

HATCHERY AND GENETIC MANAGEMENT PLAN

RESIDENT FISH VERSION

(HGMP-RF)

Hatchery Program: Sherman Creek Hatchery –
Lake Roosevelt Kokanee Net Pens

Species or Hatchery Population/Strain:
Kokanee Salmon (*Oncorhynchus nerka*)

Agency/Operator: Washington Department of
Fish and Wildlife

Watershed and Region Upper Columbia River –
Lake Roosevelt

Date Submitted: June 20, 2000

Date Last Updated: June 20, 2000

Note to HGMP-*RF* Reviewers: In terms of artificial production, the Lake Roosevelt Fisheries Restoration and Enhancement Program includes four production projects working in conjunction with each other to produce one release goal each of kokanee salmon and rainbow trout. These projects include the Spokane Tribal Hatchery (rainbow trout and kokanee), the Sherman Creek Hatchery (rainbow trout and kokanee), the Lake Roosevelt Rainbow Trout Net Pen Rearing Project and the Lake Roosevelt Kokanee Net Pen Rearing Project. This should be noted when reviewing each respective projects species specific HGMP to understand the context of restoration and enhancement through the use of artificial production in Lake Roosevelt.

SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1) Name of hatchery or program. Sherman Creek Hatchery (SCH) – Lake Roosevelt Kokanee Net Pens.

1.2) Species and population (or ~~stock~~strain) under propagation, and ESA/population status. Lake Whatcom and Meadow Creek (Kootenay Lake, B.C.)
Kokanee
Salmon (*Oncorhynchus nerka*).

1.3) Responsible organization and individuals

Indicate lead contact and on-site operations staff lead.

Name (and title): Mike Lewis, Complex Manager – Mitch Combs, FHS III

Agency or Tribe: Washington Department of Fish and Wildlife (WDFW)

Address: 3825 Mellenberger Road, Kettle Falls, WA 99141

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

- Spokane Tribe of Indians (Fishery Co-Managers) – Joint Artificial Production through Spokane Tribal Hatchery Project, Monitoring & Evaluation through Lake Roosevelt Monitoring Program, Project Direction & Oversight through Lake Roosevelt Hatcheries Coordination Team
- Colville Confederated Tribes (Fishery Co-Managers) - Monitoring & Evaluation through Lake Roosevelt Monitoring Program and Chief Joseph Kokanee Enhancement Project, Project Direction & Oversight through Lake Roosevelt Hatcheries Coordination Team
- Lake Roosevelt Development Association – Joint Artificial Production through Lake Roosevelt Rainbow Trout Rearing Project
- Lake Roosevelt Forum – Public Inter-face Source
- Eastern Washington University - Monitoring & Evaluation through Lake Roosevelt Monitoring Program, Peer Review of Project

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

The Lake Roosevelt Kokanee Net Pens are now part of the Sherman Creek Hatchery Annual Operations and Maintenance.

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- Funding Agency: Bonneville Power Administration
- Staff Level: 1 FTE Fish Hatchery Specialist III, 1 FTE Fish Hatchery Specialist II .8 FTE Complex Manager, and .8 FTE Fish Health Specialist.
- Annual Operational Cost: Currently @ \$225,000 can vary depending on any capital improvements.

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

Sherman Creek Hatchery is located immediately adjacent to Lake Roosevelt, part of the Upper Columbia River, WRIA 58, at the mouth of Sherman Creek, three miles west of Kettle Falls, Washington. Sherman Creek also consists of off shore net pens located directly out from the hatchery facility in Lake Roosevelt.

Sherman Creek Hatchery is part of the WDFW Spokane Complex which includes the Colville Trout, Spokane, Ford, Columbia Basin and Spokane Hatcheries along with the Phalon Lake Wild Rainbow Trapping Facility.

1.6) Type of program(s).

This program is primarily a harvest program but includes components of the APR defined Harvest, Integrated Harvest, and Integrated Programs. See sections 1 and 2 for further detail of program and program area.

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

The Sherman Creek Hatchery serves as a mitigation project with a goal of aiding the Lake Roosevelt fisheries restoration and enhancement program. The intention of artificial production in the restoration and enhancement program is to provide a long term readily accessible and harvestable fishery compatible with the ecological stability of the Lake Roosevelt biota as partial mitigation for hydropower-caused fish and habitat losses caused by the construction of Grand Coulee Dam.

1.8) Justification for the program.

Need of program:

Several past and present fisheries and hydrological related investigations (ie., Gangmark and Fulton 1949; Bryant and Parkhurst 1950; Earnest et al. 1966; Stober et al. 1977; Beckman et al. 1985; Scholz et al. 1985 Peone et al. 1989, Griffith and Scholz 1990; Thatcher et al. 1991 & 1992; Scholz et al. 1992; Tilson and Scholz 1991 through 1998; Underwood et al. 1993 through 1995; Chiosz et al. 1996, and Underwood et al. 1997 to present – in print) have cited that the construction and operation of Grand Coulee Dam completely blocked and subsequently extinguished anadromous fish runs in the upper Columbia, disrupted several hundred miles of fish spawning and rearing habitat, and

adversely affected the conditions and stability of the Upper Columbia River biota.

Fishery investigations from the 1940's to the present have continually determined the need for artificial production to support a viable sport fishery. Scholz et al. (1986) investigated the feasibility of restoring the fishery in Lake Roosevelt and its tributaries and formulated a restoration plan that centered around artificial propagation of kokanee salmon. The management plan also included the following elements: i) maintain existing walleye stocks via natural production and strict harvest management controls; ii) enhancing natural spawning populations of rainbow trout by improving spawning and rearing habitat and access into tributary streams, and; iii) conducting a monitoring program designed to evaluate the effectiveness of the above measures (Scholz et al. 1986).

In 1987, the Northwest Power Planning Council included two hatcheries, a rainbow habitat improvement project and a program for monitoring and evaluating these Lake Roosevelt fishery restoration measures in its 1987 Fish and Wildlife Program. The measure for the hatcheries included one constructed in 1991 at Galbraith Springs on the Spokane Indian Reservation operated by the Spokane Tribe of Indians (Spokane Tribal Hatchery), and one constructed in 1992 at Sherman Creek (a northern tributary in Lake Roosevelt) operated by the Washington Department of Fish and Wildlife.

In the 1980's, volunteers from Lake Roosevelt initiated a successful rainbow trout net pen rearing project. Fingerlings raised by state and federal hatcheries were transferred to net pens in the fall and the volunteers reared the fish to the following spring before release. Creel surveys performed by Peone et al. (1989) estimated 65,515 rainbow trout were harvested from January to December, 1989. In comparison, Harper et al. (1981) estimated anglers harvested 1,517 rainbow trout from April 15, 1981 to September 15, 1981. This large increase in harvest was attributed to the net pen rearing program (Peone et al. 1989). Fishery surveys in 1986 and 1987 conducted by the Upper Columbia United Tribes Fisheries Center indicated net pen reared trout grew in length at rates ranging from 22 to 36 mm/month and anglers caught most of the fish within 14 months after release (Peone et al. 1989). Prompted by excellent harvest returns and growth rates of net pen reared rainbow trout, as well as insufficient space at state and federal hatcheries, additional space was incorporated in the design of the kokanee hatcheries to rear 500,000 rainbow trout needed for the Lake Roosevelt net pen program. In 1994, the Northwest Power Planning Council implemented the net pen rearing operation in its Fish and Wildlife Program.

Fishery managers from the Spokane Tribe of Indians, Colville Confederated Tribes and Washington Department of Fish and Wildlife establish production goals and release strategies annually based upon ongoing scientific research activities on Lake Roosevelt. Initial stocking from 1988 to 1994 focused on annual target release goals of 13.5 million kokanee fry and 500,000 and rainbow trout yearlings. However, in 1995 fishery managers changed the target release goals to 1 million yearlings for Lake Roosevelt, 300,000 kokanee fingerlings for Banks Lake and 550,000 rainbow trout yearlings for

Lake Roosevelt. This release goal is anticipated to be met in 2000 with the implementation of the Kokanee Net Pen Rearing Project and each artificial production project working in conjunction with each other.

Benefit of program:

The hatcheries programs effect on the biota of Lake Roosevelt is under constant review by the Lake Roosevelt Monitoring Program. Most recent results of the monitoring program (Underwood et al. 1997, Tilson and Scholz 1997) indicate the impact of the hatchery and net pen programs have been beneficial to restoring and enhancing the Lake Roosevelt fishery while not negatively impacting wild (natural & native) stocks within the lake. Since 1988, the principle sport fishery has shifted from walleye (*Stizostedion vitreum*) to rainbow trout and kokanee, kokanee runs have been established and restored in Lake Roosevelt tributaries and the angler use, harvest rates for kokanee and rainbow trout and the economic value of the fishery have increased substantially. Technical reports summarizing the Spokane Tribal Hatchery fish production and accomplishments are submitted to the Bonneville Power Administration annually (Peone 1994 through 1997). Effects of the program on the Lake Roosevelt fishery before and after hatchery supplementation continues to be monitored and evaluated by the Lake Roosevelt Monitoring Program. Monitoring and evaluation results for the past 8 years can be found in the annual reports: Peone et al. 1989; Griffith and Scholz 1990; Thatcher et al. 1991 & 1992; Scholz et al. 1992; Tilson and Scholz 1991 through 1998; Underwood et al. 1993 through 1995; Cichosz et al. 1996, and; Underwood et al. 1997 & 1998 (in print).

Program operation to minimize adverse effects on listed fish:

At this time there are no listed fish in the project area. However, there are listed fish downstream of project area which actually cause adverse effects on Lake Roosevelt fishery restoration and enhancement efforts through Columbia River system operations called for in the National Marine Fisheries Service Biological Opinion.

1.9) List of program “Performance Standards.”

Not applicable at this time (see note below).

Species specific biological objectives formulated by fishery managers for mitigating fish losses in blocked area above Grand Coulee Dam were implemented in the Northwest Power Planning Council’s 1994 Fish and Wildlife Program as amended in 1995. The objectives include numerical targets for total adult populations, harvest and escapement, as well as timelines to achieve targets, based upon best available scientific evidence. The objectives were based upon the theoretical number of fish that could be supported by the primary and secondary productivity of the reservoir (Jagiello 1984, Beckman et al. 1985, reviewed by Scholz et al. 1986), the first 4 years of hatchery production and new data from the Lake Roosevelt Monitoring Program (Peone et al. 1989, Griffith and Scholz

1990 & 1991 and Underwood and Shields 1995). Included in the objectives is an annual target of 1 million age 1+ residualized smolt kokanee for release into Lake Roosevelt and 500,000 age 0+ rainbow trout for the net pen program. At the present time, the hatcheries in conjunction with the net pen programs are operated in accordance to aid in meeting these biological objectives. Performance standards and indicators are currently limited to these biological objectives. At this time, artificial production specific performance standards with indicators and methods of monitoring and evaluating them need to be compiled and implemented in Inter-Mountain Provincial Review Sub-Basin Planning Process. Further information for this section may be supplied at such a time.

Example: “ (1) Conserve the genetic and life history diversity of ~~Upper Columbia River spring chinook-westslope cutthroat trout~~ populations in the Coeur d’Alene Basin through a ~~12~~ x-year duration captive broodstock program; (2) Augment, restore and create viable naturally spawning populations using supplementation and reintroduction strategies; (3) Provide fish to satisfy legally mandated harvest in a manner which minimizes the risk of adverse effects to listed wild populations; (4)...”

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

1.10.1) “Performance Indicators”-addressing benefits.

1.10.2) “Performance Indicators” addressing risks.

1.11) Expected size of program.

The expected size of the program, in terms of fish artificially produced through joint efforts of the Spokane Tribal Hatchery, Sherman Creek Hatchery and Lake Roosevelt Net Pen Rearing Program, includes annual target release goals of 1 million kokanee yearlings, 300,000 kokanee fingerlings and 550,000 rainbow trout yearlings. Rainbow trout eggs are allotted to this program while kokanee eggs come from allotment as well as adults returning to collection sites. These collection sites include Sherman Creek as the primary site/source, Little Falls Dam and Hawk Creek, each potential sites/sources. Kokanee spawning channels for natural spawning and collection of kokanee egg sources for artificial production are currently under investigation.

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

Currently kokanee eggs are obtained from the Lake Whatcom Hatchery and Meadow Creek Spawning Channel (Kootenay Lake, B.C.). This stock is currently being used to restore natural production of kokanee in tributaries as well as provide future brood source for egg collection and artificial production.

1.11.2) Proposed annual fish release levels (maximum number) by life stage and location. (Use standardized life stage definitions by species presented in Attachment 2.)

Life Stage	Release Location	Annual Release Level
Eyed Eggs		
Unfed Fry		
Fry		
Fingerling	Banks Lake	300,000 (currently)
Yearling	Lake Roosevelt	1,000,000 (combined project goal)

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

~~Provide estimated smolt-to-adult survival rate, total adult production number, and escapement number (to the hatchery and natural areas)~~

Performance of the Lake Roosevelt artificial production projects is determined through the Lake Roosevelt Monitoring Program (LRMP). Data such as CPUE and condition factors can be found in annual reports by Peone *et al.* 1989; Griffith and Scholz 1990; Thatcher *et al.* 1991 & 1992; Scholz *et al.* 1992; Tilson and Scholz 1991 through 1998; Underwood *et al.* 1993 through 1995; Cichosz *et al.* 1996, and; Underwood *et al.* 1997 & 1998 (in print).

Performance of hatchery origin kokanee in Lake Roosevelt is currently under review by the LRMP. For the past 8 years of hatchery production, predation and entrainment have been associated with poor performance and survival of hatchery origin kokanee.

Hatchery release strategies have recently shifted and new production measures (i.e., net pen rearing) have been implemented to increase survival by reducing instantaneous post release predation and entrainment.

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

Sherman Creek began operations in March 1992 with the first releases in April 1992. Implementation of the kokanee net pens started in October 1993 with full implementation in October 2000.

1.14) Expected duration of program.

Currently, this program operates under an Intergovernmental agreement with the BPA that began in 1991 and runs through 2016. This agreement includes language pertaining to a 25-year extension at the end of the performance period.

1.15) Watersheds targeted by program.

Lake Roosevelt, (Upper Columbia River) including the Spokane and San Poil Rivers. This includes all or part of WRIA #'s 52, 53, 54, 58 and 61.

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

Management implications for operating Lake Roosevelt hatcheries has been continually reviewed each year with measures for attaining production goals derived. For example, in terms of meeting the target release goal of 1 million kokanee yearlings, the Lake Roosevelt Kokanee Net Pen Rearing Project was implemented. It is anticipated further alternative actions will be considered during regional sub-basin programmatic review and planning processes. Measurable salmonid enhancement and restoration, in terms of providing a stable long term fishery, in Lake Roosevelt is limited to the use of artificial production due to shifting reservoir operations influenced by ever changing flood control rule curves and system operation requests related to ESA listed species recovery measures.

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

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

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

~~2.2.1) Description of ESA listed salmonid population(s) affected by the program.~~

~~Include information describing: adult age class structure, sex ratio, size range, migrational timing, spawning range, and spawn timing; and juvenile life history strategy, including smolt emigration timing. Emphasize spatial and temporal distribution relative to hatchery fish release locations and weir sites~~

~~Identify the ESA listed population(s) that will be directly affected by the program. (Includes listed fish used in supplementation programs or other programs that involve integration of a listed natural population. Identify the natural population targeted for integration).~~

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

~~(Includes ESA listed fish in target hatchery fish release, adult return, and broodstock collection areas).~~

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

~~Describe the status of the listed natural population(s) relative to "critical" and~~

~~“viable” population thresholds (see definitions in “Attachment 1”).~~

~~–Provide the most recent 12 year (e.g. 1988-present) progeny to parent ratios, survival data by life stage, or other measures of productivity for the listed population. Indicate the source of these data.~~

~~–Provide the most recent 12 year (e.g. 1988-1999) annual spawning abundance estimates, or any other abundance information. Indicate the source of these data. (Include estimates of juvenile habitat seeding relative to capacity or natural fish densities, if available).~~

~~–Provide the most recent 12 year (e.g. 1988-1999) estimates of annual proportions of direct hatchery origin and listed natural origin fish on natural spawning grounds, if known.~~

~~**2.2.3) Describe hatchery activities, including associated monitoring and evaluation and research programs, that may lead to the take of listed fish in the target area, and provide estimated annual levels of take (see “Attachment 1” for definition of “take”).**~~

~~–Describe hatchery activities that may lead to the take of listed salmonid populations in the target area, including how, where, and when the takes may occur, the risk potential for their occurrence, and the likely effects of the take.~~

~~(e.g. “Broodstock collection directed at sockeye salmon has a “high” potential to take listed spring chinook salmon, through migrational delay, capture, handling, and upstream release, during trap operation at Tumwater Falls Dam between July 1 and October 15. Trapping and handling devices and methods may lead to injury to listed fish through descaling, delayed migration and spawning, or delayed mortality as a result of injury or increased susceptibility to predation”).~~

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

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

~~Complete the appended “take table” (Table 1) for this purpose. Provide a range of potential take numbers to account for alternate or “worst case” scenarios.~~

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

~~(e.g. “The number of days that steelhead are trapped at Priest Rapids Dam will be reduced if the total mortality of handled fish is projected in season to exceed the 1988-99 maximum observed level of 100 fish.”)~~

SECTION 32. RELATIONSHIP OF PROGRAM TO OTHER MANAGEMENT OBJECTIVES

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

Lake Roosevelt artificial production programs are operated under the review, guidance, and direction of the Lake Roosevelt Hatcheries Coordination Team. This group consists of personnel from the Spokane Tribe, Colville Confederated Tribes and Washington Department of Fish and Wildlife, the responsible fishery management agencies for the project area. Further hatchery plans, policies and reform measures may be implemented through regional sub-basin programmatic review and planning processes.

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

- Intergovernmental agreement with BPA for operation and maintenance
- All NPPC Columbia River Basin Fish and Wildlife Program and Amendments
- Fish Health Management and Policy

- 32.3) Relationship to harvest objectives.**

- 2.3.1) ~~3.3.1)~~ Describe fisheries benefiting from the program, and indicate harvest levels and rates for program-origin fish for the last 12 years (1988-99), if available.**

Lake Roosevelt fisheries specifically benefit from this program by increased harvest of hatchery origin fish and alleviation of fishing pressure on limited naturally producing populations. The annual harvest of rainbow trout was estimated at 79,638 by Peone et al. (1989) and has since increased to 226,809 fish in 1998 (Underwood et al. 1998 – in print).

- 32.4) Relationship to habitat protection and ~~recovery strategies~~ purposes of artificial production**

Major factors affecting natural production include reservoir operations adverse affects on fish populations (entrainment) and likewise on the limited spawning and rearing habitat.

From the 1940's to the late 1960's fishery surveys indicated a prominent population of kokanee salmon were abundant in Lake Roosevelt. Large numbers of kokanee were reportedly harvested in the forebay of Lake Roosevelt and high gill net and purse seine catches were made in the forebay in 1966 and 1967 by Bureau of Commercial Fisheries personnel (Snyder 1967, reviewed by Stober et al. and Scholz 1986). There were additional reports of large numbers of kokanee that outmigrated through Grand Coulee Dam during this time period. Interviews of local residents as well as National Park Service and Bureau of Reclamation personnel indicated that there was a salvage fishery for the "tens of thousands to hundreds of thousands" of disabled kokanee in the tail race of Grand Coulee Dam (Cash 1985). These observations indicate that ecological conditions after 1939 to the late 1960's were favorable for successful reproduction and survival of kokanee.

Kokanee abundance declined precipitously, commencing in 1968, after the reservoir was drawn down for the construction of a third powerhouse at Grand Coulee Dam. The drawdown was thought to negatively effect kokanee in at least two ways; first, through increased entrainment through the dams because of the higher flushing rate; second, by reducing access to tributaries and shoreline areas for spawning. Since completion of the third powerhouse, the magnitude and duration of reservoir level fluctuations has been altered (U.S. Geological Survey reports for water years 1960-1984; reviewed by Scholz 1986). Analysis of the increased annual drawdown over time, specifically 1941 to 1976, indicated the kokanee decline after 1968 was because reservoir elevations reduced egg and fry survival rates (Stober 1977).

Stober et al. (1977) evaluated the historical drawdown patterns of Lake Roosevelt in relation to spawning and incubation timing of kokanee and concluded that the decline in kokanee during the 1960's and 1970's could be explained by the impact of the annual drawdown regime on kokanee reproductive success (Scholz et al. 1985). Since 1968, the reservoir has been operated to produce more power, follow flood control rule curves and meet ESA requirements (1990's), thus causing lower water elevations and reduced water retention times from winter through spring. Since kokanee spawn in late fall when water levels are high, maintenance of reservoir levels in winter and spring are critical importance to the normal development of eggs and the early life history stages. Given these current reservoir operations, any type of natural production to support a sustainable kokanee salmon or fishery would be impossible (Scholz et al. 1986, Peone et al. 1989).

Comparison of zooplankton standing crops in Lake Roosevelt to those of other good kokanee producing lakes indicates zooplankton densities in Lake Roosevelt are greater than, or comparable to, other kokanee lakes (Jagiello 1984, Beckman et al. 1985, Peone et al. 1989, Griffith and Scholz 1990). Taking into account that kokanee are primarily planktivorous feeders and analyzing the high productivity of zooplankton (e.g., *Daphnia* sp.), Beckman et al. (1985) estimated the forage base in Lake Roosevelt could support about 16 million fingerling and 5.9 million adult kokanee (Scholz et al. 1986, Peone et al. 1989).

Nigro et al. (1983) determined that 27,200 m of suitable natural spawning habitat was available for kokanee in Lake Roosevelt and tributaries, and calculated that 181,000 adult fish or 5.4 fish/hectare could be produced by natural spawning if the habitat was fully utilized. Thus, the ability of naturally spawned kokanee to populate the reservoir was far less than the number that could be produced given the food availability in the reservoir. The primary (phytoplankton) and secondary (zooplankton) biological productivity of the reservoir can support 5.9 million adults, whereas the maximum number that can be produced, if all natural spawning habitat is used, is 0.18 million adults (Scholz et al. 1986, Peone et al. 1989). The amount of spawning habitat and fluctuating reservoir levels also effect the ability for Lake Roosevelt to sustain an adequate population of rainbow trout as noted by Stober et al. (1977) and Scholz et al (1986). However, these factors less severely impact the reproductive success of walleye due to a spawning and incubation cycle that compliments reservoir operations (Stober et al. 1977, Beckman et al. 1985 and Scholz et al. 1986).

In 1989, the Lake Roosevelt Tributaries Rainbow Trout Habitat and Passage Improvement Project was implemented to promote natural production of Lake Roosevelt rainbow trout by improving passage for migrating adults and instream habitat for fry and fingerling rearing in selected tributaries. Monitoring natural populations of rainbow trout in Lake Roosevelt is included in the Lake Roosevelt Monitoring/Data Collection Project.

In 1994, the Chief Joseph Kokanee Enhancement Project was implemented into the Council's Fish and Wildlife Program to evaluate the status of naturally producing kokanee in Lake Roosevelt and the feasibility of using them for the hatchery programs. This includes the identification of an actual native stock unique to Lake Roosevelt. In the past, Lake Whatcom kokanee stock were used for building runs in Lake Roosevelt. Since initiation of the hatchery programs, adult kokanee returns have varied. A combination of factors include release size/age, entrainment, predation and lake operations effect the survival of kokanee to adulthood in Lake Roosevelt. Various stocking strategies have been employed to increase the adult returns. An additional recommendation from the monitoring program, which has been incorporated into the hatchery program, includes using alternative stocks that may be more compatible with the characteristics of Lake Roosevelt. This measure takes into account maintain the genetic integrity of existing stocks. Currently, multiple stocks from Lake Whatcom, Kootenai Lake and Lake Roosevelt are used. In the past, a stock from Flathead Lake was also used, however this stock as well as the Lake Whatcom and existing Lake Roosevelt stocks are believed to be genetically related to Lake Whatcom. In respect to this, the Chief Joseph Kokanee Enhancement Project and Lake Roosevelt Monitoring/Data Collection Program are investigating the genetic diversity of Lake Roosevelt kokanee to aid in management implications of the hatchery programs (Underwood et al. 1995 and Cichosz et al. 1996). The monitoring program is performing a coded wire tagging program to differentiate stocks and analyze their effectiveness (e.g. survival, harvest benefit, return to spawning sites).

32.5) Ecological interactions.

The species that primarily negatively impact Lake Roosevelt artificial production programs are limited to predators such as walleye and northern pike minnow (*Ptychocheilus oregonensis*). Other predators such as bald eagles and ospreys are positively impacted by this project by the creation of a supplemental forage base. There are no identified species negatively impacted by artificial production in Lake Roosevelt.

Give most attention to interactions between listed and "candidate" salmonids and program fish.

SECTION 43. WATER SOURCE

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

The Lake Roosevelt Kokanee Net Pens are located at the mouth of the Colville River in Lake Roosevelt 100 miles upstream from Grand Coulee Dam.

43.2) Indicate any appropriate risk aversion measures that will be applied to minimize the likelihood for the take of listed-natural fish species as a result of hatchery water withdrawal, screening, or effluent discharge.

Listed species: N/A.

SECTION 54. FACILITIES

54.1) Broodstock collection, holding, and spawning facilities (~~or methods~~).

While the majority of the adult fish collected is done through the use of electrofishing Sherman Creek is supplied with a fish ladder and trap connected to the outfall of the raceways.

The raceways at Sherman Creek Hatchery consists of three 69' x 9.2' x 4.5' concrete raceways supplied by an upwell intake capable of 1,400 gpm water flow per raceway. Outfall is through the connected fish ladder/trap into Lake Roosevelt via Sherman Creek and is set up for direct release, which minimizes planting stress.

54.2) Fish transportation equipment (description of pen, tank truck, or container used).

Spokane Tribal Hatchery transports the majority of fish transfers to Sherman Creek Hatchery as part of the Lake Roosevelt project.

Please refer to the Spokane Tribal Hatchery HGMP for additional information.

~~5.3)~~ ~~Broodstock holding and spawning facilities.~~ ~~5.4.34)~~ **Incubation facilities.**

~~5.4.45)~~ **Rearing facilities.**

By October 2000 the kokanee net pens will consist of twenty, 20'x20'x14' pens supported by an anchor system, boat and docks for year round operations.

~~5.4.56)~~ **Acclimation/release facilities.**

Fish releases from the raceways are forced, pushing the fish downstream through the connected fish ladder into Lake Roosevelt via Sherman Creek.

~~5.4.67)~~ **Describe operational difficulties or disasters that led to significant fish mortality.**

~~5.4.6.18)~~ ~~————~~ **Indicate available back-up systems, and risk aversion measures that will be applied, that minimize the likelihood for the take of listed natural fish species that may result from equipment failure, water loss, flooding, disease transmission, or other events that could lead to injury or mortality.**

~~4.6.2)~~ ~~Indicate needed back-up systems and risk aversion measures that minimize the likelihood for the take of listed species that may result from equipment failure, water loss, flooding, disease transmission, or other events that could lead to injury or mortality.~~

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SECTION 65. BROODSTOCK ORIGIN AND IDENTITY

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

~~65.1)~~ **Source.**

Lake Whatcom
Kootenay Lake BC / Meadow Creek.

~~65.2)~~ **Supporting information.**

~~65.2.1)~~ **History.**

The Lake Whatcom stock of kokanee has been cultured in the state of Washington for 66 years with no known introduction of other stocks.

The Meadow creek stock, is one of three stocks found on Kootenay Lake in British Columbia. The Meadow creek stock is native to Kootenay Lake and has been cultured since 1938.

65.2.2) Annual size.

65.2.3) Past and proposed level of natural fish in broodstock.

65.2.4) Genetic or ecological differences.

~~5.2.5) 6.2.5)~~ Reasons for choosing **Broodstock traits**

The Lake Whatcom stock was chosen for its abundance and availability for the initial programs on Lake Roosevelt. The Meadow Creek stock has been chosen to try and identify a stock that may perform better than the Lake Whatcom as well as address the issues of the ISRP on using native stocks or locally adapted stocks for artificial production.

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5.2.6) **ESA-Listing status**

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Describe any special traits or characteristics for which broodstock was selected.

65.3) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects **that may occur as a result of using the broodstock source.**

~~to listed natural fish that may occur as a result of broodstock selection practices.~~

SECTION 76. BROODSTOCK COLLECTION

Presently reliable broodstock collection is not available within the Lake Roosevelt Project. We have to rely on outside program sources for egg supply.

We will continue to coordinate between STH, British Columbia Ministry of Environment, Lands and Parks, and the WDFW Lake Whatcom Hatchery for supplying kokanee eggs until such time as we can fulfill the egg allotments using Lake Roosevelt stock.

Alternate brood sources (ie native Kootenay Lake Stock / native red band rainbow) will continue to be sought and evaluated for future use to: improve returns, supplement native stocks and increase resident populations throughout the reservoir.

Spawning operations at SCH will follow WDFW current broodstock collection and Fish Health spawning guidelines and policies. This is to ensure genetic diversity and to prevent the spread of any known pathogens. While at this time egg take goals are at 5 million annually, we will be coordinating with the LRHCT on available adults for broodstock and viable population lots. Egg takes will be fertilized and shipped either

"green" or as eyed eggs to the STH for incubation and initial rearing.

We will be monitoring fish populations in Lake Roosevelt for any mature kokanee in the area. Our goal is to identify and recover any returning adults. We will also collect, compile and manage biological information from returning fish relative to age composition, size, survival, maturity and coded wire tagging.

| **76.1) Life-history stage to be collected (~~adults, eggs, or juveniles~~ eggs, juveniles, adults).**

Returning two, three and four year old kokanee adults.

| **76.2) Collection or sampling design.**

We will trap any and all returning adults back to SCH in order to meet program goals. Our primary method for adult collection is electrofishing. Any adult kokanee trapped will be brought into the Colville Trout Hatchery to await full maturity and spawning operations.

| **76.3) Identity.**

We will be monitoring fish populations in Lake Roosevelt for any mature kokanee in the area. Our goal is to identify and recover any returning adults. All hatchery origin releases are coded wire tagged and/or adipose clipped to identify hatchery versus natural production and those alternative stocks used on the project.

| **76.4) Proposed number to be collected:**

| **76.4.1) Program goal (assuming 1:1 sex ratio for adults):**

We will trap any and all returning adults back to SCH in order to meet the program goals, which are currently at or slightly above two million.

| **76.4.2) Broodstock collection levels for the last 12 years (e.g., 1988-99), or for most recent years available:**

Year	Adults Females	Males	Jacks	Eggs	Juveniles
1988					
1989					
1990					
1991					
1992					
1993		60 mixed			
1994		81 mixed			
1995		10 mixed			
1996		970 mixed			
1997	22	374			
1998	183	2,288 mixed			
1999	35	1,292			

Data source: ([Link to appended Excel spreadsheet using this structure. Include hyperlink to main database](#))

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

76.6) Fish transportation and holding methods.

Collected kokanee adults will be transported using an oxygen equipped transport tank to the Colville Trout Hatchery to await full maturity and spawning operations.

76.7) Describe fish health maintenance and sanitation procedures applied.

As per WDFW Fish Health Policy all containers cleaned and disinfected prior to each new lot held or transported.

76.8) Disposition of carcasses.

Spent carcasses are supplied to the natural bald eagle population on Lake Roosevelt for winter feeding.

76.9) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed endangered natural fish species resulting from the broodstock collection program.

SECTION 87. MATING

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

87.1) Selection method.

A minimum of 250 pairs should be spawned to maintain genetic diversity. Maintain a random mating pattern and avoid any deliberate selection of breeding pairs.

8.2) Males:

Specify expected use of backup males, precocious males (jacks), and repeat spawners.

87.23) Fertilization.

Spawning operations at SCH will follow WDFW current broodstock collection and Fish Health spawning guidelines and policies. This is to ensure genetic diversity and to prevent the spread of any known pathogens. While at this time egg take goals are approximately two million annually, we will be coordinating with the Lake Roosevelt Hatchery Coordination Team on available adults for broodstock and viable population lots. Egg takes depending on lot size will be handled in the following manner, small egg takes will remain at Colville Hatchery for incubation and large egg takes can be shipped to the Spokane Tribal Hatchery for incubation.

We will continue to coordinate between Spokane Tribal Hatchery, Meadow Creek, B.C. and the WDFW Lake Whatcom Hatchery for supplying kokanee eggs to meet program objectives.

87.34) Cryopreserved gametes.

87.45) ———Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish resulting from the mating scheme.

SECTION 98. INCUBATION AND REARING

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

98.1) Incubation: Please refer to the Spokane Tribal Hatchery HGMP’s for incubation

Information.

98.1.1) Number of eggs taken/received and survival rate at stages of egg development and survival rates to eye-up and/or ponding

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

~~Describe circumstances where extra eggs may be taken (e.g. as a safeguard against potential incubation losses), and the disposition of surplus fish safely carried through to the eyed eggs or fry stage to prevent exceedence of programmed levels.~~

98.1.23) Loading densities applied during incubation.

98.1.34) Incubation conditions.

98.1.45) Ponding.

~~degree of button up, cumulative temperature units, and mean length and weight (and distribution around the mean) at ponding. State dates of ponding, and whether swim up and ponding are volitional or forced.~~

~~98.1.56) Fish health maintenance and monitoring.~~

98.1.67) Indicate risk aversion measures that will be applied to minimize the likelihood of adverse genetic and ecological effects to listed fish during incubation.

98.2) Rearing:

98.2.1) Provide survival rate data (average program performance) by hatchery life stage (fry to fingerling; fingerling to releasesmolt) for the most recent twelve years (1988-99), or for years dependable data are available..

During the rearing period in the net pens survival rate for kokanee fingerling to post smolt has been at 98.32%.

98.2.2) Density and loading criteria (goals and actual levels).

Raceway maximum target loadings are: less than .5 Density Index and 1.5 Flow Index.

Maximum actual levels for the kokanee at release are: .059 Density Index and .29 Flow Index.

98.2.3) Fish rearing conditions

In following the Washington department of Fish and Wildlife Hatcheries Program standard operating procedures, fish health guidelines and criteria cited in Fish Hatchery Management, (Piper, Robert, G. et al) the net pens at Sherman Creek are annually loaded with 500,000 (320@ 25,000 each) kokanee salmon for release @15 fish per pound as post smolts each July.

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

Size counts and feed calculations/increases are performed biweekly to monthly depending on season size and current water temperature.

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

~~Contrast fall and spring growth rates for yearling smolt programs. If available, indicate hepatosomatic index (liver weight/body weight) and body moisture content as an estimate of body fat concentration data collected during rearing.~~

98.2.56) Indicate food type used, daily application schedule, feeding rate range

(e.g.

% B.W./day and lbs/gpm inflow), and estimates of total food conversion efficiency during rearing (average program performance).

Currently the fish feed used for kokanee rearing is Moore Clark, Nutra Fry, High Energy Diet, fed at 1.0 % body weight per day. This can fluctuate with water conditions and temperature experienced. Typically with see a .88 conversion on kokanee smolts.

98.2.67) Fish health monitoring, disease treatment, and sanitation procedures.

Disease prevention and treatments are per WDFW policy. The fish health monitoring for both the Sherman Creek and Spokane Tribal Hatcheries are performed by the WDFW Fish Health Program with both monthly monitoring and examinations within two weeks prior to transfers or outplanting.

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

98.2.79) Indicate the use of "natural" rearing methods as applied in the program.

98.2.810) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish under propagation.

SECTION 109. RELEASE

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

The data in this section includes fish released by this project which operates in conjunction with the Lake Roosevelt Net Pen Rearing Projects (rainbow trout and kokanee) and the Sherman Creek Hatchery to meet a final target release goal of 550,000 rainbow trout yearlings, 1 million kokanee yearlings and 300,000 kokanee fingerlings into project area. Actual total release data into the project area is compiled into a database through the upper Columbia Joint Stock Assessment Program as well as WDF&W. A summary of hatchery origin kokanee released into Lake Roosevelt 1988 through 1998 is listed in Appendix B at the end of this plan.

10.1) Proposed fish release levels. (Use standardized life stage definitions by species 9.1)

Proposed fish release levels.

Age Class	Maximum Number	Size (fpp)	Release Date	Location
Eggs				
Unfed Fry				
Fry				
Fingerling				
Yearling	500,000	15.0	June01	Lake Roosevelt

109.2) Specific location(s) of proposed release(s).

Stream, river, or watercourse: Lake Roosevelt, WRIA # 58
Release point: Sherman Creek Hatchery, mouth of Sherman Creek
Major watershed: Columbia River
Basin or Region: Upper Columbia Sub Basin, Intermountain Province

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

Release year	Eggs/ Unfed Fry	Avg size	Fry	Avg size	Fingerling	Avg size	Yearling	Avg size
1988								
1989								
1990								
1991								
1992								
1993								
1994							53,002	13.7 fpp
1995							72,252	11.4 fpp

Release year	Eggs/ Unfed Fry	Avg size	Fry	Avg size	Fingerling	Avg size	Yearling	Avg size
1996							71,055	22.0 fpp
1997							48,417	20.6 fpp
1998							211,178	14.8 fpp
1999							181,846	14.7 fpp
Average							106,292	15.5 fpp

109.4) Actual dates of release and description of release protocols.

The kokanee reared in the net pens are released as close to June 1st as possible. This date was selected to coincide with three major events. First the spring reservoir flood control drawdown is completed, second refill elevations are above 1,265' msl and third the fish should be passed smoltification, which should lessen entrainment through Grand Coulee Dam.

1995 May 17
1996 April 11 & 20
1997 June 1
1998 May 16,23 & 30
1999 March 22, April 28 and June 16

The kokanee net pens are released on site by dropping three of the four sides and allowing the fish to disperse on their own.

~~and any culling procedures applied for non-migrants.~~

109.5) Fish transportation procedures, if applicable.

N/A

109.6) Acclimation procedures (methods applied and length of time).

Rearing fish in net pens is a continual acclimation process.

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

100% adiposed clipped to identify between hatchery and natural production in Lake Roosevelt.

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

Kokanee production for Lake Roosevelt is considerably under the annual target goal of one million post-smolt yearlings. Any “surplus” fish will be released in an attempt to reach that target goal.

109.9) Fish health certification procedures applied pre-release.

Two weeks prior to all fish transfers or releases a fish health monitoring report is completed by the WDFW Fish Health Division. Prior to receiving any egg shipments to WDFW Facilities each stock/source must first complete the Fish Health Certification process, this includes importation from outside the United States shipped under USFW Title 50.

109.10)) — Emergency release procedures in response to flooding or water system failure.

N/A

109.11) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish species resulting from fish releases.

N/A

(e.g. — “All yearling coho salmon will be released in early June in the lower mainstem of the Green River to minimize the likelihood for interaction, and adverse ecological effects, to listed natural chinook salmon juveniles, which rear in up river areas and migrate seaward as sub-yearling smolts predominately in May”);

SECTION 10. PROGRAM EFFECTS ON ALL ESA-LISTED, PROPOSED, AND CANDIDATE SPECIES (FISH AND WILDLIFE)

10.1) List all ESA permits or authorizations in hand for the hatchery program.

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

10.2.1) Description of ESA-listed, proposed, and candidate species affected by the program.

Include information describing: adult age class structure, sex ratio, size range, migrational timing, spawning range, and spawn timing; and juvenile life history strategy, including smolt emigration timing. Emphasize spatial and temporal distribution relative to hatchery fish release locations and weir sites.

- Identify the ESA-listed population(s) that will be directly affected by the program. (Includes listed fish used in supplementation programs or other programs that involve integration of a listed natural population. Identify the

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natural population targeted for integration).

*** To obtain a list of listed species in your area, refer to Attachment 3 for the phone number and address of the nearest ecological field office.***

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

(Includes ESA-listed fish in target hatchery fish release, adult return, and broodstock collection areas).

10.2.2) Status of ESA-listed species affected by the program.

- Describe the status of the listed natural population(s) relative to “critical” and “viable” population thresholds (see definitions in “Attachment 1”).

- Provide the most recent 12 year (e.g. 1988 - present) progeny-to-parent ratios, survival data by life-stage, or other measures of productivity for the listed population. Indicate the source of these data.

- Provide the most recent 12 year (e.g. 1988 - 1999) annual spawning abundance estimates, or any other abundance information. Indicate the source of these data. (Include estimates of juvenile habitat seeding relative to capacity or natural fish densities, if available).

- Provide the most recent 12 year (e.g. 1988 - 1999) estimates of annual proportions of direct hatchery-origin and listed natural-origin fish on natural spawning grounds, if known.

10.2.3) Describe hatchery activities, including associated monitoring and evaluation and research programs, that may lead to the take of listed species in the target area, and provide estimated annual levels of take (see “Attachment 1” for definition of “take”). Provide the rationale for deriving the estimate.

- Describe hatchery activities that may lead to the take of listed species in the target area, including how, where, and when the takes may occur, the risk potential for their occurrence, and the likely effects of the take.

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

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

Complete the appended “take table” (Table 1) for this purpose. Provide a range

of potential take numbers to account for alternate or “worst case” scenarios.

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

(e.g. “The number of days that westslope cutthroat trout are trapped in Lake Creek will be reduced if the total mortality of handled fish is projected inseason to exceed the 1988-99 maximum observed level.”)

SECTION 11. MONITORING AND EVALUATION OF PERFORMANCE INDICATORS

This section describes how “Performance Indicators” listed in Section 1.10 will be monitored. Results of “Performance Indicator” monitoring will be evaluated annually and used to adaptively manage the hatchery program, as needed, to meet “Performance Standards”.

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

11.1.1) Describe the proposed plans and methods necessary to respond to the ~~proposed to collect data~~ appropriate “Performance Indicators” that have been identified for the program.

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

11.2) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish species resulting from monitoring and evaluation activities.

(e.g. “~~The Wenatchee River smolt trap will be continuously monitored, and checked every eight hours, to minimize the duration of holding and risk of harm to listed spring chinook and steelhead that may be incidentally captured during the sockeye smolt emigration period.~~”)

SECTION 12. RESEARCH

Research related activities associated with this project are confined to monitoring and evaluation program (Peone *et al.* 1989; Griffith and Scholz 1990; Thatcher *et al.* 1991 & 1992; Scholz *et al.* 1992; Tilson and Scholz 1991 through 1998; Underwood *et al.* 1993 through 1995; Cichosz *et al.* 1996, and; Underwood *et al.* 1997 & 1998-in print).

In the past, such studies as artificial imprinting and homing traits of hatchery origin kokanee have been investigated (Scholz et al. 1992; Tilson and Scholz 1991 through 1998). These programs have multiple research related purposes for Lake Roosevelt and include objectives of aiding in management implications for operating fish production projects (Spokane Tribal Hatchery, Sherman Creek Hatchery, Lake Roosevelt Rainbow Trout and Kokanee Net Pen Rearing Projects) in the program area.

Throughout the duration of this project, the Department of Biology from Eastern Washington University Department has peer reviewed Lake Roosevelt fisheries restoration efforts. Currently, professionals and students in the ichthyology department aid the hatcheries in collecting mature Lake Roosevelt kokanee for spawning, help analyze the kokanee coded wire tag returns and, in conjunction with the Lake Roosevelt Monitoring Program, independently reviews Lake Roosevelt fisheries restoration enhancement efforts. Their comments and recommendations are facilitated through the Lake Roosevelt Hatcheries Coordination Team.

- 12.1) **Objective or purpose.**
- 12.2) **Cooperating and funding agencies.**
- 12.3) **Principle investigator or project supervisor and staff.**
- 12.4) **Status of population, particularly the group affected by project, if different than the population(s) described in Section 2.**
- 12.5) **Techniques: include capture methods, drugs, samples collected, tags applied.**
- 12.6) **Dates or time period in which research activity occurs.**
- 12.7) **Care and maintenance of live fish or eggs, holding duration, transport methods.**
- 12.8) **Expected type and effects of take and potential for injury or mortality.**
- 12.9) **Level of take of listed fish species: number or range of fish individuals handled, injured, or killed by sex, age, or size, if not already indicated in Section 2 and the attached "take table" (Table 1).**
- 12.10) **Alternative methods to achieve project objectives.**
- 12.11) **List species similar or related to the threatened species; provide number and causes of mortality related to this research project.**
- 12.12) **Indicate risk aversion measures that will be applied to minimize the likelihood for adverse ecological effects, injury, or mortality to listed fish species as a result of the proposed research activities.**

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SECTION 13. ATTACHMENTS AND CITATIONS

- Beckman, L.G., J.F. Novotny, W.R. Persons, and T.T. Terrell. 1985. Assessment of the fisheries and limnology in Lake F.D. Roosevelt 1980-1983. U.S. Bureau of Reclamation. Contract No. WPRS-0-07-10-x0216; FWS-14-06-009-904, May 1985. 168 pp.
- Bryant, F.G. and Z.E. Parkhurst. 1950. Survey of the Columbia River and its tributaries. Part IV. U.S. Fish and Wildl. Serv. Sci. Rep. Fish. No. 37. 99-108 p.
- Combs, Mitch. 1992, 1993, 1994, 1995(I-II), 1996, 1997, 1998 and 1999. Sherman Creek Hatchery Annual Reports, Washington Department of Fish and Wildlife. Funded by Bonneville Power Administration.
- Combs, Mitch. 1992, 1993, 1994, 1995, 1996, 1997, 1998 and 1999. Sherman Creek Hatchery, Annual Operating Plan, Washington Department of Fish and Wildlife. Funded by Bonneville Power Administration.
- Combs, Mitch. April, 1992 – December, 1999. Sherman Creek Hatchery Monthly Reports, Washington Department of Fish and Wildlife. Funded by Bonneville Power Administration
- Crawford, Bruce. Washington State Game Department Fishery Research Report 1979. The origin and history of the trout brood stocks of the WDG. 56 pp.
- Cichosz, T.A., J.P. Shields, K.D. Underwood, A.T. Scholz, and M.B. Tilson. Lake Roosevelt Fisheries and Limnological Research, Annual Report 1996. Bonneville Power Administration. Portland, OR. Project No. 94-043 331 pp. plus Appendices.
- Earnest, D.E., M.E. Spence, R.W. Kiser and W.D. Brunson. 1966. A survey of the fish populations, zooplankton, bottom fauna, and some physical characteristics of Roosevelt Lake. Rep. to Wash. Dept. of Game. 46 p.
- Fulton, L.A. and M.C. Laird. No date. A cursory survey of tributaries to Roosevelt Lake with reference to spawning potential for salmon, 1965-66. Rough draft if unpublished mimeo report NOAA, Nat. Marine Fish. Serv., Seattle, WA. 100 pp.
- Gangmark, H.A. and L.A. Fulton. 1949. Preliminary surveys of Roosevelt Lake in relation to game fishes. U.S. Fish and Wildl. Service Spec. Sci. Rep. Fish. No. 5. 29 p.
- Jagiello, T. 1984. A comparison of nutrient loading, phytoplankton standing crop, and trophic state in two morphologically and hydraulically different reservoirs. M.S. Thesis Univ. of Wash., Seattle, WA 99 p.
- Nigro, A.A., T.T. Terrell and L.G. Beckman. 1981. Assessment of the limnology and fisheries

- in lake F.D. Roosevelt. Annual Rep. 1981. USFWS. 97 p.
- NPPC. 1987. Columbia River Basin Fish and Wildlife Program—Amended February 11, 1987. Northwest Power Planning Council, Portland, OR. 246 pp.+ Appendices.
- Peone, J. 1997. Colville Confederated Tribes Fish and Wildlife Department, Letter to Mr. Bernard Shanks, WDFW., May 21, 1997.
- Peone, T. 2000. Spokane Tribal Hatchery, Hatchery Genetic Management Plan – Resident Fish , BPA, June 19, 2000.
- Peone, T. and D. Ford. 1997. Spokane Tribal Hatchery, January 1997 to December 1997, Annual Report. Bonneville Power Administration. Portland, OR. Project No. 91-46. Contract DE-MS79-90BP92906. 18 pp. plus Appendices.
- Peone, T.L., A.T. Scholz, J.R. Griffith, S. Graves, and M.G. Thatcher. 1990. Lake Roosevelt Monitoring Program, August 1988 to December 1989, Annual Report. U.S. Department of Energy, Bonneville Power Administration. Project No. 88-63, Contract DE-817.
- Piper, R.G., I.B. McElwain, L.O. Orme, J.P. McCracen, L.G. Fowler and J.R. Leonard. 1982. Fish Hatchery Management. U.S. Department of Interior, Fish and Wildlife Service, Washington, D.C. 517 pp.
- Scholz, A.T., J. Uehara, J. Hisata and J. Marco. 1986. Feasibility report on restoration and enhancement of Lake Roosevelt Fisheries. Northwest Power Planning Council. Applications for Amendments Vol. 3:1375-1489.
- Scholz, A.T., R.J. White, V.A. Koehler and S.A. Horton. 1992. Measurement of thyroxine concentration as an indicator of the critical period for imprinting in kokanee salmon (*Oncorhynchus nerka*). Annual Report 1991. BPA. Portland, OR. Proj. No. 88-63.
- Scholz, A.T., R.J. White, M.B. Tilson and S.A. Horton. 1993. Artificial imprinting of Lake Roosevelt kokanee salmon (*Oncorhynchus nerka*) with synthetic chemicals. Annual Report 1993. BPA Proj. No. 88-63.
- Stober, Q.J. 1977. Fishery resource study of Rufus Woods Reservoir. In: Erickson, A.W., Q.J. Stober, J.J. Brueggeman and R.L. Knight: An assessment of the impact on fish and wildlife resources from construction of a third powerhouse at Grand Coulee Dam.
- Stober, Q.J., R.W. Tyler, C.E. Petrosky, T.J. Carlson, C. Gaudet and R.E. Nakatoni. 1977. Survey of fisheries resources in the forebay of FDR Reservoir, 19765-1977. Fisheries research institute, Univ. of WA. Final Rep. to USBR Contr. No.14-06-100-9001.

- Stober, Q.J., R.W. Tyler, E.F. Cowman, J. Wilcock and S. Quinnell. 1979. Irrigation drawdown and kokanee salmon egg to fry survival in Banks Lake. Univ. of Wash. College of Fisheries. Fish. Res. Inst. 73 p.
- Stober, Q.J., and R.W. Tyler. 1982. Rules curves for irrigatin drawdown and kokanee salmon. (Oncorhynchus nerka) egg to fry survival. Fisheries Res. 1: 195-218 p.
- Thatcher, M.G., J.R. Griffith, A.C. McDowell, and A.T. Scholz. (In press submitted 1993). Lake Roosevelt Fisheries Monitoring Program, Annual Report 1992. Bonneville Power Administration. Portland, OR. Project No. 88-63. 237 pp. plus appendices.
- Tilson, M.B., A.T. Scholz, R.J. White and J. Galloway. 1994. Thyroid Induced Chemical Imprinting in Early Life Stages and Assessment of Smoltification on Kokanee Salmon. Annual Report 1994. BPA. Project No. 88-63.
- Tilson, M.B., A.T. Scholz, R.J. White and J. Galloway. 1994. Thyroid Induced Chemical Imprinting in Early Life Stages and Assessment of Smoltification on Kokanee Salmon. Annual Report 1994. BPA. Project No. 88-63.
- Underwood, K.D. and J.P. Shields and M.B. Tilson. 1997. Lake Roosevelt Fisheries Monitoring Program, 1995 Annual Report in K.D. Underwood and J.P. Shields. Lake Roosevelt fisheries research, 1995 annual report. Bonneville Power Administration.
- Voeller, A.C. 1996. Measurements of Lake Roosevelt Biota in Relations to Reservoir Operations. Annual Report 1993. Bonneville Power Administration. Portland, OR. Project No. 94-43. 109 pp.

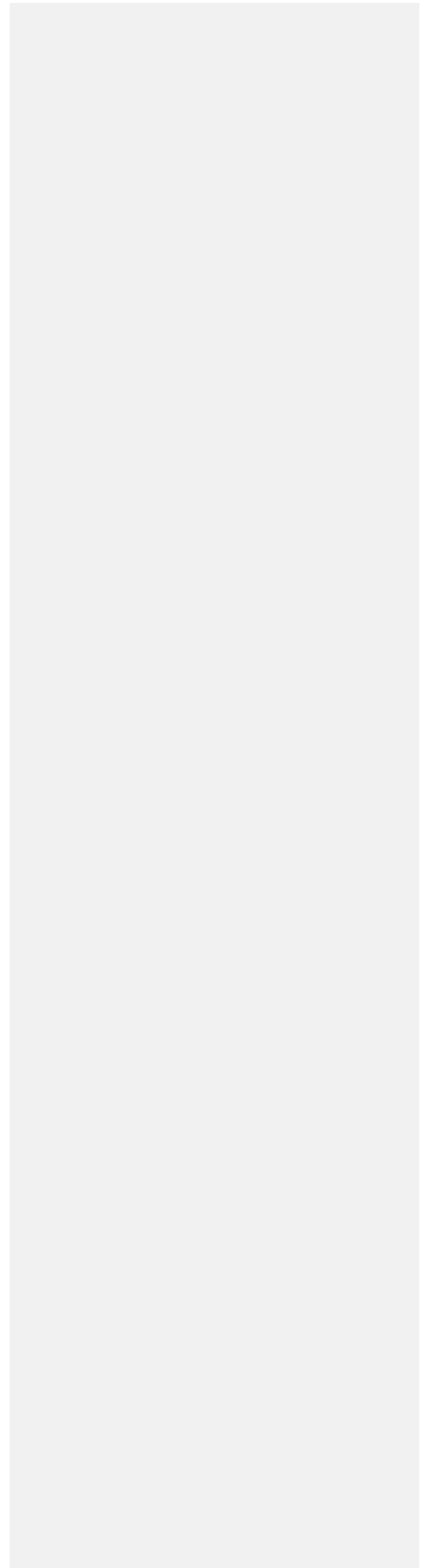
SECTION 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

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

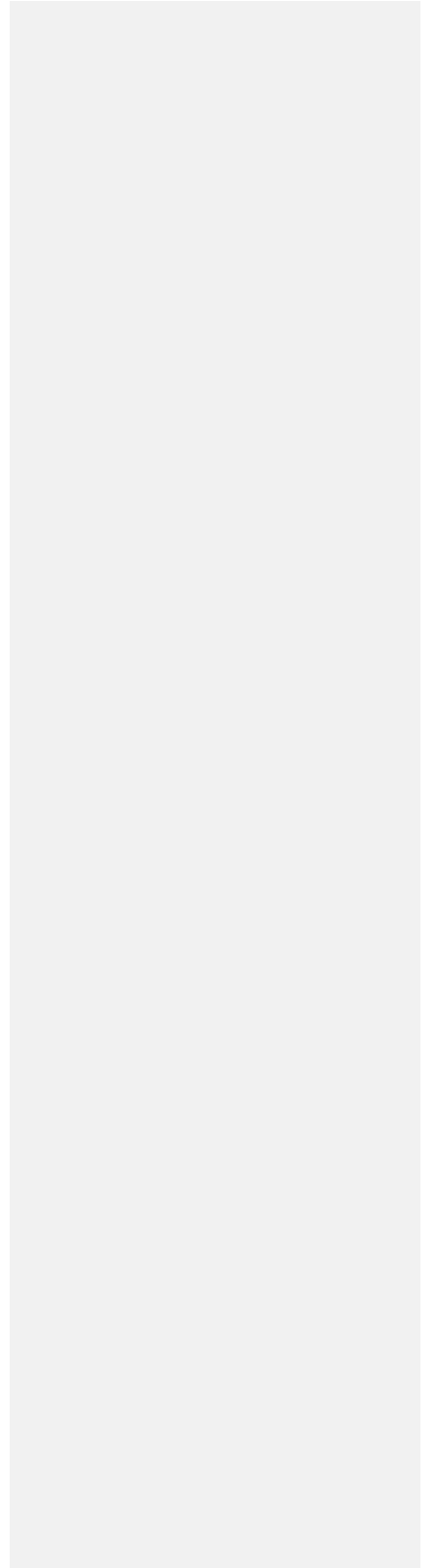
Name, Title, and Signature of Applicant:

Certified by _____ Date: _____

APPENDIX B
LAKE ROOSEVELT
HATCHERY ORIGIN KOKANEE RELEASES



1986 - 1998



Summary of hatchery origin kokanee salmon released into Lake Roosevelt from 1988 to 1998.

Year	Hatchery	Number	Life Stage	Size (#/lb)
1988	Ford	872,150	fry	500
1989	Ford	861,442	fry	280
1990	Ford	1,025,400	fry	247
1991	Spokane Tribal	1,674,577	fry	119
1992	Spokane Tribal	71,256	yearling	9
1992	Spokane Tribal	819,220	fry	158
1992	Sherman Creek	45,714	yearling	11.9
1992	Sherman Creek	976,925	fry	159
1993	Spokane Tribal	21,190	yearling	7
1993	Spokane Tribal	1,024,293	fry	225
1993	Sherman Creek	85,321	yearling	9.5
1993	Sherman Creek	902,749	fry	85.7
1994	Spokane Tribal	123,254	yearling	10
1994	Spokane Tribal	1,910,255	fry	125
1994	Sherman Creek	126,159	yearling	9.7
1994	Sherman Creek	946,762	fry	120
1995	Spokane Tribal	1,401	brood	1
1995	Spokane Tribal	59,825	yearling	10
1995	Spokane Tribal	515,425	fry	202
1995	Sherman Creek	275,609	yearling	9.5
1996	Spokane Tribal	54,194	yearling	9
1996	Sherman Creek	286,253	yearling	13.1
		50,899		
1997	Spokane Tribal	40,808	yearling	7
1997	Spokane Tribal	54,103	fry	117
1997	Sherman Creek	265,313	yearling	12.2
1998	Spokane Tribal	49,750	yearling	11
1998	Spokane Tribal	365,542	fry	120
1998	Sherman Creek	501,206	yearling	12.9
1998	Sherman Creek	87,421	Fry	81.6
1999	Sherman Creek	550,468	yearling	11.7

Table 1. Estimated listed species take levels by hatchery activity.

Listed species affected: _____	ESU/Population: _____	Activity: _____		
Location of hatchery activity: _____	Dates of activity: _____	Hatchery program operator: _____		
Type of Take	Annual Take of Listed Fish By Life Stage (<i>Number of Fish</i>)			
	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harass a)				
Collect for transport b)				
Capture, handle, and release c)				
Capture, handle, tag/mark/tissue sample, and release d)				
Removal (e.g. broodstock) e)				
Intentional lethal take f)				
Unintentional lethal take g)				
Other Take (specify) h)				

- a. Contact with listed fish through stream surveys, carcass and mark recovery projects, or migrational delay at weirs.
- b. Take associated with weir or trapping operations where listed fish are captured and transported for release.
- c. Take associated with weir or trapping operations where listed fish are captured, handled and released upstream or downstream.
- d. Take occurring due to tagging and/or bio-sampling of fish collected through trapping operations prior to upstream or downstream release, or through carcass recovery programs.
- e. Listed fish removed from the wild and collected for use as broodstock.
- f. Intentional mortality of listed fish, usually as a result of spawning as broodstock.
- g. Unintentional mortality of listed fish, including loss of fish during transport or holding prior to spawning or prior to release into the wild, or, for integrated programs, mortalities during incubation and rearing.
- h. Other takes not identified above as a category.

Instructions:

1. An entry for a fish to be taken should be in the take category that describes the greatest impact.
2. Each take to be entered in the table should be in one take category only (there should not be more than one entry for the same sampling event).
3. If an individual fish is to be taken more than once on separate occasions, each take must be entered in the take tabl

