HATCHERY AND GENETIC MANAGEMENT PLAN

Hatchery Program:	Lower Elwha Fish Hatchery *House of Salmon*
Species or Hatchery Stock:	Elwha River Chum (*Oncorhynchus keta)*
Agency/Operator:	Lower Elwha Klallam Tribe
Watershed and Region:	Elwha River; WRIA 18.0274
Date Submitted:	July 31, 2012
Date Last Updated:	July 31, 2012

HATCHERY AND GENETIC MANAGEMENT PLAN
LOWER ELWHA HATCHERY
CHUM SALMON ENHANCEMENT PROGRAM

SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1 Name of hatchery and program:

Lower Elwha Fish Hatchery: Elwha River Chum salmon program

1.2 Population or stock under propagation and ESA status:

Elwha River chum salmon, *Oncorhynchus keta*. Puget Sound fall chum are neither ESA listed nor a candidate for listing.

1.3 Responsible organization and individuals:

Name (and title): Larry Ward, Hatchery Manager

Agency or Tribe: Lower Elwha Klallam Tribe

Address: 700 Stratton Road, Port Angeles, WA 98363

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

Washington Department of Fish and Wildlife: Co-manager with the Lower Elwha Tribe of Elwha River salmon fishery resources.

NOAA Fisheries Northwest Region: Program planning, guidance and regulation under the ESA through the Elwha recovery technical group.

NOAA Fisheries Northwest Fisheries Science Center and Olympic National Park: Technical collaboration on recovery, planning and implementation, and research, monitoring and evaluation

Northwest Indian Fisheries Commission: Provides fisheries management support services, and diagnostic fish health services.

1.5 Funding source, staffing level, and annual hatchery program operational costs:

Bureau of Indian Affairs (PL-638) funding supports hatchery operation & maintenance.

National Park Service funding supports research, monitoring, and evaluation.

Staffing level: 4

1.6 Location of hatchery and associated facilities:

Name of stream: Elwha River RM 1.25

State: Washington

Watershed code: 18.0274

Regional mark processing center code: 99702

PSC location code: 3F10806 180274 H01

GIS entry information: lat/long: 123.33.00; 48.08.30

1.5 Type of broodstock management program:

Integrated broodstock recovery management program.

1.6 Program goal:

The current goal is conservation. The goals and objectives of this program are linked to four biologically-defined phases of stock recovery (preservation, recolonization, local adaptation, and self-sustaining). This HGMP will address program goals and objectives occurring during the first two phases.

Population performance indicators identify the endpoints for each recovery phase. Indicators are expressed as metrics for population abundance, productivity, diversity, and spatial distribution. Hatchery management strategies, production objectives, and protocols may change as each phase endpoint is reached. All benchmark indicators for a given phase must be achieved to transition to the next phase. Transition to a new phase may occur over two or more years. Recovery measured by all indicators may not exhibit a constant positive trend, so if metrics fall below phase indicators, management may revert to the appropriate objectives, protocols, and strategies. The co-managers will incorporate recovery phase benchmarks in the monitoring and adaptive management plan (MAMP) being developed by the recovery workgroup (see Section 11). The MAMP will initially project the recovery trajectory for different species with very limited historical data on the Elwha populations, but phase benchmarks will be revised as information accumulates to assess the actual recovery potential and performance of the population, in terms of abundance, productivity, diversity, and distribution.

Table 1.1 Recovery Objectives for the four phases of chum recovery

Phase	Objectives
Preservation: Conserve abundance	• Prevent extinction • Retain genetic identity and diversity • Hatchery returns increase adult abundance • Successful natural production in mid- and upper basin MS & tribs • Supplement spawning (outplants)
Recolonization: Increase abundance and spatial distribution	• Abundance & productivity increasing • Supplement spawning (outplant) • Spatial distribution increasing • Stable run timing and maturation rates • Population supports directed terminal harvest
Local adaptation: Viable abundance, increased productivity and life history diversity	• Increasing abundance • Spatial distribution throughout mainstem and tributary habitat • Improve genetic integrity & fitness • Tribal & recreational harvest
Self-sustaining: Population at optimum abundance, productivity, distribution, and diversity	• Abundance stable, at capacity • Productivity exhibits density dependence • Spatial distribution stable, at capacity • Genetic diversity stable • Population sustains harvest

1.7. Program justification:

The program will produce fish in accordance with the Elwha River Fish Restoration Plan (ERFRP) to restore chum salmon to the Elwha River watershed following the removal of hydroelectric dams on the Elwha River. The ERFRP is intended to be consistent with the expectation of Congress regarding the role of hatchery programs as set out in the Elwha River Ecosystem and Fisheries Restoration Act.

Natural chum production has been limited to the reach below the Elwha Dam. Although the quantity and quality of available habitat will be gradually increased and improved with the removal of the Elwha and Glines Canyon dams, chum spawning and rearing habitats will be adversely affected in the short term by high sediment transport and reduced water quality associated with dam removal and the resulting channel instability.

Hatchery operation goals and production levels will evolve under the MAMP. Annual reviews of objectives and hatchery production goals will be conducted by the Elwha restoration workgroup.

The hatchery program will assure persistence of the chum stock through the period of dam removal and channel stabilization. Subsequently, the hatchery will promote geographic distribution of fish throughout suitable spawning habitat in the watershed through the transport and release of adults into suitable habitat in the watershed.

Recovery will be the primary objective of the hatchery program during the Preservation and Recolonization phases. Hatchery production may enhance fishing opportunities in the river as the recolonization, local adaptation and self-sustaining phases of recovery are achieved.

1.8. Program Objectives, Performance Standards, and Performance Indicators

Performance standards and interim performance indicators are shown below in Tables 1.2 and 1.3 to assess recovery performance against objectives shown in Table 1.1 during the preservation and recolonization phases, and to inform the transition between phases.

Table 1.2 Objectives, performance standards, and performance indicators for the preservation phase of chum recovery.

Objective	Performance standards	Performance indicators
Abundance:	Annual fry production	Hatchery release of 450,000 fed fry
	Adult abundance	Terminal run 2000 adults
Productivity:	Growth Rate	Population growth rate > 1.0
		Successful spawning and production of outmigrant fry
Spatial distribution:	Migration	Adults reach mid-basin spawning areas;
	Spawning distribution	Natural migration and/or transport of adults into middle reaches of the basin
Diversity:	Retain genetic identity and diversity	Implement mate selection protocols Mark all hatchery-origin releases (otolith mark) to permit identification of fish origin (juveniles and adults) Limit straying through volitional release of fed fry from the hatchery Develop genotype data base

Table 1.3. Objectives, performance standards, and performance indicators for the re-colonization phase of chum recovery.

Objective	Performance standards	Performance indicators
Abundance and Productivity	Hatchery fry production	Hatchery release increases from 450,000 to 1,025,000 fed fry Survival to adult > 0.5%
	Adult NOR abundance increases	Adult NOR return numbers increasing to 1,500-5,000 Viable > Abundance > critical population
	Natural spawning increases	Adult spawning observed for 1 cycle (3 years)
	Natural smolt production increasing	Unmarked fry observed at target levels from mainstem # smolts/spawner rising to >258 (in devlpmnt MAMP)
Spatial Distribution:	Augment recolonization	Outplant adults into middle reaches of the river – numbers of HOR outplanted based on NORs returning
	Migration	No upstream or downstream barriers
	Spawning distribution	Spawning observed throughout suitable spawning habitats
		Redd density XX/mile (in development MAMP) 33% of Intrinsic Potential habitat occupied
Diversity:	Maintain genetic diversity and identity	Mate selection protocols
	Spawner & broodstock composition	Mark all hatchery-origin releases (otolith) Maximize number of natural spawners, pHOS and pNOB not constrained
Triggers for reverting to Preservation phase: Adult returns < critical threshold Natural fry production not increasing Hatchery fry survival < 0.5% Spawning distribution not increasing; redd density declining Genetic diversity unstable or declining		

1.9. Expected program size

Proposed maximum annual hatchery broodstock collection level: 460 increasing to 1,050.

Proposed annual fish release levels by life history stage and location: 450,000 increasing to 1,025,000 fed fry released from the hatchery (assuming total survival rate egg to presmolt 78%).

1.10. Program performance - survival rates, adult production levels, and escapement levels - Average survival rates (2000 to present):

Green- to eyed-egg: 86.6%

Eyed egg to swim-up 90.2%

Fingerling to fed fry (smolt) 73.7%

Average facility escapement presently: 28 (14 females, 14 males)

1.11. Program initiation date: 1994

1.12. Expected program duration: On-going

1.13. Alternative actions: None.

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

2.1. ESA authorization.

Salmon and steelhead hatchery programs operating in the Elwha River watershed are being implemented consistent with HGMPs completed by the co-managers. The HGMPs have been modified since their initial submittal in 2005 to incorporate their role identified in the Elwha Fish Restoration Plan (Ward et al. 2008), and in response to hatchery risk minimization measures recommended by the Hatchery Scientific Review Group through their review of basin hatchery programs (HSRG 2002, 2012). HGMPs for The Lower Elwha Klallam Tribe's coho, pink, fall chum and steelhead programs, and WDFW's Elwha Channel Chinook salmon program HGMPs, will be submitted to the NMFS NW Region, Salmon Management Division, Hatcheries and Inland Fisheries Branch for review of compliance with ESA conservation standards. The ESA review portion of the process will lead to a determination of whether the plans address criteria defined in the ESA (4)d Rule Limit 6 for the Puget Sound Chinook and Hood Canal summer chum salmon ESUs (70 FR 37160, June 28, 2005) and in the 4(d) Rule for the Puget Sound Steelhead DPS (73 FR 55451, September 25, 2008).

The removal of listed adult Chinook salmon and steelhead for hatchery broodstock purposes is appropriate and authorized by NMFS through incidental take statements issued to the National Park Service (NPS) in 2006 and 2012, concluding ESA Section 7 formal consultation for the "Elwha River Ecosystem and Fisheries Restoration Project (NMFS 2006; 2012).

2.2. ESA-listed salmonid populations affected by the program

2.2.1 Elwha River Chinook salmon (*Oncorhynchus tshawytscha*)

The Elwha River Chinook salmon population was delineated as one of 22 independent populations that compose the Puget Sound Chinook salmon ESU (Ruckelshaus et al. 2006). The ESU was listed as threatened under the ESA on March 24, 1999 (64 FR 14308). Chinook salmon

originating from WDFW's Elwha Channel Hatchery program are included as part of the Puget Sound Chinook ESU, and are ESA listed with natural-origin Elwha River Chinook salmon (70 FR 37160, June 28, 2005). Elwha Chinook mature primarily at age 4 (57%), with age 3 and age 5 fish comprising 13% and 29%, of annual returns, respectively (WDF et al.1993, WDFW 1995, PNPTC 1995 cited in Myers et al.1998). The average annual sex ratio for returning fish is unknown, but assumed to be 1.5 males to females when estimating the number of wild spawners from redd counts. Data collected from gaffed adults, fish volunteering to Elwha Channel Hatchery, and spawning ground surveys (WDFW database, 1987-98) indicate that Elwha River Chinook range in size from 45 cm to126 cm in length. Migrating adult fish enter the river beginning in early June and extending through early October. Spawning in the Elwha River begins in late August and peaks in late September to early October (WDF et al. 1993). The dominant juvenile life history trajectory involves short term rearing in freshwater (5 to 8 months) and seaward emigration as sub-yearling smolts. However, prior to construction of the two dams in the watershed which block the majority of anadromous habitat, multiple juvenile rearing and emigration strategies may have existed for this species. Roni (1992) reported that 45 to 83% of Elwha River smolts emigrated as yearlings, and 17 to 55 percent as subyearlings, but this study could not differentiate naturally produced smolts from hatchery releases of yearlings, because the hatchery fish were not marked to allow for their distinction from wild fish.

2.2.2. Elwha River Steelhead (*O. mykiss*)

The native late winter-run steelhead population is part of the Puget Sound steelhead Distinct Population Segment (DPS), listed as threatened under the ESA on July 11, 2007 (72 FR 26722). Hatchery-origin steelhead derived from the native population and propagated through the Lower Elwha Hatchery program will be included as part of the listed DPS and protected under ESA provisions. Early-timed, introduced steelhead produced at various hatcheries throughout Puget Sound, including the Lower Elwha Hatchery until 2011, are not part of the listed DPS (73 FR 55451, September 25, 2008). Native Elwha River natural-origin winter-run steelhead are believed to enter freshwater and spawn from February through June (McMillan et al. 2010). Little is known about the freshwater life history of native steelhead in the basin. The typical life history for Puget Sound winter-run steelhead involves spending one to three years rearing in freshwater before migrating downstream into marine waters. Once the juveniles emigrate, they move rapidly through Puget Sound into the North Pacific Ocean where they reside for several years before returning to spawn in their natal streams. Unlike other members of the genus Oncorhynchus with anadromous life history, some adult steelhead do not die after spawning and can undergo multiple spawning cycles (Wydoski and Whitney 2003). Repeat spawners typically average 3.6% (±3.4%) in Puget Sound (WDFW unpublished data).

2.2.3. Elwha River bull trout (*Salvelinus confluentus*)

Elwha River bull trout occupy a designated Core Area within the Coastal Recovery Unit of the co-terminous (Northwestern U.S.) DPS of bull trout, which is listed as threatened under the ESA. Bull trout in the Elwha River may exhibit fluvial, adfluvial, and anadromous life history strategies (Ward et al. 2008). Fish found in the basin below Elwha Dam are thought to be anadromous, while adfluvial and fluvial populations inhabit the basin above Elwha Dam. Researchers in the watershed report that few bull trout are observed in the river below the Elwha

Dam and only one redd has been documented (Ward et al. 2008). Although Dolly Varden (S. malma) are present in other Olympic Peninsula watersheds, limited genetic and morphological analysis of a few specimens collected in the Elwha River indicates that only bull trout are present (Leary and Allendorf 1997). NMFS researchers identified three char fry and a handful of adults (10″–24″ in length) during snorkel surveys initiated in 2000. This population has likely been negatively impacted by loss of access to the upper river, habitat degradation in the lower river, nearshore, and estuary, and potentially to harvests in the lower river. Construction of the mainstem dams isolated populations of bull trout in both the middle and upper Elwha River basins. The creation of lakes Aldwell and Mills also modified habitat features, resulting in the establishment of adfluvial populations in these lakes. Population size in the upper basin is unknown; however, 215 bull trout were counted during a survey of the entire mainstem Elwha River in 2007. However, this estimate does not include some of the canyon reaches or the two reservoirs. Bull trout were observed throughout the basin during these surveys; however, o the fish observed during this survey, only 27 were observed below Elwha Dam, the furthest downstream dam in the system. Bull trout have been observed as high as RM 43.9 (ONP Fish Distribution Database). They are also found in at least seven tributaries.

2.3 Status of ESA-listed salmonid population(s) affected by the program, relative to critical and viable population thresholds.

2.3.1 Elwha River Chinook salmon

Annual spawner escapement since 1999 has ranged from 1,146 to 3,439. These estimates include natural- and hatchery-origin adults counted on the spawning grounds in the lower river, and those adults removed for use as hatchery broodstock. The Puget Sound Chinook Harvest Plan (PSIT and WDFW 2010) set a low abundance threshold of 1,000, and the upper management threshold at 2,900. The NMFS refers to a critical threshold of 200 and a viable threshold of 1,250 in their evaluation of the Harvest Plan (NMFS 2011). The nominal spawning escapement goal of 2,900 has been achieved only once since the 1980s, even though harvest in U.S. marine area fisheries have been reduced, and in-river fishery impacts have been near zero for over 10 years. The average number of spawners over the last five years (2006-2010) was 1,538, which is lower than the average of 2,527 for the preceding five years (2001 - 2005).

TABLE 2.1. CHINOOK ESCAPEMENT TO THE ELWHA RIVER

	Broodstock	Natural Spawners	Pre-spawn mortality	Total
1999	699	903	23	1625
2000	1136	715	62	1913
2001	1553	655	38	2246
2002	1505	863	40	2408
2003	1182	1045	78	2305
2004	1325	2075	39	3439
2005	1396	835	7	2238
2006	1229	693	11	1933
2007	757	380	9	1146
2008	667	470	16	1153
2009	1514	651	16	2181
2010	709	564	5	1278

The recent NMFS status review concluded that the escapement abundance trend has been stable since the 1990's (0.99 – data from 1990-2009) (Ford et al 2010). The median growth rate of the population from 1990 through 2005 was 0.99 for the total adult return and 1.0 for escapement to the river. There are no estimates of the proportion or number of natural-origin adult returns, but it has been assumed that natural production is critically depressed, requiring hatchery supplementation to maintain population viability.

2.3.2 Elwha River Steelhead:

Escapement surveys of the lower river below the Elwha Dam in 2005 - 2011, indicate the number of native steelhead spawners has ranged from 45 to 246. These estimates are based on redd counts which are expanded by 1.62 adults/redd (Mike McHenry, LEKT pers comm November 13, 2011; WDFW standard redd count expansion factor). These estimates should be interpreted cautiously because replicated surveys throughout the spawning period are often prevented by high flow and turbidity. Further surveys to monitor spawner abundance and distribution in the main stem, Indian Creek, and Little River are planned for implementation subsequent to removal of the Elwha River dams (McHenry and Pess 2008).

TABLE 2.2. SPAWNING ESCAPEMENT OF ELWHA RIVER NATIVE STEELEAD.

Year	Escapement
2005	100
2006	123
2007	-
2008	-
2009	45
2010	193
2011	246

The Puget Sound Steelhead Technical Recovery Team is developing recovery guidance for the DPS, and has provided preliminary critical and viable abundance thresholds of 712 and 3,558, respectively, for the Elwha population. The co-managers harvest plan for Puget Sound steelhead set the critical threshold for Elwha steelhead at 100 (PSIT and WDFW 2010). These thresholds were developed to inform harvest management in the short term, but they lack technical basis in current or future potential productivity. Natural-origin winter steelhead production has been confined since 1911 to the five mile reach below Elwha Dam, where poor habitat conditions constrain spawning success and rearing survival. Recovery of the population to a viable level is contingent upon implementation of the Elwha River Fish Restoration Plan (Ward et al. 2008), commensurate with removal of the Elwha and Glines Canyon dams beginning in 2011 and restoration of anadromous fish access to the upper river. As dam removal enables steelhead to access spawning and rearing habitats in the upper watershed, the critical and viable population thresholds will increase.

2.3.3 Elwha River Bull Trout:

The Recovery Plan for the DPS (USFWS 2004) identified the Elwha River as a core area with one identified local population and one potential local population in Little River (USFWS 2004). Based on professional judgment, knowledge of bull trout distribution in drainages, availability of suitable habitat, and extremely low numbers of char observed in this system in recent years, the USFWS rates the lower Elwha River subpopulation as “depressed.” Migratory bull trout may persist in the Elwha core area (USFWS 2004), but until anadromous access to the upper watershed is re-established, and a viable level abundance and diversity recovered, the stocks will remain at elevated risk of extinction (Ward et al. 2008). Critical or viable population thresholds have not been developed for bull trout. USFWS (2011) set interim recovery goals of two viable populations in the Core Area, with at least 500 spawners.

2.3.4 Proportion of hatchery-origin and natural-origin fish on spawning grounds.

Elwha River Chinook: spawners predominantly of hatchery origin, but exact proportions are unknown.

Elwha River Steelhead: Spawning escapement estimates in section 2.2.2 are assumed to represent native population abundance; the proportion of early-timed hatchery-origin adults co-occurring with native steelhead is not known, but assumed to be small.

Elwha River Bull Trout: All fish in the spawning population are of natural origin.

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

Broodstock Capture: Collecting chum broodstock from the river using gillnet or seine gear, may involve handling of listed adult steelhead. For the short-term any natural-origin steelhead caught will be used for broodstock in the steelhead program or will be tagged and transported at upriver locations to promote recolonization.

Operation of Hatchery Facilities: Operation of the hatchery physical plant will have very minor effects on listed fish in the Elwha River watershed. Withdrawal of surface water to supply the hatchery is screened to avoid entrainment of juvenile salmon, in accordance with NMFS guidelines. Hatchery effluent is rapidly diluted at the point of discharge, and effluent quality is maintained within federal NPDES permit guidelines to ensure that downstream aquatic life (including fish) is adequately protected.

Competition: Age-0 chum smolts released from the hatchery may compete with juvenile Chinook during the period they co-occur in the lower river and nearshore marine waters. The potential for their interaction is expected to be low, due to the typically rapid emigration of chum from the river, and due to inter-species niche separation in the nearshore marine zone. Implementation of fish disease monitoring and control procedures consistent with the Salmonid Disease Control Policy of the Fisheries Co-managers of Washington State (2006) will reduce the risk of transmitting disease from propagated chum salmon to natural fish populations to low or insignificant levels.

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

Direct take of listed fish has not occurred in association with this program. Indirect take associated with ecological interactions with listed fish has not been quantified.

SECTION 3. RELATIONSHIP OF PROGRAM TO OTHER MANAGEMENT OBJECTIVES

3.1. Describe alignment of the hatchery program with any ESU-wide hatchery plan or other regionally accepted policies.

Implementation of the hatchery program is consistent with native Elwha River salmonid population preservation and restoration approaches stated in the Elwha Fish Restoration Plan (Ward et al. 2008). The Plan describes basin-wide fish conservation measures, including artificial propagation, research, monitoring, and evaluation actions, that have been agreed to by the tribal, federal, and Washington State partners for application during the pre-, during, and post-dam removal phases.

This hatchery plan is consistent with the approach specified for maintaining and restoring chum salmon in the Elwha Fish Restoration Plan, refining objectives and methods based on new stock status information.

The EFRP is an integral part of the Puget Sound Salmon Recovery Plan, developed by the Salmon Shared Strategy process, and adopted by the NMFS (2006) as the blueprint for recovering Puget Sound Chinook and other species.

Funding to support salmon recovery is derived from diverse sources. The NWIFC and the Washington Salmon Recovery Funding Board (SRFB) administer funds obtained from the NMFS' Pacific Coastal Salmon Recovery Fund to implement habitat restoration, hatchery reform, research, and monitoring grants. The North Olympic Peninsula Lead Entity prioritizes projects obtained through the SRFB.

This HMGP is consistent with hatchery program guidelines stated in the co-managers' Puget Sound hatchery resource management plan (PSTT and WDFW 2004), and is consistent with the following policies and permit requirements that are relevant to hatchery program management:

- Hatchery Reform - Principles and Recommendations of the Hatchery Scientific Review Group and Review of the Elwha Fish Restoration Plan and Accompanying HGMPs. These reports describe the HSRG's scientific framework, tools and resources for evaluating hatchery programs, and the processes used to apply these tools, and the resulting principles, system-wide recommendations, and program-specific recommendations to reform (HSRG 2004 & 2012).
- Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State. This policy designates and delineates Fish Health Management Zones and defines inter and intra-zone transfer policies and guidelines for eggs and fish. These are designed to limit the spread of fish pathogens between and within watersheds (WDFW and NWIFC 2006).
- National Pollutant Discharge Elimination System Permit. This permit states discharge criteria for hatchery effluent and requires monitoring to ensure that the quality of receiving waters are not impaired.

3.2. Cooperative agreements, memoranda of understanding, other management plans, or court orders under which program operates.

This program operates consistent with the Puget Sound Salmon Management Plan (1985) which was developed by the co-managers pursuant to *U.S. v Washington*. The PSSMP is the legal framework for co-management, and provides equitable sharing of fishing opportunity. The PSSMP requires that WDFW and affected tribes develop production objectives for each hatchery program in the Equilibrium Brood Document. The Future Brood Document is a detailed listing of annual production goals, which is reviewed and updated each spring and finalized in July.

3.3. Relationship to harvest objectives.

For a period of five years following dam removal there will be no chum fisheries in the Elwha River. Terminal-area chum fishing regimes will be developed as chum abundance recovers to a level that provides harvestable surplus. Prior to attaining long-term recovery goals, fisheries may

target surplus hatchery production, yet constrained to not impede recovery. Program fish will, in the interim, contribute to pre-terminal marine fisheries in the U.S. and British Columbia.

No chum-directed fisheries have occurred in the Elwha River during the last ten years, because of the low abundance of the native stock. Chum directed fisheries will not operate during the preservation or recolonization phases of recovery, or until the population achieves abundance benchmarks signifying harvestable surplus is available. Options and methods for selective harvest of hatchery-origin chum may be developed in the interim.

3.4. Relationship to habitat protection and recovery strategies.

The primary limiting factors for natural production of chum and other anadromous species in the Elwha River have been associated with construction and operation of the two dams on the river. The lower facility (Elwha Dam) is located at RM 4.9. Hatchery programs are preserving the native stocks during dam removal, which began in September 2011. Recovery of naturally self-sustaining chum population will be dependent on their access and utilization of suitable mainstem, off-channel, and tributary habitat after the dams are removed. Natural or assisted restoration of lower river habitat is also necessary to create properly functioning conditions needed to sustain native steelhead production. Numerous restoration projects (i.e., engineered log jams, levee removals, and lateral channel protection/enhancement) have been completed in the lower river to improve production of chum and other species.

The Lower Elwha Klallam Tribe and WDFW participated together with the National Park Service, Clallam County, the City of Port Angeles, local landowners, U.S. Fish and Wildlife Service, NMFS, and other local entities in basin-wide habitat preservation and restoration planning efforts. Focusing on restoration of properly functioning habitat conditions upstream and downstream areas before, during, and after removal of the dams, these entities are helping to ensure that recovered habitat will sustain salmonid species native to the Elwha River watershed.

3.5. Ecological interactions with unlisted fish and other species

3.4.1. Salmonid and non-salmonid fishes or other species that could negatively impact the program.

Chum smolts released from the hatchery are subject to predation by yearling or older juvenile coho, steelhead, bull trout, resident rainbow and coastal cutthroat trout, and other piscivorous fish species, in the mainstem river and sidechannels, and the estuary and nearshore marine waters in the Strait of Juan de Fuca. These areas serve as migration corridors for juvenile and adult fish, and spawning and incubation areas for the species. Avian predators, including terns (genus *Sterna* and several sub-species), gulls (genus *Larus* and several sub-species), mergansers (*Mergus merganser*), double crested cormorants (*Phalacrocorax auritus*), belted kingfishers (*Ceryle alcyon*), and great blue herons (*Ardea herodias*) can also prey on juvenile chum. Mammals that may be predators of migrating smolts and returning adults include: mink (*Mustela vison*), river otters (*Lutra canadensis*), harbor seals (*Phoca vitulina*), Stellar sea lions (*Eumetopias jubatus*), California sea lions (*Zalophus californianus*) and Orcas (*Orcinas orca*).

3.4.2. Salmonid and non-salmonid fishes or other species that could be negatively impacted by the program (focus is on listed and candidate salmonid species).

Program fish may compete with naturally-produced chum and pink fry, and sub-yearling Chinook salmon (see 2.2.3, above).

3.5.3. Salmonid and non-salmonid fishes or other species that could positively impact the program.

Not applicable

3.5.4. Salmonid and non-salmonid fishes or other species that could be positively impacted by the program.

Juvenile chum released by this program will contribute to the prey base of other anadromous and resident salmonids in the Elwha basin. Adult chum returns from this program will contribute to the input of marine derived nutrients into the basin, potentially benefitting primary and secondary productivity instream and in the riparian zone. Some juvenile salmon, particularly coho and steelhead, may feed directly on chum carcasses, and juvenile salmon that have extended residence in freshwater may benefit from increased productivity (Wipfli et al. 1998).

SECTION 4. WATER SOURCE

Provide a quantitative and narrative description of the water source (spring, well, surface), water quality profile, and natural limitations to production attributable to the water source

4.1 Facility water source:

The facility uses surface and ground water. Water quality is similar to that in the Elwha River. Water temperature profile will be cooler during the summer and warmer during the winter due to the influence of the ground water component.

Surface water is supplied to the hatchery from a diversion and treatment facility located at RM 3.2 of the Elwha River, which serves municipal demand from Port Angeles and the hatchery. Up to 29 CFS can be delivered to the hatchery. The treatment plant is designed to strip sediment from the surface water, to maintain a maximum turbidity of 20 NTUs. Diversion structure screening is compliant with NMFS' criteria.

Six wells on the facility can contribute a total of 4,000 GPM to the facility. Well water is de-gassed at the hatchery prior to delivery to rearing units.

Permits: National Pollutant Discharge Elimination System (NPDES). Tribal Hatcheries and Other Upland Aquaculture Facilities in the State of Washington. Permit No. WA-G13-1023.

SECTION 5. FACILITIES

5.1 Broodstock collection facilities:

With the population at current low abundance, broodstock are collected from the river. It is anticipated that adults will start returning directly to the hatchery in 2015 and subsequent years. Brood fish return voluntarily to the facility, entering through an outfall creek constructed for the hatchery. At the head of the outfall creek fish ascend a fish ladder into the trap, where they are sorted one to two times per week for species, sex, and state of sexual ripeness. Green males and females are held separately prior to spawning.

5.2 Fish transportation equipment:

Eggs and fingerlings are not expected to be outplanted off-station. Returning adults may be transported upstream to appropriate spawning and rearing areas in mainstem areas above the affected areas and in tributary streams. Both WDFW and the Tribe each have 500 gallon capacity tanker trucks appropriate for this transport activity.

5.3 Broodstock holding and spawning facilities:

Holding facilities for the program consist of a .75 acre concrete holding facility divided into sections that permit the segregation of fish based upon species, sex and ovulatory status. Spawning facilities for the program consist of a covered work area and an egg processing room in the main hatchery building.

5.4 Incubation facilities:

The incubation facility consists of 84 half-stack vertical incubation units (Marisource, INC) with a maximum instantaneous incubational capacity of 1.0 million eggs. The facility is located on the hatchery grounds and is served by pathogen-free ground water.

5.5 Rearing facilities:

The hatchery's rearing facility consists of 10 fiberglass early-rearing troughs, 16 concrete raceways, and 4 asphalt-lined rearing ponds.

5.6 Acclimation/release facilities:

Fish are released directly from rearing ponds. No additional acclimation facilities are used in the program.

5.7 Operational problems which may cause significant fish mortality:

5.7.1 Flooding has the potential to inundate the facility's fish ladder. In the event of flooding effluent water can be diverted from the facility fish ladder and pumped out of the facility.

5.7.2 Loss of electrical power may result in pump failure and loss of groundwater production. Loss of electrical power generation is mitigated through an emergency stand-by generator that is capable of supplying facility electrical needs in the event of power outages.

5.7.3 Shaft bearing failure on turbine pumps in the past have caused pump shaft shear and loss of groundwater production. The facility well field consists of six groundwater wells. No more than five wells are operated at one time, permitting redundancy in groundwater production capabilities.

5.7.4 Flooding in the Elwha River has the potential to erode and damage the buried pipeline feeding the hatchery. In the event of loss of surface water, recirculation pumps at the hatchery facility can be employed to maintain flows throughout the hatchery facility.

5.7.5 Disease outbreaks: Historical disease outbreaks include: *R. salmoninarum, F. psychrophilum, Trichodina* spp., *Epistylis*, spp.

5.7.6 Mammalian predation: Predation by piscivorous mammals has resulted in the loss of an undocumented number of juvenile salmonids.

5.7.7 Avian predation: Predation by piscivorous birds has resulted in the loss of an undocumented number of juvenile salmonids.

5.8 Backup systems/risk aversion measures to address operation problems:

5.8.1 A flood reduction levee has been constructed by the US Army Corps of Engineers to address the issue of flooding. During flood events a gate on the hatchery fish ladder can be closed, preventing the entry of flood waters into the hatchery facility. During these flood events, flap-gate closure prevents movement of adults into the hatchery and/or the release of juveniles from the hatchery.

5.8.2 The local PUD has upgraded the service entrance and transmissions lines leading to the facility, minimizing the potential of power outages at the facility.

5.8.3 An emergency standby generator is on-line and ready to provide electrical power in the event of a power outage.

5.8.4 Pump production and operation is monitored regularly. Pumps receive regular servicing and inspections.

5.8.5 A video security system has been installed to deter theft and is monitored 24/7.

5.8.6 Fish health is monitored pro-actively. Rearing conditions are maintained to promote optimal fish health.

5.8.7 Netting systems have been upgraded to limit effects of avian predation. No risk aversion measures have been taken to limit mammalian predation.

SECTION 6. BROODSTOCK ORIGIN AND IDENTITY

6.1 Source: Elwha River native, fall chum stock

6.2 Supporting information

6.2.1 History: The chum program began at the Lower Elwha Fish Hatchery in 1995 utilizing Elwha River broodstock. Egg box outplants have occurred in six recent years at several locations in the lower three miles of the river; egg box plants have ranged from 12,400 to 59,600 eggs; Age-0 smolt releases from the hatchery were begun in 2005. Release numbers have ranged from 776 to 31,290.

6.2.2 Annual size of naturally spawning population: unknown

6.2.3 Past and proposed level of natural fish in broodstock: To date, all broodstock have been natural-origin adult chum.

6.2.4 Genetic or ecological differences: There are no known differences between naturally-spawning and hatchery-origin chum. Run timing should be identical due to broodstock collection efforts.

6.2.5 Reason for choice of stock: Selection of the stock was based upon its localized adaptation, unique genetic composition, run timing characteristics, tribal cultural priorities, and stock availability.

6.3 Risk Aversion measures to be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish that may occur as a result of broodstock selection practices: No known adverse genetic or ecological effects to listed natural fish is expected from chum salmon broodstock selection.

SECTION 7 BROODSTOCK COLLECTION

7.1 Collection or sampling design:

Currently, adult chum are captured using gillnet or beach seine gear from the lower Elwha River, in November and December. Starting in 2015, adult returns from program releases will return directly to the hatchery trap, perhaps precluding the need to capture adults in the river. The hatchery collects and spawns fish from throughout the run period to insure representation of all portions of the run timing spectrum.

7.2 Identity:

Adults collected from the river exhibit the run timing of the native fall chum stock, in contrast to earlier-timed chum that may still return as remnants of the previous introduction of the Walcott Slough stock. The Walcott-stock hatchery program was terminated in 1985. Starting in 2015, gametes will be taken from all adult chum returning to the hatchery facility in order to help meet egg collection goals.

7.3 Proposed number to be collected:

The adult collection goal of the program proposed by the ERFRP:

Dam removal period: adult collection goals – up to 1000 adults

Post-removal period: adult collection goal – up to 800 adults

7.4 Previous broodstock collection and hatchery production

Table 7.1 Lower Elwha hatchery chum salmon broodstock collection, egg plants and fry releases, 2001 - 2010

Year	Females	Males	Egg take	Fecundity	Egg Plants	Fry Release
2001	21	20	49,434	2,354	47,080	0
2002	20	19	65,678	3,284	59,600	0
2003	33	33	66,063	2,002	57,600	0
2004	12	14	21,556	1,796	12,400	0
2005	1	1	2,088	2,088	0	776
2006	21	22	52,089	2,480	23,886	18,577
2007	2	2	6,254	3,127	0	3,883
2008	11	10	31,583	2,871	0	24,763
2009	22	18	67,623	3,074	22,283	31,290
2010	0	0	0	0	0	0

7.5 Disposition of surplus broodstock:

Collection of adult fish in excess of hatchery production needs is not anticipated. Fish used in broodstock collection are killed, sampled for otolith marking information, and are used in carcass nutrient enrichment programs in the Elwha River basin.

7.6 Fish transportation and holding methods:

Adults collected from the river are transported to the hatchery. Fish are sorted by sex and state of sexual ripeness within the holding facility. If flow and channel conditions significantly inhibit migration of adult chum into suitable spawning areas, managers may transport adult chum, either returns to the hatchery surplus to broodstock requirements, or those trapped at the weir, to suitable upstream habitat to promote recolonization.

7.7 Fish health maintenance and sanitation procedures:

No fish health maintenance procedures are conducted during the pre-spawn holding period at the hatchery facility. Pre-spawning mortalities are removed from the pond, and disposed of by either burial or used for in-river carcass nutrient enrichment.

7.8 Risk aversion measures to minimize adverse genetic or ecological effects to listed natural fish resulting from the broodstock collection:

No adverse effects are anticipated.

SECTION 8. MATING

8.1 Selection method: spawners are selected randomly from ripe fish on a given day.

8.2 Fertilization:

Females are spawned and eggs from up to 20 females are pooled. These eggs are randomly mixed and divided into 14 lots. Eggs are rinsed with a buffered sodium bicarbonate solution to remove debris and promote sperm motility. The rinse solution is then poured-off. Males are spawned individually and their sperm held separately. Sperm from males (one principal, one back-up) are mixed into each lot of eggs. Water is added to initiate sperm motility. Eggs are loaded into vertical tray incubators and allowed to water-harden for 60 minutes in 3 liters of 100 PPM buffered PVP iodine solution. Following water-hardening, incubation flows are begun at 3.0 GPM.

8.3 Cryopreserved Gametes: Not utilized for this program.

8.4 Risk aversion measures employed to minimize adverse genetic or ecological effects to listed natural fish resulting from the mating scheme:

Adverse genetic or ecological effects to listed natural fish are not known to result from current chum salmon mating practices.

SECTION 9. INCUBATION AND REARING

9.1 Incubation.

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

Table 9.1 Lower Elwha Hatchery chum egg takes and egg survival, 2001 – 2009.

Year	Green Eggs Taken	Percent Survival to Eyed Stage
2001	49,434	97.9%
2002	65,678	95.6%
2003	66,063	86.7%
2004	21,556	93.8%
2005	2,088	92.4%
2006	52,089	71.2%
2007	6,254	84.1%
2008	31,583	78.6%
2009	67,623	79.2%
Average	**36,237**	86.6%

9.1.2 Cause for, and disposition of surplus egg takes:

Excess eggs are taken in order to guard against loss of eggs during incubation and rearing and to ensure that the egg take proportionately represents all segments of the run timing spectrum. It is anticipated that all eggs collected in the short term will be incubated and used to achieve program goals.

9.1.3 Egg size

Table 9.2. Lower Elwha Hatchery average chum egg size,

Year	Egg Size (eggs/gm)
2001	3.94
2002	4.06
2003	3.72
2004	4.21
2005	3.73
2006	4.00
2007	3.99
2008	4.10
2009	4.24
2010	na

9.1.4 Standard incubation flows: 3.0 GPM

9.1.5 Average Loading per Heath Tray: Green to eyed: 8,000 (eggs/tray); Eyed to hatch: 5,000

9.1.6 Incubation conditions: Incubation facility is supplied by constant temperature ground water. Incubational development is tracked on a weekly basis. Eggs are shocked, sorted to remove non-viable eggs, inventoried, and retrayed prior to hatching. Eggs are retrayed in Heath trays with triple-layer of Vexar screening to inhibit coagulated yolk condition. No siltation occurs during incubation process.

9.1.7 Ponding:

Alevins are mostly buttoned-up when they are ponded; a small suture remains visible at time of ponding. Fish are transferred manually to early-rearing tanks.

Cumulative temperature units: 1,425 CTU ^{o}F

Mean length: unknown

Mean weight: unknown

Ponding dates:

Table 9.3. Lower Elwha Hatchery chum fry ponding dates, 2001 - 2009

Brood Year	First Ponding Date (Egg outplant date)	Final Ponding Date (Projected emergence date)
2001	01.10.2002 (02.18.2002)	01.17.2002 (03.02.2002
2002	01.08.2003 (02.22.2003)	01.09.2003 (03.14.2003)
2003	12.31.2003 (02.20.2004	01.06.2004 (03.10.2004)
2004	12.30.2004 (02.12.2005)	01.05.2005 (02.15.2005)
2005	02.25.2006	02.25.2006
2006	01.03.2007 (01.27.2007)	01.09..2007 (03.06.2007)
2007	3.02.2008	03.21.2008
2008	02.07.2009	03.13.2009
2009	01.14.2010 (02.12.2010)	03.06.2010

9.1.8 Fish health maintenance and monitoring: Fungus controlled by means of formalin drip treatments (166 PPM for 15 minutes, 3 days of treatment per 10 days rearing).

Yolk-sac malformation incidence: Yolk sac malformations are not observed in eggs. Egg incubation strategies are employed (3.0 GPM flows and use of incubational substrate) to prevent these malformations from occurring.

At eyed stage non-viable eggs are removed mechanically and manually. Mortalities experienced following the retraying of eggs are not removed until the ponding of fry.

9.1.9 Risk aversion employed to minimize the likelihood for adverse genetic and ecological effects to listed fish during incubation: Incubation will not genetically and ecologically effect listed fish.

9.2 Rearing

9.2.1 Survival data by hatchery life stage for the most recent 12 years

Table 9.4. Lower Elwha Hatchery chum survival rates, brood year 2001 – 2009.

Year	Fry to release	Egg to emigration
2001	-	74.8%
2002	-	99.2%
2003	-	72.9%
2004	-	98.3%
2005	41.8%	
2006	91.0%	98.3%
2007	62.1%	
2008	99.7%	
2009	-	97.6%
Average	73.7%	90.2%

9.2.2 Density and loading criteria: Flow based densities 1.20 LBS/GPM/inch fish length; Volume based densities: 0.30 LBS/FT3/inch fish length). Optimal values established by Northwest Indian Fisheries Commission Tribal Fish Health Center.

9.2.3 Fish rearing conditions - Ponds are monitored weekly for temperature and discharge flows. Fish health is monitored monthly or as needed by staff of the NWIFC Tribal Fish Health Center.

9.2.4 Monthly fish growth information: not available

9.2.5 Feed types used, feed rates, application information

Table 9.5 Lower Elwha Hatchery chum program feed types and feeding schedule.

Developmental Stage	Rearing unit	Feeding Frequency	Feed Rates	Feed Manufacture	Feed Type & Size
Fry to fingerling	Troughs/ Raceways	5x/day 7 day/wk	2.7%BW/Day	BioOregon	BioVita Starter #0,#1,#2

9.2.6 Fish health monitoring, disease treatment, sanitation: Fish health is monitored throughout the rearing period. Staff from the NWIFC Tribal Fish Health Center visit the hatchery monthly or more frequently as needed, and perform routine monitoring of juvenile fish, advise hatchery staff on disease findings, and recommend antibiotic or other treatment when appropriate.

9.2.7 Smolt development indices: Physiological indices not monitored. Fish behavior is monitored to assess degree of smoltification.

9.2.8 Risk aversion measures applied to minimize the likelihood for adverse genetic and ecological effects to listed fish under propagation: No listed fish will be propagated by this program. No known adverse genetic or ecological effects to listed natural fish will result from current chum salmon propagation practices currently employed at the Lower Elwha Fish Hatchery.

SECTION 10. RELEASE

10.1 Program objectives

The current objectives are to release 450,000 age-0 smolts during the preservation phase and 450,000 to 1,025,000 age-0 smolts during the recolonization phase. Fish will be released directly from the hatchery.

Release protocols: Age-0 smolts are released volitionally from the hatchery beginning in March or April. Fish leave the hatchery rearing ponds through a pipe, pass into the facility outfall, and travel 0.10 miles to the confluence of the outfall with a side channel of the Elwha River. The side channel enters the mainstem of the Elwha River at RM 1.3.

Fish release from the hatchery is timed to reduce interactions in the lower river with outmigrant coho late March through Mid-May (Peters, R.J. 1996), and with (yearling) chinook smolts released from the WDFW Elwha Rearing Channel mid- to late-June.

Total releases of fish and specific life history stages at which releases occur are detailed in the ERFRP. As adults return to the river, hatchery production may be adjusted downward and the release of adults upstream to promote recolonization will occur.

10.2 Number of fish released in previous years.

Table 10.1 Chum fry releases from the Lower Elwha hatchery, 2001 – 2009.

Year	Fry	Emigrated Fry
2001	0	35,231
2002	0	59,149
2003	0	41,984
2004	0	12,381
2005	1,857	0
2006	18,577	0
2007	3,883	0
2008	24,763	0
2009	31,290	21,749
Average	8,809	24,356

10.4 Dates of release and release protocol:

Table 10.2 Chum smolt release dates from the Lower Elwha hatchery, 2004 – 2009.

Year	Life History Stage	Start Release	End Release
2004	Smolt	02.28.2005	02.28.2005
2005	Smolt	03.13.2006	03.20.2006
2006	Smolt	02.26.2007	04.02.2007
2007	Smolt	03.12.2008	04.29.2008
2008	Smolt	02.22.2009	04.15.2009
2009	Smolt	02.26.2010	04.08.2010

Release dates are chosen based upon smolt readiness (pre-smolt behavior changes, scale loss, feed response) and to reduce interactions with other outmigrating juvenile salmon in the Elwha River (chum, pink, coho, Chinook, and steelhead).

10.5 Acclimation procedures: No acclimation procedures occur during the release phase.

10.6 Marks and proportions of total hatchery population marked, to identify hatchery fish: All chum produced at the hatchery will receive an otolith mark applied thermally, an adipose fin clip, or a combination of the two marks.

10.7 Disposition of fish surplus to programmed/approved levels:

No surplus anticipated in near term.

10.8 Fish health certification procedures applied pre-release:

Representative samples of pre-smolts are taken by staff of the NWIFC Tribal Fish Health Center for diagnostic analysis.

10.9 Emergency release procedures in response to flooding or water system failure:

If an emergency occurs prior to scheduled release, the situation will be evaluated and addressed if possible. If the emergency cannot be resolved, feeding will be halted and fish released. The facility is protected by a flood control levee constructed by the Army Corps of Engineers. Following levee construction, the facility has been free of impacts due to flooding. During a flood event on-going releases of fish will be halted until the end of the event. If the water supply system fails, water distribution will be altered to insure an even distribution of remaining water sources to rearing ponds.

10.10 Risk aversion measures applied to minimize adverse genetic and ecological effects to listed fish resulting from fish releases:

No genetic or ecological effects are anticipated.

SECTION 11. MONITORING AND ADAPATIVE MANAGEMENT PLAN

The Monitoring and Adaptive Management Plan (MAMP) (2012 in draft) defines and implements monitoring and management strategies that incorporate the best available scientific methods and management responses to ensure the recovery of anadromous fish, while minimizing risks to those species from dam removal and stock preservation efforts. The MAMP was developed by an interagency group through the review of technical memorandums, planning documents, the ERFRP (Ward et al 2008), recommendations from the HSRG (2012), Biological Opinions, and relevant scientific literature.

The MAMP will be subjected to peer review by independent scientists and has received policy review and concurrence by the co-managers and relevant federal agencies.

The adaptive management process includes:

- Definition of the decision making process and timeframe
- Definition of decision rules
- A Monitoring and Evaluation Plan focused on the process for establishing and modifying goals and objectives, and making decisions based on biological triggers
- Performance indicators (metrics) that drive the decision-making process
- Identification of biologically-oriented phases of recovery

The MAMP prioritizes recovery strategies for each species during each phase of recovery. The objectives of the MAMP are to evaluate restoration strategies and their associated assumptions, and to design a monitoring plan that identifies objectives and provides performance indicator values of adequate quality to evaluate management assumptions and the success of restoration strategies. The adaptive management process will modify restoration strategies in response to assessment of their efficacy.

The endpoint of each phase of recovery is identified by the population achieving benchmark levels ('triggers') of abundance, productivity, spatial distribution, and diversity. These characteristics refer to recovery standards developed by the NMFS (McElhany et al 2000). Research and monitoring will focus on measuring progress toward these benchmarks, with results informing adaptive management. The MAMP will specify data standards for adaptive management decisions, tools and analytical methods, and data management and record keeping standards.

SECTION 12. MONITORING AND EVALUATION OF PERFORMANCE INDICATORS

12.1 Supplement Abundance:

Procedures and equipment will be utilized at the hatchery to enumerate releases with the greatest possible accuracy. The weir will provide data necessary to estimate natural escapement. Methods will be developed and implemented to assess the survival of hatchery releases, and their contribution to escapement. Adult returns comprise the sum of natural and hatchery escapement.

12.2 Protect genetic legacy of the native stock:

Adherence to specified broodstock selection and mating protocols that promote genetic diversity will be documented by hatchery staff.

12.3 Ecological interactions:

Operation of the mainstem rotary screw trap will estimate chum smolt production, and describe outmigration timing and patterns relative to juveniles of other species. These data will be used to guide hatchery production practices and release strategies.

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13.2 Permits

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SECTION 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

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

Name, Title, and Signature of Applicant: Larry Ward, Fisheries Biologist

Certified by: _____ Date: 08.01.12