

# HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

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<b>Hatchery Program:</b>	Hood River Production Program
<b>Species or Hatchery Stock:</b>	Winter Steelhead (stock 50)
<b>Agency/Operator:</b>	Oregon Department of Fish and Wildlife / Confederated Tribes of Warm Springs Reservation of Oregon
<b>Watershed and Region:</b>	Hood River
<b>Date Submitted:</b>	June 23, 2000
<b>First Update Submitted:</b>	April 30, 2008
<b>Second Update Submitted:</b>	May 5, 2017
<b>Date Last Updated:</b>	May 2017

## **SECTION 1. GENERAL PROGRAM DESCRIPTION**

### **1.1) Name of hatchery or program.**

Hood River Production Program (HRPP)

### **1.2) Species and population (or stock) under propagation, and ESA status.**

Winter run steelhead *Oncorhynchus mykiss* (stock 50) is under this propagation program. The Hood River winter steelhead populations of both natural- and hatchery-origin are part of the Lower Columbia River steelhead DPS, and thus considered as ESA-listed stocks or populations.

### **1.3) Responsible organization and individuals.**

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

The Hood River winter steelhead hatchery program is implemented jointly by Oregon Department of Fish and Wildlife (ODFW) and the Confederated Tribes of the Warm Springs Reservation of Oregon (CTWSRO). The East Fork Irrigation Districts owns and operates the sand trap where the winter steelhead are acclimated. The Columbia River Intertribal Fish Commission's Hagerman Genetics Laboratory will assist with the genetic

analysis to distinguish between the summer and winter steelhead ecotype. The Oregon State University is a cooperator on studies of the reproductive fitness and genotyping of winter steelhead.

**1.4) Funding source, staffing level, and annual hatchery program operational costs.**

Funding for this project is provided by the Bonneville Power Administration (BPA) and is part of the Hood River Production Project (HRPP). The HRPP is composed of many closely related projects that share responsibilities for rebuilding fish populations in the Hood River Subbasin through hatchery supplementation and habitat restoration. Due the interrelation of the slate of HRPP projects, projected costs for this proposed program are dispersed amongst several projects. Projected annual operating costs for rearing steelhead at the Oak Springs Fish Hatchery are approximately \$173,000. Projected annual operational costs for the trapping, adult holding, and spawning, are approximately \$219,000. And the projected annual M&E costs are approximately \$515,000.

**1.5) Location(s) of hatchery and associated facilities.**

Adult Collection:

A floating resistance board type of weir and trap will be installed annually. The trap is located on the East Fork Hood River, approximately ¼ mile upstream from the confluence with the West Fork Hood River, at latitude 45.3528, and longitude -121.3746. The trap/weir will be installed as early in the winter as the hydrologic period allows. This generally occurs in early January, however it can be variable due to the volatile nature of the Hood River. The trap will be removed on June 30 each season. The trap is sampled daily during the operational period.

Spawning, rearing, acclimation and release:

Winter steelhead spawning occurs at the Parkdale Fish Hatchery. The Parkdale Fish facility is located near Parkdale on Rogers Spring Creek, tributary of the Middle Fork Hood River (Lat. 45.522; Lon. -121.622). Hatchery facilities include two adult holding ponds, two acclimation ponds, three Canadian rearing troughs, spawning and incubation facilities. The facility uses water from four sources: Rogers Spring Creek, Middle Fork Hood River Irrigation District Hydroelectric Generation Plant #3 tailrace, and two ground water wells.

Egg incubation and rearing:

Winter steelhead green eggs are transferred from Parkdale Fish Hatchery to Oak Springs Fish Hatchery for incubation and rearing. Oak Springs Hatchery is located in the Deschutes River Canyon at RM 47.2, about 3 miles northeast of Maupin, Oregon, at latitude 45.1311 and longitude -121.451. The site elevation is 850 feet above sea level. Winter steelhead green eggs are transferred from Parkdale to Oak Springs Hatchery for incubation and rearing.

Acclimation and release:

East Fork Irrigation acclimation site is located on the East Fork Hood River at RM 10.0, at latitude 45.3055, and longitude -121.3357. Approximately 50,000 winter steelhead (5 fish/lb) are transported from Oak Springs Hatchery to the acclimation site. Acclimation and volitional release is done in two of the concrete settling ponds for the irrigation diversion.

Acclimation and release:

A likely fish barrier waterfall developed in the lower reaches of the Middle Fork of Hood River in 2006. The longevity of the falls is unknown, if the waterfall no longer acts as a barrier, approximately 40% of the hatchery production will be acclimated and released from the Parkdale Fish Facility (RM 3.5). Fish will be acclimated at the Parkdale Fish Facility in one of the concrete ponds and volitionally released into Rogers Spring Creek.

**1.6) Type of program.**

The Hood River winter steelhead (stock 50) propagation program is an integrated hatchery program, and jointly managed by the CTWS and ODFW.

**1.7) Purpose (Goal) of program.**

The primary goal for the winter steelhead program is to provide harvest opportunity for sport and tribal anglers in the Hood River sub-basin. This program will accomplish that by providing approximately 1,000 hatchery winter steelhead available for harvest while, maintaining the unique genetic characteristics of wild winter steelhead in the Hood River sub-basin.

**1.8) Justification for the program.**

The Hood River winter steelhead hatchery program is operated under the *US v Oregon* treaty production agreement. The purpose of the program is to provide in-basin harvest opportunity for sport and tribal anglers, as harvest opportunity is currently limited for the indigenous wild production.

The Hood River Production Program (HRPP), steelhead component, will use artificial production of Hood River native stock of winter steelhead to increase the numbers of natural spawners and ultimately increase the population size while maintaining the long-term genetic fitness of the target populations and minimizing the ecological and genetic impacts on non-target populations within the Hood River subbasin.

The removal of Powerdale Dam and the associated Fish Trapping Facility in 2010, dictated significant alterations to the hatchery production and operations associated with the HRPP. Previously this HGMP described winter and summer run hatchery production project that relied upon the operation of the Powerdale Fish Trapping Facility for fish sorting and broodstock collection. In 2007, basin co-managers developed a revised Master Plan for the HRPP (HDR, FishPro, 2008) describing program changes required following the removal of Powerdale Dam, along with recommended program changes

following a programmatic review of the HRPP accomplishments (Underwood et al. 2003). This HGMP describes the hatchery steelhead program changes. Significant changes for the current Hood River steelhead HGMP include the cessation of the summer steelhead hatchery program in 2009, and changes in the fish sorting and broodstock collection point for the remaining winter steelhead hatchery program. Proposed changes to the winter steelhead program described in this document has been in effect since 2011 following the removal of Powerdale Dam. Broodstock collection for the Hood River summer run steelhead program was discontinued with 2008-09 run year returns.

### **1.9) List of program “Performance Standards”.**

All “Performance Standards” listed in the APR’s Performance Standards and Indicators for the Use of Artificial Production for Anadromous and Resident Fish Populations in the Pacific Northwest are followed.

Performance standards for the winter steelhead component of the Hood River Production Program include: 1) Provide 1,000 winter steelhead available for harvest in the Hood River Subbasin for sport and tribal harvest. 2) Maintain the genetic characteristics of naturally producing populations of native salmonids in the Hood River subbasin; and 3) monitor several performance standards to evaluate the HRPP’s benefit to ESA listed species in the Hood River subbasin. 4) Contribute to sport and tribal fisheries. 5) Aid in the recovery of ESA-listed Hood River steelhead.

Individual Performance standards are summarized according to the Research Objectives identified in SECTION 11 MONITORING AND EVALUATION OF PERFORMANCE INDICATORS.

### **1.10) List of program “Performance Indicators”, designated by "benefits" and "risks."**

#### **1.10.1) “Performance Indicators” addressing benefits.**

##### **Performance Standard**

1) Provide approximately 1,000 hatchery winter steelhead adults available for harvest in the Hood River (assuming 2.3% smolt-to-adult survival rate).

Release 50,000 smolts annually into the East Fork of the Hood River.

2) Maintain the unique genetic characteristics of wild winter steelhead in the Hood River. Operate the program as an integrated hatchery program (preferably using 100% wild broodstock) which will produce hatchery fish that are genetically similar to the wild population.

3) Achieve and maintain an average annual wild spawning population of 656 winter steelhead in the Hood River.

Operate the hatchery program using 100% wild winter steelhead for live-spawning and return all wild fish to the river to give them opportunity for multiple spawning in their lifetime. The approach will help sustain and facilitate the natural growth of wild

spawning population.

The research component of the HRPP monitors several performance indicators to evaluate the HRPP's benefit to ESA-listed species in the Hood River subbasin. Performance indicators are summarized according to the Research Objectives identified in SECTION 11.1 Monitoring and Evaluation of "Performance Indicators" presented in Section 1.10.

**1.10.2) "Performance Indicators" addressing risks.**

The research component of the HRPP monitors several performance indicators to evaluate the HRPP's impact (i.e., risk) on indigenous populations of fish in the Hood River subbasin. Performance indicators used to evaluate the HRPP's potential risks to ESA listed species are summarized according to the Research Objectives identified in SECTION 11.1 Monitoring and Evaluation of "Performance Indicators" presented in Section 1.10.

**1.11) Expected size of program.**

**1.11.1) Proposed annual broodstock collection level (maximum number of adult fish).**

The proposed annual maximum broodstock collection goal is about 60 adults, preferably all wild-origin fish. In the event of catastrophic failure of wild brood collection at weir or due to any other complication causing inadequate numbers of wild broodstock, up to 20 hatchery-origin adults may be collected and incorporated into broodstock to meet the production goal. All fish collected will be held at the hatchery for up to a week, pending genetic evaluation, and some fish may be released if not required to meet the genetic criteria. For the genetic evaluation, a rapid-read genotyping protocol will be used, and if any fish collected for broodstock is not required to meet the genetic criteria for offspring or considered surplus will be returned to the river at the collection weir within a week after capture.

**1.11.2) Proposed annual fish release levels (maximum number) by life stage and location.**

According to *US v Oregon* treaty production agreement (2008-2017 BY), 50,000 yearling smolts will be released into the Hood River. All smolts will be acclimated for seven days prior to a volitional release strategy. Two acclimated release sites will be utilized in the Hood River Basin, with releases into the East and Middle Forks of the river. In the East Fork of Hood River, fish will be acclimated and released from the sand settling facility at the East Fork Irrigation District's irrigation diversion on the East Fork of Hood River (RM 6.0). The Middle Fork release and acclimation site will be from the Parkdale Fish

Facility (Middle Fork Hood River RM 3.5) located on Rogers Spring Creek. Approximately 60% of total production will be released into East Fork, with the remaining 40% being released into the Middle Fork. In 2006, a glacial flood originating in the upper reaches of the Middle Fork, created a fish barrier waterfall in the lower reach of the Middle Fork of Hood River (RM 1.0). The longevity of this newly formed barrier is unknown and until the barrier again becomes passable to winter steelhead all releases will be made into the East Fork.

**1.12) Current program performance, including estimated smolt-to-adult survival rates, adult production levels, and escapement levels. Indicate the source of these data.**

Tables 1 and 2 present escapement and smolt to adult return data collect from adult traps including Powerdale Dam (1992-2010) and the East Fork Weir (2010-2016) for hatchery and wild origin winter steelhead. Data is collected and compiled by the HRPP Monitoring and Evaluation Program (Olson, 2008), Simpson (2015).

**Table 1.** Adult winter steelhead escapements to adult traps at Powerdale Dam (1992-2010) and East Fork Weir (2010-2014) trap by origin, run year, and age category. Fish of unknown origin were allocated to origin categories based on scale analysis and the ratio of fish of known origin. Data source: Olsen (2008) and Simpson (2015).

Origin, stock, run year	Total escapement	Freshwater/ocean age													Repeat spawner
		1/1	2/1	3/1	1/2	2/2	3/2	4/2	1/3	2/3	3/3	1/4	2/4	3/4	
Wild, Hood River,															
1991-	-	-				42	11								
1992	697	-	9	1	3	4	1	1	4	77	17	0	0	0	50
1992-	-	-				17				12					
1993	415	-	37	1	2	3	20	0	6	3	17	0	1	0	35
1993-	-	-				27									
1994	404	-	9	1	2	3	17	0	6	78	2	0	0	0	16
1994-	-	-				10									
1995	206	-	28	3	1	7	9	0	1	34	3	0	1	1	18
1995-	-	-				18									
1996	279	-	18	1	11	3	21	0	1	29	6	1	0	0	8
1996-	-	-				19									
1997	290	-	12	3	1	7	25	1	1	35	7	0	0	0	8
1997-	-	-				13									
1998	227	-	13	3	1	3	20	0	0	42	4	0	0	0	11
1998-	-	-				15									
1999	298	-	54	2	8	3	23	0	0	38	11	0	0	0	9
1999-	-	-				79									
2000	921	-	5	1	4	0	40	0	1	43	2	0	1	0	34
2000-	-	-				58				11					
2001	1,015	-	21	16	3	1	3	1	1	8	13	0	1	0	137
2001-	-	-				60				20					
2002	1,059	-	22	9	12	7	3	0	5	7	24	0	0	0	40
2002-	-	-				41				17					
2003	745	-	12	3	5	1	68	0	5	1	30	0	0	0	40
2003-	-	-				35									
2004	597	-	7	0	18	7	72	0	4	87	21	0	1	0	30
2004-	-	-				19									
2005	345	-	8	2	4	7	47	0	12	59	7	0	0	0	9
2005-	-	-				22									
2006	460	-	30	2	6	6	85	0	2	73	23	0	2	0	11
2006-	-	-				29									
2007	476	-	4	1	6	4	28	0	21	89	24	0	0	0	9
2007-	339	0	5	4	7	18	32	1	4	64	11	0	1	0	0
2008						6									
2008-	215	0	16	0	9	11	22	0	0	18	7	0	0	0	0
2009						5									
2009-	654	0	11	2	96	42	49	1	13	36	10	1	0	0	0
2010						9									
2010-	314	0	0	0	0	18	15	0	9	65	9	0	6	0	0
2011						8									
2011-	685	4	7	0	22	28	13	0	15	17	7	0	4	0	0
2012						3				0					
2012-	330	4	2	0	2	15	26	2	7	70	26	0	0	0	0
2013						5									
2013-	190	0	3	0	0	11	61	0	3	0	3	0	0	0	0
2014						9									
Subbasin hatchery, Big Creek,															
1991-	-	-				28									
1992	298	-	--	--	1	5	--	--	6	1	--	0	--	--	5
1992-	-	-								13					
1993	209	-	--	--	63	0	--	--	7	0	--	0	--	--	9
1993-	137	-	--	--	--	66	--	--	65	0	--	1	--	--	5

1994	-															
1994-1995	10	-	--	--	--	--	--	--	--	7	--	0	--	--	3	
Mixed, <sup>a</sup>																
1992-1993	6	6	--	--	--	--	--	--	--	--	--	--	--	--	--	
1993-1994	14	-	--	--	14	--	--	--	--	--	--	--	--	--	--	
1994-1995	8	-	--	--	--	6	--	--	2	--	--	--	--	--	--	
Hood River,																
1993-1994 <sup>b</sup>	1	1	--	--	--	--	--	--	--	--	--	--	--	--	--	
1994-1995	90	2	0	--	77	--	--	--	--	--	--	--	--	--	1	
1995-1996	274	0	0	--	24	7	0	--	--	17	--	--	--	--	0	
1996-1997	636	7	0	--	52	3	4	--	--	98	0	--	0	--	4	
1997-1998	389	3	1	--	23	9	3	--	--	12	8	1	--	0	0	14
1998-1999	317	1	0	--	16	0	16	--	--	11	6	0	--	1	0	12
1999-2000	301	2	0	--	21	6	11	--	--	6	47	4	--	1	0	16
2000-2001	917	6	0	--	71	1	5	--	--	15	8	0	--	0	1	33
2001-2002	954	7	2	--	73	0	7	--	--	19	9	0	--	0	0	12
2002-2003	502	3	3	--	28	1	1	--	--	18	5	3	--	0	0	9
2003-2004	999	1	1	--	85	5	8	--	--	11	5	3	--	0	0	13
2004-2005	481	3	1	--	7	1	5	--	--	9	0	0	--	1	0	19
2005-2006	888	1	0	--	23	6	3	--	--	20	6	0	--	1	0	2
2006-2007	427	6	0	--	74	1	1	--	--	13	7	0	--	1	0	4
2007-2008	194	5	1	--	24	0	0	--	--	17	6	0	--	4	0	1
2008-2009	397	3	1	0	93	0	0	0	0	80	0	0	7	0	0	0
2009-2010	1818	1	0	0	33	0	0	0	0	14	2	0	1	0	0	0
2010-2011	723	4	0	0	2	16	1	0	0	13	0	0	2	0	0	0
2011-2012	1306	0	0	0	69	33	0	0	0	34	0	0	7	0	0	0
2012-2013	702	0	0	0	3	96	6	0	0	30	0	0	6	0	0	0
2013-2014	952	1	2	0	2	47	0	0	0	18	0	0	15	0	0	0
Hood River(Unknown), <sup>c</sup>																
2000-2001	3	0	0	--	2	85	8	0	0	74	0	0	4	0	0	0
2001-2002	163	0	0	--	8	0	0	0	0	0	0	0	0	0	0	0
2002-2003	32	5	0	--	13	5	2	--	--	19	0	--	0	0	--	2
2003-2004	6	0	0	--	11	2	2	--	--	18	0	--	0	0	--	1
2004-	60	0	0	--	5	1	--	--	0	0	--	0	0	--	0	0

2005															
2005-2006	5	1	0	--	3	0	--	--	1	0	--	0	0	--	0
2006-2007	24	1	0	--	13	0	--	--	10	0	--	0	0	--	0

Stray hatchery,

Unknown,

1991-1992	22	0	0	--	8	0	--	--	13	0	--	0	--	--	1
1992-1993	21	0	0	--	15	0	--	--	5	0	--	0	--	--	1
1993-1994	24	0	0	--	2	1	--	--	21	0	--	0	--	--	0
1994-1995	3	0	0	--	1	0	--	--	2	0	--	0	--	--	0
1995-1996	6	0	0	--	5	0	--	--	0	0	--	0	--	--	1
1996-1997	3	0	0	--	3	0	--	--	0	0	--	0	--	--	0
1997-1998	4	0	0	--	3	1	--	--	0	0	--	0	--	--	0
1998-1999	7	0	0	--	3	0	--	--	4	0	--	0	--	--	0
1999-2000	1	0	0	--	0	0	--	--	0	0	--	1	--	--	0
2000-2001	32	2	1	--	13	6	--	--	8	1	--	0	--	--	1
2001-2002	75	0	0	--	18	21	--	--	24	1	--	3	--	--	8
2002-2003	63	0	0	--	35	1	--	--	18	3	--	0	--	--	6
2003-2004	34	0	0	--	10	1	--	--	13	1	--	1	--	--	8
2004-2005	17	2	0	--	4	0	--	--	8	0	--	0	--	--	3
2005-2006	13	1	0	--	11	0	--	--	1	0	--	0	--	--	0
2006-2007	22	1	0	--	11	0	--	--	10	0	--	0	--	--	0

<sup>a</sup>Returns from the 1991 brood are progeny of wild x Big Creek stock hatchery crosses.

<sup>b</sup>The 1993-94 run year is the first run year in which the Hood River stock (1992 brood) would have had the potential for returning as adults to Powerdale Dam. These fish would have returned as age category 1/1 adults. None were sampled at the Powerdale Dam trap.

<sup>c</sup>Adult steelhead with a valid Hood River stock summer steelhead mark, but were classified as a winter steelhead based on run timing and visual characteristics.

**Table 2.** The number of wild and hatchery adult steelhead counted at adult traps of Powerdale Dam (1992-2010) and East Fork Weir (2010-2015), and the number collected and spawned for broodstock since the 1992 run year. Data source: Olsen (2008) and Simpson (2015).

Run year	Adult Trap Count		Fish Passed above Trap					Total brood stock size, by gender
	Wild fish	Hatchery stock-50	Wild fish	Hatchery stock 50 (stock 13) (stock 24) <sup>a</sup>	Number of wild fish collected for brood	Number of wild fish spawned, by gender	Number of hatchery fish spawned, by gender	
<b>Winter Steelhead Stock-50</b>								
1991-92	697	0	618	(284)	70	40 (22m/18f)	1 (1m/0f)	41 (23m/18f)
1992-93	415	0	345	(10)	57	37 (21m/16f)	0	37 (21m/16f)
1993-94	404	1	300	(5)	78	54 (28m/26f)	0	54 (28m/26f)
1994-95	206	90	161	5	42	37 (19m/18f)	0	37 (19m/18f)
1995-96	279	274	210	161	65	37 (17m/20f)	16 (12m/4f)	53 (29m/24f)
1996-97	290	636	238	252	46	32 (15m/17f)	22 (12m/10f)	54 (27m/27f)
1997-98	227	389	182	174	39	22 (11m/11f)	20 (10m/10f)	42 (21m/21f)
1998-99	298	317	255	188	41	35 (20m/15f)	27 (13m/14f)	62 (33m/29f)
1999-00	921	301	865	224	47	24 (14m/10f)	15 (5m/10f)	39 (19m/20f)
2000-01	1,015	917	877	656	130	58 (35m/23f)	4 (0m/4f)	62 (35m/27f)
2001-02	1,059	954	950	683	74	43 (23m/20f)	0	43 (23m/20f)
2002-03	745	502	654	412	66	43 (22m/21f)	1 (0m/1f)	44 (22m/22f)
2003-04	597	999	507	570	73	45 (23m/22f)	1 (1m/0f)	46 (24m/22f)
2004-05	345	481	273	246	55	23 (11m/12f)	6 (4m/2f)	29 (15m/14f)
2005-06	460	888	342	299	109	49 (29m/20f)	1 (0m/1f)	50 (29m/21f)
2006-07	476	427	423	364	54	31 (15m/16f)	3 (1m/2f)	34 (16m/18f)
2007-08	340	194	264	111	82	37(18m/19f)	0	37(18m/19f)
2008-09	216	397	170	177	46	38(19m/19f)	0	38(19m/19f)
2009-10	667	1,818	568	563	99	46(25m/21f)	0	46(25m/21f)
2010-11	314	320	271	393	43	32(14m/19f)	0	32(14m/19f)
2011-12	685	445	653	853	32	21(12m/9f)	20(11m/9f)	41(23m/18f)
2012-13	344	288	312	377	35	19(10m/9f)	22(13m/9f)	41(23m/18f)
2013-14	190	29	177	797	15	15(13m/2f)	25(3m/22f)	40(16m/24f)
2014-15	1275	204	1233	83	42	42 (20m/22f)	5(0m/5f)	47(20m/27)

<sup>a</sup> Numbers of hatchery fish passed above the weir are estimated after the 2010-11 run year.

**1.13) Date program started (years in operation), or is expected to start.**

The Hood River Production Program began in 1992.

**1.14) Expected duration of program.**

This is an ongoing program and there is no specified concluding date.

**1.15) Watersheds targeted by program.**

This program is targeting the Hood River watershed.

**1.16) Indicate alternative actions considered for attaining program goals, and reasons why those actions are not being proposed.**

There were four alternatives considered for the Hood River Production Program.

The **preferred alternative** was selected because it best followed the Hatchery Science Review Group's guidelines, had the least potential negative impacts to listed natural steelhead (due to 100% wild-origin broodstock use), allowed for rebuilding of listed stocks, and provided for in-river fisheries. This preferred alternative allows for extensive monitoring and compliments of ongoing habitat restoration activities in the basin.

A **segregated hatchery alternative** was rejected as it would be difficult, if not impossible to keep hatchery fish segregated from wild fish. This alternative increases the risk to the wild population, from an out of basin interbreeding with wild population.

The **supplementation alternative** was rejected because recent findings in the Hood River Subbasin, and other areas indicate a decline in the relative fitness of supplemented steelhead in the Hood River Subbasin, which may lead to a decrease the fitness of the wild population (Araki et al. 2007; Araki et al. 2009; Christie et al. 2011; Christie et al. 2012). This alternative did not include a habitat improvement component.

The **no action habitat improvement alternative** is not being proposed because of the lack of immediate fishery benefits that could occur from this alternative. There was concern about the near term outlook for these depressed populations, and whether harvest opportunity could be provided.

#### **1.16.1) Brief overview of key issues.**

##### *Interbreeding between hatchery-produced and listed naturally produced winter steelhead:*

The major key issue of this program is interbreeding between hatchery-produced and listed naturally-produced winter steelhead within the Hood River basin, which may reduce the reproductive fitness of listed natural steelhead. To minimize such adverse interbreeding effects, the hatchery program will preferably use only wild winter steelhead as broodstock, which will produce offspring genetically similar to natural fish and minimize the adverse interbreeding effects.

##### *Out-of-basin egg incubation and rearing:*

Due to lack of facilities in the Hood River basin, incubation of eggs and fry rearing will occur at Oak Springs Hatchery, which may cause increased stray rates of program fish. But, incubation/rearing at Oak Springs Hatchery occur in spring waters only, which may not trigger adult fish to return to the Deschutes River. Moreover, smolts are acclimated in the Hood River for one week before volitional releases, to minimize the stray issue.

#### **1.16.2) Potential alternatives to the current program.**

See Section 1.16 above for potential alternatives to the current program.

### **1.16.3) Potential reforms and investments.**

This program is operated according to *US v Oregon* treaty production agreement (2008-2017 BY) to provide fish for in-basin tribal and sports harvests. Currently, no program reforms or investments have been proposed for this ongoing program.

## **SECTION 2. PROGRAM EFFECTS ON ESA-LISTED SALMONID POPULATIONS.**

### **2.1) List all ESA permits or authorizations in hand for the hatchery program.**

The operation of the current collection facility operates with a 4d permit (#OR2017-20795) from NOAA Fisheries. A section 6 Cooperative Agreement between the USFWS and ODFW allows for take associated with the program for bull trout.

The Hood River Production Program is a Bonneville Power Administration funded program and is included in the NMFS Section 7 consultation biological opinion entitled: “ Biological Opinion on Artificial Propagation in the Columbia River Basin – Incidental Take of listed salmon and steelhead from federal and non-federal hatchery programs that collect, rear and release unlisted fish species” (March 3, 1999).

The HGMP for this winter steelhead program was submitted to NMFS on 6/23/2000 for approval or ESA authorization, and was revised and resubmitted again on 4/30/2008. This is an updated version of the previously submitted HGMP for NMFS’s approval.

### **2.2) Provide descriptions, status, and projected take actions and levels for ESA-listed natural populations in the target area.**

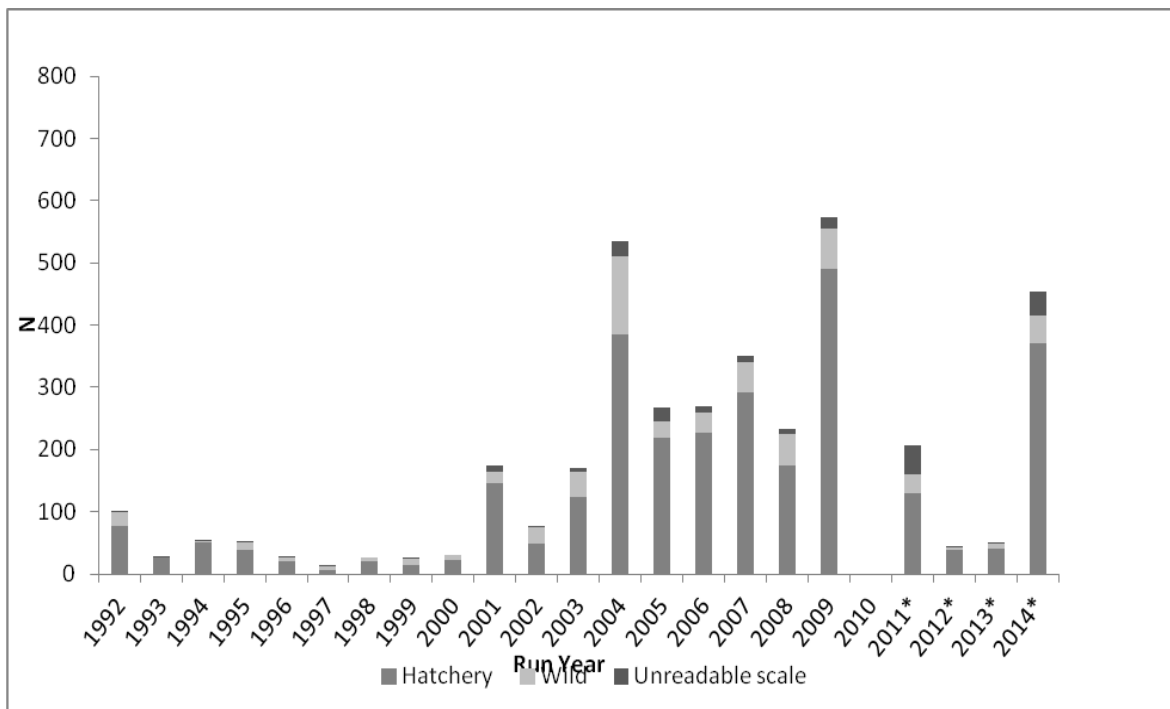
#### **2.2.1) Description of ESA-listed salmonid population(s) affected by the program.**

Hood River winter steelhead hatchery program may affect ESA-listed populations designated as Threatened include: winter steelhead *Oncorhynchus mykiss*, summer steelhead *Oncorhynchus mykiss*, coho salmon *Oncorhynchus kisutch*, Chinook salmon *Oncorhynchus tshawytscha* and bull trout *Salvelinus confluentus*.

Following the removal of Powerdale Dam in 2010, accurate counts of summer steelhead returning to the Hood River have not been available. Summer run fish are generally rare at the trap and weir site on the East Fork of the Hood River and are captured and enumerated at the Moving Falls fish ladder on the West Fork Hood River. Limited data has not made it possible to estimate an escapement for wild summer steelhead since the removal of Powerdale Dam, but in the 2014-2015 run year 143 wild summer steelhead were tagged and released at Moving Falls Fish Facility along with 90 stray hatchery summer steelhead that were removed (Simpson 2015).

The wild winter steelhead population enumerated at the East Fork weir has ranged in size from 177 to 1,233 in the last five years (Table 2). All wild steelhead, except those collected for broodstock for the winter steelhead supplementation program are passed upstream to spawn naturally.

The wild origin coho salmon population, as determined by fin-mark, has ranged in size from 4 to 75 fish in the last five years as enumerated at the Neal Creek weir (Figure 1). Following the removal of Powerdale Dam estimates of coho abundance have been limited. Olsen (2007) reports very little natural production of coho salmon in the Hood River, based upon the capture of few downstream migrant captures. Very few coho are encountered at the Est Fork Trap and Weir and are captured and enumerated at Neal Creek weir, a tributary in lower portion of Hood River.



**Figure 1.** Adult unmarked coho returns for the Hood River sub-basin where origin was determined by scale read (Powerdale Dam run years 1992 – 2009; Neal Creek run years 2011 – 2014. No data was collected on adult coho for 2010 run year). Asterisk denotes run years where abundance was reported for a portion of the subbasin.

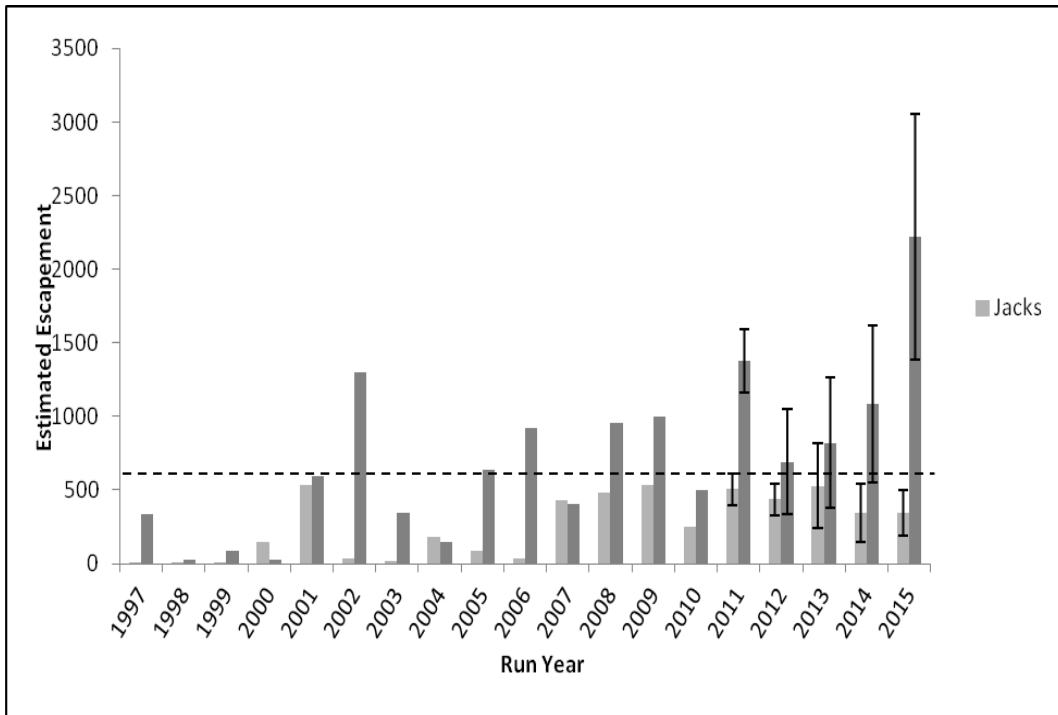
Since the removal of Powerdale Fish Facility monitoring of fall Chinook has become difficult as no adult fish traps remain in the lower portion of the Hood River during the fall migration period. The addition of the Moving Falls Fish Facility provided an opportunity for some fall fish to be monitored in the West Fork of the Hood River and five fall Chinook were captured in 2014 and 11 in 2015, their age has not yet been determined (Simpson unpublished). Many fall Chinook are believed to spawn in the lower main stem of the Hood River, below the site of the former Powerdale Dam. Therefore the Powerdale Fish Facility fall Chinook data did not reflect the total

escapement of fall Chinook, but is a good indicator of the ages and patterns of the population (Table 3).

**Table 3.** Jack and adult fall Chinook salmon escapements to the Powerdale Dam trap; by origin, run year, and age category. Fish of unknown origin were allocated to origin categories based primarily on fin and maxillary mark combinations and secondarily on scale analysis, size, and the ratio of fish of known origin.

Origin, run year	Total escapement	Freshwater Total age								
		1.2	1.3	1.4	1.5	1.6	2.2	2.3	2.4	2.5
Natural,										
1992	16	2	2	10	1	1	0	0	0	0
1993	6	0	1	3	2	0	0	0	0	0
1994	31	2	4	18	2	0	0	1	2	2
1995	8	1	0	1	1	0	0	1	2	2
1996	14	0	1	10	0	0	0	1	2	0
1997	28	0	7	9	0	0	0	2	7	3
1998	36	4	11	4	10	0	0	0	4	3
1999	19	1	5	4	1	0	0	0	6	2
2000	32	1	10	12	5	0	0	1	3	0
2001	29	1	11	14	0	0	0	0	3	0
2002	34	4	12	17	0	0	0	0	1	0
2003	61	4	9	36	10	0	0	0	1	1
2004	32	1	8	11	7	0	0	0	5	0
2005	45	2	11	22	5	1	0	0	0	4
2006	50	11	7	22	2	0	6	0	2	0
2007	45	3	18	14	0	0	1	1	4	4
Stray hatchery,										
1992	6	1	2	3	0	0	0	0	0	0
1993	4	0	1	2	1	0	0	0	0	0
1994	8	0	1	5	0	0	0	0	2	0
1995	4	0	0	1	0	0	0	0	3	0
1996	2	0	0	0	0	0	0	1	1	0
1997	2	0	0	1	0	0	0	0	1	0
1998	4	0	1	1	1	0	0	0	1	0
1999	0	--	--	--	--	--	--	--	--	--
2000	2	0	1	1	0	0	0	0	0	0
2001	10	0	3	1	0	0	0	0	6	0
2002	2	1	0	1	0	0	0	0	0	0
2003	3	0	0	2	1	0	0	0	0	0
2004	3	1	0	0	0	0	0	0	1	1
2005	4	0	1	3	0	0	0	0	0	0
2006	5	1	0	1	0	0	3	0	0	0
2007	0	--	--	--	--	--	--	--	--	--

Spring Chinook natural production is primarily in the West Fork of Hood River, although a small but increasing number of fish utilize the East and the Middle Fork Hood River. The addition of the Moving Falls Fish Facility in 2014 in the West Fork of the Hood River has made monitoring of returning adult spring Chinook more feasible. In 2015 there were 87 naturally produced spring Chinook tagged and released from the Moving Falls Fish Facility (Figure 2). Fish captured are believed to be progeny from the ongoing hatchery re-introduction program.



**Figure 2.** Total estimated adult and jack spring Chinook hatchery escapement to the mouth of the Hood River (run years 1997 to 2015). Dashed line indicates the adult numerical fish objective (N = 600) established by the Revised Master Plan for the Hood River Production Program (HDR\FishPro 2008). No stated numerical fish objective exists for hatchery jack spring Chinook salmon. Error bars are included for run years where escapement estimates are based on model estimates rather than hard counts (i.e. post-Powerdale Dam removal). Data source: Simpson (2015).

The annual escapement of adult bull trout to the East Fork weir has ranged from 2 to 4 in the last five years (Table 4). All bull trout are passed above the weir. Migratory bull trout captured at Powerdale Dam were believed to primarily home to the Middle Fork Hood River (Starceovich and Jacobs, 2007). Falls formed on the Middle Fork of Hood River following flooding events in 2006 are believed to limited passage upstream in the Middle Fork Hood River.

**Table 4.** Numbers of bull trout and cutthroat trout caught in the Hood River subbasin at downstream migrant traps and adult migrant traps operated at Powerdale Fish Facility (1992-2010) and East Fork Weir (2011-2015). Data source: Simpson (2015).

Year	Bull Trout		Cutthroat Trout	
	Downstream Migrant Traps	Upstream Adult Traps	Downstream Migrant Traps	Upstream Adult Traps
1992	--	6	--	5
1993	--	2	--	0
1994	1	11	17	0
1995	0	11	13	0
1996	6	18	25	0
1997	12	6	18	3
1998	25	18	43	0
1999	1	28	30	0
2000	1	27	34	1
2001	1	12	6	11
2002	13	5	18	3
2003	0	4	31	7
2004	0	10	42	3
2005	6	7	41	8
2006	1	4	14	6
2007	0	6	19	2
2008	1	1	31	0
2009	1	6	53	0
2010	2	6	51	0
2011	2	2	84	0
2012	1	4	173	0
2013	3	2	209	0
2014	0	0	141	0
2015	2	1	132	0

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

LCR winter steelhead DPS will be directly affected by this hatchery program. Up to 60 wild winter steelhead will be collected at the trap and weir and potentially be utilized for broodstock. The actual take will be up to 40 fish utilized for broodstock, and up to 20 additional fish may be collected and interrogated for inclusion into broodstock. Fish not meeting genetic ecotype criteria will be returned to the river within five days after genotyping. All wild winter steelhead will be live-spawned and returned to the river after spawning to give them opportunity for multiple spawning in their lifetime.

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

This program could incidentally affect the ESA-listed Hood River Bull trout, and Lower Columbia River populations of spring and fall Chinook salmon, summer steelhead, and coho salmon. Migrant adult bull trout could potentially be captured in the trap and weirs, since their run timing (based upon distribution at Powerdale) is similar to that of winter steelhead. Migratory bull trout have generally only been observed in the Middle Fork of the Hood River, therefore they would likely be subjected to being captured in a trap located downstream of the Middle Fork. Summer steelhead could also potentially be captured in traps, since their run timing overlaps that of winter steelhead in the Hood River. The capture of the summer steelhead will likely be minimal, as they are generally limited in their spatial distribution to the West Fork of Hood River, and relatively few are actively migrating at the time of trap operation. It would be unlikely that migratory fall Chinook, or coho salmon would be captured in the trap and weir, due to their difference in run timing and limited period of trap operation. Early returning spring Chinook which are primarily of hatchery origin (non-listed), can be encountered at the trap and weir and are released upstream (Table 5).

Table 5. Number of hatchery and natural origin spring Chinook captured at the east fork weir in the past five years as determined by fin mark. Spring Chinook are released upstream of the trap after sampling. Source: Simpson (2015).

<b>Spring Chinook</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>
Hatchery-origin (non-listed)	24	11	125	16	85
Natural-origin	0	4	15	8	31

Juvenile hatchery winter steelhead are released at the smolt stage, at similar times when wild-origin fish are migrating to expedite migration out of the basin. It is unknown the effects of competitive interactions that occur between hatchery-origin winter steelhead, and other species present in the Hood River.

**2.2.2) Status of ESA-listed salmonid population(s) affected by the program.**

**- Describe the status of the listed natural population(s) relative to “critical” and “viable” population thresholds.**

The Lower Columbia River Recovery Plan evaluated the viability status for the ESA listed populations in the Hood River and made the following conclusions:

- Hood River Coho** – Very High Risk of Extinction
- Hood River Spring Chinook** – Very High Risk of Extinction
- Hood River Summer Steelhead** – Very High Risk of Extinction
- Hood River Winter Steelhead** – Moderate Risk of Extinction

Recent viability status assessment for Hood River bull trout populations is not available. Both the resident population, located upstream of Laurance Lake Dam, and the migratory population are at critically low levels (i.e. less than 150 adults). Recent population data described by Starcevich and Jacobs (2007) suggests very small population size for both resident and migratory populations.

**- 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.**

See tables 1 through 7 for the most recent escapement and survival information for listed populations in the Hood River. Data is collected and compiled by the HRPP Monitoring and Evaluation Program.

**Table 6.** Estimates of Hood River stock hatchery winter steelhead sub-basin smolts releases, adult escapements to the mouth of the Hood River, and smolt-to-adult survival rate. Estimates are by year of migration. Release/Migration year is bold faced for those years in which estimates of adult escapements back to the mouth of the Hood River subbasin are more than 97% complete, and is italicized for years where adult returns of wild summer steelhead were not included in the total returns due to data limitations. Source: Simpson 2015.

Release/ Migration Year	Hatchery Release Total	Wild Smolts Estimate (FL ≥ 150mm)	Adult Return Run Year(s)	Total Hatchery Returns	Total Wild Returns	Total Hatchery SAR	Total Wild SAR
<b>1994</b>	38,034	9,554	1995 - 1999	494	546	1.30%	5.71%
<b>1995</b>	42,860	5,955	1996 - 2000	995	441	2.32%	7.41%
<b>1996</b>	50,896	8,755	1997 - 2001	570	388	1.12%	4.43%
<b>1997</b>	59,837	15,972	1998 - 2002	397	493	0.66%	3.09%
<b>1998</b>	62,135	31,035	1999 - 2003	627	1614	1.01%	5.20%
<b>1999</b>	46,781	23,942	2000 - 2004	1400	1497	2.99%	6.25%
<b>2000</b>	63,182	19,266	2001 - 2005	1702	1977	2.69%	10.26%
<b>2001</b>	50,879	6,804	2002 - 2006	733	1018	1.44%	14.96%
<b>2002</b>	62,921	12,290	2003 - 2007	1554	901	2.47%	7.33%
<b>2003</b>	51,433	14,460	2004 - 2008	560	624	1.09%	4.32%
<b>2004</b>	59,407	15,042	2005 - 2009	1338	773	2.25%	5.14%
<b>2005</b>	83,403	21,484	2006 - 2010	458	747	0.55%	3.48%
<b>2006</b>	36,819	8,395	2007 - 2011	282	544	0.76%	6.48%
<b>2007</b>	38,360	4,316	2008 - 2012	730	478	1.90%	11.08%
<b>2008</b>	66,591	16,080	2009 - 2013	2922	921	4.39%	5.73%
<b>2009</b>	57,461	9,317	2010 - 2014	1103	510	1.92%	5.47%
<b>2010</b>	47,347	16,810	2011 - 2014	1709	627	3.61%	3.73%
<i>2011</i>	50,995	18,298	2012 - 2014	1000	228	1.96%	1.25%
<i>2012</i>	54,446	25,972	2013 - 2014	1082	207	1.99%	0.80%
<i>2013</i>	55,303	43,425	2014	0	3	0.00%	0.01%
<i>2014</i>	51,987	36,628	--	--	--	--	--

**- 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.**

See tables 1 through 7 for the most recent escapement and survival information for listed populations in the Hood River. Data are collected and compiled through the HRPP's Monitoring and Evaluation Program.

**- 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.**

These data are summarized in Table 7, note that the East Fork Trap and Weir began operation in 2011.

**Table 7.** Escapement of wild and hatchery winter steelhead used to calculate the proportion hatchery origin spawners (PHOS). These numbers reflect the number of steelhead estimated to spawn above the adult collection facility of Powerdale until 2010 and then above the East Fork Weir in the years following.

Spawn Year	Wild StW Escaping to Spawn	Hatchery StW Escaping to Spawn	Total Spawners (Hatchery + Wild)	Proportion Hatchery Origin Spawners
1992	618	284	902	0.315
1993	345	10	355	0.028
1994	300	5	305	0.016
1995	161	5	166	0.03
1996	210	161	371	0.434
1997	238	252	490	0.514
1998	182	174	344	0.417
1999	255	188	442	0.423
2000	865	224	1089	0.206
2001	877	656	1533	0.428
2002	950	683	1633	0.418
2003	654	412	1066	0.386
2004	507	570	1077	0.529
2005	273	246	519	0.474
2006	342	299	641	0.466
2007	423	364	787	0.463
2008	264	111	375	0.296
2009	170	177	347	0.51
2010	568	563	1131	0.498
2011	271	393	664	0.592
2012	653	853	1506	0.566
2013	312	377	689	0.547
2014	177	797	974	0.818
2015	1233	83	1316	0.063

**2.2.3) Describe hatchery activities, including associated monitoring and evaluation and research programs, that may lead to the take of listed fish in the target area, and provide estimated annual levels of take.**

During trap operation period all adult migrants will be trapped, anesthetized, and bio-sampled at the East Fork trapping facility. All fish captured will be tagged with a PIT Tag, length measurement and scale sample will be collected from each fish. All fish will have a small tissue sample (<1cm<sup>2</sup>) removed from the anal fin for genetic study. All wild fish, other than those removed for broodstock, will be passed upstream of the trapping facility. All hatchery steelhead will be removed, and not allowed upstream for spawning. Disposition of hatchery origin fish will either be to lethally remove and provide to Warm Springs Tribal members as a food source, or outplanted to standing waterbodies in the Hood River Basin for additional angling opportunity. Projected take for this project is up to 800 wild steelhead, with up to 5 direct mortalities. Actual take and direct mortality associated with this project has been considerably less. This project is authorized under 4d permit # 19888.

Fish selected for the hatchery broodstock will be bio-sampled, and PIT tagged, then placed in a portable fish liberation tank and transported to the Parkdale Fish Hatchery. The broodstock are held in ponds specifically designed for holding adult salmon and steelhead. Brood fish are anesthetized periodically to determine the stage of sexual maturity. Mature steelhead females are air-spawned alive. After a minimum 24-hour recovery period the females are transported for release to the mouth of Hood River. Male steelhead brood are hand stripped to fertilize eggs. The spawned males are released in-subbasin above the trap and weir to give them an opportunity to contribute to natural spawning.

Downstream migrant “screw traps” are operated in the mainstem and major tributaries from March through October to monitor and estimate total natural and hatchery smolts emigration, following methods described in Simpson et al. (2015). Projected take associated with this project is projected to be up to 2,000 juvenile steelhead, with up to 40 direct mortalities, and up to 4,000 smolt steelhead with up to 80 direct mortalities. Actual take and direct mortality associated with this project has been considerably less. This smolts outmigration monitoring project is authorized under 4d permit # 19879.

**- 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.**

The East Fork trapping facility will attempt to completely block migration, and direct all upstream migrants into the trap box. As with all impediments to migration, delay, or avoidance, may occur as fish approach the facility and may be reluctant to enter the trap. Increased predation may occur, as fish are congregated as they approach the weir and trap. Changing flow and water conditions may affect trap efficiency, or cause delay in migration. The weir and trapping facility will be designed to be as non-obtrusive as

possible, but some delay may occur. The trap will be operated daily, to avoid any extending holding periods in the trap.

Trapping and handling devices may lead to injury of listed fish through descaling, or other injury associated with the trapping. Fish will be captured in appropriately sized live-box, which meets NOAA fish trapping guidelines. Trapping and fish facility fish handling devices and structures are designed to minimize the potential of injury of fish. Fish released from the facility will be released into a calm water holding area, where they will be able to recover before volitionally exiting the recovery area.

The weir and trapping facility will build upon the 16 years of trap operations at the Powerdale Facility, and experience that was gained on designing and operating the current weir and trapping facility in the most non-obtrusive, fish-friendly manner.

**Provide information regarding past takes associated with the hatchery program, (if known) including numbers taken, and observed injury or mortality levels for listed fish.**

Table 8 presents a summary of the annual numbers of steelhead collected for broodstock and the pre-spawning mortality associated with winter steelhead hatchery program. For the previous 5 year period pre-spawning mortality for broodstock has ranged from 0-1 annually. Past mortalities associated with the adults trapping at the weir site at the Powerdale Fish Facility are shown in the subsequent Table 22. It is anticipated that, low levels of mortality at the weir facility on the East Fork of Hood River will continue.

**Table 8.** Number of *wild* Hood River steelhead collected for broodstock, spawned, released, and died, for the summer and winter steelhead stock-50 broodstock development program. Data source: Unpublished data of 4/26/2008 from mid-Columbia District Research, ODFW, The Dalles, Oregon. Source: Santos (2008-2014).

Run Year	Summer Steelhead					Winter Steelhead				
	Collected	Spawned &		Unspawned		Collected	Spawned &		Unspawned	
		Released	Died	Released	Died		Released	Died	Released	Died
1992-1993						57	32	5	16	4
1993-1994						78	52	2	21	3
1994-1995						42	36	1	5	0
1995-1996						65	36	1	22	6
1996-1997						46	30	2	5	9
1997-1998	13	9	0	1	3	39	22	0	8	9
1998-1999	31	21	1	0	9	41	34	1	5	1
1999-2000	33	22	0	11	0	47	23	1	23	0
2000-2001	27	22	1	1	3	130	55	3	72	0
2001-2002	61	34	2	11	14	74	37	6	12	19
2002-2003	78	33	1	12	32	66	41	2	8	15
2003-2004	36	26	1	0	9	73	45	0	26	2
2004-2005	38	19	1	14	4	55	21	2	30	2
2005-2006	13	0	0	10	3	109	49	0	60	0
2006-2007	23	12	1	8	2	54	30	1	22	1
2007-2008						82	36	1	45	0
2008-2009						45	38	4	3	0
2009-2010						99	46	0	53	0
2010-2011						44	32	0	12	0
2011-2012						33	21	0	12	0
2012-2013						35	19	1	14	1
2013-2014						15	15	0	0	0
2014-2015						42	40	2	0	0

- Provide projected annual take levels for listed fish by life stage (juvenile and adult) quantified (to the extent feasible) by the type of take resulting from the hatchery program (e.g. capture, handling, tagging, injury, or lethal take).

See the four following “Take Tables” (Tables 9-13) for winter steelhead, summer steelhead and bull trout.

**Table 9.** Estimated listed salmonid take levels of by hatchery activity. Data source: ODFW, unpublished.

<b>Listed species affected: Summer and Winter Steelhead; ESU/Population: Hood River/Lower Columbia River</b>				
<b>Activity: Hood River Production Program’s Monitoring and Evaluation Activities</b>				
<b>Location of hatchery activity: Downstream migrant trapping; Dates of activity: Year around</b>				
<b>Hatchery program operator: Oregon Department of Fish and Wildlife</b>				
<b>Type of Take</b>	<b>Annual Take of Listed Fish By Life Stage (<i>Number of Fish</i>)</b>			
	<b>Egg/Fry</b>	<b>Juvenile/Smolt</b>	<b>Adult</b>	<b>Carcass</b>
<b>Observe or harass a)</b>	0	0	NA	NA
<b>Collect for transport b)</b>	0	0	NA	NA
<b>Capture, handle, and release c)</b>	<500	<6000	NA	14
<b>Capture, handle, tag/mark/tissue sample, and release d)</b>	0	0	NA	NA
<b>Removal (e.g. broodstock) e)</b>	-	-	NA	NA
<b>Intentional lethal take f)</b>	-	0	NA	NA
<b>Unintentional lethal take g)</b>	<50	120	NA	NA
<b>Other Take (specify) h)</b>	-	0	NA	NA

- 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.

**Table 10.** Estimated listed salmonid take levels of by hatchery activity. Data source: ODFW, unpublished.

<b>Listed species affected: Winter Steelhead; ESU/Population: Hood River/Lower Columbia River</b>				
<b>Activity: Hood River Production Program (Supplementation of wild population)</b>				
<b>Location of hatchery activity: Oak Springs Hatchery and Parkdale Fish Facility</b>				
<b>Dates of activity: Year around</b>				
<b>Hatchery program operator: Oregon Department of Fish and Wildlife and Confederated Tribes of Warm Springs Reservation of Oregon (per <i>US v Oregon</i> production agreement)</b>				
<b>Type of Take</b>	<b>Annual Take of Listed Fish By Life Stage (<i>Number of Fish</i>)</b>			
	<b>Egg/Fry</b>	<b>Juvenile/Smolt</b>	<b>Adult</b>	<b>Carcass</b>
<b>Observe or harass a)</b>	<85,000	70,000	1,000	0
<b>Collect for transport b)</b>	<85,000	65,000	<100	<20
<b>Capture, handle, and release c)</b>	-	-	-	NA
<b>Capture, handle, tag/mark/tissue sample, and release d)</b>	-	65,000	1,000	NA
<b>Removal (e.g. broodstock) e)</b>	-	-	See Table 11	NA
<b>Intentional lethal take f)</b>	-	0	0	NA
<b>Unintentional lethal take g)</b>	-	0	<20	NA
<b>Other Take (specify) h)</b>	<15,000 mortality	5,000 mortality	0	NA

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.

**Table 11.** Estimated listed salmonid take levels of by hatchery activity. Data source: ODFW, unpublished.

<b>Listed species affected: Winter Steelhead; ESU/Population: Lower Deschutes River/Hood River</b>				
<b>Activity: Hood River Production Program per <i>US v Oregon</i> production agreement</b>				
<b>Location of hatchery activity: East Fork Weir and Trap; Dates of activity: Jan 15- Jun 30</b>				
<b>Hatchery program operator: Oregon Department of Fish and Wildlife</b>				
<b>Type of Take</b>	<b>Annual Take of Listed Fish By Life Stage (<i>Number of Fish</i>)</b>			
	<b>Egg/Fry</b>	<b>Juvenile/Smolt</b>	<b>Adult</b>	<b>Carcass</b>
<b>Observe or harass a)</b>	0	0	800	0
<b>Collect for transport b)</b>	0	0	0	0
<b>Capture, handle, and release c)</b>	0	0	0	0
<b>Capture, handle, tag/mark/tissue sample, and release d)</b>	0	0	800	0
<b>Removal (e.g. broodstock) e)</b>	0	0	~60W, ~20H	0
<b>Intentional lethal take f)</b>	0	0	0	0
<b>Unintentional lethal take g)</b>	0	0	5	0
<b>Other Take (specify) h)</b>	0	0	0	0

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.

**Table 12.** Estimated listed salmonid take levels of by hatchery activity. Data source: ODFW, unpublished.

Listed species affected: Bull Trout; ESU/Population: Lower Deschutes River/Hood River				
Activity: Hood River Production Program per <i>US v Oregon</i> treaty production agreement				
Location of hatchery activity: East Fork Weir and Trap; Dates of activity: Jan 15- Jun 30				
Hatchery program operator: Oregon Department of Fish and Wildlife				
Type of Take	Annual Take of Listed Fish By Life Stage ( <i>Number of Fish</i> )			
	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harass a)	0	0	0	0
Collect for transport b)	0	0	0	0
Capture, handle, and release c)	0	0	0	0
Capture, handle, tag/mark/tissue sample, and release d)	0	0	3	0
Removal (e.g. broodstock) e)	0	0	0	0
Intentional lethal take f)	0	0	0	0
Unintentional lethal take g)	0	0	0	0
Other Take (specify) h)	0	0	0	0

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.

**- Indicate contingency plans for addressing situations where take levels within a given year have exceeded, or are projected to exceed, take levels described in this plan for the program.**

Weir and trap operations, physical components, or fish handling procedures will be modified immediately if any appreciable injury, delay, or mortality is observed. If take exceeds established guidelines or take authorizations, actions determined to be causing take will immediately be stopped until corrective measures are taken, and consultations with NOAA fisheries occurs.

## **SECTION 3. RELATIONSHIP OF PROGRAM TO OTHER MANAGEMENT OBJECTIVES**

- 3.1) Describe alignment of the hatchery program with any ESU-wide hatchery plan (e.g. Hood Canal Summer Chum Conservation Initiative) or other regionally accepted policies (e.g. the NPPC Annual Production Review Report and Recommendations - NPPC document 99-15). Explain any proposed deviations from the plan or policies.**

This program is consistent with the Lower Columbia Salmon and Steelhead Recovery Plan (ODFW, 2010), Hood River Subbasin Plan and Hood River Subbasin Management Plan (Coccoli, 2004) and Columbia River Basin Fish and Wildlife Program (NPPC, 1987). Program goals are consistent with the WY-KAN-USH-MI WA-KISH-WIT (The Columbia River anadromous fish restoration plan of the Nez Perce, Umatilla, Warm Springs, and Yakima Tribes, CRITFC, 1996). The program is fully aligned with Artificial Propagation Review and Evaluation (APRE) (NWPC, 2003) and Hatchery Scientific Review Group (HSRG, 2009) recommendations for integrated hatchery programs.

- 3.2) List all existing cooperative agreements, memoranda of understanding, memoranda of agreement, or other management plans or court orders under which program operates.**

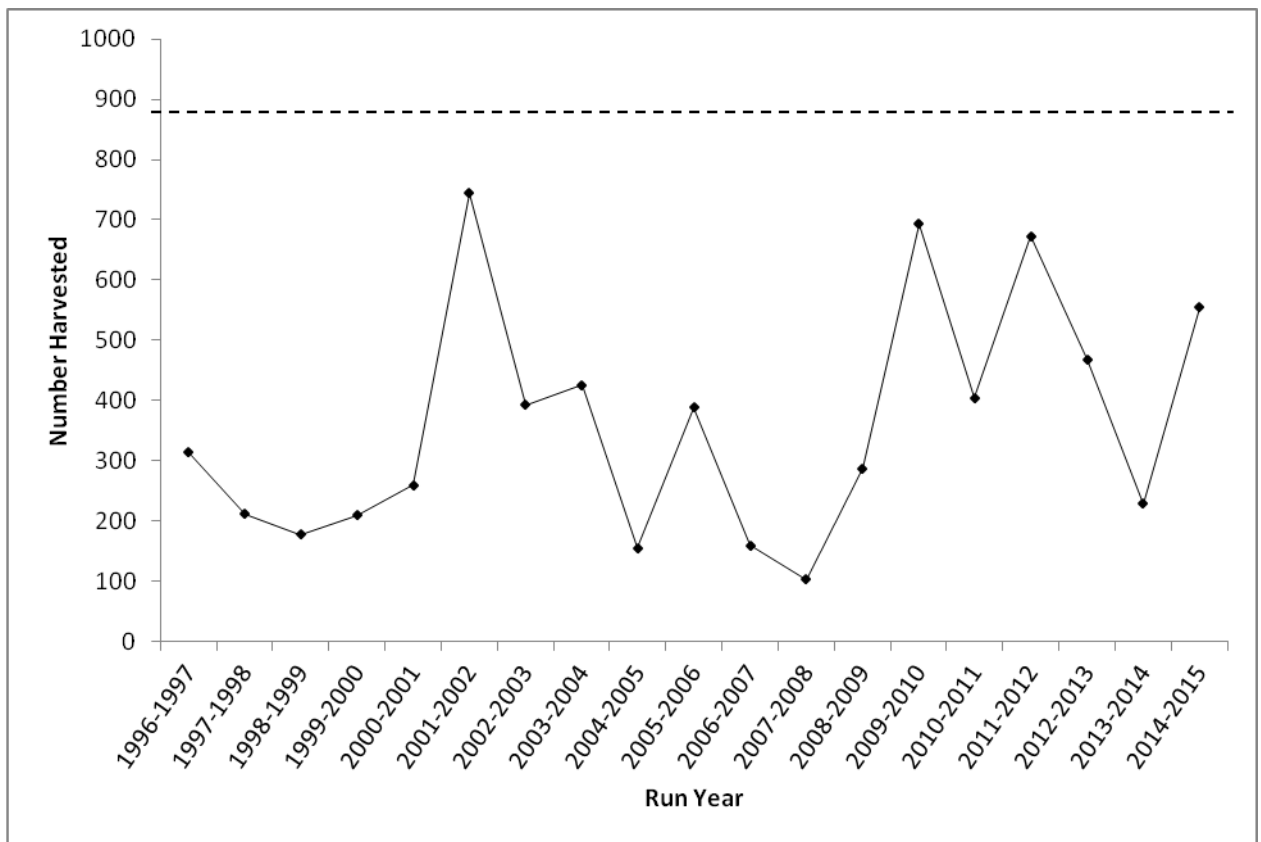
This program operates under the Hood River Master Plan, Hood River/Pelton Ladder Master Agreement, Hood River EIS and the Salmon and Steelhead Production Plan for the Hood River Subbasin (System Plan). The program is included in the *US vs. Oregon* Hatchery Production agreement tables (2007) and is consistent with the 1855 Treaty with the Tribes of Middle Oregon (12 stat. 963).

- 3.3) Relationship to harvest objectives.**

The main objective of the Hood River winter steelhead program is to release 50,000 smolts annually according to *US v Oregon* treaty production agreement for adult steelhead harvests by tribal and recreational fisheries. The program fish contribute to tribal and sport fisheries both in basin and outside of the basin. Hood River sport steelhead fisheries have been restricted to a fin-clipped hatchery fish harvest only since 1992. While some catch and release hooking mortality likely occurs on wild steelhead, the exact rate remains unknown but is believed to be low during winter steelhead fisheries on the Hood River. Winter steelhead fisheries generally occur at times when water temperatures are cool, which can reduce hooking mortality associated with catch and release. The harvest objective described in the Hood River Master Plan is 876 hatchery origin winter steelhead to be harvested in the Hood River by tribal and sport fisheries.

**3.3.1) Describe fisheries benefiting from the program, and indicate harvest levels and rates for program-origin fish for the last twelve years (1988-99), if available.**

In-river yearly sport harvest of Hood River hatchery winter steelhead has ranged from 103-744 (Figure 3). Harvest also occurs in the Lower Main-stem Columbia River sport fisheries, however, harvest rate is assumed to be minimal in these fisheries. Harvest also occurs in tribal Zone 6 commercial, ceremonial, and subsistence fisheries, although, specific harvest rates on Hood River fish are unknown.



**Figure 3.** Annual non-tribal harvest of hatchery winter steelhead for run years 1996-2015. Dashed line indicates the adult harvest objective (N = 876) established by the Revised Master Plan for the Hood River Production Program (HDR|FishPro 2008). Source: Simpson (2015).

**3.4) Relationship to habitat protection and recovery strategies.**

Several probable causes contributed to the depressed status of the Hood subbasin steelhead populations including: 1) adult fish passage problems (marginal and intermittent passage at the Edward Hines Dam, low flow below Powerdale Dam, poor fish ladder attraction, Dee Irrigation Diversion blockage, East Fork Irrigation Diversion; 2) lack of, or in-efficient juvenile fish protection at irrigation diversions East Fork Irrigation Diversion, Farmers Irrigation Diversion, Dee Irrigation Diversion, PacifiCorp diversion at Powerdale Dam); 3) degradation of suitable habitat (gravel and woody debris); 4) unfavorable natural conditions in the Hood River subbasin (glacial silt, glacial

outburst floods such as the Middle Fork 2006 event); and 5) channel dewatering from irrigation.

Habitat conditions in Hood River have changed considerably from those described in the previous paragraph. The Edward Hines Dam was removed in the mid-1960's, Powerdale Dam removed in 2010, East Fork Irrigation diversion ladder installed in 2015, Punchbowl Falls and Moving Falls fish ladders installed. Most unscreened, or improperly screened diversions, are now screened to criteria.

Agencies, irrigation districts, and concerned public cooperatively work together through the Hood River Watershed Group to coordinate restoration efforts and funding. A holistic watershed approach is under implementation with specific projects identified in the Hood River Action Plan (Cocolli, 2002). The habitat restoration component of the HRPP is actively engaged in habitat restoration activities that address limiting factors to anadromous salmonid production. Current and future activities include fish screening, flow restoration through irrigation ditch piping, fish passage, and instream/riparian restoration. Approximately \$700,000 is expended annually by the CTWSRO/BPA for these habitat restoration activities. Other significant funding is provided by OWEB, ODFW, and the USFS.

#### **3.4) Ecological interactions.**

The winter steelhead hatchery production project could potentially negatively impact listed natural winter steelhead, summer steelhead, coho salmon, fall Chinook salmon, spring Chinook salmon, and bull trout due to broodstock collection activities and competitive interactions for food and space. Predation on eggs and fry of listed natural species is possible, if released fish residualize in the Hood River and compete or prey on other species. The potential residualism problem is being addressed by rearing all fish to the smolt stage when they are most ready to migrate out of the basin. The acclimation of smolts prior to release and a volitional release method will stimulate the fish to quickly out-migrate to the ocean and thus will minimize the competitive interactions with listed natural fish.

Hatchery produced adult fish can potentially escape above the weir and potentially spawn with wild fish or spawn downstream of the weir, stray to other basins, or avoid the weir and spawn in other areas in the Hood River Subbasin. But, use of 100% wild brood will produce fish that would be genetically similar to naturally produced fish, and thus will minimize the adverse interbreeding effects.

Collecting winter steelhead broodstock in the East and Middle Forks of the Hood River will further prevent the inadvertent mixing of the summer and winter run due the spatial segregation of the two ecotypes in the Hood River. Additionally, real-time genetic identification using genetic stock identification method will further assist in avoiding mixing ecotype.

All listed species will benefit from the habitat improvement projects (i.e. in-stream and streamside habitat restoration, fish passage, and improved flows) that are an integral part of the Hood River Production Program.

## **SECTION 4. 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.**

The Parkdale Fish Hatchery has three sources of water available for all or portions of the facility operation. Rogers Spring Creek provides high quality water with a constant temperature of 38 to 40°F. Middle Fork Hood River provides a seasonally variable temperature water that ranges from the low 30's to the mid-50's. Well water provides supplemental water at a temperature of 46 to 48°F. The spring and river water sources can be used independently or they can be mixed to achieve a desired temperature regime for holding adults.

The Middle Fork water source is the same water source that the naturally spawning salmonids utilize in this portion of the Hood River system. The Rogers Spring Creek is a tributary to the lower Middle Fork Hood River and so naturally mixes with the Middle Fork water.

Oak Springs Fish Hatchery, as the name implies, has a large series of natural springs that provide a large volume of high quality spring water at a constant temperature of 53°F. This water is chilled to 43°F for use in the hatchery incubators. This hatchery has been in operation for more than fifty years and has never experienced any water quality or quantity deficiencies. The water quality is monitored at this station.

### **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.**

The Parkdale Fish Hatchery uses a relatively small amount of water for a small number of fish. The water is used in a once through scenario and there is no identified need for any effluent treatment. All three water sources originate at locations that are inaccessible to anadromous fish.

The Oak Springs Fish Hatchery water supply is a series of large springs located well up the near vertical Deschutes River canyon wall. The hatchery utilizes 50 cfs in their supply system, which is secured with a State of Oregon water right. The springs are non-fish bearing and the intake is fitted with coarse screen for debris control only. Two effluent settling ponds with capacities of 9,600 and 9,000 cubic feet are used to meet

NPDES general permit 300J water quality standards before water is discharged into the Deschutes River.

## **SECTION 5. FACILITIES**

### **5.1) Broodstock collection facilities (or methods).**

Winter steelhead will be collected at a seasonally operated (January 15 - June 30) floating weir and trap located in the East Fork Hood River approximately 200 meters downstream from the Dee Bridge. A 10 x 5 x 8 ft live box will be used that will safely accommodate expected daily catch. In the event of weir failure, fish may be collected at the Parkdale Fish Facility, or the East Fork Irrigation District Diversion. Weir and traps were designed to meet NOAA Fisheries and ODFW fish trapping criteria. The trap is checked daily, and broodstocks are randomly collected throughout the temporal distribution of the winter steelhead run.

All captured fish are anesthetized with electro-narcosis. Artificial fish slime is added to the water to protect the fish's mucous layer. Once sedated, they are identified to species, measured for fork length, sex is determined, scale and tissue samples taken, inspected for marks (fin clips and predator scars), and scanned for PIT tags. For detecting PIT tags a Destron Fearing 2001F-ISO transceiver that logs tag codes in hexadecimal format is used. To the extent practicable, fish remain submerged in water during sampling. A description of the sampling methods, updated annually, and is incorporated into the HRPP Annual Operating Plan. The trap operators enter bio-data into a laptop computer on site.

### **5.2) Fish transportation equipment (description of pen, tank truck, or container used).**

Broodstock are transported to the PFH on a one-ton dual rear axle diesel flat bed truck fitted with a two-chambered 600-gallon insulated aluminum tank. Each 300-gallon compartment of the tank is equipped with an aerator and oxygen supplementation system. The tank arrives at the trap prefilled with water.

### **5.3) Broodstock holding and spawning facilities.**

All of the broodstock used at Parkdale Fish Facility are held in one of the two 8 x 40 foot concrete holding ponds. Water levels in holding ponds can be adjusted to any desired depths. Under normal operation the ponds are four feet deep. These brood ponds are supplied with water from either the Middle Fork Hood River or Rogers Creek. The water is delivered through underground pipe and is gravity fed. Water can be adjusted for desired flows, but are normally set for 400 gpm for each pond. Each pond can be supplied with water from either source or receive a mixture of the two sources. Pond

water temperatures and depths are continually monitored by the Global Monitoring System (GMS). Flow meters monitor pond flows. The upper end of each pond is fitted with slotted aluminum screen systems. The spray bars deliver approximately 50 gpm to each pond and can utilize water from either source. The adult ponds are painted camouflage and shade cloth is attached to the perimeter railing. Adult steelhead are held in these ponds until they are spawned and/or released back to the Hood River. No adverse impacts to critical habitat is presumed to occur between the intake diversion and the discharge back to Rogers Spring.

The spawning building at Parkdale Fish Facility is located in close proximity to the adult holding ponds. The spawning building is approximately 18 x 18 feet. It is constructed of split face concrete block and has a metal roof. The building has electrical supply and is plumbed with hot and cold water. All the necessary supplies for spawning are located in this building. Emergency pumps to operate adult pond spray bars are located in this building. Adult broodstock are handled and sorted prior to spawning in this building. A floor drain diverts spawning refuse to the 8,000 gallon fish waste collection tank (FWT).

#### **5.4) Incubation facilities.**

The incubation room at the Parkdale Fish Facility is approximately 16 x 16 feet. It is a continuation of the spawning building and is constructed exactly as the spawning building. The building receives the same water sources as the adult holding ponds. Gravity fed water from the Rogers Spring or Middle Fork Hood River supplies the Marisource vertical stack incubators. There are presently four stacks of incubators with eight trays per stack. Booster pumps and a GMS sensitive head box are plumbed to the incubators. An additional aluminum head box and four more stocks of Marisource vertical incubators have been acquired for possible future incubation needs. Discharge water from the incubators is returned back to Rogers Creek. The two floor drains are plumbed to the 8,000 gallon FWT. Green eggs can be incubated and hatched and held to the swim-up stage.

At Oak Springs Fish Hatchery the steelhead eggs are incubated in Marisource isolation type incubators. The water supply to the incubators can be chilled to adjust the incubation period.

#### **5.5) Rearing facilities.**

Steelhead fry rearing at Oak Springs Fish Hatchery begins in fiberglass “Canadian” style containers that range in length from 9 to 21 feet. When the fish reach 200 per pound they are transferred to 30-foot diameter circular concrete ponds. The final rearing occurs in 46 x 8 feet concrete ponds.

#### **5.6) Acclimation/release facilities.**

Acclimation of winter steelhead smolts on the East Fork Hood River occurs at the East Fork Irrigation District’s sand trap located at RM 6.0. The sand trap consists of a series

of five rectangular concrete ponds, each with a shallow and deep end, designed to capture glacial sand that washes down the canal after water is diverted from the East Fork. With East Fork Irrigation District approval, one of the ponds was modified with screens and stoplogs so fish could be held and acclimated. The stop logs provide the same type of release as described at Parkdale Fish Facility. A caretaker remains onsite while fish are acclimating.

**5.7) Describe operational difficulties or disasters that led to significant fish mortality.**

There have been no significant losses of steelhead in this program.

**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.**

The Parkdale Fish Facility and Oak Springs Fish Hatchery are staffed full time. Both facilities have sophisticated alarm systems that alert staff to problems with water supply.

## **SECTION 6. BROODSTOCK ORIGIN AND IDENTITY**

**Describe the origin and identity of broodstock used in the program, its ESA-listing status, annual collection goals, and relationship to wild fish of the same species/population.**

**6.1) Source.**

The Hood River winter steelhead supplementation project, contained within the Hood River Production Program, began with an angler brood collection program for wild winter steelhead from the lower mainstem Hood River in 1991. From 1992 to 2010, all Hood River winter steelhead brood were collected from wild Hood River stock captured in the Powerdale Fish Facility (RM 4.0).

Beginning in January 2011 winter steelhead broodstock, as identified by lack of a fin-mark, have been collected at the East Fork Hood River trap and weir. The proposed annual collection goal is 60 wild fish from the Hood River to meet the genotypic characteristics for the offspring, although up to 40 wild fish may actually be spawned to meet the production goal. Any adult fish that do not meet the genotypic criteria for the offspring or considered surplus will be released back to the Hood River within 7 days after collection. In the event of catastrophic failure of wild brood collection, up to 20 hatchery-origin fish may be collected from the Hood River and incorporated into broodstock to meet the production goal. All wild winter steelhead are live-spawned and returned to the river after spawning to give them opportunity for multiple spawning in their lifetime.

## **6.2) Supporting information.**

### **6.2.1) History.**

Winter steelhead stock-50 was founded in 1991 by collecting wild winter steelhead of Hood River-origin. The first collection effort in 1991 was done by angling and was not very successful. The first effective year of broodstock collection was in 1992 and used the Powerdale Fish Facility, located at Powerdale Dam, Hood River (RM 4.0). Each year since 1992, the broodstock has been sub-sampled from throughout the Hood River wild winter steelhead run. Since 2011, steelhead broodstock has been collected at the floating weir and trap on the East Fork. Most of the Hood River winter steelhead population spawns in this upper basin production area. All of the hatchery fish captured at the trap are either removed or collected for broodstock. Candidates for winter steelhead stock-50 are selected randomly throughout the run. The broodstock consisted of 100% wild fish from 1991 to 1995, and included a proportion of returning hatchery fish stock-50 since 1996. The numbers of wild and hatchery winter steelhead counted at Powerdale Fish Facility and East Fork Weir with the numbers of fish taken for brood, by gender, since the founding of the stock are being provided in the previous section (Table 2).

### **6.2.2) Annual size.**

The proposed annual maximum broodstock collection goal is about 60 adults, preferably all wild-origin fish. In the event of catastrophic failure of wild brood collection at weir or due to any other complication causing inadequate numbers of wild broodstock, up to 20 hatchery-origin adults may be collected and incorporated into broodstock to meet the production goal. When funding permits all fish collected will be held at the hatchery for up to a week, pending genetic evaluation, and some fish may be released if not required to meet the genetic criteria. For the genetic evaluation, a rapid-read genotyping protocol will be used, and if any fish collected for broodstock is not required to meet the genetic criteria for offspring or considered surplus will be returned to the river at the collection weir within a week after capture.

Hood River Production Program's protocols specify that the wild fish collected for hatchery broodstock will not exceed 25% of the natural population, with less than 60 adults collected for broodstock. If wild spawner escapement is projected to not be robust enough to remain below the 25% broodstock take requirement, the project will incorporate some returning hatchery fish into the broodstock following HSRG guidelines, or will be discontinued until wild run size recovers. Based upon recent fecundity estimates of wild winter Hood River steelhead approximately 20 females will be required for the needed egg take. Approximately 70,000 eggs will need to be collected to meet program goals of producing 50,000 yearling smolts for release. Table 2 summarizes the Hood River winter steelhead broodstock collection to date, which also summarizes the sex ratio of the fish spawned, by brood year.

### **6.2.3) Past and proposed level of natural fish in broodstock.**

The number of natural fish collected in the past for broodstock, and the actual spawned are provided in Table 2. For the 1996 through 1999 brood years the winter steelhead broodstock averaged 58.6% wild fish. From 1999 brood year through the present the winter brood has had a goal of consisting of 100% wild fish, but the project has supplemented with hatchery fish when run size or lack of brood collection did not allow for 100% wild broodstock. Oregon Department of Fish and Wildlife and NOAA Fisheries policy limits the take for broodstock to 25% or less of a wild population in an effort to protect wild populations from the impact of removing fish for the purposes of developing and maintaining a hatchery broodstock. The annual wild winter steelhead broodstock take has ranged from 15 to 43 over the last five year period. Actual numbers of wild fish utilized for broodstock during that same period ranged from 15-43 (Table 2). Findings by Araki et al. (2007) suggest that first generation progeny from wild hatchery parents have the highest fitness in the Hood River, and would thus have least potential negative affects on wild Hood River Fish.

In the future, the project will strive to collect 100% wild winter steelhead for broodstock (up to a maximum of ~60 adults) if natural run size allows. If wild spawner escapement is projected to not be robust enough to remain below the 25% broodstock take requirement, the project will incorporate some returning hatchery fish into the broodstock following HSRG guidelines (up to a maximum of 20 hatchery-origin adults), or will be discontinued until wild run size recovers.

### **6.2.4) Genetic or ecological differences.**

Age structure of returning hatchery steelhead (stock 50) will be different from returning naturally produced steelhead. All hatchery steelhead smolts are released as yearlings, while wild steelhead smolts have up to four fresh water life history patterns. Wild steelhead smolts range from 1-year to 4-year smolts, but are predominately 2-year smolts and secondarily 3-year smolts. To date there is no indication that ocean age, 1 to 4 years, is different for hatchery and wild Hood River steelhead. See table 1 for age structure patterns of wild hatchery origin Hood River winter steelhead. However, the difference in freshwater age means the total age of hatchery and wild steelhead adults will be different. Yearling hatchery smolts are significantly larger in size than wild smolts at the same age. Adult size is similar between hatchery and wild origin fish.

### **6.2.5) Reasons for choosing.**

Wild winter steelhead of Hood River origin were selected for the hatchery broodstocks because they are the best representation of the wild indigenous winter steelhead populations in the Hood River subbasin and believed to have the least deleterious affects on the fitness of the wild population if wild and hatchery fish interbreed (Araki et al. 2007).

**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.**

Wild origin broodstock will be collected randomly to not intentionally select any particular trait, however selection will be stratified from throughout the entire temporal distribution of the run to help insure that all genetic attributes are represented in the hatchery stock from throughout the entire run timing distribution and that will produce offspring genetically similar to the natural stock. All wild fish will be live-spawned as they mature, with one male and one female per spawning. Females can be spawned with up to two males to increase diversity. And all wild fish after spawning will be returned to the river to give them opportunity for multiple spawning in their lifetime.

To ensure that only wild origin Hood River winter steelhead are used for broodstock, genotyping using genetic stock identification will also be utilized to ensure that fish are most likely from Hood River wild winter steelhead origin ecotype. Fish collected for broodstock not meeting these criteria, will be returned to the river within a week after capture from the weir.

## **SECTION 7. BROODSTOCK COLLECTION**

**7.1) Life-history stage to be collected (adults, eggs, or juveniles).**

Only returning adult winter steelhead will be collected for the hatchery broodstock.

**7.2) Collection or sampling design.**

The broodstock collection location, in the East Fork Hood, is generally located downstream of the primary winter steelhead natural spawning areas. We intend to capture all steelhead ascending upstream in the East Fork at the trapping site, allowing for precise bio sampling from the available fish. Broodstock will be randomly selected throughout the winter steelhead run. Broodstock collection is limited in the Hood Basin by small wild populations. Due to this concern, the limit on the take of wild fish for broodstock needs to be closely monitored. Small broodstocks have the risk of introducing potential random deviation from the phenotypic distributions of the wild fish.

There are two options for designing a broodstock selection regime to avoid bias when all possible fish are available for selection. One alternative is to select the broodstock at random from the total available fish. However, when the sample size is quite small, as in the case of the Hood River programs, this protocol may produce by random chance a sample with a skewed distribution for any particular trait. For example, if a broodstock of only 36 fish are taken from a wild population of 300 fish that has a run timing across three months, by chance all 36 fish could be selected from the first half of the run. While

this is a random outcome, the sample is not representative of the distribution from which it was drawn. A second way to select the broodstock is to stratify the small sample across the known distribution of one or more traits, such as run timing. This approach is not random but it produces a sample with a character distribution for the stratified trait that is more similar to that of the total population.

The broodstocks in the Hood are selected using both methods. The selection is stratified across run timing, but is random according to all other possible phenotypes. Stratification across run time is done by estimating the wild population size in advance, selecting a maximum broodstock size within the limit on take of wild fish, and then distributing the take evenly across the run. In a winter steelhead run, typically every N<sup>th</sup> male and female captured are selected and collected for the brood, although the actual take varies from year to year based upon success of trap operations. If hatchery fish are used in the broodstock, they will be sampled according to the same protocol.

### **7.3) Identity.**

(a) Methods for identifying target populations (if more than one population may be present).

Wild fish are identified based on lack of hatchery fin-marks or tags. The proposed trapping site is located at the East Fork of Hood, which is not in the typical distribution of Hood River summer-run steelhead. Winter ecotype steelhead will initially be identified through phenotypic traits typical of winter steelhead. Genetic stock identification will also be utilized to further identify Hood River winter steelhead.

(b) Methods for identifying hatchery origin fish from naturally spawned fish.

All hatchery steelhead released in the Hood subbasin are differentially marked to distinguish between hatchery and wild fish.

### **7.4) Proposed number to be collected:**

#### **7.4.1) Program goal (assuming 1:1 sex ratio for adults):**

A total of 40 wild Hood River winter steelhead will be needed to meet program goals. However, up to 60 wild fish may be collected and assessed to meet broodstock's genetic criteria, and fish not meeting criteria or surplus will be returned to the river within 7 days following collection.

**7.4.2) Broodstock collection levels for the last twelve years (e.g. 1988-99), or for most recent years available:**

The Hood River Production Program’s broodstock collection data are summarized in Table 2.

**Table 13.** Actual numbers of Hood River winter steelhead spawned and sex ratio. Data source: Olsen (2008) and Santos 2008-2015.

Brood year	Adults			Green Eggs	Smolts
	Females	Males	Jacks		
1991	3	1	NA	11,858	4,595
1992	18	23	NA	50,748	48,985
1993	16	21	NA	62,150	38,034
1994	26	28	NA	95,043	42,860
1995	18	19	NA	63,790	50,896
1996	24	29	NA	85,497	59,837
1997	27	27	NA	102,465	62,135
1998	21	21	NA	80,620	46,781
1999	29	33	NA	112,302	63,182
2000	20	19	NA	83,401	50,879
2001	27	35	NA	112,302	62,921
2002	20	23	NA	83,992	51,433
2003	22	22	NA	87,339	59,407
2004	22	24	NA	89,759	79,486
2005	14	15	NA	43,910	36,795
2006	21	29	NA	78,348	38,360
2007	18	16	NA	74,985	66,591
2008	19	18	NA	66,667	57,461
2009	19	19	NA	63,141	47,347
2010	21	25	NA	67,700	50,995
2011	14	9	NA	82,046	54,446
2012	19	14	NA	73,313	55,303
2013	18	23	NA	84,182	51,987
2014	18	23	NA	84,477	53,235
2015	27	20	NA	99,942	53,273

**7.5) Disposition of hatchery-origin fish collected in surplus of broodstock needs.**

It is anticipated that the proposed weir and trap will have a high capture efficiency rate. Hatchery fish returning to the trap in excess of broodstock needs will be removed from the river at the trap site. We will have three possible dispositions. Hatchery fish, in good condition, may be sacrificed and provided to Warm Springs tribal members as a food source. If tribal food banks are not requesting fish, they will be outplanted to standing waters in the local area to supplement standing water fisheries. If fish returning late in the run, or in poor condition, will be sacrificed and utilized for stream enrichment purposes in the Hood River Basin. Individual management taken on each returning excess hatchery fish will depend upon particular condition of the fish.

**7.6) Fish transportation and holding methods.**

Steelhead collected for broodstock will be transported from the East Fork Weir site to the Parkdale Fish Facility using a two-chambered 600-gallon insulated aluminum tank. Each 300-gallon chamber of the tank is equipped with an aerator and oxygen supplementation system. Transportation requires approximately 15 minutes. Fish are anesthetized with electro-narcosis prior to handling. At Parkdale Fish Facility, brood fish are held in an 8 x 40 feet concrete adult holding pond with adequate water flows and depth, until maturation or ripeness.

**7.7) Describe fish health maintenance and sanitation procedures applied.**

Fish are initially treated with Florfenicol upon capture. Once fish are transferred to the adult holding ponds they receive regular treatments with a formalin solution to prevent fungal infection. The fish are held in cold spring water, which helps to prevent disease or parasite problems.

The spawning area and equipment are routinely disinfected with an iodophor solution mixed at 100 parts per million (PPM) to minimize horizontal disease transmission. Green eggs are water-hardened in an iodophor solution to prevent disease or viral contamination.

**7.8) Disposition of carcasses.**

Wild winter steelhead will be live-spawned and returned to the river after spawning. Carcasses of incidental mortalities of spawned wild fish and any hatchery fish (if spawned) will be disposed of, and not returned to the river.

**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.**

The Hood River steelhead hatchery program includes a number of features that are designed to minimize adverse genetic or ecological effects to the listed natural fish, including:

- 1) All broodstock shall consists of listed natural fish. So, standard safe fish handling techniques at the weir facilities will be carefully followed during broodstock collection.
- 2) Collected brood fish will be treated with Florfenicol soon after capture to prevent disease infections.
- 3) Fish are transported in an aerated, and oxygenated adequately sized tank. aeration/oxygenation will be provided to transporting fish.
- 4) Adequate flows and depth shall be maintained in adult holding pond to provide a healthy environment for brood fish.
- 5) Any incidental mortality shall be removed immediately from the holding and be frozen before disposal to landfill or burial.
- 6) Genetic samples be taken from brood fish prior to brood selection to meet genetic criteria that will produce offspring similar to wild fish so that adverse interbreeding effects are minimized.
- 7) All wild winter steelhead will be live-spawned, and returned to the river after spawning to give them opportunity for multiple spawning in their lifetime so that they can contribute to building natural population within the basin.
- 8) Hatchery reared smolts are raised to a large size, acclimated, and volitionally released to minimize strays to other watersheds (Larsen, D. A. et al. in press).

## **SECTION 8. MATING**

**Describe fish mating procedures that will be used, including those applied to meet performance indicators identified previously.**

### **8.1) Selection method.**

Broodstock is collected from wild steelhead from throughout the run. Program targets are: 1) fish are paired at random from ripe fish, 2) fish are spawned with a single other individual, and 3) fish are spawned only once.

## **8.2) Males.**

Backup males have been collected to insure that there are ripe males available for spawning with ripe females. Backup males also help insure that a segment of the run is represented in the hatchery egg take if the primary male were to die. Repeat spawners may be selected in the random brood selection process. If selected, these fish would be treated as any other male brood.

The target sex ratio for this program is 1 male for every 1 female. Actual sex ratios of the past are reported in Table 2.

## **8.3) Fertilization.**

The fertilization protocol include 1:1 sex ratios, to produce a family unit for offspring from male and one female only. Gametes may be pooled, but only after the results of the IHN viral sampling verifies negative results.

ODFW has a department-wide fish disease control and prevention program. Prior to spawning, anesthetized adults are dried and wiped down with an iodine solution. Ovarian fluid and sperm samples are collected during spawning and later analyzed for the presence of IHN virus. Green eggs are water-hardened in an iodine antiseptic solution. The eggs are rinsed and treated with another iodine solution bath prior to initiation of the incubation process.

## **8.4) Cryopreserved gametes.**

Cryopreserved gametes are not used in this program.

## **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 selected at random from throughout the winter steelhead run. Spawning is done randomly based on availability of ripe fish. Matings are done on a 1:1 sex ratio (i.e. one male and one female). Disinfection methods are followed to prevent any disease transmission. Females are air-spawned to prevent physical damages as the listed natural fish will be returned to the river after mating.

## **SECTION 9. INCUBATION AND REARING -**

**Specify any management goals (e.g. “egg to smolt survival”) that the hatchery is currently operating under for the hatchery stock in the appropriate sections below. Provide data on the success of meeting the desired hatchery goals.**

### **9.1) Incubation:**

#### **9.1.1) Number of eggs taken and survival rates to eye-up and/or ponding.**

See table 14 for recent egg take and egg to smolt survival data for winter steelhead at Oak Springs Hatchery, 2012-2016.

**Table 14.** Winter steelhead eggs are collected from the Hood River brood stock and sent to Oak Springs Hatchery for incubation and rearing. Egg and fry loss percentages for the past five brood years along with the total number of fry that were ponded.

<b>Brood Year</b>	<b>Egg loss %</b>	<b>Fry loss%</b>	<b>Fry Ponded</b>
2012	6.30%	0.90%	57,577
2013	15.80%	0.90%	59,351
2014	12.90%	0.80%	58,138
2015	19.40%	2.90%	71,861
2016	9.50%	7.50%	62,878
<b>Sum Average</b>	<b>13.10%</b>	<b>2.60%</b>	<b>61,961</b>

#### **9.1.2) Cause for, and disposition of surplus egg takes.**

Extra steelhead eggs are typically collected in order to compensate for egg-to-smolt mortality. Surplus eggs, culled eggs and surplus fish are all disposed of by burial.

#### **9.1.3) Loading densities applied during incubation.**

Egg sizes are not routinely monitored. Standard flows are set at 4 gpm through the isolation incubation Marisource trays and 5 gpm on the standard incubation Marisource trays. Egg densities are determined by spawning / family group sizes. Egg densities are never higher than 1 female per incubation trap or 5,000 to 6,000 eggs per tray.

#### **9.1.4) Incubation conditions.**

Incubation of steelhead eggs begins either on 38 to 40°F spring water at the Parkdale Fish Facility, or chilled, 43°F water at Oak Springs Fish Hatchery. The eggs are chilled to retard development and allow later egg takes to catch up with the earlier eggs. Influent and effluent dissolved oxygen levels at Oak Springs Fish Hatchery have not been

previously monitored, but are now being monitored. Silt management is not an issue because both incubation sites use clean spring water.

#### **9.1.5) Ponding.**

Steelhead fry are ponded at between 994 and 1,095 temperature units into Canadian troughs. Fry are inspected daily beginning at 950 temperature units, and are ponded when an estimated 90% of the fry are buttoned up. Lengths and weights have not been sampled at ponding. The ponding rates can range from mid-June to late July. Ponding is forced, swim up is volitional, and feeding begins when an estimated 90% of the fry have surfaced in the pond. This usually occurs within four days of ponding.

#### **9.1.6) Fish health maintenance and monitoring.**

Incubating eggs are treated daily with a formalin solution at a rate of 1:600 for 10 to 15 minutes until hatching to prevent fungus. After ponding, fish are regularly monitored monthly for any obvious disease or parasite problems by a certified ODFW pathologist. ODFW fish pathologists routinely monitor the fish health status during their rearing cycle and prescribe any therapeutic treatments deemed necessary.

Hood River winter steelhead have been reared at Oak Springs Fish Hatchery for 15 brood years. There has been no egg yolk-sac malformation, or fry or fingerling deformities or disease problems.

#### **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.**

It is unlikely that incubation processes will have adverse genetic effects on program fish. To minimize adverse ecological impacts, the following measures are taken:

- Both Parkdale Fish Facility and Oak Springs Fish Hatchery is operated in compliance with ODFW's Fish Health Management Policy and the IHOT fish health guidelines.
- Disinfection procedures are implemented to ensure prevention of pathogen transmission between fish stocks.
- Eggs are incubated with spring water to reduce exposure to fish pathogens and silt.
- Eggs are kept isolated by family group.
- Dead or culled eggs are discarded in a manner that prevents transmission of diseases to the natural water bodies.
- Water supplies and the power supply are tuned to an alarmed system to notify hatchery personnel if a system failure occurs. Power supplies are connected to a backup generator in case of a power failure.
- Hatchery staff are available 24 hr/day, 7 days/week to respond to emergencies and complete daily fish culture duties.

## 9.2) Rearing:

### 9.2.1) Provide survival rate data (*average program performance*) 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.

**Table 15.** The loss of fish by live stage for Hood River hatchery winter steelhead in the past 11 years. Hood River hatchery steelhead are raised at Oak Springs Hatchery until they are transferred to the Hood River for acclimation as smolts.

Brood Year	Fry Pondered	Fingerling On hand 9/30	%Loss Fry to Fingerling	Smolts pre-transfer	%Loss Fingerling to smolt	Shortage	% Shortage
2004	84538	82292	2.60%	78576	4.50%	-1416	-1.70%
2005	50414	42110	16.50%	36875	26.80%	-13083	-26.1%
2006	71547	65341	8.70%	39798	39.10%	-25972	-36.30%
2007	73262	72529	1.00%	64763	10.70%	-5448	-7.40%
2008	58144	57685	0.80%	57546	0.20%	694	1.20%
2009	58989	57867	1.90%	47873	17.20%	-7825	-13.30%
2010	61571	60769	1.30%	51073	15.90%	-9311	-15.10%
2011	77419	76573	1.10%	65275	14.80%	-10230	-13.20%
2012	57579	57529	0.10%	52560	8.60%	-4539	-7.90%
2013	59351	57281	3.50%	52403	8.50%	-4323	-7.3%
2014	58038	55280	3.60%	53304	3.60%	-1701	-2.9%
2015	71861	69094	3.90%	55568	19.50%	-13906	-18.2%

### 9.2.2) Density and loading criteria (goals and actual levels).

Steelhead fry loading densities in the Canadian troughs are kept below 5 pounds of fish per gpm inflow, and 10 pounds per cubic foot of water volume. Steelhead transferred to 30 foot diameter circular ponds are kept at densities below 6 pounds of fish per gpm inflow and 7 pounds per cubic foot of volume. Steelhead later transferred to the 46 x 8 foot raceway ponds are kept at densities of 8.3 pounds per gpm of inflow and 2 pounds per cubic foot of volume. All the water used in the various containers for the steelhead rearing is single use water with no re-use.

### 9.2.3) Fish rearing conditions.

*Early Rearing:* Fry are directly ponded into a 40 x 50 x 4 ft. deep concrete rearing pond, holding approximately 60,000 gallons of water, in the Hatchery Lower Rearing Pond series. The large pond eliminates any density concerns initially, and there appears to be a source of natural food coming into these ponds from the spring water, and from aquatic invertebrate hatches related to the ponds' close proximity to the Deschutes River. Pond 1 has historically been used for initial ponding because of the combination of good natural shading from the overhead canopy of deciduous trees, and based on relatively good condition of the concrete walls and bottom. That being said, the pond series is over 70 years old, and does require annual maintenance to repair cracks and crevices that appear

in the concrete. After ponding, the fish are given 72-96 hours to fill their swim bladders, acclimate to the pond, and use up any remaining yolk before feeding is initiated. Feeding rates start out very low, and are gradually increased over two to three weeks to an “on demand” feeding ration, where the fish are fed as much as they will eat. Feeding at this stage is done by hand, multiple times throughout the day. Mortality is removed daily, with pond cleaning occurring on a weekly basis. Ponds are cleaned by lowering the water levels, and brooming out any wastes or unused feed. Water supply is spring fed, and is a constant 53 degrees. Inflows are set at approximately 100 gallons per minute at ponding, and are gradually increased as biomass density increases. In December, when densities reach approximately 0.4 pounds per cubic foot, fish are inventoried and split equally for final grow out into two side by side rearing ponds.

*Mid-Late Rearing:* During winter and early spring, in years when growth is good, fish are switched to a scheduled weekly feed ration. Feeding rates decline extensively in winter months despite the constant water temperature. At this time, manual feeding is assisted with two Nielson style automatic feeders mounted on each pond, providing light rations approximately twice per hour, to help meet weekly feed allocations. Mortality is removed daily, and pond cleaning occurs on a weekly schedule. Six weeks prior to acclimation, the fish are switched to a Bio Products transfer diet to help improve smoltification rates, and improve acclimation to a salt water environment. Three weeks prior to acclimation, the pond inflows are modified and increased to create a high flow circular current in the rearing ponds, to “physically exercise” the fish. At this time, feed rates are reduced to a restricted level of 0.8% of daily body weight to lower condition factors, and lean out the fish before release. At acclimation, rearing densities are less than 0.7 pounds per cubic foot, with flow index of approximately 9 pounds of fish per gallon per minute.

**9.2.4) Indicate biweekly or monthly fish growth information (*average program performance*), including length, weight, and condition factor data collected during rearing, if available.**

There were two raceway ponds of Hood stock winter steelhead. Table 16 summarizes the length, weight and condition factor for these groups of fish.

**Table 16.** Mean fork length (FL; mm), weight (gm), and condition factor (CF) for Hood River stock hatchery winter steelhead smolts sampled at Oak Springs Hatchery prior to being transferred to the Hood River subbasin <sup>a</sup> (Olsen 2008). Estimates are for early- and late- release groups.

Statistic, release group, brood year <sup>b</sup>	Size group	N	Mean	Range	95% CI
FL (mm), June, 1993 <sup>c</sup> Early Release Group,	--	130	183.8	115 - 234	± 4.2

1993	Large	185	200.2	144 - 246	± 2.9
1993	Small	193	192.7	82 - 283	± 3.9
1994	Large	200	196.9	138 - 247	± 2.5
1994	Small	207	185.7	116 - 234	± 2.7
1995	Large	208	196.1	93 - 236	± 2.6
1996	Large	203	196.5	118 - 242	± 2.5
1997	Large	199	193.1	91 - 240	± 2.9
1998	Large	200	189.2	125 - 232	± 2.3
1999	Large	208	181.0	117 - 228	± 2.6
2001 (G1;L3)	--	258	175.9	98 - 241	± 3.5
2001 (G1;L4)	--	204	173.5	109 - 250	± 4.1
2002	--	207	187.9	108 - 245	± 3.5
2003 (G1;L5)	--	200	179.6	90 - 250	± 4.5
2003 (G1;L6)	--	208	179.2	85 - 250	± 4.3
2004 (L3)	--	204	167.1	83 - 232	± 4.2
2004 (L4)	--	204	180.8	95 - 234	± 3.6
2005 (L1)	--	210	153.8	94 - 223	± 3.3
2005 (L2)	--	216	159.7	86 - 226	± 3.1
2006 (G1;L1)	--	211	182.5	90 - 267	± 3.7
2006 (G2;L2)	--	226	188.5	96 - 236	± 2.9
2007 (G1;L2)	--	215	198.7	127-252	± 2.8
2007 (G2;L3)	--	214	204.5	129-250	± 2.8
2008 (L1;L2)	--	400	186.4	88-264	± 2.7
2009 (L1;L2)	--	400	198.8	123-264	± 2.5
Late Release Group,					
1995 <sup>d</sup>	--	--	--	--	--
1996	Small	192	168.2	90 - 225	± 3.7
1997	Small	205	173.8	89 - 218	± 3.1
1998	Small	195	194.9	92 - 268	± 3.6
1999	Small	196	180.6	119 - 224	± 2.7
2000	Large	195	198.2	134 - 242	± 3.0
2000	Small	203	182.3	98 - 244	± 3.4
2001 (G1;L3)	--	200	194.0	109 - 279	± 4.3
2001 (G1;L4)	--	216	193.0	109 - 275	± 3.7
2002	--	205	188.7	100 - 265	± 3.8
2003	--	253	203.8	101 - 258	± 3.2
2004	--	207	179.8	94 - 246	± 4.1
2005 (L1)	--	200	179.8	104 - 237	± 3.6
2006 (L1)	--	228	189.7	104 - 243	± 3.1
2007	--	--	--	--	--
2008	--	204	196.8	107-272	± 3.6
2009 (L1)	--	400	207.3	121-267	± 2.0
2010 (L1;L2)	--	399	198.3	91-273	± 3.0
2011 (L1;L2)	--	406	214.1	129-276	± 2.3

2012 (L1; L2)	--	407	214.6	118-279	± 2.3
2013 (L1; L2)	--	388	202.3	89-272	± 2.6
2014 (L1; L2)	--	400	204.5	103-275	± 3.0
2014 (L3)		200	201.4	114-289	± 4.2

Weight (gm),

June,

1993 <sup>c</sup>	--	129	69.5	16.0 - 145.5	± 4.8
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Early Release Group,

1993	Large	185	91.1	33.1 - 168.5	± 3.8
1993	Small	192	87.2	6.1 - 236.4	± 4.6
1994	Large	199	86.2	29.6 - 172.1	± 3.2
1994	Small	207	72.8	16.5 - 154.0	± 3.1
1995	Large	205	89.6	8.7 - 163.5	± 3.1
1996	Large	202	86.0	18.1 - 164.3	± 3.2
1997	Large	198	88.7	9.9 - 191.1	± 3.5
1998	Large	200	76.2	21.7 - 145.4	± 2.8
1999	Large	208	64.9	16.4 - 133.3	± 3.0
2001 (G1;L3)	--	219	65.5	9.4 - 168.1	± 4.1
2001 (G1;L4)	--	201	66.0	14.3 - 223.5	± 4.9
2002	--	207	77.9	12.5 - 165.1	± 4.1
2003 (G1;L5)	--	199	77.8	10.9 - 210.0	± 5.1
2003 (G1;L6)	--	208	72.3	7.3 - 180.6	± 4.5
2004 (L3)	--	198	56.8	6.2 - 150.4	± 3.9
2004 (L4)	--	200	69.3	9.5 - 142.8	± 3.9
2005 (L1)	--	209	43.6	9.1 - 115.6	± 2.8
2005 (L2)	--	214	48.4	6.6 - 107.2	± 2.6
2006 (G1;L1)	--	210	71.3	7.9 - 253.3	± 3.9
2006 (G2;L2)	--	226	76.7	9.8 - 150.0	± 3.4
2007 (G1;L2)	--	215	92.0	31.1-181.3	± 3.7
2007 (G2;L3)	--	213	99.1	23.4-187.3	± 4.0
2008 (L1;L2)	--	400	74.4	6.6-239.9	± 3.0
2009 (L1;L2)	--	400	88.2	19.9-194.2	± 3.2

Late Release Group,

1995 <sup>d</sup>	--	--	--	--	--
1996	Small	191	53.4	5.7 - 109.8	± 3.3
1997	Small	202	60.7	7.3 - 115.8	± 2.9
1998	Small	195	84.1	7.9 - 190.1	± 4.3
1999	Small	195	62.9	17.4 - 134.3	± 2.8
2000	Large	192	89.8	26.1 - 176.0	± 3.7
2000	Small	202	73.4	13.5 - 164.6	± 3.8
2001 (G1;L3)	--	199	86.2	14.4 - 282.6	± 6.0
2001 (G1;L4)	--	215	84.0	14.9 - 262.6	± 5.0
2002	--	205	76.7	12.2 - 183.3	± 4.2

2003	--	250	95.4	14.9 - 208.3	± 4.2
2004	--	207	66.1	8.9 - 166.9	± 4.0
2005 (L1)	--	198	70.6	12.3 - 151.5	± 3.8
2006 (L1)	--	228	74.0	13.9 - 147.7	± 3.2
2007					
2008	--	204	90.1	13.5-259.7	± 4.9
2009 (L1)	--	400	98.3	17.2-214.4	± 2.8
2010 (L1;L2)	--	399	87.3	8.8-233.0	± 3.6
2011 (L1;L2)	--	406	109.3	22.5-258.0	± 3.6
2012 (L1;L2)	--	407	111.4	20.3-266.4	± 3.6
2013 (L1; L2)	--	388	92.9	7.2-231.1	± 3.3
2014 (L1; L2)	--	400	97.0	11.5-212.0	± 3.8
2014 (L3)	--	200	97.4	17.2-300.4	± 6.2

<sup>a</sup>Juveniles were sampled approximately one to seven days prior to transfer.

<sup>b</sup>G1 = group 1, G2 = group 2, L3 = pond L-3, L4 = pond L-4, L5 = pond L-5, L6 = pond L-6.

<sup>c</sup>Juveniles were sampled four days prior to release on 28 June 1994.

<sup>d</sup>No juveniles were sampled from this brood release.

**9.2.5) Indicate monthly fish growth rate and energy reserve data (average program performance), if available.**

The average growth rates of Hood River winter steelhead are included in Table 17. No energy reserve data has been collected.

**Table 17.** The average feed rates per day based on the average number fish per pound for Hood River winter steelhead raised at Oak Springs Hatchery (Unpublished Data Oak Springs Hatchery 2017).

Month	Size - Number/lb.	% Body Weight	Max. Pounds fish/gpm inflow
<b>July</b>	700	4.50%	0.5
<b>August</b>	250	3.20%	1
<b>September</b>	105	2.50%	1.4
<b>October</b>	50	1.90%	1.8
<b>November</b>	35	1.30%	3.0
<b>December</b>	20	1.10%	5.2
<b>January</b>	13	1.30%	3.6
<b>February</b>	9	1.10%	5.6
<b>March</b>	7.5	1.00%	7.5
<b>April</b>	5	0.80%	9.0

**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 (average program performance).**

Winter steelhead reared at Oak Springs Fish Hatchery are started on Ewos Micro Starter diets through 250 fish per pound, and then switched to Ewos Pacific fry diets through 6 weeks prior to acclimation. At that point, the finishing diet is Bio Products Bio Supreme. The 5-year average total amount of annual feed usage is 10356 pounds from Brood Years 2011-2015. The 5-year average food conversion is 0.91. For average feed rates and ranges, refer to Table 17.

**9.2.7) Fish health monitoring, disease treatment, and sanitation procedures.**

Fish health of juvenile winter steelhead is monitored monthly by ODFW Fish Health Services. Fish Pathologists diagnose disease problems and prescribe the appropriate treatments to eliminate or control the disease. Fish Pathologists and hatchery staff work together to perform the following fish health actions:

**Disease Control (Reactive)**

- Fish Health Specialists perform necropsies of diseased and dead fish to diagnose the cause of loss. They also prescribe appropriate treatments and remedies to disease. This may include recommending modifications in fish culture practices, when appropriate, to alleviate disease contributing factors.

**Disease Prevention (Proactive)**

- Hatchery staff removes dead fish daily from each rearing container and notify ODFW Fish Pathologists if losses accelerate. Monthly mortality records are submitted to Fish Pathology.
- Fish Health Service performs monthly examinations of live fish to assess health status and detects problems before they progress to clinical disease or mortality.
- Hatchery staff implements disease preventative strategies in all aspects of fish culture to produce healthy and quality fish.
- Hatchery staff use sanitation procedures that prevent introduction of pathogens into and/or within the facility.
- Hatchery staff utilize pond management strategies to help optimize the quality of the rearing environment and minimize fish stress that can be conducive to infectious and noninfectious diseases.

**Health Monitoring**

- Monthly examinations of healthy and clinically diseased fish are conducted at the hatchery.
- All fish are given a health inspection no longer than 6 weeks before fish are released or transferred.
- Examinations for *Myxobolus cerebralis*, agent of whirling disease, are conducted annually.
- Whenever abnormal fish behavior is reported or observed, or mortality exceeds 0.1%

per day over five consecutive days in any rearing container, the fish pathologist will examine the affected fish, make a diagnosis, and recommend the appropriate remedial or preventive measures.

- Reporting and control of specific fish pathogens are conducted in accordance with the ODFW's Fish Health Management Policy.

#### **Therapeutic and Prophylactic Treatments**

- Juvenile fish are administered antibiotics orally as needed for the control of bacterial infections and for prevention of diseases.
- Only approved or permitted therapeutic agents are used for treatments.

#### **Sanitation**

- All eggs brought to the facility are surface-disinfected with iodophor.
- Different lots of fish/eggs are physically segregated from each other by separate ponds, incubator units, and water supplies.
- Fish transport trucks are disinfected prior to use.

#### **9.2.8) Smolt development indices (e.g. gill ATPase activity), if applicable.**

The only index of smolt development collected at the hatchery is the condition factor data collected prior to liberation. No gill ATPase enzyme activity is measured.

#### **9.2.9) Indicate the use of "natural" rearing methods as applied in the program.**

Steelhead reared at Oak Springs Fish Hatchery are subject to minimal human disturbance. All feeding is automated. Fish transported to acclimation facilities in the Hood River subbasin experience natural-colored pond walls and/or in-water structure to simulate natural rearing conditions. Human contact is minimized during the acclimation.

#### **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.**

Hatchery-reared Hood River stock of winter steelhead are the progeny of parents selected from throughout the run year. There is no size grading of juveniles during the yearling rearing period. Human interactions with the rearing of steelhead is minimal. The fish are acclimated in ponds with natural cover added and the Parkdale Fish Facility has camouflaged pond walls designed to simulate the natural stream environment. Fish are allowed to voluntarily migrate from the acclimation ponds into the Hood River system.

## **SECTION 10. RELEASE**

**Describe fish release levels, and release practices applied through the hatchery program.**

### **10.1) Proposed fish release levels.**

**Table 18.** Hood River Winter Steelhead proposed hatchery-reared releases in the Hood subbasin.

<b>Age Class</b>	<b>Maximum Number</b>	<b>Size (fpp)</b>	<b>Release Date</b>	<b>Location</b>
<b>Eggs</b>	NA	NA	NA	NA
<b>Unfed Fry</b>	NA	NA	NA	NA
<b>Fry</b>	NA	NA	NA	NA
<b>Fingerling</b>	NA	NA	NA	NA
<b>Yearling</b>	50,000*	5 fish/pound	April	East Fork Hood River
<b>Yearling</b>	*	5 fish/pound	April	Middle Fork Hood River

\* Releases of about 40% of the smolts into the Middle Fork Hood River are pending evaluation of barrier waterfalls that developed following the November 2006 floods.

### **10.2) Specific location(s) of proposed release(s).**

#### *Winter Steelhead*

**Stream, river, or watercourse:** East Fork Hood River

**Release point:** RM 6.0, at latitude 45.3055 and longitude -121.3357

**Major watershed:** Hood River

**Basin or Region:** Columbia River

#### *Winter Steelhead*

**Stream, river, or watercourse:** Middle Fork Hood River

**Release point:** RM 3.5, at latitude 45.3420 and longitude -121.3920

**Major watershed:** Hood River

**Basin or Region:** Columbia River

**10.3) Actual numbers and sizes of fish released by age class through the program.**

**Table 19.** Hood River winter steelhead past releases, 1992-2007. Data source: Olsen (2008), Simpson (2015), and Santos (2015).

Release year	Eggs/ Unfed Fry	Avg size	Fry	Avg size	Fingerling	Avg size	Yearling	Avg size
1992							4,595	4.6
1993							48,985	5.8
1994							38,034	4.9
1995							42,860	5.4
1996							50,896	5.3
1997							59,837	7.1
1998							62,135	6.4
1999							46,781	5.9
2000							63,182	7.7
2001							50,879	5.6
2002							62,921	5.8
2003							51,433	5.7
2004							59,407	5.5
2005							79,486	7.7
2006							36,795	10.2
2007							38,360	6.2
2008							66,591	4.7
2009							57,461	5.7
2010							47,347	4.9
2011							50,995	5.2
2012							54,446	4.2
2013							55,303	4.1
2014							51,987	4.9
2015							53,235	4.7
Average							51,335	5.74

#### 10.4) Actual dates of release and description of release protocols.

Steelhead smolts are transported to Hood River acclimation ponds beginning in early May. The volitional release of steelhead smolts is generally complete within 7 days. Release of steelhead smolts from acclimation ponds is based on the following criteria: 1) smolt readiness in terms of appearance, crowding at the pond outlet, etc. and 2) release time that corresponds to natural smolt outmigration. Smolts are volitionally released for about one week. No migrants are forced out of the ponds. Table 20 provides release information.

**Table 20.** Hood River stock hatchery winter steelhead acclimated in the East Fork and Middle Fork Hood River drainage, 1996-2000 releases<sup>a</sup>. Data source: Olsen and French (2000); Santos (2008-2015).

Drainage, Location, Release year, Release group	Date transferred to raceway	Number transferred to raceway	Fish/lb at transfer	Number of days acclimated	Mortalities <sup>b</sup> in acclimation raceway	Number <sup>c</sup> volitionally released	Number <sup>d</sup> trucked	Total <sup>e</sup> released
East Fork, Toll Bridge Park, 1996, Group 1	Apr 1-4	24,057	5.7	9-12	26	24,031		24,031
Group 2	Apr 22-24	26,965	5.0	8-10	92	20,885	5,988	26,873
EFID Sand Trap, 1997, Group 1	Apr 11-15	27,740	5.7	6-10	29	27,711		27,711
Group 2	Apr 29	32,578	8.3	6	452	32,126		32,126
1998, Group 1	Apr 7	29,510	5.2	7	0	29,510		29,510
Group 2	Apr 21	32,626	7.5	7	0	31,707	919 (1)	32,625
1999, Group 1	Apr 6	13,439	5.6	9	4	12,430	1,005 (1)	13,434
Group 2	Apr 29	13,630	5.8	6	2,052	10,572	1,006 (1)	11,577
2000, Group 1	Apr 12	14,599	7.3	5	1	13,852	746	14,598
Group 2	Apr 25-26	16,558	7.8	5-6	20	15,694	844	16,538
2001 Group 1A	Apr 24-25	13,265	5.3	5-6	0	13,265	0	13,265
Group 1B	May 7	3,782	4.4	7	0	3,782	0	3,782
Group 2	May 7	8,557	6.4	7	0	8,557	0	8,557
2002 Group 1	Apr 4	14,659	6.1	8	54	14,436	0	
Group 2	Apr 22	16,572	5.4	7	6	16,396	339	31,171
2003 Group 1	Apr 4	11,255	5.7	6	5	10,372		
Group 2	Apr 21	13,865	5.9	8	25	12,962	1,756	25,090
2004 Group 1	Apr 5-7	29,482	5.5	15	17	28,914	551	29,465
2005 Group 1	Mar 29-30	39,000	7.6	10	56	38,385	559	38,935
2006 Group 1	Mar 7	18,000	9.9	20	16	17,356	628	17,984
2008 Group 1	April 15-17	37,845	4.8	30	8	37,649	188	37,837
2009 Group 1	May 5	33,699	6.28	7	6	33,693	0	33,693
2010 Group 1	May 10	22,956	5.2	7	22	22,934	0	22,934
2011 Group 1	May 3	17,002	5.1	8		17,002	0	17,002

Group 2 2012	May 4	17,435	4.9	7	50	17,385	0	17,385
Group 1	May 1	18,000	4.5	8				
Group 2 2013	May 2	18,497	4.5	7	46	36,451	0	36,451
Group 1	May 6	19,558	4.5	7				
Group 2 2014	May 7	18,490	4.3	6	305	37,743	0	37,743
Group 1	April 28	21,070	4.9	9				
Group 2	April 29	19,937	4.9	8				
Group 3 2015	April 30	18,490	5.0	7	474	51,987	0	51,987
Group 1	Apr 27	18,240	4.8	9				
Group 2	Apr 28	16,492	4.7	8				
Group 3 Middle Fork, Parkdale Fish Facility, 1999,	Apr 29	15,082	4.8	7	31	NA	NA	49,783
Group 1	Apr 6-7	10,012	5.5	8-9	2	9,859	153	10,010
Group 2 2000,	Apr 28	9,975	6.0	7	7	9,816	152	9,968
Group 1	Apr 11	15,912	7.3	6	8	15,279	625 (50)	15,854
Group 2 2001	Apr 25	16,235	7.7	6	20	15,578	637 (50)	16,165
Group 1	Apr 26	14,696	5.6	4	13	14,535	148	14,683
Group 2 2002	May 8	10,648	5.9	6	56	10,484	108	10,592
Group 1	Apr 5	14,142	6.3	7	75	13,809		
Group 2 2003	Apr 23	17,758	5.5	6	75	17,425	516	31,750
Group 1	Apr 3	11,256	6.5	7	53	11,103		
Group 2 2004	Apr 22-23	15,193	5.0	7-8	53	15,040	200	26,343
Group 1	Apr 1-2	15,014	6.0	7-8	5	14,904		
Group 2 2005	Apr 20	15,175	4.6	7	28	15,042	210	30,156
Group 1	Mar 30-31	20,000	7.7	8-9	30			
Group 2 2006	Apr 14-15	17,605	6.7	7-8	29	33,052	4,481	37,517
Group 1	Mar 8	9,000	10	14	15			
Group 2 2007	Mar 29	7,875	7.5	8	25	16,835	0	16,826
Group 1	April 12		5.8	11				
Group 2 2008	April 27	17,443	6.4	7		17,443	0	17,443
Group 1 2009	April 14	26,918	4.8	8-10	19	26,843	56	26,899
Group 1 2010	May 04	23,847	5.67	8	73	23,318	456	23,774
Group 1	May 4	12,475	5.2	8				
Group 2 2011	May 17	10,050	4.9	7	73	22,399	31	22,430
Group 1 2012	May 5	16,636	5.2	7	34	16,602	0	16,602
Group 1 2013	April 30	18,384	4.9	16	376	18,808	0	18,808
Group 1	May 7	3,442	4.5	7		3,442	0	3,442
Group 2 Neal Creek 2015	May 8	14,512	4.3	6	305	14,118	0	14,118

Group 1	Apr 27	1,742	4.8	9		NA	NA	
Group 2	Apr 28	1,748	4.6	8	38	NA	NA	3,452

<sup>a</sup> In the release year 1999, 1,792 smolts were direct released by truck from Oak Springs Hatchery personnel (ODFW) into the main-stem Hood River below Powerdale Dam.

<sup>b</sup> Of the total 481 mortalities in 1997, 442 were the result of sampling smolts which did not emigrate volitionally from the acclimation raceway. Of the total 2,052 mortalities recorded in 1999 at the EFID Sand Trap, 1,992 fish were the result of hauling fish to the acclimation site and 123 were from seining and holding fish for the Coanda screen testing.

<sup>c</sup> Of the total 59,837 released in 1997, 2,545 did not emigrate volitionally of which 2,103 were forced out into the East Fork Hood River.

<sup>d</sup> Number trucked indicates hatchery winter steelhead which did not emigrate volitionally from the acclimation raceways and were hauled and released near the mouth of the Hood River. In parentheses are mortalities from fish truck liberations.

<sup>e</sup> Mortality from the number trucked was subtracted from the total released.

### 10.5) Fish transportation procedures, if applicable.

Winter steelhead are transported from Oak Springs Fish Hatchery to acclimation ponds in the Hood River subbasin. Fish are in transit for about two hours. Temperatures are regulated to match the receiving water. Transport trucks are equipped with oxygen supplementation system to super-saturate water while transporting fish.

### 10.6) Acclimation procedures.

Release of winter steelhead smolts from acclimation ponds is based on the following criteria: 1) smolts readiness in terms of appearance, crowding at the pond outlet, etc. and 2) release time that corresponds to natural smolts outmigration. Smolts are volitionally released for about one week. Non migrants are forced out of the ponds. Table 20 provides acclimation details. A full-time care taker remains on site during the entire period fish are acclimated.

### 10.7) Marks applied, and proportions of the total hatchery population marked, to identify hatchery adults.

All winter steelhead smolts are marked with distinctive external adipose fin clip and/or maxillary bone clip that enable fish managers to distinguish fish from individual releases groups by brood year. Approximately 10% (5,500) smolt are implanted with a PIT tag annually prior to release.

### 10.8) Disposition plans for fish identified at the time of release as surplus to programmed or approved levels.

Releases have been within the programmed and approved levels. There have not been any surplus fish.

### 10.9) Fish health certification procedures applied pre-release.

Fish health must be certified by ODFW pathologists prior to release, and only certified fish are released.

**10.10) Emergency release procedures in response to flooding or water system failure.**

In the event of catastrophic water system failure, standby pumps would be used at each acclimation site to re-circulate water during such emergency situation to save the fish. Acclimating smolts may be forced out from the acclimation pond, if necessary.

**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 steelhead smolts are the progeny of parents that are collected at random throughout the respective steelhead run. Juvenile steelhead are not graded for size while in the fish hatchery. The smolts are acclimated prior to release into the Hood River system. The smolts volitionally migrate from the acclimation ponds during approximately the same period that naturally produced smolts are emigrating from the system.

**SECTION 11. MONITORING AND EVALUATION OF PERFORMANCE INDICATORS**

The ODFW Hood River Research Program (HRRP) represents one of the six projects under the Hood River Production Program’s umbrella and is the M&E component administered by ODFW. The Hood River Production Master Plan (O’Toole and ODFW 1991a; O’Toole and ODFW 1991b) was adopted by the NWPC in 1992, and its overarching goal was to “protect, enhance and restore wild and natural populations of anadromous and resident fish within the Hood River Subbasin” (Coccoli 2000) where production program specific goals included:

- Increasing production of wild summer and winter steelhead trout commensurate with the sub-basin’s current carrying capacity
- Re-introducing spring Chinook salmon into the Hood River subbasin
- Providing tribal and recreational fisheries for winter and summer steelhead and spring Chinook salmon

Since its inception in 1991, the HRRP has focused on evaluating the performance of the Production Program relative to its biological fish objectives for the Hood River subbasin. A set of objectives was established by the original Master Plan (1991), and later revised in 2008 (HDR|FishPro 2008). A summary of those numerical objectives were specified by the Hood River Production Program Master Plan Review (HDR|FishPro 2008).

## 11.1) Monitoring and evaluation of “Performance Indicators” presented in Section 1.10.

### 11.1.1) Describe plans and methods proposed to collect data necessary to respond to each “Performance Indicator” identified for the program.

#### Spawning Escapement and Distribution:

**Objective:** Monitor spawner escapements of wild and hatchery winter steelhead to the Hood River subbasin.

**Metric:** Status and trend monitoring of spawner escapements to the Hood River subbasin.

**Purpose:** Achieve and maintain an average annual spawner escapement of 1,100 wild adult winter steelhead. Run year specific estimates of summer and winter steelhead spawner escapements to the Hood River subbasin are summarized for the 1996 through - 2015 run years in Simpson et al. (2016).

The HRPP's numerical spawner escapement objectives are based on the prevailing hypothesis that subbasin spawner escapements are currently below the level needed to fully seed the subbasin, and that habitat improvement projects will significantly increase potential carrying capacity. Fishery managers consider the information required to reject or accept these hypothesis as critically important in refining the approach ultimately taken to implement the HRPP over the time frame of the Hood River Subbasin Plan (Coccoli 2004). The approach currently taken to achieve the HRPP's numerically defined spawner escapement objectives has been to 1) restrict harvest of unmarked summer and winter steelhead and 2) supplement the Hood River subbasin with Hood River stock hatchery winter steelhead.

The HRPP's existing M&E project is just beginning to collect the complete juvenile and adult life history information required to accept or reject **Hypothesis 1**. Maintaining and expanding on the existing data string is considered particularly important in light of the subbasin's anticipated response to 1) proposed changes in guidelines for implementing the hatchery supplementation component of the HRPP, 2) several large scale habitat improvement projects (i.e., both proposed and implemented), and 3) the de-commissioning and removal of Powerdale Dam.

**Null Hypothesis 1:** The Hood River subbasin's numerical spawner escapement objectives have not been achieved.

**Alternative 1:** The Hood River subbasin's numerical spawner escapement objectives have been achieved.

**Null Hypothesis 2:** Habitat improvement work conducted in the Hood River subbasin has significantly increased the subbasins spawner carrying capacity.

**Alternative 2:** Habitat improvement work conducted in the Hood River subbasin has not significantly increased the subbasins spawner carrying capacity.

**Timeline:** Ongoing

**Method:**

Adult wild and hatchery winter steelhead abundance was estimated a combination of mark-recapture and open survival models. All mark-recapture models refer to “adult weir facilities” as the second capture event.

*Adult Escapement to Bonneville Dam*

The primary model type used to establish adult returns to Bonneville Dam was the Lincoln-Petersen (with Chapman’s modification) mark-recapture model:

$$\hat{N} = \frac{(M + 1)(C + 1)}{(R + 1)}$$

where:

- $\hat{N}$  = estimated number of adults of species  $x$ , run type  $y$ , and origin  $z$  returning to Bonneville Dam
  - $M$  = previously PIT tagged species  $x$ , run type  $y$ , and origin  $z$  detected at the adult Bonneville Dam interrogation facilities as upstream migrants
  - $C$  = the total marked and unmarked species  $x$ , run type  $y$ , and origin  $z$  captured at the adult weir facilities within the Hood River basin
  - $R$  = the total number of recaptures within the second capture group ( $C$ )
- Variance of the estimate was calculated by:

$$var(\hat{N}) = [(M+1)(C+1)(M-R)(C-R)] / [(R+1)^2(R+2)]$$

This model was used to assess returns of wild and hatchery winter steelhead to Bonneville Dam. To accurately determine model parameter  $M$  for wild steelhead it was necessary to determine which steelhead with an unknown run type were likely to be winter-run or summer-run. Wild steelhead with an existing PIT tag that were detected at Bonneville Dam were classified as either winter, summer, or unknown run type during their initial mark/release event during the juvenile/smolt life stage. Native populations of both summer- and winter-run types occur with some degree of presumed spatial separation (i.e. winter steelhead occupy the East and Middle Fork Hood River whereas summer steelhead reside in the West Fork). Although geographic location of collection is used to assign run type during juvenile trapping events, the vast majority of steelhead smolts sampled each year are collected from the lower mainstem Hood River where geographic considerations are nullified and thus all steelhead are assigned an unknown run type. Adult steelhead with an unknown run type that are detected at Bonneville Dam are retrospectively classified as summer or winter-run if they are contacted at a Hood River adult collection weir, where run type is determined at the adult life stage. Steelhead of unknown run type that are detected at Bonneville Dam but are not recaptured at an adult collection weir are assigned to winter or summer-run based on a mixture probability model that was developed using a combination of BON interrogations and data records of adult steelhead captured at Powerdale Dam.

*Adult Escapement to the Mouth of the Hood River*

Estimations of adult escapement to the mouth of the Hood River were calculated using the aforementioned mark-recapture model to calculate total adult returns to Bonneville Dam, and then reducing that estimate by apparent survival parameter ( $\phi_1$ ), which was modeled with a CJS open population model (Figure 11.1.1a) using Program MARK (White and Burnham 1999).

The fundamental mark-recapture model that provides a closed population estimate to Bonneville Dam clearly violates the assumptions of closure, as deaths and straying are known to occur between Bonneville Dam and the Hood River adult collection weirs. To account for loss within the mainstem Columbia River (i.e. due to Zone 6 fisheries, potential strays that did not enter the Hood River, etc.), the apparent survival value  $\phi_1$  was applied to the model estimate. The result was reported as the actual number of adults escaping to Hood River weir collection facilities. Variance was calculated using the approximation method to calculate the variance of two products (Goodman 1960):

$$Var(xy) = (x^2 * Var(y)) + (y^2 * Var(x)) - (Var(x) * Var(y))$$

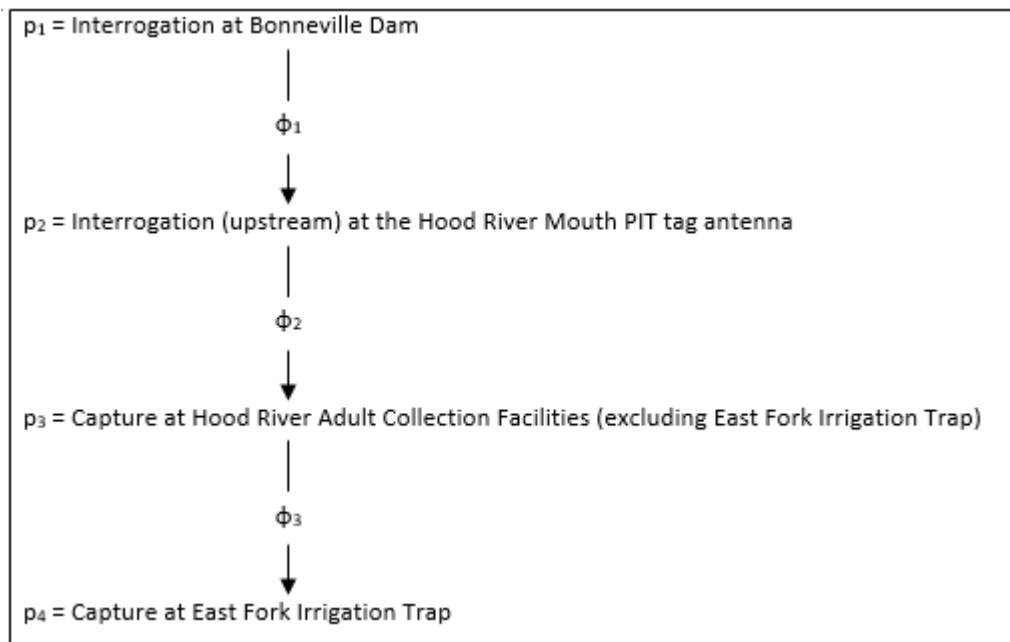


Figure 11.1.1a. Cormack-Jolly Seber open population model parameters apparent survival ( $\phi$ ) and recapture probability ( $p$ ) for adult wild and hatchery winter steelhead and hatchery spring Chinook.

Upstream movements were defined by directionality associated with detections at multiple individual antennas at the HRM, or time elapsed between the first HRM detection and the next interrogation at HRM or the Bonneville Dam Corner Collector. If elapsed time between the two detections was greater than 21 days, then it was assumed that the fish migrated into the basin and spawned without being intercepted at the Hood River adult collection weirs unless other PIT tag interrogations or recaptures indicated otherwise. Apparent survival of wild winter and summer steelhead were calculated using

the same model described in Figure 11.1.1a minus the capture-recapture occasion at the East Fork Irrigation trap (p4).

#### *Adult Escapement to Adult Collection Weirs and Weir Efficiency*

Escapement to the adult collection weirs was estimated by applying the survival estimate calculated by the CJS model to estimate escapement to the mouth of the Hood River, and then subtracting non-tribal harvest estimates (hatchery origin) or an assumed pre-spawn mortality of 10% (wild origin steelhead) (HDR|FishPro 2008). The remaining number of adults constituted the number of available spawners and was used to calculate p<sub>HOS</sub> (proportion of hatchery origin spawners) for winter steelhead after subtracting any fish collected for hatchery broodstock. Weir efficiency was estimated by CJS model detection probability parameter p<sub>3</sub>.

#### **Wild Steelhead Production in the Hood River Subbasin:**

**Objective:** Monitor smolt production of wild steelhead in the Hood River subbasin

**Metric:** Status and trend monitoring of steelhead smolt production in the Hood River subbasin.

**Purpose:** One objective of the HRPP is "**to increase production of wild summer and winter steelhead (*Oncorhynchus mykiss*) commensurate with the subbasins current carrying capacity**" (Coccoli 2004). This strategy is inextricably linked with the HRPP's numerical fish objectives for subbasin spawner escapement (*see Strategy 1*). Data collected under this strategy will provide the basis for estimating 1) smolt-to-adult survival rates for wild steelhead, 2) incidental catch of steelhead in spring fisheries below Bonneville Dam, and 3) steelhead harvest in the Bonneville Pool. The latter two parameters will be evaluated from returning PIT tagged adult steelhead. Information gathered from the continued monitoring of subbasin smolt production will be used to 1) further refine the HRPP's numerical fish objectives for spawner escapement (*see Strategy 1*) and 2) further refine the approach for implementing the HRPP's hatchery supplementation program. We attempted to ascertain underlying drivers of Hood River steelhead smolt population dynamics using a multiple linear regression model selection approach to determine which independent variables (dam removal, environmental, biological) were seemingly the greatest contributors to smolt production. We also initiated a process using existing PIT tag data to quantify hatchery residuals that survive overwinter and exhibit a freshwater age-2 outmigrant life history type. Additionally, we attempted to assess the ecological effects of residual hatchery steelhead on wild steelhead juveniles.

**Null Hypothesis:** Post-HRPP implementation smolt production is significantly greater than pre-project implementation.

**Alternative:** Post-HRPP implementation smolt production is not significantly greater than pre-project implementation.

**Timeline:** Ongoing

**Method:** Juvenile and downstream migrant steelhead were caught using a rotary screw trap (RST) at the following locations:

- Hood River mainstem, 2 traps (2.4m and 1.5m diameter cones, respectively)
- West Fork Hood River 2 traps (1.5m diameter cones)
- Middle Fork Hood River (1.5m diameter cone)
- East Fork Hood River (1.5m diameter cone)

A pooled Petersen estimate with Chapman's modification (Ricker 1975) was utilized to estimate numbers of downstream migrants, by species and size category, of wild and hatchery produced anadromous steelhead smolts migrating past each RST site:

$$\hat{N} = \frac{(M+1)(C+1)}{(R+1)}$$

- $\hat{N}$  = estimated number of downstream migrants passing the rotary-screw trap  
 $M$  = number of migrants marked and released above the rotary-screw trap  
 $C$  = total number of unmarked and marked migrants captured at the rotary-screw trap  
 $R$  = number of marked migrants recaptured at the rotary-screw trap

Approximate 95% confidence intervals (C.I.) were calculated as follows (Seber 1973, cited by Lindsay et al. 1986; Ott 1977):

$$95\% \text{ C.I.} = \hat{N} \pm 1.96 \sqrt{\text{var}(\hat{N})}$$

and

$$\text{var}(\hat{N}) = [(M+1)(C+1)(M-R)(C-R)] / [(R+1)^2(R+2)]$$

where

$\text{var}(\hat{N})$  = variance of estimated migrant abundance

Following initial capture and sampling, tagged fish were released upstream of the migrant trap as part of the mark release group ( $M$ ), where subsequent PIT tag interrogations were used to classify them as recaptures ( $R$ ) when collected with sampling group ( $C$ ). An estimate of total downstream migrant abundance at the mainstem RST site was generated using the pooled Petersen methodology. Semimonthly counts were not adjusted for seasonal variation in trap efficiency because recapture rates were typically too low to accurately estimate trap efficiency for all unique time periods where smolts were migrating through the Hood River subbasin. A Cormack Jolly-Seber (CJS) open population model was constructed using Program MARK (White and Burnham 1999) based on PIT tag mark-recapture histories where a minimum size criteria of  $FL \geq 150\text{mm}$  was used to estimate apparent survival of downstream migrant steelhead. Multiple regression models were constructed using several different predictor variables where the annual age 2 smolt

estimate was used as the response variable. Multiple linear regression models were evaluated using R package AICmodavg (version 3.1.2) and the best-fitting model was selected based on AIC criterion, however we excluded models with more than two flow variables to avoid collinear effects. To address the potential competition effects of hatchery residuals and wild steelhead during year  $y+1$ , we evaluated the proportion of “non-smolt” hatchery steelhead (<141mm FL) present during release year  $y$  relative to the number of wild steelhead smolts present during year  $y+1$ .

### **Smolt Outmigration Survival/Smolt to Adult Survival Estimates:**

**Objective:** Estimate survival of wild and hatchery steelhead smolts during outmigration as well as ocean survival.

**Metric:** Apparent survival ( $\phi$ ) of smolts to downstream of Bonneville Dam during outmigration. Smolt to adult survival may be calculated based on two different data types but ultimately is reported as the percentage of smolts given a specific outmigration year that survive to the adult life stage.

**Purpose:** Recovery and performance goals are frequently evaluated in terms of smolt-to-adult-return (SAR) rates (Carmichael and Taylor 2010). The SAR rate represents one of the most commonly used metrics to understand the relationships between within-basin productivity, ocean survival, and subsequent adult returns. It can be evaluated over time to better understand freshwater versus oceanic influences on annual adult returns when assessing abundance and productivity criteria. The Revised Master Plan for the Hood River Production Program (2008) SAR objectives (to be attained by 2018) for wild winter and summer steelhead are 7.0% and 5.0%, respectively. Accurately estimating survival during smolt outmigration is required to characterize true ocean survival.

**Null Hypothesis:** The Hood River subbasin's SAR objectives have not been achieved.

**Alternative:** The Hood River subbasin's SAR objectives have been achieved.

**Timeline:** Ongoing

**Methods:** A Cormack Jolly-Seber (CJS) open population model was constructed using Program MARK (White and Burnham 1999) based on PIT tag mark-recapture histories where a minimum size criteria of  $FL \geq 150\text{mm}$  was used to estimate apparent survival of downstream migrant rb-st (Figure 4). Data was retrieved from the PTAGIS database from the following sites:

#### **Recaptures**

- Within basin RST locations

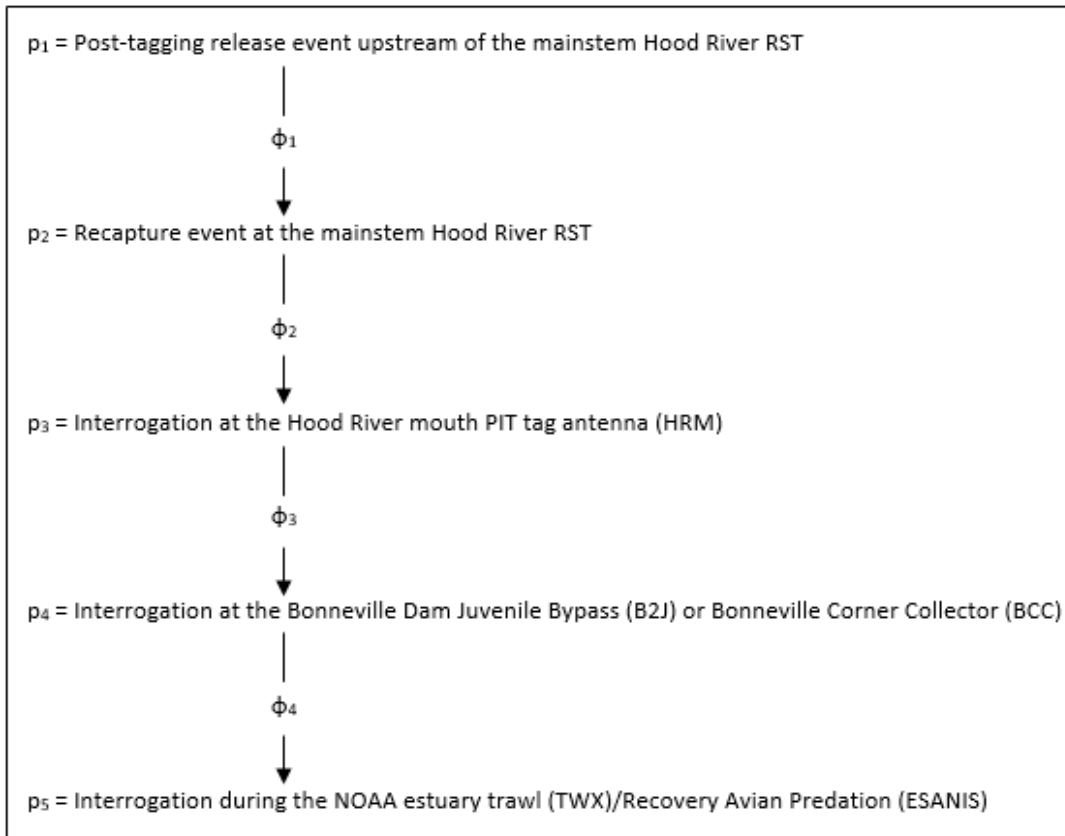
#### **Interrogations**

- HRM—Hood River Mouth PIT Tag Antenna
- B2J/BCC—Downstream migrant interrogation facilities at Bonneville Dam
- TWX—Estuary trawl survey
- BON—Up-stream migrant interrogation facilities at Bonneville Dam

#### **Recoveries**

- ESANIS—East Sand Island avian colony (or similar)

Individual covariates used in the model evaluation process included FL (mm) at tagging and mainstem Hood River flow (cfs) on the day of tagging and release. Capture histories for each individual were comprised of five sampling occasions, where  $p_i$  = sampling occasion  $i$ , and  $\phi_j$  = survival from interval  $p_i \rightarrow p_{i+1}$ :



**Figure 4.** Cormack-Jolly Seber open population model parameters apparent survival ( $\phi$ ) and recapture probability ( $p$ ) for wild rb-st ( $\geq 150$ mm FL).

Only time-varying models were selected for evaluation since capture histories were founded on occasions that vary spatially as well as temporally. Subsets of the time varying model using both individual covariates were evaluated for model selection purposes, although models with a likelihood of  $<0.01$  and models with confounded parameters were discarded. Based on corrected Akaike's Information Criterion (AICc) the simplest, best-fitting model was selected. The GIBBSIT sample size calculation was then applied (chains = 3) to determine the minimum number of samples required using the Markov Chain Monte Carlo (MCMC) estimation method, and then the MCMC estimation was repeated using the minimum number of required samples indicated by the GIBBSIT procedure.

Prior to the removal of Powerdale Dam in 2010, two measures of SAR rate were provided annually for wild steelhead:

- 1) A run-specific SAR based on brood year where run type of wild steelhead smolts was assigned retrospectively based on the proportion of winter/summer adults that returned from a specific brood class, and
- 2) A “total wild” SAR based on smolt migration year where summer and winter steelhead smolt and adult totals were combined

Both calculation methods required that winter and summer adult steelhead share an equal probability of capture—a non-issue when Powerdale Dam was present. Since the removal of the dam, adult sampling facilities have been relocated upstream to the river forks and are not operated year-round.

To calculate the contemporary SAR rate for hatchery and wild steelhead, two methods were tested:

- 1) PIT-tag SAR—the number of PIT-tagged adult returners relative to the total number of smolts that were PIT-tagged in a given outmigration year:

$$SAR_y = \frac{\sum_{SW_i}^{n} BON_{(PIT_y)}}{\sum PIT_y} \times 100$$

where:

$PIT_y$  = The total number of steelhead smolts PIT-tagged in the Hood River during year  $y$

$BON_{(PIT_y)}$  = The number of returning adult steelhead detected at Bonneville Dam adult upstream interrogation facilities originally tagged during year  $y$

$SW_i$  = saltwater age class  $i$

or

- 2) Run reconstruction SAR—the total number of adult returners categorized into a specific outmigration year (via scale analysis) relative to the respective estimated total of emigrating smolts.

$$SAR_y = \frac{\sum_{SW_i}^{n} R(M_y)}{J(M_y)} \times 100$$

where:

$J(M_y)$  = The estimated abundance of steelhead smolts during outmigration year  $y$

$R(M_y)$  = The number of returning adult steelhead from outmigration year  $y$   
 $SW_i$  = saltwater age class  $i$

Smolts were defined based on a size criteria where  $FL \geq 150\text{mm}$ . To determine the proportion of the hatchery release group that met smolt size criteria, a subsample of 400 fish were measured and weighed at the Oak Springs hatchery just prior to release.

**Non-Tribal Harvest for Hatchery Winter Steelhead:**

**Objective:** Estimate annual non-tribal harvest of hatchery winter steelhead

**Metric:** Run year specific estimates of non-tribal summer and winter steelhead harvest and exploitation rates in the Hood River subbasin are summarized for the 1996-2015 run years in Simpson et al. (2016). Angler origin and gear type is also recorded.

**Purpose:** Consumptive recreational fisheries currently harvest winter steelhead in the Hood River subbasin. These data will also provide fisheries managers with the tools required to more effectively evaluate options for allocating subbasin harvest opportunities in a manner that ensures the subbasin's numerical spawner escapement objectives are met. In addition to estimating harvest and exploitation rates in the mainstem Columbia River and the Hood River subbasin, creel surveys will be used to collect the biological information required to 1) evaluate the impact that subbasin fisheries have on selected life history patterns of returning wild, natural, and hatchery produced fish; 2) provide demographic information on non-tribal anglers.

In addition to providing data essential to evaluating harvest aspects of the hatchery winter steelhead program, the non-tribal harvest estimate is required to estimate the proportion of hatchery origin spawners (pHOS), and will ultimately determine what the proportion of natural origin broodstock (pNOB) is required to meet the HSRG proportion natural influence (PNI) guideline of 0.67.

**Null Hypothesis:** The Hood River subbasin's numerical harvest objectives have not been achieved.

**Alternative:** The Hood River subbasin's numerical harvest objectives have been achieved.

**Timeline:** Ongoing

**Methods:** Two levels of stratification (day type and weekly period) were used in evaluating the data. Estimates of catch, catch rate, and effort were determined for both strata. Sampling days were categorized as either a weekend-holiday or weekday and total catch was summarized by week. The total number of days sampled in any given sampling period ranged from 40-67% of the weekdays and 33-100% of the weekend-holiday days. Effort (i.e., total hours fished) for each sample day ( $H_i$ ) was estimated by calculating the mean pressure based on random samples of periodic pressure counts:

$$H_i = \frac{\sum_{k=1}^r [ (C_k) ]}{r}$$

where:

- r = number of pressure counts per day
- C<sub>k</sub> = angler count at the k<sup>th</sup> pressure count, where:
- angler count = total cars counted \* the average number of anglers per party

Pressure counts were conducted three times during the day. Times were determined randomly by dividing the sampling day into three equal length periods and conducting a pressure count at a random point within the first period. The remaining pressure counts were conducted 2.5 and 3.5 hours following the first count. The direction the surveyor traveled for the first pressure count was randomly selected. Subsequent pressure counts were generally made in the opposite direction of the previous count. Anglers were interviewed throughout the day to obtain catch rate information (fish caught/hour), where the catch rate on day *i* (R<sub>*i*</sub>) was estimated by:

$$R_i = \frac{\sum_{j=1}^{m_i} f_{ij}}{\sum_{j=1}^{m_i} h_{ij}}$$

where:

- m<sub>*i*</sub> = number of anglers interviewed on the *i*<sup>th</sup> day
- f<sub>*ij*</sub> = number of fish caught by the *j*<sup>th</sup> angler on the *i*<sup>th</sup> day
- h<sub>*ij*</sub> = number of hours fished by the *j*<sup>th</sup> angler on the *i*<sup>th</sup> day

Total daily catch in numbers of fish on day *i* (TC<sub>*i*</sub>) was estimated by:

$$TC_i = (R_i)(H_i)$$

Total catch for a given stratum (TC<sub>*s*</sub>) was estimated by:

$$TC_s = (N/n) \sum_{i=1}^n TC_i$$

where:

- N = number of days within a stratum
- n = number of days sampled within a stratum

Variance for the estimate of total catch in a given stratum [V(C<sub>s</sub>)] was estimated by (Su and Clapp 2013):

$$\hat{V}(\hat{C}_s) = \frac{(N^2)}{n} * \frac{\sum_{i=1}^n (TC_i - \overline{TC})^2}{n-1}$$

Semimonthly and annual estimates of total catch, and the variance associated with each estimate were determined for a given category of fish by summing the corresponding stratum estimates. Approximate 95% confidence intervals (C.I.), for a given category of fish, were calculated as follows:

$$95\% C.I. = TC \pm 1.96 \sqrt{\hat{V}(\hat{C}_s)}$$

**Fish Health Monitoring Plan:**

**11.1.2) Indicate whether funding, staffing, and other support logistics are available or committed to allow implementation of the monitoring and evaluation program.**

Although BPA funding for the Hood River Research Program (BPA project #1988-053-04) to monitor the sport harvest of hatchery winter steelhead has been in place since 1996, personnel time available to perform surveys has been reduced over the past five years due to increasing costs coupled with a flat funding rate throughout that period. Continued funding to monitor hatchery steelhead harvest may be at risk if the recent funding trend continues.

**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.**

*Juvenile Trapping*

Migrant traps are sampled daily to minimize mortality associated with trapping stress. Pre-smolt and smolt salmonids collected for bio-sampling are held in water oxygenated with a portable aerator when large numbers of downstream migrants are caught in the trap. The live box on the mainstem migrant trap was also modified from its original dimensions in order to further minimize stress-related mortality associated with the trapping of downstream migrants. The live box was enlarged by about 80%; a side compartment was added to provide some separation of migrants in the live box and to provide an area of reduced turbulence. The number of downstream migrant wild and hatchery steelhead and resident rainbow trout that are marked and released above the trap, to estimate recapture rates at the migrant traps, is limited to a relatively small percentage of the total number caught. This is done to minimize handling mortality.

*Adult Trapping*

Trapping facilities will be operated seven days a week to minimize holding stress, delay, potential for injury, or mortality. They are designed in a manner that minimizes stress-related mortality associated with the handling of fish for counting and bio sampling and complies with NOAA Fisheries and ODFW trap construction and operational guidelines. Fish released upstream from the trap will be released to calm holding water where they will be allowed to recover. On-site employees will guard against vandalism, or other contingencies, such as floods or equipment failures.

#### *Harvest Estimates*

The creel is conducted December – June to estimate harvest in the fishery located in the mainstem Hood River from the mouth to the confluence of the West Fork, and in the West Fork upstream to 200 feet below Punchbowl Falls. There are no risk aversion protocols associated with implementing the creel program.

## **SECTION 12. RESEARCH**

### **12.1) Objective or purpose.**

#### **Wild Steelhead Run Type Classification:**

Accurately reporting annual smolt abundance is critical from a Production Program appraisal standpoint, as recovery goals are frequently evaluated in terms of smolt-to-adult-return (SAR) rates (Carmichael and Taylor 2010). In order to equitably compare the performance of hatchery and wild winter steelhead SAR rates, tissue samples collected from wild steelhead smolts of unknown run type were submitted to the CRITFC Hagerman Genetics Laboratory (in cooperation with the CTWSRO) to identify the relative proportion of winter- and summer-run smolts for outmigrant years 2005 – 2014. The results will provide data necessary to produce a winter-run specific SAR rate for wild steelhead to compare with the SAR rate for hatchery winter steelhead.

#### **Residualism of Hatchery Winter Steelhead Smolts:**

Impacts to wild fish related to residualism have been raised as a concern by the ISRP Review of the Revised Hood River Production Master Plan (2008). To minimize residuals the program has released larger smolts (4 to 5 fpp) since 2013. To evaluate the assumption the larger smolts would result in low residuals NOAA researchers conducted a study of release years 2013-2015. Their results found that less 3% of the annual releases of the larger smolts residualized (Larsen, D.A., Middleton, M.A., Dickey, J.T., Gerstenberger, R.S., Brun, C.V., and Swanson, P. (in press). The use of morphological and physiological indices to characterize life history diversity in juvenile hatchery winter-run steelhead. Transactions of the American Fisheries Society).

#### **Maximum Entropy Modeling of Winter Steelhead Spawning Habitat:**

Currently, the spatial and temporal spawning patterns of winter steelhead are poorly understood but play a potentially critical role towards recovery of the wild population.

Radiotelemetry relocation data was used to provide the necessary input to model spawning distribution of winter steelhead throughout the Hood River subbasin. Spatial spawning patterns of winter steelhead in the Hood River were ascertained by employing the MaxEnt program (MaxEnt v3.3.3), which utilizes presence only records along with associated environmental and geographical attributes. MaxEnt uses relocation data to initiate the maximum entropy of a given area and then restricts the area using selected habitat variables, which in turn develops a distribution map displaying the probability of occurrence to be used as a surrogate for habitat suitability modeling (Phillips et al. 2006). This data was analyzed to provide a baseline understanding of spawning habitat use by adult winter steelhead.

**12.2) Cooperating and funding agencies.**

All research is performed in cooperation with the Confederated Tribes of Warm Springs Oregon, specifically the CTWSRO M&E Project (BPA Project #1988-053-03), and is 100% funded by BPA. ODFW BPA Project #1988-053-08 directly contributes to the operational aspects of the research.

**12.3) Principle investigator or project supervisor and staff.**

**Principle investigator**

**Name (and title):** Phil Simpson, Project Leader, Hood River Research Program  
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**Project Supervisor**

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**12.4) Status of stock, particularly the group affected by project, if different than the stock(s) described in Section 2.**

In 1998 the National Marine Fisheries Service (NMFS) listed Lower Columbia River steelhead as threatened under the Endangered Species Act (ESA), which includes Hood River winter- and summer-run types.

**12.5) Techniques: include capture methods, drugs, samples collected, tags applied.**

**Wild Steelhead Run Type Classification:**

Juvenile and downstream migrant salmonids were caught using a rotary screw trap (RST) at four different locations within the Hood River subbasin. Each RST was sampled on a daily basis and was generally conducted in the morning to minimize temperature related stress. All wild salmonids were transferred from the RST live box to aerated holding buckets or net pens where they were held at ambient water temperatures. A portion of the total catch (generally <10 individuals) was transferred to an anesthetic bath (MS-222, or Tricaine Methanesulfonate) and examined for fin and maxillary mark combinations. All fish were scanned for a Passive Integrated Transponder (PIT) tag, weighed to the nearest 0.1g, and measured (fork length (FL)) to the nearest millimeter. Any previously tagged recaptures were released downstream of the RST site. If no PIT tag was present and  $FL \geq 100\text{mm}$ , a 12.5mm pre-loaded PIT tag (Biomark HPT12 (134.2 kHz ISO FDXB)) was inserted into the abdominal cavity of the fish. Individuals where  $FL < 100\text{mm}$  generally did not receive a PIT tag but were weighed, measured, identified to species when feasible, then released downstream of the RST site. Scale samples collected from juvenile steelhead were placed directly on gum cards in the field, and fin clips were placed on Whatman paper and stored for future analysis. The procedure was repeated until all fish in holding buckets and/or net pens had been processed. All newly PIT tagged fish were released upstream of the RST site. A subsample of downstream migrant hatchery winter steelhead that were not previously PIT tagged prior to release from the acclimation area were PIT tagged (up to 30 per day; any additional hatchery captures were released below the trap site).

**Residualism of Hatchery Winter Steelhead Smolts:**

We examined recapture and interrogation records of hatchery winter steelhead that were previously PIT tagged within the parameters of current data collection protocols (see previous section), and then calculated the number of days that elapsed between the initial release date and subsequent PIT tag interrogations at rotary screw trap sites within the Hood River subbasin, at the Bonneville Dam juvenile bypass (B2J) or the Bonneville Dam Corner Collector (BCC), or PIT tag detections recorded by the NOAA estuary trawl survey (TWX). Based on the number of days elapsed between release and subsequent interrogation, we were able to discern temporal differences between true outmigrants and potential residuals that were detected in the spring of the year following ( $y+1$ ) the year of release ( $y$ ).

**Maximum Entropy Modeling of Winter Steelhead Spawning Habitat:**

ODFW Aquatic Inventory Project habitat data was converted to a raster format that would coincide with the spatial scale associated with the telemetry relocations using the maximum combined length method. The manual relocation data was then associated with habitat type, percent gravel, slope, and depth to identify specific habitat types that spawning winter steelhead and coho may select within the basin. Relocation data collected during 2013 – 2014 for radio-tagged winter steelhead was included in the model.

**12.6) Dates or time period in which research activity occurs.**

Virtually all tagging of steelhead smolts, both wild and hatchery, occurs annually during April – June. A small proportion of steelhead are PIT tagged during September – October. Radio tagging of adult winter steelhead occurred during December – April.

**12.7) Care and maintenance of live fish or eggs, holding duration, transport methods.**

Rotary screw traps were checked daily and generally during the morning hours to limit any potential holding and/or temperature stress. If the density of fish was too high to keep in aerated holding buckets, net pens were utilized where fish were held at ambient water temperatures. Holding duration in the RST live box is always less than 24 hours, and holding time in buckets or net pens is typically less than an hour.

**12.8) Expected type and effects of take and potential for injury or mortality.**

Mortalities related to RST and PIT tag methods do occur but in most cases are extremely limited. Predation within the RST live box is also a possibility, but typically capture and tagging related mortalities constitute 0.02% or less of the total capture group. Hooking mortality related to the capture and radiotagging of adult steelhead was a non-issue due to the high experience level of the anglers used to capture specimens.

**12.9) Level of take of listed fish: number or range of fish handled, injured, or killed by sex, age, or size, if not already indicated in Section 2.**

**Table 21.** Combined catch of rainbow-steelhead and hatchery summer and winter steelhead at migrant traps located in the Hood River sub-basin and total number of all mortalities. Data source: Unpublished data on 3/30/2017 from mid-Columbia District Research, ODFW, The Dalles, Oregon.

Year	Rainbow-steelhead			Hatchery Winter Steelhead			Hatchery Summer Steelhead		
	Number Caught	Mort. <sup>a</sup>	Percent Mort.	Number Caught	Mort.	Percent Mort.	Number Caught	Mort.	Percent Mort.
1994	6,231	54	0.87	2,881	94	3.26	1,821	250	13.7
1995	1,320	35	2.65	2,080	31	1.49	3,157	67	2.12
1996	1,406	35	2.49	3,942	15	0.38	5,348	109	2.04
1997	4,437	54	1.22	7,739	437	5.65	1,977	116	5.87
1998	4,495	119	2.65	3,419	119	3.48	19	1	5.26
1999	2,823	29	1.03	3,285	19	0.58	928	7	0.75
2000	6,184	59	0.95	5,006	39	0.78	3,151	17	0.54
2001	916	21	2.29	1,203	28	2.33	864	51	5.90
2002	1,336	15	1.12	2,989	130	4.35	1,823	14	0.77
2003	6,844	129	1.89	3,091	59	1.91	2,106	26	1.23
2004	5,318	89	1.67	5,688	133	2.34	1,796	118	6.57
2005	2,825	15	0.53	5,007	4	0.08	3,802	6	0.16
2006	2,323	7	0.30	2,699	10	0.37	1,815	13	0.72
2007	589	0	0	1,872	0	0	9	0	0
2008	1,154	5	.43	8,409		.06	--	--	--
2009	1,328	5	.38	4,489	4	.09	--	--	--
2010	2,213	14	.63	3,698	2	.05	--	--	--
2011	3,356	9	.27	4,036	7	.17	--	--	--
2012	2,857	13	0.46	1,188	8	0.67	--	--	--
2013	4,931	101	2.05	5,124	3,031	59.15	--	--	--
2014	3,401	6	0.18	9,846	2	0.02	--	--	--
2015	5,451	11	0.20	9,002	0	0	--	--	--

<sup>a</sup> Numbers include fish killed for genetic analysis and for samples requested by the Environmental Protection Agency.

**Table 22.** Disposition of adult winter steelhead collected adult fish traps at the Powerdale Fish Facility (1992-2010) and East Fork weir (2010-2015). Counts of wild and hatchery<sup>a</sup> adult winter steelhead may include mis-classified marked and unmarked summer steelhead, respectively. Origin (i.e., wild or hatchery) was determined based on a combination of scale analysis and mark combination. Data source: Olsen 2008. Unpublished data from the Hood River Research Program, ODFW, 8/12/2016. Santos et al. 2015

Spawn Year	Returns to Adult Trap		Broodstock collected		Number Recycled below Powerdale		Mortalities		Transfers <sup>c</sup>		Killed for Tribal Use	
	Wild	Hatchery	Wild	Hatchery	Wild <sup>d</sup>	Hatchery <sup>e</sup>	Wild	Hatchery <sup>f</sup>	Wild	Hatchery	Wild	Hatchery
1992	697	320	70 (3)	35	0	0	9	1	--	--	--	0
1993	415	236	57 (4)	1	4	222	9	3	--	--	--	0
1994	404	176	78 (3)	1 (1)	13	167 (1)	13	3	--	--	--	0
1995	206	111	42	1	2	98 (1)	1	7	--	--	--	0
1996	279	280	65 (6)	24 (1)	1	88 (1)	3	7	--	--	--	0
1997	290	639	46 (9)	37 (6)	3	308 (6)	3	42	--	--	--	0
1998	227	393	39 (9)	41 (13)	4	152 (10) <sup>g</sup>	2	26	--	--	--	0
1999	298	324	41 (1)	35	1	82 (3)	1	19	--	--	--	0
2000	921	302	47	47 (1)	5	21 (1)	4	10	--	--	--	0
2001	1,015	952	130	4	5	287	3	5	--	--	--	0
2002	1,059	1,192	74 (19)	1	26	344 (8)	9	164	--	--	--	0
2003	745	597	66 (15)	3 (2)	23	177	2	5	--	--	--	0
2004	597	1,039	73 (2)	8 (7)	17	452 (65)	0	9	--	--	--	0

2005	345	558	55 (2)	18 (8)	14 (1)	288 (23)	3	6	--	--	--	0
2006	460	906	109	44 (1)	5	555 (15)	4	8	--	--	--	0
2007	476	473	54 (1)	5	2	97 (14)	0	6	--	1	--	0
2008	340	194	82	-	0	0			--	0	--	0
2009	216	397	46	0	0	0			--	0	--	0
2010	667	1,818	99	-	0	0			--	0	--	0
2011	314	320	43	0	0	0	0	1	--	163	--	86
2012	685	445	32	75	0	0	0	1	--	319	--	50
2013	344	288	35 (1)	31	0	0	3	1	--	218	--	38
2014	190	29	15	2	0	0	0	2	--	16	--	9
2015	1275	204	42	26	0	0	0	4	--	156	--	18

<sup>a</sup> Subbasin hatchery winter steelhead returning in the 1991-1992 run year were entirely from the Big Creek stock of hatchery winter steelhead. Subbasin hatchery winter steelhead returning in the 1992-1993 through 1994-1995 were from either the Big Creek, Mixed, or Hood River stocks of hatchery winter steelhead. Subbasin hatchery winter steelhead returning in the 1995-1996 run year, and in all subsequent run years, were entirely from the Hood River stock of hatchery winter steelhead.

<sup>b</sup> Pre-spawning mortalities are included in the totals and listed in parenthesis.

<sup>c</sup> Transferred fish were either taken to Kingsley Reservoir, Bikini Pond and Taylor Lake dependent on road access and water temperatures.

<sup>d</sup> Numbers include both unmarked (i.e., with a deformed dorsal fin) and marked adults that were visually identified as a hatchery adult at Powerdale Dam and later classified as a wild adult based on scale analysis.

<sup>e</sup> Recycled adults returning more than three times to Powerdale Dam may be euthanized (i.e., depending on the condition of the fish) or transferred to either Kingsley Reservoir or Taylor Lake. The total number of adults falling into either of these three categories are summarized in parenthesis and included in the total number of recycled fish. Winter steelhead were first transferred to Kingsley Reservoir on 27 April, 2004 and to Taylor Lake on 18 March, 2004. A limited number of euthanized adults were given to Oregon's Environmental Protection Agency for a pesticide study. Adults used in the pesticide study were collected from 23 March, 1998 through 15 April, 1998.

<sup>f</sup> Numbers include adult winter steelhead sacrificed for coded wire tags.

<sup>g</sup> Number was adjusted for winter steelhead that were recycled and subsequently passed above Powerdale Dam upon return to the adult collection facility.

**Table 23.** Expected levels of takes for radio tagging steelhead on the Hood River.

Species	Listing Unit	Production	Life	Expected	Indirect	Take Action	Observe/	Procedure	Run
	or Stock	or Origin	Stage	Take	Mortality		Collect Method		
Steelhead	Lower Columbia River (NMFS Threatened)	Natural	Adult	30	1	Capture/Mark, Tag, Sample Tissue/Release Live Animal	Hook and line/angler/rod and reel	Anesthetize ; Tag,PIT; Tag, Radio (Internal); Tissue Sample Fin or Opercle; Tissue Sample Scale	Mixed
Steelhead	Lower Columbia River (NMFS Threatened)	Listed Hatchery Adipose Clip	Adult	20	1	Capture/Mark, Tag, Sample Tissue/Release Live Animal	Hook and line/angler/rod and reel	Anesthetize ; Tag,PIT; Tag, Radio (Internal); Tissue Sample Fin or Opercle; Tissue Sample Scale	Winter
Steelhead	Lower Columbia River (NMFS Threatened)	Natural	Adult	10	1	Capture/Handle/Release Fish	Hook and line/angler/rod and reel	Anesthetize	Mixed
Steelhead	Lower Columbia River (NMFS Threatened)	Listed Hatchery Adipose Clip	Adult	10	1	Capture/Handle/Release Fish	Hook and line/angler/rod and reel	Anesthetize	Winter

**12.10) Alternative methods to achieve project objectives.**

There are no viable alternatives that currently exist to individually genotype steelhead smolts in order to determine run proportion. Utilizing adult return data, where run type could be identified with some degree of certainty, of previously PIT tagged steelhead to estimate run-type proportion of out-migrant classes is not robust enough to make generalizations. Additionally, doing so would assume SAR rates are the same for both summer- and winter-run fish, and would assume all determinations of run type at the adult life stage are accurate.

Radiotagging adult steelhead to model spawning distribution could only be replaced using methods that have proven to be ineffective in a highly volatile, low visibility watershed such as the Hood River. While other data sources, such as spawning survey data or underwater sonar (i.e. DIDSON) data may be used to feed the MaxEnt model, neither is feasible to regularly collect in the Hood River.

**12.11) List species similar or related to the threatened species; provide number and causes of mortality related to this research project.**

Other species present in the Hood River that are occasionally encountered during the aforementioned data collection activities are coho salmon, fall and spring Chinook salmon, bull trout, cutthroat trout, and Pacific lamprey. Coho, fall Chinook and bull trout are all listed as “threatened” under the ESA but are rarely encountered.

**12.12) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse ecological effects, injury, or mortality to listed fish as a result of the proposed research activities.**

Temperature standards (18°C) are adhered to closely and rarely encountered during April – June field sampling. All field staff are either experienced in fish handling protocols and any new personnel are fully trained prior to handling any ESA-listed species. As previously mentioned, RST’s are checked daily and in the morning to minimize holding and temperature stress. All fish are held at acceptable densities in holding buckets and if densities are too high, net pens are utilized as an alternative.

## **SECTION 13. ATTACHMENTS AND CITATIONS**

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**SECTION 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY**

"I hereby certify that the foregoing information 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 and Title of Applicant: Bruce Eddy, Regional Manager, East Region, ODFW

Signature of Applicant: Bruce Eddy Date: 5/4/17

