



**U.S. Fish and Wildlife Service - Pacific Region
Columbia Basin Hatchery Review Team**

Columbia River Basin, Columbia Gorge Province

Little White Salmon, Big White Salmon, and Wind River Watersheds



**Carson, Spring Creek, Little White Salmon, and Willard
National Fish Hatcheries**

Assessments and Recommendations

Final Report, Summary

December 2007

Summary

Long-term conservation needs of natural salmonid populations and their inherent genetic resources require a reexamination of the role of hatcheries in basin-wide management and conservation strategies. Hatcheries must be viewed as part of the environmental and ecological landscape to help achieve both conservation and harvest goals. These goals need to be part of a holistic and integrated strategy that combines habitat, hydropower and harvest needs for conserving and managing fishery resources. These strategies must establish short- and long-term goals for both hatchery-propagated and naturally-spawning populations.

To ensure that its hatchery programs are best meeting conservation and harvest goals, the US Fish and Wildlife Service (Service) began, in October 2005, a four-year review of 21 salmon and steelhead hatcheries that the Service owns or operates in the Columbia River Basin. The goal of this review is to ensure that Service hatcheries operate in accordance with best scientific principles, and contribute to sustainable fisheries and the conservation of naturally-spawning populations of salmon, steelhead and other aquatic species. The Service's review process is modeled after the recent Puget Sound and Coastal Washington Hatchery Reform Project¹. The Service plans to complete its reviews by the end of 2009.

The report presented here provides benefit/risk assessments and recommendations for salmon and steelhead propagation programs conducted at four National Fish Hatcheries in the Columbia River Gorge region of Washington State: Carson National Fish Hatchery (NFH), Little White Salmon NFH, Willard NFH, and Spring Creek NFH.

The Review Team considered, as a foundation for its assessments, four characteristics of each salmonid stock in each watershed potentially affected by the four hatcheries: *biological significance*, *population viability*, *habitat* conditions, and *harvest* goals or contributions. The Review Team attempted to use both short- (1-15 years) and long-term (50–75 years) goals for each salmonid stock, as identified by the fishery comanagers², as a foundation for assessing the benefits and risks of the Service's hatchery programs. Source documents not readily available to the general public, including appendices and background documents for this report, are accessible via the Service's hatchery review website.³

Carson NFH

Facility Overview: Carson NFH is located at river mile (RM) 18 of the Wind River, north of the town of Carson, WA. The hatchery was authorized by Special Act 50 Stat. 220, May 28, 1937, and placed into operation in December, 1937 to mitigate for the effects of federal water projects in the Columbia River, primarily Bonneville Dam. The hatchery was reauthorized by the Mitchell Act (16 USC 755-757; 52 Stat. 345) May 11, 1938 as amended on August 8, 1946, (60 Stat. 932) for

¹ www.lltk.org/HRP.html

² *Comanagers in the Washington state side of the Columbia River Gorge region are the Washington Department of Fish and Wildlife (WDFW), Yakama Nation, National Marine Fisheries Service (NOAA Fisheries), and the U.S. Fish and Wildlife Service (USFWS). Comanagers on the Oregon side include the two federal partners (NOAA Fisheries and USFWS), Oregon Department of Fish and Wildlife (ODFW), Confederated Tribes of the Warm Springs Reservation in Oregon (CTWSRO), and the Confederated Tribes of the Umatilla Indian Reservation (CTUIR).*

³ www.fws.gov/Pacific/fisheries/HatcheryReview/

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conservation of fishery resources in the Columbia River Basin. The hatchery was remodeled in 1956 to establish a hatchery-supported run of spring Chinook in the Wind River, and is currently used for adult collection, egg incubation, rearing, and release of spring Chinook. The hatchery also provides eggs and fish for reintroducing spring Chinook to other Columbia River tributaries, as desired.

Carson NFH is upstream of a natural barrier falls (Shipherd Falls) located approximately two miles upstream of the mouth of the Wind River. Those falls historically precluded all anadromous salmonids, except summer-run steelhead, from the upper watershed. A fishway ladder around the falls was constructed in 1955 to allow Carson NFH spring Chinook access back to the hatchery.

The current personnel plan for the hatchery lists seven full-time employees. The annual operation and maintenance (O&M) budget (FY2006) for the hatchery is \$538,124 from NOAA Fisheries (via Mitchell Act) plus \$50,668 from the Service's Fisheries Program. Costs for monitoring and evaluation (M&E) activities in FY2006 were approximately \$108,000 and include \$83,377 for tagging and marking. Capital improvements to Carson NFH totaled \$1,757,085 during the period 2000- 2006.

Spring Chinook salmon

Program overview: The program is intended to operate as a *segregated harvest* program within the Wind River watershed with returning hatchery-origin adults used exclusively for broodstock. The broodstock objective at Carson NFH is to collect 1,400 adults and spawn a minimum of 1,000 adults (500 females) with an on-station release of 1.17 million yearling smolts into the Wind River. Those on-station releases support recreational and tribal fisheries in the Wind River, the lower Columbia River, and the pool behind Bonneville Dam. In addition, Carson NFH is scheduled to provide 250,000 yearling spring Chinook to the Confederated Tribes of the Umatilla Indian Reservation (Umatilla Tribe) for reintroduction of spring Chinook to the Walla Walla River. The spring Chinook broodstock at Carson NFH was originally developed in the late 1950's and early 1960's from natural-origin adults trapped at Bonneville Dam (1955-1964) during their upstream migration. Based on molecular genetic analyses, Carson NFH spring Chinook are believed to represent a composite stock derived from both upper Columbia and Snake river populations. NOAA Fisheries excludes Carson NFH spring Chinook from the *Lower Columbia River Chinook Salmon ESU*⁴ and other Chinook ESUs representing natural populations.

Benefits: Spring Chinook from the Carson NFH provide significant harvest benefits to recreational and tribal fishers in the Wind River. Mean sport and tribal harvests of spring Chinook in the Wind River representing brood years 1989-1998 were 2,615 and 868 adults, respectively. In 2001, almost 5,000 and 1,900 spring Chinook were harvested in the Wind River in recreational and tribal fisheries, respectively, with an escapement of 12,075 adults back to the hatchery. In addition, a mean of 2,575 adult spring Chinook were surplused to tribes from Carson NFH, 1989-1998. Carson NFH has also been a principal source of eyed eggs and fish for spring Chinook reintroduction programs in rivers where they have been extirpated, as well as the source of fish for successful spring Chinook hatchery programs elsewhere (e.g., Little White Salmon NFH, Leavenworth NFH).

⁴ *Evolutionarily Significant Unit.* NOAA Fisheries defines "distinct population segments" (DPS) of Pacific salmon under the U.S. Endangered Species Act as geographic subsets of populations that collectively represent "evolutionarily significant units" of the taxonomic species. NOAA Fisheries has retained the DPS designation for steelhead populations to be consistent with similar designations for non-anadromous populations of *Oncorhynchus mykiss* (a.k.a., rainbow trout).

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Risks: The Review Team did not identify any major or significant risks of the spring Chinook program at Carson NFH. The Team was initially concerned that Carson NFH spring Chinook may be posing a significant ecological risk to natural populations of steelhead in the Wind River, but ongoing field studies have not revealed significant ecological impacts of introduced spring Chinook to native populations of steelhead. Spring Chinook have not established a naturalized population in the Wind River despite nearly 50 years of hatchery propagation and natural spawning of hatchery-origin fish.

Recommendations for current program: The Review Team identified 22 specific recommendations to reduce risks and/or improve benefits of the current spring Chinook program at Carson NFH. These recommendations include: (a) working with the local watershed group to develop additional (or improved) fishing access sites to the Wind River because of the high proportion of returning adults that escape the fishery and are recaptured at the hatchery; (b) installation of a fish counter and trap at the entrance of the hatchery ladder to enumerate returning adults and prevent them from exiting the facility, respectively; (c) continuation of ongoing studies to evaluate potential ecological interactions between hatchery-origin spring Chinook and natural populations of steelhead in the Wind River; and (d) improved public outreach facilities.

Alternatives to Current Program: The Review Team considered the pros and cons of six alternatives to the existing spring Chinook program at Carson NFH. These alternatives range from the current program with full implementation of all program specific recommendations (Alternative 1) to termination of the existing program and decommissioning of the facility (Alternative 6). As a *short-term* goal (up to 15 years), the Review Team recommends continuation of the existing program (Alternative 1) but with a reduction of on-station releases by up to 250,000 yearling smolts (from 1.17 million to 920,000 smolts) to accommodate a conservation program (Alternative 5) that would assist with reintroduction of native species, particularly spring Chinook, in the Big White Salmon River after removal of Condit Dam in that watershed. This reintroduction program would be limited to three generations or 15 years. However, this reintroduction program would not be necessary if conducted at Little White Salmon NFH (see below); in which case, the current on-station release of 1.17 million yearling smolts would be retained as a short-term goal. The Review Team also supports the current, spring Chinook reintroduction program in the Walla Walla River. As a long-term goal (15+ years), the Team recommends resumption of a 1.42 million on-station smolt release (Alternative 1) contingent upon successes of spring Chinook reintroduction efforts in the Big White Salmon River, Walla Walla River, and potential program changes at Little White Salmon, Willard, and Spring Creek NFHs (see following sections on those programs).

Spring Creek NFH

Facility Overview: Spring Creek NFH is located at RM 167 along the north (Washington) shore of the Columbia River, 20 miles upstream of Bonneville Dam and approximately two miles downstream of the Big White Salmon River. Spring Creek NFH was authorized by Special Act 24 Stat. 523, March 03, 1887 and Special Act 30 Stat. 612, July 01, 1898, and placed into operation in September 1901 to support the commercial fishing industry in the Columbia River. The hatchery was reauthorized by the Mitchell Act (16 USC 755-757; 52 Stat. 345) May 11, 1938 as amended on August 8, 1946, (60 Stat. 932) for mitigation of Bonneville Dam and conservation of fishery resources in the Columbia River Basin. The hatchery was remodeled in 1938 to prevent inundation by the pool behind Bonneville Dam. The hatchery was again remodeled in 1970 to

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expand operations to meet commitments under the John Day Dam Mitigation Act. The hatchery is currently propagating tule fall Chinook salmon and includes adult broodstock collection, egg incubation, juvenile rearing, and an annual on-station release of 15.1 million subyearling smolts. A private utility dam (Condit Dam), built in 1913 and located at RM 3.4 of the Big White Salmon River, is scheduled for removal in 2008. All upstream migration of salmon and steelhead has been blocked at Condit Dam since its construction in the early 1900's. Approximately eight miles of fall Chinook habitat exists upstream of the dam. Tule fall Chinook currently propagated at Spring Creek NFH represent the stock of choice for reintroducing fall Chinook upstream of Condit Dam in the Big White Salmon River.

The current personnel plan for the hatchery lists ten full-time employees. An information and education manager for the Service's Columbia River Gorge hatcheries is also located at Spring Creek NFH. The annual operation and maintenance (O&M) budget (FY2006) for the hatchery is \$943,871 and includes \$559,141 from the Army Corps of Engineers (John Day Dam Mitigation), \$353,007 from NOAA Fisheries (Mitchell Act), and \$31,723 from the Service's Fisheries Program. Costs for monitoring and evaluation (M&E) activities in FY2006 were approximately \$1,196,178, primarily for personnel and equipment for tagging, marking, sampling, data management, and reporting. Capital improvements to Spring Creek NFH totaled \$1,114,396 during the period 1998-2006.

Tule Fall Chinook Salmon

Program overview: The program is intended to operate as a *segregated harvest* program within the Bonneville pool with returning hatchery-origin adults used for broodstock. The broodstock objective at Spring Creek NFH is to collect 10,000 adults and spawn a minimum of 8,000 adults (4,000 females) with an on-station release of 15.1 million subyearling smolts into the Bonneville pool. At the present time, approximately 7.6 million smolts are released in March and the remaining fish are released in late April and early May. Those on-station releases support commercial, tribal, and recreational fisheries in the ocean, lower Columbia River, and Bonneville pool. The tule fall Chinook broodstock propagated at Spring Creek NFH was developed from wild fish native to the Big White Salmon River. The hatchery has reared this stock since 1901. NOAA Fisheries includes Spring Creek NFH tule fall Chinook within the *Lower Columbia River Chinook Salmon ESU*, which is currently listed as *threatened* under the U.S. Endangered Species Act (ESA).

Benefits: Tule fall Chinook from Spring Creek NFH provide significant harvest benefits to commercial, tribal, and recreational fishers in the ocean, lower Columbia River, and Bonneville pool. Mean harvests of Spring Creek NFH tule fall Chinook for brood years 1990-1999 were approximately 18,000 and 19,000 fish in the ocean and Columbia River, respectively, with a mean annual return of greater than 19,000 adult fish back to the hatchery. Adult fish recaptured at the hatchery in excess of broodstock needs are provided to tribes and food banks. Tule fall Chinook propagated at Spring Creek NFH are considered a genetic repository for the original stock native to the Big White Salmon River; consequently, the hatchery confers a conservation benefit towards long-term maintenance of that stock. Natural spawning habitat for this stock was first reduced in the early 1900s after construction of Condit Dam and further reduced in the early 1940s when the pool behind Bonneville Dam inundated the lower portion of the Big White Salmon River.

Risks: The long history of hatchery propagation as a *segregated* broodstock (hatchery-origin fish used for broodstock) poses domestication risks to this stock, particularly considering its genetic repository role and anticipated restoration role for the Big White Salmon River. Early releases

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from the hatchery in March – necessary to prevent overcrowding of growing pre-smolts prior to the scheduled April-May release – has required Bonneville Power Administration to spill water at Bonneville Dam to bypass smolts around the turbines and facilitate their rapid downstream passage through the project. This spill can contribute to super-saturation of the tailwater with nitrogen gas, thus posing a demographic risk to chum salmon eggs incubating in redds downstream from the dam (lower Columbia River chum are currently listed as *threatened* under the ESA), although the spill is managed to limit those risks. In addition, the lack of automated electronic monitoring of water chemistry associated with a water reuse system (90% of the water used for rearing at the hatchery is reuse) poses a demographic risk to the hatchery stock when fish are on station (August-May). The physical location of the freshwater intake for the hatchery, a spring immediately adjacent to a major highway, also poses a demographic risk to the hatchery stock from possible vehicle intrusions, spills, and vandalism.

Recommendations for current program: The Review Team identified 19 specific recommendations to reduce risks and/or improve benefits of the current tule fall Chinook program at Spring Creek NFH. These recommendations include: (a) reduction of the size of the program from 15.1 million to 10.5 million smolts to reduce on-station risks and the potential need for a March release; (b) installation of electronic meters and equipment to continuously monitor water chemistry parameters associated with the water reuse system; (c) replumbing of the hatchery building to allow effluent water to be discharged into a settling pond instead of the water reuse system or directly into the Columbia River; (d) construction of a physical barrier and cover that would protect the hatchery's fresh water supply; and (e) continuation of ongoing studies to evaluate genetic contributions of hatchery origin fish to natural-origin fall Chinook smolts in the Big White Salmon River.

Alternatives to Current Program: The Review Team considered the pros and cons of four alternatives to the existing tule fall Chinook program, ranging from (a) the current program with full implementation of all program specific recommendations (Alternative 1), including reduction of on-station releases from 15.1 to 10.5 million smolts, to (b) termination of the existing program with decommissioning of the facility (Alternative 4). As a *short-term* goal (up to 15 years), the Review Team recommends continuation of the existing program with implementation of all recommendations (Alternative 1), but with a further reduction of on-station releases to approximately 10.1-10.2 million smolts to accommodate rearing of up to 350,000 subyearling tule fall Chinook for restoration of natural populations in the Big White Salmon River after removal of Condit Dam (Alternative 2). Spring Creek NFH could also be used to assist with reintroduction of chum salmon because of their short-term freshwater requirements and the limited water supply for the hatchery. As a *long-term* goal, the Team recommends continuation of the tule fall Chinook mitigation program (Alternative 1), but including a reevaluation of regional management priorities and continued implementation of methods for managing tule fall Chinook strays in the Bonneville Pool so that the program is consistent with conservation and recovery objectives of the region. This includes continued monitoring of the restoration of fall Chinook in the Big White Salmon River.

Little White Salmon NFH

Facility Overview: Little White Salmon NFH is located on the Little White Salmon River one mile upstream of its confluence with the Columbia River. The Little White Salmon River joins the Columbia River at RM 162. Drano Lake, a natural depression at the mouth of the river flooded by

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the pool behind Bonneville Dam, is a popular sport and tribal fishing area at the confluence of the Little White Salmon and Columbia Rivers. The Little White Salmon NFH was placed in operation following Congressional authorization in 1898 with the intent to support the commercial fishing industry. The hatchery's role expanded during the 1930's under the Mitchell Act to mitigate for loss of habitat due to the completion of Bonneville Dam in 1938. The hatchery currently propagates *upriver bright* (URB) fall Chinook and *Carson-strain* spring Chinook. A natural barrier falls immediately upstream of the hatchery precludes upstream migration by salmon and steelhead. In 1975, the Little White Salmon NFH and Willard NFH were administratively combined to form the Little White Salmon/Willard NFH Complex (LWS/Willard Complex).

The current personnel plan for the hatchery lists nine full-time employees, which includes the complex manager and deputy complex manager. The annual operation and maintenance (O&M) budget (FY2006) for the LWS/Willard Complex was \$1,211,424 with \$774,376 from NOAA Fisheries (Mitchell Act), \$207,389 from Bonneville Power Administration, \$63,699 from the Army Corps of Engineers (John Day Dam Mitigation), and \$165,960 from the Service's Fisheries Program. Costs for monitoring and evaluation (M&E) activities in FY2006 were approximately \$422,227 and include \$274,966 and \$122,261 for tagging/marketing at Little White Salmon and Willard NFHs, respectively. Capital improvements to LWS/Willard Complex totaled \$7,055,475 during the period 2000- 2006.

Upriver Bright (URB) Fall Chinook Salmon

Program overview: The program is intended to operate as a *segregated harvest* program within the lower Little White Salmon River with returning hatchery-origin adults used exclusively for broodstock. The broodstock objective at Little White Salmon NFH is to collect and spawn a minimum of 1,940 adults (930 females) to yield a minimum of 4.46 million green eggs for an on-station release of 2.0 million subyearling smolts into the Little White Salmon River. The program also transfers 1.7 million subyearling pre-smolts to the Yakama Nation for acclimation and release into the Yakima River. On-station releases support commercial, recreational and tribal fisheries in the ocean, lower Columbia River, and Bonneville pool, particularly recreational and tribal fisheries in Drano Lake. Releases in the Yakima River support tribal fisheries and restoration of natural populations in the Yakima River. The URB fall Chinook broodstock at Little White Salmon NFH was originally developed in the late 1970's from natural origin adults trapped at Bonneville Dam. The URB fall Chinook program was established at the LWS/Willard Complex in 1988. The natural population origin of those fish is unknown. NOAA Fisheries excludes Little White Salmon NFH URB fall Chinook from the *Lower Columbia River Chinook Salmon ESU* and other Chinook ESUs representing natural populations.

Benefits: URB fall Chinook released from Little White Salmon NFH provide significant harvest benefits to recreational and tribal fishers in Drano Lake. Tribes harvested 3,571 and 3,866 URB fall Chinook from Drano Lake in 2004 and 2005, respectively. In 2006, 600 fish were harvested in the recreational fishery in Drano Lake. Mean harvests in the Columbia River and ocean fisheries for brood years 1990-1999 were 1,227 and 1,973 adults, respectively, and accounted for 15% and 24% of all CWT recoveries. Ocean harvest occurs predominantly in Alaska and British Columbia. URB fall Chinook transferred to - and released from - the Prosser Tribal Hatchery on the Yakima River contributed an average of 1,605 (32% of returns) and 1,677 (33% of returns) adults to harvests in the Columbia River and ocean respectively, with an additional 1,750 adults (35%) escaping to natural spawning areas of the Yakima River.

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Risks: URB fall Chinook released from Little White Salmon NFH stray into the Big White Salmon River and spawn after fish representing the ESA-listed *Lower Columbia River Chinook ESU* have spawned. This natural spawning and superposition of redds poses genetic (interbreeding) and demographic (disruption of redd produced by tule fall Chinook) risks to naturally spawning tule fall Chinook that are considered the native stock of the region. Similarly, URB fall Chinook released into the Yakima River do not represent a native or endemic population but, instead, represent a genetically segregated hatchery stock that has been propagated artificially in the Columbia River Gorge region for nearly 30 years. The Review Team concluded that the release and natural spawning of the Little White Salmon NFH stock of URB fall Chinook in the Yakima River may not be consistent with restoration goals for fall Chinook in the Yakima River or genetic conservation goals for naturally spawning populations upstream of McNary Dam. In general, the release of URB fall Chinook at Little White Salmon NFH appears to result in significant straying within the Bonneville pool, including straying to areas upstream of The Dalles Dam.

Recommendations for current program: The Review Team identified 14 specific recommendations to reduce risks and/or improve benefits of the current URB fall Chinook program at Little White Salmon NFH. These recommendations include: (a) meeting with the Yakama Nation to review natural population restoration goals in the Yakima River and broodstock management goals for fish released into the Yakima River; (b) installation of a fish counter between the hatchery ladder and the adult holding pond to assist with broodstock collection and surplus of adult fish in excess of broodstock needs; (c) assess the feasibility of developing a terminal fishery on URB fall Chinook at the mouth of the Big White Salmon River, or reduce on-station releases, to reduce genetic and ecological risks to natural populations; and (d) develop a PIT tag program for on-station releases to assess downstream migration rates to Bonneville Dam and to detect returning adult fish at Bonneville Dam for managing terminal fisheries in the Bonneville pool.

Alternatives to Current Program: The Review Team considered the pros and cons of eight alternatives to the existing URB fall Chinook program. These alternatives range from the current program with full implementation of all program specific recommendations (Alternative 1) to termination of the existing program with decommissioning of the facility (Alternative 8). The Team recommends immediate implementation of Alternative 1, including concurrent discussions with co-managers for terminating the current program and replacing it with on-station rearing of URB fall Chinook from hatchery programs operated upstream of John Day Dam. A much smaller release program could be maintained at Little White Salmon NFH to support terminal fisheries in Drano Lake. The Review Team concluded that releases of hatchery-origin URB fall Chinook should be transferred from Columbia Gorge release sites to upriver areas consistent with the natural historic distribution of URB fall Chinook in the mid-Columbia region. Little White Salmon NFH could continue to rear URB fall Chinook for that purpose, but on-station releases would be reduced only to the level necessary to support a terminal fishery in Drano Lake. Eyed eggs or gametes would be transferred from the mid-Columbia region to Little White Salmon NFH annually, and the resulting subyearling smolts (or pre-smolts) transferred back to the source area for acclimation and release. This proposed long-term approach is expected to confer most of the benefits realized by the current URB fall Chinook segregated hatchery program while reducing risks to naturally spawning fall Chinook populations in the Big White Salmon River and elsewhere (e.g., Yakima River). This long-term approach will require cooperative agreements among co-managers.

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Spring Chinook Salmon (Carson NFH strain)

Program overview: The program is intended to operate as a *segregated harvest* program within the lower Little White Salmon River with returning hatchery-origin adults used exclusively for broodstock. The broodstock objective at Little White Salmon NFH is to collect and spawn a minimum of 1,170 adults (760 females) to yield a minimum of 1.11 million green eggs for an on-station release of 1.0 million yearling smolts into the Little White Salmon River. On-station releases support recreational and tribal fisheries in the lower Columbia River and Bonneville pool, particularly in Drano Lake. Little White Salmon NFH spring Chinook are derived from the Carson NFH, and NOAA Fisheries excludes the hatchery stock from the *Lower Columbia River Chinook Salmon ESU* and other Chinook salmon ESUs representing natural populations.

Benefits: Spring Chinook released from Little White Salmon NFH provide significant harvest benefits to recreational and tribal fishers in Drano Lake. Approximately 25% of all coded wire tag recoveries occurred in Drano Lake with a mean annual harvest of 1,289 spring Chinook. Approximately 20% of all recoveries occurred in the mainstem Columbia River with a mean return of 1,507 adults back to the hatchery (53% of adult returns). Adult spring Chinook trapped at the hatchery in excess of broodstock needs are provided to tribes and food banks.

Risks: The Review Team did not identify any significant risks of the spring Chinook program at Little White Salmon NFH. In general, these fish do not stray from the Little White Salmon River to a level that would be a concern.

Recommendations for current program: The Review Team identified seven specific recommendations to reduce risks and/or improve benefits of the current spring Chinook program at Little White Salmon NFH. These recommendations include: (a) phase out of the regularly-scheduled prophylactic use of erythromycin-medicated feed and development of criteria for the therapeutic treatment of bacterial kidney disease (BKD); (b) complete the three-year test of the new baffled raceways vs. standard raceways, plus include an evaluation of the current rearing density of 0.2 relative to a lower density of 0.1; and (c) PIT tag 15,000 fish prior to release to determine rate of outmigration to Bonneville Dam and to detect returning adults at the dam to assist with fisheries management in the Bonneville pool and Drano Lake.

Alternatives to Current Program: The Review Team considered the pros and cons of six alternatives to the current spring Chinook program. These alternatives range from the current program with full implementation of all program specific recommendations (Alternative 1) to termination of the existing program with decommissioning of the facility (Alternative 6). The Team recommends immediate implementation of Alternative 1 coupled with discussions with comanagers to transition to the Klickitat River hatchery stock of spring Chinook as a long-term goal (5-15+ years). Under this long-term alternative, the Klickitat Hatchery would develop an integrated Klickitat River broodstock by including wild spring Chinook captured at Lyle Falls on the Klickitat River. This integrated broodstock would then provide eyed eggs or gametes annually to Little White Salmon NFH to meet genetic broodstock requirements via a stepping stone approach. This “stepping stone” approach would not require direct take of wild fish for broodstock at Little White Salmon NFH but would require adequate genetic integration of the Klickitat Hatchery stock with the natural population of spring Chinook in the Klickitat River. The Klickitat River stock has been identified by the Washington Department of Fish and Wildlife (WDFW) as the appropriate stock for reintroduction of spring Chinook in the Big White Salmon River after removal of Condit Dam. This long-term approach at Little White Salmon NFH would continue to provide harvest benefits in Drano Lake and the lower Columbia River while, at the same time,

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assisting with the reintroduction of spring Chinook in the Big White Salmon River. This long-term goal is contingent upon infrastructure improvements at Klickitat Hatchery and fish collection facilities in the Klickitat River.

Willard NFH

Facility Overview: Willard NFH is located on the Little White Salmon River approximately five miles upstream of the Little White Salmon NFH. A barrier falls immediately upstream of Little White Salmon NFH precludes upstream migration of salmon and steelhead to the Willard NFH. However, Willard NFH can release juvenile salmonids which migrate downstream over the falls to the Columbia River.

The Columbia River Research Laboratory, a satellite research station of the Western Fisheries Research Center, U.S. Geological Survey (USGS), Seattle, WA, is co-located adjacent to Willard NFH (Cook, WA). Willard NFH was authorized by an amendment to the Mitchell Act to mitigate for fisheries lost due to the construction and operation of hydroelectric dams on the Columbia River. The earliest reports available indicate that the Willard NFH was initially planned and constructed as a fall Chinook facility. However, the very cold water temperatures at Willard NFH inhibited the rearing of fall Chinook, but those temperatures were adequate for rearing coho salmon and spring Chinook.

In 1975, the Little White Salmon NFH and Willard NFH were administratively combined to form the LWS/Willard Complex. Administration of the Complex occurs at Little White Salmon NFH. Complex facilities are managed, staffed, and budgeted as a single entity. The current personnel plan for Willard NFH lists four full-time employees, which includes the hatchery manager, two fish culturists, and a fish biologist.

For many years, 1.0 million yearling coho salmon were released from Willard NFH with brood stock collection at Little White Salmon NFH. Due to funding shortfalls in the Mitchell Act and shifting priorities, this coho program was discontinued in 2004. Since 2004, no fish have been released into the Little White Salmon River from Willard NFH.

Willard NFH currently rears coho salmon in support of the Yakama Nation's coho reintroduction program in the Wenatchee River.

Wenatchee River Coho Salmon

Program overview: The Yakama Nation, with assistance from the Service, conducts this program with the goal of reintroducing coho salmon to the Wenatchee River, Washington. The program was initiated in 1999 with the release of hatchery-origin coho from Eagle Creek and Willard NFHs (lower Columbia "early-returning" stocks) into the Wenatchee River. The initial goal of the program was to establish a self-sustaining hatchery-propagated stock in the Wenatchee River. That goal has been achieved (Phase I). At the present time, returning hatchery-origin adults are trapped in the Wenatchee River at Dryden Dam (near Cashmere, WA) and Tumwater Dam (upstream of Leavenworth, WA), and at Leavenworth NFH on Icicle Creek. Adult coho trapped in the Wenatchee River watershed are transported to Entiat NFH (on Entiat River) and spawned there. Fertilized eggs are incubated initially at Entiat NFH. Eyed eggs are transferred from Entiat NFH to Willard NFH for hatching and rearing. Yearling coho are transferred back to the Wenatchee River for acclimation and release from several locations, including Leavenworth NFH. At the present

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time, returning hatchery-origin adults in the Wenatchee River are used exclusively for broodstock. Current goals of the program are to establish naturally spawning populations and then integrate natural-origin fish into the broodstock as part of a naturalized, Wenatchee River stock. Willard NFH currently receives 670,000 eyed eggs annually and transfers back approximately 650,000 yearling pre-smolts (19-21 fish per pound) for acclimation and release in the Wenatchee River one year later. The long-term goal is to attain a level of abundance and viability sufficient to support tribal harvest and conservation goals in the Wenatchee River. The Wenatchee River coho program is reviewed here for the purpose of evaluating Service options and potential priorities for Willard NFH and the LWS/ Willard Complex.

Benefits: The program has successfully achieved its first major goal of establishing a self-sustaining hatchery-propagated population of coho salmon in the Wenatchee River basin.

Risks: The Review Team did not identify any significant risks of the current program, although the continued transfer of yearlings from Willard NFH to Leavenworth NFH does pose some disease risks to spring Chinook reared on station at Leavenworth NFH.

Recommendations for current program: The Review Team identified two specific recommendations for the current Wenatchee River coho reintroduction program at Willard NFH. The Service should continue to seek funding on behalf of the Yakama Nation and continue to provide facilities and logistic support for the program.

Alternatives to Current Program: The Review Team considered the pros and cons of six alternatives to the existing coho program. These alternatives range from the current program with implementation of all program specific recommendations (Alternative 1) to termination of the existing program with decommissioning of the facility (Alternative 6). The Team generally supports two alternatives contingent on Service and comanager priorities. As an immediate recommendation, the Team recommends implementation of Alternative 1 and continued support of the Yakama Nation's coho reintroduction program in the Wenatchee River. The team also supports establishment of a bull trout recovery program for the Big White Salmon River (or other locations) if artificial propagation is considered a priority in support of bull trout recovery (Alternative 3).

Little White Salmon, Willard NFH complex alternatives

The Review Team identified four additional alternatives for the current programs at Little White Salmon and Willard NFHs when treated together as a complex. Three of the four alternatives deal with various aspects of the White River spring Chinook captive breeding program. This is a new program designed to help recover endangered spring Chinook in the White River within the Wenatchee River basin. The fourth alternative includes use of an auxiliary incubation facility, Carson Depot Springs, for incubation and propagation of chum salmon, or other listed species, in support of ESA priorities in the Columbia River Gorge region.

Conclusions

The Review Team concluded that the current spring Chinook salmon program at the Carson NFH is providing a significant harvest mitigation benefit within the Wind River basin and in fisheries in the mainstem lower Columbia River. Recent ongoing studies and other available information

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indicate that ecological interactions between hatchery-origin spring Chinook and natural populations of steelhead within the Wind River basin are either minor or insignificant. In general, the spring Chinook program at Carson NFH appears to be providing significant harvest benefits with little biological risks to natural populations in the Wind River.

The Review Team similarly concluded that the current tule fall Chinook program at Spring Creek NFH is providing significant harvest mitigation benefits to tribal fisheries in the Bonneville pool and to recreational and commercial fisheries in the mainstem lower Columbia River and coastal waters of the United States and Canada. However, the current water supply and reuse system pose demographic and fish health risks to the hatchery stock, and the Team recommends that the size of the program be reduced from 15.1 million to 10.5 million fall Chinook subyearlings to reduce those risks via lowered rearing densities.

The fall Chinook stock at Spring Creek NFH was initially developed in the early 1900's from natural-origin adult spawners in the Big White Salmon River; consequently, the Review Team supports the use of this stock and facilities at Spring Creek NFH to assist with recovery of fall Chinook populations in the Big White Salmon River after removal of Condit Dam. The Team advises the Service to complete genetic stock identification work on present natural spawners in the Big White Salmon River and work with co-managers to develop a restoration strategy for the natural population in this watershed. The Team also recognizes that the presence of nearby large-scale hatchery production programs at Spring Creek and Little White Salmon NFHs require means of controlling or excluding most hatchery-origin adults from the natural production areas of the Big White Salmon River.

The Team was somewhat uncomfortable with the present lack of defined recovery strategies for listed fall Chinook, coho, and chum salmon in tributaries of the Bonneville Pool. The Big White Salmon River in particular was not addressed in the development of the state of Washington component of the Lower Columbia Recovery Plan. The Team understands that inter-agency discussions are ongoing concerning restoration of salmon and steelhead in the Big White Salmon River following the scheduled removal of Condit Dam, but a detailed restoration strategy has not yet been developed. The Team advises the Service to closely track completion of the Lower Columbia Recovery Plan and adjust future program goals for Gorge NFHs consistent with forthcoming recovery strategies.

The Review Team concluded that the current *upriver bright* (URB) fall Chinook program at Little White Salmon NFH is providing significant harvest mitigation benefits to tribal and recreational fisheries in the Bonneville pool, particularly Drano Lake, and recreational and commercial fisheries in the mainstem lower Columbia River and coastal waters of the United States and Canada. However, the Team was concerned with the genetic and ecological impacts of this introduced mid-Columbia stock on the viability and recovery of natural populations of fall Chinook that are included with the *Lower Columbia River Chinook ESU*. The Team was also concerned about biological and management inconsistencies between the current URB fall Chinook stock propagated at Little White Salmon NFH and conservation/restoration goals for URB fall Chinook in the Yakima River and mid-Columbia region. The Team concluded that the current program and on-station releases of URB fall Chinook at Little White Salmon NFH should be terminated and replaced with on-station rearing of URB fall Chinook from hatchery programs operated upstream of John Day Dam. A much smaller release program could be maintained at Little White Salmon NFH to support terminal fisheries in Drano Lake.

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As a long-term goal, the Team recommends reducing the number of URB fall Chinook released in the Bonneville pool region and increasing the number of fish released upstream within historic natural population areas of URB fall Chinook. Such a management adjustment would also serve the goal of providing *in-place* and *in-kind* mitigation for the loss of upriver bright fall Chinook spawning habitats inundated by the pools behind John Day Dam and other projects (e.g., McNary Dam). As noted above, this long-term approach will require cooperative agreements among co-managers.

Large hatchery fall Chinook mitigation programs, such as those at Little White Salmon and Spring Creek NFHs, release large numbers of juvenile fish into the lower Columbia River. The Team is aware of little information which allows fishery managers to assess any impacts which these programs may have on the continued viability of listed naturally spawning fall Chinook salmon in the lower Columbia River, including the Columbia River estuary. The Team encourages further assessment of this possible interaction and future adjustment to hatchery programs, as necessary, to reduce or eliminate possible adverse effects on natural populations.

The Review Team concluded that the current spring Chinook salmon program at Little White Salmon NFH is providing a significant harvest mitigation benefit within Drano Lake and in fisheries in the mainstem lower Columbia River. The Team proposes that the Service work closely with the Yakima Nation and the Washington Department of Fish and Wildlife to transition to a suitable local broodstock such as the Klickitat spring Chinook stock. This would allow the present mitigation program to proceed with reduced impact on nearby natural population areas and would allow this program to support the proposed reintroduction of spring Chinook into the Big White Salmon River.

The Review Team concluded that the current coho salmon reintroduction program at Willard NFH is providing a long-term conservation benefit to salmonid ecosystems in the Wenatchee River and tributaries of the upper Columbia River. The Team notes that the facilities and water supply at Willard NFH are capable of playing an important role in several proposed conservation and reintroduction programs. The Team expects that the current coho program at Willard NFH will eventually be phased out and supplanted by other conservation programs as upper river facilities are developed to support this reintroduction program and as natural reproduction of coho in the upper Columbia River increases.

Overall, the Team concludes that the four National Fish Hatcheries in the Columbia River Gorge region are playing a valuable and effective role in partially mitigating for the effects of habitat loss and mortality caused by hydroelectric development in this section of the Columbia River. These hatchery facilities are also uniquely situated to support reintroduction and restoration of native salmon species in tributary streams of the Columbia River Gorge and elsewhere while continuing to provide fishery benefits in the region.