ADDENDUM

WILD STEELHEAD RECOVERY PROGRAM

SECTION 1. GENERAL PROGRAM DESCRIPTION

An aggregate winter and summer steelhead population, influenced by past out-of-basin-origin hatchery steelhead introductions, currently occupies the Elwha River below Elwha Dam. The early returning portion (December through March) of the winter steelhead population is currently supported by Lower Elwha Klallam Tribe (LEKT) hatchery production. This hatchery run is an admixture of native Elwha River stock and nonnative Chambers Creek stock. This stock has a significantly earlier run timing than the later, natural-origin portion of the winter run.

The Elwha Fisheries Technical Group has identified the late-timed natural-origin steelhead population[1] as being most appropriate for post-dam removal supplementation efforts in the Elwha River basin. The Lower Elwha Klallam Tribe (LEKT) has maintained a hatchery steelhead program at its facility since the late 1970s. The program was initiated using eggs transferred from federal hatcheries on the Quinault and Columbia rivers. Currently the tribe produces 120,000 yearling hatchery smolts at its facility. These early timed fish were likely of Chambers Creek origin and therefore are not targeted for use in steelhead restoration efforts following dam removal. A combination of strategies will be used to restore Elwha winter steelhead. These strategies include 1) reducing outplants of nonnative steelhead prior to dam removal, 2) developing conservation hatchery rearing and release strategies using remnant wild steelhead stocks, and 3) an assumed, unknown level of contribution of anadromous smolts from upriver rainbow trout populations.

Cooperating Agencies

This program has relied extensively upon interagency consultation to aid in its development. Advice from scientists and resource managers has helped to define and implement the project. Agencies participating in this effort include:

- Washington Department of Fish and Wildlife
- Northwest Indian Fisheries Commission
- National Park Service
- NOAA Fisheries
- USFWS

Agency staff have provided program managers with advice and have assisted directly in the capture of eggs and fry. They have assisted in identifying appropriate numbers of individuals to bring into the hatchery environment to best realize the goals of the

[1]Pending results of genetic testing in 2005–2006.

program. They have provided technologies to mark fish and have conducted genetic analyses of individual of fish and have used these analyses to develop spawning matrices for the mating of individuals.

Stock Status

The naturally spawning winter steelhead stock in the Elwha River is thought to be in relatively poor condition. Limited spawner escapement surveys conducted since 2002 have documented an average of 50 redds per year. In 2005, 61 discrete redds were identified in the lower river. In past years, annual run-size forecasts were generated from hatchery returns and commercial harvest scale analyses. The forecasted natural return was approximately 75 fish in 2002. Forecasts in more recent years estimate between 100 and 200 naturally produced adult steelhead returning to the Elwha River.

Above the Elwha Dam, self-sustaining populations of rainbow trout are known to occur. These populations are thought to originate from native steelhead and rainbow trout populations isolated above the dams after their construction, as well as progeny from past fish planting efforts. Rainbow trout from the McCloud River were widely propagated throughout Washington, and the Elwha River is known to have received a series of outplants from the Goldendale Hatchery (Phelps et al. 1999). Smolt outmigration trapping operations conducted during the 1990s captured a number of fish that appeared to express the characteristics of outmigrating steelhead smolts (Hiss and Wunderlich 1994a). An analysis of the genetic relationship of seven *O. mykiss* aggregations collected from the Elwha River and its tributaries above Elwha Dam showed evidence of successful natural reproduction by hatchery-origin rainbow trout (with the exception of the South Branch Little River population) (Phelps et al. 1999). These fish are likely descendants of past hatchery outplanting efforts, including rainbow trout that originated from California (McCloud River). Despite these effects, the genetic attributes of all steelhead collections in the Elwha River differed significantly from hatchery and natural populations of Washington steelhead (Phelps et al. 1999). The population collected from the headwaters of the Little River was most closely related to wild winter-run Washington steelhead and may therefore be a landlocked descendant of native Elwha River steelhead (Phelps et al. 1999).

Harvest Status

No directed harvest currently occurs on this stock. A small portion of the run is taken each year during fisheries targeting hatchery winter steelhead. Commercial and recreational fisheries that target hatchery steelhead end no later than 28 February each year.

Hatchery Enhancement Efforts

The LEKT initiated an artificial propagation program using the native late-returning winter steelhead population as broodstock beginning in 2005. The program is directed at the preservation and restoration of the native stock and will operate parallel

to the existing Chambers Creek lineage steelhead program that the tribe operates for harvest augmentation purposes.

Escapement Level

Average estimated run size for this stock is 333 (based on a 12-year average). More recent estimates are between 100 and 200 adults.

Projected Hatchery Facility Use

Enhancement efforts are taking place at the Lower Elwha Hatchery.

SUMMARY OF RESTORATION STRATEGIES

A summary of the Elwha River winter steelhead restoration strategies includes:

- Captive brood program development,
- On-station releases of yearling smolts,
- Upstream passage of adults for natural spawning,
- Planting of eyed eggs, and
- Outplanting of fry, presmolts, yearling smolts, and 2-year-old smolts in upstream locations.

The strategies described for steelhead in this plan are intended to be adaptive, changing based on observed responses of the steelhead population. Therefore if certain strategies prove to be unsuccessful, they may be discontinued at any time in favor of options that are more likely to produce a healthy, naturally self-sustaining spawning population.

PHASING OF WINTER STEELHEAD RESTORATION STRATEGIES

Pre-dam removal period: 2005–2008

Restoration activities during this period emphasize capturing and developing a population of late-timed, natural-origin steelhead capable of returning to the hatchery facility. Enhancement efforts will include both the production of yearlings (1- and 2-year-old fish) and development of a captive brood program to accelerate egg and smolt availability. Hatchery facilities during this period will be limited by both space (incubation and rearing) and water quantity. Broodstock required to sustain this program will be acquired either through mainstem river capture and transport of adult fish to hatchery facilities for maturation and spawning, or through hydraulic mining of redds for fry or eggs. Throughout this phase, sport and commercial harvests of winter steelhead will continue to be limited to only the early returning hatchery-based stock. Table 1 summarizes the restoration strategies for the pre-dam removal period.

At low adult return levels, enhancement will emphasize the release of presmolts and smolts from the Lower Elwha Hatchery. As adult return numbers increase,

enhancement strategies will be expanded to include planting of eyed eggs, the release of fry, and the release of adults to permit natural spawning.

Broodstock collection strategies for winter steelhead during this period will include mining of redds through hydraulic pumping to acquire eggs and fry, trapping of adult fish using a weir spanning the mainstem river, hook and line capture of adults at the base of the Elwha Dam, gillnet capture in the mainstem river (stationary and driftnet), and trapping of adult returns volunteering to the tribal hatchery facility on the lower Elwha River. Hydraulic redd sampling to retrieve developing eggs and alevins from naturally produced redds will be limited to a small proportion of each redd's total production (limit of 250 eggs or alevins per redd).

Dam removal period: 2009–2011

Enhancement strategies will mimic those employed during the pre-dam removal period. Due to projected adverse environmental conditions, expectations for successful natural spawning of adults in the lower basin are not programmed into the list of enhancement strategies for this phase. Table 2 summarizes the restoration strategies for the dam removal period.

Broodstock collection strategies for winter steelhead during this period will include trapping of adult fish using a weir spanning the mainstem river, hook and line capture of adults at selected locations throughout the Elwha River basin, gillnet capture in the mainstem river (stationary and driftnet), and trapping of adult returns volunteering to the tribal hatchery facility on the lower Elwha River. Redd pumping will continue to be used for egg and alevin collection. However, environmental conditions (turbidity) may preclude the use of this method.

Post-dam removal period: 2012–2022

During this phase, dam removal will have been completed, the period of greatest turbidity will have passed, the shared water treatment facility will have been taken offline, hatchery facilities will be receiving raw surface water, and hatchery production levels will no longer be limited by water availability. Table 3 summarizes the restoration strategies for the post-dam removal period.

Enhancement strategies at low adult return numbers will emphasize the release of smolts and presmolts from the hatchery. As adult return numbers increase, restoration strategies employed will be expanded to include providing upstream passage of adults, outplanting of eyed eggs, and the upstream release of fry, presmolts, and smolts. Hatchery production proposed for this period will be phased out over time as the natural-origin population increases to a healthy, self-sustaining level.

During this time, sport and commercial harvests will target the early timed component of the run. Harvest of the late-timed component will begin based on stock status assessments that demonstrate achievement by the stock of a population size capable of supporting a directed harvest effort.

Redd pumping may still be used to collect eggs and alevins from the naturally spawning population. The need to collect eggs and alevins from redds to sustain the hatchery program may be reduced, as it is expected that late-run fish needed as broodstock will begin to return directly to the hatchery in addition to spawning naturally in the restored river channel. Other collection strategies for adult winter steelhead during this period will include a capture weir; hook and line capture of adults at selected locations throughout the Elwha River basin, and gillnet collection (stationary and driftnet).

Program Implementation

2005-2006

In May–June 2005 LEKT staff in cooperation with WDFW hatchery staff initiated a redd-pumping effort designed primarily to capture fish for genetic analysis. Weekly surveys of the river below Elwha Dam were conducted between 1 April and 15 June to identify steelhead redds. Results of these surveys confirm that the late-timed component of Elwha River steelhead population is at a very low abundance level. In 2005 a total of 61 discrete redds were identified, distributed over fairly limited spawning habitat; of the 61 redds identified at least eight redds were dewatered during extreme low flow conditions that occurred. For each identified redd, the date of creation was estimated, as well as the rate of egg development based on river temperature. A total of 30 redds were pumped between 26 April and 22 June. Approximately 1,200 eyed eggs and alevin were successfully obtained from 22 redds. Eggs and alevin from each redd were treated as individual families and reared in vertical incubators at the LEKT hatchery. As the eggs and alevin developed to fry they were transferred to individual rearing tanks as families. When fry reached a minimum length of 65 mm, they were photographed, weighed, measured, sampled for genetic material, and tagged with a unique PIT (Passive Integrated Transponder) tag. Once tagged, individual families can be reared together in a larger rearing tank and subsequently released as smolts or retained as captive brood.

Interagency consultation

On 20 October 2005 LEKT staff met with staff from the Northwest Fisheries Science Center (NWFSC) and Olympic National Park to discuss the ongoing wild steelhead (late-timed, natural-origin) program and provide LEKT staff with program recommendations. Active and passive management approaches were considered, and it was recommended that for active management the tribe implement a two-prong strategy that included reductions in outplanting of nonnative early timed steelhead (Chamber Creek origin) along with development of conservation hatchery rearing and release using the late-timed run. Such a program has been implemented on the Hamma Hamma River combining a hatchery supplementation programs (captive brood) with novel conservation elements (Berejikian et al. 2004). This program, though not yet thoroughly evaluated, shows some promise in conserving and rebuilding unique depleted stocks. For the Elwha River, fisheries scientists are faced with few other options for rebuilding native steelhead populations. The remaining late-timed run is at a

very low population level and indeed may not survive dam removal. Remnant upstream populations of rainbow trout (above dams) are thought to retain some traits of anadromy (Hiss and Wunderlich 1994a) and will be used as a form of passive restoration. Thrower and Joyce (2004) suggest that although marine survival of resident rainbow smolts derived from an anadromous population in Alaska was low, significant numbers of smolts and adults can still be produced by populations landlocked for up to 70 years. Based on these discussions it was recommended that LEKT continue redd pumping programs targeting the late-timed steelhead populations at least through 2008.

Pumping programs will be designed to maximize genetic history and minimize effects on extant wild steelhead populations until dam removal begins. Dam removal is expected to begin during the winter of 2008–2009, and impacts associated with accelerated sediment releases are anticipated to negatively affect future brood years beginning in 2005 (Figure 1). Also beginning with the 2005 brood year, the tribe is considering reducing its outplanting of early timed, Chambers Creek–origin steelhead to 45,000. With these changes in hatchery management, the work group identified a suite of options to consider for wild winter steelhead restoration for the Elwha River, including:

- Development of a captive brood program with a target of 200 adults per year to be conducted 2005–2008,
- Eventual spawning of captive brood (brood year + 4) followed by kelt reconditioning and release,
- Continued monitoring of natural spawning populations, and
- Smolt release into the Elwha River and into an alternate drainage—either Morse or Ennis creeks.

The work group also identified and proposed these specific strategies by brood year. The 2005 brood year will have wild siblings returning to the Elwha River in 2009 (prior to significant sediment transport impacts); the work group will PIT tag 100% of fish, retain 200 fish to hold as captive brood, conduct genetic analysis on all fish, and release remaining fish as smolts (approximately 750 fish) into the Elwha River. For the 2006, 2007, and 2008 brood years, the strategy will maximize number of redds represented in the hatchery; target a maximum capture of 10,000 eggs and fry; limit removal of eggs from individual redds to 250, with minimum target of 40 redds; PIT tag 100% of fish brought into the hatchery; retain 200 fish to hold as captive brood; conduct genetic analysis on all fish; and release remaining fish as smolts into the Elwha River and alternative drainage.

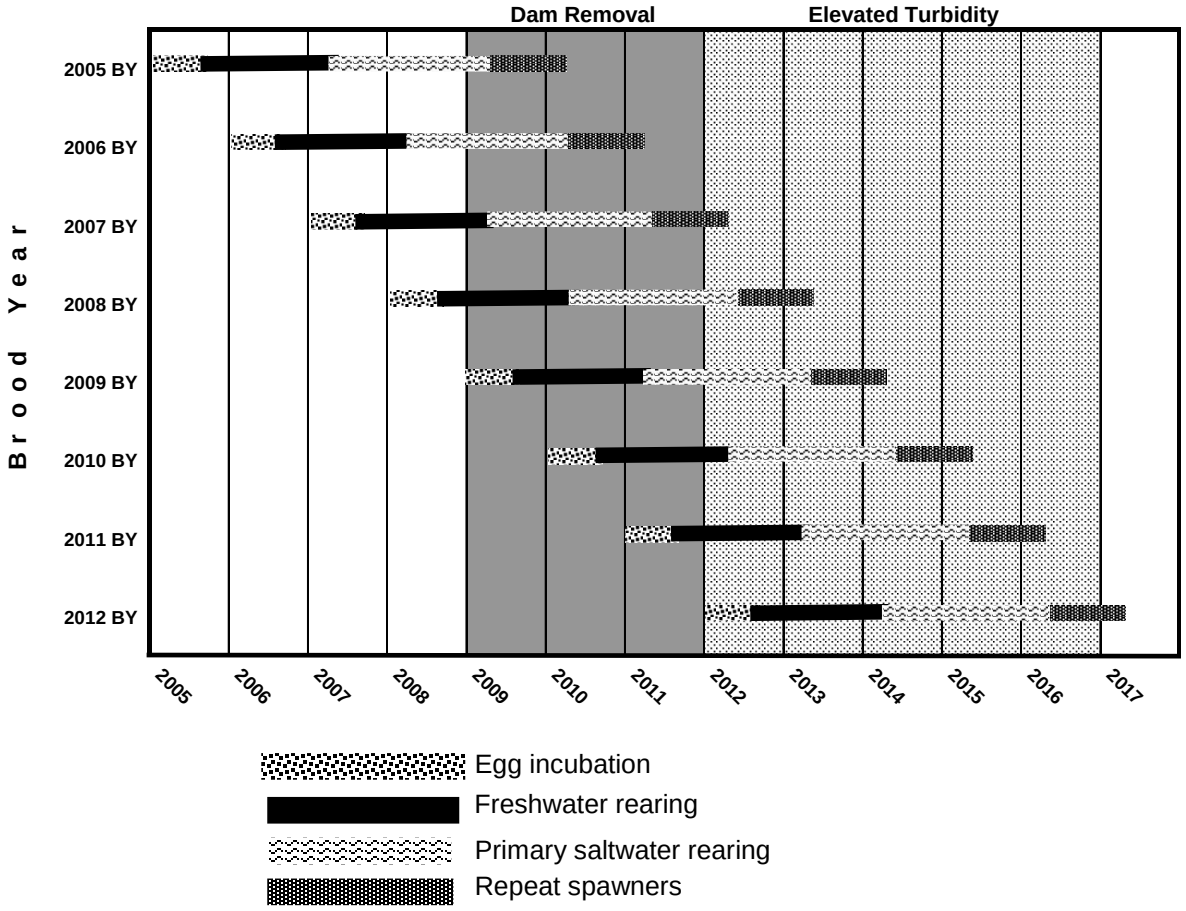

Figure 1. Life history versus dam removal timing for Elwha River wild steelhead.

Table 1. Winter steelhead recovery strategies: 2005–2008 (pre-dam removal).

			Winter steelhead production goal at adult escapement levels					
Production Facility	**Life history pattern**	**Release location**	**100**	**500**	**1,000**	**1,500**	**2,000**	**5,000**
Potential egg production			150,000	750,000	1,500,000	2,250,000	3,000,000	7,500,000
Lower Elwha	Yearling smolts	On-site	102,000	125,000	125,000	125,000	125,000	125,000
Lower Elwha	Natural spawners	Lower Elwha Basin		100	577	1,077	1,577	4,577
Lower Elwha	Eyed eggs	Upper Basin		100,000	100,000	100,000	100,000	100,000
Lower Elwha	Fry	Upper Basin		220,000	250,000	250,000	250,000	250,000
Lower Elwha	Presmolts	Upper Basin		20,000	20,000	20,000	20,000	20,000

Table 2. Winter steelhead recovery strategies: 2009–2011 (dam removal).

			Winter steelhead production goal at adult escapement levels					
Production Facility	**Life history pattern**	**Release location**	**100**	**500**	**1,000**	**1,500**	**2,000**	**5,000**
Potential egg production			150,000	750,000	1,500,000	2,250,000	3,000,000	7,500,000
Lower Elwha	Yearling smolts	On-site	80,000	100,000	100,000	100,000	100,000	100,000
Lower Elwha	Natural spawners	Lower basin		39	537	1,037	1,537	4,537
Lower Elwha	Eyed eggs	Upper basin		100,000	100,000	100,000	100,000	100,000
Lower Elwha	Fry	Upper basin		272,000	275,000	275,000	275,000	275,000
Lower Elwha	Presmolts	Upper basin	22,000	20,000	20,000	20,000	20,000	20,000
Lower Elwha	Yearling smolts	Upper basin		25,000	25,000	25,000	25,000	25,000
Lower Elwha	2-year-old smolts	Upper basin		15,000	15,000	15,000	15,000	15,000

Table 3. Winter steelhead recovery strategies: 2012–2022 (post-dam removal)

			Winter steelhead production goal at adult escapement levels					
Production Facility	**Life history pattern**	**Release Location**	**100**	**500**	**1,000**	**1,500**	**2,000**	**5,000**
Potential egg production			150,000	750,000	1,500,000	2,250,000	3,000,000	7,005,000
Lower Elwha	Yearling smolts	On-site	80,000	100,000	100,000	100,000	100,000	100,000
Lower Elwha	Natural spawners	Elwha Basin		37	537	1,037	1,537	4,537
Lower Elwha	Eyed eggs	Upper basin		100,000	100,000	100,000	100,000	100,000
Lower Elwha	Fry	Upper basin		275,000	275,000	275,000	275,000	275,000
Lower Elwha	Presmolts	Upper basin	22,000	20,000	20,000	20,000	20,000	20,000
Lower Elwha	Yearling smolts	Upper basin		25,000	25,000	25,000	25,000	25,000
Lower Elwha	2-year old smolts	Upper basin		15,000	15,000	15,000	15,000	15,000

References

Phelps, S. R., J. M. Hiss, and R. J. Peters. 1999. Genetic relationships of Elwha River *Oncorhynchus mykiss* to hatchery origin rainbow trout and Washington steelhead. Unpublished Report. Washington Department of Fish and Wildlife, Olympia, WA.