing recalculation methods (e.g. BAMP vs QAR) for the same population, and SOAs were subsequently approved for the differing methods used by each of the PUD's, that the logic behind doing so be clearly detailed. Murauskas finished his presentation by reviewing the hatchery compensation calculations for both Rock Island and Rocky Reach dams for HCP species. He said it would be up to the Hatchery Committees to decide how production would be allocated.

Mike Schiewe asked for questions from the Committees. Tonseth said spring Chinook production levels for the Chiwawa program are easily met with the 200,000 minimum production requirement in the SOA, if it is approved. Schiewe said that although there is no request for a vote on Chelan PUD's recalculation method at this time, the Committees do need to agree to a recalculation method no later than October 2011. Tonseth reiterated that if Chelan PUD's carrying capacity-based smolt production estimates are accepted, rather than the BAMP method estimate proposed by Douglas PUD, the reasoning needs to be explained.

Schiewe said the PUDs have provided their recalculation proposals as requested by the Committees and asked what action the Committees would like to take. Murauskas said Chelan PUD will ask for a vote to approve their proposed recalculation method at the next Committees' meeting.

III. Douglas PUD

A. Douglas Recalculation Methodology (Greg Mackey)

Greg Mackey said Douglas PUD was prepared to request a vote on their SOA for recalculation of hatchery NNI production, but that given earlier discussion today on Chelan PUD's recalculation proposal, he recognizes there may be still questions. Keely Murdoch said she is more comfortable with Douglas PUD's proposal to use the BAMP method rather than Chelan PUD's recalculation proposal. Bill Gale said Douglas PUD's approach to recalculating is more simple and that it might be helpful to consider their proposal before considering Chelan PUD's proposal. Mike Tonseth said he is inclined to wait on voting on Douglas PUD's proposal to allow additional discussion about how to reconcile the two PUDs' approaches to recalculation, or whether to accept two independent recalculation methods for a single population. He said if the Committees approve two different methods for a single population, the rational for doing so needs to be clearly documented.

Murdoch suggested the need for a Joint Fisheries Parties (JFP) meeting to consider options. The Committees discussed how hatchery program production is incorporated into PUD production estimates. Mackey said the BAMP method includes hatchery fish in the production estimates while carrying capacity estimates use only natural production. Mackey said an alternate approach to the BAMP would be be to simply use the known number of hatchery fish to be released, then add the estimated number of natural-origin smolts produced using either population estimates, or perhaps carrying capacity. He said this is what the BAMP method attempts to do, but this alternate approach would more simply and directly obtain NNI numbers. Bill Gale said the Chelan and Douglas PUDs should mitigate for the losses at their dams of hatchery fish intended to mitigate for Grand Coulee Dam impacts. Gale said the JFP will be prepared to discuss a JFP recalculation recommendation at the next Committees meeting. He said a proposal will be distributed prior to the next meeting to inform the discussion on approval of the PUDs' recalculation proposals.

B. Twisp Weir and Twisp and Chewuch Acclimation Ponds (Greg Mackey)

Greg Mackey reported that Douglas PUD was not able install the traps at the Twisp Weir last week because of road conditions, but they will try again tomorrow. If they are not able to install the traps tomorrow, they will install as soon as road conditions allow. Mackey also reported that Douglas PUD will begin filling the Twisp and Methow acclimation ponds on Monday, with plans to move fish in on Tuesday. Keely Murdoch asked if steelhead were going to be acclimated in the Twisp Pond this year. Mackey said Douglas PUD did not have approval of the Wells steelhead HGMP in time to allow changes in infrastructure at the pond that are needed to support two-species acclimation. Mike Tonseth proposed acclimating steelhead and Chinook together with no divider in the Twisp Ponds in 2011. He said this would allow for assessment of in-pond performance of steelhead and Chinook acclimated together using HxW steelhead prior to acclimating the WxW steelhead in 2012. Tonseth, Mackey, and Murdoch agreed to meet to discuss moving forward with co-acclimation, along with an observation approach to evaluating interactions when Chinook and steelhead are acclimated in the same pond.

C. Wells Broodstock Collection for the Entiat Summer Chinook Program (Bill Gale)

Bill Gale said the USFWS is moving forward on their Entiat NFH summer/fall Chinook program, transitioning from rearing 200,000 to rearing 400,000. Gale said the USFWS plans to continue collecting broodstock at Wells Dam until adults begin returning to the Entiat NFH. He said they had difficulties transporting adults from Wells Dam to the Entiat NFH last year, and with the expected doubling of production, proposed collecting and transferring green eggs and milt (rather than adults) in 2011.

Mackey said Douglas PUD is prepared to approve a plan similar to the SOA between DPUD and USFWS from 2010, but would like to know what extra costs or water might be involved in holding adults through spawning and obtaining green eggs and milt. Mackey and Gale will discuss additional costs and water needs associated with the change. Gale said that to accomodate the increase in production at the Entiat NFH, 240 hatchery adults will be needed. He said USFWS would provide staff and formalin for the entire spawning effort.

Mike Tonseth said WDFW had not yet received all of the summer Chinook broodstock collection requests for 2011. He said last year about 1,200 adult summer Chinook adults from Douglas PUD at Wells Dam were requested to meet Douglas PUD, Chelan PUD, Yakama Nation, and USFWS requests, and that the combined request will increase this year by at least 120 adults. Tonseth wanted to make sure the Wells facility would be able to accommodate all of the summer/fall Chinook broodstock needs including the request for 240 adults from the USFWS. Gale said he needed to know if the USFWS needs to be prepared to do an adult transfer this year. Tonseth said the change in broodstock collection would need to be included in the 2011 broodstock protocols. Gale and Mackey agreed to develop an agreement outside the Committees.

IV. WDFW

A. 2011 Broodstock Protocols (Mike Tonseth)

Mike Tonseth reported that he is still waiting on broodstock requests from the Yakama Nation and USFWS, as discussed earlier today. He will distribute a draft by the end of March for review by the Hatchery Committees. He would like comments on the draft and discussion at the next Committees meeting so that a near-final draft can be submitted to NMFS by mid-April 2011. Tonseth, Kirk Truscott, and Alene Underwood discussed coordinating equipment needs related to broodstock collection activities to maximize efficiencies. Tonseth will set up a pre-trapping coordination meeting with the appropriate parties. Because there is not yet resolution on the direction of the Methow spring Chinook program, Tonseth said he will draft the broodstock protocols to identify both potential broodstock collection scenarios: for juvenile release in either the Methow or Wenatchee basins. Keely Murdoch agreed to provide Tonseth with the coho broodstock collection protocols as soon as possible.

B. Draft Hatchery Production Management Plan (Mike Tonseth)

Mike Tonseth emailed a draft Hatchery Production Management Plan to the Hatchery Committes on March 8. He said that in the spring of 2010, there was a discussion of how to manage hatchery program overages. This discussion led to an support by the Committees to develop a Hatchery Production Management Plan. Some of the elements of the plan include using ultrasound to identify gravid females, and a method to better estimate egg take. In 2010, preliminary implementation of many features of the plan was very successful in minimizing hatchery overproduction and therefore will be repeated in 2011. Tonseth said the plan provided actions for staying within target production objectives and includes recommended actions if production objectives are not being met. Tonseth requested comments from the Committees on the draft plan.

Greg Mackey suggested language be added to the plan to indicate it can also be used to avoid under-production. He also suggested using prediction intervals to check how well model projections predict parameters in the plan. Tonseth said the plan is set up for broodstock collection over the migration period as allowed by the permit and as detailed in the broodstock collection protocols. He said the document provides a general approach to managing production but that it is up to program managers to manage individual program broodstock collection to ensure they are capturing the necessary demographics. Mackey suggested language be added to the plan to indicate that culling can be used for a variety of diseases and not be restricted to Bacterial Kidney Disease (BKD). Tonseth will make the changes to the draft plan and distribute it to the Committees for comments. The Hatchery Production Management Plan will be on the agenda for approval at the April meeting.

C. Tumwater Dam Operations Plan (Mike Tonseth)

Mike Tonseth said the draft TWD Operations Plan, distributed by email earlier this week, is available for comments and discussion. Josh Murauskas said Chelan PUD has completed their analysis of passage delays at TWD and suggested WDFW seek ESA permit coverage for their trapping operations at TWD. Mike Schiewe said WDFW's TWD Operations Plan would be the basis for an ESA permit application. Tonseth said WDFW recognizes there is a delay during fish passage at TWD, but that they do not know the ultimate effect(s) of the delay on ESA-listed fish populations. He said WDFW will describe the facility operation needed for trapping operations unique to WDFW programs so that NMFS can determine if additional actions are required. Murauskas asked if TWD operations have coverage for bull trout. Bill Gale said Steve Lewis of USFWS sent an email to Joe Miller and Tonseth regarding bull trout coverage under ESA. He read the email to the Hatchery Committees, in which Lewis said as long as Chelan PUD is working on addressing passage delays and does not exceed the allowed incidental take at TWD as stipulated in the Rocky Reach Section 7 Incidental Take permit, they are covered under ESA. Gale will forward Lewis' email to

Carmen Andonaegui for distribution to the Committees. Murauskas said Chelan PUD may request that Lewis participate in the conference call on March 29 to clarify WDFW's coverage under the existing ESA Section 6 permit for TWD operations related to bull trout.

Tonseth provided the Committees with an overview of the content and organization of the draft TWD Plan, saying it is divided into two sections. He said one section describes processing of fish during broodstock collection. The other section covers activities at TWD that are in addition to broodstock collection efforts. Tonseth said the TWD Operations Plan describes WDFW's plans to move collection of broodstock from TWD to the Dryden Weir or to the Chiwawa Weir to the extent the existing collection permit allows. .

Tonseth said the draft TWD Plan specifies the use of three-person crews and recommends that the steep pass not be closed at any time during fish passage season. If appropriate-sized crews cannot be maintained, the steep pass will be set to bypass. Tonseth said the Committees will need to decide what are acceptable passage delays and, if delays are observed, when to implement bypass operations. By July 15, or when sockeye numbers start to increase as determined by observations at Dryden Dam, reproductive study activities will stop and the fish facility will go to bypass-only. Tonseth said he anticipates that spring Chinook reproductive success study activities can be halted by July 15, based on past spring Chinook run data at TWD.

Committees' members comments on the draft TWD Operations Plan are due to Tonseth by April 6. Tonseth will provide a new draft TWD Operations Plan by April 15 for consideration at the next meeting. Tonseth said an operations plan is needed at TWD for the period from June 15 until the trap operation terminates in the fall.

V. NMFS

A. HGMP Permitting Process Update *(Craig Busack)*

Keely Murdoch asked Craig Busack to provide an update on timelines and on the status of processing HGMPs. He said timelines have not changed since his update at the last Hatchery Committees meeting in February. Busack said NMFS completed a Biological Opinion last week on three Umatilla hatchery programs, and that this will be helpful in preparing other Biological Opinions on hatchery programs. He had no update on the status of the Wenatchee subbasin hatchery program consultations. Busack said he does not think there is risk to hatchery program operators as long as program consultations are in progress. Busack said NMFS will not be issuing compliance letters in 2011 for ESA coverage. Busack said he will plan on providing monthly updates on the progress of Mid- and Upper-Columbia HGMPs at future Committees' meetings.

B. Smolt-to-Adult Return Rates (Keely Murdoch)

Keely Murdoch suggested that the Hatchery Committees undertake a review of selected HCP hatchery programs to better understand why, for example, SARs for Methow programs are substantially lower than those for the Wenatchee. The Committees discussed several Upper- and Mid-Columbia hatchery programs, their different SARs, and what factors may be contributing to the differences. Mike Schiewe suggested comparing programs side-by-side to highlight program differences. Bill Gale suggested using information on programs and SARs provided in the Methow and Chiwawa spring Chinook HGMPs. Mike Tonseth said that the Chiwawa M&E report includes information on SARs. Committees members agreed to further discuss a path forward for this evaluation. Schiewe suggested that a good starting point might be for Committees members to begin providing Andonaegui with a list of parameters that merit comparison. Andonaegui could compile and organize the list as a basis for further discussion.

VI. HETT Update

A. Update (Carmen Andonaegui)

Carmen Andonaegui reported that the Hatchery Evaluation Technical Team (HETT) met on March 8, 2011, and discussed the Non-Target Taxa of Concern (NTTOC) analysis and the control group analysis, as detailed below.

NTTOC Analysis:

- A master file has been created that contains all the compiled information collected for use in the NTTOC risk analysis.
- Greg Mackey has created an Access database for NTTOC data.
- Tracy Hillman will have carrying capacities calculated for wild and natural salmonid production for Upper Columbia Region subbasins and the mainstem Columbia River within the Upper Columbia Region by the next HETT meeting. As soon as carrying capacity estimates are completed, Greg Mackey will calculate Maximum Daily Encounter rates and risk assessment model runs can begin for the Wenatchee and

Methow subbasins. Grant PUD will conduct model runs for all species except coho, which will be conducted by Keely Murdoch.

- Cutthroat and lamprey risk assessment will be conducted using a qualitative process to provide input for the 5-year HCP M&E report.

Control Group Analysis:

- Tracy Hillman has completed running power analyses on Wenatchee spring Chinook data as part of the reference stream analysis, and is nearing completion of the Methow spring Chinook reference stream analysis. He will begin the analysis on summer Chinook soon.

The next HETT meeting will be on April 12.

VII. HCP Administration

A. Next Meetings

The next scheduled Hatchery Committees meetings are April 20 (Chelan PUD office), May 18 (Douglas PUD office), and June 15 (Chelan PUD office), all in Wenatchee.

List of Attachments

Attachment A – List of Attendees
Attachment B – Draft Chelan PUD NNI Recalculations (M&E-based)
Attachment C – Chelan PUD 2013 Recalculations PowerPoint presentation

Attachment A
List of Attendees

Name	Organization
Mike Schiewe	Anchor QEA, LLC
Carmen Andonaegui	Anchor QEA, LLC
Alene Underwood	Chelan PUD
Josh Murauskas*	Chelan PUD
Tom Kahler*	Douglas PUD
Greg Mackey*	Douglas PUD
Craig Busack* (phone)	NOAA
Kirk Truscott*	CCT
Todd Pearsons	Grant PUD
Bill Gale*	USFWS
Mike Tonseth*	WDFW
Keely Murdoch*	Yakama Nation

* Denotes Hatchery Committees member or alternate

LETTER TO ROB JONES, NMFS, REGARDING WELLS STEELHEAD HATCHERY AND GENETIC MANAGEMENT PLAN

April 13, 2011

Rob Jones
NMFS Recovery Division
National Marine Fisheries Service
1201 NE Lloyd Blvd., Suite 1100
Portland, OR 97232

April 13, 2011

Regarding: Wells Hatchery Complex Summer Steelhead HGMP

Dear Rob:

Public Utility District No. 1 of Douglas County (Douglas PUD) and the Washington State Department of Fish and Wildlife (WDFW) are pleased to submit to the National Marine Fisheries Service (NMFS) the attached final Hatchery and Genetic Management Plan (HGMP) for the Wells Hatchery Complex Summer Steelhead Program. Douglas PUD is the owner and lead funding entity of the program. The WDFW is the current operator of the program. Public Utility District No. 2 of Grant County (Grant PUD) also funds a portion of the summer steelhead raised at the Wells Hatchery.

Since October 2, 2003, Douglas PUD and WDFW have been operating the Wells Hatchery summer steelhead program as co-permittees under permit No. 1395. The ten-year term of permit No. 1395 expires in October 2013. In September 2008, Douglas PUD received a formal request from NMFS to submit a new HGMP for the Wells Hatchery summer steelhead program. Since that time Douglas PUD, as the lead entity for this HGMP, has been working closely with the Wells HCP Hatchery Committee (HCP HC) and Grant PUD to develop a program that will meaningfully contribute to recovery of summer steelhead populations upstream of Wells Dam, adhere to the guidance provided by the Hatchery Scientific Review Group, meet the mitigation obligations for passage losses at the Douglas PUD and Grant PUD hydro projects, and complement the proposed HGMP for the Winthrop National Fish Hatchery summer steelhead program operated by the United States Fish and Wildlife Service (USFWS).

In response to NMFS's request to submit a revised HGMP and pursuant to Section 10(a)(1)(A) of the Endangered Species Act and 50 C.F.R. Part 222, Douglas PUD and WDFW, on their own behalf and on behalf of Grant PUD, hereby submit this letter and the enclosed HGMP to NMFS as an application for a new Section 10 permit to span a new 10-year period. It is requested that NMFS issue the permit to Douglas PUD and WDFW as co-permittees to the extent of their respective roles as explained in detail within the HGMP.

The Wells Hatchery Complex Summer Steelhead HGMP was developed and approved by members of the Wells HCP HC and by Grant PUD. Members of the HCP HC include the NMFS, USFWS, WDFW, the Confederated Tribes of the Colville Reservation, the Confederated Tribes and Bands of the Yakama Nation, and Douglas PUD.

The goal of the program is the restoration of naturally reproducing populations of summer steelhead in their native habitats using locally adapted broodstock, while maintaining genetic and ecological integrity, and supporting harvest. The purpose is to meet the No Net Impact mitigation and inundation compensation goals established in the Wells HCP and the Priest Rapids Salmon and Steelhead Agreement in a manner consistent with overall objectives of rebuilding populations.

Roles and responsibilities for the program are as follows: The HCP HC is responsible for overseeing the implementation of the hatchery program and associated monitoring and evaluation studies. Douglas PUD funds facility improvements, operation of and changes to the artificial production programs, and the monitoring and evaluation program. WDFW, Douglas PUD's current designated agent, is charged with implementing the monitoring and evaluation studies and operating the hatchery facilities at the direction of Douglas PUD. Grant PUD is currently a co-funder of the hatchery program, including funding hatchery operations, monitoring and evaluation, and facility improvements.

Douglas PUD and WDFW encourage NMFS to expedite the review of this HGMP to facilitate implementation of the proposed programs in time for the 2012 summer steelhead run. Douglas PUD supports WDFW's separate application for a permit related to the implementation of adult summer steelhead management within the Upper Columbia Region.

If you have any questions regarding the Wells Hatchery Complex Summer Steelhead HGMP or the operation of the Wells Hatchery Complex, please feel free to contact Greg Mackey or Tom Kahler at (5509) 881-2489 or 881-2322, respectively.

Sincerely,

Shane Bickford
Natural Resources Supervisor

FOR
Heather Bartlett
Hatcheries Division Manager

Copy: Bob Turner – NMFS
Keith Kirkendall – NMFS
Bryan Nordlund – NMFS
Jeff Korth – WDFW
HCP Hatchery Committee Members
Mike Schiewe – HCP Hatchery Committee Chairman
Jeff Grizzel – Grant PUD
Tom Dresser – Grant PUD
David Duvall – Grant PUD

SUFFICIENCY FOR ESA CONSULTATION LETTER FROM NMFS

March 19, 2013

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
1201 NE Lloyd Boulevard, Suite 1100
PORTLAND, OREGON 97232-1274

March 19, 2013

NOTED
MAR 20 2013
S.A.B.

Kelly Cunningham
Washington Department of Fish and Wildlife
600 Capitol Way North
Olympia, Washington 98501-1091

Shane Bickford Shane
Douglas County Public Utility District
1151 Valley Mall Parkway
East Wenatchee, Washington 98802

Dear Mr. Cunningham and Mr. Bickford:

This letter addresses summer steelhead production at the Wells Fish Hatchery complex (WFH). NOAA's National Marine Fisheries Service (NMFS) has reviewed your request, dated October 5, 2012, and supporting information for an Endangered Species Act (ESA) section 10(a)(1)(A) permit for the Wells Complex Summer Steelhead Program, owned and funded by the Public Utility District No. 1 of Douglas County (DPUD) and operated by Washington Department of Fish and Wildlife (WDFW) at the Methow and Wells fish hatcheries. The supporting information included a Hatchery and Genetics Management Plan (HGMP) (dated March 31, 2011, and submitted on April 6, 2011) and two other documents provided by Douglas PUD and WDFW to answer questions raised by NMFS during our initial review of the HGMP. The first supplemental document provided was entitled "Analysis of Adult Management of Steelhead in the Methow Basin" (dated March 13, 2012) and a second document entitled "Supporting Information Submitted to National Marine Fisheries Service Regarding the Wells Complex Summer Steelhead HGMP" (dated October 4, 2012).

The purpose of this letter is to:

1. Clarify our understanding of the proposed action,
2. Determine whether the proposed action, biological analysis, and supporting material meet the requirements for an ESA section 10(a)(1)(A) permit (50 CFR 222.308), and
3. Identify next steps

Purpose and Goals for the Program

The goal for this hatchery program is to enhance the biological status of summer steelhead in the Methow and Okanogan basins. Steelhead that are surplus to population enhancement needs can be harvested. The Wells Complex summer steelhead hatchery program is designed to meet the hatchery compensation requirements of the Anadromous Fish Agreement and Habitat Conservation Plan for the Wells Hydroelectric Project (Wells HCP). As proposed, the Twisp component would serve as a conservation program and the remainder of the program would serve as a safety-net in the Methow River and Columbia River. According to the HGMP, the program complies with the terms of the Wells HCP. WDFW has also determined that the proposed hatchery program complies with the 2008-2017 *U.S. v. Oregon* Management Agreement.

NOTED
MAR 22 2013
MEM

Overview

The overall target production level is 408,000 juveniles per year, all released as yearling smolts. One hundred thousand (100,000) smolts would be reared for the Okanogan basin, with the management of activities external to hatchery rearing discussed in a pending HGMP for Okanogan steelhead. The remaining 308,000 fish, as explained in the supporting material, is a reduction from the numbers in the HGMP (347,571) caused by recent no-net impact (NNI) calculations of mitigation obligations. The 308,000 fish are divided into three components: Twisp (48,000; conservation program), Lower Methow[1] (100,000; safety-net), and Columbia (160,000; safety-net). The Twisp component would be managed as a conservation program, separately from the other two, and to facilitate an ongoing relative reproductive success (RRS) study.

The proportion of hatchery-origin fish on the spawning grounds (pHOS) in the Methow basin has been over 0.8 for many years. Working under recommendations of NMFS, operators of the Wells and WNFH programs would work cooperatively to reduce pHOS in the basin, and at the same time comply with the Management Agreement. Adult steelhead originating from juvenile releases in the Lower Methow would be removed at traps and through a conservation fishery in the Methow River to achieve a pHOS not to exceed 0.25 for the area upstream of the Methow River-Chewuch River confluence. Downstream of that area, pHOS would be monitored, but not regulated. The Twisp River, under the study design for the RRS study, would be managed for a pHOS of 0.50 with a resulting proportionate natural influence (PNI) of 0.67 through at least 2019. Achievement of the pHOS criterion will require effective coordination between the two steelhead programs.

Existing or Previous Endangered Species Act Authorizations

Currently, the program is permitted under section 10(a)(1)(A) permit 1395. The permit expires October 2, 2013.

Endangered Species Act Authorization Requested

Douglas PUD and WDFW are jointly requesting a section 10(a)(1)(A) permit.

Action Agency(s)

Because of its proposed issuance of an ESA section 10 permit, NMFS is the lead action agency for this consultation. The program is funded by Douglas PUD and is currently operated by WDFW.

Sufficiency of Application for Actions Proposed for Authorization under the Endangered Species Act

In order for an application for a section 10(a)(1)(A) permit to be sufficient, it must provide the necessary information described in 50 CFR part 222.308. It must analyze and provide a description of the manner in which the proposed action may affect any listed species or designated critical habitat and it must show how the action will enhance the Upper Columbia Steelhead Distinct Population Segment (DPS) through the propagation of or direct research on the DPS. To provide the necessary information, the HGMP and any other documents submitted as part of the application materials for the proposed program must be complete and accurate.

[1] Downstream of the Methow-Chewuch confluence

Broodstock Collection

Twisp component:

Broodstock would be natural x natural (NxN) parentage (N = 26) of Twisp stock adults collected at the Twisp Weir. The expected pNOB is 1.0. Broodstock would be held and spawned at the Methow Hatchery.

Lower Methow component:

Broodstock (N = 52) would be hatchery-origin (HxH) collected at Wells Hatchery, Wells Dam, Twisp Weir (up to 25% of the broodstock may be Twisp stock), WNFH, Methow Fish Hatchery, and by hook-and-line in the Methow Basin, if necessary. Broodstock would be held and spawned at Wells Hatchery.

Columbia River component:

One hundred and four (104) hatchery-origin fish (for the 160,000 smolt program size) will be collected at Wells Hatchery, Wells Dam, Twisp Weir, Winthrop National Fish Hatchery, Methow Fish Hatchery, and by hook-and-line in the Methow Basin, if necessary. Should the program size increase, broodstock numbers would be adjusted accordingly (for example: a 260,000 smolt program would require 136 adult hatchery-origin broodstock). Broodstock would be held and spawned at Wells Hatchery.

Facilities, Rearing, Acclimation, and Release

Twisp component:

Eyed eggs or fed fry would be transferred from Methow Hatchery to Wells Hatchery for rearing. Fed fry would be transferred when and if an experimental imprinting method using Twisp River water on eyed eggs through fry life stages is implemented. Otherwise, eyed eggs would be transferred to Wells Hatchery. Smolts would be acclimated in the Twisp Pond (co-acclimated with smolts from the Twisp spring Chinook program). Acclimation would occur in the spring (approximately March-May depending on weather/river conditions). Fish would be released in April or May, dependent on conditions.

Lower Methow component:

Rearing would be at Wells Hatchery. Fish would be transferred to Methow Hatchery for acclimation in the spring and released from there.

Columbia component:

Rearing and acclimation would be at Wells Hatchery. Smolts would be released directly from Wells Hatchery into the Columbia River. Up to 100,000 smolts may be released into the Okanogan River or from acclimation ponds on the Columbia River mainstem upstream from the Okanogan River, if requested by the Colville Confederated Tribes, provided that other parties develop, fund, and operate the acclimation ponds, implement the monitoring program, and perform all of the adult management requirements.

Adult Management

The HGMP anticipates that returns of hatchery steelhead to the Methow River will be in excess of population enhancement and hatchery broodstock needs. As a result of previous reviews, and of discussion with NMFS staff, the WFH and WNFH programs would work to reduce pHOS of spring Chinook salmon in the Methow to a maximum of 25% upstream of the hatcheries. Adult management actions would be necessary to remove hatchery steelhead in excess of management objectives. Some adult management would be performed at the Twisp Weir, where a 1:1 ratio of wild and hatchery adults would be passed upstream of the weir to spawn naturally, for an ongoing relative reproductive success study on summer steelhead in the Twisp River. The Twisp Weir is assumed to be nearly 100% effective in managing spring returning steelhead adults to the Twisp River.

Adult management, including removal for broodstock, of the Lower Methow component would be expected to be done at the following facilities: (1) Wells Hatchery volunteer trap (removal of 30% of the hatchery-origin return), (2) Wells Dam (17%), (3) conservation fishery (46.5%), and (4) WNFH and Methow Hatchery volunteer traps (54% at each). Adult management, including removal for broodstock, of the Columbia component would be accomplished through the use of the Wells Hatchery volunteer trap, the Wells Dam trap, and the conservation fishery. Two other plans (detailed in the supporting information) have been developed for use in the event that the primary plan is not effective in achieving pHOS targets. Removed fish could be used for broodstock needs at other facilities, for ceremonial and subsistence purposes, for food banks and prisons, or used in other ways.

NMFS notes that impacts of measures to achieve the pHOS standard on interrelated program elements such as proportionate natural influence (PNI) and escapement goals are not detailed in the supporting information document, but these can be addressed during the consultation. Also, we recognize that the transition to the lower pHOS level will not be instantaneous, but we expect it to be rapid. Specific performance standards will be developed during the consultation process.

Monitoring and Evaluation

Currently, a robust Monitoring and Evaluation (M&E) program is in place to assess the Wells Complex steelhead program. The M&E plan is currently being updated by the HCP Hatchery Committee. The objectives of the plan are expected to remain intact, with adjustments made to improve the performance or relevancy of some measures; however, the scope of implementation of the plan would be adjusted to reflect changes in the size of the Wells program and to strategically coordinate with the M&E program being developed and implemented for the WNFH steelhead conservation program. It is essential that WNFH establish an M&E program that is compatible with the HCP M&E program. The coordinated plan would estimate and report on an annual basis (in the annual M&E report submitted to the HCP Hatchery Committee) the following parameters, in addition to those already routinely assessed: pHOS, pNOB, and PNI. The data required to estimate these parameters has been collected under the current plan, but estimates of pHOS, pNOB, and PNI have not been reported, as such, in the past. Improvement to estimates of pHOS and PNI would likely be attained through the use of PIT tags and in-stream detectors.

Next Steps

WDFW, DPUD, and FWS have worked very closely on the development of the steelhead and spring Chinook salmon HGMPs for the Wells/Methow and WNFH programs. NMFS intends to review these programs under the ESA and under the National Environmental Policy Act (NEPA) concurrently. The WNFH HGMPs are in review and, after these HGMPs are determined sufficient, we expect to proceed quickly with the review process. The first step will be to draft a NEPA assessment and then publish a Notice of Availability in the Federal Register that makes the applications, including the four HGMPs and supporting information, and the draft NEPA assessment available for public comment. At the conclusion of the public review period, we will provide to you any comments received for your response, as appropriate. After public comment has been considered, we will then complete our analysis.

Sufficiency of Submitted Information

If we have correctly characterized the proposed action, we find the application materials you have provided to us are sufficient for NMFS to begin formal consultation. Therefore please notify us as to whether this letter accurately characterizes the proposed action. Note, however, that our determination of sufficiency applies only to our ability to analyze effects of the proposed action on ESA-listed species under NMFS jurisdiction. Because the proposed program requires issuance of one or more section 10 permits, NMFS, as action agency, has a responsibility to consult with USFWS on the effects of the proposed action on ESA-listed species under USFWS jurisdiction. We urge you to consult with your local USFWS office on the sufficiency of your application materials for this purpose, and to submit revised materials or addenda if necessary.

If you have any questions or comments regarding this letter, please contact Craig Busack at (503) 230-5412.

Sincerely,

Robert P. Jones, Jr., Chief
Production and Inland Fisheries Branch
Salmon Management Division

cc: Jeff Korth

Document Content(s)