PART I - ADMINISTRATIVE

Section 1. General administrative information

Title of project

Spokane Tribal (Galbraith Springs) Hatchery Operation & Maintenance

BPA project number: 9104600
Contract renewal date (mm/yyyy): 6/2015 ☐ **Multiple actions?**

Business name of agency, institution or organization requesting funding
Spokane Tribe of Indians

Business acronym (if appropriate) STOI

Proposal contact person or principal investigator:

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NPPC Program Measure Number(s) which this project addresses
901.1g.c (NPPC 1987), 1403.7.7.3 (NPPC 1987), 9.4A.1.d (NPPC 1994), 10.8B.5 (NPPC 1994) and 10.8B.2 (NPPC 1994, as amended in 1995).

FWS/NMFS Biological Opinion Number(s) which this project addresses
NA

Other planning document references
Upper Columbia River Blocked Area Management Plan (e.g. regional plan developed for intergrated framework.

Short description
Operate and maintain the Spokane Tribal Hatchery to aid in the restoration and enhancement of the Lake Roosevelt and Banks Lake fisheries.

Target species
Kokanee Salmon and Rainbow Trout

Section 2. Sorting and evaluation

Subbasin
Upper Columbia - Grand Coulee Impoundment (Lake Roosevelt and Banks Lake)

Evaluation Process Sort

CBFWA caucus	Special evaluation process	ISRP project type
Mark one or more caucus	If your project fits either of these processes, mark one or both	Mark one or more categories
☐ Anadromous fish ☒ Resident fish ☐ Wildlife	☒ Multi-year (milestone-based evaluation) ☐ Watershed project evaluation	☐ Watershed councils/model watersheds ☐ Information dissemination ☒ Operation & maintenance ☐ New construction ☐ Research & monitoring ☐ Implementation & management ☐ Wildlife habitat acquisitions

Section 3. Relationships to other Bonneville projects

Umbrella / sub-proposal relationships. List umbrella project first.

Project #	Project title/description

Other dependent or critically-related projects

Project #	Project title/description	Nature of relationship
9104700	Sherman Creek Hatchery O&M	Operated in conjunction with Spokane Tribal Hatchery; serves as kokanee egg collection site and kokanee and rainbow trout fingerling/yearling rearing and acclimation facility.
9500900	Lake Roosevelt Rainbow Trout Net Pens	Net Pen rears 530,000 rainbow trout fingerlings raised at Spokane Tribal & Sherman Creek Hatcheries. Releases into Lake Roosevelt after annual spring drawdown.
5228100	Lake Roosevelt Kokanee Net Pens	Net Pen reaer 500,000 kokanee fingerlings transferred from Spokane Tribal Hatchery for release into Lake

		Roosevelt after annual spring drawdown.
9001800	Habitat Improvement - Lake Roosevelt	Habitat improvement in Lake Roosevelt tributaries for rainbow trout juvenile rearing and adult passage to increase natural production.
9404300	Lake Roosevelt Monitoring/Data Collection Program	Monitors and evaluates effects of hatcheries on Lake Roosevelt fisheries; collects fisheries and limnological data for reservoir modeling.
950110	Chief Joseph Kokanee Enhancement Project	Monitors fish entrainment through Grand Coulee Dam and evaluates kokanee stocks in Lake Roosevelt.
	Little Falls Dam Fish Trap & Acclimation Facility	Kokanee egg collection facility for Spokane Tribal Hatchery operations; rearing and acclimation of kokanee before release into Lake Roosevelt.
	Lake Roosevelt Hatcheries Coordination Team (LRHCT)	Fishery managers from above projects; meets qyarterly for review of projects and coordination/information sharing.
	Eastern Washington University Department of Biology Support	Aids hatcheries in collecting Lake Roosevelt kokanee for spawning, performs abundance surveys, and helps analyze kokanee coded wire tag returns. Also scientifically peer reviews Lake Roosevelt NPPC FWP projects and facilitates comments through the LRHCT.

Section 4. Objectives, tasks and schedules

Past accomplishments

Year	Accomplishment	Met biological objectives?
1990	Contractual Aggreement with the BPA for funding design, construction and operation and maintainenance (25 yrs.) of Spokane Tribal Hatchery Note: FDR & SCH are acronyms for Franklin D. Roosevelt Lake & Sherman Creek Hatchery.	NA - In conjuction with all the projects listed in Section 3, this project produces kokanee and rainbow trout to aid in accomplishing specific biological objectives in Lake Roosevelt established in 1995.

1991	Construction of Spokane Tribal Hatchery and initial operation; 1,674,577 fingerling kokanee planted and 33,510 kokanee and 326,461 rainbow fingerlings transferred to FDR net pens.	Yes - in respect to producing fish per 1991 annual operating plan.
1992	819,220 kokanee fingerlings & 71,256 kokanee yearlings planted; 1,099,000 fingerling & 68,552 yearlings kokanee transferred to SCH; 424,395 rainbow fingerlings transferred to FDR net pens.	Yes - in respect to producing fish per 1992 annual operating plan.
1993	1,024,293 kokanee fingerlings & 21,190 kokanee yearlings planted; 635,267 fingerling & 72,508 yearling kokanee transferred to SCH; 40,305 kokanee & 446,798 rainbow fingerlings transferred to FDR net pens.	Yes - in respect to producing fish per 1993 annual operating plan.
1994	540,220 kokanee fingerlings & 29,111 kokanee yearlings planted; 1,087,161 fingerling, 90,881 yearling kokanee & 60,534 fingerling rainbow transferred to SCH; 288,046 rainbow fingerlings transferred to FDR net pens.	Yes - in respect to producing fish per 1994 annual operating plan.
1995	515,425 kokanee fingerlings & 59,825 kokanee yearlings planted; 210,634 yearling kokanee & 120,325 fingerling rainbow transferred to SCH; 164,328 kokanee & 288,739 rainbow fingerlings transferred to FDR net pens.	Yes - in respect to producing fish per 1995 annual operating plan.
1996	54,194 kokanee yearlings planted; 224,562 yearling kokanee & 146,380 fingerling rainbow transferred to SCH; 50,899 kokanee & 430,473 rainbow fingerlings transferred to FDR net pens.	Yes - in respect to producing fish per 1996 annual operating plan.
1997	381,513 kokanee fingerlings & 40,808 kokanee yearlings planted; 220,191 yearling kokanee & 150,801 fingerling rainbow transferred to SCH; 261,092 kokanee & 403,382 rainbow fingerlings transferred to FDR net pens.	Yes - in respect to producing fish per 1997 annual operating plan.
1998	823,844 kokanee fingerlings & 84,066 kokanee yearlings planted; 349,832 kokanee & 255,712 rainbow fingerlings transferred to SCH; 294,186 kokanee & 311,594 rainbow fingerlings transferred to FDR net pens.	Tentative

Objectives and tasks

Obj 1,2,3	Objective	Task a,b,c	Task
1	Egg collection, spawning and incubation of kokanee and rainbow trout eggs to meet the 2000 Annual Production Goal (APG).	a	Brood stock capture and holding at Little Falls Dam and Hawk Creek.
		b	Kokanee egg collection from Sherman Creek via Sherman Creek Hatchery.
		c	WDF&W egg allotments.
		d	Viral sampling of Lake Roosevelt kokanee brood.
		e	Egg enumeration and incubation.
2	Fry, fingerling and yearling rearing to meet 2000 APG.	a	Incubation and hatching kokanee and rainbow trout.
		b	Feeding, production and fish health monitoring of kokanee and rainbow trout.
3	Distribution of kokanee and rainbow trout to meet 2000 APG.	a	Transfer 500,000 kokanee fingerlings to Lake Roosevelt net pen rearing operations.
		b	Transfer 255,000 kokanee yearlings to the Sherman Creek Hatchery.
		c	Release 100,000 kokanee yearlings into Spokane Arm of Lake Roosevelt.
		d	Release 145,000 kokanee yearlings into Lake Roosevelt tributaries.
		e	Release 50,000 kokanee fingerlings into Colville River, northern tributary of Lake Roosevelt.
		f	Release 300,000 kokanee fingerlings into Banks Lake.
		g	Transfer 30,000 rainbow trout fingerlings to Lake Roosevelt summer to fall net pen rearing program.
		h	Transfer 200,000 rainbow trout fingerlings to Sherman Creek Hatchery.
		i	Transfer 300,000 rainbow trout to fall to spring Lake Roosevelt net pen rearing operations.

		j	Hold 500,000 kokanee fingerlings over at Spokane Tribal Hatchery for release in 2001.
4	Rearing volume, water quantity and quality monitoring/production necessary to meet 2000 APG.	a	Raceway loading for fry, fingerling and yearling rearing.
		b	Water flow production and regulation for fish rearing.
		c	Water quality monitoring.
		d	Raceway hygiene.
		e	Cleaning spring pump station.
5	Adipose clip kokanee before release into Lake Roosevelt.	a	kokanee fin clipping.
6	Maintenance of hatchery building and grounds, visitation improvements and cultural preservation.	a	Routine hatchery maintenance.
		b	Visitation improvements.
		c	Cultural preservation.

Objective schedules and costs

Obj #	Start date mm/yyyy	End date mm/yyyy	Measureable biological objective(s)	Milestone	FY2000 Cost %
1	10/1999	2/2000	Collection/allotment of eggs (2.3 million) and 80% survival of eggs to meet 2000 APG.	x-ongoing	11.70%
2	10/1999	10/2000	Production of 1.3 million kokanee fingerlings, 500,000 kokanee yearlings and 530,000 rainbow trout yearlings.	x-ongoing	21.60%
3	10/1999	10/2000	Transfer/release of kokanee and rainbow trout to meet 2000 APG.	x-ongoing	15.40%
4	10/1999	10/2000	Provide water quantity and quality necessary to meet 2000 APG.	x-ongoing	30.60%
5	10/1999	10/2000	Adipose clip 1 million kokanee before transfer/release to Lake Roosevelt.	x-ongoing	13.40%
6	5/1999	10/2000	Maintain hatchery	x-ongoing	7.30%

			building/grounds and preserve cultural sensitive sites on hatchery property.		
				Total	100.00%

Schedule constraints
Water source (well/surface) fluctuations may be limiting factor, initiation of kokanee net pen project in FY'00/01 and reservoir operation in spring which dictate time of fish releases.

Completion date
Current agreement ends 2015 with language extending an additional 25 years.

Section 5. Budget

FY99 project budget (BPA obligated): $486,165

FY2000 budget by line item

Item	Note	% of total	FY2000
Personnel	Includes 4 FTE's, 1 PTE @ 9 months and 5 PTE's @ 6 months (fin clippers).	%38	200,650
Fringe benefits	STOI fringe rate @ 19.3%	%7	38,726
Supplies, materials, non-expendable property	Includes non-capitalized equipment/supplies, equip. rental & office equip. maintenance.	%3	16,200
Operations & maintenance	Includes utilities, egg allotments, fish food, fish health & water quality and vehicle o&m.	%31	161,363
Capital acquisitions or improvements (e.g. land, buildings, major equip.)	Includes grounds maintenance equipment, new mower and attachments.	%2	9,800
NEPA costs		%0	0
Construction-related support		%0	0
PIT tags	# of tags:	%0	0
Travel		%1	5,265
Indirect costs	STOI rate @ 21.3%	%17	89,930
Subcontractor		%0	0
Other		%0	0
TOTAL BPA FY2000 BUDGET REQUEST			$521,934

Cost sharing

Organization	Item or service provided	% total project cost (incl. BPA)	Amount ($)
Spokane Tribe of Indians	Construction of fish trap and acclimation facility at Little Falls Dam; will aid in egg collection from Lake Roosevelt kokanee and serves as a facility for acclimation of 100,000 kokanee fingerlings before release into Spokane Arm of Lake Roosevelt	%28	219,718
Eastern Washington University/State of Washington Note: Cost share amount is approximate per Dr. Allan T. Scholz, EWU Biology Department, estimate.	Aids hatcheries in collecting Lake Roosevelt kokanee for spawning, performs abundance surveys, and helps analyze kokanee coded wire tag returns. Also scientifically peer reviews Lake Roosevelt NPPC FWP projects and facilitates comments through the LRHCT.	%5	40,000
		%0	0
		%0	0
	Total project cost (including BPA portion)		$781,652

Outyear costs

	FY2001	FY02	FY03	FY04
Total budget	$505,000	$515,000	$520,000	$525,000

Section 6. References

Watershed?	Reference
☐	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. Contact 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.
☐	Cichosz, T.A., J.P. Shields, K.D. Underwood, A.T. Scholz, and M.B. Tilson. Lake Roosevelt Fisheries and Limnoligical 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.
☐	Jagielo, 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. Anuual 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. 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 slamon (Oncorhynchus nerka). Annual Report 1991. BPA. Porltand, 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.
☐	Thatcher, M.G., J.R. Griffith, A.C. McDowell, and A.T. Scholz. (In press submitted 1993). Lake Roosevelt Fisheries Monitoring Program, Annual Report 1991. 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.
☐	Underwood, K.D. and J.P. Shields. 1996. Lake Roosevelt Fisheries Monitoring Program, Annual Report 1993. Bonneville Power Administration. Portland, OR. 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.
☐	

PART II - NARRATIVE

Section 7. Abstract

The Spokane Tribal Hatchery is a principle element of a comprehensive management plan to restore and enhance the fishery in Lake Roosevelt and its tributaries. Hatchery stocking of kokanee salmon

(*Oncorhynchus nerka*) and rainbow trout (O*ncorhynchus mykiss*) began in 1991. The hatchery is operated in conjunction with the Sherman Creek Hatchery and Lake Roosevelt Rainbow Trout and Kokanee Net Pen Rearing Projects which serve as transfer, acclimation and release sites. Production goals and release strategies are established annually by fishery managers from the Spokane Tribe of Indians, Colville Confederated Tribes and Washington Department of Fish and Wildlife. The current hatchery production goal is 500,000 kokanee yearlings, 1.3 million kokanee fingerlings and 530,000 rainbow trout fingerlings. Effects of hatchery origin kokanee and rainbow trout on the fishery are evaluated annually by the Lake Roosevelt Data Collection and Monitoring Program. 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. The intention of this project is to provide a long term readily accessible sport fishery compatible with the ecological stability of naturally producing fish as partial mitigation for hydropower –caused fish losses caused by the construction of Grand Coulee Dam. The project is funded by the Bonneville Power Administration through the Northwest Power Planning Councils 1994 Fish & Wildlife Program, Resident Fish Substitution Section, Measure 10.8B.2.

Section 8. Project description

a. Technical and/or scientific background

The technical and scientific background information presented in this section includes information leading to the implementation of this project (1987) and more recent events relevant to its continuance. It can be reviewed in the context of historical (part b of this section) background as well. [Note: Please excuse the formatting of the text in all of section 8; space (10 pg. Limit) is insufficient to adequately format while still trying to put into context the necessary information behind this project which was a valid ISRP criticism of last years proposal.]

In 1939, construction of Grand Coulee Dam permanently blocked and subsequently extinguished anadromous fish runs in the Upper Columbia River. Prior to this, the Columbia, Spokane and San Poil rivers in the region now occupied by Lake Roosevelt produced large numbers of salmon, steelhead and resident rainbow, cutthroat and bull trout, whitefish and land-locked sockeye or kokanee salmon (Gilbert and Everman 1985; Gangmark and Fulton 1949; Bryant and Parkhurst 1950; Earnest et al. 1966; Fulton and Laird 1967-unpublished; reviewed by Stober et al. 1977, Beckman et al. 1985, Scholz et al. 1985, and Peone et al. 1989).

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 disable 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 (Jagielo 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).

Scholz et al. (1986) investigated the feasibility of restoring the Lake Roosevelt fishery and 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 kokanee 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. Operation of the two hatcheries compliment each other. Kokanee eggs collected from Sherman Creek along with rainbow trout eggs received from state allotments are incubated at the Spokane Tribal Hatchery. Resulting kokanee and rainbow fry are reared to age 0+ and/or 1+ size at the Spokane Tribal Hatchery before release into Lake Roosevelt, post-spring reservoir drawdown, or transfer to either net pen rearing operations or the Sherman Creek Hatchery. Kokanee and rainbow fingerlings/yearlings are reared at these sites and also released into Lake Roosevelt after the spring drawdown period.

In the 1980's, a successful rainbow trout net pen rearing project was initiated by volunteers from Lake Roosevelt. 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.

In 1988, the Lake Roosevelt Monitoring Program began by conducting a baseline evaluation of the fishery before hatchery production. From 1991 to 1994, the Lake Roosevelt Monitoring Program was conducted to evaluate the effectiveness of the hatcheries and propose management directives. During the first 4 years (1991 to 1995) of hatchery stocking, the emphasis was for production and release of kokanee fry/fingerlings (age 0+). However, coded wire tag data and a study to chemically imprint and assess smoltification of hatchery produced kokanee indicated that kokanee released as residualized smolts (e.g. yearlings/age 1+) were captured in higher numbers than kokanee released as fry/fingerlings (age 0+) (Scholz et al. 1993, Tilson et al. 1994 and 1995). Additionally, entrainment losses and predation are thought to be a greater factor for kokanee released as fry as opposed to residualized smolts (Tilson et al. 1994 and 1995). As a result, the hatcheries have shifted from kokanee fry releases to residualized smolts. The Lake Roosevelt Monitoring Program is currently conducted to develop a model to predict biological responses to reservoir operation, evaluate the effects of releasing hatchery origin kokanee salmon and rainbow trout on the fishery and evaluate success of various stocking strategies to increase fish harvest while maximizing the return of spawning kokanee to egg collection facilities (Cichosz et al. 1996).

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 (Jagielo 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. The current production goal for the Spokane Tribal Hatchery is 500,000 kokanee yearlings, 1.3 million kokanee fingerlings and 530,000 rainbow trout fingerlings.

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).

In 1998, an adipose clip only harvest regulation for Lake Roosevelt kokanee was established by the Washington Department of Fish and Wildlife. The harvest regulation prompted 100% adipose clipping of hatchery produced kokanee before release into the reservoir. The regulation was sought by the Colville Confederated Tribes, project sponsor of the Chief Joseph Kokanee Enhancement Project, to protect naturally producing kokanee that originate from the San Poil River, a southern tributary of the reservoir. The tribe noted a decline in adult returns to the San Poil River and an increase in fishing pressure for Lake Roosevelt kokanee since 1988 as the basis for this protective measure (CCT Letter to WDF&W, May 1997). Cichosz et al. (1996) and Underwood et al. (1997) noted similar declines in kokanee catch rates and abundance during fishery surveys performed in 1996. However, their findings suggest these declines are

more closely related to increased entraiment and the severity of spring drawdowns (Cichosz et al. 1996 and Underwood et al. 1997). The decrease in kokanee harvested and abundance coincides with that of rainbow trout in 1996. Cichosz et al. (1996) reported substantial numbers of tagged rainbow trout were recovered at downstream dams as far as Bonneville Dam in 1996. Tilson and Scholz (1996) reported entrainment as a factor for poor adult kokanee returns in Lake Roosevelt.

Also in 1998, the Spokane Tribe in cooperation with the Washington Water Power Company, constructed a fish trap and acclimation facility in the tail-race of Little Falls Dam on the Spokane River (south/eastern border of Lake Roosevelt). The primary purpose of the facility is to capture, hold and spawn adult kokanee salmon, of which in large part are offspring from fish produced by the Spokane Tribal Hatchery, that congregate below the tailrace of Little Falls Dam each year during their fall (Aug-Nov) spawning migration. The kokanee eggs collected from the spawning process will be incubated (cultured) at the Spokane Tribal Hatchery and fish produced from the incubated eggs will be released back into Lake Roosevelt. Additionally, the facility will be used for temporarily rearing and acclimating kokanee before and release into Lake Roosevelt. It is expected that there will be imprinting and residualization benefits associated with the facility. Initial operation of the trap will began in the early spring, 1999.

b. Rationale and significance to Regional Programs

The Spokane Tribal Hatchery -- (Galbraith Springs) -- was originally amended under the resident fish substitution section of the Northwest Power Planning Council's 1987 Columbia Basin Fish and Wildlife Program [Sections 903(1)(g)(C)]. The significance of establishing this project to further goals of the Fish and Wildlife Program is exhibited by its includance in the Council's 1987 Five-Year Action Plan. Section 1403(7)(7.3) states that the BPA shall: *"Fund design, construction, **operation and maintenance** of kokanee salmon hatcheries at Galbraith Springs and at Sherman Creek, starting in Fiscal Year 1988."* (Emphasis added.) Additional language for the operation and maintainenance of this project is included in the resident fish substitution section [10(8)(b)(2)] of the Council's 1994 Fish and Wildlife Plan (as amended in 1995).

The fundamental goal of this project adheres to the Council's Resident Fish Substitution Policy (section 10.8) and specifically to the biological objectives that mitigate for hydropower related fish losses in the blocked area above Chief Joseph/Grand Coulee Dams (section 10.8b) of its 1994 Fish and Wildlife Program (NPPC 1994, as amended in 1995). Since this project is in a blocked area where anadromous fish will probably never return and existing populations of naturally producing fish are limited by reservoir operations (e.g. the Council's salmon flow measures, flood control) this project is identified as a "high priority".

Since 1998, the Spokane Tribal Hatchery, in conjunction with the Lake Roosevelt Hatcheries Coordination Team, has employed an annual production goal of 1.3 million kokanee fingerlings (age 0+), 500,000 kokanee yearlings/residualized smolts (age 1+) and 500,000 rainbow trout fingerlings to aid in achieving the Lake Roosevelt Biological Objectives by 2001. This production goal was not feasible prior to 1998 due to hatchery carrying capacity limitations, specifically density and flow requirements. However, with the drilling of a new production well in 1997 and the implementation of the Lake Roosevelt Kokanee Net Pens Program (expected in 2000) the hatcheries portion of achieving the objectives is being planned.

c. Relationships to other projects

COLLABORATIVE AGENCIES: The Spokane Tribal Hatchery project is a result of collaborative efforts, dating from 1985 to the present time, between the Bonneville Power Administration, Spokane Tribe of Indians, Colville Confederated Tribes, Upper Columbia United Tribes Fisheries Research Center/Eastern Washington University Biology Department, Washington Department of Fish & Wildlife, and National Park Service.

RELATED NPPC F&WP PROJECTS: The Spokane Tribal Hatchery is operated in conjunction with the Sherman Creek Hatchery (project 9104700) and Lake Roosevelt Rainbow Trout and Kokanee Net Pen Programs (project 9500900 & 5228100). These projects serve as acclimation and release sites for the 1 million kokanee fingerlings, 500,000 kokanee yearlings and 530,000 rainbow trout fingerlings raised annually at the Spokane Tribal Hatchery. The Lake Roosevelt Monitoring/Data Collection Program

(project 9404300) is the monitoring and evaluation mechanism for the hatcheries and net pen projects. This project evaluates the effects of releasing hatchery origin kokanee and rainbow trout on the fishery and the success of various stocking strategies to increase fish harvest while maximizing the return of spawning kokanee to egg collection sites. Incidentally, this project, which began in 1988, was implemented as a scientific based program (Scholz et al. 1986) for monitoring and evaluating the effectiveness of restoration and enhancement efforts for Lake Roosevelt and its tributaries. These efforts include the Spokane Tribal and Sherman Creek Hatcheries projects implemented in 1991 and the Rainbow Habitat Improvement Project (project 9001800) implemented in 1989. The Rainbow Habitat Improvement Project promotes 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. The Spokane Tribal Hatchery also operates in conjunction with the Chief Joseph Kokanee Enhancement Project (project 9500900). This project monitors entrainment of fish through Grand Coulee Dam, evaluates measures to ensure self-sustaining natural/native populations of kokanee in Lake Roosevelt and is responsible for determining the feasibility of using these fish in the kokanee hatcheries program. Currently, this project traps and separates all kokanee migrating up the San Poil River to limit hatchery kokanee from spawning with naturally produced kokanee.

PUBLIC INFORMATION SHARING: Each of these projects are facilitated through a forum of managers from their respective agencies which meet quarterly, or as needed, to coordinate their programs and exchange information. This forum includes members from the Lake Roosevelt Hatcheries Coordination Team who are responsible for establishing hatchery production, stocking and outplanting locations. Information from the projects is channeled to the public through the Lake Roosevelt Forum, which consists of agencies, public and private groups which have concerns relating to the environmental and economic integrity of Lake Roosevelt.

OTHER INTERESTS: In 1994, the Spokane Tribe and Washington Water Power Company entered into an agreement, called the Little Falls Dam Settlement, ending a 20 year litigation case over ownership of the land the hydropower facility resides on. Among other articles of the settlement agreement dealing with fish and wildlife enhancement, the utility company agreed to provide the Tribe with a payment for supporting a fish trap. After 4 years of scoping and designing, the "Little Falls Fish Trap and Acclimation Facility was constructed in 1988. The project is facilitated through the Tribes Fisheries Department in conjunction with the Spokane River Coordinating Committee, a joint technical committee comprised of representatives from the Tribe and WWP who are involved in administering provisions of the 1994 Settlement. The purpose of the facility is to compliment Lake Roosevelt fisheries restoration efforts as describe throughout this proposal.

ADDITIONAL SUPPORT & INDEPENDENT SCIENTIFIC PEER REVIEW: Throughout this project the Department of Biology from Eastern Washington University Department has supported all of the above Lake Roosevelt fisheries restoration efforts. Currently, professionals and students in the icthyology 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, indepently reviews Lake Roosevelt fisheries restoration enhancement efforts. Their comments and recommendations are facilitated through the Lake Roosevelt Hatcheries Coordination Team.

d. **Project history** (for ongoing projects)

Project history, implementation & cost: After implementation of the Pacific Northwest Electric Power Planning and Conservation Act in 1980, Scholz et al. (1986) investigated the feasibility of restoring and enhancing the Lake Roosevelt fisheries to partially mitigate hydropower caused fish losses resulting from the construction of Grand Coulee Dam. The investigation included extensive review of existing literature as well as a fishery and limnological survey study of Lake Roosevelt and its tributaries. The investigation resulted in the formulation of a fisheries restoration and enhancement management plan (Scholz et al. 1986) for Lake Roosevelt centered around artificial propagation of kokanee salmon (Peone et al. 1989). In 1986, the Spokane Tribe of Indians submitted an application for amendment, derived from this management plan, to the Northwest Power Planning Council (NPPC) for implementation into its 1987 Columbia River Basin Fish and Wildlife Program (FWP). The application was approved by NPPC and

amended into the Resident Fish Substitution Section of the FWP. In section 903 measure (g)(1)(c), the NPPC directed the BPA to "*fund the design, construction, operation and mantainenance of two kokanee salmon hatcheries: one at Galbraith Springs (Spokane Tribal Hatchery) and one at Sherman Creek. The Sherman Creek Hatchery will be used as an imprinting site and egg collection facility to provide a source of kokanee fry for: i)stocking into Banks Lake and ii) transferring to Galbraith Springs (Spokane Tribal) Hatchery for rearing to fingerling size before planting into Lake Roosevelt. Decisions on hatchery production, stocking and outplanting locations will be coordinated by a three member committee consisting of one representative each appointed by the Confederated Tribes of the Colville Reservation, the Spokane Tribe of Indians, and the Washington Department of Game"* (NPPC 1987). Additionally, the NPPC continued this language in their 1993 Phase IV Amendments [Section 9.4A(1)(d)] and 1994 FWP [Section 10.8B(5)].

In 1988, the three member committee identified in the project measure was formed and designated as the Lake Roosevelt Hatcheries Coordination Team. On June 7, 1990, the Spokane Tribe of Indians and the Bonneville Power Administration entered into a 25 year agreement for funding the design, construction, operation and maintenance of the Spokane Tribal Hatchery. Construction of the Spokane Tribal Hatchery began in 1990, was completed in April of 1991 and the facility officially dedicated on June 7, 1991. *Incidentally, this hatchery was the first one actually be designed and constructed by the Bonneville Power Administration using the Cabinet Gorge Hatchery as a model – an example of adaptive management.*

In terms of cost, this program in conjunction with Sherman Creek Hatchery and Lake Roosevelt net pen projects, is responsible for a thriving economic base surrounding the sport fishery established through its efforts. In 1985, six years before these projects began stocking fish, a U.S. Fish and Wildlife survey estimated the economic value of the Lake Roosevelt fishery at $2.8 million (Beckman et al. 1985). More recent surveys estimate an annual range from $5.3 to $12.8 million, owing in large part to these projects (Peone et al. 1989, Griffith and Scholz 1991, Thatcher et al. 1993). In 1996, the economic value of the fishery was estimated at $7.6 million, which was a bad water year for Lake Roosevelt (Cichosz et al. 1996). In contrast, it costs the Bonneville Power Administration approximately $700,000 annually to facilitate these projects. The beneficial return to the surrounding area is unquestionable.

Project results summary: The table below lists the number of fish the Spokane Tribal Hatchery has produced for stocking Lake Roosevelt and Banks Lake pursuant to its 1991 through 1998 annual operating plans. The data is separated by the number actually stocked by the Spokane Tribal Hatchery and the number transferred to Sherman Creek Hatchery and Lake Roosevelt net pens for rearing and acclimation before release into Lake Roosevelt. Rainbow trout fingerlings transferred to the Sherman Creek Hatchery, which is done in the summertime period, are later transferred to Lake Roosevelt net pens in the fall. This frees up rearing space at the Spokane Tribal Hatchery for rearing 500,000 kokanee fingerlings for transfer to Lake Roosevelt net pens in the fall and carry over 500,000 fingerlings for release as yearlings/post-smoltification the following year.

Number fish stocked into project area by Spokane Tribal Hatchery, 1991 to 1998.

Year	Kokanee Fingerlings	Kokanee Yearlings
1991	1,674,577	0
1992	819,220	71,256
1993	1,024,293	21,190
1994	540,220	29,111
1995	515,425	59,825
1996	0	54,194
1997	381,513	40,808
1998	823,844	84,066

Number fish transferred to Sherman Creek Hatchery, 1991 to 1998.

Year	Kokanee Fingerlings	Kokanee Yearlings	Rainbow Trout Fingerlings
1991	0	0	0
1992	1,099,000	68,552	0
1993	635,267	72,508	0
1994	1,087,161	90,881	60,534
1995	0	210,634	120,325
1996	0	224,562	146,380
1997	0	220,191	150,801

1998	349,832	294,532	0

Number fish transferred to Lake Roosevelt Net Pens, 1991 to 1998.

Year	Kokanee Fingerlings	Rainbow Trout Fingerlings
1991	33,510	326,461
1992	0	424,395
1993	40,305	446,798
1994	0	288,046
1995	164,328	288,739
1996	50,899	430,473
1997	261,092	403,382
1998	294,186	311,594

For the most part, this project has followed through with fish production as called for in the annual operating plans. However, during the first seven years the hatchery water supply limited the carrying capacity. In 1998, a new production well was constructed and an existing well was rehabilitated which has allowed the hatchery to produce 100% of the fish as outlined in the 1998 operating plan. Also, in order for this program to achieve its target goals, it is reliant on the Sherman Creek Hatchery and Lake Roosevelt net pen projects (existing rainbow and recently implemented kokanee net pens).

Monitoring, project reports and technical papers: Monitoring and evaluation is of necessity. The hatchery programs effect on the Lake Roosevelt fishery, as well as management implication, 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.* 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).

Adaptive management implications: Lake Roosevelt fishery investigations performed 1986 to present have determined artificial production is necessary to restore kokanee salmon and rainbow trout populations. The primary implication associated with the survival of hatchery produced released into Lake Roosevelt and Banks Lake is reservoir operation. Management strategies have changed since the beginning of this program to off set adverse reservoir operations. For example, releases of kokanee salmon fry/fingerlings (age 0+) has changed to yearlings/post-smolt releases to reduce entrainment and predation. This has increased higher survival and adult return of hatchery produced kokanee. In terms of adaptive management concerning hatchery production, this project regularly implements prudent and sound fish culturing techniques and strategies. For example, a direct oxygen injection system was constructed to compensate unfavorable water conditions (temp. and volume) that was limiting hatchery carrying capacity.

e. Proposal objectives

The *goal* of this project is to aid in the restoration and enhancement of the Lake Roosevelt fisheries adversely effected by the construction and operation of Grand Coulee Dam. In consideration of this, the hatchery program is dedicated to assure its effects on Lake Roosevelt ecological conditions and fish populations are compatible with native species recovery. The primary *objective* is to produce kokanee salmon and rainbow trout to create a sport fishery in Lake Roosevelt and its tributaries and thereby decreasing the angling pressure on existing natural (e.g. walleye, rainbow trout) and native (e.g. redband trout) fish species. This project submits an annual operating plan to the Bonneville Power Administration that details the objectives to assure that guidelines are prudent to normal fish hatchery practices. The operating plans have been approved each year with little or no question. Additionally, the objectives are

reviewed by the Lake Roosevelt Hatchery Coordination Team for approval each year. Work achieved is presented to this group during quarterly meetings as well as in monthly and annual reports. Listed in the section (f) below are the objectives and tasks to be employed by this project to meet its FY 2000 production goals.

f. Methods

OBJECTIVE 1. EGG COLLECTION, SPAWNING AND INCUBATION OF 1.2 MILLION KOKANEE EGGS AND 625,000 RAINBOW TROUT TO MEET 2000 APG.

Task 1.1 Brood stock capture and holding at Little Falls Dam and Hawk Creek: Kokanee brood stock capture and holding at Little Falls Dam (LFD) will depend on the return size. A fish trap with a holding/rearing raceways, constructed in 1998 below the tailrace of LFD, will be used for collecting adult kokanee for spawning. Natural produced kokanee will be separated from hatchery fish, distinguished by missing adipose fins, for spawning Kokanee will also be collected from Hawk Creek during their fall spawning migration. A temporary fish weir and collection box will be installed in the creek to collect kokanee spawners migrating upstream. A seasonal worker will be employed to maintain and keep the trap secure. Mature fish will be spawned on site and the eggs will be transferred to the STH. This project will be coordinated with the National Park Service and WDF&W.

Task 1.2 Kokanee egg collection from Sherman Creek: Collection of kokanee spawners from Sherman Creek will be coordinated by the WDF&W. Kokanee will be spawned on site and the water hardened eggs will be transferred to the STH.

Task 1.3 Egg allotments: As a safeguard of the success of collecting eggs from fish returning to Lake Roosevelt Kokanee, a request for 1.2 million kokanee eggs will be requested from the Washington Department of fish and Wildlife and British Columbia Ministry of Fisheries. In addition, 625,000 rainbow trout eggs will also be requested from WDF&W as a normal procedure for meeting our production goal for the net pen program.

Task 1.4 Infectious hematopoietic necrosis (IHN), infectious pancreatic necrosis (IPN) and viral hemorrhagic septicemia (VHS) virus sampling of Lake Roosevelt Kokanee: Mature female kokanee captured in Lake Roosevelt will be tested for presence of IHN, IPN and VHS viruses. Samples of ovarian fluid, spleen and kidney tissue will be collected from approximately 60 ripe females. In collecting samples, an incision will be made from the anal fin to the isthmus and a separate syringe used to extract ovarian fluid from egg skeins. Whole spleen and kidney tissue will be collected and kept on separate vials. Samples will be chilled on ice and delivered to the WDFW pathology laboratory in Olympia, WA., where they will be analyzed by WDFW personnel. Collection and delivery of samples will be coordinated with WDFW pathologist, Steve Roberts. If any samples are tested positive, then Lake Roosevelt eggs will either be restricted from entering the hatchery facilities or incubated in isolation buckets. If all samples are tested negative, WDFW will notarize a Fish Health Certificate.

Task 1.5 Egg enumeration and incubator loading: Fertilized eggs will be disinfected before entering the Spokane Tribal Hatchery as a precaution in case Lake Roosevelt kokanee contain disease. Eggs in each chest cooler will be bathed in a 100 part per liter Argentine solution (Piper *et al.* 1987) for approximately 15 minutes and then rinsed with clean water. The Von Bayer method will be used for enumeration of eggs. This method is efficient and considered the least stressful technique of enumerating eggs (Piper *et al.* 1982). Vertical flow incubators (Heath Trays) and cylindrical upwelling incubators (upwellors) will be used for egg incubation. Loading rate for the verticle flow incubators will be 12,000 eggs per verticle flow tray (7 trays in each stack) while upwelling incubator loading rates will be 67,000 rainbow eggs per unit and 100,000 kokanee eggs per unit. Total anticipated incubator use will be 2 verticle flow incubator stacks and 16 upwelling incubators.

OBJECTIVE 2. FRY AND FINGERLING REARING METHODS TO MEET 2000 APG.

Task 2.1 Incubation and hatching kokanee and rainbow trout: Water will be drawn from the production well for incubating and hatching kokanee and rainbow eggs. The water temperature from this source remains steady at 10°C during this time of year. In respect to this, approximately 31 days or 558 centigrade temperature units (CTU's) are expected for hatching the kokanee and rainbow eggs (Piper *et al.* 1982). The number of days to egg eye-up, hatch and fry emergence, as well as daily water temperature will be recorded. At 90% swim-up, kokanee fry will be released from the upwelling incubators by simply

removing the lids and letting the fry swim out into the raceways. At about the same life stage, rainbow fry will be released by removing the lids and pouring the fry into the raceways. Mortality rates will be recorded throughout the incubation period and swim-up stage.

Task 2.2 Feeding and production of kokanee and rainbow trout: Feed training of kokanee and rainbow trout will begin at the 90% swim-up stage. The following feeding projections are based on a relatively constant temperature of 10°C. Feeding rates and amount will change with varying water temperatures and will actually be calculated on a daily amount basis determined from monthly growth rates recorded from the Spokane Tribal Hatchery, 1991 to 1998. Bio-diet starter (moist) will be used for feed training kokanee fry, while silver cup starter (dry) will be used for feed training rainbow fry. For feed training, both species of fry will be fed 3 to 4% body weight 8 times per day. Bio-diet grower and silver cup dry trout feed will be used for production feeding. A frequency of five feedings per day will be performed during production.

OBJECTIVE 3. IDENTIFICATION OF 2000 DISTRIBUTION DATES AND LOCATIONS FOR OUTPLANTING/TRANSFERRING KOKANEE AND RAINBOW TROUT.

Task 3.1 Transfer of 255,000 kokanee yearlings to the Sherman Creek Hatchery: Approximately 255,000 kokanee averaging 10 fish per pound will be transferred to the Sherman Creek Hatchery in April, 2000. At a loading rate of 1,500 pounds per haul, approximately 17 trips will be required.

Task 3.2 Outplanting 85,000 kokanee yearlings into the Spokane Arm of Lake Roosevelt: Approximately 80,000 kokanee yearlings averaging 8 fish per pound will be outplanted into the Spokane Arm of Lake Roosevelt in June, 2000. The main outplanting sites will be the Blue Creek and Owl Creek (known as "A-Frame") tributaries. Approximately 8 trips will be required to outplant these fish.

Task 3.3 Outplanting 300,000 kokanee fingerlings into Banks Lake: Approximately 300,000 Kokanee fingerlings averaging 200 fish per pound will be outplanted into Banks Lake in June, 2000. At a loading rate of 500 fish per haul, 3 trips will be required to plant these fish. Planting will be coordinated with the WDF&W.

Task 3.4 Transfer 500,000 kokanee fingerlings to Lake Roosevelt net pen rearing operations: Lake Roosevelt net pens will receive 80,000 kokanee fingerlings by October 1, 2000. The fish are expected to be 50 per pound in size and will require 20 trips to each site. Kokanee transferred to the pens will be marked with coded wire tags and adipose fin clips prior to transfer.

Task 3.5 Hold 500,000 kokanee fingerlings for planting in 2001: Approximately 500,000 kokanee fingerlings will be held over at the STH for outplanting in 2000. A planting schedule for these fish will be developed during the 1999 LRHCT meetings.

Task 3.6 Transfer of 30,000 rainbow trout to the Kettle Falls summer net pen rearing program: Approximately 30,000 rainbow fingerlings averaging 45 fish per pound will be transferred to the Kettle Falls net pen rearing operation in July, 2000. Transfer of these fish will require 2 trips.

Task 3.8 Transfer 150,000 rainbow trout to Sherman Creek Hatchery: Approximately 150,000 rainbow fingerlings averaging 45 fish per pound will be transferred to the SCH in July, 2000. At total of 4 trips will be required to transfer these fish. The SCH will hold these fish for later transfer to fall net pen rearing operations at Kettle Falls and Hall Creek. The STH will assist in the later transfer to the pens.

Task 3.9 Transfer of 360,000 rainbow trout to fall FDR net pen rearing operations: Approximately 360,000 rainbow fingerlings averaging 25 fish per pound will be transferred to Lake Roosevelt Net Pen rearing sites at Keller Ferry, Seven Bays, Two Rivers and Hunters from September 15 to November 1, 2000. Each site will have 4 net pens (16 total) and will receive approximately 16,500 fish each. A total of 15 trips will be required to transfer these fish. Transfer dates will be coordinated with the Lake Roosevelt Development Association Net Pen Coordinator.

OBJECTIVE 4. DETERMINE THE REARING VOLUME, WATER QUANTITY AND QUALITY NECESSARY TO MEET THE 2000 APG.

Task 4.1 Raceway loading for fry, fingerling and adult rearing: A maximum volume of 24,320 cubic feet (ft3), or 40 raceways, rearing volume will be used to produce the 2000 APG. Fish will be loaded in raceways relative to a density index of 0.5 (or less) and spread out as they increase in size.

Task 4.2 Regulation of water inflow during incubation: Upwelling incubators containing un-eyed eggs will be supplied with 5-8 gallons per minute (gpm) per incubator until eye-up and then increased to 12-15 gpm until swim-up. Vertical flow incubators containing un-eyed eggs will be supplied with 5 gpm per incubator until eye-up and increased to 8 gpm until swim-up. The maximum water inflow needed should be 450 gpm (1.01 cfs) during incubation.

Task 4.3 Water inflow regulation during fry, fingerling and adult rearing: Water inflow required during fry, fingerling and adult rearing will be calculated using a flow index of 1.5 associated with projected lengths and weights in the following formula:

$$I = \frac{W}{L \times 1.5}$$

where: I = total inflow
W = projected weight
L = projected length

This formula, as well as size estimates, will be entered into a computer program as needed for determining water volume needed.

Task 4.4 Monitoring water quality during fry and fingerling rearing: Daily temperatures (°C) will be recorded and used in determining feeding amounts and raceway loading rates. Dissolved oxygen (DO) is expected to be near 100% saturation level (10 to 12 mg/l) while nitrogen (N_2) levels should remain below 100% saturation level. Packed column aerators in the head box should produce acceptable D.O. and N_2 levels. However, D.O. will be measured with a YSI meter and N_2 levels will be measure periodically with a WEISS saturometer. Other parameters monitored by the hatchery manager will include pH, conductivity, ammonia, nitrate and nitrite salinity and total settleable solids concentration in the hatchery effluent. At least two broad spectrum analysis of water quality will be contracted to an EPA certified laboratory.

Task 4.5 Raceway hygiene: Raceways will be sanitized and disinfected with 600 parts per million solution of Hyamine 3500 before initial incubator loading and transfer of fry to raceways. Daily raceway sanitization of fecal matter will be performed when production feeding begins. All waste water will be drained to the settling pond.

Task 4.6 Routine cleaning of spring pond waters: The spring ponds will be routinely cleaned as needed using a vacuum/trash boat. The cleaning will help keep algal and macrophyte densities at a low level to assure a clean water source flowing into the hatchery.

OBJECTIVE 5. ADIPOSE CLIP KOKANEE SALMON BEFORE RELEASE INTO LAKE ROOSEVELT.

Task 5.1 Kokanee fin clipping: Seasonal workers will clip all (approximately 960,000) adipose fins on kokanee fry and fingerlings prior to release into Lake Roosevelt. Up to 3 fin clippers and 1 experienced supervisor will be employed for approximately 6 months to perform this task. Fish will be sedated in a mix of salt and anesthetic, weighed for enumeration and adipose fins clipped using surgical type scissors. Appropriate data for monitoring and evaluation will be collected. Fin clipping will compliment coded wire tagging administered by the Lake Roosevelt Monitoring Program and facilitated by the Spokane Tribal Hatchery crew.

OBJECTIVE 6. MAINTENANCE OF HATCHERY BUILDING AND GROUNDS, VISITATION IMPROVEMENTS AND CULTURAL PRESERVATION.

Task 6.1 Routine hatchery maintenance: Routine maintenance of the hatchery building and grounds will be performed by hatchery personnel. This includes painting, net and screen mending, lawn mowing, vehicle maintenance and building cleaning .

Task 6.2 Visitation improvements: Additional visitation area will be improved for public use. This will include adding educational and informative displays such as our fish mitigation efforts, fish hatchery management and natural resource preservation.

Task 6.3 Cultural Preservation: A display illustrating the cultural significance of the Metamooteles Springs area will be put up near the visitors center and cultural sensitive sites identified during pre-hatchery construction archeological surveys. If possible, we plan on working with the Spokane Tribal Cultural Department to build pit house and camas oven replicas near the cultural sensitive sites.

g. Facilities and equipment

The Spokane Tribal Hatchery, which is actually the first fish hatchery designed and constructed by the BPA, is a state of the art facility with modern fish production equipment. The hatchery consists of 44 indoor/outdoor raceways with 26,752 cubic feet of rearing space, utilizes ground and surface water, incubates using self fabricated upwelling units, employs sophisticated oxygenation system and uses modern fish handling and transportation equipment. The hatchery has a laboratory consisting of microscopes

(phase contrast and dissecting), analytical balances, fish necropsy tools, centrifuge and microbiology equipment. The grounds surrounding the hatchery include a visitors center, picnic and cultural interpretive center (under development).

h. Budget

The hatchery is intended to operate off a base budget of $521,934 in FY2000. Major operating costs are associated with personnel @ 38% and O&M @ 31%. In terms of personnel costs, the majority is primarily due to the number of employees' necessary for raising the 60,000+ pounds of fish each year and having to adipose clip the 1 million kokanee. Operation and maintenance in large part is due to utilities and fish feed. This program intends on feeding over 50,000 pounds of feed and relies on 2 30 hp and 2 50 hp pumps that require a substantial electrical load. Additionally, part of the fin clipping period (6 months) is in the winter time making heating via 8 space heaters a necessity. This also takes a substantial amount of electricity. In summary, a very detailed budget is submitted to the BPA each year for approval. The Spokane Tribal Finance Committee and accounting department also scrutinizes the budget thoroughly. Independent audits are required annually of this program pursuant to provisions of OMB A-128 or A-133.

Section 9. Key personnel

RESUME

TIM L. PEONE, HATCHERY MANAGER

EDUCATION

Eastern Washington University; Cheney, WA; 1988.
**Bachelor of Science in Biology (3.0 GPA).

EMPLOYMENT EXPERIENCE

07/90 - Present
Spokane Tribal Hatchery, Ford, Washington.
Hatchery Manager. Duties include management of daily fish culturing of 3 million kokanee salmon and 500,000 rainbow trout. Budget and contract writing.
10/88 - 07/90
Upper Columbia United Tribes Fisheries Center, Department of Biology, Eastern Washington University, Cheney, Washington.
Fisheries Biologist. Duties include the collection and spawning of kokanee at Little Falls Dam, culturing of kokanee eggs in incubates at Galbraith Springs, and field training and release of kokanee fry.
06/88 - 12/88
Upper Columbia United Tribes Fisheries Center, Department of Biology, Eastern Washington University, Cheney, Washington.
Fisheries Biologist. Duties include developing the monitoring programs research proposal and contract, coordination from the collection and analysis of creel survey fisheries, zooplankton and water quality samples, supervising field and laboratory personnel, and responsible for reporting BPA by monthly progress and annual reports.
Wtr 1988
Idaho Department of Fish and Game; Cabinet Gorge Kokanee Salmon Hatchery; Clark Fork, Idaho.
Hatchery Internship. Duties include selection and spawning of brood stock, spawning of kokanee eggs, culturing and fungal treatment of eggs, and quantification of fertilized eggs. Extensive overview of the hatchery design and year round hatchery operations discussed.
Wtr/Spr 1987
Washington Department of Wildlife Rainbow Trout Hatchery; Spokane, Washington.
Hatchery Internship. Duties included spawning, culturing and fungal treatment of rainbow trout eggs, food training and fish grading or rainbow trout fry and release of juvenile rainbow fingerlings.

MEMBERSHIP ON REGIONAL COMMITTEES

Columbia Basin Fish and Wildlife Authority (CBFWA), Resident Fish Committee Member, 1989.
UCUT representative participating in review and evaluating resident fish program measures, identify impacts on resident fish caused by hydro-power development, and assisting CBFWA in prioritizing resident fish research protection and mitigation needs.

PUBLICATIONS AND TECHNICAL REPORTS

1994-97 Peone, T. Annual Reports of the Spokane Tribal Hatchery. Prepared for Bonneville Power Administration, Division of Fish & Wildlife (Contract No.: DE-MS79-90BP92906; Project No.: 91-046).

1995 Peone, T. Kokanee Captive Brood Investigations at the Spokane Tribal Hatchery. Prepared for 1995 International Kokanee Workshop.

1990 Peone, T., A.T. Scholz, J.R. Griffith, M. Thatcher, D. Brown, L. Hill, and C. Abrahamson. Lake Roosevelt Monitoring Program: July 1988-December 1989. Annual Report. Upper Columbia United Tribes Fisheries Center. Submitted Bonneville Power Administration (Project No. 88-63).

1989 Peone, T., A.T. Scholz and J. Griffith. Kokanee Salmon investigation as at Grand Coulee Reservoir (Lake Roosevelt). In: Proceedings of the symposium on Native American Fisheries, Western Regional Conference, American Fisheries Society. 24 p.
1989 Scholz, A.T. and T. Peone. Assessment of rainbow trout net pen program in Lake Roosevelt, WA. Submitted N. Amer. J. Fish. Mgmt.

Project Duties: Manages and supervises fish hatchery and staff, applying knowledge of management and fish culturing techniques. Determines, administers, and executes policies relating to administration, standards of hatchery operation, and maintenance of facilities. Modifies and/or changes working conditions and use of equipment to increase efficiency. Budget and contract writing. Confers with Biologists and other fishery personnel obtain data concerning fish habits; food and environmental requirements; and techniques for collecting, fertilizing, incubating spawn, and treatment of spawn and fry. Participates in various committees, teams and forums that pertain the management and coordination of this resource.

Other Key Personnel:
Fish Culturist II, Assist. Mngr. - Delbert Brown
Fish Culturist II - James Andrews
Office Manager/Assist. Fish Culturist I - Darla Ford
Part-time Seasonal Fish Culturist I - Jayne Abrahamson

Resumes will be provided upon request for the aforementioned employees.

Section 10. Information/technology transfer

Reporting requirements: 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 is being 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).

Public information sharing: Each of these projects are facilitated through a forum of managers from their respective agencies which meet quarterly, or as needed, to coordinate their programs and exchange information. This forum includes members from the Lake Roosevelt Hatcheries Coordination Team who are responsible for establishing hatchery production, stocking and outplanting locations. Information from the projects is channeled to the public through the Lake Roosevelt Forum, which consists of agencies, public and private groups that have concerns and vested interests relating to the environmental and economic integrity of Lake Roosevelt. Annually this project participates in the Spokane Bighorn Show to display and talk to the public about the programs protection, mitigation, restoration and enhancement efforts called for through the NPPC's FWP. This display and public interface is in collaboration with the Lake Roosevelt Forum, Lake Roosevelt Monitoring Program, Lake Roosevelt Rainbow Habitat Improvement Project, Lake Roosevelt Rainbow Trout Net Pen Rearing Project, Chief Joseph Kokanee Enhancement Project, Sherman Creek Hatchery Project, BPA and the Bureau of Reclamation. This project is also involved with other public and agency fish and wildlife events ranging from seminars to workshops.

Congratulations!