Section 10 Direct Take Permit Application

A. Title: **Application for Permit for Scientific Purposes and to Enhance the Propagation or Survival of Listed Species Under the Endangered Species Act of 1973**.

Project Name: **Upper Columbia River Spring Chinook Salmon White River Supplementation Program**

B. Species: **Spring Chinook Salmon (*Oncorhynchus tshawytscha*)**

C. Date: **August 21, 2006**

D. Applicants:

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E. Project Description, Purpose, and Significance:

The purpose of this program is to prevent the extinction of, conserve, and ultimately restore the naturally spawning White River spring Chinook salmon spawning aggregate which is part of the Wenatchee population within the upper Columbia River (UCR) basin.

1. Justification of the project's objectives and how will the listed species benefit from the proposed activities

The UCR spring Chinook salmon *Oncorhynchus tshawytscha* Evolutionarily Significant Unit (ESU) was listed as an endangered species on March 24, 1999 (64 FR 14307) and the endangered status was reaffirmed on June 28, 2005 (70 FR 37160). Progeny derived from the UCR spring Chinook ESU, even when artificially propagated, remain listed under the ESA (April 5, 1993, 58 FR 17573). The UCR spring Chinook salmon ESU has three remaining populations which are found in the Methow, the Entiat, and the Wenatchee basins. The Interior Columbia River Technical Recovery Team (ICTRT), which is made up of technical experts from state, federal, and tribal agencies, has determined the Wenatchee population is comprised of five primary spawning aggregates: Chiwawa, Little Wenatchee, upper Wenatchee, White River, and Nason Creek. The ICTRT believes that spatial and genetic diversity in the Wenatchee population is important to the long-term recovery of the Wenatchee population and the ESU as a whole.

The permit application requests authorization under the ESA for a period of three years in order to carry out activities necessary for the immediate implementation and support of the White River spawning aggregate of the Wenatchee spring Chinook population in a manner that is consistent with the TRT's recommendations.

These activities are;

1. Collect up to 1,500 eggs or fry of White River stock annually
2. Rear collected eggs and fry (F_1 generation) in a hatchery facility to adult
3. Artificially spawn the mature adult broodstock at a hatchery facility
4. Rear the resultant progeny (F_2 generation) to a yearling smolt stage
5. Acclimate and release F_2 generation into the White River
6. Monitor juveniles released from the program and the naturally produced fish in the White River
7. Monitor the adult returns from the program and naturally produced fish in the White River

A long-term plan in the form of a Hatchery and Genetics Management Plan (HGMP) for the program is under development by Grant PUD, the WDFW, the YN and other federal and tribal resource managers. When the HGMP is completed it will be evaluated under the ESA and National Environmental Policy Act (NEPA) as required by law.

The White River spring Chinook salmon spawning aggregate is severely depressed and persistently experiences escapement levels below critical population thresholds. The White River aggregate is one of the most genetically unique among those spawning in tributaries within the UCR spring-run Chinook Salmon ESU. This program is designed to increase the number of White River spring Chinook salmon spawners in the natural environment while maintaining the spatial and genetic diversity of the Wenatchee population.

Specifically, in the short-term the proposed supplementation program will use captive broodstock techniques and technologies to provide a survival advantage to a portion of eggs or fry collected from the White River. These eggs or fry would be reared in captivity to the adult stage and spawned in the hatchery environment. The resultant progeny (F_2 generation) would be reared at a hatchery facility to a yearling smolt stage, acclimated to the White River water and released into the White River or from net pens at the mouth of the White River.

The rapid amplification gained through survival efficiencies while in the hatchery environment is intended to result in a greater quantity of spring Chinook salmon adults returning to the White River for natural spawning. The program release target would be 150,000 yearling smolts annually. This production level is projected to result in an estimated sustained return (escapement) to the White River of 450 adults.

2. Statement as to whether or not the proposed project or program responds directly or indirectly to a Federal agency recommendation or requirement

This program has been incorporated into the mitigation responsibilities of Grant PUD in a Biological Opinion in May 2004 by NMFS (NMFS 2004) on the operation of the Priest Rapids Hydroelectric Project. Subsequent to NMFS' issuance of the Biological Opinion on the Interim Protection Plan for Operation of the Priest Rapids Hydroelectric Project FERC Project No. 2114, the FERC issued an order amending Grant PUD's license that included implementation of the Interim Protection Plan and other related actions on December 16, 2004.

3. Statement of whether or not the proposed project has broader significance then the individual project's goals, or is part of a larger scale research management or restoration plan.

Preservation and recovery of the White River spawning aggregate does have broader significance. Growth rates of the Wenatchee River UCR spring Chinook salmon population have shown a negative decline (see H.1. Spring Chinook). As part of the Wenatchee River population, the White River spring Chinook spawning aggregate is severely depressed and persistently experiences escapement levels below critical population thresholds (see H.1. Spring Chinook Salmon).

The project is consistent with the TRT guidance regarding viable salmonid populations (VSP), which is the framework of four criteria: abundance, diversity, productivity, spatial structure by which the recovery of UCR spring Chinook salmon will be evaluated. This program is consistent with basin-wide salmon recovery efforts which as stated in the Draft Upper Columbia River Salmon Recovery Plan (UCSRB 2006) include the use of hatchery programs "*to propagate locally derived stock consistent with low to moderate risk VSP criteria for major spawning areas in the Wenatchee basin.*"

4. Description of any relationships or similarities of proposed activities to other proposed or ongoing projects and programs and whether the potential exists to cooperate and coordinate with other similar studies or activities.
This program is similar to other supplementation programs in the Wenatchee and Methow basins in that the objective is to increase the abundance of locally derived stocks consistent with salmon recovery objectives.

The program monitoring activities are done in cooperation with similar activities in the basin, including hatchery programs funded by other entities, including those programs operated as part of three Habitat Conservation Plans (HCPs).

5. Justification for using listed species in the study or activities, and discuss possible alternatives to using listed species.
As previously discussed, the White River spawning aggregate is an important component of the Wenatchee population in terms of spatial structure and diversity, two of the four VSP criteria discussed above which will be considered in evaluating the recovery of the UCR spring Chinook salmon ESU. No alternatives are available.

F. Information on Personnel, Cooperators, and Sponsors

1. **Principal Investigators (responsible for the project and compliance with the permit conditions)**
   Chris Carlson, Senior Biologist, Grant PUD, **ccarlso@gcpud.org,** (509) 754-5293, resume attached.

   Andrew Murdoch, Fish and Wildlife Biologist 4, WDFW, **murdoarm@dfw.wa.gov**, (509) 664-3148, resume attached.

   Keely Murdoch, Fish Biologist, YN, **keely@mid-columbia-coho.net**, (509) 548-2206, resume attached.

   Kirk Truscott, Fish and Wildlife Biologist 3, WDFW, **trusckdt@dfw.wa.gov**, (509) 664-1227, resume attached.

   Others may be determined later.

2. **Field Personnel**
   Marc Babiar, WDFW
   Andrew Murdoch, WDFW
   John Penny, WDFW
   Rick Stilwater, WDFW
   Mike Tonseth, WDFW
   Art Viola, WDFW
   Keely Murdoch, YN
   Scott Prevatte, YN

Chris Carlson, Grant PUD
Eric Lauver, Grant PUD
Greg Hudson, AquaSeed Corp.
Jim Terry, AquaSeed Corp.
Others to be determined

3. Name, Title, Agency, Phone, other Contact Info of all sponsors and cooperating institutions.

David Carie, Fisheries Management Biologist, US Fish and Wildlife Service, (509) 548-7573, Administration of the Endangered Species Act and member of the Priest Rapids Coordinating Committee

Speros Doulos, Complex Manager, US Fish and Wildlife Service, (509) 538-2755, Little White Salmon/Willard National Fish Hatchery

Greg Hudson, Vice President Operations, AquaSeed Corporation, (360) 273-9491, Captive broodstock rearing and spawning operations; contractor to Grant PUD

Tom Dresser, Fish, Wildlife & Water Quality Manager, Fisheries Scientist, Grant PUD, 509-797-5182, Priest Rapids Coordinating Committee member

Russell Langshaw, Fisheries Scientist, Grant PUD, (509) 793-1444, Priest Rapids Coordinating Committee member

Jerry Marco, Fish Biologist, Colville Confederated Tribes, (509) 634-2114, Co-manager and Priest Rapids Coordinating Committee member

Carl Merkle, Salmon Recovery Policy Analyst, Confederated Tribes and Bands of the Umatilla Indian Reservation, (541) 276-3165, Co-manager and Priest Rapids Coordinating Committee member

Andrew Murdoch, Fish and Wildlife Biologist 4, WDFW, (509) 664-3148, Technical operations, contractor to Grant PUD

Kristine Petersen, Fishery Biologist, National Marine Fisheries Service, (503) 230-5409, Administration of the Endangered Species Act and member of the Priest Rapids Coordinating Committee

Tom Scribner, Production Enhancement Manager, YN, (503) 331-9850, Co-manager and Priest Rapids Coordinating Committee member

Kirk Truscott, Fish Biologist, WDFW, (509) 664-3148, Co-manager and Priest Rapids Coordinating Committee member

4. Contractor Activities – provide statement that a qualified member of each permit holding entity will supervise or observe the taking include copy of the contract.

The co-permit holders will work together to ensure that all contractors will follow the operational guidelines as stated in this application and all conditions specified in the ESA permit.

5. Description of the disposition of species remains.

During the spawning process, kidney and spleen tissue from each female is sampled by a fish health expert to screen for pathogens, specifically bacterial kidney disease (BKD). Additionally, ovarian fluid is also collected and submitted to the WDFW Fish

Health Laboratory or the USFWS Lower Columbia River Fish Health Center for viral screening. Remains are disposed into a municipal sewage system or delivered to a municipal refuse site. Sperm from representative families are cryopreserved and stored in a long-term holding facility (Pilchuck Veterinary Hospital, Snohomish, WA).

Juvenile and adult carcasses resulting from out-of-basin operations are assessed for cause of death, frozen and delivered to a municipal refuse site. Carcasses resulting from the adult-based supplementation phase of the project will follow standard disposition protocols, which may include distribution into the stream of origin for nutrient enhancement.

Adult carcasses sampled during White River carcass surveys will be left at the location they were found. Tissue samples collected for analysis will be transported to the appropriate laboratories and disposed of into a municipal sewage system or delivered to a municipal refuse site as needed.

6. **For transport and long-term holding of listed species provide the qualifications and experience of all staff responsible for care without supervision**
All transportation and long-term holding of White River spring Chinook salmon will be done by staff with extensive experience and training in such activities. The field staff and cooperators listed above (sections F.1 and 2 and attached resumes) are specialists in operating hatchery facilities and in the monitoring activities proposed.

G. Project Methodology:

1. Proposed project or program duration and times specific activities will occur
This permit application is requesting ESA authorization for activities expected to occur within the next three years. At this time, discussions are ongoing among the permit applicants, cooperating entities and other interested parties regarding the long-term plan for this program. This long-term plan will be in the form of an HGMP that is under development and will include input from the public. The activities proposed under this permit application are interim measures and involve take of ESA-listed species that will occur between 2006 and 2009. Subsequent to this permit application, the permit holders will submit for ESA authorization, an HGMP for long-term implementation of the White River supplementation program.

2. Discuss procedures and techniques which will be used during the project.
Hatchery facilities expected to be used for the program are Domsea, a privately owned hatchery facility near Rochester, Washington a subsidiary of AquaSeed Corporation; Little White Salmon National Fish Hatchery (NFH) operated by the USFWS; and Eastbank Hatchery owned by Public Utility District No. 1 of Chelan County (Chelan PUD), operated by the WDFW. Other facilities operated by the USFWS, the WDFW, or other entity may be used to carry out the program; any such facility would have to meet or exceed the best management practices used by the facilities identified above.

Collection of eggs or fry for Broodstock (F$_1$)
Eggs or fry would be collected from naturally deposited redds in the White River. Approximately 1,100 – 3,100 eggs or fry would be collected from up to 50 redds using standard hydraulic sampling methods during the period from September through November. This is the first generation or F_1 generation.

A range of the number of egg or fry needed for the program is necessary because spring Chinook salmon from hatchery programs outside the White River have been documented to stray into the White River. The eggs or fry collected may need to be analyzed using microsatellite genetic assessment techniques to ensure the fish retained for broodstock are White River stock. Fish determined to be from other hatchery programs will not be retained for this program.

Rearing of Broodstock to Adult
Eggs or fry collected for broodstock (F_1 generation) would be retained at a hatchery and reared to maturity. Individual family groups would be segregated until fish are large enough to receive unique marks/tags to identify each family. Each fish would receive a Passive Integrated Transponder (PIT) tag for identification of each individual. Additionally, members of each family will receive a unique coded wire tag in the adipose fin tissue as a backup identifier to minimize the risk of within family matings during spawning. After marking/tagging the families would be combined into larger rearing groups for continued rearing.

Fish rearing would follow best management practices for UCR basin spring Chinook salmon hatchery programs. These protocols set guidelines on rearing temperature, density, feed size and quality, and health monitoring.

Spawning of Broodstock
Supplementation program broodstock spawning takes place as fish become ripe (usually weekly) in August and September at the Domsea facility. Hatchery personnel separate the maturing fish in the weeks prior to spawning. Fish are identified by the PIT-tag and a mating protocol is developed based on the family origin of the mature fish.

Matings consisting of a 2 x 2 or greater factorial scheme with two or more females mated with two or more males. Sibling crosses are avoided to the extent possible. All spawned adults are killed during the spawning process using standard hatchery practices and following sanitation procedures recommended by IHOT (1995). Milt is checked by microscope to ensure adequate sperm motility.

Each female spawned is sampled for disease, eggs are water hardened in buffered iodophore disinfectant, and incubated separately. For 2006, fish are to be spawned at the Domsea Hatchery and the gametes transported green or as eyed-eggs (dependent upon chilled incubation capacity at Domsea) to the Little White Salmon NFH for incubation and to await results of health screening.

Rearing of Progeny from Broodstock (F_2 Generation)

The resultant eggs are incubated and reared following best management practices for spring Chinook salmon hatchery programs in the UCR basin. These protocols set guidelines on rearing temperature, density, feed size and quality, and health monitoring.

All fish would be externally marked or internally tagged for future identification. A portion of the fish would receive PIT-tags in order to passively monitor them after release at dams on the Columbia River that are already equipped with PIT tag detectors.

Acclimation and Release of F_2 Generation

Acclimation facilities may include portable tanks, direct release as pre-smolts, use of net pens, and ponds. With the exception of direct releases, a minimum of four to eight weeks of rearing and acclimation on White River water would be provided prior to release. Transfers to portable temporary tanks, and or those juveniles released as pre-smolts would occur in mid-March to early April. Fish would be released from acclimation facilities in late April and early May. A portion of each brood year may be released as fry or parr. Best fish culture practices for UCR basin spring Chinook salmon would be used during fish transport, acclimation and release.

Juvenile Emigration Monitoring

Monitoring of fish released from the program and of naturally produced spring Chinook salmon in the White River would be done using a five-foot diameter rotary screw trap, measuring approximately 23 feet long and 9 feet wide. The trap location is expected to be in the White River near the Sears Creek Bridge. Repositioning the trap may be required to meet flow and trapping criteria. The trap would be operated following the protocols developed by Murdoch et al. (2005) and standardized by all other similar rotary screw traps operating in the UCR basin. Trapping would occur each year from March 1 to November 30 as conditions allow. To establish a baseline of migration timing the trap may operate 24 hours a day initially, but it is likely the trap would operate only at night once the baseline data is collected. The trap would be checked once per day in the morning or more often as needed due to debris and fish movement. All fish would be removed from the live box and placed into an anesthetic solution of MS-222. The fish would be enumerated by species, degree of smoltification for anadromous species (i.e. parr, transitional, or smolt), and life stage (e.g. fry, juvenile or adult) for non-anadromous species. All fish would be examined for external marks resulting from trap efficiency trials and recorded as recaptures.

Consistent with standard juvenile monitoring projects in the UCR basin, the first 25 individuals of each species would be measured (fork length) to the nearest millimeter and weighed to the nearest tenth of a gram. Scale samples would be taken from a representative random sample of species with multiple age-class emigrants (e.g.

steelhead). All fish would be allowed to recover in fresh water prior to release into calm water downstream of the trap.

Mark-recapture efficiency trials would be conducted for target species throughout the trapping season to develop a discharge-trap efficiency linear regression model to estimate daily trap efficiency at the largest range of discharge possible. A locked auxiliary live box is securely attached to the trapping facility for holding fish to be marked to conduct efficiency trials. Ideally, no less than 100 fish are to be used per trial, however smaller groups may be released dependent upon fish availability. Parr and smolt trials may be differentiated by using alternating upper or lower caudal fin clips. Caudal fin clips may be retained for genetic analysis. Fry may be marked with dye as an alternative to fin clipping. All fish marked for efficiency trials would be held in live pens with flowing freshwater for at least eight (8) hours, after which they would be transported to a release site at least 1 km upstream of the trap. When possible the fish would be released across the width of the river or equally along each bank in pools or areas of calm water.

Nighttime efficiency trials will be conducted after sunset, with daytime efficiency trials after sunrise. The following assumptions should be valid for all mark-recapture trials: all marked fish passed the trap or were recaptured during the time period, the probability of capturing a marked or unmarked fish is equal, all marked fish recaptured were identified, and the population is not added to nor subtracted from between the time of marking or release and recapture. Estimates will be made on the daily migration population, the variance of the total daily number of fish migrating past the trap, the total emigration population with a 95% confidence interval.

Adult Monitoring Activities
The spawning aggregate in the White River would be monitored using standard redd count techniques. This includes experienced surveyors walk in the river or along the banks looking for redds, spawning fish or dead carcasses. Surveys would occur weekly from August through late September. Information that may be collected includes the abundance and location and distribution of redds as well as origin of adults, to the extent feasible. Biological data from individual carcasses would include fish length, determination of the sex, tissue samples for genetic analysis, and scale samples. Carcasses would be examined for external marks and internal tags. If the carcass received a coded-wire tag the head or tissue containing the tag would be collected so the tag could be retrieved and de-coded.

3. Discuss possible alternatives to using the proposed methods.
The co-managers (NMFS, WDFW, USFWS, YN, Colville Confederated Tribes, Confederated Tribes of the Umatilla Indian Reservation, and Chelan, Douglas, and Grant PUDs) concluded in the "Biological Assessment and Management Plan: Mid-Columbia River Hatchery Program" (BAMP 1998) that many populations are at high risk for extinction, and artificial propagation is essential for recovery. For the White River population, other alternatives considered by the co-managers were not adequate to avoid

the immediate risk of extinction. One of several significant mortality factors facing this stock is passage mortality experienced while passing through mainstem hydropower facilities during their downstream smolt migration. Passage improvements to hydropower facilities have been underway for decades. However, even when passage protection is maximized there will still be a level of mortality that is expected to require continued artificial propagation.

4. Discuss potential for injury or mortality to the species involved, and the steps that will be taken to minimize adverse effects and to ensure that the species will be taken in a humane manner.

Broodstock Collection: Some injury or mortality may occur during egg extraction for F_1 broodstock collection. Although we do not have empirical data regarding mortality of eggs remaining within the redd after some eggs are extracted, a similar program has not observed any reduction in natural production in areas where eggs or fry are collected. We conservatively assume mortality of remaining eggs would be less than 2% of the eggs extracted (see section H.3). Genetic loss to the White River aggregate would be minimized by collecting a relatively small number of eggs, approximately 135 (range 100-150) compared to the total number of eggs produced by one female (range 3,900-4,500). Additionally, activities would be timed such that eyed-eggs could be collected whenever possible, because this is one of the most durable life stages.

Adverse redd impact is minimized by hydraulic sampling beginning at the most downstream point of the redd's tailspill and progressing upstream toward the pit. Each redd is sampled carefully until the first egg is collected and the developmental stage is verified as eyed. Eyed-eggs hydraulically floated to the surface are collected in a large basket, removed by small hand dip net and placed between wet circular sponges in a small bucket. They are placed into coolers on ice and transported to a hatchery facility. At the hatchery, the eggs are disinfected with iodophore and placed in isolated incubation trays and identified by individual families. The eggs, alevins and fry would be transported to the Domsea Hatchery in egg tubes, or for hatched eggs, in heavy duty freezer bags partially filled with water and inflated with oxygen and placed on a layer of insulation over ice within a cooler.

Fish Rearing: All facilities involved in this program adhere to best management practices for UCR basin spring Chinook salmon hatchery programs. These include guidelines for water temperature and quality, low rearing densities, high quality food, and regular health monitoring that include preventative treatment for common diseases (such as BKD).

As described above, two generations of fish would be reared. The F_1 generation are collected from redds which are then reared to adulthood and the F_2 generation reared to a yearling stage for release back into the White River as smolts. Mortality throughout rearing for both generations is expected and is influenced by disease vectors (primarily BKD) and stressors related to rearing in a hatchery environment. Overall mortality during the rearing period would be minimized through the following actions: (1) Fish would be raised in vessels supplied with pathogen free water; (2) All rearing tanks are covered by a building or bird netting with ambient light to mimic natural conditions to reduce fish stress; (3) Each family within each stock and broodyear is divided and reared in two locations to provide biosecurity and reduce the risk of catastrophic loss; (4) Handling of broodstock is done only when necessary (i.e., split groups, inoculation, sorting for spawning) to minimize stress; (5) A WDFW or USFWS fish health inspector completes at least monthly inspections of live and dead fish and prescribes as needed medications and procedures.

Other steps taken to diminish potential fish injury or loss at hatchery facilities include: (1) using highly trained staff in raising fish; (2) use of disinfectant foot baths and/or equipment disinfection between use on different lots of fish; (3) backup generators for an alternate source of power during outages; (4) redundant alarm systems installed and operating to detect loss of or reduced flow and reduced operating head in each vessel; (5) rearing densities kept at minimum levels to reduce loss of fish to disease and reduce stress levels.

<u>Juvenile Monitoring</u>: Injury to juvenile spring Chinook salmon, juvenile steelhead and juvenile and adult bull trout may occur through trapping/handling and marking procedures. Primary injury and mortality events are associated with debris accumulation in the live-box, reaction to anesthesia, handling stress, over-crowding in the live-box, predation in the live-box and increased predation post release. Injury and mortality influences associated with debris, handling stress, over-crowding and within live-box predation would be minimized through diligent trap attendance (trap will be checked at a minimum of once a day in the morning or more often as needed to address debris, fish movement and species composition in the live-box). Injury and mortality associated with handling stress, anesthetizing and post release predation would be address by applying MS-222 to all fish handled and providing full recovery for fish prior to release.

<u>Adult Monitoring</u>: No injury or mortalities are expected during the White River adult carcass and spawning ground surveys. Biological data and samples will be taken from only deceased spawned out fish. Field staff will minimize disturbance to any spawning spring Chinook salmon by identifying spawning sites and using a land route around their location.

H. Description and Estimates of Take:

1. Describe the recent status and trends of each ESU/species proposed to be taken (include citations)

Spring Chinook Salmon

The White River spring Chinook salmon spawning aggregate is severely depressed and persistently experiences escapement levels below critical population thresholds. Meyers et al. (1998) reported geometric mean escapement of 25 spawning adults between 1990 and 1994 with a negative short-term population abundance trend of –35.95 and negative long-term trend of –10.6%. More recently, the West Coast Salmon Biological Review Team (WCSBRT 2003) reported a continued negative short-term abundance trend with a 1997-2001 abundance trend of -6.6% and geometric mean of nine redds.

The White River spawning aggregate is within the UCR spring Chinook salmon Evolutionary Significant Unit (ESU) currently listed as Endangered (FR Vol. 64, No. 56, March 24, 1999). This ESU includes all naturally spawned populations of Chinook salmon in all river reaches accessible to Chinook salmon in Columbia River tributaries upstream of Rock Island Dam and downstream of Chief Joseph Dam in Washington, excluding the Okanogan River. McClure et al. (2003) further delineated the ESU, describing three populations: Wenatchee River (except Icicle Creek), Entiat River, and the Methow River.

The White River aggregate is the most genetically unique among those spawning in tributaries within the ESU (Utter et al. 1995, Ford et al. 2001, McClure et al. 2003). An updated genetic evaluation (microsatellite analysis) of the White River aggregate and other spawning aggregates in the Wenatchee basin began in 2004 and is supported through a reproductive success study funded through Bonneville Power Administration (BPA Project No. 2003-0399-00). Analysis of 2004 and 2005 reproductive success data indicates that the White River spawning aggregate continues to represent a distinct sub-population in the Wenatchee River Basin (Murdoch et al. 2006).

Artificial propagation of the White River, Nason Creek, Chiwawa River, Twisp River, Methow River, and Chewuch River stocks was determined to be essential to recovery and these hatchery programs are included in the ESU.

Abundance

Final Viable Salmon Populations (VSP) abundance levels for the Wenatchee River population of the UCR spring Chinook salmon population have not been established at this time. Ford et al. (2001) proposed an interim population abundance recovery level of 3,750 adult returns from natural spawning in the Wenatchee River watershed. The Wenatchee River natural escapement continues to be below the interim VSP recovery level with a 5-yr geometric mean escapement of 274 (WCSBRT 2003).

White River spring Chinook salmon natural origin adult returns ranged between 2 to 404 since 1981 (Table 1) with the highest returns occurring in the 1980s. Since 1981, the White River aggregate has demonstrated a decline, followed by a recent improvement. A change to more favorable ocean rearing conditions may account for some of the improvement. Future adult returns may again become depressed due to declining ocean conditions.

Table 1. White River Spring Chinook Salmon Natural Origin Adult Returns For 1981 – 2005.

Year	Adults	Year	Adults	Year	Adults	Year	Adults	Year	Adults
1981	60	1986	204	1991	49	1996	26	2001	158 [a_/]
1982	180	1987	99	1992	78	1997	33	2002	68 [a_/]
1983	308	1988	139	1993	132	1998	11	2003	33 [a_/]
1984	181	1989	141	1994	7	1999	2	2004	61 [a_/]
1985	404	1990	49	1995	4	2000	21 [a_/]	2005	49 [a_/]

[a_/] White R. stock redds estimated when adjusted for stray rates

Fish spawning sites (redds) during the period of 1990 – 2005 showed a similar general decline, followed by a recent improvement (Table 2). The White River natural origin redd count shows a general downward trend in redd numbers when compared to the total redds counted in the Wenatchee River (6.6% for 1990-2005, 6.3% for 1995-2005 and 4.5% for 2000-2005).

Table 2. White River (WR) Natural Origin and Wenatchee River Basin [a_/] (WRB) Spring Chinook Salmon Redd Counts For 1990 – 2005.

Year	WR	WRB	Year	WR	WRB	Year	WR	WRB	Year	WR	WRB
1990	22	446	1994	3	125	1998	5	83	2002	33 [b_/]	748
1991	21	251	1995	2	23	1999	1	48	2003	14 [b_/]	249
1992	35	491	1996	12	72	2000	8	282	2004	20 [b_/]	492
1993	60	447	1997	15	175	2001	99 [b_/]	1,795	2005	27 [b_/]	629

[a_/] Includes redd counts from Chiwawa, Little Wenatchee, Upper Wenatchee, White Rivers and Nason Creek

[b_/] White R. stock redds estimated when adjusted for stray rates

The proposed program is expected to decrease short-term extinction risk within the White River spawning aggregation by rapidly increasing the abundance of naturally spawning spring Chinook salmon. Based on a smolt release objective of 150,000 smolts, it is estimated that up to 450 adult spawners could be generated from the supplementation program in the near term. The White River recovery effort would complement artificial propagation programs in other key tributaries of the Wenatchee River population and contribute to an overall increase in abundance, maintain/enhance diversity and spatial distribution, and enhance productivity of the Wenatchee River Basin spring Chinook salmon population. Enhancing these population metrics (VSP criteria) for the Wenatchee River Basin spring Chinook salmon population is consistent with recovery of the UCR spring Chinook salmon ESU.

Population Growth Rate:

VSP criteria state that the population growth rate should exceed a 1.0 natural return ratio (NRR) per generation and should equal at least 1.0 for recovered populations (McElhany et al. 2000, Ford et al. 2001). Previous status reviews have indicated that short-term population growth rates in the Wenatchee River population averaged –37.4% between 1977 and 1995 and continued to decline at –16% between 1990 and 2001 (Meyers et al. 1998, WCSBRT 2003). The short-term growth rates for the White River for the same periods were –35.9% and –6.6% respectively. Returns per spawner in the White River have averaged 1.37 over a 20-yr period between 1981 and 2000 with seven of 20 years showing a positive return-per-spawner (Andrew Murdoch, WDFW, personal communication).

The effectiveness of this program will ultimately be mediated by the production potential of naturally spawning adults from this recovery program. Adult returns from the program have the potential to relieve some dispensatory pressure in the White River, including mate location and selection, nutrient enhancement from increased carcass deposition, and cleaning of impacted spawning gravel. The monitoring activities proposed in this application would provide important information to evaluate productivity and population growth rate in response to the supplementation program.

Summer Steelhead

The status of the UCR steelhead ESU is presented in the Biological Opinion on the issuance of permit 1395 (NMFS 2003b) authorizing the operation of the artificial propagation programs in the UCR supported through the mid-Columbia HCPs and is summarized below.

The UCR steelhead ESU was listed as endangered on August 18, 1997 (62 FR 43937), including both naturally and artificially produced production components upstream from the Yakima River, Washington. The UCR steelhead ESU was subsequently down-listed to threatened on January 5, 2006 (62 FR 439937).

NOAA Fisheries defined interim abundance recovery targets for each spawning population (Lohn 2002) and included values for the Wenatchee, Entiat and Methow populations (2,500; 500 and 2,500, respectively).

Some improvement in adult abundance of the UCR steelhead ESU can be seen in recent years; however, the ESU is still at critically low levels compared to desired escapement levels of natural origin steelhead.

The Wenatchee River Basin is the primary habitat for adult steelhead returning between Rock Island and Wells dams. The average steelhead escapement to the Wenatchee River Basin during the recent 5-year period (2001-2005) is estimated at 4,631 fish, compared to the previous 5-year mean of 1,361 fish (Table 3). Within the Wenatchee River Basin, spawning aggregates occupy the mainstem Wenatchee River, Chiwawa River, Nason Creek and to a much lesser extent the Little Wenatchee and White rivers (Table 4). Based on 2001-2005 steelhead redd abundance and distribution in the Wenatchee River Basin, the White River spawning aggregate proves just 0.2%

of the overall steelhead redd deposition in the Wenatchee River Basin (Table 4).

Table 3. Estimated Upper Columbia River steelhead escapement to the Wenatchee River Basin, 1990-2005

	Steelhead Passage [2/]		
Run-cycle [1/] Year	**Rock Island Dam**	**Rocky Reach Dam**	**Estimated [3/] Escapement**
1990	6,915	5,004	1,911
1991	11,217	7,884	3,333
1992	12,382	7,429	4,953
1993	4,689	2,737	1,952
1994	5,626	2,823	2,803
1995	4,168	1,777	2,391
Average	**7,500**	**4,609**	**2,891**
1996	7,295	5,780	1,515
1997	7,718	6,756	962
1998	4,967	4,404	563
1999	6,345	4,845	1,500
2000	10,554	8,289	2,265
Average	**7,376**	**6,015**	**1,361**
2001	28,614	22,103	6,511
2002	15,243	11,715	3,528
2003	17,623	13,770	3,853
2004	19,448	14,613	4,835
2005	12,410	9,480	2,930
Average	**18,668**	**14,336**	**4,631**

[1/] - Run-cycle is the combined total of steelhead passing from 1 June - 30 November during year (x), plus steelhead passing between April 15 - May 31 on year (x+1).

[2/] - Steelhead passage from Fish Passage Center Database.

[3/] - Difference in Rock Island and Rocky Reach Dam passage.

Table 4. Wenatchee River Basin upper Columbia River Steelhead redd abundance and distribution, 2001-2005 (data from Tonseth 2006).

	Survey Year							
Basin/Sub-basin	**2001**	**2002**	**2003**	**2004**	**2005**	**Total**	**2001-2005 Average**	**Average Proportion**
Wenatchee Mainstem [1/]	116	315	248	151	459	1289	258	0.460
Icicle Creek	19	27	16	23	8	93	19	0.033
Peshastin Creek [2/]			15	34	97	146	49	0.087
Chiwawa River [2/]	25	80	64	62	162	393	79	0.140
Nason Creek [2/]	27	80	121	127	412	767	153	0.274
Little Wenatchee River		1	5	0	0	6	2	0.003
White River [2/]		0	3	0	2	5	1	0.002
Wenatchee Basin Total	**187**	**503**	**472**	**397**	**1140**	**2699**	**560**	**1.000**

[1/]- Includes Beaver Creek and Chiwaukum Creek

[2/]- Includes tributaries

2. Provide a justification for all potential mortalities by take category.

This program is intended to reduce the extinction risk to the UCR spring Chinook salmon ESU by increasing the abundance and maintaining the spatial structure and diversity of the Wenatchee population.

The take of eggs or fry from the natural environment would result in an increased survival to the individual compared to those eggs that remain in the gravel (Table 5). The potential loss of eggs that remain in the gravel for natural rearing (approximately 97%) is minimal and similar projects have not experienced a reduction in overall natural production.

Annual extraction of eggs from redds from broodstock purposes and subsequent mortality equating to one (1) adult equivalent (see section H.3), and has the potential to provide approximately 450 adults to the 2006 brood year, giving the White River spawning aggregate an important boost in adult abundance (Table 5). Extraction of eggs from redds in the natural environment is the only methodology in which a family size, identity, genetic contribution and effective population size can be managed. Furthermore, collection of eyed-eggs safeguards against freshets destroying a significant portion of any one brood year while providing the hatchery program with representative production from the population, and reserves the preponderance of the natural production for the natural environment.

Table 5. Estimated adult spring Chinook produced from the White River Recovery Program (brood year specific).

Stage	Survival rate	Captive brood Number
Eyed eggs		1,100 [1/] - 1,665 [2/]
Smolts	NA	
Adults	0.300	330
Green eggs	1,400	231,000
Smolts	0.65	150,150
Adults	0.003	450

[1/]- Assumes a 1:1 male to female sex ratio

[2/]- Assumes a 2:1 male to female sex ratio

No eggs or fry are expected to be lost during carcass/spawning ground surveys. For more information, see Section G.4 above.

Juvenile/Smolt

Historically, the overall juvenile to-spawn mortality of the F_1 generation has approached 70% (see section H.3) and is largely influenced by long-term captivity (4-5 years), and BKD. While this level of mortality is high for a hatchery facility, the survival (30%) is still a survival advantage above what would have occurred in the natural environment and provides a greater number of adults for spawning than what would have occurred otherwise (see section H.3 below). This increase in the number of adults contributing to second-generation smolts will provide increased smolt numbers and improved adult escapement to the natural spawning population.

Second generation mortality is expected not to exceed 35%. A 0.65 survival rate for the F_2 juvenile rearing (including incubation) is many times greater than what would occur naturally (see section H.3) and will provide substantially greater number of smolts for seaward migration that what would have occurred otherwise. The White River spring Chinook spawning aggregate is approximately 848 rkm from the Pacific Ocean and above seven (7) hydro-electric dams, subjecting them to substantial mortality associated with tributary/mainstem migration and estuary/ocean rearing. Increasing the number of emigrating White River smolts, in-part, off sets the increased mortality and should result in increased adult escapement to the White River and an increase in the number of naturally-produced juveniles for future adult returns.

Adult: All broodstock maturing to adult will be spawned (killed) as part of the program. Mortality of adults associated with spawning equals that which would have occurred had these fish spawned naturally. (see section G.4 above).

Juvenile Monitoring:
The information gathered during the juvenile trapping is necessary to effectively evaluate the efficacy of the program. Specific objective addressed include: (1) Determine if the migration timing of both the natural and hatchery components of the target population are similar; (2) Determine if the release of hatchery fish impact non-target taxa of concern (NTTOC) within acceptable limits, and (3) Determine an estimated emigrating population by brood year and age class (sub-yearling/yearling) for naturally produced progeny. Juvenile emigration monitoring will also aid in the evaluation of the impact of the proportion of hatchery origin fish on the spawning grounds and overall spawn escapement on juvenile abundance, juvenile size, smolt-to-smolt survival and juvenile-to-adult survival.

Carcasses/spawning ground surveys: Information will be gathered from already dead, spawned out carcasses. No mortalities will result from the carcass surveys (see section G.4 above). Field staff will minimize disturbance to any spawning fish. Information gathered during these surveys will be used to aid in the analysis of the following objectives: (1) Determine if the supplementation program has increased the number of naturally produced and spawning adults; (2) Determine if the spawn timing, and spawning distribution of both the natural and hatchery components of the target population are similar; (3) Determine if genetic diversity, population structure, and effective population size have changed in natural spawning populations as a result of the hatchery program, and (5) Determine if the stray rate of hatchery fish is below the acceptable levels to maintain genetic variation between populations.

3. Provide details on how all take estimates, including mortalities, were derived.

Eggs/Fry: Up to 1,100 – 3,142 eggs/fry per year will be taken from the White River for broodstock (Marlow et al. 2003) and therefore constitute a take. Egg mortality associated with egg extraction/transfer for F_1 broodstock collection has the potential loss for up to one (1) naturally produced adult equivalent. Estimated eyed-egg extraction-to-transfer survival ranges from 91%-100% and average 98% (Table 6). Assuming that future program survival is no less than 91%, 99-283 eyed-eggs may die during the egg extraction/transfer activity.

No empirical data is available for White River eyed egg-to-emigrant survival; however, Chiwawa River UCR spring Chinook salmon unfertilized egg-to-emigrant survival ranges between 4.6% and 18.1%. Assuming the White River spring Chinook salmon achieve egg-to-emigrant survival rates no less than the maximum reported for Chiwawa spring Chinook salmon, the mortality of 99-283 eyed-eggs corresponds to an estimated 18-51 juvenile equivalents. The loss of 18-51 juveniles equates to an estimated 0.17-0.49 adult equivalents, assuming the 0.97% average emigrant-to-adult survival for naturally produced fish estimated for Chiwawa spring Chinook salmon is applicable to White River Spring Chinook salmon (WDFW, unpublished data).

Table 6. White River egg collection and survival to transfer to Domsea rearing facility.

Year	Families Collected	Eggs/fry Collected	Eggs/Fry Transferred	Percent Survival
1997	8	527	527	100
1998	4	199	182	91
2000	7	272	272	100
2002	3	183	171	93
2003	8	723	699	97
2004	13	1,529	1,529	100
Totals	**43**	**3,433**	**3,380**	**98**

There is no White River empirical data available to determine the impacts of hydraulic sampling to those eggs/fry remaining within the sampled redd. Although the mortality to eggs/fry remaining in the redds is undocumented, results from a similar program on the Dungeness River, which also used hydraulic sampling, did not report subsequent declines in natural production attributed to hydraulic sampling (Marlow et al. 2001).

Second Generation (F_2):
Take associated with rearing of F_2 juveniles includes an estimated 30% mortality or approximately 45,000-90,000 juveniles for a 150,000 and 300,000 smolt release, respectively. These estimates are based on observed survival for BY 2002-2004 reared primarily at Domsea and an estimated F_2 smolt release of 150,000-300,000 for BY 2006-2007.

First Generation (F_1): survival to adulthood of F_1 generation fish may be as low as 30% and is supported by survival data from the 1997-2000 broodyears (Table 7). Recent survival due to BKD management however, appears to be improved for brood years 2002-2004 (A. Murdoch, WDFW, pers. comm.); however, complete survival for these brood years is unavailable because they are not yet complete brood years.

Table 7. Classification of mortality after ponding by source and brood year of the first generation in the White River Spring Chinook Salmon program.

	Brood Year					
	1997		1998		2000	
Source	N	%	N	%	N	%
Spawned	7	1.4	33	21.4	19	7.4
Surplus	14	2.7	11	7.1	54	21.1
Disease	12	2.3	19	12.3	164	64.1
Sampled	0	0.0	0	0.0	0	0.0
Jump Out	2	0.4	0	0.0	3	1.2
Personnel	0	0.0	0	0.0	1	0.4
Unknown	479	93.2	91	59.1	15	5.9

Juvenile Monitoring:
Take (capture/handling/tagging/release and unintentional mortality) resulting from juvenile emigration monitoring is anticipated to include a 0.20 encounter rate (capture) and up to 0.02 mortality rate of fish encountered. These encounter and mortality rate estimates are based on observation during WDFW juvenile trapping activities within the Wenatchee basin (Chiwawa spring Chinook salmon) and are summarized in Table 8, and are consistent with UCR spring Chinook salmon and steelhead take authorizations permitted through ESA section 10 permits 1196, 1395 and 1493. The impact to the White River population associated with a 0.20 encounter rate and a 0.02 mortality rate of those fish encountered equates to a 0.004 loss rate (0.4%) of juvenile emigrants (i.e., 0.20 x 0.02 = 0.004) and a projected loss rate of 0.00004 (0.004%) of returning adults (i.e. 0.004 juvenile loss rate x 0.0097 SAR = 0.00004).

Projected encounter and mortality rates incurred by juvenile steelhead and bull trout are anticipated to be no greater than spring Chinook salmon, as the encounter rate is determined by trap efficiency and mortality is largely a function of live-box holding conditions and handling stress which for this take estimate are assumed equal for all listed species encountered.

Reported take associated with juvenile emigration monitoring will be derived from calculated trap efficiency and visual documentation of mortality during trapping/handling/tagging/sampling.

Table 8. Estimated spring Chinook salmon encounter and mortality rates associated with juvenile emigration monitoring in the Chiwawa River, 2001-2005.

Sample Year	Estimated Emigrating Population	Total Fish Captured	Total Mortality	Encounter Rate	Mortality Rate
2001	31,817 [1/]	7,617 [6/]	2 [6/]	0.239	0.0003
2002	449,876 [2/]	62,255 [7/]	138 [7/]	0.138	0.0022
2003	195,148 [3/]	39,833 [8/]	183 [8/]	0.204	0.0046
2004	82,648 [4/]	17,149 [9/]	40 [9/]	0.207	0.0023
2005	81,501 [5/]	13,923 [5/]	22 [5/]	0.171	0.0016

[1/]- Murdoch 2004; [3/] Miller 2003; [5/] Miller 2006
[2/]- Miller 2003; [4/] Miller 2005; [6/]- Truscott 2002
[7/]- Truscott 2003; [8/]- Prey 2004; [9/]- Truscott 2005

4. Include a statement as to whether or not any USFWS listed species would be affected.
The White River hosts a population of bull trout (USFWS listed species). Great care is given to avoid bull trout redds during broodstock collection. Capture of some bull trout is expected during juvenile trapping and will be released unharmed back into the White River downstream of the trap site to minimize the risk of recapture.

I. Transportation and Holding:

1. Transportation of a Listed Species: Provide a description of how any live individuals taken from the capture site or other facility will be transported including:

a. Mode of transportation and name of transportation company, if applicable.

Adult Broodstock Program: Eggs or fry would be transported by the WDFW via pickup truck from the White River to Eastbank Hatchery and/or Domsea Hatchery. Transportation of fingerlings and smolts is conducted by WDFW, Grant PUD, and the USFWS. Cryopreserved milt will be transported by Grant PUD, WDFW, or AquaSeed to the long-term holding facility at Pilchuck Veterinary Hospital, Snohomish, WA.

Juvenile Trapping: All trapped fish will be released at or near the collection site. Marked fish for efficiency trials will be transported by the YN or WDFW staff using the appropriate vehicles and transport tanks.

b. Length of time in transit for the transfer of the individual(s) from the capture site to the holding facility or to the target location.

Adult Broodstock Program:
White River egg/fry collection to Eastbank Fish Hatchery - 1.5 to 2 hours
Eastbank FH to AquaSeed's Domsea Hatchery – 4 to 5 hours
Domsea Hatchery to Little White Salmon NFH – 2.5 to 3.5 hours
Domsea Hatchery to White River – 5.5 to 7 hours
Little White Salmon NFH to White River – 4 to 6 hours
Domsea Hatchery to Snohomish (Cryopreserved milt) – 2 to 3 hours

Juvenile Trapping: Marked fish for trap efficiency testing 0.15 – 0.5 hour.

c. Length of time in transit for any planned future move/transfer of the individual(s).

Adult Broodstock Program: Same as I.1.b above.

Juvenile Trapping: Marked test fish 0.5 – 1 hour.

d. The qualifications of the common carrier or agent used for transportation of the individual(s).

Adult Broodstock Program: WDFW and USFWS use highly trained staff with years of experience in the transportation of live eggs and fish. Grant PUD staff is trained with many successful transfers of live fish during main-stem Columbia River studies and during the supplementation program.

Juvenile Trapping: YN and WDFW use highly trained staff with years of experience in the transportation of live fish.

e. A description of the tank, container, or other devices used both to hold the individual(s) at the capture site and during transportation.

Adult Broodstock Program: Eyed-eggs hydraulically removed from redds are collected in a large basket, removed by small hand dip net and placed between wet circular sponges in a small sealed bucket. The eggs are inventoried and buckets labeled with redd number and egg count, placed into coolers on ice and transported to the Eastbank Hatchery by WDFW pickup truck. At the hatchery, the eggs are disinfected with iodophore and placed in isolated incubation trays and identified by individual families.

The eggs, alevins and fry are transported by WDFW vehicle to the AquaSeed Corporation's Domsea Hatchery (Rochester, WA) in custom-designed cylindrical egg tubes, or, for hatched eggs, in heavy duty freezer bags partially filled with water and inflated with oxygen. The bags labeled with each identified family are placed on a layer of insulation over ice within a cooler. Once at the Domsea Hatchery, eggs and fry are incubated until yolk sac absorption. At swim-up the fish are placed into four-foot diameter rearing tanks. Supplementation program broodstock are presently held at Domsea in circular tanks of varying size, ranging from 4 to 50 feet in diameter and 1.4 to 4 feet of operating depth depending on fish size, age, population numbers and small liquid nitrogen cooled canisters designed specifically for transport.

Second generation eggs will be transferred from Domsea to Little White Salmon NFH green or at the eyed stage. During green egg transfers, gametes will be collected and stored in Ziplock bags during transport. Ovarian extenders eggs and oxygen for milt will be used as necessary to maintain viability. Crossings will be determined at Domsea and milt will be paired with eggs in an individual container. Gametes will be insulated with burlap and chilled on ice. During eyed-egg transfers, families will be packaged individually in Ziplock bags with water and oxygen. Bags will be insulated with burlap and chilled on ice.

Second generation juveniles are transferred between rearing locations (e.g. Domsea, Eastbank FH, Little White Salmon NFH) or to the White River acclimation facilities in 225 gallon transport tanks or a 2,500 gallon hatchery distribution truck designed for juvenile fish transport. The transport tanks are insulated rectangular tanks, securely attached to transport truck. Both transport methods use recirculation and oxygenation systems with back-up power.

Juvenile Trapping: The rotary screw trap lifts the fish in water and gently deposits them in a locked, covered holding box at the stern of the trap. River water is circulated within the live box, which is checked at least daily, more often if required. Small numbers of the fish are placed into an anesthetic bath, biological information collected and allowed to recover in another container prior to release back into the White River. Fish health will be closely monitored.

f. Special care before, during and after transportation.
Adult Broodstock Program: See I.1.e. above for egg and fry broodstock collection, incubation, and transfer to rearing facilities at the Domsea Hatchery. Juvenile fish are not fed for several days prior to transport. Prior to transport all equipment is disinfected, the transportation tanks securely attached to the truck and support equipment (e.g. oxygen supply, circulation system and water quality monitoring equipment) checked for proper operation. The fish are gently loaded at a predetermined low density in an isotonic salt (0.5%) solution. Life support and backup equipment, temperature, and dissolved oxygen levels are monitored throughout the transfer. At the delivery site, water from the receiving site is exchanged to acclimate the fish to water chemistry and temperature (no greater than 2.0°F /hr). Established techniques will be used for milt cryopreservation and transport.

2. Holding of a Listed Species: Describe the plan for care and maintenance of any live individuals, including a complete description of the facilities where any such individuals will be maintained including:

a. Dimensions of the tank(s) or other holding facilities and the number of individuals, by species, life stage, and origin, to be held in each.
Only White River origin spring Chinook salmon from all life stages (egg to adult) will be reared. Egg incubation occurs in standard vertical incubators at Eastbank and Domsea Hatcheries. Supplementation broodstock are presently held at the Domsea Hatchery (Rochester, WA) in circular tanks of varying size, ranging from 4 to 50 feet in diameter and 1.4 to 4 feet of operating depth depending on fish size, age, population numbers and flow and density requirements. The F_2 progeny have been reared at different hatchery locations in tanks ranging from 4 to 50 foot diameter circular tanks and in super raceways. Length and weight samples are not taken to minimize handling stress. Other existing and undeveloped rearing locations are being investigated.

Broodstock (F_1) Rearing: Fry are presently ponded at button-up directly from vertical incubators into 4-foot diameter (17.5 ft^3) starter tanks until marked. Each family is then split into at least two; 10-foot diameter (227 ft^3), 20-foot diameter (1,256 ft^3) or 50-foot diameter (7,875 ft^3) circular rearing tanks. The number of fish held in a specific tank varies widely and is dependent upon fish size, age, overall family number and flow and density requirements. Fish are held in these tanks until spawned.

Second Generation (F_2) Rearing and Acclimation: Fry are presently ponded at button-up directly from vertical incubators into similar 4-foot diameter starter tanks or the 10-foot or 20-foot diameter tanks at the Domsea Hatchery. The fish are then reared to pre-smolt in the 10-foot, 20-foot or 50-foot tanks. In addition, some of the fish have been reared in 8-foot diameter tanks (201 ft^3) at Eastbank Fish Hatchery (East Wenatchee, WA) and 10-foot x 100-foot long x 4-foot deep (4,000 ft^3) super raceways at the Little White Salmon National Fish Hatchery (Cook, WA). Fish acclimation has occurred in 8-foot diameter tanks (201 ft^3) on the White River. As an interim measure fish may be acclimated in net pens in Lake Wenatchee at the mouth of the White River. Details will be provided ASAP. Beginning with BY06, most if not all of the F_2 incubation and rearing will occur at the Little White Salmon NFH in super raceways.

Table 9. Approximate maximum capacity of rearing vessels based on current rearing conditions and growth rates.

Rearing vessel	Fry capacity	Pre-smolt capacity	Adult capacity
4ft diameter	100	N/A	N/A
8 ft diameter	4,200	1,200	N/A
10 ft diameter	1,400	400	17
20 ft diameter	5,900	1,900	95
50 ft diameter	31,000	10,200	520
Super raceway	75,000	30,000	N/A
Net pens	N/A	need info	N/A

Juvenile Trapping: Fish captured in the rotary trap will be held up to 24 hours. The live box will be checked a minimum of once per day in the morning, or more often as needed due to debris and fish movement. Fish used in efficiency trials may be held in a locked auxiliary live box up to three days prior to release. Auxiliary live boxes will either be attached to the trap or secured to the bank.

b. The water supply, amount, and quality, including controls on temperature and dissolved oxygen.

Broodstock (F_1) Rearing: The supplementation broodstock is currently reared and spawned at AquaSeed Corporation's Domsea Hatchery.

Water for F_1 broodstock rearing is drawn from the Puget Sound Aquifer System and water is supplied to two adjacent but distinct rearing locations via pumped wells. Department of Ecology groundwater permits for the two sites total 6,000 gallons per minute (gpm). The ESA site has four wells at 125' of depth, and a permitted withdrawal of 3,500 gpm, of which 1,875 gpm is allocated to the supplementation program rearing. The Carlson site has two wells at 125' of depth supplying approximately 1,300 gpm to the broodstock program, with the potential under the existing permit for up to 2,500 gpm.

The water source is pathogen-free and presents minimal risk from disease introduced via the water supply. All hatchery water is sterilized prior to discharge.

Water temperature from the groundwater aquifer is constant at approximately 50°F. An incubation water chilling system became operational prior to incubation of 2005 brood year F_1 eggs/fry. This system is currently operated at 38°F.

Water chemistry parameters should be well within acceptable ranges for rearing spring Chinook salmon. Total dissolved gas, hardness, and pH are routinely monitored.

Total gas levels approximate 107% saturation at the well head and is reduced to approximately 102% by passing through a packed column before delivery to rearing ponds and incubators. Hardness and pH are within accepted fish health criteria. Water chemistry is evaluated annually by a professional laboratory and all parameters are within accepted fish rearing criteria.

Second Generation (F_2) Rearing:
Domsea Hatchery: See above this section for fish rearing water conditions at Domsea.

Eastbank Hatchery: The hatchery's permit allows up to 53 cfs of water pumped from the Eastbank aquifer from well depths of 115 feet. The groundwater supply is pathogen-free and presents minimal risk from disease introduced via the water supply. Water temperatures ranged from approximately 46°F to 61°F with water chemistry parameters well within acceptable ranges for rearing spring Chinook salmon.

Little White Salmon Hatchery: The fish are reared on pathogen free Little White Salmon River water. Hatchery water temperatures range from approximately 38°F to 49°F with water chemistry parameters being within acceptable ranges for rearing spring Chinook salmon. The warmest water temperatures are in August and coldest temperatures in December/January.

Acclimation: Fish transfer into the White River basin for acclimation is expected to occur once the snow has sufficiently melted (typically March or April). The water temperature difference will be tempered no more than 2°F per hour, between the shipping location and acclimation site.

Juvenile Monitoring: The fish captured in the rotary trap will be in ambient White River water.

c. Amount and type of diet used for all individuals, and food storage.
Broodstock (F_1) Rearing: Feed is procured from various suppliers depending on recommendations of fish health specialists and availability. Feed type is semi-moist or moist formulation and has been adjusted over the years as recommended.

During the last several years fish were fed Bio-Oregon™ (Warrenton, OR) semi-moist Starter #2, Bio-Diet semi-moist Grower 1.0mm, 1.3mm, 1.5mm, 2.0 mm, 2.5mm and 4.0mm, and BioDiet semi-moist Brood 6.0mm feeds. Fish are fed by hand, initially fed once an hour, eight times per day. As fish grow and feed size increased, feeding frequency is reduced to once a day for adults. Feed storage follows manufacturer recommendations and is kept frozen when possible. Feed rates range from about 3.5% body weight per day for recently ponded fry to 0.5% per day for adult fish reaching maturity. Daily feed rations are determined by water temperature and fish size, and are adjusted when feed waste is observed. Feeding is discontinued when fish mature and are near spawning.

Starting in 1999, fish were fed a prophylactic medicated feed treatment with Aquamycin at 1% body weight for about two weeks, approximately three times a year. Starting in 2002 a two-year experiment was conducted which showed a 72% increase in survival of BKD infected fish given medicated feed with azithromycin than those receiving erythromycin medicated feed. Since 2004 all brood fish were placed on an azithromycin medicated feed plan, fed at 2% body weight for 14 days, approximately three times a year. The fish are also given azithromycin injections several times each year. Feed conversion calculations are not applied during broodstock rearing because a slight excess of feed is provided to rearing tanks and accuracy would be suspect.

Second Generation (F_2) Rearing: Feeding rates range from 3.5% immediately following ponding to about 1% in the later stages. The fish are hand fed Bio-Oregon™ (Warrenton, OR) semi-moist Starter #2, Bio-Diet semi-moist Grower 1.0mm, 1.3mm, 1.5mm, 2.0 mm, and 2.5mm feed and medicated feed (see above I.2.c. under broodstock medicated feed use). Feed storage follows manufactures recommendations and is kept frozen when possible.

At the Little White Salmon NFH fish are fed Bio-Oregon™ (Warrenton, OR) Starter #2, #3, Bio-Moist Grower 1.0mm, 1.3mm, 1.5mm and Bio-Moist Feed 2.5mm and 3.0mm feeds. Fish, initially fed by hand, are fed once an hour, eight times per day, and those fed by automatic tank feeders receive feed every half hour. As fish grow and feed size increased, feeding frequency is reduced. At the time of release fish are fed two to three times each day. Daily feed rations are determined by water temperature and fish size, and are adjusted when feed waste is observed. Once final loadings are achieved, all spring Chinook undergo a prophylactic medicated feed treatment with erythromycin thiocyanate for a minimum of 21 days. The treatment is designed as a preventive measure to reduce the incidence of BKD and is applied at a dosage rate of 100 mg/kg body weight. If deemed necessary by fish pathologists, a second treatment may be administered. The treatments are covered under provisions of section 512 of Federal Food, Drug and Cosmetic Act, INAD 4333.

d. Sanitation practices used.

As recommended by IHOT (1995) facilities will implement the following sanitation procedures:

1) Disinfect/water - harden eggs in buffered iodophor disinfectant. Eggs will be disinfected prior to entering "clean" areas in incubation room. 2) Place foot baths containing disinfectant at the incubation facility's entrance and exit. 3) Sanitize equipment and rain gear utilized in broodstock handling or spawning after leaving adult area and before using in other rearing vessels or the hatchery building. 4) Sanitize equipment used to collect dead fish before use in another pond and/or fish lot. 5) Disinfect equipment, including vehicles used to transfer eggs or fish between facilities, before use with any other fish lot or at any other location. Disinfected water will be disposed of in designated areas and not in streams. 6) Sanitize rearing vessels after removing fish and before introducing a new fish lot or stock either by using a

disinfectant or by leaving dry for an extended time. 7) Properly dispose of dead fish and prevent fish that die of disease to enter natural waters. 8) Potential cross contamination is minimized by maintaining each rearing vessel as a separate unit. Equipment used is disinfected between uses in different rearing units.

For the USFWS Little White Salmon NFH, raceway cleaning is performed full length for un-baffled raceways, while baffled raceway cleaning involves flushing of the lower compartment. All waste from cleaning operations is diverted to the pollution abatement circular clarifier. Fish mortalities are removed and recorded daily and equipment is disinfected between individual fish lots. Water temperatures are monitored daily and any unusual fish behavior or culture incidents are reported to hatchery supervision.

Formalin is used on eggs to prevent losses due to fungus growth. The formalin is metered into stacks of eggs for fifteen minutes in a diluted solution (ten parts filtered water to one part formalin) to achieve a treatment concentration of 1,667 ppm formalin. This is accomplished using a formalin treatment system (installed in 2000) that automatically times the treatment and a subsequent 30-minute flush to assure that all stacks being treated receive a full 15-minute treatment and to clear the distribution system of formalin. Treatments are performed three to five times a week and are discontinued once hatching begins.

Decontamination of all holding and rearing units is necessary after release, transfer or spawning of the occupying fish. Disinfection of the brood pond after completion of spring Chinook salmon spawning is especially important to prevent carryover of pathogens. Units should be dewatered, pressure washed (where feasible), and dried to reduce problems caused by fungus, bacteria and parasites. If necessary, a chlorine treatment may be applied to the surface. Tank trucks or tagging trailers are disinfected before being brought onto the station.

Abernathy Fish Technology Center (AFTC) provides quarterly feed quality analyses to meet nutritional requirements and prevent nutritional diseases

<u>Juvenile Monitoring</u>: No special sanitation of the trap and equipment is required because trapping will only occur in the White River. Fish marking equipment such as PIT-tag needles and scissors will be disinfected prior to use and will follow procedures described in CBFWA (1999).

<u>Carcass/Spawning Ground Surveys</u>: Adult carcass sampled during the White River carcass surveys will be returned to the same river location. Samples collected for analysis will be transferred to the respective laboratories and disposed of into a municipal sewage system or delivered to a municipal refuse site as needed. Sampling gear and equipment will be disinfected between watersheds with iodophor.

3. Emergency contingencies: Identify emergency contingencies.

Each hatchery facility is protected by a number of systems from catastrophic loss to listed fish. Hatchery staffs are trained to handle emergencies. Facilities have backup generators to supply power to pumps, backup oxygen supplies available, water supplies with alarms to detect loss of flow and water level, alarm systems with both telephone and two-way radio signals, 24-hour on-call personnel with pagers and cell phones, and burglar alarm systems. Fish would be reared using best fish culture practices for UCR basin spring Chinook salmon that are designed to minimize the risk of loss due to disease and to maximize survival, all broodstock groups would be split between the two sites to avoid complete loss of any group, effluent water would be treated with a chlorination and dechlorination system to protect all resources in receiving waters, all activities would conducted in accordance with the WDFW Fish Health Manual (WDFW 1996) and the Co-Managers Salmonid Fish Disease Control Policy (1997), and all lots/groups of fish are separated according to disease certification status.

Juvenile Monitoring: The trap will be operated with staff trained to handle emergencies. Proper lighting and equipment will be used by staff when working at the trap. Trapping operations will be suspended during high flow conditions that may cause harm to fish or staff. Trapping operations may also be suspended during trap repairs and high downstream migration periods or during hatchery releases.

Carcass /Spawning Ground Surveys: Surveys may be suspended during bad flow and weather conditions.

J. Cooperative Breeding Program: **Must include a statement of willingness to participate in a cooperative breeding program and to maintain or contribute data to a breeding program, if such action is required.**

Grant PUD, WDFW, and YN are willing to participate in a cooperative breeding program for UCR spring Chinook salmon. The hatchery program described in this application is consistent with basin-side salmon recovery efforts (UCSRB 2006) and designed to preserve and restore healthy naturally-reproducing spring Chinook salmon in the region.

K. Previous or Concurrent Activities Involving Listed Species:

1. Identify all previous permits where you were the permit holder or primary investigator working with federally-listed species; identify which species.

Permit 1141, issued to Grant PUD authorized pursuant to Section 10(A)(1)(a) of the Endangered Species Act (ESA) and effective 8-31-1998 thru 12-31-2002. Species impacted are ESA-listed hatchery and wild spring Chinook salmon and ESA-listed hatchery and wild steelhead.

Scientific and Research Permit 1203, issued to WDFW under the authority of Section 10(a)(1)(A) of the ESA. Expiration date: December 31, 2003. Listed species affected: ESA-listed endangered UCR spring Chinook salmon and ESA-listed, endangered UCR summer steelhead.

Scientific and Research Permit 1114, issued to WDFW under the authority of Section 10(a)(1)(A) of the ESA. Expiration date: December 31, 2007. Listed species affected: ESA-listed, endangered, UCR spring Chinook salmon and ESA-listed, endangered, UCR summer steelhead.

Scientific Research and Enhancement Permit 1094, issued to WDFW under the authority of Section 10(a)(1)(A) of the ESA. Expiration date: May 31, 2003. Listed species affected: ESA-listed, endangered, UCR summer steelhead.

Artificial Propagation/Enhancement Permit 1395, issued to WDFW, Chelan PUD and Douglas PUD under the authority of Section 10(a)(1)(A) of the ESA. Expiration date: October 2, 2013. Listed species affected: ESA-listed, endangered, UCR spring Chinook salmon and ESA-listed, endangered, UCR summer steelhead.

Artificial Propagation/Enhancement Permit 1196, issued to WDFW under the authority of Section 10(a)(1)(A) of the ESA. Expiration date: December 31, 2007. Listed species affected: ESA-listed, endangered, UCR spring Chinook salmon and ESA-listed, endangered, UCR summer steelhead.

Amended Artificial Propagation/Enhancement Permit 1196, issued to WDFW, Chelan PUD and Douglas PUD under the authority of Section 10(a)(1)(A) of the ESA. Expiration date: October 2, 2013. Listed species affected: ESA-listed, endangered, UCR spring Chinook salmon and ESA-listed, endangered, UCR summer steelhead.

Artificial Propagation/Enhancement Permit 1347, issued to WDFW, Chelan PUD and Douglas PUD under the authority of Section 10(a)(1)(A) of the ESA. Expiration date: October 22, 2013. Listed species affected: ESA-listed, endangered, UCR spring Chinook salmon and ESA-listed, endangered, UCR summer steelhead.

2. For the above permits, list all mortality events of listed species that have occurred in the last five years.

a. List the ESU/species, life stage, origin, and population where applicable:

Permit 1141- Mortalities occurred for UCR spring Chinook and UCR steelhead run-of-river and hatchery smolts

Permit 1196- Mortalities occurred for UCR spring Chinook hatchery smolts at acclimation facilities along the Twisp and Chiwawa Rivers.

b. Describe the number and causes of mortalities; and

See this section K.a. and c.

Permit 1141 – GAS BUBBLE DISEASE SAMPLING 2001 - Grant PUD's activities under this permit included non-lethal sampling for Gas Bubble Disease (GBD) symptoms on ESA-listed UCR steelhead and spring Chinook salmon smolts collected in the gatewells of Priest Rapids Dam. During the period April 18 – June 9, 2001 a total of 1,675 were ESA-listed species. This included 1,192 juvenile spring Chinook salmon and 483 juvenile steelhead. A total of six mortalities were recorded during this project, all were ESA-listed juvenile UCR spring Chinook salmon.

GAS BUBBLE DISEASE SAMPLING 2002 - See above for a description of gas bubble disease sampling operations. During the spring and summer monitoring periods of April 23 - June 12 and June 20 - August 15, 2002 a total of 1,735 fish were ESA-listed species. This included 1,565 juvenile spring Chinook salmon and 170 juvenile steelhead. Total ESA listed mortalities consisted of three spring Chinook salmon and one steelhead.

FISH SURVIVAL DURING SPILL OPERATIONS - In 2002, Grant PUD conducted radio-telemetry studies at Wanapum and Priest Rapids dams to estimate pool, dam, and project survival of run-of-river juvenile spring Chinook salmon, as well as passage route-specific survival. At Wanapum Dam, typical fish spill patterns were evaluated and at Priest Rapids Dam the survival through a fully-open spill-gate was compared to those of typical fish spill pattern conditions.

A total of 2,392 fish were radio tagged, with 47 being recorded as mortalities. Tags were removed from recovered fish, the wound re-sutured and the fish released alive below Wanapum Dam to complete their migration.

Permit 1203- No mortality events [1/].

Permit 1114- No mortality events [1/].

Permit 1094- No mortality events [1/].

Permit 1395- No mortality events [1/].

Permit 1196- Juvenile Mortality event. 2000 brood Twisp River spring Chinook were subject to a substantial mortality event at the Twisp River Acclimation Pond on 14 April 2002. Approximately 104,688 pre-smolts were rearing at the Twisp River Acclimation Pond, when a storm event compromised their rearing environment. A rain event caused the Twisp River flow to increase over night (approximately 300%), increasing the debris load in the Twisp River, which blocked the water intake to the acclimation pond, effectively stopping the water flow to the pond. Mortality was approximately 79,688 smolts or 76% of the production in the pond. All morbid fish removed from the acclimation pond as a result of this mortality event were buried on-site.

The alarm system was checked during the pond "set-up" (prior to rearing fish) and was operating correctly, however, during or shortly after the storm event, the alarm failed to notify hatchery personnel of a problem at the acclimation pond until 14 April at approximately 0900. The alarm system is programmed to activate when the pond water level is reduced approximately 0.5 to 1.0 inches. When WDFW personnel arrived, the water level in the pond was approximately 18 inches below the normal alarm float level; a clear indication that the alarm system did not function until well after the water levels declining 0.5 to 1.0 inches. It is not clear at this time why the alarm failed, as the phone lines that support the system were operational during the time period in which the alarm should have been activated. Possible reasons for the alarm failure are that debris or ice may have prevented the alarm float from operating correctly (proper descent), preventing the activation of the alarm.

Juvenile mortality event- 2001 brood year Chiwawa River spring Chinook suffered substantial mortality at the Chiwawa River Acclimation Pond during November and December 2002. Approximately 749,306 juvenile spring Chinook were transferred to the Chiwawa Acclimation Pond during late October 2002. Mortality increased beginning 30 October 2002 as a result of an external fungus outbreak. Formalin treatments began immediately in an attempt to control the fungus. Even with formalin treatments, mortality was estimated at approximately 43%. The causative factor to the fungus outbreak is unknown, however, it may be associated with compromised fish immune systems due to rapid and significant variations in rearing water temperatures associated with multiple rearing water sources (Eastbank FH, Chiwawa River and Wenatchee River). The BY 2001 Chiwawa River spring chinook were transferred to from Eastbank FH to Chiwawa River Acclimation site between 21-24 October 2002, approximately three week later than prescribed transfer date. The transfer date was later than normal due to delays in necessary equipment repairs at the Chiwawa facility (backup generator). When the fish arrived at the acclimation site they were initially acclimated to Wenatchee River water that was approximately 9°F colder than the well water source at Eastbank Fish hatchery. Several days later (26 October) they were shifted to Chiwawa River surface water that was approximately 15°F colder than the Wenatchee River water. The fish remained on Chiwawa River water for approximately 4 days, during which time the Chiwawa River water temperature declined to a point where frazzle ice began to develop (32°F), at which time the rearing water source was shifted back to 47°F Wenatchee River water. The shift back to Wenatchee River water resulted in a temperature differential of 15°F. Each temperature fluctuation occurred within approximately two hours duration. The shift in rearing water sources effectively maintained the rearing water source, but resulting in rapid and significant water temperature fluctuations. It is likely that the water temperature regime compromised fish immune systems, providing the opportunity for fungus spore sources to develop into an epizootic mortality event. Future rearing and acclimation procedures should avoid rapid and significant water temperature fluctuations associated with multiple surface water sources. All morbid fish removed as a result of this mortality event were enumerated and buried on-site.

Permit 1347- No mortality events [1/].

1/- Mortality event that results in 10% or greater loss of the population.

c. Describe the measures that have been taken to diminish or eliminate such mortalities, and the effectiveness of those measures

Permit 1141 - GAS BUBBLE DISEASE SAMPLING: Capture and handling were minimized whenever possible to reduce stress and minimize mechanical injury. Only small proportion (approximately 100 fish per day) of the fish captured at Priest Rapids Dam are used during the study. Study fish are removed from gatewells (see above) and placed into a trough equipped with an aeration hose. Several fish are removed from the trough at a time, and anesthetized in a 30-mg/L concentration of buffered MS-222. Immediately prior to examination, fish are transferred to an 80 mg/L concentration of buffered MS-222. During the examination, a continuous flow of 80 mg/L solution of buffered MS-222 was maintained across the gills. After examination the fish are transferred into a bucket of fresh aerated river water for recovery. After recovery, the fish are placed in a holding hopper with other gatewell extracted fish. Fish were then transported and released below Priest Rapids Dam.

FISH SURVIVAL DURING SPILL OPERATIONS: Capture and handling were minimized whenever possible to reduce stress and minimize mechanical injury (see Fish Salvage above). Fish radio tagging and recovery followed standard protocols. These included individually supplied recovery containers, river water supplies and oxygenation sources, as well as shaded and protected recovery areas post tagging.

Permit 1196- Juvenile Mortality event. 2000 brood Twisp River spring Chinook salmon (see above K.2.b). Douglas PUD, NMFS and WDFW have agreed that multiple alarms system (water level and flow) is a requirement at the acclimation sites, as is the possibility of increased on-site security. Beginning with acclimation in 2003 the Twisp Acclimation Pond security system included a water-level, water-flow alarm, 24-hour staffing and a redesigned surface water withdrawal screen that is less prone to debris.

Juvenile mortality event- 2001 brood year Chiwawa River spring Chinook salmon (see above K.2.b). Current protocols for transfer and acclimation at Chiwawa

River Ponds includes transfer prior to significant water temperature differential between Eastbank FH and the natal water sources and prophylactic treatment for fungus at time of transfer to the Chiwawa River Hatchery.

L. Certification:

I hereby certify that the foregoing information is complete, true and correct to the best of my knowledge and belief. I understand this information is submitted for the purpose of obtaining a permit under the Endangered Species Act of 1973 (ESA) and regulations promulgated thereunder, and that any false statement may subject me to the criminal penalties of 18 U.S.C. 1001, or to penalties under the ESA.

Signature: Date: August 21, 2006

Name and Position Title (print):
Tom Dresser; Fish, Wildlife & Water Quality Manager

PERMIT APPLICATION RESUMES.

CHRIS CARLSON

Education

BS in Fisheries, University of Washington. 1978.

Relevant Previous Employment

Senior Biologist, Grant PUD, 10/92 - present
Biologist 3, Grant PUD, 10/90 – 10/92
Biologist 2, Grant PUD, 5/86 – 10/90
Biologist 1, Grant PUD, 4/83 – 5/86
Temporary Biologist 1, Fisheries Research Institute, 8/82 – 11/82
Fish Culturist 1, WDFW, 5/81 – 2/82
Research Biologist Aid 2, WDFW, 4/81 – 6/81
Hatchery Manager/Fish Culture Instructor, Sea Resources, Inc, 8/79 – 6/80

Current Responsibilities – Project manager for Priest Rapids Hatchery facilities upgrade, project manager for sockeye salmon mitigation, spring Chinook salmon mitigation support, Hanford Reach fall Chinook salmon protection support.

Selected Publications

Chapman, D., C. Carlson, D. Weitkamp, G. Matthews, J. Stevenson, and M. Miller. 1997. *Homing in Sockeye and Chinook Salmon transported around part of their smolt migration route in the Columbia River*. North American Journal of Fisheries Management 17: 101-113.

ANDREW R. MURDOCH

Education

M.S. Biology. Central Washington University. 1995.
B.S. Forest Biology. University of Vermont. 1990.

Recent Previous Employment

Fish and Wildlife Biologist 4, WDFW, 10/01-present
Fish and Wildlife Biologist 3, WDFW, 01/99 - 09/01
Fish and Wildlife Biologist 2, WDFW, 04/96- 12/98
Fish and Wildlife Biologist 1, WDFW, 12/95-03/96

Current Responsibilities – Team leader of the Supplementation Research Team for the WDFW. This team is focused on evaluating supplementation hatcheries in the upper Columbia River basin, recommending program modifications, and assessing potential impacts to wild stocks. Area of responsibility includes the Columbia River basin above Rock Island Dam to include Wenatchee, Methow, and Okanogan rivers basins.

Selected Publications

Murdoch, A.R., P.W. James, and T.N. Pearsons. 2006. Interactions between rainbow trout and bridgelip sucker spawning in a small Washington stream. Northwest Science 79:120-130.

Murdoch, A.R., T.N. Pearsons, T.W. Maitland, M.F. Ford, and K. Williamson. 2005. Monitoring the reproductive success of naturally spawning hatchery and natural spring Chinook salmon in the Wenatchee River. BPA Project No. 2003-039-00. Bonneville Power Administration, Portland, Oregon.

Murdoch, A.R., and C. Peven. 2005. Conceptual approach to monitoring and evaluating the Chelan County Public Utility District hatchery programs. Chelan County Public Utility District, Wenatchee, Washington.

KEELY MURDOCH

Education

M.S. Biology. Central Washington University. 1996.
B.S. Biology. Western Washington University. 1994

Recent Previous Employment

Fisheries Biologist, Yakama Nation, 2/00 – present
Fisheries Biologist, Chelan PUD, 3/97 – 12/99
Instructor - Statistical Analysis, Wenatchee Valley College, 1/99 – 12/99
Fish Biologist, USFWS, 6/96 – 3/97
Hydroacoustic Research Technician, Hydroacoustic Technology, Inc., 4/95 – 8/95

Current Responsibilities – Implementing the mid-Columbia coho salmon reintroduction feasibility study monitoring and evaluation plan. Design and implement biological studies to assess ecological interactions between coho salmon, spring chinook salmon, summer steelhead, and sockeye salmon. Studies include use of radio-telemetry to identify stray and drop-out rates of reintroduced coho salmon, redd surveys, hydro-acoustic surveys, direct predation evaluations, and micro-habitat use and competition evaluations. Techniques used include smolt-trap operation, underwater observation, electro-fishing, and tow-netting. Program coordination. Designed and implemented adult coho salmon trapping program. Responsible for spawning up to 1,400 coho salmon and early egg incubation. Participate in technical work group meetings.

Selected Publications

Murdoch, K.G., C.M. Kamphaus, and S. A. Prevatte. 2005. Feasibility and Risks of coho reintroduction in mid-Columbia tributaries: 2003 Annual Monitoring and Evaluation Report. *Prepared for* Bonneville Power Administration, Portland OR.

Murdoch, K.G. and C.M. Kamphaus. 2004. Mid-Columbia coho reintroduction feasibility project: 2001 annual broodstock development report. *Prepared for:* Bonneville Power Administration, Portland OR. Project Number 1996-040-000.

Mosey, T. R., and K.G. Murdoch. 2000. Spring and summer chinook spawning ground surveys on the Wenatchee River Basin, 1999. Chelan County Public Utility District, Wenatchee Washington.

Titus, K. 1997. Stream Survey Report, Chumstick Creek, Washington. U.S. Fish and Wildlife Service, Mid-Columbia River Fisheries Resource Office, Leavenworth WA.

KIRK TRUSCOTT

<u>Education</u>

B.S. Wildlife Biology. Washington State University. 1983

<u>Recent Previous Employment</u>

Fish and Wildlife Biologist 3, WDFW, 02/01- present.
Hatchery Biologist, Colville Tribe, 01/87 – 01/01.
Temp. Project Biologist, Grant PUD, 03/86 – 10/86
Project Biologist, Douglas PUD, 08/83 – 09/86

Current Responsibilities – Coordinate multi-agency, and WDFW intra-agency (Fish Management, Science and Hatchery Program) artificial production programs and anadromous fish management/research/monitoring and evaluation activities in the mid and Upper Columbia River Basin, consistent with ESA requirements, WDFW management goals and objectives, co-manager agreements and settlement/mitigation agreements with Mid-Columbia Public Utility Districts.

M. Length of Time and Cost to Prepare Application (Optional):

Intentionally left blank.

Anticipated Annual Take

Location/Project: White River/ Supplementation Program

ESU/ Species and Population group if appropriate	Life Stage	Origin	Take Activity	Number of Fish Requested	Requested Unintentional Mortality	Research Location	Research Period
UCR, White River Spring-run Chinook Salmon *(Oncorhynchus tshawytscha)*	Eggs/fry	Naturally Produced	Removal	1,100 – 3,142	N/A (30% adult survival, all killed during spawning)	White R. (rkm 13-21)	September through October
UCR Spring Chinook *(Oncorhynchus tshawytscha)*	Fry, Parr, Smolt	Natural and hatchery produced	Capture, handle, and release	20% of the population in the White River	2.0% of fish handled	White River	March through November
UCR Steelhead (*Oncorhynchus mykiss)*	Fry, Parr, Smolt	Naturally Produced	Capture, handle, and release	20% of the population in the White River	2.0% of fish handled	White River	March through November

CITATIONS

Biological Assessment and Management Plan (BAMP). 1998. Mid-Columbia River Hatchery Program. National Marine Fisheries Service, U.S. Fish and Wildlife Service, Washington Department of Fish and Wildlife, Confederated Tribes of the Yakama Indian Nation, Confederated Tribes of the Colville Indian Reservation, and the Confederated Tribes of the Umatilla Indian Reservation. Mid-Columbia Mainstem Conservation Plan. 135 pp.

Columbia Basin Fish and Wildlife Authority. 1999. PIT Tag Marking Procedures Manual. Portland, OR.

Ford, M., P. Budy, C. Busack, D. Chapman, T. Cooney, T. Fisher, J. Geiselman, T. Hillman, J. Lukas, C. Peven, C. Toole, E. Weber, and P. Wilson(Upper Columbia River Steelhead and Spring Chinook Salmon Biological Requirements Committee) 2001. UCR steelhead and spring Chinook salmon population structure and biological requirements. National Marine Fisheries

Service, Northwest Fisheries Science Center, Upper Columbia River Steelhead and Spring Chinook Salmon Biological Requirements Committee, Final Report, Seattle, Washington.

IHOT (Integrated Hatchery Operations Team). 1993. Policies and procedures from Columbia Basin anadromous salmonid hatcheries. Project Number 92-043. Bonneville Power Administration, Portland, OR.

McClure et al. (Interior Columbia Basin Technical Recovery Team). 2003. Independent populations of Chinook, steelhead, and sockeye for listed evolutionarily significant units within the Interior Columbia River Domain. 173 pp.

McElhany, P., M. Ruckelshaus, M.J. Ford, T. Wainwright, and E. Bjorkstedt. 2000. Viable salmonid populations and recovery of evolutionarily significant units. U.S. Dept. Commer., NOAA Tech. Memo. NMFS-NWFSC-42, 156 p.

Miller, T. 2006. 2005 Chiwawa and Wenatchee River smolt estimates. Technical memo from Todd Miller (WDFW) to the Habitat Conservation Plan Hatchery Committee. Washington Department of Fish and Wildlife, Mid-Columbia Field Office, 3515 Hwy. 97A, Wenatchee, WA.

Murdoch, A. 2004. 2001 Chiwawa and Wenatchee River smolt estimates. Technical memo from Andrew Murdoch (WDFW). Washington Department of Fish and Wildlife, Mid-Columbia Field Office, 3515 Hwy. 97A, Wenatchee, WA.

Murdoch, A.R., T.N. Pearsons, T.W. Maitland, M. Ford, and K. Williamson. 2006. Monitoring the reproductive success of naturally spawning hatchery and natural spring Chinook in the Wenatchee River. BPA Project No. 2003-039-00.

Murdoch, A.R., and C. Peven. 2005. Conceptual approach to monitoring and evaluating the Chelan County Public Utility District hatchery programs. Chelan County Public Utility District, Wenatchee, Washington.

Myers, J.M., R.G. Kope, G.J. Bryant, D. Teel, L.J. Lierheimer, T.C. Wainwright, W.S. Grand, F.W. Waknitz, K. Neely, S.T. Lindley, and R.S. Waples. 1998. Status review of Chinook salmon from Washington, Idaho, Oregon, and California. U.S. Dept. Commerce, NOAA Tech. Memo. NMFS-NWFSC-35. 443 pp.

NOAA Fisheries. 2004. Biological Opinion for ESA Section 7 consultation on interim operations for the Priest Rapids Hydroelectric Project (FERC No. 2114). NOAA Fisheries Consultation No.1999/01878. Northwest Region. Seattle, WA.

Praye, L. 2004. 2003 annual report for ESA section 10 permit 1203. Washington Department of Fish and Wildlife, Mid-Columbia Field Office, 3515 Hwy. 97A, Wenatchee, WA.

Truscott, K. 2002. 2001 annual report for ESA section 10 permit 1203. Washington Department of Fish and Wildlife, Mid-Columbia Field Office, 3515 Hwy. 97A, Wenatchee, WA.

Truscott, K. 2003. 2002 annual report for ESA section 10 permit 1203. Washington Department of Fish and Wildlife, Mid-Columbia Field Office, 3515 Hwy. 97A, Wenatchee, WA.

Truscott, K. 2005. Brood year 2002 upper Columbia spring Chinook annual report for ESA section 10 permit 1196. Washington Department of Fish and Wildlife, Mid-Columbia Field Office, 3515 Hwy. 97A, Wenatchee, WA.

Utter, F.M., D.W. Chapman, and A.R. Marshall. 1995. Genetic population structure and history of Chinook salmon of the Upper Columbia River. Am. Fish. Soc. Symp. 17:149-165.

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Young, S. and C. Marlowe. 1995. Techniques of hydraulic redd sampling, seining and electroshocking. Pages 40-57 IN: C.J. Smith and P. Wampler, editors. Dungeness River Chinook salmon rebuilding project. Progress Report 1992-1993. Northwest Fishery Resource Bulletin, Project Report Series Number 3. Northwest Indian Fisheries Commission, Olympia, WA.